DataArts Studio

User Guide

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HUAWEI

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1 DataArts Studio development process

DataArts Studio is a one-stop data operations platform that provides intelligent data lifecycle management. It supports intelligent construction of industrial knowledge libraries and incorporates data foundations such as big data storage, computing, and analysis engines. With DataArts Studio, your enterprise can easily construct end-to-end intelligent data systems. These systems can help eliminate data silos, unify data, accelerate data monetization, and promote digital transformation.

DataArts Studio Development Process

To use DataArts Studio, perform the following steps:

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Table 1-1 DataArts Studio development process

Process	Description	Task	Helpful Link
Process design	Before using DataArts Studio, you are advised to analyze your business, clarify requirements, and design a process based on the capabilities provided by DataArts Studio. 1. Analyze requirements. Analyze your business, clarify requirements, and obtain the data governance framework to facilitate the design of a data governance process. 2. Conduct a survey. Determine the capability boundary of DataArts Studio and analyze the subsequent service load. 3. Design a process. Design the data governance process based on the business status and the capabilities of DataArts Studio. The process covers all the subsequent data governance operations.	1. Requirement analysis 2. Business survey 3. Process design	The process design is closely related to your business. You can design a process by referring to **Data Governance Based on Taxi Trip Data**. You can learn more by .
Obtaining and configuring a DataArts Studio instance	If you are new to DataArts Studio, register an account, buy a DataArts Studio instance, and create a workspace.	Obtaining and configuring a DataArts Studio instance	**Buying and Configuring a DataArts Studio Instance**
Creating an IAM user and assigning DataArts Studio permissions	If you want to authorize other IAM users to use DataArts Studio, you need to create users and assign DataArts Studio permissions to them.	Creating an IAM user and assigning DataArts Studio permissions	**Authorizing Users to Use DataArts Studio**
Management Center	Select cloud services for data storage, query, and analysis as required. Then, create data connections required for the cloud services.	Creating a data connection	**Creating a DataArts Studio Data Connection**

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Process	Description	Task	Helpful Link
DataArts Migration	Use DataArts Studio to upload data from data sources to the cloud. DataArts Migration migrates data between homogeneous and heterogeneous data sources such as self-built and cloud-based file systems, relational databases, data warehouses, NoSQLs, big data cloud services, and object storage.	Integrating data	**Supported Data Sources** **Creating a CDM Cluster** **Creating a Link Between CDM and a Data Source** **Table/File Migration Jobs**
DataArts Catalog (metadata collection)	Collect metadata of raw data for data management and monitoring.	Collecting metadata	**Collecting Metadata of Data Sources**
DataArts Architecture	Use DataArts Architecture to create entity-relationship (ER) models and dimensional models to standardize and visualize data development and output data governance methods that can guide development personnel to work with ease. In DataArts Architecture, you can create dimensions, fact tables, summary tables, and metrics that fit your needs.	Adding reviewers	**Adding a Reviewer**
		Managing Configuration Center	**Managing the Configuration Center**
		Designing processes	**Designing Processes**
		Designing subjects	**Designing Subjects**
		Managing lookup tables	**Creating a Lookup Table**
		Formulating data standards	**Creating Data Standards**
		Creating ER models	**ER Modeling**
		Dimensional modeling	**Dimensional Modeling**
		Business metrics	**Business Metrics**
		Technical metrics	**Technical Metrics**
		Data mart building	**Data Mart**

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Process	Description	Task	Helpful Link
DataArts Factory	Use DataArts Factory to manage diverse big data services. The one-stop big data development environment enables a variety of operations such as data management, data integration, script development, job development, job scheduling, O&M, and monitoring, facilitating data analysis and processing.	Managing data	**Data Management Process**
		Developing scripts	**Script Development Process**
		Developing jobs	**Job Development Process**
		Performing O&M and scheduling	**Overview**
DataArts Quality	Use DataArts Quality to monitor business and technical metrics. Screen out unqualified data in a single column or cross columns, rows, and tables from the following perspectives: integrity, validity, timeliness, consistency, accuracy, and uniqueness. Use the automatically generated quality rules to standardize data repeatedly.	Monitoring data quality	**Creating a Data Quality Rule** **Creating a Data Quality Job** **Creating a Data Comparison Job**
DataArts Catalog	In the DataArts Catalog module, you can view data maps.	Data map	**Viewing Data Assets in a Workspace**
DataArts Security	DataArts Security provides all-round protection for enterprises' data. With DataArts Security, you can perform operations such as access permission management, sensitive data identification, and privacy protection and management.	Unified permission governance	**Permission Governance Process**
		Sensitive data governance	**Sensitive Data Governance Process**
		Privacy protection and management	**Overview**

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Process	Description	Task	Helpful Link
DataArts DataService	Use DataArts DataService to centrally manage API services and create data APIs based on tables.	Developing APIs	**Buying and Managing an Exclusive Cluster** **Creating a Reviewer in DataArts DataService** **Creating an API** **Debugging an API** **Publishing an API** **Managing APIs** **Orchestrating APIs** **Configuring a Throttling Policy for API Calling** **Authorizing API Calling**
		Calling APIs	**Applying for API Authorization** **Calling APIs Using Different Methods**

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2 Buying and Configuring a DataArts Studio Instance

2.1 Buying a DataArts Studio Instance

DataArts Studio is billed for a basic package and incremental packages. The basic package is a DataArts Studio instance. For how to buy a DataArts Studio instance, see **a DataArts Studio Basic Package**.

Context

- Only users with **DAYU Administrator** or **Tenant Administrator** permissions can DataArts Studio instances or incremental packages.

  NOTE

  Users with **Tenant Administrator** permissions can perform all operations except IAM user management. For security purposes, you are not advised to grant **Tenant Administrator** permissions to IAM users.

- Only users with **Security Administrator** permissions can create cloud service agencies. Cloud service agencies allow DataArts Studio to perform operations such as task scheduling and resource O&M on other cloud services on your behalf.

Prerequisites

You have obtained a VPC, subnet, and security group. You can also apply for them when you a DataArts Studio instance.

For details, see *Virtual Private Cloud User Guide*.

Logging In to the DataArts Studio Console

1. Log in to the console.
2. In the upper left corner of the console, click , and choose to access the DataArts Studio console.

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a DataArts Studio Basic Package

Step 1 Go to the package for **buying a DataArts Studio instance**.

Step 2 On the displayed page, set the parameters listed in **Table 2-1**.

Table 2-1 DataArts Studio instance parameters

Parameter	Example Value	Description
Region	N/A	Region where the instance resides. Resources in different regions cannot communicate with each other. When selecting a region, consider the following factors: • Location Select a region close to you or your target users. This reduces network latency and accelerates access. • Relationship between cloud services Cloud services in different regions cannot communicate with each other through an internal network. For example, if you want to enable communication between DataArts Studio (containing modules such as Management Center and CDM) and services in other regions (such as MRS and OBS), use a public network or Direct Connect. If DataArts Studio and the other services are in the same region, instances in the same subnet and security group can communicate with each other by default. • Resource price Resource pricing may vary in different regions. For details, see **Regions and AZs**.

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Parameter	Example Value	Description
Enterprise Project	default	Enterprise project associated with the default workspace of the DataArts Studio instance. An enterprise project facilitates management of cloud resources. For details, see ***Enterprise Management User Guide***. This parameter is available only when an enterprise project has been created. If you want to connect the DataArts Studio instance to an instance of another cloud service, such as GaussDB(DWS), MRS, and RDS, ensure that the enterprise project of the DataArts Studio instance's workspace is the same as that of the target cloud service instance. ● You can only one DataArts Studio instance for an enterprise project. ● If you want to enable communication between DataArts Studio and another cloud service, ensure that the enterprise project of DataArts Studio is the same as that of the target cloud service. **NOTE** If the enterprise project function is not enabled, only one DataArts Studio instance can be created for each IAM project.
Version	Starter	Select a DataArts Studio version. For details about the differences between versions, see **Versions**. **NOTE** When you purchase a DataArts Studio instance, you will also get a Cloud Data Migration (CDM) cluster. You are advised to use this CDM cluster as a connection agent. To migrate data, buy a CDM incremental package with higher specifications. For details, see **Buying a DataArts Migration Incremental Package**.
Billing Mode	Yearly/Monthly	The DataArts Studio basic package only supports the yearly/monthly billing mode.
Instance Name	DataArts Studio-test	Name of the DataArts Studio instance. After the instance is created, its name cannot be changed.

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Parameter	Example Value	Description
AZ	AZ1	AZ of the DataArts Studio instance, that is, the AZ where the CDM cluster is located. The DataArts Studio instance communicates with other services through the CDM cluster. When you buy your first DataArts Studio instance or incremental package, you can select any available AZ. When you buy another DataArts Studio instance or incremental package, determine whether to select the same AZ as that for the first instance or package based on your DR and network latency demands. • If your application requires good DR capability, deploy resources in different AZs in the same region. • If your application requires a low network latency between instances, deploy resources in the same AZ. For details, see **Regions and AZs**.

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Parameter	Example Value	Description
VPC	vpc1	VPC, subnet, and security group to which the CDM cluster in the DataArts Studio instance belongs. The DataArts Studio instance communicates with other services through the CDM cluster. If you want to connect the DataArts Studio instance or CDM cluster to a cloud service such as GaussDB(DWS), MRS, and RDS, ensure that the CDM cluster can communicate with the cloud service. If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If the CDM cluster and the cloud service are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about the operations on VPCs, subnets, and security groups, see ***Virtual Private Cloud User Guide***. **NOTE** • After a DataArts Studio instance is created, the VPC, subnet, and security group of the default CDM cluster cannot be changed. Set them properly when creating the DataArts Studio instance. • You can select a VPC subnet shared by the VPC owner when you a DataArts Studio instance. Through VPC subnet sharing, you can easily configure and manage multiple accounts' resources at low costs. For details about how to share a VPC subnet, see **VPC Sharing**.
Subnet	subnet-1	
Security Group	sg-1	
Required Duration	1 year	Select a duration based on your needs.
Auto-renew	N/A	You can select **Auto-renew** to enable automatic renewal of the subscription by month or by year. If you choose the monthly billing mode, your subscription will be automatically renewed each month. If you choose the yearly billing mode, your subscription will be automatically renewed each year.

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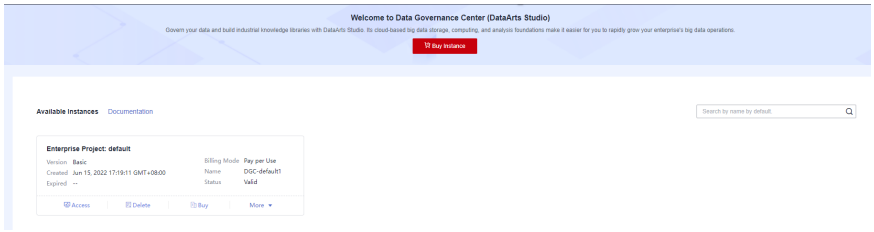
Parameter	Example Value	Description
Tags	Tag key: key1 Tag value: asd	You can add resource tags to classify resources. **NOTE** If your account belongs to an organization and the organization has configured DataArts Studio tag policies, you need to add tags based on these policies. If a tag does not comply with the tag policies, instance creation may fail. Contact your administrator to learn more about tag policies. DataArts Studio instance tags can be used in the following scenarios: • If there are a large number of cloud resources, you can add tags to them (including DataArts Studio instances) by user, maintainer, or usage. Then you can use Tag Management Service (TMS) to identify tags and manage cloud resources easily. • If there are multiple DataArts Studio instances, you can add tags to them by user, maintainer, or usage. Then you can search for and identify DataArts Studio instances by tag on the DataArts Studio instance list page. A tag consists of a key and a value. When adding a tag, you can select a predefined tag created in Tag Management Service (TMS) or enter a custom tag. Then click **Add** to the right of the text box to add the tag. **NOTE** To select predefined tags, ensure that you have created predefined tags in TMS. You can click **View predefined tags** to enter the **Predefined Tag** page of TMS. Then, click **Create Tag** to create a predefined tag. For details, see **Creating Predefined Tags** in *Tag Management Service User Guide*. A maximum of 20 tags can be added to a DataArts Studio instance. Each tag key must be unique and can only match one tag value.

Step 3 Confirm the settings and click **Now**.

Step 4 Click **Next**. After you pay for your instance, wait until the instance is created. The created instance is displayed on the homepage.

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Figure 2-1 Viewing a DataArts Studio instance



Step 5 When you return to the DataArts Studio console, the **Authorize Access** dialog box is displayed, prompting you to authorize the listed services. DataArts Studio interacts with these cloud services. You must create a cloud service agency to delegate permissions to DataArts Studio so that DataArts Studio can use these cloud services and perform task scheduling and resource O&M on your behalf.

NOTICE

Only users with **Security Administrator** permissions can create cloud service agencies. Cloud service agencies allow DataArts Studio to perform operations such as task scheduling and resource O&M on other cloud services on your behalf.

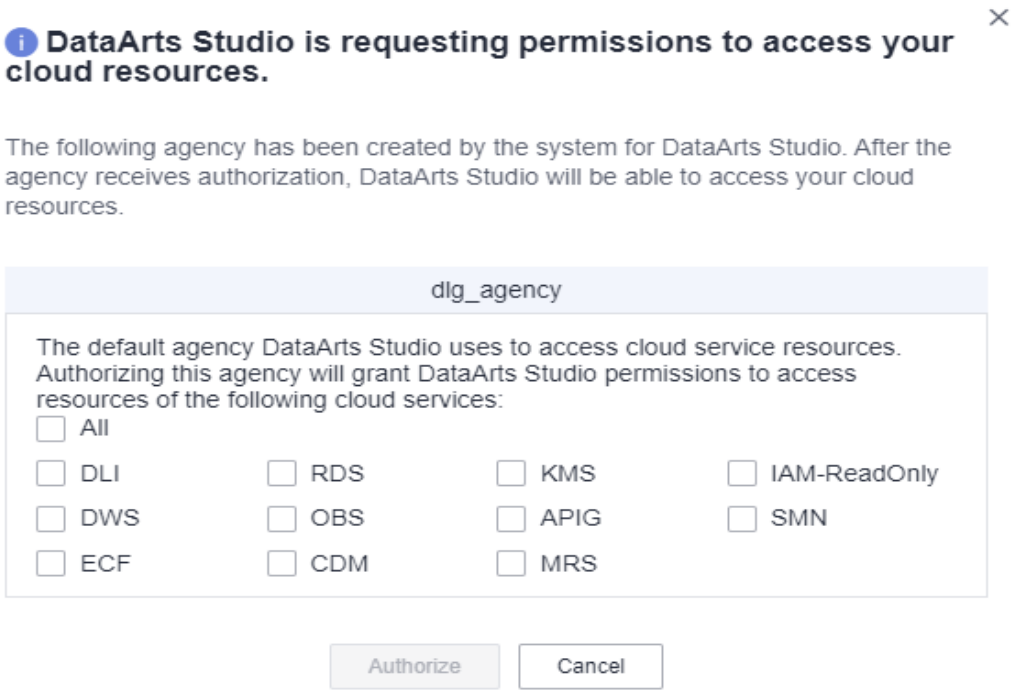
Cloud service agencies include permissions related to DWS, MRS, RDS, OBS, SMN, and KMS. You can access the IAM agency page to view the agency scope. You do not need to apply for an agency for users. The agency of the account is used.

Select all services and click **Authorize**. The system automatically creates the default dlg_agency.

- After the authorization is complete, the **Authorize Access** dialog box will not be displayed when you access the DataArts Studio console homepage next time.
- If you select only some services for authorization, this dialog box will be displayed again next time you access the DataArts Studio console, prompting you to authorize access to the unauthorized cloud services.

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Figure 2-2 Authorize Access dialog box



Step 6 In the list of instances, locate your instance and click **Access** to access the DataArts Studio console.

----End

2.2 Buying a DataArts Studio Incremental Package

2.2.1 Introduction to Incremental Packages

DataArts Studio provides and is billed based on basic and incremental packages. If the basic package cannot meet your demands, you need to buy an incremental package.

DataArts Studio Incremental Packages

Table 2-2 lists the incremental packages provided by DataArts Studio.

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Table 2-2 Incremental packages

Package Type	Description	Scenario	Purchase Mode
DataArts Migration incremental package	A DataArts Migration (that is, CDM) incremental package provides resources for a CDM cluster. • When you buy a pay-per-use CDM incremental package, the system automatically creates a CDM cluster based on the specifications you select for the incremental package. • When you buy a CDM incremental package which is billed based on a package, the system does not automatically create a CDM cluster. Instead, you can use a CDM cluster you have obtained on the DataArts Studio console for 745 hours each month within the validity period of the incremental package. CDM clusters can be used in the following scenarios: • Data migration jobs can be created and run in CDM clusters to migrate data to the cloud or import data to the data lake. • CDM clusters can be used as agents of data connections in Management Center, which enable communications between DataArts Studio instances and data sources.	The DataArts Studio instance contains a CDM cluster that can be used for informal scenarios such as testing and trial use. • If the cluster meets your needs, you do not need to buy a CDM incremental package. • If you need another CDM cluster that can meet your needs, buy a pay-per-use CDM incremental package. • If you want to reduce the costs of your CDM cluster, you can buy a CDM incremental package billed based on a package. **NOTE** Due to specifications restrictions, the free CDM cluster provided by a DataArts Studio instances can only be used for informal scenarios such as testing and trial use. To run your migration workloads, buy a CDM incremental package. In addition, you are not advised to use a CDM cluster that serves as a data connection agent to run data migration jobs.	• Pay-per-use • Package

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Package Type	Description	Scenario	Purchase Mode
DataArts DataService Exclusive cluster incremental package	This package corresponds to a DataArts DataService Exclusive cluster. When you create a DataArts DataService Exclusive cluster incremental package, the system automatically creates a DataArts DataService Exclusive cluster based on your selected specifications. DataArts DataService is a standard data service platform that allows you to generate data APIs quickly from data tables. Using the APIs, you can open your data in a simple, fast, low-cost, and secure way. To use DataArts DataService, you must create a DataArts DataService Exclusive cluster first.	A DataArts Studio instance does not contain a DataArts DataService Exclusive cluster. To use DataArts DataService Exclusive, you must create a DataArts DataService Exclusive cluster incremental package.	Yearly/ Monthly

2.2.2 Buying a DataArts Migration Incremental Package

A DataArts Migration (that is, CDM) incremental package provides resources for a CDM cluster.

- When you buy a pay-per-use CDM incremental package, the system automatically creates a CDM cluster based on the specifications you select for the incremental package.
- When you buy a CDM incremental package which is billed based on a package, the system does not automatically create a CDM cluster. Instead, you can use a CDM cluster you have obtained on the DataArts Studio console for 745 hours each month within the validity period of the incremental package.

CDM clusters can be used in the following scenarios:

- Data migration jobs can be created and run in CDM clusters to migrate data to the cloud or import data to the data lake.
- CDM clusters can be used as agents of data connections in Management Center, which enable communications between DataArts Studio instances and data sources.

The DataArts Studio instance contains a CDM cluster that can be used for informal scenarios such as testing and trial use.

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- If the cluster meets your needs, you do not need to buy a CDM incremental package.
- If you need another CDM cluster that can meet your needs, buy a pay-per-use CDM incremental package.
- If you want to reduce the costs of your CDM cluster, you can buy a CDM incremental package billed based on a package.

NOTE

Due to specifications restrictions, the free CDM cluster provided by a DataArts Studio instances can only be used for informal scenarios such as testing and trial use. To run your migration workloads, buy a CDM incremental package. In addition, you are not advised to use a CDM cluster that serves as a data connection agent to run data migration jobs.

Context

- When buying a CDM incremental package (pay-per-use resource package), pay attention to the following:
  - When you buy a CDM incremental package which is billed based on a pay-per-use package, the system does not automatically create a CDM cluster. Instead, you can use a CDM cluster you have obtained on the DataArts Studio console for 745 hours each month within the validity period of the incremental package.
  - The pay-per-use resource package can only be used to create a CDM cluster on the DataArts Studio console but not a CDM cluster on the CDM console. To create a CDM cluster on the CDM console, you must buy a discount package (pay-per-use resource package) on the CDM console.
  - A discount package can be used by one or more qualified CDM clusters in the specified region. Any resource usage beyond the package quotas is billed based on a pay-per-use basis.

    For example, if you purchase a one-month package (745 hours/month) and two CDM clusters are associated with the package, 372.5 hours (about 15.5 days) can be allocated to each cluster within the one-month subscription. Any usage beyond the allocated hours will be charged in pay-per-use mode.
  - If you purchase a package and do not associate it with any CDM clusters, the quota in the package will not be consumed and the validity period of the package will not be extended as well. Therefore, you are advised to make a plan before buying a package.
  - If you want to enjoy the preferential price of the yearly/monthly incremental package, you can buy a yearly/monthly incremental package and then buy a pay-per-use incremental package which is in the same region and has the same specifications as the yearly/monthly incremental package.
  - If you buy a pay-per-use incremental package and then a yearly/monthly incremental package in the same region and with the same specifications as the pay-per-use incremental package, the fees generated before you buy the yearly/monthly incremental package are charged in pay-per-use mode, and the subsequent fees are charged based on the yearly/monthly incremental package.

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- You can locate a DataArts Studio instance, click **More**, and select **View Packages** to view your incremental packages.
- You can buy a CDM cluster by buying an incremental package on the DataArts Studio console. You can also buy a CDM cluster directly on the CDM console. The two methods differ in the following ways:

  a. Package billing: CDM clusters purchased on the DataArts Studio console can be billed only by packages purchased on the DataArts Studio console. CDM clusters purchased on the CDM console can be billed only by discount packages purchased on the CDM console.

  b. Permission control: Permissions of the CDM clusters purchased on the DataArts Studio console are managed based on the DataArts Studio permission system. Permissions of the clusters purchased on the CDM console are managed based on the CDM permission system.

  c. Application scenarios: Clusters purchased on the DataArts Studio console are isolated by workspace and can be used only in associated workspaces. Clusters purchased on the CDM console do not support workspace-level resource isolation and can be used in all DataArts Studio workspaces.

  This section uses the first method as an example, which is recommended.

a Pay-Per-Use CDM Cluster

If you buy a pay-per-use incremental package, the system automatically creates a CDM cluster based on the specifications you select.

1. Locate an enabled instance and click .
2. On the displayed page, set parameters based on **Table 2-3**.

Table 2-3 Parameters for the CDM incremental package

Parameter	Description
Package	Select **DataArts Migration**.
Billing Mode	Select **Pay per Use**.
AZ	When you your first DataArts Studio instance or incremental package, you can select any available AZ. When you another DataArts Studio instance or incremental package, determine whether to select the same AZ as the first instance or incremental package based on your DR and network latency demands. • If your application requires good DR capability, select an AZ different from that of the first instance or incremental package in the same region. • If your application requires a low network latency between instances, select the same AZ as the first instance or incremental package. For details, see **Regions and AZs**.

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Parameter	Description
Workspace	Select the workspace where the CDM incremental package is to be used. A CDM cluster can be used in a workspace only after the CDM cluster is associated with the workspace.
Enterprise Project	If the CDM cluster is associated with multiple workspaces, select an enterprise project for the CDM cluster.
Cluster Name	Customize the cluster name.
Instance Type	The following CDM cluster flavors are available: • **cdm.large**: the large flavor with 8 vCPUs and 16 GB of memory. The maximum and assured bandwidths are 3 Gbit/s and 0.8 Gbit/s. Up to 16 jobs can be executed concurrently. • **cdm.xlarge**: the ultra-large flavor with 16 vCPUs and 32 GB of memory. The maximum and assured bandwidths are 10 Gbit/s and 4 Gbit/s. Up to 32 jobs can be executed concurrently. This flavor is suitable for migrating terabytes of data that requires a bandwidth of 10GE. • **cdm.4xlarge**: the 4x ultra-large flavor with 64 vCPUs and 128 GB of memory. The maximum and assured bandwidths are 40 Gbit/s and 36 Gbit/s. Up to 128 jobs can be executed concurrently.
VPC Subnet Security Group	VPC, subnet, and security group to which the CDM cluster in the DataArts Studio instance belongs. If you want to connect the DataArts Studio instance or CDM cluster to a cloud service such as GaussDB(DWS), MRS, and RDS, ensure that the CDM cluster can communicate with the cloud service. If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If the CDM cluster and the cloud service are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about the operations on VPCs, subnets, and security groups, see ***Virtual Private Cloud User Guide***. **NOTE** • After the CDM cluster is created, its VPC, subnet, and security group cannot be changed. Set them carefully. • You can select a VPC subnet shared by the VPC owner when you a CDM cluster. Through VPC subnet sharing, you can easily configure and manage multiple accounts' resources at low costs. For details about how to share a VPC subnet, see **VPC Sharing**.

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Parameter	Description
IPv6 Dual Stack	Whether to enable IPv6 dual stack. If you enable this function, both private IPv4 and IPv6 addresses can be used to access the cluster. **NOTE** • If you enable this function, you can only select subnets for which IPv6 CIDR blocks are enabled. If IPv6 CIDR blocks are disabled for the subnet you want to select, enable IPv6 CIDR blocks for the subnet in the VPC service. • IPv6 dual stack can be enabled for private IP addresses, but not for public IP addresses.

NOTICE

You cannot modify the specifications of an existing cluster. If you need higher specifications, create another cluster.

3. Click **Now**, confirm the specifications, and click **Next**.
4. Go to the corresponding workspace to view the CDM cluster you have .

Buying a Pay-per-Use Package

If you want to enjoy the favorable price of a package, you can buy an incremental package billed by package and then buy a pay-per-use incremental package which is in the same region and has the same specifications as the incremental package billed by package.

1. Locate an enabled instance and click .
2. Access the page for buying a DataArts Studio incremental package and set the following parameters:
   a. Select **DataArts Migration** for **Package**.
   b. Select **Pay-per-Use Package** for **Billing Mode**.
   c. Specify a validity period in **Required Duration** for the package.
   d. Enter the number of packages you want to buy in **Quantity**. For example, if you set **Required Duration** to **1 month** and **Quantity** to **2**, you will have a 1490-hour quota in one month.
3. Click **Buy Now**, confirm the specifications, and click **Next**.
4. After you buy this package, the system will not automatically create a CDM cluster. You need to buy a pay-per-use incremental package in the same region and with the same specifications as this package by following the instructions in **a Pay-Per-Use CDM Cluster**. Then you can enjoy the favorable price of this package.

2.2.3 Buying a DataArts Migration Resource Group Incremental Package

This type of incremental package provides resource groups for real-time jobs in DataArts Migration. DataArts Migration resource groups can be used to migrate

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data to the cloud and ingest data into and export data out of a data lake. It provides wizard-based configuration and management and can migrate all and incremental data from a single table, entire database, or database or table shard.

- When you buy a pay-per-use DataArts Migration resource group incremental package, the system automatically creates a resource group required by real-time data integration jobs based on the specifications you set for the incremental package.
- When you buy a DataArts Migration resource group incremental package which is billed based on a package, the system does not automatically create a resource group. Instead, you can use a resource group you have obtained on the DataArts Studio console for 745 hours each month within the validity period of the incremental package.

DataArts Migration resource groups can be used in the following scenarios:

They can be used to create and run real-time processing migration jobs to migrate data to the cloud or ingest data into the data lake.

By default, a DataArts Studio instance does not contain DataArts Migration resource groups. If you want to migrate data in real time, create a DataArts Migration resource group incremental package.

Context

- When you create a DataArts Migration resource group incremental package, the system automatically creates a resource group required by real-time data integration jobs based on the specifications you set for the incremental package.
- When buying a DataArts Migration resource group incremental package (pay-per-use resource package), pay attention to the following:
  - When you buy a DataArts Migration resource group incremental package which is billed based on a pay-per-use package, the system does not automatically create a resource group for real-time processing migration jobs. Instead, you can use a resource group you have obtained on the DataArts Studio console for 745 hours each month within the validity period of the incremental package and in a specified region.
  - If you have one or more resource groups in a region, the duration quota of your resource package will be deducted first. Any usage beyond the quota will be billed in pay-per-use mode. (If a resource package is shared by multiple clusters, the available package duration may be insufficient in each subscription period.)

    For example, if you purchase a one-month package (745 hours/month) and two resources are associated with the package, 372.5 hours (about 15.5 days) can be allocated to each resource group within the one-month subscription. Any usage beyond the allocated hours will be billed in pay-per-use mode.
  - If you purchase a package and do not associate it with any resource group, the duration quota in the package will not be consumed and the validity period of the package will not be extended as well. Therefore, you are advised to make a plan before buying a package.
  - If you want to enjoy the preferential price of the yearly/monthly incremental package, you can buy a yearly/monthly incremental package

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and then buy a pay-per-use incremental package which is in the same region and has the same specifications as the yearly/monthly incremental package.

- If you buy a pay-per-use incremental package and then a yearly/monthly incremental package in the same region and with the same specifications as the pay-per-use incremental package, the fees generated before you buy the yearly/monthly incremental package are charged in pay-per-use mode, and the subsequent fees are charged based on the yearly/monthly incremental package.

- You can locate a DataArts Studio instance, click **More**, and select **View Packages** to view your incremental packages.
- The prices of resource groups vary depending on their specifications. For details, see . You can also access the of DataArts Studio and select a region and specifications to quickly obtain the price of a resource group.

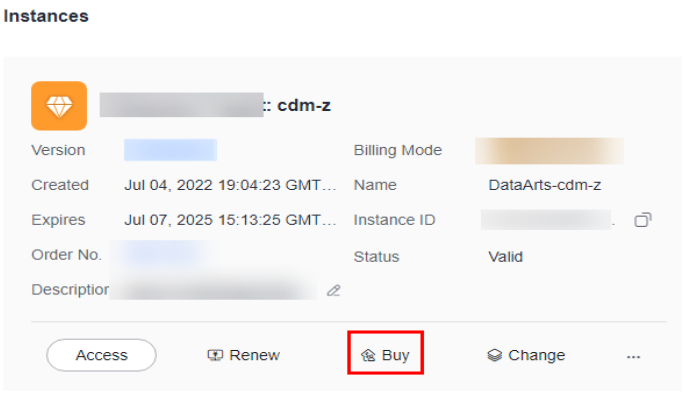
a Pay-Per-Use DataArts Migration Resource Group

When you buy a pay-per-use incremental package, the system automatically creates a resource group required by real-time data migration jobs based on the specifications you set for the incremental package.

1. You can buy a resource group in either of the following ways:
   - Method 1

     Locate an enabled instance and click .

     Figure 2-3 Incremental package

   - Method 2

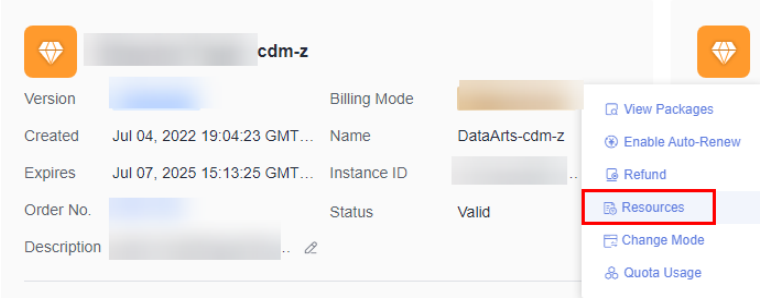
     i. Locate an instance and click **Access**.

     ii. In the upper right corner, click **Buy**.
   - Method 3

     i. Locate an instance, click **More**, and select **Resources**.

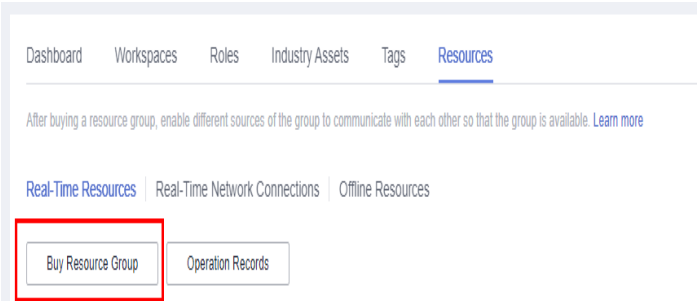
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Figure 2-4 Accessing Resources



ii. On the **Real-Time Resources** tab page, click **Buy Resource Group**.

Figure 2-5 Buying a resource group



2. On the displayed page, set parameters based on **Table 2-4**.

Figure 2-6 a DataArts Migration resource group

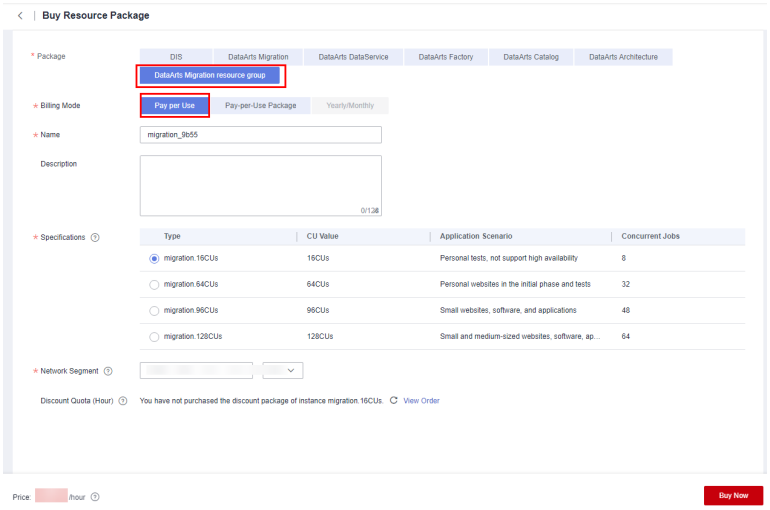


Table 2-4 Parameters for the DataArts Migration resource group incremental package

Parameter	Description
Package	DataArts Migration resource group
Billing Mode	Select **Pay per Use**.

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Parameter	Description
Name	Enter the resource group name.
Description	Enter a description for the DataArts Migration resource group.
Specifications	Select the specifications for the resource group, including the CU value, applicable environment, and maximum number of jobs that can be created. The maximum number of migration tasks or jobs that can be created varies depending on the resource group specifications. Select the specifications that suit your needs. A maximum of 50 tables can be created for a single job (at least 2 CUs are required). Small: 16 CUs and a maximum of 7 jobs This option is applicable to tests and does not support high availability. It is not recommended. Medium: 64 CUs and a maximum of 32 jobs Large: 96 CUs and a maximum of 48 jobs Super-large: 128 CUs and a maximum of 64 jobs
Network Segment	Recommended network segments: • 10.0.0.0–10.255.0.0/8–19 • 172.16.0.0–172.31.0.0/12–19 • 192.168.0.0~192.168.0.0/16 ~19 **NOTE** • To use VPC peering connections, set a network segment that does not overlap with that of the source and destination cluster or instance. If they overlap, the network will be disconnected. • Restricted by the CCE logic, the maximum length of the network segment mask is 19 bits. Network segments with a mask longer than 20 bits are not supported.
Discount Quota (Hour)	A discount package is prepaid by month or year. Compared with pay-per-use billing, the fee is reduced by 15% to 29%.

NOTICE

- You cannot modify the specifications of an existing resource group. If you need higher specifications, create another resource group.
- A pay-per-use resource package in use cannot be unsubscribed from. For details, see **Unsubscription Not Allowed**.

3. Click **Now**, confirm the settings, and click **Next**. If the resource group fails to be created and a quota issue is displayed, contact the service personnel to apply for a quota.

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4. Go to the corresponding workspace to view the DataArts Migration resource group you have .

Buying a DataArts Migration Resource Group Billed Based on a Package

If you want to enjoy the favorable price of a package, you can buy an incremental package billed by package and then buy a pay-per-use incremental package which is in the same region and has the same specifications as the incremental package billed by package.

1. On the displayed page, set the following parameters:
   a. Select **DataArts Migration resource group** for **Package**.
   b. Select **Pay-per-Use Package** for **Billing Mode**.
   c. Specify a validity period in **Required Duration** for the package.
   d. Enter the number of subscribed packages in **Quantity**. For example, if you set **Required Duration** to **1 month** and **Quantity** to **2**, you will have a 1,490-hour quota in one month.
2. Click **Buy Now**, confirm the specifications, and click **Next**.
3. After you buy this package, the system will not automatically create a DataArts Migration resource group. You need to buy a pay-per-use incremental package in the same region and with the same specifications as this package by following the instructions in **a Pay-Per-Use DataArts Migration Resource Group**. Then you can enjoy the favorable price of this package.

2.2.4 Buying a DataArts DataService Exclusive Cluster Incremental Package

This package corresponds to a DataArts DataService Exclusive cluster. When you create a DataArts DataService Exclusive cluster incremental package, the system automatically creates a DataArts DataService Exclusive cluster based on your selected specifications.

DataArts DataService is a standard data service platform that allows you to generate data APIs quickly from data tables. Using the APIs, you can open your data in a simple, fast, low-cost, and secure way. To use DataArts DataService, you must create a DataArts DataService Exclusive cluster first.

A DataArts Studio instance does not contain a DataArts DataService Exclusive cluster. To use DataArts DataService, you must create a DataArts DataService Exclusive cluster incremental package.

Context

- You can locate a DataArts Studio instance, click **More**, and select **View Packages** to view your incremental packages.

a DataArts DataService Exclusive Cluster

Step 1 Locate an enabled instance and click .

Step 2 On the displayed page, set parameters based on **Table 2-5**.

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Table 2-5 Parameters for an exclusive DataArts DataService instance

Parameter	Description
Package	Select **DataArts DataService**.
Billing Mode	Currently, **Yearly/Monthly** is supported.
Workspace	The workspace for which you want to use the incremental package. For example, if you want to use DataArts DataService Exclusive in workspace A of the DataArts Studio instance, select workspace A. After you buy an exclusive DataArts DataService cluster, you can view it in workspace A. If you want to use the cluster in other workspaces, you can share it with those workspaces by referring to **Managing Cluster Sharing**.
AZ	Select the AZ where the DataArts DataService Exclusive cluster is located. Select **One AZ** or **Multiple AZs**. **Multiple AZs** is recommended. • **One AZ**: Nodes of the DataArts DataService Exclusive cluster are deployed in the same AZ. • **Multiple AZs**: Nodes of the DataArts DataService Exclusive cluster are deployed in 2 to 10 AZs. For details, see **Regions and AZs**.
Name	The cluster name must start with a letter and can contain only letters, digits, hyphens (-), and underscores (_). It must contain at least five characters.
Description	A description of the exclusive DataArts DataService cluster.
Version	Cluster version of the exclusive DataArts DataService cluster.
Cluster Details	The number of APIs supported varies depending on the instance specifications.
Public Address	Enable this function. When the cluster is created, a new EIP is automatically bound to the cluster. You can use this EIP to call the APIs of the exclusive cluster. The EIP assigned through this function is free. If you want to call APIs locally or across networks, you are advised to enable this function. If you do not enable this function during cluster creation, you cannot bind an EIP to the cluster later.
Bandwidth	Bandwidth range on the Internet.

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Parameter	Description
VPC	VPC, subnet, and security group to which the DataArts DataService Exclusive cluster in the DataArts Studio instance belongs. Cloud resources (such as ECSs) within the same VPC, subnet, and security group can call APIs using the private IP address of the DataArts DataService Exclusive instance. Deploy the DataArts DataService Exclusive cluster in the same VPC, subnet, and security group as your other services to facilitate network configuration and secure network access. For details about the operations on VPCs, subnets, and security groups, see ***Virtual Private Cloud User Guide***. **NOTE** • After a DataArts DataService Exclusive cluster is created, the VPC, subnet, and security group of the cluster cannot be changed. Exercise caution when setting them during the cluster creation. • If **Enabling the public IP address** is selected, the security group must allow access from ports 80 (HTTP) and 443 (HTTPS) in the inbound direction. • You can select a VPC subnet shared by the VPC owner when you buy a DataArts DataService Exclusive cluster. Through VPC subnet sharing, you can easily configure and manage multiple accounts' resources at low costs. For details about how to share a VPC subnet, see **VPC Sharing**.
Subnet	
Security Group	
Managing Cluster Resources Using an Enterprise Project	Enterprise project associated with the exclusive DataArts DataService cluster. An enterprise project facilitates management of cloud resources. For details, see **Enterprise Management User Guide**.
Nodes	N/A
Required Duration	N/A

Step 3 Click **buy Now**, confirm the settings, and click **Next**.

----End

2.3 Accessing the DataArts Studio Instance Console

Prerequisites

You have obtained a DataArts Studio instance. For details, see **Buying a DataArts Studio Instance**.

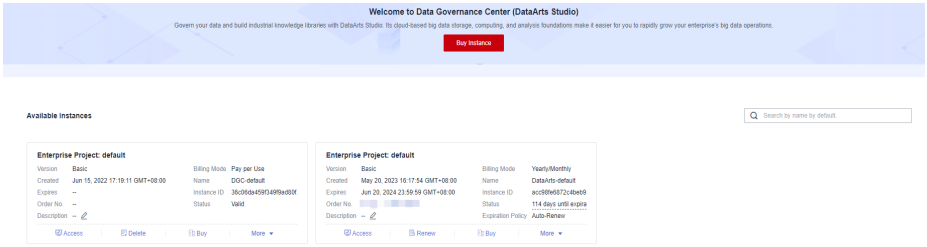
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Procedure

Step 1 Log in to the console. Choose DataArts Studio from the service list in the upper left corner.

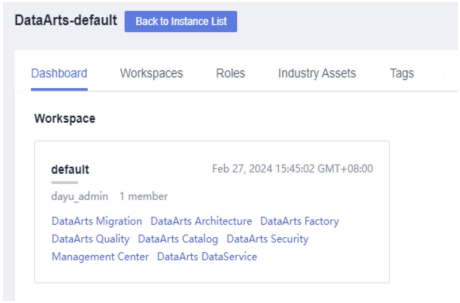
- If there are multiple DataArts Studio instances in the current region, the instance list is displayed by default. Locate an instance and click **Access** to access the DataArts Studio console homepage.

  Figure 2-7 Instance list

- If there is only one DataArts Studio instance in the current region, the DataArts Studio console homepage is displayed by default.

  Figure 2-8 Homepage of the console

----End

2.4 Creating and Configuring a Workspace in Simple Mode

2.4.1 Creating a Workspace in Simple Mode

The system creates a default workspace named **default** for the DataArts Studio instance you and assigns administrator permissions to you. You can use the default workspace or create another workspace.

A workspace in a DataArts Studio instance is the basic unit for member management and role and permission allocation. It provides all DataArts Studio functions. Workspaces are allocated by branch or subsidiary (such as the group, subsidiary, and department), business domain (such as the procurement,

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production, and sales), or implementation environment (such as the development, test, and production environment). There are no fixed rules.

As an admin, you can manage user (member) permissions, resources, and compute engines for a workspace. To enable users to work together, admins can add users to a workspace and assign the preset roles of DataArts Studio (admin, developer, operator, and visitor) to the users. Users other than admins can access Management Center, DataArts Migration, DataArts Architecture, DataArts Catalog, DataArts Quality, DataArts DataService, DataArts Security, and DataArts Factory only after they are added to a workspace and assigned relevant roles.

Notes and Constraints

- There is no limit on the number of workspaces that can be created for a DataArts Studio instance.
- The storage of job logs and dirty data depends on the OBS service.

Prerequisites

You have obtained a DataArts Studio instance. For details, see **Buying a DataArts Studio Instance**.

Context

- The system creates a default workspace named **default** for the DataArts Studio instance you and assigns admin role to you.
- In a DataArts Studio instance created by an account, if an IAM user of the account needs to create a workspace, the IAM user must be assigned the **DAYU Administrator** or **Tenant Administrator** permissions. By default, the account has all the permissions for a DataArts Studio instance created by a user of the account.
- Users with the DAYU User permissions can access a workspace only after they are added as members of the workspace.

Creating a Workspace

Step 1 Log in to the DataArts Studio console as user **DAYU Administrator** or **Tenant Administrator**. For details, see **Accessing the DataArts Studio Instance Console**.

Step 2 On the **Workspaces** page, click **Create Workspace**. In the displayed dialog box, set the parameters listed in **Table 2-6**.

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Figure 2-9 Creating a workspace

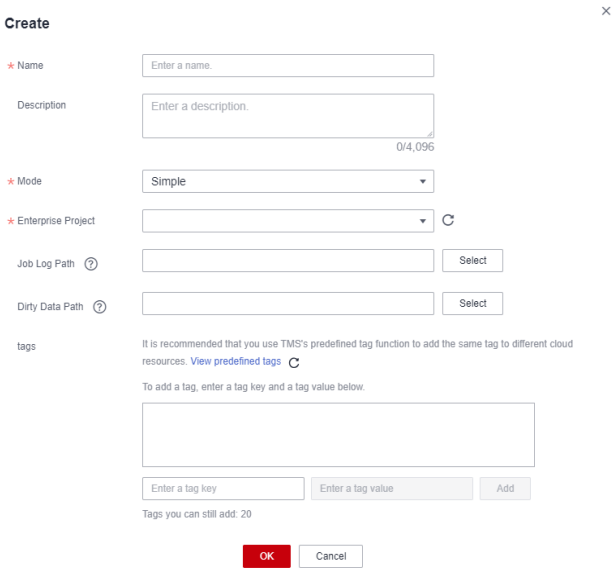


Table 2-6 Parameters for creating a workspace

Parameter	Description
Name	Workspace name. It can contain a maximum of 32 characters, including only letters, digits, underscores (_), and hyphens (-). The workspace name must be unique in the current DataArts Studio instance.
Description	Workspace description
Mode	Select the workspace mode. • **Simple**: This mode is easy to use, but does not allow you to strictly control data development processes and table permissions. • **Enterprise**: In this mode, you can isolate the development environment from the production environment in the DataArts Factory and Management Center modules of DataArts Studio. This prevents developers' operations from affecting services in the production environment. For details about the enterprise mode, see **Enterprise Mode Overview**.

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Parameter	Description
Enterprise Project	Enterprise project associated with the default workspace of the DataArts Studio instance. An enterprise project facilitates management of cloud resources. For details, see ***Enterprise Management User Guide***. This parameter is available only when an enterprise project has been created. If you want to connect the DataArts Studio instance to an instance of another cloud service, such as GaussDB(DWS), MRS, and RDS, ensure that the enterprise project of the DataArts Studio instance's workspace is the same as that of the target cloud service instance. • You can only one DataArts Studio instance for an enterprise project. • If you want to enable communication between DataArts Studio and another cloud service, ensure that the enterprise project of DataArts Studio is the same as that of the target cloud service. **NOTE** If the enterprise project function is not enabled, only one DataArts Studio instance can be created for each IAM project.
Job Log Path	OBS bucket for storing the job logs of DataArts Factory of DataArts Studio. To use the DataArts Factory module of DataArts Studio, workspace members must have the read and write permissions on the OBS bucket for storing job logs. Otherwise, the system cannot read or write job logs of DataArts Factory. • Click **Select**. You can select an existing OBS bucket. The selected OBS bucket is globally configured in the current workspace. • If this parameter is not set, job logs generated during data development are stored in the OBS bucket named **dlf-log-{projectId}** by default. **{projectId}** indicates the project ID, which can be obtained in the following way: 1. Register with and log in to the management console. 2. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list. 3. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list. **NOTE** The execution logs of data development jobs are stored in *xxxxx*.log format in an OBS bucket. *xxxxx* indicates the job ID. Deleting the historical records of SQL statements that have been executed does not affect services.

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Parameter	Description
Dirty Data Path	OBS bucket for storing dirty data generated during DLI SQL execution in DataArts Factory of DataArts Studio. To use DataArts Factory to develop and execute DLI SQL statements, workspace members must have the read and write permissions on the OBS bucket where DLI dirty data is stored. Otherwise, the system cannot read or write the dirty data generated during DLI SQL execution. • Click **Select**. You can select a created OBS bucket. The selected OBS bucket is globally configured in the current workspace. • If you do not set this parameter, dirty data generated during DLI SQL execution is stored in the OBS bucket named **dlf-log-{projectId}** by default.
Tags	You can add resource tags to classify resources. **NOTE** If your account belongs to an organization and the organization has configured DataArts Studio tag policies, you need to add tags based on these policies. If a tag does not comply with the tag policies, instance creation may fail. Contact your administrator to learn more about tag policies. If you have multiple workspaces, you can add tags to classify them by user, operator, or purpose. On the workspace list page, you can search for workspaces by tag. A tag consists of a key and a value. When adding a tag, you can select a predefined tag created in Tag Management Service (TMS) or enter a custom tag. Then click **Add** to the right of the text box to add the tag. **NOTE** To select predefined tags, ensure that you have created predefined tags in TMS. You can click **View predefined tags** to enter the **Predefined Tag** page of TMS. Then, click **Create Tag** to create a predefined tag. For details, see **Creating Predefined Tags** in *Tag Management Service User Guide*. A maximum of 20 tags can be added to a workspace. Each tag key must be unique and can only match one tag value.

Step 3 Click **OK**.

----End

Related Operations

- Disabling a workspace: After a workspace is created, it is enabled by default. If you do not need a workspace, you can disable it. If you want to use it in the future, you can enable it again.

  On the **Workspaces** page, locate the target workspace, click **More** in the **Operation** column, and select **Disable Workspace**. In the **Disable Workspace** dialog box displayed, read the impact of disabling a workspace. If you want to continue, click **Yes**.

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NOTE

If you disable a workspace, you cannot access the workspace, edit the workspace, or view the quota of the workspace. In addition, jobs being scheduled in the workspace will stop.

CDM clusters in the workspace will still be billed.

- Enabling a workspace: On the **Workspaces** page, locate the workspace you want to enable, click **More** in the **Status** column, and select **Enable Workspace**. In the **Enable Workspace** dialog box displayed, read the impact of enabling a workspace. If you want to continue, click **Yes**.
- Editing a workspace: On the **Workspaces** page, locate the workspace you want to edit and click **Edit** in the **Operation** column. In the displayed **Workspace Information** dialog box, modify workspace parameters by referring to **Table 2-6** and click **OK**.

  When editing a workspace, you cannot modify tags (see **adding or editing tags**), but you can add workspace members (see **Adding Workspace Members and Assigning Roles**) and configure workspace quotas (see **Setting Workspace Quotas**).
- Adding or editing tags: On the **Workspaces** page, locate a workspace, click **More** in the **Operation** column, and select **Tags** In the **Tags** dialog box, click **Add/Edit Tag** to add tags to the workspace or modify tags of the workspace.
- Viewing the quota usage: On the **Workspaces** page, locate a workspace and click **Quota Usage** in the **Operation** column. In the displayed **Quota Usage** dialog box, you can view the quota usage of each module.
- Pinning a workspace to top: On the **Workspaces** page, locate a workspace, click **More** in the **Operation** column, and select **Pin to Top**.
- Deleting a workspace: On the **Workspaces** page, locate a workspace, click **More** in the **Operation** column, and select **Delete**. In the **Delete Workspace** dialog box, click **OK**.

  NOTE

  Mis-deletion may result in service loss. To delete a workspace, you must use the **DAYU Administrator** or **Tenant Administrator** account and ensure that the workspace does not contain any of the following resources:

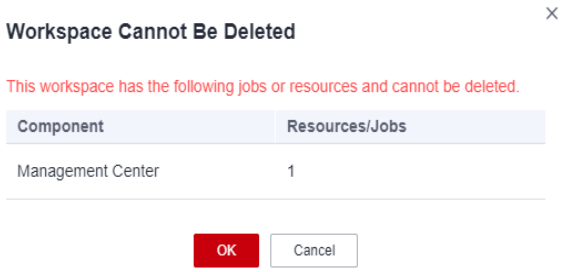
  - Management Center: data connections
  - DataArts Migration: CDM clusters
  - DataArts Architecture: subjects, logical models, standards, physical models, dimensional models, and metrics
  - DataArts Factory: jobs, job directories, scripts, script directories, and resources
  - DataArts Quality: quality jobs and comparison jobs
  - DataArts Catalog: technical assets including tables and files, and metadata collection tasks
  - DataArts DataService: clusters, APIs, and apps
  - DataArts Security: sensitive data discovery tasks, masking policies, static masking tasks, and data watermarking tasks

  If any module has resources, a message is displayed, indicating that the workspace cannot be deleted.

  If any module has resources, delete the resources as prompted and try again.

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Figure 2-10 Message indicating that the workspace cannot be deleted



2.4.2 Setting Workspace Quotas

Before using DataArts Studio, you need to set quotas for the current workspace. Currently, only the API quota of DataArts DataService Exclusive can be set. If the used quota of the current workspace exceeds the allocated quota or the total used quota exceeds the total allocated quota, some functions will be unavailable. For example, you cannot create APIs in DataArts DataService Exclusive.

- Used quota: quota that has been used in the current workspace. It is automatically calculated by the system.
- Allocated quota: quota allocated to the current workspace by the administrator
- Total used quota: quota that has been used in the current instance. It is automatically calculated by the system.
- Total allocated quota: quota that has been allocated to all workspaces in the current instance. It is automatically calculated by the system.
- Total quota: quota of the current instance. It is a fixed value and cannot be changed.

Prerequisites

You are using either of the following accounts:

- **DAYU Administrator** or **Tenant Administrator**
- **DAYU User**, which is the administrator of the current workspace

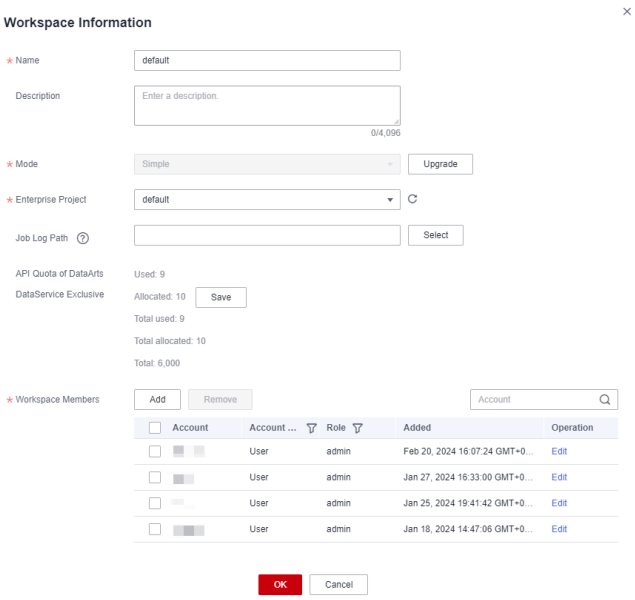
Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the **Workspaces** page, locate the target workspace and click **Edit** in the **Operation** column.

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Figure 2-11 Workspace Information dialog box



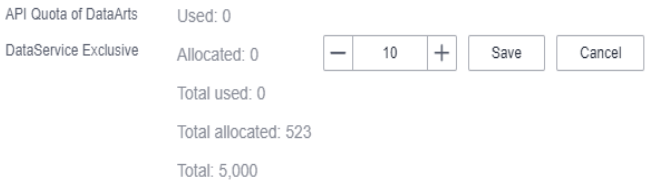
Step 3 Locate **API Quota of DataArts DataService Exclusive** and click **Edit** in the **Operation** column to set it. Click **OK** to save the change.

The allocated quota indicates the quota that can be used in the current workspace. It cannot be less than the used quota or greater than the unallocated quota (total quota minus total allocated quota).

NOTE

You can create 10 DataArts DataService Exclusive APIs for free in each DataArts Studio instance, and you will be billed for each extra API.

Figure 2-12 Setting the allocated quota



Step 4 In the **Workspace Information** dialog box, click **OK**.

----End

2.4.3 (Optional) Changing the Job Log Storage Path

By default, job logs and DLI dirty data are stored in an OBS bucket named **dlf-log-**{*project ID*}. You can customize a storage path for logs and one for DLI dirty data. You can also configure an OBS bucket globally based on the workspace.

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Notes and Constraints

- This function depends on the OBS service.
- The OBS path is only supported for OBS buckets and not for parallel file systems.

Prerequisites

You are using either of the following accounts:

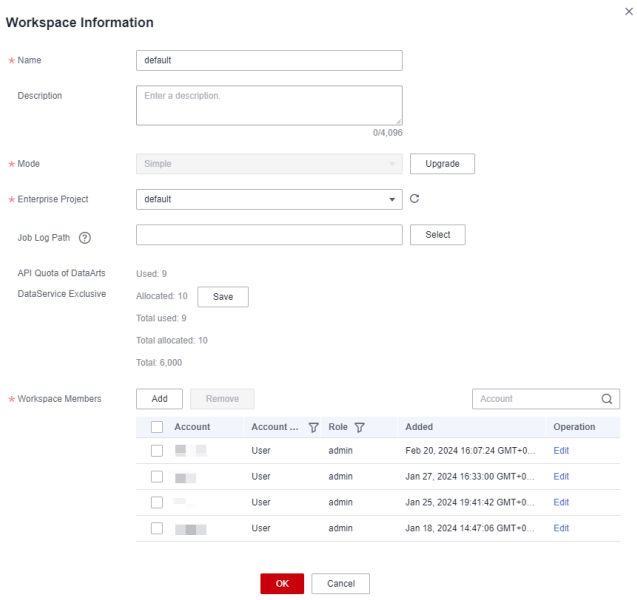
- **DAYU Administrator** or **Tenant Administrator**
- **DAYU User**, which is the administrator of the current workspace

Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts St**.

Step 2 On the **Workspaces** page, locate the target workspace and click **Edit** in the **Operation** column.

Figure 2-13 Workspace Information dialog box



Step 3 In the **Workspace Information** dialog box, click **Select** next to **Job Log Path** and **Dirty Data Path** and select a path.

Figure 2-14 Changing the job log path and DLI dirty data path



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Step 4 Click **OK**.

----End

2.5 (Optional) Creating and Using a Workspace in Enterprise Mode

2.5.1 Introduction to the Enterprise Mode

DataArts Studio provides two workspace modes, the simplified mode and enterprise mode, to help you manage your production data with varied security control requirements. This section describes the differences between the two modes from multiple dimensions, such as the physical form and impact on development.

NOTICE

Currently, only Management Center and DataArts Factory support the enterprise mode.

In simple mode, you need to create two workspaces, one for the development environment and the other for the production environment. In this way, you can isolate the development and production environment. You can export scripts or jobs from the development workspace and import them to the production workspace. In this mode, you cannot synchronize the production and development environment easily as there is no approval for the synchronization. To address these issues, you can use a workspace in enterprise mode to isolate the development and production environment. The one-click release and approval process improves your efficiency in task release.

You are advised to upgrade to the enterprise mode for your workspace to better manage the development process. For details, see **Creating a Workspace in Enterprise Mode**.

Background

This section contains the following parts which resolve the problems you may encounter when using the enterprise mode.

Table 2-7 Basics about the enterprise mode

Category	Description
Introduction to the Simple Mode and Enterprise Mode	Introduction to the two workspace modes
Comparison of Workspaces Using Different Modes in Production Task Development and O&M	Introduction to the task development and O&M mechanisms built based on the physical attributes of DataArts Studio workspaces

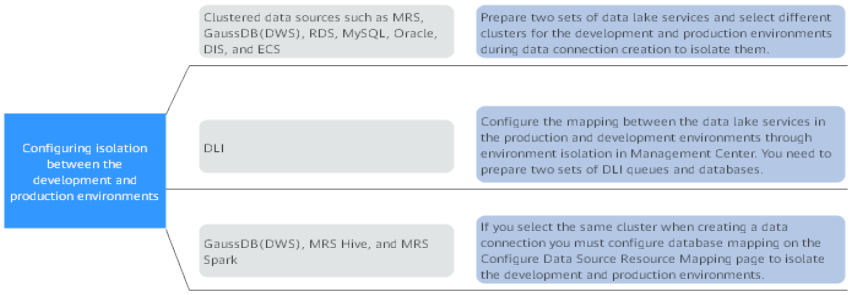
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Category	Description
Advantages and Disadvantages of Workspace Modes	Comparison of the advantages and disadvantages of the workspace modes
Process of Using DataArts Studio in Different Workspace Modes	Process control of the workspace in enterprise mode
Operations Allowed by DataArts Studio Modules in Different Workspace Modes	In the simple mode, only the production environment is available. In the enterprise mode, the development environment and production environment are available. This part describes the mapping between environments and DataArts Studio modules.

Important Notes

- Different workspace modes have certain requirements on the data lake engine. To isolate the development environment from the production environment of a workspace that uses the enterprise mode, you must configure a data lake engine for both environments. You can configure isolation between the development and production environments using any of the methods shown in the following figure.

  Figure 2-15 Configuring isolation between the development and production environments

  - Configure two sets of data lake services to isolate the development environment from the production environment.

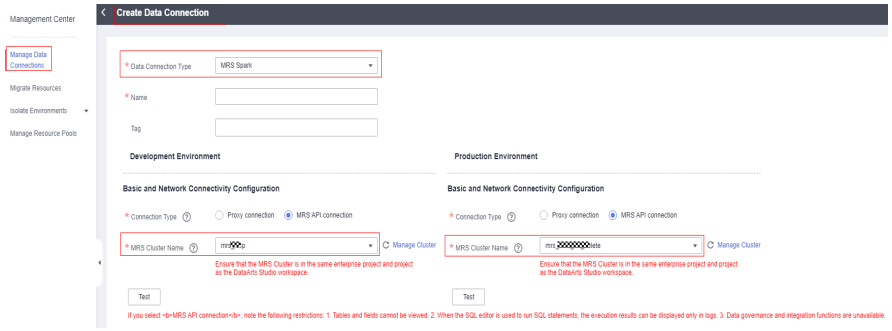
    For clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of data lake services that have the same version, specifications, components, region, VPC, subnet, and other related

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configurations. For details, see **Creating a DataArts Studio Data Connection**.

When creating a data connection, you can select different clusters for the development environment and production environment to isolate them.

Figure 2-16 Selecting different clusters during data connection creation



- Configure environment isolation for DLI.

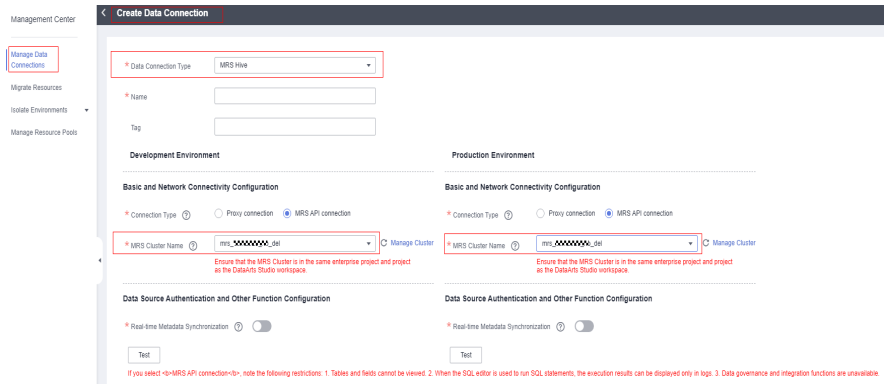
  Configure environment isolation in enterprise mode, including DLI queue configuration and DB configuration.

  For serverless services (such as DLI), you can configure the mapping between data lake services in the production environment and those in the development environment through environment isolation in Management Center. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of queues and database resources in the serverless data lake service and distinguish them by name suffix. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.

- Configure two databases in the same data lake service to isolate the development environment from the production environment.

  For GaussDB(DWS), MRS Hive, and MRS Spark, if you select the same cluster when creating a data connection (as shown in **Figure 2-17**), you must configure database mapping on the **Configure Data Source Resource Mapping** page shown in **Figure 2-18** to isolate the development and production environments. For details, see **DB configuration**.

Figure 2-17 Selecting the same cluster during data connection creation



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Figure 2-18 DB Configuration

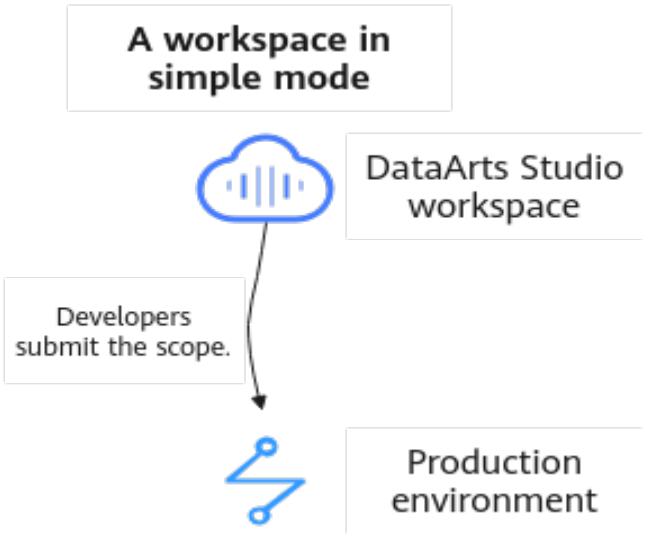


- Data development jobs in the development environment of a workspace that uses the enterprise mode are not scheduled by default. They can be scheduled only after released to the production environment.

Introduction to the Simple Mode and Enterprise Mode

Typically, DataArts Studio workspaces use the simple mode. In this mode, you cannot isolate the development and production environment in the DataArts Factory and Management Center modules of DataArts Studio, or control the data development process or table permissions. Instead, you can only perform simple data development operations. A data lake functions as the production environment of DataArts Studio.

Figure 2-19 A workspace using the simple mode



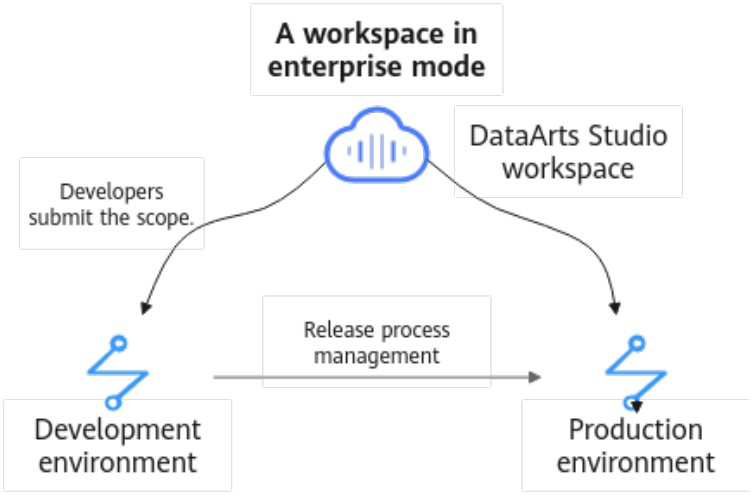
The enterprise mode of DataArts Studio workspaces eliminates the risks of the simple mode. In this mode, you can isolate the development environment from the production environment in the DataArts Factory and Management Center modules of DataArts Studio. This prevents developers' operations from affecting services in the production environment. This mode requires two data lakes, one as the development environment and the other as the production environment.

- The development environment is accessible only to developers for script and job development and release of scripts and jobs to the production environment.

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- The production environment is accessible only to end users and allows no change. Any change that is required must be made in the development environment and released to the production environment again.

Figure 2-20 A workspace using the enterprise mode



NOTE

- You can create a workspace in either mode to experience DataArts Studio. With a workspace in enterprise mode, you can isolate the code, compute resources, and permissions of the development environment from those of the production environment, and manage the task release process.
- If you are using a workspace in simple mode and want to experience the enterprise mode while retaining the code of the workspace, you can upgrade the workspace. For details, see **Creating a Workspace in Enterprise Mode**.

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Comparison of Workspaces Using Different Modes in Production Task Development and O&M

Table 2-8 Comparison of workspaces using different modes in production task development and O&M

Comparison Item	Simple Mode	Enterprise Mode (Recommended)
Management of the production task development process	After a task is submitted, it can be periodically executed to generate result data without being released. The process is submission and then production.	• You need to submit a task to the development environment and release the task to the production environment. Then the task can be automatically executed. The process is submission, release, and then production. • The production environment is accessible only to end users and allows no change. Any change that is required must be made in the development environment and released to the production environment again.
Management of the production task O&M permissions	Developers can directly edit scripts and jobs of production tasks.	Developers can edit and submit code on the DataArts Factory console, but cannot directly release code to the production environment. To release code to the production environment, developers must have the O&M permission. (The deployer, admin, and operator have this permission). • All scripts and jobs can be edited only in the development environment. The code in the production environment cannot be modified. • You can plan and manage task development and O&M processes on DataArts Studio based on the features of workspaces in enterprise mode and the role permission system of DataArts Studio. For details, see **Service Process in Enterprise Mode**.

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Comparison Item	Simple Mode	Enterprise Mode (Recommended)
Management of production data permissions	Developers can directly use production data for tests, posing security threats to production data.	Developers can use test data in the development environment. Data in the production environment is read-only.

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Advantages and Disadvantages of Workspace Modes

Table 2-9 Advantages and disadvantages of workspace modes

Comparison Item	Simple Mode	Enterprise Mode
Advantages	Simple, convenient, and easy to use • You only need to assign the developer role to data developers, and they are able to perform all data development tasks. • After submitting a script or job, you do not need to release it. The script or job can be periodically executed to generate result data.	Secure and normalized • A secure and normalized code release and management process (including code review and diff for checking code differences) is available. It ensures the stability of the production environment by avoiding unexpected circumstances such as dirty data spread and task errors caused by code logic. • Data access is effectively controlled to ensure data security. • All scripts and jobs can be edited only in the development environment. • Data in the development environment is isolated from that in the production environment. Developers cannot modify data in the production environment. • In the development environment, scripts and jobs are executed by the current developer. In the production environment, scripts and jobs are executed by a workspace-level public IAM account or public agency. • If any change is required for the production environment, the change must be made by a developer in the development environment first and then submitted to the production environment. The change can be successfully released only after being approved by the admin or deployer.

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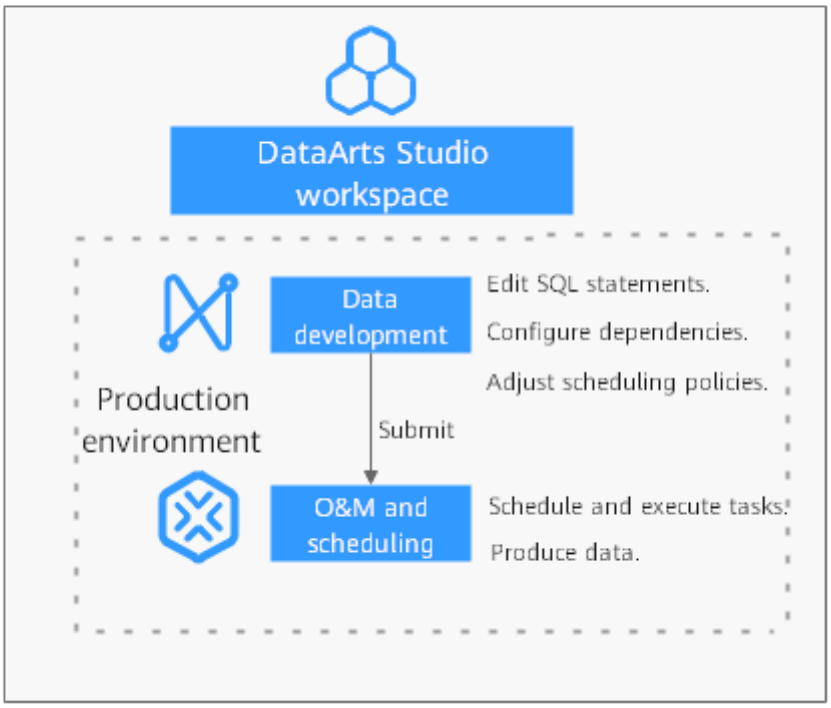
Comparison Item	Simple Mode	Enterprise Mode
Disadvantages	Unstable and insecure • The development environment cannot be isolated from the production environment. Only simple data development can be performed. • The permissions of production tables cannot be controlled. **NOTE** During development and commissioning, developers can directly access data in the production data lake and add, delete, and modify data in tables, posing threats to data security. • The data development process cannot be managed. **NOTE** Developers can add or modify scripts or jobs and submit them to the scheduling system without approval at any time, posing threats to service stability.	The process is relatively complex. Generally, one person cannot complete all data development and production tasks.

Process of Using DataArts Studio in Different Workspace Modes

- In the simple mode, you cannot isolate the development and production environment in the DataArts Factory and Management Center modules of DataArts Studio, or control the data development process or table permissions. Instead, you can only perform simple data development operations. After submitting a script or job, you do not need to release it. The script or job can be periodically executed to generate result data.

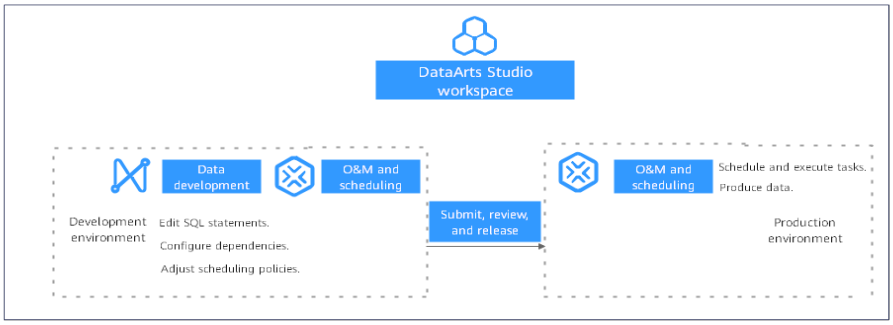
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Figure 2-21 Process in simple mode



- In the enterprise mode, you can isolate the development environment from the production environment in the DataArts Factory and Management Center modules of DataArts Studio. This prevents developers' operations from affecting services in the production environment. The development environment is accessible only to developers for script and job development and release of scripts and jobs to the production environment. The production environment is accessible only to end users and allows no change. Any change that is required must be made in the development environment and released to the production environment again.

Figure 2-22 Process in enterprise mode



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Operations Allowed by DataArts Studio Modules in Different Workspace Modes

Table 2-10 Operations allowed by modules in different workspace modes

DataArts Studio Module	Simple Mode	Enterprise Mode
Management Center	Perform operations in the production environment (data connection operations and data import and export).	Perform operations in the development and production environments (data source resource mapping configuration, data connection operations, and data import and export)
DataArts Factory	Perform operations on instances and databases in the production environment.	Perform operations on instances and databases in the development and production environments.

2.5.2 Creating a Workspace in Enterprise Mode

If you are using a workspace in simple mode and want to isolate the development and production environments, you can upgrade the workspace to one in enterprise mode. If you have not used any workspace in simple mode and do not need to inherit data, you can directly create a workspace in enterprise mode by following the instructions in this section.

Restrictions

You can upgrade your workspace mode or create a workspace in enterprise mode only if you are assigned the DAYU Administrator or Tenant Administrator role.

Prerequisites

Before creating a workspace, ensure that:

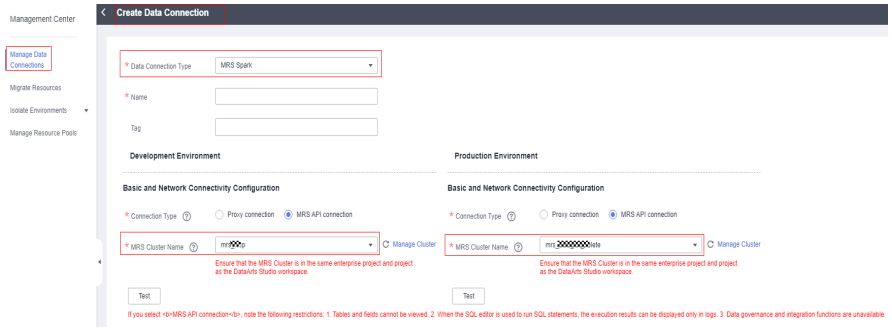
- You have understood the differences between workspaces in simple mode and those in enterprise mode, such as the differences in the development process. For details, see **Introduction to the Simple Mode and Enterprise Mode**.
- You have configured workspace-level scheduling identities, including public agencies and public IAM accounts. For details, see **Configuring a Public Agency** and **Configuring a Public IAM Account**.
- You have prepared two sets of isolated data lake engines, one for the development environment and the other for the production environment.
  - Configure two sets of data lake services to isolate the development environment from the production environment.

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For clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of data lake services that have the same version, specifications, components, region, VPC, subnet, and other related configurations. For details, see **Creating a DataArts Studio Data Connection**.

When creating a data connection, you can select different clusters for the development environment and production environment to isolate them.

Figure 2-23 Selecting different clusters during data connection creation



- Configure environment isolation for DLI.

  Configure environment isolation in enterprise mode, including DLI queue configuration and DB configuration.

  For serverless services (such as DLI), you can configure the mapping between data lake services in the production environment and those in the development environment through environment isolation in Management Center. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of queues and database resources in the serverless data lake service and distinguish them by name suffix. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.

- Configure two databases in the same data lake service to isolate the development environment from the production environment.

  For GaussDB(DWS), MRS Hive, and MRS Spark, if you select the same cluster when creating a data connection (as shown in **Figure 2-24**), you must configure database mapping on the **Configure Data Source Resource Mapping** page shown in **Figure 2-25** to isolate the development and production environments. For details, see **DB configuration**.

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Figure 2-24 Selecting the same cluster during data connection creation

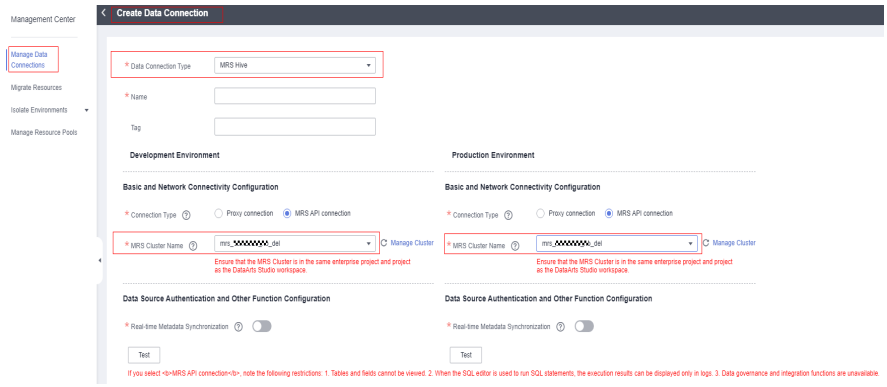
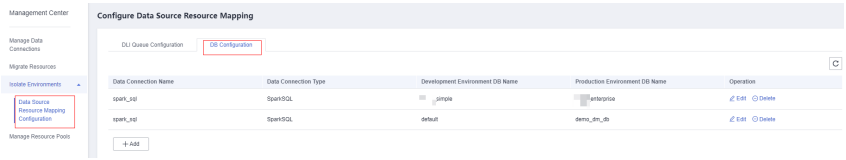


Figure 2-25 DB Configuration



- Prepare and synchronize data.
  - After creating data lake services, you must create databases, database schemas (required only for DWS), and data tables in the data lake services of the development and production environments based on the project plan (for example, the databases and tables required for data development).
    - For clustered data sources (such as MRS, DWS, RDS, MySQL, Oracle, and ECS), use two clusters, one for the development environment and the other for the production environment. The names of the databases, database schemas (required only for DWS), and data tables in the two environments must be the same.
    - For serverless services (such as DLI), you are advised to associate and distinguish the two queues and databases by name suffix (add suffix **_dev** to the names of the queues and databases in the development environment and add no suffix to those in the production environment). The names of data tables in the development environment must be the same as those in the production environment.
    - For DWS, MRS Hive, and MRS Spark data sources, if the same cluster is used for the development and production environments, use two databases to isolate the development and production environments (add suffix **_dev** to the database for the development environment and add no suffix to the database for the production environment). The names of database schemas (required only for DWS) and data tables in the development environment must be the same as those in the production environment.

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- After creating databases, database schemas (required only for DWS), and data tables, you must synchronize data of existing tables (if any) between the two data lake services.
  - Existing data in data lakes: Use data migration services such as CDM and DRS to synchronize data in batches between data lakes.
  - Data to be migrated from the data source: Use peering jobs of data migration services such as CDM and DRS to synchronize data between the data lake service of the production environment and that of the development environment.

Change Description

After the workspace mode is upgraded, a development environment isolated from the production environment is added.

Upgrading the Simple Mode to Enterprise Mode

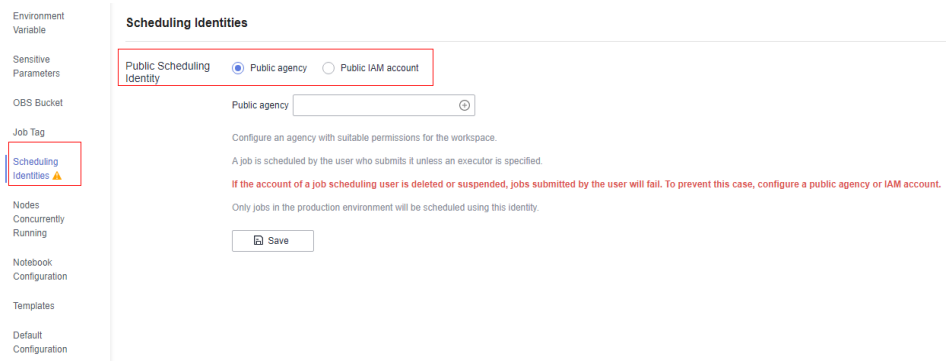
With the DAYU Administrator or Tenant Administrator role, you can upgrade a workspace in simple mode to one in enterprise mode.

- Pre-upgrade operations

  Configure a workspace-level public agency or public IAM account in DataArts Factory to avoid an upgrade failure.

  For details about how to configure an agency, see **Configuring a Scheduling Identity**.

  Figure 2-26 Configuring a workspace-level agency



- Upgrade operations

  a. Log in to the DataArts Studio console.

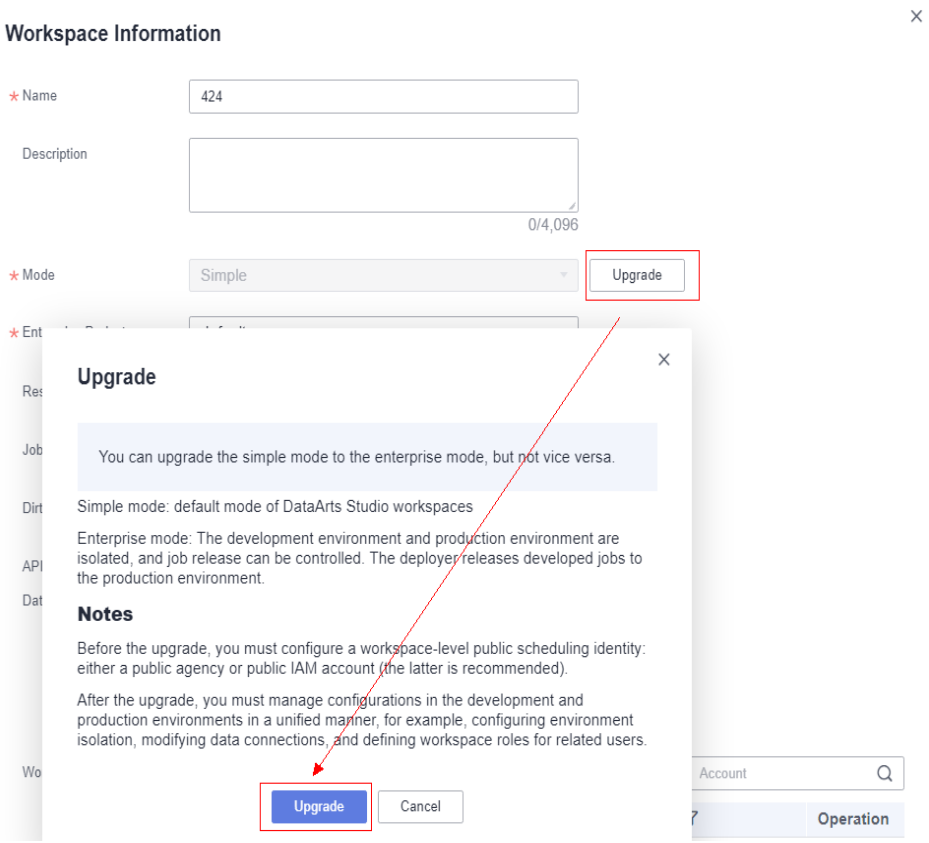
  b. Locate a DataArts Studio instance and click **Access**. Then, click the **Workspaces** tab.

  c. Locate the workspace you want to upgrade and click **Edit** in **Operation** column.

  d. In the displayed **Workspace Information** dialog box, click **Upgrade** next to the **Mode** text box. In the displayed dialog box, click **Upgrade**.

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Figure 2-27 Upgrading to the enterprise mode



- Post-upgrade operations

  After the upgrade is complete, you (as the admin) need to modify data connections, configure environment isolation, and define roles such as the admin, developer, deployer, and operator in the workspace.

  a. Modify data connections. For details, see **Creating a DataArts Studio Data Connection**.

  b. Configure environment isolation. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.

  c. Define workspace roles for other users. For details, see **Adding Workspace Members and Assigning Roles**.

Creating a Workspace in Enterprise Mode

If you have not used the simple mode before and do not need to inherit business data, you can directly create a workspace in enterprise mode.

- Create a workspace.

  a. Log in to the DataArts Studio console using an account with the DAYU Administrator or Tenant Administrator permission.

  b. Locate an instance and click **Access**. Then click the **Workspaces** tab.

  c. Click **Create**. In the displayed **Create** dialog box, set parameters based on **Table 2-11** and click **OK**.

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Figure 2-28 Creating a workspace

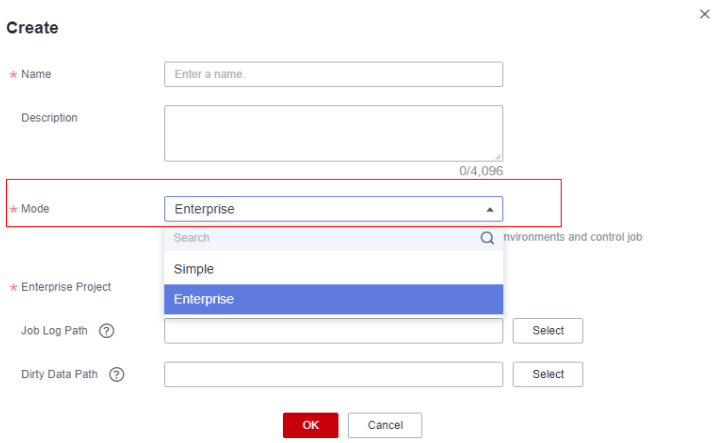


Table 2-11 Parameters for creating a workspace

Parameter	Description
Name	Workspace name. It can contain a maximum of 32 characters, including only letters, digits, underscores (_), and hyphens (-). The workspace name must be unique in the current DataArts Studio instance.
Description	Workspace description
Mode	Mode of the workspace. Available options include **Simple** and **Enterprise**. Select **Enterprise**.
Enterprise Project	Enterprise project associated with the default workspace of the DataArts Studio instance. An enterprise project facilitates management of cloud resources. For details, see ***Enterprise Management User Guide***. This parameter is available only when an enterprise project has been created. If you want to connect the DataArts Studio instance to an instance of another cloud service, such as GaussDB(DWS), MRS, and RDS, ensure that the enterprise project of the DataArts Studio instance's workspace is the same as that of the target cloud service instance. • You can only one DataArts Studio instance for an enterprise project. • If you want to enable communication between DataArts Studio and another cloud service, ensure that the enterprise project of DataArts Studio is the same as that of the target cloud service. **NOTE** If the enterprise project function is not enabled, only one DataArts Studio instance can be created for each IAM project.

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Parameter	Description
Job Log Path	OBS bucket for storing the job logs of DataArts Factory of DataArts Studio. To use the DataArts Factory module of DataArts Studio, workspace members must have the read and write permissions on the OBS bucket for storing job logs. Otherwise, the system cannot read or write job logs of DataArts Factory. • Click **Select**. You can select an existing OBS bucket. The selected OBS bucket is globally configured in the current workspace. • If you do not set this parameter, job logs of DataArts Factory are stored in the OBS bucket named **dlf-log-{projectId}** by default. **NOTE** The execution logs of data development jobs are stored in *xxxxx*.log format in an OBS bucket. *xxxxx* indicates the job ID. Deleting the historical records of SQL statements that have been executed does not affect services.
Dirty Data Path	OBS bucket for storing dirty data generated during DLI SQL execution in DataArts Factory of DataArts Studio. To use DataArts Factory to develop and execute DLI SQL statements, workspace members must have the read and write permissions on the OBS bucket where DLI dirty data is stored. Otherwise, the system cannot read or write the dirty data generated during DLI SQL execution. • Click **Select**. You can select a created OBS bucket. The selected OBS bucket is globally configured in the current workspace. • If you do not set this parameter, dirty data generated during DLI SQL execution is stored in the OBS bucket named **dlf-log-{projectId}** by default.

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Parameter	Description
Tags	You can add resource tags to classify resources. **NOTE** If your account belongs to an organization and the organization has configured DataArts Studio tag policies, you need to add tags based on these policies. If a tag does not comply with the tag policies, instance creation may fail. Contact your administrator to learn more about tag policies. If you have multiple workspaces, you can add tags to classify them by user, operator, or purpose. On the workspace list page, you can search for workspaces by tag. A tag consists of a key and a value. When adding a tag, you can select a predefined tag created in Tag Management Service (TMS) or enter a custom tag. Then click **Add** to the right of the text box to add the tag. **NOTE** To select predefined tags, ensure that you have created predefined tags in TMS. You can click **View predefined tags** to enter the **Predefined Tag** page of TMS. Then, click **Create Tag** to create a predefined tag. For details, see **Creating Predefined Tags** in *Tag Management Service User Guide*. A maximum of 20 tags can be added to a workspace. Each tag key must be unique and can only match one tag value.

- Perform follow-up operations.

  After creating the workspace, you (as the admin) need to create data connections, configure environment isolation, and define roles such as the admin, developer, deployer, and operator in the workspace.

  a. Create data connections. For details, see **Creating a DataArts Studio Data Connection**.

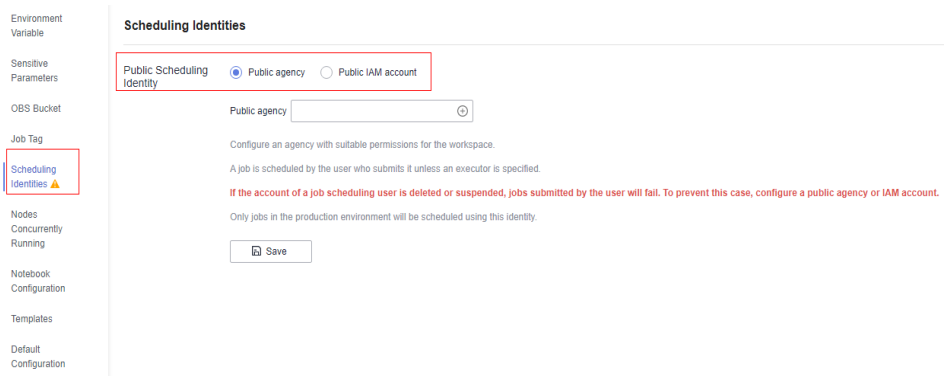
  b. Configure environment isolation. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.

  c. Define workspace roles for other users. For details, see **Adding Workspace Members and Assigning Roles**.

  d. Configure a workspace-level public agency or public IAM account in DataArts Factory. For details about how to configure an agency, see **Configuring a Scheduling Identity**.

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Figure 2-29 Configuring a workspace-level agency

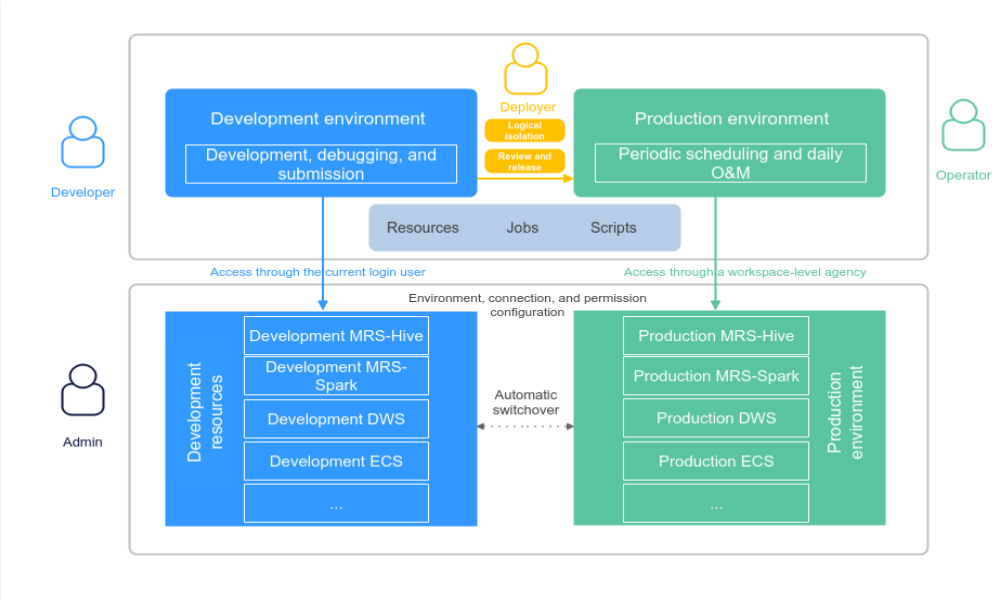


2.5.3 Operations Supported for Different Roles in Enterprise Mode

2.5.3.1 Service Process in Enterprise Mode

The DataArts Studio enterprise mode mainly involves the Management Center and DataArts Factory components. The service process is completed by the admin, developer, deployer, and operator.

Figure 2-30 Enterprise mode architecture



- The admin performs operations such as preparing a data lake, configuring data connections and environment isolation, importing and exporting data, and configuring project user permissions.
- The developer develops and tests scripts and jobs, and submits versions and release tasks in the development environment.
- The deployer reviews the submitted tasks in the development environment.

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- The operator performs operations such as job monitoring, notification management, and backup in the production environment based on the resources released by the developer.
- Custom role: You can customize operation permissions to meet your requirements.
- The viewer can only read data from DataArts Studio, but cannot perform operations or modify work items or configurations. You are advised to assign this role to users who only want to view information in the workspace.

Table 2-12 Permissions of different roles

Role	Simple Workspace	Enterprise Workspace
Admin	Has all permissions of Management Center in the production environment, including connection configuration and data import and export.	• Deployment-related operations • Connection configuration, environment isolation configuration, and data import and export in Management Center • Configuration in DataArts Factory, such as the environment, scheduling identity, and default item configuration
Developer	Has all permissions to develop jobs and scripts in the production environment.	• Development environment: all permissions • Production environment: read-only permission • Deployment: packaging and viewing release items, viewing the release item list, and viewing the release package content • Environment information configuration: read-only permission
Deployer	None	• Viewing release packages • Viewing the release item list • Releasing packages: Only the deployer and admin can perform this operation. • Canceling a release: Only the deployer and admin can perform this operation.

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Role	Simple Workspace	Enterprise Workspace
Operator	Has the permissions to monitor, schedule, and perform O&M operations on the job and script instances in the production environment.	• Development environment: read-only permission • Production environment: all permissions • Deployment: viewing the release package content • Environment information configuration: read-only permission
Viewer	Read-only permission	Read-only permission

2.5.3.2 Admin Operations

As the project owner or development owner, the admin manages the environment configuration and personnel roles in enterprise mode in a unified manner. The following table describes related operations.

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Table 2-13 Admin operations

Operation	Description
Making preparations	The preparations include preparing data lakes and preparing and synchronizing data. **Preparing data lakes:** In enterprise mode, the development environment and production environment need to be isolated. Therefore, you need to prepare two data lake services, one for the production environment and the other for the development environment. ● For clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare **two data lake services (clusters)** that have the same version, specifications, components, region, VPC, subnet, and other related configurations. For example, if your data lake service is an MRS cluster, you need to prepare two MRS clusters with the same version, specifications, components, region, VPC, and subnet. Any change to the configuration of one of the MRS clusters must be synchronized to the other cluster. ● For serverless services (such as DLI), you can configure the mapping between data lake services in the production environment and those in the development environment through environment isolation in Management Center. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of queue and database resources in the serverless data lake service. You are advised to distinguish them by name suffix. ● If GaussDB(DWS), MRS Hive, and MRS Spark data sources use **the same cluster**, you must configure database mapping on the **Configure Data Source Resource Mapping** page to isolate the development and production environments.

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Operation	Description
	Preparing and synchronizing data: ● After creating data lake services, you must create databases, database schemas (required only for DWS), and data tables in the data lake services of the development and production environments based on the project plan (for example, the databases and tables required for data development). – For clustered data sources (such as MRS, DWS, RDS, MySQL, Oracle, and ECS), use two clusters, one for the development environment and the other for the production environment. The names of the databases, database schemas (required only for DWS), and data tables in the two environments must be the same. – For serverless services (such as DLI), you are advised to associate and distinguish the two queues and databases by name suffix (add suffix **_dev** to the names of the queues and databases in the development environment and add no suffix to those in the production environment). The names of data tables in the development environment must be the same as those in the production environment. – For DWS, MRS Hive, and MRS Spark data sources that use the same cluster, use two databases to isolate the development and production environments (add suffix **_dev** to the database for the development environment and add no suffix to the database for the production environment). The names of database schemas (required only for DWS) and data tables in the development environment must be the same as those in the production environment. ● After creating databases, database schemas (required only for DWS), and data tables, you must synchronize data of existing tables (if any) between the two data lake services. – Existing data in data lakes: Use data migration services such as CDM and DRS to synchronize data in batches between data lakes.

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Operation	Description
	– Data to be migrated from the data source: Use peering jobs of data migration services such as CDM and DRS to synchronize data between the data lake service of the production environment and that of the development environment.
Creating data connections in enterprise mode	You must create data connections for all data lake engines. For clustered data sources that use different clusters, you can create a data connection between DataArts Studio and the data lake of the development environment and a data connection between DataArts Studio and the data lake of the production environment at the same time. For details, see **Creating a DataArts Studio Data Connection**.
Configuring environment isolation for a workspace in enterprise mode	Configure DLI queue and DB mapping to isolate the development and production environments. For the DWS, MRS Hive, and MRS Spark data sources, if you select the same cluster when creating a data connection, you need to configure two databases for the same data lake service to isolate the development environment from the production environment. For details, see **DB Configuration**. For the DLI data source, you can configure two DLI queues and databases to isolate the production environment from the development environment. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.
Creating an IAM user and assigning DataArts Studio permissions to the user	Create an IAM user with the **DAYU User** permissions for a project member who wants to use DataArts Studio and assign a workspace role to the created user. For details, see **Authorizing Users to Use DataArts Studio**.

2.5.3.3 Developer Operations

The developer develops scripts and jobs. The following table describes related operations.

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Table 2-14 Developer operations

Operation	Description
Script development	Select the data lake engine for the development environment, and commission and release data development scripts in the development environment. After the release, the engine is automatically replaced by the engine of the production environment. For details, see **Script Development**.
Job development	Select the data lake engine for the development environment, and commission and release data development jobs in the development environment. After the release, the engine is automatically replaced by the engine of the production environment. For details, see **Job Development**.

2.5.3.4 Deployer Operations

- The deployer reviews the tasks to be released. This section describes related operations.
- The deployer reviews the release tasks submitted by the developer. Modified jobs can be synchronized to the production environment only after the corresponding release tasks are approved.

In enterprise mode, when a developer submits a script or job version, the system generates a release task. After the developer confirms the release and the deployer approves the release request, the modified job is synchronized to the production environment.

Prerequisites

The developer has completed the operations in **Releasing a Script Task** or **Releasing a Job Task**.

Procedure

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

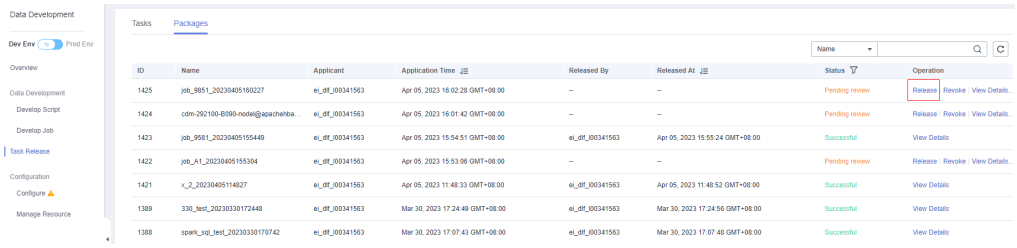
Step 2 In the left navigation pane, choose **Data Development** > **Task Release**.

Step 3 Click the **Packages** tab. You can click **View Details** in the **Operation** column to view the changes of the task compared with its previous version.

- If there is any issue, click **Revoke** to reject the release task. After the developer modifies and submits the release task again, you can review it again.
- After confirming that the release task has no remaining issue, click **Release** to approve the task.

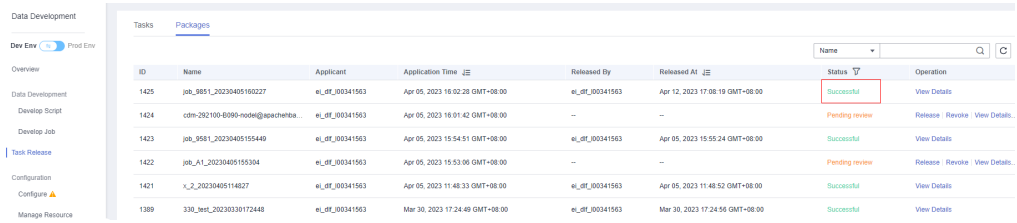
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Figure 2-31 Reviewing and releasing a task



Step 4 After the task is released, you can view its status. The developer's modification is synchronized to the production environment.

Figure 2-32 Viewing the task status



----End

2.5.3.5 Operator Operations

The operator manages the jobs, instances, notifications, and backups in the production environment in a unified manner. The following table describes related operations.

Table 2-15 Operator operations

Operation	Description
Job monitoring	Monitor batch and real-time jobs. For details, see **Monitoring a Job**.
Instance monitoring	Monitor job instances (a job instance is generated each time a job is executed). For details, see **Instance Monitoring**.
PatchData monitoring	Monitor the statuses of PatchData jobs. PatchData can be used to fix the job instances that have data errors in the historical records or to build job records for debugging programs. For details, see **Monitoring PatchData**.
Notification management	Configure notifications to be sent when a job is abnormal or runs successfully. For details, see **Notification Management**.

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Operation	Description
Backup management	Back up all the jobs, scripts, resources, and environment variables of the previous day at a specified time on each day. For details, see **Managing Backups**.

2.6 Managing DataArts Studio Resources

You can centrally manage DataArts Studio resources.

Offline Resource Management

You can view all CDM clusters in a DataArts Studio instance and associate workspaces with CDM clusters.

NOTE

A CDM cluster is available in a workspace only after they are associated with each other.

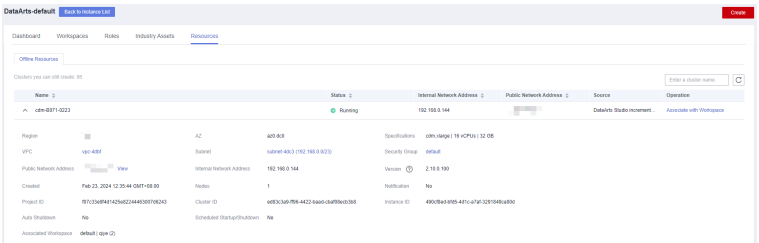
Step 1 Log in to the DataArts Studio console as user **DAYU Administrator** or **Tenant Administrator**. For details, see **Accessing the DataArts Studio Instance Console**.

Step 2 Locate an instance and click **Access**. Then click the **Resources** tab.

Step 3 On the **Offline Resources** tab page, view all CDM clusters in the instance, such as their statuses, private IP addresses, and public IP addresses.

Step 4 Click ⌄ in the **Name** column to expand the cluster details, such as the AZ, VPC, subnet, security group, specifications, cluster ID, and associated workspaces.

Figure 2-33 Viewing cluster details

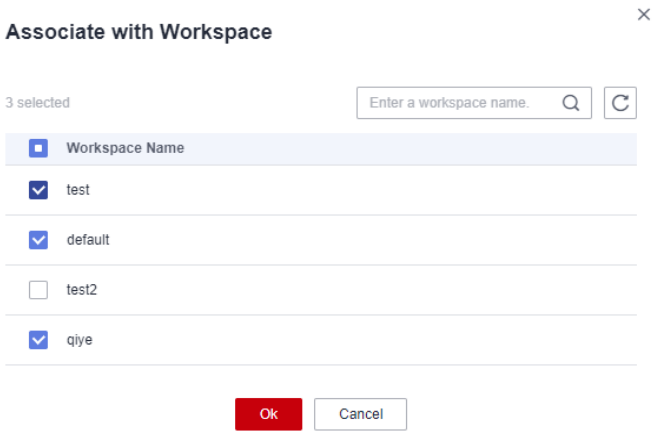


Step 5 Locate a CDM cluster and click **Associate with Workspace** in the **Operation** column. In the displayed dialog box, select or deselect workspaces and click **OK** to associate the CDM cluster with the selected workspaces.

The CDM cluster is only available in the associated workspaces.

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Figure 2-34 Associating a CDM cluster with workspaces



----End

2.6.1 Associating a Real-Time Migration Resource Group with Workspaces

Before creating a real-time data migration job, you need to associate the data migration resource group with a DataArts Studio workspace so that you can select a specified computing resource group when creating a real-time data migration job.

Prerequisites

You have purchased a resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.

Procedure

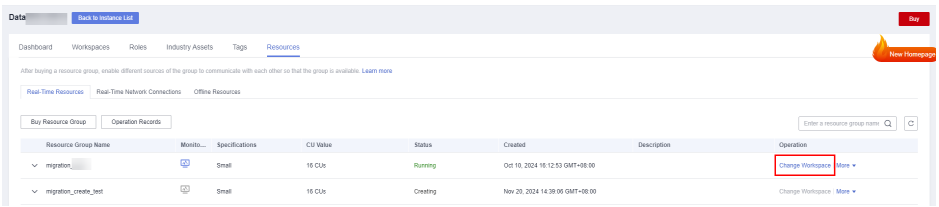
Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 Locate an instance and click **Access**.

Step 3 Click the **Resources** tab.

Step 4 On the **Real-Time Resources** page, locate a data migration resource group and click **Change Workspace** in the **Operation** column.

Figure 2-35 Associating a resource group with workspaces

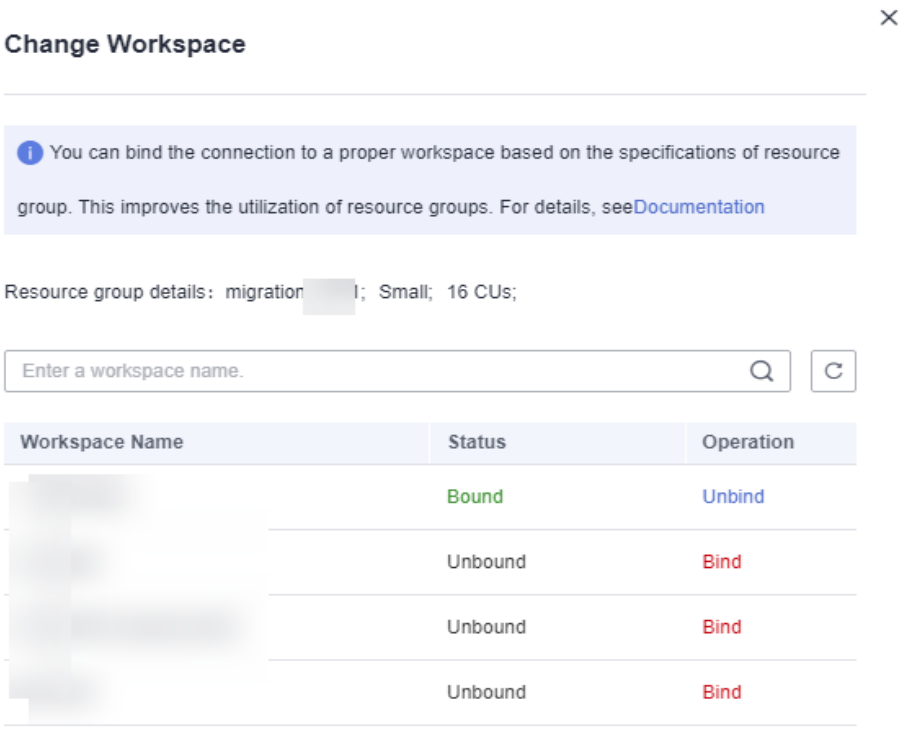


Step 5 In the displayed dialog box, search for the DataArts Studio workspace you want to use and click **Bind**. Then the data migration resource group can be selected in the workspace.

NOTE

A data migration resource group can be associated with multiple DataArts Studio workspaces.

Figure 2-36 Associating a resource group with workspaces



----End

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3 Authorizing Users to Use DataArts Studio

3.1 Creating an IAM User and Assigning DataArts Studio Permissions

Identity and Access Management (IAM) can be used for fine-grained permissions management on your DataArts Studio resources. With IAM, you can:

- Create IAM users for employees based on your enterprise's organizational structure. Each IAM user will have their own security credentials for accessing DataArts Studio resources.
- Grant users only the permissions required to perform a given task based on their job responsibilities.
- Entrust a Huawei account or cloud service to perform efficient O&M on your DataArts Studio resources.

If you do not require individual IAM users for permissions management, skip this topic.

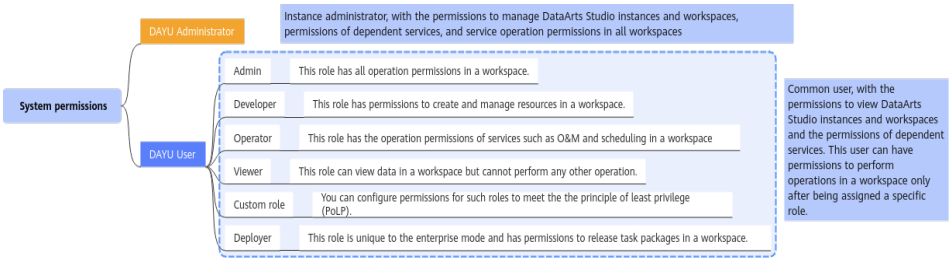
This section describes the procedure for granting permissions. See **Procedure** for details.

Context

- Before assigning permissions to a user group, you need to understand the permission system of DataArts Studio so that you can select the permissions that meet your needs. For details about DataArts Studio permissions, see **DataArts Studio Permission Management**.

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Figure 3-1 Permission system



- For the permissions of other services, see **System Permissions**.

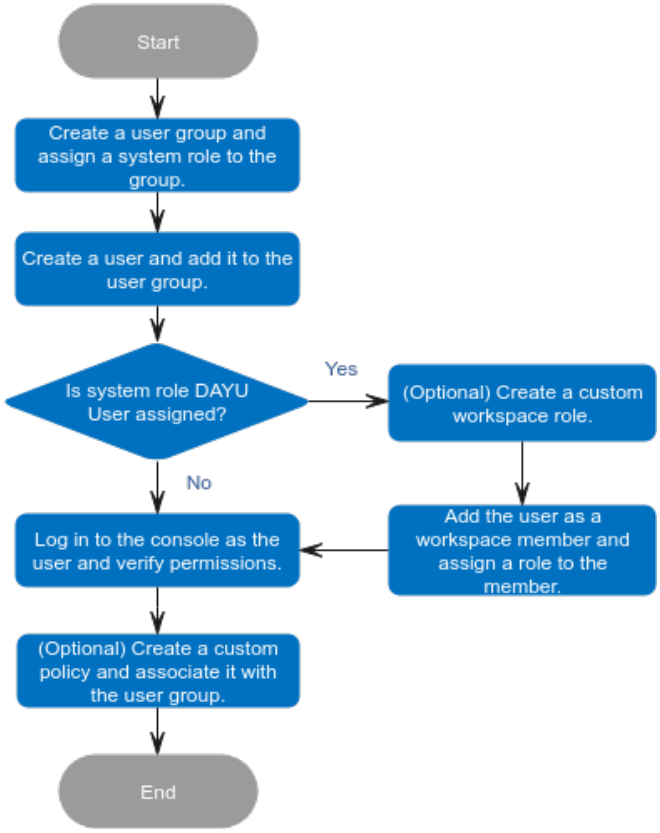
Notes and Constraints

- The DAYU User system role provides the permissions related to instances, workspaces, and dependent services. The operation permissions in workspaces are provided by workspace roles.
- IAM provides the following two authorization mechanisms: Note that DataArts Studio supports only the IAM role-based authorization and does not support the IAM policy-based authorization.
  - **IAM Roles**: IAM initially provides a coarse-grained authorization mechanism to define permissions based on users' job responsibilities. Only a limited number of service-level roles are available. However, traditional IAM roles are not an ideal choice for fine-grained authorization and secure access control.
  - **IAM Policies**: A type of fine-grained authorization mechanism that defines permissions required to perform operations on specific cloud resources under certain conditions. This type of authorization is more flexible and is ideal for least privilege access.

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Procedure

Figure 3-2 Authorization process



Step 1 Create a user group and assign a system role to the group.

Log in to the IAM console using a Huawei account, create a user group and assign a DataArts Studio system role to the group. For example, the system role can be DAYU Administrator or DAYU User.

For details, see **Creating a User Group and Assigning Permissions**.

NOTE

- When configuring DataArts Studio permissions for a user group, enter **DAYU** in the search box to search for the permissions and select the permissions to be granted to the user group, for example, **DAYU User**.
- DataArts Studio is a project-level service deployed in specific physical regions. If you select **All resources** for **Scope**, the permission takes effect in all projects of all regions. If you select **Region-specific projects** for **Scope**, the permission takes effect only for a specified project. When accessing DataArts Studio, the IAM user must switch to the region where they have been assigned the required permissions.

Step 2 Create a user and add the user to the user group.

Create users on the IAM console and add them to the group created in **Step 1**.

For details, see **Creating an IAM User and Adding It to a User Group**.

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> **NOTE**
>
> An IAM user can pass the authentication and access DataArts Studio through an API or SDK only if **Programmatic access** is selected for **Access Type** during the creation of the IAM user.

Step 3 Create a custom workspace role for DAYU User, add it as a workspace member, and assign a role to the member.

DataArts Studio workspace roles determine the permissions of DAYU User in a workspace. There are five preset roles: admin, developer, deployer, operator, and viewer. For details about how to add a workspace member and assign a role, see **Adding Workspace Members and Assigning Roles**.

For details about the permissions of the roles, see **Permissions**.

Step 4 Log in to the console and verify permissions.

Log in to the console using the created user and verify permissions of the user.

- Choose **Service List** > **DataArts Studio**. Locate a DataArts Studio instance and click **Access**. Check whether the workspace list is displayed.
- Access a service module (for example, Management Center) to which your current user has been added and check whether you can perform the operations allowed for the workspace role assigned to you.

----End

Follow-up Operations

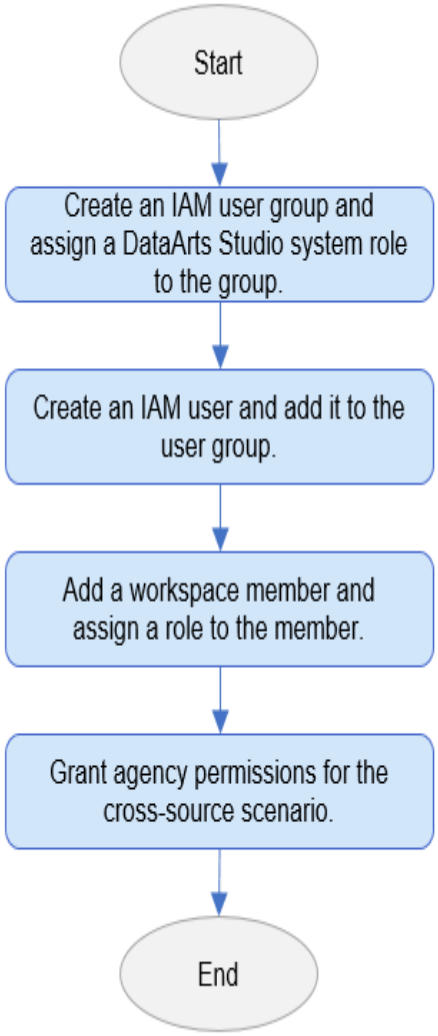
Adjusting permissions of dependent services: If the DAYU User system role has excessive permissions on dependent services, security risks may arise. You can manually adjust the permissions to make them comply with the principle of least privilege (PoLP). For details, see **Authorizing Users to Use DataArts Studio by Complying with the Principle of Least Privilege**.

3.2 Authorizing the Use of Real-Time Data Migration

DataArts Studio provides the real-time data synchronization capability. This section describes how to grant the permissions of real-time migration to users. The procedure is as follows.

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Figure 3-3 Real-time data migration authorization process



Notes and Constraints

- You have obtained and configured a DataArts Studio instance, and created a workspace.
- You have created an IAM user and granted the DataArts Studio permissions to the user. For details, see .

Procedure

Step 1 Add the current IAM user to the user group of a DataArts Studio system role (for example, DAYU Administrator or DAYU User). For details, see .

Step 2 Assign a DataArts Studio workspace role to the current IAM user. The workspace role must have the administrator or developer permissions of DataArts Factory and Management Center to view, create, and operate data connections and data migration jobs. For details about the role permissions, see .

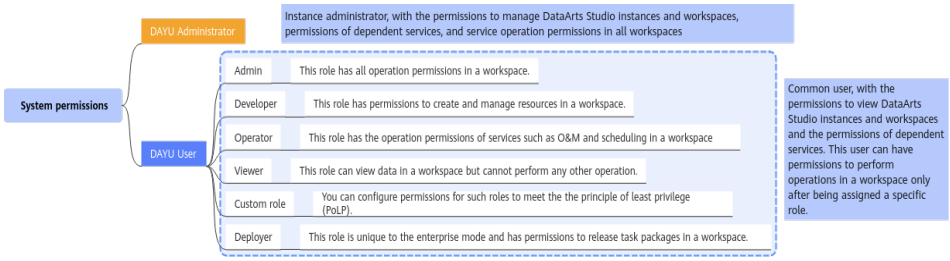
----End

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3.3 Adding Workspace Members and Assigning Roles

For IAM users with **DAYU User** account permissions, their permissions in a DataArts Studio workspace are determined by workspace roles. If you want to share a DataArts Studio instance with an IAM user with the **DAYU User** account permissions, prepare an IAM user by referring to **Creating an IAM User and Assigning DataArts Studio Permissions**, add the user as a workspace member, and assign a role to the member.

Figure 3-4 Permission system



A workspace role determines the permissions of a user in a workspace. Preset roles include admin, developer, deployer, operator, and viewer. For the detailed descriptions of the permissions of each role, see **Permissions**.

- Admin: This role has all operation permissions in a workspace. You are advised to assign the admin role to the project owner, development owner, and O&M administrator.
- Developer: This role has permissions to create and manage resources in a workspace. You are advised to assign this role to users who develop and process tasks.
- Operator: This role has the operation permissions of services such as O&M and scheduling in a workspace, but cannot modify resources or configurations. You are advised to assign this role to users responsible for O&M management and status monitoring.
- Viewer: This role can view data in a workspace but cannot perform any other operation. You are advised to assign this role to users who only need to view data in a workspace but do not need to perform operations.
- Deployer: This role is unique to the enterprise mode and has permissions to release task packages in a workspace. In enterprise mode, when a developer submits a script or job version, the system generates a release task. After the developer confirms the release and the deployer approves the release request, the modified job is synchronized to the production environment.

Context

If an IAM user is granted the **DAYU User** permissions, you also need to add the user as a workspace member and assign a role to the user. Otherwise, the IAM user cannot view existing DataArts Studio workspaces.

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Notes and Constraints

Due to the limitations of the authentication cache mechanism, a change to the role of a workspace member does not take effect immediately. The change takes effect six minutes after the workspace member stops accessing the DataArts Studio console.

Prerequisites

You are using either of the following accounts:

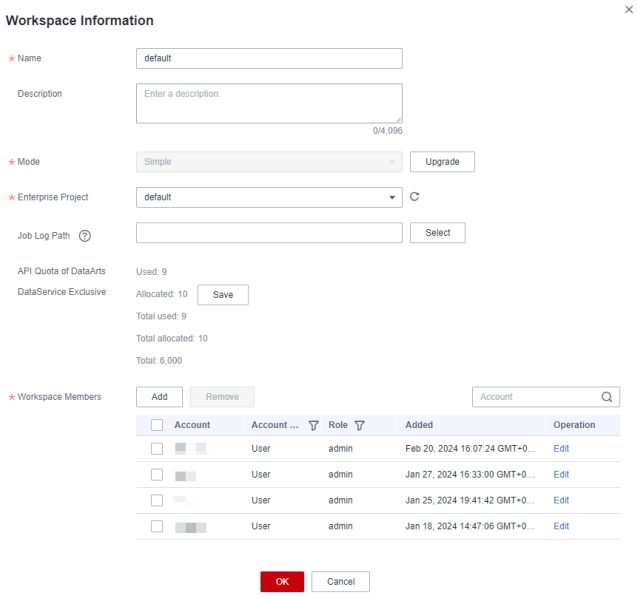
- **DAYU Administrator** or **Tenant Administrator**
- **DAYU User**, which is the administrator of the current workspace

Adding a Member and Assigning a Role

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Ins**.

Step 2 On the **Workspaces** page, locate the target workspace and click **Edit** in the **Operation** column.

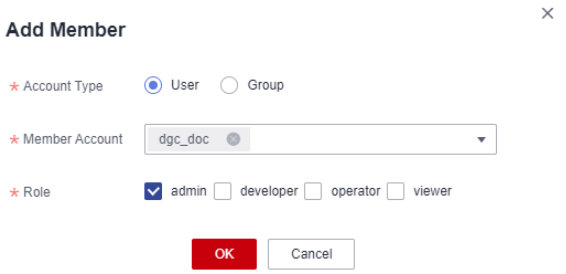
Figure 3-5 Workspace Information dialog box



Step 3 Click **Add** next to **Workspace Members**. In the displayed **Add Member** dialog box, select **User** or **Group** for **Account Type**, select a user or group from the **Member Account** drop-down list, and select a role.

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Figure 3-6 Adding a member



Step 4 Click **OK**. You can view or modify the members and roles in the member list, or delete members from the workspace.

----End

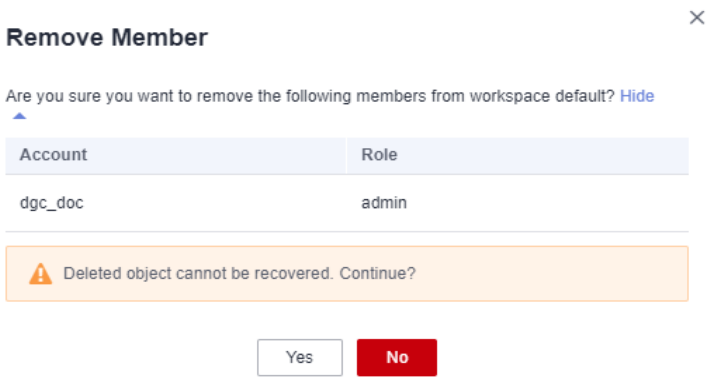
Related Operations

- Removing a workspace member: In the **Workspace Information** dialog box, select the workspace members to remove, and click **Remove**. In the **Remove Member** dialog box, click **Yes**.

  NOTE

  The creator of a workspace cannot be removed.

  Figure 3-7 Removing a member



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4 Management Center

DataArts Studio Management Center provides a unified configuration and management entry for data connections and resource migration. Personalized entries and showcases can be customized as needed.

4.1 Data Sources Supported by DataArts Studio

Before using DataArts Studio, you need to select cloud services or databases as the data foundation, which provides storage and compute capabilities. DataArts Studio provides one-stop data development, governance, and services based on the data foundation.

Supported Data Sources

This section describes the data sources supported by DataArts Studio modules other than DataArts Migration. **Table 4-1** lists the data sources supported by each module.

Except DataArts Migration, all other modules use the data connections created in Management Center. (A data connection can be used in a module which was selected during the creation of the connection.) To connect to these data sources, go to the DataArts Studio console and choose **Management Center** to create data connections.

NOTE

The data sources supported by the migration jobs in DataArts Migration are different from those supported by other modules, and are described in the DataArts Migration chapter. Migration jobs include CDM jobs, offline jobs, and real-time jobs. They support the following data sources:

- CDM jobs use the data connections created in CDM clusters. The data sources supported by CDM jobs are related to the CDM cluster version. For details, see **Data Sources Supported by CDM Jobs**.
- Offline migration jobs use the data connections for which **DataArts Migration** has been selected for **Applicable Modules** in Management Center. For details, see **Data Sources Supported by Offline Migration Jobs**.
- Real-time migration jobs use the data connections for which **DataArts Migration** has been selected for **Applicable Modules** in Management Center. For details, see **Supported Data Sources**.

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Table 4-1 Data sources supported by DataArts Studio

Data Source Type	Management Center	DataArts Architecture	DataArts Factory	DataArts Catalog[2]	DataArts Quality[3]	DataArts DataService	DataArts Security
DWS	Supported	Supported	Supported	Supported	Supported	Supported	Supported
DLI	Supported	Supported	Supported	Supported	Supported	Supported	Supported
MRS HBase	Supported	Not supported	Not supported	Supported	Not supported	Not supported	Not supported
MRS Hive	Supported	Supported	Supported	Supported	Supported	Supported	Supported
MRS Kafka	Supported	Not supported	Supported	Not supported	Not supported	Not supported	Supported
MRS Spark[1]	Supported	Supported	Supported	Not supported	Supported	Not supported	Not supported
MRS ClickHouse	Supported	Supported	Supported	Supported	Not supported	Supported	Not supported
MRS Hetu	Supported	Not supported	Supported	Not supported	Supported	Supported	Supported
MRS Impala	Supported	Not supported	Supported	Not supported	Not supported	Not supported	Not supported
MRS Ranger	Supported	Not supported	Not supported	Not supported	Not supported	Not supported	Supported
MapReduce (MRS) Presto	Supported	Not supported	Supported	Not supported	Not supported	Not supported	Not supported
MRS Doris	Supported	Supported	Supported	Supported	Not supported	Supported	Not supported
RDS for MySQL	Supported	Supported	Supported	Supported	Supported	Supported	Not supported

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Data Source Type	Management Center	DataArts Architecture	DataArts Factory	DataArts Catalog[2]	DataArts Quality[3]	DataArts DataService	DataArts Security
RDS for PostgreSQL	Supported	Supported	Supported	Supported	Supported	Not supported	Not supported
RDS for SQL Server	Supported	Not supported	Not supported	Supported	Not supported	Not supported	Not supported
MySQL	Supported	Supported	Not supported	Not supported	Supported	Supported	Not supported
Oracle	Supported	Supported	Not supported	Supported	Supported	Not supported	Not supported
Host Connection	Supported	Not supported	Supported	Not supported	Not supported	Not supported	Not supported

NOTE

DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.

Annotation

[1] MRS Spark: MRS Spark connections can be used to integrate data into the DataArts Architecture and DataArts Quality modules. MRS Hudi is a data format. The metadata is stored in Hive, and operations are performed using Spark. DataArts Catalog uses MRS Hive to collect Hudi metadata, and DataArts Architecture and DataArts Quality use MRS Spark to govern Hudi data sources. (Business metric monitoring of DataArts Quality does not support Hudi data sources.)

[2] DataArts Catalog: In addition to the data sources listed in the preceding table, DataArts Catalog can also collect metadata of the following data sources:

1. Relational databases, such as MySQL and PostgreSQL databases (You can use RDS connections to collect the metadata of these databases.)
2. Cloud Search Service (CSS)
3. Graph Engine Service (GES)
4. Object Storage Service (OBS)
5. MRS Hudi (MRS Hudi is a data format. The metadata is stored in Hive, and operations are performed using Spark.) You can enable synchronization of the

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Hive table configuration for Hudi tables, and then you can collect the metadata of Hudi tables by collecting the MRS Hive metadata.

[3] DataArts Quality: The quality jobs and comparison jobs of DataArts Quality are not supported by MRS clusters with decoupled storage and compute.

Overview

Table 4-2 Data source overview

Data Source Type	Description
DWS	DWS employs the shared-nothing architecture and massively parallel processing (MPP) engine. It is compatible with ANSI SQL 99, SQL 2003, and the PostgreSQL or Oracle database ecosystem, providing competitive solutions for analyzing petabytes of data in various industries.
DLI	DLI is a serverless big data compute and analysis service that is fully compatible with Apache Spark and Apache Flink ecosystems. With multi-model engines supported by DLI, enterprises can use SQL statements or programs to easily complete batch processing, stream processing, in-memory computing, and machine learning of heterogeneous data sources.
MRS HBase	HBase undertakes data storage. It is an open-source, column-oriented, distributed storage system that is suitable for storing massive amounts of unstructured or semi-structured data. It features high reliability, high performance, and flexible scalability, and supports real-time data read/write. MRS HBase stores massive amount of data and supports data queries in milliseconds. MRS HBase can load and update logistics data in milliseconds, and query and analyze petabytes of time series data in seconds.
MRS Hive	Hive is a mechanism that can store, query, and analyze large-scale data stored in Hadoop. Hive defines simple SQL-like query language, which is known as HiveQL. It allows a user familiar with SQL to query data. MRS Hive can be used to analyze terabytes or petabytes of data and quickly migrate on-premises Hadoop big data platforms (such as CDH and HDP) to the cloud without service interruption and service code modification.

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Data Source Type	Description
MRS Kafka	MRS provides dedicated MRS Kafka clusters. Kafka is an open-source, distributed, partitioned, and replicated commit log service. Kafka is publish-subscribe messaging, rethought as a distributed commit log. It provides features similar to Java Message Service (JMS) but another design. It features message endurance, high throughput, distributed methods, multi-client support, and real time. It applies to both online and offline message consumption, such as regular message collection, website activeness tracking, aggregation of statistical system operation data (monitoring data), and log collection. These scenarios engage large amounts of data collection for Internet services.
MRS Spark	Spark is an open-source parallel data processing framework. It helps users easily develop unified big data applications and perform cooperative processing, stream processing, and interactive analysis on data. Spark provides a framework featuring fast calculation, write, and interactive query. Spark has obvious advantages over Hadoop in terms of performance. Spark provides the Spark SQL language similar to SQL statements to process structured data.
MRS ClickHouse	ClickHouse is an open-source columnar database oriented to online analysis and processing. It is independent of the Hadoop big data system and features ultimate compression rate and fast query performance. In addition, ClickHouse supports SQL query and provides good query performance, especially the aggregation analysis and query performance based on large and wide tables. The query speed is one order of magnitude faster than that of other analytical databases. ClickHouse is widely used in various fields such as Internet advertising, apps, web, telecommunications, finance, and IoT. It suits business intelligence ideally.

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Data Source Type	Description
MRS Impala	Impala provides fast, interactive SQL queries directly on your Apache Hadoop data stored in HDFS, HBase, or the Object Storage Service (OBS). In addition to using the same unified storage platform, Impala also uses the same metadata, SQL syntax (Hive SQL), ODBC driver, and user interface (Impala query UI in Hue) as Apache Hive. This provides a familiar and unified platform for real-time or batch-oriented queries. Impala is an addition to tools available for querying big data. Impala does not replace the batch processing frameworks built on MapReduce such as Hive. Hive and other frameworks built on MapReduce are best suited for long running batch jobs.
MRS Ranger	Ranger offers a centralized security management framework and supports unified authorization and auditing. It manages fine-grained access control over Hadoop and related components, such as HDFS, Hive, HBase, Kafka, and Storm. You can use the frontend web UI console provided by Ranger to configure policies to control users' access to these components.
MRS Hudi	Hudi is a data lake table format that provides the ability to update and delete data as well as consume new data on HDFS. It supports multiple compute engines and provides insert, update, and delete (IUD) interfaces and streaming primitives, including upsert and incremental pull, over datasets on HDFS. Hudi metadata is stored in Hive, and operations are performed using Spark.
MRS Presto	Presto is an open-source SQL query engine for running interactive analytic queries against data sources of all sizes. It applies to massive structured/semi-structured data analysis, massive multi-dimensional data aggregation/report, ETL, ad-hoc queries, and more scenarios. Presto allows querying data where it lives, including HDFS, Hive, HBase, Cassandra, relational databases, or even proprietary data stores. A Presto query can combine different data sources to perform data analysis across the data sources.

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Data Source Type	Description
MRS Doris	Doris is a high-performance, real-time analytical database. It can return query results of mass data in sub-seconds and can support high-concurrency point queries and high-throughput complex analysis. Apache Doris can meet requirements in report analysis, instant query, unified data warehouse building, and data lake federated query.
RDS	RDS is an online, out-of-the-box relational database service that is based on the cloud computing platform. It is stable, reliable, scalable, and easy to manage.
MySQL	MySQL is one of the most popular open-source databases. It features excellent performance, uses mature and stable architecture, supports popular applications, adapts to multiple fields and industries, and supports various web applications. It is cost-effective and preferred by small- and medium-sized enterprises.
Host Connection	You can connect to a specified host during data development and execute shell or Python scripts on the host through script development and job development. If the host connection information changes, you only need to edit it on the **Host Connections** page, but do not need to edit it in scripts or jobs one by one.

4.2 Creating a DataArts Studio Data Connection

You can create data connections by configuring data sources. Based on the data connections of the Management Center, DataArts Studio performs data development, governance, services, and operations on the data lake base.

After the data connection between the development environment and production environment is configured, the data connection in the development environment in the script or job during data development is automatically switched to the data connection in the production environment after the process is released.

Constraints

- RDS data connections depend on OBS. If OBS is unavailable in the same region as DataArts Studio, RDS data connections are not supported.
- For host connections, only Linux hosts are supported.
- If changes occur in the connected data lake (for example, the MRS cluster capacity is expanded), you need to edit and save the connection.
- If the data lake authentication information in a data connection changes (for example, the password expires), the data connection becomes invalid. Ensure

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that the data lake authentication information is permanently valid to prevent any loss caused by connection failures.

- DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.
- If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.

Prerequisites

- You have created a data lake to connect, for example, a database or cloud service supported by DataArts Studio.
  - Before creating a DWS data connection, ensure that you have created a cluster in DWS and have the permissions required to view Key Management Service (KMS) keys.
  - Before creating an MRS connection such as an MRS HBase or MRS Hive connection, ensure that you have purchased an MRS cluster whose Kerberos encryption type is **aes256-sha1,aes128-sha1**, and that the cluster contains required components.
- You have obtained the required agent (CDM cluster). If no CDM cluster is available, create one by referring to **Creating a CDM Cluster**. The CDM cluster can communicate with the data lake to be connected.
  - If the data lake is an on-premises database, you need the Internet or Direct Connect. Ensure that the host where the data source is located and the CDM cluster can access the Internet, and the connection port has been enabled in the firewall rule.
  - If the data lake is a cloud service (such as DWS and MRS), the following requirements must be met for network interconnection:
    - If the CDM cluster and the cloud service are in different regions, a public network or a dedicated connection is required for enabling communication between the CDM cluster and the cloud service.
    - If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
    - The cloud service instance and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.
- If the enterprise mode is used, pay attention to the following points:

  In enterprise mode, the development environment and production environment need to be distinguished. Therefore, you need to prepare two

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sets of data lake services for the production environment and development environment to isolate the development environment from the production environment.

- **If two clusters are used** for clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of data lake services. The versions, specifications, components, regions, VPCs, subnets, and related configurations of the two sets of data lake services must be the same. For details on how to create data connections, see **Creating a DataArts Studio Data Connection**.
- For serverless services (such as DLI), DataArts Studio configures the mapping between data lake services in the production environment and development environment through environment isolation in the management center. The corresponding data lake is automatically switched during the development and production processes. Therefore, you need to prepare two sets of queues and database resources in the serverless data lake service and distinguish them by name suffix. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.
- For GaussDB(DWS), MRS Hive, and MRS Spark, if you **select the same cluster** when creating a data connection, you must configure database mapping on the **Configure Data Source Resource Mapping** page to isolate the development and production environments. For details, see **DB configuration**.
- Offline processing migration jobs are not supported in enterprise mode.

For example, if your data lake service is an MRS cluster, you need to prepare two MRS clusters with the same version, specifications, components, region, VPC, and subnet. If some configurations of an MRS cluster are modified, you also need to synchronize the modifications to the other MRS cluster.

Creating a Data Connection

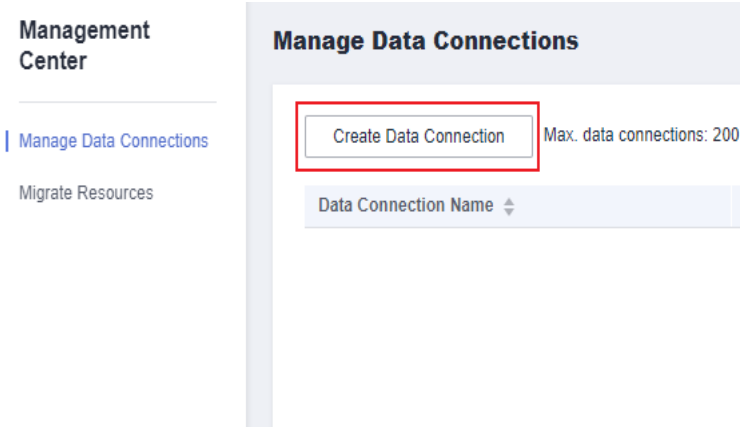
Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **Management Center**.

Step 3 On the displayed **Manage Data Connections** page, click **Create Data Connection**.

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Figure 4-1 Creating a data connection



Step 4 On the displayed page, select a data connection type and configure the parameters listed in **Table 4-3**.

NOTE

- **If two clusters are used** for clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of data lake services. The versions, specifications, components, regions, VPCs, subnets, and related configurations of the two sets of data lake services must be the same. For details on how to create data connections, see **Creating a DataArts Studio Data Connection**.
- For serverless services (such as DLI), DataArts Studio configures the mapping between data lake services in the production environment and development environment through environment isolation in the management center. The corresponding data lake is automatically switched during the development and production processes. Therefore, you need to prepare two sets of queues and database resources in the serverless data lake service and distinguish them by name suffix. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.
- For GaussDB(DWS), MRS Hive, and MRS Spark, if you **select the same cluster** when creating a data connection, you must configure database mapping on the **Configure Data Source Resource Mapping** page to isolate the development and production environments. For details, see **DB configuration**.

Table 4-3 Data connection parameters

Data Connection Type	Description
GaussDB(DWS)	See **DWS Connection Parameters**.
DLI	See **DLI Connection Parameters**.
MRS Hive	See **MRS Hive Connection Parameters**.
MRS HBase	See **MRS HBase Connection Parameters**.
MRS Kafka	See **MRS Kafka Connection Parameters**.
MRS Spark	See **MRS Spark Connection Parameters**.

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Data Connection Type	Description
MRS ClickHouse	See **MRS ClickHouse Connection Parameters**.
MRS Hetu	See **MRS Hetu Connection Parameters**.
MRS Impala	See **MRS Impala Connection Parameters**.
MRS Presto	See **MRS Presto Connection Parameters**.
MRS Doris	See **Doris Connection Parameters**.
OpenSource ClickHouse	See **OpenSource ClickHouse Connection Parameters**.
RDS	See **RDS Connection Parameters**. The RDS connection can connect to relational databases such as RDS for MySQL, PostgreSQL, DM, SQL Server, and SAP HANA.
MySQL (pending offline)	You are not advised to select this connection type. Instead, You are advised to select **RDS**. For details, see **RDS Connection Parameters**.
Oracle	See **Oracle Connection Parameters**.
Host Connection	See **Host Connection Parameters**.
Rest Client	See **Rest Client Connection Parameters**.
Redis	See **Redis Connection Parameters**.
SAP HANA	See **SAP HANA Connection Parameters**.

Step 5 Click **Test** to test connectivity of the data connection. If the test fails, the data connection cannot be created.

Step 6 After the test is successful, click **Save**. The system will create the data connection for you.

----End

Related Operations

- Edit a data connection: In the data connection list, locate a connection and click **Edit** in the **Operation** column. On the displayed page, modify the parameters listed in **Table 4-3** as needed.

  NOTE

  If you do not want to change the password, you do not need to set it. The system automatically uses the password set when the connection was created.

  Click **Test** to check whether the data connection is normal. If the connection is normal, click **Save**. If the connection is abnormal, the data connection cannot be created. Modify the connection parameters as prompted and try again.

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- Delete a data connection: In the data connection list, locate a connection and click **Delete** in the **Operation** column. In the displayed dialog box, confirm the data connection information, and click **OK**.

  If the connection to be deleted is being used, it cannot be deleted directly. In this case, you need to stop the connection from being used on the console of each component and try again.

  NOTE

  If a data connection is deleted, the data table information of the data connection will also be deleted. Exercise caution when performing this operation.

4.3 Configuring DataArts Studio Data Connection Parameters

4.3.1 DWS Connection Parameters

Table 4-4 DWS connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**DWS** is selected and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		

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Parameter	Mandatory	Description
SSL Encryption	Yes	DWS supports SSL encryption and certificate authentication for communication between the client and server. You can set this parameter based on whether SSL connection is mandatory on the server. ● If this parameter is enabled, only SSL encryption can be used for communication. ● If this parameter is disabled, both SSL encryption and certificate authentication can be used for communication.
Manual	Yes	Select either of the following modes: ● **Cluster Name Mode**: Select an existing cluster. ● **Connection String Mode**: Enter the IP address/ domain name and port of the corresponding cluster and enable the communication between the connection's agent (CDM cluster) and the DWS cluster. **NOTE** DataArts Security does not support GaussDB(DWS) connections in connection string mode.
DWS Cluster Name	Yes	This parameter is mandatory when **Manual** is set to **Cluster Name Mode**. Select a DWS cluster from all the DWS clusters with the same project ID and enterprise project.
IP Address or Domain Name	Yes	This parameter is mandatory when **Manual** is set to **Connection String Mode**. If you choose to manually enter an IP address or domain name, you must enter an internal IP address and a port that is accessible to the network segment of the resource group. Otherwise, the network is disconnected. This parameter indicates the address for accessing the cluster database through an internal network. Enter an IP address or domain name. The IP address or domain name is automatically generated during cluster creation. You can obtain them on the management console by performing the following operations: 1. Log in to the GaussDB(DWS) console. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number.

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Parameter	Mandatory	Description
Port	Yes	This parameter is mandatory when **Manual** is set to **Connection String Mode**. This parameter indicates the database port number specified during the DWS cluster creation. Ensure that you have enabled this port in the security group rule so that the DataArts Studio instance can connect to the database in the DWS cluster through this port.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	Data Warehouse Service (DWS) is not a fully managed service and thus cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating a DWS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the DWS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the DWS cluster. The security group rule must also allow the CDM cluster communicate with the DWS cluster. **NOTE** If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		
Username	Yes	The database username, which is specified when the DWS cluster is created.

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Parameter	Mandatory	Description
Password	Yes	The password for accessing the database, which is specified when the DWS cluster is created.

4.3.2 DLI Connection Parameters

Table 4-5 DLI connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**DLI** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		

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Parameter	Mandatory	Description
Project ID	No	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. Project ID in the region where DLI resides A project is a group of tenant resources, and an account ID corresponds to the current account. The IAM ID corresponds to the current user. You can view the project IDs, account IDs, and user IDs in different regions on the corresponding pages. 1. Register with and log in to the management console. 2. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list. 3. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.

4.3.3 MRS Hive Connection Parameters

Table 4-6 MRS Hive connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Hive** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		

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Parameter	Mandatory	Description
Connection Type	Yes	Connection type. **Proxy connection** is recommended. • **Proxy connection**: An agent (CDM cluster) is used to access MRS clusters. This method supports all versions of MRS clusters. • **MRS API connection**: MRS APIs are used to access MRS clusters. This method supports only MRS clusters of the 2.*X* or a later version. When you select **MRS API connection**, pay attention to the following restrictions: 1. The MRS API connection is available only for DataArts Factory. 2. In DataArts Factory, you cannot view or manage the databases, data tables, and fields of the connection in a visualized manner. If an MRS cluster of version 3.2.1 or later is connected, you can view rather than manage the databases, data tables, and fields of the connection in a visualized manner. 3. When the SQL editor of DataArts Factory is used to run SQL statements, the execution results can be displayed only in logs. **NOTE** Select **Proxy connection** for **Connection Type** so that the DataArts Architecture, DataArts Quality, DataArts Catalog, and DataArts DataService components can use the MRS connection.
Manual	Yes	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. • **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. • If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **MRS API connection** is selected for **Connection Type** or **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
KMS Key	No	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		

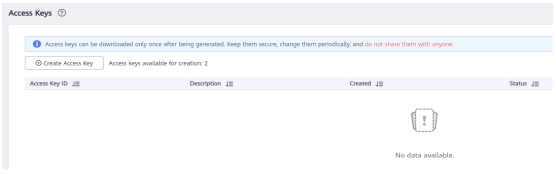
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Parameter	Mandatory	Description
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode
Username	Yes	Human-machine user of the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**. If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.
Password	Yes	The password for accessing the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**.

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Parameter	Mandatory	Description
Enable ldap	No	This parameter is available when **Connection Type** is set to **Proxy connection**. If LDAP authentication is enabled for an external LDAP server connected to MRS Hive, the LDAP username and password are required for authenticating the connection to MRS Hive. In this case, this option must be enabled. Otherwise, the connection will fail.
ldapUsername	Yes	This parameter is mandatory when **Enable ldap** is enabled. Enter the username configured when LDAP authentication was enabled for MRS Hive.
ldapPassword	Yes	This parameter is mandatory when **Enable ldap** is enabled. Enter the password configured when LDAP authentication was enabled for MRS Hive.
OBS storage support	No	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. The server must support OBS storage. When creating a Hive table, you can store the table in OBS.
Use Agency	No	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. If you enable the agency function, you can create a data connection without having a permanent AK/SK and execute CDM jobs using the scheduling identity configured in DataArts Factory.
Public agency	No	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules** and **Use Agency** is enabled. The agency is only used to check whether the connection agency function is normal. CDM jobs will be executed using the scheduling identity configured in DataArts Factory.

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Parameter	Mandatory	Description
AK	N/A	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules** and **OBS storage support** is enabled. AK and SK are used to log in to the OBS server. You need to create an access key for the current account and obtain an AK/SK pair. To obtain an access key, perform the following steps: 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 4-2**. **Figure 4-2** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.
SK	N/A	

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.

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- Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
- Set **Password Expiration Notification (Days)** to **0**.
- Retain the default values for other parameters.

3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.

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3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.4 MRS HBase Connection Parameters

Table 4-7 MRS HBase connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS HBase** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).

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Parameter	Mandatory	Description
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Manual	Yes	Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. ● **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. ● If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: ● If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. ● If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. ● The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode

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Parameter	Mandatory	Description
Username	Yes	Username of the MRS cluster If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.
Password	Yes	Password for accessing the MRS cluster.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.

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- Retain the default values for other parameters.

3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

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NOTE

- For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
- A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.5 MRS Kafka Connection Parameters

Table 4-8 MRS Kafka connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Kafka** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.

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Parameter	Mandatory	Description
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Manual	Yes	Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. • **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. • If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode

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Parameter	Mandatory	Description
Username	Yes	Username of the MRS cluster If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.
Password	Yes	Password for accessing the MRS cluster.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.

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- Retain the default values for other parameters.

3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.

   a. Log in to the MRS console.

   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.

   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

NOTE

- For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
- A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.6 MRS Spark Connection Parameters

Table 4-9 MRS Spark connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Spark** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.

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Parameter	Mandatory	Description
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Connection Type	Yes	Connection type. **Proxy connection** is recommended. • **Proxy connection**: An agent (CDM cluster) is used to access MRS clusters. This method supports all versions of MRS clusters. • **MRS API connection**: MRS APIs are used to access MRS clusters. This method supports only MRS clusters of the 2.*X* or a later version. When you select **MRS API connection**, pay attention to the following restrictions: 1. The MRS API connection is available only for DataArts Factory. 2. In DataArts Factory, you cannot view or manage the databases, data tables, and fields of the connection in a visualized manner. If an MRS cluster of version 3.2.1 or later is connected, you can view rather than manage the databases, data tables, and fields of the connection in a visualized manner. 3. When the SQL editor of DataArts Factory is used to run SQL statements, the execution results can be displayed only in logs. **NOTE** MRS Spark data connections in MRS API mode apply to data development, while MRS Spark data connections in proxy mode apply to data governance. • To ensure that required resources (such as threads, memory, CPUs, and MRS resource queues) can be independently configured for each Spark SQL job in data development scenarios, select **MRS API connection**. If you select **Proxy connection**, resources cannot be configured independently for each Spark SQL job. • To ensure that other components such as DataArts Architecture can use this connection, select **Proxy connection**.

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Parameter	Mandatory	Description
Manual	Yes	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. • **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. • If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **MRS API connection** is selected for **Connection Type** or **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
KMS Key	Yes	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		

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Parameter	Mandatory	Description
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode
MRS Version	No	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Select the MRS cluster version.
Component Name	No	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Select the Spark version.
Username	Yes	Human-machine user of the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**. If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.

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Parameter	Mandatory	Description
Password	Yes	The password for accessing the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.
4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

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NOTE

- When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
- When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.
4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

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NOTE

- When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
- When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.7 MRS ClickHouse Connection Parameters

Table 4-10 MRS ClickHouse connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS ClickHouse** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Manual	Yes	Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. • **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. • If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • MRS ClickHouse connections are supported only in CDM 2.9.2 and later versions. • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		

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Parameter	Mandatory	Description
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode
Username	Yes	Username of the MRS cluster If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.
Password	Yes	Password for accessing the MRS cluster.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

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1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.
4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.

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- Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
- Set **Password Expiration Notification (Days)** to **0**.
- Retain the default values for other parameters.

3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.8 MRS Hetu Connection Parameters

Table 4-11 MRS Hetu connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Hetu** is selected by default and cannot be changed.

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Parameter	Mandatory	Description
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Manual	Yes	Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. • **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. • If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. **NOTE** • MRS clusters of version 3.1.1 and later can be connected. • To connect to MRS clusters of version 3.2.1, add parameter **protocol.v1.alternate-header-name** with value **Presto** in the **coordinator.config.properties** and **worker.config.properties** files for the compute instance on the HetuEngine WebUI. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. **NOTE** • MRS clusters of version 3.1.1 and later can be connected. • To connect to MRS clusters of version 3.2.1, add parameter **protocol.v1.alternate-header-name** with value **Presto** in the **coordinator.config.properties** and **worker.config.properties** files for the compute instance on the HetuEngine WebUI. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

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Parameter	Mandatory	Description
		NOTE If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • MRS Hetu connections are supported only in CDM 2.9.2 and later versions. • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.

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Parameter	Mandatory	Description
hsbroker IP Address List	Yes	IP addresses of the hsbroker nodes of the MRS Hetu component. Use commas (,) to separate multiple IP addresses. To obtain the port number, perform the following operations: 1. Log in to MRS FusionInsight Manager. 2. Choose **Cluster** > **Services** > **HetuEngine** > **Role** > **HSBroker** to obtain the service IP addresses of all HSBroker instances.
hsbroker Port	Yes	Port number of the hsbroker node of the MRS Hetu component. To obtain the port number, perform the following operations: 1. Log in to MRS FusionInsight Manager. 2. Choose **Cluster** > **Services** > **HetuEngine** > **Configurations** > **All Configurations** and search for **server.port** on the right to obtain the port number of HSBroker.
Data Source Authentication and Other Function Configuration		
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: ● **SIMPLE**: for non-security mode ● **KERBEROS**: for security mode

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Parameter	Mandatory	Description
Username	Yes	Username of the MRS cluster. The user must have permissions of HetuEngine. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration. **NOTICE** After creating the HetuEngine user, you need to complete the configurations in **Using HetuEngine from Scratch**.
Password	Yes	Password for accessing the MRS cluster.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.

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- Set **Password Expiration Notification (Days)** to **0**.
- Retain the default values for other parameters.

3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

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NOTE

- For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
- A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.9 MRS Impala Connection Parameters

Table 4-12 MRS Impala connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Impala** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.

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Parameter	Mandatory	Description
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Manual	Yes	Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. ● **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. ● If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • MRS Impala connections are supported only in CDM 2.9.2 and later versions. • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.

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Parameter	Mandatory	Description
impaladlps	Yes	Management IP address of the Impalad role of the MRS Impala component To obtain it, perform the following operations: 1. Log in to MRS FusionInsight Manager. 2. Choose **Cluster** > **Services** > **Impala** > **Instance** to view the Impalad management IP address.
Data Source Authentication and Other Function Configuration		
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode
Username	Yes	Human-machine user of the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**. If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.

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Parameter	Mandatory	Description
Password	Yes	The password for accessing the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**.
Enable ldap	No	This parameter is available when **Proxy connection** is selected for **Connection Type**. If LDAP authentication is enabled for an external LDAP server connected to MRS Impala, the LDAP username and password are required for authenticating the connection to MRS Impala. In this case, this option must be enabled. Otherwise, the connection will fail.
ldapUsername	Yes	This parameter is mandatory when **Enable ldap** is enabled. Enter the username configured when LDAP authentication was enabled for MRS Impala.
ldapPassword	Yes	This parameter is mandatory when **Enable ldap** is enabled. Enter the password configured when LDAP authentication was enabled for MRS Impala.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

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NOTE

- For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
- For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
- A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

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4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.10 MRS Ranger Connection Parameters

Table 4-13 MRS Ranger connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Ranger** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		

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Parameter	Mandatory	Description
Manual	Yes	Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. • **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. • If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. ● If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. ● If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane. **NOTE** If the version of the CDM cluster selected as the agent is 2.9.3.300 or earlier, you can only create a connection to MRS Ranger in an MRS cluster in security mode. To create a connection to MRS Ranger in an MRS cluster in non-security mode, ensure that the CDM cluster version is 2.10.0.300 or later, or contact customer service or technical support to upgrade the dlg-agent component in the CDM cluster.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
		NOTE If the version of the CDM cluster selected as the agent is 2.9.3.300 or earlier, you can only create a connection to MRS Ranger in an MRS cluster in security mode. To create a connection to MRS Ranger in an MRS cluster in non-security mode, ensure that the CDM cluster version is 2.10.0.300 or later, or contact customer service or technical support to upgrade the dlg-agent component in the CDM cluster.
IP Address	Yes	Management IP address of the RangerAdmin role of the MRS Ranger component. Separate multiple IP addresses with commas (,). To obtain the port number, perform the following operations: 1. Log in to MRS FusionInsight Manager. 2. Choose **Cluster** > **Services** > **Ranger** > **Instance** to view the management IP address of the RangerAdmin role.
Port	Yes	Port number of the MRS Ranger instance. To obtain the port number, perform the following operations: 1. Log in to MRS FusionInsight Manager. 2. Choose **Cluster** > **Services** > **Ranger** > **Configurations** > **Basic Configurations**. For an MRS cluster in non-security mode, obtain the port corresponding to the **ranger.service.http.port** parameter. For an MRS cluster in security mode, obtain the port corresponding to the **ranger.service.https.port** parameter.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.

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Parameter	Mandatory	Description
Agent	Yes	MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode

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Parameter	Mandatory	Description
Username	Yes	Username of the MRS cluster If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.
Password	Yes	Password for accessing the MRS cluster.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.

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- Set **Password Expiration Notification (Days)** to **0**.
- Retain the default values for other parameters.

3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

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NOTE

- For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
- A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.

4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

      NOTE

      - When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
      - When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.11 MRS Presto Connection Parameters

Table 4-14 MRS Presto connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Presto** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.

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Parameter	Mandatory	Description
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
MRS Cluster Name	Yes	The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: ● If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. ● If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. ● The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.
Data Source Authentication and Other Function Configuration		
Description	No	You can enter the description of the connection.

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4.3.12 Doris Connection Parameters

Table 4-15 MRS Doris connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**Doris** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Doris Type	Yes	You can select **MRS Doris** or **CloudTable Doris**.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is valid when **Doris Type** is set to **MRS Doris**. **NOTE** This parameter is available only for MRS clusters of version 3.2.0 or later. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
FE IP	Yes	IP address of the frontend node of the Doris or Cloud component in the MRS cluster. You can enter one or more IP addresses. Separate multiple IP addresses with commas (,). To obtain them, perform the following operations: 1. Log in to MRS FusionInsight Manager. 2. Choose **Cluster** > **Services** > **Doris** > **Instance** to obtain the management IP address of the FE role.
Port	Yes	Port used by the Doris FE to query connections through the MySQL protocol To obtain MRS Doris, perform the following steps: 1. Log in to MRS FusionInsight Manager. 2. Choose **Cluster** > **Services** > **Doris** > **Configurations** > **Basic Configurations**, search for **query_port**, and view the port number.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.

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Parameter	Mandatory	Description
Agent	Yes	MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
SSL Encryption	No	Whether to enable SSL encrypted transmission. This function is enabled by default. Disable it if SSL is disabled at the source.
Data Source Driver Configuration		
Driver Name	Yes	Driver name. Currently, the MySQL JDBC driver is supported. The driver name is **com.mysql.jdbc.Driver**.
Driver Source	Yes	Select the source of the driver file.

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Parameter	Mandatory	Description
Driver File Path	Yes	This parameter is mandatory when **Driver file source** is set to **OBS path**. Path of the driver file in the OBS bucket. You need to download the .jar driver file from the corresponding official website and upload it to the OBS bucket. MySQL driver: Obtain the driver from **https://downloads.mysql.com/archives/c-j/**. Version 5.1.48 or later is recommended. If the version is earlier than 5.1.48, error "The db user or password invalid" will be reported. **NOTE** To update the driver, you must restart the CDM cluster in DataArts Migration and then edit the data connection to upload the driver.
Driver File	Yes	This parameter is mandatory when **Driver Source** is set to **Local file**. Select a driver version that adapts to the database type.
Data Source Authentication and Other Function Configuration		
Username	Yes	Username of the MRS or CloudTable cluster. If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user with a permanent password by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.

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Parameter	Mandatory	Description
Password	Yes	It can also be the password for accessing the MRS or CloudTable cluster.

Creating a Kerberos Authentication User for an MRS Security Cluster

To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. To create an MRS user, perform the following steps:

For clusters of MRS 3.x:

1. Log in to MRS Manager as user **admin**.
2. Choose **System** > **Permission** > **Security Policy** > **Password Policy**. Click **Add Password Policy** and add a policy under which the password never expires.
   - Set **Password Policy Name** to **neverexp**.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user and set the password policy to **neverexp**. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components.
   - For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.
4. Log in to Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

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NOTE

- When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
- When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

For clusters of MRS 2.x or earlier:

1. Log in to the MRS Manager as user **admin**.
2. On FusionInsight Manager, choose **System Settings** and click **Configure Password Policy** to modify the password policy.
   - Set **Password Validity Period (Days)** to **0**, indicating that the password never expires.
   - Set **Password Expiration Notification (Days)** to **0**.
   - Retain the default values for other parameters.
3. Choose **System** > **Manage User**. On the page displayed, add a dedicated human-machine user as the Kerberos authentication user. Select the user group **superGroup** for the user, and assign all roles to the user.

   NOTE

   - For clusters of MRS 2.*x* or earlier, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center.
   - A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.
4. Log in to MRS Manager as the new user and change the initial password. Otherwise, the connection fails to be created.
5. Synchronize IAM users.
   a. Log in to the MRS console.
   b. Choose **Clusters** > **Active Clusters**, select a running cluster, and click its name to go to its details page.
   c. In the **Basic Information** area of the **Dashboard** page, click **Synchronize** on the right side of **IAM User Sync** to synchronize IAM users.

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NOTE

- When the policy of the user group to which the IAM user belongs changes from **MRS ReadOnlyAccess** to **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** (System Security Services Daemon) cache of cluster nodes needs time to be updated. Then, submit a job. Otherwise, the job may fail to be submitted.
- When the policy of the user group to which the IAM user belongs changes from **MRS CommonOperations**, **MRS FullAccess**, or **MRS Administrator** to **MRS ReadOnlyAccess**, wait for 5 minutes until the new policy takes effect after the synchronization is complete because the **SSSD** cache of cluster nodes needs time to be updated.

4.3.13 OpenSource ClickHouse Connection Parameters

Table 4-16 OpenSource ClickHouse connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**OpenSource ClickHouse** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
IP Address	Yes	IP address of the node where the ClickHouseServer is located
Port	Yes	Used to receive JDBC requests. By default, the value of the **http_port** parameter of ClickHouseServer is used.

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	As a network proxy, the CDM cluster must be able to communicate with the ClickHouseServer. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. **NOTE** If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.

4.3.14 RDS Connection Parameters

RDS connections can be used to connect to MySQL, PostgreSQL, and SQL Server databases.

Table 4-17 RDS connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**RDS** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).

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Parameter	Mandatory	Description
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
IP Address or Domain Name	Yes	Address for accessing the relational database data source. The value can be an IP address or a domain name. If you choose to manually enter an IP address or domain name, you must enter an internal IP address and a port that is accessible to the network segment of the resource group. Otherwise, the network is disconnected. ● If the data source is RDS, you can obtain the address on the management console by performing the following operations: 1. Log in to the management console of the corresponding cloud service using the account you have obtained. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number. ● If the data source is MySQL, PostgreSQL, or DM, you can obtain the access address from the database administrator.

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Parameter	Mandatory	Description
Port	Yes	Port for accessing the relational database. • If the data source is RDS, you can obtain the address on the management console by performing the following operations: 1. Log in to the management console of the corresponding cloud service using the account you have obtained. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number. • If the data source is MySQL, PostgreSQL, or DM, you can obtain the access address from the database administrator.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.

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Parameter	Mandatory	Description
Agent	Yes	RDS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an RDS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with RDS. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as RDS. The security group rule must also allow the CDM cluster to communicate with RDS. **NOTE** If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
SSL Encryption	No	Whether to enable SSL encrypted transmission.
Data Source Driver Configuration		
Driver Name	Yes	The name of the driver. The following values are available: • **com.mysql.jdbc.Driver**: Select this driver name for RDS for MySQL or MySQL. • **org.postgresql.Driver**: Select this driver name for RDS for PostgreSQL or PostgreSQL. • **com.microsoft.sqlserver.jdbc.SQLServerDriver**: Select this driver name for RDS for SQL Server.
Driver file source	Yes	Select the source of the driver file.

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Parameter	Mandatory	Description
Driver File Path	Yes	It specifies the OBS path where the driver file is located. You need to download a .jar driver file from the corresponding official website and upload it to OBS. • MySQL driver: Download it from **https://downloads.mysql.com/archives/c-j/**. The 5.1.48 version is recommended. • PostgreSQL driver: Download it from **https://mvnrepository.com/artifact/org.postgresql/postgresql**. The 42.3.4 version is recommended. • SQL Server driver: Download it from **https://learn.microsoft.com/en-us/sql/connect/jdbc/download-microsoft-jdbc-driver-for-sql-server?view=sql-server-ver16**. The 8.4.1 version is recommended. **NOTE** • The OBS path of the driver file cannot contain Chinese characters. • To update the driver, you must restart the CDM cluster in DataArts Migration and then edit the data connection to upload the driver.
Data Source Authentication and Other Function Configuration		
Username	Yes	The username of the database. The username is required for creating a cluster.
Password	Yes	The password for accessing the database. The password is required for creating a cluster.

4.3.15 Oracle Connection Parameters

Table 4-18 Oracle connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**ORACLE** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).

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Parameter	Mandatory	Description
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
IP Address or Domain Name	Yes	Address for accessing the database to be connected. You can enter a public/private IP address or a domain name.
Port	Yes	The port of the database to connect.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	DataArts Studio cannot be directly connected to non-fully managed services. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an Oracle data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with Oracle.
Data Source Authentication and Other Function Configuration		

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Parameter	Mandatory	Description
Username	Yes	Username used for accessing the database This account must have the permissions required to read and write data tables and metadata. **NOTE** If you have the CONNECT permission (read-only permission) and are trying to create a connection, a message is displayed indicating that the table or schema does not exist. In this case, perform the following operations to grant permissions: 1. Log in to the Oracle node as user **root**. 2. Run the following command to switch to user **oracle**: **su oracle** 3. Run the following command to log in to the database: **sqlplus /nolog** 4. Run the following command to log in as user **sys**: **connect sys as sysdba;** Enter the password of user **sys**. 5. Run the following SQL statement to grant permissions: **GRANT SELECT ON GV_$INSTANCE to *xxx*;** In the preceding command, *xxx* indicates the name of the user to which the permissions will be granted.
Password	Yes	Password of the username
Connection Type	Yes	Select a connection type. ● SID SID indicates the ID of the Oracle database instance. One instance corresponds to only one database, but one database can correspond to multiple instances. ● Service Name It was introduced since Oracle8i and indicates the external service name of the Oracle database.
SID	Yes	This parameter is mandatory when **Connection type** is set to **SID**. SID indicates the ID of the Oracle database instance. One instance corresponds to only one database, but one database can correspond to multiple instances.
Service Name	Yes	This parameter is mandatory when **Connection type** is set to **Service Name**. This parameter was introduced since Oracle8i and indicates the external service name of the Oracle database.

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4.3.16 Host Connection Parameters

Table 4-19 Host Connection parameters

Parameter	Mandatory	Description
Data Connection Type	Yes	**Host Connection** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Host Address	Yes	IP address of the Linux host For details, see **Viewing Details About an ECS**.
Agent	Yes	CDM cluster used as an agent. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. **NOTE** • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload. • When scheduling shell or Python scripts, the agent accesses the ECS. If shell and Python scripts are scheduled frequently, the ECS adds the private IP address of the agent to the blocklist. To ensure normal job scheduling, you are advised to use the **root** user of the ECS to add the private IP address bound to the agent (CDM cluster) to the **/etc/hosts.allow** file. For details about how to obtain the private IP address of the CDM cluster, see **Viewing and Modifying CDM Cluster Configurations**.

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Parameter	Mandatory	Description
Port	Yes	SSH port number of the host. By default, port 22 is used to log in to a Linux host. If the port number has been changed, you can obtain the new port number from the **port** field in the **/etc/ssh/sshd_config** file.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Data Source Authentication and Other Function Configuration		
Username	Yes	Username for logging in to the host
Login Mode	Yes	Mode for logging in to the host • Key Pair • Password
Key Pair	Yes	This parameter is available only when **Login Mode** is set to **Key Pair**. If **Key Pair** is the login mode of the host, you need to obtain the private key file, upload it to OBS, and select an OBS path. **NOTE** The uploaded private key must match the public key configured on the host. For details, see **Application Scenarios for Using Key Pairs**.
Key Pair Password	Yes	If no password is set for the key pair, you do not need to set this parameter.
Password	Yes	This parameter is available only when **Login Mode** is set to **Password**. If the login mode of the host is to use a password, enter a login password.
Host Connection Description	No	Descriptive information about the host connection

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NOTICE

- The maximum number of shell or Python scripts that can run concurrently on the ECS is determined by the value of **MaxSessions** in the **/etc/ssh/sshd_config** file on the ECS. Set **MaxSessions** based on the scheduling frequency of shell or Python scripts.
- You have the permission to create and execute files in the **/tmp** directory on the host.
- Shell and Python scripts are executed in the **/tmp** directory on an ECS. Ensure that the disk space of the **/tmp** directory is not used up.

4.3.17 Rest Client Connection Parameters

Table 4-20 Rest Client connection

Parameter	Mandatory	Description
Data Connection Type	Yes	The value is fixed at **Rest Client**.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available. The connection can be used in the selected modules.
Basic and Network Connectivity Configuration		
Connection address prefix	Yes	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. Prefix of the connection address. This prefix is automatically added when an API is called during a job test or execution. HTTPS supports only TLS 1.2. Example: **https://xxx.com/prefix**

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Parameter	Mandatory	Description
Default Header	Yes	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. It specifies the default header parameter. This header is carried when an API is called. Example: {"Content-Type":"application/json"}
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. DataArts Studio cannot directly connect to non-fully managed services. An agent is required for DataArts Studio to communicate with non-fully managed services. A CDM cluster can function as an agent. If no CDM cluster is available, create one by referring to **Creating a CDM Cluster**.
Data Source Authentication and Other Function Configuration		
Rest auth type	Yes	Authentication method. The following options are available: • **NONE**: no authentication • **BASIC_AUTH**: basic authentication If the data source API supports username and password authentication, you can select this authentication type and configure the username and password used for authentication. When the data source is connected, the username and password are transferred to the RESTful address through the Basic Auth protocol for authentication. The format is {"Authorization":"Basic base64(username:password)"}. • **TOKEN_AUTH**: token authentication (The token is static and never expires. Otherwise, jobs will fail if the token expires.) If the data source API supports token-based authentication, you can select this authentication type and set a fixed token for authentication. When the data source is connected, the token is transferred to the header for authentication. The format is {"Authorization":"Bearer <token>"}. • **OAUTH_CODE_GRANT Oauth 2.0 (Authorization Code)**: Oauth2.0 authentication In this mode, a username and a password are used to obtain an access token, which is used to access APIs.

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Parameter	Mandatory	Description
Username	No	This parameter is displayed when **Rest auth type** is **BASIC_AUTH**. You can use **#username** to obtain the value and transfer it in the body and header.
Password	No	This parameter is displayed when **Rest auth type** is **BASIC_AUTH**. You can use **#password** to obtain the value and transfer it in the body and header.
Token	No	This parameter is displayed when **Rest auth type** is **TOKEN_AUTH**. You can use **#token** to obtain the value and transfer it in the body and header.
Auth request url	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**. This parameter is available when **Rest auth type** is set to **Oauth 2.0 (Authorization Code)**. This API supports OAuth 2.0. Authentication credentials are used to obtain a token. Before testing connections and jobs, call this API to obtain the token. In addition, the location, name, and value acquisition mode of the token carried in subsequent APIs are defined in the authentication token. Example: **https://xxx.com/auth/token**
Auth request method	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**. Authentication request method in OAuth 2.0 mode. The value can be **GET** or **POST**. This parameter is mandatory if **Auth request url** is set. Example: **GET**
Auth request username	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**. This parameter is mandatory for the Oauth 2.0 mode. You can use **#authUsername** to obtain the value of this parameter and enter it in the **authHeader** or **authbody** parameter.
Auth request password	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**. This parameter is mandatory for the Oauth 2.0 mode. You can use **#authPassword** to obtain the value of this parameter and enter it in the **authHeader** or **authbody** parameter.

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Parameter	Mandatory	Description
Auth request header	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**. Request header for the Oauth 2.0 mode. The authentication account and password can be obtained through **#authUsername** and **#authPassword**. Example: {"username": "#authUsername","password": "#authPassword","Content-Type":"application/json"}
Auth request body	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**. Request body for the Oauth 2.0 mode. This parameter is unavailable when **Auth request method** is set to **GET**. The authentication account and password can be obtained through **#authUsername** and **#authPassword**. Example: **{"username": "#authUsername","password": "#authPassword"}**

Auth request token	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**.
		Authentication token, which can be obtained from the response body of the authentication API and carried in the connection and job test. The token can only be placed in the header. The value contains a parameter name and a parameter value. The parameter value can be a SpEL expression.
		The following is an example:
		The authentication response body is as follows:
		{
		"code" : 200,
		"data" : {
		"access_token" : "DSFSDFWE87WE9089W9EW9ER898WER9W89ER8",
		"expired":1000
		}
		}
		To obtain the value of **access_token** in Bearer <token> format, set the value of this parameter as follows:
		NAME: Authentication
		VALUE: 'Bearer ' + #response.data.access_token

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Parameter	Mandatory	Description
Auth request token expired	No	This parameter is displayed when **Rest auth type** is **OAUTH_CODE_GRANT**. Validity period of the authentication token, in seconds. The value can be an EL expression. The default value **0** indicates that the token is permanently valid. Example 1: **300** indicates that the validity period is 300 seconds. Example 2: **#response.data.expired**. Obtain the value of the **expired** attribute from the JSON string returned by the authentication API. The default unit is second. If the value is not of the int type, enter a validity period.

4.3.18 Redis Connection Parameters

Table 4-21 Redis connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**Redis** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		

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Parameter	Mandatory	Description
Manual	No	This parameter is available when a proxy is used for connection. You can select **Cluster Name Mode** or **Connection String Mode**. • If you select **Cluster Name Mode**, select an existing cluster. • If you select **Connection String Mode**, enter the IP address and port of the corresponding cluster.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.
Server List	Yes	This parameter is displayed when **Manual** is set to **Connection String Mode**. One or more servers (server domain name/IP address:server port) separated by commas (,) Example: **192.168.0.1:27017** or **192.168.0.2:27017**

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	The CDM cluster provides an agent for communications between DataArts Studio and Redis. When creating a Redis connection, select a CDM cluster. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**.
Data Source Authentication and Other Function Configuration		
Authentication Method	Yes	This parameter is mandatory when **Manual** is set to **Connection String Mode**. Select the authentication type of the database. The options include **SIMPLE** and **KERBEROS**.
Password	Yes	Password for accessing the database. The password is required for creating a cluster.

4.3.19 SAP HANA Connection Parameters

Table 4-22 SAP HANA connection

Parameter	Mandatory	Description
Data Connection Type	Yes	The value is fixed at **RDS(SAP HANA)**.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).

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Parameter	Mandatory	Description
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
IP Address or Domain Name	Yes	Address for accessing the relational database data source. The value can be an IP address or a domain name. ● If the data source is RDS, you can obtain the address on the management console by performing the following operations: 1. Log in to the management console of the corresponding cloud service using the account you have obtained. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number. ● If the data source is MySQL, PostgreSQL, or DM, you can obtain the access address from the database administrator.
Port	Yes	Port for accessing the relational database ● If the data source is RDS, you can obtain the address on the management console by performing the following operations: 1. Log in to the management console of the corresponding cloud service using the account you have obtained. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number. ● If the data source is MySQL, PostgreSQL, or DM, you can obtain the access address from the database administrator.

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	DataArts Studio cannot be directly connected to non-fully managed services. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an SAP HANA data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**.
Data Source Driver Configuration		
Driver Name	Yes	Driver name • **com.mysql.jdbc.Driver**: Select this driver name for RDS for MySQL or MySQL. • **org.postgresql.Driver**: Select this driver name for RDS for PostgreSQL or PostgreSQL. • **com.microsoft.sqlserver.jdbc.SQLServerDriver**: Select this driver name for RDS for SQL Server.
Driver Source	Yes	Source of the driver file

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Parameter	Mandatory	Description
Driver File Path	Yes	This parameter is mandatory when **Driver File Source** is set to **OBS path**. It specifies the OBS path where the driver file is located. You need to download a .jar driver file from the corresponding official website and upload it to OBS. • MySQL driver: Download it from **https://downloads.mysql.com/archives/c-j/**. The 5.1.48 version is recommended. • PostgreSQL driver: Download it from **https://mvnrepository.com/artifact/org.postgresql/postgresql**. The 42.3.4 version is recommended. • SQL Server driver: Download it from **https://learn.microsoft.com/en-us/sql/connect/jdbc/download-microsoft-jdbc-driver-for-sql-server?view=sql-server-ver16**. The 8.4.1 version is recommended. **NOTE** • The OBS path of the driver file cannot contain Chinese characters. • To update the driver, you must restart the CDM cluster in DataArts Migration and then edit the data connection to upload the driver.
Driver File	Yes	This parameter is mandatory when **Driver Source** is set to **Local file**. You can download a driver file from the official driver website, and then click Select and upload the driver. Alternatively, you can select a driver that has been uploaded before.
Data Source Authentication and Other Function Configuration		
Username	Yes	Username of the database. The username is required for creating a cluster.
Password	Yes	Password for accessing the database. The password is required for creating a cluster.

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4.3.20 LTS Connection Parameters

Table 4-23 LTS connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**LTS** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Project ID	Yes	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. Project ID in the region where DLI resides A project is a group of tenant resources, and an account ID corresponds to the current account. The IAM ID corresponds to the current user. You can view the project IDs, account IDs, and user IDs in different regions on the corresponding pages. 1. Register with and log in to the management console. 2. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list. 3. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.

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Parameter	Mandatory	Description
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	DataArts Studio cannot be directly connected to non-fully managed services. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an LTS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**.
Data Source Authentication and Other Function Configuration		
AK	Yes	OBS AK Example: **HCXUET8G37MWF**
SK	No	SK corresponding to the OBS AK

4.4 Configuring DataArts Studio Resource Migration

To migrate resources in one workspace to another, you can use the resource migration function provided by DataArts Studio.

Resources can be imported from OBS or a local path. Resources that can be migrated include the following service data:

- Data connections created in Management Center
- CDM jobs created in DataArts Migration, including the links in jobs
- Scripts and jobs that have been submitted in DataArts Factory. By default, when jobs are exported, their dependent scripts and resources are not exported.
- Subjects, processes, lookup tables, data standards, ER models, dimensions, business metrics, atomic metrics, derivative metrics, compound metrics, and summary tables created in DataArts Architecture, excluding fact tables
- Metadata collection tasks created and metadata categories and tags defined in DataArts Catalog
- APIs published in DataArts DataService

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Constraints

- Metadata collection tasks, metadata categories, and tags with the same name in DataArts Catalog cannot be migrated repeatedly.
- Only an exported .zip file can be imported. During the import, the system verifies the resources in the file.
- For security concerns, passwords of connections are not exported when the connections are exported. You need to enter the passwords when importing the connections.
- Only the enterprise edition supports the export of data catalogs (categories, tags, and collection tasks). The expert edition does not support this function.
- The file to be imported from an OBS bucket or local path cannot be larger than 10 MB.

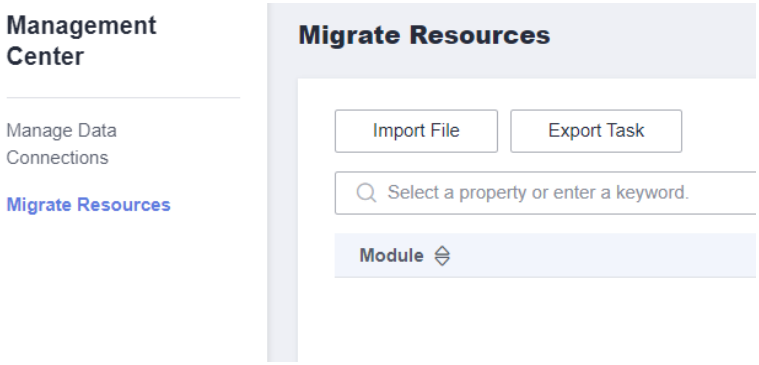
Exporting a Resource

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **Management Center**.

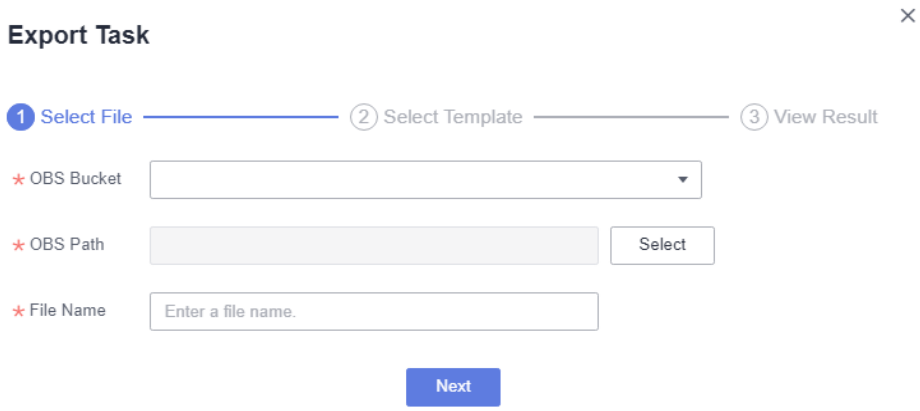
Step 3 In the navigation pane, choose **Migrate Resources**.

Figure 4-3 Migrating Resources



Step 4 Click **Export Task** to configure the file name and the OBS path for saving the file.

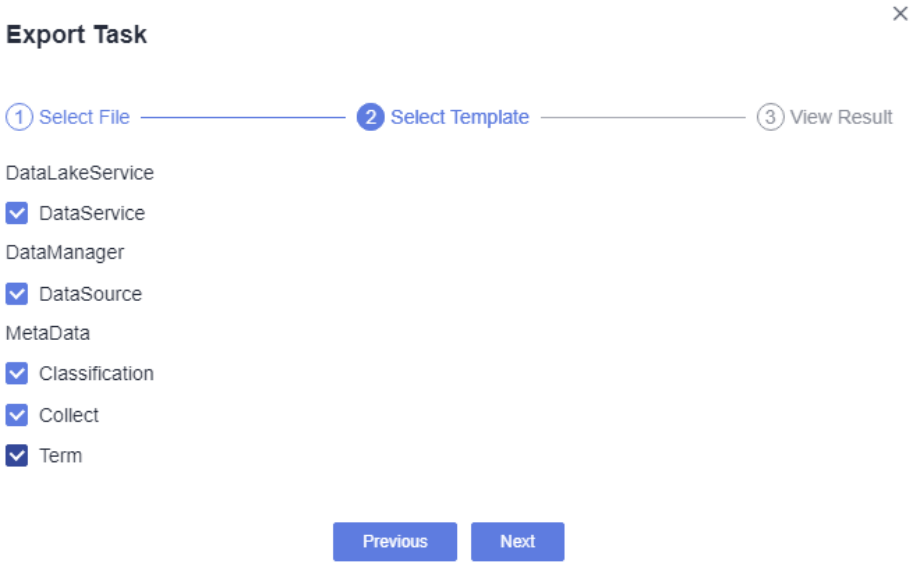
Figure 4-4 Export Task



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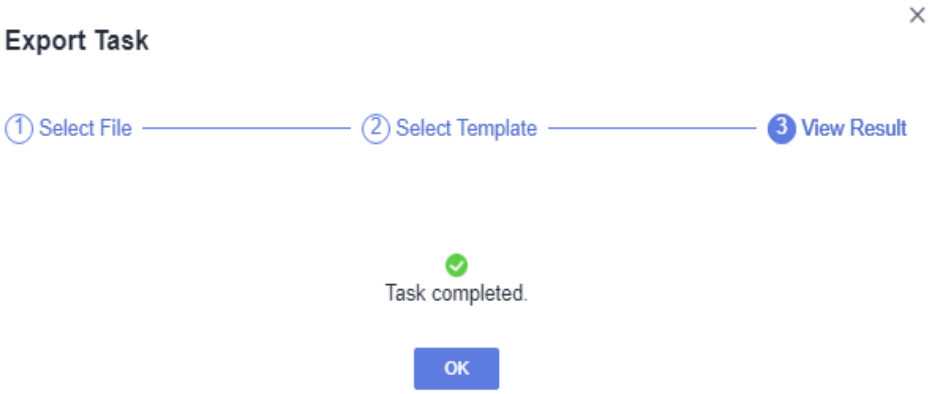
Step 5 Click **Next** and select the resources to export.

Figure 4-5 Selecting the resource to export



Step 6 Click **Next** and wait until the export is complete. The resource package is exported to the OBS path you have set.

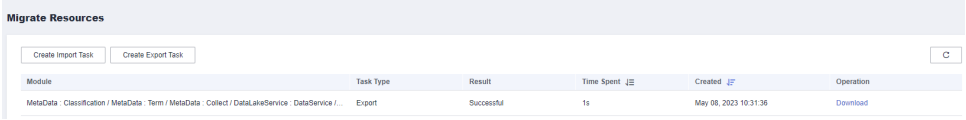
Figure 4-6 Export completed



If no result is displayed in 1 minute, the export fails. Try again. If the failure persists, contact the customer service or technical support.

Step 7 After the export is complete, you can click **Download** in the row of the corresponding migration task to download the exported resource package.

Figure 4-7 Downloading the exported result



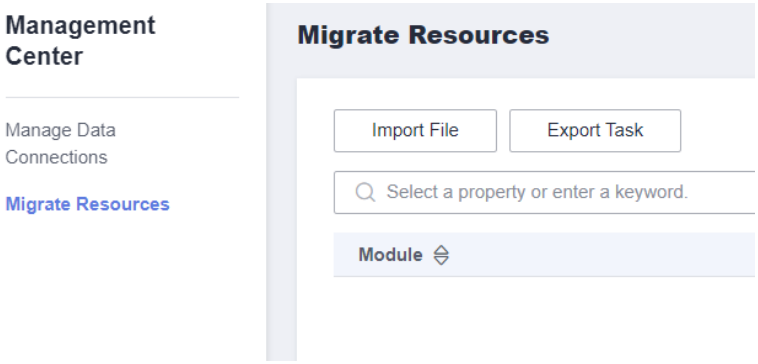
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----End

Importing a Resource

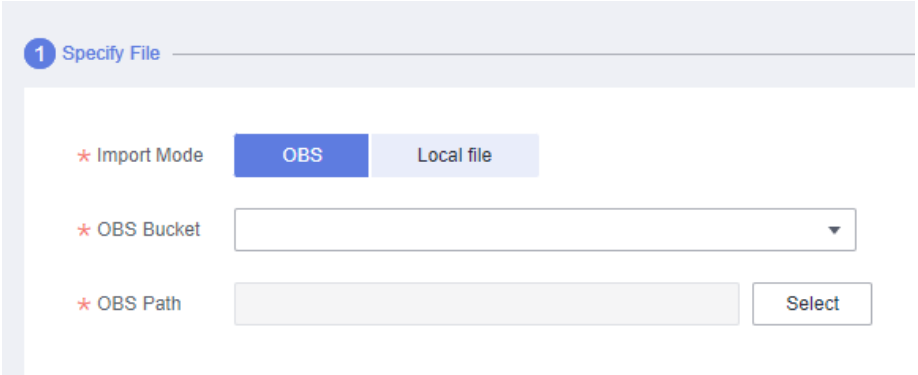
Step 1 In the navigation pane, choose **Migrate Resources**.

Figure 4-8 Migrating Resources



Step 2 Click **Import File**. On the displayed page, select an import mode and set the OBS bucket and path or local path that stores resources. The resource to be imported must be a .zip file exported from the console.

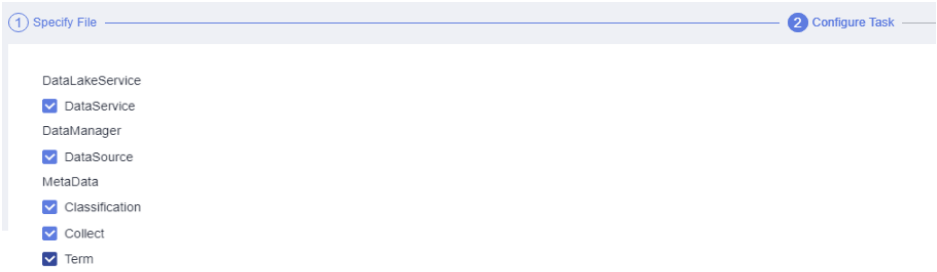
Figure 4-9 Configuring the path that stores the resources to be imported



Step 3 Click **Import File** and upload resources. a .zip resource file that you have exported.

Step 4 Click **Next** and select the resources to import.

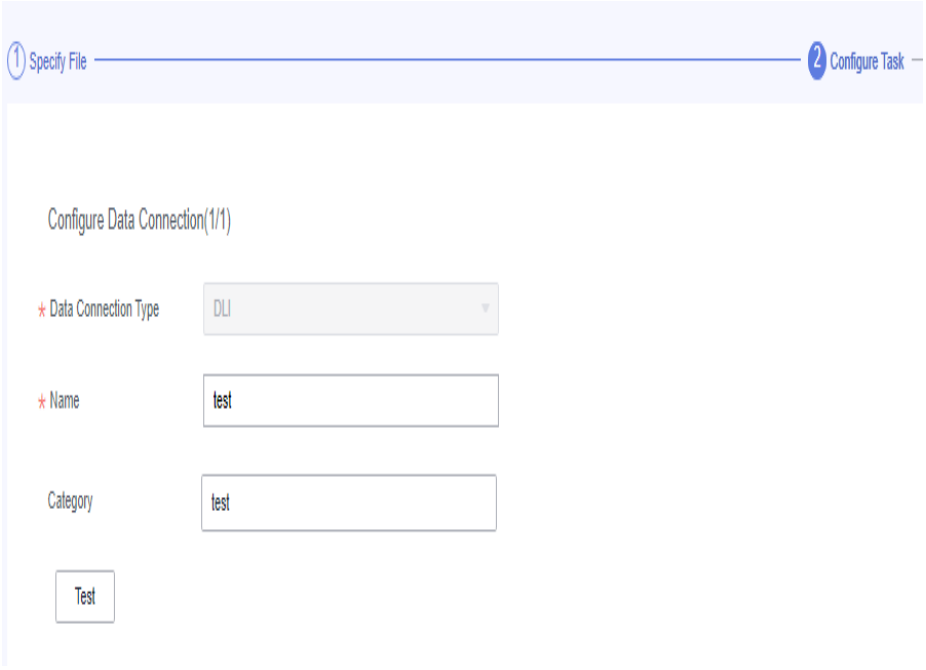
Figure 4-10 Selecting the resource to import



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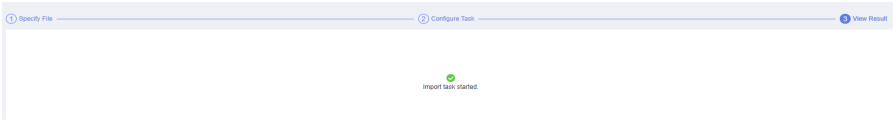
Step 5 If you select **DataSource**, click **Next** to configure a data connection.

Figure 4-11 Configuring a data connection



Step 6 Click **Next** and wait until the import task is delivered. When the import task is delivered successfully, the system displays message "Import task started."

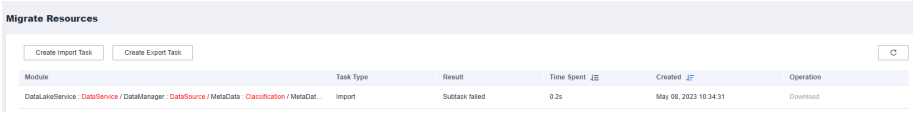
Figure 4-12 Import task started



Step 7 Click **OK**. You can view the import result in the resource migration task list.

Subtasks that fail are marked in red. You can click their names to view the failure causes.

Figure 4-13 Viewing the import result



----End

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4.5 Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode

- You can configure isolation between the development and production environments for DLI and DB.
- After the environment isolation is configured, the data connection in the development environment in the script or job during data development is automatically switched to the data connection in the production environment after the process is released.

Prerequisites

- Before configuring environment isolation for DLI, ensure that you have created a DLI **data connection**.

(Optional) Configuring DLI Environment Isolation

Environment isolation needs to be configured only for a serverless service (that is, DLI).

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance C**.
2. On the DataArts Studio console, locate a workspace and click **Management Center**.
3. In the left navigation pane on the **Management Center** page, choose **Data Source Resource Mapping Configuration**.

   Figure 4-14 Data Source Resource Mapping Configuration

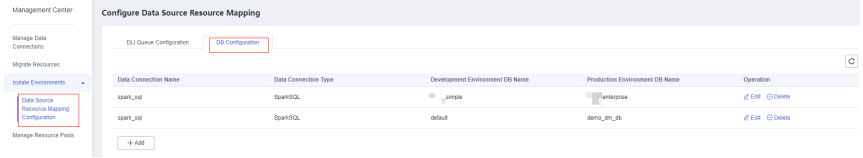
   

4. Click the **DB Configuration** tab and then **Add**. Set the database names for the development and production environments respectively and click **Save**.

   You can click  and  to edit and delete records.

   The database names must be the names of created databases. It is recommended that the database name for the development environment be the same as that for the production environment, and that suffix **_dev** be added to the database name for the development environment so that it can be distinguished from the database name for the production environment.

   Figure 4-15 DB Configuration

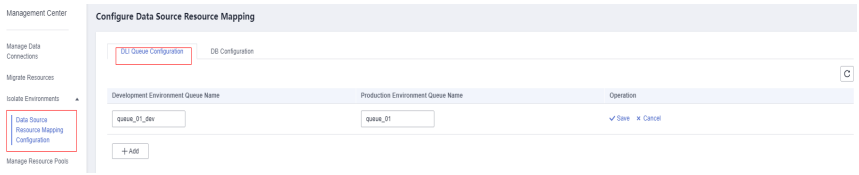
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5. Click the **DLI Queue Configuration** tab and then **Add**. Set the queue names for the development and production environments respectively and click **Save**.

   You can use  and  to edit and delete records.

   The queue names must be the names of created DLI queues. It is recommended that the queue name for the development environment be the same as that for the production environment, and that suffix **_dev** be added to the queue name for the development environment so that it can be distinguished from the queue name for the production environment.

Figure 4-16 DLI Queue Configuration



6. After the preceding operations are complete, DLI environment isolation configuration is complete.

DB Configuration

1. On the DataArts Studio console, locate a workspace and click **Management Center**.
2. In the left navigation pane on the **Management Center** page, choose **Data Source Resource Mapping Configuration**.
3. Click the **DB Configuration** tab and then **Add**. Set the database names for the development and production environments respectively and click **Save**.

   You can click  and  to edit and delete records.

   The database names must be the names of created databases. It is recommended that the database name for the development environment be the same as that for the production environment, and that suffix **_dev** be added to the database name for the development environment so that it can be distinguished from the database name for the production environment.

NOTICE

For GaussDB(DWS), MRS Hive, and MRS Spark, if you **select the same cluster** when creating a data connection, you must configure database mapping on the **Configure Data Source Resource Mapping** page to isolate the development and production environments.

Figure 4-17 DB Configuration



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4.6 Typical Scenarios for Using Management Center

4.6.1 Creating a Connection Between DataArts Studio and an MRS Hive Data Lake

This section describes how to create an MRS Hive connection between DataArts Studio and the data lake base.

Prerequisites

- You have created a data lake to connect, for example, a database or cloud service supported by DataArts Studio.
  - Before creating a DWS data connection, ensure that you have created a cluster in DWS and have the permissions required to view Key Management Service (KMS) keys.
  - Before creating an MRS connection such as an MRS HBase or MRS Hive connection, ensure that you have purchased an MRS cluster whose Kerberos encryption type is **aes256-sha1,aes128-sha1**, and that the cluster contains required components.
- You have obtained the required agent (CDM cluster). If no CDM cluster is available, create one by referring to **Creating a CDM Cluster**. The CDM cluster can communicate with the data lake to be connected.
  - If the data lake is an on-premises database, you need the Internet or Direct Connect. Ensure that the host where the data source is located and the CDM cluster can access the Internet, and the connection port has been enabled in the firewall rule.
  - If the data lake is a cloud service (such as DWS and MRS), the following requirements must be met for network interconnection:
    - If the CDM cluster and the cloud service are in different regions, a public network or a dedicated connection is required for enabling communication between the CDM cluster and the cloud service.
    - If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
    - The cloud service instance and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.
- If the enterprise mode is used, pay attention to the following points:

  In enterprise mode, the development environment and production environment need to be distinguished. Therefore, you need to prepare two sets of data lake services for the production environment and development

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environment to isolate the development environment from the production environment.

- **If two clusters are used** for clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of data lake services. The versions, specifications, components, regions, VPCs, subnets, and related configurations of the two sets of data lake services must be the same. For details on how to create data connections, see **Creating a DataArts Studio Data Connection**.
- For serverless services (such as DLI), DataArts Studio configures the mapping between data lake services in the production environment and development environment through environment isolation in the management center. The corresponding data lake is automatically switched during the development and production processes. Therefore, you need to prepare two sets of queues and database resources in the serverless data lake service and distinguish them by name suffix. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.
- For GaussDB(DWS), MRS Hive, and MRS Spark, if you **select the same cluster** when creating a data connection, you must configure database mapping on the **Configure Data Source Resource Mapping** page to isolate the development and production environments. For details, see **DB configuration**.
- Offline processing migration jobs are not supported in enterprise mode.

For example, if your data lake service is an MRS cluster, you need to prepare two MRS clusters with the same version, specifications, components, region, VPC, and subnet. If some configurations of an MRS cluster are modified, you also need to synchronize the modifications to the other MRS cluster.

Creating a Data Connection

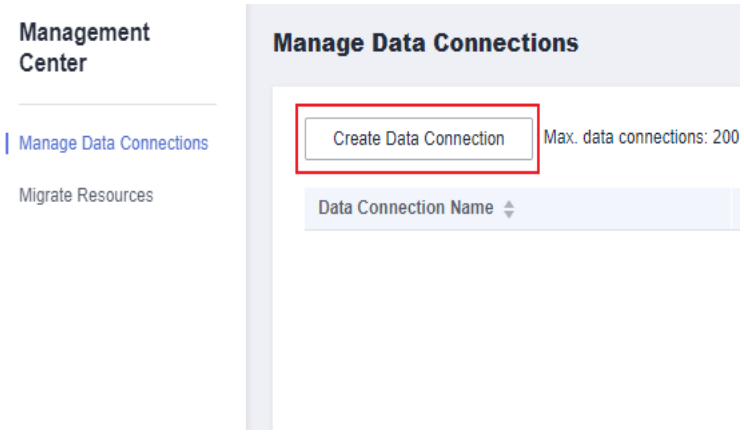
Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **Management Center**.

Step 3 On the displayed **Manage Data Connections** page, click **Create Data Connection**.

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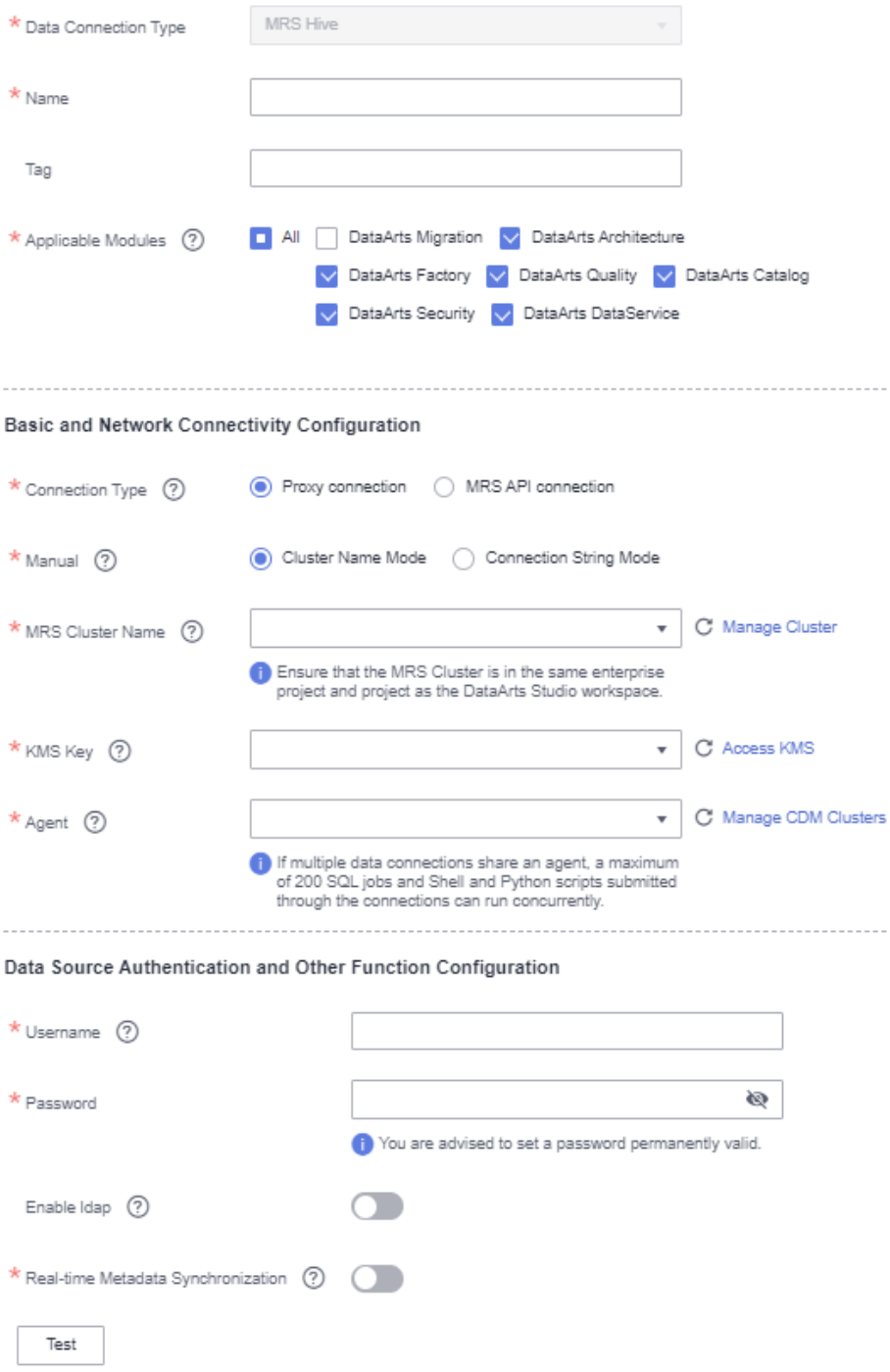
Figure 4-18 Creating a data connection



Step 4 On the **Manage Data Connections** page, click **Create Data Connection**. On the displayed page, select **MRS Hive** for **Data Connection Type** and set other parameters based on the descriptions in **Table 4-24**.

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Figure 4-19 MRS Hive connection parameters



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Table 4-24 MRS Hive connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**MRS Hive** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Connection Type	Yes	Connection type. **Proxy connection** is recommended. • **Proxy connection**: An agent (CDM cluster) is used to access MRS clusters. This method supports all versions of MRS clusters. • **MRS API connection**: MRS APIs are used to access MRS clusters. This method supports only MRS clusters of the 2.*X* or a later version. When you select **MRS API connection**, pay attention to the following restrictions: 1. The MRS API connection is available only for DataArts Factory. 2. In DataArts Factory, you cannot view or manage the databases, data tables, and fields of the connection in a visualized manner. If an MRS cluster of version 3.2.1 or later is connected, you can view rather than manage the databases, data tables, and fields of the connection in a visualized manner. 3. When the SQL editor of DataArts Factory is used to run SQL statements, the execution results can be displayed only in logs. **NOTE** Select **Proxy connection** for **Connection Type** so that the DataArts Architecture, DataArts Quality, DataArts Catalog, and DataArts DataService components can use the MRS connection.

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Parameter	Mandatory	Description
Manual	Yes	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. Select the connection mode. If you do not need to access MRS clusters in other projects or enterprise projects, select **Cluster Name Mode**. • **Cluster Name Mode**: Select an existing cluster. You can only connect to an MRS cluster in the same project and enterprise project. • If you select **Connection String Mode**, you can set **Manager IP** and enable communication between this connection's agent (CDM cluster) and an MRS cluster in another project or enterprise project so that you can access the MRS cluster.

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Parameter	Mandatory	Description
Manager IP	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. Set this parameter to the floating IP address of MRS Manager. Only MRS clusters are supported. A Hadoop cluster can be connected only after it is managed by MRS. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. You can click **Select** next to the text box and select an MRS cluster in the same project and enterprise project. If you want to access an MRS cluster in another project or enterprise project, obtain and enter the floating IP address of MRS Manager and ensure that the connection's agent (CDM cluster) can communicate with the tenant-plane MRS cluster. To obtain the floating IP address of MRS Manager, log in to the active master node of the MRS cluster and run the **ifconfig** command. In the command output, the IP address of **eth0:wsom** is the floating IP address of MRS Manager. For details about how to log in to the master node of the MRS cluster, see **Logging In to an MRS Cluster Node**. Enter multiple IP addresses based on the scenario in sequence and separate them with commas (,), for example, **127.0.0.1** or **127.0.0.1,127.0.0.2,127.0.0.3**. • If you enter one IP address, enter the management-plane floating IP address of the MRS cluster. • If you enter three IP addresses, enter the IP address of the active node on the MRS cluster service plane, IP address of the standby node on the MRS cluster service plane, and the floating IP address of the MRS cluster management plane.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	This parameter is mandatory when **MRS API connection** is selected for **Connection Type** or **Cluster Name Mode** is selected for **Manual**. The name of the MRS cluster. Select an MRS cluster that Hive belongs to. Only MRS clusters are supported. A Hadoop cluster can be selected only after it is managed by MRS. All the MRS clusters with the same project ID and enterprise project are displayed. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios: • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule. • If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**. • The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace. **NOTE** If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

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Parameter	Mandatory	Description
KMS Key	No	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Agent	Yes	This parameter is mandatory when **Connection Type** is set to **Proxy connection**. MRS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an MRS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the MRS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the MRS cluster. The security group rule must also allow the CDM cluster to communicate with the MRS cluster. **NOTE** • If you use the same CDM cluster as the agent for multiple connections to MRS clusters with Kerberos authentication enabled, jobs will fail. You are advised to plan multiple CDM clusters based on service requirements. • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		

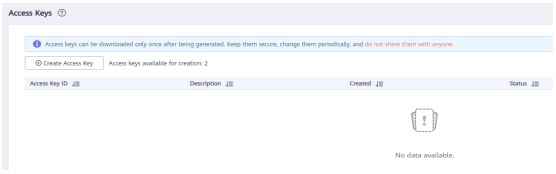
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Parameter	Mandatory	Description
Authentication Method	Yes	This parameter is mandatory when **Connection String Mode** is selected for **Manual**. It specifies the authentication method used for accessing the MRS cluster. The following options are available: • **SIMPLE**: for non-security mode • **KERBEROS**: for security mode
Username	Yes	Human-machine user of the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**. If a new MRS user is used for connection, you need to log in to Manager and change the initial password. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user whose password never expires by referring to **Creating a Kerberos Authentication User for an MRS Security Cluster**. When creating an MRS data connection, set **Username** and **Password** to the new MRS username and password. **NOTE** • For clusters of MRS 3.1.0 or later, the user must at least have permissions of the **Manager_viewer** role to create data connections in Management Center. To perform database, table, and data operations on components, the user must also have user group permissions of the components. • For clusters earlier than MRS 3.1.0, the user must have permissions of the **Manager_administrator** or **System_administrator** role to create data connections in Management Center. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections. • You are advised to set a user password that never expires to prevent connection failures and service loss caused by password expiration.
Password	Yes	The password for accessing the MRS cluster. This parameter is mandatory when **Connection Type** is set to **Proxy connection**.

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Parameter	Mandatory	Description
Enable ldap	No	This parameter is available when **Connection Type** is set to **Proxy connection**. If LDAP authentication is enabled for an external LDAP server connected to MRS Hive, the LDAP username and password are required for authenticating the connection to MRS Hive. In this case, this option must be enabled. Otherwise, the connection will fail.
ldapUsername	Yes	This parameter is mandatory when **Enable ldap** is enabled. Enter the username configured when LDAP authentication was enabled for MRS Hive.
ldapPassword	Yes	This parameter is mandatory when **Enable ldap** is enabled. Enter the password configured when LDAP authentication was enabled for MRS Hive.
OBS storage support	No	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. The server must support OBS storage. When creating a Hive table, you can store the table in OBS.
Use Agency	No	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules**. If you enable the agency function, you can create a data connection without having a permanent AK/SK and execute CDM jobs using the scheduling identity configured in DataArts Factory.
Public agency	No	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules** and **Use Agency** is enabled. The agency is only used to check whether the connection agency function is normal. CDM jobs will be executed using the scheduling identity configured in DataArts Factory.

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Parameter	Mandatory	Description
AK	N/A	This parameter is displayed when **DataArts Migration** is selected for **Applicable Modules** and **OBS storage support** is enabled. AK and SK are used to log in to the OBS server. You need to create an access key for the current account and obtain an AK/SK pair. To obtain an access key, perform the following steps: 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 4-20**. **Figure 4-20** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** – Only two access keys can be added for each user. – To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.
SK	N/A	

Step 5 Click **Test** to test connectivity of the data connection. If the test fails, the data connection fails to be created.

Step 6 After the test is successful, click **Save** to create the data connection.

----End

Reference

1. Why is no MRS Hive cluster displayed on the Create Data Connection page?

   Possible causes are as follows:

   – Hive/HBase components were not selected during MRS cluster creation.

   – The enterprise project selected during MRS cluster creation is different from that in the workspace.

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  - The network between the CDM cluster and MRS cluster was disconnected when an MRS data connection is created.

    The CDM cluster functions as a network agent. MRS data connections that you are going to create need to communicate with CDM.

2. Why does a Hive data connection fail to obtain information about databases or tables?

   The possible cause is that the CDM cluster is stopped or a concurrency conflict occurs. You can switch to another agent to temporarily avoid this issue.

4.6.2 Creating a Connection Between DataArts Studio and a GaussDB(DWS) Data Lake

This section describes how to create a DWS connection between DataArts Studio and the data lake base.

Prerequisites

- You have created a data lake to connect, for example, a database or cloud service supported by DataArts Studio.
  - Before creating a DWS data connection, ensure that you have created a cluster in DWS and have the permissions required to view Key Management Service (KMS) keys.
  - Before creating an MRS connection such as an MRS HBase or MRS Hive connection, ensure that you have purchased an MRS cluster whose Kerberos encryption type is **aes256-sha1,aes128-sha1**, and that the cluster contains required components.
- You have obtained the required agent (CDM cluster). If no CDM cluster is available, create one by referring to **Creating a CDM Cluster**. The CDM cluster can communicate with the data lake to be connected.
  - If the data lake is an on-premises database, you need the Internet or Direct Connect. Ensure that the host where the data source is located and the CDM cluster can access the Internet, and the connection port has been enabled in the firewall rule.
  - If the data lake is a cloud service (such as DWS and MRS), the following requirements must be met for network interconnection:
    - If the CDM cluster and the cloud service are in different regions, a public network or a dedicated connection is required for enabling communication between the CDM cluster and the cloud service.
    - If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
    - The cloud service instance and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

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- If the enterprise mode is used, pay attention to the following points:

  In enterprise mode, the development environment and production environment need to be distinguished. Therefore, you need to prepare two sets of data lake services for the production environment and development environment to isolate the development environment from the production environment.

  - **If two clusters are used** for clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of data lake services. The versions, specifications, components, regions, VPCs, subnets, and related configurations of the two sets of data lake services must be the same. For details on how to create data connections, see **Creating a DataArts Studio Data Connection**.
  - For serverless services (such as DLI), DataArts Studio configures the mapping between data lake services in the production environment and development environment through environment isolation in the management center. The corresponding data lake is automatically switched during the development and production processes. Therefore, you need to prepare two sets of queues and database resources in the serverless data lake service and distinguish them by name suffix. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.
  - For GaussDB(DWS), MRS Hive, and MRS Spark, if you **select the same cluster** when creating a data connection, you must configure database mapping on the **Configure Data Source Resource Mapping** page to isolate the development and production environments. For details, see **DB configuration**.
  - Offline processing migration jobs are not supported in enterprise mode.

  For example, if your data lake service is an MRS cluster, you need to prepare two MRS clusters with the same version, specifications, components, region, VPC, and subnet. If some configurations of an MRS cluster are modified, you also need to synchronize the modifications to the other MRS cluster.

Creating a Data Connection

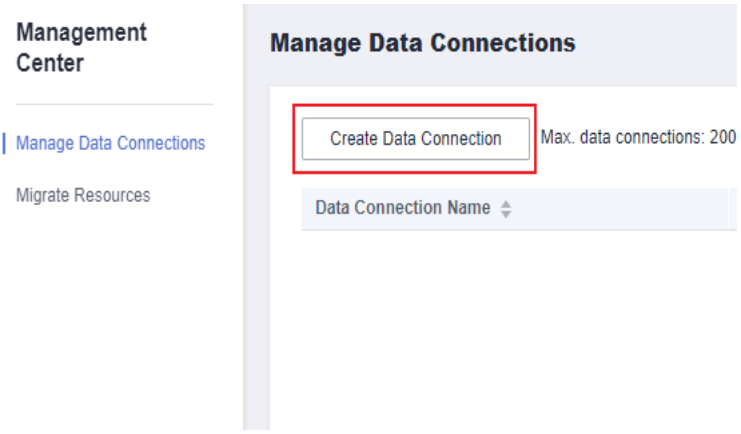
Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studi**.

Step 2 On the DataArts Studio console, locate a workspace and click **Management Center**.

Step 3 On the displayed **Manage Data Connections** page, click **Create Data Connection**.

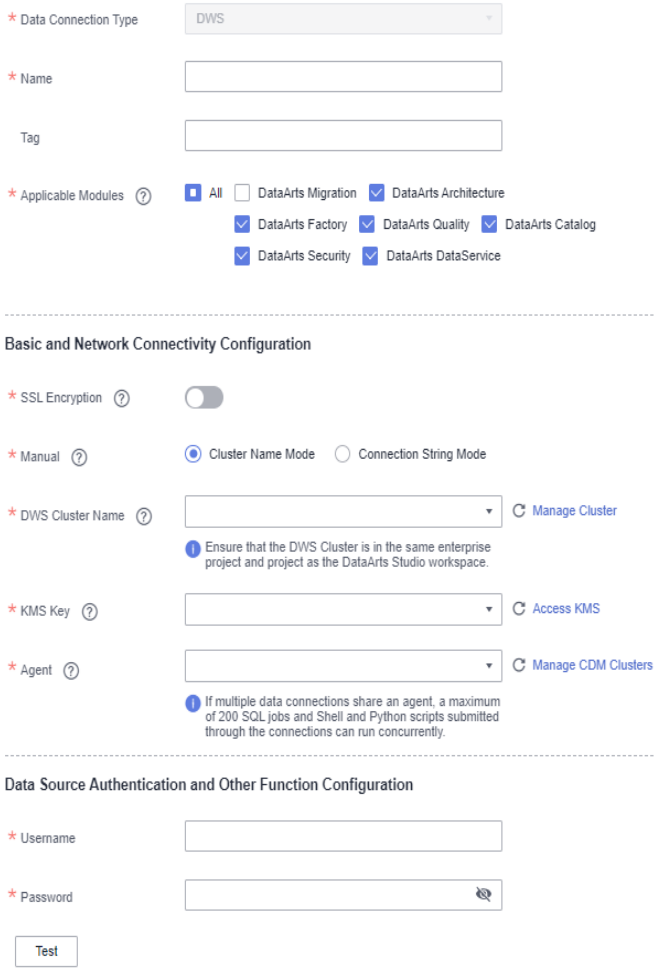
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Figure 4-21 Creating a data connection



Step 4 On the **Manage Data Connections** page, click **Create Data Connection**. On the displayed page, select **DWS** for **Data Connection Type** and set other parameters based on the descriptions in **Table 4-25**.

Figure 4-22 DWS connection parameters



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Table 4-25 DWS connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**DWS** is selected and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
SSL Encryption	Yes	DWS supports SSL encryption and certificate authentication for communication between the client and server. You can set this parameter based on whether SSL connection is mandatory on the server. ● If this parameter is enabled, only SSL encryption can be used for communication. ● If this parameter is disabled, both SSL encryption and certificate authentication can be used for communication.
Manual	Yes	Select either of the following modes: ● **Cluster Name Mode**: Select an existing cluster. ● **Connection String Mode**: Enter the IP address/ domain name and port of the corresponding cluster and enable the communication between the connection's agent (CDM cluster) and the DWS cluster. **NOTE** DataArts Security does not support GaussDB(DWS) connections in connection string mode.
DWS Cluster Name	Yes	This parameter is mandatory when **Manual** is set to **Cluster Name Mode**. Select a DWS cluster from all the DWS clusters with the same project ID and enterprise project.

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Parameter	Mandatory	Description
IP Address or Domain Name	Yes	This parameter is mandatory when **Manual** is set to **Connection String Mode**. If you choose to manually enter an IP address or domain name, you must enter an internal IP address and a port that is accessible to the network segment of the resource group. Otherwise, the network is disconnected. This parameter indicates the address for accessing the cluster database through an internal network. Enter an IP address or domain name. The IP address or domain name is automatically generated during cluster creation. You can obtain them on the management console by performing the following operations: 1. Log in to the GaussDB(DWS) console. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number.
Port	Yes	This parameter is mandatory when **Manual** is set to **Connection String Mode**. This parameter indicates the database port number specified during the DWS cluster creation. Ensure that you have enabled this port in the security group rule so that the DataArts Studio instance can connect to the database in the DWS cluster through this port.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.

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Parameter	Mandatory	Description
Agent	Yes	Data Warehouse Service (DWS) is not a fully managed service and thus cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating a DWS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with the DWS cluster. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as the DWS cluster. The security group rule must also allow the CDM cluster communicate with the DWS cluster. **NOTE** If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
Data Source Authentication and Other Function Configuration		
Username	Yes	The database username, which is specified when the DWS cluster is created.
Password	Yes	The password for accessing the database, which is specified when the DWS cluster is created.

Step 5 Click **Test** to test connectivity of the data connection. If the test fails, the data connection fails to be created.

Step 6 After the test is successful, click **Save** to create the data connection.

----End

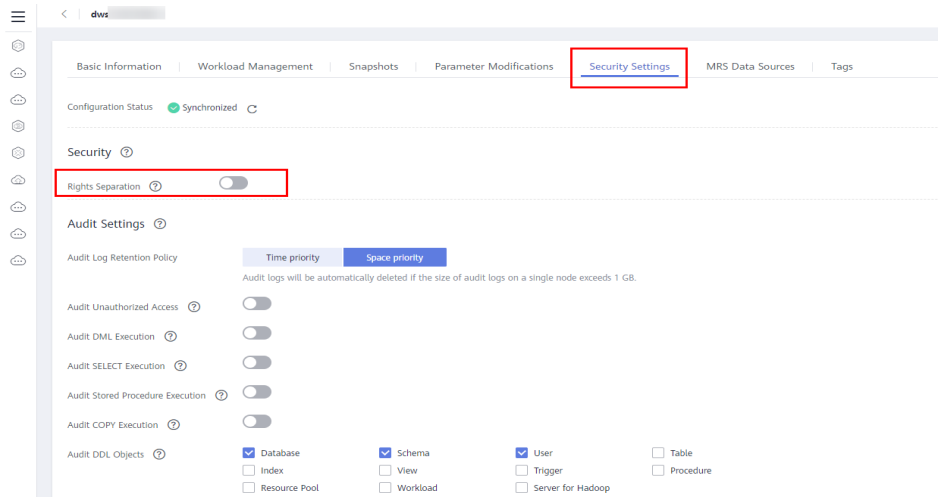
Reference

1. What should I do if the connection test fails when I enable the SSL connection during the creation of a DWS data connection?

   On the DWS console, click the corresponding cluster, choose **Security Settings**, and disable **Rights Separation**.

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Figure 4-23 Disabling Rights Separation for the DWS cluster



2. Why does a DWS data connection fail to obtain information about databases or tables?

   The possible cause is that the CDM cluster is stopped or a concurrency conflict occurs. You can switch to another agent to temporarily avoid this issue.

4.6.3 Creating a Connection Between DataArts Studio and a MySQL Database

This section describes how to create a MySQL connection between DataArts Studio and the data lake base.

Prerequisites

- You have created a data lake to connect, for example, a database or cloud service supported by DataArts Studio.
  - Before creating a DWS data connection, ensure that you have created a cluster in DWS and have the permissions required to view Key Management Service (KMS) keys.
  - Before creating an MRS connection such as an MRS HBase or MRS Hive connection, ensure that you have purchased an MRS cluster whose Kerberos encryption type is **aes256-sha1,aes128-sha1**, and that the cluster contains required components.
- You have obtained the required agent (CDM cluster). If no CDM cluster is available, create one by referring to **Creating a CDM Cluster**. The CDM cluster can communicate with the data lake to be connected.
  - If the data lake is an on-premises database, you need the Internet or Direct Connect. Ensure that the host where the data source is located and the CDM cluster can access the Internet, and the connection port has been enabled in the firewall rule.
  - If the data lake is a cloud service (such as DWS and MRS), the following requirements must be met for network interconnection:
    - If the CDM cluster and the cloud service are in different regions, a public network or a dedicated connection is required for enabling communication between the CDM cluster and the cloud service.

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    - If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
    - The cloud service instance and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

- If the enterprise mode is used, pay attention to the following points:

  In enterprise mode, the development environment and production environment need to be distinguished. Therefore, you need to prepare two sets of data lake services for the production environment and development environment to isolate the development environment from the production environment.

  - **If two clusters are used** for clustered data sources, such as MRS, GaussDB(DWS), RDS, MySQL, Oracle, and ECS, you can create data connections in Management Center to distinguish data lake services in the development environment from those in the production environment. The data lake is automatically switched during development and production. Therefore, you need to prepare two sets of data lake services. The versions, specifications, components, regions, VPCs, subnets, and related configurations of the two sets of data lake services must be the same. For details on how to create data connections, see **Creating a DataArts Studio Data Connection**.
  - For serverless services (such as DLI), DataArts Studio configures the mapping between data lake services in the production environment and development environment through environment isolation in the management center. The corresponding data lake is automatically switched during the development and production processes. Therefore, you need to prepare two sets of queues and database resources in the serverless data lake service and distinguish them by name suffix. For details, see **Configuring Environment Isolation for a DataArts Studio Workspace in Enterprise Mode**.
  - For GaussDB(DWS), MRS Hive, and MRS Spark, if you **select the same cluster** when creating a data connection, you must configure database mapping on the **Configure Data Source Resource Mapping** page to isolate the development and production environments. For details, see **DB configuration**.
  - Offline processing migration jobs are not supported in enterprise mode.

  For example, if your data lake service is an MRS cluster, you need to prepare two MRS clusters with the same version, specifications, components, region, VPC, and subnet. If some configurations of an MRS cluster are modified, you also need to synchronize the modifications to the other MRS cluster.

Creating a Data Connection

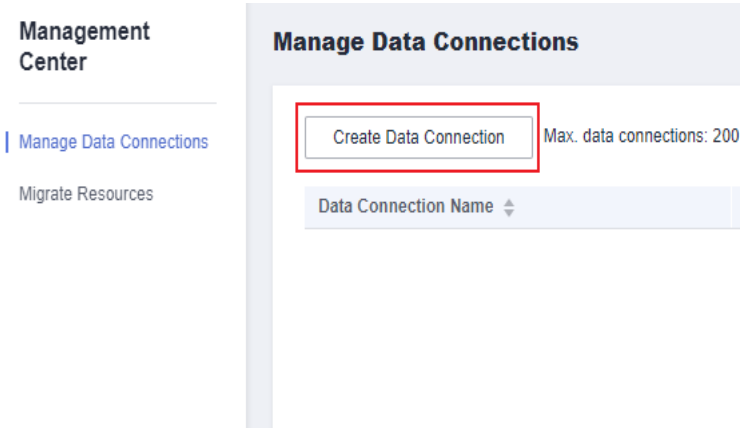
Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

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Step 2 On the DataArts Studio console, locate a workspace and click **Management Center**.

Step 3 On the displayed **Manage Data Connections** page, click **Create Data Connection**.

Figure 4-24 Creating a data connection



Step 4 On the **Manage Data Connections** page, click **Create Data Connection**. On the displayed page, select **RDS** for **Data Connection Type** and set other parameters based on the descriptions in **Table 4-26**.

NOTE

- You are not advised to select **MySQL (pending offline)** for **Data Connection Type**. Instead, You are advised to select **RDS**.
- RDS data connections depend on OBS. If OBS is unavailable in the same region as DataArts Studio, RDS data connections are not supported.

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Figure 4-25 RDS connection parameters

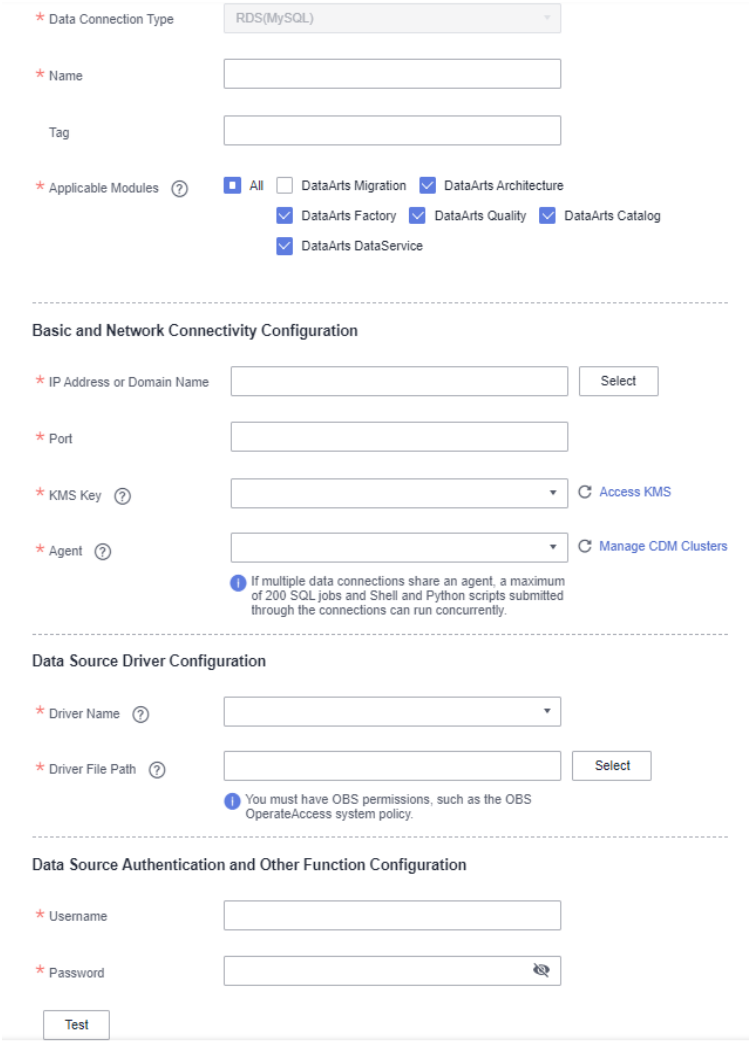


Table 4-26 RDS connection

Parameter	Mandatory	Description
Data Connection Type	Yes	**RDS** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).

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Parameter	Mandatory	Description
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
IP Address or Domain Name	Yes	Address for accessing the relational database data source. The value can be an IP address or a domain name. If you choose to manually enter an IP address or domain name, you must enter an internal IP address and a port that is accessible to the network segment of the resource group. Otherwise, the network is disconnected. ● If the data source is RDS, you can obtain the address on the management console by performing the following operations: 1. Log in to the management console of the corresponding cloud service using the account you have obtained. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number. ● If the data source is MySQL, PostgreSQL, or DM, you can obtain the access address from the database administrator.

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Parameter	Mandatory	Description
Port	Yes	Port for accessing the relational database. • If the data source is RDS, you can obtain the address on the management console by performing the following operations: 1. Log in to the management console of the corresponding cloud service using the account you have obtained. 2. In the left navigation pane, choose **Instances**. 3. Click the name of an instance to enter the basic information page. In the **Connection Information** area, you can obtain the private IP address, domain name, and port number. • If the data source is MySQL, PostgreSQL, or DM, you can obtain the access address from the database administrator.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.

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Parameter	Mandatory	Description
Agent	Yes	RDS is not a fully managed service and cannot be directly connected to DataArts Studio. A CDM cluster can provide an agent for DataArts Studio to communicate with non-fully-managed services. Therefore, you need to select a CDM cluster when creating an RDS data connection. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. As a network proxy, the CDM cluster must be able to communicate with RDS. To ensure network connectivity, the CDM cluster must be in the same region and AZ and use the same VPC and subnet as RDS. The security group rule must also allow the CDM cluster to communicate with RDS. **NOTE** If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload.
SSL Encryption	No	Whether to enable SSL encrypted transmission.
Data Source Driver Configuration		
Driver Name	Yes	The name of the driver. The following values are available: • **com.mysql.jdbc.Driver**: Select this driver name for RDS for MySQL or MySQL. • **org.postgresql.Driver**: Select this driver name for RDS for PostgreSQL or PostgreSQL. • **com.microsoft.sqlserver.jdbc.SQLServerDriver**: Select this driver name for RDS for SQL Server.
Driver file source	Yes	Select the source of the driver file.

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Parameter	Mandatory	Description
Driver File Path	Yes	It specifies the OBS path where the driver file is located. You need to download a .jar driver file from the corresponding official website and upload it to OBS. • MySQL driver: Download it from **https://downloads.mysql.com/archives/c-j/**. The 5.1.48 version is recommended. • PostgreSQL driver: Download it from **https://mvnrepository.com/artifact/org.postgresql/postgresql**. The 42.3.4 version is recommended. • SQL Server driver: Download it from **https://learn.microsoft.com/en-us/sql/connect/jdbc/download-microsoft-jdbc-driver-for-sql-server?view=sql-server-ver16**. The 8.4.1 version is recommended. **NOTE** • The OBS path of the driver file cannot contain Chinese characters. • To update the driver, you must restart the CDM cluster in DataArts Migration and then edit the data connection to upload the driver.
Data Source Authentication and Other Function Configuration		
Username	Yes	The username of the database. The username is required for creating a cluster.
Password	Yes	The password for accessing the database. The password is required for creating a cluster.

Step 5 Click **Test** to test connectivity of the data connection. If the test fails, the data connection fails to be created.

Step 6 After the test is successful, click **Save** to create the data connection.

----End

Reference

1. What Are the Precautions for Creating an RDS Data Connection?

   When creating an RDS data connection, you need to bind an agent provided by the CDM cluster. Currently, a version of the CDM cluster earlier than 1.8.6 is not supported.

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5 DataArts Migration (CDM Jobs)

5.1 Overview

DataArts Migration is an efficient and easy-to-use data integration service. Based on the big data migration to the cloud and intelligent data lake solutions, CDM provides easy-to-use migration capabilities and can integrate various types of data sources into the data lake, which simplifies data source migration and integration and improves efficiency for you.

In this document, DataArts Migration refers to Cloud Data Migration (CDM).

You can access the CDM console using either of the following methods:

- Log in to the CDM console and choose **Cluster Management** in the navigation pane.
- Log in to the DataArts Studio console. Locate a workspace and click **DataArts Migration**.

Introduction to CDM

CDM uses a distributed compute framework and concurrent processing techniques to help you migrate enterprise data in batches without any downtime and rapidly build desired data structures.

Functions

- **Table/file/entire DB migration**

  Tables or files can be migrated in batches. An entire database can be migrated between homogeneous and heterogeneous databases. A job can migrate hundreds of tables.

- **Incremental data migration**

  CDM supports incremental migration of files, relational databases, and HBase/CloudTable, as well as with WHERE clauses and macro variables of date and time.

- **Migration in transaction mode**

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When a CDM job fails to be executed, CDM rolls back the data to the state before the job starts and automatically deletes data from the destination table.

- **Field conversion**

  CDM supports field conversion functions, such as anonymization, character string operations, and date operations.

- **File encryption**

  When files are migrated to a file system, CDM can encrypt the files written to the cloud.

- **MD5 verification**

  MD5 verification is supported to check the file consistency from end to end and output verification result.

- **Dirty data archiving**

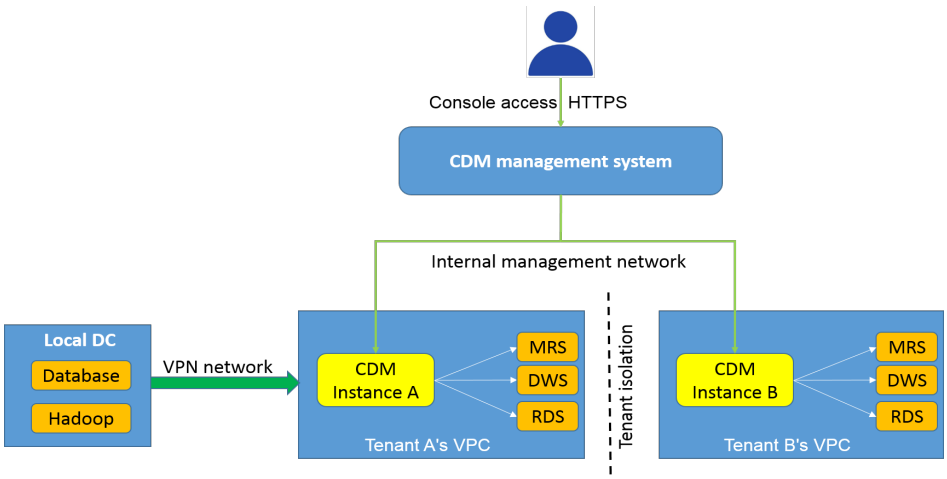
  CDM can archive the data that fails to be processed during migration, has been filtered out, or is not compliant with conversion or cleaning rules to dirty data logs. The threshold for dirty data ratio can be set to determine whether a task is successful.

Migration Principles

When a tenant uses CDM, the CDM system provisions a fully-managed CDM instance in the tenant's VPC. The instance allows only console and RESTful API access. Therefore the tenant cannot access the instance through other interfaces (such as SSH). This ensures data isolation between CDM tenants, prevents data leakage, and ensures transmission security during data migration between different cloud services in a VPC. Tenants can also use the VPN to migrate data from the on-premises data center to cloud services to ensure migration security.

CDM works in push-pull mode. CDM pulls data from the migration source and pushes the data to the migration destination. Data access operations are initiated by CDM. SSL will be used if the data source (such as RDS) supports it. During the migration, the usernames and passwords of the migration source and destination are required. Such information is stored in the database of the CDM instance. Protecting such information is critical to ensure CDM security.

Figure 5-1 Migration principles



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5.2 Notes and Constraints

CDM System Notes and Constraints

1. Due to specifications restrictions, the free CDM cluster provided by a DataArts Studio instance can only be used for tests or as a data connection agent.
2. You can purchase CDM clusters of other specifications on the DataArts Studio console as incremental packages or directly purchase clusters on the CDM console. The differences are as follows:
   a. Package billing: CDM clusters purchased on the DataArts Studio console can be billed only by packages purchased on the DataArts Studio console. CDM clusters purchased on the CDM console can be billed only by discount packages purchased on the CDM console.
   b. Permission control: Permissions of the CDM clusters purchased on the DataArts Studio console are managed based on the DataArts Studio permission system. Permissions of the clusters purchased on the CDM console are managed based on the CDM permission system.
   c. Application scenarios: Clusters purchased on the DataArts Studio console are isolated by workspace and can be used only in associated workspaces. Clusters purchased on the CDM console do not support workspace-level resource isolation and can be used in all DataArts Studio workspaces.
3. You cannot modify the flavor of an existing cluster. If you require a higher flavor, create a cluster with your desired flavor.
4. The CDM cluster version (Arm or x86) is determined by the architecture of underlying resources.
5. CDM does not support the function of controlling the data migration speed. Therefore, do not perform data migration during peak hours.
6. During data migration, CDM imposes pressure on the data source. You are advised to create a database account for data migration and configure an account policy to reduce the resource consumption of the data source. For example, you can configure a policy to delete the connections of the account when the CPU usage exceeds 30% to prevent impact on services.
7. The baseline and maximum bandwidths of the NIC of the cdm.large CDM instance is 0.8 Gbit/s and 3 Gbit/s, respectively. The theoretical maximum volume of data that can be transmitted per instance per day is about 8 TB. Similarly, the baseline and maximum bandwidths of the NIC of the cdm.xlarge instance are 4 Gbit/s and 10 Gbit/s, respectively, and the theoretical maximum volume of data that can be transmitted per instance per day is about 40 TB. The baseline and maximum bandwidths of the NIC of the cdm.4xlarge instance is 36 Gbit/s and 40 Gbit/s, respectively, and the theoretical maximum volume of data that can be transmitted per instance per day is about 360 TB. You can use multiple CDM instances if you want faster data transfer.

   The actual amount of data that can be migrated in a day depends on the data source type, the read and write performance of the source and destination, and the actual available bandwidth. Typically you can migrate as much as 8 TB per day (large file migration to OBS) using the cdm.large instance. It is recommended that you test the speed with a small amount of data before migration.

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8. CDM supports incremental file migration (by skipping repeated files), but does not support resumable transfer.

   For example, if three files are to be migrated and the second file fails to be migrated due to the network fault. When the migration task is started again, the first file is skipped. The second file, however, cannot be migrated from the point where the fault occurs, but can only be migrated again.
9. During file migration, a single task supports millions of files. If there are too many files in the directory to be migrated, you are advised to split the files into different directories and create multiple tasks.
10. You can export links and jobs configured on CDM to a local directory. To ensure password security, CDM does not export the link password of the corresponding data source. Therefore, before importing job configurations to CDM, you need to manually input the password in the exported JSON file or configure the password in the import dialog box.
11. The cluster cannot automatically upgrade to a new version. You need to use the job export and import functions to upgrade the cluster to the new version.
12. If OBS is unavailable, CDM does not automatically back up users' job configurations. You need to export and back up configuration data using the export function.
13. If VPC peering connection is configured, the peer VPC subnet may overlap with the CDM management network. As a result, data sources in the peer VPC cannot be accessed. You are advised to use the public network for cross-VPC data migration, or contact the administrator to add specific routes to the VPC peering connection in the CDM background.
14. If the destination of a CDM job is a DWS or NewSQL database, constraints of the source end, such as the primary key and unique index, cannot be migrated together.
15. When performing a CDM job, ensure that the JSON file formats of the two clusters are the same so that jobs can be imported from the source cluster to the destination cluster.
16. If a running job is interrupted unexpectedly, the data that has been written to the destination will not be deleted. You must manually delete the data if needed.
17. The size of a file to be transferred cannot exceed 1 TB.

General Notes and Constraints on Database Migration

1. CDM is mainly used for batch migration. It supports only limited incremental migration but does not support real-time incremental migration. You are advised to use Data Replication Service (DRS) to migrate the incremental data of the database to RDS.
2. The entire DB migration of CDM supports only data table migration but not migration of database objects such as stored procedures, triggers, functions, and views.

   CDM applies only to scenarios where databases are migrated to the cloud at a time, including homogeneous and heterogeneous database migrations. CDM is not applicable to data synchronization, for example, disaster recovery and real-time synchronization.
3. If CDM fails to migrate an entire database or table, the data that has been imported to the target table will not be rolled back automatically. If you want

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to perform migration in transaction mode, configure the **Import to Staging Table** parameter to enable a rollback upon a migration failure.

In extreme cases, the created stage table or temporary table cannot be automatically deleted. You need to manually clear the table (the name of the stage table ends with **_cdm_stage**), for example, **cdmtet_cdm_stage**).

4. If CDM needs to access data sources in the on-premises data center (for example, the on-premises MySQL database), the data sources must support Internet access and the CDM instances must be bound with elastic IP addresses. In this case, the security practice is to configure the firewall or security policies to allow only the EIPs of the CDM instances to access the local data sources.
5. Only common data types are supported, including character strings, digits, and dates. Object types are limited. If objects are too large, migration cannot be performed.
6. Only the GBK and UTF-8 character sets are supported.
7. A field name cannot contain & or %.
8. jdbc2hive and hive2jdbc entire DB migration is implemented by field name mapping, and is unavailable if the source and destination field names are inconsistent.

Permissions Configuration for Relational Database Migration

Common minimum permissions required by relational database migration:

- MySQL: You need to have the read permission on the **INFORMATION_SCHEMA** database and data tables.
- Oracle: You need to have the **resource** role and have the **select** permissions on the data table in the tablespace.
- Dameng: You need to have the **select any table** permission in the schema.
- DWS: You need to have the **schema usage** permission and the query permission on the data tables.
- SQL Server: You need to have the **sysadmin** permission.
- PostgreSQL: You need to have the **select** permission on schema tables in the database.

Constraints on FusionInsight HD and Apache Hadoop

If the FusionInsight HD and Apache Hadoop data sources are deployed in the on-premises data center, CDM must access all nodes in the cluster for reading and writing the Hadoop files. Therefore, the network access must be enabled for each node.

You are advised to use **Direct Connect** to improve the migration speed while ensuring network access.

Constraints on GaussDB(DWS)

1. If the DWS primary key or table contains only one field, the field type must be a common character string, value, or date. When data is migrated from another database to DWS, if automatic table creation is selected, the primary key must be of the following types. If no primary key is set, at least one of the

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following fields must be set. Otherwise, the table cannot be created and the CDM job fails.

- INTEGER TYPES: TINYINT, SMALLINT, INT, BIGINT, NUMERIC/DECIMAL
- CHARACTER TYPES: CHAR, BPCHAR, VARCHAR, VARCHAR2, NVARCHAR2, TEXT
- DATA/TIME TYPES: DATE, TIME, TIMETZ, TIMESTAMP, TIMESTAMPTZ, INTERVAL, SMALLDATETIME

NOTE

For clusters of version 2.9.1.200 or earlier, the NVARCHAR2 data type is not supported for DWS.

2. In DWS, the character string '' is null. A null character string cannot be inserted into a field with non-null constraints. This is inconsistent with the MySQL behavior. MySQL does not consider that '' is null. Migration from MySQL to DWS may fail due to the preceding reason.
3. When the Gauss Data Service (GDS) mode is used to quickly import data to DWS, you need to configure a security group or firewall policy to allow DataNodes of DWS or FusionInsight LibrA to access port 25000 of the CDM IP address.
4. When data is imported to DWS in GDS mode, CDM automatically creates a foreign table for data import. The table name ends with a universally unique identifier (UUID), for example, **cdmtest_aecf3f8n0z73dsl72d0d1dk4lcir8cd**. If a job fails, it will be automatically deleted. In extreme cases, you may need to manually delete it.

Constraints on OBS

1. During file migration, the system automatically transfers the files concurrently. In this case, **Concurrent Extractors** in the task configuration is invalid.
2. Resumable transmission is not supported. If CDM fails to transfer files, OBS fragments are generated. You need to clear fragments on the OBS console to prevent space occupation.
3. CDM does not support the versioning control function of OBS.
4. During incremental migration, the number of files or objects in the source directory of a single job depends on the CDM cluster flavor. A cdm.large cluster supports a maximum of 300,000 files; a cdm.medium cluster supports a maximum of 200,000 files; and a cdm.small cluster supports a maximum of 100,000 files.

   If the number of files or objects in a single directory exceeds the upper limit, split the files or objects into multiple migration jobs based on subdirectories.

Constraints on DLI

- To use CDM to migrate data to DLI, you must have the read permissions of OBS.
- If the destination is DLI, you are advised to set the number of concurrent extractors to 1. Otherwise, data may fail to be written.

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Constraints on Oracle

Real-time incremental data synchronization is not supported for Oracle databases.

Constraints on DCS and Redis

1. The Redis service of the third-party cloud cannot serve as the migration source. However, the Redis set up in the on-premises data center or on the ECS can be the migration source and destination.
2. Only the hash and string data formats are supported.

Constraints on DDS and MongoDB

When you migrate MongoDB or DDS data, CDM reads the first row of the collection as an example of the field list. If the first row of data does not contain all fields of the collection, you need to manually add fields.

Constraints on CSS and Elasticsearch

1. CDM supports automatic creation of indexes and field types. The index and field type names can contain only lowercase letters.
2. You cannot modify the field type under an index after it is created, but only create another field.

   If you need to modify the field type, you need to create an index or run the Elasticsearch command on Kibana to delete the existing index and create another index (the data is also deleted).
3. When the field type of the index created by CDM is date, the data format must be *yyyy-MM-dd HH:mm:ss.SSS Z*. For example, **2018-08-08 08:08:08.888 +08:00**.

   During data migration to CSS, if the original data of the **date** field does not meet the format requirements, you can use the **field conversion** function of CDM to convert the data to the preceding format.

Constraints on Kafka

- The data in the message body is a record in CSV format that supports multiple delimiters. Messages cannot be parsed in binary or other formats.
- If the source is MRS Kafka, custom fields are not supported in field mapping.
- If the source is DMS Kafka, custom fields are supported in field mapping.

Constraints on CloudTable and HBase

1. When you migrate data from CloudTable or HBase, CDM reads the first row of the table as an example of the field list. If the first row of data does not contain all fields of the table, you need to manually add fields.
2. Because HBase is schema-less, CDM cannot obtain the data types. If the data is stored in binary format, CDM cannot parse the data.

Constraints on Hive

- If Hive stores timestamp data in Parquet format, timestamps are accurate to the nanosecond, for example, 2023-03-27 00:00:00.000. If the source data

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precision is higher than the nanosecond, the data will be truncated during field mapping. For example, if the source data is **2023-03-27 00:00:00.12345**, it will be truncated to **2023-03-27 00:00:00.123** at the destination.

- If Hive serves as the migration destination and the storage format is Textfile, delimiters must be explicitly specified in the statement for creating Hive tables. The following is an example:

```
CREATE TABLE csv_tbl(
smallint_value smallint,
tinyint_value tinyint,
int_value int,
bigint_value bigint,
float_value float,
double_value double,
decimal_value decimal(9, 7),
timestmamp_value timestamp,
date_value date,
varchar_value varchar(100),
string_value string,
char_value char(20),
boolean_value boolean,
binary_value binary,
varchar_null varchar(100),
string_null string,
char_null char(20),
int_null int
)
ROW FORMAT SERDE 'org.apache.hadoop.hive.serde2.OpenCSVSerde'
WITH SERDEPROPERTIES (
"separatorChar" = "\t",
"quoteChar"     = "'",
"escapeChar"    = "\\"
)
STORED AS TEXTFILE;
```

5.3 Supported Data Sources

5.3.1 Supported Data Sources (2.10.0.300)

CDM provides the following migration modes which support different data sources:

- **Table/File migration** in the import of data into a data lake or migration of data to the cloud. For details, see **Data Sources Supported by Table/File Migration**.
- **Entire DB migration** in the import of data into a data lake or migration of data to the cloud. For details, see **Supported Data Sources in Entire DB Migration**.

NOTE

This section describes the data sources supported by CDM clusters of version 2.10.0.300. The supported data sources vary depending on the CDM cluster version.

Data Sources Supported by Table/File Migration

Table/File migration can migrate data in tables or files.

Table 5-1 describes the supported data sources.

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Table 5-1 Supported data sources during table/file migration

Category	Source	Destination	Description
Data warehouse	GaussDB(DWS)	• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), Doris, and MRS ClickHouse • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	The DWS physical machine management mode is not supported.
	Data Lake Insight (DLI)	• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), Doris, and MRS ClickHouse • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: MongoDB • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	Recommended MongoDB version: 4.2 You must have the SELECT permission (for querying tables) on all fields of the DLI data source.

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Category	Source	Destination	Description
	MRS ClickHouse	Data warehouse: MRS ClickHouse and Data Lake Insight (DLI)	• Recommended MRS ClickHouse version: 21.3.4.*X* • MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
	Doris	Data warehouses: Doris	MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.

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<table>
<tr><th>Category</th><th>Source</th><th>Destination</th><th>Description</th></tr>
<tr><td rowspan="3">Hadoop</td><td>MRS HDFS
MRS HBase</td><td>• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI)
• Hadoop: MRS HDFS, MRS HBase, and MRS Hive
• Object storage: Object Storage Service (OBS)
• Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle
• Search: Elasticsearch
• In OBT: Cloud Search Service (CSS) and CloudTable</td><td rowspan="3">• Supported by local storage. Only MRS Hive and MRS Hudi are supported in storage-compute decoupling scenarios.
• Only MRS Hive is supported in Ranger scenarios.
• Not supported if SSL is enabled for ZooKeeper
• Recommended MRS HDFS versions:
– 2.8.X
– 3.1.X
• Recommended MRS HBase versions:
– 2.1.X
– 1.3.X
• MRS Hive and MRS Hudi 2.x versions are not supported. The following versions are recommended:
– 1.2.X
– 3.1.X
• MRS clusters whose Kerberos encryption type is aes256-sha2,aes128-sha2 are not supported, and only MRS clusters whose Kerberos</td></tr>
<tr><td>MRS Hive</td><td>• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), Doris, and MRS ClickHouse
• Hadoop: MRS HDFS, MRS HBase, and MRS Hive
• Object storage: Object Storage Service (OBS)
• Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle
• Search: Elasticsearch
• In OBT: Cloud Search Service (CSS), CloudTable, and SAP HANA</td></tr>
<tr><td>MRS Hudi</td><td>• Data warehouse: GaussDB(DWS)
• Hadoop: MRS HBase</td></tr>
</table>

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Category	Source	Destination	Description
			encryption type is **aes256-sha1,aes128-sha1** are supported.
	Apache HBase Apache Hive Apache HDFS	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	• Apache cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • Recommended Apache HBase versions: – 2.1.X – 1.3.X • Apache Hive 2.*x* versions are not supported. The following versions are recommended: – 1.2.X – 3.1.X • Recommended Apache HDFS versions: – 2.8.X – 3.1.X

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Category	Source	Destination	Description
Object storage	Object Storage Service (OBS)	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	• Object Storage Migration Service (OMS) is recommended for migration between object storage services. • Binary files cannot be imported to a database or NoSQL.
File system	FTP	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Search: Elasticsearch • Object storage: Object Storage Service (OBS) • In OBT: Cloud Search Service (CSS) and CloudTable	• The file system cannot serve as the destination. • Only text files such as CSV files can be migrated from FTP or SFTP servers to search services. Binary files cannot. • Only binary files can be migrated from FTP or SFTP servers to OBS. • obsutil is recommended for migrating data from HTTP servers to OBS.
	SFTP		
	HTTP	Hadoop: MRS HDFS	

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Category	Source	Destination	Description
Relational database	RDS for MySQL	• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), and Doris • Hadoop: MRS HDFS, MRS HBase, MRS Hive, and MRS Hudi • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch • In OBT: Cloud Search Service (CSS), CloudTable, and SAP HANA	• You are advised to use Data Replication Service (DRS) to migrate data between OLTP databases. • Recommended Microsoft SQL Server version: 2005 or later • Greenplum, Kingbase, and GaussDB can be connected using the PostgreSQL connector. The supported source and destination are the same as those of the PostgreSQL data source.
	RDS for SQL Server RDS for PostgreSQL	• Data warehouse: GaussDB(DWS) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	
	MySQL PostgreSQL Oracle	• Data warehouse: GaussDB(DWS) • Hadoop: MRS HDFS, MRS HBase, MRS Hive, and MRS Hudi • Object storage: Object Storage Service (OBS) • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	
	Microsoft SQL Server	• Data warehouse: GaussDB(DWS) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	

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Category	Source	Destination	Description
NoSQL	Distributed Cache Service (DCS) Redis MongoDB	• Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS)	NoSQL cannot serve as the destination. For how to migrate data from Redis to DCS, see **Migrating Data from Self-Hosted Redis to DCS**.
Message system	Apache Kafka DMS Kafka	In OBT: Cloud Search Service (CSS)	The message system cannot serve as the destination.
	MRS Kafka	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• MRS Kafka cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.

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Category	Source	Destination	Description
Search	Elasticsearch	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch • In OBT: CloudTable and Cloud Search Service (CSS)	Only the non-security mode is supported.
In OBT	CloudTable HBase	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • Search: Elasticsearch • In OBT: CloudTable and Cloud Search Service (CSS)	-
	Cloud Search Service (CSS)	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch • In OBT: CloudTable and Cloud Search Service (CSS)	N/A

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Category	Source	Destination	Description
	SAP HANA	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS Hive	SAP HANA data sources have the following restrictions: • SAP HANA cannot serve as the destination. • Only the 2.00.050.00.1592305219 version is supported. • Only the Generic Edition is supported. • BW/4 FOR HANA is not supported. • Only database names, table names, and column names consisting of English letters are supported. Special characters such as spaces and symbols are not allowed. • The following data types are supported: date, digit, Boolean, and character (except SHORTTEXT). Other data types such as binary are not supported. • During migration, tables cannot be automatically created at the destination.

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Category	Source	Destination	Description
	FusionInsight HDFS FusionInsight HBase FusionInsight Hive	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	• FusionInsight cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • Recommended FusionInsight HDFS versions: – 2.8.X – 3.1.X • Recommended FusionInsight HBase versions: – 2.1.X – 1.3.X • Recommended FusionInsight Hive versions: – 1.2.X – 3.1.X
	Database shard	• Data warehouse shard: Data Lake Insight (DLI) • Hadoop: MRS HBase and MRS Hive • Search: Elasticsearch • Object storage: Object Storage Service (OBS) • In OBT: Cloud Search Service (CSS)	Database shards cannot serve as the destination.
	Dameng database	• Data warehouse: GaussDB(DWS) • Hadoop: MRS Hive and MRS Hudi	-
	ShenTong	Hadoop: MRS Hive and MRS Hudi	-

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Category	Source	Destination	Description
	Document Database Service (DDS)	Hadoop: MRS HDFS, MRS HBase, and MRS Hive	-
	Cassandra	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Search: Elasticsearch • In OBT: Cloud Search Service (CSS) and CloudTable	-
	GBASE8S	• Hadoop: MRS HDFS and MRS HBase • Message system: MRS Kafka	-
	GBASE8A	• Hadoop: MRS HDFS, MRS Hive, and MRS HBase • Message system: MRS Kafka	-

NOTE

In the preceding table, the non-cloud data sources, such as MySQL, include on-premises MySQL, MySQL built on ECSs, or MySQL on the third-party cloud.

Supported Data Sources in Entire DB Migration

Entire DB migration is used when an on-premises data center or a database created on an ECS needs to be synchronized to a database service or big data service on the cloud. It is suitable for offline database migration but not online real-time migration.

Table 5-2 lists the data sources supporting entire DB migration using CDM.

Table 5-2 Supported data sources in entire DB migration

Category	Data Source	Read	Write	Description
Data warehouse	GaussDB(DWS)	Supported	Supported	-

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Category	Data Source	Read	Write	Description
Hadoop (available only for local storage, and not for storage-compute decoupling, Ranger, or ZooKeeper for which SSL is enabled)	MRS HBase	Supported	Supported	Entire DB migration only to MRS HBase Recommended versions: • 2.1.X • 1.3.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.

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Category	Data Source	Read	Write	Description
	MRS Hive	Supported	Supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: ● 1.2.X ● 3.1.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
	Apache HBase	Supported	Not supported	Recommended versions: ● 2.1.X ● 1.3.X
	Apache Hive	Supported	Not supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: ● 1.2.X ● 3.1.X

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Category	Data Source	Read	Write	Description
	MRS Hudi	Supported	Supported	Supported only by local storage and in storage-compute decoupling scenarios 2.*x* versions are not supported. The following versions are recommended: • 1.2.X • 3.1.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
Relational database	RDS for MySQL	Supported	Supported	Migration from OLTP to OLTP is not supported. In this scenario, you are advised to use the Data Replication Service (DRS).
	RDS for PostgreSQL	Supported	Supported	
	RDS for SQL Server	Supported	Supported	
	MySQL	Supported	Not supported	
	PostgreSQL	Supported	Not supported	
	Microsoft SQL Server	Supported	Not supported	

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Category	Data Source	Read	Write	Description
	Oracle	Supported	Not supported	
NoSQL	Distributed Cache Service (DCS)	Not supported	Supported	Only migration from MRS to DCS is supported.
In OBT	CloudTable	Supported	Supported	-
	FusionInsight HBase	Supported	Not supported	Recommended versions: • 2.1.X • 1.3.X
	FusionInsight Hive	Supported	Not supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: • 1.2.X • 3.1.X

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Category	Data Source	Read	Write	Description
	SAP HANA	Supported	Not supported	• Only the 2.00.050.00.1592305219 version is supported. • Only the Generic Edition is supported. • BW/4 FOR HANA is not supported. • Only database names, table names, and column names consisting of English letters are supported. Special characters such as spaces and symbols are not allowed. • The following data types are supported: date, digit, Boolean, and character (except SHORTTEXT). Other data types such as binary are not supported. • During migration, tables cannot be automatically created at the destination.
	Dameng database	Supported	Not supported	Only to DWS and Hive

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Category	Data Source	Read	Write	Description
	Document Database Service (DDS)	Supported	Supported	Only migration between DDS and MRS is supported.

5.3.2 Supported Data Sources (2.9.3.300)

CDM provides the following migration modes which support different data sources:

- **Table/File migration** in the import of data into a data lake or migration of data to the cloud. For details, see **Data Sources Supported by Table/File Migration**.
- **Entire DB migration** in the import of data into a data lake or migration of data to the cloud. For details, see **Supported Data Sources in Entire DB Migration**.

NOTE

This section describes the data sources supported by CDM clusters of version 2.9.3.300. The supported data sources vary depending on the CDM cluster version.

Data Sources Supported by Table/File Migration

Table/File migration can migrate data in tables or files.

Table 5-3 describes the supported data sources.

Table 5-3 Supported data sources during table/file migration

Category	Source	Destination	Description
Data warehouse	Data Warehouse Service	• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), and MRS ClickHouse • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	The DWS physical machine management mode is not supported.

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Category	Source	Destination	Description
	Data Lake Insight (DLI)	• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), and MRS ClickHouse • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: CloudTable and MongoDB • Search: Elasticsearch and Cloud Search Service (CSS)	Recommended MongoDB version: 4.2 You must have the SELECT permission (for querying tables) on all fields of the DLI data source.
	MRS ClickHouse	Data warehouse: MRS ClickHouse and Data Lake Insight (DLI)	• Recommended MRS ClickHouse version: 21.3.4.*X* • MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.

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Category	Source	Destination	Description
Hadoop	MRS HDFS MRS HBase	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• Supported by local storage. Only MRS Hive and MRS Hudi are supported in storage-compute decoupling scenarios. • Only MRS Hive is supported in Ranger scenarios. • Not supported if SSL is enabled for ZooKeeper • Recommended MRS HDFS versions: – 2.8.X – 3.1.X • Recommended MRS HBase versions: – 2.1.X – 1.3.X • MRS Hive and MRS Hudi 2.*x* versions are not supported. The following versions are recommended: – 1.2.X – 3.1.X • MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose
	MRS Hive	• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), and MRS ClickHouse • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	
	MRS Hudi	• Data warehouse: GaussDB(DWS) • Hadoop: MRS HBase	

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Category	Source	Destination	Description
			Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
	FusionInsight HDFS FusionInsight HBase FusionInsight Hive	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• FusionInsight cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • Recommended FusionInsight HDFS versions: – 2.8.X – 3.1.X • Recommended FusionInsight HBase versions: – 2.1.X – 1.3.X • Recommended FusionInsight Hive versions: – 1.2.X – 3.1.X

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Category	Source	Destination	Description
	Apache HBase Apache Hive Apache HDFS	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• Apache cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • Recommended Apache HBase versions: – 2.1.X – 1.3.X • Apache Hive 2.*x* versions are not supported. The following versions are recommended: – 1.2.X – 3.1.X • Recommended Apache HDFS versions: – 2.8.X – 3.1.X

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Category	Source	Destination	Description
Object storage	Object Storage Service (OBS)	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• Object Storage Migration Service (OMS) is recommended for migration between object storage services. • Binary files cannot be imported to a database or NoSQL.
File system	FTP	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS) • Object-based storage: Object Storage Service (OBS)	• The file system cannot serve as the destination. • Only text files such as CSV files can be migrated from FTP or SFTP servers to search services. Binary files cannot. • Only binary files can be migrated from FTP or SFTP servers to OBS. • obsutil is recommended for migrating data from HTTP servers to OBS.
	SFTP		
	HTTP	Hadoop: MRS HDFS	

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Category	Source	Destination	Description
Relational database	RDS for MySQL	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, MRS Hive, and MRS Hudi • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch and Cloud Search Service (CSS)	• Recommended Microsoft SQL Server version: 2005 or later • The KingBase database and GaussDB can be connected using the PostgreSQL connector. The supported source and destination are the same as those of the PostgreSQL data source.
	RDS for SQL Server RDS for PostgreSQL	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch and Cloud Search Service (CSS)	
	MySQL PostgreSQL Oracle	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, MRS Hive, and MRS Hudi • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	

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Category	Source	Destination	Description
	Microsoft SQL Server	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	

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Category	Source	Destination	Description
	SAP HANA	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS Hive	SAP HANA data sources have the following restrictions: • SAP HANA cannot serve as the destination. • Only the 2.00.050.00.1592305219 version is supported. • Only the Generic Edition is supported. • BW/4 FOR HANA is not supported. • Only database names, table names, and column names consisting of English letters are supported. Special characters such as spaces and symbols are not allowed. • The following data types are supported: date, digit, Boolean, and character (except SHORTTEXT). Other data types such as binary are not supported. • During migration, tables cannot be automatically

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Category	Source	Destination	Description
			created at the destination.
	Database Sharding	• Data warehouse: Data Lake Insight (DLI) • Hadoop: MRS HBase and MRS Hive • Search: Elasticsearch and Cloud Search Service (CSS) • Object-based storage: Object Storage Service (OBS)	Database shards cannot serve as the destination.
	ShenTong	• Hadoop: MRS Hive and MRS Hudi	-
NoSQL	Distributed Cache Service (DCS)	Hadoop: MRS HDFS, MRS HBase, and MRS Hive	NoSQL except CloudTable cannot serve as the destination. For how to migrate data from Redis to DCS, see **Migrating Data from Self-Hosted Redis to DCS**.
	Redis		
	Document Database Service		
	MongoDB		
	CloudTable HBase	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	

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Category	Source	Destination	Description
	Cassandra	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	
Message system	Apache Kafka	Search: Cloud Search Service (CSS)	The message system cannot serve as the destination.
	DMS Kafka		

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Category	Source	Destination	Description
	MRS Kafka	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• MRS Kafka cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
Search	Elasticsearch	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	Only the non-security mode is supported.
	Cloud Search Service (CSS)		N/A

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NOTE

In the preceding table, the non-cloud data sources, such as MySQL, include on-premises MySQL, MySQL built on ECSs, or MySQL on the third-party cloud.

Supported Data Sources in Entire DB Migration

Entire DB migration is used when an on-premises data center or a database created on an ECS needs to be synchronized to a database service or big data service on the cloud. It is suitable for offline database migration but not online real-time migration.

Table 5-4 lists the data sources supporting entire DB migration using CDM.

Table 5-4 Supported data sources in entire DB migration

Category	Data Source	Read	Write	Description
Data warehouse	Data Warehouse Service	Supported	Supported	-
Hadoop (available only for local storage, and not for storage-compute decoupling, Ranger, or ZooKeeper for which SSL is enabled)	MRS HBase	Supported	Supported	Entire DB migration only to MRS HBase Recommended versions: • 2.1.X • 1.3.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.

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Category	Data Source	Read	Write	Description
	MRS Hive	Supported	Supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: ● 1.2.X ● 3.1.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
	FusionInsight HBase	Supported	Not supported	Recommended versions: ● 2.1.X ● 1.3.X
	FusionInsight Hive	Supported	Not supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: ● 1.2.X ● 3.1.X
	Apache HBase	Supported	Not supported	Recommended versions: ● 2.1.X ● 1.3.X

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Category	Data Source	Read	Write	Description
	Apache Hive	Supported	Not supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: • 1.2.X • 3.1.X
	MRS Hudi	Supported	Supported	Supported only by local storage and in storage-compute decoupling scenarios 2.*x* versions are not supported. The following versions are recommended: • 1.2.X • 3.1.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
Relational database	RDS for MySQL	Supported	Supported	Migration from OLTP to OLTP is not supported. In this scenario, you are advised to use the Data Replication Service (DRS).
	RDS for PostgreSQL	Supported	Supported	
	RDS for SQL Server	Supported	Supported	

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Category	Data Source	Read	Write	Description
	MySQL	Supported	Not supported	
	PostgreSQL	Supported	Not supported	
	Microsoft SQL Server	Supported	Not supported	
	Oracle	Supported	Not supported	

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Category	Data Source	Read	Write	Description
	SAP HANA	Supported	Not supported	• Only the 2.00.050.00.1592305219 version is supported. • Only the Generic Edition is supported. • BW/4 FOR HANA is not supported. • Only database names, table names, and column names consisting of English letters are supported. Special characters such as spaces and symbols are not allowed. • The following data types are supported: date, digit, Boolean, and character (except SHORTTEXT). Other data types such as binary are not supported. • During migration, tables cannot be automatically created at the destination.
	Dameng database	Supported	Not supported	Only to DWS and Hive

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Category	Data Source	Read	Write	Description
NoSQL	Distributed Cache Service (DCS)	Not supported	Supported	Only migration from MRS to DCS is supported.
	Document Database Service (DDS)	Supported	Supported	Only migration between DDS and MRS is supported.
	CloudTable	Supported	Supported	-

5.3.3 Supported Data Sources (2.9.2.200)

CDM provides the following migration modes which support different data sources:

- **Table/File migration** in the import of data into a data lake or migration of data to the cloud. For details, see **Data Sources Supported by Table/File Migration**.
- **Entire DB migration** in the import of data into a data lake or migration of data to the cloud. For details, see **Supported Data Sources in Entire DB Migration**.

NOTE

This section describes the data sources supported by CDM clusters of version 2.9.2.200. The supported data sources vary depending on the CDM cluster version.

Data Sources Supported by Table/File Migration

Table/File migration can migrate data in tables or files.

Table 5-5 describes the supported data sources.

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Table 5-5 Supported data sources during table/file migration

Category	Source	Destination	Description
Data warehouse	GaussDB(DWS)	• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), and MRS ClickHouse • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	The DWS physical machine management mode is not supported.
	Data Lake Insight (DLI)		You must have the SELECT permission (for querying tables) on all fields of the DLI data source.
	MRS ClickHouse	Data warehouse: MRS ClickHouse and Data Lake Insight (DLI)	• Recommended MRS ClickHouse version: 21.3.4.*X* • MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.

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<table>
<tr><th>Category</th><th>Source</th><th>Destination</th><th>Description</th></tr>
<tr><td rowspan="3">Hadoop</td><td>MRS HDFS
MRS HBase</td><td>• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI)
• Hadoop: MRS HDFS, MRS HBase, and MRS Hive
• Object storage: Object Storage Service (OBS)
• Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle
• NoSQL: CloudTable
• Search: Elasticsearch and Cloud Search Service (CSS)</td><td rowspan="3">• Supported by local storage. Only MRS Hive and MRS Hudi are supported in storage-compute decoupling scenarios.
• Only MRS Hive is supported in Ranger scenarios.
• Not supported if SSL is enabled for ZooKeeper
• Recommended MRS HDFS versions:
– 2.8.X
– 3.1.X
• Recommended MRS HBase versions:
– 2.1.X
– 1.3.X
• MRS Hive and MRS Hudi 2.x versions are not supported. The following versions are recommended:
– 1.2.X
– 3.1.X
• MRS clusters whose Kerberos encryption type is aes256-sha2,aes128-sha2 are not supported, and only MRS clusters whose Kerberos</td></tr>
<tr><td>MRS Hive</td><td>• Data warehouse: GaussDB(DWS), Data Lake Insight (DLI), and MRS ClickHouse
• Hadoop: MRS HDFS, MRS HBase, and MRS Hive
• Object storage: Object Storage Service (OBS)
• Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle
• NoSQL: CloudTable
• Search: Elasticsearch and Cloud Search Service (CSS)</td></tr>
<tr><td>MRS Hudi</td><td>Data warehouse: GaussDB(DWS)</td></tr>
</table>

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Category	Source	Destination	Description
			encryption type is **aes256-sha1,aes128-sha1** are supported.
	FusionInsight HDFS FusionInsight HBase FusionInsight Hive	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• FusionInsight cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • Recommended FusionInsight HDFS versions: – 2.8.X – 3.1.X • Recommended FusionInsight HBase versions: – 2.1.X – 1.3.X • Recommended FusionInsight Hive versions: – 1.2.X – 3.1.X

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Category	Source	Destination	Description
	Apache HBase Apache Hive Apache HDFS	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• Apache cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • Recommended Apache HBase versions: – 2.1.X – 1.3.X • Apache Hive 2.*x* versions are not supported. The following versions are recommended: – 1.2.X – 3.1.X • Recommended Apache HDFS versions: – 2.8.X – 3.1.X
Object storage	Object Storage Service (OBS)	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• Object Storage Migration Service (OMS) is recommended for migration between object storage services. • Binary files cannot be imported to a database or NoSQL.

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Category	Source	Destination	Description
File system	FTP	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• The file system cannot serve as the destination. • Only text files such as CSV files can be migrated from FTP or SFTP servers to search services. Binary files cannot. • obsutil is recommended for migrating data from HTTP servers to OBS.
	SFTP		
	HTTP	Hadoop: MRS HDFS	
Relational database	RDS for MySQL	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, MRS Hive, and MRS Hudi • Object storage: Object Storage Service (OBS) • NoSQL: CloudTable • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch and Cloud Search Service (CSS)	• Recommended Microsoft SQL Server version: 2005 or later • Greenplum, Kingbase, and GaussDB can be connected using the PostgreSQL connector. The supported source and destination are the same as those of the PostgreSQL data source.
	RDS for SQL Server	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • NoSQL: CloudTable • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • Search: Elasticsearch and Cloud Search Service (CSS)	
	RDS for PostgreSQL		

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Category	Source	Destination	Description
	MySQL PostgreSQL Oracle	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, MRS Hive, and MRS Hudi • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	
	Microsoft SQL Server	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	

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Category	Source	Destination	Description
	SAP HANA	• Data warehouse: Data Lake Insight (DLI) • Hadoop: MRS Hive	SAP HANA data sources have the following restrictions: • SAP HANA cannot serve as the destination. • Only the 2.00.050.00.1592305219 version is supported. • Only the Generic Edition is supported. • BW/4 FOR HANA is not supported. • Only database names, table names, and column names consisting of English letters are supported. Special characters such as spaces and symbols are not allowed. • The following data types are supported: date, digit, Boolean, and character (except SHORTTEXT). Other data types such as binary are not supported. • During migration, tables cannot be automatically created at the destination.

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Category	Source	Destination	Description
	Database sharding	• Data warehouse: Data Lake Insight (DLI) • Hadoop: MRS HBase and MRS Hive • Search: Elasticsearch and Cloud Search Service (CSS) • Object-based storage: Object Storage Service (OBS)	Database shards cannot serve as the destination. A shard link connects to multiple backend data sources at the same time. The link can be used as the job source to migrate data from those data sources to other data sources.
NoSQL	Redis	Hadoop: MRS HDFS, MRS HBase, and MRS Hive	NoSQL except CloudTable cannot serve as the destination.
	Document Database Service (DDS)		
	MongoDB		
	CloudTable HBase	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, and Oracle • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	
	Cassandra	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	

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Category	Source	Destination	Description
Message system	Apache Kafka	Search: Cloud Search Service (CSS)	The message system cannot serve as the destination.
	DMS Kafka		
	MRS Kafka	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object-based storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	• MRS Kafka cannot serve as the destination. • Supported only by local storage and not in storage-compute decoupling scenarios • Not supported by Ranger • Not supported if SSL is enabled for ZooKeeper • MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
Search	Elasticsearch	• Data warehouse: GaussDB(DWS) and Data Lake Insight (DLI) • Hadoop: MRS HDFS, MRS HBase, and MRS Hive • Object storage: Object Storage Service (OBS) • Relational database: RDS for MySQL, RDS for PostgreSQL, and RDS for SQL Server • NoSQL: CloudTable • Search: Elasticsearch and Cloud Search Service (CSS)	Only the non-security mode is supported.
	Cloud Search Service (CSS)		N/A

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NOTE

In the preceding table, the non-cloud data sources, such as MySQL, include on-premises MySQL, MySQL built on ECSs, or MySQL on the third-party cloud.

Supported Data Sources in Entire DB Migration

Entire DB migration is used when an on-premises data center or a database created on an ECS needs to be synchronized to a database service or big data service on the cloud. It is suitable for offline database migration but not online real-time migration.

Table 5-6 lists the data sources supporting entire DB migration using CDM.

Table 5-6 Supported data sources in entire DB migration

Category	Data Source	Read	Write	Description
Data warehouse	Data Warehouse Service (DWS)	Supported	Supported	-
Hadoop (available only for local storage, and not for storage-compute decoupling, Ranger, or ZooKeeper for which SSL is enabled)	MRS HBase	Supported	Supported	Entire DB migration only to MRS HBase Recommended versions: • 2.1.X • 1.3.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.

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Category	Data Source	Read	Write	Description
	MRS Hive	Supported	Supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: ● 1.2.X ● 3.1.X MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
	FusionInsight HBase	Supported	Not supported	Recommended versions: ● 2.1.X ● 1.3.X
	FusionInsight Hive	Supported	Not supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: ● 1.2.X ● 3.1.X
	Apache HBase	Supported	Not supported	Recommended versions: ● 2.1.X ● 1.3.X

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Category	Data Source	Read	Write	Description
	Apache Hive	Supported	Not supported	Entire DB migration only to a relational database 2.*x* versions are not supported. The following versions are recommended: • 1.2.X • 3.1.X
Relational database	RDS for MySQL	Supported	Supported	Migration from OLTP to OLTP is not supported. In this scenario, you are advised to use the Data Replication Service (DRS).
	RDS for PostgreSQL	Supported	Supported	
	RDS for SQL Server	Supported	Supported	
	MySQL	Supported	Not supported	
	PostgreSQL	Supported	Not supported	
	Microsoft SQL Server	Supported	Not supported	
	Oracle	Supported	Not supported	

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Category	Data Source	Read	Write	Description
	SAP HANA	Supported	Not supported	• Only the 2.00.050.00.1592305219 version is supported. • Only the Generic Edition is supported. • BW/4 FOR HANA is not supported. • Only database names, table names, and column names consisting of English letters are supported. Special characters such as spaces and symbols are not allowed. • The following data types are supported: date, digit, Boolean, and character (except SHORTTEXT). Other data types such as binary are not supported. • During migration, tables cannot be automatically created at the destination.
	Dameng database	Supported	Not supported	Only to DWS and Hive

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Category	Data Source	Read	Write	Description
NoSQL	Redis	Supported	Supported	-
	Document Database Service (DDS)	Supported	Supported	Only migration between DDS and MRS is supported.
	CloudTable Service (CloudTable)	Supported	Supported	-

5.3.4 Supported Data Types

To ensure that data is completely imported to the migration destination, correctly configure field mappings based on data types supported for different data sources. For details, see **Table 5-7**.

Table 5-7 Supported data types

Data Connection Type	Data Type
MySQL	**Data Types Supported in MySQL Database Migration**
SQL Server	**Data Types Supported in SQL Server Database Migration**
Oracle	**Data Types Supported in Oracle Database Migration**
PostgreSQL	**Data Types Supported in PostgreSQL Database Migration**
ShenTong	**Data Types Supported in ShenTong Database Migration**
SAP HANA	**Data Types Supported in SAP HANA Database Migration**
DWS	**Data Types Supported in DWS Database Migration**
Dameng	**Data Types Supported in Dameng Database Migration**
DLI	**Data Types Supported in DLI Database Migration**
Elasticsearch/Cloud Search Service (CSS)	**Data Types Supported in Elasticsearch/CSS Database Migration**

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Data Types Supported in MySQL Database Migration

When the source end is a MySQL database and the destination end is a Hive or DWS database, the following data types are supported:

Table 5-8 Data types supported for the open-source MySQL database

Category	Type	Description	Storage Format Example	Hive	DWS
Character string	CHAR(M)	A fixed-length string of 1 to 255 characters, for example, CHAR(5). The string is padded to a specified length with spaces on the right. The length limit is not mandatory. It is set to 1 by default.	'a' or 'aaaaa'	CHAR	CHAR
	VARCHAR(M)	A variable-length string of 1 to 255 characters (more than 255 characters for MySQL of a later version), for example, VARCHAR(25). When creating a field of the VARCHAR type, you must define the length.	'a' or 'aaaaa'	VARCHAR	VARCHAR
Value	DECIMAL(M, D)	Uncompressed floating-point numbers cannot be unsigned. In unpacking decimals, each decimal corresponds to a byte. Defining the number of display lengths (M) and decimals (D) is required. NUMERIC is the synonym of DECIMAL.	52.36	DECIMAL	When D is 0, it corresponds to BIGINT. When D is not 0, it corresponds to NUMBERIC.
	NUMBERIC	Same as DECIMAL	-	DECIMAL	NUMBERIC

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Category	Type	Description	Storage Format Example	Hive	DWS
	INTEGER	An integer of normal size that can be signed. If the value is signed, it ranges from -2147483648 to 2147483647. If the value is unsigned, the value ranges from 0 to 4294967295. Up to 11-bit width can be specified.	5236	INT	INTEGER
	INTEGER UNSIGNED	Unsigned form of INTEGER	-	BIGINT	INTEGER
	INT	Same as INTEGER	5236	INT	INTEGER
	INT UNSIGNED	Same as INTEGER UNSIGNED	-	BIGINT	INTEGER
	BIGINT	A large integer that can be signed. If the value is signed, it ranges from -9223372036854775808 to 9223372036854775807. If the value is unsigned, the value ranges from 0 to 18446744073709551615. Up to 20-bit width can be specified.	5236	BIGINT	BIGINT
	BIGINT UNSIGNED	Unsigned form of BIGINT	-	BIGINT	BIGINT

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Category	Type	Description	Storage Format Example	Hive	DWS
	MEDIUMINT	A medium-sized integer that can be signed. If the value is signed, it ranges from -8388608 to 8388607. If the value is unsigned, it ranges from 0 to 16777215, and you can specify a maximum of 9-bit width.	-128 to 127	INT	INTEGER
	MEDIUMINT UNSIGNED	Unsigned form of MEDIUMINT	-	BIGINT	INTEGER
	TINYINT	A very small integer that can be signed. If signed, the value ranges from -128 to 127. If unsigned, the value ranges from 0 to 255, and you can specify a maximum of 4-bit width.	100	TINYINT	SMALLINT
	TINYINT UNSIGNED	Unsigned form of TINYINT	-	TINYINT	SMALLINT
	BOOL	The bool of MySQL is tinyint(1).	-128, 127	SMALLINT	BYTEA
	SMALLINT	A small integer that can be signed. If the value is signed, it ranges from -32768 to 32767. If unsigned, the value ranges from 0 to 65535, and you can specify a maximum of 5-bit width.	9999	SMALLINT	SMALLINT

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Category	Type	Description	Storage Format Example	Hive	DWS
	SMALLINT UNSIGNED	Unsigned form of SMALLINT	-	INT	SMALLINT
	REAL	Same as DOUBLE	-	DOUBLE	-
	FLOAT(M,D)	Unsigned floating-point numbers cannot be used. The display length (M) and number of decimal places (D) can be specified. This is not mandatory, and the default value is 10,2. In the preceding information, 2 indicates the number of decimal places and 10 indicates the total number of digits (including decimal places). The decimal precision can reach 24 floating points.	52.36	FLOAT	FLOAT4
	DOUBLE(M,D)	Unsigned double-precision floating-point numbers cannot be used. The display length (M) and number of decimal places (D) can be specified. This is not mandatory. The default value is 16,4, where 4 is the number of decimal places. The decimal precision can reach 53-digit. REAL is a synonym of DOUBLE.	52.36	DOUBLE	FLOAT8
	DOUBLE PRECISION	Similar to DOUBLE	52.3	DOUBLE	FLOAT8

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Category	Type	Description	Storage Format Example	Hive	DWS
Bit	BIT(M)	Stored bit type value. BIT(M) can store up to *M* bits of values, and *M* ranges from 1 to 64.	B'1111100' B'1100'	TINYINT	BYTEA
Time and date	DATE	The value is in the *YYYY-MM-DD* format and ranges from **1000-01-01** to **9999-12-31**. For example, **December 30, 1973** will be stored as **1973-12-30**.	1999-10-01	DATE	TIMESTAMP
	TIME	Stores information about the hour, minute, and second.	'09:10:21' or '9:10:21'	Not supported (string)	TIME
	DATETIME	The date and time are in the *YYYY-MM-DD HH:MM:SS* format and range from **1000-01-01 00:00:00** to **9999-12-31 23:59:59**. For example, **3:30 p.m. on December 30, 1973** will be stored as **1973-12-30 15:30:00**.	'1973-12-30 15:30:00'	TIMESTAMP	TIMESTAMP
	TIMESTAMP	Timestamp type. Timestamp between midnight on January 1, 1970 and a time point in 2037. Similar to the DATETIME format (YYYYMMDDHHMMSS), except that no hyphen is required. For example, **3:30 p.m. December 30, 1973** will be stored as **19731230153000**.	19731230153000	TIMESTAMP	TIMESTAMP

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Category	Type	Description	Storage Format Example	Hive	DWS
	YEAR(M)	The year is stored in 2-digit or 4-digit number format. If the length is specified as 2 (for example, YEAR(2)), the year ranges from 1970 to 2069 (70 to 69). If the length is specified as 4, the year ranges from 1901 to 2155. The default length is 4.	2000	Not supported (string)	Not supported
Multimedia (binary)	BINARY(M)	The number of bytes is *M*. The length of a variable-length binary string ranges from 0 to *M*. *M* is the value length plus 1.	0x2A3B4058 (binary data)	Not supported	BYTEA
	VARBINARY(M)	The number of bytes is *M*. A fixed binary string with a length of 0 to *M*.	0x2A3B4059 (binary data)	Not supported	BYTEA
	TEXT	The maximum length of the field is 65535 characters. TEXT is a "binary large object" and is used to store large binary data, such as images or other types of files.	0x5236 (binary data)	Not supported	Not supported
	TINYTEXT	A binary string of 0 to 255 bytes in short text	-	-	Not supported
	MEDIUMTEXT	A binary string of 0 to 167772154 bytes in medium-length text	-	-	Not supported
	LONGTEXT	A binary string of 0 to 4294967295 bytes in large-length text	-	-	Not supported

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Category	Type	Description	Storage Format Example	Hive	DWS
	BLOB	The maximum length of the field is 65535 characters. BLOB is a "binary large object" and is used to store large binary data, such as images or other types of files. BLOB is case-sensitive.	0x5236 (binary data)	Not supported	Not supported
	TINYBLOB	A binary string of 0 to 255 bytes in short text	-	Not supported	Not supported
	MEDIUMBLOB	A binary string of 0 to 167772154 bytes in medium-length text	-	Not supported	Not supported
	LONGBLOB	A binary string of 0 to 4294967295 bytes in large-length text	0x5236 (binary data)	Not supported	Not supported
Special type	SET	SET is a string object that can have no or multiple values. The values come from the allowed column of values specified when the table is created. When specifying the SET column values that contain multiple SET members, separate the members with commas (,). The SET member value cannot contain commas (,).	-	-	Not supported
	JSON	-	-	Not supported	Not supported (TEXT)

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Category	Type	Description	Storage Format Example	Hive	DWS
	ENUM	When an ENUM is defined, a list of its values is created, which are the items that must be used for selection (or NULL). For example, if you want a field to contain "A", "B", or "C", you can define an ENUM ("A", "B", or "C"). Only these values (or NULL) can be used to fill in the field.	-	Not supported	Not supported

Data Types Supported in Oracle Database Migration

When the source end is an Oracle database and the destination end is a Hive or DWS database, the following data sources are supported:

Table 5-9 Data types supported for the Oracle database

Category	Type	Description	Hive	DWS
Character string	char	Fixed-length character string, which is padded with spaces to reach the maximum length.	CHAR	CHAR
	nchar	Fixed-length character string contains data in Unicode format.	CHAR	CHAR
	varchar2	Synonym of VARCHAR. It is a variable-length string, unlike the CHAR type, which does not pad the field or variable to reach its maximum length with spaces.	VARCHAR	VARCHAR
	nvarchar2	Variable-length character string contains data in Unicode format.	VARCHAR	VARCHAR
Value	number	Stores numbers with a precision of up to 38 digits.	DECIMAL	NUMERIC

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Category	Type	Description	Hive	DWS
	binary_float	2-bit single-precision floating point number	FLOAT	FLOAT8
	binary_double	64-bit double-precision floating point number	DOUBLE	FLOAT8
	long	A maximum of 2 GB character data can be stored.	Not supported	Not supported
Time and date	date	7-byte date/time data type, including seven attributes: century, year in the century, month, day in the month, hour, minute, and second.	DATE	TIMESTAMP
	timestamp	7-byte or 11-byte fixed-width date/time data type that contains decimals (seconds)	TIMESTAMP	TIMESTAMP
	timestamp with time zone	3-byte timestamp, which supports the time zone.	TIMESTAMP	TIME WITH TIME ZONE
	timestamp with local time zone	7-byte or 11-byte fixed-width date/time data type. Time zone conversion occurs when data is inserted or read.	TIMESTAMP	Not supported (TEXT)
	interval year to month	5-byte fixed-width data type, which is used to store a time segment.	Not supported	Not supported (TEXT)
	interval day to second	11-byte fixed-width data type, which is used to store a time segment. The time segment is stored in days/hours/minutes/seconds. The value can also contain nine decimal places (seconds).	Not supported	Not supported (TEXT)
Multimedia (binary)	raw	A variable-length binary data type. Character set conversion is not performed for data stored in this data type.	Not supported	Not supported

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Category	Type	Description	Hive	DWS
	long raw	Stores up to 2 GB binary information.	Not supported	Not supported
	blob	A maximum of 4 GB data can be stored.	Not supported	Not supported
	clob	In Oracle 10g and later versions, a maximum of (4 GB) x (database block size) bytes of data can be stored. CLOB contains the information for which character set conversion is to be performed. This data type is ideal for storing plain text information.	String	Not supported
	nclob	This type can store a maximum of 4 GB data. When the character set is converted, this type is affected.	Not supported	Not supported
	bfile	An Oracle directory object and a file name can be stored in the database column, and the file can be read through the Oracle directory object and file name.	Not supported	Not supported
Others	rowid	It is the address of a row in the database table. It is 10 bytes long.	Not supported	Not supported
	urowid	It is a common row ID and does not have a fixed rowid table.	Not supported	Not supported

Data Types Supported in SQL Server Database Migration

When the source end is a SQL Server database and the destination end is a Hive, Oracle or DWS database, the following data sources are supported:

Table 5-10 Data types supported for the SQL Server database

Category	Type	Description	Hive	DWS	Oracle
String data type	char	Fixed-length character string, which is padded with spaces to reach the maximum length.	CHAR	CHAR	CHAR

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Category	Type	Description	Hive	DWS	Oracle
	nchar	Fixed-length character string contains data in Unicode format.	CHAR	CHAR	CHAR
	varchar	A variable-length string consists of 1 to 255 characters (more than 255 characters for MySQL of a later version). Example: VARCHAR(25). When creating a field of the VARCHAR type, you must define the length.	VARCHAR	VARCHAR	VARCHAR
	nvarchar	Stores variable-length Unicode character data, similar to varchar.	VARCHAR	VARCHAR	VARCHAR
Numeric data type	int	int is stored in four bytes, where one binary bit represents a sign bit, and the other 31 binary bits represent a length and a size, and may represent all integers ranging from -2^{31} to $2^{31} - 1$.	INT	INTEGER	INT
	bigint	bigint is stored in eight bytes, where one binary bit represents a sign bit, and the other 63 binary bits represent a length and a size, and may represent all integers ranging from -2^{63} to $2^{63} - 1$.	BIGINT	BIGINT	NUMBER
	smallint	Data of the smallint type occupies two bytes of storage space. One binary bit indicates a positive or negative sign of an integer value, and the other 15 binary bits indicate a length and a size, and may represent all integers ranging from -2^{15} to 2^{15}.	SMALLINT	SMALLINT	NUMBER
	tinyint	Tinyint data occupies one byte of storage space and can represent all integers ranging from 0 to 255.	TINYINT	TINYINT	NUMBER
	real	The value can be a positive or negative decimal number.	DOUBLE	FLOAT4	NUMBER
	float	The number of digits (in scientific notation) of the mantissa of a float value, which determines the precision and storage size	FLOAT	FLOAT8	binary_float
	decimal	Numeric data type with fixed precision and scale	DECIMAL	NUMERIC	NUMBER

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Category	Type	Description	Hive	DWS	Oracle
	numeric	Stores zero, positive, and negative fixed point numbers.	DECIMAL	NUMERIC	NUMBER
Date and time data type	date	Stores date data represented by strings.	DATE	TIMESTAMP	DATE
	time	Time of a day, which is recorded in the form of a character string.	Not supported (string)	TIME	Not supported
	datetime	Stores time and date data.	TIMESTAMP	TIMESTAMP	Not supported
	datetime2	Extended type of datetime, which has a larger data range. By default, the minimum precision is the highest, and the user-defined precision is optional.	TIMESTAMP	TIMESTAMP	Not supported
	smalldatetime	The smalldatetime type is similar to the datetime type. The difference is that the smalldatetime type stores data from January 1, 1900 to June 6, 2079. When the date and time precision is low, the smalldatetime type can be used. Data of this type occupies 4-byte storage space.	TIMESTAMP	TIMESTAMP	Not supported
	datetimeoffset	A time that uses the 24-hour clock and combined with date and the time zone.	Not supported (string)	TIMESTAMP	Not supported
Multimedia data types (binary)	text	Stores text data.	Not supported (string)	Not supported (string)	Not supported
	ntext	The function of this type is the same as that of the text type. It is non-Unicode data with variable length.	Not supported (string)	Not supported (string)	Not supported

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Category	Type	Description	Hive	DWS	Oracle
	image	Variable-length binary data used to store pictures, catalog pictures, or paintings.	Not supported (string)	Not supported (string)	Not supported
	binary	Binary data with a fixed length of *n* bytes, where *n* ranges from 1 to 8,000.	Not supported (string)	Not supported (string)	Not supported
	varbinary	Variable-length binary data	Not supported (string)	Not supported (string)	Not supported
Currency data type	money	Stores currency values.	Not supported (string)	Not supported (string)	Not supported
	smallmoney	Similar to the money type, a currency symbol is prefixed to the input data. For example, the currency symbol of USD is $.	Not supported (string)	Not supported (string)	Not supported
Data type	bit	Bit data type. The value is 0 or 1. The length is 1 byte. A bit value is often used as a logical value to determine whether it is true(1) or false(0). If a non-zero value is entered, the system replaces it with 1.	Not supported	Not supported	Not supported
Other data types	rowversion	Each piece of data has a counter. The value of the counter increases when an insert or update operation is performed on a table that contains the **rowversion** column in the database.	Not supported	Not supported	Not supported

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Category	Type	Description	Hive	DWS	Oracle
	unique identifier	A 16-byte globally unique identifier (GUID) is a unique number generated by the SQL Server based on the network adapter address and host CPU clock. Each GUID is a hexadecimal number ranging from 0 to 9 or a to f.	Not supported	Not supported	Not supported
	cursor	Cursor data type	Not supported	Not supported	Not supported
	sql_variant	Stores any valid SQL Server data except the text, image, and timestamp data, which facilitates the development of the SQL Server.	Not supported	Not supported	Not supported
	table	Stores the result set after a table or view is processed.	Not supported	Not supported	Not supported
	xml	Data type of the XML data. XML instances can be stored in columns or variables of the XML type. The stored XML instance size cannot exceed 2 GB.	Not supported	Not supported	Not supported

Data Types Supported in PostgreSQL Database Migration

When the source end is a PostgreSQL database and the destination end is Hive, DLI, or DWS, the following data types are supported:

Table 5-11 Data types supported for the PostgreSQL database

Category	Type	Description	Hive	DWS	DLI
Character	char	Fixed-length string, which is padded to a specified length with spaces on the right.	CHAR	CHAR	Not supported (string)

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Category	Type	Description	Hive	DWS	DLI
	varchar	Variable-length string. Fields or variables are not padded to the maximum length with spaces.	CARCHAR	CARCHAR	Not supported (string)
Value	smallint	The extension name int2 is stored in two bytes and ranges from –32768 to 32767.	SMALLINT	SMALLINT	SMALLINT
	int	The extension name int4 is stored in four bytes and ranges from –2147483648 to 2147483647.	INTEGER	INT	INT
	bigint	The extension name int8 is stored in eight bytes and ranges from –9223372036854775808 to 9223372036854775807.	BIGINT	BIGINT	BIGINT
	decimal(p,s)	The precision p represents the number of valid digits stored in the value, and the scale s represents the number of digits after the decimal point that can be stored. The maximum value of p is 1000.	DECIMAL(P,S)	DECIMAL(P,S)	DECIMAL(P,S)

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Category	Type	Description	Hive	DWS	DLI
	float	4-byte or 8-byte storage. float(n): For the single precision, the value of n ranges from 1 to 24, the number of valid precision digits is 6, and the length is four bytes. For the double precision, the value of n ranges from 25 to 53, the number of valid precision digits is 15, and the length is 8 bytes.	FLOAT/ DOUBLE	FLOAT/ DOUBLE	FLOAT/ DOUBLE
	smallserial	Sequence data type, which is stored in smallint format	SMALLINT	SMALLINT	SMALLINT
	serial	Sequence data type, which is stored in int format	INTEGER	INT	INT
	bigserial	Sequence data type, which is stored in bigint format	BIGINT	BIGINT	BIGINT
Time and date	date	Stores the date.	DATE	DATE	DATE
	timestamp	Stores date and time data without time zones.	TIMESTAMP	TIMESTAMP	Not supported (string)
	timestamptz	Stores the date and time, including the time zone.	TIMESTAMP	TIMESTAMPZ	Not supported (string)
	time	Time within one day, excluding the time zone	Not supported (string)	TIME	Not supported (string)
	timez	Time within one day, including the time zone	Not supported (string)	TIMEZ	Not supported (string)

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Category	Type	Description	Hive	DWS	DLI
	interval	Time interval	Not supported (string)	Not supported (string)	Not supported (string)
Bit string	bit	Fixed-length string, for example, **b'000101'**	Not supported (string)	Not supported (string)	Not supported (string)
	varbit	Variable-length string, for example, **b'101'**	Not supported (string)	Not supported (string)	Not supported (string)
Currency type	money	The value is stored in eight bytes and ranges from –922337203685477.5808 to 922337203685477.5807.	DOUBLE	MONEY	DECIMAL(P,S)
Boolean	boolean	The value is stored in one byte and can be **1**, **0**, or **NULL**.	BOOLEAN	BOOLEAN	BOOLEAN
Text type	text	Variable-length text without a length limit	Not supported (string)	Not supported (string)	Not supported (string)

Data Types Supported in DWS Database Migration

If the migration source is a DWS database, the following data types are supported.

Table 5-12 Data types supported for the DWS database

Category	Type	Description
Character	char	Fixed-length string, which is padded to a specified length with spaces on the right.
	varchar	Variable-length string. Fields or variables are not padded to the maximum length with spaces.
Value	double	Stores double-precision floating-point numbers.

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Category	Type	Description
	decimal(p,s)	The precision p represents the number of valid digits stored in the value, and the scale s represents the number of digits after the decimal point that can be stored. The maximum value of p is 1000.
	numeric	Stores zero, positive, and negative fixed point numbers.
	real	Same as double
	int	int is stored in four bytes, where one binary bit represents a sign bit, and the other 31 binary bits represent a length and a size, and may represent all integers ranging from -2^{31} to $2^{31} - 1$.
	bigint	bigint is stored in eight bytes, where one binary bit represents a sign bit, and the other 63 binary bits represent a length and a size, and may represent all integers ranging from -2^{63} to $2^{63} - 1$.
	smallint	Data of the smallint type occupies two bytes of storage space. One binary bit indicates a positive or negative sign of an integer value, and the other 15 binary bits indicate a length and a size, and may represent all integers ranging from -2^{15} to 2^{15}.
	tinyint	Tinyint data occupies one byte of storage space and can represent all integers ranging from 0 to 255.
Time and date	date	Stores the date.
	timestamp	Stores date and time data without time zones.
	time	Time within one day, excluding the time zone
Bit string	bit	Fixed-length string, for example, **b'000101'**
Boolean	boolean	The value is stored in one byte and can be **1**, **0**, or **NULL**.
Text type	text	Variable-length text without a length limit

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Data Types Supported in ShenTong Database Migration

When the source is a ShenTong database and the destination is MRS Hive or MRS Hudi, the following data types are supported.

Table 5-13 Data types supported for the ShenTong database

Category	Type	Description	Storage Format Example	MRS Hive	MRS Hudi
Character	VARCHAR	Stores specified fixed-length character strings.	'a' or 'aaaaa'	VARCHAR(765)	STRING
	BPCHAR	Stores specified variable-length character strings.	'a' or 'aaaaa'	VARCHAR(765)	STRING
Value	NUMERIC	Stores zero, positive, and negative fixed point numbers.	52.36	DECIMAL(10, 0)	DECIMAL(18, 0)
	INT	Stores zero, positive, and negative fixed point numbers.	5236	INT	INT
	BIGINT	Stores signed integers. Integer part: 19 digits; decimal part: 0 digits	5236	BIGINT	BIGINT
	TINYINT	Stores signed integers. Integer part: 3 digits; decimal part: 0 digits	100	SMALLINT	INT
	BINARY	Stores fixed-length binary data.	0x2A3B4058	Not supported	FLOAT
	VARBINARY	Stores variable-length binary data.	0x2A3B4058	Not supported	BINARY
	FLOAT	Stores floating-point numbers with binary precision.	52.36	FLOAT	FLOAT
	DOUBLE	Stores double-precision floating-point numbers.	52.3	DOUBLE	DOUBLE

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Category	Type	Description	Storage Format Example	MRS Hive	MRS Hudi
Time and date	DATE	Stores information about the year, month, and day.	'1999-10-01', '1999/10/01', or '1999.10.01'	DATE	DATE
	TIME	Stores information about the hour, minute, and second.	'09:10:21' or '9:10:21'	STRING	STRING
	TIMESTAMP	Stores information about the year, month, day, hour, minute, and second.	'2002-12-12 09:10:21', '2002-12-12 9:10:21', '2002/12/12 09:10:21', or '2002.12.12 09:10:21'	TIMESTAMP	TIMESTAMP
Multimedia	CLOB	Stores variable-length binary large objects with a maximum length of 2 GB minus 1 byte.	0x5236 (binary data)	STRING	STRING
	BLOB	Stores variable-length binary large objects with a maximum length of 2 GB minus 1 byte.	0x5236 (binary data)	Not supported	BINARY
Boolean	BOOLEAN	The value is stored in one byte and can be **1**, **0**, or **NULL**.	1	BOOLEAN	BOOLEAN

Data Types Supported in SAP HANA Database Migration

If the source is an SAP HANA database, the following data types are supported.

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Table 5-14 Data types supported for the SAP HANA database

Category	Type	Description
Character	VARCHAR	Stores specified fixed-length character strings.
	NVARCHAR	Variable-length character string contains data in Unicode format.
	TEXT	Stores long character strings. The maximum length of a character string is 2 GB minus 1 byte. Long text strings are stored.
Value	BIGINT	Stores signed integers. Integer part: 19 digits; decimal part: 0 digits
	TINYINT	Stores signed integers. Integer part: 3 digits; decimal part: 0 digits
	SMALLINT	Data of the smallint type occupies two bytes of storage space. One binary bit indicates a positive or negative sign of an integer value, and the other 15 binary bits indicate a length and a size, and may represent all integers ranging from -2^{15} to 2^{15}.
	REAL	The value can be a positive or negative decimal number.
	DECIMAL	Numeric data type with fixed precision and scale
	FLOAT	Stores floating-point numbers with binary precision.
	DOUBLE	Stores double-precision floating-point numbers.
Time and date	DATE	Stores information about the year, month, and day.
	TIME	Stores information about the hour, minute, and second.
	TIMESTAMP	Stores information about the year, month, day, hour, minute, and second.
Multimedia	CLOB	Stores variable-length binary large objects with a maximum length of 2 GB minus 1 byte.
	NCLOB	This type can store a maximum of 4 GB data. When the character set is converted, this type is affected.
Boolean	BOOLEAN	The value is stored in one byte and can be **1**, **0**, or **NULL**.

Data Types Supported in DLI Database Migration

If the migration source is a DLI database, the following data types are supported.

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Table 5-15 Data types supported for the DLI database

Category	Type	Description
Character	CHAR	Stores specified fixed-length character strings.
	VARCHAR	Same as CHAR
	STRING	Stores long character strings. The maximum length of a character string is 2 GB minus 1 byte. Long text strings are stored.
Value	BIGINT	Stores signed integers. Integer part: 19 digits; decimal part: 0 digits
	TINYINT	Stores signed integers. Integer part: 3 digits; decimal part: 0 digits
	SMALLINT	Data of the smallint type occupies two bytes of storage space. One binary bit indicates a positive or negative sign of an integer value, and the other 15 binary bits indicate a length and a size, and may represent all integers ranging from -2^{15} to 2^{15}.
	INT	Stores signed integers. Integer part: 10 digits; decimal part: 0 digits
	DECIMAL	Numeric data type with fixed precision and scale
	FLOAT	Stores floating-point numbers with binary precision.
	DOUBLE	Stores double-precision floating-point numbers.
Time and date	DATE	Stores information about the year, month, and day.
	TIMESTAMP	Stores information about the year, month, day, hour, minute, and second.
Boolean	BOOLEAN	The value is stored in one byte and can be **1**, **0**, or **NULL**.

Data Types Supported in Elasticsearch/CSS Database Migration

If the migration source is an Elasticsearch/CSS database, the following data types are supported.

Table 5-16 Data types supported for the Elasticsearch/CSS database

Category	Type	Description	Storage Format Example	MySQL
Character	keyword	Stores strings.	"keyword"	String

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Category	Type	Description	Storage Format Example	MySQL
	text	Stores long character strings. The maximum length of a character string is 2 GB minus 1 byte. Long text strings are stored.	"long string"	TEXT
	string	Stores long character strings. The maximum length of a character string is 2 GB minus 1 byte. Long text strings are stored.	"a string"	String
Integer	short	Stores 16-bit signed integers ranging from –32768 to 32767.	32765	smallInt
	integer	Stores 32-bit signed integers ranging from -2^{31} to $2^{31} - 1$.	3276566	int
	long	Stores 64-bit signed integers ranging from -2^{63} to $2^{63} - 1$.	3276566666	BIGINT
Value	double	64-bit IEEE 754 double-precision floating-point format	21.333	double
	float	32-bit IEEE 754 single-precision floating-point format	21.333	double
Boolean	boolean	The value is stored in one byte and can be **1**, **0**, or **NULL**.	1	Boolean
Object	object	A string of flat storage objects	{"users.name": ["John","Smith"], users.age": [26,28], "users.gender":[1, 2]}	TEXT

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Category	Type	Description	Storage Format Example	MySQL
Nested	nested	A string of nested storage objects	{"users.name" : "John" , "users.age" : 26, "users.gender" : 1} { "users.name" : "Smith", "users.age" : 28, "users.gender" : 2}	TEXT
Date	date	A string in the date format	"2018-01-13" or "2018-01-13 12:10:30"	DATE or timeStamp
Special type	ip	A string in the IP address format	"192.168.127.100"	String
Array	string_array	An array of strings	["str","str"]	TEXT
	short_array	An array of 16-bit integers	[1,1,1]	TEXT
	integer_array	An array of 32-bit integers	[1,1,1]	TEXT
	long_array	An array of 64-bit integers	[1,1,1]	TEXT
	float_array	An array of 32-bit floating-point numbers	[1.0,1.0,1.0]	TEXT
	double_array	An array of 64-bit floating-point numbers	[1.0,1.0,1.0]	TEXT
Value range	completion	A string that is automatically completed	"string"	TEXT

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Data Types Supported in Doris Database Migration

If the migration source is a Doris database, the following data types are supported.

Table 5-17 Data types supported for the Doris database

Category	Type	Description
String	CHAR(M)	Range: char[(length)]. A fixed-length string of 1 to 255 characters (1 by default).
	VARCHAR(M)	Range: char(length). A variable-length string of 1 to 65,535 characters.
Value	DECIMAL(M,D)	Uncompressed floating-point numbers cannot be unsigned. In unpacking decimals, each decimal corresponds to a byte. Defining the number of display lengths (M) and decimals (D) is required. NUMERIC is the synonym of DECIMAL.
Value type	TINYINT	Length: 1-byte signed integer Range: [-128, 127]
	SMALLINT	Length: 2-byte signed integer Range: [-32768, 32767]
	INT	Length: 4-byte signed integer Range: [-2147483648, 2147483647]
	BIGINT	Length: 8-byte signed integer Range: [-9223372036854775808, 9223372036854775807]
	LARGEINT	Length: 16-byte signed integer Range: [-2^127, 2^127-1]
	FLOAT	Length: 4-byte floating point number Range: -3.40E+38 to +3.40E+38
	DOUBLE	Length: 8-byte floating point number Range: -1.79E+308 to +1.79E+308
	DECIMAL[M,D]	Decimal type that ensures precision. M indicates the total number of valid digits, and D indicates the maximum number of digits after the decimal point. The range of M is [1,27], and that of D is [1,9]. In addition, M must be greater than or equal to D. The default value is decimal[10,0]. Precision: 1–27 Scale: 0–9

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Category	Type	Description
Date	DATE	Range: ['1000-01-01', '9999-12-31']. The default printing format is 'YYYY-MM-DD'.
	DATETIME	Range: ['1000-01-01 00:00:00', '9999-12-31 00:00:00']. The default printing format is 'YYYY-MM-DD HH:MM:SS'.
Special type	HLL	HyperLogLog (HLL) is a binary type. It can be used only for aggregation tables, and the aggregation type must be HLL_UNION. This type is mainly used to pre-aggregate data in non-accurate and fast deduplication scenarios. HLL columns can be queried or used only using hll_union_agg, hll_cardinality, or hll_hash.
	BITMAP	BITMAP is a binary type. It can be used only for aggregation tables, and the aggregation type must be BITMAP_UNION. This type is mainly used to pre-aggregate data in accurate deduplication scenarios. It can also be used to store user IDs in user profile scenarios. BITMAP columns can be queried or used only using BITMAP functions.

Data Types Supported in Dameng Database Migration

When the source end is a Dameng database and the destination end is a Hive or DWS database, the following data types are supported.

Table 5-18 Data types supported for the Dameng database

Category	Type	Description	Storage Format Example	Hive	DWS
Character	CHAR	Stores specified fixed-length character strings.	'a' or 'aaaaa'	CHAR	CHAR
	CHARACTER	Same as CHAR	'a' or 'aaaaa'	CHAR	CHAR
	VARCHAR	Stores specified variable-length character strings.	'a' or 'aaaaa'	VARCHAR	VARCHAR
	VARCHAR2	Same as VARCHAR	'a' or 'aaaaa'	VARCHAR	VARCHAR

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Category	Type	Description	Storage Format Example	Hive	DWS
Value	NUMERIC	Stores zero, positive, and negative fixed point numbers.	52.36	DECIMAL	NUMERIC
	DECIMAL	Similar to NUMERIC	52.36	DECIMAL	NUMERIC
	DEC	Same as DECIMAL	52.36	DECIMAL	NUMERIC
	INTEGER	Stores signed integers. Integer part: 10 digits; decimal part: 0 digits	5236	INT	INTEGER
	INT	Same as INTEGER	5236	INT	INTEGER
	BIGINT	Stores signed integers. Integer part: 19 digits; decimal part: 0 digits	5236	BIGINT	BIGINT
	TINYINT	Stores signed integers. Integer part: 3 digits; decimal part: 0 digits	100	TINYINT	SMALLINT
	SMALLINT	Stores signed integers. Integer part: 5 digits; decimal part: 0 digits	9999	SMALLINT	SMALLINT
	BYTE	Similar to TINYINT. Integer part: 3 digits; decimal part: 0 digits	100	TINYINT	SMALLINT
	BINARY	Stores fixed-length binary data.	0x2A3B4058	BINARY (NULL)	BYTEA (NULL)
	VARBINARY	Stores variable-length binary data.	0x2A3B4058	BINARY (NULL)	BYTEA (NULL)
	FLOAT	Stores floating-point numbers with binary precision.	52.36	FLOAT	FLOAT8

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Category	Type	Description	Storage Format Example	Hive	DWS
	DOUBLE	Similar to FLOAT	52.36	DOUBLE	FLOAT8
	REAL	Stores binary floating-point numbers.	52.3	FLOAT	FLOAT4
	DOUBLE PRECISION	Stores double-precision floating-point numbers.	52.3	DOUBLE	FLOAT8
Bit string	BIT	Stores 1, 0, or NULL.	1, 0, or NULL	TINYINT(1 0 NULL)	BOOLEAN (true false NULL)
Time and date	DATE	Stores information about the year, month, and day.	'1999-10-01', '1999/10/01', or '1999.10.01'	DATE	TIMESTAMP
	TIME	Stores information about the hour, minute, and second.	'09:10:21' or '9:10:21'	Not supported (string)	TIME
	TIMESTAMP	Stores information about the year, month, day, hour, minute, and second.	'2002-12-12 09:10:21', '2002-12-12 9:10:21', '2002/12/12 09:10:21', or '2002.12.12 09:10:21'	TIMESTAMP	TIMESTAMP
	TIME WITH TIME ZONE	Stores a TIME value with a time zone. Add the time zone information to the end of the TIME type.	'09:10:21 +8:00', '09:10:21+8:00', or '9:10:21+8:00'	Not supported (string)	TIME WITH TIME ZONE

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Category	Type	Description	Storage Format Example	Hive	DWS
	TIMESTAMP WITH TIME ZONE	Stores a TIMESTAMP value with a time zone. Add the time zone information to the end of the TIMESTAMP type.	'2002-12-12 09:10:21 +8:00', '2002-12-12 9:10:21 +8:00', '2002/12/12 09:10:21 +8:00', or '2002.12.12 09:10:21 +8:00'	TIMESTAMP	TIMESTAMP WITH TIME ZONE
	TIMESTAMP WITH LOCAL TIME ZONE	Stores the TIMESTAMP value of a local time zone. The standard time zone type (TIMESTAMP WITH TIME ZONE) can be converted to the local time zone type.	'2002-12-12 09:10:21 +8:00', '2002-12-12 9:10:21 +8:00', '2002/12/12 09:10:21 +8:00', or '2002.12.12 09:10:21 +8:00'	Not supported (string)	Not supported (TEXT)
	DATETIME WITH TIME ZONE	Same as TIMESTAMP WITH TIME ZONE	'2002-12-12 09:10:21 +8:00', '2002-12-12 9:10:21 +8:00', '2002/12/12 09:10:21 +8:00', or '2002.12.12 09:10:21 +8:00'	TIMESTAMP	TIMESTAMP WITH TIME ZONE
	INTERVAL YEAR	Interval of years. The leading precision specifies the range of years.	INTERVAL '0015' YEAR	Not supported (string)	Not supported (VARCHAR)
	INTERVAL YEAR TO MONTH	Interval of months and years. The leading precision specifies the range of years.	INTERVAL '0015-08' YEAR TO MONTH	Not supported (string)	Not supported (VARCHAR)

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Category	Type	Description	Storage Format Example	Hive	DWS
	INTERVAL MONTH	Interval of months. The leading precision specifies the range of months.	INTERVAL '0015' MONTH	Not supported (string)	Not supported (VARCHAR)
	INTERVAL DAY	Interval of days. The leading precision specifies the range of days.	INTERVAL '150' DAY	Not supported (string)	Not supported (VARCHAR)
	INTERVAL DAY TO HOUR	Interval of hours and days. The leading precision specifies the range of days.	INTERVAL '9 23' DAY TO HOUR	Not supported (string)	Not supported (VARCHAR)
	INTERVAL DAY TO MINUTE	Interval of minutes, hours, and days. The leading precision specifies the range of days.	INTERVAL '09 23:12' DAY TO MINUTE	Not supported (string)	Not supported (VARCHAR)
	INTERVAL DAY TO SECOND	Interval of seconds, minutes, hours, and days. The leading precision specifies the range of days.	INTERVAL '09 23:12:01.1' DAY TO SECOND	Not supported (string)	Not supported (VARCHAR)
	INTERVAL HOUR	Interval of hours. The leading precision specifies the range of hours.	INTERVAL '150' HOUR	Not supported (string)	Not supported (VARCHAR)
	INTERVAL HOUR TO MINUTE	Interval of minutes and hours. The leading precision specifies the range of hours.	INTERVAL '23:12' HOUR TO MINUTE	Not supported (string)	Not supported (VARCHAR)
	INTERVAL HOUR TO SECOND	Interval of seconds, minutes, and hours. The leading precision specifies the range of hours.	INTERVAL '23:12:01.1' HOUR TO SECOND	Not supported (string)	Not supported (VARCHAR)

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Category	Type	Description	Storage Format Example	Hive	DWS
	INTERVAL MINUTE	Interval of minutes. The leading precision specifies the range of minutes.	INTERVAL '150' MINUTE	Not supported (string)	Not supported (VARCHAR)
	INTERVAL MINUTE TO SECOND	Interval of minutes and seconds. The leading precision specifies the range of minutes.	INTERVAL '12:01.1' MINUTE TO SECOND	Not supported (string)	Not supported (VARCHAR)
	INTERVAL SECOND	Interval of seconds. The leading precision specifies the value range of the integer part of the second	INTERVAL '51.1' SECOND	Not supported (string)	Not supported (VARCHAR)
Multimedia	IMAGE	IMAGE specifies the image type in the multimedia information. An image consists of a pixel lattice with a maximum length of 2 GB minus 1 byte. In addition to storing image data, other binary data can also be stored.	0x2A3B4058 (binary data)	Not supported	Not supported
	LONGVARBINARY	Same as IMAGE	0x2A3B4059 (binary data)	Not supported	Not supported
	TEXT	Stores the long string type. The maximum length of a string is 2 GB minus 1 byte.	0x5236 (binary data)	Not supported	Not supported
	LONGVARCHAR	Similar to TEXT	0x5236 (binary data)	Not supported	Not supported

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Category	Type	Description	Storage Format Example	Hive	DWS
	BLOB	Stores variable-length binary large objects with a maximum length of 2 GB minus 1 byte.	0x5236 (binary data)	Not supported	Not supported
	CLOB	Stores variable-length binary large objects with a maximum length of 2 GB minus 1 byte.	0x5236 (binary data)	Not supported	Not supported
	BFILE	Specified the binary files stored in the operating systems. Files are stored in the operating systems instead of the databases. They can be read only.	-	Not supported	Not supported

5.4 Creating and Managing a CDM Cluster

5.4.1 Creating a CDM Cluster

CDM provides independent clusters for secure and reliable data migration. Clusters are isolated from each other and cannot access each other.

CDM clusters can be used in the following scenarios:

- They can be used to create and run data migration jobs.
- They can function as agents for connecting Management Center to a data lake.

Prerequisites

You have applied for a VPC, subnet, and security group. If the CDM cluster tries to connect to another cloud service, ensure that the cluster and the cloud service are in the same VPC. Otherwise, an EIP is required.

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NOTE

- If the CDM cluster and a cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other through an intranet.
- If the CDM cluster and the cloud service are in the same region and VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
- If the CDM cluster and a cloud service are in different VPCs of the same region, you can create a VPC peering connection to enable them to communicate with each other. For details about how to configure a VPC peering connection, see **VPC Peering Connection**

  Note: If a VPC peering connection is created, the peer VPC subnet may overlap with the CDM management network. As a result, data sources in the peer VPC cannot be accessed. You are advised to use the Internet for cross-VPC data migration, or contact the administrator to add specific routes for the VPC peering connection in the CDM background.
- If the CDM cluster and a cloud service are located in different regions, you need to use the Internet or Direct Connect to enable them to communicate with each other. When using the Internet, ensure that an EIP has been bound to the CDM cluster, the security group of CDM allows outbound traffic from the host where the off-cloud data source is located, the host where the data source is located can access the Internet, and the connection port has been enabled in the firewall rules.
- In addition, an enterprise project may also affect the communication between the CDM cluster and other cloud services. The CDM cluster can communicate with a cloud service only if they have the same enterprise project.

Scenario

The DataArts Studio instance contains a CDM cluster that can be used for informal scenarios such as testing and trial use.

- If the cluster meets your needs, you do not need to buy a CDM incremental package.
- If you need another CDM cluster that can meet your needs, buy a pay-per-use CDM incremental package. For details, see **a Pay-Per-Use CDM Cluster**.
- If you want to reduce the costs of your CDM cluster, you can buy a CDM incremental package billed based on a package. For details, see **a Pay-Per-Use CDM Cluster**.

NOTE

Due to specifications restrictions, the free CDM cluster provided by a DataArts Studio instances can only be used for informal scenarios such as testing and trial use. To run your migration workloads, buy a CDM incremental package. In addition, you are not advised to use a CDM cluster that serves as a data connection agent to run data migration jobs.

5.4.2 Binding or Unbinding an EIP

Scenario

After creating a CDM cluster, you can bind an EIP to or unbind an EIP from the cluster.

If CDM needs to access a local or Internet data source, or a cloud service in another VPC, bind an EIP to the CDM cluster or use a NAT gateway to enable the

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CDM cluster to share the EIP with ECSs to access the Internet. For details, see **Adding an SNAT Rule**.

NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

Prerequisites

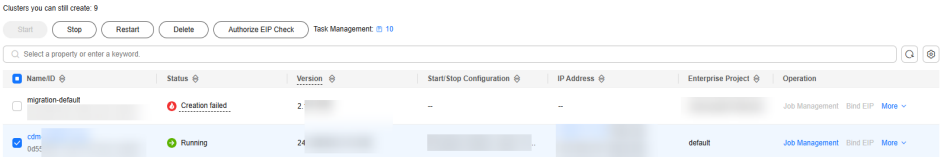
- You have created a CDM cluster.
- Your EIP quota is sufficient.

Procedure

Step 1 Log in to the CDM console and choose **Cluster Management** in the left navigation pane.

Log in to the DataArts Studio console by following the instructions in . On the DataArts Studio console, locate a workspace and click **DataArts Migration** to access the CDM console.

Figure 5-2 Cluster list



NOTE

The **Source** column is displayed only when you access the **DataArts Migration** page from the DataArts Studio console.

Step 2 Bind an EIP to or unbind an EIP from a cluster.

- Binding an EIP: In the **Operation** column, click **Bind EIP**. The **Bind EIP** dialog box is displayed.
- Unbinding an EIP: In the **Operation** column, choose **More** > **Unbind EIP**.

Step 3 Click **Yes**.

----End

5.4.3 Restarting a CDM Cluster

Scenario

After modifying some configurations (for example, disabling user isolation), you must restart the cluster to make the modification take effect.

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NOTICE

If you restart a CDM cluster process or VM, jobs that are running will fail, and no jobs can be scheduled during the restart. Exercise caution when performing this operation.

Prerequisites

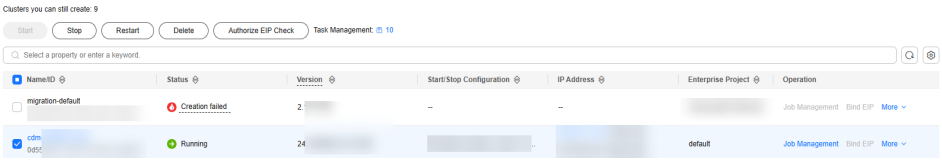
You have created a CDM cluster.

Restarting a cluster

Step 1 Log in to the CDM console and choose **Cluster Management** in the left navigation pane.

Log in to the DataArts Studio console by following the instructions in . On the DataArts Studio console, locate a workspace and click **DataArts Migration** to access the CDM console.

Figure 5-3 Cluster list

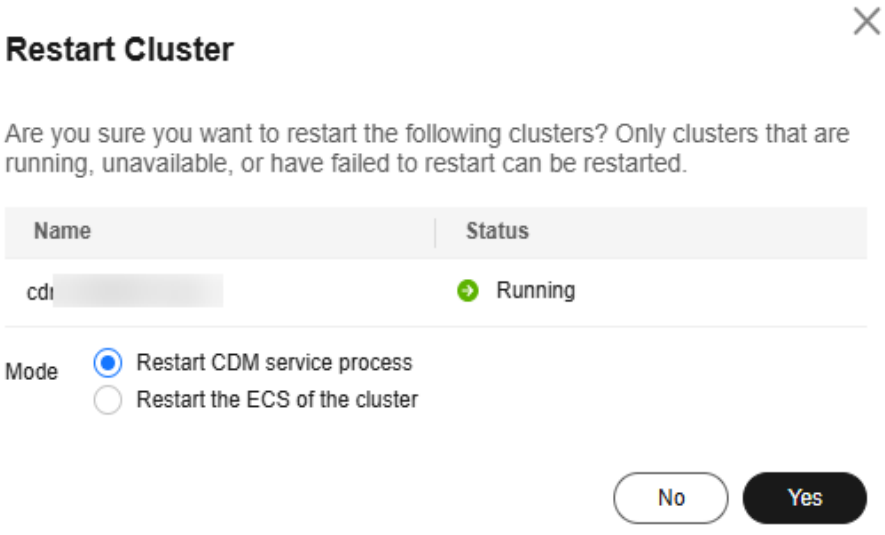


NOTE

The **Source** column is displayed only when you access the **DataArts Migration** page from the DataArts Studio console.

Step 2 Locate the row that contains the target cluster, click **More** in the **Operation** column, and select **Restart** from the drop-down list.

Figure 5-4 Restarting a cluster



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Step 3 Select **Restart CDM service process** or **VM restart** and click **OK**.

- **Restart CDM service process**: Only the CDM service process is restarted. The cluster VM will not be restarted.
- **VM restart**: The service process will be interrupted and VMs in the cluster will be restarted.

----End

5.4.4 Deleting a CDM Cluster

Scenario

You can delete a CDM cluster that you no longer use.

CAUTION

After a CDM cluster is deleted, the cluster and its data are destroyed and cannot be restored. Exercise caution when performing this operation.

Before deleting a cluster, note the following:

- Ensure that the cluster is not in use.
- Ensure that the links and jobs in the cluster have been backed up through the job export function described in **Managing CDM Jobs**.
- You are not advised to delete the CDM cluster which is free of charge. If you delete it, you can only purchase clusters.
- After a CDM cluster is deleted, it will not be billed in pay-per-use mode and the package duration will not be deducted. If you have purchased a CDM discount package or a yearly/monthly CDM incremental package for the CDM cluster to delete, unsubscribe from the package.

Prerequisites

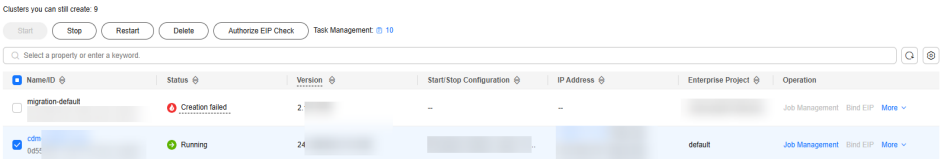
You have created a CDM cluster.

Deleting a Cluster

Step 1 Log in to the CDM console and choose **Cluster Management** in the left navigation pane.

Log in to the DataArts Studio console by following the instructions in . On the DataArts Studio console, locate a workspace and click **DataArts Migration** to access the CDM console.

Figure 5-5 Cluster list



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NOTE

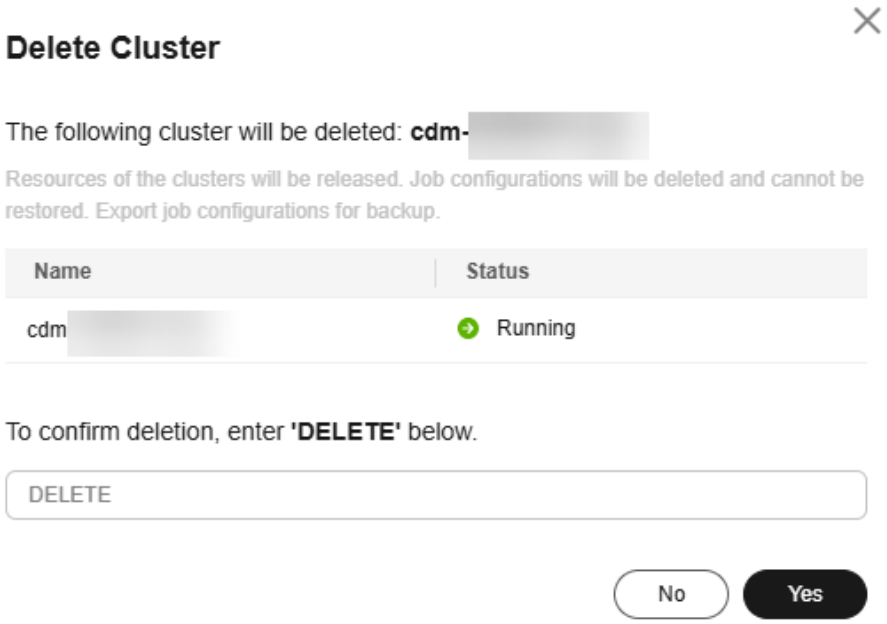
The **Source** column is displayed only when you access the **DataArts Migration** page from the DataArts Studio console.

Step 2 Delete a cluster using either of the following methods:

- Locate a cluster, click **More** in the **Operation** column, and select **Delete**.
- Select a cluster and click **Delete** above the cluster list.

Step 3 Enter **DELETE** and click **Yes**.

Figure 5-6 Deleting a cluster



----End

5.4.5 Downloading CDM Cluster Logs

Scenario

This section describes how to obtain cluster logs to view the job running history and locate job failure causes.

Prerequisites

You have created a CDM cluster.

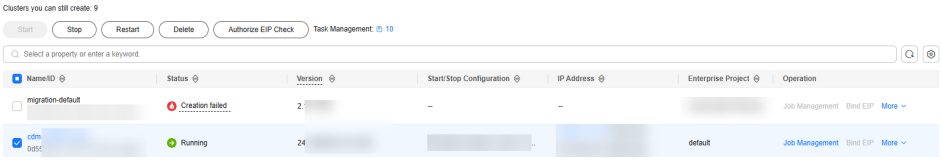
Procedure

Step 1 Log in to the CDM console and choose **Cluster Management** in the left navigation pane.

Log in to the DataArts Studio console by following the instructions in . On the DataArts Studio console, locate a workspace and click **DataArts Migration** to access the CDM console.

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Figure 5-7 Cluster list

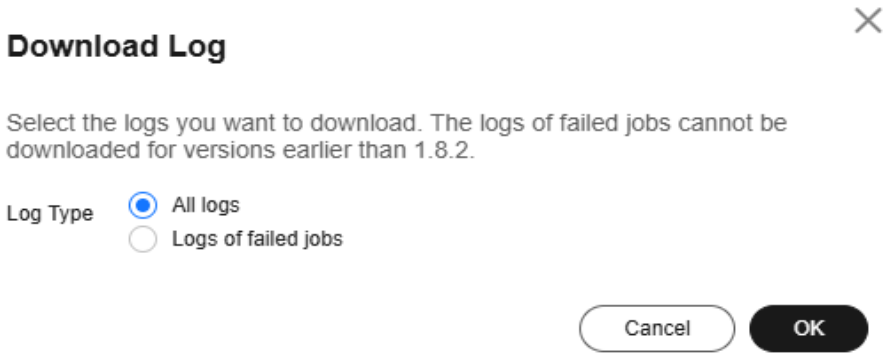


NOTE

The **Source** column is displayed only when you access the **DataArts Migration** page from the DataArts Studio console.

Step 2 Locate the row that contains a cluster, click **More** in the **Operation** column, and select **Download Log** from the drop-down list.

Figure 5-8 Download Log



Step 3 In the displayed dialog box, click **OK** to download logs to a local PC.

----End

5.4.6 Viewing and Modifying CDM Cluster Configurations

Scenario

After creating a CDM cluster, you can view its basic information and modify its configurations.

- You can view the following basic cluster information:
  - **Cluster Information**: cluster version, creation time, project ID, instance ID, and cluster ID
  - **Instance Configuration**: cluster flavor, CPU, and memory
  - **Network**
- You can modify the following cluster configurations:
  - **Notification**: If a CDM migration job (only table/file migration) fails or the EIP is abnormal, CDM sends an SMS or email notification to the user. Notifications generated by this function will not be charged.
  - **User Isolation**: determines whether other users can view and operate the migration jobs and links in the cluster.

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- If this function is enabled, migration jobs and links in the cluster are isolated. Other IAM users of the a Huawei account cannot view or operate the migration jobs and links in the cluster.

  NOTE

  Starting jobs by group will run all jobs in the group. If user isolation is enabled, starting jobs by group will still run all jobs in the group even if otherIAM users in the a Huawei account cannot view the jobs in the group. Therefore, you are not advised to start jobs by group in user isolation scenarios.

- If this function is disabled, migration jobs and links in the cluster can be shared with other users. All IAM users with the required permission in the a Huawei account can view and operate migration jobs and links.

  After disabling **User Isolation**, restart the cluster VM for the settings to take effect.

– **Maximum Concurrent Extractors**: This parameter specifies the total number of concurrent extractors of a job. If the total number of concurrent extractors of all jobs exceeds the upper limit, the excess extractors will wait in a queue.

  The value of this parameter ranges from 1 to 1000. You are advised to set it based on the cluster specifications. For details about the recommended value, see **Maximum Concurrent Extractors**. If the number of concurrent extractors is too large, memory overflow may occur. Exercise caution when changing the value.

  NOTE

  This parameter is also available on the **Settings** tab page. You can change its value either on this page or the **Settings** page.

Prerequisites

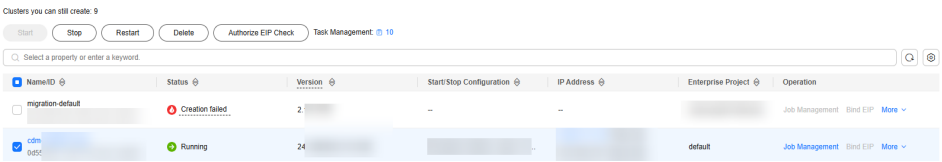
You have created a CDM cluster.

Viewing Basic Cluster Information

Step 1 Log in to the CDM console and choose **Cluster Management** in the left navigation pane.

Log in to the DataArts Studio console by following the instructions in . On the DataArts Studio console, locate a workspace and click **DataArts Migration** to access the CDM console.

Figure 5-9 Cluster list



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NOTE

The **Source** column is displayed only when you access the **DataArts Migration** page from the DataArts Studio console.

Step 2 Click the cluster name to view its basic information.

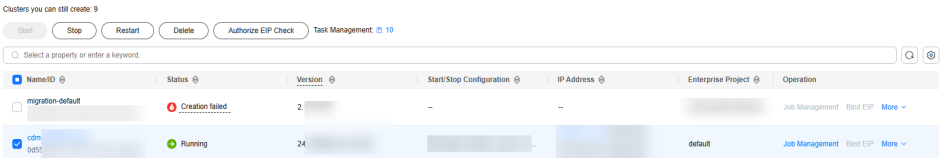
----End

Modifying Cluster Configurations

Step 1 Log in to the CDM console and choose **Cluster Management** in the left navigation pane.

Log in to the DataArts Studio console by following the instructions in . On the DataArts Studio console, locate a workspace and click **DataArts Migration** to access the CDM console.

Figure 5-10 Cluster list



NOTE

The **Source** column is displayed only when you access the **DataArts Migration** page from the DataArts Studio console.

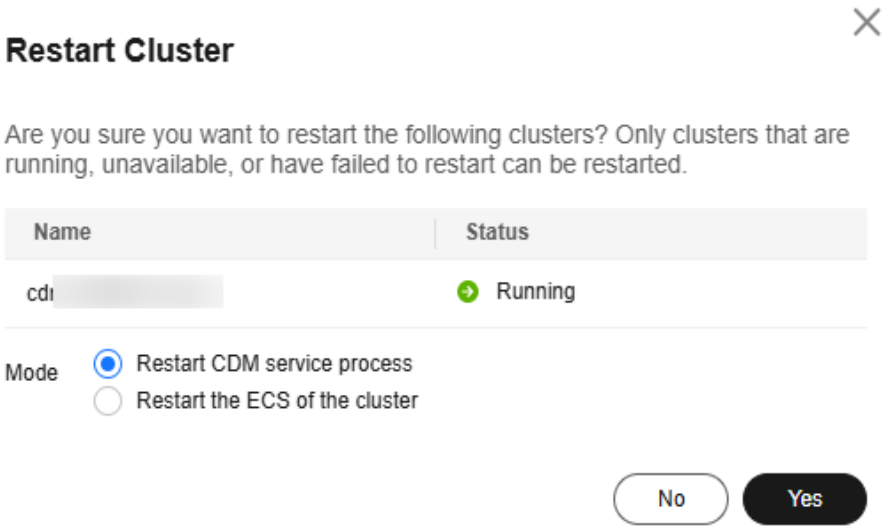
Step 2 Click the name of a cluster and click the **Cluster Configuration** tab to modify **Notification**, **User Isolation** and **Maximum Concurrent Extractors**.

Step 3 Click **Save**. The **Cluster Management** page is displayed.

Step 4 If **User Isolation** is disabled, choose **More** > **Restart** in the **Operation** column to restart the cluster VM for the settings to take effect.

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Figure 5-11 Restarting a cluster



- **Restart CDM service process**: Only the CDM service process is restarted. The cluster VM will not be restarted.
- **VM restart**: The service process will be interrupted and VMs in the cluster will be restarted.

Step 5 Select **VM restart** and click **Yes**.

----End

5.4.7 Managing and Viewing CDM Metrics

5.4.7.1 CDM Metrics

Function

Cloud Eye monitors the running status of cloud services and usage of each metric, and creates alarm rules for monitoring metrics.

After you create a CDM cluster, Cloud Eye automatically associates with CDM monitoring metrics to help you understand the running status of the CDM cluster.

- This section describes the CDM metrics that can be monitored by Cloud Eye as well as their namespaces and dimensions.
- For details about CDM monitoring metrics, see **Querying CDM Metrics**.
- For details about how to set alarm rules, see **Configuring CDM Alarm Rules**.

Prerequisites

You have obtained required Cloud Eye permissions.

Namespace

SYS.CDM

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Metrics

Table 5-19 lists the CDM metrics.

Table 5-19 CDM metrics

ID	Name	Description	Value Range	Monitored Object	Monitoring Period (Raw Data)
bytes_in	Bytes In	Measures the network inbound rate of the monitored object. Unit: byte/s	≥ 0 bytes/s	Cloud Data Migration	1 minute
bytes_out	Bytes Out	Measures the network outbound rate of the monitored object. Unit: byte/s	≥ 0 bytes/s	Cloud Data Migration	1 minute
cpu_usage	CPU Usage	Measures the CPU usage of the monitored object. Unit: %	0% to 100%	Cloud Data Migration	1 minute
mem_usage	Memory Usage	Measures the memory usage of the monitored object. Unit: %	0% to 100%	Cloud Data Migration	1 minute
pg_pending_job	Number of Queued Jobs	Number of jobs in the PENDING state in the CDM instance. Unit: count **NOTE** This metric is available in version 2.10.0.300 and later versions.	>=0	Cloud Data Migration	1 minute
pending_threads	Maximum Concurrent Extractors	Number of concurrent extraction threads in the Waiting state in the CDM instance. Unit: count **NOTE** This metric is available in version 2.10.0.300 and later versions.	>=0	Cloud Data Migration	1 minute

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ID	Name	Description	Value Range	Monitored Object	Monitoring Period (Raw Data)
disk_usage	Disk Usage	Measures the disk usage of the physical server accommodating the monitored ECS, which is not accurate as that obtained on the monitored ECS. Unit: %	0.001% to 90%	Cloud Data Migration	1 minute
disk_io	Disk I/O	Measures the bytes read from and written to a disk per second on the physical server accommodating the monitored ECS, which is not accurate as those obtained on the monitored ECS. Unit: Byte/s	0 GB to 10 GB	Cloud Data Migration	1 minute
tomcat_heap_usage	Heap Memory Usage	Measures the heap memory usage of the physical server accommodating the monitored ECS, which is not accurate as that obtained on the monitored ECS. Unit: %	0.001% to 90%	Cloud Data Migration	1 minute
tomcat_connect	Tomcat Concurrent Connections	Measures the number of Tomcat concurrent connections on the physical server.	0 to 2,147,483,647	Cloud Data Migration	1 minute
tomcat_thread_count	Tomat Threads	Measures the number of Tomcat threads on the physical server.	0 to 2,147,483,647	Cloud Data Migration	1 minute
pg_connect	Database Connections	Measures the number of Postgres database connections on the physical server.	0 to 2,147,483,647	Cloud Data Migration	1 minute

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ID	Name	Description	Value Range	Monitored Object	Monitoring Period (Raw Data)
pg_submission_row	Rows	Measures the number of rows in the submission table of the Postgres database on the physical server.	0 to 2,147,483,647	Cloud Data Migration	1 minute
pg_failed_job_rate	Job Failure Rate	Measures the job failure rate of the sqoop process on the physical server. Unit: %	0.001% to 100%	Cloud Data Migration	1 minute
inodes_usage	Inodes Usage	Measures the disk inodes usage of the physical server accommodating the monitored ECS, which is not accurate as that obtained on the monitored ECS. Unit: %	0.001% to 100%	Cloud Data Migration	1 minute

Dimension

Key	Value
instance_id	CDM instance

5.4.7.2 Configuring CDM Alarm Rules

Scenario

Set the alarm rules to customize the monitored objects and notification policies. Then, learn CDM running status in a timely manner.

A CDM alarm rule includes the alarm rule name, monitored object, metric, threshold, monitoring interval, and whether to send a notification. This section describes how to set CDM alarm rules.

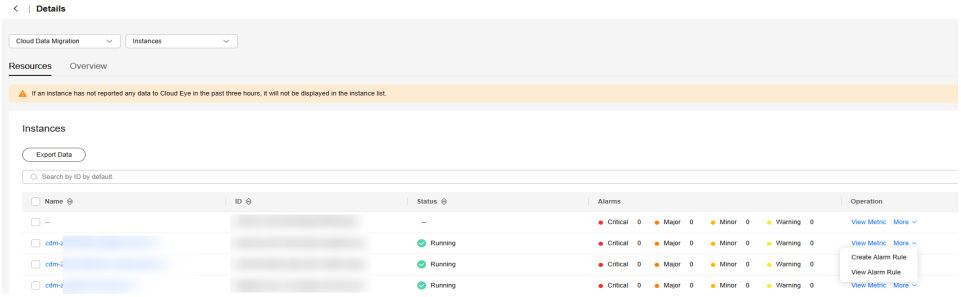
Procedure

Step 1 Access the CDM console, choose **Cluster Management**. Locate a cluster, click **More** in the **Operation** column, and select **View Metric** from the drop-down list.

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Step 2 In the navigation pane, choose **Cloud Service Monitoring** > **Cloud Data Migration**. In the right pane, locate a CDM cluster and click **Create Alarm Rule** in the **Operation** column.

Figure 5-12 Monitored CDM clusters



Step 3 Set the alarm rule for the CDM cluster as prompted.

Step 4 After the setting is complete, click **Confirm**. When an alarm that meets the rule is generated, the system automatically sends a notification.

NOTE

For more information about monitoring and alarms, see the .

----End

5.4.7.3 Querying CDM Metrics

Scenario

You can use Cloud Eye to monitor the running status of a CDM cluster. You can view the monitoring metrics on the Cloud Eye console.

Monitored data takes some time for transmission and display. The status displayed on the Cloud Eye console is the status obtained 5 to 10 minutes before. You can view the monitored data of a newly created CDM cluster 5 to 10 minutes later.

Prerequisites

- The CDM cluster is running properly.

  If a cluster fails to be restarted or is unavailable, its monitoring metrics are unavailable. You can view the monitored data only after the cluster is restarted or recovered.
- The cluster has been properly running for about 10 minutes.

  The monitored data and graphs are available for a newly created cluster after the cluster runs for at least 10 minutes.

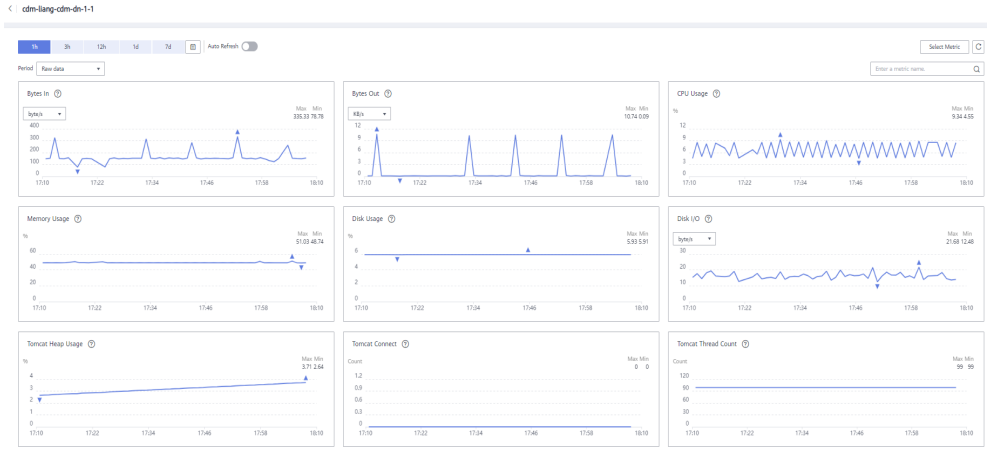
Procedure

Step 1 Access the CDM console, choose **Cluster Management**. Locate a cluster, click **More** in the **Operation** column, and select **View Metric** from the drop-down list.

Step 2 On the CDM monitoring page, you can view the graphs of all monitoring metrics.

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Figure 5-13 Querying Metrics



Step 3 Click in the upper right corner of the graphs to zoom in the graphs.

Step 4 You can select a time period in the upper left corner to view metric changes in this time period.

----End

5.5 Creating a Link in a CDM Cluster

5.5.1 Creating a Link Between CDM and a Data Source

Scenario

Before creating a data migration job, create a link to enable the CDM cluster to read data from and write data to a data source. A migration job requires a source link and a destination link. For details on the data sources that can be exported (source links) and imported (destination links) in different migration modes (table/file migration), see **Supported Data Sources**.

The link configurations depend on the data source. This section describes how to create these links.

Constraints

- If changes occur in the connected data source (for example, the MRS cluster capacity is expanded), you need to edit and save the connection.
- Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Prerequisites

- A CDM cluster is available.
- The CDM cluster can communicate with the destination data source.
  - If the destination data source is an on-premises database, you need the Internet or Direct Connect. When using the Internet, ensure that an EIP

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has been bound to the CDM cluster, the security group of CDM allows outbound traffic from the host where the off-cloud data source is located, the host where the data source is located can access the Internet, and the connection port has been enabled in the firewall rules.

- If the destination data source is a cloud service (such as DWS, MRS, and ECS), the following requirements must be met for network interconnection:
  - If the CDM cluster and the cloud service are in different regions, a public network or a dedicated connection is required for enabling communication between the CDM cluster and the cloud service. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, the host where the data source is located can access the Internet, and the port has been enabled in the firewall rules.
  - If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
  - The cloud service instance and the CDM cluster belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

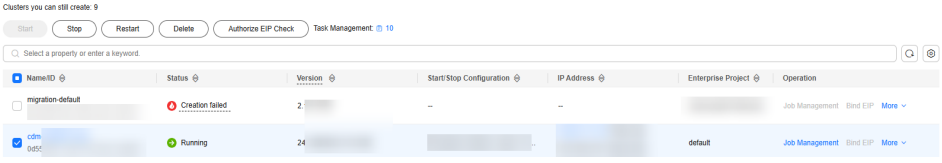
- You have obtained the URL and the account for accessing the data source. The account is granted with the read and write permissions for the data source.

Creating Links

Step 1 Log in to the CDM console and choose **Cluster Management** in the left navigation pane.

Log in to the DataArts Studio console by following the instructions in . On the DataArts Studio console, locate a workspace and click **DataArts Migration** to access the CDM console.

Figure 5-14 Cluster list



NOTE

The **Source** column is displayed only when you access the **DataArts Migration** page from the DataArts Studio console.

Step 2 On the CDM console, choose **Cluster Management** in the left navigation pane. Locate the row that contains the target cluster and click **Job Management** in the

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Operation column. On the displayed **Links** page, click **Create Link**. On the displayed page shown in **Figure 5-15**, select a connector.

The connectors are classified based on the type of the data source to be connected. All supported data types are displayed.

Figure 5-15 Selecting a connector type



Step 3 Select a data source and click **Next**. The following describes how to create a MySQL link.

The link parameters of different data sources vary. **Table 5-20** describes the link parameters.

Table 5-20 Link parameters

Connector	Description
• RDS for PostgreSQL • RDS for SQL Server • PostgreSQL • Microsoft SQL Server	Because the JDBC drivers used by these relational databases are the same, the parameters to be configured are also the same and are described in **PostgreSQL/SQLServer Link Parameters**.
Data Warehouse Service	For details about the parameters, see **GaussDB(DWS) Link Parameters**.
SAP HANA	For details about the parameters, see **SAP HANA Link Parameters**.
Dameng database	For details about the parameters, see **Dameng Database Link Parameters**.
MySQL	For details about the parameters, see **RDS for MySQL/MySQL Database Link Parameters**.

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Connector	Description
Oracle	For details about the parameters, see **Oracle Database Link Parameters**.
Database Sharding	For details about the parameters, see **Shard Link Parameters**.
Object Storage Service (OBS)	For details about the parameters, see **OBS Link Parameters**.
• MRS HDFS • FusionInsight HDFS • Apache HDFS	If the data source is HDFS of MRS, Apache Hadoop, or FusionInsight HD, see **HDFS Link Parameters**.
• MRS HBase • FusionInsight HBase • Apache HBase	If the data source is HBase of MRS, Apache Hadoop, or FusionInsight HD, see **HBase Link Parameters**.
• MRS Hive • FusionInsight Hive • Apache Hive	If the data source is Hive on MRS, Apache Hadoop, or FusionInsight HD, see **Hive Link Parameters**.
CloudTable Service	If the data source is CloudTable, see **CloudTable Link Parameters**.
• FTP • SFTP	If the data source is an FTP or SFTP server, see **FTP/SFTP Link Parameters**.
HTTP	These connectors are used to read files with an HTTP/HTTPS URL, such as reading public files on the third-party object storage system and web disks. When creating an HTTP link, you only need to configure the link name. The URL is configured during job creation.
MongoDB	If the data source is a local MongoDB, see **MongoDB Link Parameters**.
Document Database Service (DDS)	If the data source is DDS, see **DDS Link Parameters**.
• Redis • Distributed Cache Service	If the data source is Redis or DCS, see **Redis Link Parameters**.
• MRS Kafka • Apache Kafka	If the data source is MRS Kafka or Apache Kafka, see **Kafka Link Parameters**.
Cloud Search Service (CSS) Elasticsearch	If the data source is CSS or Elasticsearch, see **CSS Link Parameters**.

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Connector	Description
Data Lake Insight	If the data source is DLI, see **DLI Link Parameters**.
DMS Kafka	If the data source is DMS Kafka, see **DMS Kafka Link Parameters**.
Cassandra	If the data source is Cassandra, see **Cassandra Link Parameters**. **NOTE** Cassandra is not supported in version 2.9.3.300 or later.
MRS Hudi	For details about the parameters, see **MRS Hudi Link Parameters**.
MRS ClickHouse	For details about the parameters, see **MRS ClickHouse Link Parameters**.
LogHub (SLS)	For details about the parameters, see **LogHub (SLS) Link Parameters**.
Shentong database	For details about the parameters, see **ShenTong Database Link Parameters**.

NOTE

Currently, the following data sources are in the OBT phase: FusionInsight HDFS, FusionInsight HBase, FusionInsight Hive, SAP HANA, Document Database Service, CloudTable Service, Cassandra, DMS Kafka, Cloud Search Service, Sharding Database, and ShenTong Database.

Step 4 After configuring the parameters of the link, click **Test** to check whether the link is available. Alternatively, click **Save**, and the system checks automatically.

If the network is poor or the data source is too large, the link test may take 30 to 60 seconds.

----End

Managing Links

CDM allows you to perform the following operations on created links:

- Deleting links: You can delete links that are not used by any job.
- Editing a link: You can modify link parameters but cannot reselect the connector. To modify a link, you need to re-enter the password needed to access the data source.
- Testing connectivity: You can test connectivity of a link that has been saved.
- Viewing the JSON file of a link: You can view parameters of a link in a JSON file.
- Editing the JSON file of a link: Modify parameters of a link in a JSON file.

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- Viewing the backend link: You can view the backend link corresponding to a link. For example, you can query details about the backend link if it is enabled.

Before managing a link, ensure that the link is not used by any job to avoid affecting job execution. The procedure for managing connections is as follows:

Step 1 Log in to the management console and choose **Service List** > **Cloud Data Migration**. On the CDM console, choose **Cluster Management** in the left navigation pane. Locate the row that contains the target cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab.

Step 2 On the **Links** page, locate the link to be modified.

- Deleting a link: Click **Delete** in the **Operation** column to delete a link. Alternatively, select the links that are not used by any job and click **Delete Link** above the list to delete them.
- Editing the link: Click the link name or click **Edit** in the **Operation** column to access the page for modifying the link. When modifying the link, you need to enter the password for logging in to the data source again.
- Testing connectivity of the link: Click **Test Connectivity** in the **Operation** column.
- Viewing the JSON file of the link: In the **Operation** column, choose **More** > **View Link JSON** to view link parameters in JSON format.
- Editing the JSON file of the link: In the **Operation** column, choose **More** > **Edit Link JSON** to modify link parameters in JSON format.
- Viewing the backend link: Locate the row that contains a link and click **More** in the **Operation** column and select **View Backend Link** to view the backend link corresponding to the link.

----End

5.5.2 Configuring Link Parameters

5.5.2.1 OBS Link Parameters

When connecting CDM to the destination OBS bucket, you need to add the read and write permissions to the destination OBS bucket, and file authentication is not required.

NOTE

- If the CDM cluster and OBS bucket are not in the same region, the CDM cluster cannot access the OBS bucket.
- Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

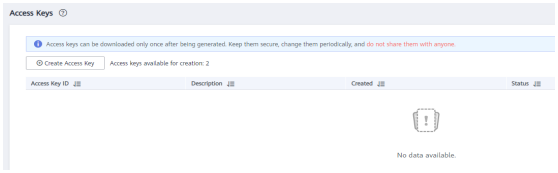
When connecting CDM to OBS, configure the parameters as described in **Table 5-21**.

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Table 5-21 Parameter description

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	obs_link
OBS Endpoint	An endpoint is the **request address** for calling an API. Endpoints vary depending on services and regions. You can obtain the OBS bucket endpoint by either of the following means: To obtain the endpoint of an OBS bucket, go to the OBS console and click the bucket name to go to its details page. **NOTE** • If the CDM cluster and OBS bucket are not in the same region, the CDM cluster cannot access the OBS bucket. • Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.	obs.myregion.mycloud.com
Port	Data transmission port. The HTTPS port number is 443 and the HTTP port number is 80.	443
OBS Bucket Type	Select a value from the drop-down list, generally, **Object Storage**.	Object Storage

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Parameter	Description	Example Value
AK	AK and SK are used to log in to the OBS server. You need to create an access key for the current account and obtain an AK/SK pair. To obtain an access key, perform the following steps: 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-16**. **Figure 5-16** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-
Link Attributes	(Optional) Displayed when you click **Show Advanced Attributes**. You can click **Add** to add custom attributes for the link. Only **connectionTimeout**, **socketTimeout**, and **idleConnectionTime** are supported. The following are some examples: • **socketTimeout**: timeout interval for data transmission at the socket layer, in milliseconds • **connectionTimeout**: timeout interval for establishing an HTTP/HTTPS connection, in milliseconds	-

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5.5.2.2 PostgreSQL/SQLServer Link Parameters

Table 5-22 lists the parameters for creating a link to PostgreSQL/SQLServer. Greenplum, Kingbase, and GaussDB can be connected through the PostgreSQL connector. The source and destination data sources supported by migration jobs are the same as those for PostgreSQL.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-22 PostgreSQL/SQLServer link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	sql_link
Database Server	IP address or domain name of the database to connect Click **Select** next to the text box to obtain the list of instances.	192.168.0.1
Port	Port of the database to connect	The port number varies depending on the database. Examples: Default port of SQL Server: **1433** Default port of PostgreSQL: **5432**
Database Name	Name of the database to connect	dbname
Username	Username used for accessing the database This account must have the permissions required to read and write data tables and metadata.	cdm
Password	Password of the user	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Driver Class Name	Class name of the uploaded driver Select **org.postgresql.Driver** or **com.kingbase8.Driver**.	-

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Parameter	Description	Example Value
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	"
Driver Version	Different types of relational databases adapt to different drivers. For details, see **How Do I Obtain a Driver?**	-
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time.	1000
Commit Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of records submitted each time. Set this parameter based on the destination and data size of the job. If the value is too large or too small, the job execution time may be affected.	10000
SSL Encryption	Whether to connect to the database in SSL mode	Yes

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Parameter	Description	Example Value
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database. The following are some examples: • **connectTimeout=60** and **socketTimeout=300**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (s) and socket timeout interval (s) to prevent failures caused by timeout. • **useCursorFetch=false**: By default, **useCursorFetch** is enabled, indicating that the JDBC connector communicates with relational databases using a binary protocol. Some third-party systems may have compatibility issues, causing migration time conversion errors. In this case, you can disable this function. • **trustServerCertificate=true**: A PKIX error may be reported during the creation of a secure connection. You are advised to set this parameter to **true**. • **sslmode=require**: The link to PostgreSQL may fail when SSL authentication is enabled. Set this parameter to **require**.	sslmode=require
Link Secret Attributes	(Optional) Displayed when you click **Show Advanced Attributes**. Custom secret attributes of the link	sk=09fUgD5WOF1L6f

5.5.2.3 GaussDB(DWS) Link Parameters

Table 5-23 describes the DWS link parameters.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

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Table 5-23 DWS link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	dws_link
Database Server	IP address or domain name of the database to connect Click **Select** next to the text box to obtain the list of instances.	192.168.0.1
Port	Port of the database to connect	The port number varies depending on the database.
Database Name	Name of the database to connect	dbname
Username	Username used for accessing the database. This user must have the permissions to read and write data tables and metadata.	cdm
Password	Password of the user	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	"
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time.	1000
Commit Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of records submitted each time. Set this parameter based on the destination and data size of the job. If the value is too large or too small, the job execution time may be affected.	10000

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Parameter	Description	Example Value
SSL Encryption	Whether to connect to the data warehouse in SSL mode	Yes **NOTE** To enable SSL encryption, you must ensure that it is enabled for GaussDB(DWS).
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database. The following are some examples: • **connectTimeout=60** and **socketTimeout=300**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (s) and socket timeout interval (s) to prevent failures caused by timeout. • **useCursorFetch=false**: By default, **useCursorFetch** is enabled, indicating that the JDBC connector communicates with relational databases using a binary protocol. Some third-party systems may have compatibility issues, causing migration time conversion errors. In this case, you can disable this function. Open-source MySQL databases support the **useCursorFetch** parameter, and you do not need to set this parameter.	sslmode=require **NOTE** If SSL encryption is enabled but **sslmode** is not set, the link may fail.
Link Secret Attributes	(Optional) Displayed when you click **Show Advanced Attributes**. Custom secret attributes of the link	sk=09fUgD5WOF1L6f

5.5.2.4 RDS for MySQL/MySQL Database Link Parameters

Table 5-24 lists the parameters for a link to a MySQL database.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

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Table 5-24 MySQL database link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	mysql_link
Database Server	IP address or domain name of the database to connect Click **Select** next to the text box and select a MySQL DB instance in the displayed dialog box.	192.168.0.1
Port	Port of the database to connect	3306
Database Name	Name of the database to connect	dbname
Username	Username used for accessing the database This account must have the permissions required to read and write data tables and metadata.	cdm
Password	Password of the user	-
Use Local API	(Optional) Whether to use the local API of the database for acceleration. When you create a MySQL link, CDM automatically enables the **local_infile** system variable of the MySQL database to enable the LOAD DATA function, which accelerates data import to the MySQL database. If this parameter is enabled, the date type that does not meet the format requirements will be stored as 0000-00-00. For details, visit the official MySQL website. If CDM fails to enable this function, contact the database administrator to enable the **local_infile** system variable. Alternatively, set **Use Local API** to **No** to disable API acceleration. If data is imported to RDS for MySQL, the LOAD DATA function is disabled by default. In such a case, you need to modify the parameter group of the MySQL instance and set **local_infile** to **ON** to enable the LOAD DATA function. **NOTE** If **local_infile** on RDS is uneditable, it is the default parameter group. You need to create a parameter group, modify its values, and apply it to the RDS for MySQL instance. For details, see the *Relational Database Service User Guide*.	Yes
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-

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Parameter	Description	Example Value
Agent	The agent function will be unavailable soon and does not need to be configured.	-
local_infile Character Set	When using local_infile to import data to MySQL, you can configure the encoding format.	utf8
Driver Version	Select a driver version that adapts to the database type.	-
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time.	1000
Commit Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of records submitted each time. Set this parameter based on the data destination and the job's data size. If the value is either too large or too small, the job may run for a long time.	10000
SSL Encryption	(Optional) Whether to connect to the database using SSL. This parameter is available for a MySQL link.	Yes

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Parameter	Description	Example Value
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database. The following are some examples: • **connectTimeout=600000** and **socketTimeout=300000**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (ms) and socket timeout interval (ms) to prevent failures caused by timeout. • **tinyInt1isBit=true** (default): If the length of tinyInt is 1, the value is converted to a Boolean value. **tinyInt1isBit=false**: The value is converted to an integer. If data fails to be written because true or false is read from the source, set this parameter to **false** to avoid migration errors. For details, see **MySQL Documentation**. • **useCursorFetch=false**: By default, **useCursorFetch** is enabled, indicating that the JDBC connector communicates with relational databases using a binary protocol. Some third-party systems may have compatibility issues, causing migration time conversion errors. In this case, you can disable this function. Open-source MySQL databases support the **useCursorFetch** parameter, and you do not need to set this parameter. • **allowPublicKeyRetrieval=true**: By default, public key retrieval is disabled for MySQL databases. If TLS is unavailable and an RSA public key is used for encryption, connection to an MySQL database may fail. In this case, you can enable public key retrieval to avoid connection failures. • **useSSL=false**: Enable SSL encryption using this attribute when the CDM cluster version is 2.10.0.300 and the MySQL version is later than 5.7.43.	sslmode=require
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	`

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Parameter	Description	Example Value
Batch Size	Number of rows written each time. It should be less than Commit Size. When the number of rows written reaches the value of Commit Size, the rows will be committed to the database.	100

5.5.2.5 Oracle Database Link Parameters

Table 5-25 lists the parameters for a link to an Oracle database.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-25 Oracle database link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	oracle_link
Database Server	IP address or domain name of the database to connect	192.168.0.1
Port	Port of the database to connect	Default port: 1521
Connection Type	Oracle database connection type. The following options are available: • **Service Name**: Use **SERVICE_NAME** to connect to the Oracle database. • **SID**: Use **SID** to connect to the Oracle database.	SID
Instance Name	Oracle instance ID, which is used to differentiate databases by instances. This parameter is available only when **Connection Type** is set to **SID**.	dbname
Database Name	Name of the database to connect This parameter is available only when **Connection Type** is set to **Service Name**.	dbname
Username	Username used for accessing the database This account must have the permissions required to read and write data tables and metadata.	cdm
Password	Password of the username	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-

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Parameter	Description	Example Value
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Oracle Version	Oracle database version. This parameter is available only for Oracle links. If **java.sql.SQLException: Protocol violation** is displayed, select another version.	Later than 12.1
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	"
Driver Version	Different types of relational databases adapt to different drivers. For details, see **How Do I Obtain a Driver?**	-
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time. A migration from the Oracle to DWS database may time out due to a long data write duration in the DWS database. In this case, reduce the value of **Fetch Size** for the Oracle database.	1000
Commit Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows submitted in a batch	10000
Link Attributes	This parameter is optional. You can click **Add** to add custom attributes for the link. The following are some examples: • **oracle.net.CONNECT_TIMEOUT**: connection timeout, in milliseconds. The default value is **60000**. • **oracle.jdbc.ReadTimeout**: socket read timeout, in milliseconds. The default value is **300000**.	60000
Link Secret Attributes	(Optional) Displayed when you click **Show Advanced Attributes**. Custom secret attributes of the link	sk=09fUgD5WOF1L6f

5.5.2.6 DLI Link Parameters

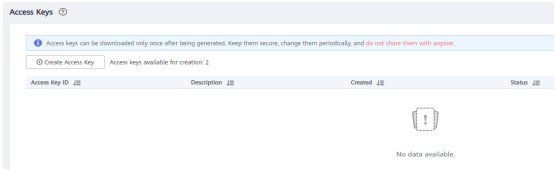
When connecting CDM to DLI, configure the parameters as described in **Table 5-26**.

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NOTE

- Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.
- When data is migrated to DLI, DLI generates data files in the *dli-trans** temporary OBS bucket. Therefore, you need to grant the user who uses the AK/SK the permissions to read and write the *dli-trans** bucket and create directories. Otherwise, the migration will fail. For details about how to add permission policies for temporary bucket *dli-trans**, see **Adding an Authorization Policy for the dli-trans* Temporary Bucket**.

Table 5-26 DLI link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	dli_link
AK	AK/SK required for authentication during access to the DLI database. You need to create an access key for the current account and obtain an AK/SK pair. 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-17**. **Figure 5-17** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

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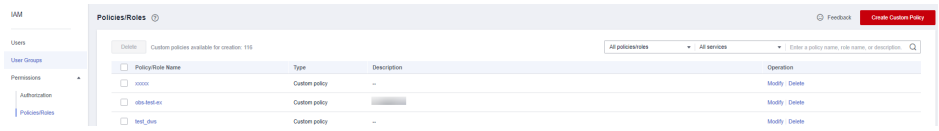
Parameter	Description	Example Value
Project ID	Project ID in the region where DLI resides A project is a group of tenant resources, and an account ID corresponds to the current account. The IAM ID corresponds to the current user. You can view the project IDs, account IDs, and user IDs in different regions on the corresponding pages. 1. Register with and log in to the management console. 2. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list. 3. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.	-
Batch Size	Number of rows written each time. When the number of rows written reaches the value of **Commit Size**, the rows will be committed to the database.	50000

Adding an Authorization Policy for the *dli-trans** Temporary Bucket

Step 1 Log in to the IAM console.

Step 2 In the navigation pane, choose **Permissions** > **Policies/Roles** and click **Create Custom Policy** in the upper right corner.

Figure 5-18 Creating a custom policy



Step 3 On the **Create Custom Policy** page, select **JSON** for **Policy View** and create custom policy **obs_dli-trans**.

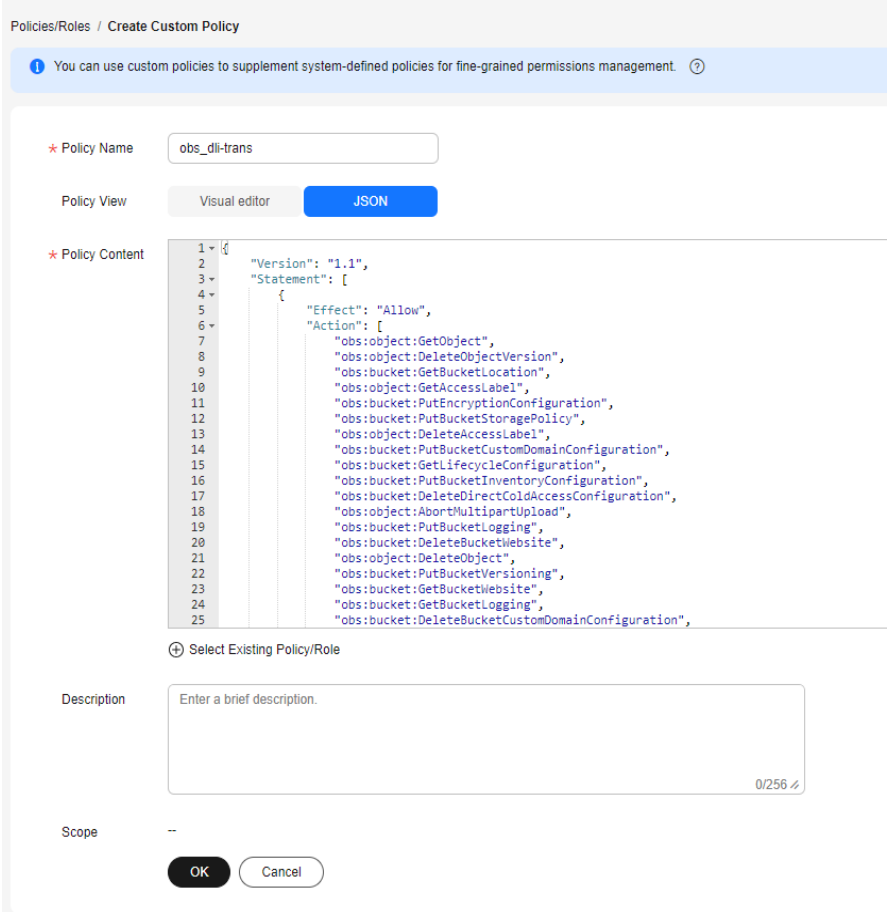
```
{
  "Version": "1.1",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "obs:object:GetObject",
        "obs:object:DeleteObjectVersion",
        "obs:bucket:GetBucketLocation",
        "obs:object:GetAccessLabel",
        "obs:bucket:PutEncryptionConfiguration",
        "obs:bucket:PutBucketStoragePolicy",
        "obs:object:DeleteAccessLabel",
        "obs:bucket:PutBucketCustomDomainConfiguration",
        "obs:bucket:GetLifecycleConfiguration",
```

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```
            "obs:bucket:PutBucketInventoryConfiguration",
            "obs:bucket:DeleteDirectColdAccessConfiguration",
            "obs:object:AbortMultipartUpload",
            "obs:bucket:PutBucketLogging",
            "obs:bucket:DeleteBucketWebsite",
            "obs:object:DeleteObject",
            "obs:bucket:PutBucketVersioning",
            "obs:bucket:GetBucketWebsite",
            "obs:bucket:GetBucketLogging",
            "obs:bucket:DeleteBucketCustomDomainConfiguration",
            "obs:object:PutObject",
            "obs:object:RestoreObject",
            "obs:bucket:PutReplicationConfiguration",
            "obs:bucket:GetBucketQuota",
            "obs:object:GetObjectVersionAcl",
            "obs:bucket:DeleteBucket",
            "obs:bucket:CreateBucket",
            "obs:bucket:GetDirectColdAccessConfiguration",
            "obs:bucket:PutDirectColdAccessConfiguration",
            "obs:bucket:GetBucketAcl",
            "obs:bucket:GetBucketVersioning",
            "obs:bucket:GetBucketInventoryConfiguration",
            "obs:bucket:GetBucketStoragePolicy",
            "obs:bucket:GetEncryptionConfiguration",
            "obs:bucket:PutBucketCORS",
            "obs:bucket:PutBucketTagging",
            "obs:bucket:GetBucketTagging",
            "obs:bucket:PutLifecycleConfiguration",
            "obs:bucket:GetBucketCustomDomainConfiguration",
            "obs:object:ListMultipartUploadParts",
            "obs:object:ModifyObjectMetaData",
            "obs:bucket:ListBucketVersions",
            "obs:bucket:PutBucketQuota",
            "obs:object:PutAccessLabel",
            "obs:bucket:ListBucket",
            "obs:bucket:GetBucketCORS",
            "obs:bucket:DeleteBucketInventoryConfiguration",
            "obs:object:GetObjectVersion",
            "obs:bucket:PutBucketWebsite",
            "obs:bucket:DeleteReplicationConfiguration",
            "obs:object:GetObjectAcl",
            "obs:bucket:GetBucketNotification",
            "obs:bucket:PutBucketNotification",
            "obs:bucket:GetReplicationConfiguration",
            "obs:bucket:GetBucketPolicy",
            "obs:bucket:DeleteBucketTagging",
            "obs:bucket:GetBucketStorage"
        ],
        "Resource": [
            "OBS:*:*:object:*",
            "OBS:*:*:bucket:dli-trans*"
        ]
    }
  ]
}
```

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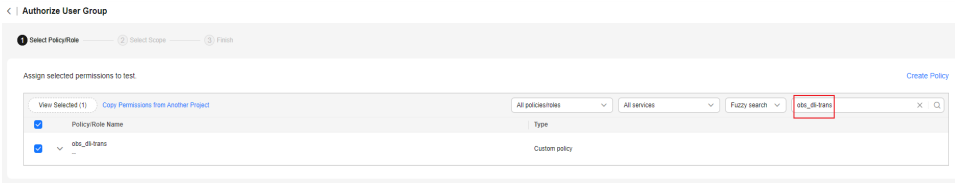
Figure 5-19 Creating custom policy **obs_dli-trans**



Step 4 Click **OK**.

Step 5 In the navigation pane, choose **User Groups**, locate the user group to which the DLI link user using the AK/SK belongs, and click **Authorize** to assign the custom **obs_dli-trans** policy to the user.

Figure 5-20 Assigning the custom **obs_dli-trans** policy to a user group



----End

5.5.2.7 Hive Link Parameters

CDM supports the following Hive data sources:

- **MRS Hive**
- **FusionInsight Hive**

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- **Apache Hive**

  NOTE

  Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

MRS Hive

You can view a table during field mapping only when you have the permission to access the table connected to MRS Hive.

MRS Hive links apply to the MapReduce Service (MRS) on Huawei Cloud. **Table 5-27** describes related parameters.

NOTE

- MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
- Before creating an MRS Hive link, you need to add an authenticated Kerberos user on MRS and log in to the MRS management page to change the initial password. Then use the new user to create an MRS link.
- To connect to an MRS 2.*x* cluster, create a CDM cluster of version 2.*x* first. CDM 1.8.*x* clusters cannot connect to MRS 2.*x* clusters.
- Currently, the Hive link obtains the **core-site.xml** configuration information from MRS HDFS. Therefore, if MRS Hive uses OBS as the underlying storage system, configure the AK/SK of OBS on MRS HDFS before creating the Hive link.
- Ensure that the MRS cluster and the DataArts Studio instance can communicate with each other. The following requirements must be met for network interconnection:
  - If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule.
  - If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
  - The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

Table 5-27 MRS Hive link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hivelink

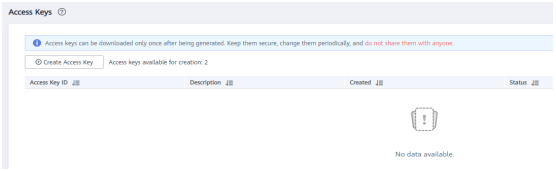
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Parameter	Description	Example Value
Manager IP	Floating IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select an MRS cluster. CDM automatically fills in the authentication information. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.	127.0.0.1
Authentication Method	Authentication method used for accessing MRS ● **SIMPLE**: Select this for non-security mode. ● **KERBEROS**: Select this for security mode.	SIMPLE
HIVE Version	Set this to the Hive version on the server.	HIVE_3_X
Username	If **Authentication Method** is set to **KERBEROS**, you must provide the username and password used for logging in to MRS Manager. If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user and set **Username** and **Password** to the username and password of the created MRS user when creating an MRS data connection. **NOTE** ● If the CDM cluster version is 2.9.0 or later and the MRS cluster version is 3.1.0 or later, the created user must have the permissions of the **Manager_viewer** role to create links on CDM. To perform operations on databases, tables, and columns of an MRS component, you also need to add the database, table, and column permissions of the MRS component to the user by following the instructions in the MRS documentation. ● If the CDM cluster version is earlier than 2.9.0 or the MRS cluster version is earlier than 3.1.0, the created user must have the permissions of **Manager_administrator** or **System_administrator** to create links on CDM. ● A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.	cdm
Password	Password used for logging in to MRS Manager	-

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Parameter	Description	Example Value
Enable ldap	This parameter is available when **Proxy connection** is selected for **Connection Type**. If LDAP authentication is enabled for an external LDAP server connected to MRS Hive, the LDAP username and password are required for authenticating the connection to MRS Hive. In this case, this option must be enabled. Otherwise, the connection will fail.	No
ldapUsername	This parameter is mandatory when **Enable ldap** is enabled. Enter the username configured when LDAP authentication was enabled for MRS Hive.	-
ldapPassword	This parameter is mandatory when **Enable ldap** is enabled. Enter the password configured when LDAP authentication was enabled for MRS Hive.	-
OBS storage support	The server must support OBS storage. When creating a Hive table, you can store the table in OBS.	No

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Parameter	Description	Example Value
AK	This parameter is mandatory when **OBS storage support** is enabled. The account corresponding to the AK/SK pair must have the OBS Buckets Viewer permission. Otherwise, OBS cannot be accessed and the "403 AccessDenied" error is reported. You need to create an access key for the current account and obtain an AK/SK pair. 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-21**. **Figure 5-21** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

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Parameter	Description	Example Value
Run Mode	This parameter is used only when the Hive version is **HIVE_3_X**. Possible values are: • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. **NOTE** The **STANDALONE** mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	EMBEDDED
Check Hive JDBC Connectivity	Whether to check the Hive JDBC connectivity	No
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hive_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

The following are some examples:

- **connectTimeout=360000** and **socketTimeout=360000**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (ms) and socket timeout interval (ms) to prevent failures caused by timeout.
- **hive.server2.idle.operation.timeout=360000**: To prevent Hive migration jobs from being suspended for a long time, you can customize the operation timeout period (ms).
- **hive.storeFormat=textfile**: During data migration from a relational database to Hive, tables in ORC format are automatically created by default. If you

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want textfile or parquet tables to be created, add **hive.storeFormat=textfile** or **hive.storeFormat=parquet**.

- **fs.defaultFS=obs://hivedb**: If the interconnected MRS Hive uses decoupled storage and compute, you can use this configuration to achieve better compatibility.

FusionInsight Hive

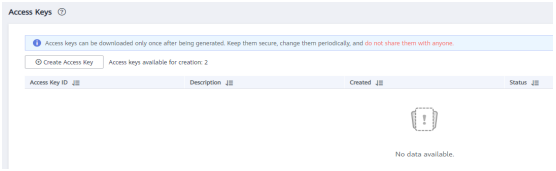
The FusionInsight Hive link is applicable to data migration of FusionInsight HD in the local data center. You must use Direct Connect to connect to FusionInsight HD.

Table 5-28 describes related parameters.

Table 5-28 FusionInsight Hive link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hivelink
Manager IP	IP address of FusionInsight Manager	127.0.0.1
Manager Port	Port number of FusionInsight Manager	28443
CAS Server Port	Port number of the CAS server used to connect to FusionInsight	20009
Authentication Method	Authentication method used for accessing the cluster: • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	SIMPLE
HIVE Version	Hive version	HIVE_3_X
Username	Username used for logging in to FusionInsight Manager.	cdm
Password	Password used for logging in to FusionInsight Manager	-
OBS storage support	The server must support OBS storage. When creating a Hive table, you can store the table in OBS.	No

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Parameter	Description	Example Value
AK	This parameter is mandatory when **OBS storage support** is enabled. The account corresponding to the AK/SK pair must have the OBS Buckets Viewer permission. Otherwise, OBS cannot be accessed and the "403 AccessDenied" error is reported. You need to create an access key for the current account and obtain an AK/SK pair. 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-21**. **Figure 5-22** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

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Parameter	Description	Example Value
Run Mode	This parameter is used only when the Hive version is **HIVE_3_X**. Possible values are: • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. **NOTE** The **STANDALONE** mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	EMBEDDED
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hive_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

The following are some examples:

- **connectTimeout=360000** and **socketTimeout=360000**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (ms) and socket timeout interval (ms) to prevent failures caused by timeout.
- **hive.server2.idle.operation.timeout=360000**: To prevent Hive migration jobs from being suspended for a long time, you can customize the operation timeout period (ms).

Apache Hive

The Apache Hive link is applicable to data migration of the third-party Hadoop in the local data center or ECS. You must use Direct Connect to connect to Hadoop in the local data center.

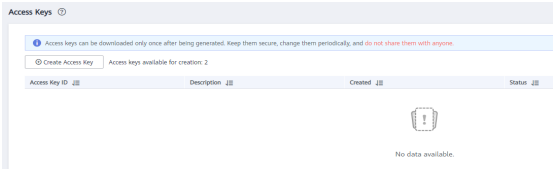
Table 5-29 describes related parameters.

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Table 5-29 Apache Hive link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hivelink
URI	NameNode URI	hdfs://hacluster
Hive Metastore	Hive metadata address. For details, see the **hive.metastore.uris** configuration item. Example: thrift://host-192-168-1-212:9083	-
Authentication Method	Authentication method used for accessing the cluster: ● **SIMPLE**: Select this for non-security mode. ● **KERBEROS**: Select this for security mode.	SIMPLE
Hive Version	Hive version	HIVE_3_X
IP and Host Name Mapping	If the Hadoop configuration file uses the host name, configure the mapping between the IP address and host name. Separate the IP addresses and host names by spaces and mappings by semicolons (;), carriage returns, or line feeds.	-
OBS storage support	The server must support OBS storage. When creating a Hive table, you can store the table in OBS.	No

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Parameter	Description	Example Value
AK	This parameter is mandatory when **OBS storage support** is enabled. The account corresponding to the AK/SK pair must have the OBS Buckets Viewer permission. Otherwise, OBS cannot be accessed and the "403 AccessDenied" error is reported. You need to create an access key for the current account and obtain an AK/SK pair. 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-21**. **Figure 5-23** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

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Parameter	Description	Example Value
Run Mode	This parameter is used only when the Hive version is **HIVE_3_X**. Possible values are: • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. **NOTE** The **STANDALONE** mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	EMBEDDED
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid when **Use Cluster Config** is set to **Yes** or **Authentication Method** is set to **KERBEROS**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hive_01
Hive JDBC URL	URL for connecting to Hive JDBC. By default, anonymous users are used.	-

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

The following are some examples:

- **connectTimeout=360000** and **socketTimeout=360000**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (ms) and socket timeout interval (ms) to prevent failures caused by timeout.
- **hive.server2.idle.operation.timeout=360000**: To prevent Hive migration jobs from being suspended for a long time, you can customize the operation timeout period (ms).

5.5.2.8 HBase Link Parameters

CDM supports the following HBase data sources:

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- **MRS HBase**
- **FusionInsight HBase**
- **Apache HBase**

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

MRS HBase

When connecting CDM to HBase of MRS, configure the parameters as described in **Table 5-30**.

NOTE

- MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
- Before creating an MRS link, you need to add an authenticated Kerberos user on MRS and log in to the MRS management page to change the initial password. Then use the new user to create an MRS link.
- To connect to an MRS 2.*x* cluster, create a CDM cluster of version 2.*x* first. CDM 1.8.*x* clusters cannot connect to MRS 2.*x* clusters.
- If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios:
  - If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule.
  - If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
  - The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

NOTE

If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

Table 5-30 MRS HBase link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	mrs_hbase_link

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Parameter	Description	Example Value
Manager IP	Floating IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select an MRS cluster. CDM automatically fills in the authentication information. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.	127.0.0.1
Username	If **Authentication Method** is set to **KERBEROS**, you must provide the username and password used for logging in to MRS Manager. If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user and set **Username** and **Password** to the username and password of the created MRS user when creating an MRS data connection. **NOTE** ● If the CDM cluster version is 2.9.0 or later and the MRS cluster version is 3.1.0 or later, the created user must have the permissions of the **Manager_viewer** role to create links on CDM. To perform operations on databases, tables, and columns of an MRS component, you also need to add the database, table, and column permissions of the MRS component to the user by following the instructions in the MRS documentation. ● If the CDM cluster version is earlier than 2.9.0 or the MRS cluster version is earlier than 3.1.0, the created user must have the permissions of **Manager_administrator** or **System_administrator** to create links on CDM. ● A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.	cdm
Password	Password used for logging in to MRS Manager	-

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Parameter	Description	Example Value
Authentication Method	Authentication method used for accessing the cluster: • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	SIMPLE
HBase Version	HBase version	HBASE_2_X
Run Mode	Run mode of the HBase link. This parameter is used only when the HBase version is **HBASE_2_X**. • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. Note: The STANDALONE mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	STANDALONE
Use Cluster Config	You can create cluster configurations on the **Links** page to simplify the configuration of Hadoop link parameters.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hbase_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

FusionInsight HBase

When connecting CDM to HBase of FusionInsight HD, configure the parameters as described in **Table 5-31**.

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Table 5-31 FusionInsight HBase link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	FI_hbase_link
Manager IP	IP address of FusionInsight Manager	127.0.0.1
Manager Port	Port number of FusionInsight Manager	28443
CAS Server Port	Port number of the CAS server used to connect to FusionInsight	20009
Username	Username used for logging in to FusionInsight Manager.	cdm
Password	Password used for logging in to FusionInsight Manager	-
Authentication Method	Authentication method used for accessing the cluster: • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	Kerberos
HBase Version	HBase version	HBASE_2_X
Run Mode	Run mode of the HBase link. This parameter is used only when the HBase version is **HBASE_2_X**. • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. **NOTE** The **STANDALONE** mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	STANDALONE
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No

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Parameter	Description	Example Value
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hbase_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

Apache HBase

When connecting CDM to HBase of Apache Hadoop, configure the parameters as described in **Table 5-32**.

Table 5-32 Apache HBase link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hadoop_hbase_link
ZK Link	ZooKeeper link of HBase Format: <host1>:<port>,<host2>:<port>,<host3>:<port>	zk1.example.com:2181,zk2.example.com:2181,zk3.example.com:2181
Authentication Method	Authentication method used for accessing the cluster: • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	Kerberos
IP and Host Name Mapping	IP address and host name. If the configuration file uses host names, configure the mappings between all IP addresses and hosts. Use spaces to separate hosts.	IP: 10.3.6.9 Host name: hostname01
HBase Version	HBase version	HBASE_2_X

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Parameter	Description	Example Value
Run Mode	Run mode of the HBase link. This parameter is used only when the HBase version is **HBASE_2_X**. • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. **NOTE** The **STANDALONE** mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	STANDALONE
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hbase_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

5.5.2.9 HDFS Link Parameters

CDM supports the following HDFS data sources:

- **MRS HDFS**
- **FusionInsight HDFS**
- **Apache HDFS**

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

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MRS HDFS

When connecting CDM to HDFS of MRS, configure the parameters as described in **Table 5-33**.

NOTE

- MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2** are not supported, and only MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1** are supported.
- Before creating an MRS link, you need to add an authenticated Kerberos user on MRS and log in to the MRS management page to change the initial password. Then use the new user to create an MRS link.
- To connect to an MRS 2.*x* cluster, create a CDM cluster of version 2.*x* first. CDM 1.8.*x* clusters cannot connect to MRS 2.*x* clusters.
- If the connection fails after you select a cluster, check whether the MRS cluster can communicate with the CDM instance which functions as the agent. They can communicate with each other in the following scenarios:
  - If the CDM cluster in the DataArts Studio instance and the MRS cluster are in different regions, a public network or a dedicated connection is required. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, and the MRS cluster can access the Internet and the port has been enabled in the firewall rule.
  - If the CDM cluster in the DataArts Studio instance and the MRS cluster are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
  - The MRS cluster and the DataArts Studio workspace belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

  NOTE

  If an agent is connected to multiple MRS clusters and one of the MRS clusters is deleted or abnormal, connections to the other MRS clusters will be affected. Therefore, you are advised to connect an agent to only one MRS cluster.

Table 5-33 MRS HDFS link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	mrs_hdfs_link
Manager IP	Floating IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select an MRS cluster. CDM automatically fills in the authentication information. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.	127.0.0.1

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Parameter	Description	Example Value
Username	If **Authentication Method** is set to **KERBEROS**, you must provide the username and password used for logging in to MRS Manager. If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user and set **Username** and **Password** to the username and password of the created MRS user when creating an MRS data connection. **NOTE** • If the CDM cluster version is 2.9.0 or later and the MRS cluster version is 3.1.0 or later, the created user must have the permissions of the **Manager_viewer** role to create links on CDM. To perform operations on databases, tables, and columns of an MRS component, you also need to add the database, table, and column permissions of the MRS component to the user by following the instructions in the MRS documentation. • If the CDM cluster version is earlier than 2.9.0 or the MRS cluster version is earlier than 3.1.0, the created user must have the permissions of **Manager_administrator** or **System_administrator** to create links on CDM. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.	cdm
Password	Password used for logging in to MRS Manager	-
Authentication Method	Authentication method used for accessing MRS • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	SIMPLE

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Parameter	Description	Example Value
Run Mode	Run mode of the HDFS link. The options are as follows: • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **STANDALONE**: The link instance runs in an independent process. If you want to connect CDM to multiple Hadoop data sources (MRS, Hadoop, or CloudTable), and both **KERBEROS** and **SIMPLE** authentication modes are available, you must select **STANDALONE** for this parameter. Note: The STANDALONE mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict. If a CDM cluster connects to two or more clusters with Kerberos authentication enabled and the same realm, only one cluster can be connected in **EMBEDDED** mode, and the other clusters must be connected in **STANDALONE** mode.	STANDALONE
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hdfs_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

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FusionInsight HDFS

When connecting CDM to HDFS of FusionInsight HD, configure the parameters as described in **Table 5-34**.

Table 5-34 FusionInsight HDFS link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	FI_hdfs_link
Manager IP	IP address of FusionInsight Manager	127.0.0.1
Manager Port	Port number of FusionInsight Manager	28443
CAS Server Port	Port number of the CAS server used to connect to FusionInsight	20009
Username	Username used for logging in to FusionInsight Manager. If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS.	cdm
Password	Password used for logging in to FusionInsight Manager	-
Authentication Method	Authentication method used for accessing the cluster: • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	KERBEROS

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Parameter	Description	Example Value
Run Mode	Run mode of the HDFS link. The options are as follows: • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **STANDALONE**: The link instance runs in an independent process. If you want to connect CDM to multiple Hadoop data sources (MRS, Hadoop, or CloudTable), and both **KERBEROS** and **SIMPLE** authentication modes are available, you must select **STANDALONE** for this parameter. Note: The STANDALONE mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	STANDALONE
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hdfs_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

Apache HDFS

When connecting CDM to HDFS of Apache Hadoop, configure the parameters as described in **Table 5-35**.

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Table 5-35 Apache HDFS link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hadoop_hdfs_link
URI	NameNode URI You can enter **hdfs://*IP address of the NameNode instance*:8020**.	hdfs://*IP*:8020
Authentication Method	Authentication method used for accessing the cluster: ● **SIMPLE**: Select this for non-security mode. ● **KERBEROS**: Select this for security mode.	KERBEROS
Run Mode	Run mode of the HDFS link. The options are as follows: ● **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. ● **STANDALONE**: The link instance runs in an independent process. If you want to connect CDM to multiple Hadoop data sources (MRS, Hadoop, or CloudTable), and both **KERBEROS** and **SIMPLE** authentication modes are available, you must select **STANDALONE** for this parameter. Note: The STANDALONE mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	STANDALONE
IP and Host Name Mapping	This parameter is used only when **Run Mode** is set to **EMBEDDED** or **STANDALONE**. If the HDFS configuration file uses the host name, configure the mapping between the IP address and host name. Separate the IP addresses and host names by spaces and mappings by semicolons (;), carriage returns, or line feeds.	10.1.6.9 hostname01 10.2.7.9 hostname02
Agent	The agent function will be unavailable soon and does not need to be configured.	-

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Parameter	Description	Example Value
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid when **Use Cluster Config** is set to **Yes** or **Authentication Method** is set to **KERBEROS**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hdfs_01

5.5.2.10 FTP/SFTP Link Parameters

The FTP/SFTP link is used to migrate files from the on-premises file server or ECS to a database.

NOTE

- Only FTP servers running Linux are supported.
- Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

When connecting CDM to an FTP or SFTP server, configure the parameters as described in **Table 5-36**.

Table 5-36 FTP/SFTP link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	ftp_link
Host Name/IP Address	Host name or IP address of the FTP or SFTP server	ftp.apache.org
Port	Port number of the FTP or SFTP server. The default value is **21** for FTP and **22** for SFTP.	21
Username	Username used for logging in to the FTP or SFTP server	cdm
Password	Password used for logging in to the FTP or SFTP server	-

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Parameter	Description	Example Value
FTP File Name controlEncoding	This parameter is available for a FTP link. It indicates the controlEncoding file name encoding configuration of ftp-client. The value can be **ISO-8859-1** or **UFT8**. The default value is **ISO-8859-1**.	ISO-8859-1

5.5.2.11 Redis Link Parameters

The Redis link is applicable to data migration of Redis created in the local data center or ECS. It is used to load data in the database or files to Redis.

Links to Redis data encrypted using SSL are not supported.

When connecting CDM to an on-premises Redis database, configure the parameters as described in **Table 5-37**.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-37 Redis link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	redis_link
Redis Deployment Method	Two deployment methods are available: • **Single**: installation on a single-node system • **Cluster**: installation on a cluster • **Proxy**: installation using a proxy	Single
Redis Server List	List of Redis server addresses. Enter each address in the format of *IP address or domain name of the database server*:*port number*, Separate multiple server lists by semicolons (;).	192.168.0.1:7300;192.168.0.2:7301
Password	Password used for logging in to Redis	-
Redis Database Index	Index ID of a Redis database A Redis database is similar to a relational database. The total number of Redis databases can be set in the Redis configuration file. By default, there are 16 Redis databases. The database names are integers ranging from 0 to 15 instead of character strings.	0

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Parameter	Description	Example Value
Authentication Method	Authentication method used for accessing MRS • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	SIMPLE
Username	If **Authentication Method** is set to **KERBEROS**, you must provide the username and password used for logging in to MRS Manager. If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user and set **Username** and **Password** to the username and password of the created MRS user when creating an MRS data connection. **NOTE** • If the CDM cluster version is 2.9.0 or later and the MRS cluster version is 3.1.0 or later, the created user must have the permissions of the **Manager_viewer** role to create links on CDM. To perform operations on databases, tables, and columns of an MRS component, you also need to add the database, table, and column permissions of the MRS component to the user by following the instructions in the MRS documentation. • If the CDM cluster version is earlier than 2.9.0 or the MRS cluster version is earlier than 3.1.0, the created user must have the permissions of **Manager_administrator** or **System_administrator** to create links on CDM. • A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.	cdm
Cluster Config Name	This parameter is valid only when **Authentication Method** is set to **KERBEROS**. Select a cluster configuration you have created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hdfs_01

5.5.2.12 DDS Link Parameters

The DDS link is used to synchronize data from Document Database Service (DDS) on HUAWEI CLOUD to a big data platform.

When connecting CDM to DDS, configure the parameters as described in **Table 5-38**.

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NOTE

- DDS data sources with SSL enabled are not supported.
- Do not change the password or user when a job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-38 DDS link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	dds_link
Server List	List of server addresses. Enter each address in the format of *IP address or domain name of the database server*:*port number*, and separate the entered addresses with semicolons (;).	192.168.0.1:7300;192.168.0.2:7301
Database Name	Name of the DDS database to be connected	DB_dds
Username	Username used for logging in to DDS	cdm
Password	Password used for logging in to DDS	-
Is direct connection mode	This mode applies to the scenario where the network of the primary node is normal but that of the replica node is abnormal. **NOTE** • Only one IP address can be configured for the server list in direct connection mode. • This mode applies to the scenario where the network of the primary node is normal but the network of the replica node is abnormal.	No

5.5.2.13 CloudTable Link Parameters

When connecting CDM to CloudTable, configure the parameters as described in **Table 5-39**.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

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Table 5-39 CloudTable link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	cloudtable_link
ZK Link	Obtain this parameter value from the cluster management page of CloudTable.	cloudtable-cdm-zk1.cloudtable.com:2181,cloudtable-cdm-zk2.cloudtable.com:2181
IAM Authentication	If IAM authentication is enabled for the CloudTable cluster to be connected, set this parameter to **Yes**. Otherwise, set this to **No**. If you select **Yes**, enter the username, AK, and SK.	No
Username	Username used for accessing the CloudTable cluster	admin
AK	AK for accessing the CloudTable cluster. You need to create an access key for the current account and obtain an AK/SK pair.	-
SK	SK for accessing the CloudTable cluster. You need to create an access key for the current account and obtain an AK/SK pair.	-
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hadoop_01

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

5.5.2.14 MongoDB Link Parameters

This link is used to transfer data from a third-party cloud MongoDB service or MongoDB created in the on-premises data center or ECS to a big data platform.

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When connecting CDM to an on-premises MongoDB database, configure the parameters as described in **Table 5-40**.

NOTE

- MongoDB data sources with SSL enabled are not supported.
- Do not change the password or user when a job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-40 MongoDB link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	mongodb_link
Server List	List of MongoDB server addresses. Enter each address in the format of *IP address or domain name of the database server*:*port number*, and separate the entered addresses with semicolons (;).	192.168.0.1:7300;192.168.0.2:7301
Database Name	Name of the MongoDB database to be connected	DB_mongodb
Username	Username for logging in to MongoDB	cdm
Password	Password for logging in to MongoDB	-
Direct Connection	This mode applies to the scenario where the network of the primary node is normal but the network of the replica node is abnormal. **NOTE** • Only one IP address can be configured for the server list in direct connection mode. • This mode applies to the scenario where the network of the primary node is normal but the network of the replica node is abnormal.	No
Link Attributes	Custom link attributes. The MongoDB attributes are supported. The unit is ms. The link attributes are as follows: • **socketTimeout**: The default value is **60000**. • **maxWaitTime**: The default value is **10000**. • **connectTimeout**. The default value is **10000**. • **serverSelectionTimeout**: The default value is **5000**.	socketTimeout=60000

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5.5.2.15 Cassandra Link Parameters

NOTE

- Cassandra is not supported in version 2.9.3.300 or later.
- Do not change the password or user when a job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-41 Parameter description

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	mongodb_link
Service node	An address of one node or addresses of multiple nodes. Separate addresses with semicolons (;). You are advised to configure multiple nodes at a time.	192.168.0.1;192.168.0.2
Port	Port number of the Cassandra node to be connected.	9042
Username	User name for connecting to Cassandra.	cdm
Password	Password for connecting to Cassandra.	-
Connection timeout duration	(Optional) Displayed when you click **Show Advanced Attributes**. Connection timeout interval, in seconds.	5
Read timeout duration	(Optional) Displayed when you click **Show Advanced Attributes**. Read timeout interval, in seconds. If the value is less than or equal to 0, no timeout occurs.	12

5.5.2.16 Kafka Link Parameters

MRS Kafka

When connecting CDM to Kafka of MRS, configure the parameters as described in **Table 5-42**.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

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Table 5-42 MRS Kafka link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	kafka_link
Manager IP	Floating IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select an MRS cluster. CDM automatically fills in the authentication information. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.	127.0.0.1
Username	Username used for logging in to MRS Manager To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user and set **Username** and **Password** to the username and password of the created MRS user when creating an MRS data connection. **NOTE** ● If the CDM cluster version is 2.9.0 or later and the MRS cluster version is 3.1.0 or later, the created user must have the permissions of the **Manager_viewer** role to create links on CDM. To perform operations on databases, tables, and columns of an MRS component, you also need to add the database, table, and column permissions of the MRS component to the user by following the instructions in the MRS documentation. ● If the CDM cluster version is earlier than 2.9.0 or the MRS cluster version is earlier than 3.1.0, the created user must have the permissions of **Manager_administrator** or **System_administrator** to create links on CDM. ● A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.	-
Password	Password used for logging in to MRS Manager	-
Authentication Method	Authentication method used for accessing MRS ● **SIMPLE**: for non-security mode ● **KERBEROS**: for security mode	Yes

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Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

Apache Kafka

The Apache Kafka link is applicable to data migration of the third-party Hadoop in the local data center or ECS. You must use Direct Connect to connect to Hadoop in the local data center.

When connecting CDM to Kafka of Apache Hadoop, configure the parameters as described in **Table 5-43**.

Table 5-43 Parameter description

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	kafka_link
Kafka broker	IP address and port number of the Kafka broker	192.168.1.1:9092

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

5.5.2.17 DMS Kafka Link Parameters

When connecting CDM to DMS Kafka, configure the parameters as described in **Table 5-44**.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-44 DMS Kafka link parameter

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	dms_link
Service Type	DMS Kafka edition. Currently, only the Platinum edition is available.	Platinum
Kafka Broker	Address of a Kafka premium instance. The format is host:port.	-

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Parameter	Description	Example Value
Kafka SASL_SSL	Whether to enable SSL authentication when a client connects to a Kafka premium instance. This function must be enabled if the SASL_SSL security protocol is enabled for the link to the DMS Kafka instance. If Kafka SASL_SSL is enabled, data will be encrypted before transmission for higher security, but performance will suffer. **NOTE** When SSL authentication is enabled, Kafka continuously parses the Kafka broker connection address as a domain name, which undermines performance. You are advised to add the self-mapping of the broker connection address to the **/etc/hosts** file on the ECS corresponding to the CDM cluster (search for the ECS based on the cluster IP address) so that the client can quickly resolve the broker of the instance. For example, if the Kafka broker address is 10.154.48.120, add the following self-mapping to the **/etc/hosts** file: 10.154.48.120 10.154.48.120	Yes
Username	Username for connecting to DMS Kafka. This parameter is displayed when **Kafka SASL_SSL** is enabled.	-
Password	Password for connecting to DMS Kafka. This parameter is displayed when **Kafka SASL_SSL** is enabled.	-
Kafka Properties	• If a security protocol is enabled for the link to the DMS Kafka instance, you must add a data encryption attribute, and set the attribute name to **security.protocol** and value to **SASL_SSL** or **SASL_PLAINTEXT** based on the security protocol of the Kafka instance. • If SASL authentication is enabled for the link to the DMS Kafka instance, you must add an authentication mode attribute, and set the attribute name to **sasl.mechanism** and value to **PLAIN** or **SCRAM-SHA-512** based on the SASL authentication mechanism configured for the Kafka instance (set the value to either **PLAIN** or **SCRAM-SHA-512** if both are supported).	-

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5.5.2.18 CSS Link Parameters

Huawei Cloud Cloud Search Service (CSS) is a fully hosted distributed search service powered by open-source Elasticsearch. CSS links can be used to migrate log files and database records to CSS for search and analysis using Elasticsearch.

NOTE

- Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-45 lists the parameters for a CSS link.

Table 5-45 CSS link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	css_link
Elasticsearch Server List	IP addresses or domain names (including the port numbers) of one or more Elasticsearch servers. The format is *ip:port*. Use semicolons (;) to separate multiple IP addresses.	192.168.0.1:9200;192.168.0.2:9200
Security Mode Authentication	Whether to enable security mode. If **Security Mode** has been enabled for the CSS cluster to be connected, set this parameter to **Yes**. Otherwise, set this to **No**.	Yes
Username	This parameter is displayed when **Security Mode Authentication** is set to **Yes**. It indicates the username used for connecting to CSS.	admin
Password	This parameter is displayed when **Security Mode Authentication** is set to **Yes**. It indicates the password used for connecting to CSS.	-
HTTPS Access	This parameter is displayed when **Security Mode Authentication** is set to **Yes**. This parameter specifies whether to enable HTTPS access. HTTPS access is more secure than HTTP access.	Yes

5.5.2.19 Elasticsearch Link Parameters

Elasticsearch links can be used to connect to Elasticsearch services in third-party clouds and local data centers and on Elastic Cloud Servers (ECSs).

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NOTE

- The Elasticsearch connector only supports Elasticsearch clusters in non-security mode.
- Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-46 lists the parameters for an Elasticsearch link.

Table 5-46 Elasticsearch link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	es_link
Elasticsearch Server List	IP addresses or domain names (including the port numbers) of one or more Elasticsearch servers. The format is *ip:port*. Use semicolons (;) to separate multiple IP addresses or domain names.	192.168.0.1:9200;192.168.0.2:9200

5.5.2.20 Dameng Database Link Parameters

When connecting CDM to a Dameng database, configure the parameters as described in Table 5-47.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-47 Parameters for a link to a Dameng database

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	dm_link
Database Server	IP address or domain name of the database to connect. Use semicolons (;) to separate multiple values.	192.168.0.1;192.168.0.2
Port	Port of the database to connect	The port number varies depending on the database.
Database Name	Name of the database to connect	dbname

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Parameter	Description	Example Value
Username	Username used for accessing the database This account must have the permissions required to read and write data tables and metadata.	cdm
Password	Password of the user	-
Driver Version	Select a driver version that adapts to the database type.	-
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time.	1000
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database.	sslmode=require
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	'

5.5.2.21 SAP HANA Link Parameters

Table 5-48 describes the SAP HANA link parameters.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-48 SAP HANA link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	sap_link
Database Server	IP address or domain name of the database to connect Click **Select** next to the text box to obtain the list of instances.	192.168.0.1

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Parameter	Description	Example Value
Port	Port of the database to connect	The port number varies depending on the database.
Database Name	Name of the database to connect	dbname
Username	Username used for accessing the database. This user must have the permissions to read and write data tables and metadata.	cdm
Password	Password of the user	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time.	1000

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Parameter	Description	Example Value
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database. The following are some examples: • **connectTimeout=360000** and **socketTimeout=360000**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (ms) and socket timeout interval (ms) to prevent failures caused by timeout. • **useCursorFetch=false**: By default, **useCursorFetch** is enabled, indicating that the JDBC connector communicates with relational databases using a binary protocol. Some third-party systems may have compatibility issues, causing migration time conversion errors. In this case, you can disable this function. Open-source MySQL databases support the **useCursorFetch** parameter, and you do not need to set this parameter.	sslmode=require
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	'

5.5.2.22 Shard Link Parameters

Sharding refers to the link to multiple backend data sources at the same time. The link can be used as the job source to migrate data from multiple data sources to other data sources. **Table 5-49** lists the link parameters.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

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Table 5-49 Database shard link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	my_link
Username	Username used for accessing the database For a backend database A, this configuration takes effect only when no username and password are configured for A in the data source list. For a backend database B that has configured the username and password, this configuration does not takes effect.	cdm
Password	Password used for accessing the database. For a backend database A, this configuration takes effect only when no username and password are configured for A in the data source list. For a backend database B that has configured the username and password, this configuration does not takes effect.	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
backendDatasource	Enter the type of the backend database. Currently, only MySQL is supported.	MySQL
Data Source List	Enter the IP address, port number, database name, account name, and password of the backend database, and separate them with colons (:). That is, ip:port:dbs:username:password. You can leave username:password empty. In this case, the username and password are used. If there are multiple backend databases, ensure that the table structures are the same and use vertical bars (|) to separate data sources. If the password contains a vertical bar (|) or colon (:), use a backslash (\) to escape the vertical bar. For example, **192.168.3.0:3306:cdm| 192.168.2.2:3306:cdm:user:password** indicates that the IP address of the first backend database is **192.168.3.0**, the port number is **3306**, the database name is **cdm**, and the account name and password are configured in *user* and *password*. The IP address of the second backend database is **192.168.2.2**, the port number is **3306**, the database name is **cdm**, the account name is **user** and the password is **password**.	192.168.3.0:3306:cdm| 192.168.2.2:3306:cdm:user:password

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Parameter	Description	Example Value
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time.	1000
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database.	sslmode=require
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	'

5.5.2.23 MRS Hudi Link Parameters

Table 5-50 describes the MRS Hudi link parameters.

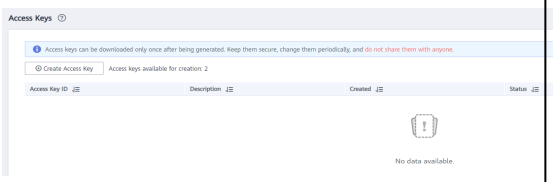
NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-50 Hudi link parameters

Parameter	Description	Example Value
Name	Link name	Hudilink
Manager IP	Floating IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select an MRS cluster. CDM automatically fills in the authentication information. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.	127.0.0.1
Authentication Method	Authentication method used for accessing MRS • **SIMPLE**: Select this for non-security mode. • **KERBEROS**: Select this for security mode.	KERBEROS

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Parameter	Description	Example Value
Account	Username for logging in to MRS Manager	cdm
Password	Password for logging in to MRS Manager	-
OBS storage support	Whether to support OBS storage. If the Hudi table data is stored in OBS, you need to enable this function.	Yes
AK	This parameter is available when **OBS storage support** is set to **Yes**. AK and SK are used to log in to the OBS server. You need to create an access key for the current account and obtain an AK/SK pair. To obtain an access key, perform the following steps: 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-24**. **Figure 5-24** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

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Parameter	Description	Example Value
OBS Test Path	This parameter is available when **OBS storage support** is set to **Yes**. Enter a complete file path. The permission to access the path will be verified through the metadata query API. **NOTE** • For object storage, the path must be accurate to object, for example, **obs://bucket/dir/test.txt**. Otherwise, a 404 error occurs. • For a parallel file system, the path must be accurate to directory, for example, **obs://bucket/dir**.	obs://bucket/dir/test.txt
Hive Properties	Names of the tables to be integrated. Use commas (,) to separate multiple table names. This parameter is mandatory and cannot contain spaces.	-

5.5.2.24 MRS ClickHouse Link Parameters

Table 5-51 describes the MRS ClickHouse link parameters.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-51 ClickHouse link parameters

Parameter	Description	Example Value
Name	Link name	cklink
Database Server	IP address or domain name of the database to connect **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**. Log in to Manager of the cluster where the MRS ClickHouse data source is located, choose **Cluster** > **Services** > **ClickHouse** > **Instance**, and view the ClickHouseServer service IP address.	192.168.0.1

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Parameter	Description	Example Value
Port	Port of the database to connect **NOTE** • If the Server node is used, enable **SSL Encryption** and set the default port. Log in to the Manager of the cluster where the MRS ClickHouse data source is located, choose **Cluster** > **Services** > **ClickHouse** > **Instance**, and set the default port of ClickHouseServer. For an MRS cluster in non-security mode, set it to the value of the **http_port** parameter. For an MRS cluster in security mode, set it to the value of the **https_port** parameter. • If the Balancer node is used, enable **SSL Encryption** and set the default port. Log in to the Manager of the cluster where the MRS ClickHouse data source is located, choose **Cluster** > **Services** > **ClickHouse** > **Instance**, and set the default port of ClickHouseBalancer. For an MRS cluster in non-security mode, set it to the value of the **lb_http_port** parameter. For an MRS cluster in security mode, set it to the value of the **lb_https_port** parameter. • If MRS ClickHouse is deployed in a security cluster, set this parameter to the default HTTPS port.	8123
Database Name	Name of the database to connect	dbname
Username	Username used for accessing the database. This user must have the permissions to read and write data tables and metadata.	cdm
Password	Password of the user	-
SSL Encryption	(Optional) If you set this parameter to **Yes**, CDM can connect to the database (on-premises databases excluded) in SSL encryption mode.	No
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	'

5.5.2.25 ShenTong Database Link Parameters

Table 5-52 lists the parameters for a link to a ShenTong database.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

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Table 5-52 ShenTong database link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	st_link
Database Server	IP address or domain name of the database to connect Click **Select** next to the text box and select a ShenTong DB instance in the displayed dialog box.	192.168.0.1
Port	Port of the database to connect	3306
Database Name	Name of the database to connect	dbname
Username	Username used for accessing the database. This user must have the permissions to read and write data tables and metadata.	cdm
Password	Password of the user	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	'
Driver Version	Select a driver version that adapts to the database type.	-
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is either too large or too small, the job may run for a long time.	1000

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Parameter	Description	Example Value
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database. The following are some examples: • **connectTimeout=360000** and **socketTimeout=360000**: When a large amount of data needs to be migrated or the entire table is retrieved using query statements, the migration fails due to connection timeout. In this case, you can customize the connection timeout interval (ms) and socket timeout interval (ms) to prevent failures caused by timeout.	sslmode=require

5.5.2.26 LogHub (SLS) Link Parameters

Table 5-53 describes the LogHub (SLS) link parameters.

Table 5-53 LogHub (SLS) link parameters

Parameter	Description	Example Value
Name	Link name	sls_link
EndPoint	URL for accessing a project and its logs An endpoint is the **request address** for calling an API. Endpoints vary depending on services and regions. You can obtain the endpoints of the service from **Endpoints**.	-
Project	Project name of the target log service. It is a resource management unit in the log service and is used to isolate and control resources.	sls_project
AccessKeyID	Key for accessing the log service, which is used to identify a user	-
accessKeySecret	Key for accessing the log service, which is used to authenticate the user	-

5.5.2.27 CloudTable OpenTSDB Link Parameters

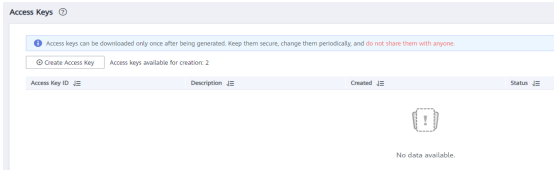
When connecting CDM to CloudTable OpenTSDB, configure the parameters as described in Table 5-54.

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Table 5-54 CloudTable OpenTSDB link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	TSDB_link
OpenTSDB Link	ZK link of OpenTSDB	opentsdb-sp8afz7bgbps5ur.cloudtable.com:4242
Security Mode	Security or non-security mode If you select **Security**, enter the project ID, username, and AK/SK.	Nonsecurity
Project ID	Project ID in the region where CloudTable resides A project is a group of tenant resources, and an account ID corresponds to the current account. The IAM ID corresponds to the current user. You can view the project IDs, account IDs, and user IDs in different regions on the corresponding pages. 1. Register with and log in to the management console. 2. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list. 3. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.	-
Username	Username for accessing CloudTable	admin

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Parameter	Description	Example Value
AK	AK and SK for accessing CloudTable. You need to create an access key for the current account and obtain an AK/SK pair. 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-25**. **Figure 5-25** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** • Only two access keys can be added for each user. • To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

5.5.2.28 GBASE Link Parameters

Table 5-55 lists the parameters for a link to GBASE.

Table 5-55 GBASE link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	adb_link
Connector	The default value is **Relational Database** and cannot be changed.	N/A

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Parameter	Description	Example Value
Database Server	IP address or domain name of the database to connect. Use semicolons (;) to separate multiple values.	192.168.0.1;192.168.0.2
Port	Port of the database to connect	3306
Database Name	Name of the database to connect	dbname
Username	Username used for accessing the database When you create a database shard link, this configuration is applied to all backend links in the data source list for which no username or password has been configured. When you edit a database shard link, if you want to modify an existing backend link, specify the username and password in the data source list.	cdm
Password	Database password	N/A
Use Agent	This parameter does not need to be set as the agent function will be unavailable soon. This parameter is available for GBASE8A.	N/A
Agent	This parameter does not need to be set as the agent function will be unavailable soon. This parameter is available for GBASE8A.	N/A
Reference Sign	Database enclosure character. This parameter is optional. For some databases, the value is case sensitive. Leave this parameter blank if no enclosure character is required.	"
Driver Version	Different types of relational databases adapt to different drivers. For details, see **How Do I Obtain a Driver?** This parameter is available for GBASE8A.	N/A
Fetch Size	This parameter is optional. It is displayed when you click **Show Advanced Attributes**. It specifies the number of rows obtained by each request. Set this parameter based on the data source and the amount of data of the job. If the value is either too large or too small, the job may run for a long time.	10,000

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Parameter	Description	Example Value
Commit Size	This parameter is optional. It is displayed when you click **Show Advanced Attributes**. It specifies the number of records submitted each time. Set this parameter based on the data destination and the amount of data of the job. If the value is either too large or too small, the job may run for a long time.	1,000
Link Attributes	Custom attributes of the link. This parameter is optional. Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database. The following are some examples: • **socketTimeout**: JDBC connection timeout duration, in milliseconds • **mysql.bool.type.transform**: whether to parse tinyint(1) to a Boolean value during data reading from a MySQL database. The default value is **true**.	N/A

5.5.2.29 YASHAN Link Parameters

Table 5-56 describes the YASHAN link parameters.

NOTE

Do not change the password or user when the job is running. If you do so, the password will not take effect immediately and the job will fail.

Table 5-56 YASHAN link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	yashan_link
Database Server	IP address or domain name of the database to connect Click **Select** next to the text box to obtain the list of instances.	192.168.0.1
Port	Port of the database to connect	1688
Database Name	Name of the database to connect	dbname

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Parameter	Description	Example Value
Username	Username used for accessing the database This account must have the permissions required to read and write data tables and metadata.	cdm
Password	Password of the user	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Reference Sign	(Optional) Delimiter between the names of the referenced tables or columns. For details, see the product documentation of the corresponding database.	"
Driver Version	Different types of relational databases adapt to different drivers. For details, see **How Do I Obtain a Driver?**	-
Fetch Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of rows obtained by each request. Set this parameter based on the data source and the job's data size. If the value is too large or too small, the job execution time may be affected.	1000
SSL Encryption	(Optional) Displayed when you click **Show Advanced Attributes**. Select **Yes** if you want to enable SSL encrypted transmission.	Yes
Link Attributes	(Optional) Click **Add** to add the JDBC connector attributes of multiple specified data sources. For details, see the JDBC connector document of the corresponding database. The following are some examples: • **socketTimeout**: JDBC connection timeout duration, in milliseconds • **mysql.bool.type.transform**: whether to parse tinyint(1) to a Boolean value during data reading from a MySQL database. The default value is true.	socketTimeout=300
Link Secret Attributes	Custom secret attributes of the link	xxx=xxx

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5.5.3 Uploading a CDM Link Driver

The Java Database Connectivity (JDBC) provides programmatic access to relational databases. Applications can execute SQL statements and retrieve data using the JDBC API.

Before connecting CDM to a relational database, you need to upload the JDK 8 .jar driver of the relational database.

Prerequisites

- A cluster has been created.
- You have downloaded one of the drivers listed in **Table 5-57**.
- (Optional) An SFTP link has been created by referring to **FTP/SFTP Link Parameters** and the corresponding driver has been uploaded to the offline file server.

How Do I Obtain a Driver?

Select a driver version that adapts to the database type. Note that the version of the uploaded driver does not need to match the version of the database to be connected. Obtain the JDK8 .jar driver of the recommended version by referring to **Table 5-57**.

Table 5-57 Drivers

Relational Database Type	Driver Name	How to Obtain	Recommended Version
• RDS for MySQL • MySQL	MySQL	**https://downloads.mysql.com/archives/c-j/**	mysql-connector-java-5.1.48.jar
Oracle	ORACLE_6 ORACLE_7 ORACLE_8	Driver packages: **https://www.oracle.com/database/technologies/appdev/jdbc-downloads.html** Driver packages of historical versions: **https://repo1.maven.org/maven2/com/oracle/database/jdbc/**	ojdbc8.jar for version 12.2.0.1 **NOTE** New versions (for example, Oracle Database 21c (21.3) drivers) are not supported. If they are used, the schema name cannot be obtained during job creation.
• RDS for PostgreSQL • PostgreSQL	POSTGRESQL	**https://mvnrepository.com/artifact/org.postgresql/postgresql**	postgresql-42.3.4.jar for version 42.3.4

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Relational Database Type	Driver Name	How to Obtain	Recommended Version
YASHAN	YashanDB 23.2.4	**https://download.yashandb.com/download**	23.2.4 • Linux x86: yashandb-23.2.4.100-linux-x86_64.tar • Linux ARM: yashandb-23.2.4.100-linux-aarch64.tar
KingBase	POSTGRESQL	**https://mvnrepository.com/artifact/org.postgresql/postgresql**	postgresql-42.2.9.jar for PostgreSQL 42.2.9
GaussDB	POSTGRESQL	GaussDB JDBC driver: Search for "JDBC Package, Driver Class, and Environment Class" in GaussDB Documentation, select the document corresponding to the instance version, and obtain **gsjdbc4.jar** by referring to the document.	Obtain **gsjdbc4.jar** from the release package of the corresponding version.
• RDS for SQL Server • Microsoft SQL Server	SQLServer	**https://docs.microsoft.com/en-us/sql/connect/jdbc/release-notes-for-the-jdbc-driver?view=sql-server-ver15#previous-releases**	sqljdbc42.jar
Dameng database	DM	**https://eco.dameng.com/download/** Obtain **DmJdbcDriver18.jar** from the DM installation directory **/dmdbms/drivers/jdbc**.	DmJdbcDriver18.jar

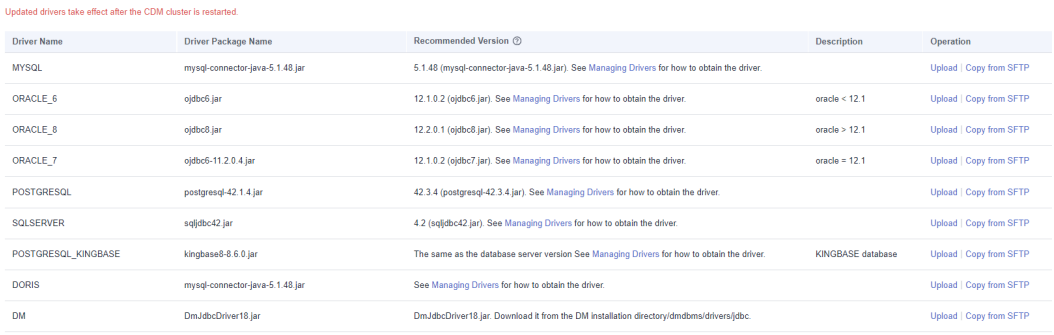
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Relational Database Type	Driver Name	How to Obtain	Recommended Version
POSTGRESQL_KINGBASE	POSTGRESQL_KINGBASE	https://www.kingbase.com.cn/rjcxxz/index.htm	Driver version matching the KingBase database version

Procedure

Step 1 Access the CDM console, choose **Cluster Management** in the navigation pane, locate the target cluster, and choose **Job Management** > **Link Management** > **Driver Management**. On the **Driver Management** page, upload a driver.

Figure 5-26 Uploading a driver



Step 2 Click **Upload** in the **Operation** column and select a local driver.

Alternatively, click **Copy from SFTP** in the **Operation** column and configure the **SFTP Link** name and **Driver File Path**.

Step 3 (Optional) If you have uploaded an updated version of a driver, you must restart the CDM cluster for the new driver to take effect.

----End

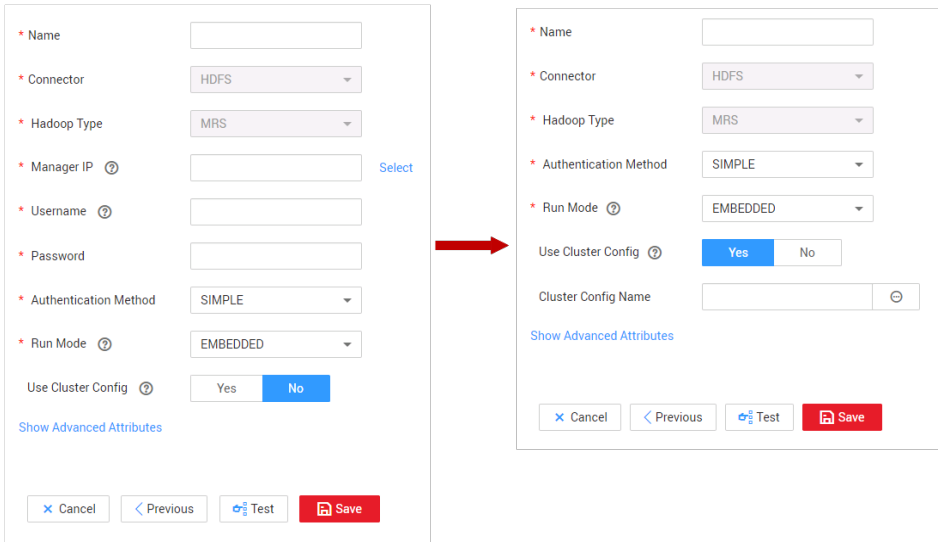
5.5.4 Creating a Hadoop Cluster Configuration

On the **Cluster Configurations** page, you can create, edit, or delete Hadoop cluster configurations.

When creating a Hadoop link, the Hadoop cluster configurations can simplify the link creation. See **Figure 5-27** for details.

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Figure 5-27 Comparison before and after using the cluster configurations



CDM supports the following types of Hadoop links:

- MRS clusters: MRS HDFS, MRS HBase, and MRS Hive
- FusionInsight clusters: FusionInsight HDFS, FusionInsight HBase, and FusionInsight Hive
- Apache clusters: Apache HDFS, Apache HBase, and Apache Hive

Scenario

Before creating a Hadoop link, you are advised to create cluster configurations to simplify the link parameter configurations.

Prerequisites

- A cluster has been created.
- You have obtained the Hadoop cluster configuration file and keytab file. See **Table 1** for details.

Obtaining the Cluster Configuration File and Keytab File

The methods for obtaining the Hadoop cluster configuration file and keytab file vary depending on the Hadoop cluster type. For details, see **Table 1**.

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Table 5-58 Obtaining the cluster configuration file and keytab file

Hadoop Link	Obtaining the Cluster Configuration File	Obtaining the Keytab File
MRS cluster • MRS HDFS • MRS HBase • MRS Hive • MRS Hudi • MRS ClickHouse	For clusters of MRS 3.x: 1. Log in to FusionInsight Manager. 2. Choose **Cluster** > *Name of the desired cluster* > **Dashboard** > **More** > **Download Client**. 3. In the dialog box that is displayed, select **Configuration Files Only**. The platform type must be the same as that on the server. Retain the default values of other parameters and click **OK** to download the configuration file to the local host. 4. Obtain the downloaded TAR package, which is the FusionInsight cluster configuration file. For clusters of MRS 2.x or earlier: 1. Log in to the MRS console. 2. Choose **Clusters** > **Active Clusters** and click a cluster name to go to the cluster details page. Click the **Components** tab. 3. Click **Download Client**. Set **Client Type** to **Only configuration files**, set **Download To** to **Server** or **Remote host**, customize the client path, and click **OK** to generate the client configuration file. 4. Save the generated configuration file to a local path. See MRS documentation for details.	For clusters of MRS 3.x: 1. Log in to FusionInsight Manager. 2. Choose **System** > **Permission** > **User**, locate the row that contains the target user, and choose **More** > **Download Authentication Credential** to download the authentication credential file. 3. Obtain the downloaded TAR package, which is the keytab file of the FusionInsight cluster. For clusters of MRS 2.x or earlier: 1. Log in to MRS Manager and click **System**. In the **Permission** area, click **Manage User**. 2. In the row of the user for whom you want to export the keytab file, choose **More** > **Download authentication credential** to download the authentication file. After the file is automatically generated, save it to a specified path and keep it properly. See MRS documentation for details.

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Hadoop Link	Obtaining the Cluster Configuration File	Obtaining the Keytab File
FusionInsight clusters: • FusionInsight HDFS • FusionInsight HBase • FusionInsight Hive	1. Log in to FusionInsight Manager. 2. Choose **Cluster** > *Name of the desired cluster* > **Dashboard** > **More** > **Download Client**. 3. In the dialog box that is displayed, select **Configuration Files Only**. The platform type must be the same as that on the server. Retain the default values of other parameters and click **OK** to download the configuration file to the local host. 4. Obtain the downloaded TAR package, which is the FusionInsight cluster configuration file. See the FusionInsight documentation for details.	1. Log in to FusionInsight Manager. 2. Choose **System** > **Permission** > **User**, locate the row that contains the target user, and choose **More** > **Download Authentication Credential** to download the authentication credential file. 3. Obtain the downloaded TAR package, which is the keytab file of the FusionInsight cluster. See the FusionInsight documentation for details.

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Hadoop Link	Obtaining the Cluster Configuration File	Obtaining the Keytab File
Apache clusters: • Apache HDFS • Apache HBase • Apache Hive	In the Apache cluster scenario, only the required configuration files and packaging rules are described. For details about how to obtain each configuration file, see the corresponding documentation. • HDFS needs to compress the following files into a .zip package without the directory format: – hosts – core-site.xml – hdfs-site.xml – yarn-site.xml – mapred-site.xml – krb5.conf (optional, for clusters in security mode) • HBase needs to compress the following files into a .zip package without the directory format: – hosts – core-site.xml – hdfs-site.xml – yarn-site.xml – mapred-site.xml – hbase-site.xml – krb5.conf (optional, for clusters in security mode) • Hive needs to compress the following files into a .zip package without the directory format: – hosts – core-site.xml – hdfs-site.xml – yarn-site.xml	In the Apache cluster scenario, only the principles for packaging authentication credential files are required. For details about how to obtain the authentication credential files, see the corresponding documentation. 1. Rename the user's authentication credential file as **user.keytab**. 2. Compress the **user.keytab** file into a .zip package without the directory format: **user.keytab.zip**.

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Hadoop Link	Obtaining the Cluster Configuration File	Obtaining the Keytab File
	– mapred-site.xml – hive-site.xml – hivemetastore-site.xml – krb5.conf (optional, for clusters in security mode)	

NOTE

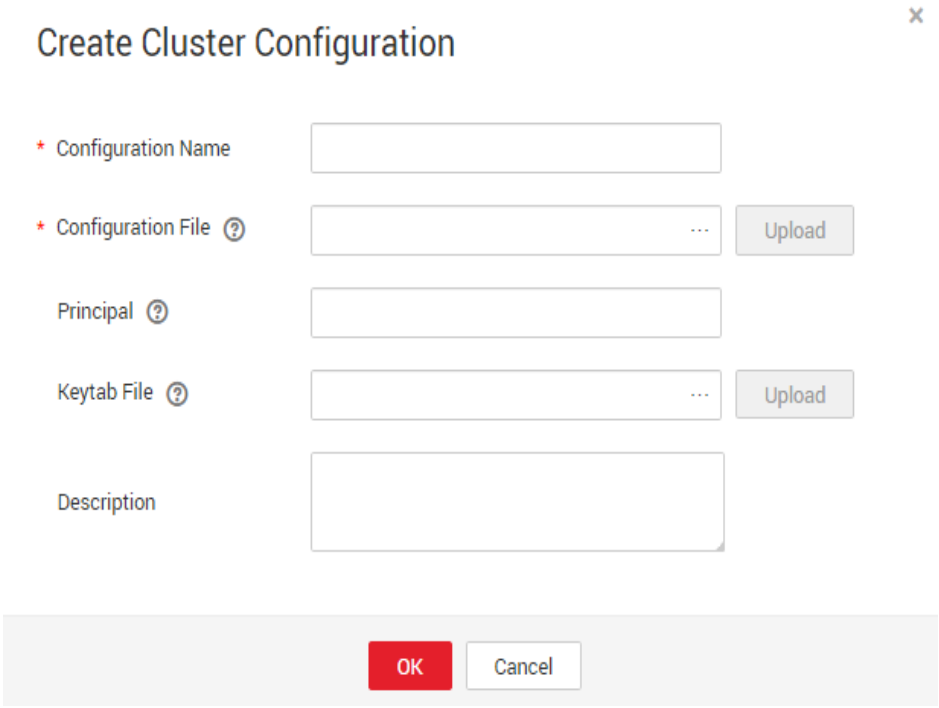
- A cluster configuration file contains the configuration parameters of the cluster. If the cluster configuration parameters are modified, you need to obtain the configuration file again.
- The keytab file is the authentication credential file. Before obtaining the keytab file, you need to change the password of this user at least once in the cluster. Otherwise, the downloaded keytab file may be unavailable. After a user password is changed, the exported keytab file becomes invalid, and you need to export a keytab file again.
- The keytab file is used only in a cluster in security mode. In other cases, you do not need to prepare the keytab file.

Procedure

1. On the CDM console, choose **Cluster Management** in the left navigation pane. Locate the row that contains a cluster and choose **Job Management** > **Links** > **Cluster Configurations**.
2. On the **Cluster Configurations** page, click **Create Cluster Configuration** and set the parameters as prompt.

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Figure 5-28 Creating cluster configurations

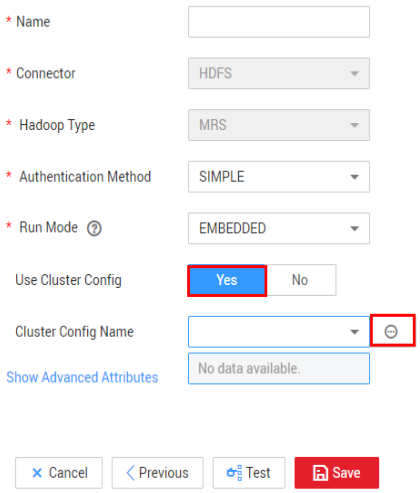


- **Configuration Name**: Enter a cluster configuration name that is easy to remember and distinguish based on the type of the data source to be connected.
- **Configuration File**: Click **Select File** to select a local cluster configuration file, and then click **Upload** on the right to upload the file.
- **Principal**: This parameter is required only for clusters in security mode. Principal is the username in Kerberos security mode and must be the same as that in the keytab file.
- **Keytab File**: Upload the keytab file only for clusters in security mode. Click **Select File** to select a local keytab file, and then click **Upload** on the right to upload the file.
- **Description**: Add a description to identify and distinguish the cluster configuration.

3. Click **OK**. When creating a Hadoop link, set **Authentication Method** as required, **Use Cluster Config** to **Yes**, and then select the corresponding cluster configuration name to quickly create a Hadoop link.

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Figure 5-29 Use Cluster Config



5.6 Creating a Job in a CDM Cluster

5.6.1 Table/File Migration Jobs

Scenario

CDM supports table and file migration between homogeneous or heterogeneous data sources. For details about supported data sources, see **Supported Data Sources**.

Constraints

- The dirty data recording function depends on OBS.
- The JSON file of a job to be imported cannot exceed 1 MB.
- The size of a file to be transferred cannot exceed 1 TB.
- Field names of the source and destination parameters cannot contain ampersands (&) or number signs (%).

Prerequisites

- A link has been created. For details, see **Creating a Link Between CDM and a Data Source**.
- The CDM cluster can communicate with the data source.

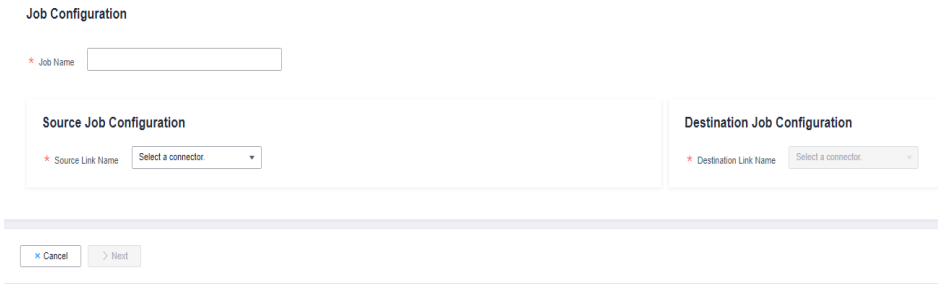
Procedure

Step 1 Log in to the management console and choose **Service List** > **Cloud Data Migration**. In the left navigation pane, choose **Cluster Management**. Locate the target cluster and click **Job Management**.

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Step 2 Choose **Table/File Migration** > **Create Job**. The page for configuring the job is displayed.

Figure 5-30 Creating a migration job

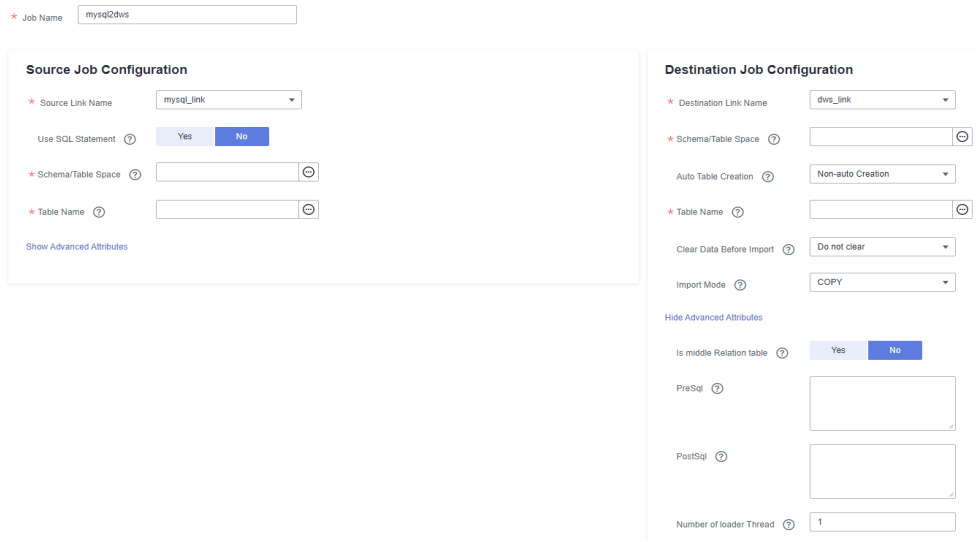


Step 3 Select the source and destination links.

- **Job Name**: Enter a string consisting of 1 to 240 characters. The name can contain digits, letters, hyphens (-), underscores (_), and periods (.), and cannot start with a hyphen (-) or period (.). An example value is **oracle2rds_t**.
- **Source Link Name**: Select the data source from which data will be exported.
- **Destination Link Name**: Select the data source to which data will be imported.

Step 4 Configure the source link parameters. **Figure 5-31** shows the job configurations for migrating MySQL to DWS.

Figure 5-31 Creating a job



The parameters vary with data sources. For details about the job parameters of other types of data sources, see **Table 5-59** and **Table 5-60**.

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Table 5-59 Source link parameter description

Migration Source	Description	Parameter Settings
OBS	Data can be extracted in CSV, JSON, or binary format. Data extracted in binary format is free from file resolution, which ensures high performance and is more suitable for file migration.	For details, see **From OBS**.
• MRS HDFS • FusionInsight HDFS • Apache HDFS	HDFS data can be exported in CSV, Parquet, or binary format and can be compressed in multiple formats.	For details, see **From HDFS**.
• MRS HBase • FusionInsight HBase • Apache HBase • CloudTable Service	Data can be exported from MRS, FusionInsight HD, open source Apache Hadoop HBase, or CloudTable. You need to know all column families and field names of HBase tables.	For details, see **From HBase/CloudTable**.
• MRS Hive • FusionInsight Hive • Apache Hive	Data can be exported from Hive through the JDBC API. If the data source is Hive, CDM will automatically partition data using the Hive data partitioning file.	For details, see **From Hive**.
DLI	Data can be exported from DLI.	For details, see **From DLI**.
• FTP • SFTP	FTP and SFTP data can be exported in CSV, JSON, or binary format.	For details, see **From FTP/SFTP**.

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Migration Source	Description	Parameter Settings
• HTTP	These connectors are used to read files with an HTTP/HTTPS URL, such as reading public files on the third-party object storage system and web disks. Currently, data can only be exported from the HTTP URLs.	For details, see **From HTTP**.
Data Warehouse Service	Data can be exported from DWS.	For details, see **From DWS**.
SAP HANA	Data can be exported from SAP HANA.	For details, see **From SAP HANA**.
• RDS for PostgreSQL • RDS for SQL Server • Microsoft SQL Server • PostgreSQL	Data can be exported from the cloud database services. The non-cloud databases can be those created in the on-premises data center or deployed on ECSs, or database services on the third-party clouds.	When data is exported from these data sources, CDM uses the JDBC API to extract data. The job parameters for the migration source are the same. For details, see **From PostgreSQL/SQL Server**.
MySQL	Data can be exported from a MySQL database.	For details, see **From MySQL**.
Oracle	Data can be exported from an Oracle database.	For details, see **From Oracle**.
Database Sharding	Data can be exported from a shard.	For details, see **From a Database Shard**.
• MongoDB • Document Database Service	Data can be exported from MongoDB or DDS. **NOTE** MongoDB and DDS data sources with SSL enabled are not supported.	For details, see **From MongoDB/DDS**.
Redis	Data can be exported from open source Redis.	For details, see **From Redis**.

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Migration Source	Description	Parameter Settings
• Apache Kafka • DMS Kafka • MRS Kafka	Data can only be exported to Cloud Search Service (CSS).	For details, see **From Kafka/DMS Kafka**.
• Cloud Search Service • Elasticsearch	Data can be exported from CSS or Elasticsearch.	For details, see **From Elasticsearch or CSS**.
MRS Hudi	Data can be exported from MRS Hudi.	For details, see **From MRS Hudi**.
MRS ClickHouse	Data can be exported from MRS ClickHouse.	For details, see **From MRS ClickHouse**.
LogHub (SLS)	Data can be exported from LogHub (SLS).	For details, see **From LogHub (SLS)**.
ShenTong database	Data can be exported from a ShenTong database.	For details, see **From a ShenTong Database**.
Dameng database	Data can be exported from a Dameng database.	For details, see **From a Dameng Database**.

Step 5 Configure job parameters for the migration destination based on **Table 5-60**.

Table 5-60 Parameter description

Migration Destination	Description	Parameter Settings
OBS	Files (even in a large volume) can be batch migrated to OBS in CSV or binary format.	For details, see **To OBS**.
MRS HDFS	You can select a compression format when importing data to HDFS.	For details, see **To HDFS**.
MRS HBase CloudTable Service	Data can be imported to HBase. The compression algorithm can be set when a new HBase table is created.	For details, see **To HBase/ CloudTable**.
MRS Hive	Data can be rapidly imported to MRS Hive.	For details, see **To Hive**.

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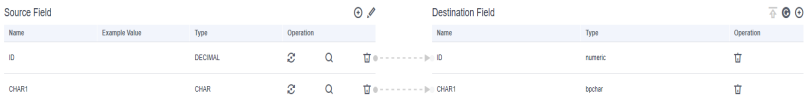
Migration Destination	Description	Parameter Settings
• MySQL • SQL Server • PostgreSQL	Data can be imported to cloud database services.	For details about how to use the JDBC API to import data, see **To MySQL/SQL Server/ PostgreSQL**.
DWS	Data can be imported to DWS.	For details, see **To DWS**.
Oracle	Data can be imported to an Oracle database.	For details, see **To Oracle**.
DLI	Data can be imported to DLI.	For details, see **To DLI**.
Elasticsearchor Cloud Search Service (CSS)	Data can be imported to CSS.	For details, see **To Elasticsearch/CSS**.
MRS Hudi	Data can be rapidly imported to MRS Hudi.	For details, see **To MRS Hudi**.
MRS ClickHouse	Data can be rapidly imported to MRS ClickHouse.	For details, see **To MRS ClickHouse**.
MongoDB	Data can be rapidly imported to MongoDB. **NOTE** MongoDB data sources with SSL enabled are not supported.	For details, see **To MongoDB**.

Step 6 After the parameters are configured, click **Next**. The **Map Field** tab page is displayed.

If files are migrated between FTP, SFTP, OBS, and HDFS and the migration source's **File Format** is set to **Binary**, files will be directly transferred, free from field mapping.

In other scenarios, CDM automatically maps fields of the source table and the destination table. You need to check whether the mapping and time format are correct. For example, check whether the source field type can be converted into the destination field type.

Figure 5-32 Field mapping



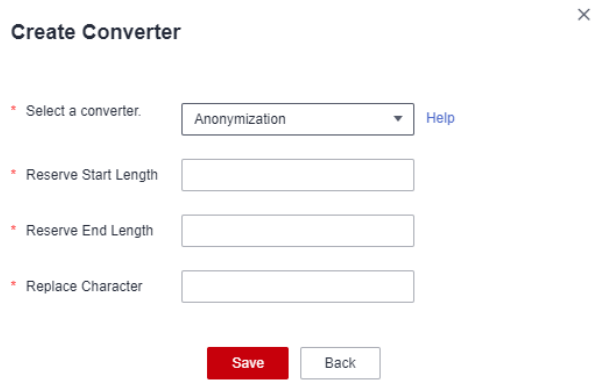
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NOTE

- If the fields from the source and destination do not match, you can drag the fields to make adjustments.
- On the **Map Field** tab page, if CDM fails to obtain all columns by obtaining sample values (for example, when data is exported from HBase, CloudTable, or MongoDB, or when data is migrated from SFTP/FTP to DLI, there is a high probability that CDM failed to obtain all columns), you can click and select **Add a new field** to add new fields to ensure that the data imported to the migration destination is complete.
- When a relational database, Hive, DLI, or MRS Hudi is used as the migration source, sample values cannot be obtained.
- On the **Map Field** page, you can click to add custom constants, variables, and expressions.
- Column names are displayed when the source of the migration job is OBS, CSV files are to be migrated, and parameter **Extract first row as columns** is set to **Yes**.
- When SQLServer is the destination, fields of the timestamp type cannot be written. You must change their type (for example, to datatime) so that they can be written.
- When Hive serves as the source, data of the array and map types can be read.
- Field mapping is not involved when the binary format is used to migrate files to files.
- If the data is imported to DWS, you need to select the distribution columns in the destination fields. You are advised to select the distribution columns according to the following principles:
  1. Use the primary key as the distribution column.
  2. If multiple data segments are combined as primary keys, specify all primary keys as the distribution column.
  3. In the scenario where no primary key is available, if no distribution column is selected, DWS uses the first column as the distribution column by default. As a result, data skew risks exist.

Step 7 CDM supports field conversion. Click and then click **Create Converter**.

Figure 5-33 Creating a converter



CDM supports the following converters:

- **Anonymization**: hides key data in the character string.

  For example, if you want to convert **12345678910** to **123****8910**, configure the parameters as follows:

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  - Set **Reserve Start Length** to **3**.
  - Set **Reserve End Length** to **4**.
  - Set **Replace Character** to *****.
- **Trim** automatically deletes the spaces before and after the character string.
- **Reverse string** automatically reverses a character string. For example, reverse **ABC** into **CBA**.
- **Replace string** replaces the specified character string.
- **Expression conversion** uses the JSP expression language (EL) to convert the current field or a row of data. For details, see **Field Conversion**.
- **Remove line break** deletes the newline characters, such as \n, \r, and \r\n from the field.

NOTE

If **Use SQL Statement** is set to **Yes** in the source job configuration, converters cannot be created.

Step 8 Click **Next**, set job parameters, and click **Show Advanced Attributes** to display and configure optional parameters.

Figure 5-34 Task parameters

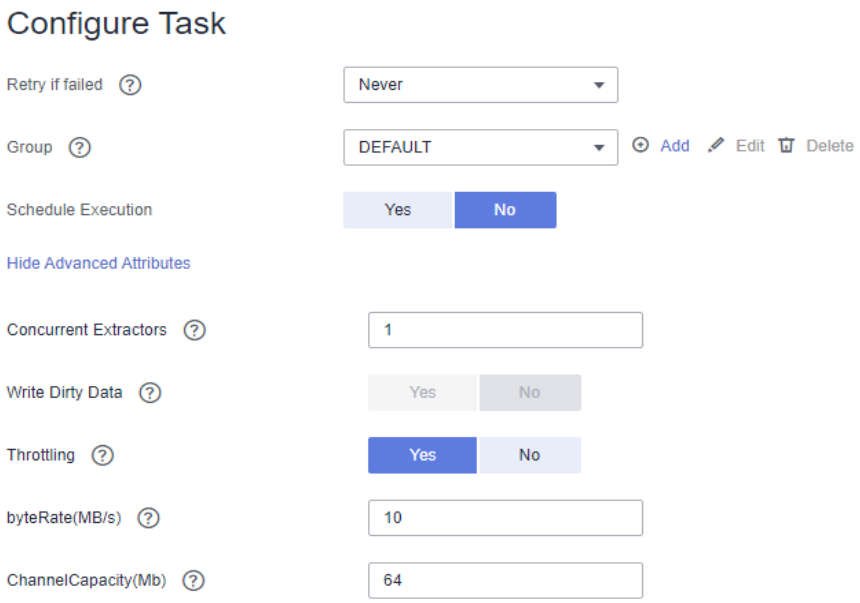


Table 5-61 describes related parameters.

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Table 5-61 Parameter description

Parameter	Description	Example Value
Retry upon Failure	You can select **Retry 3 times** or **Never**. You are advised to configure automatic retry for only file migration jobs or database migration jobs with **Import to Staging Table** enabled to avoid data inconsistency caused by repeated data writes. **NOTE** If you want to set parameters in DataArts Studio DataArts Factory to schedule the CDM migration job, do not configure this parameter. Instead, set parameter **Retry upon Failure** for the CDM node in DataArts Factory.	Never
Job	Select a group where the job resides. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.	DEFAULT
Schedule Execution	If you select **Yes**, you can set the start time, cycle, and validity period of a job. For details, see **Configuring a Scheduled CDM Job**. **NOTE** If you use DataArts Studio DataArts Factory to schedule the CDM migration job and configure this parameter, both configurations take effect. To ensure unified service logic and avoid scheduling conflicts, enable job scheduling in DataArts Factory and do not configure a scheduled task for the job in DataArts Migration.	No

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Parameter	Description	Example Value
Concurrent Extractors	Maximum number of threads of the job for reading data from the source **NOTE** The number of concurrent threads may be less than or equal to the value of this parameter for some data sources that do not support concurrent extraction, for example, CSS and ClickHouse. CDM migrates data through data migration jobs. It works in the following way: 1. When data migration jobs are submitted, CDM splits each job into multiple tasks based on the **Concurrent Extractors** parameter in the job configuration. **NOTE** Jobs for different data sources may be split based on different dimensions. Some jobs may not be split based on the **Concurrent Extractors** parameter. 2. CDM submits the tasks to the running pool in sequence. Tasks (defined by **Maximum Concurrent Extractors**) run concurrently. Excess tasks are queued. By setting appropriate values for this parameter and the **Maximum Concurrent Extractors** parameter, you can accelerate migration. Configure the number of concurrent extractors based on the following rules: 1. When data is to be migrated to files, CDM does not support multiple concurrent tasks. In this case, set a single process to extract data.	1

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Parameter	Description	Example Value
	2. If each row of the table contains less than or equal to 1 MB data, data can be extracted concurrently. If each row contains more than 1 MB data, it is recommended that data be extracted in a single thread. 3. Set **Concurrent Extractors** for a job based on **Maximum Concurrent Extractors** for the cluster. It is recommended that **Concurrent Extractors** is less than **Maximum Concurrent Extractors**. 4. If the destination is DLI, you are advised to set the number of concurrent extractors to 1. Otherwise, data may fail to be written. The maximum number of concurrent extractors for a cluster varies depending on the CDM cluster flavor. You are advised to set the maximum number of concurrent extractors to twice the number of vCPUs of the CDM cluster. For example, the maximum number of concurrent extractors for a cluster with 8 vCPUs and 16 GB memory is 16.	
Concurrent Loaders	Number of Loaders to be concurrently executed This parameter is displayed only when HBase or Hive serves as the destination data source.	3
Number of split retries	Number of retries when a split fails to be executed. Value **0** indicates that no retry will be performed.	0

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Parameter	Description	Example Value
Write Dirty Data	Whether to record dirty data. By default, this parameter is set to **No**. Dirty data in CDM refers to the data in invalid format. If the source data contains dirty data, you are advised to enable this function. Otherwise, the migration job may fail. **NOTE** Dirty data can only be written to OBS paths. Therefore, this parameter is available only when an OBS link is available.	Yes
Write Dirty Data Link	This parameter is displayed only when **Write Dirty Data** is set to **Yes**. You can only select an OBS link.	obs_link
OBS Bucket	This parameter is displayed only when **Write Dirty Data Link** is a link to OBS. Name of the OBS bucket to which the dirty data will be written.	dirtydata
Dirty Data Directory	This parameter is displayed only when **Write Dirty Data** is set to **Yes**. Dirty data is stored in the directory for storing dirty data on OBS. Dirty data is saved only when this parameter is configured. You can go to this directory to query data that fails to be processed or is filtered out during job execution, and check the source data that does not meet conversion or cleaning rules.	/user/dirtydir

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Parameter	Description	Example Value
Max. Error Records in a Single Shard	This parameter is displayed only when **Write Dirty Data** is set to **Yes**. When the number of error records of a single map exceeds the upper limit, the job will automatically terminate and the imported data cannot be rolled back. You are advised to use a temporary table as the destination table. After the data is imported, rename the table or combine it into the final data table.	0
Throttling	Enabling throttling reduces the read pressure on the source. It controls the CDM transmission rate, not the NIC traffic. **NOTE** • Throttling can be enabled for non-binary file migration jobs. • To configure throttling for multiple jobs, multiply the rate by the number of concurrent jobs. • Throttling is not supported for binary transmission between files.	Yes
byteRate(MB/s)	Maximum read/write speed of the job Throttling can be enabled for a job for migrating data to Hive, DLI, JDBC, OBS, or HDFS. If multiple concurrent jobs are allowed, the actual maximum speed can be calculated by the value of this parameter multiplied by the number of concurrent jobs. **NOTE** The rate is an integer greater than 1.	20

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Parameter	Description	Example Value
Intermediate Queue Cache Size (MB)	Amount of data that the intermediate queue can cache. The value ranges from 1 to 500. The default value is **64**. If the amount of data of a row exceeds the value of this parameter, the migration may fail. If the value of this parameter is too large, the cluster may not run properly. Set an appropriate value for this parameter and use the default value (**64**) unless otherwise specified.	64

Step 9 Click **Save** or **Save and Run**. On the displayed page, you can view the job status.

NOTE

The job status can be **New**, **Pending**, **Booting**, **Running**, **Failed**, **Succeeded**, or **Stopped**.

Pending indicates that the job is waiting to be scheduled by the system, and **Booting** indicates that the data to be migrated is being analyzed.

----End

5.6.2 Creating an Entire Database Migration Job

Scenario

CDM supports entire DB migration between homogeneous and heterogeneous data sources. The migration principles are the same as those in **Table/File Migration Jobs**. Each type of Elasticsearch, each key prefix of Redis, or each collection of MongoDB can be executed concurrently as a subtask.

NOTE

Each time an entire DB migration job is executed, its subtasks are recreated based on the configuration of the migration job. You cannot modify the subtasks and then run the migration job again.

Supported Data Sources lists the data sources supporting entire database migration.

Constraints

Field names of the source and destination parameters cannot contain ampersands (&) or number signs (%).

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Prerequisites

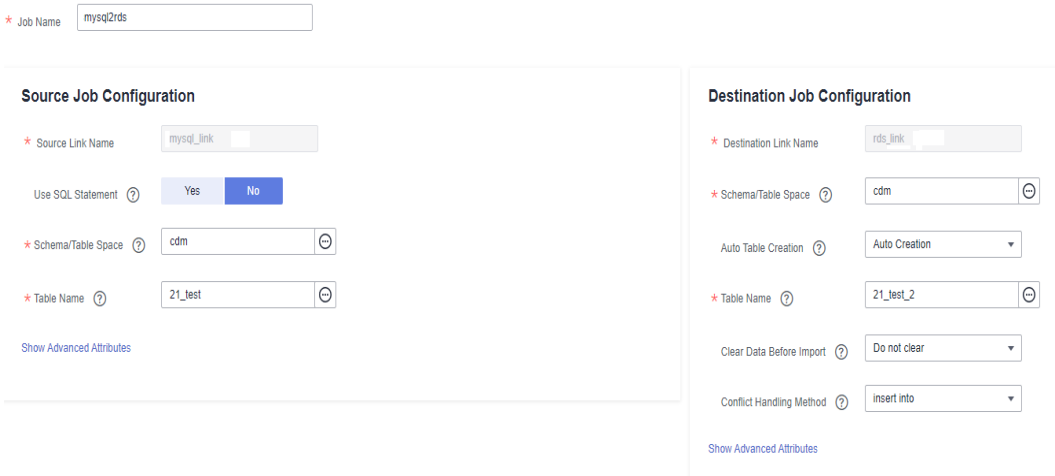
- A link has been created. For details, see **Creating a Link Between CDM and a Data Source**.
- The CDM cluster can communicate with the data source.

Procedure

Step 1 Log in to the management console and choose **Service List** > **Cloud Data Migration**. In the left navigation pane, choose **Cluster Management**. Locate the target cluster and click **Job Management**.

Step 2 Choose **Entire DB Migration** > **Create Job**. The page for configuring the job is displayed.

Figure 5-35 Creating an entire DB migration job



Step 3 Configure the related parameters of the source database according to **Table 5-62**.

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Table 5-62 Parameter description

Source Database	Parameter	Description	Example Value
• DWS • MySQL • PostgreSQL • SQL Server • Oracle • SAP HANA	Schema/ Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata.	schema
	WHERE Clause	WHERE clause used to specify the tables to be extracted. This parameter applies to all subtables in the entire DB migration. If this parameter is not set, the entire table is extracted. If the table to be migrated does not contain the fields specified by the WHERE clause, the migration will fail. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**.	age > 18 and age <= 60
	Null in Partition Column	Whether a partition field can be null	Yes

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Source Database	Parameter	Description	Example Value
Hive	Database Name	Name of the database to be migrated. The user configured in the source link must have the permission to read the database.	hivedb
HBase CloudTable	Start Time	Start time (included). The format is *yyyy-MM-dd hh:mm:ss*. The dateformat time macro variable function is supported. Examples: **2017-12-31 20:00:00**, **${dateformat(yyyy-MM-dd, -1, DAY)} 02:00:00**, and **${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}**	"2017-12-31 20:00:00"
	End Time	End time (excluded) The format is *yyyy-MM-dd hh:mm:ss*. The dateformat time macro variable function is supported. Examples: **2018-01-01 20:00:00**, **${dateformat(yyyy-MM-dd, -1, DAY)} 02:00:00**, and **${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}**	"2018-01-01 20:00:00"
Redis	Key Filter Character	Filter character used to determine the keys to be migrated For example, if the value of this parameter is **a***, all asterisks (*) will be migrated.	a*

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Source Database	Parameter	Description	Example Value
DDS	Database Name	Name of the database from which data is to be migrated. The user configured in the source link must have the permission to read the database.	ddsdb
	Query Filter	Filter used to match documents. Example: **{HTTPStatusCode:{$gt:"400",$lt:"500"},HTTPMethod:"GET"}**	-

Step 4 Configure the related parameters, from **Table 5-63**, for the destination cloud service.

Table 5-63 Destination job parameters

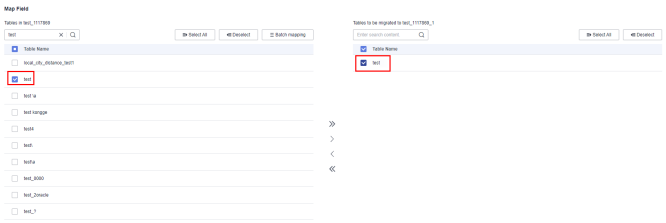
Destination Database	Parameter	Description	Example Value
• RDS for MySQL • RDS for PostgreSQL • RDS for SQL Server	-	For details about the destination job parameters required for entire DB migration to an RDS database, see **To MySQL/SQL Server/PostgreSQL**.	schema
DWS	-	For details about the destination job parameters required for entire DB migration to DWS, see **To DWS**.	-
MRS Hive	-	For details about the destination job parameters required for entire DB migration to MRS HIVE, see **To Hive**.	hivedb
MRS HBase CloudTable	-	For details about the destination job parameters required for entire DB migration to MRS HBase or CloudTable, see **To HBase/CloudTable**.	Yes
Redis	Clear Database	Clears the database data before data import.	Yes

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Destination Database	Parameter	Description	Example Value
DDS	Database Name	Name of the database from which data is to be migrated. The user configured in the source link must have the permission to read the database.	mongodb
	Migration Behavior	Select **Add** or **Replace**.	-

Step 5 If you are migrating an entire relational database, click **Next** after configuring job parameters to select source and destination tables. Ensure that the destination table names are the same as the source table names. For example, if the source table name is **test**, the destination table name must also be **test**.

Figure 5-36 Field mapping



Step 6 Click **Next** and set job parameters.

Figure 5-37 Task parameters

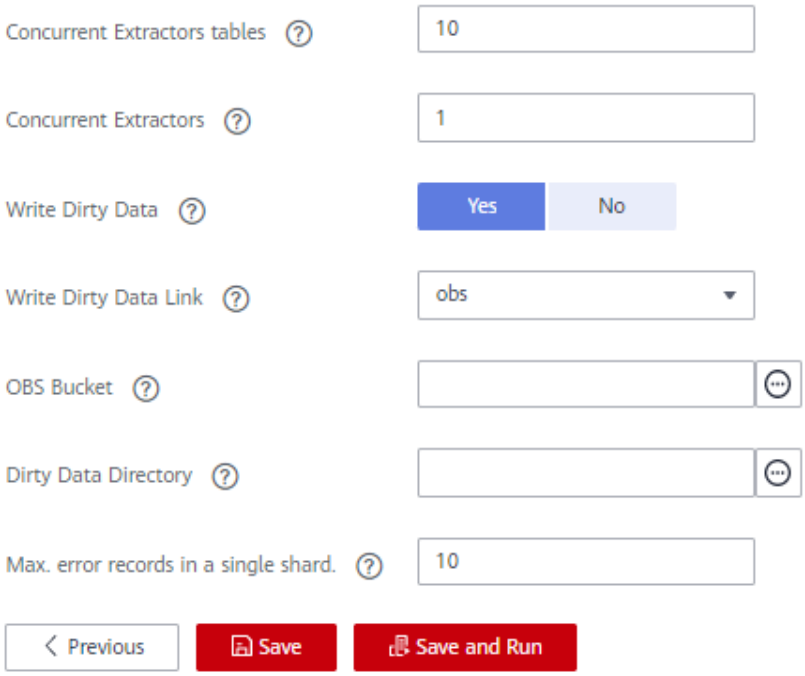


Table 5-64 describes related parameters.

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Table 5-64 Task configuration parameters

Parameter	Description	Example Value
Concurrent Tables	Number of tables to be concurrently executed	3
Concurrent Extractors	Maximum number of threads of the job for reading data from the source **NOTE** The number of concurrent threads may be less than or equal to the value of this parameter for some data sources that do not support concurrent extraction, for example, CSS and ClickHouse.	1
Write Dirty Data	Whether to record dirty data. By default, this parameter is set to **No**.	Yes
Write Dirty Data Link	This parameter is only displayed when **Write Dirty Data** is set to **Yes**. Only links to OBS support dirty data writes.	obs_link
OBS Bucket	This parameter is only displayed when **Write Dirty Data Link** is a link to OBS. Name of the OBS bucket to which the dirty data will be written.	dirtydata
Dirty Data Directory	This parameter is only displayed when **Write Dirty Data** is set to **Yes**. Directory for storing dirty data on OBS. Dirty data is saved only when this parameter is configured. You can go to this directory to query data that fails to be processed or is filtered out during job execution, and check the source data that does not meet conversion or cleaning rules.	/user/dirtydir
Max. Error Records in a Single Shard	This parameter is only displayed when **Write Dirty Data** is set to **Yes**. When the number of error records of a single map exceeds the upper limit, the job will automatically terminate and the imported data cannot be rolled back. You are advised to use a temporary table as the destination table. After the data is imported, rename the table or combine it into the final data table.	0

Step 7 Click **Save** or **Save and Run**.

When the job starts running, a sub-job will be generated for each table. You can click the job name to view the sub-job list.

----End

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NOTE

During the migration of an entire Oracle database to Hudi, if you select a view or a table that has no primary key at the source, automatic table creation is not supported.

5.6.3 Configuring CDM Source Job Parameters

5.6.3.1 From OBS

If the source link of a job is an **OBS link**, configure the source job parameters based on **Table 5-65**.

Advanced attributes are optional and not displayed by default. You can click **Show Advanced Attributes** to display them.

Table 5-65 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Bucket Name	Name of the bucket from which data will be migrated	BUCKET_2

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Category	Parameter	Description	Example Value
	Source Directory/File	This parameter is available only when **Pull List File** is set to **No**. Directory or file path from which data will be extracted. You can enter a maximum of 50 file paths. By default, the file paths are separated by vertical bars (|). You can also customize a file separator. For details, see **Migration of a List of Files**. Directory from which data is to be migrated. All files (including all nested subdirectories and their subfiles) in the directory will be migrated. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	FROM/example.csv
	File Format	Format in which CDM parses data. The options are as follows: • **CSV**: Source files will be migrated to tables after being converted to CSV format. • **Binary**: Files (even not in binary format) will be transferred directly. It is used for file copy. • **JSON**: Source files will be migrated to tables after being converted to JSON format.	CSV

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Category	Parameter	Description	Example Value
	Pull List File	This parameter is displayed only when **File Format** is set to **Binary**. If the pull list file function is enabled, the content of a file (such as a .txt file) in an OBS bucket can be read as the list of files to be migrated. The content in the file must be the absolute path of the file to be migrated (rather than a directory). For example, the content is as follows: /052101/DAY20211110.data /052101/DAY20211111.data	Yes
	OBS Link of List File	This parameter is available only when **Pull List File** is set to **Yes**. You can select the OBS link where the list file is located.	OBS_test_link
	OBS Bucket of entries files	This parameter is available only when **Pull List File** is set to **Yes**. It indicates the name of the OBS bucket where the list file is located.	01
	Path/ Directory of entries files	This parameter is available only when **Pull List File** is set to **Yes**. It indicates the absolute path or directory of the list file in the OBS bucket. You are advised to select the absolute path of the file. If you select a directory, files in subdirectories can also be migrated. However, if the number of files in the directory is too large, the cluster memory may become insufficient.	/0521/ Lists.txt
	JSON Type	This parameter is displayed only when **File Format** is set to **JSON**. Type of a JSON object stored in a JSON file. The options are **JSON object** and **JSON array**.	JSON object
	JSON Reference Node	This parameter is used only when **File Format** is set to **JSON** and **JSON Type** is set to **JSON Object**. CDM parses the data under the JSON node. If the node's corresponding data is a JSON array, the system will extract data from the array in the same pattern. Use periods (.) to separate multi-layer nested JSON nodes.	data.list

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Category	Parameter	Description	Example Value
Advanced attributes	Line Separator	Lind feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. This parameter is displayed only when **File Format** is set to **CSV**.	\n
	Field Delimiter	Character used to separate fields in the file. To set the **Tab** key as the delimiter, set this parameter to **\t**. This parameter is displayed only when **File Format** is set to **CSV**.	,
	Use Quote Character	If you set this parameter to **Yes**, the field delimiters in the encircling symbol are regarded as a part of the string value. Currently, the default encircling symbol of CDM is **"**.	No
	Using Escape Char	If you select **Yes**, the backslash (\) in the data row is used as an escape character. If you select **No**, the backslash (\) in the CSV file will not be escaped. CSV supports only the backslash (\) as the escape character.	Yes
	Use RE to Separate Fields	Whether to use regular expressions to separate fields. If you set this parameter to **Yes**, **Field Delimiter** becomes invalid. This parameter is displayed only when **File Format** is set to **CSV**.	Yes
	Regular Expression	Regular expression used to separate fields. For details about regular expressions, see **Regular Expressions for Separating Semi-structured Text**.	^(\d.*\d) (\w*) \[(.*) \] ([\w\.]*) (\w.*).*
	Use First N Rows as Header	This parameter is displayed only when **File Format** is set to **CSV**. When you migrate a CSV file to a table, CDM writes all data to the table by default. If you set this parameter to **Yes**, CDM uses the first N rows of the CSV file as the heading row and does not write the row to the destination table.	No

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Category	Parameter	Description	Example Value
	The Number of Header Rows	This parameter is available when **Use First N Rows as Header** is set to **Yes**. It specifies the number of header rows to be skipped during data extraction. **NOTE** The number of header rows cannot be empty. The value is an integer from 1 to 99.	1
	Extract first row as columns	This parameter is available when **Use First N Rows as Header** is set to **Yes**. It specifies whether to parse the first row of the header as a column name. The column name is displayed in the source field during field mapping configuration. **NOTE** • If the number of header rows is greater than 1, only the first row of the header can be parsed as the column name. • The column name cannot contain the ampersand (&). Otherwise, the job migration fails. If the column name contains the ampersand (&), you must change it in the CSV file to ensure successful migration.	Yes
	Encoding Type	Encoding type, for example, **UTF-8** or **GBK**. You can set the encoding type for text files only. This parameter is invalid when **File Format** is set to **Binary**.	GBK
	Compression Format	The options are as follows: • **NONE**: Files in all formats can be transferred. • **GZIP**: Only files in gzip format can be transferred. • **ZIP**: Only files in Zip format can be transferred. • **TAR.GZ**: Files in TAR.GZ format are transferred.	NONE

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Category	Parameter	Description	Example Value
	Compressed File Suffix	This parameter is displayed when **Compression Format** is not **NONE**. This parameter specifies the extension of the files to be decompressed. The decompression operation is performed only when the file name extension is used in a batch of files. Otherwise, files are transferred in the original format. If you enter ***** or leave the parameter blank, all files are decompressed.	*
	Start Job by Marker File	Whether to start a job by a marker file. A job is only started if there is a marker file for starting the job in the source path. If there is no marker file, the job will be suspended for a period of time specified by **Suspension Period**.	No
	Marker File	Name of the marker file for starting a job. If you specify a marker file, the migration job is executed only when the marker file exists in the source path. The marker file will not be migrated.	ok.txt
	Suspension Period	Waiting period for a marker file. If you set **Start Job by Marker File** to **Yes** but there is no marker file in the source path, the job fails when the suspension period times out. If you set this parameter to **0** and there is no marker file in the source path, the job will fail immediately. Unit: second	10
	File Separator	File separator. If you enter multiple file paths in **Source Directory/Files**, CDM uses the file separator to identify files. The default value is **|**.	|
	Filter Type	Only paths or files that meet the filtering conditions are transferred. The options are **None**, **Wildcard**, and **Regex**. For details, see **Incremental File Migration**.	Wildcard

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Category	Parameter	Description	Example Value
	Directory Filter	If you set **Filter Type** to **Wildcard** or **Regex**, enter a wildcard character to filter paths. The paths that meet the filtering condition are migrated. You can configure multiple paths separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*input
	File Filter	If you set **Filter Type** to **Wildcard** or **Regex**, you can enter a wildcard character to search for files in a specified path. The files that meet the search criteria are migrated. You can configure multiple files separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*.csv,*.txt
	Time Filter	If you select **Yes**, files are transferred based on their modification time.	Yes

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Category	Parameter	Description	Example Value
	Minimum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified at or after the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss,-90,DAY))}** indicates that only files generated within the latest 90 days are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-06-01 00:00:00
	Maximum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified before the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss))}** indicates that only the files whose modification time is earlier than the current time are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-07-01 00:00:00
	Disregard Non-existent Path or File	If this is set to **Yes**, the job can be successfully executed even if the source path does not exist.	No

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Category	Parameter	Description	Example Value
	MD5 File Extension	This parameter is displayed only when **File Format** is set to **Binary**. This parameter is used to check whether the files extracted by CDM are consistent with source files. For details, see **MD5 Verification**.	.md5

NOTE

1. CDM supports incremental file migration (by skipping repeated files), but does not support resumable transfer.

   For example, if three files are to be migrated and the second file fails to be migrated due to the network fault. When the migration task is started again, the first file is skipped. The second file, however, cannot be migrated from the point where the fault occurs, but can only be migrated again.
2. During file migration, a single task supports millions of files. If there are too many files in the directory to be migrated, you are advised to split the files into different directories and create multiple tasks.

5.6.3.2 From HDFS

If the source link of a job is an **HDFS link**, that is, if data is exported from MRS HDFS, FusionInsight HDFS, or Apache HDFS, configure the source job parameters based on **Table 5-66**.

Table 5-66 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Source Link Name	Select a type from the drop-down list box.	hdfs_to_cdm

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Category	Parameter	Description	Example Value
	Source Directory/ File	This parameter is available only when **Pull List File** is set to **No**. Directory or file path from which data will be extracted. Directory from which data is to be migrated. All files (including all nested subdirectories and their subfiles) in the directory will be migrated. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	/user/cdm/
	File Format	File format used when transferring data. The options are as follows: • **CSV**: Source files will be migrated to tables after being converted to CSV format. • **Binary**: Files (even not in binary format) will be transferred directly. It is used for file copy. • **Parquet**: Source files will be migrated to tables after being converted to Parquet format.	CSV

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Category	Parameter	Description	Example Value
	Pull List File	This parameter is displayed only when **File Format** is set to **Binary**. If the pull list file function is enabled, the content of a file (such as a .txt file) in an OBS bucket can be read as the list of files to be migrated. The content in the file must be the absolute path of the file to be migrated (rather than a directory). The following is example content: /mrs/job-properties/application_1634891604621_0014/job.properties /mrs/job-properties/application_1634891604621_0029/job.properties	Yes
	OBS Link of List File	This parameter is available only when **Pull List File** is set to **Yes**. You can select the OBS link where the list file is located.	OBS_test_link
	OBS Bucket of entries files	This parameter is available only when **Pull List File** is set to **Yes**. It indicates the name of the OBS bucket where the list file is located.	01
	Path/Directory of entries files	This parameter is available only when **Pull List File** is set to **Yes**. It indicates the absolute path or directory of the list file in the OBS bucket.	/0521/Lists.txt
Advanced attributes	Line Separator	Lind feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. This parameter is displayed only when **File Format** is set to **CSV**.	\n
	Field Delimiter	Character used to separate fields in the file. To set the **Tab** key as the delimiter, set this parameter to **\t**. This parameter is displayed only when **File Format** is set to **CSV**.	,

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Category	Parameter	Description	Example Value
	Use First Row as Header	This parameter is displayed only when **File Format** is set to **CSV**. When you migrate a CSV file to a table, CDM writes all data to the table by default. If you set this parameter to **Yes**, CDM uses the first N rows of the CSV file as the heading row and does not write the row to the destination table.	No
	Encoding Type	Encoding type, for example, **UTF-8** or **GBK**. You can set the encoding type for text files only. This parameter is invalid when **File Format** is set to **Binary**.	GBK
	Start Job by Marker File	Whether to start a job by a marker file. A job is only started if there is a marker file for starting the job in the source path. If there is no marker file, the job will be suspended for a period of time specified by **Suspension Period**.	ok.txt
	Filter Type	Only paths or files that meet the filtering conditions are transferred. The options are **None**, **Wildcard**, and **Regex**. For details, see **Incremental File Migration**.	-

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Category	Parameter	Description	Example Value
	Directory Filter	If you set **Filter Type** to **Wildcard** or **Regex**, enter a wildcard character to filter paths. The paths that meet the filtering condition are migrated. You can configure multiple paths separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*input
	File Filter	If you set **Filter Type** to **Wildcard** or **Regex**, you can enter a wildcard character to search for files in a specified path. The files that meet the search criteria are migrated. You can configure multiple files separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*.csv
	Time Filter	If you select **Yes**, files are transferred based on their modification time.	Yes

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Category	Parameter	Description	Example Value
	Minimum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified at or after the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss,-90,DAY))}** indicates that only files generated within the latest 90 days are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-07-01 00:00:00

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Category	Parameter	Description	Example Value
	Maximum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified before the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss))}** indicates that only the files whose modification time is earlier than the current time are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-07-30 00:00:00
	Create Snapshot	If you set this parameter to **Yes**, CDM creates a snapshot for the source directory to be migrated (the snapshot cannot be created for a single file) before it reads files from HDFS. Then CDM migrates the data in the snapshot. Only the HDFS administrator can create a snapshot. After the CDM job is completed, the snapshot is deleted.	No

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Category	Parameter	Description	Example Value
	Encryption	This parameter is displayed only when **File Format** is set to **Binary**. If the source data is encrypted, CDM can decrypt the data before exporting it. Select whether to decrypt the source data and select a decryption algorithm. The options are as follows: • **NONE**: Export data without decrypting it. • **AES-256-GCM**: The AES 256-bit encryption algorithm is used to encrypt data. Currently, only the AES-256-GCM (NoPadding) encryption algorithm is supported. This parameter is used for encryption at the migration destination and decryption at the migration source. For details, see **Encryption and Decryption During File Migration**.	AES-256-GCM
	DEK	This parameter is displayed only when **Encryption** is set to **AES-256-GCM**. The key consists of 64 hexadecimal numbers and must be the same as the **DEK** configured during encryption. If the encryption and decryption keys are inconsistent, the system does not report an exception, but the decrypted data is incorrect.	DD0AE00DFECD78BF051BCFDA25BD4E320DB0A7AC75A1F3FC3D3C56A457DCDC1B

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Category	Parameter	Description	Example Value
	IV	This parameter is displayed only when **Encryption** is set to **AES-256-GCM**. The initialization vector consists of 32 hexadecimal numbers and must be the same as the **IV** configured during encryption. If the encryption and decryption keys are inconsistent, the system does not report an exception, but the decrypted data is incorrect.	5C91687BA886EDCD12ACBC3FF19A3C3F
	MD5 File Extension	This parameter is displayed only when **File Format** is set to **Binary**. This parameter is used to check whether the files extracted by CDM are consistent with source files. For details, see **MD5 Verification**.	.md5

5.6.3.3 From HBase/CloudTable

If the source link of a job is an **HBase** or **CloudTable** link, that is, if data is exported from MRS HBase, FusionInsight HBase, CloudTable, or Apache HBase, configure the source job parameters based on **Table 5-67**.

NOTE

1. When you migrate data from CloudTable or HBase, CDM reads the first row of the table as an example of the field list. If the first row of data does not contain all fields of the table, you need to manually add fields.
2. Because HBase is schema-less, CDM cannot obtain the data types. If the data is stored in binary format, CDM cannot parse the data.
3. When data is exported from HBase or CloudTable, because HBase/CloudTable is schema-less storage systems, CDM requires that the source numeric fields be stored in regular decimal format rather than in binary format. For example, the value 100 needs to be stored as **100** rather than **01100100**.

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Table 5-67 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Table Name	Name of the HBase table that data will be exported from This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_2
	Column Families	(Optional) Column families to which the exported data belongs	CF1&CF2
Advanced attributes	Split Rowkey	(Optional) Whether to split a rowkey. The default value is **No**.	Yes
	Rowkey Delimiter	(Optional) Delimiter used to split a rowkey. If this parameter is left empty, the rowkey will not be split.	|

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Category	Parameter	Description	Example Value
	Start Time	(Optional) Start time (including the value) for extracting data. The format is *yyyy-MM-dd HH:mm:ss*. Only the data generated at the specified time and later is extracted. This parameter can be set to a macro variable of date and time. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-01-01 20:00:00
	End Time	(Optional) End time (excluding the value) for extracting data. The format is *yyyy-MM-dd HH:mm:ss*. Only the data generated before the time point is extracted. This parameter can be set to a macro variable of date and time. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-02-01 20:00:00

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5.6.3.4 From Hive

If the source link of a job is a **Hive link**, configure the source job parameters based on **Table 5-68**.

Table 5-68 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Database Name	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	default
	Table Name	Hive table name. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_E

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Category	Parameter	Description	Example Value
	Read Mode	Two read modes are available: HDFS and JDBC. By default, the HDFS mode is used. If you do not need to use the WHERE condition to filter data or add new fields on the field mapping page, select the HDFS mode. • The HDFS mode shows good performance, but in this mode, you cannot use the WHERE condition to filter data or add new fields on the field mapping page. • The HDFS mode allows you to use the WHERE condition to filter data or add new fields on the field mapping page. **NOTE** If the migration source is Hive and JDBC is used to read data, CDM does not support concurrency. That is, **Concurrent Extractors** can only be set to **1**.	HDFS
	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Category	Parameter	Description	Example Value

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		● SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		● With statements are not supported.
		● Comments, such as **--** and **/***, are not supported.
		● Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  ● load data
		  ● delete from
		  ● alter table
		  ● create table
		  ● drop table
		  ● into outfile
		● If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Category	Parameter	Description	Example Value
Advanced attributes	Partition Values	This parameter is displayed when you select the HDFS read mode and click **Show Advanced Attributes**. This parameter indicates extracting the partition of a specified value. The attribute name is the partition name. You can configure multiple values (separated by spaces) or a field value range. The time macro function is supported. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	• Attribute value in the single-value or multi-value filtering scenario: ${dateformat(yyyyMMdd, -1, DAY)} ${dateformat(yyyyMMdd)} • Attribute value in the range filtering scenario: ${value} >= ${dateformat(yyyyMMdd, -7, DAY)} && ${value} < ${dateformat(yyyyMMdd)}

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Category	Parameter	Description	Example Value
	WHERE Clause	This parameter is displayed when you select the JDBC read mode and click **Show Advanced Attributes**. This parameter indicates the WHERE clause to be extracted. If this parameter is not set, the entire table is extracted. If the table to be migrated does not contain the fields specified by the WHERE clause, the migration will fail. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	age > 18 and age <= 60

NOTE

If the data source is Hive, CDM will automatically partition data using the Hive data partitioning file.

5.6.3.5 From DLI

If the source link of a job is a **DLI link**, configure the source job parameters based on **Table 5-69**.

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Table 5-69 Parameter description

Parameter	Description	Example Value
Resource Queue	Resource queue to which the destination table belongs The default queue of DLI cannot be used for migration jobs. You need to create a SQL queue in DLI.	cdm
Database Name	Name of the database to which data will be written	dli
Table Name	Name of the table to which data will be written	car_detail

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Parameter	Description	Example Value
Partition	Partition information	• ['year=2020'] • ['year=2020,location=sun'] • ['year=2020,location=sun', 'year=2021,location=earth'] • Read data of the previous day: If the current date is 2024-07-16, **['DS=${dateformat(yyyy-MM-dd, -1, DAY)}']** indicates that the data whose DS partition value is 2024-07-15 is extracted. For details about other scenarios, see **Using Macro Variables of Date and Time**.

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5.6.3.6 From FTP/SFTP

If the source link of a job is an **FTP or SFTP link**, configure the source job parameters based on **Table 5-70**.

Advanced attributes are optional and not displayed by default. You can click **Show Advanced Attributes** to display them.

Table 5-70 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Source Directory/File	Directory or file path from which data will be extracted. You can enter a maximum of 50 file paths. By default, the file paths are separated by vertical bars (|). You can also customize a file separator. For details, see **Migration of a List of Files**. Directory from which data is to be migrated. All files (including all nested subdirectories and their subfiles) in the directory will be migrated. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	/ftp/a.csv|/ftp/b.txt

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Category	Parameter	Description	Example Value
	File Format	Format in which CDM parses data. The options are as follows: • **CSV**: Source files will be migrated to tables after being converted to CSV format. • **Binary**: Files (even not in binary format) will be transferred directly. This format is used to copy data from a file to another. • **JSON**: Source files will be migrated to tables after being converted to JSON format. **NOTE** If the destination is OBS, only the binary format is supported.	CSV
	JSON Type	This parameter is displayed only when **File Format** is set to **JSON**. Type of a JSON object stored in a JSON file. The options are **JSON object** and **JSON array**.	JSON object
	JSON Reference Node	This parameter is used only when **File Format** is set to **JSON** and **JSON Type** is set to **JSON Object**. CDM parses the data under the JSON node. If the node's corresponding data is a JSON array, the system will extract data from the array in the same pattern. Use periods (.) to separate multi-layer nested JSON nodes.	data.list
Advanced attributes	Use rfc4180 Parser	This parameter is displayed only when **File Format** is set to **CSV**. It specifies whether to use the rfc4180 parser to parse CSV files.	No
	Line Separator	Lind feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. This parameter is displayed only when **File Format** is set to **CSV**.	\n
	Field Delimiter	Character used to separate fields in the file. To set the **Tab** key as the delimiter, set this parameter to **\t**. This parameter is displayed only when **File Format** is set to **CSV**.	,

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Category	Parameter	Description	Example Value
	Use Quote Character	If you set this parameter to **Yes**, the field delimiters in the encircling symbol are regarded as a part of the string value. Currently, the default encircling symbol of CDM is **"**.	No
	Using Escape Char	If you select **Yes**, the backslash (\) in the data row is used as an escape character. If you select **No**, the backslash (\) in the CSV file will not be escaped. CSV supports only the backslash (\) as the escape character.	Yes
	Use RE to Separate Fields	Whether to use regular expressions to separate fields. If you set this parameter to **Yes**, **Field Delimiter** becomes invalid. This parameter is displayed only when **File Format** is set to **CSV**.	Yes
	Regular Expression	This parameter is available only when **Using RE to separate fields** is set to **Yes**. Regular expression used to separate fields. For details about regular expressions, see **Regular Expressions for Separating Semi-structured Text**.	^(\d.*\d) (\w*) \[(.*) \] ([\w\.]*) (\w.*).*
	Use First Row as Header	This parameter is displayed only when **File Format** is set to **CSV**. When you migrate a CSV file to a table, CDM writes all data to the table by default. If you set this parameter to **Yes**, CDM uses the first N rows of the CSV file as the heading row and does not write the row to the destination table.	Yes
	Encoding Type	Encoding type, for example, **UTF-8** or **GBK**. You can set the encoding type for text files only. This parameter is invalid when **File Format** is set to **Binary**.	UTF-8
	Compression Format	The options are as follows: • **NONE**: Files in all formats can be transferred. • **GZIP**: Only files in gzip format can be transferred. • **ZIP**: Only files in Zip format can be transferred. • **TAR.GZ**: Files in TAR.GZ format are transferred.	NONE

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Category	Parameter	Description	Example Value
	Compressed File Suffix	This parameter is displayed when **Compression Format** is not **NONE**. This parameter specifies the extension of the files to be decompressed. The decompression operation is performed only when the file name extension is used in a batch of files. Otherwise, files are transferred in the original format. If you enter ***** or leave the parameter blank, all files are decompressed.	*
	Start Job by Marker File	Whether to start a job by a marker file. A job is only started if there is a marker file for starting the job in the source path. If there is no marker file, the job will be suspended for a period of time specified by **Suspension Period**.	Yes
	File Separator	File separator. If you enter multiple file paths in **Source Directory/Files**, CDM uses the file separator to identify files. The default value is **|**.	|
	Marker File	Name of the marker file for starting a job. If you specify a marker file, the migration job is executed only when the marker file exists in the source path. The marker file will not be migrated.	ok.txt
	Suspension Period	Waiting period for a marker file. If you set **Start Job by Marker File** to **Yes** but there is no marker file in the source path, the job fails when the suspension period times out. If you set this parameter to **0** and there is no marker file in the source path, the job will fail immediately. Unit: second	10
	Filter Type	Only paths or files that meet the filtering conditions are transferred. The options are **None**, **Wildcard**, and **Regex**. For details, see **Incremental File Migration**.	None

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Category	Parameter	Description	Example Value
	Directory Filter	If you set **Filter Type** to **Wildcard** or **Regex**, enter a wildcard character to filter paths. The paths that meet the filtering condition are migrated. You can configure multiple paths separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*input,*out
	File Filter	If you set **Filter Type** to **Wildcard** or **Regex**, enter a wildcard character to filter paths. The files that meet the filtering condition are migrated. You can configure multiple files separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*.csv
	Time Filter	If you select **Yes**, files are transferred based on their modification time.	Yes
	Minimum Timestamp	If you set **Time Filter** to **Yes**, you can specify a point in time for **Minimum Timestamp**, and then only the files modified at or after the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss,-90,DAY))}** indicates that only files generated within the latest 90 days are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-07-01 00:00:00

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Category	Parameter	Description	Example Value
	Maximum Timestamp	If you set **Time Filter** to **Yes**, you can specify a point in time for **Maximum Timestamp**, and then only the files modified before the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss))}** indicates that only the files whose modification time is earlier than the current time are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-07-30 00:00:00
	Disregard Non-existent Path or File	If this parameter is set to **Yes**, the job can be successfully executed even if the source path does not exist.	No
	Marker File Type	This parameter is available only when **Start Job by Marker File** is set to **Yes**. • **MARK_DONE**: The migration job is executed only when the marker file exists in the source path. • **MARK_DOING**: The migration job is executed only when the marker file does not exist in the source path.	MARK_DOING
	Whether to skip empty lines	This parameter is available only when **File Format** is set to **CSV**. If a line is empty, it is skipped.	No
	null value	This parameter is available only when **File Format** is set to **Binary**. No string can be used to define a null value in text files. This parameter specifies the string to be identified as a null value.	No

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Category	Parameter	Description	Example Value
	MD5 File Extension	This parameter is displayed only when **File Format** is set to **Binary**. This parameter is used to check whether the files extracted by CDM are consistent with source files. For details, see **MD5 Verification**.	.md5

5.6.3.7 From HTTP

If the source link of a job is an HTTP link, configure the source job parameters based on **Table 5-71**. Currently, data can only be exported from the HTTP URLs.

Table 5-71 Parameter description

Parameter	Description	Example Value
File URL	Use the GET method to obtain data from the HTTP/HTTPS URL. These connectors are used to read files with an HTTP/HTTPS URL, such as reading public files on the third-party object storage system and web disks.	https://bucket.obs.myhuaweicloud.com/object-key
Pull List File	If this parameter is set to **Yes**, the system pulls the files corresponding to the URLs in the text file to be uploaded and stores them on OBS. The text file records the file paths on HDFS.	Yes
OBS Link of List File	Select an existing OBS link.	obs_link
OBS Bucket of entries files	Name of the OBS bucket that stores the text file	obs-cdm
Path/ Directory of entries files	Custom OBS directories that store the text file. Use slashes (/) to separate different directories.	test1
File Format	Format used for transmitting data. The CSV and JSON formats are supported for migration to tables, and the binary format is supported for file migration.	Binary

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Parameter	Description	Example Value
Compression Format	Compression format of the source files. The options are as follows: • **NONE**: Files in all formats can be transferred. • **GZIP**: Only files in gzip format can be transferred. • **ZIP**: Only files in Zip format can be transferred. • **TAR.GZ**: Files in TAR.GZ format are transferred.	NONE
Compressed File Suffix	This parameter is displayed when **Compression Format** is not **NONE**. This parameter specifies the extension of the files to be decompressed. The decompression operation is performed only when the file name extension is used in a batch of files. Otherwise, files are transferred in the original format. If you enter ***** or leave the parameter blank, all files are decompressed.	*
File Separator	File separator. When multiple files are transferred, CDM uses the file separator to identify files. The default value is **|**. This parameter is not displayed if **Pull List File** is set to **Yes**.	|
Query Parameter	• If you set this parameter to **Yes**, the name of the objects uploaded to OBS does not include the **query** parameter. • If you set this parameter to **No**, the name of the objects uploaded to OBS includes the **query** parameter.	No
Disregard Non-existent Path or File	If this is set to **Yes**, the job can be successfully executed even if the source path does not exist.	No
MD5 File Extension	This parameter is used to check whether the files extracted by CDM are consistent with source files. For details, see **MD5 Verification**.	.md5
Query Parameter	If this parameter is set to **Yes**, the name of the object to be uploaded is a string with the query parameter removed.	No

5.6.3.8 From PostgreSQL/SQL Server

If the source link of a job is an RDS for PostgreSQL, RDS for SQL Server, PostgreSQL, or Microsoft SQL Server link, configure the source job parameters based on **Table 5-72**.

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Table 5-72 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Category	Parameter	Description	Example Value
	Schema/Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. The examples are as follows: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Category	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. The examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Category	Parameter	Description	Example Value
Advanced attributes	Partition Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating that a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Where Clause	WHERE clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Null in Partition Column	Whether the partition column can contain null values	Yes

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Category	Parameter	Description	Example Value
	Extract by Partition	Data can be extracted from each partition in the partitioned table. If this function is enabled, you can configure **Table Partition** to specify specific table partitions from which data is extracted. • This function does not support non-partitioned tables. • This parameter can be configured only when the migration source is a PostgreSQL database. • The database user must have the **SELECT** permission on the system views **dba_tab_partitions** and **dba_tab_subpartitions**.	No
	Split Job	If this parameter is set to **Yes**, the job is split into multiple subjobs based on the value of **Job Split Field**, and the subjobs are executed concurrently. **NOTE** This parameter and parameters *Job Split Field*, *Minimum Split Field Value*, *Maximum Split Field Value*, and *Number of subjobs* are available only when the destination link is a DLI or Hive link.	Yes
	Job Split Field	Field used to split a job into multiple subjobs for concurrent execution. This parameter is available when **Split Job** is set to **Yes**.	-
	Minimum Split Field Value	Minimum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
	Maximum Split Field Value	Maximum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
	Number of subjobs	Number of subjobs split from a job for concurrent execution based on the data range specified by the minimum and maximum values of **Job Split Field**. This parameter is available when **Split Job** is set to **Yes**.	-

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5.6.3.9 From DWS

If the source link of a job is a **DWS link**, configure the source job parameters based on **Table 5-73**.

Table 5-73 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. Examples: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. The examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Type	Parameter	Description	Example Value
Advanced attributes	WHERE Clause	WHERE clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Partition Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Null in Partition Column	Whether the partition column can contain null values	Yes
	Split Job	If this parameter is set to **Yes**, the job is split into multiple subjobs based on the value of **Job Split Field**, and the subjobs are executed concurrently. **NOTE** This parameter and parameters *Job Split Field*, *Minimum Split Field Value*, *Maximum Split Field Value*, and *Number of subjobs* are available only when the destination link is a DLI or Hive link.	Yes

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Type	Parameter	Description	Example Value
	Job Split Field	Field used to split a job into multiple subjobs for concurrent execution. This parameter is available when **Split Job** is set to **Yes**.	-
	Minimum Split Field Value	Minimum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
	Maximum Split Field Value	Maximum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
	Number of subjobs	Number of subjobs split from a job for concurrent execution based on the data range specified by the minimum and maximum values of **Job Split Field**. This parameter is available when **Split Job** is set to **Yes**.	-

5.6.3.10 From SAP HANA

Table 5-74 lists the job parameters when the source link is a SAP HANA link.

Table 5-74 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Type	Parameter	Description	Example Value

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. Examples: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. The examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Type	Parameter	Description	Example Value
Advanced attributes	WHERE Clause	WHERE clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Partition Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id

5.6.3.11 From MySQL

If the source link of a job is an **RDS for MySQL or MySQL link**, configure the source job parameters based on **Table 5-75**.

Table 5-75 Parameter description

Parameter	Description	Example Value
Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Parameter	Description	Example Value

SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
	NOTE
	• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
	• With statements are not supported.
	• Comments, such as **--** and **/***, are not supported.
	• Addition, deletion, and modification operations are not supported, including but not limited to the following:
	  • load data
	  • delete from
	  • alter table
	  • create table
	  • drop table
	  • into outfile
	• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
		select id,name from sqoop.user;

Schema/ Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_E

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Parameter	Description	Example Value
Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
Partition Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id

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Parameter	Description	Example Value
Where Clause	WHERE clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
Retain One Decimal Place for Date Values	Whether to retain one decimal place for date values	Yes
Null in Partition Column	Whether the partition column can contain null values	Yes
Split Job	If this parameter is set to **Yes**, the job is split into multiple subjobs based on the value of **Job Split Field**, and the subjobs are executed concurrently. **NOTE** This parameter and parameters *Job Split Field*, *Minimum Split Field Value*, *Maximum Split Field Value*, and *Number of subjobs* are available only when the destination link is a DLI or Hive link.	Yes
Job Split Field	Field used to split a job into multiple subjobs for concurrent execution. This parameter is available when **Split Job** is set to **Yes**.	-
Minimum Split Field Value	Minimum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
Maximum Split Field Value	Maximum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
Number of subjobs	Number of subjobs split from a job for concurrent execution based on the data range specified by the minimum and maximum values of **Job Split Field**. This parameter is available when **Split Job** is set to **Yes**.	-

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Parameter	Description	Example Value
Extract by Partition	When data is exported from a MySQL database, data can be extracted from each partition in the partitioned table. If this function is enabled, you can configure **Table Partition** to specify specific MySQL table partitions from which data is extracted. • This function does not support non-partitioned tables. • The database user must have the **SELECT** permission on the system views **dba_tab_partitions** and **dba_tab_subpartitions**.	No

5.6.3.12 From Oracle

If the source link of a job is an **Oracle link**, configure the source job parameters based on **Table 5-76**.

Table 5-76 Parameter description

Parameter	Description	Example Value
Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Parameter	Description	Example Value

SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
	NOTE
	• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
	• With statements are not supported.
	• Comments, such as **--** and **/***, are not supported.
	• Addition, deletion, and modification operations are not supported, including but not limited to the following:
	  • load data
	  • delete from
	  • alter table
	  • create table
	  • drop table
	  • into outfile
	• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
		select id,name from sqoop.user;

Schema/ Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. For example: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Parameter	Description	Example Value
Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. The examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Parameter	Description	Example Value
Partition Column	This parameter is displayed when **Extract by Partition** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
Where Clause	WHERE clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
Null in Partition Column	Whether the partition field can contain null values. This parameter is displayed when **Extract by Partition** is set to **No**.	Yes
Extract by Partition	When data is exported from an Oracle database, data can be extracted from each partition in the partitioned table. If this function is enabled, you can configure **Table Partition** to specify specific Oracle table partitions from which data is extracted. • This function does not support non-partitioned tables. • The database user must have the **SELECT** permission on the system views **dba_tab_partitions** and **dba_tab_subpartitions**.	No

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Parameter	Description	Example Value
Table Partition	Oracle table partition from which data is migrated. Separate multiple partitions with ampersands (&). If you do not set this parameter, all partitions will be migrated. If there is a subpartition, enter the partition in the *Partition.Subpartition* format, for example, **P2.SUBP1**.	P0&P1&P2.SUBP1&P2.SUBP3
Split Job	If this parameter is set to **Yes**, the job is split into multiple subjobs based on the value of **Job Split Field**, and the subjobs are executed concurrently. **NOTE** This parameter and parameters *Job Split Field*, *Minimum Split Field Value*, *Maximum Split Field Value*, and *Number of subjobs* are available only when the destination link is a DLI or Hive link.	Yes
Job Split Field	Field used to split a job into multiple subjobs for concurrent execution. This parameter is available when **Split Job** is set to **Yes**.	-
Minimum Split Field Value	Minimum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
Maximum Split Field Value	Maximum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
Number of subjobs	Number of subjobs split from a job for concurrent execution based on the data range specified by the minimum and maximum values of **Job Split Field**. This parameter is available when **Split Job** is set to **Yes**.	-

NOTE

When an Oracle database is the migration source, if **Partitioning Field** or **Extract by Partition** is not configured, CDM automatically uses the ROWIDs to partition data.

5.6.3.13 From a Database Shard

If the source link of a job is a **database shard link**, configure the source job parameters based on **Table 5-77**.

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Table 5-77 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Schema/Tablespace	Indicates the name of the schema or tablespace from which data is to be extracted. Click the icon next to the text box to go to the page for selecting a schema or tablespace. During a sharded link job, the tablespace corresponding to the first backend link is displayed by default. You can also enter a schema or tablespace name. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched.	SCHEMA_E

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Category	Parameter	Description	Example Value
	Table Name	Indicates the name of the table from which data is to be extracted. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
Advanced attributes	WHERE Clause	Specifies the data extraction range. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'

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NOTE

- If the **Source Link Name** is the backend link of the sharded link, the job is a common MySQL job.
- When creating a job whose source end is a sharded link, you can add a custom field with the sample value of **${custom(host)}** to the source field during field mapping. This field is used to view the data source of the table after the data of multiple tables across databases is migrated to the same table. The following sample values are supported:
  - ${custom(host)}
  - ${custom(database)}
  - ${custom(fromLinkName)}
  - ${custom(schemaName)}
  - ${custom(tableName)}

5.6.3.14 From MongoDB/DDS

When you migrate MongoDB or DDS data, CDM reads the first row of the collection as an example of the field list. If the first row of data does not contain all fields of the collection, you need to manually add fields.

If the source link of a job is a **MongoDB link**, that is, if data is exported from an on-premises MongoDB or DDS, configure the source job parameters based on **Table 5-78**.

Table 5-78 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Database Name	Name of the database from which data will be migrated	mongodb
	Collection Name	Collection name, similar to the table name of a relational database. Click the icon next to the text box to go to the page for selecting the collection or directly enter a collection name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata.	COLLECTION

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Category	Parameter	Description	Example Value
Advanced attributes	Filter Condition	Conditions for filtering documents. CDM migrates only the data that meets the filter conditions. The examples are as follows: 1. Filter by expression: **{'last_name': 'Smith'}** indicates that all files whose **last_name** value is **Smith** are queried. 2. Filter by parameter: **{ x : "john" }, { z : 1 }** indicates that all **z** fields whose **x** is **john** are queried. 3. Filter by condition: **{ "field" : { $gt: 5 } }** indicates that the **field** values greater than 5 are queried. 4. Filter by time macro: {"ts":{$gte:ISODate("${dateformat(yyyy-MM-dd'T'HH:mm:ss.SSS'Z',-1,HOUR)}")}} indicates that the values greater than those after time macro conversion in the **ts** field are queried.	{'last_name': 'Smith'}

5.6.3.15 From Redis

The Redis service of the third-party cloud cannot serve as the migration source. However, the Redis set up in the on-premises data center or on the ECS can be the migration source and destination.

If the source link of a job is an on-premises Redis link, configure the source job parameters based on **Table 5-79**.

Table 5-79 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Redis Key Prefix	Key prefix, which is similar to the table name of a relational database	TABLE
	Value Storage Type	The options are as follows: • **String**: without column name, such as **value1,value2** • **Hash**: with column name, such as **column1=value1,column2=value2**	String

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Category	Parameter	Description	Example Value
Advanced attributes	Key Delimiter	Character used to separate table names and column names of a relational database	_
	Value Delimiter	Character used to separate columns when the storage type is string	;
	Same Field	This parameter is displayed when **Value Storage Type** is set to **Hash**. The hash key contains the same field.	Yes

5.6.3.16 From Kafka/DMS Kafka

If the source link of a job is a **Kafka link** or **DMS Kafka link**, configure the source job parameters based on **Table 5-80**.

Table 5-80 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Topics	One or more topics can be entered.	est1,est2
	Data Format	Format used for parsing data. The options are as follows: • **Binary**: Data is transferred directly. It is not converted to another format. This setting is suitable for file migration. • **CSV**: Source data will be migrated after being converted in CSV format. • **JSON**: Source data will be migrated after being converted in JSON format. • **CDC (DRS)**: Source data will be migrated after being converted in DRS format. • **CDC (JSON)**: Source data will be migrated after being converted in JSON format. • **CDC (DRS_AVRO)**: Source data will be migrated after being converted in DRS_AVRO format. • **CDC (DRS_JSON)**: Source data will be migrated after being converted in DRS_JSON format.	Binary

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Type	Parameter	Description	Example Value
	Offset	Initial offset parameter • **Latest**: Maximum offset, indicating that the latest data will be extracted. • **Earliest**: Minimum offset, indicating that the earliest data will be extracted. • **Submitted**: data that has been submitted • **Time Range**: data within a specified time range	Latest
	Data Extraction Timeout Duration	Maximum duration (minutes) of data extraction. For example, a job scheduled daily needs a sufficient duration to extract the data generated by the topic every day.	60
	Suspension Period	If the value is set to 60 and no data is returned within 60s after the consumer requests data extraction from Kafka (generally because all the data in the topic has been read or the network or Kafka cluster is unavailable), the task will stop immediately. Otherwise, the system will retry reading data.	60
	Consumer Group ID	Consumer group ID If you export data from DMS Kafka, enter any value for Kafka Platinum but a valid consumer group ID for Kafka Basic.	sumer-group
	Start Time	This parameter is required when **Offset** is set to **Time Range**. It specifies the start time for pulling data, including the data at the specified time point.	2020-12-20 12:00:00
	End Time	This parameter is required when **Offset** is set to **Time Range**. It specifies the end time for pulling data, excluding the data at the specified time point.	2020-12-20 20:00:00
	Field Delimiter	This parameter is required when **Data Format** is set to **CSV**. The default value is space. To set the **Tab** key as the delimiter, set this parameter to **\t**.	,
	Record Delimiter	This parameter is required when **Data Format** is set to **CSV** or **JSON**. The default value is space. To set the **Tab** key as the delimiter, set this parameter to **\t**.	,

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Type	Parameter	Description	Example Value
Advanced parameters	UseConfigFile	This parameter is required when **Data Format** is set to **CDC**. It is used to configure OBS files.	No
	OBS Link	Select an OBS link.	obs_link
	OBS Bucket	Select an OBS bucket.	obs_test
	Config File	Select the OBS configuration file.	/obs/config.csv
	Max. Poll Records	(Optional) Maximum number of records per poll	100
	Max. Poll Interval	(Optional) Maximum interval between polls (seconds)	100
	Notice Topic	Topic for sending notification data. If the data format is CDC, the notification content is the names of the generated files.	notice

5.6.3.17 From Elasticsearch or CSS

If the source link of a job is a link described in **Elasticsearch Link Parameters** or **CSS Link Parameters**, configure the source job parameters based on **Table 5-81**.

Table 5-81 Job parameters when Elasticsearch or CSS is the source

Category	Parameter	Description	Example Value
Basic parameters	Index	Elasticsearch index, which is similar to the name of a relational database. The index name can contain only lowercase letters.	index
	Type	Elasticsearch type, which is similar to the table name of a relational database. The type name can contain only lowercase letters. **NOTE** Elasticsearch 7.x and later versions do not support custom types. Instead, only the **_doc** type can be used. In this case, this parameter does not take effect even if it is set.	_doc
Advanced attributes	Split Nested Field	(Optional) Whether to split the JSON content of the nested fields. For example, **a:{ b:{ c:1, d:{ e:2, f:3 } } }** can be split into **a.b.c**, **a.b.d.e**, and **a.b.d.f**.	No

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Category	Parameter	Description	Example Value
	Filter Conditions	(Optional) CDM migrates only the data that meets the filter conditions. • Currently, only the query string (q syntax) of Elasticsearch can be used to filter source data. The q syntax is used in the following way: – In exact match, the ***column*:*data*** format is used to match and filter data. ***column*** indicates the field name, and ***data*** indicates the query condition, for example, **last_name:Smith**. In addition, if ***data*** is a string containing spaces, it must be enclosed in double quotation marks. If ***column*** is not specified, all fields will be matched by ***data***. – Multiple query conditions can be combined with connection words. The format is ***column1*:*data1* AND *column2*:*data2***. The connection words can be **AND**, **OR**, or **NOT**. They must be in uppercase, and there must be a space before and after each connection word. Example: **first_name:Alec AND last_name:John** – In range matching, you can directly use a condition expression to filter data. The expression is in ***column*:>*data*** format. The operator can be >, >=, <, or <=. An example is **time:>=1636905600000 AND time:<1637078400000**. It can also be used together with a macro variable of date and time, for example, **createTime:>=${timestamp(dateformat(yyyyMMdd,-1,DAY))} AND createTime:< ${timestamp(dateformat(yyyyMMdd))}**. – In range matching, you can also use the range syntax to filter data. The format is ***column*:{*data1* TO *data2*}**. **{** and **}** indicate that a value is not included. **[** and **]** indicate that a	last_name:Smith

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Category	Parameter	Description	Example Value
		value is included. **TO** must be capitalized, and there must be a space before and after it. * indicates all data. For example, **time:{1636992000000 TO *]** filters out all the data greater than 1636992000000 in the **time** field. It can also be used together with a macro variable of date and time, for example, **createTime:[${timestamp(dateformat(yyyyMMdd,-1,DAY))} TO ${timestamp(dateformat(yyyyMMdd))}}**. • Source data cannot be filtered using the query domain-specific language (DSL) of Elasticsearch.	
	Extract Meta-field	Whether to extract index meta-fields. For example, _index, _type, _id, and _score.	Yes
	Page size	Elasticsearch page size	1000
	ScrollId Time Out	During a scroll query using Elasticsearch, a **scroll_id** is recorded. When the query times out or is complete, the recorded **srcoll_id** will be cleared. You can set this parameter to specify the timeout duration.	5

5.6.3.18 From OpenTSDB

If the source link of a job is a **CloudTable OpenTSDB link**, configure the source job parameters based on **Table 5-82**.

Table 5-82 Parameter description

Parameter	Description	Example Value
Start Time	Start time of the query. The value is a character string or timestamp in the format of *yyyyMMddHHmmdd*.	20180920145505
End Time	(Optional) End time of the query. The value is a string or timestamp in the format of *yyyyMMddHHmmdd*.	20180921145505

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Parameter	Description	Example Value
Metric	Metric of the data to be migrated. You can specify a metric or select an existing metric in OpenTSDB.	city.temp
Aggregate Function	Aggregate function	sum
Tag	(Optional) If you specify a tag, only the tagged data will be migrated.	tagk1:tagv1,tagk2:tagv2

5.6.3.19 From MRS Hudi

If the source link of a job is an **MRS Hudi link**, configure the source job parameters based on **Table 5-83**.

Table 5-83 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Source Link Name	MRS Hudi link	hudi_from_cdm
	Database Name	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	default
	Table Name	Hudi table name. Click the icon next to the text box. The dialog box for selecting the table is displayed. You can set a macro variable of date and time, and a path name can contain multiple macro variables. You can use macro variables of date and time in a scheduled job to synchronize incremental data periodically. For details, see **Using Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_E

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Category	Parameter	Description	Example Value
Advanced attributes	Where Clause	This parameter indicates the where clause to be extracted. If this parameter is not set, the entire table is extracted. If the table to be migrated does not contain the fields specified by the where clause, the migration will fail. You can set a macro variable of date and time to extract the data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	age > 18 and age <= 60

5.6.3.20 From MRS ClickHouse

If the source link of a job is an **MRS ClickHouse link**, configure the source job parameters based on **Table 5-84**.

Table 5-84 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Source Link Name	MRS ClickHouse link	ck_from_cdm
	Schema/ Tablespace	Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** This parameter can be set to a regular expression to export all databases that meet the rule.	default

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Category	Parameter	Description	Example Value
	Table Name	Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. **NOTE** This parameter can be set to a regular expression to export all databases that meet the rule.	TBL_E
Advanced attributes	WHERE Clause	This parameter indicates the WHERE clause to be extracted. If this parameter is not set, the entire table is extracted. If the table to be migrated does not contain the fields specified by the WHERE clause, the migration will fail. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	age > 18 and age <= 60

5.6.3.21 From LogHub (SLS)

If the source link of a job is a **LogHub (SLS) link**, configure the source job parameters based on **Table 5-85**.

Table 5-85 Parameter description

Parameter	Description	Example Value
Source Link Name	LogHub (SLS) link	sls_link
LogStore	Name of the target logstore	-
BatchSize	Number of data records obtained from the log service at a time	128

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Parameter	Description	Example Value
BeginDateTime	Start time of data consumption, that is, the time when log data reaches LogHub (SLS). The value is a time string in *yyyyMMddHHmmss* format. **NOTE** This parameter must be used together with **EndDateTime**. The value range includes **BeginDateTime** and excludes **EndDateTime**.	20220113013000
EndDateTime	End time of data consumption. The value is a string in *yyyyMMddHHmmss* format.	20220213013000

5.6.3.22 From a ShenTong Database

If the source link of a job is a ShenTong database link, configure the source job parameters based on **Table 5-86**.

Table 5-86 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Type	Parameter	Description	Example Value

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. For example: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. The examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Type	Parameter	Description	Example Value
Advanced attributes	Partition Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating that a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	WHERE Clause	WHERE clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Null in Partition Column	Whether the partition column can contain null values	Yes

5.6.3.23 From a Dameng Database

If the source link of a job is a Dameng database link, configure the source job parameters based on **Table 5-87**.

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Table 5-87 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		● SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		● With statements are not supported.
		● Comments, such as **--** and **/***, are not supported.
		● Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  ● load data
		  ● delete from
		  ● alter table
		  ● create table
		  ● drop table
		  ● into outfile
		● If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. For example: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. The examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Type	Parameter	Description	Example Value
Advanced attributes	Partition Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating that a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** • The following types of partition columns are supported: CHAR, VARCHAR, LONGVARCHAR, TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index. • If the partition column type is CHAR, VARCHAR, or LONGVARCHAR, the column value cannot contain characters other than those in the ASCII character code table or Chinese characters.	id
	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Null in Partition Column	Whether the partition column can contain null values	Yes

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5.6.3.24 From YASHAN

If the source link of a job is a YASHAN link, configure the source job parameters based on **Table 5-88**.

Table 5-88 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/Tablespace	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. For example: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. The examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Type	Parameter	Description	Example Value
Advanced attributes	WHERE Clause	WHERE clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Retain One Decimal Place for Date Values	Whether to retain one decimal place for date values	No
	Partition Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating that a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. The partition column should have an index.	id
	Null in Partition Column	Whether the partition column can contain null values During concurrent extraction, if the partition column does not contain null, set this parameter to **No** to improve performance. If you are not sure whether the partition column contains null, set this parameter to **Yes** to avoid data loss.	No

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Type	Parameter	Description	Example Value
	Split Job	If this parameter is set to **Yes**, the job is split into multiple subjobs based on the value of **Job Split Field**, and the subjobs are executed concurrently. **NOTE** This parameter and parameters *Job Split Field*, *Minimum Split Field Value*, *Maximum Split Field Value*, and *Number of subjobs* are available only when the destination link is a DLI or Hive link.	No
	Job Split Field	Field used to split a job into multiple subjobs for concurrent execution. This parameter is available when **Split Job** is set to **Yes**.	-
	Minimum Split Field Value	Minimum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
	Maximum Split Field Value	Maximum value of **Job Split Field** during data extraction. This parameter is available when **Split Job** is set to **Yes**.	-
	Number of subjobs	Number of subjobs split from a job for concurrent execution based on the data range specified by the minimum and maximum values of **Job Split Field**. This parameter is available when **Split Job** is set to **Yes**.	-

5.6.4 Configuring CDM Destination Job Parameters

5.6.4.1 To OBS

If the destination link of a job is an **OBS link**, that is, data is to be imported to OBS, configure the destination job parameters based on **Table 5-89**.

Advanced attributes are optional and not displayed by default. You can click **Show Advanced Attributes** to display them.

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Table 5-89 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Bucket Name	Name of the OBS bucket that data will be written to	bucket_2
	Write Directory	OBS directory to which data will be written. Do not add **/** in front of the directory name. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	directory/
	File Format	Format in which data is written. The options are as follows: • **CSV**: Data is written in CSV format, which is used for migrating data tables to files. • **Binary**: Files will be transferred directly. CDM writes the files without changing their format. This setting is suitable for file migration. If data is migrated between file-related data sources, such as FTP, SFTP, OBS, and HDFS, the value of **File Format** must the same as the source file format. **NOTE** • The format can only be CSV when the source link is an MRS Hive link. • If the source is an FTP/SFTP server, only the binary format is supported.	CSV

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Category	Parameter	Description	Example Value
	Duplicate File Processing Method	This parameter is available when the migration source is HDFS. Files with the same name and size are identified as duplicate files. If there are duplicate files during data writing, the following methods are available: • Replace • Skip • Stop job For details, see **Incremental File Migration**.	Skip
Advanced attributes	Encryption	Whether to encrypt the uploaded data and the encryption mode. The options are as follows: • **None**: Data is written without encryption. • **KMS**: KMS in Data Encryption Workshop (DEW) is used for encryption. If KMS encryption is enabled, MD5 verification for data cannot be performed. For details, see **Encryption and Decryption During File Migration**.	KMS
	KMS ID	Data encryption key. This parameter is displayed when **Encryption** is set to **KMS**. Click next to the text box to select the KMS key that was created in DEW. • If the KMS key of the same project as that of the CDM cluster is used, you do not need to modify **Project ID**. • If the KMS key of another project is used, you need to modify **Project ID**.	53440ccb-3e73-4700-98b5-71ff5476e621
	Project ID	ID of the project to which KMS ID belongs. The default value is the ID of the project to which the current CDM cluster belongs. • If KMS and the CDM cluster are in the same project, retain the default value of **Project ID**. • If KMS of another project is used, set this parameter to the ID of the project to which KMS belongs.	9bd7c4bd54e5417198f9591bef07ae67

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Category	Parameter	Description	Example Value
	Copy Content-Type	This parameter is displayed only when **File Format** is **Binary**, and both the migration source and destination are object storage. If you set this parameter to **Yes**, the Content-Type attribute of the source file is copied during object file migration. This function is mainly used for static website migration. The Content-Type attribute cannot be written to Archive buckets. Therefore, if you set this parameter to **Yes**, the migration destination must be a non-Archive bucket.	No
	Line Separator	Lind feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. This parameter is not used when **File Format** is set to **Binary**.	\n
	Field Delimiter	Field delimiter in the file. This parameter is not used when **File Format** is set to **Binary**.	,
	File Size	This parameter is displayed only when the migration source is a database. Files are partitioned as multiple files by size so that they can be exported in proper size. The unit is MB.	1024
	Validate MD5 Value	The MD5 value can be verified only when files are transferred in **Binary** format. KMS encryption cannot be used if the MD5 value needs to be verified. Calculate the MD5 value of the source files and verify it with the MD5 value returned by OBS. If an MD5 file exists on the migration source, the system directly reads the MD5 file from the migration source and verifies it with the MD5 value returned by OBS. For details, see **MD5 Verification**.	Yes
	Record MD5 Verification Result	Whether to record the MD5 verification result when **Validate MD5 Value** is set to **Yes**	Yes
	Record MD5 Link	OBS link to which the MD5 verification result will be written	obslink

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Category	Parameter	Description	Example Value
	Record MD5 Bucket	OBS bucket to which the MD5 verification result will be written	cdm05
	Record MD5 Directory	Directory to which the MD5 verification result will be written	/md5/
	Encoding Type	Encoding type, for example, **UTF-8** or **GBK**. This parameter is not used when **File Format** is set to **Binary**.	GBK
	Use Quote Character	This parameter is displayed only when **File Format** is **CSV**. It is used when database tables are migrated to file systems. If you set this parameter to **Yes** and a field in the source data table contains a field delimiter or line separator, CDM uses double quotation marks (") as the quote character to quote the field content as a whole to prevent a field delimiter from dividing a field into two fields, or a line separator from dividing a field into different lines. For example, if the **hello,world** field in the database is quoted, it will be exported to the CSV file as a whole.	No
	Use First Row as Header	This parameter is displayed only when data is exported from a relational database to OBS and **File Format** is set to **CSV**. When a table is migrated to a CSV file, CDM does not migrate the heading line of the table by default. If you set this parameter to **Yes**, CDM writes the heading line of the table to the file.	No
	Job Success Marker File	Whether to generate a marker file with a custom name in the destination directory after a job is executed successfully. If you do not specify a file name, this function is disabled by default.	finish.txt

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Category	Parameter	Description	Example Value
	Folder Mode	This parameter is available only when data is exported from a relational database to OBS. If this function is enabled, generated files are named in the following format: *Root directory-Table name-Data type-Data folder format*. Example: **raw_schema/tbl_student/datas/tbl_student_1.csv**	Yes
	Blog/Clog File Name Extension	This parameter is available only when **Folder Mode** is set to **Yes**. It specifies the extension for the names of the files that contain custom Blob/Clog data in folder mode.	.dat/.jpg/.png
	Customize Hierarchical Directory	If this parameter is set to **Yes**, the files after migration can be stored in a custom directory. That is, only files are migrated. The directories to which the files belong are not migrated.	Yes
	Hierarchical Directory	Custom storage directory for files after migration. The time macro variable is supported. **NOTE** If the source link is a relational database link, the directory name consists of the source table name and a custom directory name. In other scenarios, the directory is a custom directory.	${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}

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Category	Parameter	Description	Example Value
	Customize File Name	This parameter is displayed only when data is exported from a relational database to OBS and **File Format** is set to **CSV**. This parameter specifies the name of the file generated by OBS. The options are as follows: • **Character string**: Special characters are allowed. For example, if this parameter is set to **cdm#**, the name of the generated file is **cdm#.csv**. • Macro variable of time: If this parameter is set to **${timestamp()}**, the name of the generated file is **1554108737.csv**. • Macro variable of table name: If this parameter is set to **${tableName}**, the name of the generated file is the source table name **sqltabname.csv**. • Macro variable of version number: If this parameter is set to **${version}**, the name of the generated file is the cluster version number **2.9.2.200.csv**. • Any combination of the character string and macro variable (macro variable of time, table name, or version number). For example, if this parameter is set to **cdm#${timestamp()}_${version}**, the name of the generated file is **cdm#1554108737_2.9.2.200.csv**.	cdm

5.6.4.2 To HDFS

If the destination link of a job is an **HDFS link**, configure the destination job parameters based on **Table 5-90**.

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Table 5-90 Parameter description

Parameter	Description	Example Value
Write Directory	HDFS directory to which data will be written. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	/user/output
File Format	Format in which data is written. The options are as follows: • **CSV**: Data is written in CSV format, which is used for migrating data tables to files. • **Binary**: Files will be transferred directly. CDM writes the files without changing their format. This setting is suitable for file migration. If data is migrated between file-related data sources, such as FTP, SFTP, OBS, and HDFS, the value of **File Format** must the same as the source file format.	CSV
Duplicate File Processing Method	This parameter is available when the migration source is a file data source, such as HTTP, FTP, SFTP, OBS, and HDFS. Files with the same name and size are identified as duplicate files. If there are duplicate files during data writing, the following methods are available: • Replace • Skip • Stop job	Stop job

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Parameter	Description	Example Value
Compression Format	File compression format after data writing. The following compression formats are supported: • **None**: The files are not compressed. • **DEFLATE**: The files are compressed in DEFLATE format. • **gzip**: The files are compressed in gzip format. • **bzip2**: The files are compressed in bzip2 format. • **LZ4**: The files are compressed in LZ4 format. • **Snappy**: The files are compressed in snappy format.	Snappy
Line Separator	Lind feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. This parameter is not used when **File Format** is set to **Binary**.	\n
Field Delimiter	Field delimiter in the file. This parameter is not used when **File Format** is set to **Binary**.	,
Use Quote Character	This parameter is displayed only when **File Format** is **CSV**. It is used when database tables are migrated to file systems. If you set this parameter to **Yes** and a field in the source data table contains a field delimiter or line separator, CDM uses double quotation marks (") as the quote character to quote the field content as a whole to prevent a field delimiter from dividing a field into two fields, or a line separator from dividing a field into different lines. For example, if the **hello,world** field in the database is quoted, it will be exported to the CSV file as a whole.	No
Use First Row as Header	When a table is migrated to a CSV file, CDM does not migrate the heading line of the table by default. If you set this parameter to **Yes**, CDM writes the heading line of the table to the file.	No
Write to Temporary File	Whether to write the binary file to a **.tmp** file first. After the migration is successful, run the **rename** or **move** command at the migration destination to restore the file.	No
Job Success Marker File	Whether to generate a marker file with a custom name in the destination directory after a job is executed successfully. If you do not specify a file name, this function is disabled by default.	finish.txt

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Parameter	Description	Example Value
Customize Hierarchical Directory	Users can customize the directory hierarchy of files. Example: [Table name]/[Year]/[Month]/[Day]/[Data file name]. csv	-
Hierarchical Directory	Used to specify the directory level of a file, with time macro supported (the time format is yyyy/MM/dd). If this parameter is left blank, the directory does not have a hierarchical structure. **NOTE** If the source link is a relational database link, the directory name consists of the source table name and a custom directory name. In other scenarios, the directory is a custom directory.	${dateformat(yyyy/MM/dd, -1, DAY)}
Encryption	This parameter is displayed only when **File Format** is set to **Binary**. Whether to encrypt the uploaded data. The options are as follows: • **None**: Data is written without encryption. • **AES-256-GCM**: The AES 256-bit encryption algorithm is used to encrypt data. Currently, only the AES-256-GCM (NoPadding) encryption algorithm is supported. This parameter is used for encryption at the migration destination and decryption at the migration source. For details, see **Encryption and Decryption During File Migration**.	AES-256-GCM
DEK	This parameter is displayed only when **Encryption** is set to **AES-256-GCM**. The key consists of 64 hexadecimal numbers. Remember the key configured here because the decryption key must be the same as that configured here. If the encryption and decryption keys are inconsistent, the system does not report an exception, but the decrypted data is incorrect.	DD0AE00DFECD78BF051BCFDA25BD4E320DB0A7AC75A1F3FC3D3C56A457DCDC1B
IV	This parameter is displayed only when **Encryption** is set to **AES-256-GCM**. The initialization vector consists of 32 hexadecimal numbers. Remember the initialization vector configured here because the initialization vector used for decryption must be the same as that configured here. If the encryption and decryption keys are inconsistent, the system does not report an exception, but the decrypted data is incorrect.	5C91687BA886EDCD12ACBC3FF19A3C3F

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NOTE

HDFS supports the **UTF-8** encoding only. Retain the default value **UTF-8**.

5.6.4.3 To HBase/CloudTable

If the destination link of a job is an **HBase link** or **CloudTable link**, configure the destination job parameters based on **Table 5-91**.

Table 5-91 Parameter description

Parameter	Description	Example Value
Table Name	Name of the HBase table to which data will be written. If you want to create an HBase table, you can copy the field names from the migration source. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_2
Clear Data Before Import	Whether the data in the destination table is cleared before data import. The options are as follows: • **Yes**: The data is cleared. • **No**: The data is not cleared. Instead, it will be added to the existing table.	Yes

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Parameter	Description	Example Value
Auto Table Creation	This parameter is displayed only when the source is a relational database. The options are as follows: ● **Non-auto creation**: CDM will not automatically create a table. ● **Auto creation**: If the destination database does not contain the table specified by **Table Name**, CDM will automatically create the table. If the table specified by **Table Name** already exists, no table is created and data is written to the existing table. **NOTE** The automatically created HBase table contains the column family and coprocessor information. For other attributes, default values are retained.	Non-auto creation
Rowkey Delimiter	(Optional) Used to combine multiple columns as a rowkey. Spaces are used by default.	,
Rowkey Data Redundancy	(Optional) Whether to write the rowkey data into HBase columns. The default value is **No**.	No
Compression Format	(Optional) Compression format used in creating an HBase table. The default value is **None**. ● **None**: The files are not compressed. ● **Snappy**: The files are compressed in snappy format. ● **gzip**: The files are compressed in gzip format.	None
Write WAL	Whether to enable Write Ahead Log (WAL) of HBase. The options are as follows: ● **Yes**: If the HBase server breaks down after the function is enabled, you can replay the operations that have not been performed in WAL. ● **No**: If you set this parameter to **No**, the write performance is improved. However, if the HBase server breaks down, data may be lost.	No

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Parameter	Description	Example Value
Match Data Type	• **Yes**: Data of the Short, Int, Long, Float, Double, and Decimal columns in the source database is converted into Byte[] arrays (binary) and written into HBase. Other types of data are written as character strings. If several types of data mentioned above are combined as rowkeys, they will be written as character strings. This function saves storage space. In specific scenarios, the rowkey distribution is evener. • **No**: All types of data in the source database are written into HBase as character strings.	No

5.6.4.4 To Hive

If the destination link of a job is a **Hive link**, configure the destination job parameters based on **Table 5-92**.

Table 5-92 Parameter description

Parameter	Description	Example Value
Database Name	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	default
Table Name	Destination table name. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_X

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Parameter	Description	Example Value
Auto Table Creation	This parameter is displayed only when the source is a relational database. The options are as follows: ● **Non-auto creation**: CDM will not automatically create a table. ● **Auto creation**: If the destination database does not contain the table specified by **Table Name**, CDM will automatically create the table. If the table specified by **Table Name** already exists, no table is created and data is written to the existing table. ● **Deletion before creation**: CDM deletes the table specified by **Table Name**, and then creates the table again. **NOTE** ● Only column comments are synchronized during automatic table creation. Table comments are not synchronized. ● Primary keys cannot be synchronized during automatic table creation.	Non-auto creation
Source side null value conversion value	Value to which the source null value is converted ● TO_NULL ● TO_EMPTY_STRRING ● TO_NULL_STRING	TO_NULL
Clear Data Before Import	Whether the data in the destination table is cleared before data import. The options are as follows: ● **Yes**: The data is cleared. ● **No**: The data is not cleared. Instead, it will be added to the existing table.	Yes
Processing mode of newline characters	Policy for processing the newline characters in the data written to Hive textfile tables ● Delete ● Replace with another string ● Ignore	Delete
Hive Table Partition Field	This parameter is unavailable when **Auto Table Creation** is set to **Non-auto Creation**. Partition fields for creating a Hive table. Use commas (,) to separate multiple fields.	A,B
Table Path	This parameter is unavailable when **Auto Table Creation** is set to **Non-auto Creation**. It specifies the table path.	-

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Parameter	Description	Example Value
Storage Format	This parameter is unavailable when **Auto Table Creation** is set to **Non-auto Creation**. It specifies the storage format. • Row-based storage format: TEXTFILE • Column-based storage formats: ORC, RCFILE, and PARQUET TEXTFILE data is stored in plaintext. If data contains special characters, data may be written incorrectly. Exercise caution when using this format. The ORC format is recommended.	ORC
ClearDataMode	This parameter is available when **Clear Data Before Import** is set to **Yes**. It specifies the mode for clearing data in the Hive table. • **LOAD_OVERWRITE**: A temporary data file directory is generated and loaded to the Hive table using the load overwrite syntax of Hive. • **TRUNCATE**: Data files in partitions are deleted, but partitions are not deleted. **NOTE** If the destination is a partitioned table, you are advised to select LOAD_OVERWRITE. Otherwise, the cluster memory or disks may be overloaded.	TRUCATE
Partitions info	This parameter is available when **Clear Data Before Import** is set to **Yes**. If the destination is a partitioned table, you must specify partitions. • If you select the **TRUCATE** mode, only the data files in the partitions are deleted. • If you select the **LOAD_OVERWRITE** mode, data is written to a specified partition and overwrites the existing data.	Single partition: **year=2020,location=sun** Multiple partitions: **['year=2020,location=sun', 'year=2021,location=earth']** Partitions of the previous day: day='${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}',

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Parameter	Description	Example Value
Executing Analyze Statements	After all data is written, the ANALYZE TABLE statement is asynchronously executed to accelerate query of data from Hive tables. Run the following SQL statements: • Non-partitioned table: **ANALYZE TABLE tablename COMPUTE STATISTICS** • Partitioned table: **ANALYZE TABLE tablename PARTITION(partcol1[=val1], partcol2[=val2], ...) COMPUTE STATISTICS** **NOTE** Parameter **Executing Analyze Statements** applies only to the migration of a single table. Running the ANALYZE statements may exert pressure on Hive.	Yes
Maximum memory size of the internal write queue	If the memory is insufficient, change the value of this parameter as needed. If the value is too small, the migration speed will be affected. The value ranges from 1 to 128 MB. The default value is empty, indicating that there is no limit. If you set a value beyond the range, there is no limit.	16
Maximum memory size of the internal conversion queue	If the memory is insufficient, change the value of this parameter as needed. If the value is too small, the migration speed will be affected. The value ranges from 1 to 128 MB. The default value is empty, indicating that there is no limit. If you set a value beyond the range, there is no limit.	16

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NOTE

- If the source Hive contains both the array and map types of data, the destination table format can only be the ORC or parquet complex type. If the destination table format is RC or TEXT, the source data will be processed and can be successfully written.
- As the map type is an unordered data structure, the data type may change after a migration.
- If Hive serves as the migration destination and the storage format is Textfile, delimiters must be explicitly specified in the statement for creating Hive tables. The following is an example:

```
CREATE TABLE csv_tbl(
smallint_value smallint,
tinyint_value tinyint,
int_value int,
bigint_value bigint,
float_value float,
double_value double,
decimal_value decimal(9, 7),
timestmamp_value timestamp,
date_value date,
varchar_value varchar(100),
string_value string,
char_value char(20),
boolean_value boolean,
binary_value binary,
varchar_null varchar(100),
string_null string,
char_null char(20),
int_null int
)
ROW FORMAT SERDE 'org.apache.hadoop.hive.serde2.OpenCSVSerde'
WITH SERDEPROPERTIES (
"separatorChar" = "\t",
"quoteChar"     = "'",
"escapeChar"    = "\\"
)
STORED AS TEXTFILE;
```

5.6.4.5 To MySQL/SQL Server/PostgreSQL

Table 5-93 lists the destination job parameters when the destination link is an MySQL, SQL Server, or PostgreSQL link.

Table 5-93 Parameter description

Category	Parameter	Description	Example Value
Basic parameters	Schema/ Tablespace	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema

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Category	Parameter	Description	Example Value
	Auto Table Creation	This parameter is displayed only when the source is a relational database. The options are as follows: • **Non-auto creation**: CDM will not automatically create a table. • **Auto creation**: If the destination database does not contain the table specified by **Table Name**, CDM will automatically create the table. If the table specified by **Table Name** already exists, no table is created and data is written to the existing table. • **Deletion before creation**: CDM deletes the table specified by **Table Name**, and then creates the table again.	Non-auto creation
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data

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Category	Parameter	Description	Example Value
	WHERE Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60
	Constraint Conflict Handling	How to handle data conflicts when data is being imported to RDS for MySQL • **insert into**: When a primary key or unique index conflict occurs, data cannot be written and will become dirty data. • **replace into**: When a primary key or unique index conflict occurs, the original row is deleted and a new row is inserted to replace all the fields in the original row. • **on duplicate key update**: When a primary key or unique index conflict occurs in a row in the destination table, the data columns except the unique constraint column in this row are updated.	insert into
Advanced parameters	Import to Staging Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No

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Category	Parameter	Description	Example Value
	Extend Field Length	When **Auto creation** is selected, the length of the character fields can be extended to three times the original length and then written to the destination table. If the encoding types of the source and destination databases are different, but the character fields in the source and destination tables are the same, errors may occur during data migration due to character length difference. **NOTE** When this function is enabled, some fields consume three times the storage space of the user.	No
	Use NOT NULL Constraint	If you choose to create a target table automatically and specify the NOT NULL constraint, keep the NOT NULL constraints of the source and target tables consistent.	Yes
	Prepare for Data Import	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Complete Statement After Data Import	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** This parameter is unavailable if **Constraint Conflict Handling** is set to **replace into** or **on duplicate key update**.	1

5.6.4.6 To Oracle

If the destination link of a job is an **Oracle database link**, configure the destination job parameters based on **Table 5-94**.

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Table 5-94 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Tablespace	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data
	WHERE Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60

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Type	Parameter	Description	Example Value
Advanced parameters	Import to Staging Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Prepare for Data Import	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Complete Statement After Data Import	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** This parameter is unavailable if **Constraint Conflict Handling** is set to **replace into** or **on duplicate key update**.	1

5.6.4.7 To DWS

If the destination link of a job is a **DWS link**, configure the destination job parameters based on **Table 5-95**.

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Table 5-95 Parameter description

Parameter	Description	Example Value
Schema / Tablespace	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
Auto Table Creation	This parameter is displayed only when the source is a relational database. The options are as follows: • **Non-auto creation**: CDM will not automatically create a table. • **Auto creation**: If the destination database does not contain the table specified by **Table Name**, CDM will automatically create the table. If the table specified by **Table Name** already exists, no table is created and data is written to the existing table. • **Deletion before creation**: CDM deletes the table specified by **Table Name**, and then creates the table again. **Field Mapping in Automatic Table Creation on DWS** describes the field mapping between the DWS tables created by CDM and source tables. **NOTE** Only column comments are synchronized during automatic table creation. Table comments are not synchronized.	Non-auto creation
Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
Compress Data	Whether to compress data when data is imported to DWS and **Auto creation** is selected	No

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Parameter	Description	Example Value
Storage Mode	When data is imported to DWS and **Auto Creation** is selected, you can specify the data storage mode: • **Row-based**: Row-based storage. It is used for point queries (index-based simple queries with fewer return records), or the scenario that requires a large number of addition, deletion, and modification operations. • **Column-based**: Column-based storage. It is used for statistical analysis queries (group and join scenarios) or ad hoc queries (query conditions are uncertain and indexes can hardly be used to scan row-based tables).	Row-based
Import Mode	Mode for importing data to DWS • In COPY mode, the source data is copied to the DataNode of DWS after passing through the management node. • In UPSERT mode, if a primary key or unique constraint conflict occurs, other data columns, except the primary key and unique constraint column, are updated.	COPY
Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data
WHERE Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60

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Parameter	Description	Example Value
Import to Staging Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
Extending field length	When **Auto creation** is selected, the length of the character fields can be extended to four times the original length and then written to the destination table. If the encoding types of the source and destination databases are different, but the character fields in the source and destination tables are the same, errors may occur during data migration due to character length difference. When a character field containing Chinese characters is imported to DWS, the length of the character field must be automatically increased by four times. If a job fails to be executed and an error message similar to **value too long for type character varying** exists in the log when you import Chinese characters to DWS, you can enable this function to solve the problem. **NOTE** When this function is enabled, some fields consume four times the storage space of the user.	No
Use NOT NULL Constraint	If you choose to create a target table automatically and specify the NOT NULL constraint, keep the NOT NULL constraints of the source and target tables consistent.	Yes
Prepare for Data Import	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table

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Parameter	Description	Example Value
Complete Statement After Data Import	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations.	1

Field Mapping in Automatic Table Creation on DWS

Figure 5-38 describes the field mapping between DWS tables created by CDM and source tables. For example, if you use CDM to migrate the Oracle database to DWS, CDM automatically creates a table on DWS and maps the **NUMBER(3,0)** field of the Oracle database to the **SMALLINT** field of DWS.

Figure 5-38 Field mapping in automatic table creation

Source Database Type							Destination Database Type
Oracle	MySQL	SQL Server	PostgreSQL	Db2	GaussDB	SAP HANA	DWS
NUMBER(p,0) (p=3 or p=5)	SMALLINT,TINYINT	SMALLINT,TINYINT	SMALLINT	DECIMAL	SMALLINT	SMALLINT,TINYINT	SMALLINT
NUMBER(10,0)	INT	INT	INTEGER	INT	INTEGER	INTEGER	INTEGER
NUMBER(19,0)	BIGINT	BIGINT	BIGINT	DECIMAL	BIGINT	BIGINT	BIGINT
None	None	None	OID	None	OID	CHAR(128)	OID
NUMBER(p,s) (0 < p <= 38)	DECIMAL(p,s) (0 < p <= 65)	DECIMAL(p,s) (0 < p <= 30)	NUMERIC(p,s) (p <= 1000)	DECIMAL	NUMERIC(p,s) (p <= 1000)	DECIMAL(p,s) (0 < p <= 38)	NUMERIC(p,s) (p <= 1000)
RAW	BINARY	BINARY	BYTEA	BINARY	BYTEA	BINARY	BYTEA
CHAR	CHAR	CHAR	CHAR	CHAR	CHAR	CHAR(p) (p <= 2000)	CHAR
NCHAR	NCHAR	NCHAR	NCHAR	NCHAR	NCHAR	NCHAR(p) (p <= 5000)	NCHAR
DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE
DATE	DATETIME	DATETIME2	TIMESTAMP	TIMESTAMP	TIMESTAMP	TIMESTAMP	TIMESTAMP
VARCHAR2(p) (p <= 4000)	VARCHAR	VARCHAR(p) (if p >= 8000 p=max)	VARCHAR(p) (p <= 10485760)	VARCHAR	VARCHAR(p) (p <= 10485760)	VARCHAR(p) (p <= 5000)	VARCHAR(p) (p <= 10485760)
FLOAT	DOUBLE	FLOAT	DOUBLE PRECISION	FLOAT	DOUBLE PRECISION	DOUBLE	DOUBLE PRECISION
FLOAT	REAL	FLOAT	REAL	FLOAT	REAL	REAL	REAL
CLOB	TEXT	TEXT	TEXT	TEXT	TEXT	CLOB	TEXT
DATE	None	TIME	TIME	TIME	TIME	TIME	TIME
BOOLEAN	None	None	BOOLEAN	BOOLEAN	BOOLEAN	BOOLEAN	BOOLEAN

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NOTE

Indexes cannot be created in automatic table creation scenarios.

5.6.4.8 To DDS

If the destination link of a job is a **DDS link**, configure the destination job parameters based on **Table 5-96**.

Table 5-96 Parameter description

Parameter	Description	Example Value
Database Name	Database to which data is to be imported	ddsdb
Collection Name	Collection of data to be imported, which is similar to the table name of a relational database. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata.	COLLECTION

5.6.4.9 To Redis

Table 5-97 lists the destination job parameters when the destination link is a Redis link.

Table 5-97 Parameter description

Parameter	Description	Example Value
Redis Key Prefix	Key prefix, which is similar to the table name of a relational database	TABLE
Value Storage Type	The options are as follows: • **String**: without column name, such as **value1,value2** • **Hash**: with column name, such as **column1=value1,column2=value2**	String
Use Column Value as Field	This parameter is displayed when **Value Storage Type** is set to **HASH**. Only **Hash** is supported. If this function is enabled, values are alternately used as fields and values in sequence except the primary key column.	Yes

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Parameter	Description	Example Value
Delete Same Key Before Writing	Whether to delete the same key before writing. • **No**: If a key with the same name but of a different type already exists in Redis, the migration job skips the key. • **Yes**: Redis deletes the existing key with the same name and then performs the migration.	No
Key Delimiter	Character used to separate table names and column names of a relational database	_
Value Delimiter	Character used to separate columns when the storage type is string	;
Validity period of the key value	Unified time to live (TTL) of a key, in seconds	300

5.6.4.10 To Elasticsearch/CSS

If the destination link of a job is a link described in **Elasticsearch Link Parameters** or **CSS Link Parameters**, configure the destination job parameters based on **Table 5-98**.

NOTICE

The parameters required for table/file migration are different from those for entire DB migration. The following table lists the parameters for table/file migration. The actual parameters are subject to those displayed on the console.

Table 5-98 Job parameters when Elasticsearch/CSS is the destination

Parameter	Description	Example Value
Index	Elasticsearch index, which is similar to the name of a relational database. CDM supports automatic creation of indexes and field types. The index and field type names can contain only lowercase letters.	index

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Parameter	Description	Example Value
Type	Elasticsearch type, which is similar to the table name of a relational database. The type name can contain only lowercase letters. **NOTE** Elasticsearch 7.x and later versions do not support custom types. Instead, only the **_doc** type can be used. In this case, this parameter does not take effect even if it is set.	type
Operation	Operation type • **INDEX**: No primary key is required. Elasticsearch generates IDs so that data is written to a new file with a unique ID for each write operation. • **CREATE**: A primary key needs to be specified. If the primary key already exists, the write operation fails. • **UPDATE**: A primary key needs to be specified. If the primary key already exists, the original data is overwritten. • **UPSERT**: A primary key needs to be specified. If a primary key already exists, the existing data is overwritten. If there is no primary key, a new document is created for writing data.	INDEX
Pipeline ID	ID of the pipeline used to convert the format of the data transferred to Elasticsearch. If the destination is Elasticsearch, you need to create a pipeline ID in Kibana first. If the destination is CSS, you do not need to create a pipeline ID. Instead, enter the name of the configuration file, which is **name** by default.	If the destination is Elasticsearch: pipeline_id If the destination is CSS: **name** (name of the configuration file)
Write ES with Routing	If you enable this function, a column can be written to Elasticsearch as a route. **NOTE** Before enabling this function, create indexes at the destination to improve the query efficiency.	No
Route Column	This parameter is available when **Write ES with Routing** is set to **Yes**. It specifies the destination routing column. If the destination index exists but the column information cannot be obtained, you can manually enter the column. The route column can be empty. If it is empty, no routing value is specified for the data written to Elasticsearch.	value1

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Parameter	Description	Example Value
Periodically Create Index	For streaming jobs that continuously write data to Elasticsearch, CDM periodically creates indexes and writes data to the indexes, which helps you delete expired data. The indexes can be created based on the following periods: • **Every hour**: CDM creates indexes on the hour. The new indexes are named in the format of *Index name+Year+Month+Day+Hour*, for example, **index2018121709**. • **Every day**: CDM creates indexes at 00:00 every day. The new indexes are named in the format of *Index name+Year+Month+Day*, for example, **index20181217**. • **Every week**: CDM creates indexes at 00:00 every Monday. The new indexes are named in the format of *Index name+Year+Week*, for example, **index201842**. • **Every month**: CDM creates indexes at 00:00 on the first day of each month. The new indexes are named in the format of *Index name+Year +Month*, for example, **index201812**. • **Do not create**: Do not create indexes periodically. When extracting data from a file, you must configure a single extractor, which means setting **Concurrent Extractors** to **1**. Otherwise, this parameter is invalid.	Every hour

5.6.4.11 To DLI

If the destination link of a job is a **DLI link**, configure the destination job parameters based on **Table 5-99**.

CAUTION

When data is migrated to DLI using CDM, DLI generates data files in the *dli-trans** temporary OBS bucket. Therefore, you need to grant the user who uses the AK/SK the permissions to read and write the *dli-trans** bucket and create directories. Otherwise, the migration will fail. For details about how to add permission policies for temporary bucket *dli-trans**, see **Adding an Authorization Policy for the dli-trans* Temporary Bucket**.

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Table 5-99 Parameter description

Parameter	Description	Example Value
Resource Queue	Resource queue to which the destination table belongs The default queue of DLI cannot be used for migration jobs. You need to create a SQL queue in DLI.	cdm
Database Name	Name of the database to which data will be written	dli
Table Name	Name of the table to which data will be written	car_detail
Clear Data Before Import	Whether to clear data in the destination table before data import If this parameter is set to **Yes**, data in the destination table will be cleared before the task is started.	No
Convert empty strings to null	If this parameter is set to **Yes**, an empty string is regarded as null.	No
Data Clearing Mode	This parameter is available when **Clear Data Before Import** is set to **Yes**. **TRUNCATE**: deletes standard data. **INSERT_OVERWRITE**: overwrites existing data with inserted data. **NOTE** If the source link is a Kafka link and **Clear Data Before Import** is set to **Yes**, **INSERT_OVERWRITE** is unavailable.	TRUNCATE
Partition	This parameter is available when **Clear Data Before Import** is set to **Yes**. When you enter partitions, data in these partitions will be cleared.	year=2020,location=sun

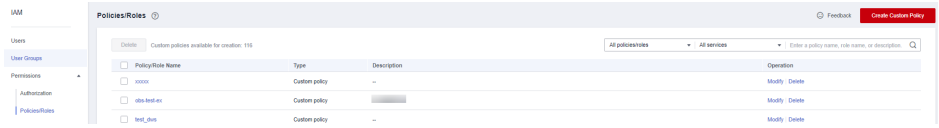
Adding an Authorization Policy for the *dli-trans** Temporary Bucket

Step 1 Log in to the IAM console.

Step 2 In the navigation pane, choose **Permissions** > **Policies/Roles** and click **Create Custom Policy** in the upper right corner.

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Figure 5-39 Creating a custom policy



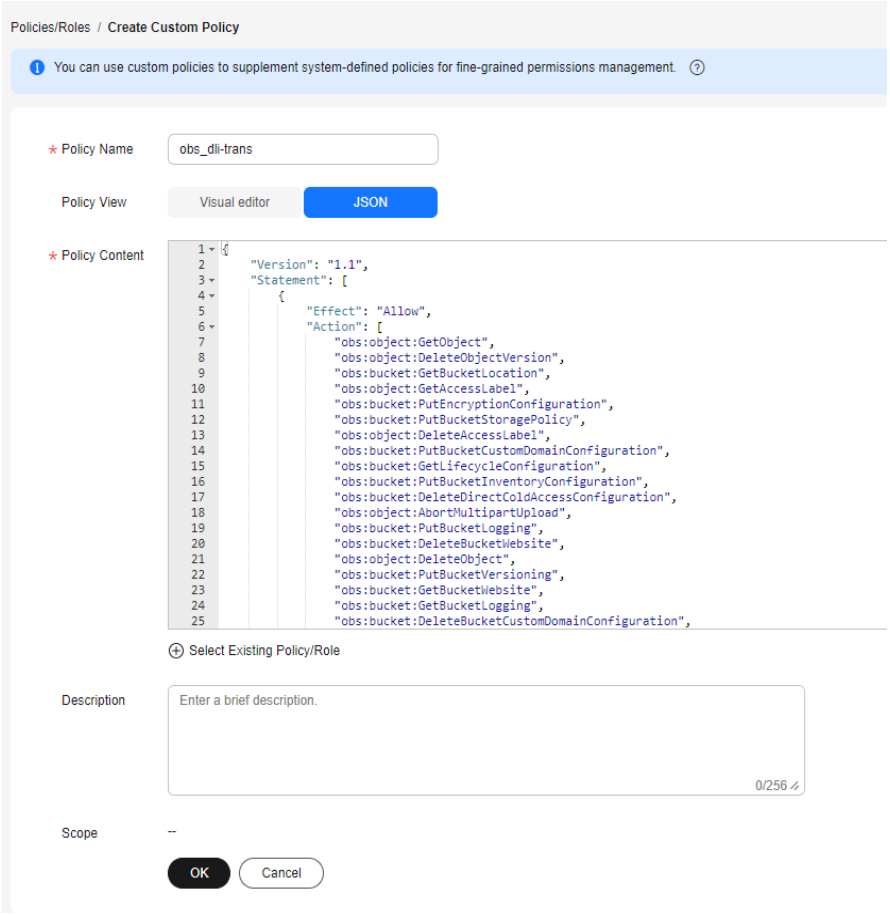
Step 3 On the **Create Custom Policy** page, select **JSON** for **Policy View** and create custom policy **obs_dli-trans**.

```
{
   "Version": "1.1",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": [
            "obs:object:GetObject",
            "obs:object:DeleteObjectVersion",
            "obs:bucket:GetBucketLocation",
            "obs:object:GetAccessLabel",
            "obs:bucket:PutEncryptionConfiguration",
            "obs:bucket:PutBucketStoragePolicy",
            "obs:object:DeleteAccessLabel",
            "obs:bucket:PutBucketCustomDomainConfiguration",
            "obs:bucket:GetLifecycleConfiguration",
            "obs:bucket:PutBucketInventoryConfiguration",
            "obs:bucket:DeleteDirectColdAccessConfiguration",
            "obs:object:AbortMultipartUpload",
            "obs:bucket:PutBucketLogging",
            "obs:bucket:DeleteBucketWebsite",
            "obs:object:DeleteObject",
            "obs:bucket:PutBucketVersioning",
            "obs:bucket:GetBucketWebsite",
            "obs:bucket:GetBucketLogging",
            "obs:bucket:DeleteBucketCustomDomainConfiguration",
            "obs:object:PutObject",
            "obs:object:RestoreObject",
            "obs:bucket:PutReplicationConfiguration",
            "obs:bucket:GetBucketQuota",
            "obs:object:GetObjectVersionAcl",
            "obs:bucket:DeleteBucket",
            "obs:bucket:CreateBucket",
            "obs:bucket:GetDirectColdAccessConfiguration",
            "obs:bucket:PutDirectColdAccessConfiguration",
            "obs:bucket:GetBucketAcl",
            "obs:bucket:GetBucketVersioning",
            "obs:bucket:GetBucketInventoryConfiguration",
            "obs:bucket:GetBucketStoragePolicy",
            "obs:bucket:GetEncryptionConfiguration",
            "obs:bucket:PutBucketCORS",
            "obs:bucket:PutBucketTagging",
            "obs:bucket:GetBucketTagging",
            "obs:bucket:PutLifecycleConfiguration",
            "obs:bucket:GetBucketCustomDomainConfiguration",
            "obs:object:ListMultipartUploadParts",
            "obs:object:ModifyObjectMetaData",
            "obs:bucket:ListBucketVersions",
            "obs:bucket:PutBucketQuota",
            "obs:object:PutAccessLabel",
            "obs:bucket:ListBucket",
            "obs:bucket:GetBucketCORS",
            "obs:bucket:DeleteBucketInventoryConfiguration",
            "obs:object:GetObjectVersion",
            "obs:bucket:PutBucketWebsite",
            "obs:bucket:DeleteReplicationConfiguration",
            "obs:object:GetObjectAcl",
            "obs:bucket:GetBucketNotification",
            "obs:bucket:PutBucketNotification",
            "obs:bucket:GetReplicationConfiguration",
```

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```
            "obs:bucket:GetBucketPolicy",
            "obs:bucket:DeleteBucketTagging",
            "obs:bucket:GetBucketStorage"
        ],
        "Resource": [
            "OBS:*:*:object:*",
            "OBS:*:*:bucket:dli-trans*"
        ]
    }
  ]
}
```

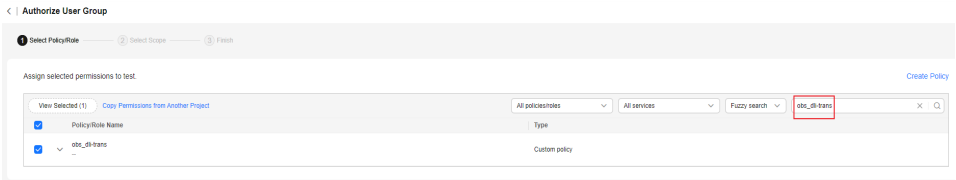
Figure 5-40 Creating custom policy **obs_dli-trans**



Step 4 Click **OK**.

Step 5 In the navigation pane, choose **User Groups**, locate the user group to which the DLI link user using the AK/SK belongs, and click **Authorize** to assign the custom **obs_dli-trans** policy to the user.

Figure 5-41 Assigning the custom **obs_dli-trans** policy to a user group



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----End

5.6.4.12 To OpenTSDB

If the destination link of a job is a **CloudTable OpenTSDB link**, configure the destination job parameters based on **Table 5-100**.

Table 5-100 Parameter description

Parameter	Description	Example Value
Metric	(Optional) You can specify a metric or select an existing metric in OpenTSDB.	city.temp
Time	(Optional) Data point. The value is a string or timestamp in the format of *yyyyMMddHHmmdd*.	1598870800
Tag	(Optional) Data tag	tagk:tagv, tagk2:tagv2

5.6.4.13 To MRS Hudi

If the destination link of a job is an **MRS Hudi link**, configure the destination job parameters based on **Table 5-101**.

Table 5-101 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Destination Link Name	MRS Hudi link	hudi_to_cdm
	Database Name	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	dbadmin

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Type	Parameter	Description	Example Value
	Table Name	Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. You can use macro variables of date and time in a scheduled job to synchronize incremental data periodically. For details, see **Using Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	cdm
	Auto Table Creation	Whether to automatically create Hudi tables • **Non-auto creation**: CDM will not automatically create a table. • **Auto creation**: If the destination database does not contain the table specified by **Table Name**, CDM will automatically create the table. If the table specified by **Table Name** already exists, no table is created and data is written to the existing table.	Non-auto creation
	Clear Data Before Import	Whether the data in the destination table is cleared before data import. The options are as follows: • **Yes**: The data is cleared. • **No**: The data is not cleared. Instead, it will be added to the existing table.	No

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Type	Parameter	Description	Example Value
	Full Data Mode to Write Hoodie	Hoodie write mode. The default value is **Yes**, indicating the full mode. Value **No** indicates the microbatch mode. • In full mode, data is asynchronously written to Hoodie by fragments, which is suitable for writing all data at a time. • In microbatch mode, data is asynchronously written to Hoodie in batches. This mode is suitable if there are strict SLA requirements on the import time, a small number of resources are required, or the MOR table storage types are compressed online. **NOTE** This mode cannot be changed during a retry upon failure.	Yes
	Batch Size	This parameter is available when **Full Data Mode to Write Hoodie** is set to **No**. It specifies the number of data rows written to Hoodie in a single batch. The default value is **100000**.	100000
	Use the import time field	A field marked as the import time field. If a table is automatically created, this field is automatically added to the table creation statement. When data is written to Hudi, the value of this field is replaced by the current time. If the table is not automatically created, select the existing import time field.	Yes
	Data import time field name	This parameter is available when **Use the import time field** is set to **Yes**. It specifies the time when data is written to Hudi. **NOTE** • If the destination table already has an import time field, you can directly use the existing timestamp field. • In the automatic table creation scenario, this field is concatenated to the table creation statement and it is a timestamp. The field name cannot be the same as that of any source field (including custom fields).	cdc_last_update_date

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Type	Parameter	Description	Example Value
Hudi table creation parameters	Location	OBS or HDFS path where database table files are stored	-
	Hudi Table Type	Storage type of the Hudi table • **MOR**: Data is written to a log file in avro format and then merged into a Parquet file when being read. • **COW**: Data is directly written to a Parquet file.	MOR
	Hudi table primary key	Primary keys for creating a Hudi table. Use commas (,) to separate multiple keys.	-
	Hudi Table Key Generator Class	Primary key generation type, which implements **org.apache.hudi.keygen.KeyGenerator** to extract key values from input records.	-
	Hudi table pre-combine key	If two records have the same primary key, the record with a larger **precombine** value is retained. **NOTE** If no time field is available, you can set a field that is the same as the primary key. When a primary key conflict occurs, the latest record is retained.	ts
	Hudi Table Partition Fields	Partition fields for creating a Hudi table. Use commas (,) to separate multiple fields.	-
	Hudi table compression policy (whether to enable write compression)	Policy for compressing data online. This parameter takes effect only for MOR tables.	Yes
	Hudi Table Clean Policy (Reserved Submissions)	Number of submissions reserved during clearance	1

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Type	Parameter	Description	Example Value
	Hudi Table Archiving Policy (Minimum Retention Submissions)	Minimum number of submissions retained during archiving	1
	Hudi Table Archiving Policy (Maximum Number of Retained Submissions)	Maximum number of submissions retained during archiving	100
	Hudi table options	Custom parameters for creating a Hudi table. The parameters take effect in options, for example, **primary key**, **combineKey**, or **index**.	-

5.6.4.14 To MRS ClickHouse

If the destination link of a job is an **MRS ClickHouse link**, configure the destination job parameters based on **Table 5-102**.

NOTE

If the source link of the job is an MRS ClickHouse, DWS, or Hive link:

- If the int or float fields are null, set the field type to **nullable()** when creating an MRS ClickHouse table. Otherwise, the value written to MRS ClickHouse is **0**.
- Check whether the destination table engine is ReplicatedMergeTree. This engine has a deduplication mechanism, in which the data to be deduplicated cannot be predicted accurately. If this engine is used, ensure that data is unique. Otherwise, non-unique data will be ignored and not written, or ReplicatedMergeTree will be replaced by other types of table engines such as MergeTree.

Table 5-102 Parameter description

Parameter	Description	Example Value
Schema/ Tablespace	Click the icon next to the text box to select a schema or tablespace.	schema

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Parameter	Description	Example Value
Table Name	Destination table name. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data
Whether On Cluster	This parameter is displayed when **Clear Data Before Import** is set to **Clear part of data** or **Clear all data**. If this parameter is set to **Yes**, all or part of data on all the nodes in the cluster will be cleared.	Yes
WHERE Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60

5.6.4.15 To MongoDB

If the destination link of a job is a **MongoDB link**, configure the destination job parameters based on **Table 5-103**.

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Table 5-103 Parameter description

Parameter	Description	Example Value
Database Name	Database to which data is to be imported	mddb
Collection Name	Collection of data to be imported, which is similar to the table name of a relational database. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata.	COLLECTION
Behavior	Insert operation to be performed during record migration to the MongoDB • **Insert**: Insert file records into a specified set. • **Insert**: Use a specified filter key as the query condition. If a matching record is found in the set, the record is replaced. (If multiple matching records are found, only the first found record is replaced.) Otherwise, the new record will be added. • **Replace**: Use a specified filter key as the query condition. If a matching record is found in the set, the record is replaced. (If multiple matching records are found, only the first found record is replaced.) Otherwise, the new record will not be added.	Add
Prepare for Data Import	MongoDB query statement that needs to be executed before a task is executed **NOTE** • The value is a JSON string that contains two key-value pairs. The first key-value pair specifies the operation type. The key is **type**, and the value can only be **remove** or **drop**. The second key-value pair is the name of the data condition or set to be configured for the operation type. • The execution of the data import preparation statement does not affect the data to be written.	{"type":"remove","json":"{$or:[{Pid:{$gt:'0',$lt:'2'}},{X:{$gt:'50',$lt:'80'}}]}"}

5.6.5 Configuring CDM Job Field Mapping

Scenario

- After the job parameters are configured, you can configure field mapping. You can click on the **Map Field** page to customize new fields or click in the **Operation** column to create a field converter.

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- If files are migrated between FTP, SFTP, OBS, and HDFS and the migration source's **File Format** is set to **Binary**, files will be directly transferred, free from field mapping.
- In other scenarios, CDM automatically maps fields of the source table and the destination table. You need to check whether the mapping and time format are correct. For example, check whether the source field type can be converted into the destination field type.
- In the auto table creation scenario, you need to add fields to the destination table in advance, and add the fields to the field mapping.

Constraints

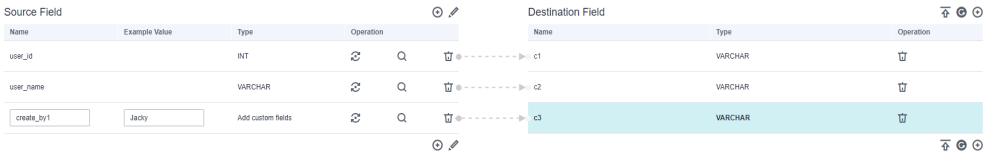
- If **Use SQL Statement** is set to **Yes** in the source job configuration, converters cannot be created.
- On the **Map Field** tab page, if CDM fails to obtain all columns by obtaining sample values (for example, when data is exported from HBase, CloudTable, or MongoDB, there is a high probability that CDM failed to obtain all columns), you can click  and select **Add a new field** to add new fields to ensure that the data imported to the migration destination is complete.
- When a relational database, Hive, DLI, or MRS Hudi is used as the migration source, sample values cannot be obtained.
- When SQLServer is the destination, fields of the timestamp type cannot be written. You must change their type (for example, to datetime) so that they can be written.
- Column names are displayed when the source of the migration job is OBS, CSV files are to be migrated, and parameter **Extract first row as columns** is set to **Yes**.
- Field mapping is not involved when the binary format is used to migrate files to files.
- In the automatic table creation scenario, you need to manually add fields to the destination table in advance and then add fields to the field mapping.
- After a field is added, its sample value is not displayed on the console. This does not affect the field value transmission. CDM directly writes the field value to the destination end.
- If the field mapping is incorrect, you can adjust the field mapping by dragging fields or clicking  to map fields in batches.
- If the data is imported to DWS, you need to select the distribution columns in the destination fields. You are advised to select the distribution columns according to the following principles:
  a. Use the primary key as the distribution column.
  b. If multiple data segments are combined as primary keys, specify all primary keys as the distribution column.
  c. In the scenario where no primary key is available, if no distribution column is selected, DWS uses the first column as the distribution column by default. As a result, data skew risks exist.
- If a source field type is not supported, convert the field type to a type supported by CDM by referring to **Converting Unsupported Data Types**.

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Adding a Field

You can click on the **Map Field** page and select **Add** to customize a new field. This field is usually used to mark the database source to ensure the integrity of the data imported to the migration destination.

Figure 5-42 Field mapping



Currently, the following field types are supported:

- **Constant Parameter**

  Constant parameters are fixed parameters and do not need to be reconfigured. For example, **lable** = **friends** is used to identify a constant value.

- **Variables**

  You can use variables such as time macros, table name macros, and version macros to mark database source information. The variable syntax is ${variable}, where **variable** indicates a variable. For example, **input_time** = **${timestamp()}** indicates the timestamp of the current time.

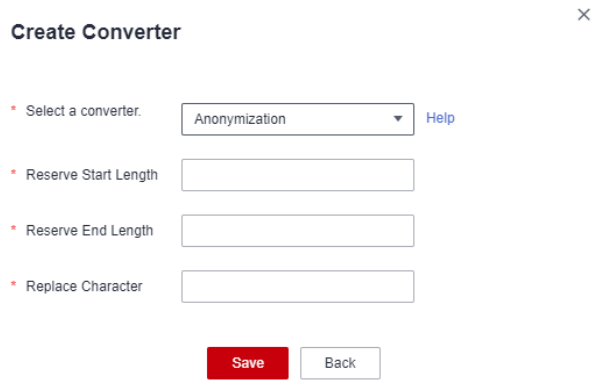
- Expression

  You can use the expression language to dynamically generate parameter values based on the running environment. The expression syntax is #{expr}, where **expr** indicates an expression. For example, **time** = **#{DateUtil.now()}** is used to identify the current date string.

Creating a Converter

CDM supports field conversion. Click and then click **Create Converter**.

Figure 5-43 Creating a converter



CDM can convert fields during migration. Currently, the following field converters are supported:

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- **Anonymization**

  This converter is used to hide key information about the character string. For example, if you want to convert **12345678910** to **123****8910**, configure the parameters as follows:

  - Set **Reserve Start Length** to **3**.
  - Set **Reserve End Length** to **4**.
  - Set **Replace Character** to *****.

- **Trim**

  This converter is used to automatically delete the spaces before and after a string. No parameters need to be configured.

- **Reverse string**

  This converter is used to automatically reverse a string. For example, reverse **ABC** into **CBA**. No parameters need to be configured.

- **Replace string**

  This converter is used to replace a character string. You need to configure the object to be replaced and the new value.

- **Remove line break**

  This converter is used to delete the newline characters, such as \n, \r, and \r\n from the field.

- **Expression conversion**

  During data conversion, if the content to be replaced contains a special character, use a backslash (\) to escape the special character to a common one.

  - The expression supports the following environment variables:
    - **value**: indicates the current field value.
    - **row**: indicates the current row, which is an array type.
  - The expression supports the following Utils:
    i. If the field is of the string type, convert all character strings into lowercase letters, for example, convert **aBC** to **abc**.

       Expression: StringUtils.lowerCase(value)

    ii. Convert all character strings of the current field to uppercase letters.

       Expression: StringUtils.upperCase(value)

    iii. Convert the format of the first date field from 2018-01-05 15:15:05 to 20180105.

       Expression: DateUtils.format(DateUtils.parseDate(row[0],"yyyy-MM-dd HH:mm:ss"),"yyyyMMdd")

    iv. Convert a timestamp to a date string in *yyyy-MM-dd hh:mm:ss* format, for example, convert **1701312046588** to **2023-11-30 10:40:46**.

       Expression: DateUtils.format(NumberUtils.toLong(value),"yyyy-MM-dd HH:mm:ss")

    v. Convert a date string in the yyyy-MM-dd hh:mm:ss format to a timestamp.

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Expression: DateUtils.getTime(DateUtils.parseDate(value,"yyyy-MM-dd hh:mm:ss"))

vi. If the field value is a date string in *yyyy-MM-dd* format, extract the year from the field value, for example, extract **2017** from **2017-12-01**.

Expression: StringUtils.substringBefore(value,"-")

vii. If the field value is of the numeric type, convert the value to a new value which is two times greater than the original value:

Expression: value*2

viii. Convert the field value **true** to **Y** and other field values to **N**.

Expression: value=="true"?"Y":"N"

ix. If the field value is of the string type and is left empty, convert it to **Default**. Otherwise, the field value will not be converted.

Expression: empty value? "Default":value

x. Convert date format **2018/01/05 15:15:05** to **2018-01-05 15:15:05**:

Expression: DateUtils.format(DateUtils.parseDate(value,"yyyy/MM/dd HH:mm:ss"),"yyyy-MM-dd HH:mm:ss")

xi. Obtain a 36-bit universally unique identifier (UUID):

Expression: CommonUtils.randomUUID()

xii. If the field is of the string type, capitalize the first letter, for example, convert **cat** to **Cat**.

Expression: StringUtils.capitalize(value)

xiii. If the field is of the string type, convert the first letter to a lowercase letter, for example, convert **Cat** to **cat**.

Expression: StringUtils.uncapitalize(value)

xiv. If the field is of the string type, use a space to fill in the character string to the specified length and center the character string. If the length of the character string is not shorter than the specified length, do not convert the character string. For example, convert **ab** to meet the specified length 4.

Expression: StringUtils.center(value,*4*)

xv. Delete a newline (including **\n**, **\r**, and **\r\n**) at the end of a character string. For example, convert **abc\r\n\r\n** to **abc\r\n**.

Expression: StringUtils.chomp(value)

xvi. If the string contains the specified string, **true** is returned; otherwise, **false** is returned. For example, **abc** contains **a** so that **true** is returned.

Expression: StringUtils.contains(value,"*a*")

xvii. If the string contains any character of the specified string, **true** is returned; otherwise, **false** is returned. For example, **zzabyycdxx** contains either **z** or **a** so that **true** is returned.

Expression: StringUtils.containsAny(value,"*za*")

xviii. If the string does not contain any one of the specified characters, **true** is returned. If any specified character is contained, **false** is returned. For example, **abz** contains one character of **xyz** so that **false** is returned.

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Expression: StringUtils.containsNone(value,"*xyz*")

xix. If the string contains only the specified characters, **true** is returned. If any other character is contained, **false** is returned. For example, **abab** contains only characters among **abc** so that **true** is returned.

Expression: StringUtils.containsOnly(value,"*abc*")

xx. If the character string is empty or null, convert it to the specified character string. Otherwise, do not convert the character string. For example, convert the empty character string to null.

Expression: StringUtils.defaultIfEmpty(value,*null*)

xxi. If the string ends with the specified suffix (case sensitive), **true** is returned; otherwise, **false** is returned. For example, if the suffix of **abcdef** is not null, **false** is returned.

Expression: StringUtils.endsWith(value,*null*)

xxii. If the string is the same as the specified string (case sensitive), **true** is returned; otherwise, **false** is returned. For example, after strings **abc** and **ABC** are compared, **false** is returned.

Expression: StringUtils.equals(value,"*ABC*")

xxiii. Obtain the first index of the specified character string in a character string. If no index is found, **-1** is returned. For example, the first index of **ab** in **aabaabaa** is 1.

Expression: StringUtils.indexOf(value,"*ab*")

xxiv. Obtain the last index of the specified character string in a character string. If no index is found, **-1** is returned. For example, the last index of **k** in **aFkyk** is 4.

Expression: StringUtils.lastIndexOf(value,"*k*")

xxv. Obtain the first index of the specified character string from the position specified in the character string. If no index is found, **-1** is returned. For example, the first index of **b** obtained after the index 3 of **aabaabaa** is 5.

Expression: StringUtils.indexOf(value,"*b*",*3*)

xxvi. Obtain the first index of any specified character in a character string. If no index is found, **-1** is returned. For example, the first index of **z** or **a** in **zzabyycdxx.** is 0.

Expression: StringUtils.indexOfAny(value,"*za*")

xxvii. If the string contains any Unicode character, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only non-Unicode characters so that **false** is returned.

Expression: StringUtils.isAlpha(value)

xxviii. If the string contains only Unicode characters and digits, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only Unicode characters and digits, so that **true** is returned.

Expression: StringUtils.isAlphanumeric(value)

xxix. If the string contains only Unicode characters, digits, and spaces, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only Unicode characters and digits, so that **true** is returned.

Expression: StringUtils.isAlphanumericSpace(value)

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xxx. If the string contains only Unicode characters and spaces, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains Unicode characters and digits so that **false** is returned.

Expression: StringUtils.isAlphaSpace(value)

xxxi. If the string contains only printable ASCII characters, **true** is returned; otherwise, **false** is returned. For example, for **!ab-c~**, **true** is returned.

Expression: StringUtils.isAsciiPrintable(value)

xxxii. If the string is empty or null, **true** is returned; otherwise, **false** is returned.

Expression: StringUtils.isEmpty(value)

xxxiii. If the string contains only Unicode digits, **true** is returned; otherwise, **false** is returned.

Expression: StringUtils.isNumeric(value)

xxxiv. Obtain the leftmost characters of the specified length. For example, obtain the leftmost two characters **ab** from **abc**.

Expression: StringUtils.left(value,*2*)

xxxv. Obtain the rightmost characters of the specified length. For example, obtain the rightmost two characters **bc** from **abc**.

Expression: StringUtils.right(value,*2*)

xxxvi. Concatenate the specified character string to the left of the current character string and specify the length of the concatenated character string. If the length of the current character string is not shorter than the specified length, the character string will not be converted. For example, if **yz** is concatenated to the left of **bat** and the length must be 8 after concatenation, the character string is **yzyzybat** after conversion.

Expression: StringUtils.leftPad(value,*8*,"*yz*")

xxxvii. Concatenate the specified character string to the right of the current character string and specify the length of the concatenated character string. If the length of the current character string is not shorter than the specified length, the character string will not be converted. For example, if **yz** is concatenated to the right of **bat** and the length must be 8 after concatenation, the character string is **batyzyzy** after conversion.

Expression: StringUtils.rightPad(value,*8*,"*yz*")

xxxviii. If the field is of the string type, obtain the length of the current character string. If the character string is null, **0** is returned.

Expression: StringUtils.length(value)

xxxix. If the field is of the string type, delete all the specified character strings from it. For example, delete **ue** from **queued** to obtain **qd**.

Expression: StringUtils.remove(value,"*ue*")

xl. If the field is of the string type, remove the substring at the end of the field. If the specified substring is not at the end of the field, no conversion is performed. For example, remove **.com** at the end of **www.domain.com**.

Expression: StringUtils.removeEnd(value,"*.com*")

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xli. If the field is of the string type, delete the substring at the beginning of the field. If the specified substring is not at the beginning of the field, no conversion is performed. For example, delete **www.** at the beginning of **www.domain.com**.

Expression: StringUtils.removeStart(value,"*www.*")

xlii. If the field is of the string type, replace all the specified character strings in the field. For example, replace **a** in **aba** with **z** to obtain **zbz**.

Expression: StringUtils.replace(value,"*a*","*z*")

If the content to be replaced contains a special character, the special character must be escaped to a common character. For example, if you want to delete **\t** from a string, use the following expression: StringUtils.replace(value,"\\t",""), which means escaping the backslash (\) again.

xliii. If the field is of the string type, replace multiple characters in the character string at a time. For example, replace **h** in **hello** with **j** and **o** with **y** to obtain **jelly**.

Expression: StringUtils.replaceChars(value,"*ho*","*jy*")

xliv. If the string starts with the specified prefix (case sensitive), **true** is returned; otherwise, **false** is returned. For example, **abcdef** starts with **abc**, so that **true** is returned.

Expression: StringUtils.startsWith(value,"*abc*")

xlv. If the field is of the string type, delete all the specified characters at the beginning and end of the field. the field. For example, delete all **x**, **y**, **z**, and **b** from **abcyx** to obtain **abc**.

Expression: StringUtils.strip(value,"*xyz*b")

xlvi. If the field is of the string type, delete all the specified characters at the end of the field, for example, delete the "abc" string at the end of the field.

Expression: StringUtils.stripEnd(value,*"abc"*)

xlvii. If the field is of the string type, delete all the specified characters at the beginning of the field, for example, delete all spaces at the beginning of the field.

Expression: StringUtils.stripStart(value,*null*)

xlviii. If the field is of the string type, obtain the substring after the specified position (the index starts from 0, including the character at the specified position) of the character string. If the specified position is a negative number, calculate the position in the descending order. The first digit at the end is -1. For example, obtain the character whose index is 2 from **abcde** (that is, **c**) and the string after it, that is, **cde**.

Expression: StringUtils.substring(value,*2*)

xlix. If the field is of the string type, obtain the substring in a specified range (the index starts from 0, including the character at the start and excluding the character at the end). If the range is a negative number, calculate the position in the descending order. The first digit at the end is -1. For example, obtain the string between the second character (c) and fourth character (e) of **abcde**, that is, **cd**.

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Expression: StringUtils.substring(value,*2*,4)

l. If the field is of the string type, obtain the substring after the first specified character. For example, obtain the substring after the first **b** in **abcba**, that is, **cba**.

Expression: StringUtils.substringAfter(value,"*b*")

li. If the field is of the string type, obtain the substring after the last specified character. For example, obtain the substring after the last **b** in **abcba**, that is, **a**.

Expression: StringUtils.substringAfterLast(value,"*b*")

lii. If the field is of the string type, obtain the substring before the first specified character. For example, obtain the substring before the first **b** in **abcba**, that is, **a**.

Expression: StringUtils.substringBefore(value,"*b*")

liii. If the field is of the string type, obtain the substring before the last specified character. For example, obtain the substring before the last **b** in **abcba**, that is, **abc**.

Expression: StringUtils.substringBeforeLast(value,"*b*")

liv. If the field is of the string type, obtain the substring nested within the specified string. If no substring is found, **null** is returned. For example, obtain the substring between **tag** in **tagabctag**, that is, **abc**.

Expression: StringUtils.substringBetween(value,"*tag*")

lv. If the field is of the string type, delete the control characters (char≤32) at both ends of the character string, for example, delete the spaces at both ends of the character string.

Expression: StringUtils.trim(value)

lvi. Convert the character string to a value of the byte type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toByte(value)

lvii. Convert the character string to a value of the byte type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toByte(value,*1*)

lviii. Convert the character string to a value of the double type. If the conversion fails, **0.0d** is returned.

Expression: NumberUtils.toDouble(value)

lix. Convert the character string to a value of the double type. If the conversion fails, the specified value, for example, **1.1d**, is returned.

Expression: NumberUtils.toDouble(value,*1.1d*)

lx. Convert the character string to a value of the float type. If the conversion fails, **0.0f** is returned.

Expression: NumberUtils.toFloat(value)

lxi. Convert the character string to a value of the float type. If the conversion fails, the specified value, for example, **1.1f**, is returned.

Expression: NumberUtils.toFloat(value,*1.1f*)

lxii. Convert the character string to a value of the int type. If the conversion fails, **0** is returned.

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Expression: NumberUtils.toInt(value)

lxiii. Convert the character string to a value of the int type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toInt(value,*1*)

lxiv. Convert the character string to a value of the long type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toLong(value)

lxv. Convert the character string to a value of the long type. If the conversion fails, the specified value, for example, **1L**, is returned.

Expression: NumberUtils.toLong(value,*1L*)

lxvi. Convert the character string to a value of the short type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toShort(value)

lxvii. Convert the character string to a value of the short type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toShort(value,*1*)

lxviii. Convert the IP string to a value of the long type, for example, convert **10.78.124.0** to **172915712**.

Expression: CommonUtils.ipToLong(value)

lxix. Read an IP address and physical address mapping file from the network, and download the mapping file to the map collection. *url* indicates the address for storing the IP mapping file, for example, **http://10.114.205.45:21203/sqoop/IpList.csv**.

Expression: HttpsUtils.downloadMap("*url*")

lxx. Cache the IP address and physical address mappings and specify a key for retrieval, for example, **ipList**.

Expression: CommonUtils.setCache("*ipList*",HttpsUtils.downloadMap("*url*"))

lxxi. Obtain the cached IP address and physical address mappings.

Expression: CommonUtils.getCache("*ipList*")

lxxii. Check whether the IP address and physical address mappings are cached.

Expression: CommonUtils.cacheExists("*ipList*")

lxxiii. Based on the specified offset type (month/day/hour/minute/second) and offset (positive number indicates increase and negative number indicates decrease), convert the time in the specified format to a new time, for example, add 8 hours to **2019-05-21 12:00:00**.

Expression: DateUtils.getCurrentTimeByZone("*yyyy-MM-dd HH:mm:ss*",value, "*hour*", *8*)

lxxiv. If the value is empty or null, "aaa" is returned. Otherwise, **value** is returned.

Expression: StringUtils.defaultIfEmpty(value,*"aaa"*)

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Special Links

- If the source link is a DLI link, and the destination link is a DWS link, fields of the tinyint type of the DLI link are mapped to fields of the smallint type of the DWS link.
- If the source link is a Hudi link, and the destination link is a DWS link, fields of the Double type of the Hudi link are mapped to fields of the Float type of the DWS link.

5.6.6 Configuring a Scheduled CDM Job

CDM supports scheduled execution of table/file migration jobs by minute, hour, day, week, and month. This section describes how to configure scheduled job parameters.

NOTE

- When configuring scheduled jobs, do not set the same scheduled time for different jobs. Instead, set different times to avoid exceptions.
- If you use DataArts Studio DataArts Factory to schedule the CDM migration job and configure this parameter, both configurations take effect. To ensure unified service logic and avoid scheduling conflicts, enable job scheduling in DataArts Factory and do not configure a scheduled task for the job in DataArts Migration.
- The scheduled execution function uses the Java Quartz timer, which is similar to the Cron expression configuration. It parses the minute, hour, day, and month of the start time, and constructs a cronb expression.

  For example, in the daily scheduling mode where the interval is set to 1 day: if the current time is 2022-10-14 12:00 and the start time is set to 2022-10-14 00:00, the job is executed at 2022-10-15 00:00; if the current time is 2022-10-14 12:00 and the start time is set to 2022-10-14 00:00, the job is executed at 2022-10-15 00:00.

  In the daily scheduling mode where the interval is set to 2 days: if the current time is 2022-10-14 12:00 and the start time is set to 2022-10-14 00:00, the job is executed at 2022-10-16 00:00; if the current time is 2022-10-14 12:00 and the start time is set to 2022-10-14 00:00, the job is executed at 2022-10-16 00:00.

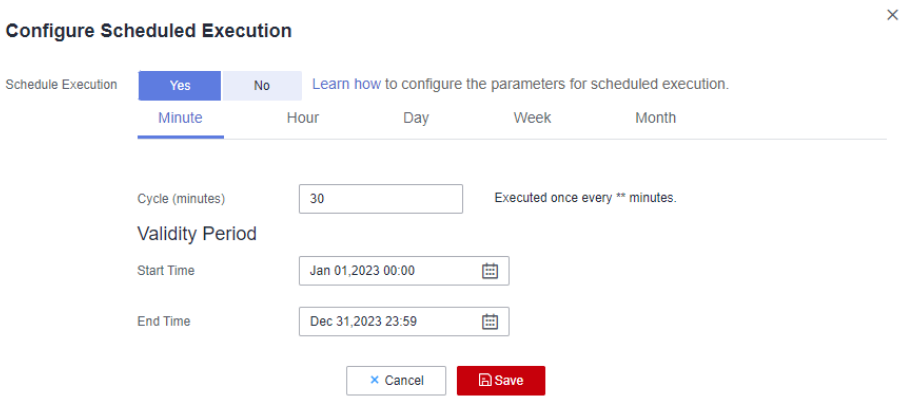
Scheduling Job Execution by Minute

CDM allows jobs to be executed every several minutes. It is recommended that the cycle be at least 5 minutes.

- **Start Time**: indicates the time when the scheduled configuration takes effect, or the first time when the job is automatically executed.
- **Cycle (minutes)**: indicates the interval when a job is executed starting from the start time.
- **End Time**: This parameter is optional. If it is not set, the scheduled job keeps being automatically executed. If it is set, the scheduled job will be automatically stopped at the end time.

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Figure 5-44 Scheduling job execution by minute



For example, the settings shown in the above figure mean that the job will be automatically executed at 00:00 on January 1, 2023 for the first time at a cycle of 30 minutes until 23:59 on December 31, 2023.

Scheduling Job Execution by Hour

CDM allows jobs to be executed every several hours.

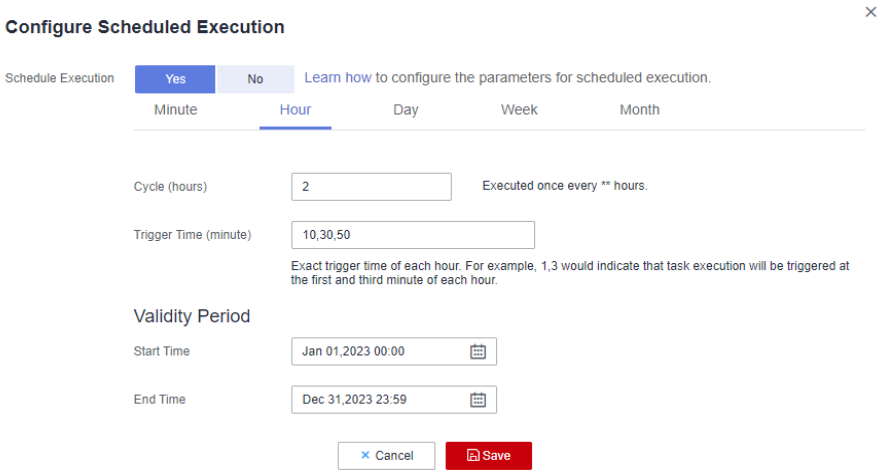
- **Cycle (hours)**: indicates the interval when a job is automatically executed.
- **Trigger Time (minute)**: indicates the exact time in each hour when a scheduled task is triggered. The value ranges from 0 to 59. You can set a maximum of 60 values and use commas (,) to separate these values. However, the values must be unique.

  If the trigger time is not within the validity period, the system selects a trigger time closest to the validity period for the scheduled job to be automatically executed at the first time. The following gives an example:

  - **Start Time**: **1:20**
  - **Cycle (hours)**: **3**
  - **Trigger Time (minute)**: **10**
- **Validity Period**: includes **Start Time** and **End Time**.
  - **Start Time**: indicates the time when the scheduled configuration takes effect.
  - **End Time**: This parameter is optional, which indicates the time when the scheduled job is automatically stopped. If this parameter is not set, the scheduled job keeps being automatically executed.

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Figure 5-45 Scheduling job execution by hour



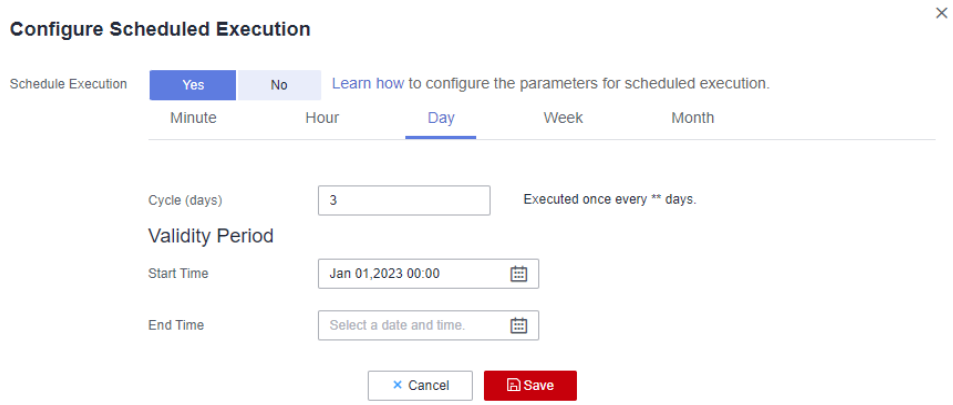
For example, the settings shown in the above figure mean that the job will be automatically executed at 00:10 on January 1, 2023 for the first time, at 00:30 for the second time, and at 00:50 for the third time. It will be executed three times every two hours until 23:59 on December 31, 2023.

Scheduling Job Execution by Day

CDM allows jobs to be executed every several days.

- **Cycle (days)**: indicates the interval when a job is executed starting from the start time.
- **Validity Period**: includes **Start Time** and **End Time**.
  - **Start Time**: indicates the time when the scheduled configuration takes effect, or the first time when the job is automatically executed.
  - **End Time**: This parameter is optional, which indicates the time when the scheduled job is automatically stopped. If this parameter is not set, the scheduled job keeps being automatically executed.

Figure 5-46 Scheduling job execution by day



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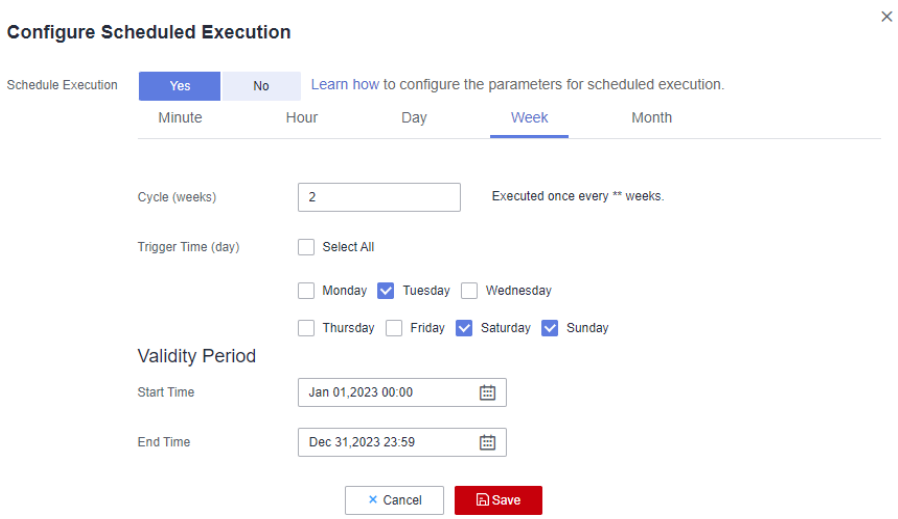
For example, the settings shown in the above figure mean that the job will be automatically executed at 00:00 on January 1, 2023 for the first time, and will be executed once every three days. The configuration is valid permanently.

Scheduling Job Execution by Week

CDM allows jobs to be executed every several weeks.

- **Cycle (weeks)**: indicates the interval when a scheduled job is executed starting from the start time.
- **Trigger Time (day)**: You can specify the day of each week when the job is automatically executed. One or more days can be selected at a time.
- **Validity Period**: includes **Start Time** and **End Time**.
  - **Start Time**: indicates the time when the scheduled configuration takes effect.
  - **End Time**: This parameter is optional, which indicates the time when the scheduled job is automatically stopped. If this parameter is not set, the scheduled job keeps being automatically executed.

Figure 5-47 Scheduling job execution by week



For example, the settings shown in the above figure mean that the job will be automatically executed at 00:00 every Tuesday, Saturday, and Sunday every two weeks starting from 00:00 on January 1, 2023 until 23:59 on December 31, 2023.

Scheduling Job Execution by Month

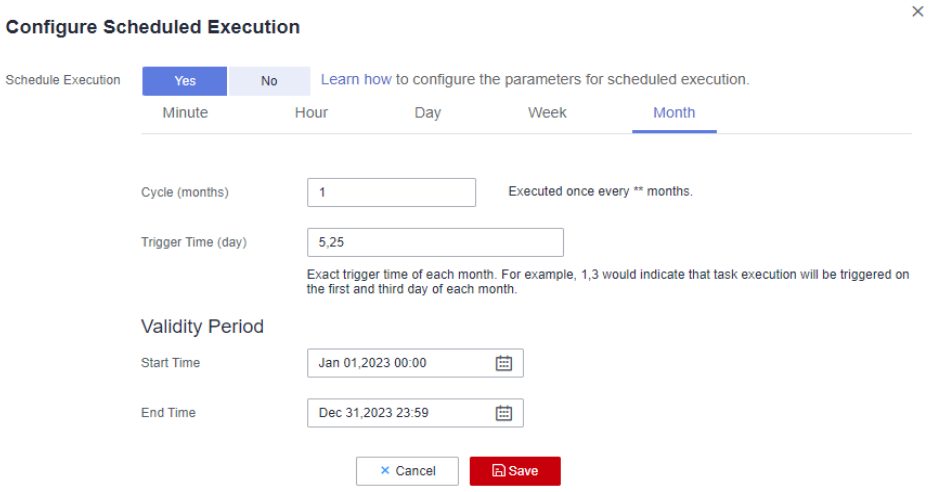
CDM allows jobs to be executed every several months.

- **Cycle (months)**: indicates the interval when a scheduled job is executed starting from the start time.
- **Trigger Time (day)**: indicates the day of each month when the job is executed. The value ranges from 1 to 31. You can set multiple values and use commas (,) to separate these values. However, the values must be unique.

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- **Validity Period**: includes **Start Time** and **End Time**.
  - **Start Time**: indicates the time when the scheduled configuration takes effect. The automatic execution time is accurate to hour, minute, and second.
  - **End Time**: This parameter is optional, which indicates the time when the scheduled job is automatically stopped. If this parameter is not set, the scheduled job keeps being automatically executed.

Figure 5-48 Scheduling job execution by month



For example, the settings shown in the above figure mean that the job will be automatically executed at 00:00 on the 5th and 25th days of each month starting from 00:00 on January 1, 2023 until 23:59 on December 31, 2023.

5.6.7 Managing CDM Job Configuration

On the **Settings** tab page, you can perform the following operations:

- **Maximum Concurrent Extractors**
- **Scheduled Backup/Restoration**
- **Environment Variables of Job Parameters**

Maximum Concurrent Extractors

Maximum number of concurrent extraction tasks in a cluster

NOTE

This parameter is also available on the **Cluster Configuration** page. You can change its value either on this page or the **Cluster Configuration** page.

CDM migrates data through data migration jobs. It works in the following way:

1. When data migration jobs are submitted, CDM splits each job into multiple tasks based on the **Concurrent Extractors** parameter in the job configuration.

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NOTE

Jobs for different data sources may be split based on different dimensions. Some jobs may not be split based on the **Concurrent Extractors** parameter.

2. CDM submits the tasks to the running pool in sequence. Tasks (defined by **Maximum Concurrent Extractors**) run concurrently. Excess tasks are queued.

By setting appropriate values for the **Concurrent Extractors** and **Maximum Concurrent Extractors** parameters, you can accelerate migration.

1. You are advised to set **Maximum Concurrent Extractors** to twice the number of vCPUs. For details, see **Table 5-104**.

   Table 5-104 Recommended maximum number of concurrent extractors for a CDM cluster

Flavor	vCPUs/Memory	Recommended Maximum Concurrent Extractors
cdm.large	8 vCPUs, 16 GB	16
cdm.xlarge	16 vCPUs, 32 GB	32
cdm.4xlarge	64 vCPUs, 128 GB	128

2. Configure the number of concurrent extractors based on the following rules:
   a. When data is to be migrated to files, CDM does not support multiple concurrent tasks. In this case, set a single process to extract data.
   b. If each row of the table contains less than or equal to 1 MB data, data can be extracted concurrently. If each row contains more than 1 MB data, it is recommended that data be extracted in a single thread.
   c. Set **Concurrent Extractors** for a job based on **Maximum Concurrent Extractors** for the cluster. It is recommended that the value of **Concurrent Extractors** is less than that of **Maximum Concurrent Extractors**.
   d. If the migration source is Hive and JDBC is used to read data, CDM does not support multi-concurrency. In this case, set the number of concurrent extractors to 1.
   e. If the destination is DLI, you are advised to set the number of concurrent extractors to 1. Otherwise, data may fail to be written.

Scheduled Backup/Restoration

This function depends on the OBS service. Backup files cannot be automatically aged. You need to manually delete backup files on a regular basis.

- Prerequisites

  An OBS link has been created. For details, see **OBS Link Parameters**.

- Scheduled backup

  On the **Job Management** page, click **Settings** and configure **Scheduled Backup** and its related parameters.

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Table 5-105 Scheduled backup parameters

Parameter	Description	Example Value
Scheduled Backup	Whether to enable automatic backup. This function is used to back up jobs but not links.	Enable
Backup Policy	• **All jobs**: CDM backs up all table/file migration jobs and entire DB migration jobs regardless of the job statuses. However, historical jobs are not backed up. • **All jobs by groups**: You select one or more job groups to back up.	All jobs
Backup Cycle	Select the backup cycle. • **Day**: The backup is performed daily at 00:00:00. • **Week**: The backup is performed at 00:00:00 every Monday. • **Month**: The backup is performed at 00:00:00 on the first day of each month.	Day
OBS Link for Writing Backups	Link used to back up jobs to OBS buckets. Select a link you have created on the **Links** page.	obslink
OBS Bucket	OBS bucket where backup files are stored	cdm
Backup Data Directory	Directory where backup files are stored	/cdm-bk/

- Restoring jobs

  If automatic backup has been performed, the backup list is displayed on the **Configuration Management** tab page. The OBS buckets where the backup files reside, backup paths, and backup time are displayed.

  You can click **Restore Backup** in the **Operation** column of the backup list to restore the CDM jobs.

Environment Variables of Job Parameters

When creating a migration job on CDM, the parameter (such as the OBS bucket name or file path) that can be manually configured, a field in a parameter, or a character in a field can be configured as a global variable, so that you can change parameter values in batches, or batch replace certain characters after jobs are exported or imported.

The following describes how to batch replace the OBS bucket name in a migration job.

1. On the **Job Management** page, click the **Configuration Management** tab and configure environment variables.

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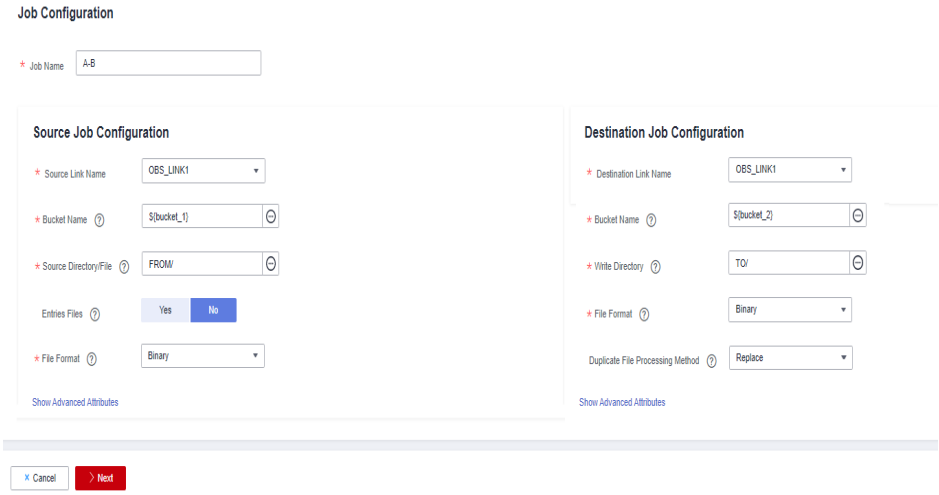
```
bucket_1=A
bucket_2=B
```

Variable **bucket_1** indicates bucket A, and variable **bucket_2** indicates bucket B.

2. On the page for creating a CDM migration job, migrate data from bucket A to bucket B.

   Set the source bucket name to **${bucket_1}** and destination bucket name to **${bucket_2}**.

   Figure 5-49 Setting the bucket names to environment variables



3. If you want to migrate data from bucket C to bucket D, you do not need to change the job parameters. You only need to change the environment variables on the **Configuration Management** tab page as follows:

```
bucket_1=C
bucket_2=D
```

5.6.8 Managing a CDM Job

Existing CDM jobs can be viewed, modified, deleted, started, and stopped. This section describes how to view and modify a job.

Viewing a Job

- **Viewing job status**

  The job status can be **New**, **Pending**, **Booting**, **Running**, **Failed**, **Succeeded**, or **Stopped**.

  Pending indicates that the job is waiting to be scheduled by the system, and **Booting** indicates that the data to be migrated is being analyzed.

- **Viewing the historical records**

  You can view job execution results and historical information in the last 30 days, including job execution records, read/write statistics, and job execution logs.

- **Viewing job logs**

  On the **Historical Record** page, you can view all logs of a job.

  Alternatively, in the **Operation** column, choose **More** > **Log** to view the latest logs of the job.

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- **Viewing the JSON file of a job**

  You can directly edit the JSON file of a job, which is equivalent to modifying the parameter settings of the job.

- **Querying the job statistics**

  You can open the preview window of a configured database job and view up to 1,000 pieces of data. By comparing the number of data records of the migration source and destination, you can check whether the migration was successful and whether data was lost.

Modifying a Job

- **Modifying the job parameters**

  You can reconfigure job parameters and reselect source and destination links.

- **Editing the JSON file of a job**

  You can directly edit the JSON file of a job, which is equivalent to modifying the parameter settings of the job.

Procedure

Step 1 Log in to the management console and choose **Service List** > **Cloud Data Migration**. In the left navigation pane, choose **Cluster Management**. Locate the target cluster and click **Job Management**.

Step 2 Click **Table/File Migration**. The job list is displayed. You can perform the following operations on a single job:

- Modify the job parameters: Click **Edit** in the **Operation** column to modify the job parameters.
- Run the job: Click **Run** in the **Operation** column to manually start the job.
- View the historical records: Click **Historical Record** in the **Operation** column. On the **Historical Record** page that is displayed, view the job's historical execution records and read/write statistics. Click **Log** to view the job logs.
- Delete the job: Choose **More** > **Delete** in the **Operation** column to delete the job.
- Stop the job: Choose **More** > **Stop** in the **Operation** column to stop the job.
- View the job JSON: Choose **More** > **View Job JSON** in the **Operation** column to view the job JSON.
- Edit the job JSON: Choose **More** > **Edit Job JSON** in the **Operation** column to edit the job JSON files, which is similar to modify the job parameters.
- Configure a scheduled job: Locate a job and choose **More** > **Configure Scheduled Execution**. You can set the cycle for periodically executing the job. For details, see **Configuring a Scheduled CDM Job**.
- View logs: Locate a job, click **More** in the **Operation** column, and select **Log** to view the latest log of the job.

  You can also view all logs of the job on the **Historical Record** page.
- Retry the job: Locate a failed job, click **More** in the **Operation** column, and select **Retry**. The job will be automatically retried three times.

Step 3 After the modification, click **Save** or **Save and Run**.

----End

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5.6.9 Managing CDM Jobs

Scenario

This section describes how to manage CDM table/file migration jobs in batches. The following operations are supported:

- Managing jobs by group
- Running jobs in batches
- Deleting jobs in batches
- Exporting jobs in batches
- Importing jobs in batches

You can export and import jobs in batches in the following scenarios:

- Job migration between CDM clusters: You can migrate jobs from a cluster of an earlier version to a new version.
- Job backup: You can stop or delete CDM clusters to reduce costs. In this case, you can export the job scripts in batches and save them, and create a cluster and import the job scripts if necessary.
- Batch job creation: You can manually create a job and export the job configuration file in JSON format. Copy the content in the JSON file to the same file or new files, and then import the file/files to CDM to create jobs in batches.

Procedure

Step 1 Log in to the management console and choose **Service List** > **Cloud Data Migration**. In the left navigation pane, choose **Cluster Management**. Locate the target cluster and click **Job Management**.

Step 2 Click **Table/File Migration**. The job list is displayed. You can perform the following batch operations:

- **Manage jobs by group.**

  CDM allows users to add, modify, search for, and delete job groups. When a group is deleted, all jobs in the group are deleted.

  When creating a job, if jobs have been assigned to different groups, you can display, start, or export jobs by group.

  NOTE

  Starting jobs by group will run all jobs in the group. If user isolation is enabled, starting jobs by group will still run all jobs in the group even if otherIAM users in the a Huawei account cannot view the jobs in the group. Therefore, you are not advised to start jobs by group in user isolation scenarios.

- **Run jobs in batches.**

  After selecting one or more jobs, click **Run** to start these jobs in batches.

- **Delete jobs in batches.**

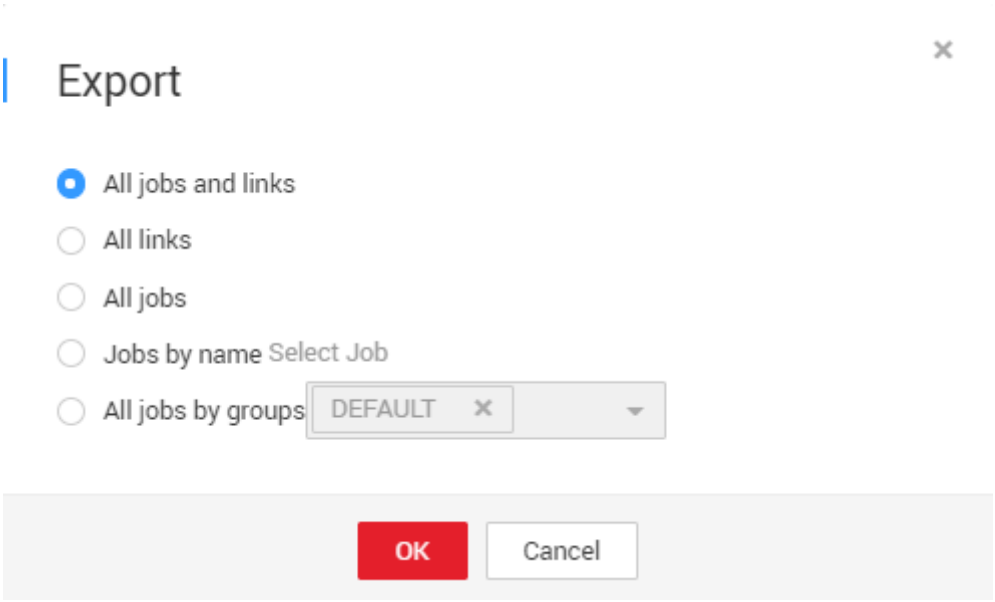
  After selecting one or more jobs, click **Delete** to delete these jobs in batches.

- **Export jobs in batches.**

  Click **Export**.

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Figure 5-50 Export



  - **All jobs and links**: Export all jobs and links at a time.
  - **All jobs**: Export all jobs at a time.
  - **All links**: Export all links at a time.
  - **Jobs by name**: Select the jobs to export and click **OK**.
  - **All jobs by groups**: Select the group to export and click **OK**.

  Exported jobs are stored in JSON files, which can be used as backups or imported to other clusters.

  NOTE

  For security purposes, no link password is exported when jobs are exported. All passwords are replaced by *Add password here*.

- **Import jobs in batches.**

  Click **Import** and select the import format (text file or JSON).

  - **By JSON string**: Job files to be imported must be in JSON format and the file size cannot exceed 1 MB. If the job files to be imported are exported from CDM, edit the JSON files before importing them to CDM. Replace *Add password here* with the correct link passwords.
  - **By text file**: This mode can be used when the local JSON files cannot be uploaded properly. Paste the JSON strings for the jobs into the text box.

  NOTE

  Existing jobs cannot be overwritten during the import.

----End

5.7 Using Macro Variables of Date and Time

During the creation of table/file migration jobs, CDM supports the macro variables of date and time in the following parameters of the source and destination links:

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- Source directory or file
- Source table name
- Directory filter and file filter of the **wildcard** type
- Start time and end time of the **time filter** type
- Partition filter criteria and where clause
- Write directory
- Destination table name

You can use the **${}** macro variable definition identifier to define the macros of the time type. currently, dateformat and timestamp are supported.

By using the macro variables of date and time and scheduled job, you can implement incremental synchronization of databases and files.

NOTE

If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).

dateformat

dateformat supports two types of parameters:

- **dateformat(format)**

  format indicates the date and time format. For details about the format definition, see the definition in **java.text.SimpleDateFormat.java**.

  For example, if the current date is **2017-10-16 09:00:00**, **yyyy-MM-dd HH:mm:ss** indicates **2017-10-16 09:00:00**.

- dateformat(format, dateOffset, dateType)
  - **format** indicates the format of the returned date.
  - **dateOffset** indicates the date offset.
  - **dateType** indicates the type of the date offset.

    Currently, **dateType** supports SECOND, MINUTE, HOUR, MONTH, YEAR, and DAY.

    NOTE

    Pay attention to the following special scenarios of **MONTH** and **YEAR**:
    - If the date does not exist after the offset, the latest date of the month in the calendar is used.
    - These two offset types cannot be used for the start time and end time in the **Time Filter** parameter of the source and destination jobs.

  For example, if the current date is **2023-03-01 09:00:00**, then:
  - **dateformat(yyyy-MM-dd HH:mm:ss, -1, YEAR)** indicates the year before the current time, that is, **2022-03-01 09:00:00**.
  - **dateformat(yyyy-MM-dd HH:mm:ss, -3, MONTH)** indicates three months before the current time, that is, **2022-12-01 09:00:00**.
  - **dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)** indicates the day before the current time, that is, **2023-02-28 09:00:00**.

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  - **dateformat(yyyy-MM-dd HH:mm:ss, -1, HOUR)** indicates one hour before the current time, that is, **2023-03-01 08:00:00**.
  - **dateformat(yyyy-MM-dd HH:mm:ss, -1, MINUTE)** indicates one minute before the current time, that is, **2023-03-01 08:59:00**.
  - **dateformat(yyyy-MM-dd HH:mm:ss, -1, SECOND)** indicates one second before the current time, that is, **2023-03-01 08:59:59**.

timestamp

timestamp supports two types of parameters:

- **timestamp()**

  Indicates the returned timestamp of the current time, that is, the number of milliseconds that have elapsed since 00:00:00 on January 1, 1970 (1970-01-01 00:00:00 GMT). For example, 1508078516286.

- **timestamp(dateOffset, dateType)**

  Indicates the timestamp returned after time offset. **dateOffset** and **dateType** indicate the date offset and the offset type, respectively.

  For example, if the current date is **2017-10-16 09:00:00**, **timestamp(-10, MINUTE)** indicates that the timestamp generated 10 minutes before the current time point is returned, that is, **1508115000000**.

Macro Variable Definition of Time and Date

Suppose that the current time is **2017-10-16 09:00:00**, then **Table 5-106** describes the macro variable definitions of time and date.

NOTE

The examples in the table must be embedded in ''. For example, '${dateformat(yyyy-MM-dd)}' returns the current time in yyyy-MM-dd format.

Table 5-106 Macro variable definition of time and date

Macro Variable	Description	Display Effect
${dateformat(yyyy-MM-dd)}	Returns the current date in **yyyy-MM-dd** format.	2017-10-16
${dateformat(yyyy/MM/dd)}	Returns the current date in **yyyy/MM/dd** format.	2017/10/16
${dateformat(yyyy_MM_dd HH:mm:ss)}	Returns the current time in **yyyy_MM_dd HH:mm:ss** format.	2017_10_16 09:00:00
${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}	Returns the current time in **yyyy-MM-dd HH:mm:ss** format. The date is one day before the current day.	2017-10-15 09:00:00

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Macro Variable	Description	Display Effect
${dateformat(yyyy-MM-dd, -1, DAY)} 00:00:00	Returns 00:00:00 of the day before the current day in *yyyy-MM-dd HH:mm:ss* format.	2017-10-15 00:00:00
${dateformat(yyyy-MM-dd, -1, DAY)} 12:00:00	Returns 12:00:00 of the day before the current day in *yyyy-MM-dd HH:mm:ss* format.	2017-10-15 12:00:00
${dateformat(yyyy-MM-dd, -N, DAY)} 00:00:00	Returns 00:00:00 of the day N days before the current day in *yyyy-MM-dd HH:mm:ss* format.	When N is 3: 2017-10-13 00:00:00
${dateformat(yyyy-MM-dd, -N, DAY)} 12:00:00	Returns 12:00:00 of the day N days before the current day in *yyyy-MM-dd HH:mm:ss* format.	When N is 3: 2017-10-13 12:00:00
${timestamp()}	Returns the timestamp of the current time, that is, the number of milliseconds that have elapsed since 00:00:00 on January 1, 1970.	1508115600000
${timestamp(-10, MINUTE)}	Returns the timestamp generated 10 minutes before the current time point.	1508115000000
${timestamp(dateformat(yyyyMMdd))}	Returns the timestamp of 00:00:00 of the current day.	1508083200000
${timestamp(dateformat(yyyyMMdd,-1,DAY))}	Returns the timestamp of 00:00:00 of the previous day.	1507996800000
${timestamp(dateformat(yyyyMMddHH))}	Returns the timestamp of the current hour.	1508115600000

Time and Date Macro Variables of Paths and Table Names

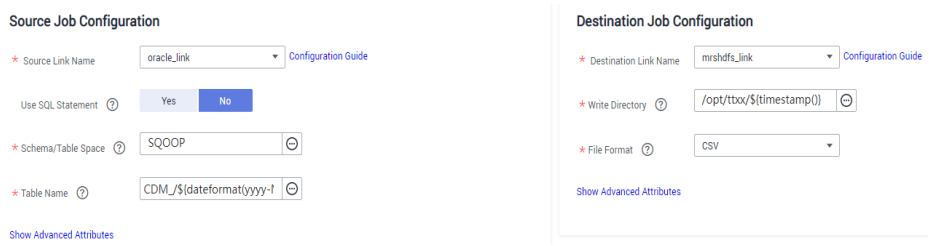
Figure 5-51 shows an example. If:

- **Table Name** under **Source Link Configuration** is set to **CDM_/${dateformat(yyyy-MM-dd)}**.
- **Write Directory** under **Destination Link Configuration** is set to **/opt/ttxx/${timestamp()}**.

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After the macro definition conversion, this job indicates that data in table **SQOOP.CDM_20171016** in the Oracle database is migrated to the **/opt/ttxx/1508115701746** directory of the HDFS server.

Figure 5-51 Setting **Table Name** and **Write Directory** to a time and date macro variable



Currently, a table name or path name can contain multiple macro variables. For example, **/opt/ttxx/${dateformat(yyyy-MM-dd)}/${timestamp()}** is converted to **/opt/ttxx/2017-10-16/1508115701746**.

Time and Date Macro Variables in the Where Clause

Figure 5-52 uses table **SQOOP.CDM_20171016** as an example. The table contains column **DS**, which indicates the time.

Figure 5-52 Table data

SELECT * FROM SQOOP.CDM_20171016

	FOO	BAR	DS
1	5	snap	2017-05-01
2	5	snap	2017-05-01
3	1	google	2017-05-02
4	4	oracle	2017-05-02
5	6	amd	2017-05-02
6	7	nvda	2017-05-02
7	1	google	2017-05-02
8	4	oracle	2017-05-02
9	6	amd	2017-05-02
10	7	nvda	2017-05-02
11	2	facebook	2017-10-15
12	3	tesla	2017-10-15
13	2	facebook	2017-10-15
14	3	tesla	2017-10-15

Suppose that the current date is **2017-10-16** and you want to export data generated the day before the current day (DS = 2017-10-15), then you can set the value of **Where Clause** to **DS='${dateformat(yyyy-MM-dd,-1,DAY)}'** when creating a job. In this way, you can export all data that complies with the DS = 2017-10-15 condition.

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Implementing Incremental Synchronization by Configuring the Macro Variables of Date and Time and Scheduled Jobs

Two simple application scenarios are as follows:

- The database table contains column **DS** that indicates the time, the value type of the column is **varchar(30)**, and the inserted time format is similar to **2017-xx-xx**.

  In a scheduled job, the cycle is one day, and the scheduled job is executed at 00:00:00 every day. Set the value of **Where Clause** to **DS='${dateformat(yyyy-MM-dd,-1,DAY)}'**, and then data generated in the previous day will be exported at 00:00:00 every day.
- The database table contains column **time** that indicates the time, the type is **Number**, and the inserted time format is timestamp.

  In a scheduled job, the cycle is one day, and the scheduled job is executed at 00:00:00 every day. Set the value of **Where Clause** to **time between ${timestamp(-1,DAY)} and ${timestamp()}**, and then data generated on the previous day will be exported at 00:00:00 every day.

Configuration principles of other application scenarios are the same.

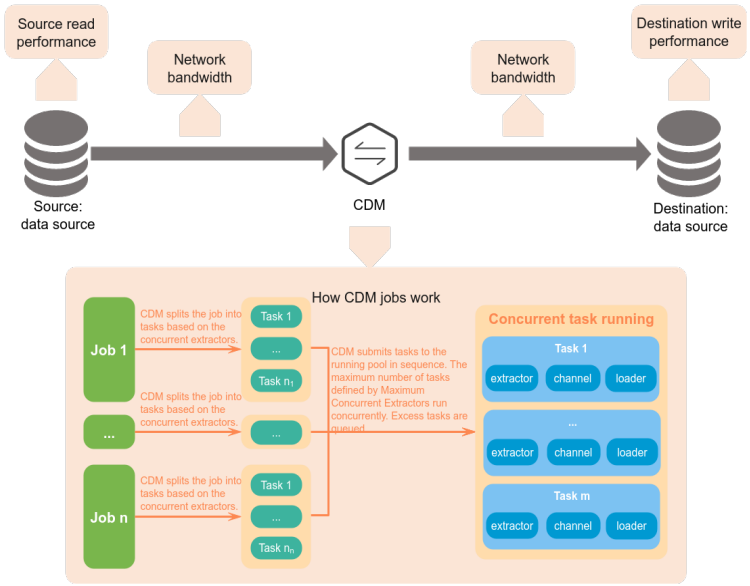
5.8 Improving Migration Performance

5.8.1 How Migration Jobs Work

Data Migration Model

Figure 5-53 shows the simplified migration model used by CDM.

Figure 5-53 Migration model used by CDM



CDM migrates data through data migration jobs. It works in the following way:

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1. When data migration jobs are submitted, CDM splits each job into multiple tasks based on the **Concurrent Extractors** parameter in the job configuration.

   NOTE

   Jobs for different data sources may be split based on different dimensions. Some jobs may not be split based on the **Concurrent Extractors** parameter.

2. CDM submits the tasks to the running pool in sequence. Tasks (defined by **Maximum Concurrent Extractors**) run concurrently. Excess tasks are queued.

Factors Affecting Migration Performance

According to the migration model, the migration speed is affected by factors such as the source read speed, network bandwidth, destination write performance, and CDM cluster and job configuration.

Table 5-107 Factors affecting migration performance

Factor		Description
Service-related factors	Concurrent extractors of a job	The number of concurrent extractors can be set for a CDM job during the job creation. Setting a proper value for this parameter can effectively improve the migration speed. If the value is too small, migration will be too slow. If the value is too large, the migration job is overloaded and may fail. • When data is to be migrated to files, CDM does not support multiple concurrent tasks. In this case, set a single process to extract data. • If each row of the table contains less than or equal to 1 MB data, data can be extracted concurrently. If each row contains more than 1 MB data, it is recommended that data be extracted in a single thread.
	Maximum concurrent extractors of a cluster	Setting a proper value for this parameter can effectively improve the migration speed. If the value is too small, migration will be too slow. If the value is too large, the source is overloaded and the system may be unstable. The maximum concurrent extractors vary depending on the CDM cluster flavor. The upper limit is twice the number of vCPUs. The following are the maximum concurrent extractors of some flavors: • cdm.large: 16 • cdm.xlarge: 32 • cdm.4xlarge: 128
	Service model	If the number of CDM jobs that run concurrently exceeds the maximum concurrent extractors for the CDM cluster, some jobs will be queued, and the migration will be prolonged. Avoid running too many jobs simultaneously, which may cause slow migration due to insufficient resources.

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Factor		Description
	Data model	The migration speed is also affected by the data structure. The following are some examples: ● The wider a table is and the more string types the table has, the slower the migration is. ● A large file is migrated more quickly than multiple small files whose total size is the same as the large file. ● The more content a message has and the higher bandwidth it uses, the less transactions per second (TPS) are.
Source read speed		It depends on the performance of the data source at the source. For details about how to increase the read speed, see the documents of data sources at the source.
Network bandwidth		The CDM cluster can communicate with the data source through an intranet, public network VPN, NAT, or Direct Connect. ● If they communicate through an intranet, the network bandwidth varies depending on the CDM instance flavor. – For cdm.large instances, the baseline and maximum bandwidths of the CDM cluster NIC are 0.8 and 3 Gbit/s, respectively. – For cdm.xlarge instances, the baseline and maximum bandwidths of the CDM cluster NIC are 4 and 10 Gbit/s, respectively. – For cdm.4xlarge instances, the baseline and maximum bandwidths of the CDM cluster NIC are 36 and 40 Gbit/s, respectively. ● If they communicate through the Internet, the network bandwidth is subject to the Internet bandwidth. The bandwidth for the CDM cluster depends on the EIP bound to the CDM cluster, and the bandwidth for the data source depends on the Internet bandwidth. ● If they communicate through a VPN, NAT, or Direct Connect, the network bandwidth is subject to the VPN, NAT, or Direct Connect bandwidth.
Destination write performance		It depends on the performance of the data source at the destination. For details about how to improve the performance, see the documents of data sources at the destination.

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5.8.2 Performance Tuning

Overview

In addition to increasing the source read speed, improving the destination write performance, and increasing the bandwidth, you can accelerate migration using the following methods:

- **Use a CDM cluster of higher specifications**

  The NIC bandwidth and maximum number of concurrent extractors vary depending on the CDM cluster specifications. If you want to migrate data faster, or the metrics of your CDM cluster (such as the CPU usage, disk usage, and memory usage) are often high, you may need a CDM cluster with higher specifications for data migration.

- **Use multiple CDM clusters**

  In some scenarios, you are advised to use multiple CDM clusters to share workloads to improve migration efficiency and stability. The following are some examples:

  – Multiple CDM clusters are required for different purposes or by multiple business departments. For example, you may need one CDM cluster for running data migration jobs and another one as an agent for DataArts Studio Management Center.

  – You want to migrate a large number of tables. In this case, you can use multiple CDM clusters to run jobs simultaneously to improve migration efficiency.

  – The CPU usage, disk usage, and memory usage of the in-use CDM cluster are often high. In this case, you are advised to use multiple CDM clusters to shared workloads.

- **Avoid running too many CDM jobs simultaneously**

  If the number of CDM jobs that run concurrently exceeds the maximum concurrent extractors for the CDM cluster, some jobs will be queued, and the migration will be prolonged.

  Avoid running too many jobs simultaneously, which may cause slow migration due to insufficient resources.

- **Change concurrent extractors**

  If the number of tasks is small, adjusting the number of concurrent extractors is the best way to improve performance. You can set the number of concurrent extractors for a job and the maximum number of concurrent extractors for a cluster.

  CDM migrates data through data migration jobs. It works in the following way:

  a. When data migration jobs are submitted, CDM splits each job into multiple tasks based on the **Concurrent Extractors** parameter in the job configuration.

     NOTE

     Jobs for different data sources may be split based on different dimensions. Some jobs may not be split based on the **Concurrent Extractors** parameter.

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b. CDM submits the tasks to the running pool in sequence. Tasks (defined by **Maximum Concurrent Extractors**) run concurrently. Excess tasks are queued.

By setting appropriate values for parameters **Concurrent Extractors** and **Maximum Concurrent Extractors**, you can accelerate migration. For details about how to change **Concurrent Extractors**, see **Changing Concurrent Extractors**.

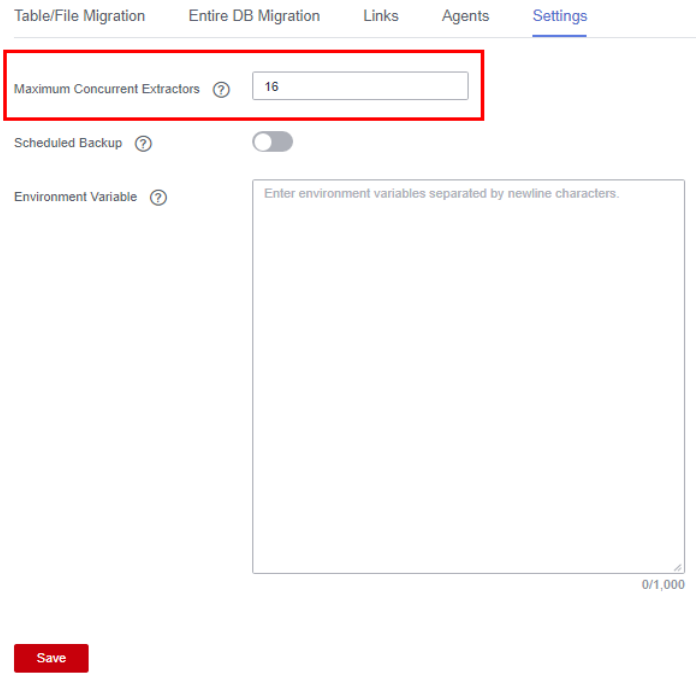
Changing Concurrent Extractors

1. The maximum number of concurrent extractors for a cluster varies depending on the CDM cluster flavor. You are advised to set the maximum number of concurrent extractors to twice the number of vCPUs of the CDM cluster.

Table 5-108 Maximum number of concurrent extractors for a CDM cluster

Flavor	vCPUs/Memory	Maximum Concurrent Extractors
cdm.large	8 vCPUs, 16 GB	16
cdm.xlarge	16 vCPUs, 32 GB	32
cdm.4xlarge	64 vCPUs, 128 GB	128

Figure 5-54 Setting Maximum Concurrent Extractors for a CDM cluster



2. Configure the number of concurrent extractors based on the following rules:

a. When data is to be migrated to files, CDM does not support multiple concurrent tasks. In this case, set a single process to extract data.

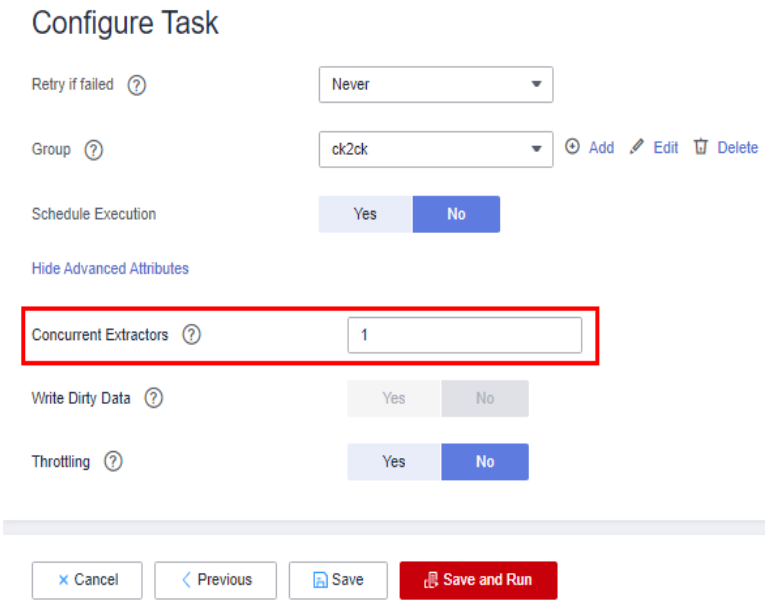
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b. If each row of the table contains less than or equal to 1 MB data, data can be extracted concurrently. If each row contains more than 1 MB data, it is recommended that data be extracted in a single thread.

c. Set **Concurrent Extractors** for a job based on **Maximum Concurrent Extractors** for the cluster. It is recommended that **Concurrent Extractors** is less than **Maximum Concurrent Extractors**.

d. If the destination is DLI, you are advised to set the number of concurrent extractors to 1. Otherwise, data may fail to be written.

Figure 5-55 Setting Concurrent Extractors for a job



5.8.3 Reference: Job Splitting Dimensions

CDM splits jobs for different data sources based on different dimensions. **Table 5-109** lists the splitting dimensions.

Table 5-109 Job splitting dimensions for different data sources

Data Source Category	Data Source	Job Splitting Rule
Data warehouse	GaussDB(DWS)	• Jobs can be split based on table fields. • Jobs cannot be split based on table partitions.
	Data Lake Insight (DLI)	• Jobs can be split based on the partitioning information of partitioned tables. • Jobs cannot be split based on non-partitioned tables.
Hadoop	MRS HDFS	Jobs can be split based on files.

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Data Source Category	Data Source	Job Splitting Rule
	MRS HBase	Jobs can be split based on HBase regions.
	MRS Hive	• When the read mode is HDFS, jobs can be split based on Hive files. • When the read mode is JDBC, jobs cannot be split.
	FusionInsight HDFS	Jobs can be split based on files.
	FusionInsight HBase	Jobs can be split based on HBase regions.
	FusionInsight Hive	• When the read mode is HDFS, jobs can be split based on Hive files. • When the read mode is JDBC, jobs cannot be split.
	Apache HDFS	Jobs can be split based on files.
	Apache HBase	Jobs can be split based on HBase regions.
	Apache Hive	• When the read mode is HDFS, jobs can be split based on Hive files. • When the read mode is JDBC, jobs cannot be split.
Object storage	Object Storage Service (OBS)	Jobs can be split based on files.
File system	FTP	Jobs can be split based on files.
	SFTP	Jobs can be split based on files.
	HTTP	Jobs can be split based on files.
Relational database	RDS for MySQL	• Jobs can be split based on table fields. • Jobs can be split based on table partitions only when **Extract by Partition** is configured.
	RDS for PostgreSQL	• Jobs can be split based on table fields. • Jobs can be split based on table partitions only when **Extract by Partition** is configured.
	RDS for SQL Server	• Jobs can be split based on table fields. • Jobs can be split based on table partitions only when **Extract by Partition** is configured.

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Data Source Category	Data Source	Job Splitting Rule
	MySQL	• Jobs can be split based on table fields. • Jobs can be split based on table partitions only when **Extract by Partition** is configured.
	PostgreSQL	• Jobs can be split based on table fields. • Jobs can be split based on table partitions only when **Extract by Partition** is configured.
	Microsoft SQL Server	• Jobs can be split based on table fields. • Jobs cannot be split based on table partitions.
	Oracle	• Jobs can be split based on table fields. • Jobs can be split based on table partitions only when **Extract by Partition** is configured.
	SAP HANA	• Jobs can be split based on table fields. • Jobs cannot be split based on table partitions.
	Database shard	Each backend connects to a subjob, which can be split based on primary keys.
NoSQL	Distributed Cache Service (DCS)	Jobs cannot be split.
	Redis	Jobs cannot be split.
	Document Database Service (DDS)	Jobs cannot be split.
	MongoDB	Jobs cannot be split.
	Cassandra	Jobs can be split based on the token range of Cassandra.
Message system	Apache Kafka	Jobs can be split based on topics.
	DMS Kafka	Jobs can be split based on topics.
	MRS Kafka	Jobs can be split based on topics.
Search	Elasticsearch	Jobs cannot be split.
	Cloud Search Service (CSS)	Jobs cannot be split.

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5.8.4 Reference: CDM Performance Test Data

Background

The performance metrics provided in this document are for reference only. The performance at your site may be affected by factors such as the data source performance at the source or destination, network bandwidth, latency, and the data and service model. It is recommended that you test the speed with a small amount of data before migration.

Environment

- An xlarge CDM cluster of the 2.9.1 200 version
- A table which has 50 million rows and 100 columns, and three HDFS binary files which have 35.97 million rows and 100 columns, 66.67 million rows and 100 columns, and 100 million rows and 100 columns, respectively.
- Number of concurrent extraction jobs for determining the maximum extraction/write rate: 1, 10, 20, 30, and 50

Data Source Extraction and Write Performance Test Data

Table 5-110 and **Table 5-111** provide the data extraction and write performance, respectively.

Table 5-110 Data extraction performance

Data Source	Specifications	Version	Extraction Rate for a Single Job (Lines per Second)	Extraction Rate for Multiple Jobs (Lines per Second)
RDS for MySQL	8 vCPUs, 32 GB	MySQL 5.7	42,052	195,313 (concurrency: 40)
Oracle	8 vCPUs, 16 GB	19C	18,539	18,706 (concurrency: 10)
MRS HBase	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 32 GB x 3	MRS 3.1.0	6,296	69,156 (concurrency: 30)
MRS Hive	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 32 GB x 3	MRS 3.1.0	22,321	170,068 (concurrency: 30)

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Data Source	Specifications	Version	Extraction Rate for a Single Job (Lines per Second)	Extraction Rate for Multiple Jobs (Lines per Second)
MRS HDFS (binary files)	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 32 GB x 3	MRS 3.1.0	138,727	141,468 (concurrency: 20)
			125,556	126,990 (concurrency: 10)
			120,919	120,919 (concurrency: 10)
DWS	8 vCPUs, 16 GB	8.1.1.300	13,434	/
DLI	16 vCPUs	SQL queue	71,023	19,290 (concurrency: 20)
MRS Hudi (MOR)	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 64 GB x 3	MRS 3.2.0	75187	467,289 (concurrency: 30)
MRS Hudi (COW)	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 64 GB x 3	MRS 3.2.0	84033	485,436 (concurrency: 30)
ClickHouse	Node: 8 vCPUs, 32 GB x 2	ClickHouse 22.3.2.2	187265	/
Elasticsearch	4 vCPUs, 8 GB x 6	Elasticsearch 7.10.2	28752	/
RDS for PostgreSQL	4 vCPUs, 32 GB (active/standby)	PostgreSQL 13.12	128865	1,351,351 (concurrency: 30)

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Table 5-111 Data write performance

Data Source	Specifications	Version	Write Rate for a Single Job (Rows per Second)	Write Rate for Multiple Jobs (Rows per Second)
RDS for MySQL	8 vCPUs, 32 GB	MySQL 5.7	2,658	/
Oracle	8 vCPUs, 16 GB	19C	/	/
MRS HBase	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 32 GB x 3	MRS 3.1.0	3,959	4,120 (concurrency: 10)
MRS Hive	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 32 GB x 3	MRS 3.1.0	25,813	26,882 (concurrency: 10)
MRS HDFS (binary files)	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 32 GB x 3	MRS 3.1.0	65,075	90,155 (concurrency: 10)
			86,248	86,248 (concurrency: 1)
			76,687	76,687 (concurrency: 1)
DWS	8 vCPUs, 16 GB	8.1.1.300	26,624	27,902 (concurrency: 10)
DLI	16 vCPUs	SQL queue	15,211	18,430 (concurrency: 10)
MRS Hudi (MOR)	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 64 GB x 3	MRS 3.2.0	16345	183,150 (concurrency: 10)
MRS Hudi (COW)	Master: 16 vCPUs, 64 GB x 3 Node: 8 vCPUs, 64 GB x 3	MRS 3.2.0	21088	88,183 (concurrency: 20)

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Data Source	Specifications	Version	Write Rate for a Single Job (Rows per Second)	Write Rate for Multiple Jobs (Rows per Second)
ClickHouse	Node: 8 vCPUs, 32 GB x 2	ClickHouse 22.3.2.2	93984	/
Elasticsearch	4 vCPUs, 8 GB x 6	Elasticsearch 7.10.2	22271	/
RDS for PostgreSQL	4 vCPUs, 32 GB (active/standby)	PostgreSQL 13.12	34746	153,374 (concurrency: 10)

5.9 Key Operation Guide

5.9.1 Incremental Migration

5.9.1.1 Incremental File Migration

CDM supports incremental migration of file systems. After full migration is complete, all new files or only specified directories or files can be exported.

Currently, CDM supports the following incremental migration modes:

1. **Exporting the files in a specified directory**
   - Application scenarios: The migration source is a file system (OBS/HDFS/FTP/SFTP). In incremental migration, only the specified files are written to the migration destination. The existing records are not updated or deleted.
   - Key configurations: **File/Path Filter** and Schedule Execution
   - Prerequisites: The source directory or file name contains the time field.
2. **Exporting the files modified after the specified time point**
   - Application scenarios: The migration source is a file system (OBS/HDFS/FTP/SFTP). The specified time point refers to the time when the file is modified. CDM migrates the files modified at or after the specified time point.
   - Key configurations: **Time Filter** and Schedule Execution
   - Prerequisites: None

NOTE

If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).

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File/Path Filter

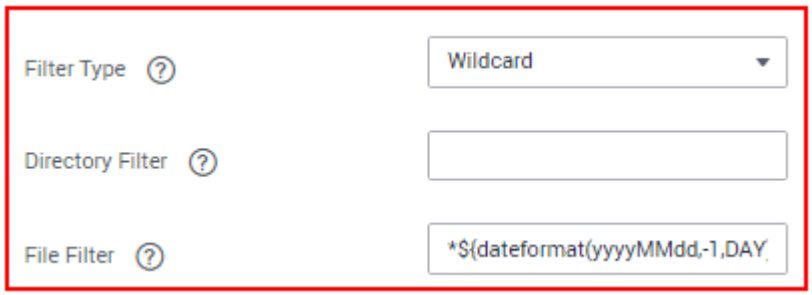
- Parameter position: When creating a table/file migration job, if the migration source is a file system, set **Filter Type** in advanced attributes of **Source Job Configuration** to **Wildcard** or **Regular expression**.
- Parameter principle: If you select **Wildcard** for **Filter Type**, CDM filters files or paths based on the configured wildcard character and migrates only files or paths that meet the specified condition.
- Example configurations:

  Suppose that the source file name contains the date and time field, such as **2017-10-15 20:25:26**, the **/opt/data/file_20171015202526.data** file is generated. Set the parameters as follows:

  a. **Filter Type**: Select **Wildcard**.

  b. **File Filter**: Enter **"*${dateformat(yyyyMMdd,-1,DAY)}*"**, which is the format of the macro variables of date and time supported by CDM. For details, see **Using Macro Variables of Date and Time**.

  Figure 5-56 Filtering files

  c. Schedule Execution: Set **Cycle (days)** to **1**.

In this way, you can import the files generated in the previous day to the destination directory every day to implement incremental synchronization.

In incremental file migration, **Path Filter** is used in the same way as **File Filter**. The path name must contain the time field. In this case, all files in the specified path can be synchronized periodically.

Time Filter

- Parameter position: When creating a table/file migration job, if the migration source is a file system, set select **Yes** for **Time Filter**.
- Parameter principle: After you specify the start time and end time, only files that are modified between the start time (included) and end time (excluded) will be migrated.
- Example configurations:

  For example, if you want CDM to synchronize only the files generated from January 1, 2021 to January 1, 2022 to the destination, configure the following parameters:

  a. **Time Filter**: select **Yes**.

  b. **Minimum Timestamp**: Enter a value in the format of *yyyy-MM-dd HH:mm:ss*, such as **2021-01-01 00:00:00**.

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c. **Maximum Timestamp**: Enter a value in the format of *yyyy-MM-dd HH:mm:ss*, such as **2022-01-01 00:00:00**.

Figure 5-57 Time Filter



In this way, the CDM job migrates only the files generated from January 1, 2021 to January 1, 2022, and performs incremental synchronization next time it is started.

5.9.1.2 Incremental Migration of Relational Databases

CDM supports incremental migration of relational databases. After a full migration is complete, data in a specified period can be incrementally migrated. For example, data added on the previous day can be exported at 00:00:00 every day.

- **Migrating incremental data within a specified period of time**
  - Application scenarios: The source end is a relational database. The destination end can be of any type.
  - Key configurations: **WHERE Clause** and Schedule Execution
  - Prerequisites: The data table contains a date and time field or timestamp field.

In incremental migration, only the specified data is written to the data table. The existing records are not updated or deleted.

NOTE

If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).

WHERE Clause

- Parameter position: When creating a table/file migration job, if the source end is a relational database, the **Where Clause** parameter is available in the advanced attributes of **Source Job Configuration**.
- Parameter principle: Set **WHERE Clause** to an SQL statement, for example, **age > 18 and age <= 60**, CDM exports only the data that meets the SQL statement requirement. If **WHERE Clause** is not specified, the entire table is exported.

  Where Clause can be set to **macro variables of date and time**. When the data table contains the **date** or **timestamp** field, **Where Clause** and Schedule Execution can be used together to extract data of a specified date.

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- Example configurations:

  Suppose that the database table contains column **DS** indicating the time, the value type of the column is **varchar(30)**, and the inserted time format is similar to *2017-xx-xx*. See **Figure 5-58**. Set the parameters as follows:

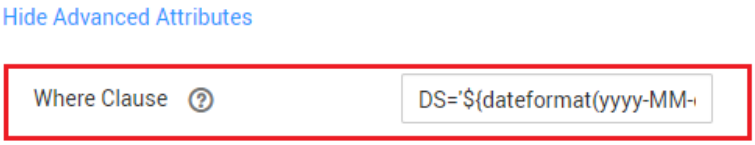
  Figure 5-58 Table data

  SELECT * FROM SQOOP.CDM_20171016

	FOO	BAR	DS
1	5	s	2017-05-01
2	5	s	2017-05-01
3	1	g	2017-05-02
4	4	o	2017-05-02
5	6	a	2017-05-02
6	7	n	2017-05-02
7	1	g	2017-05-02
8	4	o	2017-05-02
9	6	a	2017-05-02
10	7	n	2017-05-02
11	2	fa	2017-10-15
12	3	te	2017-10-15
13	2	fa	2017-10-15
14	3	te	2017-10-15

  a. **WHERE Clause**: Set this parameter to **DS='${dateformat(yyyy-MM-dd,-1,DAY)}'**.

  Figure 5-59 WHERE Clause

  b. Scheduling job execution: Set **Cycle (days)** to **1** and **Start Time** to **00:00:00**.

  In this way, all data generated on the previous day can be exported at 00:00:00 every day. **WHERE Clause** can be configured to various **macro variables of date and time**. You can use the macro variables of date and time and scheduled jobs with specified cycle of minutes, hours, days, weeks, or months together to automatically export data at a specific time.

5.9.1.3 HBase/CloudTable Incremental Migration

You can use CDM to export data in a specified period of time from HBase (including MRS HBase, FusionInsight HBase, and Apache HBase) and CloudTable. The CDM scheduled jobs can be used together to implement incremental migration of HBase and CloudTable.

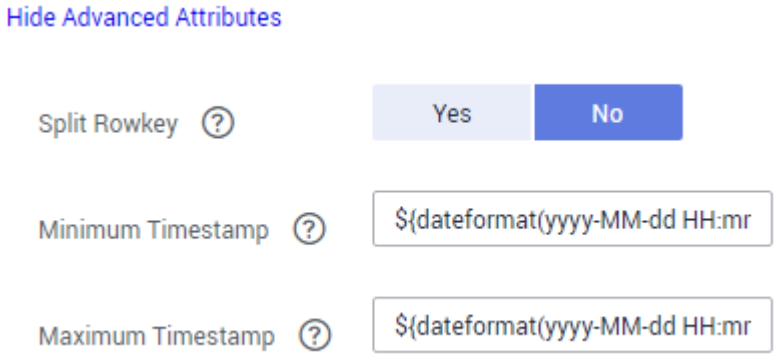
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NOTE

If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).

When creating a table/file migration job and selecting the link to HBase or CloudTable as the source link, you can set the time range in advanced attributes.

Figure 5-60 Time range



- Start time (including the value) for extracting data. The format is *yyyy-MM-dd HH:mm:ss*. Only the data generated at the specified time and later is extracted.
- End time (excluding the value) for extracting data. The format is *yyyy-MM-dd HH:mm:ss*. Only the data generated before the time point is extracted.

The two parameters can be set to **macro variables of date and time**. Examples are as follows:

- If **Minimum Timestamp** is set to **${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}**, only the data generated after the day before is exported.
- If **Maximum Timestamp** is set to **${dateformat(yyyy-MM-dd HH:mm:ss)}**, only the data generated before the specified time point is exported.

If both parameters are configured, CDM exports only the data generated on the previous day. In addition, if the job is configured to execute at 00:00:00 every day, the data generated every day can be incrementally synchronized.

5.9.1.4 MongoDB/DDS Incremental Migration

By using CDM, you can export MongoDB or DDS data within a specified period. With the scheduled jobs of CDM, you can implement incremental migration of MongoDB and DDS.

NOTE

If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).

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When creating a table/file migration job and selecting the link to MongoDB or DDS as the source link, you can set the query filters in advanced attributes.

Figure 5-61 Setting query filters



You can set this parameter to a **macro variable of date and time**, for example, **{"ts":{$gte:ISODate("${dateformat(yyyy-MM-dd'T'HH:mm:ss.SSS'Z',-1,DAY)}")}}**, which indicates searching for the values in the **ts** field that are greater than those after time macro conversion, that is, only the data generated after the previous day is exported.

After this parameter is set, CDM exports only the data generated on the previous day. In addition, you can set the job to be executed at 00:00:00 every day, so that the data generated every day can be incrementally synchronized.

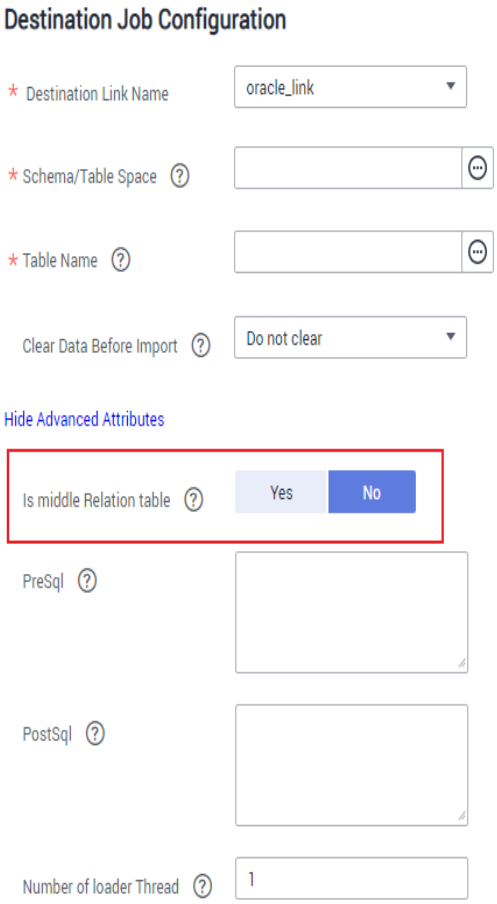
5.9.2 Migration in Transaction Mode

When a CDM job fails to be executed, CDM rolls back the data to the state before the job starts and automatically deletes data from the destination table.

- Parameter position: When creating a table/file migration job, if the migration source is a relational database, set **Import to Staging Table** in the advanced attributes of **Destination Job Configuration** to determine whether to enable the transaction mode.
- Parameter principle: If you set this parameter to **Yes**, CDM automatically creates a temporary table and imports the data to the temporary table. After the data is imported successfully, CDM migrates the data to the destination table in transaction mode of the database. If the import fails, the destination table is rolled back to the state before the job starts.

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Figure 5-62 Migration in transaction mode



NOTE

If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.

5.9.3 Encryption and Decryption During File Migration

When you migrate files to a file system, CDM can encrypt and decrypt those files. Currently, CDM supports the following encryption modes:

- **AES-256-GCM**
- **KMS Encryption**

AES-256-GCM

Currently, only AES-256-GCM (NoPadding) is supported. This algorithm is used for encryption at the migration destination and decryption at the migration source. The supported source and destination data sources are as follows:

- Data sources supported by the migration source: HDFS (supported in the binary format)
- Data sources supported by the migration destination: HDFS (supported in the binary format)

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The following part describes how to use AES-256-GCM to decrypt the encrypted files to be exported from HDFS and encrypt the files to be imported to HDFS.

- **Configure decryption at the migration source.**

  When you use CDM to create a job for exporting files from HDFS, set the migration source to HDFS and file format to binary, and set the following parameters in the advanced settings of **Source Job Configuration**:

  a. **Encryption**: Select **AES-256-GCM**.

  b. **DEK**: The key must be the same as that configured in encryption. Otherwise, the decrypted data is incorrect and the system does not display an error message.

  c. **IV**: The initialization vector must be the same as that configured in encryption. Otherwise, the decrypted data is incorrect and the system does not display an error message.

  In this way, after CDM exports encrypted files from HDFS, the files written to the migration destination are decrypted plaintext files.

- **Configure encryption at the migration destination.**

  When you create a CDM job to import files to HDFS, set the migration destination to HDFS and file format to binary, and set the following parameters in the advanced settings of **Destination Job Configuration**:

  a. **Encryption**: Select **AES-256-GCM**.

  b. **DEK**: custom encryption key. The key consists of 64 hexadecimal numbers. It is case-insensitive but must contain 64 characters. For example, **DD0AE00DFECD78BF051BCFDA25BD4E320DB0A7AC75A1F3FC3D3C56A457DCDC1B**.

  c. **IV**: custom initialization vector. The initialization vector consists of 32 hexadecimal numbers. It is case-insensitive but must contain 32 characters. For example, **5C91687BA886EDCD12ACBC3FF19A3C3F**.

  In this way, after CDM imports files to HDFS, the files in the destination HDFS are encrypted using the AES-256-GCM algorithm.

KMS Encryption

NOTE

The migration source does not support KMS encryption.

CDM supports KMS encryption if tables, files, or a whole database is migrated to OBS. In the **Advanced Attributes** area of the **Destination Job Configuration** page, set the parameters.

A key must be created in KMS of DEW in advance. For details, see the *Data Encryption Workshop User Guide*.

After KMS encryption is enabled, objects to be uploaded will be encrypted and stored on OBS. When you download the encrypted objects, the encrypted data will be decrypted on the server and displayed in plaintext to users.

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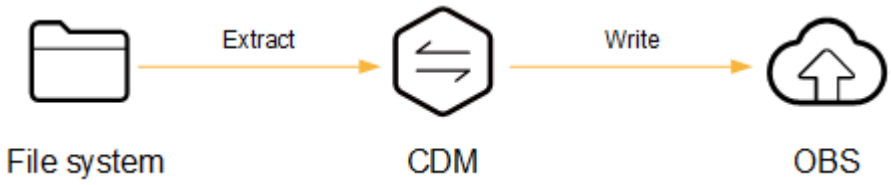
NOTE

- If KMS encryption is enabled, **MD5 verification** cannot be used.
- If the KMS ID of another project is used, change **Project ID** to the ID of the project to which KMS belongs. If KMS and CDM are in the same project, retain the default value of **Project ID**.
- After KMS encryption is performed, the encryption status of the objects on OBS cannot be changed.
- A key in use cannot be deleted. Otherwise, the object encrypted with this key cannot be downloaded.

5.9.4 MD5 Verification

CDM extracts data from the migration source and writes the data to the migration destination. **Figure 5-63** shows the migration mode when files are migrated to OBS.

Figure 5-63 Migrating files to OBS



During the process, CDM uses MD5 to verify file consistency.

- **Extract**
  - The migration source can be OBS, HDFS, FTP, SFTP, or HTTP. It can check whether the files extracted by CDM are consistent with source files.
  - This function is controlled by the **MD5 File Extension** parameter (available when **File Format** is set to **Binary**) in **Source Job Configuration**. Set this parameter to the file name extension of the MD5 file in the source file system.
  - If a source file **build.sh** and a file for saving MD5 value **build.sh.md5** are located in the same directory, and **MD5 File Extension** is configured, only the file **build.sh.md5** is migrated to the destination. Files without the MD5 value or whose MD5 values do not match fail to be migrated, and the MD5 file is not migrated.
  - If **MD5 File Extension** is not configured, all files are migrated.
- **Write**
  - Currently, this function can be used only when OBS serves as the migration destination. It can check whether the files written to OBS are consistent with those extracted from CDM.
  - This function is controlled by the **Validate MD5 Value** parameter in **Destination Job Configuration**. After the files are read and written to OBS, the MD5 value in the HTTP header is used to verify the files on OBS and the verification result is written to an OBS bucket (the bucket can be the one that does not store migration files). If the migration source does not have the MD5 file, the verification will not be performed.

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NOTE

- When files are migrated to a file system, only the extracted files are verified.
- When files are migrated to OBS, both the extracted files and files written to OBS are verified.
- If MD5 verification is used, **KMS encryption** cannot be used.

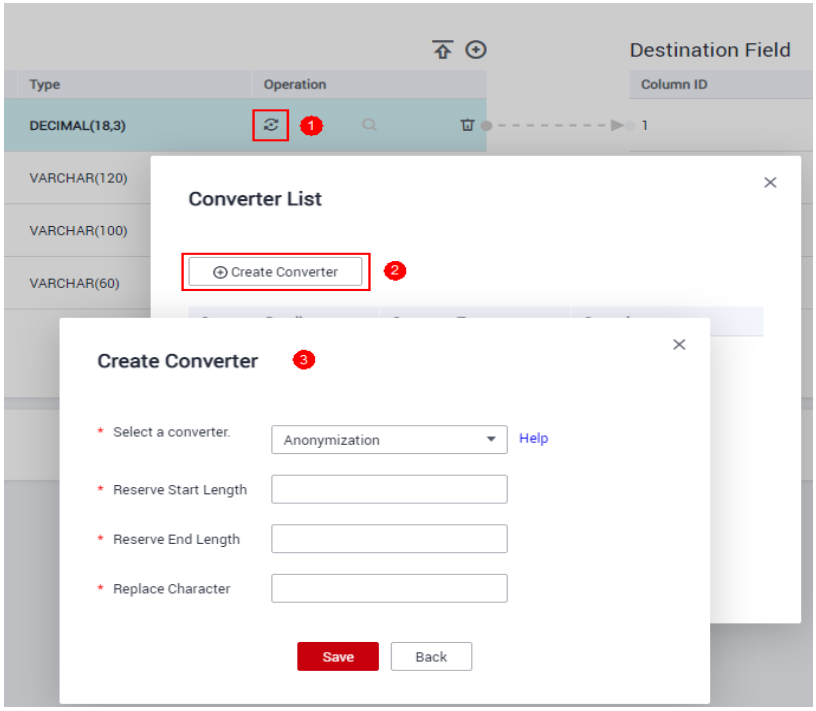
5.9.5 Configuring Field Converters

Scenario

- After the job parameters are configured, field mapping needs to be configured. You can click in the **Operation** column to create a field converter.
- If files are migrated between FTP, SFTP, OBS, and HDFS and the migration source's **File Format** is set to **Binary**, files will be directly transferred, free from field mapping.

You can create a field converter on the **Map Field** page when creating a table/file migration job.

Figure 5-64 Creating a field converter



CDM can convert fields during migration. Currently, the following field converters are supported:

- **Anonymization**
- **Trim**
- **Reverse String**
- **Replace String**

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- **Remove line break**
- **Expression Conversion**

Constraints

- If **Use SQL Statement** is set to **Yes** in the source job configuration, converters cannot be created.
- On the **Map Field** tab page, if CDM fails to obtain all columns by obtaining sample values (for example, when data is exported from HBase, CloudTable, or MongoDB, there is a high probability that CDM failed to obtain all columns), you can click  and select **Add a new field** to add new fields to ensure that the data imported to the migration destination is complete.
- When a relational database, Hive, DLI, or MRS Hudi is used as the migration source, sample values cannot be obtained.
- When SQLServer is the destination, fields of the timestamp type cannot be written. You must change their type (for example, to datetime) so that they can be written.
- Column names are displayed when the source of the migration job is OBS, CSV files are to be migrated, and parameter **Extract first row as columns** is set to **Yes**.
- Field converters configuration is not involved when the binary format is used to migrate files to files.
- In the automatic table creation scenario, you need to manually add fields to the destination table in advance and then add fields to the field mapping.
- After a field is added, its sample value is not displayed on the console. This does not affect the field value transmission. CDM directly writes the field value to the destination end.
- If the field mapping is incorrect, you can adjust the field mapping by dragging fields or clicking  to map fields in batches.
- An expression processes the data of a field. When you create an expression converter, do not use a time macro. If you need to use a time macro, use either of the following methods (if the source is of the file type, only **Method 1** is supported):
  - Method 1: When creating an expression converter, use two single quotation marks ('') to enclose the expression.

    For example, if expression **${dateformat(yyyy-MM-dd)}** is not enclosed in quotation marks, the hyphen (-) in the value **2017-10-16** parsed from the expression will be recognized as a minus sign, and further calculation will be performed to generate result **1991**, which is incorrect. If you enclose the expression in quotation marks, that is, **'${dateformat(yyyy-MM-dd)}'**, you will obtain **'2017-10-16'**, which is correct.

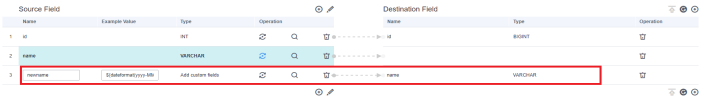
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Figure 5-65 Using two single quotation marks ('') to enclose an expression



- Method 2: Add a custom source field, enter a macro variable of date and time for **Example Value**, and map the field to a destination field again.

  Figure 5-66 Adding a custom source field

- If the data is imported to GaussDB(DWS), you need to select the distribution columns in the destination fields. You are advised to select the distribution columns according to the following rules:

  a. Use the primary key as the distribution column.

  b. If multiple data segments are combined as primary keys, specify all primary keys as the distribution column.

  c. In the scenario where no primary key is available, if no distribution column is selected, DWS uses the first column as the distribution column by default. As a result, data skew risks exist.

Anonymization

This converter is used to hide key information about the character string. For example, if you want to convert **12345678910** to **123****8910**, configure the parameters as follows:

- Set **Reserve Start Length** to **3**.
- Set **Reserve End Length** to **4**.
- Set **Replace Character** to *****.

Trim

This converter is used to automatically delete the spaces before and after a string. No parameters need to be configured.

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Reverse String

This converter is used to automatically reverse a string. For example, reverse **ABC** into **CBA**. No parameters need to be configured.

Replace String

This converter is used to replace a character string. You need to configure the object to be replaced and the new value.

Remove line break

This converter is used to delete the newline characters, such as \n, \r, and \r\n from the field.

Expression Conversion

This converter uses the JSP expression language (EL) to convert the current field or a row of data. The JSP EL is used to create arithmetic and logical expressions. In an expression, you can use integers, floating point numbers, strings, constants **true** and **false**, and **null**.

During data conversion, if the content to be replaced contains a special character, use a backslash (\) to escape the special character to a common one.

- The expression supports the following environment variables:
  - **value**: indicates the current field value.
  - **row**: indicates the current row, which is an array type.
- The expression supports the following Utils:
  a. If the field is of the string type, convert all character strings into lowercase letters, for example, convert **aBC** to **abc**.

     Expression: StringUtils.lowerCase(value)

  b. Convert all character strings of the current field to uppercase letters.

     Expression: StringUtils.upperCase(value)

  c. Convert the format of the first date field from 2018-01-05 15:15:05 to 20180105.

     Expression: DateUtils.format(DateUtils.parseDate(row[0],"yyyy-MM-dd HH:mm:ss"),"yyyyMMdd")

  d. Convert a timestamp to a date string in *yyyy-MM-dd hh:mm:ss* format, for example, convert **1701312046588** to **2023-11-30 10:40:46**.

     Expression: DateUtils.format(NumberUtils.toLong(value),"yyyy-MM-dd HH:mm:ss")

  e. Convert a date string in the yyyy-MM-dd hh:mm:ss format to a timestamp.

     Expression: DateUtils.getTime(DateUtils.parseDate(value,"yyyy-MM-dd hh:mm:ss"))

  f. If the field value is a date string in *yyyy-MM-dd* format, extract the year from the field value, for example, extract **2017** from **2017-12-01**.

     Expression: StringUtils.substringBefore(value,"-")

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g. If the field value is of the numeric type, convert the value to a new value which is two times greater than the original value:

   Expression: value*2

h. Convert the field value **true** to **Y** and other field values to **N**.

   Expression: value=="true"?"Y":"N"

i. If the field value is of the string type and is left empty, convert it to **Default**. Otherwise, the field value will not be converted.

   Expression: empty value? "Default":value

j. Convert date format **2018/01/05 15:15:05** to **2018-01-05 15:15:05**:

   Expression: DateUtils.format(DateUtils.parseDate(value,"yyyy/MM/dd HH:mm:ss"),"yyyy-MM-dd HH:mm:ss")

k. Obtain a 36-bit universally unique identifier (UUID):

   Expression: CommonUtils.randomUUID()

l. If the field is of the string type, capitalize the first letter, for example, convert **cat** to **Cat**.

   Expression: StringUtils.capitalize(value)

m. If the field is of the string type, convert the first letter to a lowercase letter, for example, convert **Cat** to **cat**.

   Expression: StringUtils.uncapitalize(value)

n. If the field is of the string type, use a space to fill in the character string to the specified length and center the character string. If the length of the character string is not shorter than the specified length, do not convert the character string. For example, convert **ab** to meet the specified length 4.

   Expression: StringUtils.center(value,*4*)

o. Delete a newline (including **\n**, **\r**, and **\r\n**) at the end of a character string. For example, convert **abc\r\n\r\n** to **abc\r\n**.

   Expression: StringUtils.chomp(value)

p. If the string contains the specified string, **true** is returned; otherwise, **false** is returned. For example, **abc** contains **a** so that **true** is returned.

   Expression: StringUtils.contains(value,"*a*")

q. If the string contains any character of the specified string, **true** is returned; otherwise, **false** is returned. For example, **zzabyycdxx** contains either **z** or **a** so that **true** is returned.

   Expression: StringUtils.containsAny(value,"*za*")

r. If the string does not contain any one of the specified characters, **true** is returned. If any specified character is contained, **false** is returned. For example, **abz** contains one character of **xyz** so that **false** is returned.

   Expression: StringUtils.containsNone(value,"*xyz*")

s. If the string contains only the specified characters, **true** is returned. If any other character is contained, **false** is returned. For example, **abab** contains only characters among **abc** so that **true** is returned.

   Expression: StringUtils.containsOnly(value,"*abc*")

t. If the character string is empty or null, convert it to the specified character string. Otherwise, do not convert the character string. For example, convert the empty character string to null.

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Expression: StringUtils.defaultIfEmpty(value,*null*)

u. If the string ends with the specified suffix (case sensitive), **true** is returned; otherwise, **false** is returned. For example, if the suffix of **abcdef** is not null, **false** is returned.

Expression: StringUtils.endsWith(value,*null*)

v. If the string is the same as the specified string (case sensitive), **true** is returned; otherwise, **false** is returned. For example, after strings **abc** and **ABC** are compared, **false** is returned.

Expression: StringUtils.equals(value,"*ABC*")

w. Obtain the first index of the specified character string in a character string. If no index is found, **-1** is returned. For example, the first index of **ab** in **aabaabaa** is 1.

Expression: StringUtils.indexOf(value,"*ab*")

x. Obtain the last index of the specified character string in a character string. If no index is found, **-1** is returned. For example, the last index of **k** in **aFkyk** is 4.

Expression: StringUtils.lastIndexOf(value,"*k*")

y. Obtain the first index of the specified character string from the position specified in the character string. If no index is found, **-1** is returned. For example, the first index of **b** obtained after the index 3 of **aabaabaa** is 5.

Expression: StringUtils.indexOf(value,"*b*",*3*)

z. Obtain the first index of any specified character in a character string. If no index is found, **-1** is returned. For example, the first index of **z** or **a** in **zzabyycdxx.** is 0.

Expression: StringUtils.indexOfAny(value,"*za*")

aa. If the string contains any Unicode character, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only non-Unicode characters so that **false** is returned.

Expression: StringUtils.isAlpha(value)

ab. If the string contains only Unicode characters and digits, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only Unicode characters and digits, so that **true** is returned.

Expression: StringUtils.isAlphanumeric(value)

ac. If the string contains only Unicode characters, digits, and spaces, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only Unicode characters and digits, so that **true** is returned.

Expression: StringUtils.isAlphanumericSpace(value)

ad. If the string contains only Unicode characters and spaces, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains Unicode characters and digits so that **false** is returned.

Expression: StringUtils.isAlphaSpace(value)

ae. If the string contains only printable ASCII characters, **true** is returned; otherwise, **false** is returned. For example, for **!ab-c~**, **true** is returned.

Expression: StringUtils.isAsciiPrintable(value)

af. If the string is empty or null, **true** is returned; otherwise, **false** is returned.

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Expression: StringUtils.isEmpty(value)

ag. If the string contains only Unicode digits, **true** is returned; otherwise, **false** is returned.

Expression: StringUtils.isNumeric(value)

ah. Obtain the leftmost characters of the specified length. For example, obtain the leftmost two characters **ab** from **abc**.

Expression: StringUtils.left(value,*2*)

ai. Obtain the rightmost characters of the specified length. For example, obtain the rightmost two characters **bc** from **abc**.

Expression: StringUtils.right(value,*2*)

aj. Concatenate the specified character string to the left of the current character string and specify the length of the concatenated character string. If the length of the current character string is not shorter than the specified length, the character string will not be converted. For example, if **yz** is concatenated to the left of **bat** and the length must be 8 after concatenation, the character string is **yzyzybat** after conversion.

Expression: StringUtils.leftPad(value,*8*,"*yz*")

ak. Concatenate the specified character string to the right of the current character string and specify the length of the concatenated character string. If the length of the current character string is not shorter than the specified length, the character string will not be converted. For example, if **yz** is concatenated to the right of **bat** and the length must be 8 after concatenation, the character string is **batyzyzy** after conversion.

Expression: StringUtils.rightPad(value,*8*,"*yz*")

al. If the field is of the string type, obtain the length of the current character string. If the character string is null, **0** is returned.

Expression: StringUtils.length(value)

am. If the field is of the string type, delete all the specified character strings from it. For example, delete **ue** from **queued** to obtain **qd**.

Expression: StringUtils.remove(value,"*ue*")

an. If the field is of the string type, remove the substring at the end of the field. If the specified substring is not at the end of the field, no conversion is performed. For example, remove **.com** at the end of **www.domain.com**.

Expression: StringUtils.removeEnd(value,"*.com*")

ao. If the field is of the string type, delete the substring at the beginning of the field. If the specified substring is not at the beginning of the field, no conversion is performed. For example, delete **www.** at the beginning of **www.domain.com**.

Expression: StringUtils.removeStart(value,"*www.*")

ap. If the field is of the string type, replace all the specified character strings in the field. For example, replace **a** in **aba** with **z** to obtain **zbz**.

Expression: StringUtils.replace(value,"*a*","*z*")

If the content to be replaced contains a special character, the special character must be escaped to a common character. For example, if you want to delete **\t** from a string, use the following expression:

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StringUtils.replace(value,"\\t",""), which means escaping the backslash (\) again.

aq. If the field is of the string type, replace multiple characters in the character string at a time. For example, replace **h** in **hello** with **j** and **o** with **y** to obtain **jelly**.

Expression: StringUtils.replaceChars(value,"*ho*","*jy*")

ar. If the string starts with the specified prefix (case sensitive), **true** is returned; otherwise, **false** is returned. For example, **abcdef** starts with **abc**, so that **true** is returned.

Expression: StringUtils.startsWith(value,"*abc*")

as. If the field is of the string type, delete all the specified characters at the beginning and end of the field. the field. For example, delete all **x**, **y**, **z**, and **b** from **abcyx** to obtain **abc**.

Expression: StringUtils.strip(value,"*xyz*b")

at. If the field is of the string type, delete all the specified characters at the end of the field, for example, delete the "abc" string at the end of the field.

Expression: StringUtils.stripEnd(value,*"abc"*)

au. If the field is of the string type, delete all the specified characters at the beginning of the field, for example, delete all spaces at the beginning of the field.

Expression: StringUtils.stripStart(value,*null*)

av. If the field is of the string type, obtain the substring after the specified position (the index starts from 0, including the character at the specified position) of the character string. If the specified position is a negative number, calculate the position in the descending order. The first digit at the end is -1. For example, obtain the character whose index is 2 from **abcde** (that is, **c**) and the string after it, that is, **cde**.

Expression: StringUtils.substring(value,*2*)

aw. If the field is of the string type, obtain the substring in a specified range (the index starts from 0, including the character at the start and excluding the character at the end). If the range is a negative number, calculate the position in the descending order. The first digit at the end is -1. For example, obtain the string between the second character (c) and fourth character (e) of **abcde**, that is, **cd**.

Expression: StringUtils.substring(value,*2*,4)

ax. If the field is of the string type, obtain the substring after the first specified character. For example, obtain the substring after the first **b** in **abcba**, that is, **cba**.

Expression: StringUtils.substringAfter(value,"*b*")

ay. If the field is of the string type, obtain the substring after the last specified character. For example, obtain the substring after the last **b** in **abcba**, that is, **a**.

Expression: StringUtils.substringAfterLast(value,"*b*")

az. If the field is of the string type, obtain the substring before the first specified character. For example, obtain the substring before the first **b** in **abcba**, that is, **a**.

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Expression: StringUtils.substringBefore(value,"*b*")

ba. If the field is of the string type, obtain the substring before the last specified character. For example, obtain the substring before the last **b** in **abcba**, that is, **abc**.

Expression: StringUtils.substringBeforeLast(value,"*b*")

bb. If the field is of the string type, obtain the substring nested within the specified string. If no substring is found, **null** is returned. For example, obtain the substring between **tag** in **tagabctag**, that is, **abc**.

Expression: StringUtils.substringBetween(value,"*tag*")

bc. If the field is of the string type, delete the control characters (char≤32) at both ends of the character string, for example, delete the spaces at both ends of the character string.

Expression: StringUtils.trim(value)

bd. Convert the character string to a value of the byte type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toByte(value)

be. Convert the character string to a value of the byte type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toByte(value,*1*)

bf. Convert the character string to a value of the double type. If the conversion fails, **0.0d** is returned.

Expression: NumberUtils.toDouble(value)

bg. Convert the character string to a value of the double type. If the conversion fails, the specified value, for example, **1.1d**, is returned.

Expression: NumberUtils.toDouble(value,*1.1d*)

bh. Convert the character string to a value of the float type. If the conversion fails, **0.0f** is returned.

Expression: NumberUtils.toFloat(value)

bi. Convert the character string to a value of the float type. If the conversion fails, the specified value, for example, **1.1f**, is returned.

Expression: NumberUtils.toFloat(value,*1.1f*)

bj. Convert the character string to a value of the int type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toInt(value)

bk. Convert the character string to a value of the int type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toInt(value,*1*)

bl. Convert the character string to a value of the long type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toLong(value)

bm. Convert the character string to a value of the long type. If the conversion fails, the specified value, for example, **1L**, is returned.

Expression: NumberUtils.toLong(value,*1L*)

bn. Convert the character string to a value of the short type. If the conversion fails, **0** is returned.

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Expression: NumberUtils.toShort(value)

bo. Convert the character string to a value of the short type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toShort(value,*1*)

bp. Convert the IP string to a value of the long type, for example, convert **10.78.124.0** to **172915712**.

Expression: CommonUtils.ipToLong(value)

bq. Read an IP address and physical address mapping file from the network, and download the mapping file to the map collection. *url* indicates the address for storing the IP mapping file, for example, **http://10.114.205.45:21203/sqoop/IpList.csv**.

Expression: HttpsUtils.downloadMap("*url*")

br. Cache the IP address and physical address mappings and specify a key for retrieval, for example, **ipList**.

Expression: CommonUtils.setCache("*ipList*",HttpsUtils.downloadMap("*url*"))

bs. Obtain the cached IP address and physical address mappings.

Expression: CommonUtils.getCache("*ipList*")

bt. Check whether the IP address and physical address mappings are cached.

Expression: CommonUtils.cacheExists("*ipList*")

bu. Based on the specified offset type (month/day/hour/minute/second) and offset (positive number indicates increase and negative number indicates decrease), convert the time in the specified format to a new time, for example, add 8 hours to **2019-05-21 12:00:00**.

Expression: DateUtils.getCurrentTimeByZone("*yyyy-MM-dd HH:mm:ss*",value, "*hour*", *8*)

bv. If the value is empty or null, "aaa" is returned. Otherwise, **value** is returned.

Expression: StringUtils.defaultIfEmpty(value,*"aaa"*)

5.9.6 Adding Fields

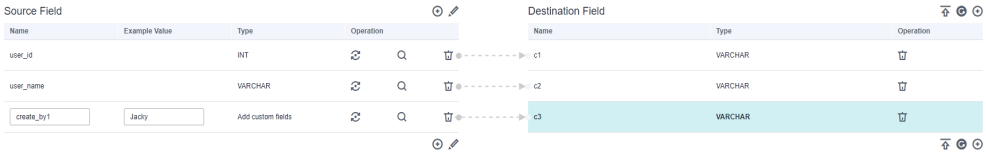
Scenario

- After job parameters are configured, field mapping needs to be configured. You can customize new fields by clicking on the **Map Field** page.
- If files are migrated between FTP, SFTP, OBS, and HDFS and the migration source's **File Format** is set to **Binary**, files will be directly transferred, free from field mapping.
- In other scenarios, CDM automatically maps fields of the source table and the destination table. You need to check whether the mapping and time format are correct. For example, check whether the source field type can be converted into the destination field type.

You can click on the **Map Field** page and select **Add** to customize a new field. This field is usually used to mark the database source to ensure the integrity of the data imported to the migration destination.

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Figure 5-67 Field mapping



Currently, the following field types are supported:

- **Constant Parameter**

  Constant parameters are fixed parameters and do not need to be reconfigured. For example, **lable** = **friends** is used to identify a constant value.

- **Variables**

  You can use variables such as time macros, table name macros, and version macros to mark database source information. The variable syntax is ${variable}, where **variable** indicates a variable. For example, **input_time** = **${timestamp()}** indicates the timestamp of the current time.

- Expression

  You can use the expression language to dynamically generate parameter values based on the running environment. The expression syntax is #{expr}, where **expr** indicates an expression. For example, **time** = **#{DateUtil.now()}** is used to identify the current date string.

Constraints

- On the **Map Field** tab page, if CDM fails to obtain all columns by obtaining sample values (for example, when data is exported from HBase, CloudTable, or MongoDB, there is a high probability that CDM failed to obtain all columns), you can click and select **Add a new field** to add new fields to ensure that the data imported to the migration destination is complete.
- When a relational database, Hive, DLI, or MRS Hudi is used as the migration source, sample values cannot be obtained.
- When SQLServer is the destination, fields of the timestamp type cannot be written. You must change their type (for example, to datetime) so that they can be written.
- Column names are displayed when the source of the migration job is OBS, CSV files are to be migrated, and parameter **Extract first row as columns** is set to **Yes**.
- Field mapping is not involved when the binary format is used to migrate files to files.
- In the automatic table creation scenario, you need to manually add fields to the destination table in advance and then add fields to the field mapping.
- After a field is added, its sample value is not displayed on the console. This does not affect the field value transmission. CDM directly writes the field value to the destination end.
- If the field mapping is incorrect, you can adjust the field mapping by dragging fields or clicking to map fields in batches.

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- If the data is imported to DWS, you need to select the distribution columns in the destination fields. You are advised to select the distribution columns according to the following principles:
  a. Use the primary key as the distribution column.
  b. If multiple data segments are combined as primary keys, specify all primary keys as the distribution column.
  c. In the scenario where no primary key is available, if no distribution column is selected, DWS uses the first column as the distribution column by default. As a result, data skew risks exist.
- If a source field type is not supported, convert the field type to a type supported by CDM by referring to **Converting Unsupported Data Types**.

5.9.7 Migrating Files with Specified Names

You can migrate files (a maximum of 50) with specified names from FTP, OBS, or SFTP at a time. The exported files can only be written to the same directory on the migration destination.

When creating a table/file migration job, if the migration source is FTP, OBS, or SFTP, **Source Directory/File** can contain a maximum of 50 file names, which are separated by vertical bars (|). You can also customize a file separator.

NOTE

1. CDM supports incremental file migration (by skipping repeated files), but does not support resumable transfer.
   For example, if three files are to be migrated and the second file fails to be migrated due to the network fault. When the migration task is started again, the first file is skipped. The second file, however, cannot be migrated from the point where the fault occurs, but can only be migrated again.
2. During file migration, a single task supports millions of files. If there are too many files in the directory to be migrated, you are advised to split the files into different directories and create multiple tasks.

5.9.8 Regular Expressions for Separating Semi-structured Text

During table/file migration, CDM uses delimiters to separate fields in CSV files. However, delimiters cannot be used in complex semi-structured data because the field values also contain delimiters. In this case, the regular expression can be used to separate the fields.

The regular expression is configured in **Source Job Configuration**. The migration source must be an object storage or file system, and **File Format** must be **CSV**.

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Figure 5-68 Setting regular expression parameters



During the migration of CSV files, CDM can use regular expressions to separate fields and write parsed results to the migration destination. For details about the syntax of the regular expression, refer to the related documents. This section describes the regular expressions of the following log files:

- **Log4J Log**
- **Log4J Audit Log**
- **Tomcat Log**
- **Django Log**
- **Apache Server Log**

Log4J Log

- Log sample:
  ```
  2018-01-11 08:50:59,001 INFO
  [org.apache.sqoop.core.SqoopConfiguration.configureClassLoader(SqoopConfiguration.java:251)]
  Adding jars to current classloader from property: org.apache.sqoop.classpath.extra
  ```
- Regular expression:
  ```
  ^(\d.*\d) (\w*)  \[(.*)\] (\w.*).*
  ```
- Parsing result:

Table 5-112 Log4J log parsing result

Column Number	Example Value
1	2018-01-11 08:50:59,001
2	INFO
3	org.apache.sqoop.core.SqoopConfiguration.configureClassLoader(SqoopConfiguration.java:251)
4	Adding jars to current classloader from property: org.apache.sqoop.classpath.extra

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Log4J Audit Log

- Log sample:
```
2018-01-11 08:51:06,156 INFO
[org.apache.sqoop.audit.FileAuditLogger.logAuditEvent(FileAuditLogger.java:61)]
user=sqoop.anonymous.user    ip=189.xxx.xxx.75    op=show    obj=version    objId=x
```
- Regular expression:
```
^(\d.*\d) (\w*) \[(.*)\] user=(\w.*)    ip=(\w.*)    op=(\w.*)    obj=(\w.*)    objId=(.*).*
```
- Parsing result:

Table 5-113 Log4J audit log parsing result

Column Number	Example Value
1	2018-01-11 08:51:06,156
2	INFO
3	org.apache.sqoop.audit.FileAuditLogger.logAuditEvent(FileAuditLogger.java:61)
4	sqoop.anonymous.user
5	189.xxx.xxx.75
6	show
7	version
8	x

Tomcat Log

- Log sample:
```
11-Jan-2018 09:00:06.907 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log OS
Name:               Linux
```
- Regular expression:
```
^(\d.*\d) (\w*) \[(.*)\] ([\w\.]*) (\w.*).*
```
- Parsing result:

Table 5-114 Tomcat log parsing result

Column Number	Example Value
1	11-Jan-2018 09:00:06.907
2	INFO
3	main

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Column Number	Example Value
4	org.apache.catalina.startup.VersionLoggerListener.log
5	OS Name:Linux

Django Log

- Log sample:
  ```
  [08/Jan/2018 20:59:07 ] settings     INFO     Welcome to Hue 3.9.0
  ```
- Regular expression:
  ```
  ^\[(.*)\] (\w*)     (\w*)     (.*).*
  ```
- Parsing result:

Table 5-115 Django log parsing result

Column Number	Example Value
1	08/Jan/2018 20:59:07
2	settings
3	INFO
4	Welcome to Hue 3.9.0

Apache Server Log

- Log sample:
  ```
  [Mon Jan 08 20:43:51.854334 2018] [mpm_event:notice] [pid 36465:tid 140557517657856] AH00489: Apache/2.4.12 (Unix) OpenSSL/1.0.1t configured -- resuming normal operations
  ```
- Regular expression:
  ```
  ^\[(.*)\] \[(.*)\] \[(.*)\] (.*).*
  ```
- Parsing result:

Table 5-116 Apache server log parsing result

Column Number	Example Value
1	Mon Jan 08 20:43:51.854334 2018
2	mpm_event:notice

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Column Number	Example Value
3	pid 36465:tid 140557517657856
4	AH00489: Apache/2.4.12 (Unix) OpenSSL/1.0.1t configured -- resuming normal operations

5.9.9 Recording the Time When Data Is Written to the Database

When you create a job on the CDM console to migrate tables or files of a relational database, you can add a field to record the time when they were written to the database.

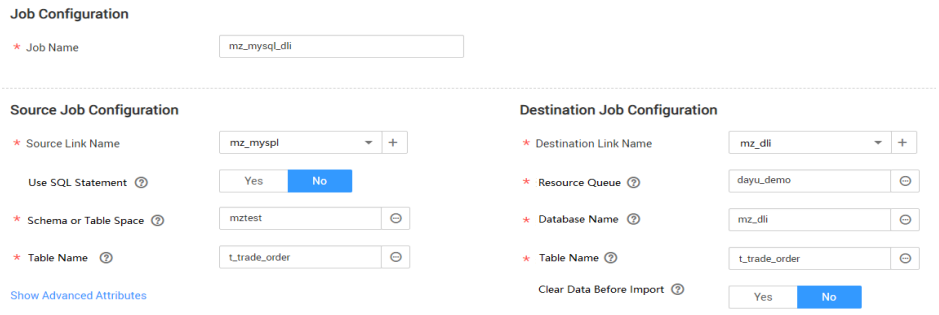
Prerequisites

- A link has been created, and the source end of the connector is a relational database.
- The destination data table contains a date and time field or timestamp field. In the automatic table creation scenario, you need to manually create the date and time field or timestamp field in the destination table in advance.

Creating a Table/File Migration Job

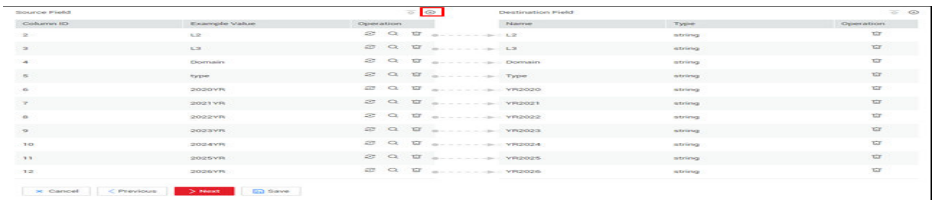
Step 1 Create a table/file migration job, and select the created source connector and destination connector.

Figure 5-69 Configuring the job



Step 2 Click **Next** to go to the **Map Field** page and click .

Figure 5-70 Configuring field mapping



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Step 3 Click the **Custom Fields** tab, set the field name and value, and click **OK**.

Name: Enter **InputTime**.

Value: Enter **${timestamp()}**. For more time macro variables, see **Table 5-117**.

Figure 5-71 Add Field

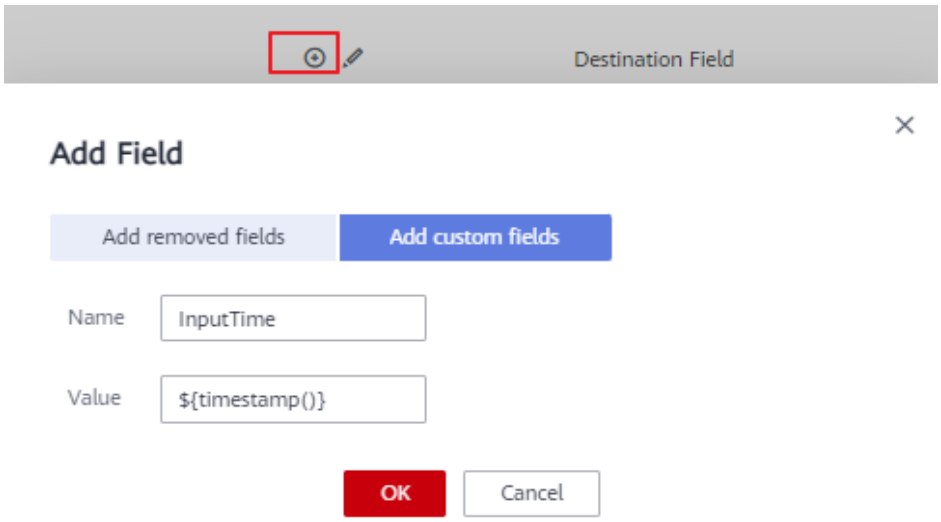


Table 5-117 Macro variable definition of time and date

Macro Variable	Description	Display Effect
${dateformat(yyyy-MM-dd)}	Returns the current date in **yyyy-MM-dd** format.	2017-10-16
${dateformat(yyyy/MM/dd)}	Returns the current date in **yyyy/MM/dd** format.	2017/10/16
${dateformat(yyyy_MM_dd HH:mm:ss)}	Returns the current time in **yyyy_MM_dd HH:mm:ss** format.	2017_10_16 09:00:00
${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}	Returns the current time in **yyyy-MM-dd HH:mm:ss** format. The date is one day before the current day.	2017-10-15 09:00:00
${dateformat(yyyy-MM-dd, -1, DAY)} 00:00:00	Returns 00:00:00 of the day before the current day in *yyyy-MM-dd HH:mm:ss* format.	2017-10-15 00:00:00
${dateformat(yyyy-MM-dd, -1, DAY)} 12:00:00	Returns 12:00:00 of the day before the current day in *yyyy-MM-dd HH:mm:ss* format.	2017-10-15 12:00:00

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Macro Variable	Description	Display Effect
${dateformat(yyyy-MM-dd, -N, DAY)} 00:00:00	Returns 00:00:00 of the day N days before the current day in *yyyy-MM-dd HH:mm:ss* format.	When N is 3: 2017-10-13 00:00:00
${dateformat(yyyy-MM-dd, -N, DAY)} 12:00:00	Returns 12:00:00 of the day N days before the current day in *yyyy-MM-dd HH:mm:ss* format.	When N is 3: 2017-10-13 12:00:00
${timestamp()}	Returns the timestamp of the current time, that is, the number of milliseconds that have elapsed since 00:00:00 on January 1, 1970.	1508115600000
${timestamp(-10, MINUTE)}	Returns the timestamp generated 10 minutes before the current time point.	1508115000000
${timestamp(dateformat(yyyyMMdd))}	Returns the timestamp of 00:00:00 of the current day.	1508083200000
${timestamp(dateformat(yyyyMMdd,-1,DAY))}	Returns the timestamp of 00:00:00 of the previous day.	1507996800000
${timestamp(dateformat(yyyyMMddHH))}	Returns the timestamp of the current hour.	1508115600000

NOTE

- After a field is added, its sample value is not displayed on the console. This does not affect the field value transmission. CDM directly writes the field value to the destination end.
- The **Custom Fields** tab is available only when the source connector is JDBC, HBase, MongoDB, Elasticsearch, or Kafka, or the destination connector is HBase.
- After adding the fields, ensure that the customized import time field matches the field type of the destination table.

Step 4 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

Step 5 Click **Save and Run**. On the **Table/File Migration** page, you can view the job execution progress and result.

Step 6 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

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Step 7 Go to the destination data source to check the time when the data is imported to the database.

----End

5.9.10 File Formats

When creating a CDM job, you need to specify **File Format** in the job parameters of the migration source and destination in some scenarios. This section describes the application scenarios, subparameters, common parameters, and usage examples of the supported file formats.

- **CSV**
- **JSON**
- **Binary**
- **Common parameters**
- **Solutions to File Format Problems**

CSV

To read or write a CSV file, set **File Format** to **CSV**. The CSV format can be used in the following scenarios:

- Import files to a database or NoSQL.
- Export data from a database or NoSQL to files.

After selecting the CSV format, you can also configure the following optional sub-parameters:

1. Line Separator

2. Field Delimiter

3. Encoding Type

4. Use Quote Character

5. Use RE to Separate Fields

6. Use First Row as Header

7. File Size

1. **Line Separator**

   Character used to separate lines in a CSV file. The value can be a single character, multiple characters, or special characters. Special characters can be entered using the URL encoded characters. The following table lists the URL encoded characters of commonly used special characters.

   Table 5-118 URL encoded characters of special characters

Special Character	URL Encoded Character
Space	%20
Tab	%09

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Special Character	URL Encoded Character
%	%25
Enter	%0d
Newline character	%0a
Start of heading\u0001 (SOH)	%01

2. **Field Delimiter**

   Character used to separate columns in a CSV file. The value can be a single character, multiple characters, or special characters. For details, see **Table 5-118**.

3. **Encoding Type**

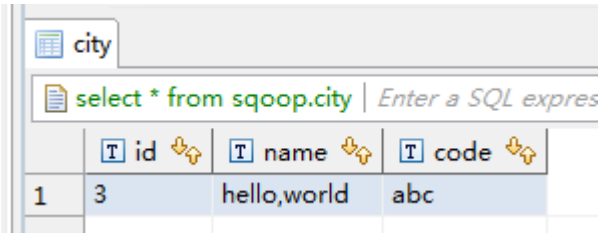
   Encoding type of a CSV file. The default value is **UTF-8**.

   If this parameter is specified at the migration source, the specified encoding type is used to parse the file. If this parameter is specified at the migration destination, the specified encoding type is used to write data to the file.

4. **Use Quote Character**

   - Exporting data from a database or NoSQL to CSV files (configuring **Use Quote Character** at the migration destination): If a field delimiter appears in the character string of a column of data at the migration source, set **Use Quote Character** to **Yes** at the migration destination to quote the character string as a whole and write it into the CSV file. Currently, CDM uses double quotation marks ("") as the quote character only. **Figure 5-72** shows that the value of the **name** field in the database contains a comma (,).

     Figure 5-72 Field value containing the field delimiter

     If you do not use the quote character, the exported CSV file is displayed as follows:

     ```
     3,hello,world,abc
     ```

     If you use the quote character, the exported CSV file is displayed as follows:

     ```
     3,"hello,world",abc
     ```

     If the data in the database contains double quotation marks ("") and you set **Use Quote Character** to **Yes**, the quote character in the exported CSV file is displayed as three double quotation marks (""""). For example, if the value of a field is **a"hello,world"c**, the exported data is as follows:

     ```
     """a"hello,world"c"""
     ```

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  - Exporting CSV files to a database or NoSQL (configuring **Use Quote Character** at the migration source): If you want to import the CSV files with quoted values to a database correctly, set **Use Quote Character** to **Yes** at the migration source to write the quoted values as a whole.

5. **Use RE to Separate Fields**

   This function is used to parse complex semi-structured text, such as log files. For details, see **Using Regular Expressions to Separate Semi-structured Text**.

6. **Use First Row as Header**

   This parameter is used when CSV files are exported to other locations. If this parameter is specified at the migration source, CDM uses the first row as the header when extracting data. When the CSV files are transferred, the headers are skipped. The number of rows extracted from the migration source is more than the number of rows written to the migration destination. The log files will output the information that the header is skipped during the migration.

7. **File Size**

   This parameter is used when data is exported from the database to a CSV file. If a table contains a large amount of data, a large CSV file is generated after migration, which is inconvenient to download or view. In this case, you can specify this parameter at the migration destination so that multiple CSV files with the specified size can be generated. The value of this parameter is an integer. The unit is MB.

JSON

The following describes information about the JSON format:

- **JSON Types Supported by CDM**
- **JSON Reference Node**
- **Copying Data from a JSON File**

1. **JSON types supported by CDM: JSON object and JSON array**
   - JSON object: A JSON file contains a single object or multiple objects separated/merged by rows.
     i. The following is a single JSON object:

```
{
    "took" : 190,
    "timed_out" : false,
    "total" : 1000001,
    "max_score" : 1.0
}
```

     ii. The following are JSON objects separated by rows:

```
{"took" : 188, "timed_out" : false, "total" : 1000003, "max_score" : 1.0 }
{"took" : 189, "timed_out" : false, "total" : 1000004, "max_score" : 1.0 }
```

     iii. The following are merged JSON objects:

```
{
   "took": 190,
   "timed_out": false,
   "total": 1000001,
   "max_score": 1.0
}
{
   "took": 191,
   "timed_out": false,
   "total": 1000002,
```

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```
    "max_score": 1.0
  }
```

– JSON array: A JSON file is a JSON array consisting of multiple JSON objects.

```
[{
    "took" : 190,
    "timed_out" : false,
    "total" : 1000001,
    "max_score" : 1.0
},
{
    "took" : 191,
    "timed_out" : false,
    "total" : 1000001,
    "max_score" : 1.0
}]
```

2. **JSON Reference Node**

   Root node that records data. The data corresponding to the node is a JSON array. CDM extracts data from the array in the same mode. Use periods (.) to separate multi-layer nested JSON nodes.

3. **Copying Data from a JSON File**

   a. Example 1

   Extract data from multiple objects that are separated or merged. A JSON file contains multiple JSON objects. The following gives an example:

```
{
  "took": 190,
  "timed_out": false,
  "total": 1000001,
  "max_score": 1.0
}
{
  "took": 191,
  "timed_out": false,
  "total": 1000002,
  "max_score": 1.0
}
{
  "took": 192,
  "timed_out": false,
  "total": 1000003,
  "max_score": 1.0
}
```

   To extract data from the JSON object and write data to the database in the following formats, set **File Format** to **JSON** and **JSON Type** to **JSON object**, and then map fields.

   Table 5-119 Example

took	timedOut	total	maxScore
190	false	1000001	1.0
191	false	1000002	1.0
192	false	1000003	1.0

   b. Example 2

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Extract data from the reference node. A JSON file contains a single JSON object, but the valid data is on a data node. The following gives an example:

```
{
   "took": 190,
   "timed_out": false,
   "hits": {
      "total": 1000001,
      "max_score": 1.0,
      "hits":
       [{
          "_id": "650612",
          "_source": {
             "name": "tom",
             "books": ["book1","book2","book3"]
          }
       },
       {
          "_id": "650616",
          "_source": {
             "name": "tom",
             "books": ["book1","book2","book3"]
          }
       },
     {
          "_id": "650618",
          "_source": {
             "name": "tom",
             "books": ["book1","book2","book3"]
          }
       }]
   }
}
```

To write data to the database in the following formats, set **File Format** to **JSON**, **JSON Type** to **JSON object**, and **JSON Reference Node** to **hits.hits**, and then map fields.

Table 5-120 Example

ID	SourceName	SourceBooks
650612	tom	["book1","book2","book3"]
650616	tom	["book1","book2","book3"]
650618	tom	["book1","book2","book3"]

c. Example 3

Extract data from the JSON array. A JSON file is a JSON array consisting of multiple JSON objects. The following gives an example:

```
[{
    "took" : 190,
    "timed_out" : false,
    "total" : 1000001,
    "max_score" : 1.0
 },
 {
    "took" : 191,
    "timed_out" : false,
    "total" : 1000002,
    "max_score" : 1.0
 }]
```

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To write data to the database in the following formats, set **File Format** to **JSON** and **JSON Type** to **JSON array**, and then map fields.

Table 5-121 Example

took	timedOut	total	maxScore
190	false	1000001	1.0
191	false	1000002	1.0

d. Example 4

Configure a converter when parsing the JSON file. On the premise of **example 2**, to add the **hits.max_score** field to all records, that is, to write the data to the database in the following formats, perform the following operations:

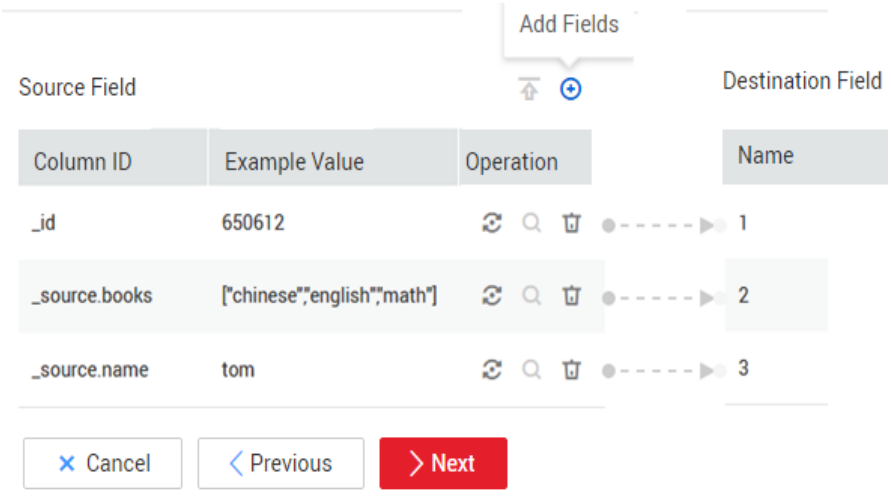
Table 5-122 Example

ID	SourceName	SourceBooks	MaxScore
650612	tom	["book1","book2","book3"]	1.0
650616	tom	["book1","book2","book3"]	1.0
650618	tom	["book1","book2","book3"]	1.0

Set **File Format** to **JSON**, **JSON Type** to **JSON object**, and **JSON Reference Node** to **hits.hits**, and then create a converter.

i. Click ⊕ to add a field.

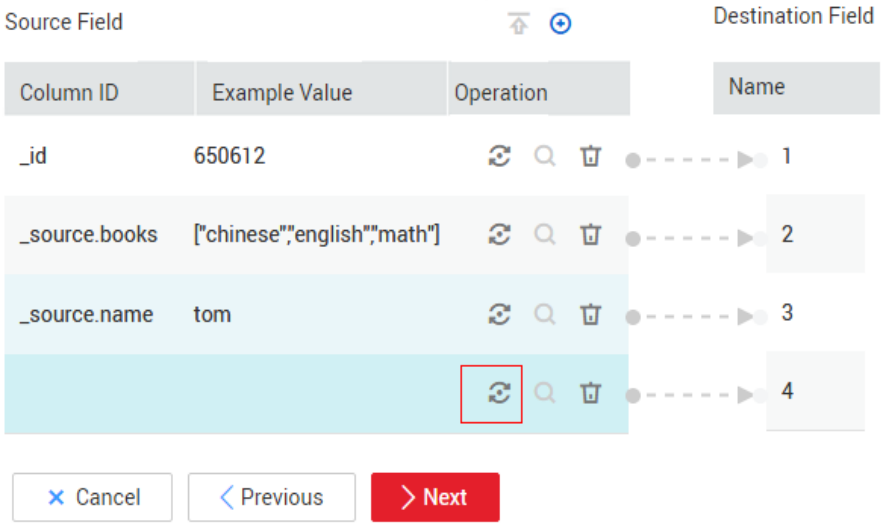
Figure 5-73 Adding a field



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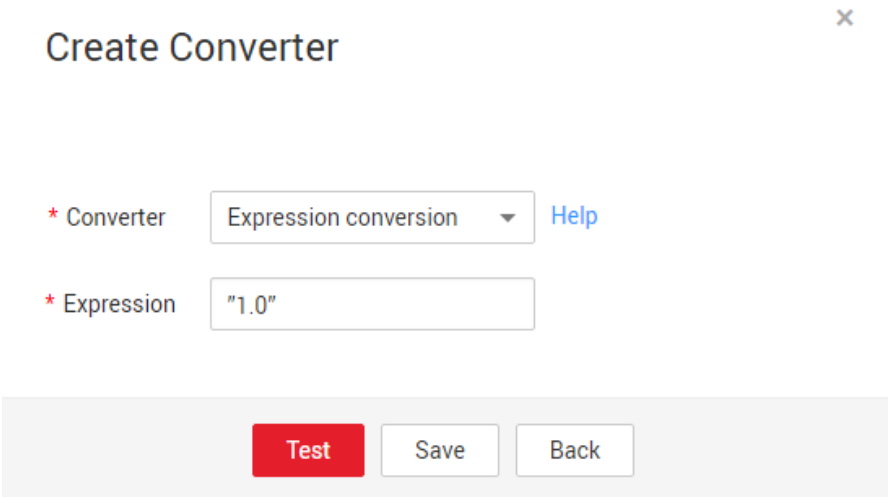
ii. Click to create a converter for the new field.

Figure 5-74 Creating a field converter



iii. Set **Converter** to **Expression conversion**, enter **"1.0"** in the **Expression** text box, and click **Save**.

Figure 5-75 Configuring a field converter



Binary

If you want to copy files between file systems, you can select the binary format. Files can be transferred in binary format at a high speed and stable performance. In addition, field mapping is not required in the second step of the job.

- **Directory structure for file transfer**

  CDM can transfer a single file or all files in a directory at a time. After the files are transferred to the migration destination, the directory structure remains unchanged.

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- **Migrating incremental files**

  When you use CDM to transfer files in binary format, configure **Duplicate File Processing Method** at the migration destination for incremental file migration. For details, see **Incremental File Migration**.

  During incremental file migration, set **Duplicate File Processing Method** to **Skip**. If new files exist at the migration source or a failure occurs during the migration, run the job again, so that the migrated files will not be migrated repeatedly.

- **Write to Temporary File**

  When migrating files in binary format, you can specify whether to write the files to a temporary file at the migration destination. If this parameter is specified, the file is written to a temporary file during file replication. After the file is successfully migrated, run the **rename** or **move** command to restore the file at the migration destination.

- **Generate MD5 Hash Value**

  An MD5 hash value is generated for each transferred file, and the value is recorded in a new **.md5** file. You can specify the directory where the MD5 value is generated.

Common parameters

- **Start Job by Marker File**

  In automation scenarios, a scheduled task is configured on CDM to periodically read files from the migration source. However, files are being generated at the migration source. As a result, CDM reads data repeatedly or fails to read data from the migration source. You can specify the marker file for starting a job as **ok.txt** in the job parameters of the migration source. After the file is successfully generated at the migration source, the **ok.txt** file is generated in the file directory. In this way, CDM can read the complete file.

  In addition, you can set the suspension period. Within the suspension period, CDM periodically queries whether the marker file exists. If the file does not exist after the suspension period expires, the job fails.

  The marker file will not be migrated.

- **Job Success Marker File**

  After data is successfully migrated to a file system, an empty file is generated in the destination directory. You can specify the file name. Generally, this parameter is used together with **Start Job by Marker File**.

  The name of the job success marker file cannot be the same as that of the transferred file, for example, finish.txt. If the two files have the same name, they will overwrite each other.

- **Filter**

  When using CDM to migrate files, you can specify a filter to filter files. Files can be filtered by wildcard character or time filter.

  - If you select **Wildcard**, CDM migrates only the paths or files that meet the filter condition.
  - If you select **Time Filter**, CDM migrates only the files modified after the specified time point.

  For example, the **/table/** directory stores a large number of data table directories divided by day. **DRIVING_BEHAVIOR_20180101** to

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DRIVING_BEHAVIOR_20180630 store all data of **DRIVING_BEHAVIOR** from January to June. If you only want to migrate the table data of **DRIVING_BEHAVIOR** in March, set the source directory to **/table**, filter type to wildcard, and path filter to **DRIVING_BEHAVIOR_201803***.

Solutions to File Format Problems

1. When data in a database is exported to a CSV file, if the data contains commas (,), the data in the exported CSV file is disordered.

   The following solutions are available:

   - Specify a field delimiter.

     Use a character that does not exist in the database or a rare non-printable character as the field delimiter. For example, you can set **Field Delimiter** at the destination to **%01**. In this way, the exported field delimiter is **\u0001**. For details, see **Table 5-118**.

   - Use a quote character.

     Set **Use Quote Character** to **Yes** at the migration destination. In this way, if the field in the database contains the field delimiter, CDM quotes the field using the quote character and write the field as a whole to the CSV file.

2. The data in the database contains line separators.

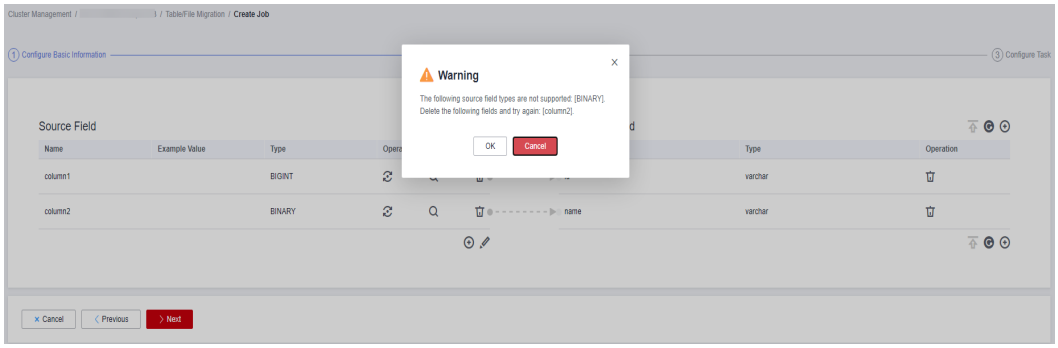
   - Scenario: When you use CDM to export a table in the MySQL database (a field value contains the line separator **\n**) to a CSV file, and then use CDM to import the exported CSV file to MRS HBase, data in the exported CSV file is truncated.
   - Solution: Specify a line separator.

     When you use CDM to export MySQL table data to a CSV file, set **Line Separator** at the migration destination to **%01** (ensure that the value does not appear in the field value). In this way, the line separator in the exported CSV file is **%01**. Then use CDM to import the CSV file to MRS HBase. Set **Line Separator** at the migration source to **%01**. This avoids data truncation.

5.9.11 Converting Unsupported Data Types

Scenario

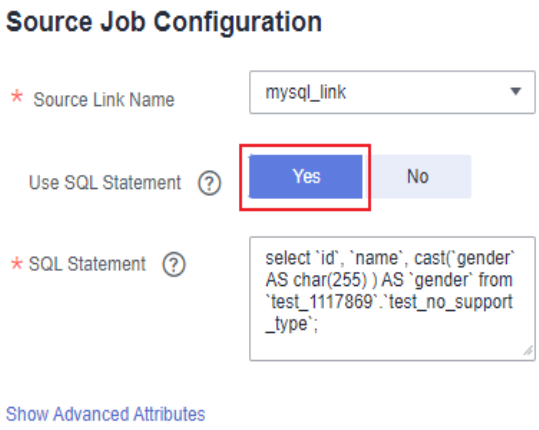
When field mapping is configured on CDM, a message is displayed indicating that the data type of the field is not supported and the field needs to be deleted. If you need to use this field, you can use SQL statements to convert the field type in the source job configuration to the type supported by CDM for data migration.



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Procedure

Step 1 Modify the CDM migration job and enable **Use SQL Statement**.



NOTE

The SQL statement format is as follows: **select id,cast**(*Original field name* **as INT) as** *New field name, which can be the same as the original field name* **from schemaName.tableName;**

Example: select `id`, `name`, cast(`gender` AS char(255)) AS `gender` from `test_1117869`.`test_no_support_type`;

Step 2 Wait for the fields to be converted to the data types supported by CDM.



----End

5.9.12 Auto Table Creation

CDM converts the field type of the source to the field type of the destination based on the default rule and creates a table at the destination.

Field Mapping in Automatic Table Creation

Figure 5-76 describes the field mapping between the DWS tables created by CDM and source tables. For example, if you use CDM to migrate the Oracle database to DWS, CDM automatically creates a table on DWS and maps the **NUMBER(3,0)** field of the Oracle database to the **SMALLINT** field of DWS.

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Figure 5-76 Field mapping in automatic table creation

Source Database Type							Destination Database Type
Oracle	MySQL	SQL Server	PostgreSQL	Db2	GaussDB	SAP HANA	DWS
NUMBER(p,0) (p=3 or p=5)	SMALLINT,TINYINT	SMALLINT,TINYINT	SMALLINT	DECIMAL	SMALLINT	SMALLINT,TINYINT	SMALLINT
NUMBER(10,0)	INT	INT	INTEGER	INT	INTEGER	INTEGER	INTEGER
NUMBER(19,0)	BIGINT	BIGINT	BIGINT	DECIMAL	BIGINT	BIGINT	BIGINT
None	None	None	OID	None	OID	CHAR(128)	OID
NUMBER(p,s) (0 < p <= 38)	DECIMAL(p,s) (0 < p <= 65)	DECIMAL(p,s) (0 < p <= 30)	NUMERIC(p,s) (p <= 1000)	DECIMAL	NUMERIC(p,s) (p <= 1000)	DECIMAL(p,s) (0 < p <= 38)	NUMERIC(p,s) (p <= 1000)
RAW	BINARY	BINARY	BYTEA	BINARY	BYTEA	BINARY	BYTEA
CHAR	CHAR	CHAR	CHAR	CHAR	CHAR	CHAR(p) (p <= 2000)	CHAR
NCHAR	NCHAR	NCHAR	NCHAR	NCHAR	NCHAR	NCHAR(p) (p <= 5000)	NCHAR
DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE
DATE	DATETIME	DATETIME2	TIMESTAMP	TIMESTAMP	TIMESTAMP	TIMESTAMP	TIMESTAMP
VARCHAR2(p) (p <= 4000)	VARCHAR	VARCHAR(p) (if p >= 8000 p=max)	VARCHAR(p) (p <= 10485760)	VARCHAR	VARCHAR(p) (p <= 10485760)	VARCHAR(p) (p <= 5000)	VARCHAR(p) (p <= 10485760)
FLOAT	DOUBLE	FLOAT	DOUBLE PRECISION	FLOAT	DOUBLE PRECISION	DOUBLE	DOUBLE PRECISION
FLOAT	REAL	FLOAT	REAL	FLOAT	REAL	REAL	REAL
CLOB	TEXT	TEXT	TEXT	TEXT	TEXT	CLOB	TEXT
DATE	None	TIME	TIME	TIME	TIME	TIME	TIME
BOOLEAN	None	None	BOOLEAN	BOOLEAN	BOOLEAN	BOOLEAN	BOOLEAN

Table 5-123, **Table 5-124**, **Table 5-125**, and **Table 5-126** describe the field type mapping between Hive tables and source tables when CDM automatically creates tables in Hive. For example, if you use CDM to migrate the MySQL database to Hive, CDM automatically creates a table on Hive and maps the **YEAR** field of the MySQL database to the **DATE** field of Hive.

NOTE

- For the DECIMAL type, if the length of the source data exceeds the Hive length, the precision may be lost.
- For the DECIMAL type, the precision is greater than or equal to 1 and less than or equal to 38, and the scale is greater than or equal to 0. If the precision for the source is greater than 38 bits, the precision for Hive table creation is 38 bits. If the scale is less than 0, the scale for Hive table creation is 0. In this case, precision loss may occur after data is written.

Table 5-123 Field mapping in automatic table creation for MySQL-to-Hive migration

Data Type (MySQL)	Data Type (Hive)	Description
Value		

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Data Type (MySQL)	Data Type (Hive)	Description
tinyint(1), bit(1)	BOOLEAN	-
TINYINT	SMALLINT	-
TINYINT UNSIGNED	SMALLINT	-
SMALLINT	SMALLINT	-
SMALLINT UNSIGNED	INTEGER	-
MEDIUMINT	INTEGER	-
MEDIUMINT UNSIGNED	BIGINT	-
INT	INTEGER	-
INT UNSIGNED	BIGINT	-
BIGINT	BIGINT	-
BIGINT UNSIGNED	DECIMAL(38,0)	-
DECIMAL(P,S)	DECIMAL(P,S)	The MySQL database supports a maximum of 65 bits. For Hive, the precision is greater than or equal to 1 and less than or equal to 38, and the scale is greater than or equal to 0. If the precision for the MySQL database is greater than 38 bits, the precision for Hive table creation is 38 bits. If the scale is less than 0, the scale for Hive table creation is 0.
FLOAT	FLOAT	-
FLOAT UNSIGNED	FLOAT	-
DOUBLE	DOUBLE	-
DOUBLE UNSIGNED	DOUBLE	-
Time		
DATE	DATE	-
YEAR	DATE	-
DATETIME	TIMESTAMP	-
TIMESTAMP	TIMESTAMP	-

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Data Type (MySQL)	Data Type (Hive)	Description
TIME	STRING	-
Character		
CHAR(N)	CHAR(N*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.
VARCHAR(N)	VARCHAR(N*3)	If the value is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.
BINARY	BINARY	-
VARBINARY	BINARY	-
TINYBLOB	BINARY	-
MEDIUMBLOB	BINARY	-
BLOB	BINARY	-
LONGBLOB	BINARY	-
TINYTEXT	VARCHAR(765)	-
MEDIUMTEXT	STRING	-
TEXT	STRING	-
LONGTEXT	STRING	-
Others	STRING	-

Table 5-124 Field mapping in automatic table creation for Oracle-to-Hive migration

Data Type (Oracle)	Data Type (Hive)	Description
Character		
CHAR(N)	CHAR(N*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.

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Data Type (Oracle)	Data Type (Hive)	Description
VARCHAR(N)	VARCHAR(N*3)	If the value is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.
VARCHAR2	VARCHAR(N*3)	If the value is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.
NCHAR	CHAR(N*3)	-
NVARCHAR2	STRING	-
Value		
NUMBER	DECIMAL(P,S)	For Hive, the precision is greater than or equal to 1 and less than or equal to 38, and the scale is greater than or equal to 0. If the precision for the MySQL database is greater than 38 bits, the precision for Hive table creation is 38 bits. If the scale is less than 0, the scale for Hive table creation is 0.
BINARY_FLOAT	FLOAT	-
BINARY_DOUBLE	DOUBLE	-
FLOAT	FLOAT	-
Time		
DATE	TIMESTAMP	-
TIMESTAMP	TIMESTAMP	-
TIMESTAMP WITH TIME ZONE	STRING	-
TIMESTAMP WITH LOCAL TIME ZONE	STRING	-
INTERVAL	STRING	-
Binary		
BLOB	BINARY	-
CLOB	STRING	-
NCLOB	STRING	-
LONG	STRING	-
LONG_RAW	BINARY	-

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Data Type (Oracle)	Data Type (Hive)	Description
RAW	BINARY	-
Other	STRING	-

Table 5-125 Field mapping in automatic table creation for PostgreSQL/DWS-to-Hive migration

Data Type (PostgreSQL/ DWS)	Data Type (Hive)	Description
Value		
int2	SMALLINT	-
int4	INT	-
int8	BIGINT	-
real	FLOAT	-
float4	FLOAT	-
float8	DOUBLE	-
smallserial	SMALLINT	-
serial	INT	-
bigserial	BIGINT	-
numeric(p,s)	DECIMAL(P,S)	For Hive, the precision is greater than or equal to 1 and less than or equal to 38, and the scale is greater than or equal to 0. If the precision for the MySQL database is greater than 38 bits, the precision for Hive table creation is 38 bits. If the scale is less than 0, the scale for Hive table creation is 0.
money	DOUBLE	-
bit(1)	TINYINT	-
varbit	STRING	-
Character		
varchar(n)	VARCHAR(N*3)	If the value is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.

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Data Type (PostgreSQL/ DWS)	Data Type (Hive)	Description
bpchar(n)	CHAR(N*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.
char(n)	CHAR(N*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.
bytea	BINARY	-
text	STRING	-
Time		
interval	STRING	-
date	DATE	-
time	STRING	-
timetz	STRING	-
timestamp	TIMESTAMP	-
timestamptz	TIMESTAMP	-
Boolean		
bool	BOOLEAN	-
Other	STRING	-

Table 5-126 Field mapping in automatic table creation for SQL Server-to-Hive migration

Data Type (SQL Server)	Data Type (Hive)	Description
Value		
TINYINT	SMALLINT	-
SMALLINT	SMALLINT	-
INT	INT	-

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Data Type (SQL Server)	Data Type (Hive)	Description
BIGINT	BIGINT	-
DECIMAL	DECIMAL(P,S)	For Hive, the precision is greater than or equal to 1 and less than or equal to 38, and the scale is greater than or equal to 0. If the precision for the MySQL database is greater than 38 bits, the precision for Hive table creation is 38 bits. If the scale is less than 0, the scale for Hive table creation is 0.
NUMERIC	DECIMAL(P,S)	For Hive, the precision is greater than or equal to 1 and less than or equal to 38, and the scale is greater than or equal to 0. If the precision for the MySQL database is greater than 38 bits, the precision for Hive table creation is 38 bits. If the scale is less than 0, the scale for Hive table creation is 0.
FLOAT	DOUBLE	-
REAL	FLOAT	-
SMALLMONEY	DECIMAL(10,4)	-
MONEY	DECIMAL(19,4)	-
BIT(1)	TINYINT	-
Time		
DATE	DATE	-
DATETIME	TIMESTAMP	-
DATETIME2	TIMESTAMP	-
DATETIMEOFFSET	STRING	-
TIME(p)	STRING	-
TIMESTAMP	BINARY	-
Character		
CHAR(n)	CHAR(n*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65535 (VARCHAR_MAX_LENGTH), a string is created.

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Data Type (SQL Server)	Data Type (Hive)	Description
VARCHAR(n)	VARCHAR(n*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65536 (VARCHAR_MAX_LENGTH), a string is created.
NCHAR(n)	VARCHAR(n*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65537 (VARCHAR_MAX_LENGTH), a string is created.
NVARCHAR(n)	VARCHAR(n*3)	If the value of (n*3<255) is greater than 255 (CHAR_MAX_LENGTH), varchar(N*3) is created. If the value of (n*3<255) is greater than 65538 (VARCHAR_MAX_LENGTH), a string is created.
Binary		
BINARY	BINARY	-
VARBINARY	BINARY	-
TEXT	STRING	-
Other	STRING	-

5.10 Tutorials

5.10.1 Creating an MRS Hive Link

MRS Hive links are applicable to the MapReduce Service (MRS). This tutorial describes how to create an MRS Hive link.

Prerequisites

- You have created a CDM cluster.
- You have obtained the Manager IP address, and administrator account and password of the MRS cluster, and the account has the permissions to import and export data.
- The MRS cluster and the CDM cluster can communicate with each other. The following requirements must be met for network interconnection:
  - If the CDM cluster and the cloud service are in different regions, a public network or a dedicated connection is required for enabling

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communication between the CDM cluster and the cloud service. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, the host where the data source is located can access the Internet, and the port has been enabled in the firewall rules.

- If the CDM cluster and the cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
- The cloud service instance and the CDM cluster belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

Creating an MRS Hive Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

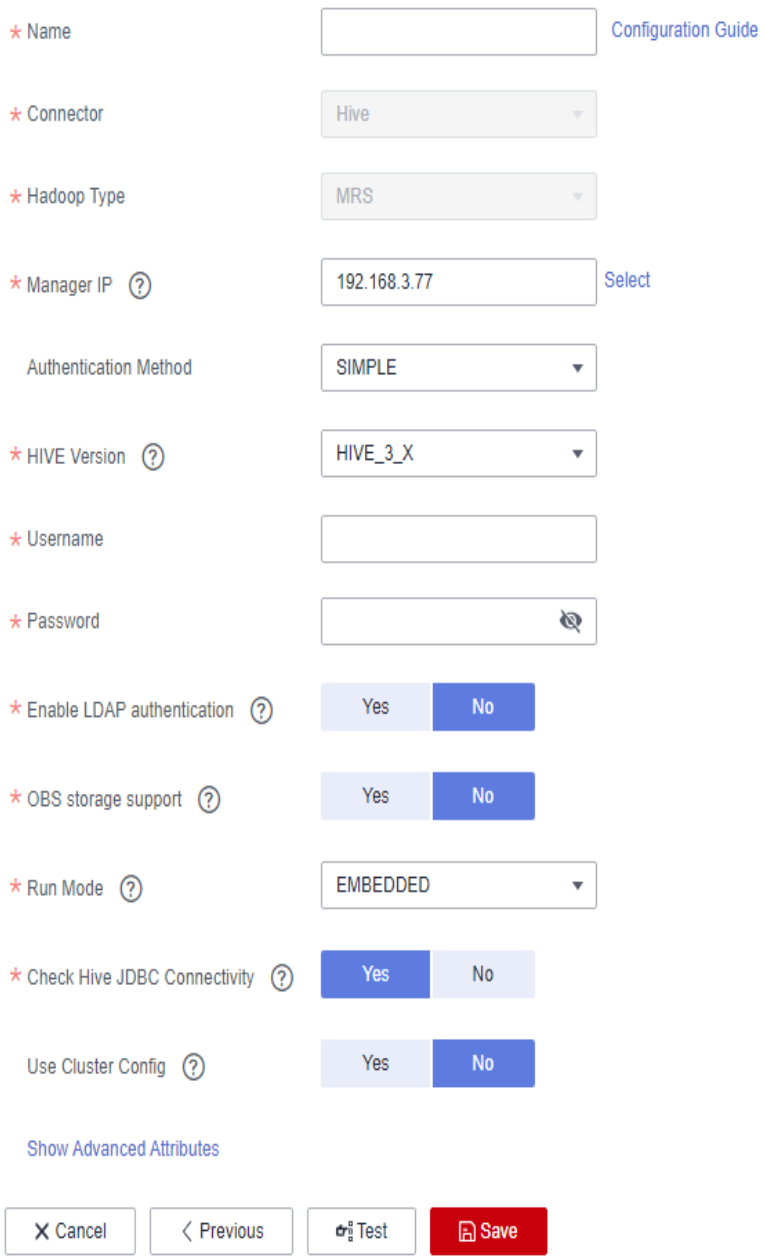
Figure 5-77 Selecting a connector type



Step 2 Select **MRS Hive** and click **Next** to configure parameters for the MRS Hive link.

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Figure 5-78 Creating an MRS Hive link



Step 3 Click **Show Advanced Attributes** to view more optional parameters. Retain their default values. The following table lists the mandatory parameters.

Table 5-127 MRS Hive link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hivelink

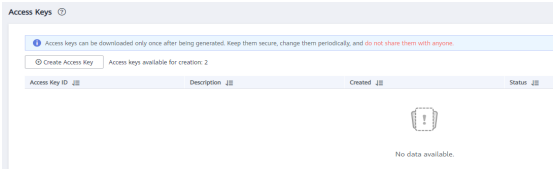
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Parameter	Description	Example Value
Manager IP	Floating IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select an MRS cluster. CDM automatically fills in the authentication information. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.	127.0.0.1
Authentication Method	Authentication method used for accessing MRS ● **SIMPLE**: Select this for non-security mode. ● **KERBEROS**: Select this for security mode.	SIMPLE
HIVE Version	Set this to the Hive version on the server.	HIVE_3_X
Username	If **Authentication Method** is set to **KERBEROS**, you must provide the username and password used for logging in to MRS Manager. If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user and set **Username** and **Password** to the username and password of the created MRS user when creating an MRS data connection. **NOTE** ● If the CDM cluster version is 2.9.0 or later and the MRS cluster version is 3.1.0 or later, the created user must have the permissions of the **Manager_viewer** role to create links on CDM. To perform operations on databases, tables, and columns of an MRS component, you also need to add the database, table, and column permissions of the MRS component to the user by following the instructions in the MRS documentation. ● If the CDM cluster version is earlier than 2.9.0 or the MRS cluster version is earlier than 3.1.0, the created user must have the permissions of **Manager_administrator** or **System_administrator** to create links on CDM. ● A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.	cdm
Password	Password used for logging in to MRS Manager	-

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Parameter	Description	Example Value
Enable ldap	This parameter is available when **Proxy connection** is selected for **Connection Type**. If LDAP authentication is enabled for an external LDAP server connected to MRS Hive, the LDAP username and password are required for authenticating the connection to MRS Hive. In this case, this option must be enabled. Otherwise, the connection will fail.	No
ldapUsername	This parameter is mandatory when **Enable ldap** is enabled. Enter the username configured when LDAP authentication was enabled for MRS Hive.	-
ldapPassword	This parameter is mandatory when **Enable ldap** is enabled. Enter the password configured when LDAP authentication was enabled for MRS Hive.	-
OBS storage support	The server must support OBS storage. When creating a Hive table, you can store the table in OBS.	No

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Parameter	Description	Example Value
AK	This parameter is mandatory when **OBS storage support** is enabled. The account corresponding to the AK/SK pair must have the OBS Buckets Viewer permission. Otherwise, OBS cannot be accessed and the "403 AccessDenied" error is reported. You need to create an access key for the current account and obtain an AK/SK pair. 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-79**. **Figure 5-79** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** – Only two access keys can be added for each user. – To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

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Parameter	Description	Example Value
Run Mode	This parameter is used only when the Hive version is **HIVE_3_X**. Possible values are: • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. **NOTE** The **STANDALONE** mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	EMBEDDED
Check Hive JDBC Connectivity	Whether to check the Hive JDBC connectivity	No
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hive_01

NOTE

Click **Show Advanced Attributes**, and then click **Add** to add configuration attributes of other clients. The name and value of each attribute must be configured. You can click **Delete** to delete no longer used attributes.

Step 4 Click **Save** to return to the **Links**page.

----End

5.10.2 Creating a MySQL Link

MySQL links are applicable to third-party cloud MySQL services and MySQL created in a local data center or ECS. This tutorial describes how to create a MySQL link.

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Prerequisites

- You have obtained the IP address, port, database name, username, and password for connecting to the MySQL database. In addition, the user must have the read and write permissions on the MySQL database.
- The on-premises MySQL database can be accessed through the public network. If the MySQL database is deployed on an on-premises data center or a third-party cloud, ensure that an IP address that can be accessed from the public network has been configured for the MySQL database, or the VPN or Direct Connect between the on-premises data center and the cloud service platform has been established.
- You have created a CDM cluster.

Creating a MySQL Link

Step 1 Access the CDM console, choose **Cluster Management** in the navigation pane, locate the target cluster, and choose **Job Management** > **Link Management** > **Driver Management**. The **Driver Management** page is displayed.

Step 2 On the **Driver Management** page, click the document link in the **Recommended Version** column of the MySQL driver and obtain the driver file as instructed.

Step 3 On the **Driver Management** page, upload the MySQL driver using either of the following methods:

Click **Upload** in the **Operation** column and select a local driver.

Alternatively, click **Copy from SFTP** in the **Operation** column and configure the **SFTP Link** name and **Driver File Path**.

Step 4 On the **Cluster Management** page, click **Job Management** of the cluster and choose **Links** > **Create Link** to enter the page for selecting the connector.

Figure 5-80 Selecting a connector type



Step 5 Select **MySQL** and click **Next** to configure parameters for the MySQL link.

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Table 5-128 MySQL link parameters

Parameter	Description	Example Value
Name	Enter a unique link name.	mysqllink
Database Server	IP address or domain name of the MySQL database	192.168.1.110
Port	MySQL database port	3306
Database Name	Name of the MySQL database	sqoop
Username	User who has the read, write, and delete permissions on the MySQL database	admin
Password	Password of the user	-
Use Local API	Whether to use the local API of the database for acceleration. (The system attempts to enable the **local_infile** system variable of the MySQL database.)	Yes
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
local_infile Character Set	When using local_infile to import data to MySQL, you can configure the encoding format.	utf8
Driver Version	A driver version that adapts to MySQL	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Fetch Size	Number of rows obtained by each request	1000
Commit Size	(Optional) Displayed when you click **Show Advanced Attributes**. Number of records submitted each time. Set this parameter based on the destination and data size of the job. If the value is too large or too small, the job execution time may be affected.	1000
Link Attributes	Custom attributes of the link	useCompression=true

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Parameter	Description	Example Value
Reference Sign	Delimiter used to separate referenced table names or column names This parameter is left blank by default.	'
Batch Size	Number of rows written each time. It should be less than **Commit Size**. When the number of rows written reaches the value of **Commit Size**, the rows will be committed to the database.	100

Step 6 Click **Save** to return to the **Links** page.

NOTE

If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

5.10.3 Migrating Data from MySQL to MRS Hive

MRS provides enterprise-level big data clusters on the cloud. It contains HDFS, Hive, and Spark components and is applicable to massive data analysis of enterprises.

Hive supports SQL to help users perform extraction, transformation, and loading (ETL) operations on large-scale data sets. Query on large-scale data sets takes a long time. In many scenarios, you can create Hive partitions to reduce the total amount of data to be scanned each time. This significantly improves query performance.

Hive partitions are implemented by using the HDFS subdirectory function. Each subdirectory contains the column names and values of each partition. If there are multiple partitions, many HDFS subdirectories exist. It is not easy to load external data to each partition of the Hive table without relying on tools. With CDM, you can easily load data of the external data sources (relational databases, object storage services, and file system services) to Hive partition tables.

This section describes how to migrate data from the MySQL database to the MRS Hive partition table.

Scenario

Suppose that there is a **trip_data** table in the MySQL database. The table stores cycling records such as the start time, end time, start sites, end sites, and rider IDs. For details about the fields in the **trip_data** table, see **Figure 5-81**.

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Figure 5-81 MySQL table fields

Column Name	#	Data Type
TripID	1	int(11)
Duration	2	int(11)
StartDate	3	timestamp
StartStation	4	varchar(64)
StartTerminal	5	int(11)
EndDate	6	timestamp
EndStation	7	varchar(64)
EndTerminal	8	int(11)
Bike	9	int(11)
SubscriberType	10	varchar(32)
ZipCodev	11	varchar(10)

The following describes how to use CDM to import the **trip_data** table in the MySQL database to the MRS Hive partition table. The procedure is as follows:

1. **Creating a Hive Partition Table on MRS Hive**
2. **Creating a CDM Cluster and Binding an EIP to the Cluster**
3. **Creating a MySQL Link**
4. **Creating a Hive Link**
5. **Creating a Migration Job**

Prerequisites

- MRS is available.
- You have obtained the IP address, port, database name, username, and password for connecting to the MySQL database. In addition, the user must have the read and write permissions on the MySQL database.
- You have uploaded the MySQL database driver on the **Job Management** > **Links** > **Driver Management** page.

Creating a Hive Partition Table on MRS Hive

On MRS Hive, run the following SQL statement to create a Hive partition table named **trip_data** with three new fields **y**, **ym**, and **ymd** used as partition fields. The SQL statement is as follows:

```
create table trip_data(TripID int,Duration int,StartDate timestamp,StartStation varchar(64),StartTerminal int,EndDate timestamp,EndStation varchar(64),EndTerminal int,Bike int,SubscriberType varchar(32),ZipCodev varchar(10))partitioned by (y int,ym int,ymd int);
```

NOTE

The **trip_data** partition table has three partition fields: year, year and month, and year, month, and date of the start time of a ride. For example, if the start time of a ride is **2018/5/11 9:40**, the record is saved in the **trip_data/2018/201805/20180511** partition. When the records in the **trip_data** table are summarized, only part of the data needs to be scanned, greatly improving the performance.

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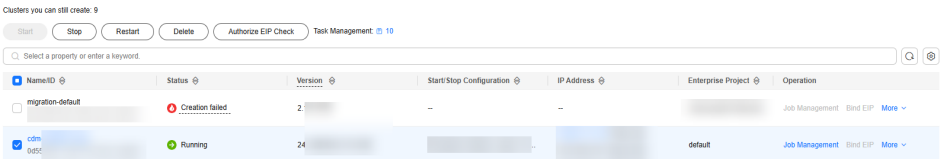
Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 The key configurations are as follows:

- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.
- The CDM and MRS clusters must be in the same VPC, subnet, and security group.

Step 2 After the CDM cluster is created, on the **Cluster Management** page, click **Bind EIP** in the **Operation** column to bind an EIP to the cluster. The CDM cluster uses the EIP to access MySQL.

Figure 5-82 Cluster list



NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating a MySQL Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

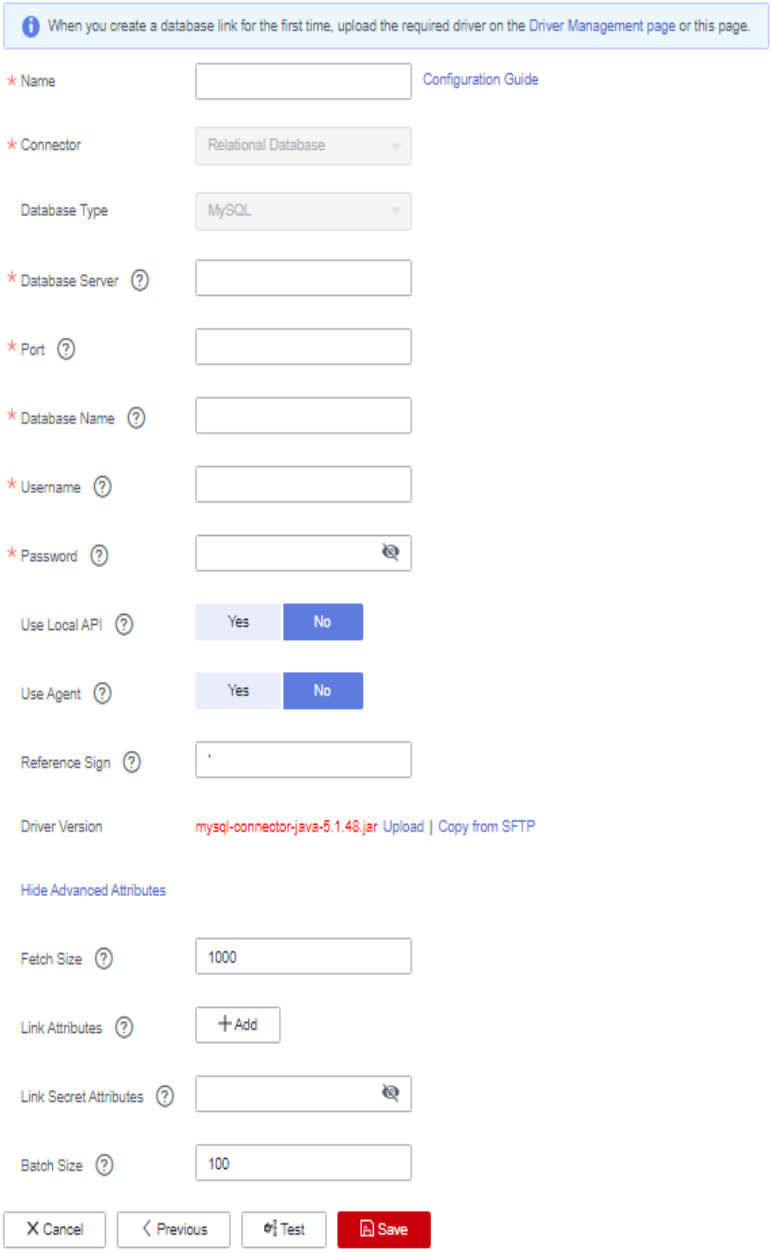
Figure 5-83 Selecting a connector



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Step 2 Select **RDS for MySQL** and click **Next** to set the link parameters.

Figure 5-84 Creating a MySQL Link



Click **Show Advanced Attributes** to view more optional parameters. For details, see **Link to an RDS for MySQL/MySQL Database**. Retain the default values for the optional parameters and configure the mandatory parameters described in **Table 5-129**.

Table 5-129 MySQL link parameters

Parameter	Description	Example Value
Name	Enter a unique link name.	mysqllink

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Parameter	Description	Example Value
Database Server	IP address or domain name of the MySQL database	N/A
Port	MySQL database port	3306
Database Name	Name of the MySQL database	sqoop
Username	User who has the read, write, and delete permissions on the MySQL database	admin
Password	Password of the user	N/A
Use Local API	Whether to use the local API of the database for acceleration. (The system attempts to enable the **local_infile** system variable of the MySQL database.)	Yes
Use Agent	Whether to extract data from the data source through an agent	No
local_infile Character Set	When using local_infile to import data to MySQL, you can configure the encoding format.	utf8
Driver Version	Before connecting CDM to a relational database, you need to upload the JDK 8 .jar driver of the relational database. Download the MySQL driver 5.1.48 from **https://downloads.mysql.com/archives/c-j/**, obtain **mysql-connector-java-5.1.48.jar**, and upload it.	N/A

Step 3 Click **Save**. The **Link Management** page is displayed.

NOTE

If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

Creating a Hive Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

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Figure 5-85 Selecting a connector type



Step 2 Select **MRS Hive** and click **Next** to configure parameters for the MRS Hive link.

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Figure 5-86 Creating an MRS Hive link

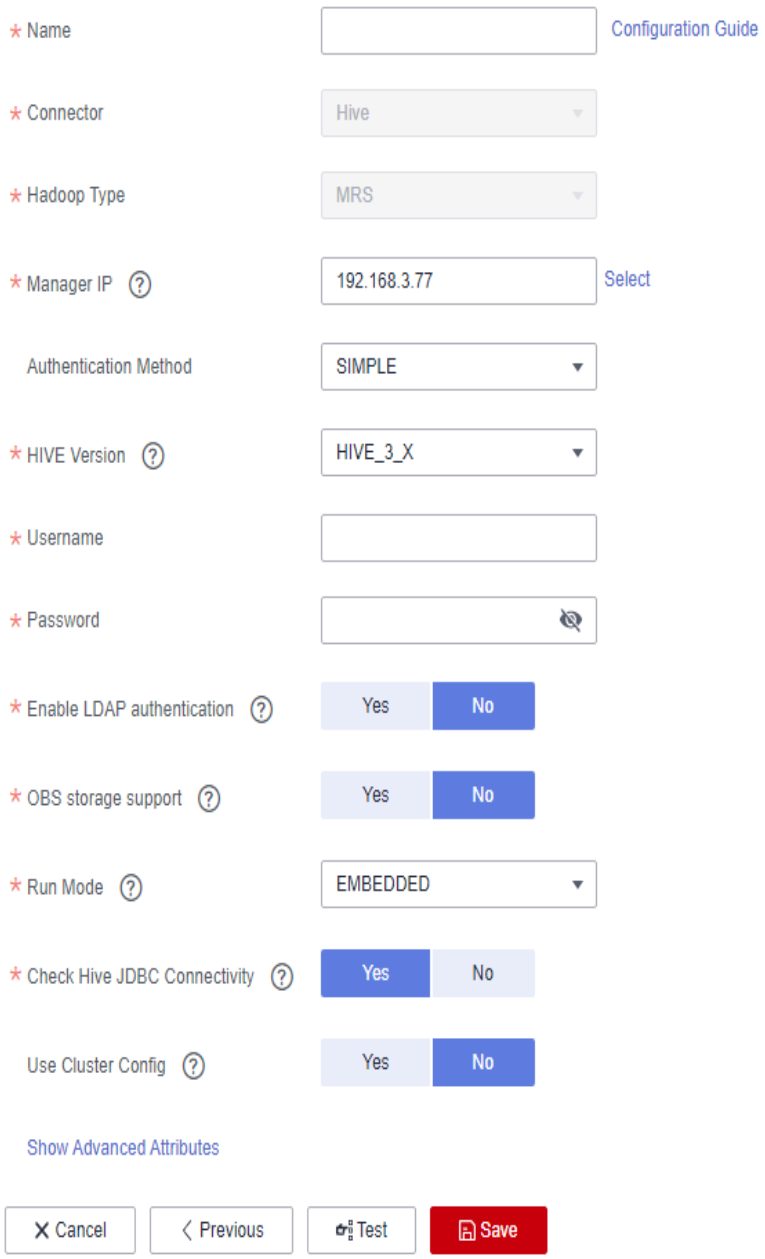


Table 5-130 lists the parameters. Configure these parameters based on your actual situation.

Table 5-130 MRS Hive link parameters

Parameter	Description	Example Value
Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hivelink

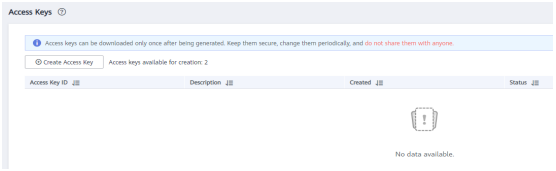
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Parameter	Description	Example Value
Manager IP	Floating IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select an MRS cluster. CDM automatically fills in the authentication information. **NOTE** DataArts Studio does not support MRS clusters whose Kerberos encryption type is **aes256-sha2,aes128-sha2**, and only supports MRS clusters whose Kerberos encryption type is **aes256-sha1,aes128-sha1**.	127.0.0.1
Authentication Method	Authentication method used for accessing MRS ● **SIMPLE**: Select this for non-security mode. ● **KERBEROS**: Select this for security mode.	SIMPLE
HIVE Version	Set this to the Hive version on the server.	HIVE_3_X
Username	If **Authentication Method** is set to **KERBEROS**, you must provide the username and password used for logging in to MRS Manager. If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS. To create a data connection for an MRS security cluster, do not use user **admin**. The **admin** user is the default management page user and cannot be used as the authentication user of the security cluster. You can create an MRS user and set **Username** and **Password** to the username and password of the created MRS user when creating an MRS data connection. **NOTE** ● If the CDM cluster version is 2.9.0 or later and the MRS cluster version is 3.1.0 or later, the created user must have the permissions of the **Manager_viewer** role to create links on CDM. To perform operations on databases, tables, and columns of an MRS component, you also need to add the database, table, and column permissions of the MRS component to the user by following the instructions in the MRS documentation. ● If the CDM cluster version is earlier than 2.9.0 or the MRS cluster version is earlier than 3.1.0, the created user must have the permissions of **Manager_administrator** or **System_administrator** to create links on CDM. ● A user with only the **Manager_tenant** or **Manager_auditor** permission cannot create connections.	cdm
Password	Password used for logging in to MRS Manager	-

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Parameter	Description	Example Value
Enable ldap	This parameter is available when **Proxy connection** is selected for **Connection Type**. If LDAP authentication is enabled for an external LDAP server connected to MRS Hive, the LDAP username and password are required for authenticating the connection to MRS Hive. In this case, this option must be enabled. Otherwise, the connection will fail.	No
ldapUsername	This parameter is mandatory when **Enable ldap** is enabled. Enter the username configured when LDAP authentication was enabled for MRS Hive.	-
ldapPassword	This parameter is mandatory when **Enable ldap** is enabled. Enter the password configured when LDAP authentication was enabled for MRS Hive.	-
OBS storage support	The server must support OBS storage. When creating a Hive table, you can store the table in OBS.	No

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Parameter	Description	Example Value
AK	This parameter is mandatory when **OBS storage support** is enabled. The account corresponding to the AK/SK pair must have the OBS Buckets Viewer permission. Otherwise, OBS cannot be accessed and the "403 AccessDenied" error is reported. You need to create an access key for the current account and obtain an AK/SK pair. 1. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list. 2. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-87**. **Figure 5-87** Clicking Create Access Key  3. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**. **NOTE** – Only two access keys can be added for each user. – To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.	-
SK		-

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Parameter	Description	Example Value
Run Mode	This parameter is used only when the Hive version is **HIVE_3_X**. Possible values are: • **EMBEDDED**: The link instance runs with CDM. This mode delivers better performance. • **Standalone**: The link instance runs in an independent process. If CDM needs to connect to multiple Hadoop data sources (MRS, Hadoop, or CloudTable) with both Kerberos and Simple authentication modes, **Standalone** prevails. **NOTE** The **STANDALONE** mode is used to solve the version conflict problem. If the connector versions of the source and destination ends of the same link are different, a JAR file conflict occurs. In this case, you need to place the source or destination end in the STANDALONE process to prevent the migration failure caused by the conflict.	EMBEDDED
Check Hive JDBC Connectivity	Whether to check the Hive JDBC connectivity	No
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	No
Cluster Config Name	This parameter is valid only when **Use Cluster Config** is set to **Yes**. Select a cluster configuration that has been created. For details about how to configure a cluster, see **Managing Cluster Configurations**.	hive_01

Step 3 Click **Save**. The **Link Management** page is displayed.

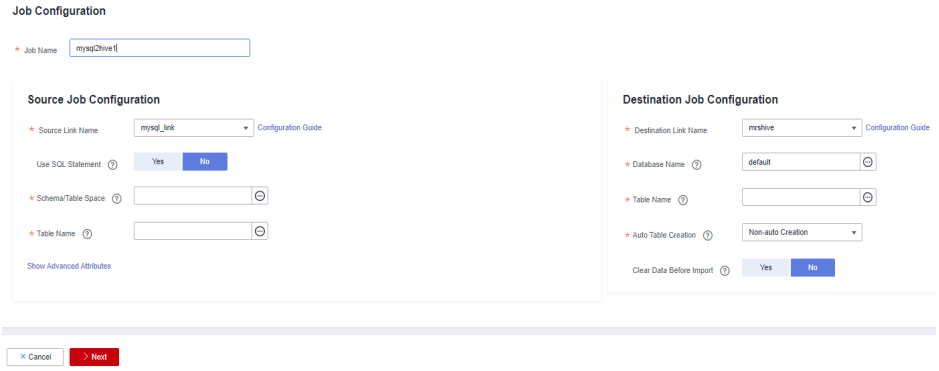
----End

Creating a Migration Job

Step 1 Click the **Table/File Migration** tab and then **Create Job**.

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Figure 5-88 Creating a job for migrating data from MySQL to Hive



NOTE

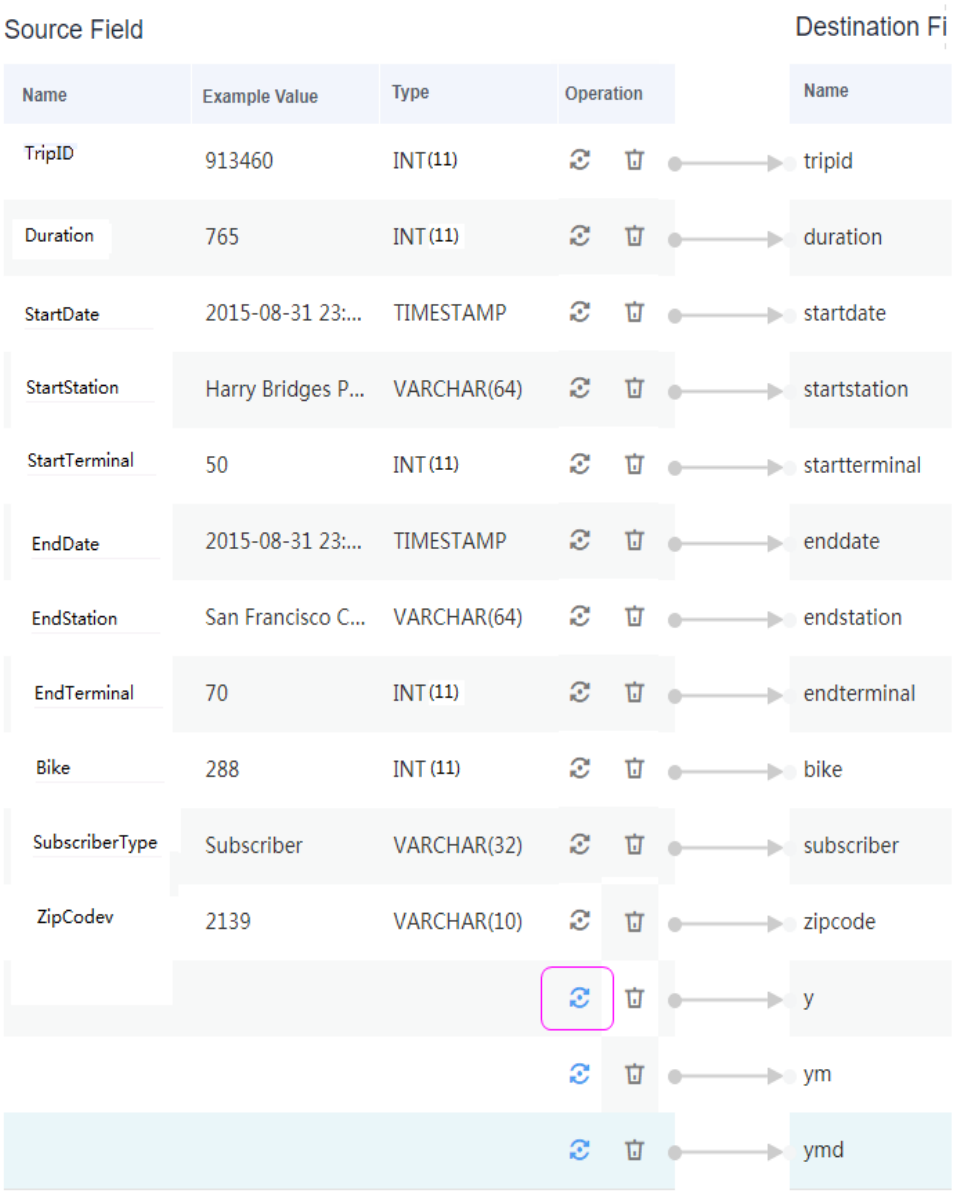
Set **Clear Data Before Import** to **Yes**, so that the data in the Hive table will be cleared before data import.

Step 2 After configuring the parameters, click **Next** to go to the **Map Field** page shown in **Figure 5-89**.

Map the fields of the MySQL table and Hive table. The Hive table has three more fields **y**, **ym**, and **ymd** than the MySQL table, which are the Hive partition fields. Because the fields of the source table cannot be directly mapped to the destination table, you need to configure an expression to extract data from the **StartDate** field in the source table.

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Figure 5-89 Hive field mapping



Step 3 Click to display the **Converter List** dialog box, and then choose **Create Converter** > **Expression conversion**. See **Figure 5-90**.

The expressions for the **y**, **ym**, and **ymd** fields are as follows:

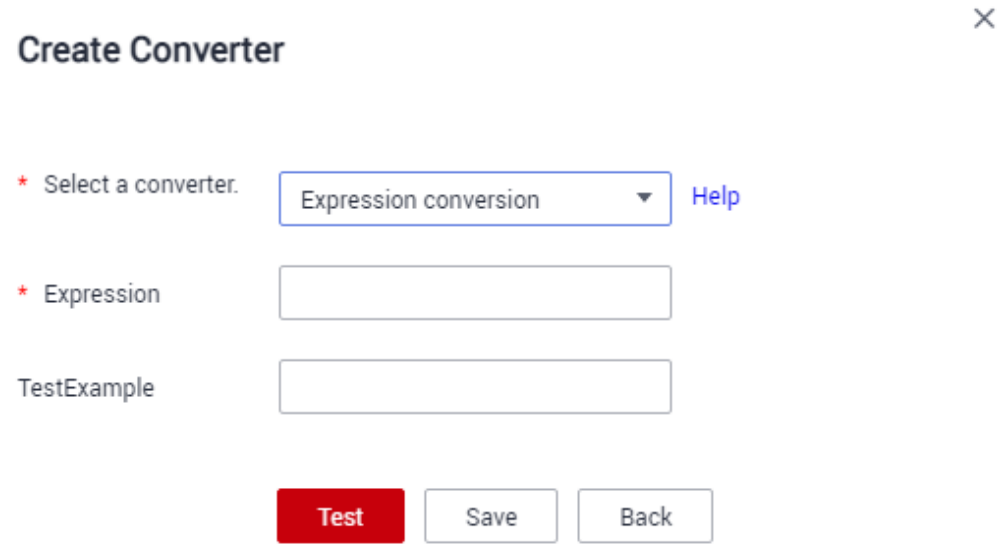
DateUtils.format(DateUtils.parseDate(row[2],"yyyy-MM-dd HH:mm:ss.SSS"),"yyyy")

DateUtils.format(DateUtils.parseDate(row[2],"yyyy-MM-dd HH:mm:ss.SSS"),"yyyyMM")

DateUtils.format(DateUtils.parseDate(row[2],"yyyy-MM-dd HH:mm:ss.SSS"),"yyyyMMdd")

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Figure 5-90 Configuring the expression



NOTE

The expressions in CDM support field conversion of common character strings, dates, and values.

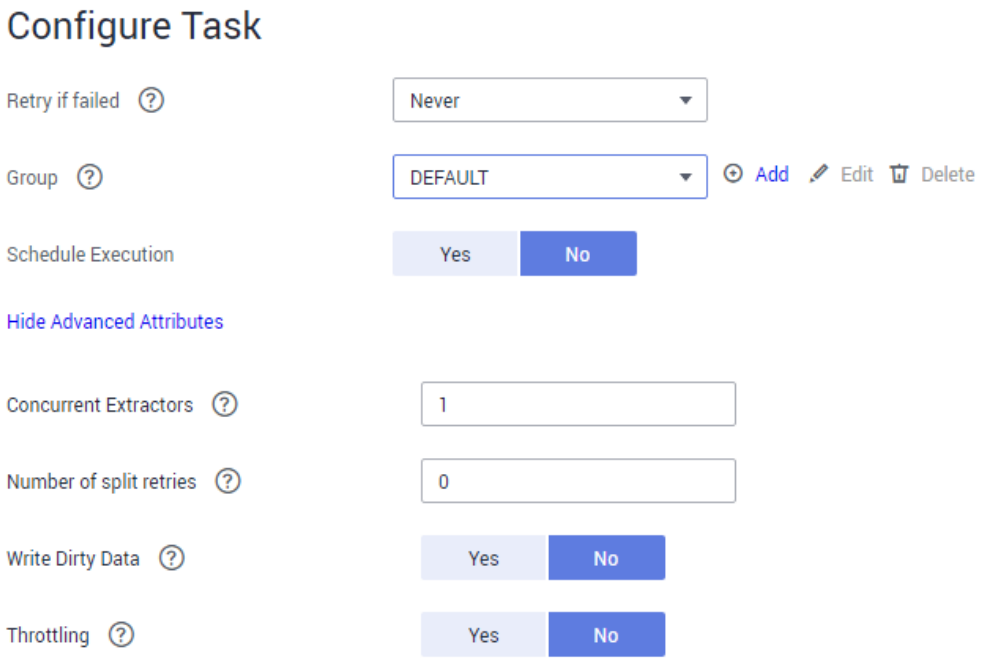
Step 4 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

In this step, you can configure the following optional functions:

- **Retry If Failed**: Determine whether to automatically retry the job if it fails. Retain the default value **Never**.
- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Determine whether to automatically execute the job at a scheduled time. Retain the default value **No** in this example.
- **Concurrent Extractors**: Enter the number of concurrent extractors. An appropriate value improves migration efficiency. For details, see **Performance Tuning**. Retain the default value **1**.
- **Write Dirty Data**: Specify this parameter if data that fails to be processed or filtered out during job execution needs to be written to OBS for future viewing. Before writing dirty data, create an OBS link on the CDM console. Retain the default value **No** so that dirty data is not recorded.

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Figure 5-91 Configuring the task



Step 5 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 6 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

----End

5.10.4 Migrating Data from MySQL to OBS

Scenario

CDM supports table-to-OBS data migration. This section describes how to migrate tables from a MySQL database to OBS. The process is as follows:

1. **Creating a CDM Cluster and Binding an EIP to the Cluster**
2. **Creating a MySQL Link**
3. **Creating an OBS Link**
4. **Creating a Migration Job**

Prerequisites

- You have obtained the domain name, port number, AK, and SK for accessing OBS.
- You have obtained the IP address, port, database name, username, and password for connecting to the MySQL database. In addition, the user must have the read and write permissions on the MySQL database.

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- You have uploaded the MySQL database driver on the **Job Management** > **Links** > **Driver Management** page.

Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.

Step 2 After the CDM cluster is created, on the **Cluster Management** page, click **Bind EIP** in the **Operation** column to bind an EIP to the cluster. The CDM cluster uses the EIP to access MySQL.

NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating a MySQL Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

Figure 5-92 Selecting a connector



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Step 2 Select **MySQL** and click **Next**. On the displayed page, configure MySQL link parameters.

Click **Show Advanced Attributes** to view more optional parameters. For details, see **Link to an RDS for MySQL/MySQL Database**. Retain the default values of the optional parameters and configure the mandatory parameters according to **Table 5-131**.

Table 5-131 MySQL link parameters

Parameter	Description	Example Value
Name	Unique link name	mysqllink
Database Server	IP address or domain name of the MySQL database server	-
Port	MySQL database port	3306
Database Name	Name of the MySQL database	sqoop
Username	User who has the read, write, and delete permissions on the MySQL database	admin
Password	Password of the user	-
Use Local API	Whether to use the local API of the database for acceleration. (The system attempts to enable the **local_infile** system variable of the MySQL database.)	Yes
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
local_infile Character Set	When using local_infile to import data to MySQL, you can configure the encoding format.	utf8
Driver Version	Before connecting CDM to a relational database, you need to upload the JDK 8 .jar driver of the relational database. Download the MySQL driver 5.1.48 from **https://downloads.mysql.com/archives/c-j/**, obtain **mysql-connector-java-5.1.48.jar**, and upload it.	-

Step 3 Click **Save**. The **Link Management** page is displayed.

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NOTE

If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

Creating an OBS Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-93 Selecting a connector type



Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

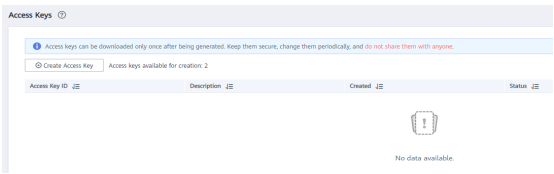
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  To obtain an access key, perform the following steps:

  a. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list.

  b. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-94**.

Figure 5-94 Clicking Create Access Key



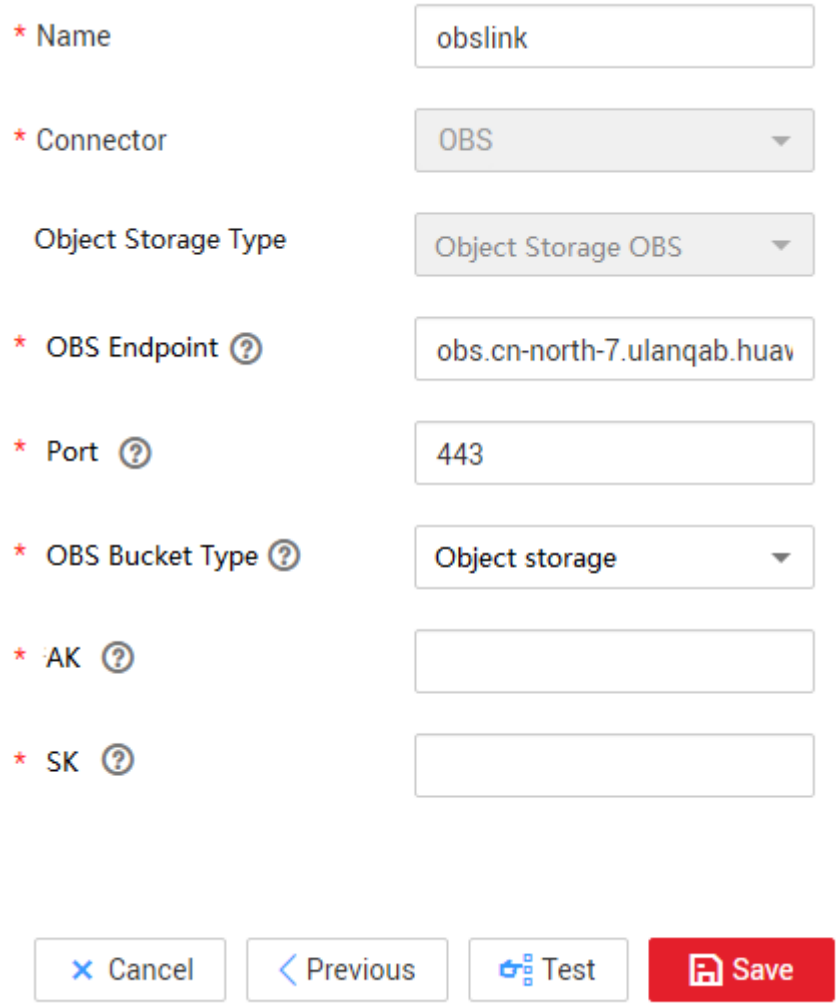
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c. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**.

NOTE

- Only two access keys can be added for each user.
- To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.

Figure 5-95 Creating an OBS link



Step 3 Click **Save**. The **Link Management** page is displayed.

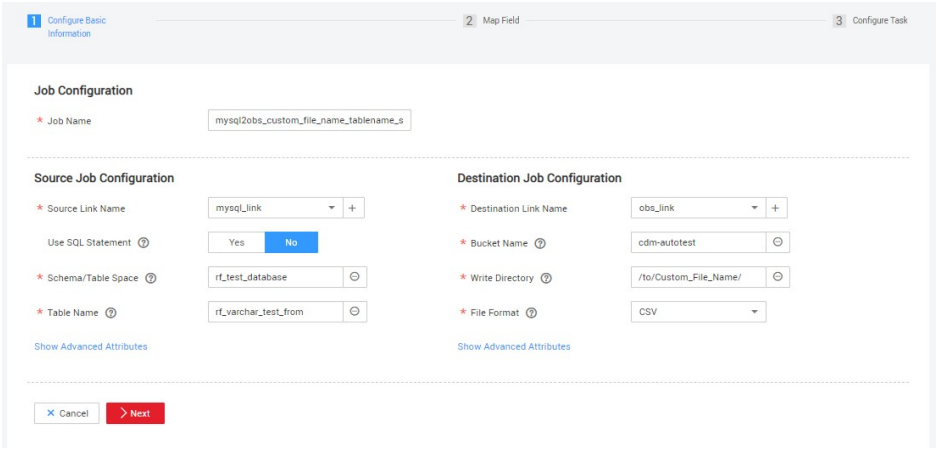
----End

Creating a Migration Job

Step 1 Choose **Table/File Migration** > **Create Job** to create a job for exporting data from the MySQL database to OBS.

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Figure 5-96 Creating a job for migrating data from MySQL to OBS

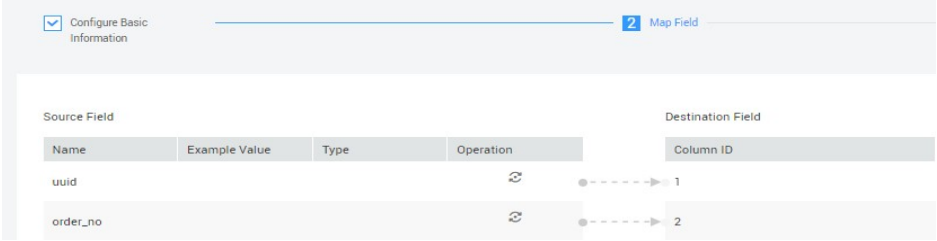


- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **mysqllink** created in **Creating a MySQL Link**.
  - **Use SQL Statement**: Select **No**.
  - **Schema/Tablespace**: name of the schema or tablespace from which data is to be extracted
  - **Table Name**: name of the table from which data is to be extracted
  - Retain the default values of other optional parameters.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **obslink** created in **Creating an OBS Link**.
  - **Bucket Name**: Select the bucket from which the data will be migrated.
  - **Write Directory**: Enter the directory to which data is to be written on the OBS server.
  - **File Format**: Select **CSV**.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.

Step 2 Click **Next**. The **Map Field** page is displayed. CDM automatically matches the source and destination fields, as shown in **Figure 5-97**.

- If the field mapping is incorrect, you can drag the fields to adjust the mapping.
- The expressions in CDM support field conversion of common character strings, dates, and values. For details, see **Converting Fields**.

Figure 5-97 Table-to-file field mapping



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Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

In this step, you can configure the following optional functions:

- **Retry Upon Failure**: If the job fails to be executed, you can determine whether to automatically retry. Retain the default value **Never**.
- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Enable it if you need to configure scheduled jobs. Retain the default value **No**.
- **Concurrent Extractors**: Enter the number of extractors to be concurrently executed. CDM supports concurrent extraction of MySQL data. If indexes are configured for the source table, you can increase the number of concurrent extractors to accelerate the migration.
- **Write Dirty Data**: Specify this parameter if data that fails to be processed or filtered out during job execution needs to be written to OBS for future viewing. Before writing dirty data, create an OBS link. For file-to-table data migration, you are advised to write dirty data.
- **Delete Job After Completion**: Retain the default value **Do not delete**. You can also set this parameter to **Delete** to prevent an accumulation of too many migration jobs.

Step 4 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 5 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

----End

5.10.5 Migrating Data from MySQL to DWS

Scenario

CDM supports table-to-table data migration. This section describes how to migrate data from MySQL to DWS. The process is as follows:

1. **Creating a CDM Cluster and Binding an EIP to the Cluster**
2. **Creating a MySQL Link**
3. **Creating a DWS Link**
4. **Creating a Migration Job**

Prerequisites

- You have obtained the IP address, port number, database name, username, and password for connecting to DWS. In addition, you must have the read, write, and delete permissions on the DWS database.

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- You have obtained the IP address, port, database name, username, and password for connecting to the MySQL database. In addition, the user must have the read and write permissions on the MySQL database.
- You have uploaded the MySQL database driver on the **Job Management** > **Links** > **Driver Management** page.

Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.
- The VPC, subnet, and security group of the CDM cluster must be the same as those of the DWS cluster.

Step 2 After the CDM cluster is created, on the **Cluster Management** page, click **Bind EIP** in the **Operation** column to bind an EIP to the cluster. The CDM cluster uses the EIP to access MySQL.

NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating a MySQL Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

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Figure 5-98 Selecting a connector



Step 2 Select **MySQL** and click **Next**. On the displayed page, configure MySQL link parameters.

Click **Show Advanced Attributes** to view more optional parameters. For details, see **Link to an RDS for MySQL/MySQL Database**. Retain the default values of the optional parameters and configure the mandatory parameters according to **Table 5-132**.

Table 5-132 MySQL link parameters

Parameter	Description	Example Value
Name	Unique link name	mysqllink
Database Server	IP address or domain name of the MySQL database server	-
Port	MySQL database port	3306
Database Name	Name of the MySQL database	sqoop
Username	User who has the read, write, and delete permissions on the MySQL database	admin
Password	Password of the user	-
Use Local API	Whether to use the local API of the database for acceleration. (The system attempts to enable the **local_infile** system variable of the MySQL database.)	Yes

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Parameter	Description	Example Value
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
local_infile Character Set	When using local_infile to import data to MySQL, you can configure the encoding format.	utf8
Driver Version	Before connecting CDM to a relational database, you need to upload the JDK 8 .jar driver of the relational database. Download the MySQL driver 5.1.48 from **https://downloads.mysql.com/archives/c-j/**, obtain **mysql-connector-java-5.1.48.jar**, and upload it.	-

Step 3 Click **Save**. The **Link Management** page is displayed.

NOTE

If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

Creating a DWS Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

Figure 5-99 Selecting a connector type



Step 2 Select **Data Warehouse Service** and click **Next** to configure the DWS link parameters. Set the mandatory parameters listed in **Table 5-133** and retain the default values for the optional parameters.

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Table 5-133 DWS link parameters

Parameter	Description	Example Value
Name	Enter a unique link name.	dwslink
Database Server	IP address or domain name of the DWS database	192.168.0.3
Port	DWS database port	8000
Database Name	Name of the DWS database	db_demo
Username	User who has the read, write, and delete permissions on the DWS database	dbadmin
Password	Password of the user	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Import Mode	**COPY**: Migrate the source data to the DWS management node and then copy the data to DataNodes. To access DWS through the Internet, select **COPY**.	COPY

Step 3 Click **Save**.

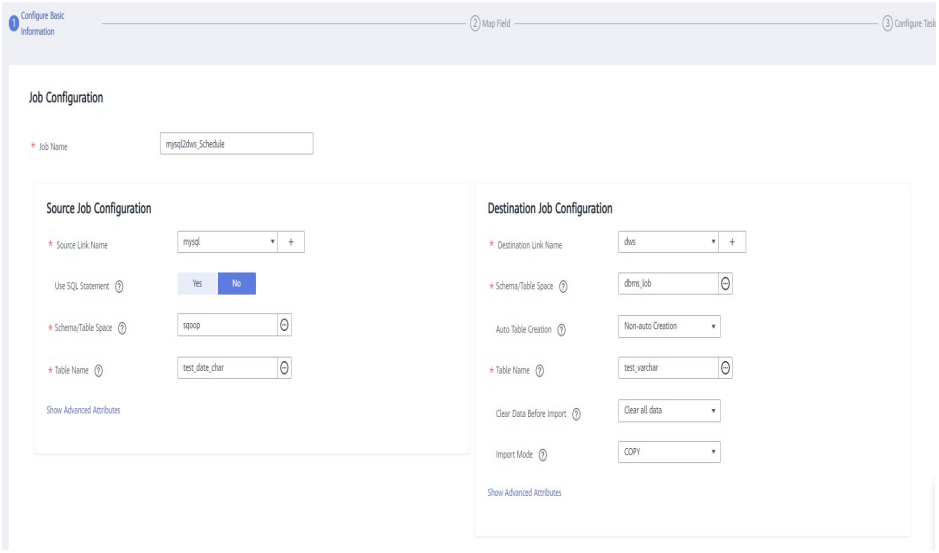
----End

Creating a Migration Job

Step 1 Choose **Table/File Migration** > **Create Job** to create a job for exporting data from the MySQL database to DWS.

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Figure 5-100 Creating a job for migrating data from MySQL to DWS



- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **mysqllink** created in **Creating a MySQL Link**.
  - **Use SQL Statement**: Select **No**.
  - **Schema/Tablespace**: name of the schema or tablespace from which data is to be extracted
  - **Table Name**: name of the table from which data is to be extracted
  - Retain the default values of other optional parameters.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **dwslink** created in **Creating a DWS Link**.
  - **Schema/Tablespace**: Select the DWS database to which data is to be written.
  - **Auto Table Creation**: This parameter is displayed only when both the migration source and destination are relational databases.
  - **Table Name**: Name of the table to which data is to be written. You can enter a table name that does not exist. CDM automatically creates the table in DWS.
  - **isCompress**: whether to compress data. If you select **Yes**, high-level compression will be performed. CDM applies to compression scenarios where the I/O read/write volume is large and the CPU is sufficient (the computing load is relatively low). For more compression levels, see **Compression Levels**.
  - **Orientation**: You can create row- or column-store tables as needed. Generally, if a table contains many columns (called a wide table) and its query involves only a few columns, column storage is recommended. If a table contains only a few columns and a query includes most of the fields, row storage is recommended.

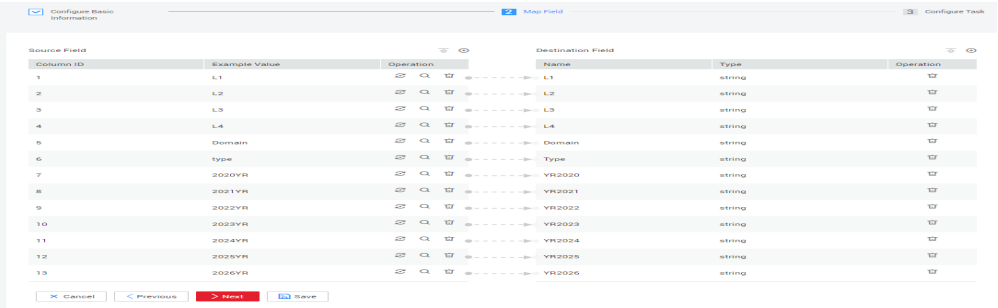
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  - **Extend char length**: If the data encoding formats of the migration source and destination are different, the character length of the automatic table creation may be insufficient. If you select **Yes** for this parameter, the character length will be increased by three times during automatic table creation.
  - **Clear Data Before Import**: whether to clear data in the destination table before the migration task starts.

Step 2 Click **Next**. The **Map Field** page is displayed. CDM automatically matches the source and destination fields, as shown in **Figure 5-101**.

- If the field mapping is incorrect, you can drag the fields to adjust the mapping.
- The expressions in CDM support field conversion of common character strings, dates, and values. For details, see **Converting Fields**.

Figure 5-101 Table-to-table field mapping



Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

In this step, you can configure the following optional functions:

- **Retry Upon Failure**: If the job fails to be executed, you can determine whether to automatically retry. Retain the default value **Never**.
- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Enable it if you need to configure scheduled jobs. Retain the default value **No**.
- **Concurrent Extractors**: Enter the number of extractors to be concurrently executed. You can increase the value of this parameter to improve migration efficiency.
- **Write Dirty Data**: Dirty data may be generated during data migration between tables. You are advised to select **Yes**.
- **Delete Job After Completion**: Retain the default value **Do not delete**.

Step 4 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 5 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

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On the **Historical Record** page, click **Log** to view the job logs.

----End

5.10.6 Migrating an Entire MySQL Database to RDS

Scenario

This section describes how to migrate the entire on-premises MySQL database to RDS using the CDM's entire DB migration function.

Currently, CDM can migrate the entire on-premises MySQL database to RDS for MySQL, RDS for PostgreSQL, or RDS for SQL Server. The following describes how to migrate the entire database to RDS. The procedure is as follows:

1. **Creating a CDM Cluster and Binding an EIP to the Cluster**
2. **Creating a MySQL Link**
3. **Creating an RDS Link**
4. **Creating an Entire DB Migration Job**

Prerequisites

- You have sufficient EIP quota.
- You have obtained an RDS database instance and the database engine of this instance is MySQL.
- The on-premises MySQL database can be accessed through the public network. If the MySQL database is deployed on an on-premises data center or a third-party cloud, ensure that an IP address that can be accessed from the public network has been configured for the MySQL database, or the VPN or Direct Connect between the on-premises data center and the cloud service platform has been established.
- You have obtained the IP addresses, names, usernames, and passwords of the on-premises MySQL database and RDS for MySQL.
- You have uploaded the MySQL database driver on the **Job Management** > **Links** > **Driver Management** page.

Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

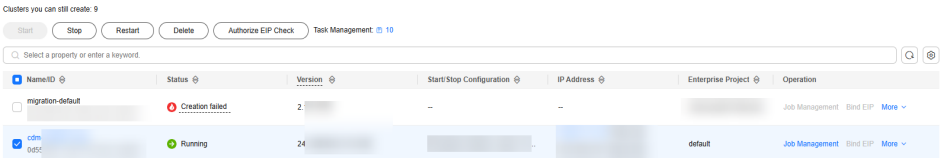
- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.
- The CDM cluster and the RDS for MySQL instance must be in the same VPC. In addition, it is recommended that the CDM cluster be in the same subnet and security group as the RDS for MySQL instance.

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- If the same subnet and security group cannot be used for security purposes, ensure that a security group rule has been configured to allow the CDM cluster to access the RDS for MySQL instance.

Step 2 After the CDM cluster is created, on the **Cluster Management** page, click **Bind EIP** in the **Operation** column to bind an EIP to the cluster. The CDM cluster uses the EIP to access the on-premises MySQL database.

Figure 5-102 Cluster list



NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating a MySQL Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

Figure 5-103 Selecting a connector



Step 2 Select **MySQL** and click **Next**. On the displayed page, configure MySQL link parameters.

Click **Show Advanced Attributes** to view more optional parameters. For details, see **Link to an RDS for MySQL/MySQL Database**. Retain the default values of

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the optional parameters and configure the mandatory parameters according to **Table 5-134**.

Table 5-134 MySQL link parameters

Parameter	Description	Example Value
Name	Unique link name	mysqllink
Database Server	IP address or domain name of the MySQL database server	-
Port	MySQL database port	3306
Database Name	Name of the MySQL database	sqoop
Username	User who has the read, write, and delete permissions on the MySQL database	admin
Password	Password of the user	-
Use Local API	Whether to use the local API of the database for acceleration. (The system attempts to enable the **local_infile** system variable of the MySQL database.)	Yes
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
local_infile Character Set	When using local_infile to import data to MySQL, you can configure the encoding format.	utf8
Driver Version	Before connecting CDM to a relational database, you need to upload the JDK 8 .jar driver of the relational database. Download the MySQL driver 5.1.48 from **https://downloads.mysql.com/archives/c-j/**, obtain **mysql-connector-java-5.1.48.jar**, and upload it.	-

Step 3 Click **Save**. The **Link Management** page is displayed.

NOTE

If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

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Creating an RDS Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-104 Selecting a connector type



Step 2 Select **RDS for MySQL** and click **Next** to configure parameters for the RDS for MySQL link.

- **Name**: Enter a custom link name, for example, **rds_link**.
- **Database Server** and **Port**: Enter the address information about the RDS for MySQL database.
- **Database Name**: Enter the name of the RDS for MySQL database.
- **Username** and **Password**: Enter the username and password used for logging in to the database.

NOTE

- During RDS link creation, if **Use Local API** in **Show Advanced Attributes** is set to **Yes**, you can use the LOAD DATA function provided by MySQL to speed up data import.
- The LOAD DATA function is disabled by default on RDS for MySQL, so you need to modify the parameter group of the MySQL instance and set **local_infile** to **ON** to enable this function.
- If the **local_infile** parameter group cannot be edited, it is the default parameter group. You need to create a parameter group and modify its value, and apply it to the MySQL instance of RDS.

Step 3 Click **Save**. The **Link Management** page is displayed.

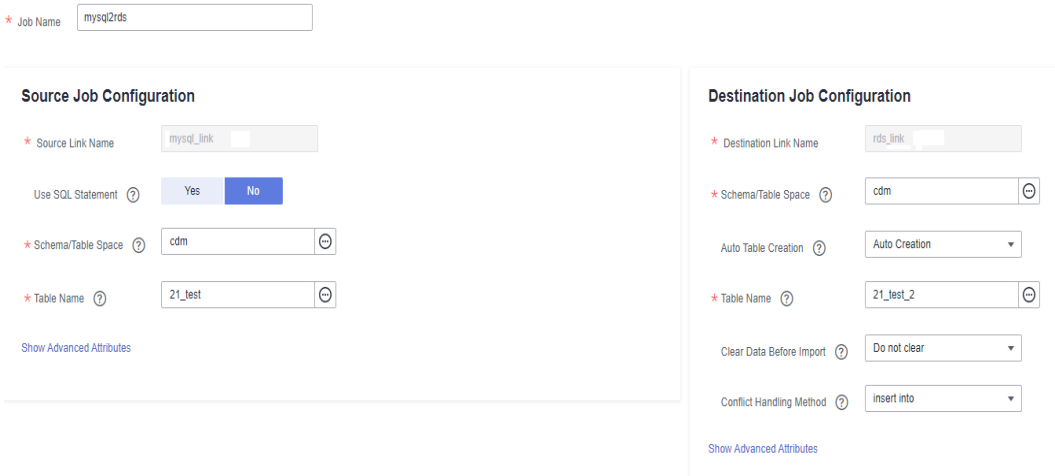
----End

Creating an Entire DB Migration Job

Step 1 After the two links are created, choose **Entire DB Migration** > **Create Job** to create a migration job. See **Figure 5-105**.

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Figure 5-105 Creating an entire DB migration job



- **Job Name**: Enter a name for the entire DB migration job.
- **Source Job Configuration**
  - **Source Link Name**: Select the **mysqllink** created in **Creating a MySQL Link**.
  - **Schema/Tablespace**: Select the on-premises MySQL database from which data is to be exported.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **rds_link** link created in **Creating an RDS Link**.
  - **Schema/Tablespace**: Select the name of the RDS database to which data is to be imported.
  - **Auto Table Creation**: Select **Auto creation**, which indicates that CDM automatically creates tables in the RDS database when tables of the on-premises MySQL database do not exist in the RDS database.
  - **Clear Data Before Import**: Select **Yes**, which indicates that when a table with the same name as the table in the on-premises MySQL database exists in the RDS database, CDM clears data in the table on RDS.
  - **Constraint Conflict Handling**: Select **insert into**.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.

Step 2 Click **Next**. The page for selecting tables to be migrated is displayed. You can select all or part of tables to migrate.

Step 3 Click **Save and Run** and CDM immediately starts the entire DB migration job.

When the job starts running, a sub-job will be generated for each table. You can click the job name to view the sub-job list.

Step 4 In the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

There are no logs for the entire DB migration job. However, the sub-jobs have logs. On the **Historical Record** page of the sub-jobs, click **Log** to view the job logs.

----End

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5.10.7 Migrating Data from Oracle to CSS

Scenario

Cloud Search Service provides users with structured and unstructured data search, statistics, and report capabilities. This section describes how to use CDM to migrate data from the Oracle database to Cloud Search Service. The procedure is as follows:

1. **Creating a CDM Cluster and Binding an EIP to the Cluster**
2. **Creating a Cloud Search Service Link**
3. **Creating an Oracle Link**
4. **Creating a Migration Job**

Prerequisites

- You have subscribed to Cloud Search Service and obtained the IP address and port number of the Cloud Search Service cluster.
- You have obtained the IP address, name, username, and password of the Oracle database.
- If the Oracle database is deployed on an on-premises data center or a third-party cloud, ensure that an IP address that can be accessed from the public network has been configured for the Oracle database, or the VPN or Direct Connect between the on-premises data center and has been established.
- You have uploaded the Oracle database driver on the **Job Management** > **Links** > **Driver Management** page.

Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.
- The CDM and Cloud Search Service clusters must be in the same VPC. In addition, it is recommended that the CDM cluster be in the same subnet and security group as the Cloud Search Service cluster.
- If the same subnet and security group cannot be used for security purposes, ensure that a security group rule has been configured to allow the CDM cluster to access the Cloud Search Service cluster.

Step 2 After the CDM cluster is created, on the **Cluster Management** page, click **Bind EIP** in the **Operation** column to bind an EIP to the cluster. The CDM cluster uses the EIP to access the Oracle data source.

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NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating a Cloud Search Service Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-106 Selecting a connector

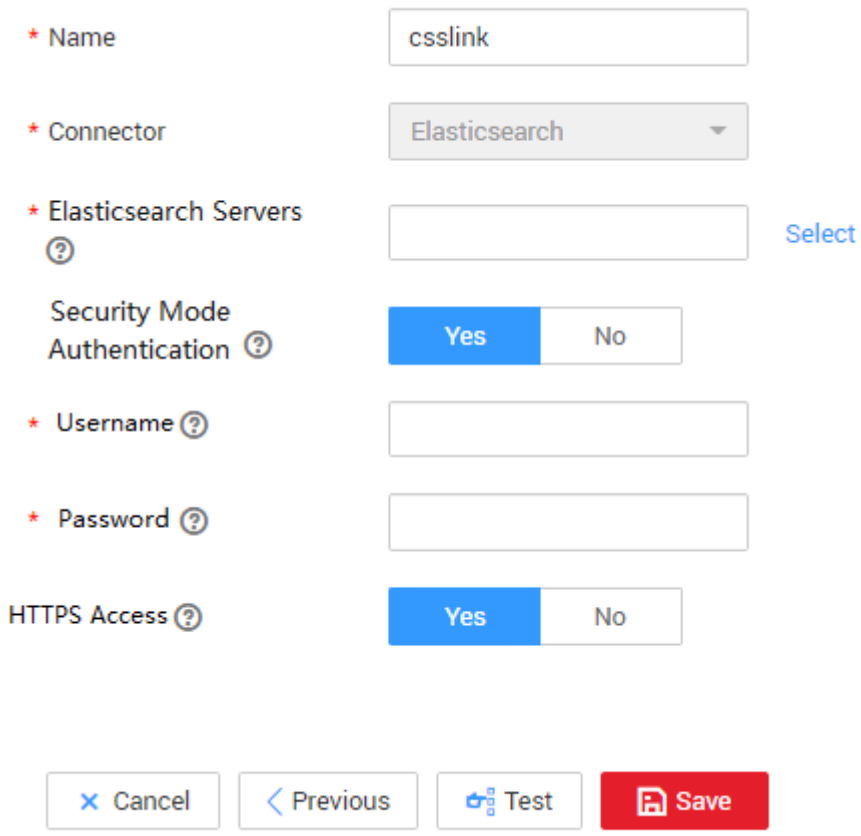


Step 2 Select **Cloud Search Service** and click **Next**. On the page that is displayed, configure the CSS link parameters.

- **Name**: Enter a custom link name, for example, **csslink**.
- **Elasticsearch Server List**: Enter the IP address and port number of the Cloud Search Service cluster (cluster later than 5.*x*). The format is *ip:port*. Use semicolons to separate multiple addresses. For example, **192.168.0.1:9200;192.168.0.2:9200**.
- **Username** and **Password**: Enter the username and password used for logging in to the Cloud Search Service cluster. The user must have the read and write permissions on the database.

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Figure 5-107 Creating a CSS link



Step 3 Click **Save**. The **Link Management** page is displayed.

----End

Creating an Oracle Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

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Figure 5-108 Selecting a connector type



Step 2 Select **Oracle** and click **Next** to configure parameters for the Oracle link.

- **Name**: Enter a custom link name, for example, **oracle_link**.
- **Database Server** and **Port**: Enter the address and port number of the Oracle server.
- **Database Name**: Enter the name of the Oracle database whose data is to be exported.
- **Username** and **Password**: Enter the username and password used for logging in to the Oracle database. The user must have the permission to read the Oracle metadata.

Step 3 Click **Save**. The **Link Management** page is displayed.

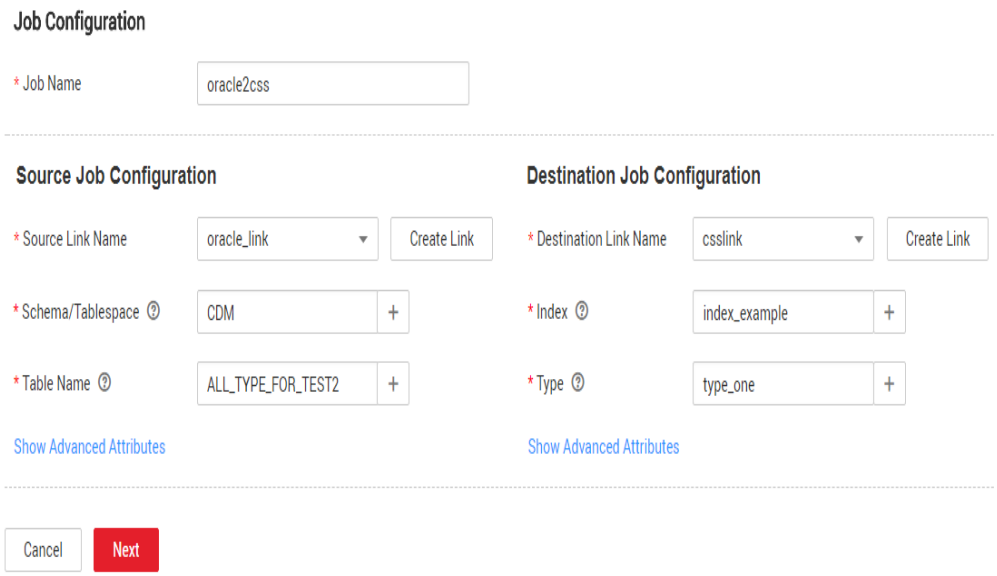
----End

Creating a Migration Job

Step 1 Choose **Table/File Migration** > **Create Job** to create a job for exporting data from the Oracle database to Cloud Search Service.

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Figure 5-109 Creating a job for migrating data from Oracle to Cloud Search Service



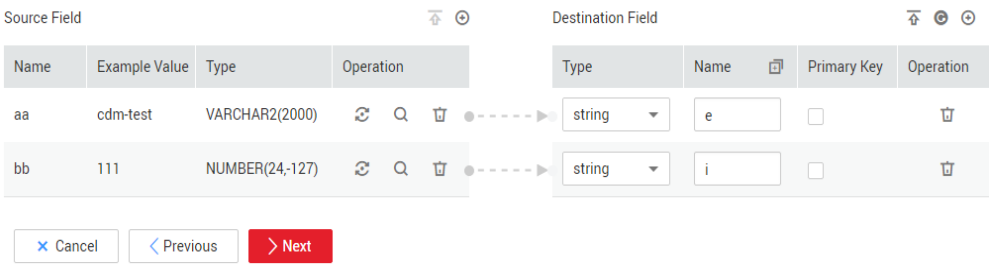
- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **oracle_link** link created in **Creating an Oracle Link**.
  - **Schema/Tablespace**: Enter the name of the database whose data is to be migrated.
  - **Table Name**: Enter the name of the table to be migrated.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **csslink** link created in **Creating a Cloud Search Service Link**.
  - **Index**: Select the Elasticsearch index of the data to be written. You can also enter a new index. CDM automatically creates the index on Cloud Search Service.
  - **Type**: Select the Elasticsearch type of the data to be written. You can enter a new type. CDM automatically creates a type at the migration destination.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.

Step 2 Click **Next**. The **Map Field** page is displayed. CDM automatically matches the source and destination fields, as shown in **Figure 5-110**.

- If the field mapping is incorrect, you can drag the fields to adjust the mapping.
- If the type is automatically created at the migration destination, you need to configure the type and name of each field.
- CDM supports field conversion during the migration. For details, see **Converting Fields**.

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Figure 5-110 Field mapping of Cloud Search Service

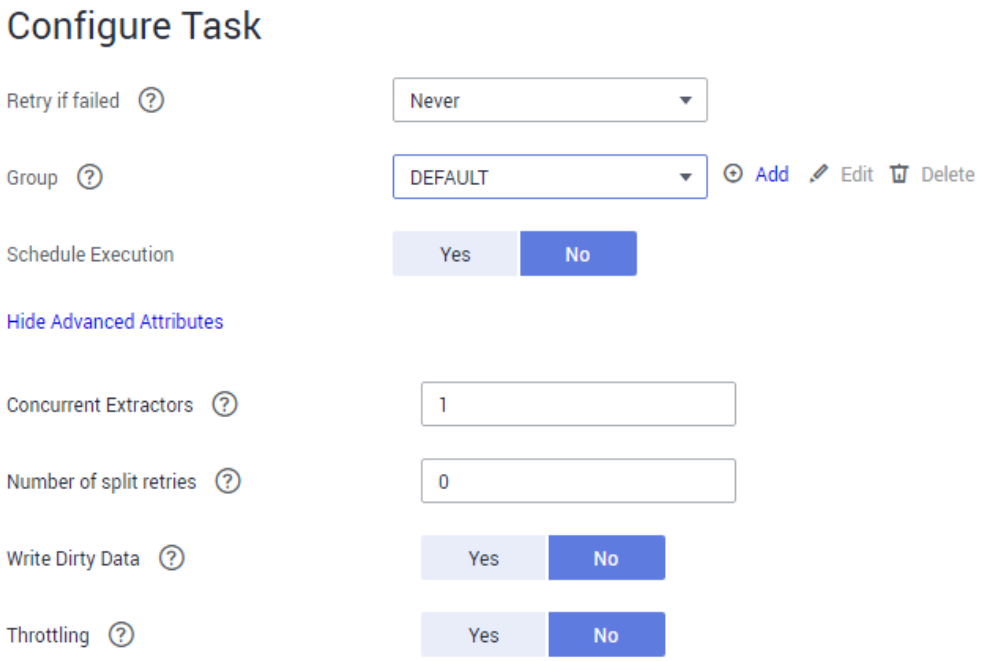


Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

In this step, you can configure the following optional functions:

- **Retry If Failed**: Determine whether to automatically retry the job if it fails. Retain the default value **Never**.
- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Determine whether to automatically execute the job at a scheduled time. Retain the default value **No** in this example.
- **Concurrent Extractors**: Enter the number of concurrent extractors. An appropriate value improves migration efficiency. For details, see **Performance Tuning**. Retain the default value **1**.
- **Write Dirty Data**: Specify this parameter if data that fails to be processed or filtered out during job execution needs to be written to OBS for future viewing. Before writing dirty data, create an OBS link on the CDM console. Retain the default value **No** so that dirty data is not recorded.

Figure 5-111 Configuring the task



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Step 4 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 5 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

----End

5.10.8 Migrating Data from Oracle to DWS

Scenario

CDM supports table-to-table migration. This section describes how to use CDM to migrate data from Oracle to Data Warehouse Service (DWS). The procedure is as follows:

1. **Creating a CDM Cluster and Binding an EIP to the Cluster**
2. **Creating an Oracle Link**
3. **Creating a DWS Link**
4. **Creating a Migration Job**

Prerequisites

- You have obtained a DWS cluster and the IP address, port number, database name, username, and password for connecting to the DWS database. In addition, you must have the read, write, and delete permissions on the DWS database.
- You have obtained the IP address, name, username, and password of the Oracle database.
- If the Oracle database is deployed on an on-premises data center or a third-party cloud, ensure that an IP address that can be accessed from the public network has been configured for the Oracle database, or the VPN or Direct Connect between the on-premises data center and Huawei Cloud has been established.
- You have uploaded the Oracle database driver on the **Job Management** > **Links** > **Driver Management** page.

Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.

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- The VPC, subnet, and security group of the CDM cluster must be the same as those of the DWS cluster.
- If the same subnet and security group cannot be used, for security reasons, ensure that a security group rule has been configured to allow the CDM cluster to access the CSS cluster.

Step 2 After the CDM cluster is created, locate the row that contains the cluster and click **Bind EIP** in the **Operation** column. (CDM uses an EIP to access the Oracle data source.)

NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating an Oracle Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

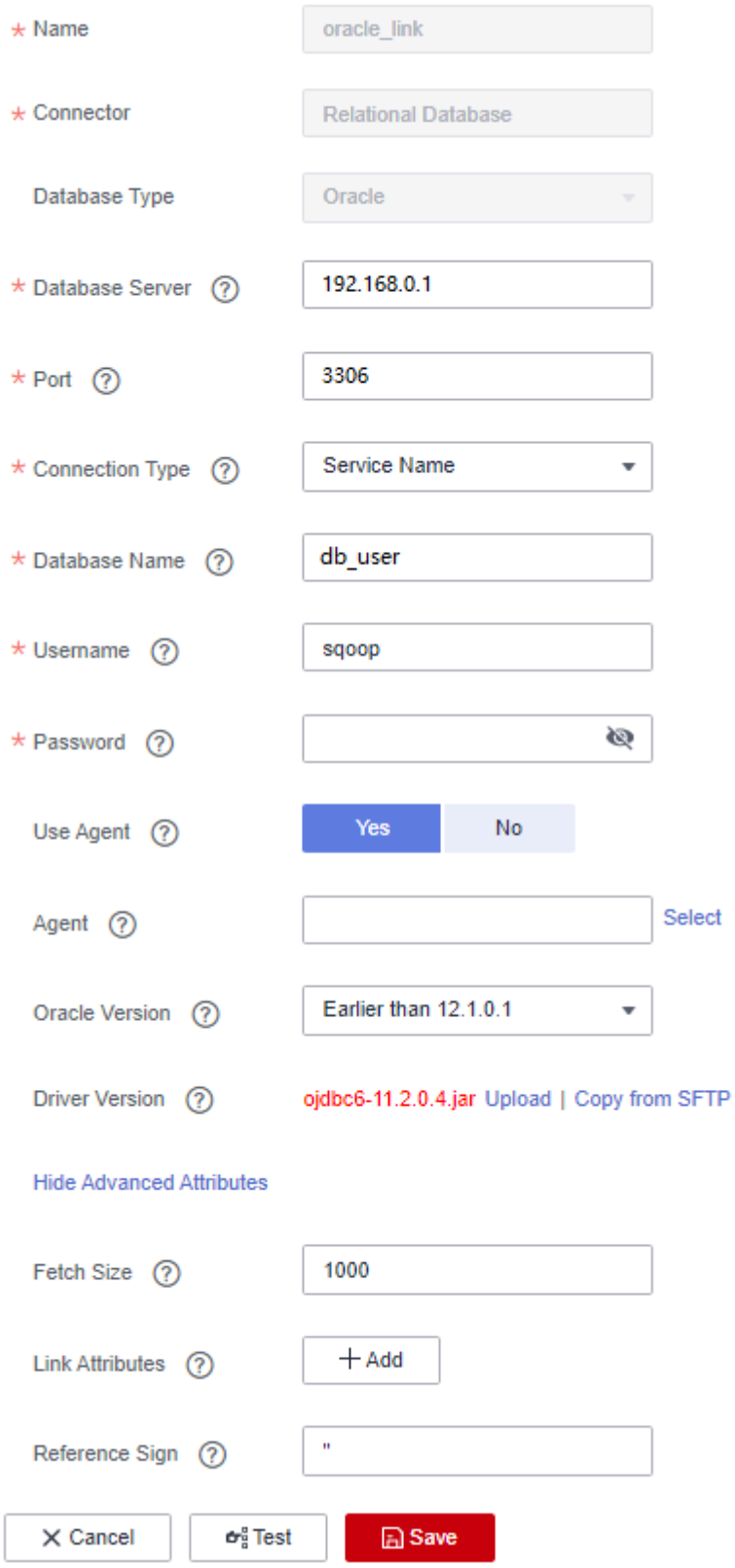
Figure 5-112 Selecting a connector



Step 2 Select **Oracle** and click **Next** to configure parameters for the link.

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Figure 5-113 Creating an Oracle link



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Table 5-135 Oracle link parameters

Parameter	Description	Example Value
Name	Enter a unique link name.	oracle_link
Database Server	Database server domain name or IP address	192.168.0.1
Port	Oracle database port	3306
Connection Type	Type of the Oracle database link	Service Name
Database Name	Name of the database to be connected	db_user
Username	User who has the read permission of the Oracle database	admin
Password	Password used for logging in to the Oracle database	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-
Oracle Version	The latest version is used by default. If the version is incompatible, select another version.	Later than 12.1
Driver Version	A driver version that adapts to the Oracle database	-
Fetch Size	Number of rows obtained by each request	1000
Link Attributes	Custom attributes of the link	useCompression=true
Reference Sign	Delimiter used to separate referenced table names or column names This parameter is left blank by default.	'

Step 3 Click **Save**. The **Links** page is displayed.

----End

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Creating a DWS Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-114 Selecting a connector type



Step 2 Select **Data Warehouse Service** and click **Next** to configure the DWS link parameters. Set the mandatory parameters listed in **Table 5-136** and retain the default values for the optional parameters.

Table 5-136 DWS link parameters

Parameter	Description	Example Value
Name	Enter a unique link name.	dwslink
Database Server	IP address or domain name of the DWS database	192.168.0.3
Port	DWS database port	8000
Database Name	Name of the DWS database	db_demo
Username	User who has the read, write, and delete permissions on the DWS database	dbadmin
Password	Password of the user	-
Use Agent	The agent function will be unavailable soon and does not need to be configured.	-
Agent	The agent function will be unavailable soon and does not need to be configured.	-

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Parameter	Description	Example Value
Import Mode	**COPY**: Migrate the source data to the DWS management node and then copy the data to DataNodes. To access DWS through the Internet, select **COPY**.	COPY

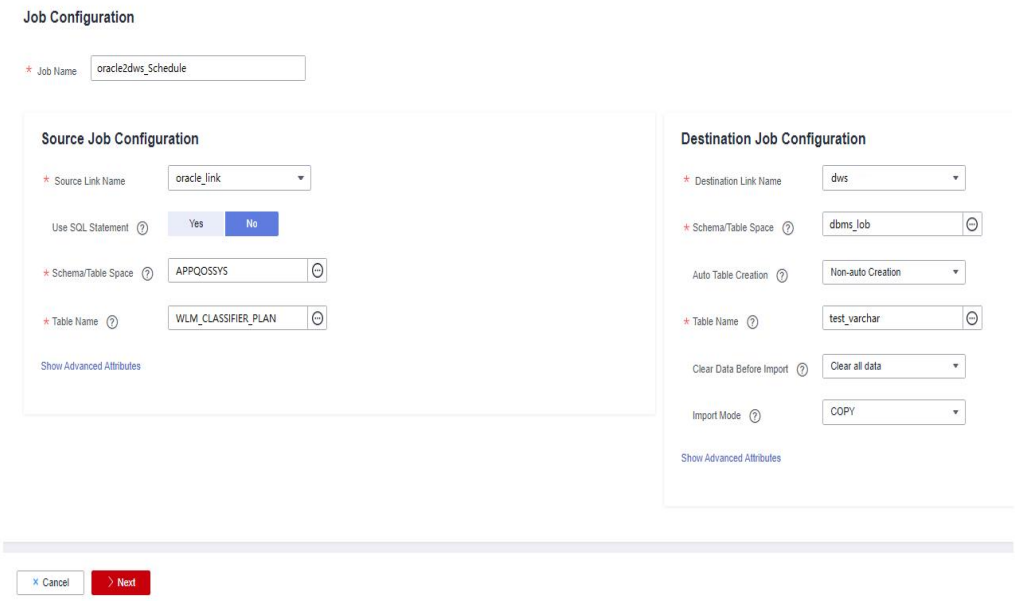
Step 3 Click **Save**.

----End

Creating a Migration Job

Step 1 Choose **Table/File Migration** > **Create Job** to create a job for exporting data from the Oracle database to DWS.

Figure 5-115 Creating a job for migrating data from Oracle to DWS



- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **oracle_link** created in **Creating an Oracle Link**.
  - **Schema/Tablespace**: Enter the name of the database whose data is to be migrated.
  - **Table Name**: Enter the name of the table whose data is to be migrated.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **dwslink** created in **Creating a DWS Link**.

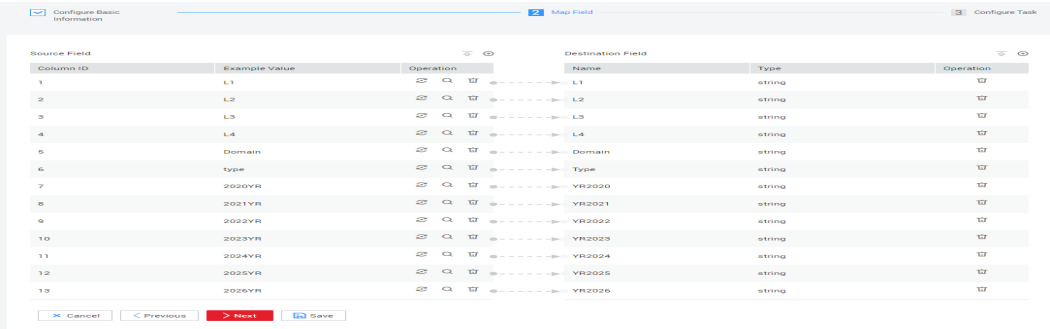
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- **Schema/Tablespace**: Select the DWS database to which data is to be written.
- **Auto Table Creation**: This parameter is displayed only when both the migration source and destination are relational databases.
- **Table Name**: Name of the table to which data is to be written. You can enter a table name that does not exist. CDM automatically creates the table in DWS.
- **Orientation**: You can create row- or column-store tables as needed. Generally, if a table contains many columns (called a wide table) and its query involves only a few columns, column storage is recommended. If a table contains only a few columns and a query includes most of the fields, row storage is recommended.
- **Extend char length**: If the data encoding formats of the migration source and destination are different, the character length of the automatic table creation may be insufficient. If you select **Yes** for this parameter, the character length will be increased by three times during automatic table creation.
- **Clear Data Before Import**: whether to clear data in the destination table before the migration task starts.

Step 2 Click **Next**. The **Map Field** page is displayed. CDM automatically matches the source and destination fields, as shown in **Figure 5-116**.

- If the field mapping is incorrect, you can drag the fields to adjust the mapping.
- The expressions in CDM support field conversion of common character strings, dates, and values. For details, see **Converting Fields**.

Figure 5-116 Table-to-table field mapping



Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

In this step, you can configure the following optional functions:

- **Retry Upon Failure**: If the job fails to be executed, you can determine whether to automatically retry. Retain the default value **Never**.
- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Enable it if you need to configure scheduled jobs. Retain the default value **No**.

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- **Concurrent Extractors**: Enter the number of extractors to be concurrently executed. You can increase the value of this parameter to improve migration efficiency.
- **Write Dirty Data**: Dirty data may be generated during data migration between tables. You are advised to select **Yes**.
- **Delete Job After Completion**: Retain the default value **Do not delete**.

Step 4 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 5 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

----End

NOTE

If the migration times out because writing data to the destination costs a long time, reduce the value of the **Fetch Size** parameter.

5.10.9 Migrating Data from OBS to CSS

Scenario

CDM supports data migration between cloud services. This section describes how to use CDM to migrate data from OBS to CSS. The procedure is as follows:

1. **Creating a CDM Cluster**
2. **Creating a Cloud Search Service Link**
3. **Creating an OBS Link**
4. **Creating a Migration Job**

Prerequisites

- You have obtained the domain name, port number, AK, and SK for accessing OBS.
- You have subscribed to Cloud Search Service and obtained the IP address and port number of the Cloud Search Service cluster.

Creating a CDM Cluster

If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.

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- The CDM and Cloud Search Service clusters must be in the same VPC. In addition, it is recommended that the CDM cluster be in the same subnet and security group as the Cloud Search Service cluster.
- If the same subnet and security group cannot be used for security purposes, ensure that a security group rule has been configured to allow the CDM cluster to access the Cloud Search Service cluster.

Creating a Cloud Search Service Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-117 Selecting a connector

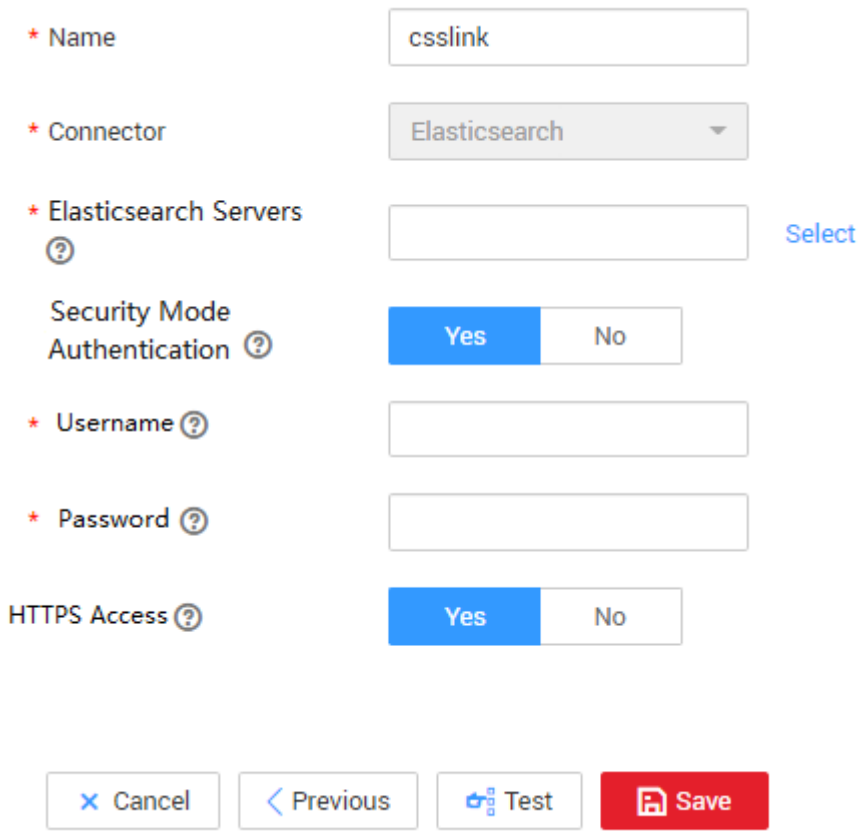


Step 2 Select **Cloud Search Service** and click **Next**. On the page that is displayed, configure the CSS link parameters.

- **Name**: Enter a custom link name, for example, **csslink**.
- **Elasticsearch Server List**: Enter the IP address and port number of the Cloud Search Service cluster (cluster later than 5.*x*). The format is *ip:port*. Use semicolons to separate multiple addresses. For example, **192.168.0.1:9200;192.168.0.2:9200**.
- **Username** and **Password**: Enter the username and password used for logging in to the Cloud Search Service cluster. The user must have the read and write permissions on the database.

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Figure 5-118 Creating a CSS link



Step 3 Click **Save**. The **Link Management** page is displayed.

----End

Creating an OBS Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

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Figure 5-119 Selecting a connector type



Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

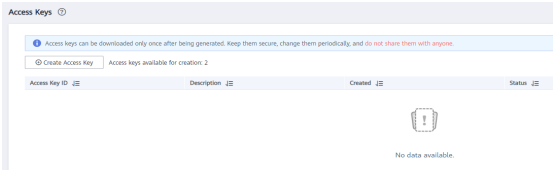
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  To obtain an access key, perform the following steps:

  a. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list.

  b. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-120**.

  Figure 5-120 Clicking Create Access Key

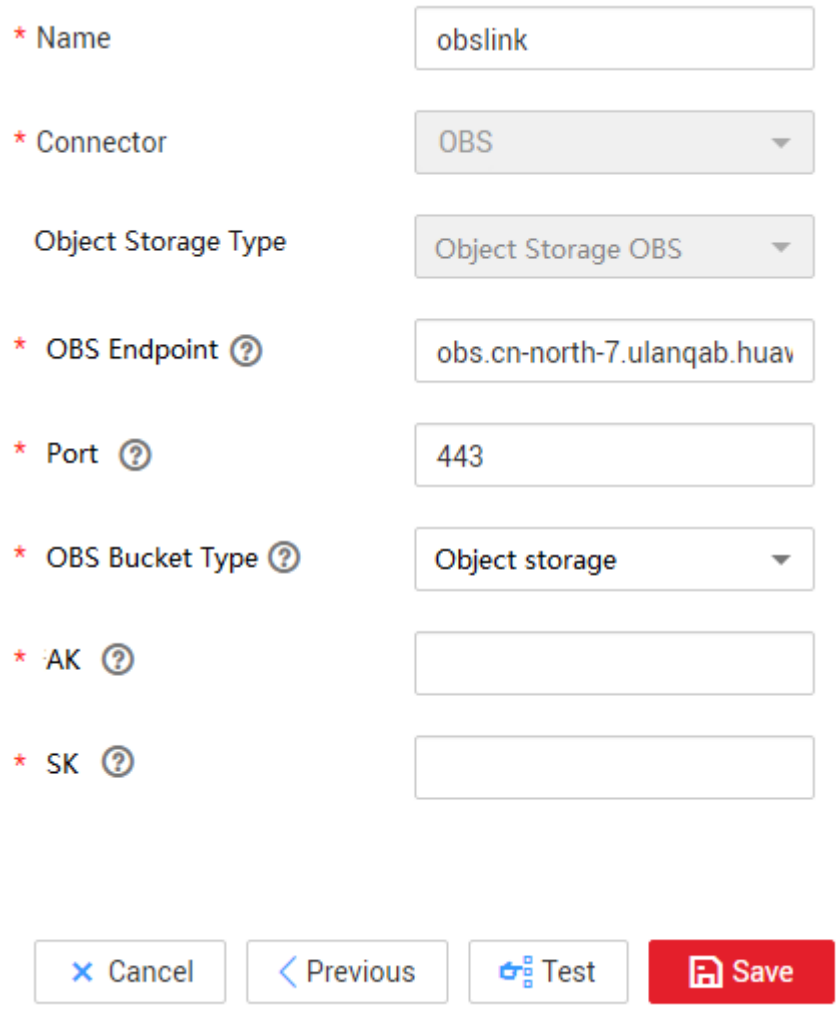
  c. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**.

  NOTE

  - Only two access keys can be added for each user.
  - To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.

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Figure 5-121 Creating an OBS link



Step 3 Click **Save**. The **Link Management** page is displayed.

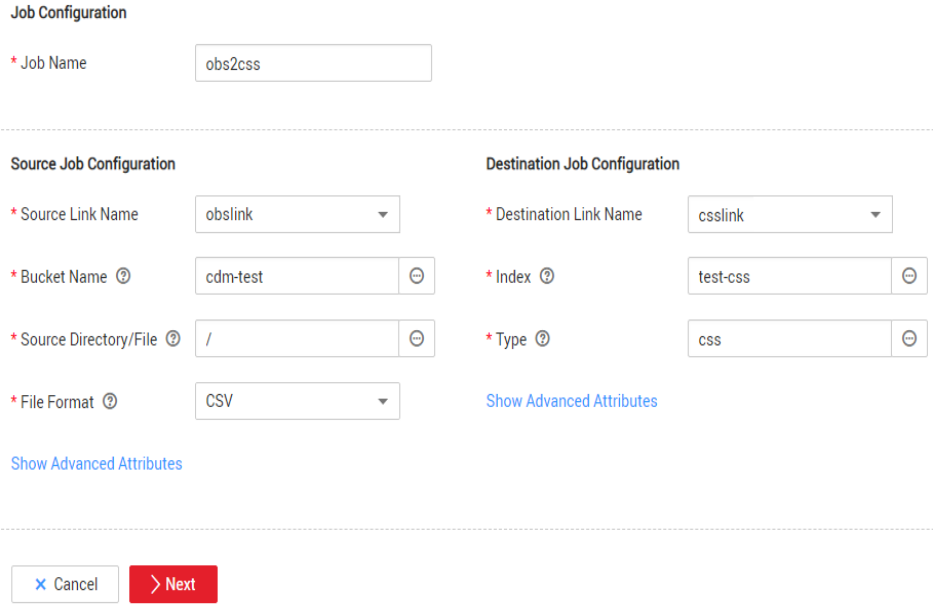
----End

Creating a Migration Job

Step 1 Choose **Table/File Migration** > **Create Job** to create a job for exporting data from OBS to Cloud Search Service.

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Figure 5-122 Creating a job for migrating data from OBS to Cloud Search Service



- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **obslink** link created in **Creating an OBS Link**.
  - **Bucket Name**: Select the bucket from which the data will be migrated.
  - **Source Directory/File**: Set this parameter to the path of the data to be migrated. You can migrate all directories and files in the bucket.
  - **File Format**: Select **CSV** for migrating files to a data table.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **csslink** link created in **Creating a Cloud Search Service Link**.
  - **Index**: Select the Elasticsearch index of the data to be written. You can also enter a new index. CDM automatically creates the index on Cloud Search Service.
  - **Type**: Select the Elasticsearch type of the data to be written. You can enter a new type. CDM automatically creates a type at the migration destination.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.

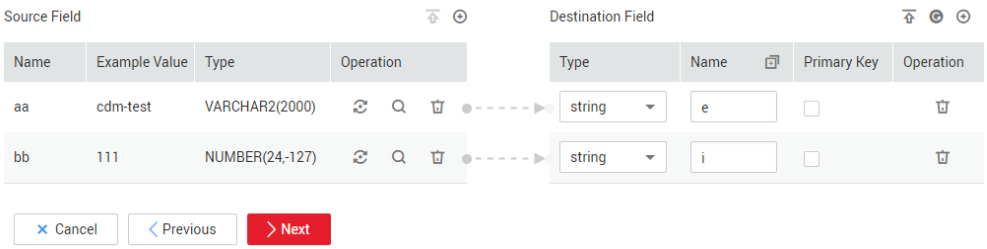
Step 2 Click **Next**. The **Map Field** page is displayed. CDM automatically matches the source and destination fields. See **Figure 5-123**.

- If the field mapping is incorrect, you can drag the fields to adjust the mapping.
- If the type is automatically created at the migration destination, you need to configure the type and name of each field.

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- CDM supports field conversion during the migration. For details, see **Converting Fields**.

Figure 5-123 Field mapping of Cloud Search Service



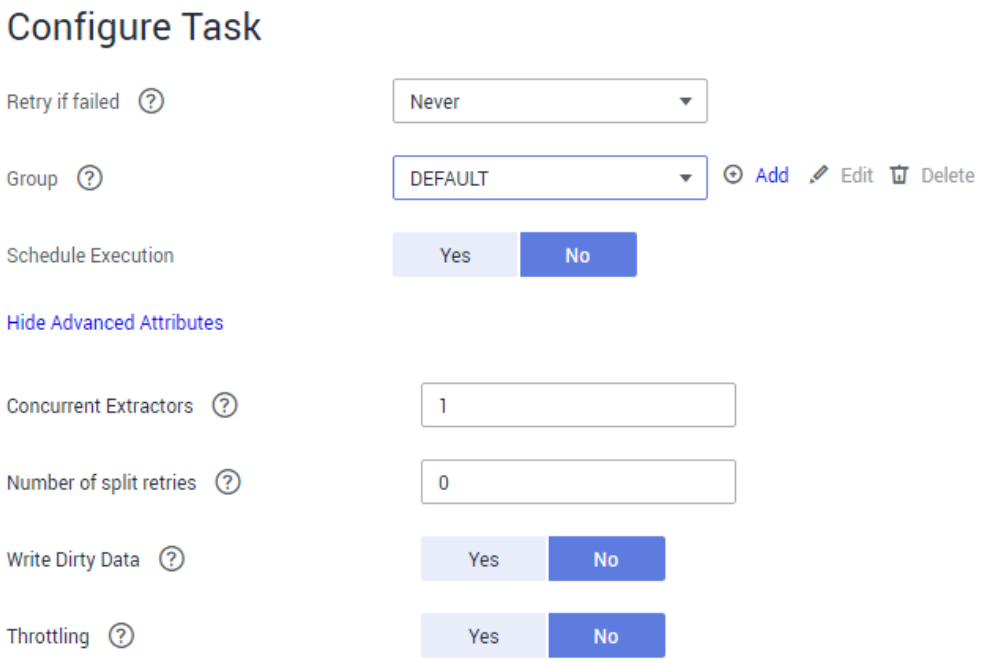
Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

In this step, you can configure the following optional functions:

- **Retry If Failed**: Determine whether to automatically retry the job if it fails. Retain the default value **Never**.
- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Determine whether to automatically execute the job at a scheduled time. Retain the default value **No** in this example.
- **Concurrent Extractors**: Enter the number of concurrent extractors. An appropriate value improves migration efficiency. For details, see **Performance Tuning**. Retain the default value **1**.
- **Write Dirty Data**: Specify this parameter if data that fails to be processed or filtered out during job execution needs to be written to OBS for future viewing. Before writing dirty data, create an OBS link on the CDM console. Retain the default value **No** so that dirty data is not recorded.

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Figure 5-124 Configuring the task



Step 4 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 5 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

----End

5.10.10 Migrating Data from OBS to DLI

Scenario

DLI is a fully hosted big data query service. This section describes how to use CDM to migrate data from OBS to DLI. The procedure includes four steps:

1. **Creating a CDM Cluster**
2. **Creating a DLI Link**
3. **Creating an OBS Link**
4. **Creating a Migration Job**

Prerequisites

- You have enabled OBS and DLI and have the permissions to read data from OBS.
- You have created resource queues, databases, and tables on DLI.

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Creating a CDM Cluster

If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

In this scenario, if the CDM cluster is used only to migrate data from OBS to DLI and does not need to migrate data of other data sources, there is no special requirements on the VPC, subnet, and security group of the CDM cluster. You can specify them based on your needs. CDM accesses DLI and OBS through the intranet. The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.

Creating a DLI Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-125 Selecting a connector

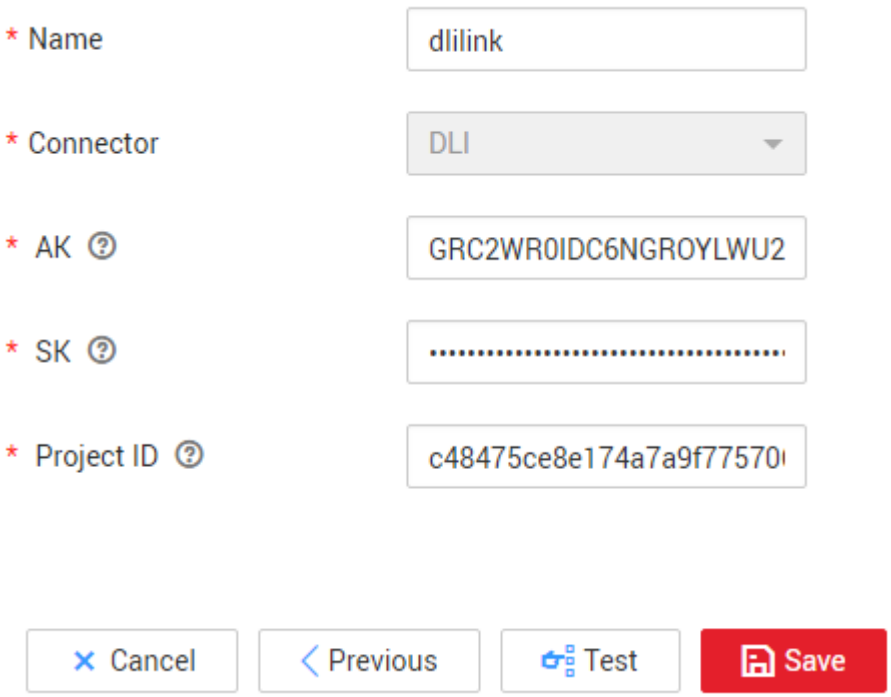


Step 2 Select **Data Lake Insight**, click **Next**, and configure the DLI link parameters. See **Figure 5-126**.

- **Name**: Enter a custom link name, for example, **dlilink**.
- **AK** and **SK**: Enter the AK and SK used for accessing the DLI database.
- **Project ID**: Enter the project ID of the region to which DLI belongs.

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Figure 5-126 Creating a DLI link



Step 3 Click **Save**. The **Link Management** page is displayed.

----End

Creating an OBS Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-127 Selecting a connector type



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Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

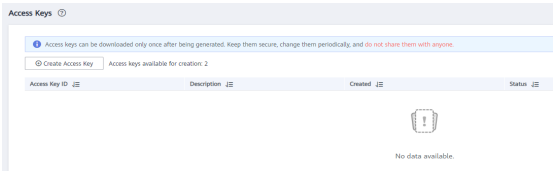
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  To obtain an access key, perform the following steps:

  a. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list.

  b. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-128**.

  Figure 5-128 Clicking Create Access Key

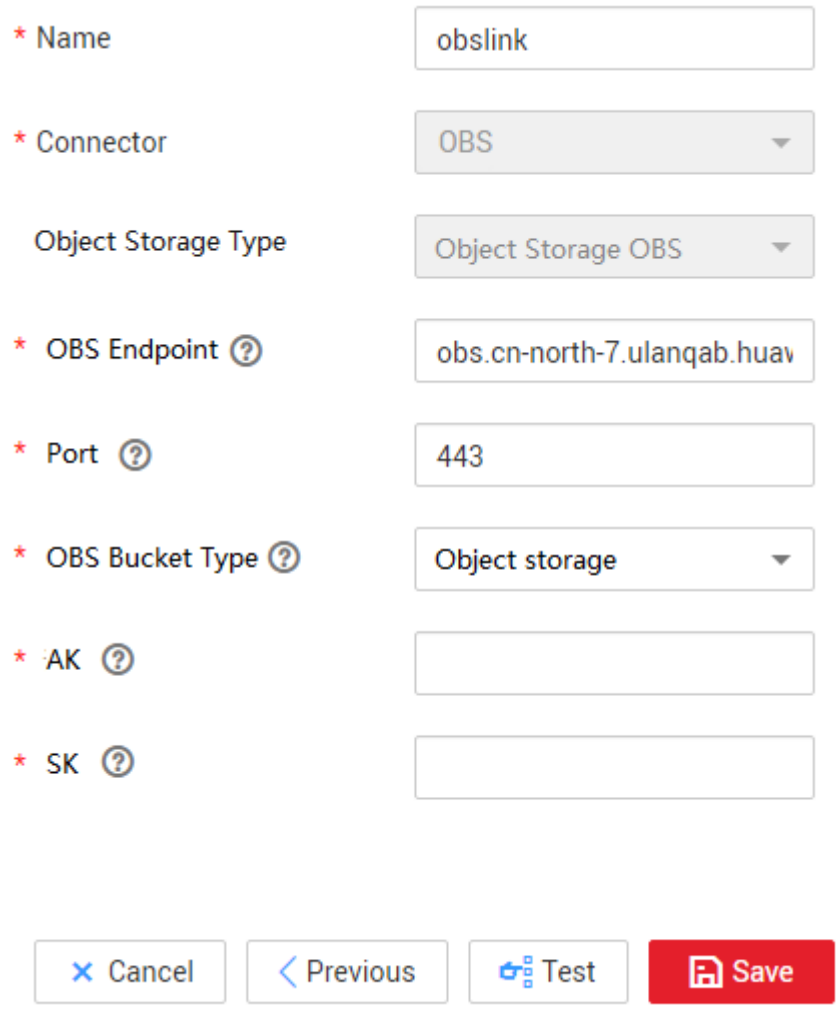
  c. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**.

  NOTE

  - Only two access keys can be added for each user.
  - To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.

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Figure 5-129 Creating an OBS link



Step 3 Click **Save**. The **Link Management** page is displayed.

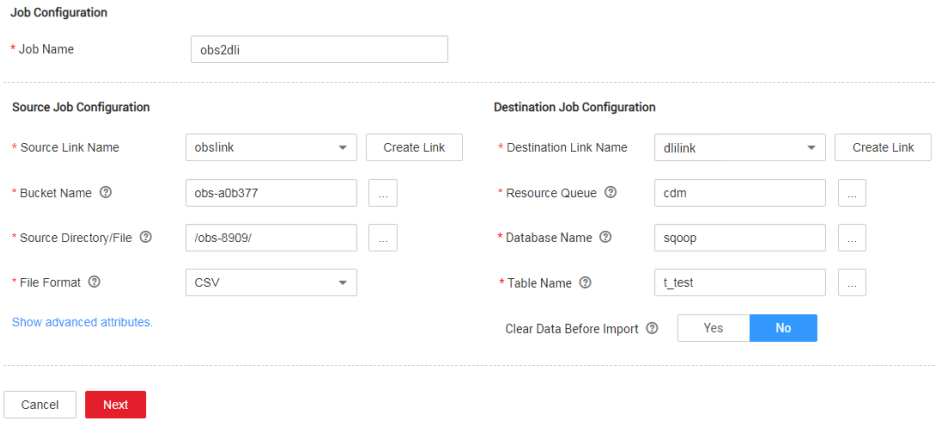
----End

Creating a Migration Job

Step 1 Choose **Table/File Migration** > **Create Job** to create a job for migrating data from OBS to DLI. See **Figure 5-130**.

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Figure 5-130 Creating a job for migrating data from OBS to DLI



- **Job Name**: Enter a custom job name.
- **Source Link Name**: Select the **obslink** link created in **Creating an OBS Link**.
  - **Bucket Name**: Select the bucket from which the data is to be migrated.
  - **Source Directory/File**: Set this parameter to the path of the data to be migrated.
  - **File Format**: Select **CSV** or **JSON** for transferring files to a data table.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.
- **Destination Link Name**: Select the **dlilink** link created in **Creating a DLI Link**.
  - **Resource Queue**: Enter the resource queue to which the destination table belongs.
  - **Database Name**: Enter the name of the database to which data is to be written.
  - **Table Name**: Enter the name of the table to which data is to be written. CDM cannot automatically create tables on DLI. The table must be created on DLI in advance, and the field types and formats of the table must be consistent with those of the data to be migrated.
  - **Clear Before Importing Data**: Choose whether to clear data in the destination table before data import. In this example, retain the default value.

Step 2 Click **Next**. The **Map Field** page is displayed. CDM automatically matches the source and destination fields.

- If the field mapping is incorrect, you can drag the fields to adjust the mapping.
- CDM supports field conversion during the migration. For details, see **Converting Fields**.

Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

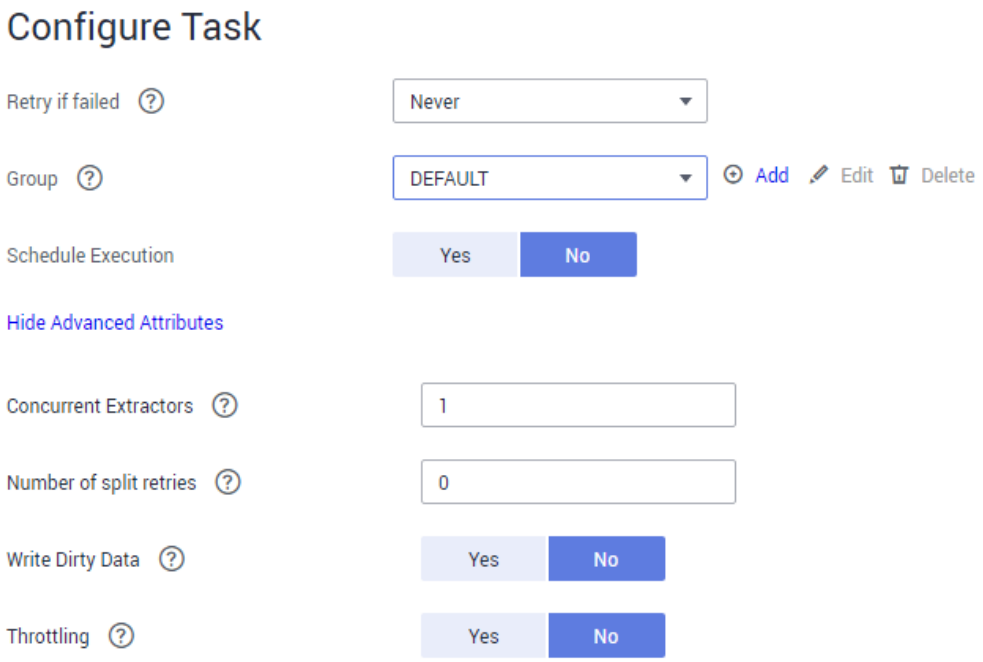
In this step, you can configure the following optional functions:

- **Retry If Failed**: Determine whether to automatically retry the job if it fails. Retain the default value **Never**.

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- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Determine whether to automatically execute the job at a scheduled time. Retain the default value **No** in this example.
- **Concurrent Extractors**: Enter the number of concurrent extractors. An appropriate value improves migration efficiency. For details, see **Performance Tuning**. Retain the default value **1**.
- **Write Dirty Data**: Specify this parameter if data that fails to be processed or filtered out during job execution needs to be written to OBS for future viewing. Before writing dirty data, create an OBS link on the CDM console. Retain the default value **No** so that dirty data is not recorded.

Figure 5-131 Configuring the task



Step 4 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 5 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

----End

5.10.11 Migrating Data from MRS HDFS to OBS

Scenario

CDM supports file-to-file data migration. This section describes how to migrate data from MRS HDFS to OBS. The process is as follows:

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1. **Creating a CDM Cluster and Binding an EIP to the Cluster**
2. **Creating an MRS HDFS Link**
3. **Creating an OBS Link**
4. **Creating a Migration Job**

Prerequisites

- You have obtained the domain name, port number, AK, and SK for accessing OBS.
- You have purchased an MRS cluster.
- Your EIP quota is sufficient.

Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.
- The VPC, subnet, and security group of the CDM cluster must be the same as those of the MRS cluster.

Step 2 After the CDM cluster is created, on the **Cluster Management** page, click **Bind EIP** in the **Operation** column to bind an EIP to the cluster. The CDM cluster uses the EIP to access MRS HDFS.

NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating an MRS HDFS Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

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Figure 5-132 Selecting a connector type



Step 2 Select **MRS HDFS** and click **Next** to configure parameters for the MRS HDFS link.

- **Name**: Enter a custom link name, for example, **mrs_hdfs_link**.
- **Manager IP**: IP address of MRS Manager. Click **Select** next to the **Manager IP** text box to select a created MRS cluster. CDM automatically fills in the authentication information.
- **Username**: If **Authentication Method** is set to **KERBEROS**, set the username and password for logging in to MRS Manager.

  If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS.
- **Password**: password for logging in to MRS Manager
- **Authentication Method**: authentication method for accessing MRS
- **Run Mode**: Select the running mode of the HDFS link.

----End

Creating an OBS Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

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Figure 5-133 Selecting a connector type



Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

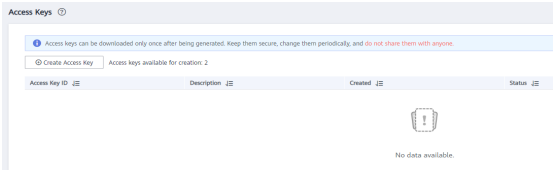
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  To obtain an access key, perform the following steps:

  a. Log in to the management console, move the cursor to the username in the upper right corner, and select **My Credentials** from the drop-down list.

  b. On the **My Credentials** page, choose **Access Keys**, and click **Create Access Key**. See **Figure 5-134**.

  Figure 5-134 Clicking Create Access Key

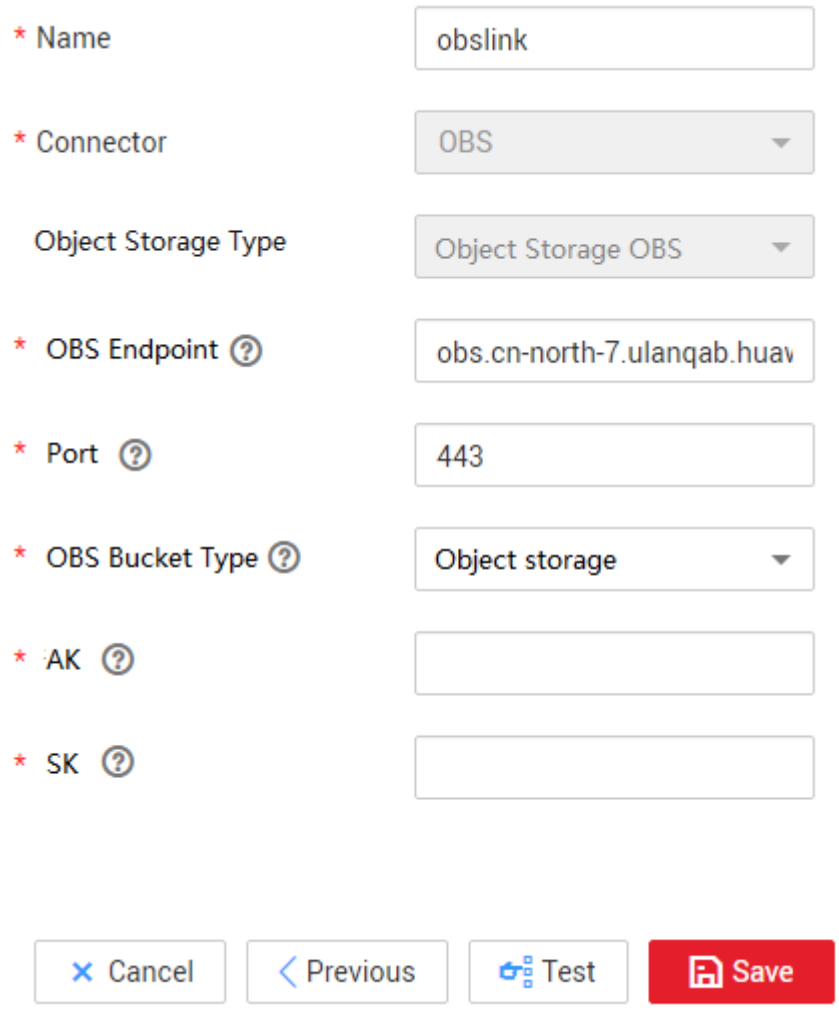
  c. Click **OK** and save the access key file as prompted. The access key file will be saved to your browser's configured download location. Open the **credentials.csv** file to view **Access Key Id** and **Secret Access Key**.

  NOTE

  - Only two access keys can be added for each user.
  - To ensure access key security, the access key is automatically downloaded only when it is generated for the first time and cannot be obtained from the management console later. Keep them properly.

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Figure 5-135 Creating an OBS link



Step 3 Click **Save**. The **Link Management** page is displayed.

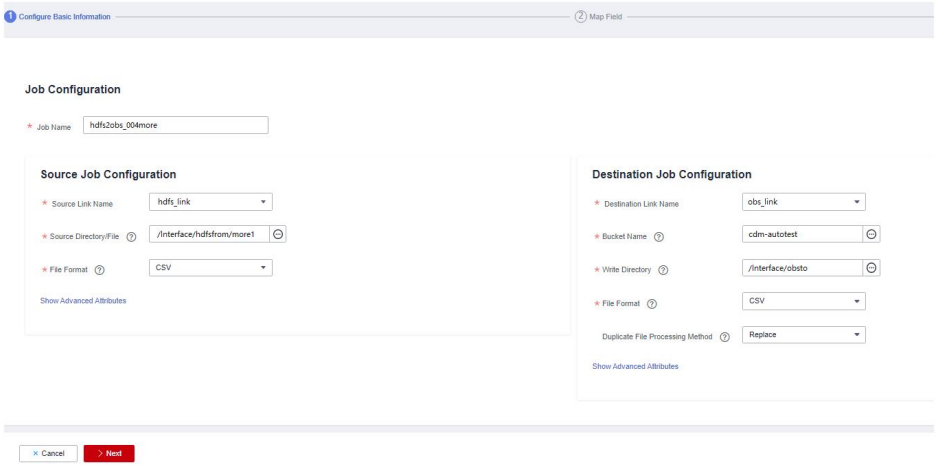
----End

Creating a Migration Job

Step 1 Choose **Table/File Migration** > **Create Job** to create a job for exporting data from the MRS HDFS database to OBS.

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Figure 5-136 Creating a job for migrating data from MRS HDFS to OBS



- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **hdfs_llink** created in **Creating an MRS HDFS Link**.
  - **Source Directory/File**: Enter the directory or file path of the data to be migrated.
  - **File Format**: Select the file format used for data transmission. Select **Binary**. If files are transferred without being parsed, the file format does not have to be **Binary**. This applies to file copy.
  - Retain the default values of other optional parameters.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **obs_link** created in **Creating an OBS Link**.
  - **Bucket Name**: Select the bucket from which the data will be migrated.
  - **Write Directory**: Enter the directory to which data is to be written on the OBS server.
  - **File Format**: Select **Binary**.
  - Retain the default values of the optional parameters in **Show Advanced Attributes**.

Step 2 Click **Next**. The **Map Field** page is displayed. CDM automatically matches the source and destination fields.

- If the field mapping is incorrect, you can drag the fields to adjust the mapping.
- The expressions in CDM support field conversion of common character strings, dates, and values. For details, see **Converting Fields**.

Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

In this step, you can configure the following optional functions:

- **Retry Upon Failure**: If the job fails to be executed, you can determine whether to automatically retry. Retain the default value **Never**.

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- **Group**: Select the group to which the job belongs. The default group is **DEFAULT**. On the **Job Management** page, jobs can be displayed, started, or exported by group.
- **Schedule Execution**: Enable it if you need to configure scheduled jobs. Retain the default value **No**.
- **Concurrent Extractors**: Enter the number of extractors to be concurrently executed. CDM supports concurrent extraction of multiple files. Increasing the value of this parameter can improve migration efficiency.
- **Write Dirty Data**: Select **No**. The file-to-file migration is binary, and no dirty data will be generated.
- **Delete Job After Completion**: Retain the default value **Do not delete**. You can also set this parameter to **Delete** to prevent an accumulation of too many migration jobs.

Step 4 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

Step 5 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records and read/write statistics.

On the **Historical Record** page, click **Log** to view the job logs.

----End

5.10.12 Migrating the Entire Elasticsearch Database to CSS

Scenario

CSS provides users with structured and unstructured data search, statistics, and report capabilities. This section describes how to use CDM to migrate the entire Elasticsearch database to Cloud Search Service. The procedure is as follows:

1. **Creating a CDM Cluster and Binding an EIP to the Cluster**
2. **Creating a Cloud Search Service Link**
3. **Creating an Elasticsearch Link**
4. **Creating an Entire DB Migration Job**

Prerequisites

- You have sufficient EIP quota.
- You have subscribed to CSS and obtained the IP address and port number of the CSS cluster.
- You have obtained the IP address, port number, username, and password of the on-premises Elasticsearch database server.

  If the Elasticsearch server is deployed on an on-premises data center or a third-party cloud, ensure that an IP address that can be accessed from the public network has been configured for the Elasticsearch server, or the VPN or Direct Connect between the on-premises data center and HUAWEI CLOUD has been established.

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Creating a CDM Cluster and Binding an EIP to the Cluster

Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

The key configurations are as follows:

- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.
- The CDM and Cloud Search Service clusters must be in the same VPC. In addition, it is recommended that the CDM cluster be in the same subnet and security group as the Cloud Search Service cluster.
- If the same subnet and security group cannot be used for security purposes, ensure that a security group rule has been configured to allow the CDM cluster to access the Cloud Search Service cluster.

Step 2 After the CDM cluster is created, on the **Cluster Management** page, click **Bind EIP** in the **Operation** column to bind an EIP to the cluster. The CDM cluster uses the EIP to access the on-premises Elasticsearch.

NOTE

If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----End

Creating a Cloud Search Service Link

Step 1 Click **Job Management** in the **Operation** column of the CDM cluster. On the displayed page, click the **Links** tab and then **Create Link**. The **Select Connector** page is displayed.

Figure 5-137 Selecting a connector

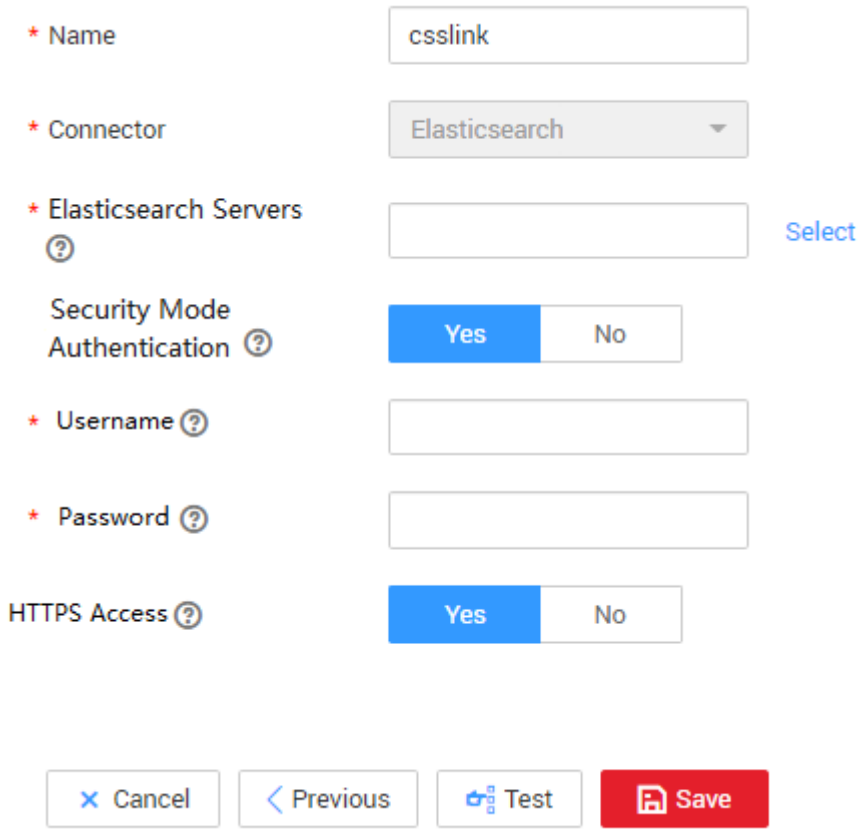


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Step 2 Select **Cloud Search Service** and click **Next**. On the page that is displayed, configure the CSS link parameters.

- **Name**: Enter a custom link name, for example, **csslink**.
- **Elasticsearch Server List**: Enter the IP address and port number of the Cloud Search Service cluster (cluster later than 5.*x*). The format is *ip:port*. Use semicolons to separate multiple addresses. For example, **192.168.0.1:9200;192.168.0.2:9200**.
- **Username** and **Password**: Enter the username and password used for logging in to the Cloud Search Service cluster. The user must have the read and write permissions on the database.

Figure 5-138 Creating a CSS link



Step 3 Click **Save**. The **Link Management** page is displayed.

----End

Creating an Elasticsearch Link

Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

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Figure 5-139 Selecting a connector type



Step 2 Select **Elasticsearch** and click **Next** to configure parameters for the Elasticsearch link. The parameters are the same as those for the CSS link.

- **Name**: Enter a custom link name, for example, **es_link**.
- **Elasticsearch Server List**: Enter the IP address and port number of the on-premises Elasticsearch database. Use semicolons to separate multiple addresses.

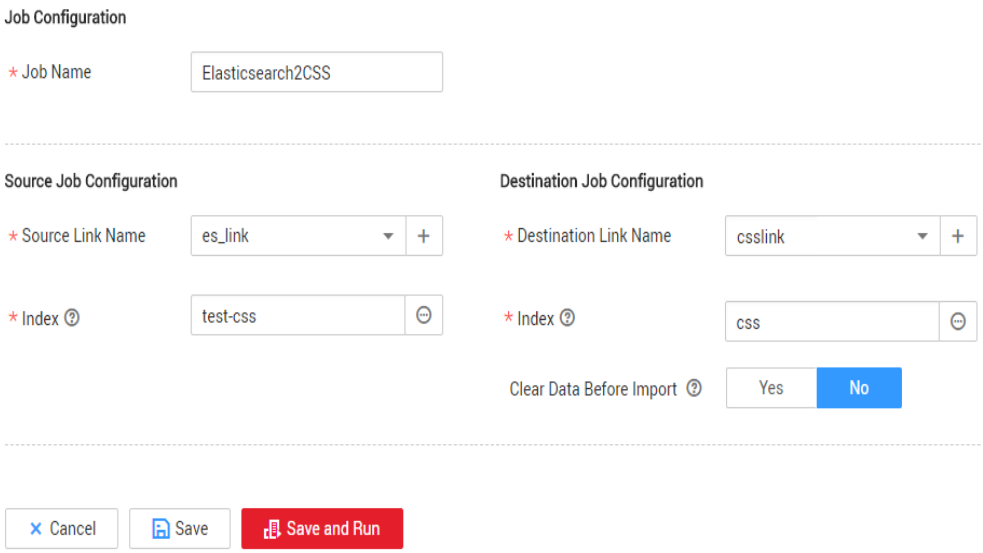
Step 3 Click **Save**. The **Link Management** page is displayed.

----End

Creating an Entire DB Migration Job

Step 1 Choose **Entire DB Migration** > **Create Job** to create an entire DB migration job.

Figure 5-140 Creating an entire DB migration job



- **Job Name**: Enter a unique name.

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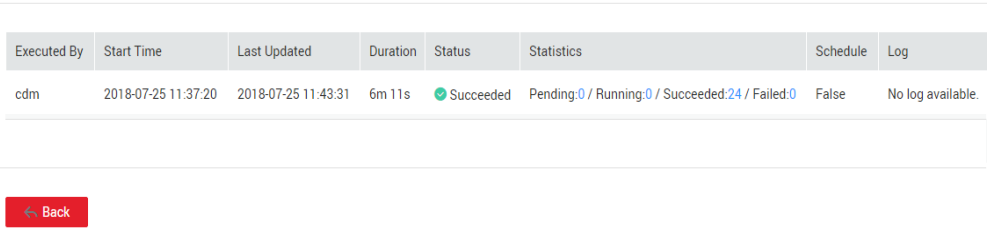
- **Source Job Configuration**
  - **Source Link Name**: Select the **es_link** link created in **Creating an Elasticsearch Link**.
  - **Index**: Click the icon next to the text box to select an index in the on-premises Elasticsearch database or manually enter an index name. The name can contain only lowercase letters. If multiple indexes need to be migrated at a time, set this parameter to a wildcard character. CDM migrates all indexes that meet the wildcard condition. For example, if this parameter is set to **cdm***, CDM migrates all indexes starting with **cdm**, such as **cdm01**, **cdmB3**, **cdm_45** and so on.
- **Destination Job Configuration**
  - **Destination Link Name**: Select the **csslink** link created in **Creating a Cloud Search Service Link**.
  - **Index**: Enter the index of the data to be written. You can select an existing index in Cloud Search Service or manually enter an index name that does not exist. The name can contain only lowercase letters. CDM automatically creates the index in Cloud Search Service. If multiple indexes are migrated at a time, this parameter cannot be configured. CDM automatically creates indexes at the migration destination.
  - **Clear Data Before Import**: If the selected index already exists in Cloud Search Service, you can choose whether to clear the data in the index before importing data. If you select **No**, the data is added to the index.

Step 2 Click **Save and Run**. The **Job Management** page is displayed, on which you can view the job execution progress and result.

A sub-job will be generated for each type in the on-premises Elasticsearch index for concurrent execution. You can click the job name to view the sub-job progress.

Step 3 After the job is successfully executed, in the **Operation** column of the job, click **Historical Record** to view the job's historical execution records, read/write statistics, and job logs (only the sub-jobs have job logs).

Figure 5-141 Historical Record



----End

5.11 Error Codes

If an exception occurs during the execution of an operation request and the request is not processed, an error message is returned. The error information contains the error code and error description. **Table 5-137** lists some common error code in CDM error messages. You can handle the exceptions by referring to the solutions in **Table 5-137**.

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Error Code Description

Table 5-137 Description

Error Code	Error Message	Solution
Cdm.0000	System error.	Contact customer service or technical support.
Cdm.0003	Kerberos login failed.	Check whether the keytab and principal configuration files are correct.
Cdm.0009	*%s* is not an integer or is beyond the value range [0, 2147483647].	Modify the parameter settings based on the error message and try again.
Cdm.0010	The integer must be within the range of [*%s*].	Check whether the parameter value is valid based on the error message. If it is not, correct it and try again.
Cdm.0011	The parameter value exceeds the value range.	Check whether the parameter value is valid based on the error message. If it is not, correct it and try again.
Cdm.0012	JDBC driver class is not found.	Contact customer service or technical support.
Cdm.0013	Failed to connect to the agent.	It is possible that the network is disconnected, or no security group or firewall rule is configured to allow access. If the fault persists, contact customer service or technical support.
Cdm.0014	The parameter is invalid.	Change the parameter value and try again.
Cdm.0015	An error occurred during file parse.	Check whether the content or format of the uploaded file is correct. If it is not, correct it and try again.
Cdm.0016	The file to be uploaded cannot be empty.	Ensure that the file you uploaded is not empty and try again.
Cdm.0017	MRS Kerberos authentication failed.	Check whether the password used for Kerberos authentication is strong. If it is not, change to a strong password and try again.
Cdm.0018	The content of jobs or links is invalid.	Contact customer service or technical support.

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Error Code	Error Message	Solution
Cdm.0019	Invalid IP address and port number.	Try again later or contact customer service or technical support.
Cdm.0020	The string must contain the following substring: *%s*.	Modify the parameter settings based on the error message and try again.
Cdm.0021	Failed to connect to the server: *%s*.	Contact customer service or technical support.
Cdm.0023	Failed to write data. Cause: *%s*.	Contact customer service or technical support.
Cdm.0024	[*%s*] must be within the range of [*%s*].	Modify the parameter settings based on the error message and try again.
Cdm.0025	The length of the written data exceeds the length defined by the table field. Error message: %s.	Modify the length of the data to be written based on the error message and try again.
Cdm.0026	The primary key already exists. Error message: %s.	Check the data based on the error message and resolve the primary key conflict.
Cdm.0027	The code of the written character string may be different from the code defined in the table. Error message: %s.	Modify the character string code based on the error message.
Cdm.0028	Incorrect username or password. Error message: %s.	Change the username or password and try again.
Cdm.0029	The database name does not exist. Error message: %s.	Select a correct database and try again.
Cdm.0030	Incorrect username, password, or database name. Error message: %s.	Correct the username, password, and database name as prompted and try again.
Cdm.0031	The connection timed out.	Connection timed out. Check whether the IP address, host name, and port number are correct, and whether the security group and firewall are correctly configured.
Cdm.0032	Incorrect username or password. See the error message returned by the server: %s.	Change the username and password based on the error message and try again.

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Error Code	Error Message	Solution
Cdm.0033	SIMPLE authentication is not supported.	Select the Kerberos authentication type and try again.
Cdm.0034	Restart the CDM cluster to reload MRS or FusionInsight configurations.	Restart the CDM cluster to reload MRS or FusionInsight configurations.
Cdm.0035	You do not have the write permission on the file. Error message: %s.	Configure the permission based on the error message and try again.
Cdm.0036	Invalid datestamp or date format. Error message: %s.	Configure the datestamp or date format based on the error message and try again.
Cdm.0037	The parameter is invalid. Error message: %s.	Modify the parameter settings based on the error message and try again.
Cdm.0038	The connection timed out.	Check the VPC and security group rules.
Cdm.0039	The connection name cannot be modified.	The connection name cannot be changed.
Cdm.0040	Logs are deleted because they are periodically cleared.	Contact customer service or technical support.
Cdm.0041	The group in use cannot be updated or deleted.	Do not modify the group.
Cdm.0042	Failed to operate the group. Error message: %s.	Select a correct group based on the error message and try again.
Cdm.0043	Failed to trigger data extraction or loading failed. Cause: %s.	Contact customer service or technical support.
Cdm.0051	Invalid submission engine: *%s*.	Specify a correct job engine and try again.
Cdm.0052	Job *%s* is running.	The operation cannot be performed because the job is running. Try again after the job completes.
Cdm.0053	Job *%s* is not running.	Run the job and try again.
Cdm.0054	Job *%s* does not exist.	Check whether the job exists.
Cdm.0055	Unsupported job type.	Specify a correct job type and try again.

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Error Code	Error Message	Solution
Cdm.0056	Failed to submit the job. Cause: *%s*.	Locate the cause based on the error message, rectify the fault, and try again.
Cdm.0057	Invalid job execution engine: *%s*.	Specify a correct job engine and try again.
Cdm.0058	Invalid combination of submission and execution engines.	Specify a correct job engine and try again.
Cdm.0059	Job *%s* has been disabled. Failed to submit the job.	Create a job and try again. Alternatively, contact customer service or technical support.
Cdm.0060	Link *%s* for this job has been disabled. Failed to submit the job.	Change the link and submit the job again.
Cdm.0061	Connector *%s* does not support the specified direction. Failed to submit the job.	The connector cannot be used as the source or destination of a job. Change the link and submit the job again.
Cdm.0062	The binary file is applicable only to the SFTP, FTP, HDFS, or OBS connector.	Specify a correct connector and try again.
Cdm.0063	An error occurred during table creation. Cause: *%s*.	Locate the cause based on the error message, rectify the fault, and try again.
Cdm.0064	The data format is incorrect.	Check whether the data format is correct based on the error message. If it is not, correct it and try again.
Cdm.0065	Failed to start the scheduler. Cause: *%s*.	Contact customer service or technical support.
Cdm.0066	Failed to obtain the sample value. Cause: *%s*.	Contact customer service or technical support.
Cdm.0067	Failed to obtain the schema. Cause: *%s*.	Contact customer service or technical support.

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Error Code	Error Message	Solution
Cdm.0068	Failed to clear table data. Cause: %s.	• Check whether the current account has the operation permissions on the table. • Check whether the table is locked. • If neither of the preceding methods is feasible, contact customer service or technical support.
Cdm.0070	Failed to run task %s because the maximum number of running jobs has been reached.	Contact customer service or technical support.
Cdm.0071	Failed to obtain table data. Cause: %s.	Contact customer service or technical support.
Cdm.0074	Failed to repair the table. Cause: %s.	Contact customer service or technical support.
Cdm.0075	Failed to delete the table. Cause: %s.	• Check whether the current account has the operation permissions on the table. • Check whether the table is locked. • If neither of the preceding methods is feasible, contact customer service or technical support.
Cdm.0080	Invalid username.	Correct the username based on the error message and try again.
Cdm.0081	Invalid certificate.	Contact customer service or technical support.
Cdm.0082	The certificate is not readable.	Contact customer service or technical support.
Cdm.0083	A process cannot be configured with multiple certificates. Restart to use the new certificate.	Modify the certificate based on the error message and restart the system.
Cdm.0085	The value exceeds the upper limit.	Contact customer service or technical support.
Cdm.0088	Incorrect *XX* configuration item.	Modify the configuration item based on the error message and try again.

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Error Code	Error Message	Solution
Cdm.0089	The configuration item XX does not exist.	• Modify the configuration item based on the error message and try again. • During the switchover from a CDM cluster of an earlier version to a CDM cluster of a later version, configuration items may be unavailable occasionally when you create a data connection or save a job. In this case, manually clear the cache and try again.
Cdm.0091	The patches cannot be installed.	Contact customer service or technical support.
Cdm.0092	The backup file does not exist.	Contact customer service or technical support.
Cdm.0093	Failed to load the krb5.conf file.	Contact customer service or technical support.
Cdm.0094	The link named *XX* does not exist.	Check whether the *XX* link exists based on the error message and try again.
Cdm.0095	The job named *XX* does not exist.	Check whether the *XX* job exists based on the error message and try again.
Cdm.0100	Job [*%s*] does not exist.	Specify a correct job and try again.
Cdm.0101	Link [*%s*] does not exist.	Specify a correct link and try again.
Cdm.0102	Connector [*%s*] does not exist.	Specify a correct connector and try again.
Cdm.0104	The job name exists.	Rename the job and try again.
Cdm.0105	The expression is empty.	• Check whether the expression is valid by referring to the help document. • If the fault persists, contact customer service or technical support.

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Error Code	Error Message	Solution
Cdm.0106	Failed to calculate the *XX* expression.	• Check whether the expression is valid by referring to the help document. • If the fault persists, contact customer service or technical support.
Cdm.0107	The task is being executed. Modify job configurations later.	After the task is complete, modify the job configurations.
Cdm.0108	Failed to query table records.	• Ensure that the custom SQL statement is correct. • Ensure that the query does not time out (less than 60s). • If the preceding errors cannot be avoided, contact customer service or technical support.
Cdm.0109	The length of a job or link name cannot exceed %s.	Modify the job or link name based on the error message.
Cdm.0110	Invalid name. The name must start with a character or digit and consist of only letters, digits, underscores (_), hyphens (-), and dots (.).	Change the name based on the error message.
Cdm.0201	Failed to obtain the instance.	Contact customer service or technical support.
Cdm.0202	Unknown job status.	Try again later or contact customer service or technical support.
Cdm.0204	No MRS link is created.	Go to the **Link Management** page to create an MRS link and try again.
Cdm.0230	Failed to load the specified class: *%s*.	Contact customer service or technical support.
Cdm.0231	Failed to initialize the specified class: *%s*.	Contact customer service or technical support.
Cdm.0232	Failed to write data. Cause: *%s*.	Contact customer service or technical support.
Cdm.0233	An exception occurred during data extraction. Cause: *%s*.	Contact customer service or technical support.

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Error Code	Error Message	Solution
Cdm.0234	An exception occurred during data loading. Cause: *%s*.	Contact customer service or technical support.
Cdm.0235	All data has been consumed. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact customer service or technical support.
Cdm.0236	Invalid partitions have been retrieved from Partitioner.	Locate the cause based on the error message. If the fault persists, contact customer service or technical support.
Cdm.0237	Failed to find the JAR file of the connector.	Contact customer service or technical support.
Cdm.0238	*%s* cannot be empty.	Modify the parameter settings based on the error message and try again.
Cdm.0239	Failed to obtain HDFS. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact customer service or technical support.
Cdm.0240	Failed to obtain the status of the *%s* file.	Contact customer service or technical support.
Cdm.0241	Failed to obtain the type of the *%s* file.	Contact customer service or technical support.
Cdm.0242	An exception occurred during file check: *%s*.	Contact customer service or technical support.
Cdm.0243	Failed to rename *%s* to *%s*.	Rename the job and try again.
Cdm.0244	Failed to create the *%s* file.	Check whether you have the permissions or try again later. If the fault persists, contact customer service or technical support.
Cdm.0245	Failed to delete the *%s* file.	Check whether you have the permissions or try again later. If the fault persists, contact customer service or technical support.
Cdm.0246	Failed to create the *%s* directory.	Check whether you have the permissions or try again later. If the fault persists, contact customer service or technical support.

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Error Code	Error Message	Solution
Cdm.0247	HBase operation failure. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact customer service or technical support.
Cdm.0248	Failed to clear data in *%s*. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.0249	The file name *%s* is invalid.	Modify the file name and try again.
Cdm.0250	Failed to perform operations in the path: *%s*.	Check whether you have the permissions or try again later. If the fault persists, contact .
Cdm.0251	Failed to load data to HBase. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.0307	Failed to release the link. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.0315	The link name *%s* already exists.	Specify another link name and try again.
Cdm.0316	The link that does not exist cannot be updated.	Specify a correct link and try again.
Cdm.0317	Link *%s* is invalid.	Specify a correct link and try again.
Cdm.0318	The job exists and cannot be created repeatedly.	Specify another job name and try again.
Cdm.0319	The job that does not exist cannot be updated.	Check whether the job to be updated exists. If it does, modify the job name and try again.
Cdm.0320	Job *%s* is invalid.	Contact .
Cdm.0321	Link *%s* has been used.	Release the link and try again.
Cdm.0322	Job *%s* has been used.	Contact .
Cdm.0323	The submission already exists and cannot be created repeatedly.	Try again later.

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Error Code	Error Message	Solution
Cdm.0327	Invalid link or job: *%s*.	Specify a correct link or job and try again.
Cdm.0411	An error occurred when connecting to the file server.	Contact .
Cdm.0412	An error occurred when disconnecting from the file server.	Contact .
Cdm.0413	An error occurred in data transfer to the file server.	Contact .
Cdm.0415	An error occurred when downloading files from the file server.	Contact .
Cdm.0416	An error occurred during data extraction.	Contact .
Cdm.0420	The source file or source directory does not exist.	Check whether the source file or source directory exists. If it does not, specify a correct source file or directory and try again.
Cdm.0423	Duplicate files exist in the destination path.	Delete duplicate files from the destination path and try again.
Cdm.0500	The source directory or the [*%s*] file does not exist.	Specify a correct source file or directory and try again.
Cdm.0501	Invalid URI [*%s*].	Specify a correct URI and try again.
Cdm.0518	Failed to connect to HDFS. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.0523	Connection timed out due to insufficient user permissions.	Create another service user, grant required permissions to the user, and try again.
Cdm.0600	Failed to connect to the FTP server. Cause: **%s**.	It is possible that the network is disconnected, no security group or firewall rule is configured to allow access, the FTP host name cannot be parsed, or the FTP username or password is incorrect. If the fault persists, contact .

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Error Code	Error Message	Solution
Cdm.0700	Failed to connect to the SFTP server. Cause: **%s**.	It is possible that the network is disconnected, no security group or firewall rule is configured to allow access, the SFTP host name cannot be parsed, or the SFTP username or password is incorrect. If the fault persists, contact .
Cdm.0800	Failed to connect to the OBS server. Cause: **%s**.	It is possible that the OBS endpoint is inconsistent with the current region, the AK/SK pair is incorrect, the AK/SK pair is not the current user's, or no security group or firewall rule is configured to allow access. If the fault persists, contact .
Cdm.0801	OBS bucket [*%s*] does not exist.	The OBS bucket may not exist or is not in the current region. Specify a correct OBS bucket and try again.
Cdm.0900	Table [*%s*] does not exist.	Specify a correct table name and try again.
Cdm.0901	Failed to connect to the database server. Cause: *%s*.	Contact .
Cdm.0902	Failed to execute the SQL statement. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.0903	Failed to obtain metadata. Cause: *%s*.	Check whether the quote character is correct or whether the database table exists when you create the link. If the fault persists, contact .
Cdm.0904	An error occurred while retrieving data from the result. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.0905	No partition column is found.	Specify a partition column and try again.
Cdm.0906	No boundary is found in the partition column.	Contact .
Cdm.0911	The table name or SQL must be specified.	Specify a table name or SQL statement and try again.
Cdm.0912	The table name and SQL cannot be specified at the same time.	Specify one of them and try again.

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Error Code	Error Message	Solution
Cdm.0913	Schema and SQL cannot be specified at the same time.	Specify one of them and try again.
Cdm.0914	Partition column is mandatory for query-based import.	Specify a partition column and try again.
Cdm.0915	The SQL-based import mode and **columnList** cannot be used at the same time.	Use either of them and try again.
Cdm.0916	Last value is mandatory for incremental read.	Specify the last value and try again.
Cdm.0917	Last value cannot be obtained without field check.	Contact .
Cdm.0918	If no transfer table is specified, **shouldClearStageTable** cannot be specified.	Specify a transfer table and try again.
Cdm.0921	Type *%s* is not supported.	Specify a correct type and try again.
Cdm.0925	The partition column contains unsupported values.	Correct the values and try again.
Cdm.0926	Failed to obtain the schema. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.0927	The transfer table is not empty.	Specify an empty transfer table and try again.
Cdm.0928	An error occurred when data is migrated from the transfer table to the destination table.	Contact .
Cdm.0931	Schema column size [*%s*] does not match the result set column size [*%s*].	Change the schema column size to be the same as the result set column size and try again.
Cdm.0932	Failed to obtain the maximum value of the field.	Contact .
Cdm.0934	Multiple tables of the same name exist in different schemas or catalogs.	Contact .
Cdm.0935	No primary key. Specify the partition column.	Specify a partition column and try again.

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Error Code	Error Message	Solution
Cdm.0936	The maximum number of error dirty data records has been reached.	Edit the job and increase the number of error dirty data records.
Cdm.0940	Failed to match the exact table name.	Specify a correct table name and try again.
Cdm.0941	Failed to connect to the server. Cause: *%s*.	Check whether the IP address, host name, and port number are correct, and whether the network security group and firewall are correctly configured. Locate the fault based on the error message. If the fault persists, contact .
Cdm.0950	Failed to connect to the database with the existing authentication information.	Incorrect authentication information. Correct it and try again.
Cdm.0960	Server address must be specified.	Specify the server address and try again.
Cdm.0961	Invalid server address format.	Change to the correct format and try again.
Cdm.0962	The host IP address must be specified.	Specify the host IP address and try again.
Cdm.0963	The host port must be specified.	Specify the host port and try again.
Cdm.0964	The database must be specified.	Specify a database and try again.
Cdm.1000	Hive table [*%s*] does not exist.	Specify a correct Hive table name and try again.
Cdm.1010	Invalid URI [*%s*]. The URI must be either null or a valid URI.	Specify a correct URI and try again. Correct URI examples: ● hdfs://example.com:8020/ ● hdfs://example.com/ ● file:/// ● file:///tmp ● file://localhost/tmp
Cdm.1011	Failed to connect to Hive. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1012	Failed to initialize the Hive client. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .

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Error Code	Error Message	Solution
Cdm.1100	Table [*%s*] does not exist.	Enter a correct table name and try again.
Cdm.1101	Failed to obtain the link. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1102	Failed to create the table. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1103	No rowkey is set.	Set the rowkey and try again.
Cdm.1104	Failed to open the table. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1105	Failed to initialize the job. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1111	The table name is mandatory.	Specify a correct table name and try again.
Cdm.1112	The import mode is mandatory.	Set the import mode and try again.
Cdm.1113	Whether to clear data before import has not been specified.	Set **Clear Data Before Import** and try again.
Cdm.1114	The rowkey is empty. Set it in field mapping.	Fix the error based on the error message.
Cdm.1115	**Columns** is empty. Set it in field mapping.	Fix the error based on the error message.
Cdm.1116	Duplicate column names. Set it in field mapping.	Fix the error based on the error message.
Cdm.1117	An error occurred when checking whether the table exists. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1118	Table *%s* does not contain the *%s* column family.	Specify a column family and try again.
Cdm.1119	The number of column families is *%s* and the number of columns is *%s*.	Change the number of column families to the same as the number of columns and try again.

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Error Code	Error Message	Solution
Cdm.1120	The table contains data. Clear the table data or set the configuration item to specify whether to clear the table data before the import.	Fix the error based on the error message.
Cdm.1121	Failed to close the link. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1201	Failed to connect to the Redis server. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1202	Failed to connect to the Redis cluster in single-node mode.	Connect to the Redis cluster in another mode.
Cdm.1203	Failed to extract data from the Redis server. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1205	Redis Key Prefix cannot be blank.	Delete the whitespace before the Redis prefix and try again.
Cdm.1206	The storage type of the Redis value must be **STRING** or **HASH**.	Fix the error based on the error message.
Cdm.1207	When the value of the storage type is **STRING**, **Value Delimiter** must be specified.	Specify a value delimiter and try again.
Cdm.1208	**columnList** of Redis must be specified.	Specify **columnList** and try again.
Cdm.1209	Redis Key Delimiter cannot be empty.	Enter a correct delimiter and try again.
Cdm.1210	**primaryKeyList** of Redis must be specified.	Specify **primaryKeyList** and try again.
Cdm.1211	**primaryKeyList** of Redis must exist in **columnList**.	Specify **primaryKeyList** and try again.
Cdm.1212	**databaseType** of Redis must be **Original** or **DCS**.	Fix the error based on the error message.
Cdm.1213	**Redis Server Address** must be specified.	Specify **Redis Server Address** and try again.

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Error Code	Error Message	Solution
Cdm.1301	Failed to connect to the MongoDB server. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1302	Failed to extract data from the MongoDB server. Cause: *%s*	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1304	The collection of MongoDB servers must be specified.	Specify the collection of MongoDB servers and try again.
Cdm.1305	**Server Address** of MongoDB must be specified.	Specify **Server Address** and try again.
Cdm.1306	The database name of the MongoDB service must be specified.	Specify a database and try again.
Cdm.1307	**serverlist** of MongoDB must be specified.	Specify **serverlist** and try again.
Cdm.1400	Failed to connect to the NAS server.	Contact .
Cdm.1401	No permissions to access the NAS server.	Apply for the permissions and try again.
Cdm.1501	Failed to connect to the Elasticsearch server. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1502	Failed to write data to the Elasticsearch server. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1503	Failed to close the Elasticsearch link. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1504	An error occurred when obtaining the Elasticsearch index. Cause: *%s*	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1505	An error occurred when obtaining the Elasticsearch type. Cause: *%s*	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1506	An error occurred when obtaining the Elasticsearch field. Cause: *%s*	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1507	An error occurred when obtaining the Elasticsearch sample data. Cause: *%s*	Locate the cause based on the error message. If the fault persists, contact .

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Error Code	Error Message	Solution
Cdm.1508	The host name or IP address of the Elasticsearch server must be specified.	Specify the host name or IP address and try again.
Cdm.1509	The port of the Elasticsearch server must be specified.	Specify a port and try again.
Cdm.1510	The Elasticsearch index must be specified.	Specify an index and try again.
Cdm.1511	The Elasticsearch type must be specified.	Specify a type and try again.
Cdm.1512	**columnList** of Elasticsearch must be specified.	Specify **columnList** and try again.
Cdm.1513	**columnList** must contain the field type definition.	Include the field type definition and try again.
Cdm.1514	**columnList** must contain **primaryKey**.	Set the primary key field and try again.
Cdm.1515	An error occurred when resolving the JSON character string. Cause: *%s*.	Locate the cause based on the error message, rectify the fault, and try again. If the fault persists, contact .
Cdm.1516	The column name *%s* is invalid.	Enter a correct column name and try again.
Cdm.1517	An error occurred when obtaining the number of documents.	Contact .
Cdm.1518	The partition fails to be created.	Contact .
Cdm.1519	An error occurred during data extraction.	Contact .
Cdm.1520	Failed to obtain the type. Cause: *%s*.	Locate the cause based on the error message. If the fault persists, contact .
Cdm.1601	Failed to connect to the server.	Contact .
Cdm.1603	Failed to obtain the sample value of the *%s* topic.	Contact .
Cdm.1604	No data exists in topic *%s*.	Locate the cause. Alternatively, change the topic and try again.
Cdm.1605	Invalid **brokerList**.	Specify a correct **brokerList** and try again.

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6 DataArts Migration (Offline Jobs)

6.1 Overview of Offline Jobs

Offline processing migration jobs support cross-cluster delivery of data migration jobs to implement batch job migration.

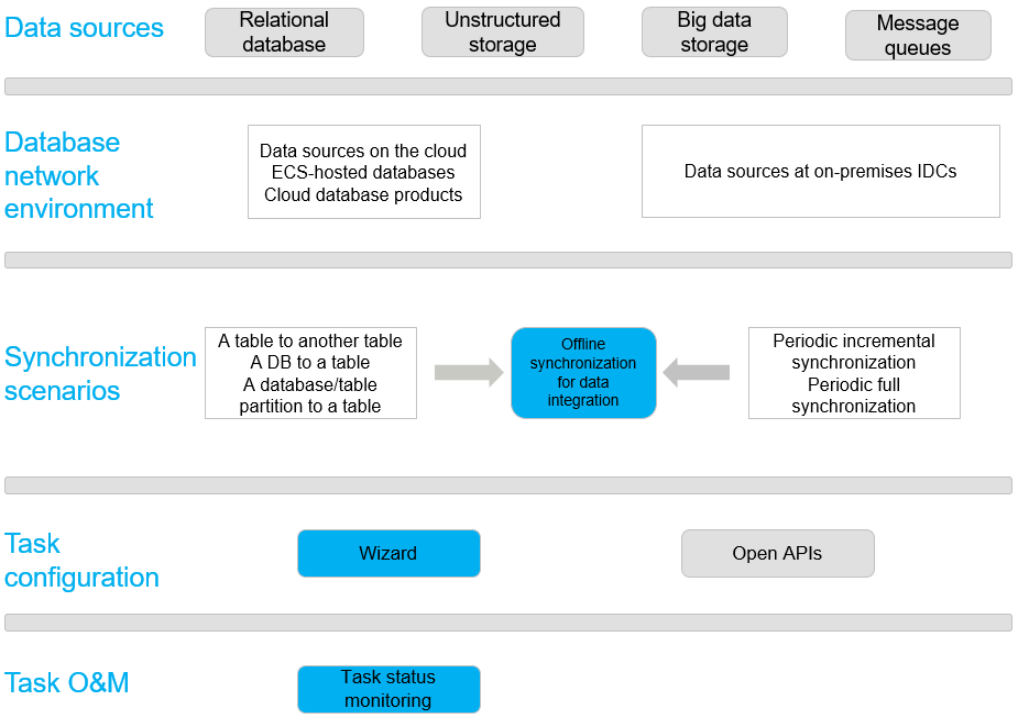
Compared with traditional migration jobs that are managed in CDM clusters, offline processing migration jobs are managed in DataArts Factory which centrally schedules jobs and controls resources in CDM clusters. In this way, offline migration jobs run more reliably and provide better experience.

NOTE

You can use offline processing migration jobs only after apply for the whitelist membership. To use this feature, contact customer service or technical support.

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Figure 6-1 How an offline processing migration job works



6.2 Supported Data Sources

Offline data integration jobs support the following synchronization modes: from a table to another table, from a database to a table, and from a database/table partition to a table. The supported data sources vary depending on the synchronization mode.

- Table synchronization: synchronization of table or file data to a data lake or migration of such data to the cloud. For details about the supported data sources, see **Data Sources Supported for Table/File Synchronization**.
- Database/table partition synchronization: synchronization of multiple databases or tables to a data lake or migration of them to the cloud. For details about the supported data sources, see **Data Sources Supported for Database/Table Partition Synchronization**.
- Entire DB migration: import of data into a data lake or migration of data from on-premises databases to the cloud. For details, see **Data Sources Supported for Entire DB Synchronization**.

NOTE

The supported data sources vary depending on the CDM cluster version.

Different CDM clusters support different data sources.

Data Sources Supported for Table/File Synchronization

Table/File synchronization can synchronize data in tables or files.

Table 6-1 lists the data sources that support single table synchronization.

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Table 6-1 Reading and writing of a single table from different data sources in offline jobs

Category	Data Source	Read	Write	Description
Data warehouse	GaussDB(DWS) and DLI	Supported	Supported	The GaussDB(DWS) physical machine management mode is not supported.
Hadoop	MRS Hive, MRS Hudi, Doris, MRS ClickHouse, and MRS HBase	Supported	Supported	• Recommended MRS ClickHouse version: 21.3.4.*X* • Recommended MRS HBase versions: – 2.1.X – 1.3.X • MRS Hive and MRS Hudi 2.*x* versions are not supported. The following versions are recommended: – 1.2.X – 3.1.X
Object storage	OBS	Supported	Supported	-
File system	FTP and SFTP	Supported	Not supported	-

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Category	Data Source	Read	Write	Description
Relational database	RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, Oracle, RDS for SAP HANA, and GBase 8a	Supported	Supported	• You can create a connection to your on-premises database, such as MySQL, PostgreSQL, SQL Server, Dameng (DM), and SAP HANA by selecting **RDS(MySQL)**, **RDS(PostgreSQL)**, **RDS(SQL Server)**, **RDS(DM)**, and **RDS(SAP HANA)**, respectively on the page for creating a data connection. • SAP HANA: Only the 2.00.050.00.1592305219 version is supported.
	RDS for Dameng database	Not supported	Not supported	-
Non-relational database	MongoDB and Redis	Supported	Supported	• Recommended MongoDB version: 4.2 • MongoDB data sources with SSL enabled are not supported.
Message system	Apache HDFS and DMS Kafka	Supported	Supported	• Apache HDFS can only be the source. • Recommended Apache HDFS versions: – 2.8.X – 3.1.X
	LTS	Supported	Not supported	-

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Category	Data Source	Read	Write	Description
	Apache RocketMq	Not supported	Supported	-
Search	Elasticsearch	Supported	Supported	-
Other	Rest Client	Supported	Not supported	-
	OpenGauss (GaussDB)	Supported	Supported	-

Data Sources Supported for Database/Table Partition Synchronization

Database/Table partition synchronization is applicable to synchronizing data from on-premises data centers or ECS-hosted databases to database services or big data services on the cloud. It is suitable for the synchronization of multiple databases and tables.

The data sources supported for database/table partition synchronization are as follows:

If the migration source is RDS for MySQL, database/table partition synchronization is supported.

Data Sources Supported for Entire DB Synchronization

Entire DB synchronization is used when an on-premises data center or a database created on an ECS needs to be synchronized to a database service or big data service on the cloud. It is suitable for offline database synchronization but not online real-time synchronization.

The following data sources are supported for entire DB synchronization (they can serve as the source or destination in different links):

- Read capability: GaussDB(DWS), RDS for MySQL, and RDS for PostgreSQL
- Write capability: GaussDB(DWS) and DLI

6.3 Creating an Offline Processing Migration Job

Notes and Constraints

- Offline processing migration jobs are not supported in enterprise mode.

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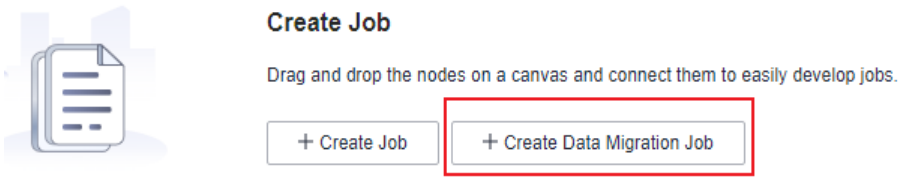
- You can use offline processing migration jobs only after apply for the whitelist membership. To use this feature, contact customer service or technical support.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. Create a migration job using either of the following methods:

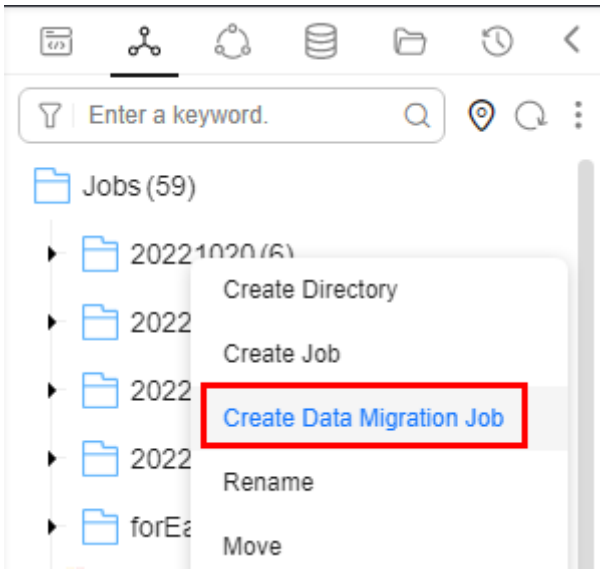
   Method 1: On the **Develop Job** page, click **Create Data Migration Job**.

   Figure 6-2 Creating a migration job (method 1)

   Method 2: In the directory list, right-click a directory and select **Create Data Migration Job**.

   Figure 6-3 Creating a migration job (method 2)

5. In the displayed **Create Data Migration Job** dialog box, configure job parameters. **Table 6-2** describes the job parameters.

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Figure 6-4 Configuring data migration job parameters

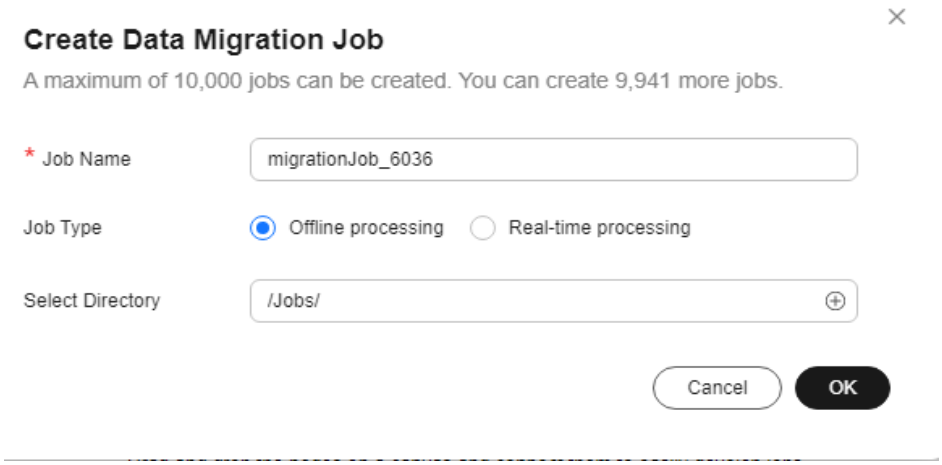


Table 6-2 Job parameters

Parameter	Description
Job Name	Name of the job. The name must contain 1 to 128 characters, including only letters, numbers, hyphens (-), underscores (_), and periods (.).
Job Type	Job type. Select **Offline processing**. • **Offline processing**: A large amount of collected data is processed and analyzed in batches. These tasks usually use optimized computing and storage resources to ensure efficient data processing and analysis. These tasks are usually executed periodically (for example, every day or every week) to process a large amount of historical data for batch analysis and data warehouses. • **Real-time processing**: New data generated continuously is processed and analyzed in real time to meet the requirements for data timeliness. This mode requires instant processing of data upon generation and returns the result or triggers operations.
Select Directory	Directory to which the job belongs. The root directory is selected by default.

6. Click **OK**.

Configuring Basic Job Information

After you configure the owner and priority for a job, you can search for the job by the owner and priority. The procedure is as follows:

Click the **Basic Info** tab on the right of the canvas to expand the configuration page and configure job parameters, as listed in **Table 6-3**.

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Table 6-3 Basic job information

Parameter	Description
Owner	An owner configured during job creation is automatically matched. This parameter value can be modified.
Executor	This parameter is available when **Scheduling Identities** is set to **Yes**. User that executes the job. When you enter an executor, the job is executed by the executor. If the executor is left unspecified, the job is executed by the user who submitted the job for startup. **NOTE** You can configure execution users only after you apply for the whitelist membership. To enable it, contact customer service or technical support.
Job Agency	This parameter is available when **Scheduling Identities** is set to **Yes**. After an agency is configured, the job interacts with other services as an agency during job execution.
Priority	Priority configured during job creation is automatically matched. This parameter value can be modified.
Execution Timeout	Timeout of the job instance. If this parameter is set to 0 or is not set, this parameter does not take effect. If the notification function is enabled for the job and the execution time of the job instance exceeds the preset value, the system sends a specified notification.
Exclude Waiting Time from Instance Timeout Duration	Whether to exclude the wait time from the instance execution timeout duration If you select this option, the time to wait before an instance starts running is excluded from the timeout duration. You can modify this setting on the **Default Configuration** page. If you do not select this option, the time to wait before an instance starts running is included in the timeout duration.
Custom Parameter	Set the name and value of the parameter.
Job Tag	Configure job tags to manage jobs by category. Click **Add** to add a tag to the job. You can also select a tag configured in **Managing Job Tags**.
Node Status Polling Interval (s)	How often the system checks completeness of the node task. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Description
Retry upon Failure	You can select **Retry 3 times** or **Never**. **Never** is recommended. You are advised to configure automatic retry for only file migration jobs or database migration jobs with **Import to Staging Table** enabled to avoid data inconsistency caused by repeated data writes. **NOTE** If you want to set parameters in DataArts Studio DataArts Factory to schedule the CDM migration job, do not configure this parameter. Instead, set parameter **Retry upon Failure** for the CDM node in DataArts Factory.
Policy for Handling Subsequent Nodes If the Current node Fails	Policy for handling subsequent nodes if the current node fails • **End the current job execution plan**: Execution of the current job will stop, and the job instance status will become **Failed**. If the job is scheduled periodically, subsequent periodic scheduling will run properly. • **Ignore the failure and set the job execution result to success**: The failure of the current node will be ignored. The job instance status will become **Successful**. If the job is scheduled periodically, subsequent periodic scheduling will run properly.

Configuring Job Parameters

Job parameters can be globally used in any node in jobs. The procedure is as follows:

Click **Parameter Setup** on the right of the editor and set the parameters described in **Table 6-4**.

Table 6-4 Job parameter setup

Functions	Description
Variables	
Add	Click **Add** and enter the variable parameter name and parameter value in the text boxes. • Parameter Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter Value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*parameter name*} in the job.

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Functions	Description
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modifying a Job	Change the parameter name or value in the corresponding text boxes.
Mask	If the parameter value is a key, click  to mask the value for security purposes.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Constant Parameter	
Add	Click **Add** and enter the constant parameter name and parameter value in the text boxes. • Parameter Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter Value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modifying a Job	Modify the parameter name and parameter value in text boxes and save the modifications.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.

6.4 Configuring an Offline Processing Migration Job

When creating an offline processing data migration job, you can select the source and destination data and configure parameters to periodically synchronize all or incremental data of a table, database/table partition, or entire database from the source to a destination table.

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This section describes the common configurations of an offline processing migration job. The configuration varies depending on the data source. For details, see **Configuring Source Job Parameters** and **Configuring Destination Job Parameters**.

Notes and Constraints

The field type and precision of the source must be the same as those of the destination. Otherwise, the job may fail to run.

NOTE

Pay attention to the precision of the field types at the source and destination. If the maximum value of the field type at the destination is less than the maximum value at the source (or the minimum value of the field type at the destination is greater than the minimum value of the field type at the source, or the precision is lower than the precision at the source), the write may fail or the precision may be truncated.

Prerequisites

- A data connection has been created, and **DataArts Migration** has been selected for the connection. For details, see **Creating a DataArts Studio Data Connection**.
- A CDM cluster is running. For details, see **Creating a CDM Cluster**.

  NOTE

  If the CDM cluster provided by the DataArts Studio instance (except the trial version) meets your requirements, you do not need to buy a DataArts Migration incremental package. If you need to create another CDM cluster, buy a CDM incremental package by referring to **Buying a CDM Incremental Package**.
- The CDM cluster can communicate with the data source.

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NOTE

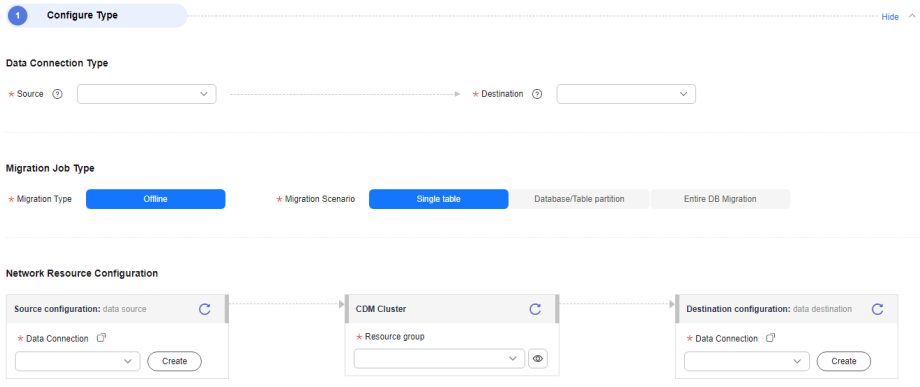
- If the CDM cluster and a cloud service are in the same region, VPC, subnet, and security group, they can communicate with each other through an intranet.
- If the CDM cluster and the cloud service are in the same region and VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
- If the CDM cluster and a cloud service are in different VPCs of the same region, you can create a VPC peering connection to enable them to communicate with each other. For details about how to configure a VPC peering connection, see **VPC Peering Connection**

  Note: If a VPC peering connection is created, the peer VPC subnet may overlap with the CDM management network. As a result, data sources in the peer VPC cannot be accessed. You are advised to use the Internet for cross-VPC data migration, or contact the administrator to add specific routes for the VPC peering connection in the CDM background.
- If the CDM cluster and a cloud service are located in different regions, you need to use the Internet or Direct Connect to enable them to communicate with each other. When using the Internet, ensure that an EIP has been bound to the CDM cluster, the security group of CDM allows outbound traffic from the host where the off-cloud data source is located, the host where the data source is located can access the Internet, and the connection port has been enabled in the firewall rules.
- In addition, an enterprise project may also affect the communication between the CDM cluster and other cloud services. The CDM cluster can communicate with a cloud service only if they have the same enterprise project.

Procedure

1. Create an offline processing migration job by referring to **Creating an Offline Processing Migration Job**.
2. Configure types.

Figure 6-5 Configuring types



a. Set the source connection type and destination connection type. For details about supported data sources, see **Supported Data Sources**.

b. Set **Migration Job Type**.

   i. **Migration Type**: The default value is **Offline** and cannot be changed.

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ii. **Migration Scenario**: Select one from **Single table**, **Database/Table partition**, and **Entire DB Migration**. For details about the supported data sources, see **Supported Data Sources**.

c. Configure **Network Resource Configuration**.

i. Select a created source data connection (**DataArts Migration** was selected for the connection). If no connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.

Check whether the source and the resource group can communicate with each other. If they cannot, modify the network settings as prompted.

ii. Select a resource group. For details about how to create a cluster, see **Creating a CDM Cluster**.

If multiple clusters are selected, the system randomly delivers tasks. Therefore, you are advised to select clusters of the same version. Otherwise, the job may fail due to inconsistent cluster versions.

iii. Select a created destination data connection (**DataArts Migration** was selected for the connection). If no connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.

Check whether the data connection is available. If the data connection is unavailable, change another one as prompted.

3. Configure source parameters.

The configuration varies depending on the data source and synchronization scenario. After selecting a source connection, configure job parameters by referring to **Configuring Source Job Parameters**.

Table 6-5 Required source job parameters

Scenario	Required Source Parameters	Field Mapping
Single table	• Basic parameters • Advanced attributes	Supported
Database/Table partition	• Database/Table mode, exact match or regular expression match • Advanced attributes	Supported
Entire DB migration	• Database tables to be migrated • Advanced attributes	Not supported

4. Configure destination parameters.

The configuration varies depending on the data source and synchronization scenario. After selecting a destination connection, configure job parameters by referring to **Configuring Destination Job Parameters**.

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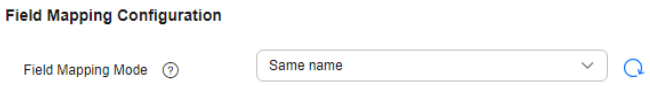
Table 6-6 Required destination job parameters

Scenario	Required Destination Parameters	Field Mapping
Single table	• Basic parameters • Advanced attributes	Supported
Database/Table partition	• Basic parameters • Advanced attributes	Supported
Entire DB migration	Database and table matching policy	Not supported

5. Configuring field mapping.

   After configuring source and destination parameters, you need to configure the mapping between source and destination columns. After the field mapping is configured, the job writes source fields to fields of the corresponding types at the destination based on the field mapping.

   a. Field mapping configuration: Set the field mapping mode and batch field mapping rule.

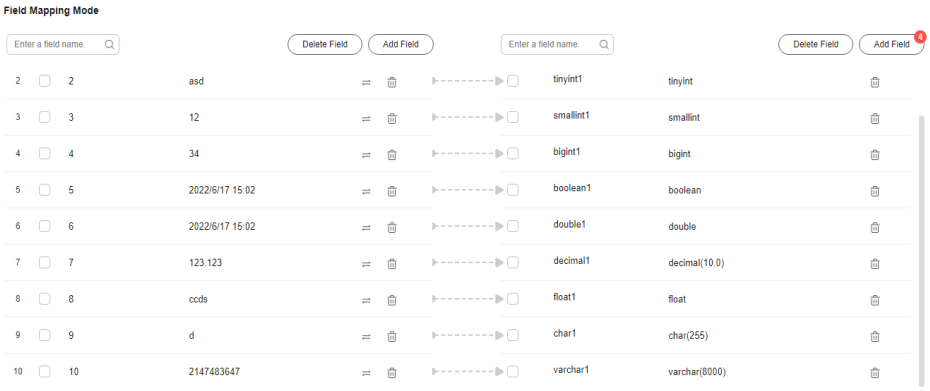
   - **Field Mapping Mode**
     - **Same name**: Fields with the same name are mapped. Fields with the same column name are automatically mapped.
     - **Same row**: Fields with different names but in the same row of the source and destination table are mapped. Source and destination fields in the same row are automatically mapped.
   - **Batch Field Mapping**: This parameter is not displayed when **Use SQL Statement** in the source configuration is set to **Yes**.

     Enter field mappings, with one field mapping in each row. Place fields from the source table to the left of the equal sign (=) and fields from the destination table to the right of the equal sign (=), for example, reader_column=writer_column.

     Click **View and Edit** to set the batch field mapping.

   b. Field mapping: batch conversion, field adding, and row moving

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- Sensitive information detection: Check whether the source data contains sensitive information. If there is sensitive information, data cannot be migrated, and you need to modify the information as prompted.
- **Set Converter**: Convert source fields in batches.

  Select the target fields and click **Set Converter**. In the displayed dialog box, create a converter as prompted.

  Delete Field: This parameter is unavailable when **Use SQL Statement** in the source configuration is set to **Yes**. Select the target fields and click **Delete Field**.

  You can view the deleted fields in **Removed Fields** in the **Add Field** dialog box.
- **Add Field**: This parameter is unavailable when **Use SQL Statement** in the source configuration is set to **Yes**. You can add new fields or removed fields to the source and destination configurations.

  The following types of fields are supported:

  Functions, for example, **now()**, **curdate()**, or **postgresql** for MySQL.

  now() or **transaction_timestamp()**

  Functions with keywords, for example, **to_char(current_date,'yyyy-MM-dd')** for PostgreSQL

  Fixed values, such as **123** and **'123'** (both indicate string 123)

  Variable values, for example, **${workDate}** (**workDate** must be defined in the job variable.)

  Fixed variables for JDBC, such as **DB_NAME_SRC** (source database name), **TABLE_NAME_SRC** (source table name), and **DATASOURCE_NAME_SRC** (data source name)

  as statements are supported, such as **'123' as test** and **now() as curTime**.
- Move rows: This function is unavailable when **Use SQL Statement** in the source configuration is set to **Yes**. Drag the row of a field and move the row up or down.
- View converters: (Optional) CDM can convert fields. Click and then click **Create Converter**. For details about how to use converters, see **Configuring Field Converters**.

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- Search for and match destination fields: Click  in the **Operation** column. In the displayed dialog box, search for a field by keyword or click a field directly.
- Delete fields: You can delete the default fields of the table. To delete a field, click  in the **Operation** column. Removed fields can be found in **Removed Fields** in the **Add Field** dialog box.
- **Example Field Mapping**: This parameter is not displayed when **Use SQL Statement** in the source configuration is set to **Yes**. You can view the example mapping of source and destination fields.

  NOTE

  - If files are migrated between FTP, SFTP, HDFS, and OBS and the migration source's **File Format** is set to **Binary**, files will be directly transferred, free from field mapping.

    Field mapping configuration is not required for entire DB migration.
  - During the migration, the field types at the source and destination may not match. As a result, dirty data is generated, and data cannot be written to the destination. For details about the number of dirty data records allowed during the migration, see the next step.
  - If a field at the source is not mapped to a field at the destination, the field at the source will not be synchronized to the destination.
  - In other scenarios, CDM automatically maps fields of the source table and the destination table. You need to check whether the mapping and time format are correct. For example, check whether the source field type can be converted into the destination field type.
  - If the field mapping is incorrect, you can drag fields to adjust the mapping. (This function is supported when **Use SQL Statement** in the source configuration is set to **No**.)
  - If you cannot obtain all columns by obtaining sample values on the field mapping page, you can click  to add a custom field or click  in the **Operation** column to create a field converter to ensure that all required data can be imported to the destination.
  - In the **Field Mapping** area, you can click  to add custom constants, variables, and expressions.
  - The column name is available only the **Extract first row as columns** parameter is set to **Yes** during the migration of a CSV file from OBS.
  - When SQLServer is the destination, fields of the timestamp type cannot be written. You must change their type (for example, to datatime) so that they can be written.
  - If the data is imported to DWS, you need to select the distribution columns in the destination fields. You are advised to select the distribution columns according to the following principles:
    1. Use the primary key as the distribution column.
    2. If multiple data segments are combined as primary keys, specify all primary keys as the distribution column.
    3. In the scenario where no primary key is available, if no distribution column is selected, DWS uses the first column as the distribution column by default. As a result, data skew risks exist.

6. Configuring task properties.

   You can configure the parameters listed in **Table 6-7** for data synchronization.

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Table 6-7 Task parameters

Parameter	Description	Example Value
Expected Max. Concurrent Threads	The maximum number of concurrent threads to read data from the source or write data to the destination. Due to the sharding policy, the actual number of concurrent threads may be smaller than the value of this parameter. The maximum number of concurrent extractors for a cluster varies depending on the CDM cluster flavor. You are advised to set the maximum number of concurrent extractors to twice the number of vCPUs of the CDM cluster. For example, the maximum number of concurrent extractors for a cluster with 8 vCPUs and 16 GB memory is 16.	3
Number of split retries	Number of retries when a split fails to be executed. Value **0** indicates that no retry will be performed. **NOTE** This parameter takes effect only when the destination is Hudi or DWS and the import mode is UPSERT.	0

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Parameter	Description	Example Value
Write Dirty Data	Whether to record dirty data. By default, dirty data is not recorded. If there is a large amount of dirty data, the synchronization speed of the task is affected. • **No**: Dirty data is not recorded. This is the default value. Dirty data is not allowed. If dirty data is generated during the synchronization, the task fails and exits. • **Yes**: Dirty data is allowed, that is, dirty data does not affect task execution. When dirty data is allowed and its threshold is set: – If the generated dirty data is within the threshold, the synchronization task ignores the dirty data (that is, the dirty data is not written to the destination) and is executed normally. – If the generated dirty data exceeds the threshold, the synchronization task fails and exits. **NOTE** Criteria for determining dirty data: Dirty data is meaningless to services, is in an invalid format, or is generated when the synchronization task encounters an error. If an exception occurs when a piece of data is written to the destination, this piece of data is dirty data. Therefore, data that fails to be written is classified as dirty data. For example, if data of the VARCHAR type at the source is written to a destination column of the INT type, dirty data cannot be written to the migration destination due to improper conversion. When configuring a synchronization task, you can configure whether to write dirty data during the synchronization and configure the number of dirty data records (maximum number of error records allowed in a single partition) to ensure task running. That is, when the number of dirty data records exceeds the threshold, the task fails and exits.	No
Write Dirty Data Link	This parameter is only displayed when **Write Dirty Data** is set to **Yes**. Only links to OBS support dirty data writes.	obslink

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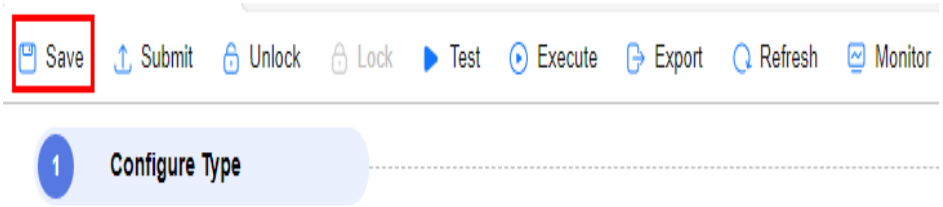
Parameter	Description	Example Value
OBS Bucket	This parameter is only displayed when **Write Dirty Data Link** is a link to OBS. Name of the OBS bucket to which the dirty data will be written.	dirtydata
Dirty Data Directory	This parameter is only displayed when **Write Dirty Data** is set to **Yes**. Directory for storing dirty data on OBS. Dirty data is saved only when this parameter is configured. You can go to this directory to query data that fails to be processed or is filtered out during job execution, and check the source data that does not meet conversion or cleaning rules.	/user/dirtydir
Max. Error Records in a Single Shard	This parameter is only displayed when **Write Dirty Data** is set to **Yes**. When the number of error records of a single partition exceeds the upper limit, the job will automatically terminate and the imported data cannot be rolled back. You are advised to use a temporary table as the destination table. After the data is imported, rename the table or combine it into the final data table.	0
Throttling	Whether to enable throttling for the synchronization. This rate indicates the CDM transmission rate, not the NIC traffic. ● **Yes**: By limiting the synchronization rate, you can prevent the source database from being overloaded due to a high extraction speed. The minimum rate allowed is 1 MB/s. ● **No**: The task provides the highest transmission performance with the existing hardware based on the configured maximum number of concurrent tasks. **NOTE** ● It can control the rate for a job migrating data to MRS Hive, DLI, relational databases, OBS, or Apache HDFS. ● To configure throttling for multiple jobs, multiply the rate by the number of concurrent jobs.	Yes

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Parameter	Description	Example Value
byteRate(MB/s)	Maximum rate for a job. To configure throttling for multiple jobs, multiply the rate by the number of concurrent jobs. Unit: MB/s **NOTE** The rate is an integer greater than 1.	10
Max. Rows Migrated Concurrently per Second	Maximum number of rows that can be migrated concurrently per second. The unit is record/s.	100000
ChannelCapacity(Mb)	Amount of data that the intermediate queue can cache. The value ranges from 1 to 500. If the amount of data of a row exceeds the value of this parameter, the migration may fail. If the value of this parameter is too large, the cluster may not run properly. Set an appropriate value for this parameter and use the default value unless otherwise specified.	64
Detect Sensitive Information in Jobs in Real Time	Whether to detect sensitive information in jobs in real time	No

7. Save the job.

   After configuring the job, click **Save** in the upper left corner to save the job configuration.

   If real-time sensitive information detection is enabled for a job, the system automatically checks whether the source data contains sensitive information. If there is sensitive information, data cannot be migrated. In this case, you must make modifications as prompted.

   After the job is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a job multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

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8. Test the job.

   After configuring the job, click **Test** in the upper left corner to test the job. If the test fails, view the logs of the job node and locate and rectify the fault.

   NOTE

   - A test execution is similar to a single execution and migrates data.
   - You can view the test run logs of the job by clicking **View Log**.
   - If you test the job before submitting a version, the version of the generated job instance is 0 on the **Job Monitoring** page.

9. Submit a job version.

   If you want the job to be scheduled periodically, you need to release the job to the production environment. For how to release a job, see **Releasing a Job Task**.

10. Schedule the job.

    Set the scheduling mode for the job. For details about how to schedule the job, see **Setting Up Scheduling for a Job**.

6.5 Configuring Source Job Parameters

6.5.1 From MySQL

Data can be exported from a MySQL database.

Table 6-8 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Type	Parameter	Description	Example Value

	SQL Statement	When **Use SQL Statement** is set to **Yes**, enter an SQL statement here. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Retain One Decimal Place for Date Values	Whether to retain one decimal place for date values.	No
	Extract by Partition	When data is exported from a MySQL database, data can be extracted from each partition in the partitioned table. If this function is enabled, you can configure **Table Partition** to specify specific MySQL table partitions from which data is extracted. • This function does not support non-partitioned tables. • The database user must have the **SELECT** permission on the system views **dba_tab_partitions** and **dba_tab_subpartitions**.	No

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Type	Parameter	Description	Example Value
	Partition Extraction Column	This parameter is displayed when **Extract by Partition** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Null for Partition Column	Whether the partition field can contain null values. This parameter is displayed when **Extract by Partition** is set to **No**. During concurrent extraction, if the partition column does not contain null, set this parameter to **No** to improve performance. If you are not sure whether the partition column contains null, set this parameter to **Yes** to avoid data loss.	Yes

6.5.2 From Hive

Data can be exported from Hive through the JDBC API.

If the data source is Hive, CDM will automatically partition data using the Hive data partitioning file.

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Table 6-9 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	readMode	Two read modes are available: HDFS and JDBC. By default, the HDFS mode is used. If you do not need to use the WHERE condition to filter data or add new fields on the field mapping page, select the HDFS mode. • The HDFS mode shows good performance, but in this mode, you cannot use the WHERE condition to filter data or add new fields on the field mapping page. • The JDBC mode allows you to use the WHERE condition to filter data or add new fields on the field mapping page.	HDFS
	Database	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	default

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Type	Parameter	Description	Example Value
	Table Name	Hive table name. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_E
	Use SQL Statement	This parameter is displayed when **readMode** is set to **JDBC**. Whether you can use SQL statements to export data from a relational database	No

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Type	Parameter	Description	Example Value

	SQL Statement	This parameter is displayed when **Use SQL Statement** is set to **Yes**. CDM exports data based on the SQL statement you enter.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
			select id,name from sqoop.user;

	Transmission Mode	The value can be **Record migration** (default) or **File migration**. File migration is supported only when the source is Hive 2.*x* with data stored in HDFS and the destination is Hive 3.*x* with data stored in OBS. If you select **File**, ensure that the table format and attributes of the source and destination are the same.	• Record migration • File migration

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Type	Parameter	Description	Example Value
	Partition Values	This parameter is displayed when **readMode** is set to **HDFS**. This parameter indicates extracting the partition of a specified value. The attribute name is the partition name. You can configure multiple values (separated by spaces) or a field value range. The time macro function is supported. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	• Attribute value in the single-value or multi-value filtering scenario: ${dateformat(yyyyMMdd, -1, DAY)} ${dateformat(yyyyMMdd)} • Attribute value in the range filtering scenario: ${value} >= ${dateformat(yyyyMMdd, -7, DAY)} && ${value} < ${dateformat(yyyyMMdd)}

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	This parameter is displayed when **readMode** is set to **JDBC** and **Use SQL Statement** is set to **No**. This parameter indicates the where clause used to extract data. If this parameter is not set, data of the entire table will be extracted. If the table to be migrated does not contain the fields specified by the where clause, the migration will fail. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	age > 18 and age <= 60

6.5.3 From HDFS

Table 6-10 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Source Link Name	Select a type from the drop-down list box.	hdfs_to_cdm

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Type	Parameter	Description	Example Value
	Source Directory/File	This parameter is available only when **Pull List File** is set to **No**. Directory or file path from which data will be extracted. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	/user/cdm/
	File Format	File format used for data transmission. The options are as follows: • **CSV**: Source files will be migrated to tables after being converted to CSV format. • **Binary**: Files (even not in binary format) will be transferred directly. It is used for file copy. • **Parquet**: Source files will be migrated to tables after being converted to Parquet format.	CSV

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Type	Parameter	Description	Example Value
	Entries Files	This parameter is displayed only when **File Format** is set to **Binary**. If the pull list file function is enabled, the content of a file (such as a .txt file) in an OBS bucket can be read as the list of files to be migrated. The content in the file must be the absolute path of the file to be migrated (rather than a directory). The following is example content: /mrs/job-properties/application_1634891604621_0014/job.properties /mrs/job-properties/application_1634891604621_0029/job.properties	Yes
	OBS Link of entries files	This parameter is available only when **Entries Files** is set to **Yes**. You can select the OBS link where the list file is located.	OBS_test_link
	OBS Bucket of entries files	This parameter is available only when **Entries Files** is set to **Yes**. It indicates the name of the OBS bucket where the list file is located.	01
	Path/ Directory of entries files	This parameter is available only when **Entries Files** is set to **Yes**. It indicates the absolute path or directory of the list file in the OBS bucket.	/0521/Lists.txt
Advanced Attributes	Line Separator	Lind feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. This parameter is displayed only when **File Format** is set to **CSV**.	\n
	Field Delimiter	Character used to separate fields in the file. To set the **Tab** key as the delimiter, set this parameter to **\t**. This parameter is displayed only when **File Format** is set to **CSV**.	,

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Type	Parameter	Description	Example Value
	First Row As Header	This parameter is displayed only when **File Format** is set to **CSV**. When you migrate a CSV file to a table, CDM writes all data to the table by default. If you set this parameter to **Yes**, CDM uses the first N rows of the CSV file as the heading row and does not write the row to the destination table.	No
	Encode Type	Encoding type, for example, **UTF-8** or **GBK**. You can set the encoding type for text files only. This parameter is invalid when **File Format** is set to **Binary**.	GBK
	Start Job by Marker File	Whether to start a job by a marker file. A job is only started if there is a marker file for starting the job in the source path. If there is no marker file, the job will be suspended for a period of time specified by **Suspension Period**.	ok.txt
	Marker File	This parameter is available when **Start Job by Marker File** is set to **Yes**. If you enter the name of the marker file, the migration job is executed only when the marker file exists in the source path. The marker file will not be migrated.	ok.txt
	Wait Time	Waiting period for a marker file. A job fails when this waiting period times out. This parameter is available when **Start Job by Marker File** is set to **Yes**. If you set this parameter to **0** and there is no marker file in the source path, the job will fail immediately. The unit is second.	60
	Filter Type	Only paths or files that meet the filtering conditions are transferred. The options are **None**, **Wildcard**, and **Regex**. For details, see **Incremental File Migration**.	N/A

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Type	Parameter	Description	Example Value
	Directory Filter	If you set **Filter Type** to **Wildcard** or **Regex**, enter a wildcard character to filter paths. The paths that meet the filtering condition are migrated. You can configure multiple paths separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*input
	File Filter	If you set **Filter Type** to **Wildcard** or **Regex**, you can enter a wildcard character to search for files in a specified path. The files that meet the search criteria are migrated. You can configure multiple files separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*.csv
	Time Filter	If you select **Yes**, files are transferred based on their modification time.	Yes

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Type	Parameter	Description	Example Value
	Minimum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified at or after the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss,-90,DAY))}** indicates that only files generated within the latest 90 days are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-07-01 00:00:00
	Maximum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified before the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set to a macro variable of date and time. For example, **${timestamp(dateformat(yyyy-MM-dd HH:mm:ss))}** indicates that only the files whose modification time is earlier than the current time are migrated. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	2019-07-30 00:00:00

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Type	Parameter	Description	Example Value
	Create Snapshot	If you set this parameter to **Yes**, CDM creates a snapshot for the source directory to be migrated (the snapshot cannot be created for a single file) before it reads files from HDFS. Then CDM migrates the data in the snapshot. Only the HDFS administrator can create a snapshot. After the CDM job is completed, the snapshot is deleted.	No
	Encryption	This parameter is displayed only when **File Format** is set to **Binary**. If the source data is encrypted, CDM can decrypt the data before exporting it. Select whether to decrypt the source data and select a decryption algorithm. The options are as follows: • **None**: Directly export the data without decrypting it. • **AES-256-GCM**: Use the AES 256-bit encryption algorithm to encrypt data. Currently, only the AES-256-GCM (NoPadding) encryption algorithm is supported. This parameter is used for encryption at the migration destination and decryption at the migration source. For details, see **Encryption and Decryption During File Migration**.	AES-256-GCM
	DEK	This parameter is displayed only when **Encryption** is set to **AES-256-GCM**. The key consists of 64 hexadecimal numbers and must be the same as the **DEK** configured during encryption. If the encryption and decryption keys are inconsistent, the system does not report an exception, but the decrypted data is incorrect.	DD0AE00DFECD78BF051BCFDA25BD4E320DB0A7AC75A1F3FC3D3C56A457DCDC1B

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Type	Parameter	Description	Example Value
	IV	This parameter is displayed only when **Encryption** is set to **AES-256-GCM**. The initialization vector consists of 32 hexadecimal numbers and must be the same as the **IV** configured during encryption. If the encryption and decryption keys are inconsistent, the system does not report an exception, but the decrypted data is incorrect.	5C91687BA886EDCD12ACBC3FF19A3C3F
	MD5 File Extension	This parameter is displayed only when **File Format** is set to **Binary**. This parameter is used to check whether the files extracted by CDM are consistent with source files. For details, see **MD5 Verification**.	.md5

6.5.4 From Hudi

Table 6-11 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Database Name	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	default

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Type	Parameter	Description	Example Value
	Table Name	Hudi table name. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_E
Advanced attributes	Where Clause	This parameter indicates the where clause to be extracted. If this parameter is not set, the entire table is extracted. If the table to be migrated does not contain the fields specified by the where clause, the migration will fail. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	age > 18 and age <= 60

6.5.5 From PostgreSQL

Data can be exported from the cloud database services.

The non-cloud databases can be those created in the on-premises data center or deployed on ECSs, or database services on the third-party clouds.

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You can configure the OpenGauss data source parameters by referring to this section.

Table 6-12 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	If you have set **Use SQL Statement** to **Yes**, enter an SQL statement. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_E
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Extract by Partition	During data export, data can be extracted from each partition in the partitioned table. If this function is enabled, you can configure **Table Partition** to specify specific table partitions from which data is extracted. • This function does not support non-partitioned tables. • The database user must have the **SELECT** permission on the system views **dba_tab_partitions** and **dba_tab_subpartitions**.	No
	Partition Extraction Column	This parameter is displayed when **Extract by Partition** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id

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Type	Parameter	Description	Example Value
	Null for Partition Column	Whether the partition field can contain null values. This parameter is displayed when **Extract by Partition** is set to **No**.	Yes

6.5.6 From SQLServer

Data can be exported from the cloud database services.

The non-cloud databases can be those created in the on-premises data center or deployed on ECSs, or database services on the third-party clouds.

Table 6-13 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	If you have set **Use SQL Statement** to **Yes**, enter an SQL statement. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_E
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
Advanced attributes	Partition Extraction Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating that a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Null for Partition Column	Whether the partition field can contain null values. This parameter is displayed when **Extract by Partition** is set to **No**.	Yes

6.5.7 From Oracle

Data can be exported from an Oracle database.

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Table 6-14 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	If you have set **Use SQL Statement** to **Yes**, enter an SQL statement. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Retain One Decimal Place for Date Values	Whether to retain one decimal place for date values.	No
	Extract by Partition	This parameter is displayed when **Extract by Partition** is set to **No**. It indicates that when data is exported from an Oracle database, data can be extracted from each partition in the partitioned table. If this function is enabled, you can configure **Table Partition** to specify specific Oracle table partitions from which data is extracted. • This function does not support non-partitioned tables. • The database user must have the **SELECT** permission on the system views **dba_tab_partitions** and **dba_tab_subpartitions**.	No

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Type	Parameter	Description	Example Value
	Partition Extraction Column	This parameter is displayed when **Extract by Partition** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Null for Partition Column	Whether the partition field can contain null values. This parameter is displayed when **Extract by Partition** is set to **No**. During concurrent extraction, if the partition column does not contain null, set this parameter to **No** to improve performance. If you are not sure whether the partition column contains null, set this parameter to **Yes** to avoid data loss.	Yes

6.5.8 From DLI

Data can be exported from DLI.

Table 6-15 Parameter description

Parameter	Description	Example Value
Resource Queue	Resource queue to which the destination table belongs The default queue of DLI cannot be used for migration jobs. You need to create a SQL queue in DLI.	cdm
Database	Name of the database to which data will be written	dli
Table	Name of the table to which data will be written	car_detail

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Parameter	Description	Example Value
Partition	Partition information Whether this parameter is supported depends on the actual console.	year=2020,location=sun

6.5.9 From OBS

Table 6-16 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Bucket Name	Name of the bucket from which data will be migrated	BUCKET_2
	File Format	Format used for transmitting data. • **CSV**: Source files will be migrated to tables after being converted to CSV format. • **JSON**: Source files will be migrated to tables after being converted to JSON format. • **ORC**: Source files will be migrated to tables after being converted to ORC format. • **PARQUET**: Source files will be migrated to tables after being converted to PARQUET format. • **Binary**: Files (even not in binary format) will be transferred directly. This mode is applicable to file migration, for example, between OBS.	CSV
	Source Directory/File	Directory or file path from which data will be extracted. You can enter a maximum of 50 file paths. By default, the file paths are separated by vertical bars (|). You can also customize a file separator. For details, see **Migration of a List of Files**.	FROM_DIRECTORY/ or FROM_DIRECTORY/example.csv

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Type	Parameter	Description	Example Value
	Entries Files	This parameter is displayed only when **File Format** is set to **Binary**. If the pull list file function is enabled, the content of a file (such as a .txt file) in an OBS bucket can be read as the list of files to be migrated. The content in the file must be the absolute path of the file to be migrated (rather than a directory). For example, the content is as follows: /052101/DAY20211110.data /052101/DAY20211111.data	Yes
	OBS Link of entries files	This parameter is available only when **Entries Files** is set to **Yes**. You can select the OBS link where the list file is located.	OBS_test_link
	OBS Bucket of entries files	This parameter is available only when **Entries Files** is set to **Yes**. It indicates the name of the OBS bucket where the list file is located.	01
	Path/ Directory of entries files	This parameter is available only when **Entries Files** is set to **Yes**. It indicates the absolute path or directory of the list file in the OBS bucket. You are advised to select the absolute path of the file. If you select a directory, files in subdirectories can also be migrated. However, if the number of files in the directory is too large, the cluster memory may become insufficient.	/0521/ Lists.txt
	JSON Type	This parameter is displayed only when **File Format** is set to **JSON**. Type of a JSON object stored in a JSON file. The options are **JSON object** and **JSON array**.	JSON object
	JSON Reference Node	This parameter is available only when **File Format** is set to **JSON** and **JSON Type** is set to **JSON object**. CDM parses the data under the JSON node. If the node's corresponding data is a JSON array, the system will extract data from the array in the same pattern. Use periods (.) to separate multi-layer nested JSON nodes.	data.list

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Type	Parameter	Description	Example Value
Advanced attributes	Line Separator	Lind feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. This parameter is displayed only when **File Format** is set to **CSV**.	\n
	Use Quote Char	If you set this parameter to **Yes**, the field delimiters in the encircling symbol are regarded as a part of the string value. Currently, the default encircling symbol of CDM is **"**.	No
	Using Escape Char	If you select **Yes**, the backslash (\) in the data row is used as an escape character. If you select **No**, the backslash (\) in the CSV file will not be escaped. CSV supports only the backslash (\) as the escape character.	Yes
	Using RE to separate fields	Whether to use regular expressions to separate fields. If you set this parameter to **Yes**, **Field Delimiter** becomes invalid. This parameter is displayed only when **File Format** is set to **CSV**.	Yes
	Regular Expression	Regular expression used to separate fields. For details about regular expressions, see **Regular Expressions for Separating Semi-structured Text**.	^(\d.*\d) (\w*) \[(.*) \] ([\w\.]*) (\w.*).*
	First N Rows As Header	This parameter is displayed only when **File Format** is set to **CSV**. When you migrate a CSV file to a table, CDM writes all data to the table by default. If you set this parameter to **Yes**, CDM uses the first N rows of the CSV file as the heading row and does not write the row to the destination table.	No
	The Number of Header Rows	This parameter is available when **First N Rows As Header** is set to **Yes**. It specifies the number of header rows to be skipped during data extraction. **NOTE** The number of header rows cannot be empty. The value is an integer from 1 to 99.	1

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Type	Parameter	Description	Example Value
	Extract first row as columns	This parameter is available when **First N Rows As Header** is set to **Yes**. It specifies whether to parse the first row of the header as a column name. The column name is displayed in the source field during field mapping configuration. **NOTE** • If the number of header rows is greater than 1, only the first row of the header can be parsed as the column name. • The column name cannot contain the ampersand (&). Otherwise, the job migration fails. If the column name contains the ampersand (&), you must change it in the CSV file to ensure successful migration.	Yes
	Encode type	Encoding type, for example, **UTF-8** or **GBK**. You can set the encoding type for text files only. This parameter is invalid when **File Format** is set to **Binary**.	GBK
	Compression Format	The options are as follows: • **NONE**: Files in all formats can be transferred. • **GZIP**: Only files in .gzip format can be transferred. • **ZIP**: Only files in .zip format can be transferred. • **TAR.GZ**: Files in TAR.GZ format are transferred.	None
	Compressed File Extension	Extension of the files to be decompressed. The decompression operation is performed only when the file name extension is used in a batch of files. Otherwise, files are transferred in the original format. If you enter ***** or leave the parameter blank, all files are decompressed.	*

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Type	Parameter	Description	Example Value
	Start Job by Marker File	Whether to start a job by a marker file. A job is only started if there is a marker file for starting the job in the source path. If there is no marker file, the job will be suspended for a period of time specified by **Suspension Period**.	No
	File Separator	File separator. If you enter multiple file paths in **Source Directory/Files**, CDM uses the file separator to identify files. The default value is **|**.	|
	Marker File	Name of the marker file for starting a job. If you specify a marker file, the migration job is executed only when the marker file exists in the source path. The marker file will not be migrated.	ok.txt
	Wait Time	Waiting period for a marker file. If you set **Start Job by Marker File** to **Yes** but there is no marker file in the source path, the job fails when the suspension period times out. If you set this parameter to **0** and there is no marker file in the source path, the job will fail immediately. Unit: second	10
	Filter Type	Only paths or files that meet the filtering conditions are transferred. The options are **None**, **Wildcard**, and **Regex**. For details, see **Incremental File Migration**.	Wildcard
	Directory Filter	If you set **Filter Type** to **Wildcard** or **Regex**, enter a wildcard character to filter paths. The paths that meet the filtering condition are migrated. You can configure multiple paths separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*input

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Type	Parameter	Description	Example Value
	File Filter	If you set **Filter Type** to **Wildcard** or **Regex**, you can enter a wildcard character to search for files in a specified path. The files that meet the search criteria are migrated. You can configure multiple files separated by commas (,). **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	*.csv,*.txt
	Time Filter	If you select **Yes**, files are transferred based on their modification time.	Yes
	Minimum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified after the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set using a **DateUtil embedded object**. For example, **#{DateUtil.format(DateUtil.addDays(Job.planTime,-90),"yyyy-MM-dd")}** indicates migrating the files generated within the latest 90 days.	2019-06-01 00:00:00
	Maximum Timestamp	If you set **Filter Type** to **Time Filter**, and specify a point in time for this parameter, only the files modified before the specified time are transferred. The time format must be *yyyy-MM-dd HH:mm:ss*. This parameter can be set using a **DateUtil embedded object**. For example, **#{DateUtil.format(DateUtil.now(),"yyyy-MM-dd HH:mm:ss")}** indicates migrating the files that were modified before the current time.	2019-07-01 00:00:00

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Type	Parameter	Description	Example Value
	Disregard Non-existent Path/File	Whether to proceed when the selected file does not exist in the source path. If you select **Yes**, the job can be successfully executed even if the file does not exist in the source path.	No
	MD5 File Extension	This parameter is displayed only when **File Format** is set to **Binary**. This parameter is used to check whether the files extracted by CDM are consistent with source files. For details, see **MD5 Verification**.	.md5

6.5.10 From SAP HANA

Table 6-17 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	If you have set **Use SQL Statement** to **Yes**, enter an SQL statement. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. Some examples are as follows: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*). **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. Some examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported.	table

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Partition Extraction Column	This parameter is displayed when **Use SQL Statement** is set to **No**, indicating that a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Null for Partition Column	During concurrent extraction, if the partition column does not contain null, set this parameter to **No** to improve performance. If you are not sure whether the partition column contains null, set this parameter to **Yes** to avoid data loss.	Yes

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6.5.11 From Kafka

Table 6-18 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Topic	Topic name. You can add a single topic.	cdm_topic
	Data Format	Format used for parsing data. The options are as follows: • **JSON**: Source data will be migrated after being converted in JSON format. • **CSV**: Source data will be migrated after being converted in CSV format.	JSON
	Consumer Group ID	Consumer group ID If you export data from DMS Kafka, enter any value for Kafka Platinum but a valid consumer group ID for Kafka Basic.	sumer-group
	Consumption Record Policy	Consumption record policy • **Start/End Time**: Check whether the extracted records are within the specified start time and end time based on the Kafka record metadata TIMESTAMP. When the end time of the consumed record arrives, the extraction task is terminated. The start time is included and end time is excluded. It can be used together with scheduling tasks. • **Earliest**: Data is consumed from the start point. • **Latest**: Data is consumed from the last point. **Submitted** indicates that data has been submitted. The start/end time, waiting time, and maximum extraction time are independent of each other. If any of the conditions is met, the Kafka extraction ends.	Start/End Time
	Minimum Timestamp	This parameter is mandatory if the **Consumption Record Policy** is set to **Start/End Time**. The format is yyyy-MM-dd HH:mm:ss. This parameter can be used together with variables in DataArts Factory.	2024-07-25 00:00:00

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Type	Parameter	Description	Example Value
	End Time	This parameter is mandatory if the **Consumption Record Policy** is set to **Start/End Time**. The format is yyyy-MM-dd HH:mm:ss. This parameter can be used together with variables in DataArts Factory.	2024-07-25 23:59:59
	Wait Data Timeout	Time (in minutes) to wait before the task stops when null is returned for a data acquisition request from the consumer	30s
	Pull Data Runtime	Maximum extraction time for the consumer, in minutes It indicates the maximum duration for Kafka to extract data from the consumer end. When the duration ends, the extraction is forcibly terminated. If this parameter is not set, the default value 30 min is used.	1440
	Field Delimiter	Field delimiter during migration. The default value is a space.	,
	Record Delimiter	Currently, the following special characters cannot be used as separators: @||$.	,

6.5.12 From Rest Client

Table 6-19 Parameter description

Parameter	Description	Example Value
Requested Data Address	Address of the requested data	/data/query
Request Method	Request method. The value can be **GET** or **POST**.	GET
Request Body	This parameter is available when **Request Method** is **POST**. The request body is in JSON format.	Yes {"namePrefix": "test"}

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Parameter	Description	Example Value
Records Obtained Each Time	Number of data records obtained each time	1000
Page Size Parameter Name	Name of the page size parameter. By default, this parameter is placed in the query parameter. If the parameter name is set to **page_size**, it can also be obtained using **#page_size**.	page_size
Page Number	Name of the pagination parameter. By default, this parameter is placed in the query parameter. If the parameter name is set to **page_index**, it can also be obtained using **#page_index**.	page_index
Data Path	Location of data in JSON. The default value is the root path. If you do not set this parameter, the default value is used.	student
Data Records	Total number of data records. It can be either of the following: 1. A fixed value, for example, **100000** 2. A value obtained from the result returned by an API, for example, **page.pageCount**. **NOTE** If the API to be called is not a pagination API and the value of this parameter is less than or equal to the data obtained each time, the API will be called only once. Otherwise, the API will be called more than once and may result in repeated.	100000

6.5.13 From DWS

Table 6-20 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Type	Parameter	Description	Example Value

	SQL Statement	If you have set **Use SQL Statement** to **Yes**, enter an SQL statement. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. **NOTE** The parameter value can contain wildcard characters (*), which is used to export all databases whose names start with a certain prefix or end with a certain suffix. Some examples are as follows: • **SCHEMA*** indicates that all databases whose names starting with **SCHEMA** are exported. • ***SCHEMA** indicates that all databases whose names ending with **SCHEMA** are exported. • ***SCHEMA*** indicates that all databases whose names containing **SCHEMA** are exported.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** The table name can contain wildcard characters (*), which is used to export all tables whose names start with a certain prefix or end with a certain suffix. The number and types of fields in the tables must be the same. Some examples are as follows: • **table*** indicates that all tables whose names starting with **table** are exported. • ***table** indicates that all tables whose names ending with **table** are exported. • ***table*** indicates that all tables whose names containing **table** are exported. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. Where clause that specifies the data extraction range. If this parameter is not set, data of the entire table will be extracted. If the table to be migrated does not contain the fields specified by the where clause, the migration will fail. Example: **age > 18 and age <= 60**. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Partition Extraction Column	This field is used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Null for Partition Column	Whether the partition column can contain null values During concurrent extraction, if the partition column does not contain null, set this parameter to **No** to improve performance. If you are not sure whether the partition column contains null, set this parameter to **Yes** to avoid data loss.	Yes

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6.5.14 From FTP/SFTP

Table 6-21 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Source Directory/File	Directory or a single file path to be transferred	FROM_DIRECTORY/ or FROM_DIRECTORY/example.csv
	File Format	Format used for transmitting data. CSV, JSON, and binary formats are supported. The CSV and JSON formats are supported for migration to tables, and the binary format is supported for file migration.	CSV
	JSON Type	This parameter is available when **File Format** is set to **JSON**. Type of a JSON object stored in a JSON file. The options are **JSON object** and **JSON array**.	JSON object
	JSON Reference Node	This parameter is available when **JSON Type** is set to **JSON object**. It indicates the root node that records data. The data recorded is a JSON array. The system extracts data from the array in the same mode. Use periods (.) to separate multi-layer nested JSON nodes.	data.list
Advanced attributes	Use rfc4180 Parser	This parameter is available when **File Format** is set to **CSV**. It specifies whether to use the rfc4180 parser to parse CSV files.	No
	Line Separator	This parameter is available when **File Format** is set to **CSV**. It indicates the line feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**.	\n

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Type	Parameter	Description	Example Value
	Use Quote Char	This parameter is available when **File Format** is set to **CSV**. Quote characters are used to enclose a string value. Field separators in the quote characters are regarded as a part of the string value. Only quotation marks (") can be used as quote characters.	No
	Use Escape Char	This parameter is available when **File Format** is set to **CSV**. CSV supports only the backslash (\) as the escape character. If you select **Yes**, the backslash (\) in the data row is used as an escape character. If you select **No**, the backslash (\) in the CSV file will not be escaped.	Yes
	Using RE to separate fields	This parameter is available when **File Format** is set to **CSV**. It specifies whether to use a regular expression to separate fields.	Yes
	Regular Expression	This parameter is available when **File Format** is set to **CSV** and **Use RE to Separate Fields** is set to **Yes**. It indicates the regular expression used to separate fields.	^(\d.*\d) (\w*) \[(.*) \] ([\w\.]*) (\w.*).*
	File Separator	This parameter is available when **File Format** is set to **CSV** and **Use RE to Separate Fields** is set to **No**. It indicates the field delimiter in the file.	,
	First Row As Header	This parameter is available when **File Format** is set to **CSV**. If you set this parameter, the program reads the first row as the header row when extracting data.	No
	Encode Type	This parameter is available when **File Format** is set to **CSV** or **JSON**. It indicates the file encoding type. The encoding type can be set only for text files. Otherwise, the setting is invalid. Two file encoding types are supported: UTF-8 and GBK.	UTF-8

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Type	Parameter	Description	Example Value
	Compression Format	Compression format Default value: none. The following compression formats are supported: GZIP, ZIP, and TAR.GZ.	GZIP
	Compressed File Extension	This parameter is available when the compression format is GZIP, ZIP, or TAR.GZ. It indicates the extension of the file to be decompressed. The decompression operation is performed only when the file name extension is used in a batch of files. Otherwise, files are transferred in the original format. If you enter ***** or leave this parameter blank, all files will be decompressed.	tar.gz
	File Separator	Character used to separate files	|
	Start Job by Marker File	A job is started only when there is a marker file for starting the job in the source path. Otherwise, the job will be suspended for a period of time.	No
	Marker File	This parameter is available when **Start Job by Marker File** is set to **Yes**. It indicates the name of the marker file for starting a job. If you enter the name of the marker file, the migration job is executed only when the marker file exists in the source path. The marker file will not be migrated.	ok.txt
	Wait Time	This parameter is available when **Start Job by Marker File** is set to **Yes**. It indicates the maximum time for detecting a marker file. If the wait time ends and no marker file is detected, the job fails. If the wait time is set to 0 and there is no marker file in the source path, the job fails immediately. The unit is second.	60

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Type	Parameter	Description	Example Value
	Marker File Type	This parameter is available when **Start Job by Marker File** is set to **Yes**. It indicates the marker file type. • **MARK_DONE**: The migration job is executed only when the marker file exists in the source path. • **MARK_DOING**: The migration job is executed only when the marker file does not exist in the source path.	MARK_DONE
	Filter Type	Type of the file that will be transmitted. The following filter criteria are supported: none, wildcard, and regular expression.	None
	Directory Filter	This parameter is available when **Filter Type** is set to **Wildcard** or **Regular expression**. It filters one or multiple levels of directories in the input path.	• **input*/test*** for a wildcard • **intput.*/test.*** for a regular expression.
	File Filter	This parameter is available when **Filter Type** is set to **Wildcard** or **Regular expression**. It filters files in the input path.	• ***csv** for a wildcard • **.*\.csv** for a regular expression
	Time Filter	Filters files that meet a specified time range. • Files modified after the start time or before the end time will be transferred. • If both the start time and end time are specified, files modified within this time range will be transferred.	No
	Minimum Timestamp	This parameter is available only when **Time Filter** is set to **Yes**. Files modified after the specified time will be transferred. The specified time must be earlier than the current timestamp and cannot be later than the end time. The time is in *yyyy-MM-dd HH:mm:ss* format.	2018-01-01 00:00:00

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Type	Parameter	Description	Example Value
	Maximum Timestamp	This parameter is available only when **Time Filter** is set to **Yes**. Files modified before the specified time will be transferred. The specified time must be earlier than the current timestamp but cannot be earlier than the start time. The time is in *yyyy-MM-dd HH:mm:ss* format.	2018-01-01 00:00:00
	Disregard Non-existent Path or File	Whether to proceed when the selected file does not exist in the source path. If you select **Yes**, the job can be successfully executed even if the file does not exist in the source path.	No
	Whether to Skip Empty Lines	This parameter is available when **File Format** is set to **CSV**. It specifies whether to skip an empty line.	No
	Null Value	This parameter is available when **File Format** is set to **CSV**. No string can be used to define a null value in text files. This parameter specifies the string to be identified as a null value. If this parameter is set to null and the value of a column in a row is null, the value will be parsed as null.	N/A
	MD5 File Extension	This parameter is available when **File Format** is set to **Binary**. Check whether the files extracted by CDM are consistent with source files.	.md5

6.5.15 From Doris

Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

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Type	Parameter	Description	Example Value

	SQL Statement	If you have set **Use SQL Statement** to **Yes**, enter an SQL statement. CDM exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_E

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Type	Parameter	Description	Example Value
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'
	Partition Extraction Column	This field is used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, REAL, FLOAT, DOUBLE, NUMERIC, DECIMAL, BIT, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id
	Null in Partition Column	Whether the partition field can contain null values. This parameter is displayed when **Extract by Partition** is set to **No**.	Yes

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6.5.16 From HBase

Table 6-22 Parameter description

Type	Parameter	Description	Mandatory	Example Value
Basic parameters	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	Yes	table
	Migrate Entire Table	This parameter is displayed when the source and destination links are both HBase links. All information about the table is transferred in binary mode. Entire HBase table migration transfers the timestamp information, and non-entire HBase table migration only transfers column values.	Yes	No
	Column Family	Column family from which data is exported, for example, **CF1&CF2**	Yes	CF1&CF2
Advanced attributes	Split Rowkey	Whether to write rowkey data to the HBase column at the same time. The default value is **No**.	No	No
	Rowkey Delimiter	This parameter is displayed when **Split Rowkey** is set to **Yes**. The delimiter is used to split rowkeys. If this parameter is not set, rowkeys are not split. An example delimiter is **|**.	No	|

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Type	Parameter	Description	Mandatory	Example Value
	Start Time	Start time (included). The format is *yyyy-MM-dd hh:mm:ss*. The dateformat time macro variable function is supported. Examples: **2017-12-31 20:00:00**, **${dateformat(yyyy-MM-dd, -1, DAY)} 02:00:00**, and **${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}**	No	**2017-12-31 20:00:00**, **${dateformat(yyyy-MM-dd, -1, DAY)} 02:00:00**, and **${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}**
	End Time	End time (excluded) The format is *yyyy-MM-dd hh:mm:ss*. The dateformat time macro variable function is supported. Examples: **2018-01-01 20:00:00**, **${dateformat(yyyy-MM-dd, -1, DAY)} 02:00:00**, and **${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}**	No	**2018-01-01 20:00:00**, **${dateformat(yyyy-MM-dd, -1, DAY)} 02:00:00**, and **${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}**
	Start RowKey	Start RowKey	No	0001
	End RowKey	End RowKey	No	0100

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6.5.17 From ClickHouse

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_E
	Table Name	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	DS='${dateformat(yyyy-MM-dd,-1,DAY)}'

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6.5.18 From Elasticsearch

Table 6-23 Parameter description

Type	Parameter	Description	Mandatory	Example Value
Basic parameters	Index	It is similar to the schema or name of a relational database. Multiple indexes for entire DB migration are separated by commas (,). You can enter index aliases. You can also enter an expression containing wildcard characters, for example, asterisks (*). If you select multiple indexes, their structure must be the same. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	Yes	index_sample
	Type	It is similar to the schema or name of a relational database. Multiple indexes for entire DB migration are separated by commas (,). You can enter index aliases. You can also enter an expression containing wildcard characters, for example, asterisks (*). If you select multiple indexes, their structure must be the same.	Yes	type_example
Advanced attributes	Split Nested Field	Whether to split the JSON content of nested fields, for example, splitting **a:{ b:{ c:1, d:{ e:2, f:3 } } }** into **[a.b.c]**, **[a.b.d.e]**, and **[a.b.d.f]**.	No	Yes

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Type	Parameter	Description	Mandatory	Example Value
	Filter Conditions	Condition used to filter source data. The q syntax of Elasticsearch is used.	No	last_name: Smith
	Meta-field Extraction	Whether to extract meta-fields from the index. Currently, only _index, _type, _id, and _score are supported. Examples: **_index**, **_type**, **_id**, and **_score**	No	_index
	Page Size	Number of records displayed on each page	No	1000
	ScrollId Time Out	ScrollId timeout duration, which is five minutes by default.	No	5
	Retries	Number of retries upon a request failure. The maximum number of retries is 10.	No	3

6.5.19 From MongoDB

NOTE

MongoDB data sources with SSL enabled are not supported.

Table 6-24 Parameter description

Type	Parameter	Description	Mandatory	Example Value
Basic parameters	Database	Enter or select a database name. Click the button next to the text box to enter the page for selecting a set.	Yes	default

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Type	Parameter	Description	Mandatory	Example Value
	Collection Name	Enter or select a collection name. Click the button next to the text box to enter the page for selecting a collection. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	Yes	table
Advanced attributes	query filters	Filter used to match documents Example: **{HTTPStatusCode:{$gt:"400",$lt:"500"},HTTPMethod:"GET"}**	No	{HTTPStatusCode:{$gt:"400",$lt:"500"},HTTPMethod:"GET"}

6.5.20 From RestApi

Table 6-25 Parameter description

Type	Parameter	Description	Mandatory	Example Value
Basic parameters	Requested Data Path	Path of the requested data	Yes	/api/getUsers
	Request Method	Request method. The value can be **GET** or **POST**.	Yes	GET

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Type	Parameter	Description	Mandatory	Example Value
	Request Body	This parameter is available when **Request Method** is **POST**. The request body is in JSON format.	Yes	{"namePrefix":"test"}
	Records Obtained Each Time	Number of data records obtained each time	Yes	1000
	Page Size	Page size • By default, this parameter is placed in query parameters. The value of this parameter is the number of records obtained each time. • If body parameters include this parameter, its value will be replaced by the number of records pulled each time.	Yes	pageSize
	Page Number	Page number • By default, this parameter is placed in query parameters. The value of this parameter is the page number. • If this parameter is included in body parameters, its value will be replaced with the page number.	Yes	pageNumber
	Data Path	Location of data in the response JSON body. The default value is the root path.	No	data.students
	Data Records	Total number of data records. The value can be a fixed value or obtained using an API. the interface. The value can also be a SpEL expression. • Fixed value • Obtain using an API: **data.pageCount** **NOTE** If you want to call a non-pagination API only once, set the value of this parameter to less than or equal to the number of data records obtained each time.	Yes	Recommended fixed value: 1,000

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6.5.21 From GBase

Table 6-26 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Use SQL Statement	Whether you can use SQL statements to export data from a relational database	No

	SQL Statement	If you have set **Use SQL Statement** to **Yes**, enter an SQL statement. The job exports data based on the SQL statement.
		NOTE
		• SQL statements can only be used to query data. Join and nesting are supported, but multiple query statements are not allowed, for example, **select * from table a; select * from table b**.
		• With statements are not supported.
		• Comments, such as **--** and **/***, are not supported.
		• Addition, deletion, and modification operations are not supported, including but not limited to the following:
		  • load data
		  • delete from
		  • alter table
		  • create table
		  • drop table
		  • into outfile
		• If the SQL statement is too long, the request fails to be delivered. If you continue to create a job, the system displays an error message indicating that the request is incorrect. In this case, you need to simplify or clear the SQL statement and try again.
			select id,name from sqoop.user;

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Type	Parameter	Description	Example Value
	Schema/ Table Space	Name of the schema or tablespace from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting a schema or directly enter a schema or tablespace. If the desired schema or tablespace is not displayed, check whether the login account has the permissions required to query metadata. This parameter can be set to a regular expression to export all databases that meet the rule.	SCHEMA_EXAMPLE
	Table	Name of the table from which data will be extracted. This parameter is displayed when **Use SQL Statement** is set to **No**. Click the icon next to the text box to go to the page for selecting the table or directly enter a table name. If the desired table is not displayed, check whether the table exists or whether the login account has the permission to query metadata. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. This parameter can be set to a regular expression to export all databases that meet the rule. For example, if **Table Name** is set to *user_[0-9]{1,2}*, tables from **user_0** to **user_9** and from **user_00** to **user_99** are matched. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TABLE_EXAMPLE

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Type	Parameter	Description	Example Value
Advanced attributes	Where Clause	Where clause used to specify the data extraction range. This parameter is displayed when **Use SQL Statement** is set to **No**. If this parameter is not set, the entire table is extracted. If the table to be migrated does not contain the fields specified by the where clause, the migration will fail. You can set a date macro variable to extract data generated on a specific date. For details, see **Incremental Migration of Relational Databases**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	age > 18 and age <= 60
	Retain One Decimal Place for Date Values	Whether to retain one decimal place for date values This parameter is displayed when the destination is Hudi or Hive.	No
	Partition Extraction Column	This parameter is displayed when **Extract by Partition** is set to **No**, indicating a field used to split data during data extraction. CDM splits a job into multiple tasks based on this field and executes the tasks concurrently. Fields with data distributed evenly are used, such as the sequential number field. Click the icon next to the text box to go to the page for selecting a field or directly enter a field. **NOTE** The following types of partition columns are supported: TINYINT, SMALLINT, INTEGER, BIGINT, FLOAT, DOUBLE, NUMERIC, DECIMAL, BOOLEAN, DATE, TIME, and TIMESTAMP. It is recommended that the partition column have an index.	id

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Type	Parameter	Description	Example Value
	Null in Partition Column	Whether the partition field can contain null values. This parameter is displayed when **Extract by Partition** is set to **No**. During concurrent extraction, if the partition column does not contain null, set this parameter to **No** to improve performance. If you are not sure whether the partition column contains null, set this parameter to **Yes** to avoid data loss.	Yes

6.5.22 From Redis

Table 6-27 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Redis Key Prefix	Corresponding to the table name of a relational database	TABLENAME
	Value Storage Type	The storage type can be STRING or HASH.	STRING
Advanced attributes	Key Delimiter	Used to separate table names and column names of a relational database	_
	Value Delimiter	Used to separate columns when the storage type is string. It is the character used to split a string into arrays when the storage type is list.	;
	Same Field	Whether duplicate fields are allowed in a hash key. This parameter is displayed when **Value Storage Type** is set to **HASH**.	No

6.5.23 From LTS

Table 6-28 Parameter description

Parameter	Description	Example Value
Source Link Name	Table name of a relational database	TABLENAME

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Parameter	Description	Example Value
Records Queried at a Time	Number of data records obtained from the LTS service at a time	128
Log Group	Log group, which is the basic unit for LTS to manage logs	_
Log Stream	Log stream, which is the basic unit for log read and write	N/A
Data Consumption Start Time	Start time of data consumption, that is, the time when log data reaches LogHub (LTS). Data is consumed at the start time.	20240701235959
Data Consumption End Time	End time of data consumption. Data is not consumed at the end time.	20240702235959

6.6 Configuring Destination Job Parameters

6.6.1 To PostgreSQL

You can configure the OpenGauss data source parameters by referring to this section.

Table 6-29 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema

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Type	Parameter	Description	Example Value
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **Where Clause** to specify which part will be deleted.	Clear part of data
	Where Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60

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Type	Parameter	Description	Example Value
Advanced attributes	Import Data to Phase Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** This parameter is unavailable if **Constraint Conflict Handling** is set to **replace into** or **on duplicate key update**.	1

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6.6.2 To Oracle

Table 6-30 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data
	Where Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60

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Type	Parameter	Description	Example Value
Advanced attributes	Import Data to Phase Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** This parameter is unavailable if **Constraint Conflict Handling** is set to **replace into** or **on duplicate key update**.	1

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6.6.3 To MySQL

Table 6-31 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data

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Type	Parameter	Description	Example Value
	Constraint Conflict Handling	How to handle data conflicts when data is being imported to RDS for MySQL • **insert into**: When a primary key or unique index conflict occurs, data cannot be written and will become dirty data. • **replace into**: When a primary key or unique index conflict occurs, the original row is deleted and a new row is inserted to replace all the fields in the original row. • **on duplicate key update**: When a primary key or unique index conflict occurs in a row in the destination table, the data columns except the unique constraint column in this row are updated.	insert into
	Where Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60
Advanced attributes	Import Data to Phase Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** This parameter is unavailable if **Constraint Conflict Handling** is set to **replace into** or **on duplicate key update**.	1

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Type	Parameter	Description	Example Value
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into

6.6.4 To SQLServer

Table 6-32 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table

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Type	Parameter	Description	Example Value
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **Where Clause** to specify which part will be deleted.	Clear part of data
	Where Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60
Advanced attributes	Import Data to Phase Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table

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Type	Parameter	Description	Example Value
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** This parameter is unavailable if **Constraint Conflict Handling** is set to **replace into** or **on duplicate key update**.	1

6.6.5 To Hudi

Table 6-33 Parameter description

Type	Parameter	Description	Recommended Configuration
Basic parameters	Database Name	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	dbadmin

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Type	Parameter	Description	Recommended Configuration
	Table Name	Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	cdm
	Table Preparation Mode	Whether to automatically create Hudi tables • **One-click creation**: The destination table is automatically created. • **Auto creation**: If the destination database does not contain the table specified by **Table Name**, CDM will automatically create the table. If the table specified by **Table Name** already exists, no table is created and data is written to the existing table.	Auto creation

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Type	Parameter	Description	Recommended Configuration
	Writing Mode	Data write mode • **TRUNCATE+LOAD**: The TRUNCATE statement is executed to clear data in partitions before new data is written. • **LOAD**: No operation is performed before data is written. • **INSERT_OVERWRITE**: Data is overwritten.	LOAD
	Partition	Partition information. To write data to a partitioned table, you can select the partitions to write data to. Example: year=2020,location=sun.	N/A
Advanced attributes	DB Write Time Field	When a table is automatically created, this field is automatically added to the table creation statement. When the data is written to the Hudi table, the value of this field is the current time. The field must be of the timestamp type.	N/A
	Write Parameters	Parameter configured using the set syntax to control the insertion of data into Hudi through a Spark SQL statement	hoodie.combine.before.upsert

6.6.6 To Hive

Data can be rapidly imported to MRS Hive.

Table 6-34 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Database	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	default

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Type	Parameter	Description	Example Value
	Table Name	Destination table name. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TBL_X
	Hive Write Mode	Mode of writing data to Hive • **TRUNCATE+LOAD**: Data files in partitions are cleared, but partitions are not deleted. • **LOAD**: No operation is performed before data is written. • **LOAD_OVERWRITE**: A temporary directory named *Table name*_**UUID** is generated. The load overwrite syntax of Hive is used to load the temporary directory into the Hive table.	LOAD_OVERWRITE
	Partition Values	In **TRUNCATE** mode, multiple partitions are supported. You only need to enter values in the corresponding text boxes. In **LOAD_OVERWRITE** mode, data can be written to only one partition.	N/A
Advanced attributes	Source side null value conversion value	Null value conversion type • **TO_NULL**: The null value is not processed. • **TO_EMPTY_STRRING**: converts the null value to an empty string. • **TO_NULL_STRING**: converts the null value to a "null" string.	TO_NULL
	Newline character processing mode	Policy for processing the newline characters in the data written to Hive textfile tables. You can select **Delete**, **Replace with another character string**, or **Do not process**.	Delete

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Type	Parameter	Description	Example Value
	Newline Replacement String	This parameter is available when **Processing mode of newline characters** is set to **Replace with another character string**. It indicates the string that will replace newline characters.	N/A
	Executing Analyze Statements	After all data is written, the ANALYZE TABLE statement is asynchronously executed to accelerate the Hive table query. The SQL statement is as follows: • Non-partitioned table: **ANALYZE TABLE tablename COMPUTE STATISTICS** • Partitioned table: **ANALYZE TABLE tablename PARTITION(partcol1[=val1], partcol2[=val2], ...) COMPUTE STATISTICS** **NOTE** • Parameter **Executing Analyze Statements** applies only to the migration of a single table. • Running the ANALYZE statement may exert pressure on Hive.	Yes

6.6.7 To DLI

Table 6-35 Parameter description

Parameter	Description	Example Value
Resource Queue	Resource queue to which the destination table belongs The default queue of DLI cannot be used for migration jobs. You need to create a SQL queue in DLI.	cdm
Database Name	Name of the database to which data will be written	dli
Table Name	Name of the table to which data will be written	car_detail

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Parameter	Description	Example Value
Import Mode	Import mode • **TRUNCATE**: The task is executed before the import. • **TRUNCATE**: DLI table partitions are cleared. • **INSERT_OVERWRITE**: Data is written in partition overwriting mode.	INSERT_OVERWRITE
Convert empty strings to null	If this parameter is set to **Yes**, an empty string is regarded as null.	No
Table Preparation Mode	**One-click creation**: During job configuration, one-click table creation is performed. After a table is generated, the job can be configured.	One-click creation
Partition	Partition information. Enter the partition value in the text box corresponding to the partition field.	year=2020,location=sun

6.6.8 To Elasticsearch

Table 6-36 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Index	Elasticsearch index, which is similar to the name of a relational database.CDM supports automatic creation of indexes and field types. The index and field type names can contain only lowercase letters.	index
	Type	Elasticsearch type, which is similar to the table name of a relational database. The type name can contain only lowercase letters. **NOTE** Elasticsearch 7.x and later versions do not support custom types. Instead, only the **_doc** type can be used. In this case, this parameter does not take effect even if it is set.	type

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Type	Parameter	Description	Example Value
	Operation	Operation type • **INDEX**: No primary key is required. Elasticsearch generates IDs so that data is written to a new file with a unique ID for each write operation. • **CREATE**: A primary key needs to be specified. If the primary key already exists, the write operation fails. • **UPDATE**: A primary key needs to be specified. If the primary key already exists, the original data is overwritten. • **UPSERT**: A primary key needs to be specified. If the primary key already exists, the operation is the same as that of **UPDATE**. If no primary key exists, data is written to a new document.	UPSERT
	Primary Key Mode	This parameter is available when **Operator** is **UPSERT**, **UPDATE**, or **CREATE**. • **Single primary key**: Select a primary key and write its value to the ID. • **Composite primary key**: Select multiple primary keys and write their values to the ID using primary key delimiters. • **No primary key**: This value is available only when **Operator** is set to **CREATE**. You do not need to specify a primary key. The destination automatically generates an ID as the primary key.	Single primary key
	Clear Data Before Import	Whether to delete data when the current task already exists in the index. • **Yes**: Data in the index needs to be deleted. • **No**: Existing data is retained before new data is written.	No
	Primary Key Delimiter	This parameter is available when **Primary Key Mode** is **Composite primary key**. It separates the primary keys to be written to the ID.	_
Advanced attributes	Pipeline ID	This parameter is available only after a pipeline ID is created in Kibana. It is used to convert the data format using the data transformation pipeline of Elasticsearch after data is transferred to Elasticsearch.	pipeline_id

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Type	Parameter	Description	Example Value
	Write ES with Routing	If you enable this function, a column can be written to Elasticsearch as a route. **NOTE** Before enabling this function, create indexes at the destination to improve the query efficiency.	No
	Routing Column	This parameter is available when **Write ES with Routing** is set to **Yes**. It specifies the destination routing column. If the destination index exists but the column information cannot be obtained, you can manually enter the column. The routing column can be empty. If it is empty, no routing value is specified for the data written to Elasticsearch.	value1
	Periodically Create Index	For streaming jobs that continuously write data to Elasticsearch, CDM periodically creates indexes and writes data to the indexes, which helps you delete expired data. The indexes can be created based on the following periods: ● **Every hour**: CDM creates indexes on the hour. The new indexes are named in the format of *Index name+Year+Month+Day+Hour*, for example, **index2018121709**. ● **Every day**: CDM creates indexes at 00:00 every day. The new indexes are named in the format of *Index name+Year+Month+Day*, for example, **index20181217**. ● **Every week**: CDM creates indexes at 00:00 every Monday. The new indexes are named in the format of *Index name+Year+Week*, for example, **index201842**. ● **Every month**: CDM creates indexes at 00:00 on the first day of each month. The new indexes are named in the format of *Index name+Year+Month*, for example, **index201812**. ● **Do not create**: Do not create indexes periodically. When extracting data from a file, you must configure a single extractor, which means setting **Concurrent Extractors** to **1**. Otherwise, this parameter is invalid.	Every hour
	Commits	Size of data to be submitted at a time	10000
	Retries	Number of retries upon a request failure. A maximum of 10 retries are allowed.	3

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6.6.9 To DWS

Table 6-37 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace. This parameter is unavailable for entire DB migration.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter is unavailable for entire DB migration. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Import Mode	Mode for importing data to GaussDB(DWS) • **COPY**: The source data is copied to the DataNode of DWS after passing through the management node. • **UPSERT**: If a primary key or unique constraint conflict occurs, other data columns, except the primary key and unique constraint column, are updated. • **COPY_UPSERT**: The high-performance batch import tool of GaussDB(DWS) is used.	COPY

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Type	Parameter	Description	Example Value
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data
	Where Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60
Advanced attributes This parameter is unavailable for entire DB migration.	Import Data to Phase Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table

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Type	Parameter	Description	Example Value
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** Conflict handling policies do not support "replace into" or "on duplicate key update".	1

6.6.10 To OBS

Files (even in a large volume) can be batch migrated to OBS in CSV, CarbonData, or binary format.

Table 6-38 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Bucket Name	Name of the OBS bucket to which data is to be written	bucket_2
	Write Directory	OBS directory to which data will be written. Do not add **/** in front of the directory name. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	directory/

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Type	Parameter	Description	Example Value
	File Format	Format used for transmitting data. The CSV and JSON formats are supported for migration to tables, and the binary format is supported for file migration. Format in which data is written. The options are as follows: ● **CSV**: Data is written in CSV format, which is used for migrating data tables to files. ● **Parquet**: Data is written in Parquet format, which is used for migrating data tables to files. ● **ORC**: Data is written in ORC format, which is used for migrating data tables to files. ● **Binary**: Files will be transferred directly. CDM writes the files without changing their format. This setting is suitable for file migration. If data is migrated between file-related data sources, such as FTP, SFTP, HDFS, and OBS, the value of **File Format** must the same as the source file format. **NOTE** ● The format can only be CSV when the source link is an MRS Hive link. ● If the source is an FTP/SFTP server, only the binary format is supported.	CSV

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Type	Parameter	Description	Example Value
	Duplicate File Processing Method	This parameter is unavailable when **File Format** is **CSV**. • In binary and CSV file migration scenarios, files with the same name and size are duplicate files. – **REPLACE**: Replace duplicate files. – **SKIP**: Skip duplicate files. – **ABANDON**: Stop the task. • In the Parquet and ORC structured integration scenarios, files with the same prefix in their custom names are duplicate files. – **REPLACE**: Delete all files with the same custom file name prefix as the file to be written. For example, if the custom file name is **abc**, all files whose names start with **abc** will be deleted. – **APPEND**: No processing is performed before the file is written. – **ABANDON**: If a file with the same custom name prefix as the file to be written, an error is reported.	REPLACE
Advanced attributes	Field Delimiter	Field delimiter in the file. This parameter is not used when **File Format** is set to **Binary**.	,
	File Size	This parameter is displayed only when the migration source is a database. Files are partitioned as multiple files by size so that they can be exported in proper size. The unit is MB.	1024
	Encode type	Encoding type, for example, **UTF-8** or **GBK**. This parameter is not used when **File Format** is set to **Binary**.	GBK
	First Row As Header	This parameter is displayed only when data is exported from a relational database to OBS and **File Format** is set to **CSV**. When a table is migrated to a CSV file, CDM does not migrate the heading line of the table by default. If you set this parameter to **Yes**, CDM writes the heading line of the table to the file.	No

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Type	Parameter	Description	Example Value
	Validate MD5 Value	Calculate the MD5 value of the source files and verify it with the MD5 value returned by OBS. This parameter is displayed only when **File Format** is set to **Binary**. If an MD5 file exists at the migration source, the system directly reads the MD5 file from the source and verifies it with the MD5 value returned by OBS.	No
	Record MD5 Verification Result	This parameter is displayed only when **File Format** is set to **Binary**. It specifies whether to write the MD5 verification result to OBS and record the verification result of each file.	No
	Job Success Marker File	Whether to generate a marker file with a custom name in the destination directory after a job is executed successfully. If you do not specify a file name, this function is disabled by default.	finish.txt
	Use Quote Char	This parameter is displayed only when **File Format** is **CSV**. It is used for migrating database tables to file systems. If you set this parameter to **Yes** and a field in the source data table contains a field delimiter or line separator, CDM uses double quotation marks (") as the quote character to quote the field content as a whole to prevent a field delimiter from dividing a field into two fields, or a line separator from dividing a field into different lines. For example, if the **hello,world** field in the database is quoted, it will be exported to the CSV file as a whole.	No
	Customize Hierarchical Directory	If this parameter is set to **Yes**, the files after migration can be stored in a custom directory. That is, only files are migrated. The directories to which the files belong are not migrated.	Yes

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Type	Parameter	Description	Example Value
	Hierarchical Directory	Custom storage directory for files after migration. The time macro variable is supported. **NOTE** If the source link is a relational database link, the directory name consists of the source table name and a custom directory name. In other scenarios, the directory is a custom directory.	${dateformat(yyyy-MM-dd HH:mm:ss, -1, DAY)}
	Compression Format	This parameter is unavailable when **File Format** is **CSV**. The options are as follows: • **NONE**: Files in all formats can be transferred. • **GZIP**: Only files in .gzip format can be transferred.	NONE
	Encryption	Whether to encrypt the uploaded data and the encryption mode. The options are as follows: • **NONE**: Data is written without encryption. • **KMS**: KMS in Data Encryption Workshop (DEW) is used for encryption. If KMS encryption is enabled, MD5 verification for data cannot be performed. For details, see **Encryption and Decryption During File Migration**.	KMS
	KMS ID	Data encryption key. This parameter is displayed when **Encryption** is set to **KMS**. Click next to the text box to select the KMS key that was created in DEW. • If the KMS key of the same project as that of the CDM cluster is used, you do not need to modify **Project ID**. • If the KMS key of another project is used, you need to modify **Project ID**.	53440ccb-3e73-4700-98b5-71ff5476e621

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Type	Parameter	Description	Example Value
	Project ID	ID of the project to which KMS ID belongs. The default value is the ID of the project to which the current CDM cluster belongs. ● If KMS and the CDM cluster are in the same project, retain the default value of **Project ID**. ● If KMS of another project is used, set this parameter to the ID of the project to which KMS belongs.	9bd7c4bd54e5417198f9591bef07ae67
	Copy Content-Type	This parameter is displayed only when **File Format** is set to **Binary**. Whether to copy the Content-Type attribute of the source file during object upload. This attribute is mainly used for static website migration. It cannot be written to the Archive bucket.	No

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Type	Parameter	Description	Example Value
	Custom File Name	This parameter is displayed only when data is exported from a relational database to OBS and **File Format** is set to **CSV**. This parameter specifies the name of the file generated by OBS. The options are as follows: • String: Special characters are allowed. For example, if this parameter is set to **cdm#**, the name of the generated file is **cdm#.csv**. • Macro variable of time: If this parameter is set to **${timestamp()}**, the name of the generated file is **1554108737.csv**. • Macro variable of table name: If this parameter is set to **${tableName}**, the name of the generated file is the source table name **sqltabname.csv**. • Macro variable of version number: If this parameter is set to **${version}**, the name of the generated file is the cluster version number **2.9.2.200.csv**. • Any combination of the character string and macro variable (macro variable of time, table name, or version number). For example, if this parameter is set to **cdm#${timestamp()}_${version}**, the name of the generated file is **cdm#1554108737_2.9.2.200.csv**.	cdm
	Blob	This parameter is available only when data is exported from a relational database to OBS. If this function is enabled, generated files are named in the following format: *Root directory-Table name-Data type-Data folder format*. Example: **raw_schema/tbl_student/datas/tbl_student_1.csv**	No
	Blog File Name Extension	This parameter is available only when **Folder Mode** is set to **Yes**. It specifies the extension for the names of the files that contain custom Blob/Clog data in folder mode.	.dat/.jpg/.png

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6.6.11 To SAP HANA

Table 6-39 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **Where Clause** to specify which part will be deleted.	Clear part of data
	WHERE Clause	This parameter is displayed when **Clear Data Before Import** is set to **Clear part of data**. It specifies the data to be deleted from the destination table before data import.	age > 18 and age <= 60

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Type	Parameter	Description	Example Value
	Insert Mode	• **INSERT**: inserts one or more rows of data into a table. • **UPSERT**: updates exiting data or adds data.	INSERT
Advanced attributes	Import Data to Phase Table	If you set this parameter to **Yes**, the transaction mode is enabled. CDM automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that CDM directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. **NOTE** This parameter is unavailable if **Constraint Conflict Handling** is set to **replace into** or **on duplicate key update**.	1

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6.6.12 To ClickHouse

Table 6-40 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
Advanced attributes	Batch Size	Number of rows to be written in a batch. (100 batches of data are submitted in a transaction.)	10000
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into

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6.6.13 To Doris

Table 6-41 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	schema
	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **WHERE Clause** to specify which part will be deleted.	Clear part of data
	Where Clause	This parameter is displayed when **Clear Data Before Import** is set to **Clear part of data**. It specifies the data to be deleted from the destination table before data import.	age > 18 and age <= 60

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Type	Parameter	Description	Example Value
Advanced attributes	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into
	Number of Loader Threads	Number of threads started in each loader. A larger number allows more concurrent write operations. Conflict handling policies do not support "replace into" or "on duplicate key update".	1
	Stream Load Configuration Parameters	Stream load configuration parameters	max_filter_ratio=0

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6.6.14 To HBase

Table 6-42 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Table Name	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
	Clear Data Before Import	Whether to clear table data before import **Yes**: Table data will be cleared before import. **No**: Table data will not be cleared before import.	No
Advanced attributes	Rowkey Data Redundancy	Whether to write rowkey data to the HBase column at the same time	No
	Write WAL	Whether to write WALs. If this is disabled, performance can be improved, but data may be lost when HBase breaks down.	Yes
	Type Match	Whether to match the data type, for example, whether column data of the int type in the database will be converted into binary data before written to HBase.	No

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6.6.15 To MongoDB

Table 6-43 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Database	Database name. Click the icon next to the text box. The dialog box for selecting the database is displayed.	default
	Collection Name	Name of the collection to which data will be written. Click the icon next to the text box to enter the page for selecting a collection. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	table
Advanced attributes	Behavior	Mode for writing data to the destination. • **Insert**: Insert file records into a specified set. • **Upsert**: Use a specified filter key as the query condition. If a record already exists in the set, the record is replaced. Otherwise, the new record will be added. • **Replace**: Use a specified filter key as the query condition. If a record already exists in the set, the record is replaced. Otherwise, the new record will not be added.	Insert
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed.	create table

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6.6.16 To MRS Kafka

Table 6-44 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Topic	Topic database name	default
	Data Format	Format of the data written to the database **CSV**: Columns are concatenated based on field separators. **JSON**: All columns are concatenated into a JSON string based on specified field names.	JSON
	Field Delimiter	This parameter is available when **Data Format** is set to **CSV**. Field delimiter between data written to the destination. The default value is a space.	,
	keyIndex	This parameter is available when **Data Format** is set to **CSV**. Key column in Kafka Writer. After this parameter is set, this column is not recorded in the value. For example, if the subscripts of a field column are 0, 1, and 2, and the value of **keyIndex** is **0**, the values of **valueIndex** are **1** and **2**. The subscript of **keyIndex** must be a positive integer starting from 0. Otherwise, an error is reported during task execution.	N/A

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Type	Parameter	Description	Example Value
	Additional Configuration	This parameter is available when **Data Format** is set to **JSON**. This parameter specifies different types of formats of the data to be written and configuration parameters. To use this function, you must set the **configType** parameter to **COMBINE_DATA** first. When **configType** is set to **COMBINE_DATA**, the following parameters are supported: • **batchnum**: combines multiple pieces of data into one. The default value is **1**. • **featureTag**: adds a tag to each piece of data. • **startEndMark**: The default value is **false**. If this parameter is set to **true**, a start message and an end message are synchronized before a message is written. • **columnAsKey**: key value of the data to be written. You can also specify a field value as the key by configuring **@{column1}--@{column2}**. For example, if the destination fields are **id** and **name**, set this parameter to **@{id}--@{name}**. • **schema**: This parameter is displayed in the message body of the written data. If this parameter is set, the configured value is displayed. If this parameter is not set, the schema value of the source table is used by default. • **table**: This parameter is displayed in the message body of the written data. If this parameter is set, the configured value is displayed. If this parameter is not set, the name of the source table is used by default. • **acks**: The value can be **0**, **1**, or **all**. • **jobId**: The default value is **0**. If this parameter is set, its value is generated in the message.	For example, to tag data, you need to set **configType** to **COMBINE_DATA** and **featureTag** to **group**.

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6.6.17 To GBase

Table 6-45 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Schema/ Table Space	Name of the database to which data will be written. The schema can be automatically created. Click the icon next to the text box to select a schema or tablespace.	SCHEMA_EXAMPLE
	Table	Name of the table to which data will be written. Click the icon next to the text box. The dialog box for selecting the table is displayed. This parameter can be configured as a macro variable of date and time and a path name can contain multiple macro variables. When the macro variable of date and time works with a scheduled job, the incremental data can be synchronized periodically. For details, see **Incremental Synchronization Using the Macro Variables of Date and Time**. **NOTE** If you have configured a macro variable of date and time and schedule a CDM job through DataArts Studio DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).	TABLE_EXAMPLE
	Clear Data Before Import	Whether to clear the data in the destination table before data import. The options are as follows: • **Do not clear**: The data in the destination table is not cleared before data import. The imported data is just added to the table. • **Clear all data**: All data is cleared from the destination table before data import. • **Clear part of data**: Part of the data in the destination table is cleared before data import. If you select **Clear part of data**, you must configure **Where Clause** to specify which part will be deleted.	Clear part of data
	Where Clause	If **Clear Data Before Import** is set to **Clear part of data**, data in the destination table will be deleted based on the WHERE clause after the configuration is complete and before the import starts.	age > 18 and age <= 60

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Type	Parameter	Description	Example Value
Advanced attributes	Import Data to Phase Table	Whether to write data to the phase table before writing data to the destination table. Data written to the phase table can be imported to the destination table. This prevents some residual data in the destination table if the import fails. If you set this parameter to **Yes**, the transaction mode is enabled. The job automatically creates a temporary table and imports data to the temporary table. After the data is imported successfully, it is migrated to the destination table in transaction mode. If the import fails, the destination table is rolled back to the state before the job starts. For details, see **Migration in Transaction Mode**. The default value is **No**, indicating that the job directly imports the data to the destination table. In this case, if the job fails to be executed, the data that has been imported to the destination table will not be rolled back automatically. **NOTE** If you select **Clear part of data** or **Clear all data** for **Clear Data Before Import**, CDM does not roll back the deleted data in transaction mode.	No
	Pre-import SQL Statement	The SQL statement that is first executed before a task is executed. Currently, only one SQL statement can be executed in wizard mode.	create temp table
	Post-import SQL Statement	The SQL statement that is executed after a task is executed. Currently, only one SQL statement can be executed.	merge into

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6.6.18 To Redis

Table 6-46 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Redis Key Prefix	Corresponding to the table name of a relational database	TABLENAME
	Value Storage Type	The value can be **STRING**, **hash**, **list**, **set**, or **zset**.	STRING
	Delete Same Key Before Writing	Whether to delete the same key before writing	No
Advanced attributes	Key Delimiter	Used to separate table names and column names of a relational database	_
	Value Delimiter	Used to separate columns when the storage type is string. It is the character used to split a string into arrays when the storage type is list.	;
	Key Value Validity Period	Validity period of the key, in seconds	3600

6.6.19 To HDFS

Table 6-47 Parameter description

Type	Parameter	Description	Example Value
Basic parameters	Write Directory	HDFS directory to which data will be written.	/user/cdm/output
	File Format	Format used for transmitting data. The CSV and JSON formats are supported for migration to tables, and the binary format is supported for file migration.	CSV

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Type	Parameter	Description	Example Value
	Newline character processing mode	Policy for processing newline characters when the data written to a text file table contains newline characters (\n|\r|\r\n) • Delete • Ignore • Replace with another string	Delete
	Newline Replacement String	It indicates the string that will replace newline characters.	N/A
Advanced attributes	Write to Temporary File	This parameter is displayed only when **File Format** is set to **Binary**. It indicates writing the binary file to a temporary file whose name extension is .tmp.	No
	Line Separator	This parameter is displayed only when **File Format** is set to **CSV**. It indicates the line feed character in a file. By default, the system automatically identifies **\n**, **\r**, and **\r\n**. You can configure special characters. For spaces and carriage returns, encode them with URL. You can also configure them by editing the job JSON, in which case URL encoding is not required.	\n
	Field Delimiter	This parameter is displayed only when **File Format** is set to **CSV**. Field delimiter in the file. Special characters must be encoded using URLs.	,
	Job Success Marker File	Marker file name When the job is successful, a marker file is generated in the destination directory. If this parameter is left blank, no marker file will be generated.	finish.txt
	Use Quote Character	This parameter is displayed only when **File Format** is set to **CSV**. Enclose a string using quote characters. Field separators in the quote characters are regarded as a part of the string value. Only quotation marks (") can be used as quote characters.	No

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Type	Parameter	Description	Example Value
	Customize Hierarchical Directory	Users can customize the directory hierarchy of files. Example: [Table name]/[Year]/[Month]/[Day]/[Data file name]. csv	No
	Hierarchical Directory	This parameter is displayed when **Customize Hierarchical Directory** is set to **Yes**. Used to specify the directory level of a file, with time macro supported (the time format is yyyy/MM/dd). If the source link is a relational database link, the directory name consists of the source table name and a custom directory name. In other scenarios, the directory is a custom directory.	${dateformat(yyyy/MM/dd, -1, DAY)}
	File Name Prefix	This parameter is displayed only when **File Format** is set to **CSV**. Prefix of the file name. File name format: prefix-jobname-timestamp-index	data
	Compression Format	This parameter is displayed only when **File Format** is set to **CSV**. Compression format of the file to be written • NONE • DEFLATE • GZIP • BZIP2 • SNAPPY	SNAPPY
	Encryption	This parameter is displayed only when **File Format** is set to **Binary**. Encryption mode for the uploaded data • None • AES-256-GCM	None
	DEK	This parameter is displayed when **File Format** is set to **Binary** and **Encryption Mode** is set. It indicates the data encryption key. The AES-256-GCM key consists of 64 hexadecimal digits.	DD0AE00DFECD78BF051BCFDA25BD4E320DB0A7AC75A1F3FC3D3C56A457DCDC1B

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Type	Parameter	Description	Example Value
	IV	This parameter is displayed when **File Format** is set to **Binary** and **Encryption Mode** is set. It indicates the initialization vector, which consists of 32 hexadecimal digits.	5C91687BA886EDCD12ACBC3FF19A3C3F

6.7 Configuring Field Converters

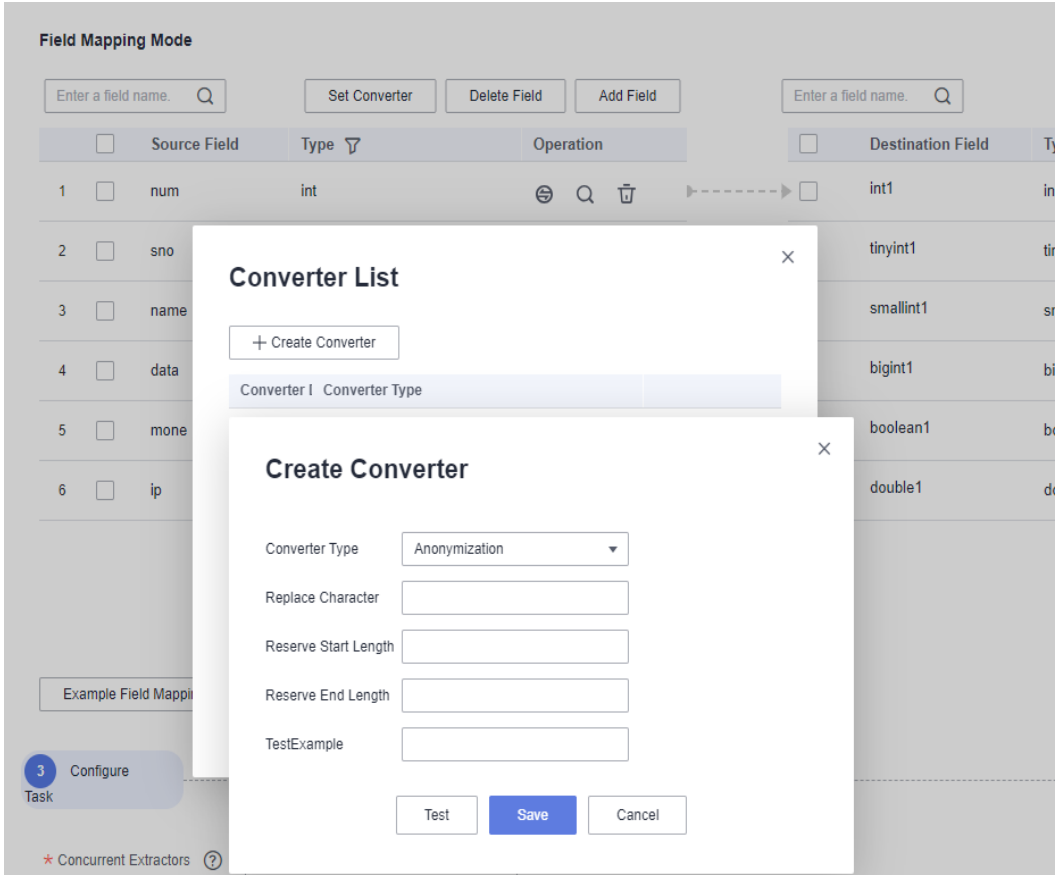
Scenario

- After the job parameters are configured, field mapping needs to be configured. You can click  in the **Operation** column to create a field converter.
- If files are migrated between FTP, SFTP, HDFS, and OBS and the migration source's **File Format** is set to **Binary**, files will be directly transferred, free from field mapping.

You can create a field converter on the **Map Field** page when creating a table/file migration job.

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Figure 6-6 Creating a field converter



Fields can be converted during migration. Currently, the following field converters are supported:

- **Anonymization**
- **Trim**
- **Reverse String**
- **Replace String**
- **Remove line break**
- **Expression Conversion**

Constraints

- If **Use SQL Statement** is set to **Yes** in the source job configuration, converters cannot be created.
- On the **Map Field** tab page, if all columns cannot be obtained through sample values (for example, when data is exported from HBase, CloudTable, or MongoDB, there is a high probability that CDM failed to obtain all columns), you can click ⊕ and select **Add a new field** to add new fields to ensure that the data imported to the migration destination is complete.
- When a relational database, Hive, DLI, or MRS Hudi is used as the migration source, sample values cannot be obtained.

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- When SQLServer is the destination, fields of the timestamp type cannot be written. You must change their type (for example, to datetime) so that they can be written.
- Column names are displayed when the source of the migration job is OBS, CSV files are to be migrated, and parameter **Extract first row as columns** is set to **Yes**.
- Field converters configuration is not involved when the binary format is used to migrate files to files.
- In the automatic table creation scenario, you need to manually add fields to the destination table in advance and then add fields to the field mapping.
- After a field is added, its sample value is not displayed on the console. This does not affect the field value transmission. The field value is directly written to the destination end.
- If the field mapping is incorrect, you can adjust the field mapping by dragging fields or clicking  to map fields in batches.
- When creating an expression converter, do not use a time macro because the expression is used to process data in the field.
- If the data is imported to GaussDB(DWS), you need to select the distribution columns in the destination fields. You are advised to select the distribution columns according to the following rules:
  a. Use the primary key as the distribution column.
  b. If multiple data segments are combined as primary keys, specify all primary keys as the distribution column.
  c. In the scenario where no primary key is available, if no distribution column is selected, DWS uses the first column as the distribution column by default. As a result, data skew risks exist.

Anonymization

This converter is used to hide key information about the character string. For example, if you want to convert **12345678910** to **123****8910**, configure the parameters as follows:

- Set **Reserve Start Length** to **3**.
- Set **Reserve End Length** to **4**.
- Set **Replace Character** to *****.

Trim

This converter is used to automatically delete the spaces before and after a string. No parameters need to be configured.

Reverse String

This converter is used to automatically reverse a string. For example, reverse **ABC** into **CBA**. No parameters need to be configured.

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Replace String

This converter is used to replace a character string. You need to configure the object to be replaced and the new value.

Remove line break

This converter is used to delete the newline characters, such as \n, \r, and \r\n from the field.

Expression Conversion

This converter uses the JSP expression language (EL) to convert the current field or a row of data. The JSP EL is used to create arithmetic and logical expressions. Within a JSP EL expression, you can use integers, floating point numbers, strings, the built-in constants **true** and **false** for boolean values, and **null**.

- The expression supports the following environment variables:
  - **value**: indicates the current field value.
  - **row**: indicates the current row, which is an array type.
- The expression supports the following Utils:
  a. If the field is of the string type, convert all character strings into lowercase letters, for example, convert **aBC** to **abc**.

     Expression: StringUtils.lowerCase(value)

  b. Convert all character strings of the current field to uppercase letters.

     Expression: StringUtils.upperCase(value)

  c. Convert the format of the first date field from 2018-01-05 15:15:05 to 20180105.

     Expression: DateUtils.format(DateUtils.parseDate(row[0],"yyyy-MM-dd HH:mm:ss"),"yyyyMMdd")

  d. Convert a timestamp to a date string in *yyyy-MM-dd hh:mm:ss* format, for example, convert **1701312046588** to **2023-11-30 10:40:46**.

     Expression: DateUtils.format(NumberUtils.toLong(value),"yyyy-MM-dd HH:mm:ss")

  e. Convert a date string in the yyyy-MM-dd hh:mm:ss format to a timestamp.

     Expression: DateUtils.getTime(DateUtils.parseDate(value,"yyyy-MM-dd hh:mm:ss"))

  f. If the field value is a date string in *yyyy-MM-dd* format, extract the year from the field value, for example, extract **2017** from **2017-12-01**.

     Expression: StringUtils.substringBefore(value,"-")

  g. If the field value is of the numeric type, convert the value to a new value which is two times greater than the original value:

     Expression: value*2

  h. Convert the field value **true** to **Y** and other field values to **N**.

     Expression: value=="true"?"Y":"N"

  i. If the field value is of the string type and is left empty, convert it to **Default**. Otherwise, the field value will not be converted.

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Expression: empty value? "Default":value

j. Convert date format **2018/01/05 15:15:05** to **2018-01-05 15:15:05**:

Expression: DateUtils.format(DateUtils.parseDate(value,"yyyy/MM/dd HH:mm:ss"),"yyyy-MM-dd HH:mm:ss")

k. Obtain a 36-bit universally unique identifier (UUID):

Expression: CommonUtils.randomUUID()

l. If the field is of the string type, capitalize the first letter, for example, convert **cat** to **Cat**.

Expression: StringUtils.capitalize(value)

m. If the field is of the string type, convert the first letter to a lowercase letter, for example, convert **Cat** to **cat**.

Expression: StringUtils.uncapitalize(value)

n. If the field is of the string type, use a space to fill in the character string to the specified length and center the character string. If the length of the character string is not shorter than the specified length, do not convert the character string. For example, convert **ab** to meet the specified length 4.

Expression: StringUtils.center(value,*4*)

o. Delete a newline (including **\n**, **\r**, and **\r\n**) at the end of a character string. For example, convert **abc\r\n\r\n** to **abc\r\n**.

Expression: StringUtils.chomp(value)

p. If the string contains the specified string, **true** is returned; otherwise, **false** is returned. For example, **abc** contains **a** so that **true** is returned.

Expression: StringUtils.contains(value,"*a*")

q. If the string contains any character of the specified string, **true** is returned; otherwise, **false** is returned. For example, **zzabyycdxx** contains either **z** or **a** so that **true** is returned.

Expression: StringUtils.containsAny(value,"*za*")

r. If the string does not contain any one of the specified characters, **true** is returned. If any specified character is contained, **false** is returned. For example, **abz** contains one character of **xyz** so that **false** is returned.

Expression: StringUtils.containsNone(value,"*xyz*")

s. If the string contains only the specified characters, **true** is returned. If any other character is contained, **false** is returned. For example, **abab** contains only characters among **abc** so that **true** is returned.

Expression: StringUtils.containsOnly(value,"*abc*")

t. If the character string is empty or null, convert it to the specified character string. Otherwise, do not convert the character string. For example, convert the empty character string to null.

Expression: StringUtils.defaultIfEmpty(value,*null*)

u. If the string ends with the specified suffix (case sensitive), **true** is returned; otherwise, **false** is returned. For example, if the suffix of **abcdef** is not null, **false** is returned.

Expression: StringUtils.endsWith(value,*null*)

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v. If the string is the same as the specified string (case sensitive), **true** is returned; otherwise, **false** is returned. For example, after strings **abc** and **ABC** are compared, **false** is returned.

   Expression: StringUtils.equals(value,"*ABC*")

w. Obtain the first index of the specified character string in a character string. If no index is found, **-1** is returned. For example, the first index of **ab** in **aabaabaa** is 1.

   Expression: StringUtils.indexOf(value,"*ab*")

x. Obtain the last index of the specified character string in a character string. If no index is found, **-1** is returned. For example, the last index of **k** in **aFkyk** is 4.

   Expression: StringUtils.lastIndexOf(value,"*k*")

y. Obtain the first index of the specified character string from the position specified in the character string. If no index is found, **-1** is returned. For example, the first index of **b** obtained after the index 3 of **aabaabaa** is 5.

   Expression: StringUtils.indexOf(value,"*b*",*3*)

z. Obtain the first index of any specified character in a character string. If no index is found, **-1** is returned. For example, the first index of **z** or **a** in **zzabyycdxx.** is 0.

   Expression: StringUtils.indexOfAny(value,"*za*")

aa. If the string contains any Unicode character, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only non-Unicode characters so that **false** is returned.

   Expression: StringUtils.isAlpha(value)

ab. If the string contains only Unicode characters and digits, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only Unicode characters and digits, so that **true** is returned.

   Expression: StringUtils.isAlphanumeric(value)

ac. If the string contains only Unicode characters, digits, and spaces, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains only Unicode characters and digits, so that **true** is returned.

   Expression: StringUtils.isAlphanumericSpace(value)

ad. If the string contains only Unicode characters and spaces, **true** is returned; otherwise, **false** is returned. For example, **ab2c** contains Unicode characters and digits so that **false** is returned.

   Expression: StringUtils.isAlphaSpace(value)

ae. If the string contains only printable ASCII characters, **true** is returned; otherwise, **false** is returned. For example, for **!ab-c~**, **true** is returned.

   Expression: StringUtils.isAsciiPrintable(value)

af. If the string is empty or null, **true** is returned; otherwise, **false** is returned.

   Expression: StringUtils.isEmpty(value)

ag. If the string contains only Unicode digits, **true** is returned; otherwise, **false** is returned.

   Expression: StringUtils.isNumeric(value)

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ah. Obtain the leftmost characters of the specified length. For example, obtain the leftmost two characters **ab** from **abc**.

Expression: StringUtils.left(value,*2*)

ai. Obtain the rightmost characters of the specified length. For example, obtain the rightmost two characters **bc** from **abc**.

Expression: StringUtils.right(value,*2*)

aj. Concatenate the specified character string to the left of the current character string and specify the length of the concatenated character string. If the length of the current character string is not shorter than the specified length, the character string will not be converted. For example, if **yz** is concatenated to the left of **bat** and the length must be 8 after concatenation, the character string is **yzyzybat** after conversion.

Expression: StringUtils.leftPad(value,*8*,"*yz*")

ak. Concatenate the specified character string to the right of the current character string and specify the length of the concatenated character string. If the length of the current character string is not shorter than the specified length, the character string will not be converted. For example, if **yz** is concatenated to the right of **bat** and the length must be 8 after concatenation, the character string is **batyzyzy** after conversion.

Expression: StringUtils.rightPad(value,*8*,"*yz*")

al. If the field is of the string type, obtain the length of the current character string. If the character string is null, **0** is returned.

Expression: StringUtils.length(value)

am. If the field is of the string type, delete all the specified character strings from it. For example, delete **ue** from **queued** to obtain **qd**.

Expression: StringUtils.remove(value,"*ue*")

an. If the field is of the string type, remove the substring at the end of the field. If the specified substring is not at the end of the field, no conversion is performed. For example, remove **.com** at the end of **www.domain.com**.

Expression: StringUtils.removeEnd(value,"*.com*")

ao. If the field is of the string type, delete the substring at the beginning of the field. If the specified substring is not at the beginning of the field, no conversion is performed. For example, delete **www.** at the beginning of **www.domain.com**.

Expression: StringUtils.removeStart(value,"*www.*")

ap. If the field is of the string type, replace all the specified character strings in the field. For example, replace **a** in **aba** with **z** to obtain **zbz**.

Expression: StringUtils.replace(value,"*a*","*z*")

aq. If the field is of the string type, replace multiple characters in the character string at a time. For example, replace **h** in **hello** with **j** and **o** with **y** to obtain **jelly**.

Expression: StringUtils.replaceChars(value,"*ho*","*jy*")

ar. If the string starts with the specified prefix (case sensitive), **true** is returned; otherwise, **false** is returned. For example, **abcdef** starts with **abc**, so that **true** is returned.

Expression: StringUtils.startsWith(value,"*abc*")

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as. If the field is of the string type, delete all the specified characters at the beginning and end of the field. the field. For example, delete all **x**, **y**, **z**, and **b** from **abcyx** to obtain **abc**.

Expression: StringUtils.strip(value,"*xyz*b")

at. If the field is of the string type, delete all the specified characters at the end of the field, for example, delete the **abc** string at the end of the field.

Expression: StringUtils.stripEnd(value,*"abc"*)

au. If the field is of the string type, delete all the specified characters at the beginning of the field, for example, delete all spaces at the beginning of the field.

Expression: StringUtils.stripStart(value,*null*)

av. If the field is of the string type, obtain the substring after the specified position (the index starts from 0, including the character at the specified position) of the character string. If the specified position is a negative number, calculate the position in the descending order. The first digit at the end is -1. For example, obtain the second character (c) of **abcde** and the string after it, that is, **cde**.

Expression: StringUtils.substring(value,*2*)

aw. If the field is of the string type, obtain the substring in a specified range (the index starts from 0, including the character at the start and excluding the character at the end). If the range is a negative number, calculate the position in the descending order. The first digit at the end is -1. For example, obtain the string between the second character (c) and fourth character (e) of **abcde**, that is, **cd**.

Expression: StringUtils.substring(value,*2*,4)

ax. If the field is of the string type, obtain the substring after the first specified character. For example, obtain the substring after the first **b** in **abcba**, that is, **cba**.

Expression: StringUtils.substringAfter(value,"*b*")

ay. If the field is of the string type, obtain the substring after the last specified character. For example, obtain the substring after the last **b** in **abcba**, that is, **a**.

Expression: StringUtils.substringAfterLast(value,"*b*")

az. If the field is of the string type, obtain the substring before the first specified character. For example, obtain the substring before the first **b** in **abcba**, that is, **a**.

Expression: StringUtils.substringBefore(value,"*b*")

ba. If the field is of the string type, obtain the substring before the last specified character. For example, obtain the substring before the last **b** in **abcba**, that is, **abc**.

Expression: StringUtils.substringBeforeLast(value,"*b*")

bb. If the field is of the string type, obtain the substring nested within the specified string. If no substring is found, **null** is returned. For example, obtain the substring between **tag** in **tagabctag**, that is, **abc**.

Expression: StringUtils.substringBetween(value,"*tag*")

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bc. If the field is of the string type, delete the control characters (char≤32) at both ends of the character string, for example, delete the spaces at both ends of the character string.

Expression: StringUtils.trim(value)

bd. Convert the character string to a value of the byte type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toByte(value)

be. Convert the character string to a value of the byte type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toByte(value,*1*)

bf. Convert the character string to a value of the double type. If the conversion fails, **0.0d** is returned.

Expression: NumberUtils.toDouble(value)

bg. Convert the character string to a value of the double type. If the conversion fails, the specified value, for example, **1.1d**, is returned.

Expression: NumberUtils.toDouble(value,*1.1d*)

bh. Convert the character string to a value of the float type. If the conversion fails, **0.0f** is returned.

Expression: NumberUtils.toFloat(value)

bi. Convert the character string to a value of the float type. If the conversion fails, the specified value, for example, **1.1f**, is returned.

Expression: NumberUtils.toFloat(value,*1.1f*)

bj. Convert the character string to a value of the int type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toInt(value)

bk. Convert the character string to a value of the int type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toInt(value,*1*)

bl. Convert the character string to a value of the long type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toLong(value)

bm. Convert the character string to a value of the long type. If the conversion fails, the specified value, for example, **1L**, is returned.

Expression: NumberUtils.toLong(value,*1L*)

bn. Convert the character string to a value of the short type. If the conversion fails, **0** is returned.

Expression: NumberUtils.toShort(value)

bo. Convert the character string to a value of the short type. If the conversion fails, the specified value, for example, **1**, is returned.

Expression: NumberUtils.toShort(value,*1*)

bp. Convert the IP string to a value of the long type, for example, convert **10.78.124.0** to **172915712**.

Expression: CommonUtils.ipToLong(value)

bq. Read an IP address and physical address mapping file from the network, and download the mapping file to the map collection. *url* indicates the

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address for storing the IP mapping file, for example, **http://10.114.205.45:21203/sqoop/IpList.csv**.

Expression: HttpsUtils.downloadMap("*url*")

br. Cache the IP address and physical address mappings and specify a key for retrieval, for example, **ipList**.

Expression: CommonUtils.setCache("*ipList*",HttpsUtils.downloadMap("*url*"))

bs. Obtain the cached IP address and physical address mappings.

Expression: CommonUtils.getCache("*ipList*")

bt. Check whether the IP address and physical address mappings are cached.

Expression: CommonUtils.cacheExists("*ipList*")

bu. Based on the specified offset type (month/day/hour/minute/second) and offset (positive number indicates increase and negative number indicates decrease), convert the time in the specified format to a new time, for example, add 8 hours to **2019-05-21 12:00:00**.

Expression: DateUtils.getCurrentTimeByZone("*yyyy-MM-dd HH:mm:ss*",value, "*hour*", *8*)

bv. If the value is empty or null, "aaa" is returned. Otherwise, **value** is returned.

Expression: StringUtils.defaultIfEmpty(value, *"aaa"*)

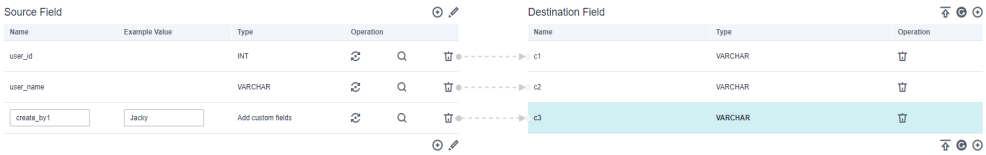
6.8 Adding Fields

Scenario

- After job parameters are configured, field mapping needs to be configured. You can customize new fields by clicking on the **Map Field** page.
- If files are migrated between FTP, SFTP, OBS, and HDFS and the migration source's **File Format** is set to **Binary**, files will be directly transferred, free from field mapping.
- In other scenarios, CDM automatically maps fields of the source table and the destination table. You need to check whether the mapping and time format are correct. For example, check whether the source field type can be converted into the destination field type.

You can click on the **Map Field** page and select **Add** to customize a new field. This field is usually used to mark the database source to ensure the integrity of the data imported to the migration destination.

Figure 6-7 Field mapping



Currently, the following field types are supported:

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- **Constant Parameter**

  Constant parameters are fixed parameters and do not need to be reconfigured. For example, **lable** = **friends** is used to identify a constant value.

- **Variables**

  You can use variables such as time macros, table name macros, and version macros to mark database source information. The variable syntax is ${variable}, where **variable** indicates a variable. For example, **input_time** = **${timestamp()}** indicates the timestamp of the current time.

- Expression

  You can use the expression language to dynamically generate parameter values based on the running environment. The expression syntax is #{expr}, where **expr** indicates an expression. For example, **time** = **#{DateUtil.now()}** is used to identify the current date string.

Constraints

- On the **Map Field** tab page, if CDM fails to obtain all columns by obtaining sample values (for example, when data is exported from HBase, CloudTable, or MongoDB, there is a high probability that CDM failed to obtain all columns), you can click  and select **Add a new field** to add new fields to ensure that the data imported to the migration destination is complete.
- When a relational database, Hive, DLI, or MRS Hudi is used as the migration source, sample values cannot be obtained.
- When SQLServer is the destination, fields of the timestamp type cannot be written. You must change their type (for example, to datetime) so that they can be written.
- Column names are displayed when the source of the migration job is OBS, CSV files are to be migrated, and parameter **Extract first row as columns** is set to **Yes**.
- Field mapping is not involved when the binary format is used to migrate files to files.
- In the automatic table creation scenario, you need to manually add fields to the destination table in advance and then add fields to the field mapping.
- After a field is added, its sample value is not displayed on the console. This does not affect the field value transmission. CDM directly writes the field value to the destination end.
- If the field mapping is incorrect, you can adjust the field mapping by dragging fields or clicking  to map fields in batches.
- If the data is imported to DWS, you need to select the distribution columns in the destination fields. You are advised to select the distribution columns according to the following principles:

  a. Use the primary key as the distribution column.

  b. If multiple data segments are combined as primary keys, specify all primary keys as the distribution column.

  c. In the scenario where no primary key is available, if no distribution column is selected, DWS uses the first column as the distribution column by default. As a result, data skew risks exist.

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- If a source field type is not supported, convert the field type to a type supported by CDM by referring to **Converting Unsupported Data Types**.

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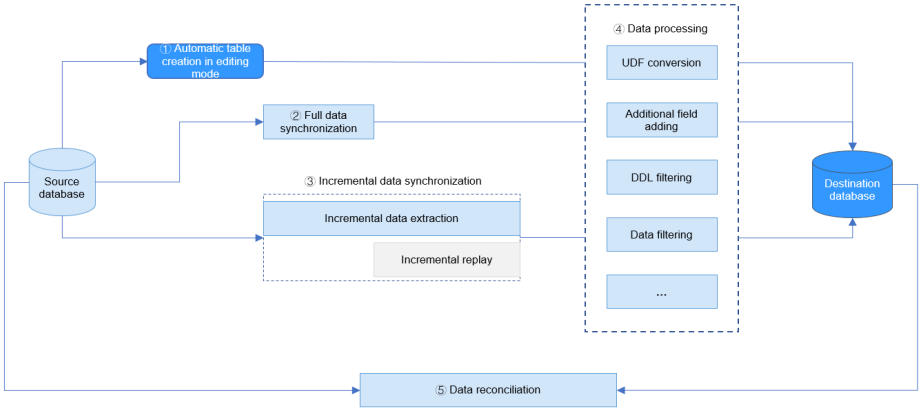
7 DataArts Migration (Real-Time Jobs)

7.1 Overview of Real-Time Jobs

The DataArts Migration module of DataArts Studio provides real-time data synchronization, which replicates data from one source to another without affecting data consistency. This function enables real-time flow of key service data.

- Typical scenarios: real-time analysis, report systems, and data warehouse environments
- Characteristics: Real-time synchronization meets requirements such as many-to-one and one-to-many synchronization, dynamic addition and deletion of synchronization tables, and synchronization between tables with different names.

Figure 7-1 How real-time synchronization works



Functions

Real-time migration jobs support real-time data synchronization between a wide range of data sources in various scenarios. You can synchronize multiple database tables in full or incremental mode at a time. The following figure shows the detailed functions.

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Table 7-1 Basic functions

Function	Description
Data synchronization between sources	Various types of data sources are supported. You can combine multiple input and output data sources to form a synchronization link. For details, see **Supported Data Sources**.
Data synchronization in multiple scenarios	Real-time incremental data synchronization is supported for a table, an entire database, and database and table shards. • Single table synchronization: A table in an instance can be synchronized to another instance. • Entire database synchronization: Multiple tables in multiple databases in an instance can be synchronized to another instance in real time. A task can synchronize a maximum of 200 tables. • Database and table shard synchronization: Multiple table shards of multiple databases in multiple instances can be synchronized to a database table in an instance.
Real-time synchronization task configuration	Real-time data synchronization can be implemented through simple visualized configuration. • Customization of data source parameters • Selection of source databases and tables on a GUI and matching of source databases and tables using regular expressions • Customization of the matching rule between source and destination databases and tables. • Field mapping: additional fields and field value assignment (constants, variables, and UDFs) • Automatic table creation • Definition of DDL message processing policies
Real-time synchronization task O&M	Recovering tasks upon exceptions, dynamically adding or deleting tables, configuring alarms, and viewing and exporting task logs

Synchronization Scenarios

DataArts Migration supports synchronization scenarios of multiple topology types. You can plan synchronization based on your requirements.

- **Single table synchronization**

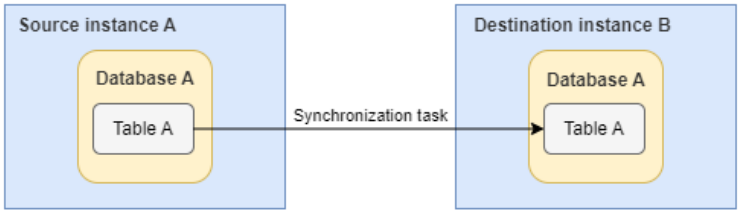
  A table in an instance can be synchronized to another instance.

  The following links are supported:

  to Hudi

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Figure 7-2 Single table synchronization



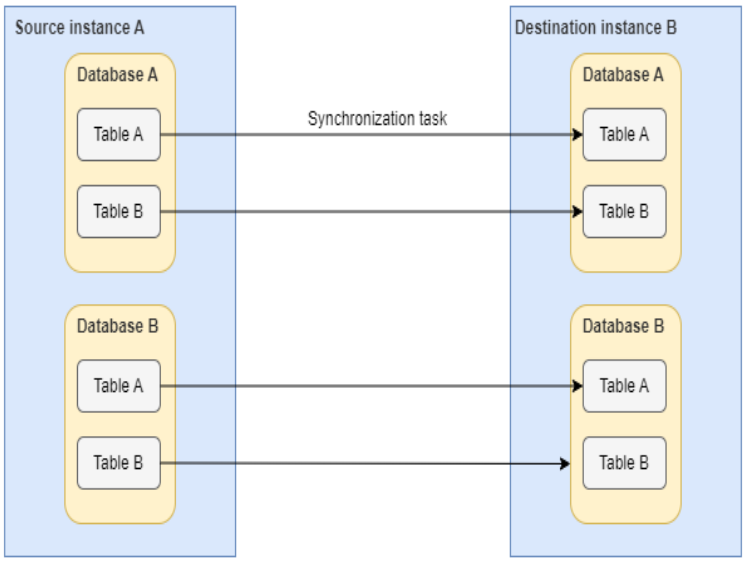
- **Entire database synchronization**

  Multiple tables in multiple databases in an instance can be synchronized to another instance in real time. A task can synchronize a maximum of 200 tables.

  The following links are supported:

  - MySQL to MRS Hudi, MySQL to GaussDB(DWS), and MySQL to Kafka
  - SQL Server to MRS Hudi and SQL Server to GaussDB(DWS)
  - PostgreSQL to GaussDB(DWS), PostgreSQL to MRS Hudi, and PostgreSQL to
  - Oracle to GaussDB(DWS), Oracle to MRS Hudi, and Oracle to
  - GaussDB Centralized/Distributed to GaussDB(DWS), GaussDB Centralized/Distributed to MRS Hudi, and GaussDB Centralized/Distributed to

Figure 7-3 Entire database synchronization



- **Database and table shard synchronization**

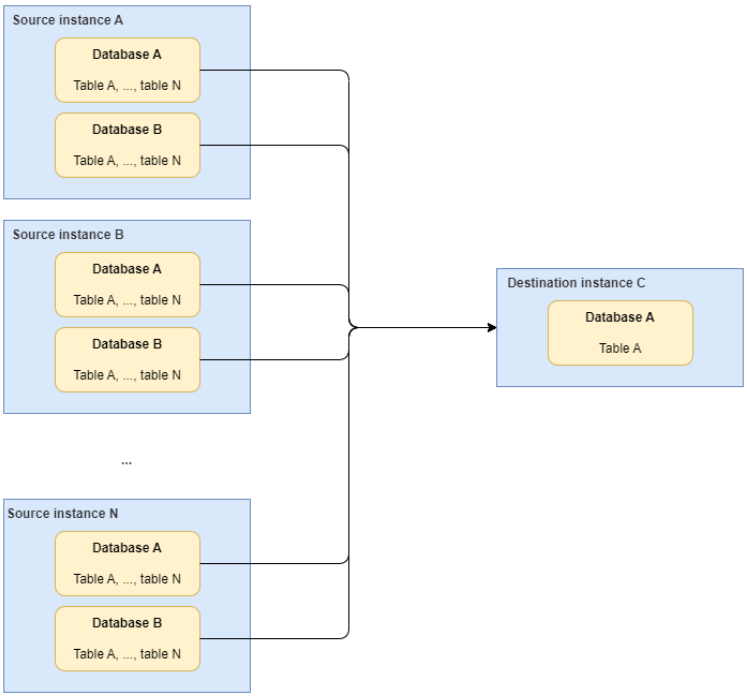
  Multiple table shards of multiple databases in multiple instances can be synchronized to a database table in an instance.

  The following links are supported:

  - MySQL to MRS Hudi and MySQL to GaussDB(DWS)
  - PostgreSQL to GaussDB(DWS)

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Figure 7-4 Database and table shard synchronization



Basic Features

Real-time data migration provides support for big data development and has the following features:

- Timeliness: Data can be synchronized within seconds.
- Reliability: Mechanisms such as recovery upon exceptions and automatic retry ensure data consistency and accuracy.
- Diversity:
  - Diverse data sources: Multiple data sources can be selected at the source and destination.
  - Diverse scenarios: Some links support full and incremental synchronization, and some links support database and table shards.
- Maintainability: Job monitoring and logs are supported, enabling O&M engineers to locate faults.
- Ease-of-use: You only need to configure necessary information on the console.

7.2 Notes and Constraints

Constraints on the MySQL Source

Type	Description
Applicable Version	5.6, 5.7, and 8.*x*

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Type	Description
Required Permissions	The source database account must have the following minimal permissions required for running SQL statements: SELECT, SHOW DATABASES, REPLICATION SLAVE and REPLICATION CLIENT. `GRANT SELECT, SHOW DATABASES, REPLICATION SLAVE, REPLICATION CLIENT ON *.* TO 'Username'@'%';`
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • The DDL operation of adding columns can be synchronized. • Only MyISAM and InnoDB tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Foreign keys that contain reference operations such as CASCADE, SET NULL, and SET DEFAULT cannot be synchronized. These operations will cause the update or deletion of rows in parent tables and affect records in child tables. Also, operations related to child tables are not recorded in Binlogs.
Database	The names of the source databases, tables, and fields cannot contain non-ASCII characters or the following characters: .<'>/\" (You are advised to use common characters to avoid a failure.)

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Type	Description
Usage	• General: – During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. – The source database cannot be restored. – Binlogs must be enabled for the source database and the value of **binlog_row_image** must be **full**. – It is recommended that MySQL binlogs be retained for more than three days. Binlogs cannot be forcibly cleared. When a job is restored after an exception, the recorded binlog location may expire. As a result, the job fails to be restored. It is important to monitor the duration of job exceptions and the binlog retention period. – During real-time synchronization, the source MySQL database cannot be upgraded across major versions. Otherwise, data may become inconsistent or the synchronization task may fail (data, table structures, and keywords may cause compatibility changes after the cross-version upgrade). You are advised to create a synchronization task again if the source MySQL database is upgraded across major versions. – Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. – Synchronizing tables that have no primary keys may cause duplicate data. Exercise caution when performing this operation. – If the source database is MySQL 8.0.23 or a later version and the

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Type	Description
	data to be synchronized or migrated contains hidden columns, data in these columns may fail to be obtained and may be lost. • Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. • Incremental synchronization phase: – During incremental synchronization, executing non-idempotent DDL statements (for example, ALTER TABLE ddl_test ADD COLUMN c3 timestamp default now();) may cause data inconsistency. – During incremental synchronization, the following DDL types can be identified: creating a table, deleting a table, adding a column, deleting a column, renaming a table, renaming a column, modifying the column type, and clearing a table. For details about the DDL types supported by different links, see the notes and constraints of each link. – Foreign keys that contain reference operations such as CASCADE, SET NULL, and SET DEFAULT cannot be synchronized. These operations will cause the update or deletion of rows in parent tables and affect records in child tables. Also, operations related to child tables are not recorded in Binlogs. – The position cannot be set before DDL operations that involves table structure changes, such as table modification and column addition. – After incremental data is synchronized to Hudi MOR tables

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Type	Description
	in MRS clusters earlier than 3.2.0-LTS1.5, CDM or Spark SQL cannot be used to write data. You need to perform compaction before writing data. – Database/Table sharding: In the database and table sharding scenario, you must stop service operations before renaming columns. Otherwise, data inconsistency may occur. In the database and table sharding scenario, you are advised to synchronize only the DDL for adding columns. If you synchronize other DDL operations, the job may fail or data may be inconsistent because the destination table has been modified. In the database and table sharding scenario, ensure that the types of columns to be added to each table are the same. Otherwise, the task may fail. ● Extraction from the standby database: Before extracting data from the standby database, ensure that a value can be returned after the **SHOW MASTER STATUS** command is executed on the standby database node. Otherwise, data jobs may be abnormal and data may be lost.

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Type	Description
Other	Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail.

Constraints on the SQL Server Source

Type	Description
Applicable Version	Enterprise Edition 2016, 2017, 2019, and 2022; Standard Edition 2016 SP2 and later, 2017, 2019, and 2022

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Type	Description

Required Permissions	sysadmin or view server state permissions, and db_datareader or db_owner permissions of the database to be synchronized
	• Enable CDC for a database and a table.
	1. Enable CDC for a database.
	`USE YourDatabaseName;`
	`EXEC sys.sp_cdc_enable_db;`
	`-- Check whether CDC is enabled for a database.`
	`SELECT is_cdc_enabled, name FROM sys.databases WHERE name = 'YourDatabaseName'`
	2. Enable CDC for a table.
	`EXEC sys.sp_cdc_enable_table`
	`@source_schema = N'dbo', -- Schema`
	`@source_name = N'YourTable',-- Table name`
	`@role_name = NULL,-- (Optional) CDC access role name`
	`@supports_net_changes = 0;`
	`-- Check whether CDC is enabled for the table.`
	`SELECT name,is_tracked_by_cdc FROM sys.tables WHERE name = 'YourTable';`
	• The following permissions for the SQL Server must be granted to the user configured in the data connection:
	– Grant the CONNECT and VIEW DATABASE STATE permissions to the user.
	`USE YourDatabaseName;`
	`GRANT CONNECT, VIEW DATABASE STATE TO [YourUserName];`
	– Grant the SELECT permissions on the CDC schema to the user.
	`USE YourDatabaseName;`
	`GRANT SELECT ON SCHEMA::[cdc] TO [YourUserName];`
	– Grant the SELECT permissions on the table to the user.
	`USE YourDatabaseName;`
	`GRANT SELECT ON OBJECT::[YourSchema].[YourTable] TO [YourUserName];`

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Type	Description
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Transparent Data Encryption (TDE) encrypted databases in the source instance cannot be synchronized. • Column encryption is not supported. • Auto-increment columns cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.
Database	If **Force Protocol Encryption** is set to **Yes** for the source database, **Trust Server Certificate** also must be set to **Yes**.
Usage	• General: During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • Full synchronization: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. • Incremental synchronization phase: – DML operations INSERT, UPDATE, and DELETE can be synchronized. – DDL operations performed on the source database will not be synchronized to the destination database. – The IMAGE, TEXT, and NTEXT big data types cannot be deleted. – Tables in a job cannot be modified during synchronization.

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Type	Description
Other	• Tables in the source database can contain more or less columns than those in the destination database. However, task failures may occur in the following scenarios: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • Do not perform primary/standby switchover on the source database. Otherwise, the synchronization task will fail. • Source Microsoft SQL Server databases using TLS 1.0 or TLS 1.1 cannot be synchronized. To enable synchronization of such databases, you are advised to upgrade the protocol used by the databases to TLS 1.2 or later.

Constraints on the PostgreSQL Source

Type	Description
Applicable Version	PostgreSQL 9.4, 9.5, 9.6, 10, 11, 12, 13, 14, 15, and 16

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Type	Description
Required Permissions	Database CONNECT permission, schema USAGE permission, table SELECT permission, sequence SELECT permission, and REPLICATION connection permission **NOTE** To add the permission to create replication connections, perform the following steps: • Add **host replication <src_user_name> <drs_instance_ip>/32** *<Authentication mode>* before all configurations in the **pg_hba.conf** file of the source database. For details about the authentication mode, see **pg_hba.conf**. Common authentication modes include scram-sha-256. • Run **select pg_reload_conf();** in the source database as user SUPERUSER, or restart the DB instance to apply the changes.
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.
Database	• The partition table trigger of the source database cannot be set to **disable**. • If incremental synchronization is required, the **pg_hba.conf** file of the source database contains the following configuration: `host replication all 0.0.0.0/0 md5`

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Type	Description
Usage	• General: – During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. – The WAL logs of the PostgreSQL database should be retained for more than three days. – Source tables must be published in dbz_publiction. Use "select * from pg_publication_tables;" to query the PUBLICATION of all tables and use "ALTER PUBLICATION name ADD TABLE [ONLY] table_name [*] [, ...]" to add the tables to the publish list. • Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. • Incremental synchronization phase: – Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. – Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. – When the number of replication slots of the PostgreSQL data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting max_replication_slots or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see

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Type	Description
Other	• Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. • After the job is started, the active/standby switchover is not allowed for the source database. • Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database.

Constraints on the Oracle Source

Type	Description
Applicable Version	10, 11, 12, and 19

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Type	Description
Required Permissions	The account must have the permissions to archive logs, query tables, and parse logs of the Oracle database. For details about how to grant the permissions, see .
Synchronization objects	• The following DML operations can be synchronized: INSERT, UPDATE, and DELETE. • The DDL operation of adding columns can be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, unique indexes, foreign key indexes, and check constraints cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.
Database	The names of the source databases, tables, and fields cannot contain periods (.), hyphens (-), or non-ASCII characters. You are advised to use common characters to avoid a failure.

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Type	Description
Usage	• Driver package installation: • General: – During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. – It is recommended that Oracle archive logs be retained for more than three days. Otherwise, the task may fail because logs cannot be obtained. In some special cases, data may be inconsistent or lost. – resetlogs operations cannot be performed on the source Oracle database. Otherwise, data cannot be synchronized, and the job cannot be recovered. – The username (schema name) of the source Oracle database cannot be changed, neither by modifying the **USER$** dictionary table in versions earlier than 11.2.0.2 nor by running the **ALTER USER username RENAME TO new_username** command in 11.2.0.2 and later versions. – If the source is an Oracle database, CLOB, NCLOB, and BLOB data cannot be migrated. – Oracle RAC clusters cannot be the source. – If the source is an Oracle database, it can connect to the standby Oracle database of a single instance but cannot connect to a standby database in an RAC cluster. Only archive logs can be read from the standby database, and standby logs cannot be read from the standby database. When connecting to the standby database, you are advised to configure scheduled archiving to reduce the data synchronization latency.

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Type	Description
	– It is recommended that the network bandwidth be greater than 100 Mbit/s. • Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. • Incremental synchronization phase: – DML operations INSERT, UPDATE, and DELETE can be synchronized. – The DDL operation of adding columns can be synchronized. – Mixed partitioned tables are not supported. When data in the external partition of a mixed partitioned table changes, no DML log is generated. As a result, the change information cannot be obtained during incremental data synchronization, which may cause data inconsistency. – The table name and column name can contain a maximum of 30 characters. Oracle LogMiner is used to read Oracle logs. The table name and column name can contain a maximum of 30 characters. For details, see **Using LogMiner to Analyze Redo Log Files**. – During incremental startup, select a time point. Ensure that the Oracle database is in the same time zone as the host where the database is located to ensure the accuracy of the incremental time point. – Distributed transactions (XA transactions) and PARALLEL DML on Oracle cannot be incrementally synchronized. – During incremental synchronization, Oracle extended characters are not supported. The standard character set cannot

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Type	Description
	parse Oracle customized extended characters. – During incremental synchronization, triggers cannot be synchronized or migrated. You must disable the triggers on the destination Oracle database. – Data with foreign key constraints cannot be incrementally synchronized or migrated. – Data imported to the source database using Oracle Data Pump cannot be incrementally synchronized or migrated.

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Type	Description
Other	• Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – If extra columns in the destination database are not null and have no default values, when newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • During incremental synchronization from the PDB database, all PDBs must be enabled due to restrictions of Oracle LogMiner. • For a full and incremental job or an incremental job that migrates data from an Oracle database, if you want to synchronize tables in the PDB database, you need to enter the username and password of the CDB database in the Oracle connection. This is because Oracle logs are stored in the CDB database and Oracle LogMiner can run only in the CDB database. • To delete a table using DDL, run the **drop table test_table_name purage** command. Deleting a table in the Oracle database is a high-risk operation by default. When the **drop table test_table_name** command is executed, the Oracle database

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Type	Description
	converts the command to **rename table test_table_name as** *xxxxx*. That is, the table is renamed as a table to be processed in the Oracle temporary tablespace. The original table is not deleted, and DataArts Migration ignores the syntax by default. The data deletion statement **drop table test_table_name purage** of the Oracle database completely deletes the table. DataArts Migration automatically identifies and delivers the deleted table to the downstream. • Tables with no primary keys are not supported. • Data control language (DCL) operations are not supported. • Consecutive RENAME TABLE operations cannot be synchronized or migrated. Otherwise, the task may fail. • Global temporary tables cannot be synchronized or migrated (the task is running properly). • Tables that contain default value functions cannot be synchronized or migrated. Otherwise, data will be inconsistent. • Tables with default values that contain expressions cannot be synchronized or migrated. • Foreign tables cannot be synchronized or migrated. • Compute columns and encrypted columns cannot be synchronized or migrated. • Virtual private databases (VPDs) cannot be synchronized or migrated. • Jobs created by dbms_scheduler and dbms_job cannot be synchronized or migrated. • Schema name changes cannot be synchronized or migrated.

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Type	Description
	• Nested tables cannot be synchronized or migrated. Otherwise, an error will occur. • Materialized views cannot be synchronized or migrated. • DDL operations with attribute names that contain keywords or special characters cannot be synchronized or migrated. • ROWID change operations (such as split partition, table move, table shrink, and move partition key) are not supported. Otherwise, data inconsistency or task failures may occur. • The Secure Sockets Layer (SSL) encryption transmission mode is not supported. • The Oracle Label Security mode is not supported.

Constraints on the GaussDB Source

Type	Description
Applicable Version	Kernel engine versions: 505.1.0, 505.1.0.SPC0100, and 505.2.0

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Type	Description
Required Permissions	1. The REPLICATION permission or the permissions inherited from the built-in role gs_role_replication, the CONNECT permission of databases, USAGE permission of schemas, and SELECT permission of tables and sequences 2. Remote connection permission To add the remote connection permission, perform the following steps: • Centralized: Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the source database. • Distributed: Add **host all <user> 0.0.0.0/0 sha256** to the gs_hba.conf configuration file of the CN node of the source database. Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the DN node of the source database. • Run **select pg_reload_conf();** in the source database as the system administrator, or restart the DB instance to apply the changes. 3. Ensure that the corresponding connection ports are enabled in the security group and firewall policies. Security group and firewall policies: Common and replication connection ports are enabled for database connections. Centralized: The replication connection port number is the common connection port number plus 1. Distributed: The replication connection port number is the CN/DN connection port number plus 1. You can run the **select * from**

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Type	Description
	pgxc_node statement in the source database to obtain the DN connection port.
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

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Type	Description
Database	• Source database parameter requirements: – The **password_encryption_type** parameter is set to **1**. Change the password to make it take effect. – The **wal_level** parameter is set to **logical**. – The value of parameter **max_replication_slots** must be greater than the number of used replication slots. You can determine the value based on the number of real-time jobs to be created. • The names of the databases, schemas, and tables to be synchronized cannot contain /<.>\\'`|\?!, and the column names cannot be any fields forbidden in the destination database. You are advised to use common characters to avoid task failures. • The partition table trigger of the source database cannot be set to **disable**.

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Type	Description
Usage	• General: – During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. – The WAL logs of the GaussDB database should be retained for more than three days. • Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. • Incremental synchronization phase: – Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. – Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. – When the number of replication slots of the GaussDB data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting **max_replication_slots** or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see
Other	• Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. • After the job is started, the active/standby switchover is not allowed for the source database.

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Constraints on the Hudi Destination

Type	Description
Applicable Version	• MRS cluster (3.2.0-LTS.*x* and 3.5.*x*) • Hudi (0.11.0)
Required Permissions	The MRS user must have read and write permissions for the Hadoop and Hive components. You are advised to assign the roles and user groups shown in the following figure to the MRS user. **Figure 7-5** Minimal permissions for MRS Hudi  For details, see .
Database	The names of the Hudi databases, tables, and fields can only contain digits, letters, and underscores (_). Field names must start with a letter or an underscore (). You are advised to use common characters in names.

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Type	Description
Usage	• General: – During real-time synchronization, the MRS accounts and passwords cannot be changed. – During real-time synchronization, if the MRS Hadoop component or role is stopped or restarted, the Hadoop component may be unavailable for a short period of time. As a result, the real-time synchronization task is abnormal. – Ensure that the Hudi parameters are supported by Flink on Hudi. Otherwise, the task may fail. Some Spark on Hudi parameters are not applicable in the Flink on Hudi scenario or the parameter names are inconsistent. – After incremental data is synchronized to Hudi MOR tables in MRS clusters earlier than 3.2.0-LTS1.5 through a real-time synchronization task (Flink), CDM or Spark SQL cannot be used to write data. You need to perform compaction before writing data. • Create a table. – Do not update the partition fields of a Hudi table. Otherwise, there will be data with the same primary key in different partitions in the soft deletion scenario. Choose columns with stable field values as Hudi partition fields. – Real-time synchronization tasks only support Hudi tables with three audit fields: **cdc_last_update_date** (timestamp), **logical_is_deleted** (Boolean), and **_hoodie_event_time** (string). You need to add the three audit fields when creating a table. Otherwise, the task will be abnormal. – If a field name contains uppercase letters during manual

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Type	Description
	creation of a Hudi table, ensure that the name and case of the field are the same as those of the corresponding field in the source table. Otherwise, the job will be abnormal or the data will be null after migration. When a real-time synchronization job automatically creates a Hudi table, the field names of the table are lowercase letters. ● Job stability: – The memory overhead of a Hudi table with BLOOM indexes is high, and the job is unstable. You are advised to use BUCKET indexes to create a table. – Real-time compaction consumes a large amount of memory, and the job is unstable. Therefore, you are advised to use offline compaction. ● Changelog tables: If changelogs are enabled for Hudi and data is lost, downstream Flink jobs must be restarted after data is patched using a Spark or Flink job. Otherwise, changelogs may be lost and Flink status may be abnormal. Currently, data cannot be patched at the operation level (-U, +U, +I, and -D data) for Hudi changelog tables. Instead, data patching can only ensure data consistency during Spark query, but cannot ensure the consistency of data read by Flink streams. ● DDL synchronization: – DDL operations (for example, ALTER TABLE ddl_test ADD COLUMN c2 AFTER/FIRST c1;) for adding columns to a specified position are not supported. The AFTER/FIRST attribute will be deleted, which may cause column sequence inconsistency.

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Type	Description
	– Executing non-idempotent DDL statements (for example, ALTER TABLE ddl_test ADD COLUMN c3 timestamp default now();) may cause data inconsistency. – The following DDL operations can be identified: creating a table, deleting a table, adding a column, deleting a column, renaming a table, renaming a column, modifying a column type, and clearing a table. Only column adding operations can be synchronized to the destination Hudi database. You can set the processing policy for the other DDL operations to **Ignore** or **Error**. – In the database and table sharding scenario, ensure that the types of columns to be added to each table are the same. Otherwise, the task may fail. – If the column type is changed, a column is deleted, or a column is renamed at the source, you must stop the real-time synchronization task in a timely manner and use Spark SQL to update the DDL of the Hudi table. Otherwise, the job will fail or data inconsistency will occur. – The column name can contain no more than 256 characters. Otherwise, the task fails.

Constraints on the GaussDB(DWS) Destination

Type	Description
Applicable Version	8.1.3, 8.2.0, or a later version, except GaussDB(DWS) 3.0

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Type	Description
Required Permissions	Table permissions: The account must have the INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE permissions on the destination table.
Database	The name of an object in the database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($).

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Type	Description
Usage	• General: – During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. – Data cannot be synchronized to GaussDB(DWS) tables that have no primary keys. – GaussDB(DWS) column-store tables cannot be concurrently synchronized because there are distributed locks. Concurrent updates may cause locks or deadlocks. You are advised to use GaussDB(DWS) row-store tables or hybrid row- and column-store tables. For details, see the GaussDB(DWS) documentation. • Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. • Incremental synchronization phase: – During incremental synchronization, DDL operations (for example, ALTER TABLE ddl_test ADD COLUMN c2 AFTER/FIRST c1;) for adding columns to a specified position are not supported. The AFTER/FIRST attribute will be deleted, which may cause column sequence inconsistency. – During incremental synchronization, executing non-idempotent DDL statements (for example, ALTER TABLE ddl_test ADD COLUMN c3 timestamp default now();) may cause data inconsistency. – During incremental synchronization, database-level synchronization does not support online DDL operations, and table-level synchronization supports

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Type	Description
	only online DDL operations generated by DMS on some clouds. – During incremental synchronization, the following DDL operations can be synchronized: creating tables, deleting tables, adding columns, deleting columns, renaming tables, renaming columns, changing the column type, and clearing tables. You can select the DDL types to be synchronized as needed. – In the database and table sharding scenario, you must stop service operations before renaming columns. Otherwise, data inconsistency may occur. – In the database and table sharding scenario, you are advised to synchronize only the DDL for adding columns. If you synchronize other DDL operations, the job may fail or data may be inconsistent because the destination table has been modified. – In the database and table sharding scenario, ensure that the types of columns to be added to each table are the same. Otherwise, the task may fail. – The name of a table or column to be added or modified can contain no more than 63 characters. Otherwise, the job will fail. – During incremental migration, when **CHANGE COLUMN** is executed in the source database to modify a column which is a distribution column in the destination GaussDB(DWS) database, an exception may occur because

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Type	Description
	distribution columns in GaussDB(DWS) databases cannot be modified.

Type	Description
Other	• Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • During automatic table creation, the length of the char, varchar, nvarchar, enum, and set characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database. • During full synchronization of timestamp data, the on update current_timestamp syntax in the default value will not be synchronized to the destination GaussDB(DWS) database. • Only DDL operations (for example, RENAME TABLE A TO B, in which B must be within the synchronization scope) can be performed to rename tables only if the renamed tables are within the synchronization scope. You are not advised to perform rename operations in the database and table synchronization scenario.

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Type	Description
	Otherwise, the task may fail or data may be inconsistent.

7.3 Supported Data Sources

Table 7-2 lists the data sources supported by real-time migration jobs.

Table 7-2 Data sources supported by real-time migration jobs

Category	Source	Destination	Reference	Description

7.4 Check Before Use

Before creating a real-time synchronization task in DataArts Migration, you must check the items listed in the following table to ensure that the environment meets the requirements of the task.

Table 7-3 Check items

Item	Description	Preparation
Relevant service components	DataArts Migration depends on the following components: cdm-instance 851, dps-agent 851, migration-engine 851, migration-resource 851, and DLF 851, and later versions of these components. Supported MRS cluster versions: 330, 350, and 351	Upgrade related service components to their available versions.
Account and permissions	Create a user and authorize the user to use DataArts Migration.	See **Authorizing the Use of Real-Time Data Migration**.
Real-time computing resource group	You need to the compute resources required by the real-time migration task.	See **Buying a DataArts Migration Resource Group Incremental Package**. See **Associating a Real-Time Migration Resource Group with Workspaces**.

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Item	Description	Preparation
Databases	Prepare the source and destination databases and the corresponding connection account permissions. **NOTE** • You are advised to create an independent database account for the connection of the migration task to prevent task failures caused by account modification. • After changing the account passwords for the source or destination databases, modify the connection information in the migration task as soon as possible to prevent automatic retry after a task failure. Automatic retries will lock the database accounts.	The required permissions vary depending on the link and database. For details, see **Tutorials**.
Connections	Create data connections in DataArts Studio Management Center. **NOTE** • When creating a data connection, you must select **DataArts Migration** for **Applicable Modules**. • The agent used in a data connection is a CDM cluster. You must upgrade the cluster to a later version to meet function and feature requirements. For details, contact the customer service or technical support.	For details, see **Configuring DataArts Studio Data Connection Parameters**.
Network communications	Enable network communications between the resource group, migration source, and migration destination.	For details, see FAQ: descriptions of enabling ports of the data source security group. There are additional network constraints for some data sources. For details, see **data source constraints**.

7.5 Enabling Network Communications

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

7.5.1 Database Deployed in an On-premises IDC

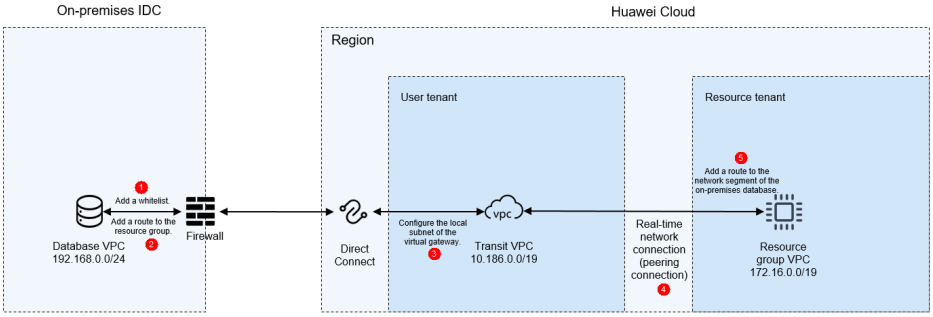
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7.5.1.1 Using Direct Connect to Enable Network Communications

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to use a Direct Connect connection to enable communications when the database is deployed in an on-premises IDC.

Figure 7-6 Network diagram



Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.
- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

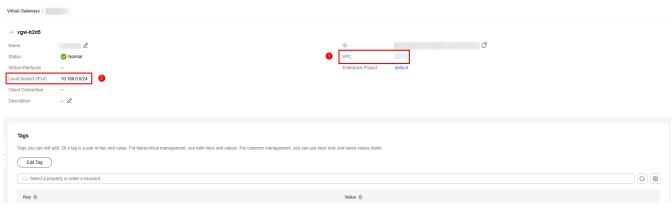
- You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.
- You have purchased and configured a Direct Connect connection which connects to at least one VPC on the cloud. To enable Direct Connect and configure a direction, see **Using Direct Connect to Connect an On-Premises Data Center to the Cloud**.

Preparations

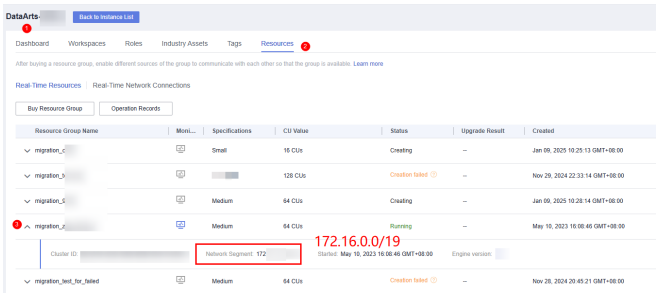
Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

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Table 7-4 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source network segment	Private network segment of the data source of the on-premises IDC. Obtain the value based on the site requirements.	192.168.0.0/24
Transit VPC and its subnet	Used for the communications between the data source and migration resource group. In this solution, a VPC configured for the virtual gateway of Direct Connect and the corresponding subnet are used. **NOTE** To obtain the VPC and subnet, log in to the Direct Connect console. In the navigation pane on the left, choose **Direct Connect** > **Virtual Gateways**. In the gateway list, locate the virtual gateway used by the on-premises IDC and click its name to view the associated VPC and subnet. **Figure 7-7** Viewing the virtual gateway 	VPC: 10.186.0.0/19 Subnet: 10.186.0.0/24

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. **NOTE** To obtain the VPC, perform the following steps: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-8** Obtaining the migration resource group network segment 	172.16.0.0/19

Network Configuration Process

Step 1 Configure a whitelist for the databases of the on-premises IDC.

Allow the VPC network segment (for example, 172.16.0.0/19) of the migration resource group to access the databases of the on-premises IDC. The method of configuring a whitelist varies depending on the database type. For details, see the official documentation of each database.

NOTE

The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 2 (Optional) Add a route for the on-premises IDC.

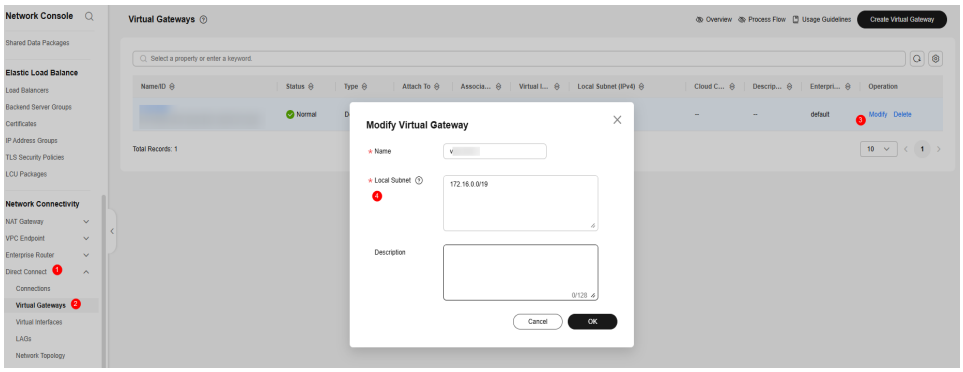
Add a route for the on-premises IDC to the VPC network segment (for example, 172.16.0.0/19) of the migration resource group and Huawei gateway. For details about how to add a route, see .

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Step 3 Add the migration resource group network segment to the local subnet of the Direct Connect connection.

To allow Direct Connect to access the migration resource group network segment, perform the following operations: Log in to the Direct Connect console. In the navigation pane on the left, choose **Direct Connect** > **Virtual Gateways**. In the list, locate the virtual gateway used for connecting to the on-premises IDC and click **Modify** in the **Operation** column. In the displayed dialog box, enter the VPC network segment (for example, **172.16.0.0/19**) of the migration resource group for **Local Subnet**.

Figure 7-9 Adding a local subnet

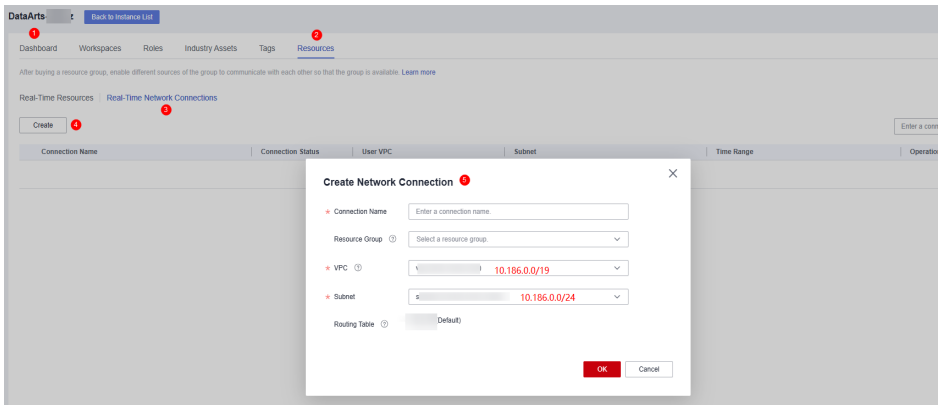


Step 4 Create a real-time network connection (VPC peering connection) for migration.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

Figure 7-10 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

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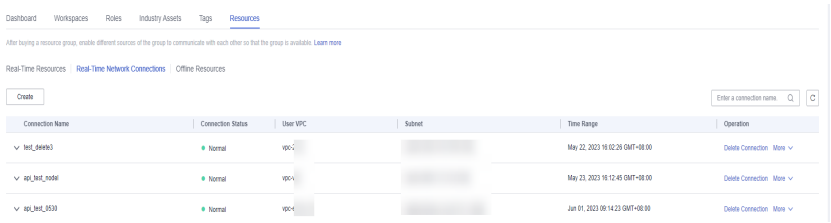
Table 7-5 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 5 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

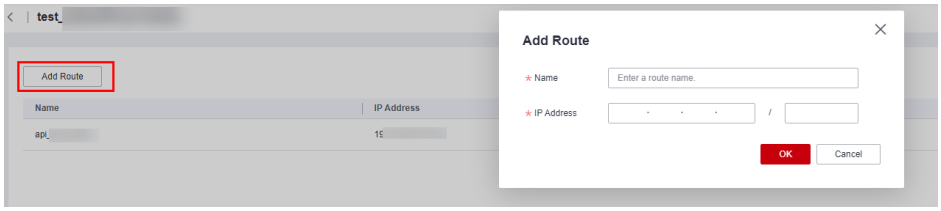
Locate the real-time network connection created in **step 4**, click **More** in the **Operation** column and select **Add Route**. In the displayed dialog box, enter the private network address of the database of the on-premises IDC, for example, **192.168.0.0/24**.

Figure 7-11 Adding route 1



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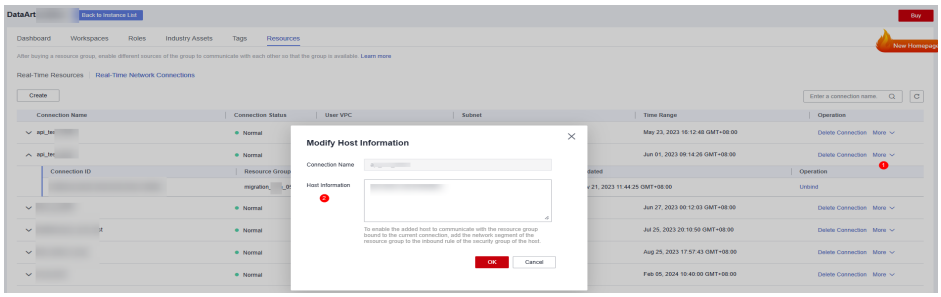
Figure 7-12 Adding route 2



Step 6 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-13 Modifying host information



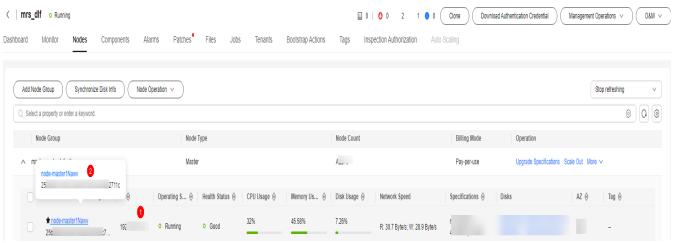
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-14 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 7 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration

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resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

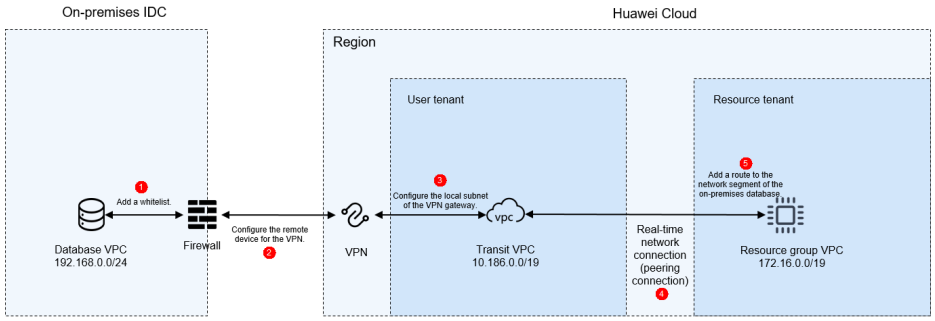
----End

7.5.1.2 Using VPN to Enable Network Communications

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to use a VPN to enable communications when the database is deployed in an on-premises IDC.

Figure 7-15 Network diagram



Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.
- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

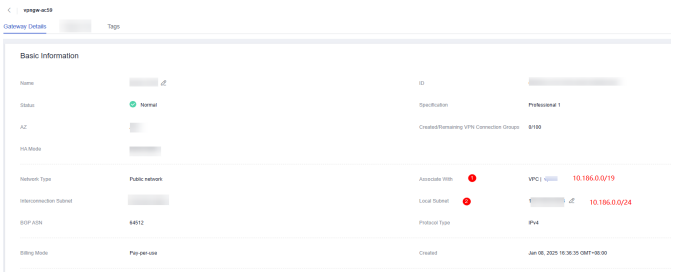
- You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.
- You have purchased and configured a VPN which connects to at least one VPC on the cloud. For how to enable and configure a VPN, see .

Preparations

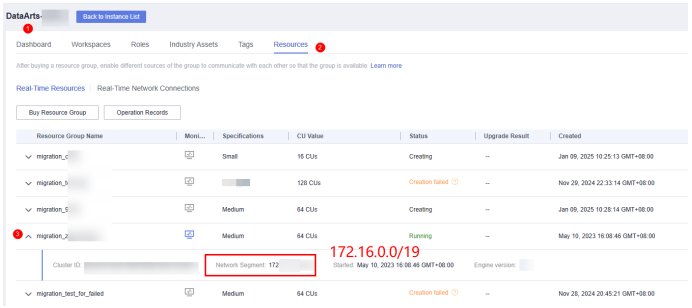
Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

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Table 7-6 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source network segment	Private network segment of the data source of the on-premises IDC. Obtain the value based on the site requirements.	192.168.0.0/24
Transit VPC and its subnet	Used for the communications between the data source and migration resource group. In this solution, a VPC configured for the virtual gateway of VPN and the corresponding subnet are used. To obtain the VPC and subnet, perform the following operations: To obtain the VPC and subnet, log in to the VPN console. In the navigation pane on the left, choose **Virtual Private Network** > **VPN Gateways**. In the gateway list, locate the virtual gateway used by the on-premises IDC and click its name to view the associated VPC and subnet. **Figure 7-16** Viewing the VPN gateway 	VPC: 10.186.0.0/19 Subnet: 10.186.0.0/24

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-17** Obtaining the migration resource group network segment  	172.16.0.0/19

Network Configuration Process

Step 1 Configure a whitelist for the databases of the on-premises IDC.

Allow the VPC network segment (for example, 172.16.0.0/19) of the migration resource group to access the databases of the on-premises IDC. The method of configuring a whitelist varies depending on the database type. For details, see the official documentation of each database.

NOTE

The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 2 (Optional) Configure the VPN peer gateway for the on-premises IDC.

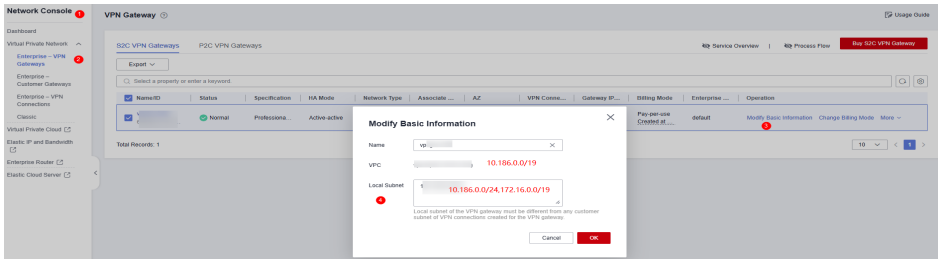
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Enable the communications between the database of the on-premises IDC and the VPC network segment (for example, 172.16.0.0/19) of the Huawei Cloud migration resource group by referring to in the *Virtual Private Network Getting Started*.

Step 3 Add the migration resource group network segment to the local subnet of the VPN.

To allow VPN to access the migration resource group network segment, perform the following operations: Log in to the VPN console. In the navigation pane on the left, choose **Virtual Private Network** > **VPN Gateways**. In the list, locate the VPN gateway used for connecting to the on-premises IDC and click **Modify** in the **Operation** column. In the displayed dialog box, enter the VPC network segment (for example, **172.16.0.0/19**) of the migration resource group for **Local Subnet**.

Figure 7-18 Adding a local subnet

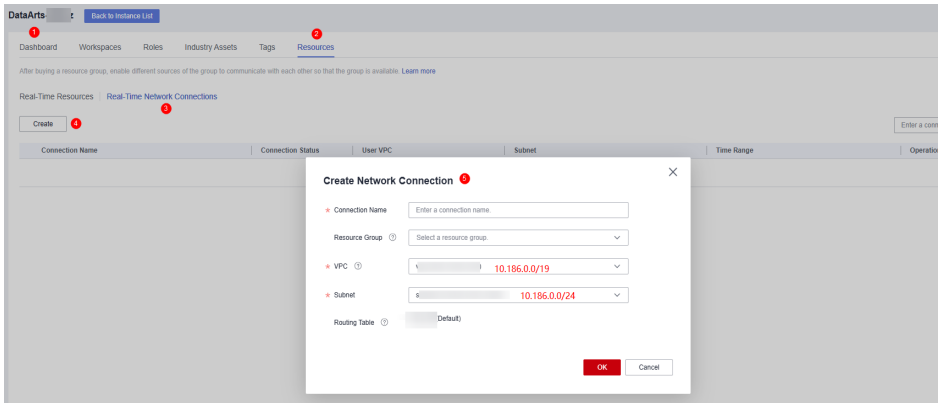


Step 4 Create a real-time network connection (VPC peering connection) for migration.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

Figure 7-19 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

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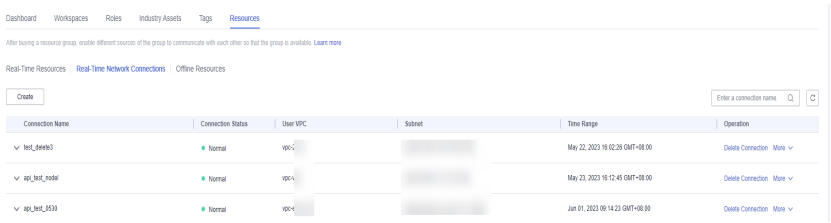
Table 7-7 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 5 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

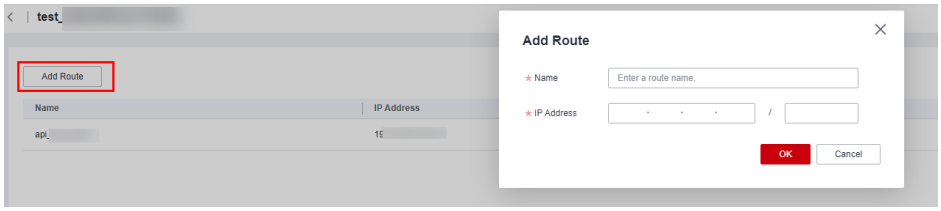
Locate the real-time network connection created in **step 4**, click **More** in the **Operation** column and select **Add Route**. In the displayed dialog box, enter the private network address of the database of the on-premises IDC, for example, **192.168.0.0/24**.

Figure 7-20 Adding route 1



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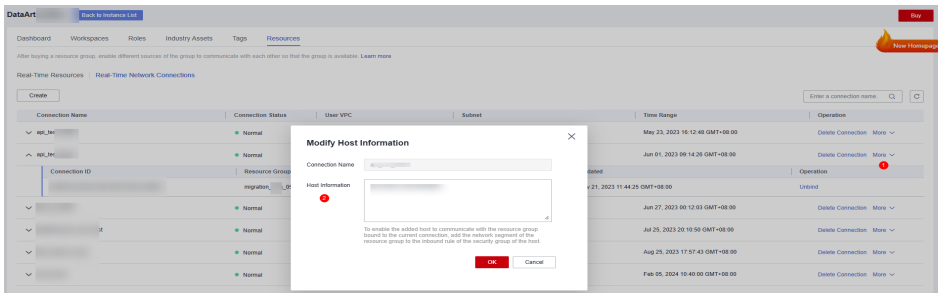
Figure 7-21 Adding route 2



Step 6 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-22 Modifying host information



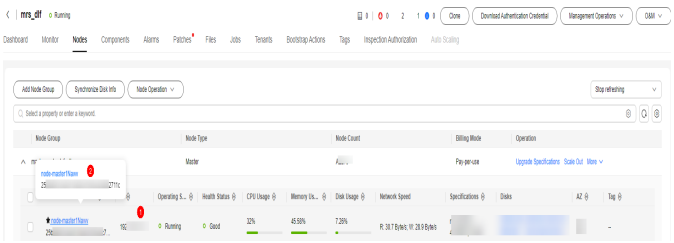
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-23 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 7 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration

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resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

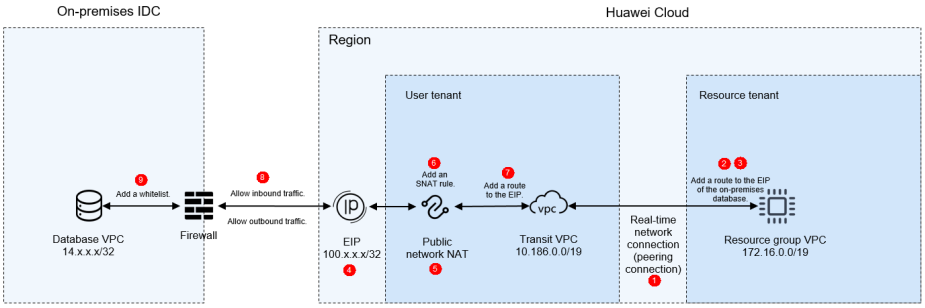
----End

7.5.1.3 Using a Public Network to Enable Network Communications

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to use a public network to enable communications when the database is deployed in an on-premises IDC.

Figure 7-24 Network diagram



Notes and Constraints

A migration resource group does not have a public network segment. You can only use the public network NAT to convert its IP address into an EIP so that the resource group can access the public network. The EIP cannot be the same as the public IP address of the data source.

Prerequisites

You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.

Preparations

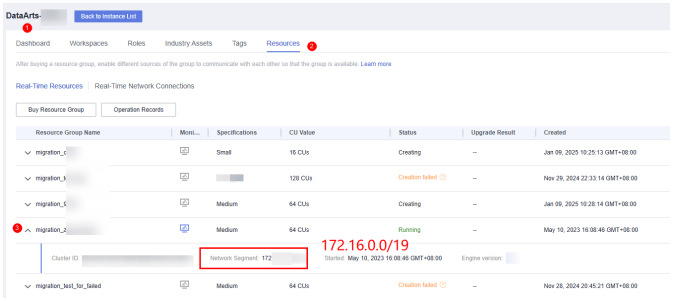
Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

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Table 7-8 Network segment planning for resources

Resource	Description	Example Private Network Segment
Public IP address of the data source	Public IP address of the data source of the on-premises IDC. Obtain the value based on the site requirements.	14.x.x.x/32
EIP	A migration resource group does not have a public network segment. You can only use the public network NAT to convert its IP address into an EIP so that the resource group can access the public network. To enable an EIP, log in to the EIP console and click **Buy EIP**. Configure the EIP parameters by referring to .	100.x.x.x/32
Transit VPC and its subnet	Used for the communications between the data source and migration resource group. In this solution, a VPC of the current tenant is used. For how to create a VPC, see .	VPC: 10.186.0.0/19 Subnet: 10.186.0.0/24

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-25** Obtaining the migration resource group network segment  	172.16.0.0/19

Network Configuration Process

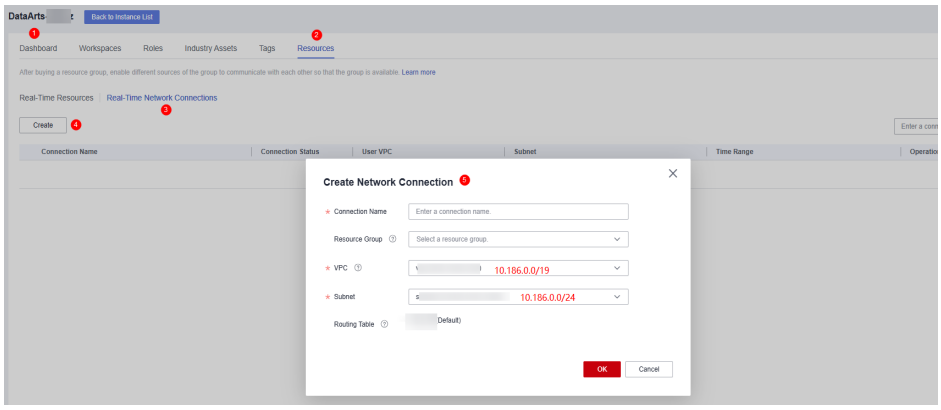
Step 1 Create a real-time network connection (VPC peering connection) for migration.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-26 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-9 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 2 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

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Locate the real-time network connection created in **step 1**, click **More** in the **Operation** column and select **Add Route**. In the displayed dialog box, enter the public network address of the database of the on-premises IDC, for example, **14.***x.x.x***/32**.

Figure 7-27 Adding route 1

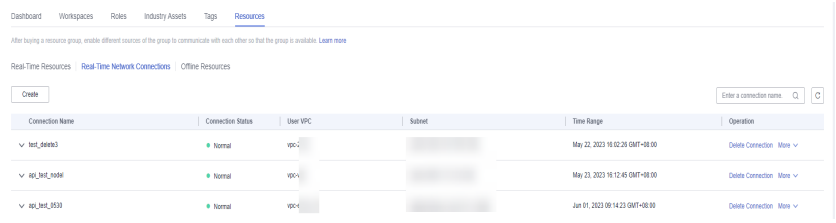
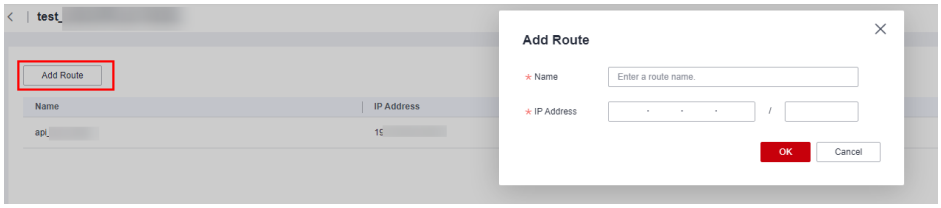


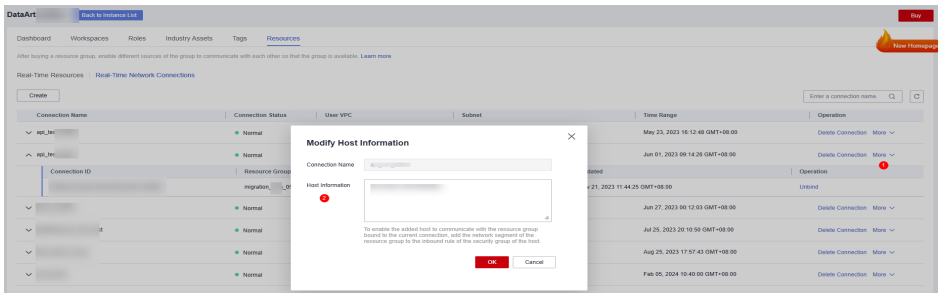
Figure 7-28 Adding route 2



Step 3 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-29 Modifying host information



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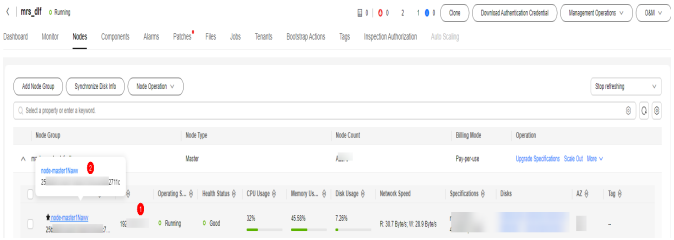
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-30 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 4 Buy an EIP.

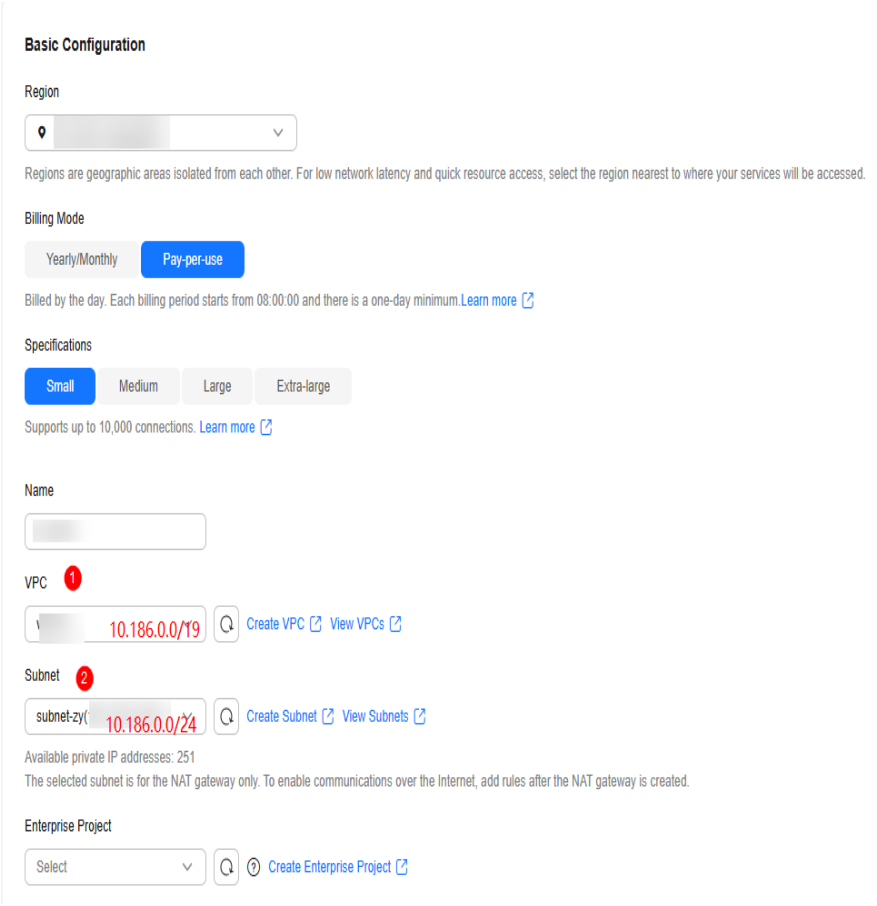
Log in to the EIP console, click **Buy EIP**, and set the parameters as prompted. For details, see .

Step 5 Create a public NAT gateway.

1. Log in to the NAT Gateway console, choose **NAT Gateway** > **Public NAT Gateways** in the navigation pane on the left, and click **Buy Public NAT Gateway**.
2. When configuring the NAT gateway, set **Region** to the region where DataArts Migration is located, **VPC** to the transit VPC (for example, 10.186.0.0/19), and **Subnet** to the subnet of the transit VPC (for example, 10.186.0.0/24). For details about how to configure other parameters, see .

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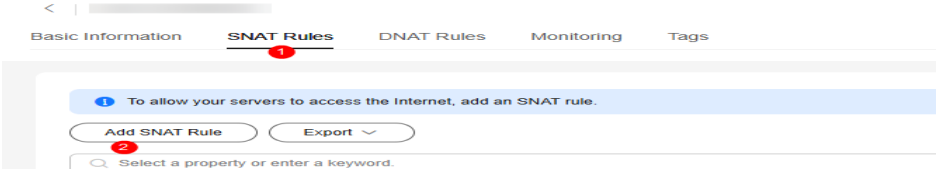
Figure 7-31 Configuring a public NAT gateway



Step 6 Add an SNAT rule for the public NAT gateway.

You need to add an SNAT rule for the NAT gateway to allow the hosts in the migration resource group to communicate with the Internet. Click the name of the public NAT gateway you have created and then the **SNAT Rules** tab. On the displayed page, click **Add SNAT Rule**.

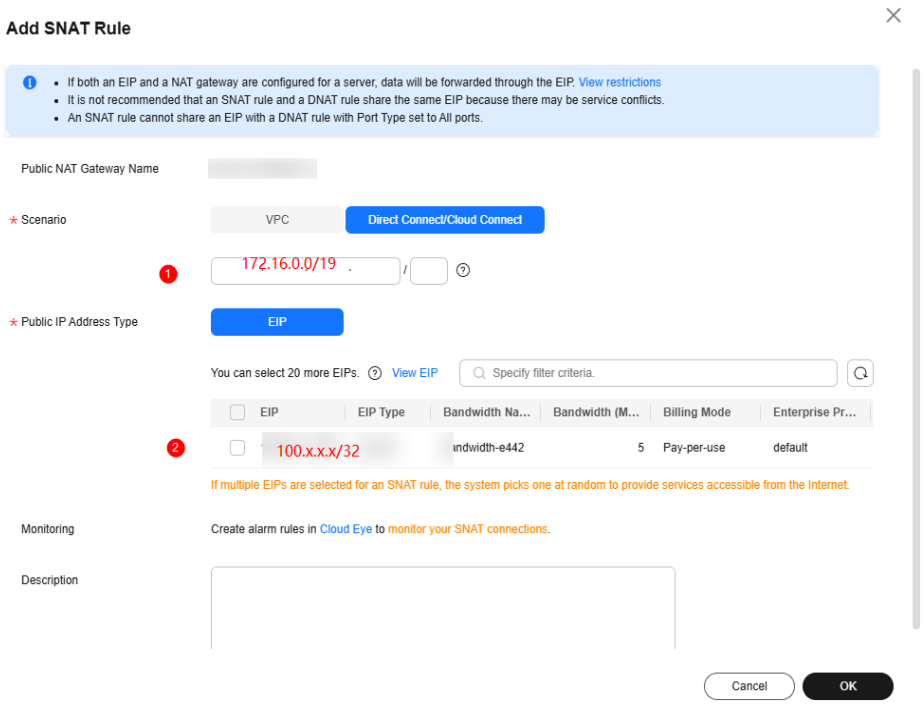
Figure 7-32 Adding an SNAT rule 1



Select **Direct Connect/Cloud Connect** for **Scenario**, enter the network segment (for example, **172.16.0.0/19**) of the migration resource group VPC, and select the EIP (**100.***x.x.x***/32**) purchased in step 3.

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Figure 7-33 Adding an SNAT rule 2

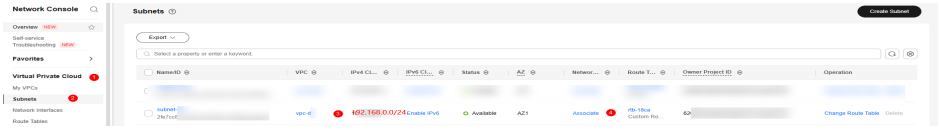


Step 7 Add a route to the transit VPC subnet.

Add a route to the route table of the transit VPC subnet. Set the destination to the EIP (for example, 14.*x.x.x*/32) of the database of the on-premises IDC and the next hop to the NAT gateway you have configured.

1. Log in to the VPC console. In the navigation pane on the left, choose **Virtual Private Cloud** > **Subnets**. Locate the subnet of the transit VPC, and click the route table name to go to the configuration page.

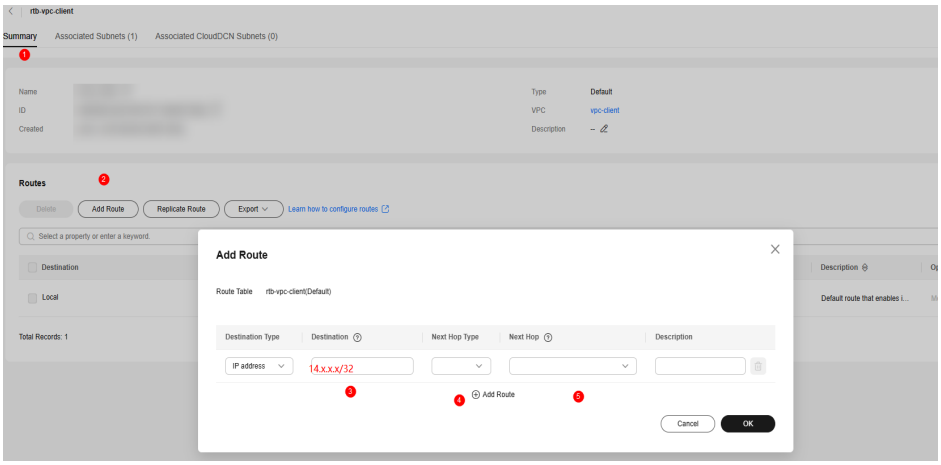
   Figure 7-34 Querying the route table

2. Click the **Summary** tab and **Add Route**. In the displayed dialog box, set **Destination** to the EIP (for example, 14.*x.x.x*/32) of the database of the on-premises IDC and **Next Hop** to the NAT gateway you have configured.

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Figure 7-35 Adding a route to the route table



Step 8 Configure the firewall of the on-premises IDC.

The firewall of the on-premises IDC must allow access from the EIP (for example, 100.*x.x.x*/32) so that DataArts Migration can access the databases in the on-premises IDC.

- Inbound rule: Allow access to the database listening port from the EIP.
- Outbound rule: Allow data transmission from the database listening port to the EIP.

Step 9 Configure a whitelist for the databases of the on-premises IDC.

Allow the EIP (for example, 100.*x.x.x*/32) to access the databases of the on-premises IDC. The method of configuring a whitelist varies depending on the database type. For details, see the official documentation of each database.

NOTE

The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 10 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

----End

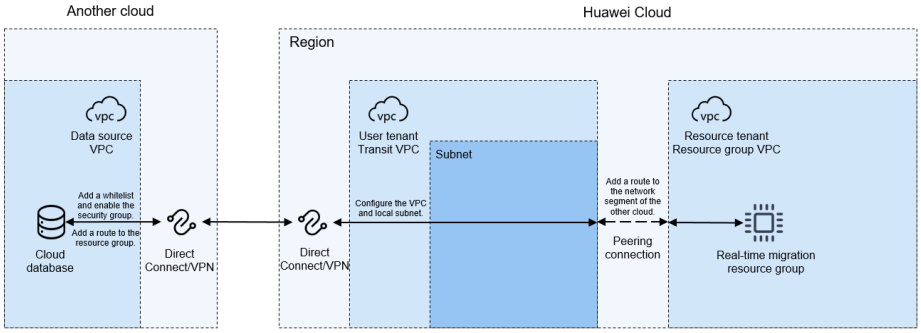
7.5.2 Database Deployed on Another Cloud

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to enable network communications when the database is deployed on another cloud.

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Figure 7-36 Network diagram



Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.
- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.

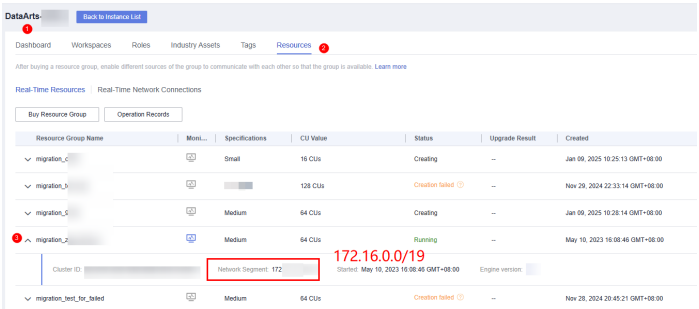
Network Configuration Process

Step 1 Obtain the VPC network segment of the real-time migration resource group.

The real-time resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment.

Figure 7-37 Obtaining the migration resource group network segment



Step 2 Create and configure a transit VPC and subnet.

Create a VPC and subnet as the transit VPC. For details, see . If you already have an available VPC, skip this step.

Step 3 Buy and configure a Direct Connect connection or VPN on Huawei Cloud.

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To connect another cloud computing environment and Huawei Cloud computing environment, you can enable Direct Connect or VPN.

- For details about how to buy and configure a Direct Connect connection, see . When creating a virtual gateway, select the transit VPC created in step 2 and add the VPC network segment of the real-time migration resource group in addition to the subnet of the transit VPC for the local subnet.
- For details about how to buy and configure a VPN, see . When creating a VPN gateway, select the transit VPC created in **step 2** and add the VPC network segment of the real-time migration resource group in addition to the subnet of the transit VPC for the local subnet.

Step 4 Buy a Direct Connect connection or VPN on another cloud.

For details, see the documentation on its official website.

Step 5 Add a route to the network of the database on another cloud.

Add a route to the route table of the network of the databases on another cloud. Set the destination to the VPC network segment of the migration resource group, and set the next hop to the Direct Connect connection or the VPN peer gateway created in step 3.

Step 6 Configure a whitelist and security group rules for the database of another cloud.

- Allow access to the database on another cloud from the VPC network segment of the resource group. The method of configuring a whitelist varies depending on the database vendor. For details, see the official documentation of each database.
- In addition, if a security group has been configured for the database on another cloud, you need to add an inbound rule to allow the VPC network segment of the resource group to access the database listening port.

NOTE

The ports used by different data sources vary. Configure the ports for security group rules by referring to .

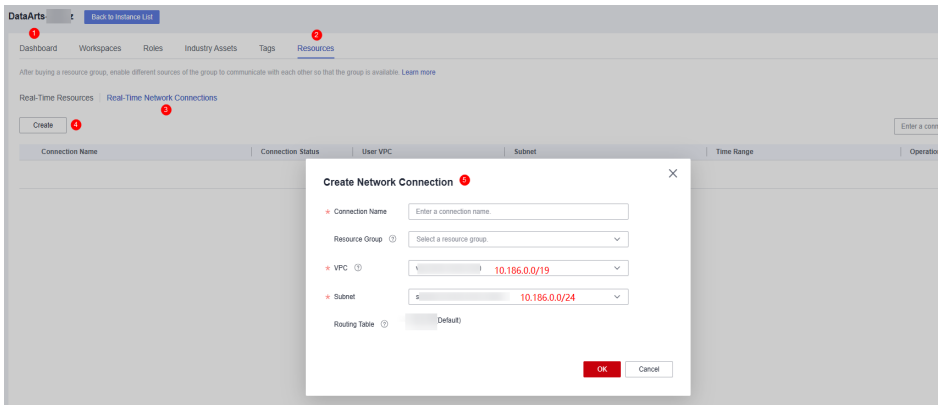
Step 7 Create a real-time network connection.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-38 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-10 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select the VPC and subnet of the transit VPC.
Subnet	Subnet of the transit VPC
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 8 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

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Locate the real-time network connection created in step 7, click **More** in the **Operation** column and select **Add Route**. In the displayed dialog box, enter the private network address of the database of the on-premises IDC.

Figure 7-39 Adding route 1

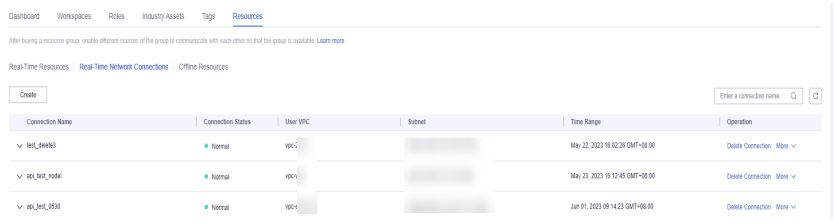
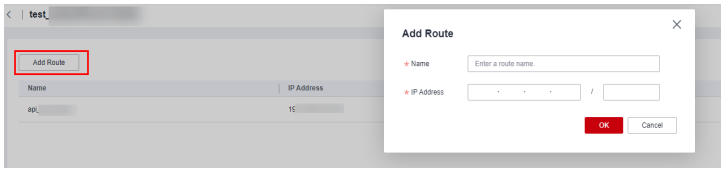


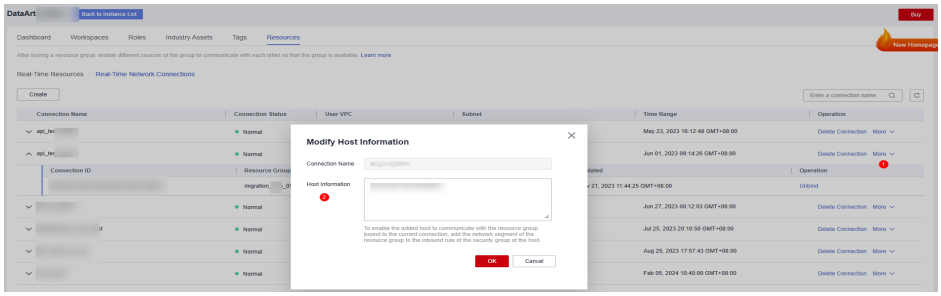
Figure 7-40 Adding route 2



Step 9 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-41 Modifying host information



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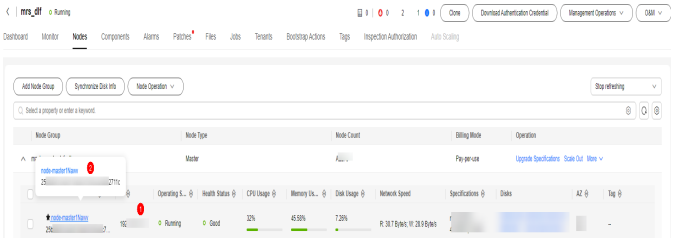
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-42 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 10 Test the network connectivity.

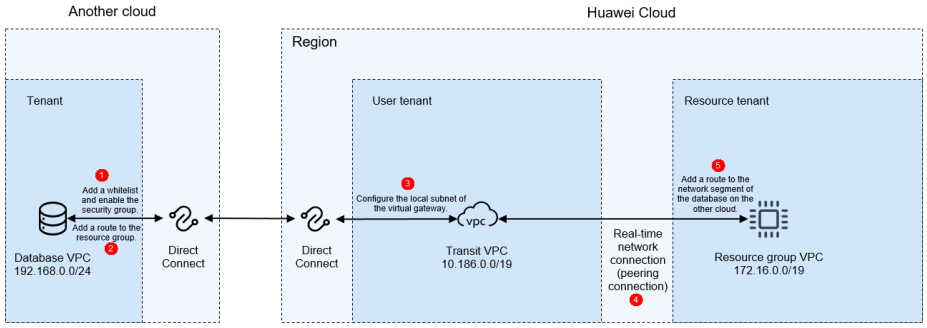
In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

----End

7.5.2.1 Using Direct Connect to Enable Network Communications

This section describes how to use a Direct Connect connection to enable communications when the database is deployed in another cloud.

Figure 7-43 Network diagram



Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.

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- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

- You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.
- You have purchased and configured a Direct Connect connection which connects to at least one VPC on the cloud. To enable Direct Connect and configure a direction, see and the documentation on the official website of another cloud.

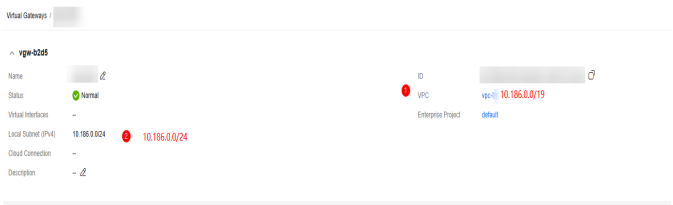
Preparations

Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

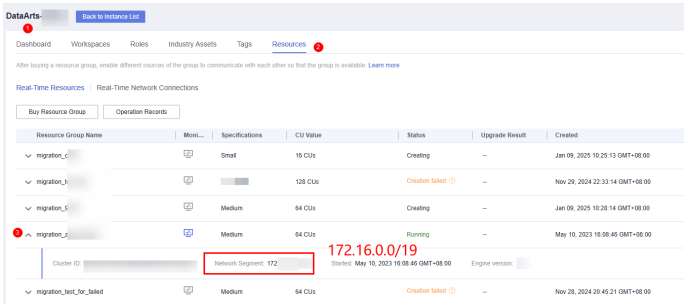
Table 7-11 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source network segment	Private network segment of the data source of another cloud. Obtain the value based on the site requirements.	192.168.0.0/24

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Resource	Description	Example Private Network Segment
Transit VPC and its subnet	Used for the communications between the data source and migration resource group. In this solution, a VPC configured for the virtual gateway of Direct Connect and the corresponding subnet are used. To obtain the VPC and subnet, perform the following operations: Log in to the Direct Connect console. In the navigation pane on the left, choose **Direct Connect** > **Virtual Gateways**. In the gateway list, locate the virtual gateway used by another cloud and click its name to view the associated VPC and subnet. **Figure 7-44** Viewing the virtual gateway 	VPC: 10.186.0.0/19 Subnet: 10.186.0.0/24

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-45** Obtaining the migration resource group network segment 	172.16.0.0/19

Network Configuration Process

Step 1 Configure a whitelist and security group rules for the database of another cloud.

- Allow the VPC network segment (for example, 172.16.0.0/19) of the migration resource group to access the database of another cloud. The method of configuring a whitelist varies depending on the database type. For details, see the official documentation of each database.
- If a security group has been configured for the database on another cloud, you need to add an inbound rule to allow the VPC network segment (for example, 172.16.0.0/19) of the resource group to access the database listening port.

NOTE

The ports used by different data sources vary. Configure the ports for security group rules by referring to .

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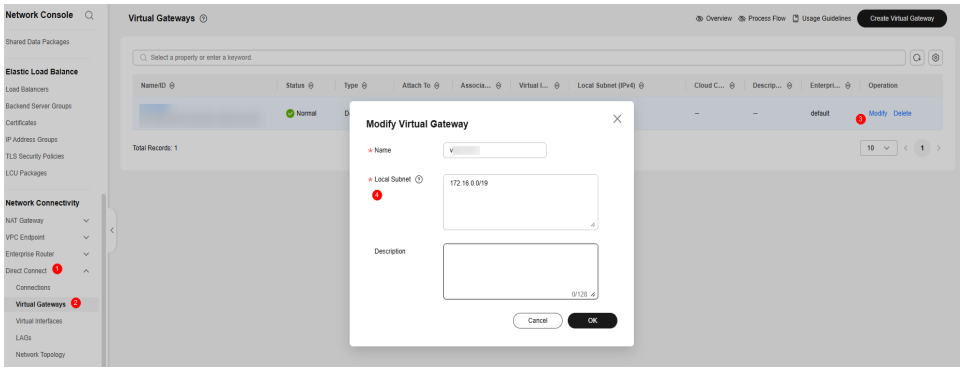
Step 2 (Optional) Add a route to the network of the database on another cloud and add a remote subnet to the Direct Connect connection.

- If necessary, add a route for the network of the database on another cloud, set the destination to the VPC network segment (for example, 172.16.0.0/19) of the resource group, and set the next hop to the Direct Connect connection. For details, see the documentation on the official website of another cloud.
- If necessary, add the VPC network segment (for example, 172.16.0.0/19) of the resource group to the remote subnet of the Direct Connect connection of another cloud to ensure that the route is reachable. For details, see the documentation on the official website of another cloud.

Step 3 Add the migration resource group network segment to the local subnet of the Direct Connect connection.

To allow Direct Connect to access the migration resource group network segment, perform the following operations: Log in to the Direct Connect console. In the navigation pane on the left, choose **Direct Connect** > **Virtual Gateways**. In the list, locate the virtual gateway used for connecting to another cloud and click **Modify** in the **Operation** column. In the displayed dialog box, enter the VPC network segment (for example, **172.16.0.0/19**) of the migration resource group for **Local Subnet**.

Figure 7-46 Adding a local subnet



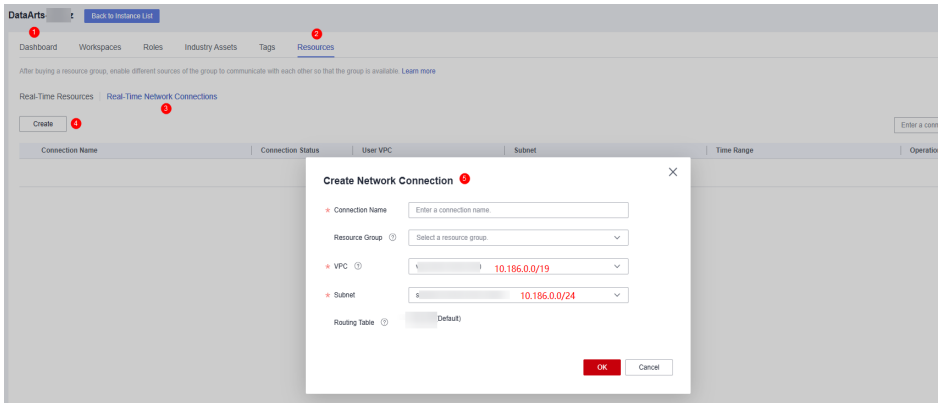
Step 4 Create a real-time network connection (VPC peering connection) for migration.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-47 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-12 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 5 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

Locate the real-time network connection created in **step 4**, click **More** in the **Operation** column and select **Add Route**. In the displayed dialog box, enter the

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private network address of the database of the on-premises IDC, for example, **192.168.0.0/24**.

Figure 7-48 Adding route 1

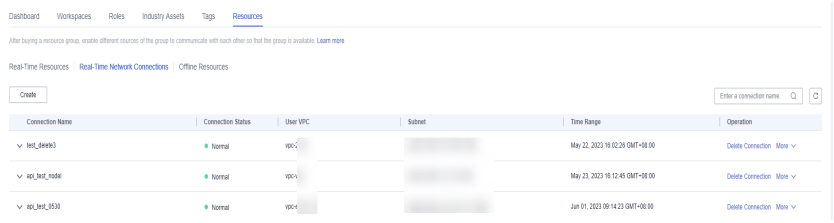
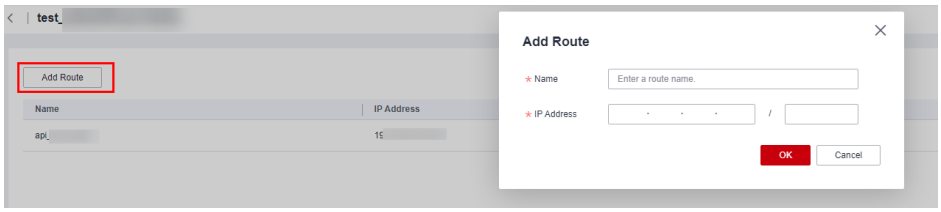


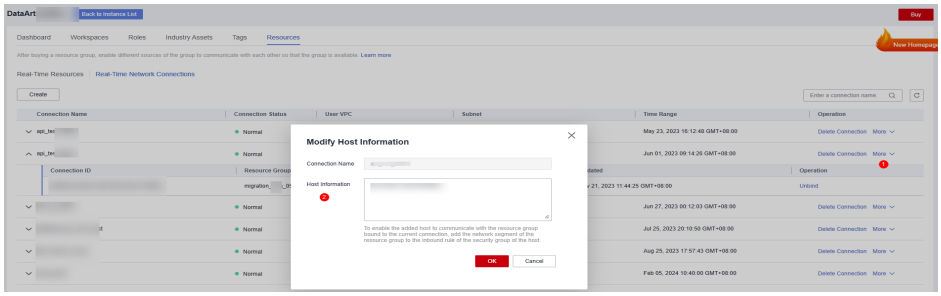
Figure 7-49 Adding route 2



Step 6 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-50 Modifying host information



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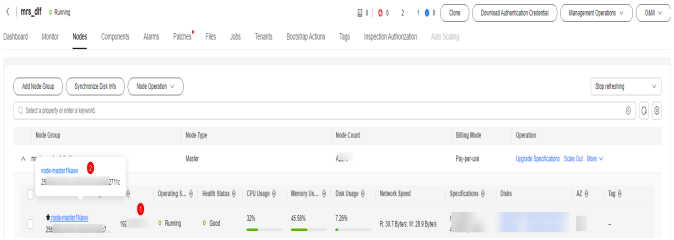
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-51 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 7 Test the network connectivity.

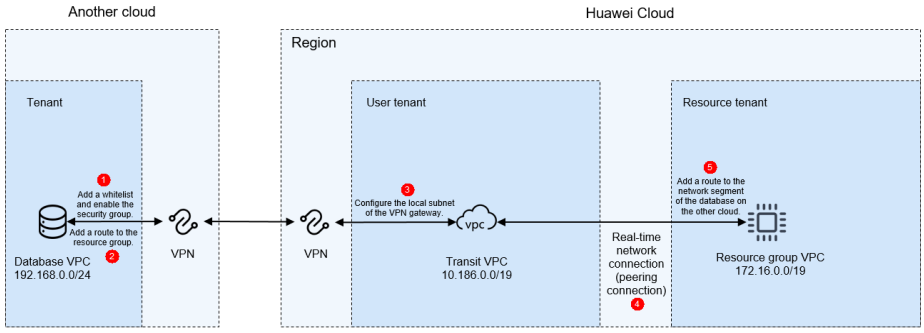
In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

----End

7.5.2.2 Using VPN to Enable Network Communications

This section describes how to enable network communications when the database is deployed on another cloud.

Figure 7-52 Network diagram



Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.

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- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

- You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.
- You have purchased and configured a VPN which connects to at least one VPC on the cloud. For details about how to buy and configure a VPN, see .

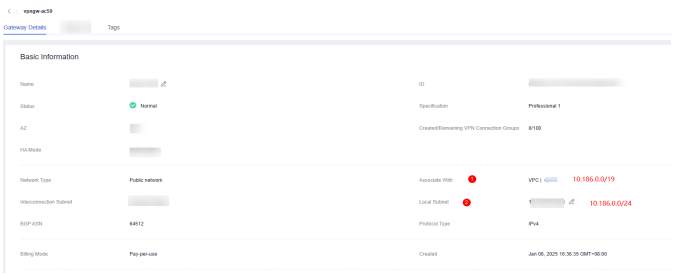
Preparations

Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

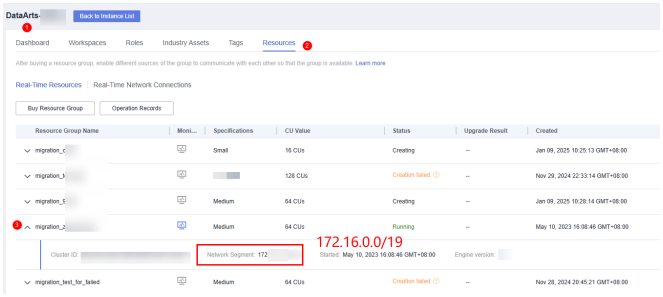
Table 7-13 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source network segment	Private network segment of the data source of another cloud. Obtain the value based on the site requirements.	192.168.0.0/24

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Resource	Description	Example Private Network Segment
Transit VPC and its subnet	Used for the communications between the data source and migration resource group. In this solution, a VPC configured for the virtual gateway of VPN and the corresponding subnet are used. To obtain the VPC and subnet, perform the following operations: To obtain the VPC and subnet, log in to the VPN console. In the navigation pane on the left, choose **Virtual Private Network** > **VPN Gateways**. In the gateway list, locate the virtual gateway used by another cloud and click its name to view the associated VPC and subnet. **Figure 7-53** Viewing the VPN gateway 	VPC: 10.186.0.0/19 Subnet: 10.186.0.0/24

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-54** Obtaining the migration resource group network segment 	172.16.0.0/19

Network Configuration Process

Step 1 Configure a whitelist and security group rules for the database of another cloud.

- Allow the VPC network segment (for example, 172.16.0.0/19) of the migration resource group to access the database of another cloud. The method of configuring a whitelist varies depending on the database type. For details, see the official documentation of each database.
- If a security group has been configured for the database on another cloud, you need to add an inbound rule to allow the VPC network segment (for example, 172.16.0.0/19) of the resource group to access the database listening port.

NOTE

The ports used by different data sources vary. Configure the ports for security group rules by referring to .

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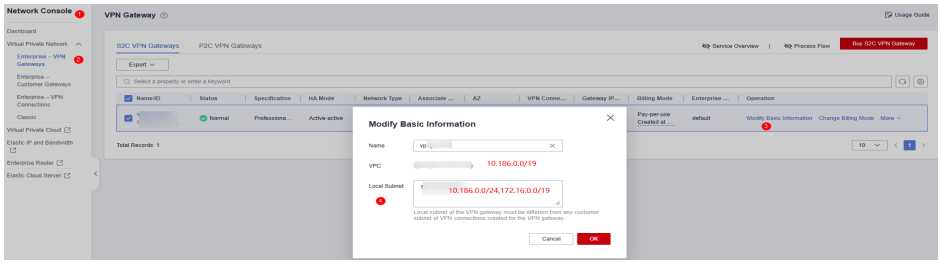
Step 2 (Optional) Add a route to the network and VPN gateway of the database on another cloud.

- If necessary, add a route for the network of the database on another cloud, set the destination to the VPC network segment (for example, 172.16.0.0/19) of the resource group, and set the next hop to the VPN gateway of another cloud. For details, see the VPN documentation on the official website of another cloud.
- If necessary, add a route to the VPN gateway route table on another cloud, set the destination to the VPC network segment (for example, 172.16.0.0/19) of the resource group, and set the next hop to the VPN gateway of another cloud. For details, see the VPN documentation on the official website of another cloud.

Step 3 Add the migration resource group network segment to the local subnet of the VPN.

To allow VPN to access the migration resource group network segment, perform the following operations: Log in to the VPN console. In the navigation pane on the left, choose **Virtual Private Network** > **VPN Gateways**. In the list, locate the VPN gateway used for connecting to another cloud and click **Modify** in the **Operation** column. In the displayed dialog box, enter the VPC network segment (for example, **172.16.0.0/19**) of the migration resource group for **Local Subnet**.

Figure 7-55 Adding a local subnet



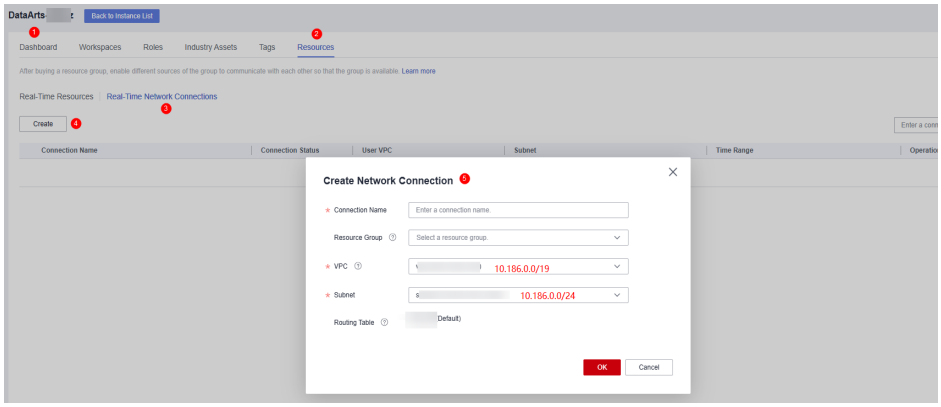
Step 4 Create a real-time network connection (VPC peering connection) for migration.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-56 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-14 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 5 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

Locate the real-time network connection created in **step 4**, click **More** in the **Operation** column and select **Add Route**. In the displayed dialog box, enter the

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private network address of the database of the on-premises IDC, for example, **192.168.0.0/24**.

Figure 7-57 Adding route 1

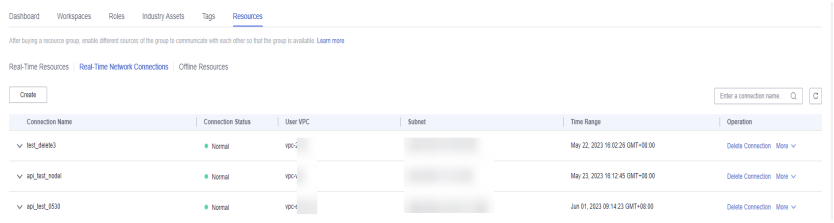
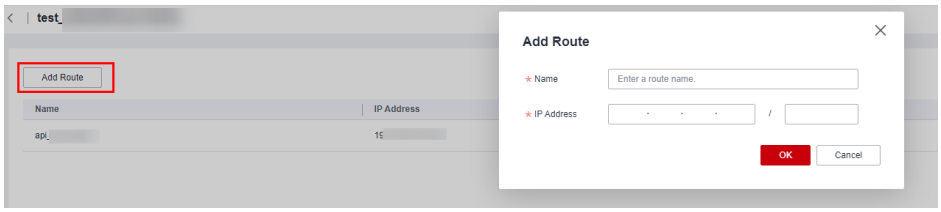


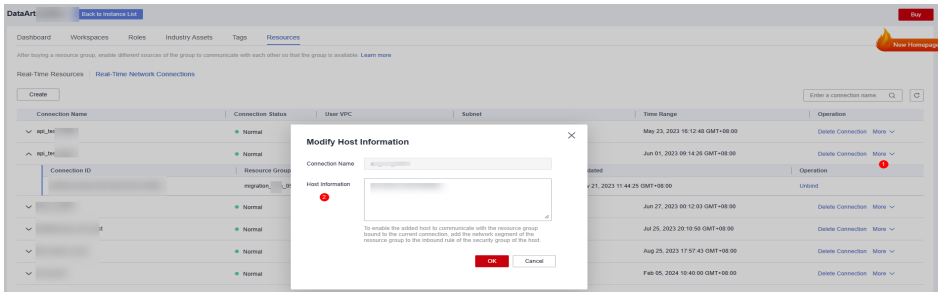
Figure 7-58 Adding route 2



Step 6 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-59 Modifying host information



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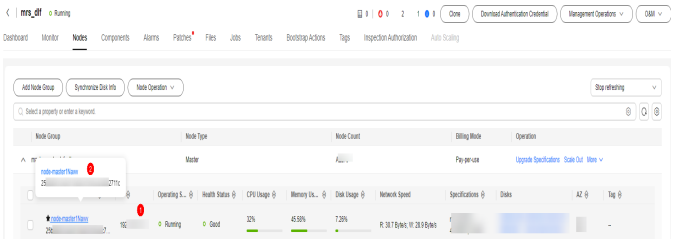
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-60 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 7 Test the network connectivity.

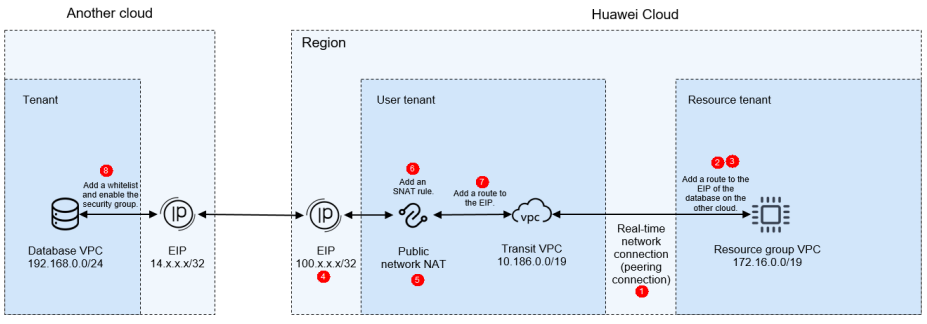
In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

----End

7.5.2.3 Using a Public Network to Enable Network Communications

This section describes how to use a public network to enable communications when the database is deployed in another cloud.

Figure 7-61 Network diagram



Notes and Constraints

A migration resource group does not have a public network segment. You can only use the public network NAT to convert its IP address into an EIP so that the resource group can access the public network. The EIP cannot be the same as the public IP address of the data source.

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Prerequisites

You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.

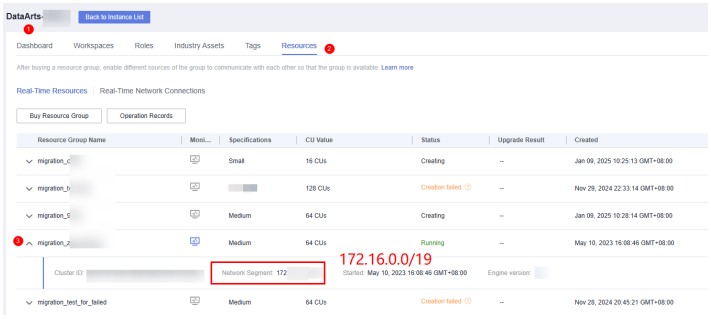
Preparations

Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

Table 7-15 Network segment planning for resources

Resource	Description	Example Private Network Segment
Public IP address of the data source	Public IP address of the data source of another cloud. Obtain the value based on the site requirements.	14.x.x.x/32
EIP	A migration resource group does not have a public network segment. You can only use the public network NAT to convert its IP address into an EIP so that the resource group can access the public network. To enable an EIP, log in to the EIP console and click **Buy EIP**. Configure the EIP parameters by referring to .	100.x.x.x/32
Transit VPC and its subnet	Used for the communications between the data source and migration resource group. In this solution, a VPC of the current tenant is used. For how to create a VPC, see .	VPC: 10.186.0.0/19 Subnet: 10.186.0.0/24

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-62** Obtaining the migration resource group network segment 	172.16.0.0/19

Network Configuration Process

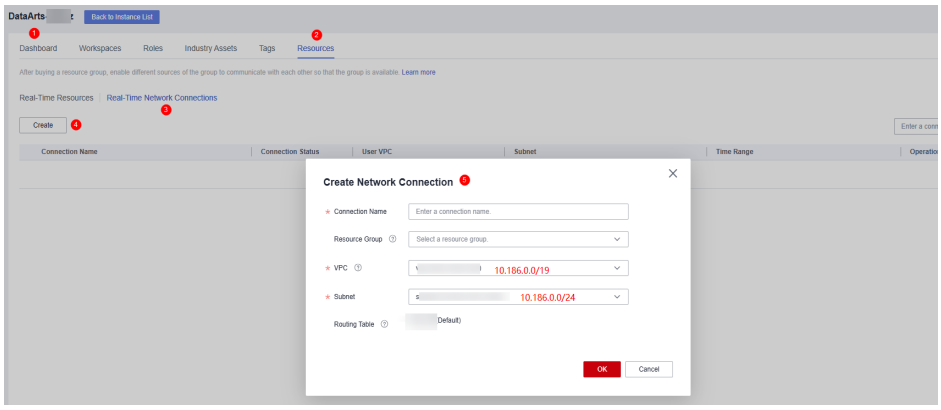
Step 1 Create a real-time network connection (VPC peering connection) for migration.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-63 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-16 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 2 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

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Locate the real-time network connection created in **step 1**, click **More** in the **Operation** column and select **Add Route**. In the displayed dialog box, enter the public network address of the database of the on-premises IDC, for example, **14.***x.x.x***/32**.

Figure 7-64 Adding route 1

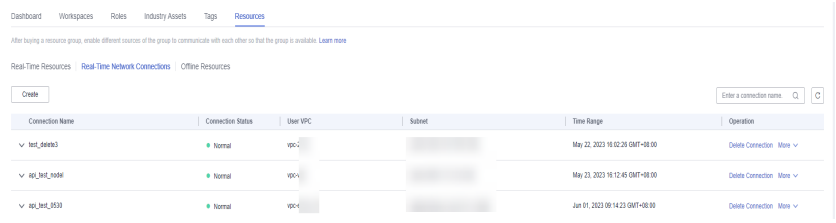
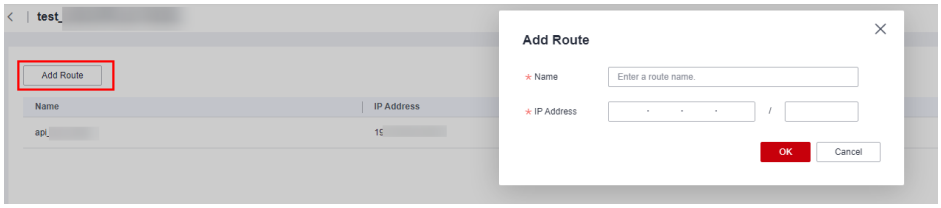


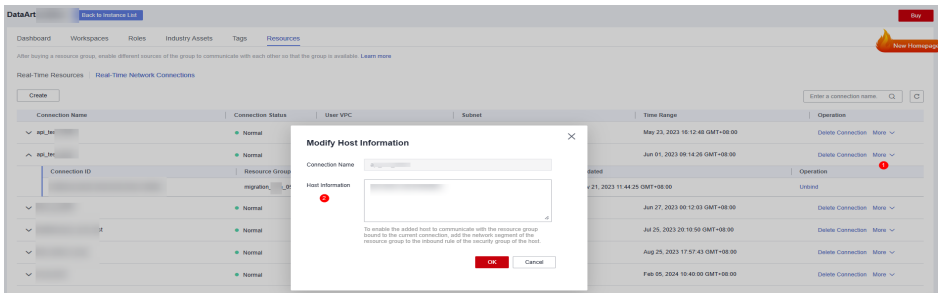
Figure 7-65 Adding route 2



Step 3 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-66 Modifying host information



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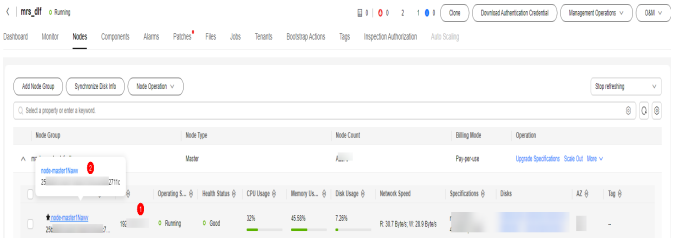
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-67 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 4 Buy an EIP.

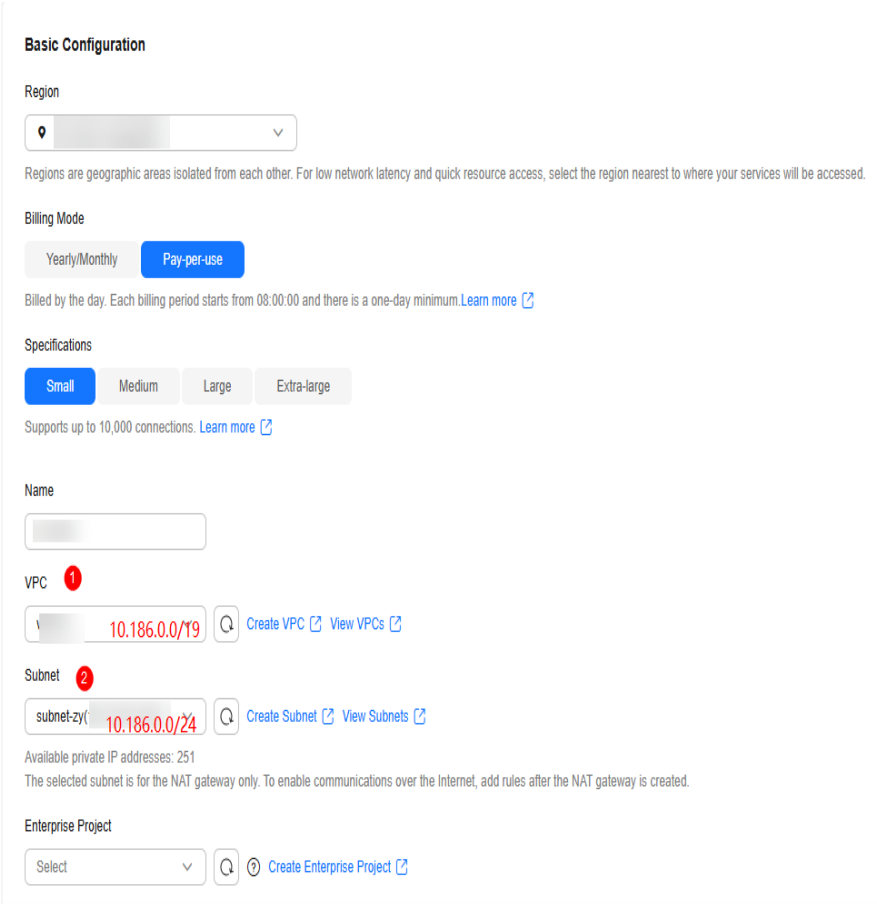
Log in to the EIP console, click **Buy EIP**, and set the parameters as prompted. For details, see .

Step 5 Create a public NAT gateway.

1. Log in to the NAT Gateway console, choose **NAT Gateway** > **Public NAT Gateways** in the navigation pane on the left, and click **Buy Public NAT Gateway**.
2. When configuring the NAT gateway, set **Region** to the region where DataArts Migration is located, **VPC** to the transit VPC (for example, 10.186.0.0/19), and **Subnet** to the subnet of the transit VPC (for example, 10.186.0.0/24). For details about how to configure other parameters, see .

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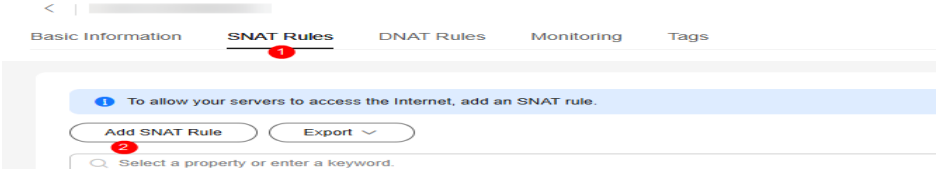
Figure 7-68 Configuring a public NAT gateway



Step 6 Add an SNAT rule for the public NAT gateway.

You need to add an SNAT rule for the NAT gateway to allow the hosts in the migration resource group to communicate with the Internet. Click the name of the public NAT gateway you have created and then the **SNAT Rules** tab. On the displayed page, click **Add SNAT Rule**.

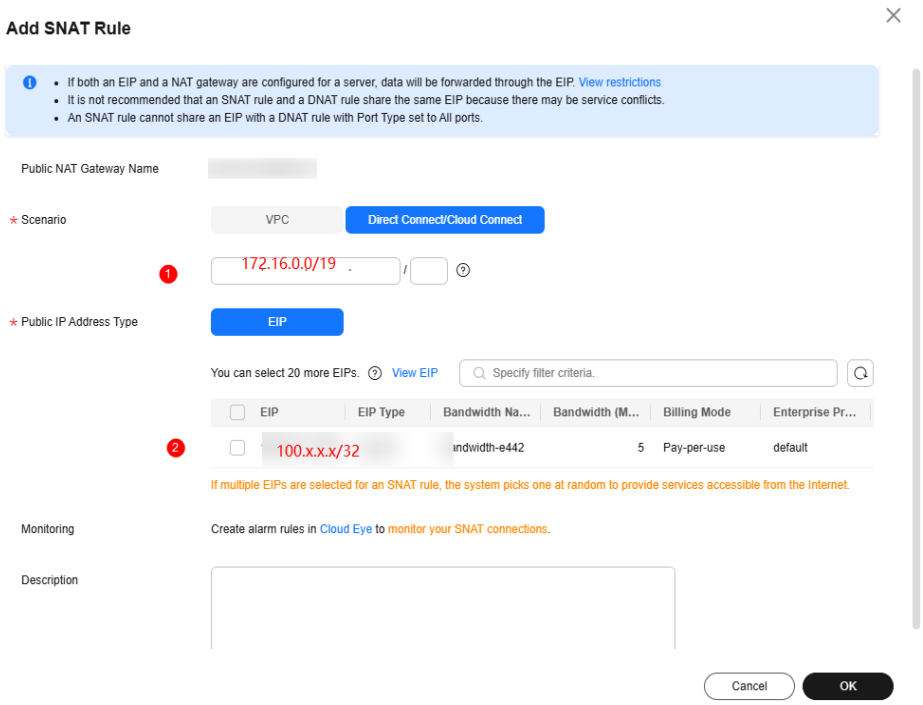
Figure 7-69 Adding an SNAT rule 1



Select **Direct Connect/Cloud Connect** for **Scenario**, enter the network segment (for example, **172.16.0.0/19**) of the migration resource group VPC, and select the EIP (**100.***x.x.x***/32**) purchased in step 3.

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Figure 7-70 Adding an SNAT rule 2

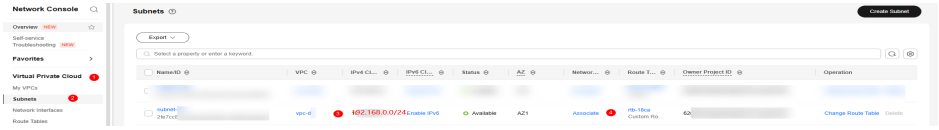


Step 7 Add a route to the transit VPC subnet.

Add a route to the route table of the transit VPC subnet. Set the destination to the EIP (for example, 14.*x.x.x*/32) of the database of the on-premises IDC and the next hop to the NAT gateway you have configured.

1. Log in to the VPC console. In the navigation pane on the left, choose **Virtual Private Cloud** > **Subnets**. Locate the subnet of the transit VPC, and click the route table name to go to the configuration page.

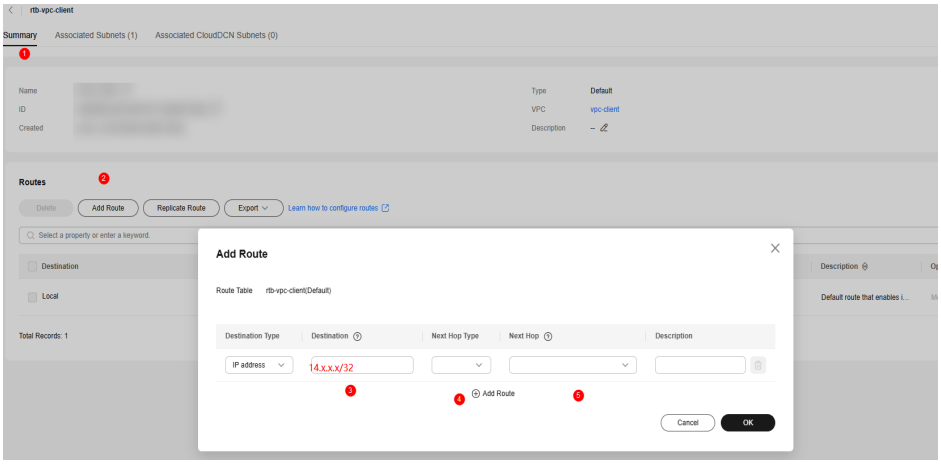
   Figure 7-71 Querying the route table

2. Click the **Summary** tab and **Add Route**. In the displayed dialog box, set **Destination** to the EIP (for example, 14.*x.x.x*/32) of the database of the on-premises IDC and **Next Hop** to the NAT gateway you have configured.

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Figure 7-72 Adding a route to the route table



Step 8 Configure a whitelist and security group rules for the database of another cloud.

- Allow the VPC network segment (for example, 100.*x.x.x*/32) of the migration resource group to access the database of another cloud. The method of configuring a whitelist varies depending on the database type. For details, see the official documentation of each database.
- If a security group has been configured for the database on another cloud, you need to add an inbound rule to allow the VPC network segment (for example, 100.*x.x.x*/32) of the resource group to access the database listening port.

NOTE

The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 9 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

----End

7.5.3 Database Deployed on Huawei Cloud

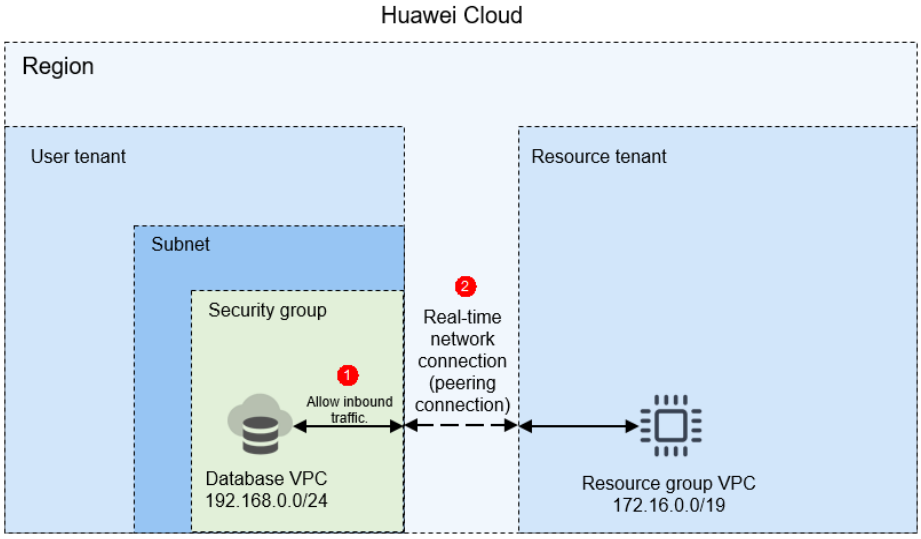
7.5.3.1 Enabling Network Communications Directly for the Same Region and Tenant

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to enable communications between a database deployed on Huawei Cloud and a migration resource group in the same region and of the same tenant as the database.

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Figure 7-73 Network diagram



Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.
- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

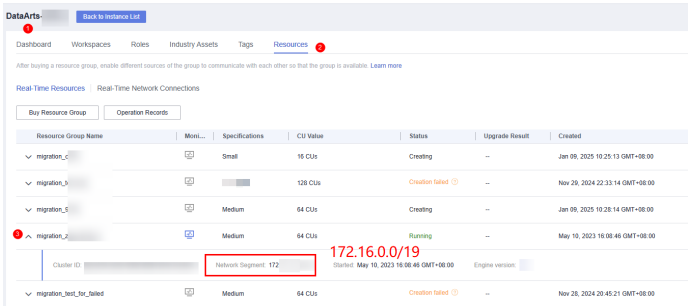
You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.

Preparations

Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

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Table 7-17 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source VPC	VPC to which the Huawei Cloud data source belongs. The method of viewing the VPC varies depending on the data source. For details, see the official documentation of the corresponding data source.	192.168.0.0/24
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-74** Obtaining the migration resource group network segment 	172.16.0.0/19

Network Configuration Process

Step 1 Configure rules for the security group to which the Huawei Cloud database belongs.

Add an inbound rule for the security group of the Huawei Cloud database to allow the VPC network segment (for example, 172.16.0.0/19) of the resource group to access the database listening port.

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To add a security group rule, perform the following steps: Go to the data source service page, access the user cluster, locate the network information, and click the security group. On the displayed security group editing page, add an inbound rule. The following is an example of how to allow access from the migration resource group.

Priority	Policy	Type	Protocol Port	Source Address
1	Allow	IPv4	All protocols	IP address: migration resource group network segment

NOTE

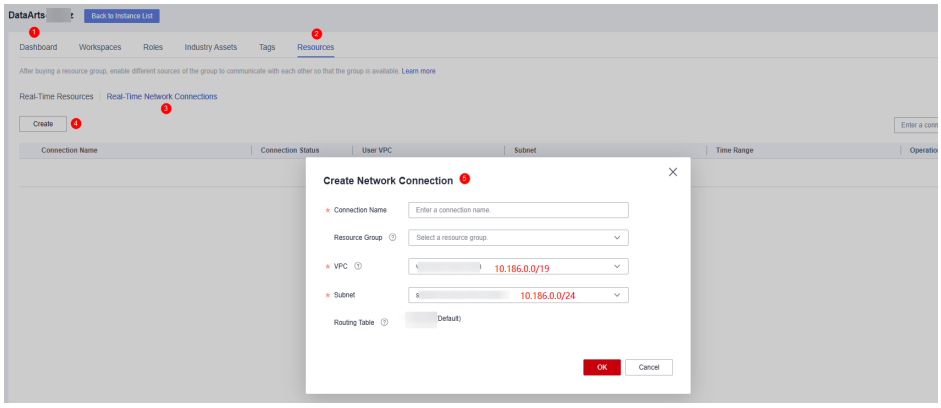
The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 2 Create a real-time network connection (VPC peering connection) for migration.

To connect the VPC of the Huawei Cloud database to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

Figure 7-75 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-18 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.

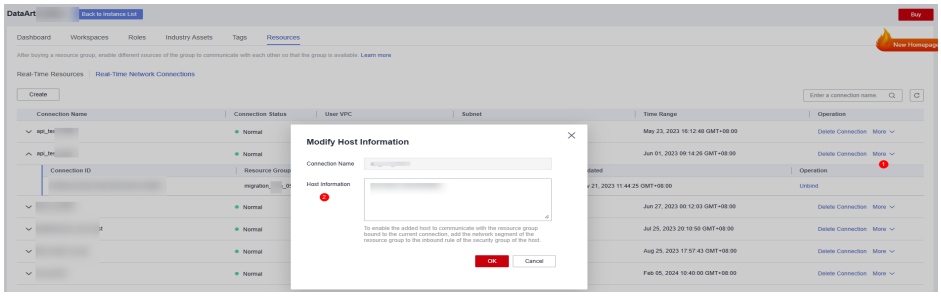
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Parameter	Description
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the data source cluster or instance, for example, 192.168.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 3 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-76 Modifying host information



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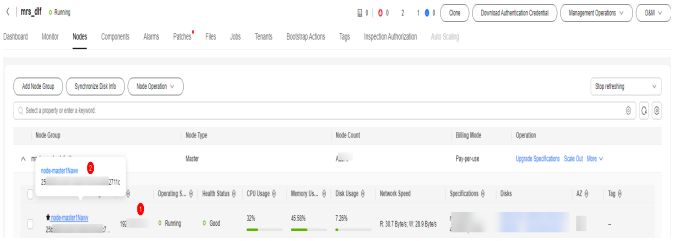
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-77 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 4 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

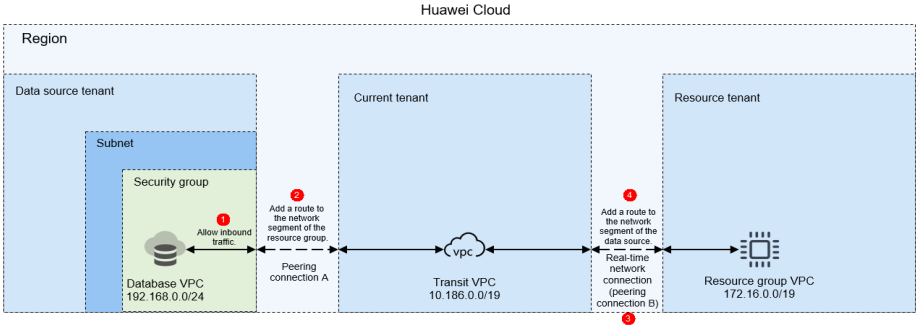
----End

7.5.3.2 Using a VPC Peering Connection to Enable Network Communications for the Same Region but Different Tenants

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to enable communications between a database deployed on Huawei Cloud and a migration resource group in the same region as but of different tenants from the database using a VPC peering connection.

Figure 7-78 Network diagram



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Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.
- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

- You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.
- You have created a VPC peering connection between the data source VPC and a VPC of the current tenant. If no VPC peering connection is available, create one by referring to .

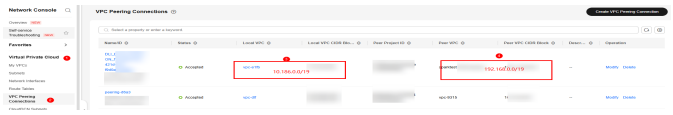
Preparations

Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

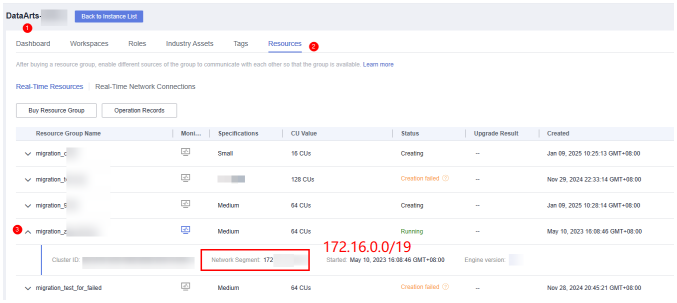
Table 7-19 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source VPC	VPC to which the Huawei Cloud data source belongs. The method of viewing the VPC varies depending on the data source. For details, see the official documentation of the corresponding data source.	192.168.0.0/24

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Resource	Description	Example Private Network Segment
Transit VPC	VPC used to connect the data source and migration resource group. In this solution, a VPC of the current tenant that is connected to the data source tenant through a VPC peering connection is used. To obtain the VPC, perform the following operations: Log in to the VPC console using the current tenant. In the navigation pane on the left, choose **Virtual Private Cloud** > **VPC Peering Connections**. In the list, locate the VPC peering connection whose peer VPC network segment is that of the data source VPC. The local VPC of that connection can be used as the transit VPC. **Figure 7-79** Viewing a VPC peering connection 	VPC: 10.186.0.0/19

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-80** Obtaining the migration resource group network segment  	172.16.0.0/19

Network Configuration Process

Step 1 Configure rules for the security group to which the Huawei Cloud database belongs.

Add an inbound rule for the security group of the Huawei Cloud database to allow the VPC network segment (for example, 172.16.0.0/19) of the resource group to access the database listening port.

To add a security group rule, perform the following steps: Go to the data source service page, access the user cluster, locate the network information, and click the security group. On the displayed security group editing page, add an inbound rule. The following is an example of how to allow access from the migration resource group.

Priority	Policy	Type	Protocol Port	Source Address
1	Allow	IPv4	All protocols	IP address: migration resource group network segment

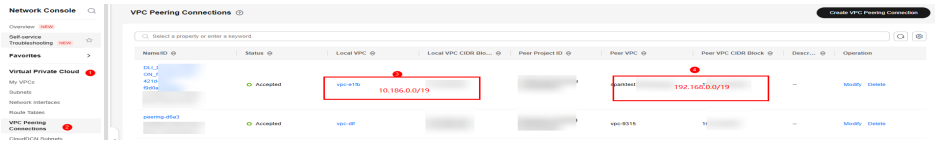
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> **NOTE**
>
> The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 2 Add a route for the VPC peering connection between the data source VPC and transit VPC.

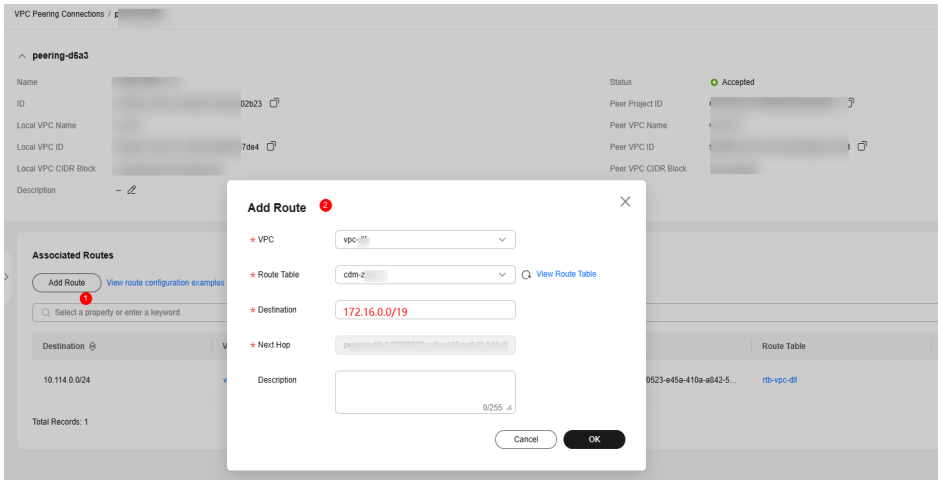
Log in to the VPC console using the tenant to which the data source belongs. In the navigation pane on the left, choose **Virtual Private Cloud** > **VPC Peering Connections**. In the list, locate the connection whose local VPC is the data source VPC (for example, 192.168.0.0/19) and whose peer VPC is the transit VPC (for example, 10.186.0.0/19). Click the connection name to go to the configuration page.

Figure 7-81 Locating a VPC peering connection



Click **Add Route**. The data source VPC is selected by default. Select the route table of the transit VPC for **Route Table**, and enter the IP address of the migration resource group VPC (for example, **172.16.0.0/19**) for **Destination**. This VPC peering connection is selected for **Next Hop** by default.

Figure 7-82 Adding a route to the migration resource group network segment for a VPC peering connection



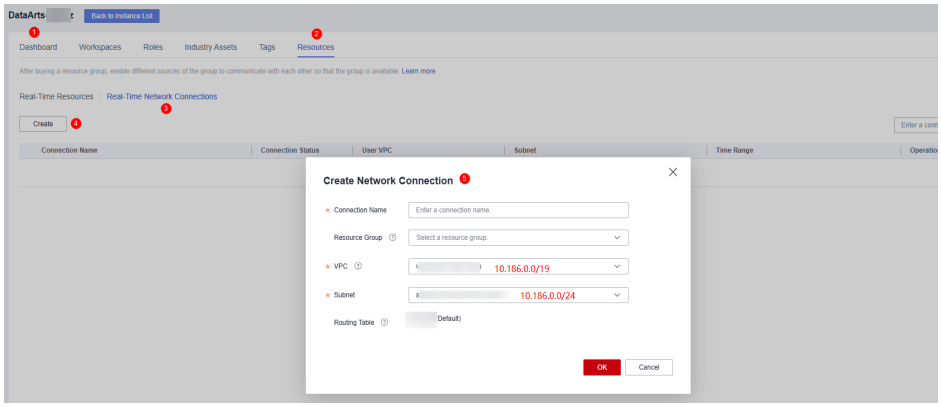
Step 3 Create a real-time network connection (VPC peering connection) for migration.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-83 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-20 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 4 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

Locate the real-time network connection created in step 3, click **More** in the **Operation** column, and select **Add Route**. In the displayed dialog box, enter the

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network segment of the VPC subnet of the Huawei Cloud data source, for example, **192.168.0.0/24**.

Figure 7-84 Adding route 1

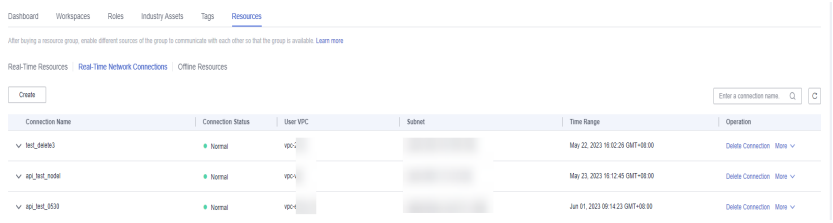
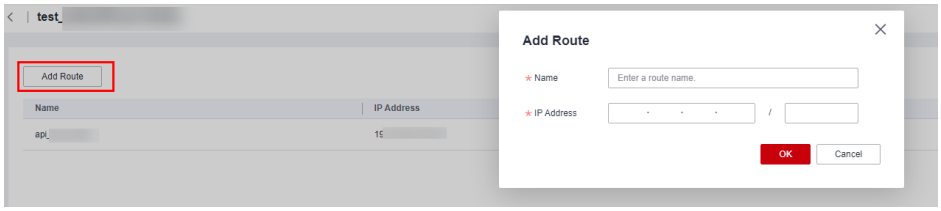


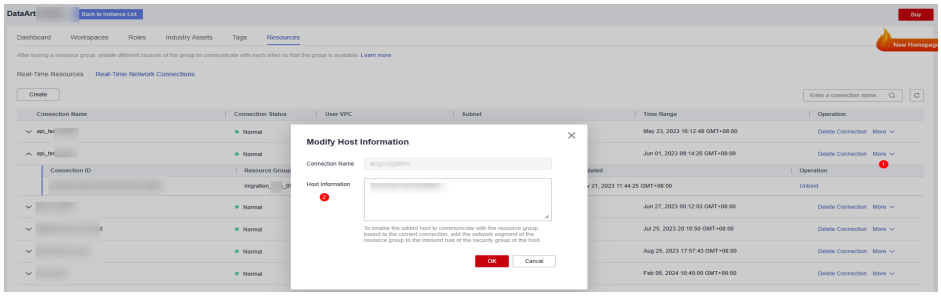
Figure 7-85 Adding route 2



Step 5 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-86 Modifying host information



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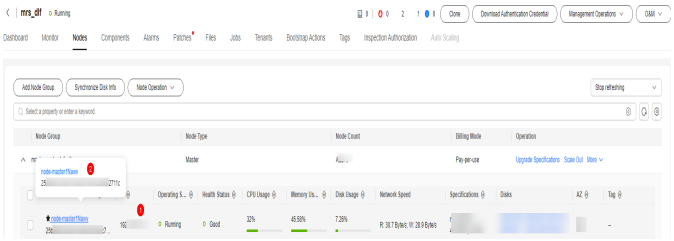
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-87 Obtaining the IP addresses and domain names of the nodes in the MRS cluster



- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 6 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

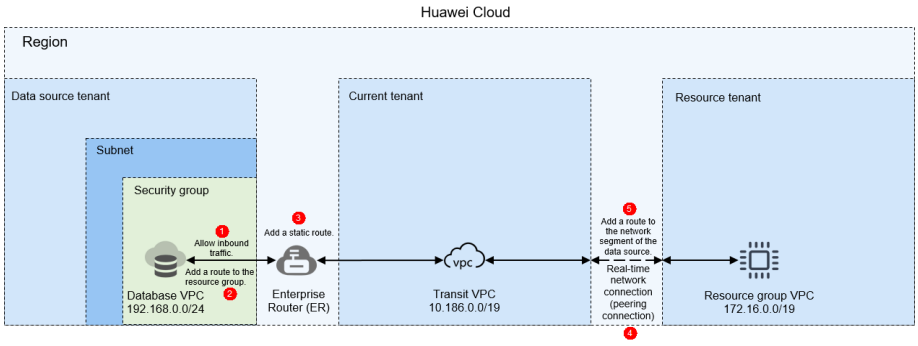
----End

7.5.3.3 Using an Enterprise Router to Enable Network Communications for the Same Region but Different Tenants

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to enable communications between a database deployed on Huawei Cloud and a migration resource group in the same region as but of different tenants from the database using an enterprise router.

Figure 7-88 Network diagram



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Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.
- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

- You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.
- You have purchased and configured an enterprise router to enable communications between the data source VPC and a VPC of the current tenant. For how to enable and configure an enterprise router, see and .

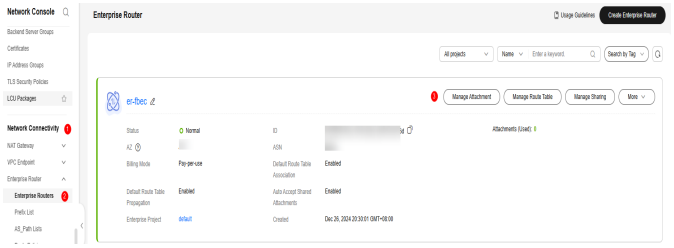
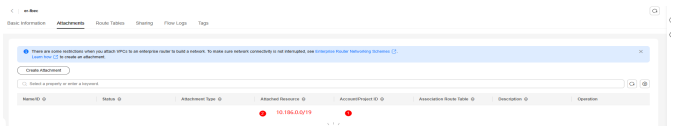
Preparations

Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

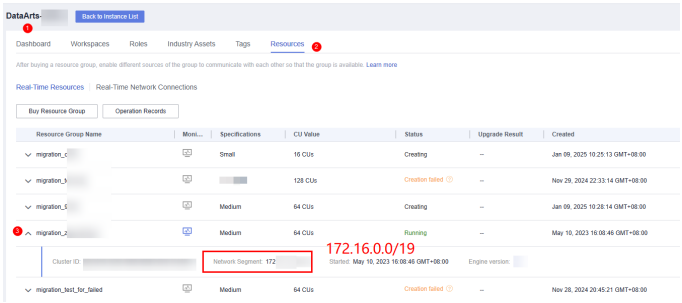
Table 7-21 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source network segment	VPC to which the Huawei Cloud data source belongs. The method of viewing the VPC varies depending on the data source. For details, see the official documentation of the corresponding data source.	192.168.0.0/24

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Resource	Description	Example Private Network Segment
Transit VPC	Used for the communications between the data source and migration resource group. In this solution, a VPC of the current tenant configured in the enterprise router is used. To obtain the VPC, perform the following operations: Log in to the Enterprise Router console as the current tenant. In the navigation pane on the left, choose **Enterprise Router** > **Enterprise Routers**. In the router list, locate a router and click **Manage Attachment**. On the displayed **Attachments** page, find the VPC of the current tenant, which can be used as the transit VPC. **Figure 7-89** Viewing attachments of an enterprise router  **Figure 7-90** Determining the transit VPC 	VPC: 10.186.0.0/19

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-91** Obtaining the migration resource group network segment 	172.16.0.0/19

Network Configuration Process

Step 1 Configure rules for the security group to which the Huawei Cloud database belongs.

Add an inbound rule for the security group of the Huawei Cloud database to allow the VPC network segment (for example, 172.16.0.0/19) of the resource group to access the database listening port.

To add a security group rule, perform the following steps: Go to the data source service page, access the user cluster, locate the network information, and click the security group. On the displayed security group editing page, add an inbound rule. The following is an example of how to allow access from the migration resource group.

Priority	Policy	Type	Protocol	Port	Source Address
1	Allow	IPv4	All protocols		IP address: migration resource group network segment

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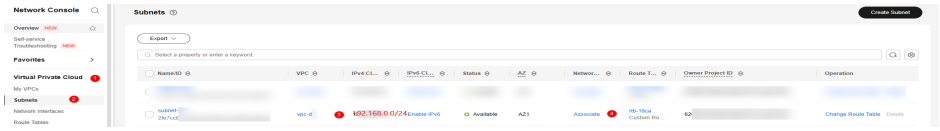
> **NOTE**
>
> The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 2 Add a route to the network of the database on Huawei Cloud.

Add a route to the route table of the VPC subnet to which the Huawei Cloud database belongs. Set the destination to the VPC network segment of the migration resource group (for example, 172.16.0.0/19), and set the next hop to the enterprise router you have configured.

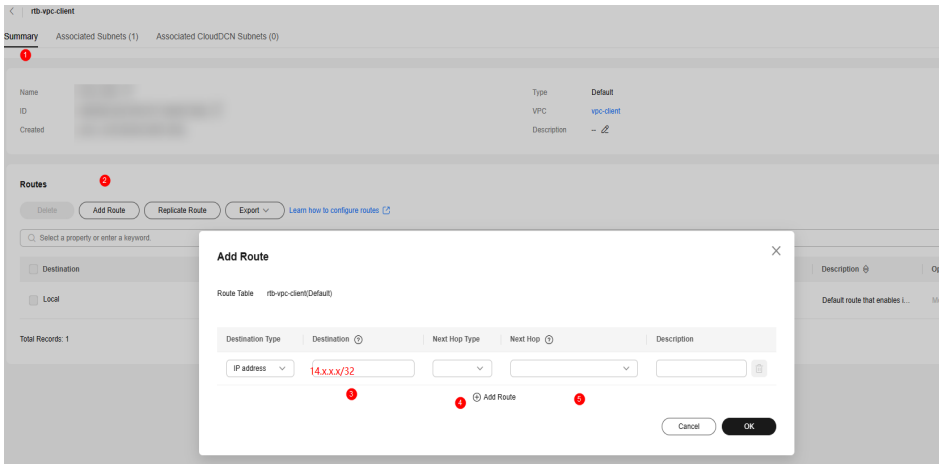
1. Log in to the VPC console as the data source tenant. In the navigation pane on the left, choose **Virtual Private Cloud** > **Subnets**. Locate the subnet of data source and click the route table name to go to the configuration page.

   Figure 7-92 Obtaining the data source route table

2. On the displayed page, click the **Summary** tab and then **Add Route**. In the displayed dialog box, set **Destination** to the VPC network segment of the migration resource group (for example, 172.16.0.0/19) and **Next Hop** to the enterprise router you have configured.

   Figure 7-93 Adding a route to the route table of the data source

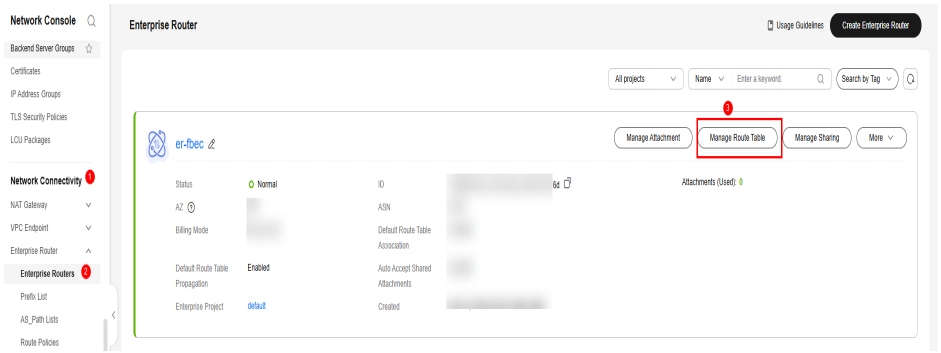
   

Step 3 Add a route to the enterprise router.

Log in to the Enterprise Router console. In the navigation pane on the left, choose **Enterprise Router** > **Enterprise Routers**. In the router list, locate the target router and click **Manage Route Table**.

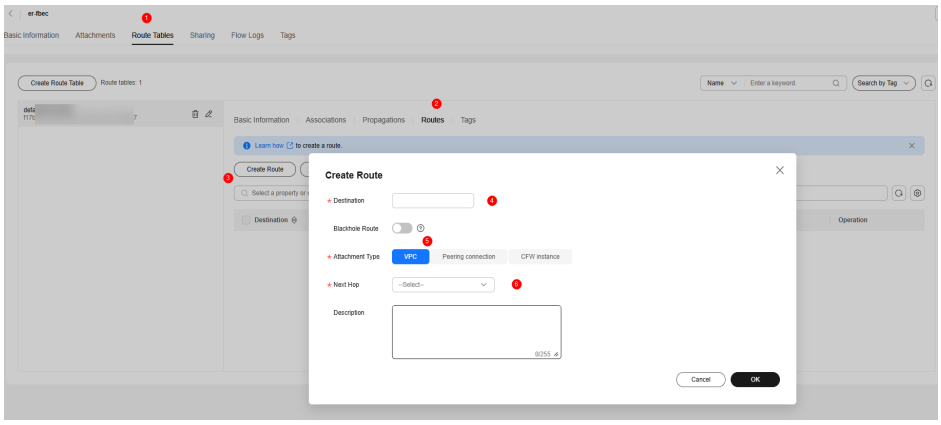
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Figure 7-94 Viewing the route tables of an enterprise router



Click the **Routes** tab and then **Create Route**. In the displayed dialog box, set **Destination** to the VPC network segment of the real-time migration resource group (for example, **172.16.0.0/19**), **Attachment Type** to **VPC**, and **Next Hop** to the connection corresponding to the transit VPC.

Figure 7-95 Creating a route



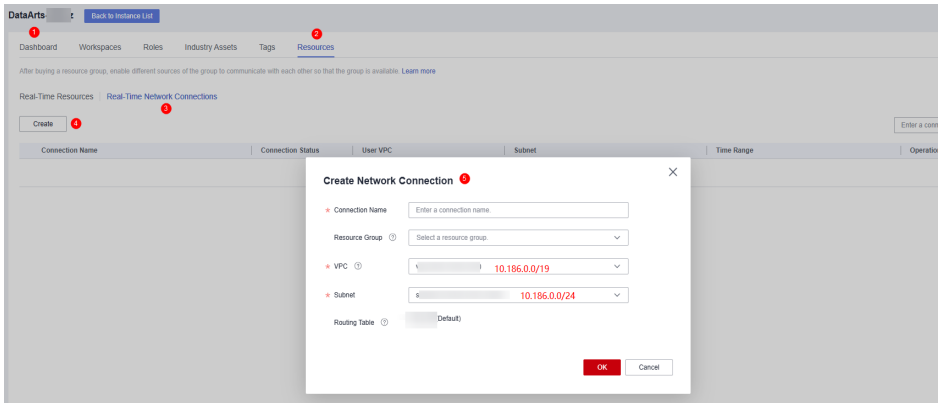
Step 4 Create a real-time network connection.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-96 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-22 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 5 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

Locate the real-time network connection created in step 4, click **More** in the **Operation** column, and select **Add Route**. In the displayed dialog box, enter the

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network segment of the VPC subnet of the Huawei Cloud database, for example, **192.168.0.0/24**.

Figure 7-97 Adding route 1

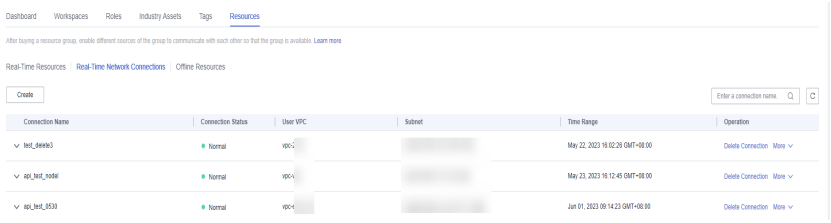
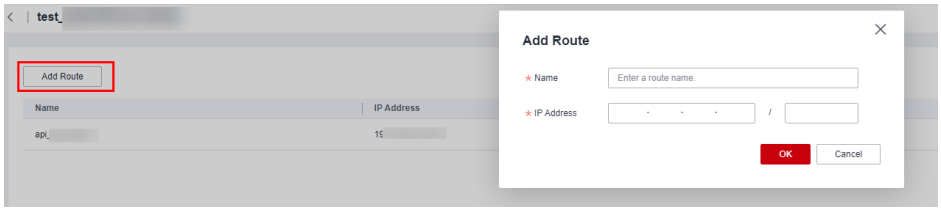


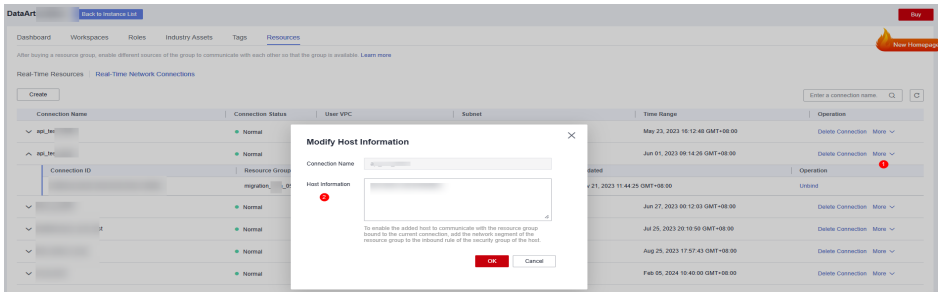
Figure 7-98 Adding route 2



Step 6 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-99 Modifying host information



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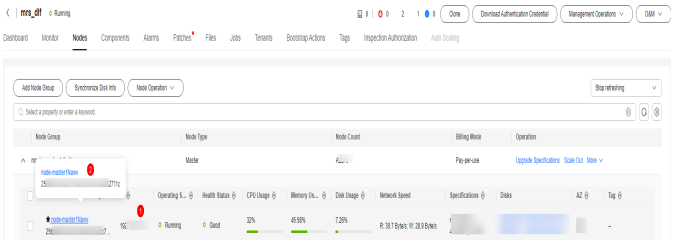
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-100 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 7 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

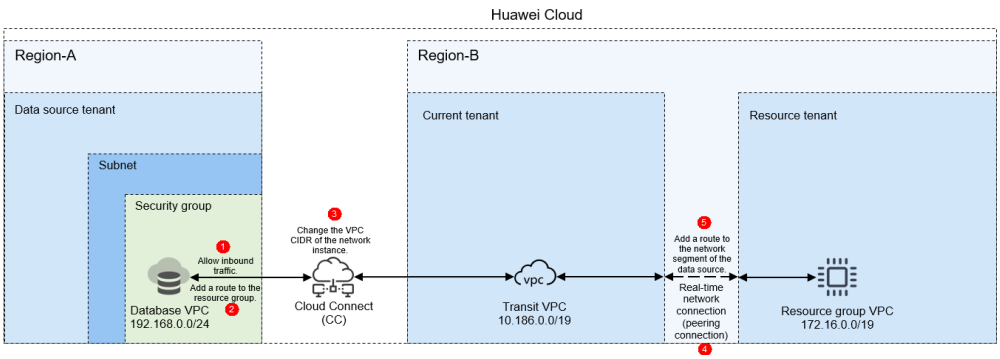
----End

7.5.3.4 Using a Cloud Connection to Enable Cross-Region Network Communications

Before configuring a real-time synchronization task, ensure that the source and destination databases can communicate with the real-time compute resource group that you want to use to run the real-time synchronization task. You can choose a proper network solution based on the network environments of the databases.

This section describes how to enable communications between a database deployed on Huawei Cloud and a migration resource group in another region using a VPC peering connection.

Figure 7-101 Network diagram



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Notes and Constraints

- The migration resource group uses a private network segment that cannot overlap with the network segment of the data source. Otherwise, the network cannot be connected.
- The migration resource group does not have a public network segment and can only connect to the private network of the data source.

Prerequisites

- You have purchased a migration resource group. For details, see **Buying a DataArts Migration Resource Group Incremental Package**.
- You have purchased and configured a cloud connection to enable communications between the data source VPC and a VPC of the current tenant. For how to enable and configure a cloud connection, see .

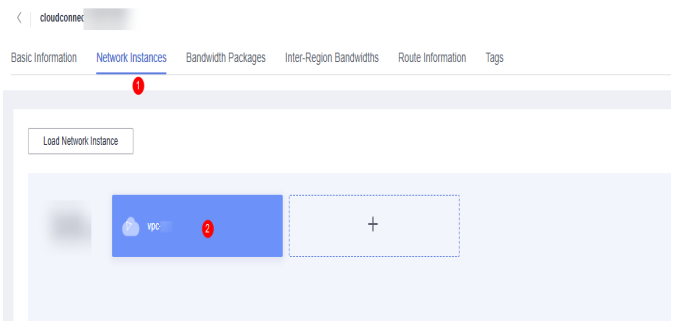
Preparations

Obtain the network segments of the related objects (including the data source, transit VPC, and migration resource group).

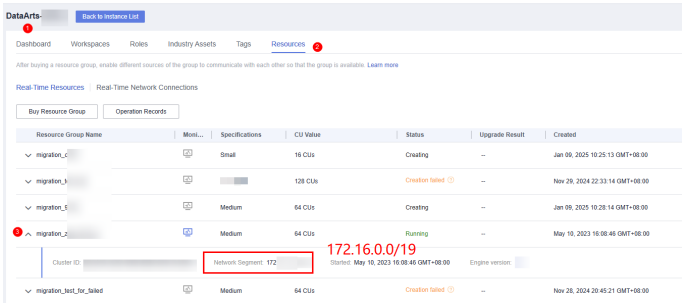
Table 7-23 Network segment planning for resources

Resource	Description	Example Private Network Segment
Data source network segment	VPC to which the Huawei Cloud data source belongs. The method of viewing the VPC varies depending on the data source. For details, see the official documentation of the corresponding data source.	192.168.0.0/24

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Resource	Description	Example Private Network Segment
Transit VPC	Used for the communications between the data source and migration resource group. In this solution, a VPC in the same region and of the same tenant configured in the cloud connection is used. To obtain the VPC, perform the following operations: Log in to the Cloud Connect console. In the navigation pane on the left, choose **Cloud Connect** > **Cloud Connections**. In the cloud connection list, click the name of the target cloud connection. On the displayed page, click the **Network Instances** tab and locate the VPC that is in the same region and of the same tenant as the migration resource group. This VPC can be used as the transit VPC. **Figure 7-102** Viewing a cloud connection  **Figure 7-103** Determining the transit VPC 	VPC: 10.186.0.0/19

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Resource	Description	Example Private Network Segment
Migration resource group VPC	VPC to which the real-time computing resource group belongs. The migration resource group is created under the resource tenant of the user account and uses the VPC network segment of the resource tenant. To obtain the VPC, perform the following operations: Log in to the DataArts Studio console, access an instance, and click the **Resources** tab. On the **Real-Time Resources** page, expand the target migration resource group to view its VPC network segment. **Figure 7-104** Obtaining the migration resource group network segment  	172.16.0.0/19

Network Configuration Process

Step 1 Configure rules for the security group to which the Huawei Cloud database belongs.

Add an inbound rule for the security group of the Huawei Cloud database to allow the VPC network segment (for example, 172.16.0.0/19) of the resource group to access the database listening port.

To add a security group rule, perform the following steps: Go to the data source service page, access the user cluster, locate the network information, and click the security group. On the displayed security group editing page, add an inbound rule. The following is an example of how to allow access from the migration resource group.

Priority	Policy	Type	Protocol Port	Source Address
1	Allow	IPv4	All protocols	IP address: migration resource group network segment

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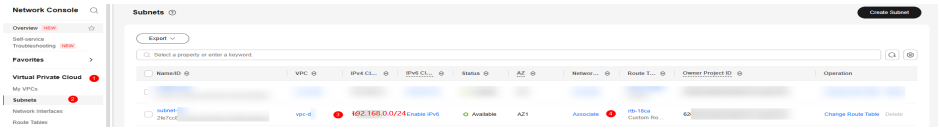
> **NOTE**
>
> The ports used by different data sources vary. Configure the ports for security group rules by referring to .

Step 2 Add a route to the network of the database on Huawei Cloud.

Add a route to the route table of the VPC subnet to which the Huawei Cloud database belongs. Set the destination to the VPC network segment of the migration resource group (for example, 172.16.0.0/19), and set the next hop to the cloud connection you have configured.

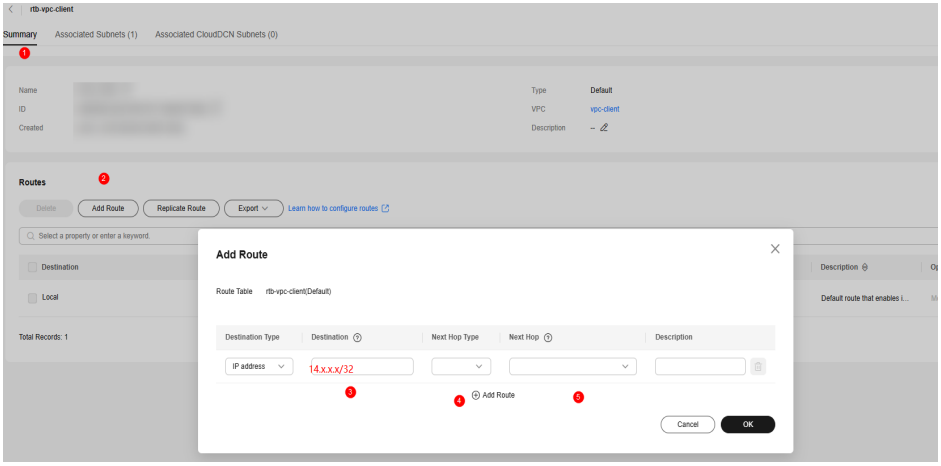
1. Log in to the VPC console as the data source tenant. In the navigation pane on the left, choose **Virtual Private Cloud** > **Subnets**. Locate the subnet of data source and click the route table name to go to the configuration page.

   Figure 7-105 Obtaining the data source route table

2. On the displayed page, click the **Summary** tab and then **Add Route**. In the displayed dialog box, set **Destination** to the VPC network segment of the migration resource group (for example, 172.16.0.0/19) and **Next Hop** to the cloud connection you have configured.

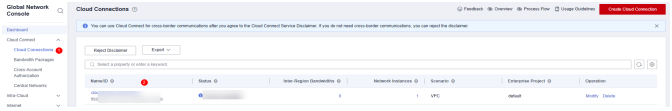
   Figure 7-106 Adding a route to the route table of the data source

Step 3 Modify the VPC CIDR block of the transit VPC.

Log in to the Cloud Connect console. In the navigation pane on the left, choose **Cloud Connect** > **Cloud Connections**. In the cloud connection list, click the name of the target cloud connection. On the displayed page, click the **Network Instances** tab, locate the transit VPC, and click **Modify VPC CIDR Block**. In the displayed dialog box, enter the VPC CIDR block of the migration resource group (for example, **172.16.0.0/19**) for **Other CIDR Block**.

Figure 7-107 Viewing a cloud connection



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Figure 7-108 Cloud Connect network instance

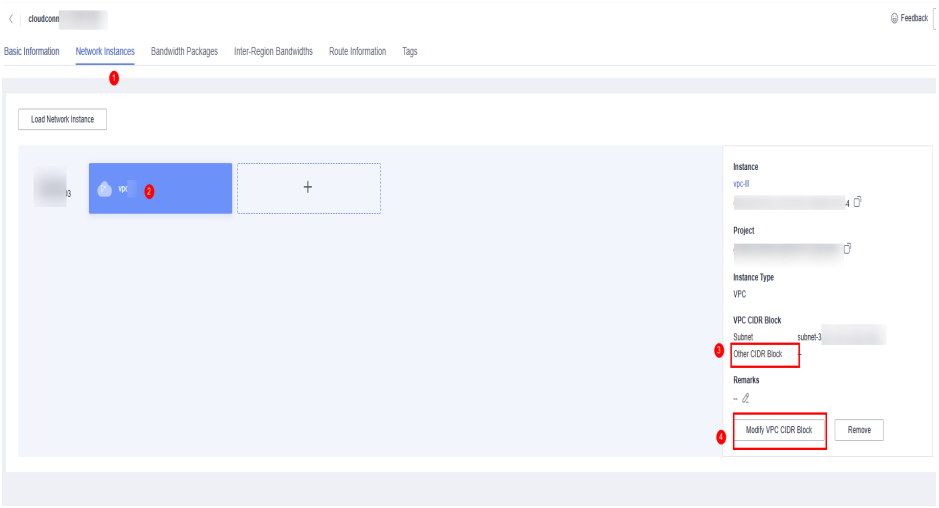
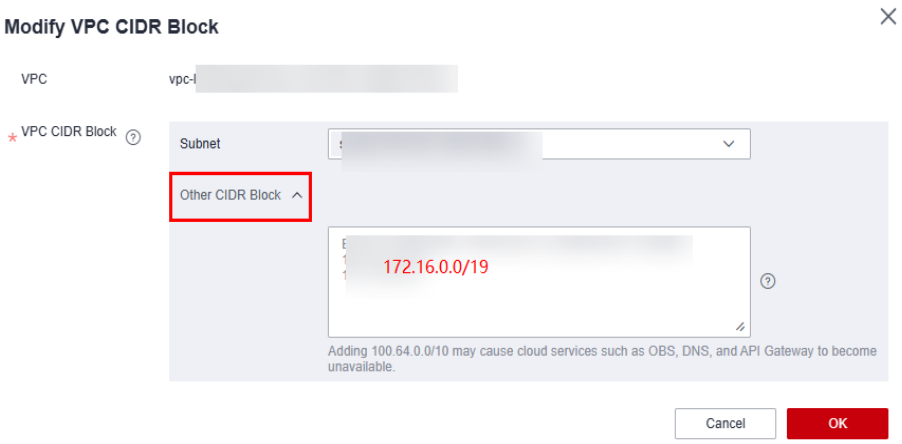


Figure 7-109 Changing the VPC CIDR block of the Cloud Connect network instance



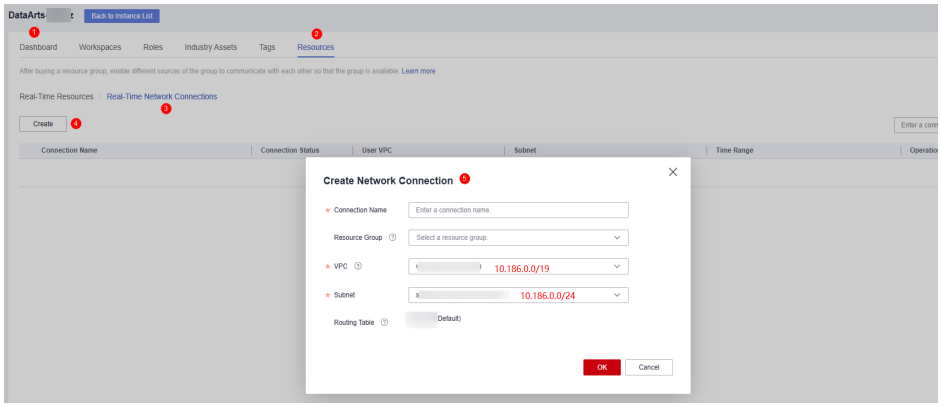
Step 4 Create a real-time network connection.

To connect the transit VPC to the real-time migration resource group VPC, you can create a VPC peering connection between the two VPCs using the resource management function provided of DataArts Studio.

Log in to the DataArts Studio console, access an instance, and click the **Resources** tab.

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Figure 7-110 Creating a network connection



On the **Real-Time Network Connections** tab page, click **Create**. In the displayed **Create Network Connection** dialog box, set required parameters.

Table 7-24 Parameters for creating a network connection

Parameter	Description
Connection Name	Name of the network connection Only letters, digits, and underscores (_) are allowed.
Resource Group	Migration resource group that can communicate with the specified VPC. If you do not select a migration resource group, you can bind migration resource groups to the connection after the connection is created by clicking **More** in the **Operation** column and selecting **Bind Resource Group**.
VPC	VPC that can communicate with the migration resource group In this solution, the migration resource group network segment and the transit VPC are connected through a VPC peering connection. Therefore, you must select a transit VPC (for example, 10.186.0.0/19).
Subnet	Subnet of the transit VPC, for example, 10.186.0.0/24
Routing Table	Routing table associated with the subnet. When the connection is bound to a migration resource group, routing information of the migration resource group is added to the routing table. You do not need to set this parameter. When the connection is bound to a migration resource group, a route to the migration resource group VPC network segment is added to the routing table. The route connects the migration resource group network segment to the transit VPC.

Step 5 Add a route to the data source network segment for the real-time network connection (VPC peering connection).

Locate the real-time network connection created in step 4, click **More** in the **Operation** column, and select **Add Route**. In the displayed dialog box, enter the

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network segment of the VPC subnet of the Huawei Cloud database, for example, **192.168.0.0/24**.

Figure 7-111 Adding route 1

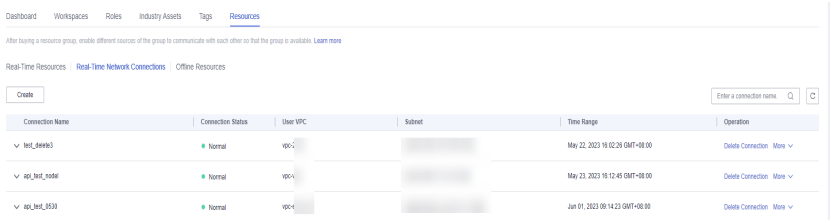
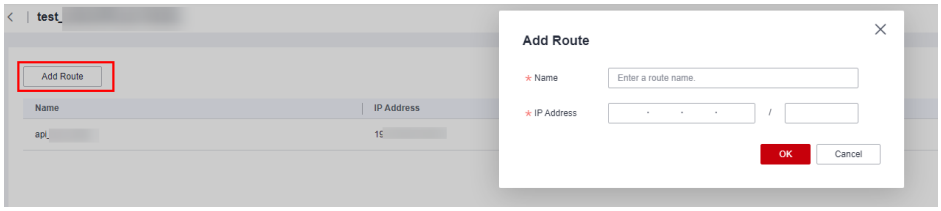


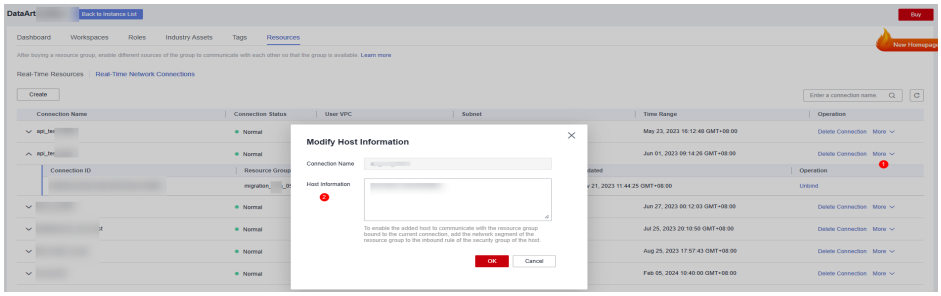
Figure 7-112 Adding route 2



Step 6 (Optional) For MRS data sources, perform the following extra operations to enable network communications:

After creating a real-time network connection and binding it to a migration resource group, click **More** in the **Operation** column and select **Modify Host Information**. In the displayed dialog box, enter the IP addresses and domain names of all nodes in the MRS cluster as prompted.

Figure 7-113 Modifying host information



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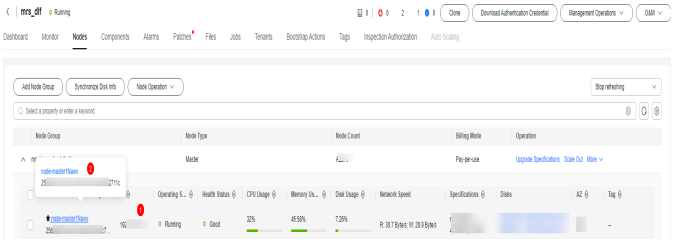
NOTE

To obtain the IP addresses and domain names of the nodes in an MRS cluster, perform the following steps:

- Open the MRS page, access the MRS cluster, click the **Nodes** tab, and expand all node groups to view the IP address and name (domain name) of each node.

  Add the IP addresses (1 in the figure) and domain names (2 in the figure) of all nodes and separate them by pressing **Enter**.

  Figure 7-114 Obtaining the IP addresses and domain names of the nodes in the MRS cluster

- Log in to an MRS cluster node by referring to and run the **cat /etc/hosts** command to list the IP addresses and domain names of all nodes.

Step 7 Test the network connectivity.

In a DataArts Studio workspace, create a data connection and a real-time migration job, and select the corresponding data connection and migration resource group to test the connectivity. For details, see **Creating a Real-Time Migration Job**.

----End

7.6 Creating a Real-Time Migration Job

Prerequisites

Each workspace can hold a maximum of 10,000 jobs. Ensure that the number of your jobs does not reach this upper limit.

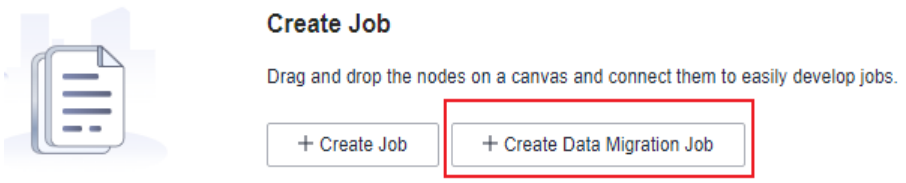
Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. Create a migration job using either of the following methods:

   Method 1: On the **Develop Job** page, click **Create Data Migration Job**.

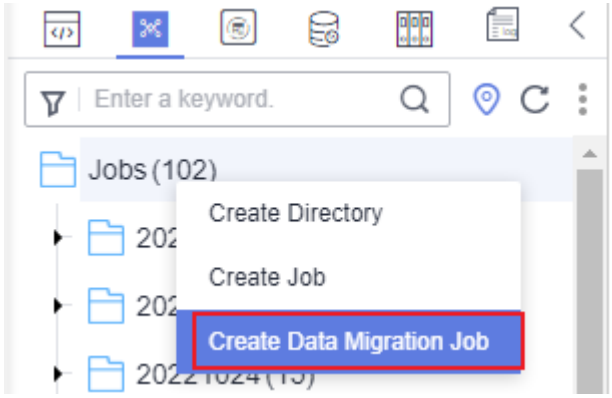
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Figure 7-115 Creating a migration job (method 1)



Method 2: In the directory list, right-click a directory and select **Create Data Migration Job**.

Figure 7-116 Creating a migration job (method 2)



5. In the displayed **Create Data Migration Job** dialog box, configure job parameters. **Table 7-25** describes the job parameters.

Table 7-25 Job parameters

Parameter	Description
Job Name	Job name. It can contain only letters, digits, hyphens (-), and underscores (_).
Job Type	Job type. Select **Real-time processing**. • **Offline processing**: A large amount of collected data is processed and analyzed in batches. These tasks usually use optimized computing and storage resources to ensure efficient data processing and analysis. These tasks are usually executed periodically (for example, every day or every week) to process a large amount of historical data for batch analysis and data warehouses. • **Real-time processing**: New data generated continuously is processed and analyzed in real time to meet the requirements for data timeliness. This mode requires instant processing of data upon generation and returns the result or triggers operations.

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Parameter	Description
Select Directory	Directory to which the job belongs. The root directory is selected by default.
Log Path	Path for storing job logs. The default path is **obs://dlf-log-...../**. Select "I confirm that OBS bucket obs://dlf-log-...../ will be created and used to store DLF job logs only". To change the log path, go to the workspace management page on the DataArts Studio console. For details, see **(Optional) Changing the Job Log Storage Path**.
Job Description	Description of the job

6. Click **OK**.

7.7 Configuring a Real-Time Migration Job

After configuring data connections, networks, and migration resource groups, you can create and configure a real-time migration job to combine multiple input and output data sources into a synchronization link for real-time data synchronization.

Prerequisites

- You have **authorized the use of real-time data migration**.
- You have prepared data sources and the connection account has required permissions. For details, see the requirements for database account permissions in **Check Before Use**.
- A data connection has been created, and **DataArts Migration** has been selected for the connection. For details, see **Creating a DataArts Studio Data Connection**.

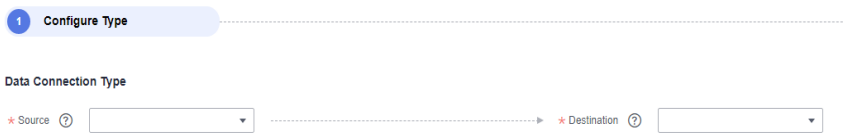
Procedure

Step 1 Create a real-time processing migration job by referring to **Creating a Real-Time Migration Job**.

Step 2 Set the data connection type.

Select the data type of the source and that of the destination. For details about the supported source and destination data types, see **Creating a Real-Time Migration Job**.

Figure 7-117 Selecting the data connection type



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Step 3 Set the migration job type.

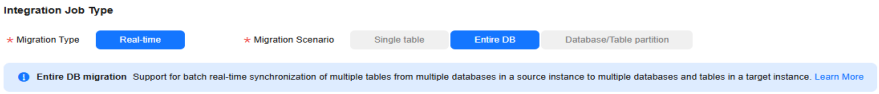
1. **Migration Type**: The default value is **Real-time** and cannot be changed.
2. **Migration Scenario**: Select **Single table**, **Entire DB**, or **Database/Table shard**.

   Table 7-26 lists the scenarios.

Table 7-26 Synchronization scenario parameters

Scenario	Description
Single table	A table in an instance can be synchronized to another instance.
Entire DB	Multiple tables in multiple databases in an instance can be synchronized to another instance in real time. A task can synchronize a maximum of 200 tables.
Database/Table shard	Multiple table shards of multiple databases in multiple instances can be synchronized to a database table in an instance.

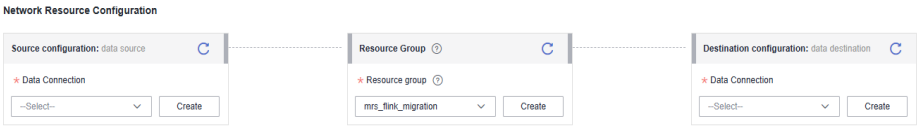
Figure 7-118 Setting the migration job type



Step 4 Configure network resources.

Select a source data connection, a destination data connection, and a migration resource group for which network connections have been configured.

Figure 7-119 Selecting data connections and a migration resource group



NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source and destination parameters.

The parameters vary depending on the source type. For details, see **Tutorials**.

Step 6 Update the mapping between the source table and destination table, check whether the mapping is correct, and modify table attributes and add additional fields as required.

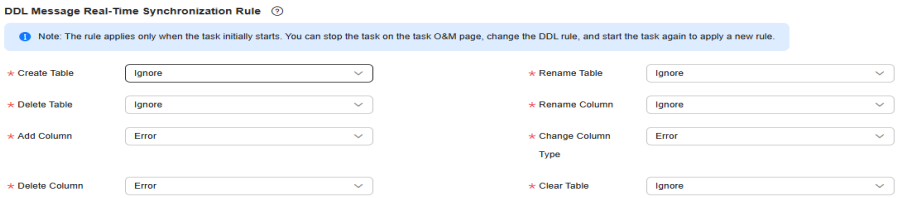
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Step 7 (Optional) Configure DDL message processing rules.

Real-time migration jobs can synchronize data manipulation language (DML) operations, such as adding, deleting, and modifying data, as well as some table structure changes using the data definition language (DDL). You can set the processing policy for a DDL operation to **Normal processing**, **Ignore**, or **Error**.

- **Normal processing**: When a DDL operation on the source database or table is detected, the operation is automatically synchronized to the destination.
- **Ignore**: When a DDL operation on the source database or table is detected, the operation is ignored and not synchronized to the destination.
- **Error**: When a DDL operation on the source database or table is detected, the migration job throws an exception.

Figure 7-120 DDL configuration



Step 8 Configure task parameters.

Table 7-27 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores.	8 GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Add Custom Attribute	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	N/A

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

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Figure 7-121 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-122 Starting the job

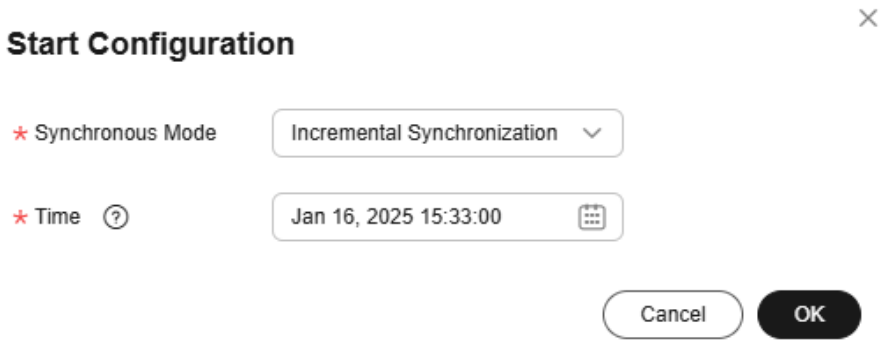


Table 7-28 Parameters for starting the job

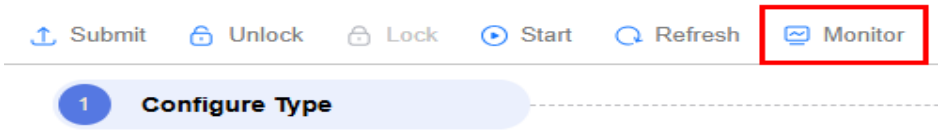
Parameter	Description
Synchronization Mode	Common data synchronization modes include: • **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
	Kafka data synchronization modes include: • **Earliest**: Data consumption starts from the earliest offset of the Kafka topic. • **Latest**: Data consumption starts from the latest offset of the Kafka topic. • **Start/End time**: Data consumption starts from the offset of the Kafka topic obtained based on the time.
Time	Time when incremental synchronization starts. This parameter is mandatory when **Synchronization Mode** is set to **Incremental synchronization** or **Start/End time**. **NOTE** • If you set a time that is earlier than the earliest time of the incremental data log, data consumption starts from the latest log time by default. • If you set a time earlier than the earliest offset of Kafka messages, data consumption starts from the earliest offset by default.

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Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-123 Monitoring the job



----End

7.8 Real-Time Migration Job O&M

7.8.1 Viewing Monitoring Metrics

Scenario

After you start a real-time migration job, Cloud Eye automatically associates monitoring metrics of the job. This helps you learn the status of the job.

NOTE

It takes some time for the system to obtain and transmit monitoring data, so the job status displayed on the **Job Monitoring** page is not up-to-date. If you just started a real-time migration job, wait for 5 to 10 minutes and then view the monitoring data.

Prerequisites

- You have obtained required Cloud Eye permissions.
- The real-time migration job is running properly. If it has been stopped or is abnormal, you can only view its monitoring metrics in the last seven days.
- The real-time migration job has been running properly for about 10 minutes.

Supported Monitoring Metrics

Table 7-29 lists the monitoring metrics supported for real-time processing migration jobs.

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Table 7-29 Monitoring metrics supported for real-time processing migration jobs

Metric Name	Description	Value Range	Monitored Object	Monitoring Period (Raw Data)
Source Database WAL Extraction Latency	Latency of extracting WALs from the source database	≥ 0 ms	Real-time processing migration job	1 minute
Job Data Read Rate	Data input rate of a Flink job for monitoring and debugging	≥ record/s	Real-time processing migration job	1 minute
Job Data Write Rate	Data output rate of a Flink job for monitoring and debugging	≥ record/s	Real-time processing migration job	1 minute
Job Total Data Read	Total number of data inputs of a Flink job for monitoring and debugging	≥ records	Real-time processing migration job	1 minute
Job Total Data Write	Total number of output data records of Flink jobs for monitoring and debugging.	≥ records	Real-time processing migration job	1 minute
Job Byte Read Rate	Input bytes of a Flink job per second	≥ Byte/s	Real-time processing migration job	1 minute
Job Byte Write Rate	Output bytes of a Flink job per second	≥ Byte/s	Real-time processing migration job	1 minute
Job Total Read Byte	Total number of input bytes of a Flink job	≥ Byte	Real-time processing migration job	1 minute
Job Total Write Byte	Total number of output bytes of a Flink job	≥ Byte	Real-time processing migration job	1 minute

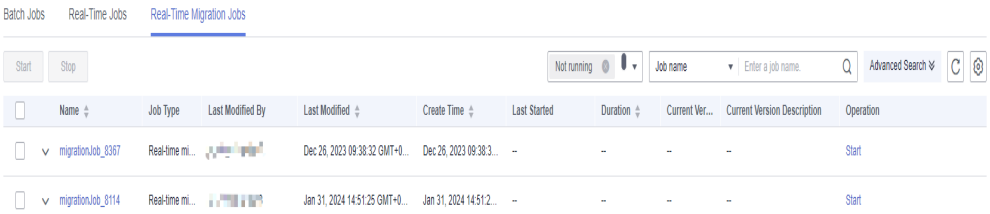
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Metric Name	Description	Value Range	Monitored Object	Monitoring Period (Raw Data)
Job CPU Usage	CPU usage of the Flink job	≥ 0%	Real-time processing migration job	1 minute
Job Memory Usage	Memory usage of the Flink job	≥ 0%	Real-time processing migration job	1 minute
Job Maximum Operator Latency	Maximum operator latency of a Flink job, in milliseconds	≥ 0 ms	Real-time processing migration job	1 minute
Job Maximum Operator Backpressure	Maximum operator back pressure value of a Flink job. The value ranges from 0 to 1. A larger value indicates severer back pressure.	≥ 0	Real-time processing migration job	1 minute

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. On the **Real-Time Migration Jobs** page, click a job name.

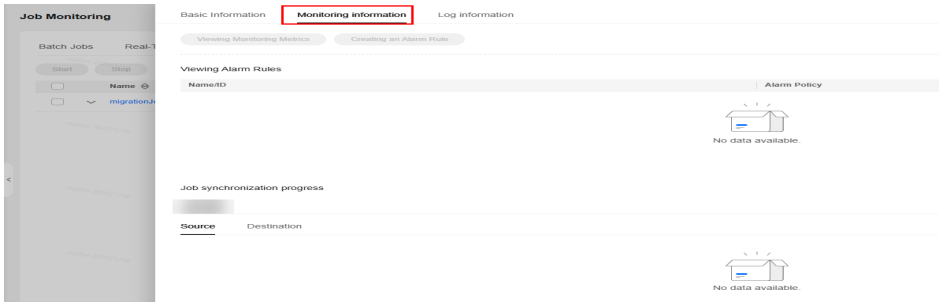
   Figure 7-124 Monitoring a real-time migration job

5. On the details page, click the **Monitoring Information** tab. You can view some key metrics of the job at the bottom of the page.

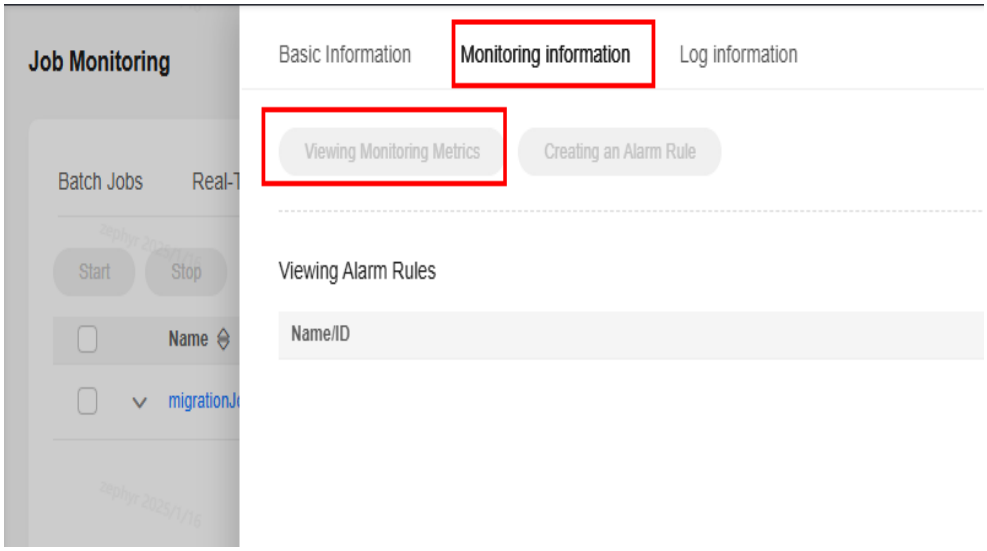
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Figure 7-125 Key metrics



6. Click **View Monitoring Metrics** to go to the Cloud Eye console and view monitoring metrics.

Figure 7-126 Viewing monitoring metrics



NOTE

For more information about monitoring metrics, see the .

7.8.2 Viewing Synchronization Logs

Prerequisites

The real-time migration job has been running properly for about five minutes.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.

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7.8.3 Modifying Job Configurations

You can a real-time migration job, add or delete tables or modify the job configuration, and then the job.

Prerequisites

A real-time migration job is running.

Procedure

Step 1 Modify job configurations.

Modify parameters of the real-time migration job, save it, and then submit it.

----End

7.9 Field Type Mapping

7.9.1 Mapping Between MySQL and MRS Hudi Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from MySQL to Hudi.

Table 7-30 Field types supported by a job that migrates data from MySQL to Hudi

Type	MySQL Data Type	Hudi Data Type	Description
String	CHAR(M)	STRING	N/A
	VARCHAR(M)	STRING	N/A
Value	BOOLEAN	BOOLEAN	N/A
	TINYINT	INT	By default, TINYINT(1) is converted to BOOLEAN. If you want to keep it as TINYINT(1), add the following attribute to the MySQL data connection in Management Center: **tinyInt1isBit = false**
	TINYINT UNSIGNED	INT	N/A
	SMALLINT	INT	N/A

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Type	MySQL Data Type	Hudi Data Type	Description
	SMALLINT UNSIGNED	INT	N/A
	MEDIUMINT	INT	N/A
	MEDIUMINT UNSIGNED	BIGINT	N/A
	INT	INT	N/A
	INT UNSIGNED	BIGINT	N/A
	BIGINT	BIGINT	N/A
	BIGINT UNSIGNED	DECIMAL(20,0)	N/A
	REAL	Not supported	N/A
	DECIMAL(M,D)	DECIMAL(38,10)	N/A
	NUMBERIC	Not supported	N/A
	FLOAT(M,D)	FLOAT	N/A
	DOUBLE(M,D)	DOUBLE	N/A
	DOUBLE PRECISION	DOUBLE	N/A
Bit	BIT(M)	Not supported	N/A
Date and time	DATE	DATE	N/A
	TIME	STRING	N/A
	DATETIME	TIMESTAMP	N/A
	TIMESTAMP	TIMESTAMP	N/A
	YEAR(M)	STRING	N/A
Multimedia (binary)	BINARY(M)	Not supported	N/A
	VARBINARY(M)	Not supported	N/A
	TEXT	STRING	N/A
	TINYTEXT	STRING	N/A
	MEDIUMTEXT	STRING	N/A
	LONGTEXT	STRING	N/A
	BLOB	Not supported	N/A
	TINYBLOB	Not supported	N/A
	MEDIUMBLOB	Not supported	N/A
	LONGBLOB	Not supported	N/A

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Type	MySQL Data Type	Hudi Data Type	Description
Special type	SET	Not supported	N/A
	JSON	STRING	N/A
	ENUM	Not supported	N/A

7.9.2 Mapping Between MySQL and GaussDB(DWS) Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from MySQL to GaussDB(DWS).

Table 7-31 Field types supported by a job that migrates data from MySQL to GaussDB(DWS)

Type	MySQL Data Type	GaussDB(DWS) Data Type	Description
String	CHAR(M)	CHAR(4M)	N/A
	VARCHAR(M)	VARCHAR(4M)	N/A
Value	BOOLEAN	BOOL	N/A
	TINYINT	SMALLINT	By default, TINYINT(1) is converted to BOOLEAN. If you want to keep it as TINYINT(1), add the following attribute to the MySQL data connection in Management Center: **tinyInt1isBit = false**
	TINYINT UNSIGNED	SMALLINT	N/A
	SMALLINT	SMALLINT	N/A
	SMALLINT UNSIGNED	INTEGER	N/A
	MEDIUMINT	INTEGER	N/A
	MEDIUMINT UNSIGNED	INTEGER	N/A
	INT	INTEGER	N/A

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Type	MySQL Data Type	GaussDB(DWS) Data Type	Description
	INT UNSIGNED	BIGINT	N/A
	BIGINT	BIGINT	N/A
	BIGINT UNSIGNED	NUMERIC(38)	N/A
	REAL	FLOAT8	N/A
	DECIMAL(M,D)	DECIMAL(M,D)	N/A
	NUMBERIC	NUMBERIC(M,D)	N/A
	FLOAT(M,D)	FLOAT4	N/A
	DOUBLE(M,D)	FLOAT8	N/A
	DOUBLE PRECISION	FLOAT8	N/A
Bit	BIT(M)	BOOL	N/A
Time and date	DATE	TIMESTAMP(0)	N/A
	TIME	TIME	N/A
	DATETIME	TIMESTAMP	N/A
	TIMESTAMP	TIMESATMPTZ	N/A
	YEAR(M)	VARCHAR(15)	N/A
Media (binary)	BINARY(M)	BYTEA	N/A
	VARBINARY(M)	BYTEA	N/A
	TEXT	TEXT	N/A
	TINYTEXT	TEXT	N/A
	MEDIUMTEXT	TEXT	N/A
	LONGTEXT	TEXT	N/A
Special type	SET	VARCHAR	N/A
	JSON	JSON	N/A
	ENUM	VARCHAR	N/A

7.9.3 Mapping Between PostgreSQL and GaussDB(DWS) Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

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Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from PostgreSQL to GaussDB(DWS).

Table 7-32 Field types supported by a job that migrates data from PostgreSQL to GaussDB(DWS)

Type	PostgreSQL Data Type	GaussDB(DWS) Data Type	Description
String	CHAR(M)	CHAR(M)	Fixed-length string, filled with spaces
	VARCHAR(M)	VARCHAR(M)	Variable-length string with an upper limit of length
	TEXT	TEXT	Variable-length string with no upper limit of length, similar to VARCHAR without length declaration
Value	BOOLEAN	BOOL	Logical Boolean value (true/false)
	SMALLINT	SMALLINT	int2
	INTEGER	INTEGER	int/int4
	BIGINT	BIGINT	int8
	DECIMAL(M,D)	DECIMAL(M,D)	Accurate number with precision
	NUMERIC(M,D)	NUMERIC(M,D)	Equivalent to NUMERIC
	REAL	REAL	Single-precision floating point number (4 bytes)
	DOUBLE	DOUBLE	Double-precision floating point number (8 bytes). It can also be represented by FLOAT without precision.
Date and time	DATE	TMESTAMP	A date (without the specific time) at the source will be converted to a timestamp consisting of the date and time at the destination.
	TIME(M)	TIME	Time of a day (without the date)
	TIME(M) WITH TIME ZONE	TIMETZ	Time of a day, with the time zone but without the date

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Type	PostgreSQL Data Type	GaussDB(DWS) Data Type	Description
	TIMESTAMP(M)	TMESTAMP	Data and time, without the time zone
	TIMESTAMP(M) WITH TIME ZONE	TMESTAMPTZ	Data and time, with the time zone
	INTERVAL	INTERVAL	Time interval
Binary	BYTEA	BYTEA	Binary data ("byte array")

7.9.4 Mapping Between PostgreSQL and MRS Hudi Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from PostgreSQL to Hudi.

Table 7-33 Field types supported by a job that migrates data from PostgreSQL to Hudi

Type	PostgreSQL Data Type	Hudi Data Type	Description
String	CHAR(M)	STRING	Fixed-length string, filled with spaces
	VARCHAR(M)	STRING	Variable-length string with an upper limit of length
	TEXT	STRING	Variable-length string with no upper limit of length, similar to VARCHAR without length declaration
Value	BOOLEAN	BOOLEAN	Logical Boolean value (true/false)
	SMALLINT	INT	int2
	INTEGER	INT	int/int4
	BIGINT	BIGINT	int8
	DECIMAL(M,D)	DECIMAL(M,D)	Accurate number with precision
	NUMERIC(M,D)	DECIMAL(M,D)	Equivalent to NUMERIC

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Type	PostgreSQL Data Type	Hudi Data Type	Description
	REAL	FLOAT	Single-precision floating point number (4 bytes)
	DOUBLE	DOUBLE	Double-precision floating point number (8 bytes). It can also be represented by FLOAT without precision.
Date and time	DATE	DATE	Date (1970-01-01)
	TIME(M)	STRING	Time of a day (08:00:00)
	TIMESTAMP(M)	TMESTAMP	Date and time without the time zone (1970-01-01 00:00:00)
	TIMESTAMP(M) WITH TIME ZONE	TMESTAMP	Date and time with the time zone (1970-01-01 00:00:00). It is TMESTAMPTZ.
Binary	BYTEA	Not supported	Binary data ("byte array")

7.9.5 Mapping Between Centralized/Distributed GaussDB and GaussDB(DWS) Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from GaussDB to GaussDB(DWS).

Table 7-34 Field types supported by a job that migrates data from GaussDB to GaussDB(DWS)

Type	GaussDB Data Type	GaussDB(DWS) Data Type	Description
String	CHAR(M)	CHAR(M)	Fixed-length string, filled with spaces
	VARCHAR(M)	VARCHAR(M)	Variable-length string with an upper limit of length

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Type	GaussDB Data Type	GaussDB(DWS) Data Type	Description
	TEXT	TEXT	Variable-length string with no upper limit of length, similar to VARCHAR without length declaration
Value	BOOLEAN	BOOL	Logical Boolean value (true/false)
	SMALLINT	SMALLINT	int2
	INTEGER	INTEGER	int/int4
	BIGINT	BIGINT	int8
	DECIMAL(M,D)	DECIMAL(M,D)	Accurate number with precision
	NUMERIC(M,D)	NUMERIC(M,D)	Equivalent to NUMERIC
	REAL	REAL	Single-precision floating point number (4 bytes)
	DOUBLE	DOUBLE	Double-precision floating point number (8 bytes). It can also be represented by FLOAT without precision.
Date and time	DATE	TMESTAMP	If the source data is a date (1970-01-01), it will be converted to a timestamp containing the date and time (1970-01-01 00:00:00).
	TIME(M)	TIME	Time of a day (08:00:00)
	TIME(M) WITH TIME ZONE	TIMETZ	Time of a day, with the time zone (08:00:00)
	TIMESTAMP(M)	TMESTAMP	Date and time without the time zone (1970-01-01 00:00:00)
	TIMESTAMP(M) WITH TIME ZONE	TMESTAMPTZ	Date and time with the time zone (1970-01-01 00:00:00). It is TMESTAMPTZ.
	INTERVAL	INTERVAL	Time interval
Binary	BYTEA	BYTEA	Binary data ("byte array")

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7.9.6 Mapping Between Centralized/Distributed GaussDB and MRS Hudi Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from GaussDB to Hudi.

Table 7-35 Field types supported by a job that migrates data from GaussDB to Hudi

Type	GaussDB Data Type	Hudi Data Type	Description
String	CHAR(M)	STRING	Fixed-length string, filled with spaces
	VARCHAR(M)	STRING	Variable-length string with an upper limit of length
	TEXT	STRING	Variable-length string with no upper limit of length, similar to VARCHAR without length declaration
Value	BOOLEAN	BOOLEAN	Logical Boolean value (true/false)
	SMALLINT	INT	int2
	INTEGER	INT	int/int4
	BIGINT	BIGINT	int8
	DECIMAL(M,D)	DECIMAL(M,D)	Accurate number with precision
	NUMERIC(M,D)	DECIMAL(M,D)	Equivalent to NUMERIC
	REAL	FLOAT	Single-precision floating point number (4 bytes)
	DOUBLE	DOUBLE	Double-precision floating point number (8 bytes). It can also be represented by FLOAT without precision.
Date and time	DATE	DATE	Date (1970-01-01)
	TIME(M)	STRING	Time of a day (08:00:00)
	TIME(M) WITH TIME ZONE	STRING	Time of a day, with the time zone (08:00:00)

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Type	GaussDB Data Type	Hudi Data Type	Description
	TIMESTAMP(M)	TMESTAMP	Date and time without the time zone (1970-01-01 00:00:00)
	TIMESTAMP(M) WITH TIME ZONE	TMESTAMP	Date and time with the time zone (1970-01-01 00:00:00). It is TMESTAMPTZ.
	INTERVAL	STRING	Time interval
Binary	BYTEA	Not supported	Binary data ("byte array")

7.9.7 Mapping Between SQL Server and GaussDB(DWS) Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from SQL Server to GaussDB(DWS).

Table 7-36 Field types supported by a job that migrates data from SQL Server to GaussDB(DWS)

Type	SQL Server Data Type	GaussDB(DWS) Data Type	Description
String	BINARY	BYTEA	N/A
	VARBINARY	BYTEA	N/A
	CHAR	CHAR	N/A
	VARCHAR	VARCHAR	N/A
	NCHAR	VARCHAR	N/A
	NVARCHAR	VARCHAR	N/A
	NTEXT	TEXT	N/A
	TEXT	TEXT	N/A
	IMAGE	BYTEA	N/A
	XML	TEXT	N/A
Value	DECIMAL	NUMERIC	N/A

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Type	SQL Server Data Type	GaussDB(DWS) Data Type	Description
	NUMERIC	NUMERIC	N/A
	FLOAT	FLOAT8	N/A
	REAL	FLOAT8	N/A
	INT	INTEGER	N/A
	BIGINT	BIGINT	N/A
	SMALLINT	SMALLINT	N/A
	TINYINT	SMALLINT	N/A
	MONEY	NUMERIC(19,4)	N/A
	SMALLMONEY	NUMERIC(10,4)	N/A
Bit	BIT	BOOLEAN	N/A
Date and time	DATE	DATE	N/A
	TIME	TIME	N/A
	DATETIME	TIMESTAMP(6)	N/A
	DATETIME2	TIMESTAMP(6)	N/A
	SMALLDATETIME	TIMESTAMP(6)	N/A
	DATETIMEOFFSET	TIMESTAMPZ(6)	N/A

7.9.8 Mapping Between SQL Server and Hudi Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from SQL Server to Hudi.

Table 7-37 Field types supported by a job that migrates data from SQL Server to Hudi

Type	SQL Server Data Type	Hudi Data Type	Description
String	BINARY	STRING	N/A
	VARBINARY	STRING	N/A
	CHAR	STRING	N/A

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Type	SQL Server Data Type	Hudi Data Type	Description
	VARCHAR	STRING	N/A
	NCHAR	STRING	N/A
	NVARCHAR	STRING	N/A
	NTEXT	STRING	N/A
	TEXT	STRING	N/A
	IMAGE	STRING	N/A
	XML	STRING	N/A
Value	DECIMAL	DECIMAL	N/A
	NUMERIC	DECIMAL	N/A
	FLOAT	DOUBLE	N/A
	REAL	FLOAT	N/A
	INT	INT	N/A
	BIGINT	BIGINT	N/A
	SMALLINT	INT	N/A
	TINYINT	INT	N/A
	MONEY	DECIMAL(19,4)	N/A
	SMALLMONEY	DECIMAL(10,4)	N/A
	NUMERIC	DECIMAL	N/A
Bit	BIT	STRING	N/A
Date and time	DATE	DATE	N/A
	TIME	STRING	N/A
	DATETIME	STRING	N/A
	DATETIME2	STRING	N/A
	SMALLDATETIME	STRING	N/A
	DATETIMEOFFSET	STRING	N/A

7.9.9 Mapping Between Oracle and MRS Hudi Field Types

DataArts Migration converts the source field type to the destination field type based on the default rule, and creates tables and synchronizes data in real time.

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Field Type Mapping Rules

The following table lists the field types supported by a job that migrates data from Oracle to Hudi.

Table 7-38 Field types supported by a job that migrates data from Oracle to Hudi

Oracle Data Type	Hudi Data Type
char	STRING
varchar	STRING
varchar2	STRING
nchar	STRING
nvarchar2	STRING
raw	STRING
number	STRING/DECIMAL
decimal	STRING/DECIMAL
float	FLOAT
binary_float	FLOAT
binary_double	DOUBLE
date	TIMESTAMP
timestamp	TIMESTAMP
timestamp with time zone	STRING
timestamp with local time zone	STRING

7.10 Job Performance Optimization

7.10.1 Overview

If the latency of a real-time migration job keeps increasing, the back pressure is high, or the synchronization is too much slower than the expected synchronization speed of the real-time migration job, the possible causes are as follows:

- Too slow writing at the destination
- Too slow extraction at the source
- Other problems (contact technical support)

If data is written to the destination too slowly, data extraction at the source will also be slow. To find out the cause of a slow link, check the write speed at the destination, and then check the upstream.

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Slow Writing at the Destination

1. Check whether the load at the destination has reached the upper limit by checking the monitoring metrics of the data source, such as the CPU usage, memory usage, and I/O.
2. If the load at the destination has not reached the upper limit, increase the number of concurrent jobs to improve the writing speed.
3. If the performance is not improved after step 2 is performed, check the performance of the source based on **Slow Extraction at the Source**.
4. If you have excluded the source problems, optimize parameters by following the instructions in the link performance optimization document.
5. If none of the preceding steps work, contact technical support.

Slow Extraction at the Source

1. Check whether the load at the source has reached the upper limit by checking the monitoring metrics of the data source, such as the CPU usage, memory usage, and I/O.
2. If the source load has not reached the upper limit, and if the source is a full and incremental MySQL, Oracle, SQL Server, PostgreSQL, or GaussDB migration job in the full extraction phase, or is a Kafka or Hudi migration job with slow extraction, increase the number of concurrent jobs to improve the concurrent extraction rate.

   Data in relational databases such as MySQL, Oracle, SQL Server, PostgreSQL, and GaussDB is extracted in single concurrency mode during incremental migration. Increasing the concurrency does not improve the extraction performance.
3. If the performance is not improved after step 2 is performed, optimize parameters by following the instructions in the link performance optimization document.
4. If none of the preceding steps work, contact technical support.

7.10.2 Optimizing Job Parameters

Overview

The real-time data migration service uses the Flink stream processing framework and contains JobManager and TaskManager, which are the most important components of the Flink system.

If you adjust the parameters of a job, such as **CPU Cores**, **Maximum Concurrent Requests**, and **Execution Memory**, JobManager and TaskManager can be adjusted. By default, a job uses 2 CPUs and 8 GB memory, and a JobManager process and a TaskManager process are created, both of which use 1 CPU and 4 GB memory.

Job Optimization

The JobManager and TaskManager processes that both use 1 CPU and 4 GB memory can meet requirements in most scenarios. You can also modify the specifications of JobManager and TaskManager to meet requirements in special

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scenarios. A good case in point is the job memory overflow, where you can add custom attributes in the **Configure Task** area on the real-time migration job page and adjust the memory of JobManager and TaskManager to meet synchronization requirements.

Figure 7-127 Adding custom attributes

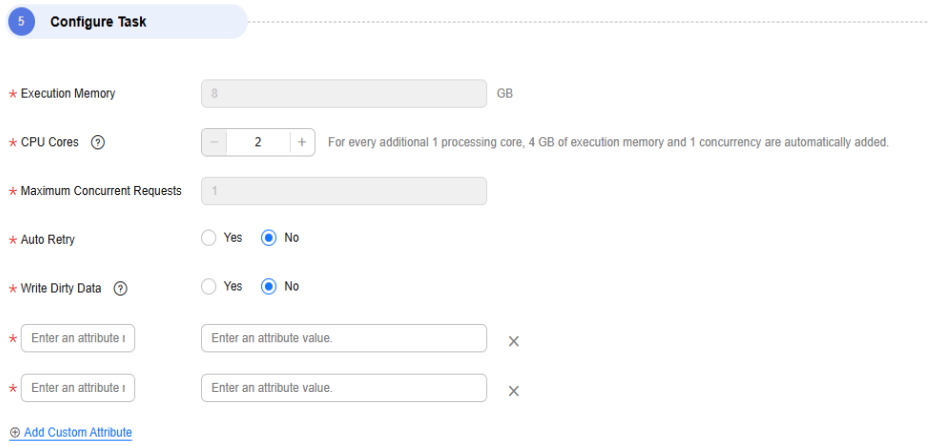


Table 7-39 Job parameters

Parameter	Type	Default Value	Description
jobmanager.memory.process.size	int	3586 MB	Processing memory of JobManager, which directly affects the heap memory size **NOTE** This memory occupies resources and may stop you from adding other jobs. Do not configure it unless necessary.
taskmanager.memory.process.size	int	3686 MB	Processing memory of TaskManager, which directly affects the heap memory size **NOTE** This memory occupies resources and may stop you from adding other jobs. Do not configure it unless necessary.
taskmanager.memory.managed.fraction	int	0.2	Percentage of the TaskManager managed memory
taskmanager.memory.network.max	int	128 MB	This parameter is not required by default. If there are too many instances and tables in the database and table sharing scenario, you can increase the network memory as needed.

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Parameter	Type	Default Value	Description
taskmanager.memory.network.fraction	int	0.1	This parameter is not required by default. If there are too many instances and tables in the database and table sharing scenario, you can increase the network memory as needed.
checkpoint.interval	int	60000	Interval at which a Flink job generates checkpoints, in milliseconds. For jobs with a large amount of data, you are advised to set this parameter to a larger value, which allows for a longer time for data flushing but increases the latency.
checkpoint.timeout.ms	int	600000	Timeout interval for a Flink job to generate checkpoints, in milliseconds

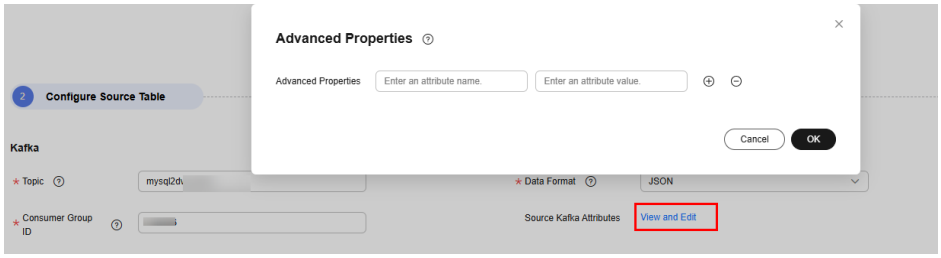
7.10.3 Optimizing the Parameters of a Job for Migrating Data from MRS Kafka to MRS Hudi

Optimizing Source Parameters

Optimization of data extraction from Kafka

You can click **Source Kafka Attributes** in the source configuration to add Kafka optimization configurations.

Figure 7-128 Adding custom attributes



The following tuning parameters are available.

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Table 7-40 Tuning parameters for full data synchronization

Parameter	Type	Default Value	Description
properties.fetch.max.bytes	int	57671680	Maximum number of bytes returned for each fetch request when Kafka data is consumed. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.
properties.max.partition.fetch.bytes	int	1048576	Maximum number of bytes in each partition returned by the server when Kafka data is consumed. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.
properties.max.poll.records	int	500	Maximum number of messages returned by a consumer in each poll. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.

Optimizing Destination Parameters

Optimization of data writing to Hudi

If data is written to the Hudi table slowly, check whether the table is properly designed. You are advised to use an MOR table that uses Hudi bucket indexes and configure the number of buckets to achieve an optimal migration performance.

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NOTE

- Using bucket indexes: You can configure the **index.type** and **hoodie.bucket.index.num.buckets** attributes in **Global Configuration of Hudi Table Attributes** or **Edit Table Attribute** of the mapped table.
- Determine whether to use partitioned or non-partitioned tables.

  There are two types of tables, fact tables and dimension tables.

  - Fact tables generally have a large amount of data, most of which is new data and a small proportion of which is the data updated in a recent period (years, months, or days). A downstream system that reads a fact table for ETL calculation splits the table based on the data creation time (for example, last day, month, or year) into partitioned tables, ensuring optimal read and write performance.
  - Dimension tables generally contain a small amount of data, most of which is updated data and a small proportion of which is new data. The data volume of a dimension table is stable, and all data is read for ETL calculation such as join. Therefore, non-partitioned tables are more suitable as they provide better performance.
- Determine the number of buckets in a table.

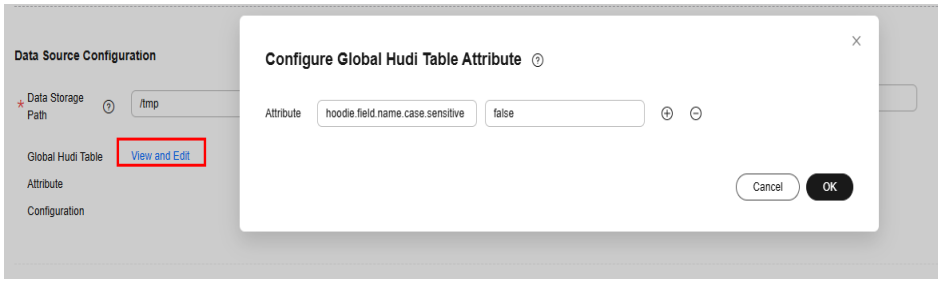
  If you use a Hudi bucket table, you need to set the number of buckets, which affects the table performance.

  - Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4)
  - Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1)

    Notes:
  - The total data volume of a table, rather than the size of a compressed file, is used.
  - An even number is preferred for the number of buckets. Set the minimum number of buckets for a non-partitioned table to 4 and that for a partitioned table to 1.

In addition, you can click **Global Configuration of Hudi Table Attributes** in the Hudi destination configuration or click **Edit Table Attribute** in the mapped table to add optimization parameters.

Figure 7-129 Adding custom attributes



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Table 7-41 Parameters for optimizing Hudi writing

Parameter	Type	Default Value	Description
hoodie.sink.flush.tasks	int	1	Number of concurrent Hudi flush tasks. The default value is 1, indicating sequential writing. If Hudi commits a large number of FleGroups (for example, a large amount of historical data of the source table is updated), you can increase the value of this parameter. FileGroup data flushed by a single thread = Number of FileGroups committed at a time/Number of concurrent jobs If the number of FileGroups flushed by a single thread is less than or equal to 5, the recommended value for this parameter is 2. If the number of FileGroups flushed by a single thread is less than or equal to 10, the recommended value for this parameter is 5. If the number of FileGroups flushed by a single thread is less than or equal to 25, the recommended value for this parameter is 10. If the number of FileGroups flushed by a single thread is less than or equal to 50, the recommended value for this parameter is 20. If the number of FileGroups flushed by a single thread is greater than 50, the recommended value for this parameter is 30. The larger the number of concurrent flush tasks, the higher the memory during flushing. Adjust the value based on the memory monitoring of the real-time processing migration job.

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Parameter	Type	Default Value	Description
hoodie.context.flatmap.parallelism	int	1	When Hudi performs commit operations, it scans partitions. By default, one scan operation is performed at a time. If a large number of partitions are involved in a commit operation, you can increase the value of this parameter to accelerate the commit operation. If the number of partitions committed at a time is less than or equal to 10, the recommended value for this parameter is 5. If the number of partitions committed at a time is less than or equal to 25, the recommended value for this parameter is 10. If the number of partitions committed at a time is less than or equal to 50, the recommended value for this parameter is 20. If the number of partitions committed at a time is greater than 50, the recommended value for this parameter is 30.
compaction.async.enabled	boolean	true	Whether to enable compaction. The default value is **true**, indicating that compaction is enabled for Hudi. The compaction operation affects the write performance of a real-time migration job. To ensure the stability of the migration job, you can set this parameter to **false** and split Hudi Compaction into Spark jobs for MRS to execute. For details, see
compaction.delta_commits	int	5	Frequency at which compaction requests are generated for real-time processing migration jobs. The default value is **5**, indicating that a compaction request is generated every five commits. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If the incremental Hudi data is small, you can increase the value of this parameter.

7.10.4 Optimizing the Parameters of a Job for Migrating Data from MySQL to MRS Hudi

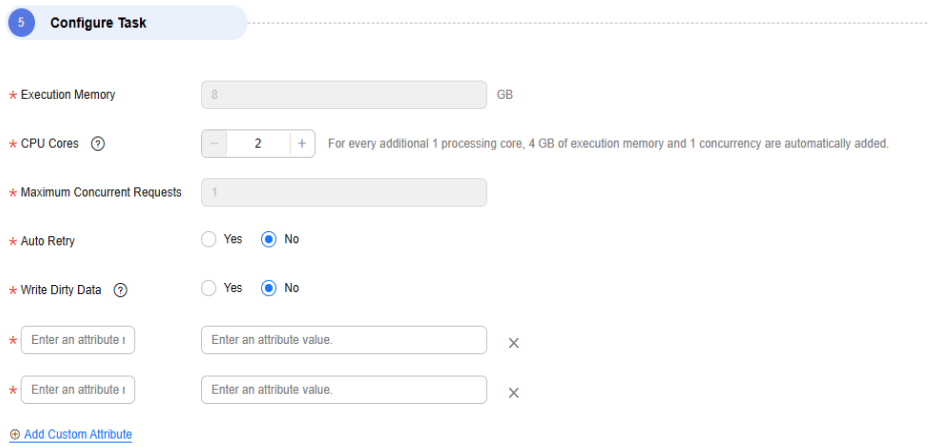
Optimizing Source Parameters

Optimization of data extraction from MySQL

You can click **Add Custom Attribute** in the **Configure Task** area and add MySQL synchronization parameters.

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Figure 7-130 Adding custom attributes



The following tuning parameters are available.

Table 7-42 Tuning parameters for full data synchronization

Parameter	Type	Default Value	Description
scan.incremental.snapshot.backfill.skip	boolean	true	Whether to skip reading Binlog data. The default value is **true**. Skipping reading Binlog data can effectively reduce memory usage. Note that skipping reading Binlog data provides only at-least-once guarantee.
scan.incremental.snapshot.chunk.size	int	50000	Shard size, which determines the maximum number of data records in a single shard and the number of shards in the full migration phase. The larger the shard size, the more data records in a single shard, and the smaller the number of shards. If a table has a large number of records, the job will be divided into multiple shards, occupying too much memory. To avoid this issue, reduce the number of records in the table. If **scan.incremental.snapshot.backfill.skip** is **false**, the real-time processing migration job caches data of a single shard. In this case, a larger shard occupies more memory, causing memory overflow. To avoid this issue, reduce the shard size.

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Parameter	Type	Default Value	Description
scan.snapshot.fetch.size	int	1024	Maximum number of data records that can be extracted from the MySQL database in a single request during full data extraction. Increasing the number of requests can reduce the number of requests to the MySQL database and improve performance.
debezium.max.queue.size	int	8192	Number of data cache queues. The default value is **8192**. If the size of a single data record in the source table is too large (for example, 1 MB), memory overflow occurs when too much data is cached. You can reduce the value.
debezium.max.queue.size.in.bytes	int	0	Size of the data cache queue. The default value is **0**, indicating that the cache queue is calculated based on the number of data records instead of the data size. If **debezium.max.queue.size** cannot effectively limit memory usage, you can explicitly set this parameter to limit the size of cached data.
jdbc.properties.socketTimeout	int	300000	Timeout interval of the socket for connecting to the MySQL database in the full migration phase. The default value is 5 minutes. If the MySQL database is overloaded, and the SocketTimeout exception occurs for a job, you can increase the value of this parameter.
jdbc.properties.connectTimeout	int	60000	Timeout interval of the connection to the MySQL database in the full migration phase. The default value is 1 minute. If the MySQL database is overloaded, and the ConnectTimeout exception occurs for a job, you can increase the value of this parameter.

Table 7-43 Tuning parameters for incremental data synchronization

Parameter	Type	Default Value	Description
debezium.max.queue.size	int	8192	Number of data cache queues. The default value is **8192**. If the size of a single data record in the source table is too large (for example, 1 MB), memory overflow occurs when too much data is cached. You can reduce the value.

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Parameter	Type	Default Value	Description
debezium.max.queue.size.in.bytes	int	0	Size of the data cache queue. The default value is **0**, indicating that the cache queue is calculated based on the number of data records instead of the data size. If **debezium.max.queue.size** cannot effectively limit memory usage, you can explicitly set this parameter to limit the size of cached data.

Optimizing Destination Parameters

Optimization of data writing to Hudi

If data is written to the Hudi table slowly, check whether the table is properly designed. You are advised to use an MOR table that uses Hudi bucket indexes and configure the number of buckets to achieve an optimal migration performance.

NOTE

- Using bucket indexes: You can configure the **index.type** and **hoodie.bucket.index.num.buckets** attributes in **Global Configuration of Hudi Table Attributes** or **Edit Table Attribute** of the mapped table.
- Determine whether to use partitioned or non-partitioned tables.

  There are two types of tables, fact tables and dimension tables.

  - Fact tables generally have a large amount of data, most of which is new data and a small proportion of which is the data updated in a recent period (years, months, or days). A downstream system that reads a fact table for ETL calculation splits the table based on the data creation time (for example, last day, month, or year) into partitioned tables, ensuring optimal read and write performance.
  - Dimension tables generally contain a small amount of data, most of which is updated data and a small proportion of which is new data. The data volume of a dimension table is stable, and all data is read for ETL calculation such as join. Therefore, non-partitioned tables are more suitable as they provide better performance.
- Determine the number of buckets in a table.

  If you use a Hudi bucket table, you need to set the number of buckets, which affects the table performance.

  - Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4)
  - Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1)

    Notes:
  - The total data volume of a table, rather than the size of a compressed file, is used.
  - An even number is preferred for the number of buckets. Set the minimum number of buckets for a non-partitioned table to 4 and that for a partitioned table to 1.

In addition, you can click **Global Configuration of Hudi Table Attributes** in the Hudi destination configuration or click **Edit Table Attribute** in the mapped table to add optimization parameters.

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Figure 7-131 Adding custom attributes

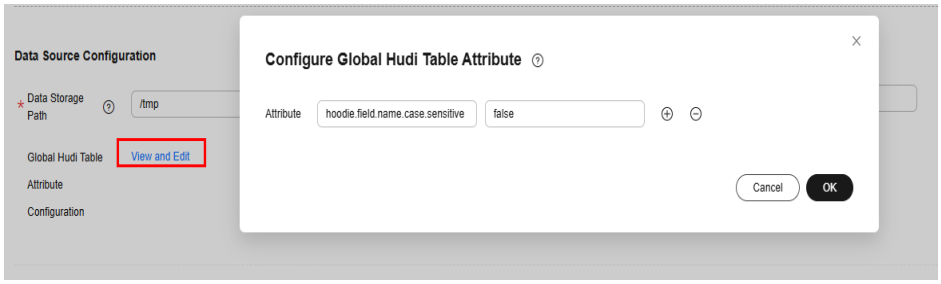


Table 7-44 Parameters for optimizing Hudi writing

Parameter	Type	Default Value	Description
hoodie.sink.flush.tasks	int	1	Number of concurrent Hudi flush tasks. The default value is 1, indicating sequential writing. If Hudi commits a large number of FleGroups (for example, a large amount of historical data of the source table is updated), you can increase the value of this parameter. FileGroup data flushed by a single thread = Number of FileGroups committed at a time/Number of concurrent jobs If the number of FileGroups flushed by a single thread is less than or equal to 5, the recommended value for this parameter is 2. If the number of FileGroups flushed by a single thread is less than or equal to 10, the recommended value for this parameter is 5. If the number of FileGroups flushed by a single thread is less than or equal to 25, the recommended value for this parameter is 10. If the number of FileGroups flushed by a single thread is less than or equal to 50, the recommended value for this parameter is 20. If the number of FileGroups flushed by a single thread is greater than 50, the recommended value for this parameter is 30. The larger the number of concurrent flush tasks, the higher the memory during flushing. Adjust the value based on the memory monitoring of the real-time processing migration job.

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Parameter	Type	Default Value	Description
hoodie.context.flatmap.parallelism	int	1	When Hudi performs commit operations, it scans partitions. By default, one scan operation is performed at a time. If a large number of partitions are involved in a commit operation, you can increase the value of this parameter to accelerate the commit operation. If the number of partitions committed at a time is less than or equal to 10, the recommended value for this parameter is 5. If the number of partitions committed at a time is less than or equal to 25, the recommended value for this parameter is 10. If the number of partitions committed at a time is less than or equal to 50, the recommended value for this parameter is 20. If the number of partitions committed at a time is greater than 50, the recommended value for this parameter is 30.
compaction.async.enabled	boolean	true	Whether to enable compaction. The default value is **true**, indicating that compaction is enabled for Hudi. The compaction operation affects the write performance of a real-time migration job. To ensure the stability of the migration job, you can set this parameter to **false** and split Hudi Compaction into Spark jobs for MRS to execute. For details, see
compaction.delta_commits	int	5	Frequency at which compaction requests are generated for real-time processing migration jobs. The default value is **5**, indicating that a compaction request is generated every five commits. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If the incremental Hudi data is small, you can increase the value of this parameter.

7.10.5 Optimizing the Parameters of a Job for Migrating Data from MySQL to GaussDB(DWS)

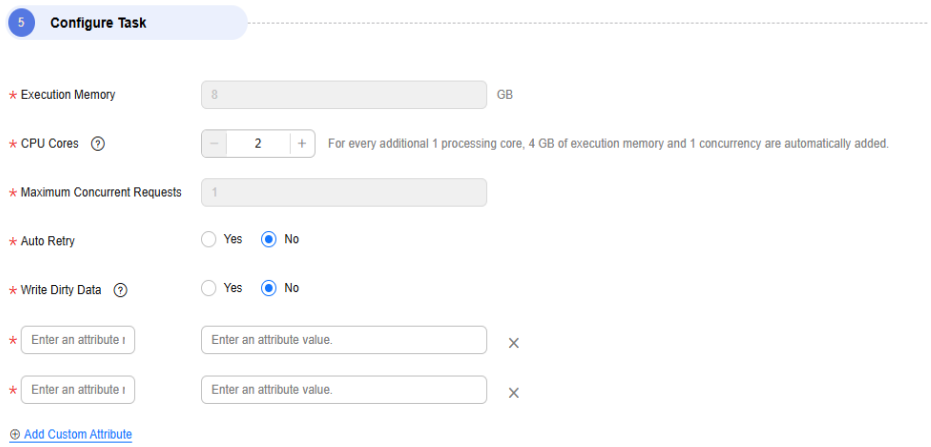
Optimizing Source Parameters

Optimization of data extraction from MySQL

You can click **Add Custom Attribute** in the **Configure Task** area and add MySQL synchronization parameters.

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Figure 7-132 Adding custom attributes



The following tuning parameters are available.

Table 7-45 Tuning parameters for full data synchronization

Parameter	Type	Default Value	Description
scan.incremental.snapshot.backfill.skip	boolean	true	Whether to skip reading Binlog data. The default value is **true**. Skipping reading Binlog data can effectively reduce memory usage. Note that skipping reading Binlog data provides only at-least-once guarantee.
scan.incremental.snapshot.chunk.size	int	50000	Shard size, which determines the maximum number of data records in a single shard and the number of shards in the full migration phase. The larger the shard size, the more data records in a single shard, and the smaller the number of shards. If a table has a large number of records, the job will be divided into multiple shards, occupying too much memory. To avoid this issue, reduce the number of records in the table. If **scan.incremental.snapshot.backfill.skip** is **false**, the real-time processing migration job caches data of a single shard. In this case, a larger shard occupies more memory, causing memory overflow. To avoid this issue, reduce the shard size.

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Parameter	Type	Default Value	Description
scan.snapshot.fetch.size	int	1024	Maximum number of data records that can be extracted from the MySQL database in a single request during full data extraction. Increasing the number of requests can reduce the number of requests to the MySQL database and improve performance.
debezium.max.queue.size	int	8192	Number of data cache queues. The default value is **8192**. If the size of a single data record in the source table is too large (for example, 1 MB), memory overflow occurs when too much data is cached. You can reduce the value.
debezium.max.queue.size.in.bytes	int	0	Size of the data cache queue. The default value is **0**, indicating that the cache queue is calculated based on the number of data records instead of the data size. If **debezium.max.queue.size** cannot effectively limit memory usage, you can explicitly set this parameter to limit the size of cached data.
jdbc.properties.socketTimeout	int	300000	Timeout interval of the socket for connecting to the MySQL database in the full migration phase. The default value is 5 minutes. If the MySQL database is overloaded, and the SocketTimeout exception occurs for a job, you can increase the value of this parameter.
jdbc.properties.connectTimeout	int	60000	Timeout interval of the connection to the MySQL database in the full migration phase. The default value is 1 minute. If the MySQL database is overloaded, and the ConnectTimeout exception occurs for a job, you can increase the value of this parameter.

Table 7-46 Tuning parameters for incremental data synchronization

Parameter	Type	Default Value	Description
debezium.max.queue.size	int	8192	Number of data cache queues. The default value is **8192**. If the size of a single data record in the source table is too large (for example, 1 MB), memory overflow occurs when too much data is cached. You can reduce the value.

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Parameter	Type	Default Value	Description
debezium.max.queue.size.in.bytes	int	0	Size of the data cache queue. The default value is **0**, indicating that the cache queue is calculated based on the number of data records instead of the data size. If **debezium.max.queue.size** cannot effectively limit memory usage, you can explicitly set this parameter to limit the size of cached data.

Optimizing Destination Parameters

Optimization of data writing to GaussDB(DWS)

You can modify writing parameters in the GaussDB(DWS) destination configuration or click **View and Edit** in the advanced configuration to add advanced attributes.

Figure 7-133 Adding advanced attributes

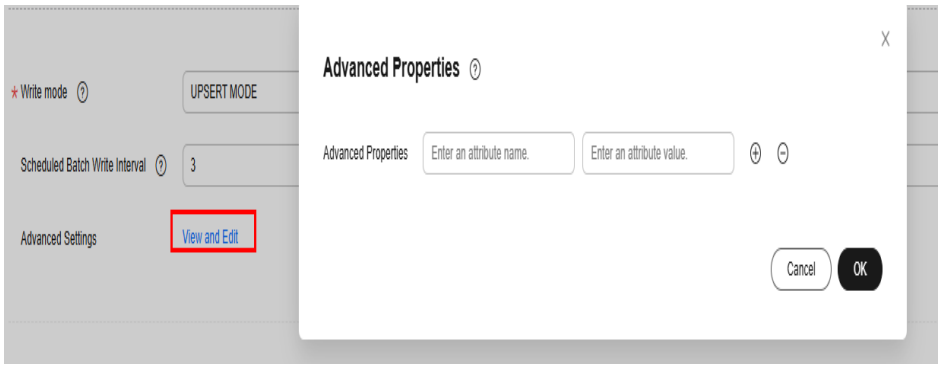


Table 7-47 Parameters for optimizing GaussDB(DWS) writing

Parameter	Type	Default Value	Description
Write Mode	enum	UPSERT	Mode for writing data to GaussDB(DWS), which can be set in the destination configuration. **COPY MODE** is recommended for real-time migration jobs. • **UPSERT**: batch update • **COPY**: GaussDB(DWS)-dedicated high-performance batch import

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Parameter	Type	Default Value	Description
Maximum Data Volume for Batch Write	int	500000	Maximum number of data records that can be written to GaussDB(DWS) at a time. You can set this parameter in the destination configuration. If **Maximum Data Volume for Batch Write** or **Scheduled Batch Write Interval** is met, data will be written. Increasing the number of data records written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the GaussDB(DWS) specifications and load.
Scheduled Batch Write Interval	int	3	Interval for writing data to GaussDB(DWS). You can set this parameter in the destination configuration. If the interval is reached, cached data will be written. Increasing the value of this parameter increases the number of data records cached in a single write, but it takes a longer time for DWS data to become visible.
sink.buffer-flush.max-size	int	512	Amount of the data that can be written to GaussDB(DWS) at a time. The default value is 512 MB. You can set this parameter in the advanced settings of the destination configuration. If the size of cached data reaches the upper limit, data will be written. Similar to **Maximum Data Volume for Batch Write**, increasing the amount of data written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the DWS specifications and load.

7.10.6 Optimizing the Parameters of a Job for Migrating Data from MySQL to

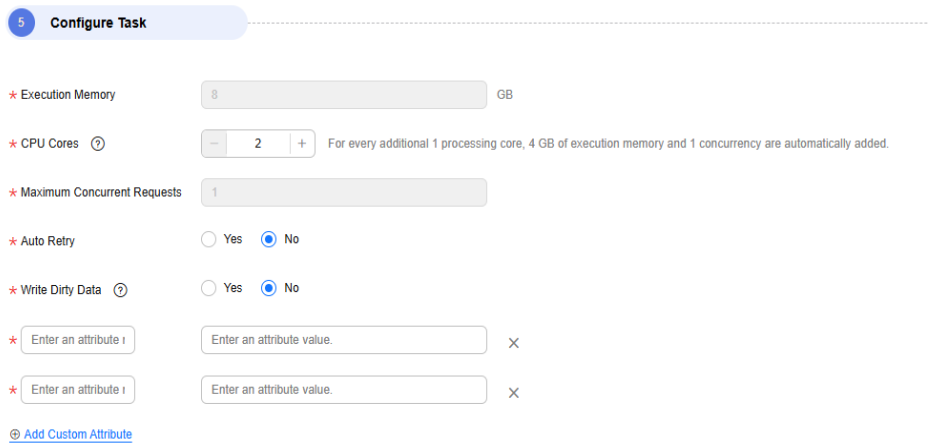
Optimizing Source Parameters

Optimization of data extraction from MySQL

You can click **Add Custom Attribute** in the **Configure Task** area and add MySQL synchronization parameters.

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Figure 7-134 Adding custom attributes



The following tuning parameters are available.

Table 7-48 Tuning parameters for full data synchronization

Parameter	Type	Default Value	Description
scan.incremental.snapshot.backfill.skip	boolean	true	Whether to skip reading Binlog data. The default value is **true**. Skipping reading Binlog data can effectively reduce memory usage. Note that skipping reading Binlog data provides only at-least-once guarantee.
scan.incremental.snapshot.chunk.size	int	50000	Shard size, which determines the maximum number of data records in a single shard and the number of shards in the full migration phase. The larger the shard size, the more data records in a single shard, and the smaller the number of shards. If a table has a large number of records, the job will be divided into multiple shards, occupying too much memory. To avoid this issue, reduce the number of records in the table. If **scan.incremental.snapshot.backfill.skip** is **false**, the real-time processing migration job caches data of a single shard. In this case, a larger shard occupies more memory, causing memory overflow. To avoid this issue, reduce the shard size.

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Parameter	Type	Default Value	Description
scan.snapshot.fetch.size	int	1024	Maximum number of data records that can be extracted from the MySQL database in a single request during full data extraction. Increasing the number of requests can reduce the number of requests to the MySQL database and improve performance.
debezium.max.queue.size	int	8192	Number of data cache queues. The default value is **8192**. If the size of a single data record in the source table is too large (for example, 1 MB), memory overflow occurs when too much data is cached. You can reduce the value.
debezium.max.queue.size.in.bytes	int	0	Size of the data cache queue. The default value is **0**, indicating that the cache queue is calculated based on the number of data records instead of the data size. If **debezium.max.queue.size** cannot effectively limit memory usage, you can explicitly set this parameter to limit the size of cached data.
jdbc.properties.socketTimeout	int	300000	Timeout interval of the socket for connecting to the MySQL database in the full migration phase. The default value is 5 minutes. If the MySQL database is overloaded, and the SocketTimeout exception occurs for a job, you can increase the value of this parameter.
jdbc.properties.connectTimeout	int	60000	Timeout interval of the connection to the MySQL database in the full migration phase. The default value is 1 minute. If the MySQL database is overloaded, and the ConnectTimeout exception occurs for a job, you can increase the value of this parameter.

Table 7-49 Tuning parameters for incremental data synchronization

Parameter	Type	Default Value	Description
debezium.max.queue.size	int	8192	Number of data cache queues. The default value is **8192**. If the size of a single data record in the source table is too large (for example, 1 MB), memory overflow occurs when too much data is cached. You can reduce the value.

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Parameter	Type	Default Value	Description
debezium.max.queue.size.in.bytes	int	0	Size of the data cache queue. The default value is **0**, indicating that the cache queue is calculated based on the number of data records instead of the data size. If **debezium.max.queue.size** cannot effectively limit memory usage, you can explicitly set this parameter to limit the size of cached data.

Optimizing Destination Parameters

Optimization of data writing to Kafka

Generally, data is written to Kafka fast. If the speed is slow, increase the concurrency.

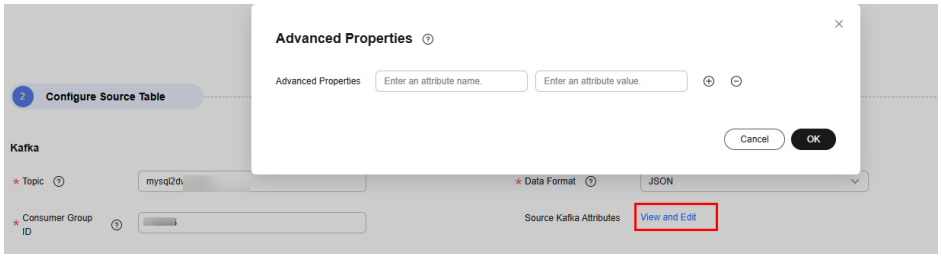
7.10.7 Optimizing the Parameters of a Job for Migrating Data from DMS for Kafka to OBS

Optimizing Source Parameters

Optimization of data extraction from Kafka

You can click **Source Kafka Attributes** in the source configuration to add Kafka optimization configurations.

Figure 7-135 Adding custom attributes



The following tuning parameters are available.

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Table 7-50 Tuning parameters for full data synchronization

Parameter	Type	Default Value	Description
properties.fetch.max.bytes	int	57671680	Maximum number of bytes returned for each fetch request when Kafka data is consumed. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.
properties.max.partition.fetch.bytes	int	1048576	Maximum number of bytes in each partition returned by the server when Kafka data is consumed. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.
properties.max.poll.records	int	500	Maximum number of messages returned by a consumer in each poll. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.

Optimizing Destination Parameters

Optimization of data writing to OBS

If automatic combination is enabled, disable it. Otherwise, increase the concurrency first.

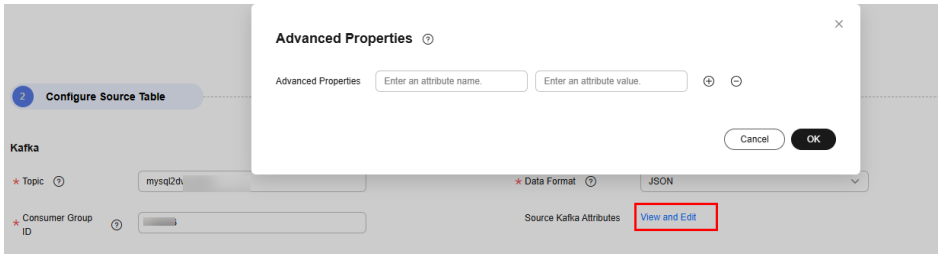
7.10.8 Optimizing the Parameters of a Job for Migrating Data from Apache Kafka to MRS Kafka

Optimizing Source Parameters

Optimization of data extraction from Kafka

You can click **Source Kafka Attributes** in the source configuration to add Kafka optimization configurations.

Figure 7-136 Adding custom attributes



The following tuning parameters are available.

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Table 7-51 Tuning parameters for full data synchronization

Parameter	Type	Default Value	Description
properties.fetch.max.bytes	int	57671680	Maximum number of bytes returned for each fetch request when Kafka data is consumed. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.
properties.max.partition.fetch.bytes	int	1048576	Maximum number of bytes in each partition returned by the server when Kafka data is consumed. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.
properties.max.poll.records	int	500	Maximum number of messages returned by a consumer in each poll. If the size of a single Kafka message is large, you can increase the amount of data obtained each time to improve performance.

Optimizing Destination Parameters

Optimization of data writing to Kafka

Generally, data is written to Kafka fast. If the speed is slow, increase the concurrency.

7.10.9 Optimizing the Parameters of a Job for Migrating Data from SQL Server to MRS Hudi

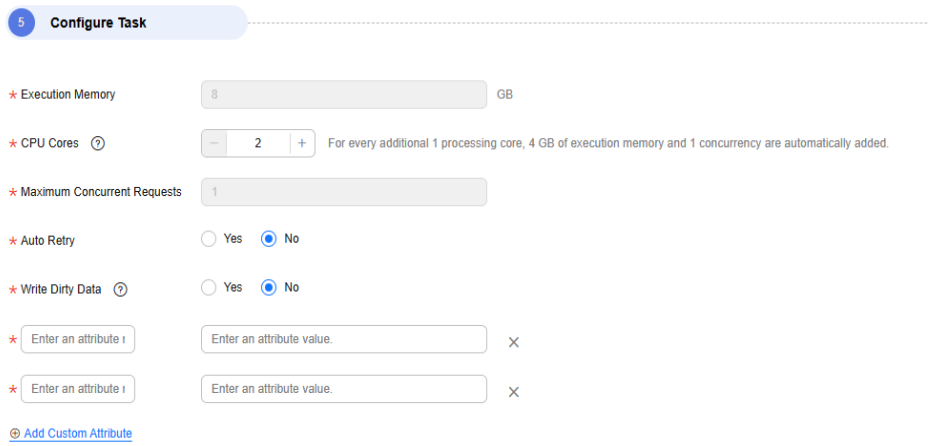
Optimizing Source Parameters

Optimization of data extraction from SQL Server

You can click **Add Custom Attribute** in the **Configure Task** area and add SQL Server synchronization parameters.

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Figure 7-137 Adding custom attributes



The following tuning parameters are available.

Table 7-52 Tuning parameters for full data synchronization

Parameter	Type	Default Value	Description
scan.incremental.snapshot.backfill.skip	boolean	true	Whether to skip reading Binlog data. The default value is **true**. Skipping reading Binlog data can effectively reduce memory usage. Note that skipping reading Binlog data provides only at-least-once guarantee.

Table 7-53 Tuning parameters for incremental data synchronization

Parameter	Type	Default Value	Description
debezium.max.iteration.transactions	int	1,000	Number of data records extracted from each table at a time during data replay. If the value of this parameter is large, the memory usage increases and incremental synchronization tasks are blocked.

Optimizing Destination Parameters

Optimization of data writing to Hudi

If data is written to the Hudi table slowly, check whether the table is properly designed. You are advised to use an MOR table that uses Hudi bucket indexes and configure the number of buckets to achieve an optimal migration performance.

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NOTE

- Using bucket indexes: You can configure the **index.type** and **hoodie.bucket.index.num.buckets** attributes in **Global Configuration of Hudi Table Attributes** or **Edit Table Attribute** of the mapped table.
- Determine whether to use partitioned or non-partitioned tables.

  There are two types of tables, fact tables and dimension tables.

  - Fact tables generally have a large amount of data, most of which is new data and a small proportion of which is the data updated in a recent period (years, months, or days). A downstream system that reads a fact table for ETL calculation splits the table based on the data creation time (for example, last day, month, or year) into partitioned tables, ensuring optimal read and write performance.
  - Dimension tables generally contain a small amount of data, most of which is updated data and a small proportion of which is new data. The data volume of a dimension table is stable, and all data is read for ETL calculation such as join. Therefore, non-partitioned tables are more suitable as they provide better performance.
- Determine the number of buckets in a table.

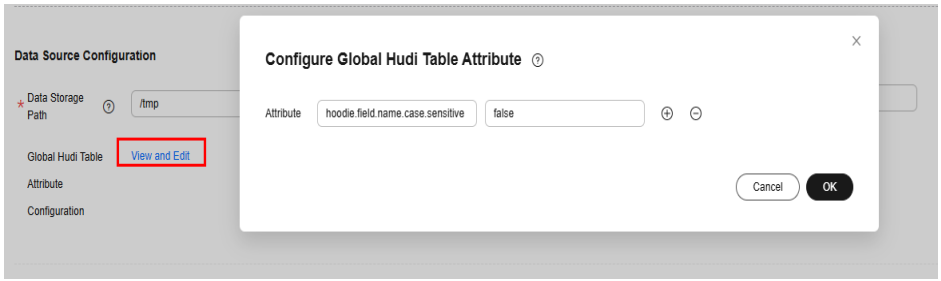
  If you use a Hudi bucket table, you need to set the number of buckets, which affects the table performance.

  - Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4)
  - Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1)

    Notes:
  - The total data volume of a table, rather than the size of a compressed file, is used.
  - An even number is preferred for the number of buckets. Set the minimum number of buckets for a non-partitioned table to 4 and that for a partitioned table to 1.

In addition, you can click **Global Configuration of Hudi Table Attributes** in the Hudi destination configuration or click **Edit Table Attribute** in the mapped table to add optimization parameters.

Figure 7-138 Adding custom attributes



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Table 7-54 Parameters for optimizing Hudi writing

Parameter	Type	Default Value	Description
hoodie.sink.flush.tasks	int	1	Number of concurrent Hudi flush tasks. The default value is 1, indicating sequential writing. If Hudi commits a large number of FleGroups (for example, a large amount of historical data of the source table is updated), you can increase the value of this parameter. FileGroup data flushed by a single thread = Number of FileGroups committed at a time/Number of concurrent jobs If the number of FileGroups flushed by a single thread is less than or equal to 5, the recommended value for this parameter is 2. If the number of FileGroups flushed by a single thread is less than or equal to 10, the recommended value for this parameter is 5. If the number of FileGroups flushed by a single thread is less than or equal to 25, the recommended value for this parameter is 10. If the number of FileGroups flushed by a single thread is less than or equal to 50, the recommended value for this parameter is 20. If the number of FileGroups flushed by a single thread is greater than 50, the recommended value for this parameter is 30. The larger the number of concurrent flush tasks, the higher the memory during flushing. Adjust the value based on the memory monitoring of the real-time processing migration job.

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Parameter	Type	Default Value	Description
hoodie.context.flatmap.parallelism	int	1	When Hudi performs commit operations, it scans partitions. By default, one scan operation is performed at a time. If a large number of partitions are involved in a commit operation, you can increase the value of this parameter to accelerate the commit operation. If the number of partitions committed at a time is less than or equal to 10, the recommended value for this parameter is 5. If the number of partitions committed at a time is less than or equal to 25, the recommended value for this parameter is 10. If the number of partitions committed at a time is less than or equal to 50, the recommended value for this parameter is 20. If the number of partitions committed at a time is greater than 50, the recommended value for this parameter is 30.
compaction.async.enabled	boolean	true	Whether to enable compaction. The default value is **true**, indicating that compaction is enabled for Hudi. The compaction operation affects the write performance of a real-time migration job. To ensure the stability of the migration job, you can set this parameter to **false** and split Hudi Compaction into Spark jobs for MRS to execute. For details, see
compaction.delta_commits	int	5	Frequency at which compaction requests are generated for real-time processing migration jobs. The default value is **5**, indicating that a compaction request is generated every five commits. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If the incremental Hudi data is small, you can increase the value of this parameter.

7.10.10 Optimizing the Parameters of a Job for Migrating Data from PostgreSQL to GaussDB(DWS)

Optimizing Source Parameters

Optimization of data extraction from PostgreSQL

No optimization configuration items are available.

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Optimizing Destination Parameters

Optimization of data writing to GaussDB(DWS)

You can modify writing parameters in the GaussDB(DWS) destination configuration or click **View and Edit** in the advanced configuration to add advanced attributes.

Figure 7-139 Adding advanced attributes

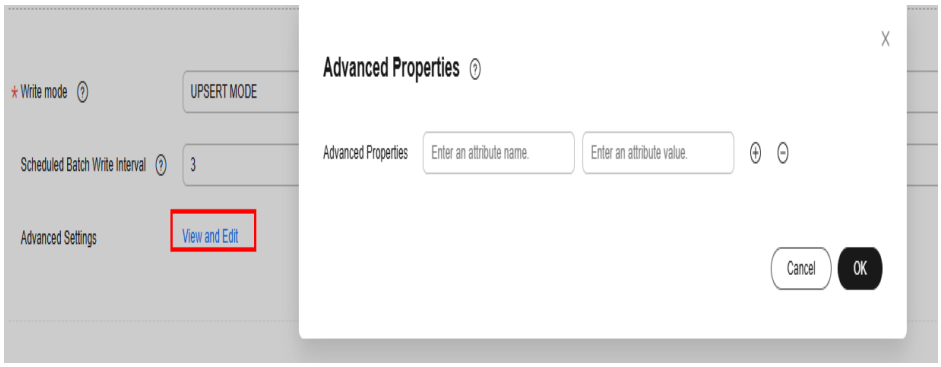


Table 7-55 Parameters for optimizing GaussDB(DWS) writing

Parameter	Type	Default Value	Description
Write Mode	enum	UPSERT	Mode for writing data to GaussDB(DWS), which can be set in the destination configuration. **COPY MODE** is recommended for real-time migration jobs. • **UPSERT**: batch update • **COPY**: GaussDB(DWS)-dedicated high-performance batch import
Maximum Data Volume for Batch Write	int	50000	Maximum number of data records that can be written to GaussDB(DWS) at a time. You can set this parameter in the destination configuration. If **Maximum Data Volume for Batch Write** or **Scheduled Batch Write Interval** is met, data will be written. Increasing the number of data records written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the GaussDB(DWS) specifications and load.

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Parameter	Type	Default Value	Description
Scheduled Batch Write Interval	int	3	Interval for writing data to GaussDB(DWS). You can set this parameter in the destination configuration. If the interval is reached, cached data will be written. Increasing the value of this parameter increases the number of data records cached in a single write, but it takes a longer time for DWS data to become visible.
sink.buffer-flush.max-size	int	512	Amount of the data that can be written to GaussDB(DWS) at a time. The default value is 512 MB. You can set this parameter in the advanced settings of the destination configuration. If the size of cached data reaches the upper limit, data will be written. Similar to **Maximum Data Volume for Batch Write**, increasing the amount of data written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the DWS specifications and load.

7.10.11 Optimizing the Parameters of a Job for Migrating Data from PostgreSQL to MRS Hudi

Optimizing Source Parameters

Optimization of data extraction from PostgreSQL

No optimization configuration items are available.

Optimizing Destination Parameters

Optimization of data writing to Hudi

If data is written to the Hudi table slowly, check whether the table is properly designed. You are advised to use an MOR table that uses Hudi bucket indexes and configure the number of buckets to achieve an optimal migration performance.

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NOTE

- Using bucket indexes: You can configure the **index.type** and **hoodie.bucket.index.num.buckets** attributes in **Global Configuration of Hudi Table Attributes** or **Edit Table Attribute** of the mapped table.
- Determine whether to use partitioned or non-partitioned tables.

  There are two types of tables, fact tables and dimension tables.

  - Fact tables generally have a large amount of data, most of which is new data and a small proportion of which is the data updated in a recent period (years, months, or days). A downstream system that reads a fact table for ETL calculation splits the table based on the data creation time (for example, last day, month, or year) into partitioned tables, ensuring optimal read and write performance.
  - Dimension tables generally contain a small amount of data, most of which is updated data and a small proportion of which is new data. The data volume of a dimension table is stable, and all data is read for ETL calculation such as join. Therefore, non-partitioned tables are more suitable as they provide better performance.
- Determine the number of buckets in a table.

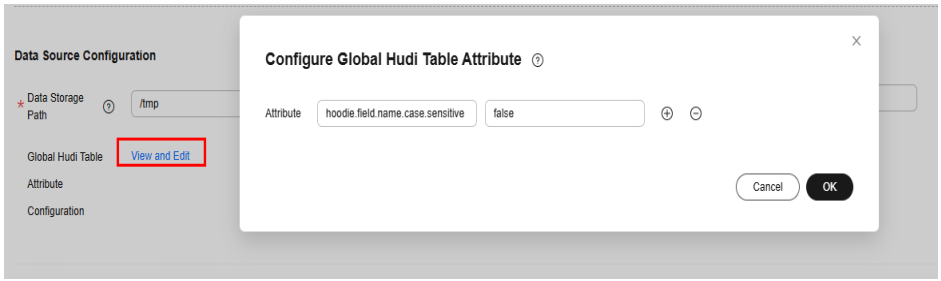
  If you use a Hudi bucket table, you need to set the number of buckets, which affects the table performance.

  - Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4)
  - Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1)

    Notes:
  - The total data volume of a table, rather than the size of a compressed file, is used.
  - An even number is preferred for the number of buckets. Set the minimum number of buckets for a non-partitioned table to 4 and that for a partitioned table to 1.

In addition, you can click **Global Configuration of Hudi Table Attributes** in the Hudi destination configuration or click **Edit Table Attribute** in the mapped table to add optimization parameters.

Figure 7-140 Adding custom attributes



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Table 7-56 Parameters for optimizing Hudi writing

Parameter	Type	Default Value	Description
hoodie.sink.flush.tasks	int	1	Number of concurrent Hudi flush tasks. The default value is 1, indicating sequential writing. If Hudi commits a large number of FleGroups (for example, a large amount of historical data of the source table is updated), you can increase the value of this parameter. FileGroup data flushed by a single thread = Number of FileGroups committed at a time/Number of concurrent jobs If the number of FileGroups flushed by a single thread is less than or equal to 5, the recommended value for this parameter is 2. If the number of FileGroups flushed by a single thread is less than or equal to 10, the recommended value for this parameter is 5. If the number of FileGroups flushed by a single thread is less than or equal to 25, the recommended value for this parameter is 10. If the number of FileGroups flushed by a single thread is less than or equal to 50, the recommended value for this parameter is 20. If the number of FileGroups flushed by a single thread is greater than 50, the recommended value for this parameter is 30. The larger the number of concurrent flush tasks, the higher the memory during flushing. Adjust the value based on the memory monitoring of the real-time processing migration job.

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Parameter	Type	Default Value	Description
hoodie.context.flatmap.parallelism	int	1	When Hudi performs commit operations, it scans partitions. By default, one scan operation is performed at a time. If a large number of partitions are involved in a commit operation, you can increase the value of this parameter to accelerate the commit operation. If the number of partitions committed at a time is less than or equal to 10, the recommended value for this parameter is 5. If the number of partitions committed at a time is less than or equal to 25, the recommended value for this parameter is 10. If the number of partitions committed at a time is less than or equal to 50, the recommended value for this parameter is 20. If the number of partitions committed at a time is greater than 50, the recommended value for this parameter is 30.
compaction.async.enabled	boolean	true	Whether to enable compaction. The default value is **true**, indicating that compaction is enabled for Hudi. The compaction operation affects the write performance of a real-time migration job. To ensure the stability of the migration job, you can set this parameter to **false** and split Hudi Compaction into Spark jobs for MRS to execute. For details, see
compaction.delta_commits	int	5	Frequency at which compaction requests are generated for real-time processing migration jobs. The default value is **5**, indicating that a compaction request is generated every five commits. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If the incremental Hudi data is small, you can increase the value of this parameter.

7.10.12 Optimizing the Parameters of a Job for Migrating Data from Oracle to GaussDB(DWS)

Optimizing Source Parameters

Optimization of data extraction from Oracle

No optimization configuration items are available.

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Optimizing Destination Parameters

Optimization of data writing to GaussDB(DWS)

You can modify writing parameters in the GaussDB(DWS) destination configuration or click **View and Edit** in the advanced configuration to add advanced attributes.

Figure 7-141 Adding advanced attributes

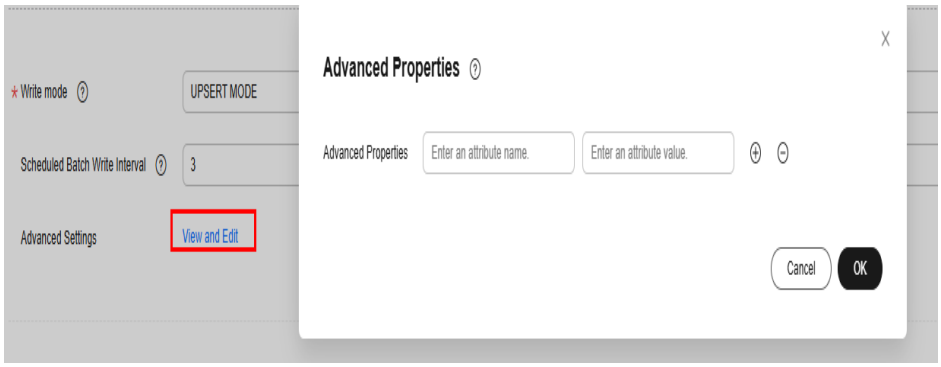


Table 7-57 Parameters for optimizing GaussDB(DWS) writing

Parameter	Type	Default Value	Description
Write Mode	enum	UPSERT	Mode for writing data to GaussDB(DWS), which can be set in the destination configuration. **COPY MODE** is recommended for real-time migration jobs. • **UPSERT**: batch update • **COPY**: GaussDB(DWS)-dedicated high-performance batch import
Maximum Data Volume for Batch Write	int	50000	Maximum number of data records that can be written to GaussDB(DWS) at a time. You can set this parameter in the destination configuration. If **Maximum Data Volume for Batch Write** or **Scheduled Batch Write Interval** is met, data will be written. Increasing the number of data records written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the GaussDB(DWS) specifications and load.

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Parameter	Type	Default Value	Description
Scheduled Batch Write Interval	int	3	Interval for writing data to GaussDB(DWS). You can set this parameter in the destination configuration. If the interval is reached, cached data will be written. Increasing the value of this parameter increases the number of data records cached in a single write, but it takes a longer time for DWS data to become visible.
sink.buffer-flush.max-size	int	512	Amount of the data that can be written to GaussDB(DWS) at a time. The default value is 512 MB. You can set this parameter in the advanced settings of the destination configuration. If the size of cached data reaches the upper limit, data will be written. Similar to **Maximum Data Volume for Batch Write**, increasing the amount of data written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the DWS specifications and load.

7.10.13 Optimizing the Parameters of a Job for Migrating Data from Oracle to MRS Hudi

Optimizing Source Parameters

Optimization of data extraction from Oracle

No optimization configuration items are available.

Optimizing Destination Parameters

Optimization of data writing to Hudi

If data is written to the Hudi table slowly, check whether the table is properly designed. You are advised to use an MOR table that uses Hudi bucket indexes and configure the number of buckets to achieve an optimal migration performance.

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NOTE

- Using bucket indexes: You can configure the **index.type** and **hoodie.bucket.index.num.buckets** attributes in **Global Configuration of Hudi Table Attributes** or **Edit Table Attribute** of the mapped table.
- Determine whether to use partitioned or non-partitioned tables.

  There are two types of tables, fact tables and dimension tables.

  - Fact tables generally have a large amount of data, most of which is new data and a small proportion of which is the data updated in a recent period (years, months, or days). A downstream system that reads a fact table for ETL calculation splits the table based on the data creation time (for example, last day, month, or year) into partitioned tables, ensuring optimal read and write performance.
  - Dimension tables generally contain a small amount of data, most of which is updated data and a small proportion of which is new data. The data volume of a dimension table is stable, and all data is read for ETL calculation such as join. Therefore, non-partitioned tables are more suitable as they provide better performance.
- Determine the number of buckets in a table.

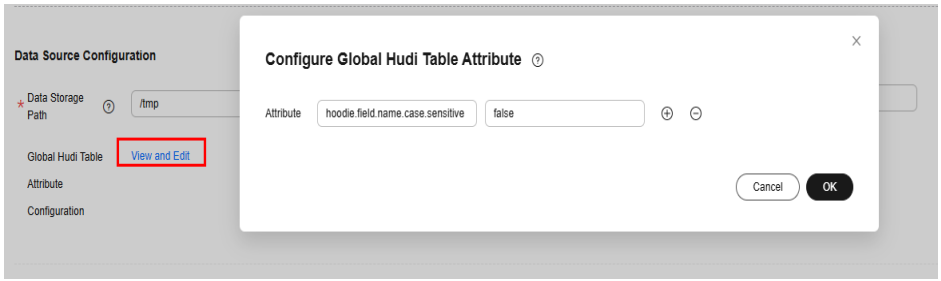
  If you use a Hudi bucket table, you need to set the number of buckets, which affects the table performance.

  - Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4)
  - Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1)

    Notes:
  - The total data volume of a table, rather than the size of a compressed file, is used.
  - An even number is preferred for the number of buckets. Set the minimum number of buckets for a non-partitioned table to 4 and that for a partitioned table to 1.

In addition, you can click **Global Configuration of Hudi Table Attributes** in the Hudi destination configuration or click **Edit Table Attribute** in the mapped table to add optimization parameters.

Figure 7-142 Adding custom attributes



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Table 7-58 Parameters for optimizing Hudi writing

Parameter	Type	Default Value	Description
hoodie.sink.flush.tasks	int	1	Number of concurrent Hudi flush tasks. The default value is 1, indicating sequential writing. If Hudi commits a large number of FleGroups (for example, a large amount of historical data of the source table is updated), you can increase the value of this parameter. FileGroup data flushed by a single thread = Number of FileGroups committed at a time/Number of concurrent jobs If the number of FileGroups flushed by a single thread is less than or equal to 5, the recommended value for this parameter is 2. If the number of FileGroups flushed by a single thread is less than or equal to 10, the recommended value for this parameter is 5. If the number of FileGroups flushed by a single thread is less than or equal to 25, the recommended value for this parameter is 10. If the number of FileGroups flushed by a single thread is less than or equal to 50, the recommended value for this parameter is 20. If the number of FileGroups flushed by a single thread is greater than 50, the recommended value for this parameter is 30. The larger the number of concurrent flush tasks, the higher the memory during flushing. Adjust the value based on the memory monitoring of the real-time processing migration job.

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Parameter	Type	DefaultValue	Description
hoodie.context.flatmap.parallelism	int	1	When Hudi performs commit operations, it scans partitions. By default, one scan operation is performed at a time. If a large number of partitions are involved in a commit operation, you can increase the value of this parameter to accelerate the commit operation. If the number of partitions committed at a time is less than or equal to 10, the recommended value for this parameter is 5. If the number of partitions committed at a time is less than or equal to 25, the recommended value for this parameter is 10. If the number of partitions committed at a time is less than or equal to 50, the recommended value for this parameter is 20. If the number of partitions committed at a time is greater than 50, the recommended value for this parameter is 30.
compaction.async.enabled	boolean	true	Whether to enable compaction. The default value is **true**, indicating that compaction is enabled for Hudi. The compaction operation affects the write performance of a real-time migration job. To ensure the stability of the migration job, you can set this parameter to **false** and split Hudi Compaction into Spark jobs for MRS to execute. For details, see
compaction.delta_commits	int	5	Frequency at which compaction requests are generated for real-time processing migration jobs. The default value is **5**, indicating that a compaction request is generated every five commits. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If the incremental Hudi data is small, you can increase the value of this parameter.

7.10.14 Optimizing the Parameters of a Job for Migrating Data from SQL Server to GaussDB(DWS)

Optimizing Source Parameters

Optimization of data extraction from SQL Server

No optimization configuration items are available.

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Optimizing Destination Parameters

Optimization of data writing to GaussDB(DWS)

You can modify writing parameters in the GaussDB(DWS) destination configuration or click **View and Edit** in the advanced configuration to add advanced attributes.

Figure 7-143 Adding advanced attributes

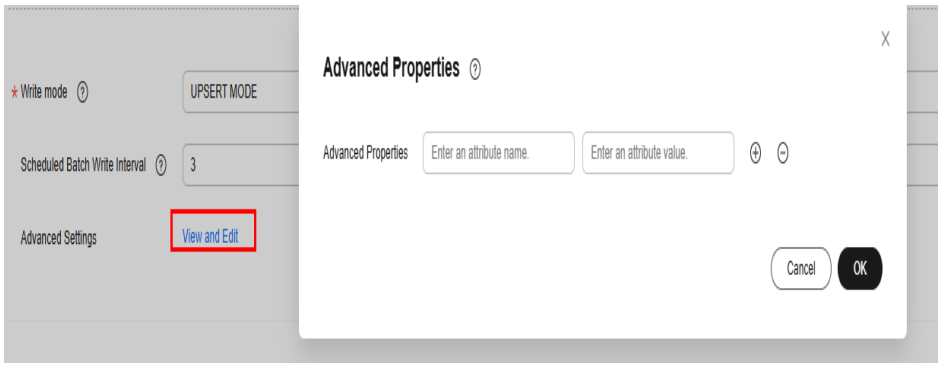


Table 7-59 Parameters for optimizing GaussDB(DWS) writing

Parameter	Type	Default Value	Description
Write Mode	enum	UPSERT	Mode for writing data to GaussDB(DWS), which can be set in the destination configuration. **COPY MODE** is recommended for real-time migration jobs. • **UPSERT**: batch update • **COPY**: GaussDB(DWS)-dedicated high-performance batch import
Maximum Data Volume for Batch Write	int	50000	Maximum number of data records that can be written to GaussDB(DWS) at a time. You can set this parameter in the destination configuration. If **Maximum Data Volume for Batch Write** or **Scheduled Batch Write Interval** is met, data will be written. Increasing the number of data records written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the GaussDB(DWS) specifications and load.

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Parameter	Type	Default Value	Description
Scheduled Batch Write Interval	int	3	Interval for writing data to GaussDB(DWS). You can set this parameter in the destination configuration. If the interval is reached, cached data will be written. Increasing the value of this parameter increases the number of data records cached in a single write, but it takes a longer time for DWS data to become visible.
sink.buffer-flush.max-size	int	512	Amount of the data that can be written to GaussDB(DWS) at a time. The default value is 512 MB. You can set this parameter in the advanced settings of the destination configuration. If the size of cached data reaches the upper limit, data will be written. Similar to **Maximum Data Volume for Batch Write**, increasing the amount of data written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the DWS specifications and load.

7.10.15 Optimizing the Parameters of a Job for Migrating Data from a Centralized/Distributed GaussDB to GaussDB(DWS)

Optimizing Source Parameters

Optimization of data extraction from GaussDB

No optimization configuration items are available.

Optimizing Destination Parameters

Optimization of data writing to GaussDB(DWS)

You can modify writing parameters in the GaussDB(DWS) destination configuration or click **View and Edit** in the advanced configuration to add advanced attributes.

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Figure 7-144 Adding advanced attributes

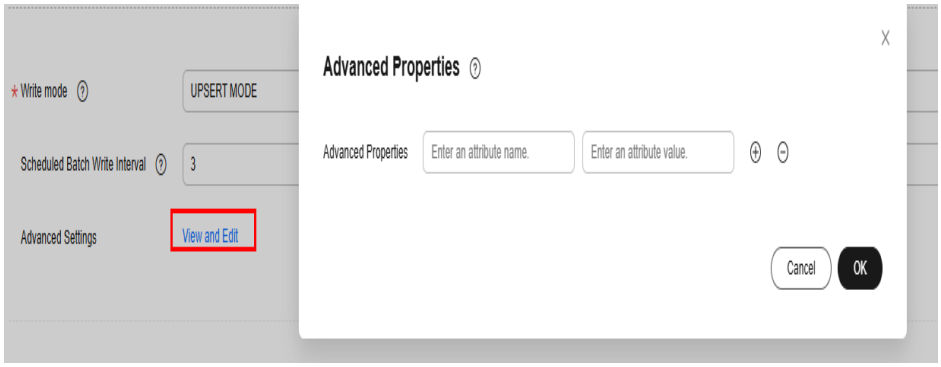


Table 7-60 Parameters for optimizing GaussDB(DWS) writing

Parameter	Type	Default Value	Description
Write Mode	enum	UPSERT	Mode for writing data to GaussDB(DWS), which can be set in the destination configuration. **COPY MODE** is recommended for real-time migration jobs. • **UPSERT**: batch update • **COPY**: GaussDB(DWS)-dedicated high-performance batch import
Maximum Data Volume for Batch Write	int	50000	Maximum number of data records that can be written to GaussDB(DWS) at a time. You can set this parameter in the destination configuration. If **Maximum Data Volume for Batch Write** or **Scheduled Batch Write Interval** is met, data will be written. Increasing the number of data records written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the GaussDB(DWS) specifications and load.
Scheduled Batch Write Interval	int	3	Interval for writing data to GaussDB(DWS). You can set this parameter in the destination configuration. If the interval is reached, cached data will be written. Increasing the value of this parameter increases the number of data records cached in a single write, but it takes a longer time for DWS data to become visible.

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Parameter	Type	Default Value	Description
sink.buffer-flush.max-size	int	512	Amount of the data that can be written to GaussDB(DWS) at a time. The default value is 512 MB. You can set this parameter in the advanced settings of the destination configuration. If the size of cached data reaches the upper limit, data will be written. Similar to **Maximum Data Volume for Batch Write**, increasing the amount of data written at a time can reduce the number of DWS requests but may increase the duration of a single request and the amount of cached data, which affects memory usage. Adjust the value based on the DWS specifications and load.

7.10.16 Optimizing the Parameters of a Job for Migrating Data from a Centralized/Distributed GaussDB to MRS Hudi

Optimizing Source Parameters

Optimization of data extraction from GaussDB

No optimization configuration items are available.

Optimizing Destination Parameters

Optimization of data writing to Hudi

If data is written to the Hudi table slowly, check whether the table is properly designed. You are advised to use an MOR table that uses Hudi bucket indexes and configure the number of buckets to achieve an optimal migration performance.

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NOTE

- Using bucket indexes: You can configure the **index.type** and **hoodie.bucket.index.num.buckets** attributes in **Global Configuration of Hudi Table Attributes** or **Edit Table Attribute** of the mapped table.
- Determine whether to use partitioned or non-partitioned tables.

  There are two types of tables, fact tables and dimension tables.

  - Fact tables generally have a large amount of data, most of which is new data and a small proportion of which is the data updated in a recent period (years, months, or days). A downstream system that reads a fact table for ETL calculation splits the table based on the data creation time (for example, last day, month, or year) into partitioned tables, ensuring optimal read and write performance.
  - Dimension tables generally contain a small amount of data, most of which is updated data and a small proportion of which is new data. The data volume of a dimension table is stable, and all data is read for ETL calculation such as join. Therefore, non-partitioned tables are more suitable as they provide better performance.
- Determine the number of buckets in a table.

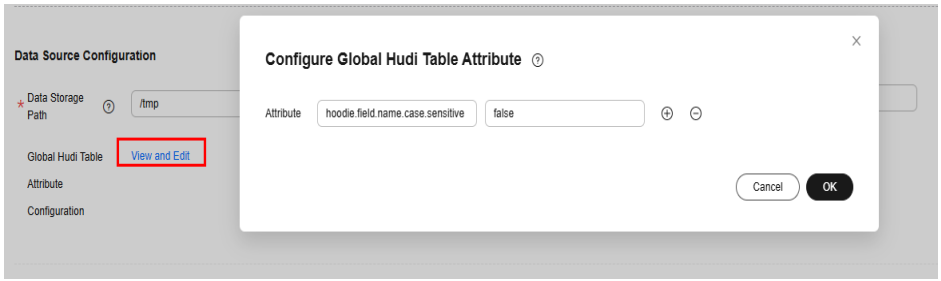
  If you use a Hudi bucket table, you need to set the number of buckets, which affects the table performance.

  - Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4)
  - Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1)

    Notes:
  - The total data volume of a table, rather than the size of a compressed file, is used.
  - An even number is preferred for the number of buckets. Set the minimum number of buckets for a non-partitioned table to 4 and that for a partitioned table to 1.

In addition, you can click **Global Configuration of Hudi Table Attributes** in the Hudi destination configuration or click **Edit Table Attribute** in the mapped table to add optimization parameters.

Figure 7-145 Adding custom attributes



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Table 7-61 Parameters for optimizing Hudi writing

Parameter	Type	DefaultValue	Description
hoodie.sink.flush.tasks	int	1	Number of concurrent Hudi flush tasks. The default value is 1, indicating sequential writing. If Hudi commits a large number of FleGroups (for example, a large amount of historical data of the source table is updated), you can increase the value of this parameter. FileGroup data flushed by a single thread = Number of FileGroups committed at a time/Number of concurrent jobs If the number of FileGroups flushed by a single thread is less than or equal to 5, the recommended value for this parameter is 2. If the number of FileGroups flushed by a single thread is less than or equal to 10, the recommended value for this parameter is 5. If the number of FileGroups flushed by a single thread is less than or equal to 25, the recommended value for this parameter is 10. If the number of FileGroups flushed by a single thread is less than or equal to 50, the recommended value for this parameter is 20. If the number of FileGroups flushed by a single thread is greater than 50, the recommended value for this parameter is 30. The larger the number of concurrent flush tasks, the higher the memory during flushing. Adjust the value based on the memory monitoring of the real-time processing migration job.

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Parameter	Type	Default Value	Description
hoodie.context.flatmap.parallelism	int	1	When Hudi performs commit operations, it scans partitions. By default, one scan operation is performed at a time. If a large number of partitions are involved in a commit operation, you can increase the value of this parameter to accelerate the commit operation. If the number of partitions committed at a time is less than or equal to 10, the recommended value for this parameter is 5. If the number of partitions committed at a time is less than or equal to 25, the recommended value for this parameter is 10. If the number of partitions committed at a time is less than or equal to 50, the recommended value for this parameter is 20. If the number of partitions committed at a time is greater than 50, the recommended value for this parameter is 30.
compaction.async.enabled	boolean	true	Whether to enable compaction. The default value is **true**, indicating that compaction is enabled for Hudi. The compaction operation affects the write performance of a real-time migration job. To ensure the stability of the migration job, you can set this parameter to **false** and split Hudi Compaction into Spark jobs for MRS to execute. For details, see
compaction.delta_commits	int	5	Frequency at which compaction requests are generated for real-time processing migration jobs. The default value is **5**, indicating that a compaction request is generated every five commits. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If the incremental Hudi data is small, you can increase the value of this parameter.

7.11 Tutorials

7.11.1 Overview

This section provides the applications scenarios of DataArts Migration and the tutorials on using it in these scenarios. For each scenario, we provide detailed solution descriptions and operation guide to help you quickly migrate databases and synchronize data.

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Table 7-62 Tutorials on using DataArts Migration

Category	Source	Destination	Reference

7.11.2 Migrating a DRS Task to DataArts Migration

This section describes how to migrate a Data Replication Service (DRS) task to DataArts Migration.

Prerequisites

- A real-time synchronization task has been created in DRS. For details, see
- A real-time data integration environment has been prepared based on **Check Before Use**.

Preparations

- **Assess required DataArts Migration resources.**

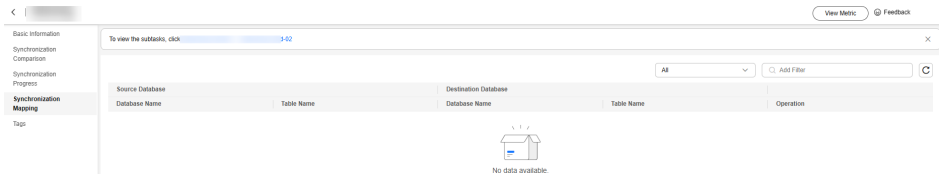
  Assess the DataArts Migration resources required to run the DRS task. If resources are insufficient, purchase a new migration resource group.

  Consider the following factors during the assessment:

  – Check the number of tables in the DRS task.

    Click the DRS task name to view its details. Choose **Synchronization Mapping** and view the number of tables. A job in DataArts Migration provides an optimal performance when the number of tables in the job is less than 50.

    Figure 7-146 Checking the number of tables in a DRS task

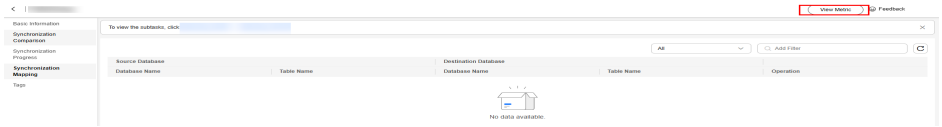
    

  – View the maximum amount data that can be synchronized concurrently.

    Go to the DRS task monitoring page and view the monitoring metrics, mainly the Rows Written into Destination Database per Second metric. In addition, check whether the DRS task has a latency.

    A job with 8 CUs in DataArts Migration can synchronize 8,000 records per second. You are advised to configure an independent job for a table with a large amount of data.

    Figure 7-147 Viewing monitoring metrics

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Figure 7-148 Viewing metric details

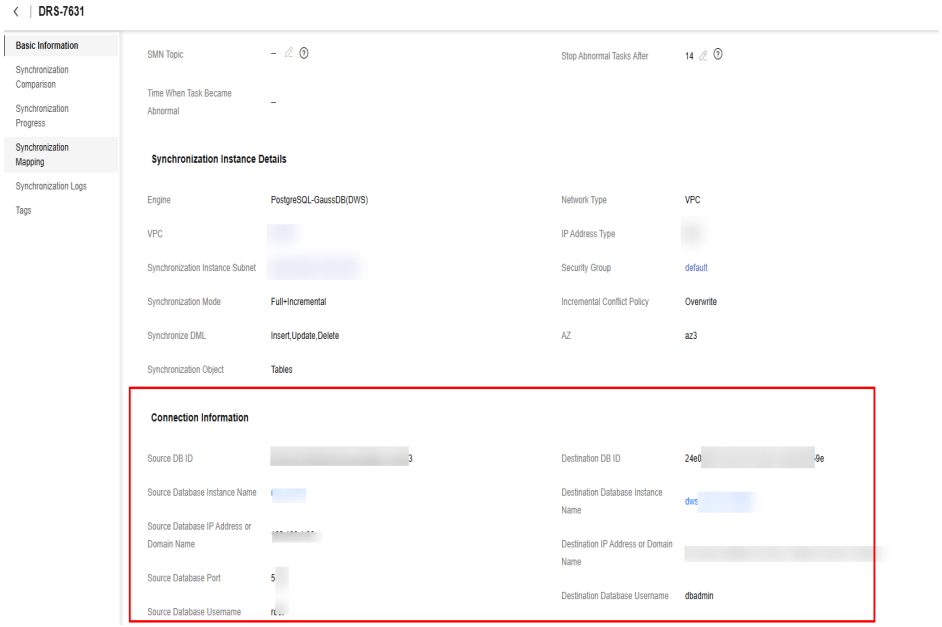


– Create jobs based on the customer's requirements.

- **Enable network communications.**

  Enable communications between the migration resource group and the data source. In the basic information of the DRS task, view the data source configuration. Enable the communications by following corresponding instructions

Figure 7-149 Viewing the data source configuration



Creating and Starting a Migration Job

Step 1 Create a job.

Create a migration job based on the prepared job splitting solution. Do not start the job.

Step 2 Obtain the DRS security location.

Migration jobs need to be started based on the DRS synchronization location to ensure that data transmission is not interrupted and that no data is missing.

Contact DRS O&M personnel to obtain the security location (a Binlog file name) for DRS task synchronization. Contact MySQL database O&M personnel to query the timestamp of the synchronized DRS Binlog based on the security location and start the migration job based on the timestamp.

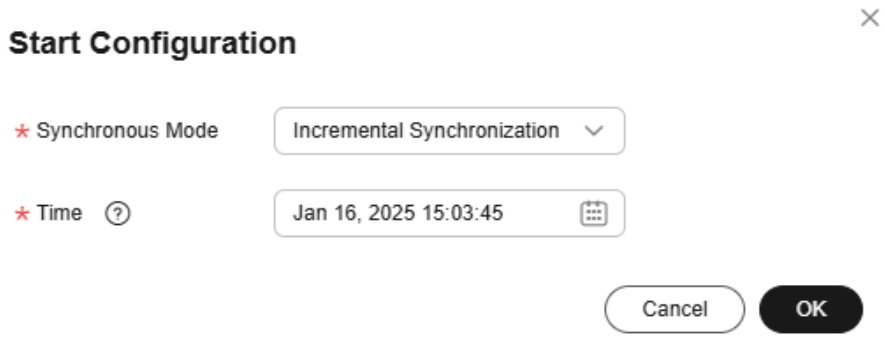
Step 3 Before starting a migration job, suspend the DRS job to avoid write conflicts.

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Start the migration job based on the obtained security location. You can set the start time of the migration job to a time earlier (30 minutes recommended) than the security location to avoid data loss.

For example, if the obtained DRS security location timestamp is 2024-11-29 12:00:00, you can set the time for starting the migration job to 2024-11-29 11:30:00.

Figure 7-150 Setting the time for starting the migration job



After the migration job is started and is running stably, you can stop the DRS task.

----End

7.11.3 Configuring a Job for Synchronizing Data from MySQL to MRS Hudi

Supported Source and Destination Database Versions

Table 7-63 Supported database versions

Source	Destination
MySQL database (5.6, 5.7, and 8.*x*)	• MRS cluster (3.2.0-LTS.*x* and 3.5.*x*) • Hudi (0.11.0)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. Different types of synchronization tasks require different permissions. For details, see **Table 7-64**.

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Table 7-64 Database account permissions

Account	Required Permissions
Source database account	The source database account must have the following minimal permissions required for running SQL statements: SELECT, SHOW DATABASES, REPLICATION SLAVE and REPLICATION CLIENT. `GRANT SELECT, SHOW DATABASES, REPLICATION SLAVE, REPLICATION CLIENT ON *.* TO 'Username'@'%';`
Destination database account	The MRS user must have read and write permissions for the Hadoop and Hive components. You are advised to assign the roles and user groups shown in the following figure to the MRS user. **Figure 7-151** Minimal permissions for MRS Hudi  For details, see .

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

Table 7-65 lists the objects that can be synchronized in different scenarios.

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Table 7-65 Synchronization objects

Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • The DDL operation of adding columns can be synchronized. • Only primary key tables can be synchronized. • Only MyISAM and InnoDB tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation. • Foreign keys that contain reference operations such as CASCADE, SET NULL, and SET DEFAULT cannot be synchronized. These operations will cause the update or deletion of rows in parent tables and affect records in child tables. Also, operations related to child tables are not recorded in Binlogs.

Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in **Table 7-66**.

Table 7-66 Notes

Type	Restriction
Database	• The names of the source databases, tables, and fields cannot contain non-ASCII characters or the following characters: .<'>/\" (You are advised to use common characters to avoid a failure.) • The names of the destination databases, tables, and fields can only contain digits, letters, and underscores (_). Field names must start with a letter or an underscore (). You are advised to use common characters in names.

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The source database cannot be restored. • Binlogs must be enabled for the source database and the value of **binlog_row_image** must be **full**. • It is recommended that MySQL binlogs be retained for more than three days. Binlogs cannot be forcibly cleared. When a job is restored after an exception, the recorded binlog location may expire. As a result, the job fails to be restored. It is important to monitor the duration of job exceptions and the binlog retention period. • During real-time synchronization, the source MySQL database cannot be upgraded across major versions. Otherwise, data may become inconsistent or the synchronization task may fail (data, table structures, and keywords may cause compatibility changes after the cross-version upgrade). You are advised to create a synchronization task again if the source MySQL database is upgraded across major versions. • If a Hudi table uses bucket indexes, the partition key cannot be updated. Otherwise, duplicate data may be generated. • If a Hudi table uses bucket indexes, ensure that the primary key is unique in a single partition. • Every Hudi table in this task must contain three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi tables. If an existing table is used, these three audit fields must also be configured for it. Otherwise, the task may fail. – **cdc_last_update_date**: time when migration task processes CDC data – **logical_is_deleted**: logical deletion flag – **_hoodie_event_time**: timestamp of data in MySQL binlogs Full synchronization phase: • During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. • Any existing data in Hudi tables cannot be overwritten during full synchronization. You are advised to clear the Hudi tables in advance. Incremental synchronization phase: • During incremental synchronization, DDL operations (for example, ALTER TABLE ddl_test ADD COLUMN c2 AFTER/FIRST c1;) for adding columns to a specified position are not supported. The AFTER/FIRST attribute will be deleted, which may cause column sequence inconsistency.

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Type	Restriction
	• During incremental synchronization, executing non-idempotent DDL statements (for example, ALTER TABLE ddl_test ADD COLUMN c3 timestamp default now();) may cause data inconsistency. • During incremental synchronization, the following DDL operations can be identified: creating a table, deleting a table, adding a column, deleting a column, renaming a table, renaming a column, modifying a column type, and clearing a table. Only column adding operations can be synchronized to the destination Hudi database. You can set the processing policy for the other DDL operations to **Ignore** or **Error**. – In the database and table sharding scenario, you must stop service operations before renaming columns. Otherwise, data inconsistency may occur. – In the database and table sharding scenario, you are advised to synchronize only the DDL for adding columns. If you synchronize other DDL operations, the job may fail or data may be inconsistent because the destination table has been modified. – In the database and table sharding scenario, ensure that the types of columns to be added to each table are the same. Otherwise, the task may fail. – The column name can contain no more than 256 characters. Otherwise, the task fails. • Foreign keys that contain reference operations such as CASCADE, SET NULL, and SET DEFAULT cannot be synchronized. These operations will cause the update or deletion of rows in parent tables and affect records in child tables. Also, operations related to child tables are not recorded in Binlogs. • The position cannot be set before DDL operations that involves table structure changes, such as table modification and column addition. • After incremental data is synchronized to Hudi MOR tables in MRS clusters earlier than 3.2.0-LTS1.5, CDM or Spark SQL cannot be used to write data. You need to perform compaction before writing data. Extraction from the standby database: Before extracting data from the standby database, ensure that a value can be returned after the **SHOW MASTER STATUS** command is executed on the standby database node. Otherwise, data jobs may be abnormal and data may be lost. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other restrictions	Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail.

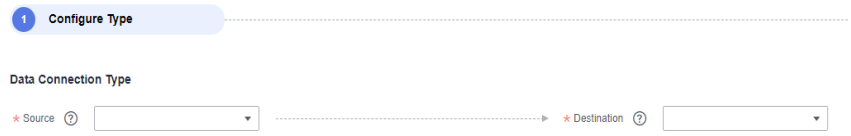
Procedure

This section uses real-time synchronization from RDS for MySQL to MRS Hudi as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **MySQL** for **Source** and **Hudi** for **Destination**.

Figure 7-152 Selecting the data connection type



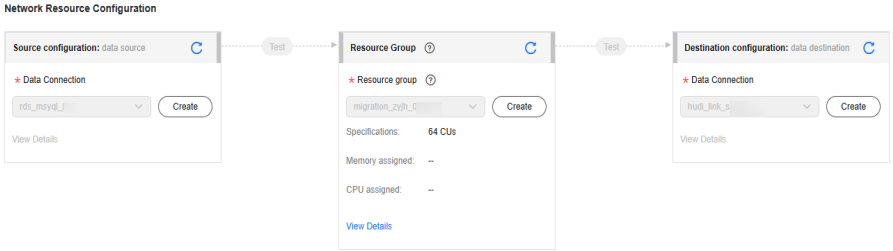
Step 3 Select a job type. The default migration type is **Real-time**. The migration scenarios include **Entire DB** and **Database/Table partition**.

NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created MySQL and MRS Hudi data connections and the migration resource group for which the network connection has been configured.

Figure 7-153 Selecting data connections and a migration resource group



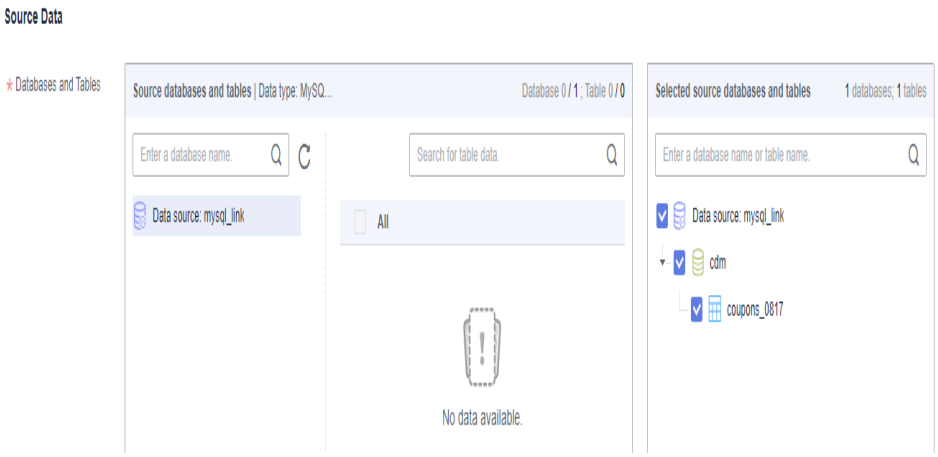
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> **NOTE**
>
> If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

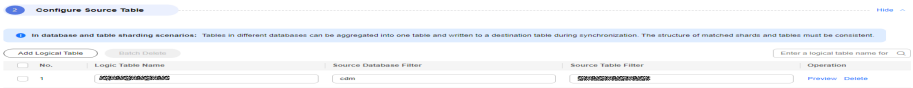
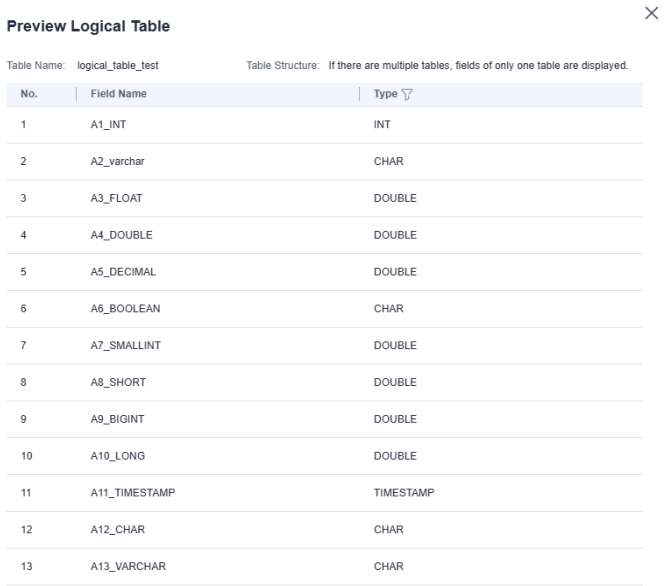
Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on **Table 7-67**.

Table 7-67 Selecting the databases and tables to be synchronized

Scenario	Configuration
Entire DB	Select the MySQL databases and tables to be migrated. **Figure 7-154** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

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Scenario	Configuration
Database/Table partition	Add a logical table. • **Logical Table Name**: Enter the name of the table to be written to Hudi. • **Source Database Filter**: You can enter a regular expression to filter all the database shards to be written to the destination Hudi aggregation table. • **Source Table Filter**: You can enter a regular expression to filter all the table shards in the source database shard to be written to the destination Hudi aggregation table. **Figure 7-155** Adding a logical table  You can click **Preview** in the **Operation** column to preview an added logical table. When you preview a logical table, the more the source tables, the longer the waiting time. **Figure 7-156** Previewing the logical table  Preview Logical Table Table Name: logical_table_test Table Structure: If there are multiple tables, fields of only one table are displayed. No. | Field Name | Type 1 A1_INT INT 2 A2_varchar CHAR 3 A3_FLOAT DOUBLE 4 A4_DOUBLE DOUBLE 5 A5_DECIMAL DOUBLE 6 A6_BOOLEAN CHAR 7 A7_SMALLINT DOUBLE 8 A8_SHORT DOUBLE 9 A9_BIGINT DOUBLE 10 A10_LONG DOUBLE 11 A11_TIMESTAMP TIMESTAMP 12 A12_CHAR CHAR 13 A13_VARCHAR CHAR

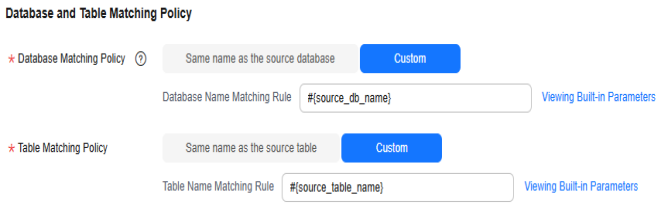
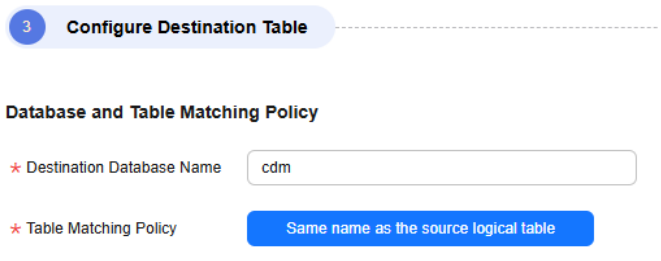
Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see **Table 7-68**.

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Table 7-68 Database and table matching policy

Scenario	Configuration
Entire DB	– **Database Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the Hudi database with the same name as the source MySQL database. ▪ **Custom**: Data will be synchronized to the Hudi database you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the Hudi table with the same name as the source MySQL table. ▪ **Custom**: Data will be synchronized to the Hudi table you specify. **Figure 7-157** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.
Database/ Table partition	– **Destination Database Name**: Data will be synchronized to the specified Hudi database. – **Table Matching Policy**: By default, the value is the same as the name of the logical table entered in the source configuration. **Figure 7-158** Database and table matching policy in the sharding scenario 

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- Set Hudi parameters.
  For details, see **Table 7-69**.

Figure 7-159 Hudi destination parameters



Table 7-69 Hudi destination parameters

Parameter	Default Value	Unit	Description
Data Storage Path	N/A	N/A	Warehouse path when tables are automatically created in Hudi. A subdirectory is created in the warehouse path for each table. You can enter an HDFS or OBS path. The path format is as follows: – OBS path: obs://bucket/warehouse – HDFS path: /tmp/warehouse
Global Configuration of Hudi Table Attributes	N/A	N/A	Some advanced functions can be configured using parameters. For details, see **Hudi advanced parameters**.
Compaction Job	N/A	N/A	An independent SparkSQL job. If this parameter is not specified, Flink performs compaction.

Table 7-70 Hudi advanced parameters

Parameter	Type	Default Value	Unit	Description
index.type	string	BLOOM	N/A	Index type of the Hudi table BLOOM and BUCKET indexes are supported. If a large amount of data need to be migrated, BUCKET indexes are recommended for better performance.

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Parameter	Type	Default Value	Unit	Description
hoodie.bucket.index.num.buckets	int	256	Count	Number of buckets within a Hudi table partition **NOTE** When using Hudi BUCKET tables, you need to set the number of buckets for a table partition. The number of buckets affects the table performance. – Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4) – Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1) Pay attention to the following: – The total data volume of a table, instead of the compressed size, is used. – Setting an even number of buckets is recommended. The minimum number of buckets should be 4 for a non-partitioned table and 1 for a partitioned table.
changelog.enabled	boolean	false	N/A	Whether to enable the Hudi ChangeLog function. If this function is enabled, the migration job can output DELETE and UPDATE BEFORE data.
logical.delete.enabled	boolean	true	N/A	Whether to enable logical deletion. If the ChangeLog function is enabled, logical deletion must be disabled.
hoodie.write.liststatus.optimized	boolean	true	N/A	Whether to enable liststatus optimization when log files are written. If the migration job involves large tables or a large amount of partition data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.

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Parameter	Type	Default Value	Unit	Description
hoodie.index.liststatus.optimized	boolean	false	N/A	Whether to enable liststatus optimization during data locating. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.
compaction.async.enabled	boolean	true	N/A	Whether to enable asynchronous compaction. The compaction operation affects the writing performance of real-time jobs. If you use an external compaction operation, you can set this parameter to **false** to disable compaction for real-time processing migration jobs.
compaction.schedule.enabled	boolean	true	N/A	Whether to generate compaction plans. Compaction plans must be generated by this service and can be executed by Spark.
compaction.delta_commits	int	5	Count	Frequency of generating compaction requests. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If there is a small volume of incremental data to be synchronized to Hudi, you can set a larger value for this parameter. **NOTE** For example, if this parameter is set to **40**, a compaction request is generated every 40 commits. Since DataArts Migration generates a commit every minute, the interval between compaction requests is 40 minutes.
clean.async.enabled	boolean	true	N/A	Whether to clear data files of historical versions

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Parameter	Type	Default Value	Unit	Description
clean.retain_commits	int	30	Count	Number of recent commits to retain. Data files related to these commits will be retained for a period calculated by multiplying the number of specified commits by the interval between commits. You are advised to set this parameter to twice the value of **compaction.delta_commits**. **NOTE** For example, if this parameter is set to **80** and since DataArts Migration generates a commit every minute, data files related to commits generated 80 minutes earlier are cleaned, and data files related to the recent 80 commits are retained.
hoodie.archive.automatic	boolean	true	N/A	Whether to age Hudi commit files
archive.min_commits	int	40	Count	Number of recent commits to keep when historical commits are archived to log files You are advised to set this parameter to one greater than **clean.retain_commits**. **NOTE** For example, if this parameter is set to **81**, the files related to the recent 81 commits are retained when an archive operation is triggered.
archive.max_commits	int	50	Count	Number of commits that triggers an archive operation You are advised to set this parameter to 20 greater than **archive.min_commits**. **NOTE** For example, if the parameter is set to **101**, an archive operation is triggered when the files of 101 commits are generated.

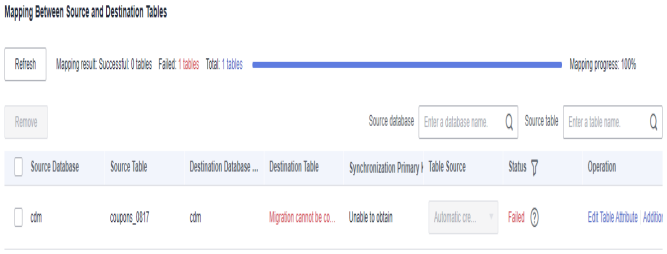
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NOTE

- To achieve optimal performance for the migration job, you are advised to use an MOR table that uses Hudi BUCKET indexes and configure the number of buckets based on the actual data volume.
- To ensure the stability of the migration job, you are advised to split the Hudi Compaction job into Spark jobs and execute them by MRS, and enable compaction plans to be generated for this migration job. For details, see

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination Hudi database.

Figure 7-160 Mapping between source and destination tables



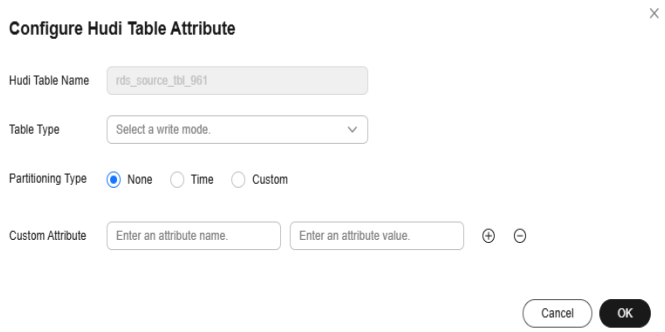
- Synchronization Primary Key

  The primary key must be set for Hudi tables. If the source table has no primary key, you must manually select the primary key during field mapping.

- Edit Table Attribute

  Click **Edit Table Attributes** in the **Operation** column to configure Hudi table attributes, including the table type, partition type, and custom attributes.

  Figure 7-161 Configuring the Hudi table attributes

  - **Table Type**: **MERGE_ON_READ** or **COPY_ON_WRITE**
  - **Partition Type**: **No partition**, **Time partition**, or **Custom partition**

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NOTE

- For **Time**, you need to specify a source field name and select a time conversion format.

  For example, you can specify the source field name **src_col_1** and select a time conversion format, for example, day(yyyyMMdd), month(yyyyMM), or year(yyyy). During automatic table creation, a **cdc_partition_key** field is created in the Hudi table by default. The system formats the value of the source field (**src_col_1**) based on the configured time conversion format and writes the value to **cdc_partition_key**.

- Custom partitions do not support timestamp fields. If you use timestamp fields, the job will fail.

  - Customize table attributes. Some advanced functions of a single table can be configured using parameters. For details about the parameters, see the table that lists Hudi advanced configurations.

- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination Hudi table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination Hudi table
  - **Field Type**: Type of the new field in the destination Hudi table
  - **Field Value**: Value source of the new field in the destination Hudi table

Table 7-71 Configuring the field value obtaining mode

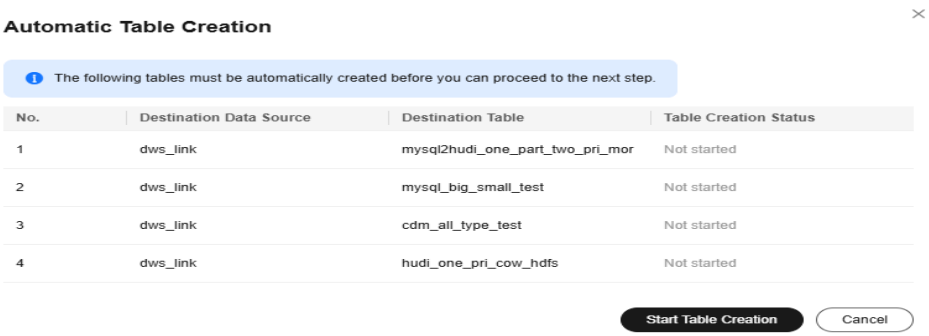
Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.
Built-in variable	■ Source host IP address: source.host ■ Source schema name: source.schema ■ Source table name: source.table ■ Destination schema name: target.schema ■ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.

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Type	Example
UDF	▪ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ▪ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ▪ now([tz]): obtains the current time in a specified time zone. ▪ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ▪ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ▪ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ▪ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

Figure 7-162 Automatic table creation



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NOTE

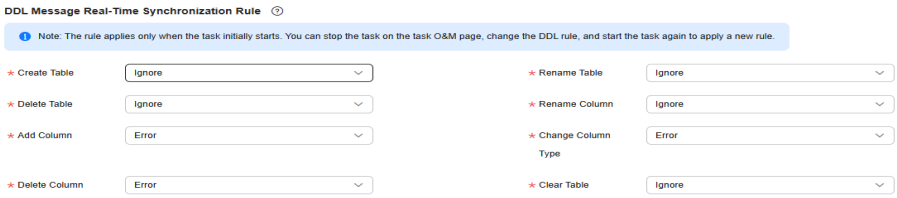
- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.
- An automatically created Hudi table contains three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi table.

Step 8 Configure DDL message processing rules.

Real-time migration jobs can synchronize data manipulation language (DML) operations, such as adding, deleting, and modifying data, as well as some table structure changes using the data definition language (DDL). You can set the processing policy for a DDL operation to **Normal processing**, **Ignore**, or **Error**.

- **Normal processing**: When a DDL operation on the source database or table is detected, the operation is automatically synchronized to the destination.
- **Ignore**: When a DDL operation on the source database or table is detected, the operation is ignored and not synchronized to the destination.
- **Error**: When a DDL operation on the source database or table is detected, the migration job throws an exception.

Figure 7-163 DDL configuration



Step 9 Configure task parameters.

Table 7-72 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

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Step 10 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-164 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-165 Starting the job

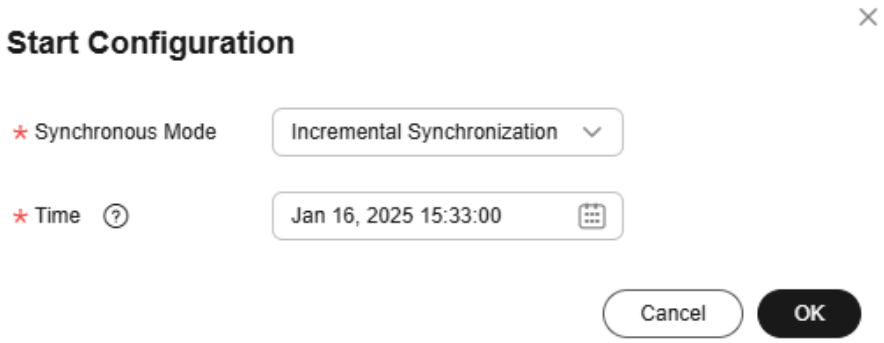


Table 7-73 Parameters for starting the job

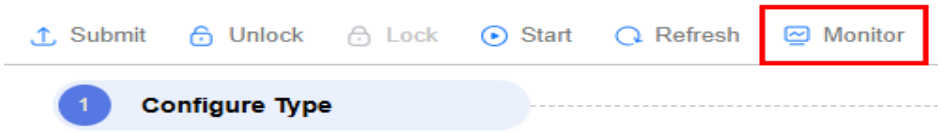
Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest binlog time, the earliest log time is used.

Step 11 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

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Figure 7-166 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.4 Configuring a Job for Synchronizing Data from MySQL to GaussDB(DWS)

Supported Source and Destination Database Versions

Table 7-74 Supported database versions

Source Database	Destination Database
MySQL database (5.6, 5.7, and 8.*x*)	GaussDB(DWS) cluster of version 8.1.3, 8.2.0, or a later version, except GaussDB(DWS) 3.0

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. Different types of synchronization tasks require different permissions. For details, see **Table 7-75**.

Table 7-75 Database account permissions

Type	Required Permissions
Source database account	The source database account must have the following minimal permissions required for running SQL statements: SELECT, SHOW DATABASES, REPLICATION SLAVE and REPLICATION CLIENT. `GRANT SELECT, SHOW DATABASES, REPLICATION SLAVE, REPLICATION CLIENT ON *.* TO 'Username'@'%';`
Destination database account	The destination database account must have the following permissions for each table in the database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

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NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

Table 7-76 lists the objects that can be synchronized in different scenarios.

Table 7-76 Synchronization objects

Type	Note
Synchronization objects	• The following DML operations can be synchronized: INSERT, UPDATE, and DELETE. • The following DDL operations can be synchronized: deleting tables, adding columns, deleting columns, renaming tables, renaming columns, changing the column type, and clearing tables. • Only primary key tables can be synchronized. • Only MyISAM and InnoDB tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation. • Foreign keys that contain reference operations such as CASCADE, SET NULL, and SET DEFAULT cannot be synchronized. These operations will cause the update or deletion of rows in parent tables and affect records in child tables. Also, operations related to child tables are not recorded in Binlogs.

Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in Table 7-77.

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Table 7-77 Notes

Type	Restriction
Database	• The names of the source databases, tables, and fields cannot contain non-ASCII characters or the following characters: .<'>/\" (You are advised to use common characters to avoid a failure.) • The name of an object in the destination database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($).

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Type	Restriction
Usage	General: ● During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. ● The source database cannot be restored. ● Binlogs must be enabled for the source database and the value of **binlog_row_image** must be **full**. ● It is recommended that MySQL binlogs be retained for more than three days. Binlogs cannot be forcibly cleared. When a job is restored after an exception, the recorded binlog location may expire. As a result, the job fails to be restored. It is important to monitor the duration of job exceptions and the binlog retention period. ● During real-time synchronization, the source MySQL database cannot be upgraded across major versions. Otherwise, data may become inconsistent or the synchronization task may fail (data, table structures, and keywords may cause compatibility changes after the cross-version upgrade). You are advised to create a synchronization task again if the source MySQL database is upgraded across major versions. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: ● During incremental synchronization, DDL operations (for example, ALTER TABLE ddl_test ADD COLUMN c2 AFTER/FIRST c1;) for adding columns to a specified position are not supported. The AFTER/FIRST attribute will be deleted, which may cause column sequence inconsistency. ● During incremental synchronization, executing non-idempotent DDL statements (for example, ALTER TABLE ddl_test ADD COLUMN c3 timestamp default now();) may cause data inconsistency. ● During incremental synchronization, database-level synchronization does not support online DDL operations, and table-level synchronization supports only online DDL operations generated by DMS on some clouds. ● During incremental synchronization, the following DDL operations can be synchronized: creating tables, deleting tables, adding columns, deleting columns, renaming tables, renaming columns, changing the column type, and clearing tables. You can select the DDL types to be synchronized as needed. – In the database and table sharding scenario, you must stop service operations before renaming columns. Otherwise, data inconsistency may occur. – In the database and table sharding scenario, you are advised to synchronize only the DDL for adding columns. If you

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Type	Restriction
	synchronize other DDL operations, the job may fail or data may be inconsistent because the destination table has been modified. – In the database and table sharding scenario, ensure that the types of columns to be added to each table are the same. Otherwise, the task may fail. – The name of a table or column to be added or modified can contain no more than 63 characters. Otherwise, the job will fail. – During incremental migration, when **CHANGE COLUMN** is executed in the source database to modify a column which is a distribution column in the destination GaussDB(DWS) database, an exception may occur because distribution columns in GaussDB(DWS) databases cannot be modified. Extraction from the standby database: Before extracting data from the standby database, ensure that a value can be returned after the **SHOW MASTER STATUS** command is executed on the standby database node. Otherwise, data jobs may be abnormal and data may be lost. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • During automatic table creation, the length of the char, varchar, nvarchar, enum, and set characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database. • During full synchronization of timestamp data, the on update current_timestamp syntax in the default value will not be synchronized to the destination GaussDB(DWS) database. • Only DDL operations (for example, RENAME TABLE A TO B, in which B must be within the synchronization scope) can be performed to rename tables only if the renamed tables are within the synchronization scope. You are not advised to perform rename operations in the database and table synchronization scenario. Otherwise, the task may fail or data may be inconsistent.

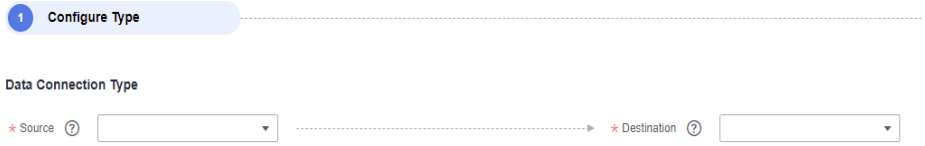
Procedure

This section uses real-time synchronization from RDS for MySQL to GaussDB(DWS) as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **MySQL** for **Source** and **DWS** for **Destination**.

Figure 7-167 Selecting the data connection type



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Step 3 Select a job type. The default migration type is **Real-time**. The migration scenarios include **Entire DB** and **Database/Table partition**.

Figure 7-168 Setting the migration job type

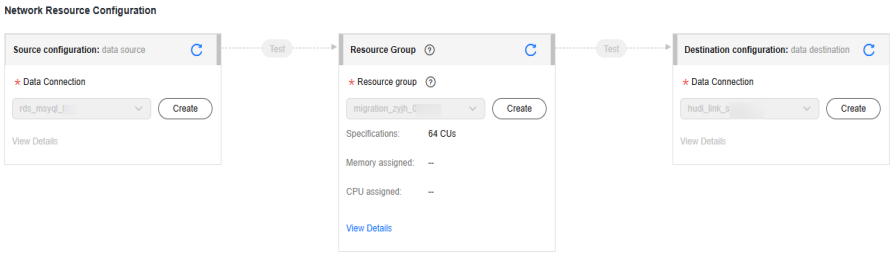


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created MySQL and GaussDB(DWS) data connections and the migration resource group for which the network connection has been configured.

Figure 7-169 Selecting data connections and a migration resource group



NOTE

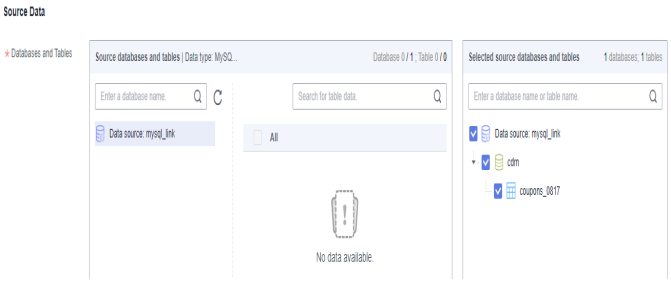
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

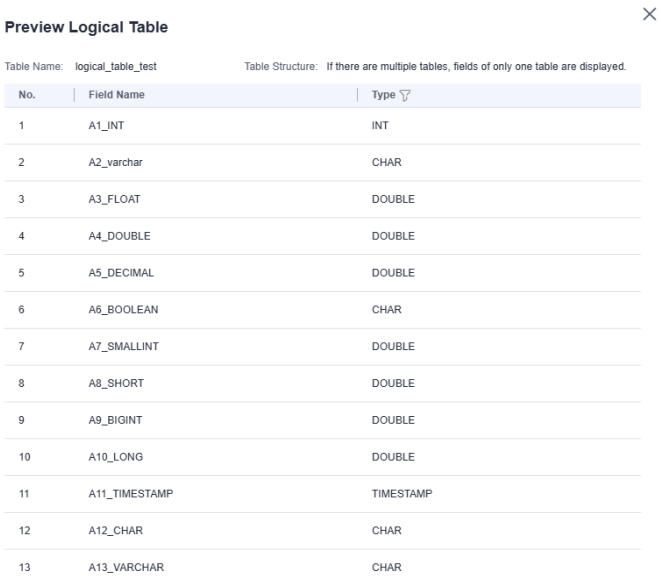
Select the databases and tables to be synchronized based on the following table.

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Table 7-78 Selecting the databases and tables to be synchronized

Scenario	Configuration
Entire DB	• Select synchronization objects. – Table-level synchronization: Synchronize multiple tables in multiple databases of a MySQL instance. – Database-level synchronization: Synchronize all tables in multiple databases of a MySQL instance. • Select the MySQL databases and tables to be migrated. **Figure 7-170** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

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Scenario	Configuration
Database/Table partition	Add a logical table. • **Logical Table Name**: Enter the name of the table to be written to DWS. • **Source Database Filter**: You can enter a regular expression to filter all the database shards to be written to the destination GaussDB(DWS) aggregation table. • **Source Table Filter**: You can enter a regular expression to filter all the table shards in the source database shard to be written to the destination GaussDB(DWS) aggregation table. **Figure 7-171** Adding a logical table  You can click **Preview** in the **Operation** column to preview an added logical table. When you preview a logical table, the more the source tables, the longer the waiting time. **Figure 7-172** Previewing a logical table 

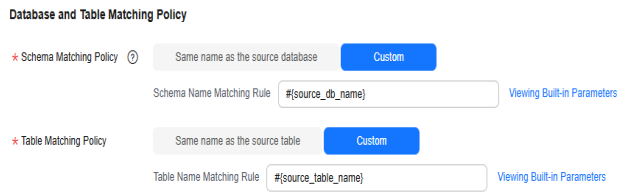
Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

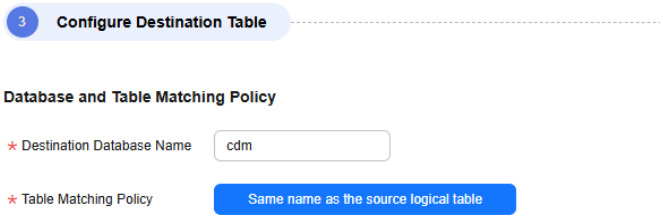
  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

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Table 7-79 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– Schema matching policy ▪ **Same name as the source database**: Data will be synchronized to the GaussDB(DWS) schema with the same name as the source MySQL database. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) schema you specify. – Table matching policy ▪ **Same name as the source table**: Data will be synchronized to the GaussDB(DWS) table with the same name as the source MySQL table. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) table you specify. **Figure 7-173** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

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Synchronization Scenario	Configuration Method
Database/ Table shard	– **Destination Database Name**: Data will be synchronized to the specified GaussDB(DWS) schema. – **Table Matching Policy**: By default, the value is the same as the name of the logical table entered in the source configuration. **Figure 7-174** Database and table matching policy in the sharding scenario 

- Configure GaussDB(DWS) parameters.

  For details, see the following table.

  Figure 7-175 GaussDB(DWS) parameters

  Table 7-80 GaussDB(DWS) parameters

Parameter	Default Value	Unit	Description
Write Mode	UPSERT MODE	N/A	– **UPSERT MODE**: batch update – **COPY MODE**: DWS-dedicated high-performance batch import
Maximum Data Volume for Batch Write	50000	Count	Number of data records written to GaussDB(DWS) in a batch. You can adjust the value based on the table data size and job memory usage.
Scheduled Batch Write Interval	3	Second	Interval at which data is written to GaussDB(DWS)

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Parameter	Default Value	Unit	Description
Advanced Settings	N/A	N/A	Some advanced functions can be configured using parameters. For details, see GaussDB(DWS) advanced parameters.

Table 7-81 GaussDB(DWS) advanced parameters

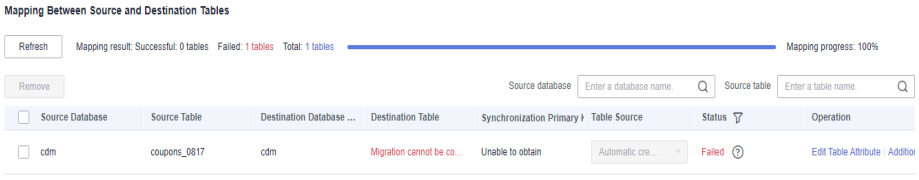
Parameter	Type	Default Value	Unit	Description
sink.buffer-flush.max-size	int	512	MB	Maximum number of bytes in each batch of data written to GaussDB(DWS). You can adjust the value based on the memory and data size configured for the job.
sink.keyby.enable	boolean	true	N/A	Whether to enable data distribution. If this function is enabled in multi-concurrency scenarios, data can be distributed to different processes based on specific rules and written to the destination, which improves the write performance.
sink.keyby.mode	string	table	N/A	Data distribution mode. The following modes are available: – **pk**: Data is distributed by primary key value. – **table**: Data is distributed by table name. **NOTE** ■ In multi-concurrency scenarios, if DDL is enabled, data can be distributed only by table name. Otherwise, data may be inconsistent. ■ If there is no DDL, you can select **pk**, which improves the write performance in multi-concurrency scenarios.
sink.field.name.case-sensitive	boolean	true	N/A	Whether to enable case sensitivity for data synchronization. If this function is enabled, the database names, table names, and field names are case sensitive during data synchronization.

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Parameter	Type	Default Value	Unit	Description
sink.verify.column-number	boolean	false	N/A	Whether to verify the number of data columns. By default, the link synchronizes data in the same-name mapping mode. The system does not check whether all columns are synchronized. If this function is enabled and the number of columns at the source is different from that at the destination, the system determines that data is inconsistent. As a result, the job is abnormal.
sink.server.timezone	string	Local timezone	N/A	Session time zone specified for connecting to the destination database. The standard time zone format is supported, for example, UTC +08:00.
logical.delete.enabled	boolean	false	N/A	Whether to enable logical deletion
logical.delete.column	string	logical_is_deleted	N/A	Name of the logical deletion column. The default value is **logical_is_deleted**. You can customize the value.

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination GaussDB(DWS) database.

Figure 7-176 Mapping between source and destination tables



- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination GaussDB(DWS) table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination GaussDB(DWS) table
  - **Field Type**: type of the new field in the destination GaussDB(DWS) table
  - (Optional) **Field Type Length**: length of the new field type in the destination GaussDB(DWS) table
  - **Field Value**: Value source of the new field in the destination GaussDB(DWS) table

    Table 7-82 Additional field value obtaining mode

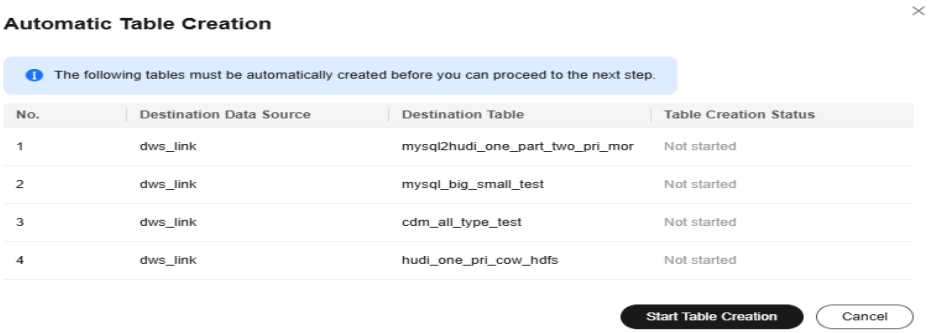
Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.
Built-in variable	▪ Source host IP address: source.host ▪ Source schema name: source.schema ▪ Source table name: source.table ▪ Destination schema name: target.schema ▪ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.

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Type	Example
UDF	▪ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ▪ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ▪ now([tz]): obtains the current time in a specified time zone. ▪ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ▪ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ▪ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ▪ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

Figure 7-177 Automatic table creation



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NOTE

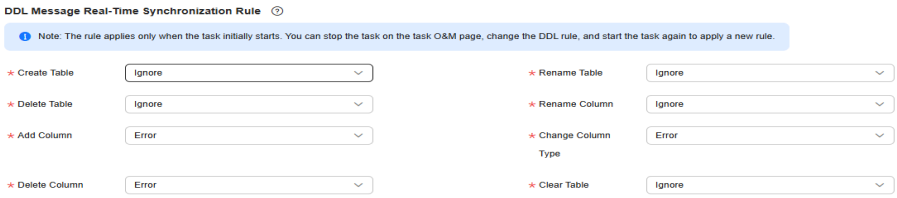
- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.
- An automatically created Hudi table contains three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi table.

Step 8 Configure DDL message processing rules.

Real-time migration jobs can synchronize data manipulation language (DML) operations, such as adding, deleting, and modifying data, as well as some table structure changes using the data definition language (DDL). You can set the processing policy for a DDL operation to **Normal processing**, **Ignore**, or **Error**.

- **Normal processing**: When a DDL operation on the source database or table is detected, the operation is automatically synchronized to the destination.
- **Ignore**: When a DDL operation on the source database or table is detected, the operation is ignored and not synchronized to the destination.
- **Error**: When a DDL operation on the source database or table is detected, the migration job throws an exception.

Figure 7-178 DDL configuration



Step 9 Configure task parameters.

Table 7-83 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

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Step 10 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-179 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-180 Starting the job

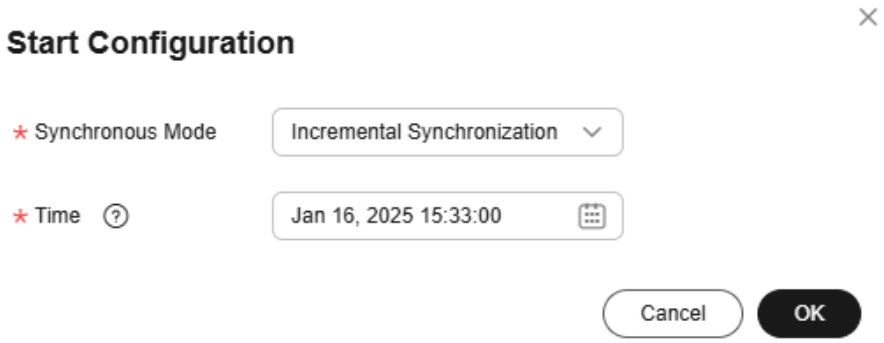


Table 7-84 Parameters for starting the job

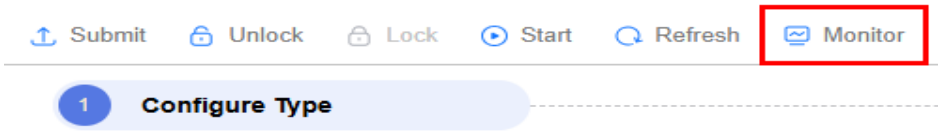
Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest binlog time, the latest log time is used.

Step 11 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

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Figure 7-181 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.5 Configuring a Job for Synchronizing Data from MySQL to Kafka

Supported Source and Destination Database Versions

Table 7-85 Supported database versions

Source Database	Destination Database
MySQL database (5.6, 5.7, and 8.*x*)	Kafka cluster (2.7 and 3.*x*)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-86 Database account permissions

Type	Required Permissions
Source database account	The source database account must have the following minimal permissions required for running SQL statements: SELECT, SHOW DATABASES, REPLICATION SLAVE and REPLICATION CLIENT. `GRANT SELECT, SHOW DATABASES, REPLICATION SLAVE, REPLICATION CLIENT ON *.* TO 'Username'@'%';`
Destination database account	The MRS user must have the read and write permissions on corresponding Kafka topics, that is, the user must belong to the kafka/kafkaadmin/kafkasuperuser user group. **NOTE** A common Kafka user can access a topic only after being granted the read and write permissions on the topic by the Kafka administrator.

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NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-87 Synchronization objects

Type	Note
Synchronization objects	• DML and DDL can be synchronized. • Only MyISAM and InnoDB tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Foreign keys that contain reference operations such as CASCADE, SET NULL, and SET DEFAULT cannot be synchronized. These operations will cause the update or deletion of rows in parent tables and affect records in child tables. Also, operations related to child tables are not recorded in Binlogs.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-88 Important notes

Type	Restriction
Database	The names of the source databases, tables, and fields cannot contain non-ASCII characters or the following characters: .<'>/\" (You are advised to use common characters to avoid a failure.)

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The source database cannot be restored. • Binlogs must be enabled for the source database and the value of **binlog_row_image** must be **full**. • It is recommended that MySQL binlogs be retained for more than three days. Binlogs cannot be forcibly cleared. When a job is restored after an exception, the recorded binlog location may expire. As a result, the job fails to be restored. It is important to monitor the duration of job exceptions and the binlog retention period. • During real-time synchronization, the source MySQL database cannot be upgraded across major versions. Otherwise, data may become inconsistent or the synchronization task may fail (data, table structures, and keywords may cause compatibility changes after the cross-version upgrade). You are advised to create a synchronization task again if the source MySQL database is upgraded across major versions. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Extraction from the standby database: Before extracting data from the standby database, ensure that a value can be returned after the **SHOW MASTER STATUS** command is executed on the standby database node. Otherwise, data jobs may be abnormal and data may be lost. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	Only DDL operations (for example, RENAME TABLE A TO B, in which B must be within the synchronization scope) can be performed to rename tables only if the renamed tables are within the synchronization scope.

Procedure

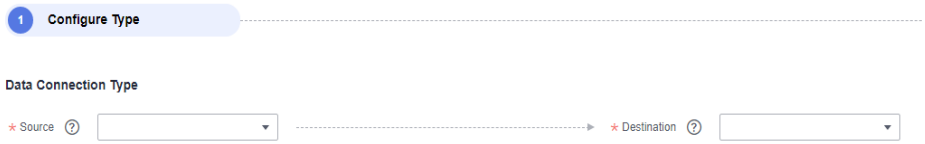
This section uses real-time synchronization from RDS for MySQL to as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

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Step 2 Select the data connection type. Select **MySQL** for **Source** and for **Destination**.

Figure 7-182 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenarios include **Entire DB**.

Figure 7-183 Setting the migration job type

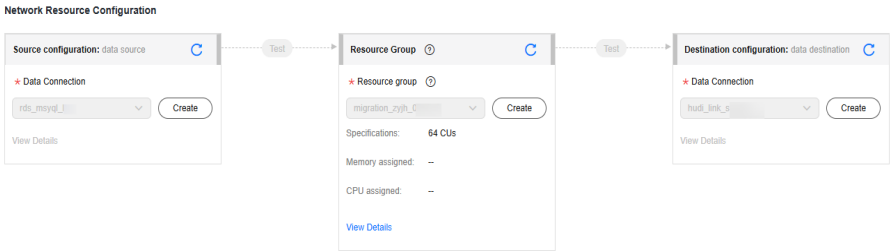


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created MySQL and data connections and the migration resource group for which the network connection has been configured.

Figure 7-184 Selecting data connections and a migration resource group



NOTE

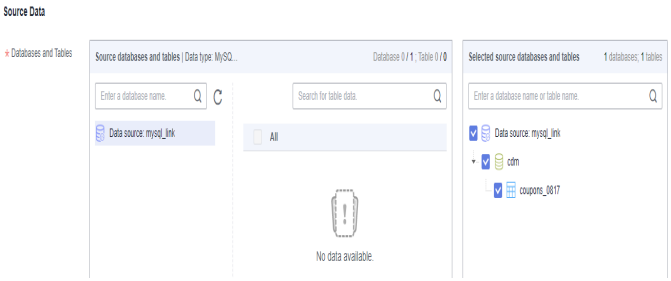
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

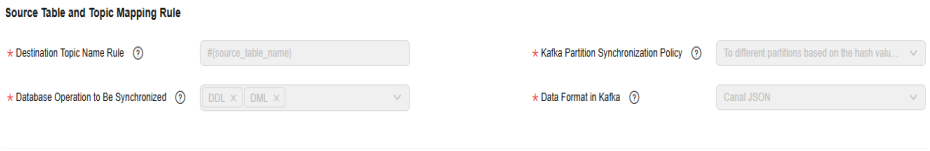
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Table 7-89 Selecting the databases and tables to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the MySQL databases and tables to be migrated. **Figure 7-185** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

Step 6 Configure destination parameters.

Figure 7-186 Kafka destination parameters



- **Destination Topic Name Rule**

  Configure the rule for mapping source MySQL database tables to destination Kafka topics.

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Table 7-90 Destination topic name rule

Synchronization Scenario	Configuration Method
Entire DB	Configure the rule for mapping source MySQL database tables to destination Kafka topics. You can specify a fixed topic or use built-in variables to synchronize data from source tables to destination topics. The following built-in variables are available: – Source database name: **#{source_db_name}** – Source table name: **#{source_table_name}**

- **Kafka Partition Synchronization Policy**

  The following three policies are available for synchronizing source data to specified partitions of destination Kafka topics:

  – To partition 0
  – To different partitions based on the hash values of database names/table names
  – To different partitions based on the hash values of table primary keys

  NOTE

  If the source has no primary key, data is synchronized to partition 0 at the destination by default.

- **Partitions of New Topic**

  If the destination Kafka does not have the corresponding topic, the topic automatically created by DataArts Migration has three partitions.

- **Destination Kafka Attributes**

  You can add Kafka configuration items with the properties. prefix. The job automatically removes the prefix and transfers configuration items to the underlying Kafka client. For details about the parameters, see the configuration descriptions in **Kafka documentation**.

- **Advanced Settings**

  You can add custom attributes in the **Configure Task** area to enable some advanced functions. For details about the parameters, see the following table.

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Figure 7-187 Adding custom attributes

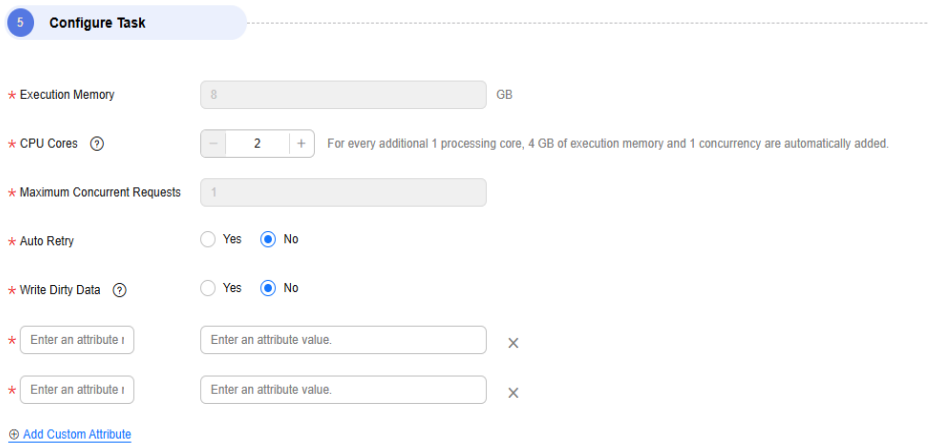


Table 7-91 Advanced parameters of the job for migrating data from MySQL to Kafka

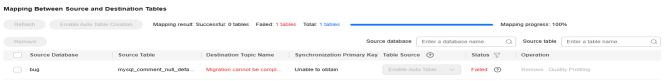
Parameter	Type	DefaultValue	Unit	Description
source.server.timezone	string	Localtimezone	N/A	Session time zone specified for connecting to the source database. The standard time zone format is supported, for example, UTC+08:00.
source.convert.timestampWithServerTimeZone	boolean	true	N/A	Whether to convert the output timestamp data to data with the source time zone.
source.convert.bit1AsInt	boolean	true	N/A	Whether to output bit1 data as int data

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Parameter	Type	Default Value	Unit	Description
sink.delivery-guarantee	string	at-least-once	N/A	Semantic assurance when Flink writes data to Kafka – **at-least-once**: At a checkpoint, the system waits for all data in the Kafka buffer to be confirmed by the Kafka producer. No message will be lost due to events that occur on the Kafka broker. However, duplicate messages may be generated when Flink is restarted because Flink processes old data again. – **exactly-once**: In this mode, the Kafka sink writes all data through the transactions submitted at a checkpoint. Therefore, if the consumer reads only submitted data, duplicate data will not be generated when Flink is restarted. However, data is visible only when a checkpoint is complete, so you need to adjust the checkpoint interval as needed.

Step 7 Update the mapping between the source table and destination table and check whether the mapping is correct.

Table 7-92 Mapping between source and destination tables

Synchronization Scenario	Configuration Method
Entire DB	You can change the names of mapped destination topics as needed. You can map one source topic to one destination topic or map multiple source topics to one destination topic. **Figure 7-188** Mapping between the source and destination tables in the entire database migration scenario 

Step 8 Configure task parameters.

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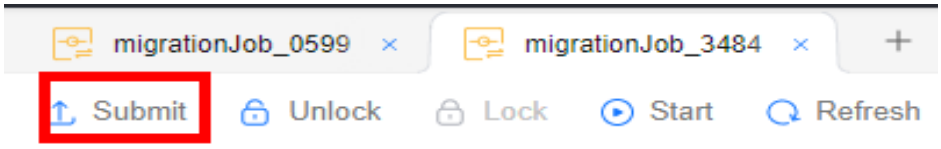
Table 7-93 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

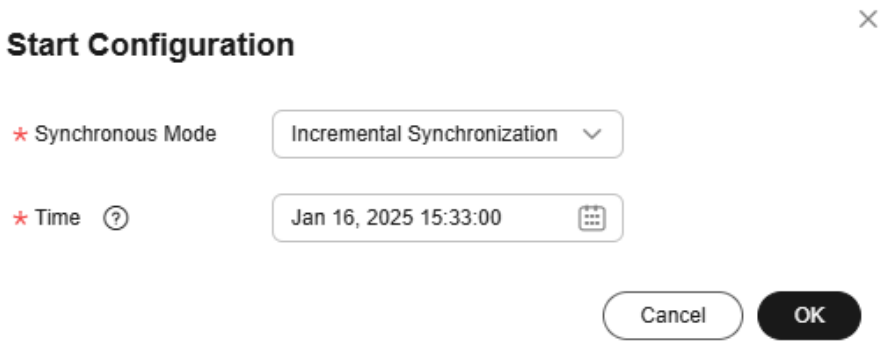
After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-189 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-190 Starting the job



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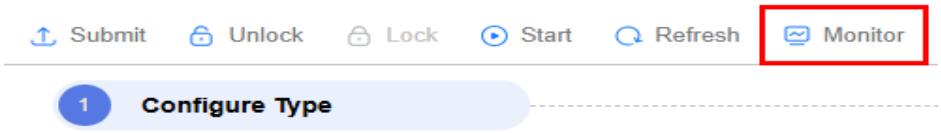
Table 7-94 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest binlog time, the latest log time is used.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-191 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.6 Configuring a Job for Synchronizing Data from DMS for Kafka to OBS

Supported Source and Destination Database Versions

Table 7-95 Supported database versions

Source Database	Destination Database
Kafka cluster (2.7 and 3.*x*)	N/A

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following

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table. The required account permissions vary depending on the synchronization task type.

Table 7-96 Database account permissions

Type	Required Permissions
Source database account	When ciphertext access is enabled for DMS for Kafka, the account must have the permissions to publish and subscribe to topics. In other scenarios, there are no special permission requirements.
Destination database account	You must have the permissions to access, read objects from, and write objects to the destination OBS bucket. For details, see .

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-97 Synchronization objects

Type	Note
Synchronization objects	All Kafka messages can be synchronized, and message bodies in JSON or CSV format can be parsed.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

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Table 7-98 Important notes

Type	Restriction
Database	• Kafka instances are supported if SASL_PLAINTEXT is enabled, including the SCRAM-SHA-512 and PLAIN authentication mechanisms. • Kafka instances for which SASL_SSL is enabled are not supported.
Usage	General: During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. Incremental synchronization phase: In the entire database migration scenario, you need to increase the number of concurrent jobs based on the number of topic partitions to be synchronized. Otherwise, a memory overflow may occur. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	• Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • During automatic table creation, the length of the char, varchar, nvarchar, enum, and set characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database. • During full synchronization of timestamp data, the on update current_timestamp syntax in the default value will not be synchronized to the destination GaussDB(DWS) database. • Only DDL operations (for example, RENAME TABLE A TO B, in which B must be within the synchronization scope) can be performed to rename tables only if the renamed tables are within the synchronization scope.

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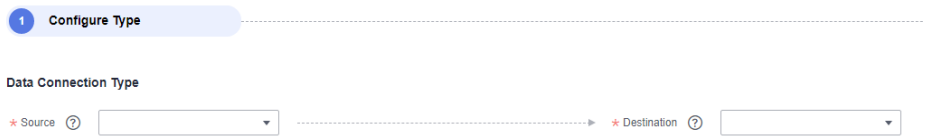
Procedure

This section uses real-time synchronization from DMS for Kafka to OBS as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **DMS Kafka** for **Source** and **OBS** for **Destination**.

Figure 7-192 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenarios include **Single table** and **Entire DB**.

Figure 7-193 Setting the migration job type

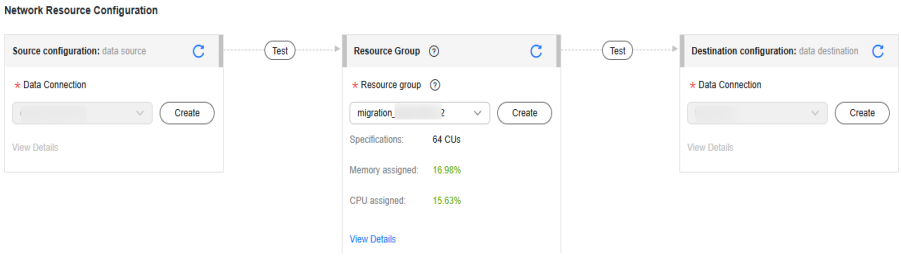


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created DMS for Kafka and OBS data connections and the migration resource group for which the network connection has been configured.

Figure 7-194 Selecting data connections and a migration resource group



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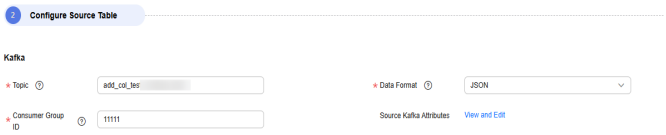
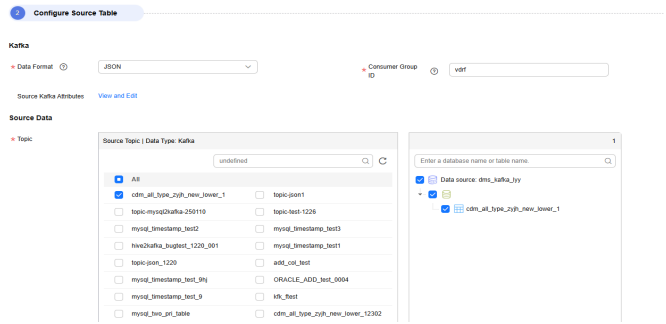
NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

- Select the Kafka topics to be synchronized in different migration scenarios based on the following table.

Table 7-99 Selecting the Kafka topics to be synchronized

Synchronization Scenario	Configuration Method
Single table	Enter a Kafka topic to be migrated. **Figure 7-195** Entering a Kafka topic 
Entire DB	Select the Kafka topics to be migrated. **Figure 7-196** Selecting Kafka topics 

- **Data Format**

  Format of the message content in the source Kafka topic. DataArts Migration can process the following types of messages:

  - **JSON**: Messages can be parsed in JSON format.
  - **CSV**: Messages can be parsed using specified separators in CSV format.
  - **TEXT**: The entire message is synchronized as text.

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- **Consumer Group ID**

  A consumer subscribes to a topic. A consumer group consists of one or more consumers. DataArts Migration allows you to specify the Kafka consumer group to which a consumption action belongs.

- **Source Kafka Attributes**

  You can set Kafka attributes and add the **properties.** prefix. The job will automatically remove the prefix and transfer the attributes to the Kafka client. For details about the parameters, see the configuration descriptions in the **Kafka documentation**.

Step 6 Configure destination parameters.

Figure 7-197 Configuring destination OBS parameters



- **File Storage Format**

  Format of the files to be written to OBS. Parquet, SequenceFile, and TextFile are supported.

- **File Compression Mode**

  Compression mode of the data to be written to OBS files. By default, data is not compressed. The following compression modes are supported:

  – Parquet format: **UNCOMPRESSED** or **SNAPPY**

  – SequenceFile format: **UNCOMPRESSED**, **SNAPPY**, **GZIP**, **LZ4**, or **BZIP2**.

  – TextFile format: **UNCOMPRESSED**

- **OBS Path**

  Path for storing OBS files. You can enter the #{source_Topic_name} built-in variable so that topics at the source can be written to different paths. An example path is **obs://bucket/dir/test.db/prefix_#{source_Topic_name}_suffix/**.

- **Global Advanced Settings**

  You can configure the parameters in the following table to enable some advanced functions.

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Table 7-100 OBS advanced parameters

Parameter	Type	Default Value	Unit	Description
auto-compaction	boolean	false	N/A	Whether to compact merge files. Data is written to a temporary file first. This parameter specifies whether to compact the generated temporary files after the checkpoint is complete. Enabling this function reduces the number of small files in some scenarios, but greatly slows down the synchronization.

Step 7 Refresh the mapping between the source table and destination table. Click **Edit Destination Field** to check the fields to be written to the destination and configure partition fields as needed.

Figure 7-198 Mapping between source and destination tables



- Partition Field

  After you configure partition fields, a partition directory is automatically generated when data is written to OBS. The directory name is in *Partition field=Partition value* format. In addition, the field selection sequence affects the partition level. For example, if **par1** and **par2** are selected as partition fields, **par1** is a level-1 partition and **par2** is a level-2 partition. A maximum of five levels of partitions are supported.

- **Edit Destination Field**

  DataArts Migration automatically parses source messages based on the selected source message format and generates corresponding fields. You can customize the names, types, and values of the fields.

  - **Field Name**: name of the field to be written to the destination OBS file. The name must contain at least one letter and can contain underscores (_) and hyphens (-), but cannot contain only digits.
  - **Field Type**: type of the field to be written to the destination OBS file. The following types are supported: STRING, BOOLEAN, INTEGER, LONG, FLOAT, DOUBLE, SHORT, DECIMAL, DATE, and TIMESTAMP.
  - **Field Value**: value source of the field to be written to the destination OBS file

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Table 7-101 Destination field value obtaining mode

Type	Value
Manually assigned value	Any character
Built-in variable	Kafka metadata, including six fields: **__key__**, **__value__**, **__Topic__**, **__partition__**, **__offset__**, and **__timestamp__**.
Source table field	Any field parsed from the source Kafka topic message **NOTE** If the source Kafka message is in nested JSON format, this link can parse field values at different levels (including arrays whose subscript indexes start from 1). The following is an example of the JSON content: `{ "col1": "1", "col2": "2", "level1": { "level2": [ { "level3": "test" } ] } }` You can obtain **test** using **level1.level2[1].level3** and use it as the value of a field at the destination.
UDF	Flink built-in function used to transform data. The following are examples: ▪ CONCAT(CAST(NOW() as STRING), `col_name`) ▪ DATE_FORMAT(NOW(), 'yy') Note that the field name must be enclosed in backquotes. For details about the built-in functions of Flink, see the **official Flink documentation**.

Step 8 Configure task parameters.

Table 7-102 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2

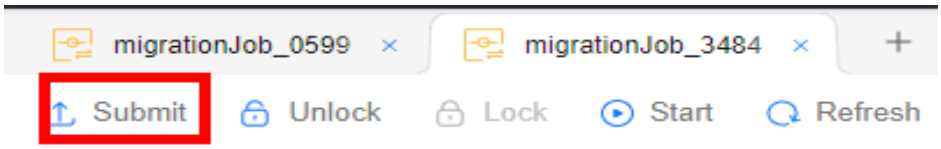
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Parameter	Description	Default Value
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Adding custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	N/A

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-199 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-200 Starting the job

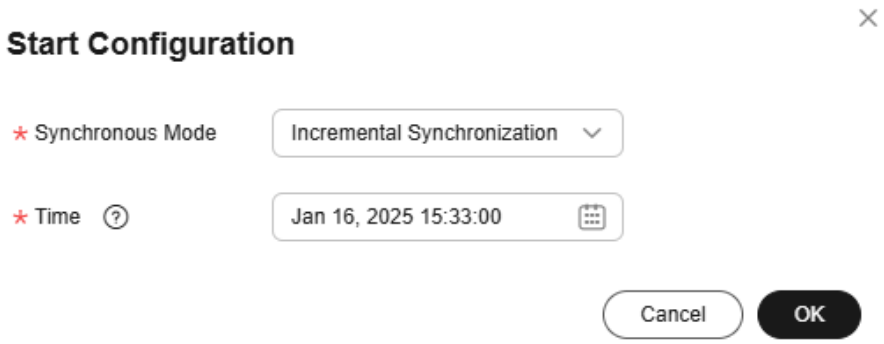


Table 7-103 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Earliest**: Data consumption starts from the earliest offset of the Kafka topic. • **Latest**: Data consumption starts from the latest offset of the Kafka topic. • **Start/End time**: Data consumption starts from the offset of the Kafka topic obtained based on the time.

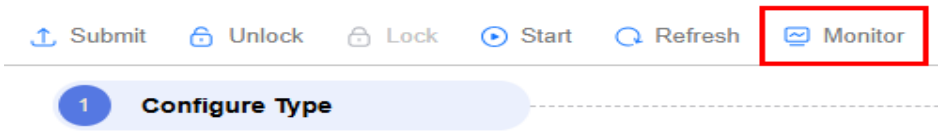
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Parameter	Description
Time	This parameter is required if **Offset** is set to **Start/End time**. It specifies the start time of synchronization. **NOTE** If you set a time earlier than the earliest offset of Kafka messages, data consumption starts from the earliest offset by default.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-201 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.7 Configuring a Job for Synchronizing Data from Apache Kafka to MRS Kafka

Supported Source and Destination Database Versions

Table 7-104 Supported database versions

Source Database	Destination Database
Kafka cluster (2.7 and 3.*x*)	Kafka cluster (2.7 and 3.*x*)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

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Table 7-105 Database account permissions

Type	Required Permissions
Source database account	N/A
Destination database account	The MRS user must have the read and write permissions on corresponding Kafka topics, that is, the user must belong to the kafka/kafkaadmin/kafkasuperuser user group. **NOTE** A common Kafka user can access a topic only after being granted the read and write permissions on the topic by the Kafka administrator.

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-106 Synchronization objects

Type	Note
Synchronization objects	All Kafka topic messages can be synchronized, but the messages cannot be synchronized after being parsed and reassembled.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-107 Important notes

Type	Restriction
Database	• Kafka instances in MRS clusters are supported, regardless of whether Keberos authentication is enabled. • Kafka instances with SASL_SSL enabled are not supported.

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Type	Restriction
Usage	General: During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. Incremental synchronization phase: In the entire database migration scenario, you need to increase the number of concurrent jobs based on the number of topic partitions to be synchronized. Otherwise, a memory overflow may occur. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	N/A

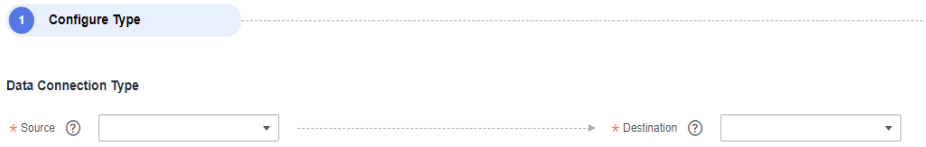
Procedure

This section uses real-time synchronization from Apache Kafka to MRS Kafka as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

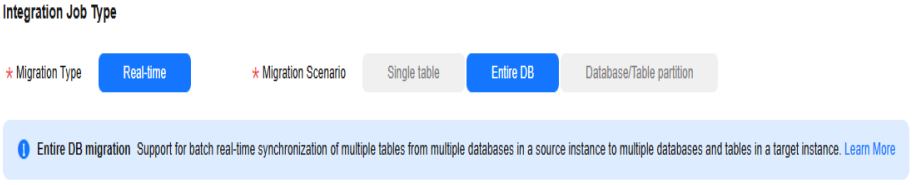
Step 2 Select the data connection type. Select **Apache_Kafka** for **Source** and **MRS_Kafka** for **Destination**.

Figure 7-202 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario can only be **Entire DB**.

Figure 7-203 Setting the migration job type



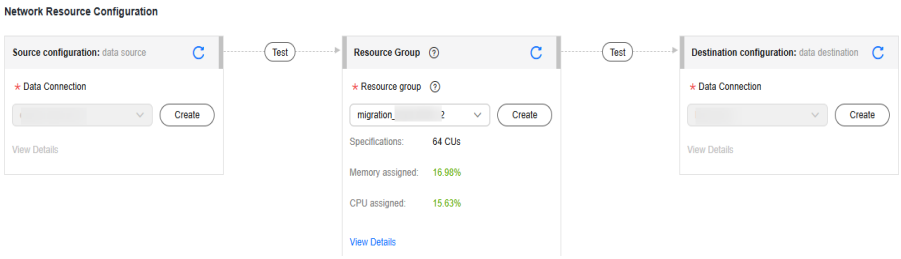
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NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created DMS for Kafka and OBS data connections and the migration resource group for which the network connection has been configured.

Figure 7-204 Selecting data connections and a migration resource group



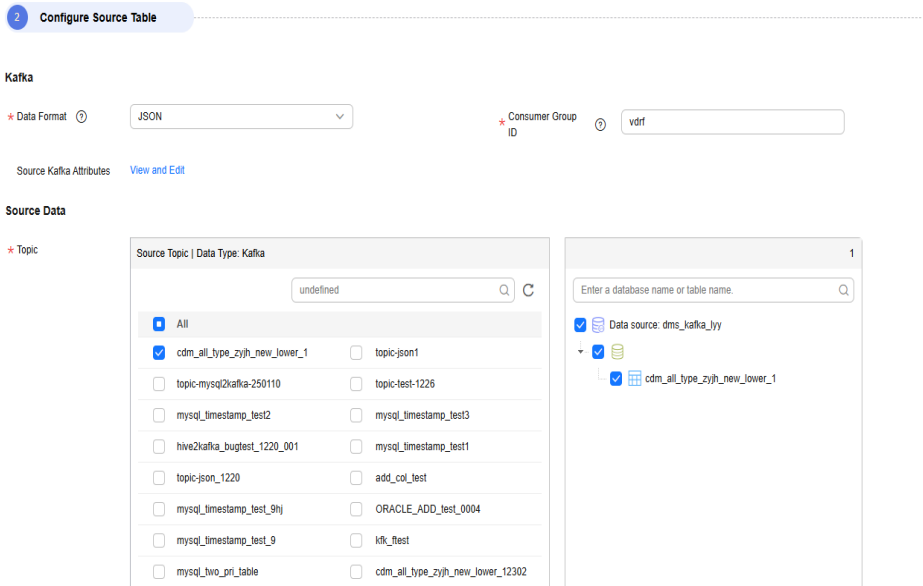
NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

- Select the Kafka topics to be synchronized.

Figure 7-205 Selecting the Kafka topics to be synchronized



- **Consumer Group ID**

  A consumer subscribes to a topic. A consumer group consists of one or more consumers. DataArts Migration allows you to specify the Kafka consumer group to which a consumption action belongs.

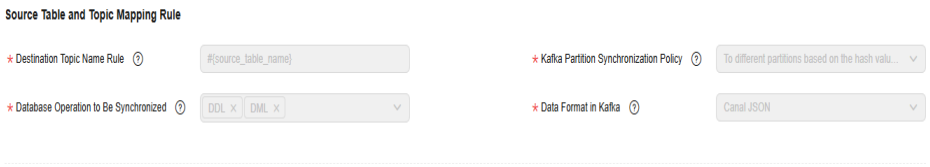
- **Source Kafka Attributes**

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You can add Kafka configuration items with the properties. prefix. The job automatically removes the prefix and transfers configuration items to the underlying Kafka client. For details about the parameters, see the configuration descriptions in **Kafka documentation**.

Step 6 Configure destination parameters.

Figure 7-206 Kafka destination parameters



- **Destination Topic Name Rule**

  Configure the rule for mapping source MySQL database tables to destination Kafka topics. You can specify a fixed topic or use a built-in variable to synchronize data from source tables to topics.

  The following built-in variable can be used: #{source_Topic_name}

- **Kafka Partition Synchronization Policy**

  The following three policies are available for synchronizing source data to specified partitions of destination Kafka topics:

  - **To partition 0**
  - **To the partition corresponding to the source partition**: Source messages are delivered to their corresponding destination partitions. This policy ensures that the message sequence remains unchanged.
  - **To different partitions in polling mode**: The Kafka sticky partitioning policy is used to evenly deliver messages to all destination partitions. This policy cannot keep the message sequence unchanged.

- Partitions of New Topic

  If the destination Kafka does not have the corresponding topic, the topic automatically created by DataArts Migration has three partitions.

- **Destination Kafka Attributes**

  You can set Kafka attributes and add the **properties.** prefix. The job will automatically remove the prefix and transfer the attributes to the Kafka client. For details about the parameters, see the configuration descriptions in the **Kafka documentation**.

Step 7 Refresh the mapping between the source table and destination table, and check whether the mapping between the source topic and destination topic is correct. You can change the name of the destination topic as needed. One source topic can be mapped to one destination topic, or multiple source topics can be mapped to one destination topic.

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Figure 7-207 Mapping between source and destination tables



Step 8 Configure task parameters.

Table 7-108 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Adding custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	N/A

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-208 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

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Figure 7-209 Starting the job

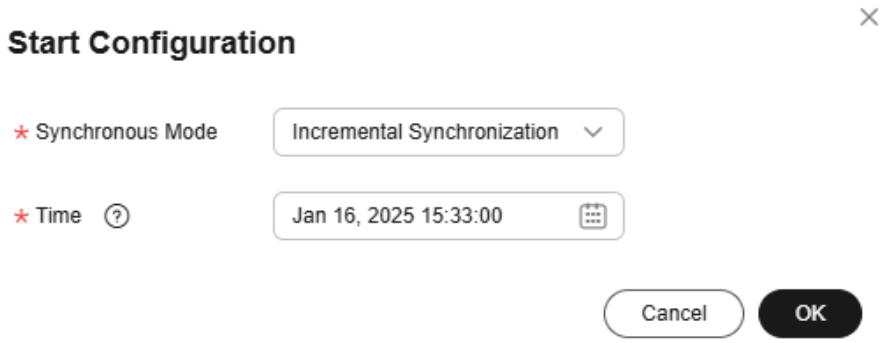


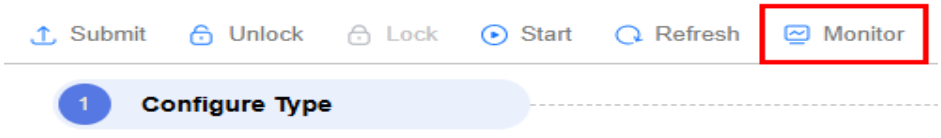
Table 7-109 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Earliest**: Data consumption starts from the earliest offset of the Kafka topic. • **Latest**: Data consumption starts from the latest offset of the Kafka topic. • **Start/End time**: Data consumption starts from the offset of the Kafka topic obtained based on the time.
Time	This parameter is required if **Offset** is set to **Start/End time**. It specifies the start time of synchronization. **NOTE** If you set a time earlier than the earliest offset of Kafka messages, data consumption starts from the earliest offset by default.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-210 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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7.11.8 Configuring a Job for Synchronizing Data from to Hudi

Supported Source and Destination Database Versions

Table 7-110 Supported database versions

Source Database	Destination Database
Kafka cluster (2.7 and 3.*x*)	MRS cluster (3.2.0-LTS.*x* and 3.5.*x*) Hudi (0.11.0 and 0.15.0)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-111 Database account permissions

Type	Required Permissions
Source database connection account	The MRS user must have the read and write permissions on corresponding Kafka topics, that is, the user must belong to the kafka/kafkaadmin/kafkasuperuser user group. **NOTE** A common Kafka user can access a topic only after being granted the read and write permissions on the topic by the Kafka administrator.
Destination database connection account	The MRS user must have read and write permissions for the Hadoop and Hive components. You are advised to assign the roles and user groups shown in the following figure to the MRS user. **Figure 7-211** Minimal permissions for MRS Hudi  For details, see .

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NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-112 Synchronization objects

Type	Note
Synchronization objects	All Kafka messages can be synchronized, and message bodies in JSON or CSV format can be parsed.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-113 Important notes

Type	Restriction
Database	• Kerberos authentication can be enabled. • Kafka instances using SASL_PLAINTEXT can be used in MRS clusters for which Kerberos authentication is disabled. The SCRAM-SHA-512 and PLAIN authentication mechanisms are supported. • Kafka instances with SASL_SSL enabled are not supported. • The names of the destination Hudi databases, tables, and fields can only contain digits, letters, and underscores (_). Field names must start with a letter or an underscore (). You are advised to use common characters in names.

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • If a Hudi table uses bucket indexes, the partition key cannot be updated. Otherwise, duplicate data may be generated. • If a Hudi table uses bucket indexes, ensure that the primary key is unique in a single partition. Incremental synchronization phase: After incremental data is synchronized to Hudi MOR tables in MRS clusters earlier than 3.2.0-LTS1.5, CDM or Spark SQL cannot be used to write data. You need to perform compaction before writing data. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	N/A

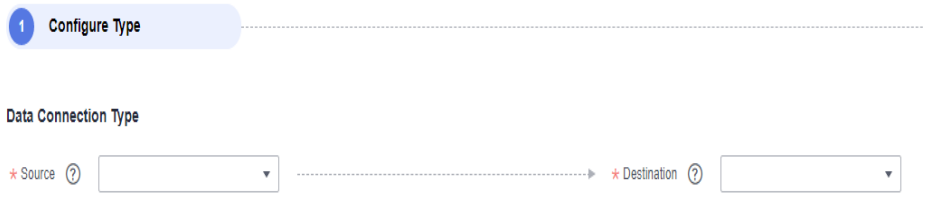
Procedure

This section uses real-time synchronization from MRS Kafka to MRS Hudi as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **MRS Kafka** for **Source** and **Hudi** for **Destination**.

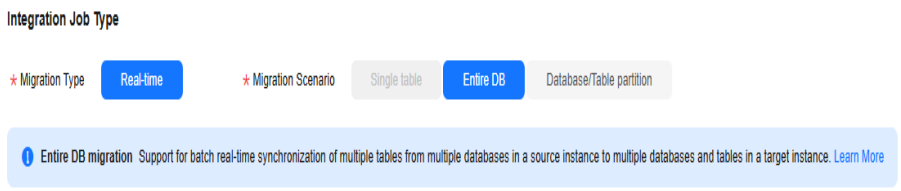
Figure 7-212 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Single table**.

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Figure 7-213 Setting the job type

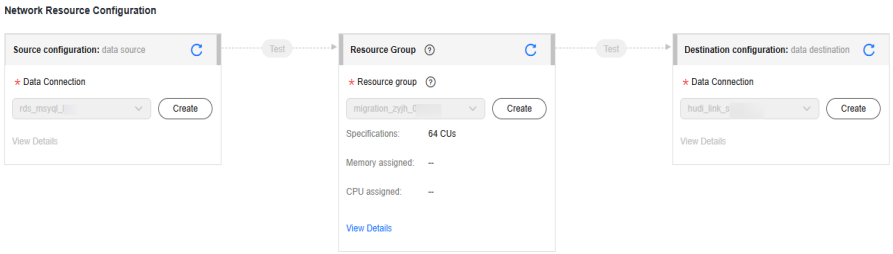


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created and MRS Hudi data connections and the migration resource group for which the network connection has been configured.

Figure 7-214 Selecting data connections and a migration resource group



NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

- **Topic**

  Enter a Kafka topic to be migrated.

  Figure 7-215 Entering a Kafka topic

- **Data Format**

  Format of the message content in the source Kafka topic. DataArts Migration can process the following types of messages:

  – **JSON**: Messages can be parsed in JSON format.

  – **CSV**: Messages can be parsed using specified separators in CSV format.

  – **TEXT**: The entire message is synchronized as text.

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- **Consumer Group ID**

  A consumer subscribes to a topic. A consumer group consists of one or more consumers. DataArts Migration allows you to specify the Kafka consumer group to which a consumption action belongs.

- **Source Kafka Attributes**

  You can set Kafka attributes and add the **properties.** prefix. The job will automatically remove the prefix and transfer the attributes to the Kafka client. For details about the parameters, see the configuration descriptions in the **Kafka documentation**.

Step 6 Configure destination parameters.

Figure 7-216 Hudi destination parameters



- **Basic Configuration**

  Set the database to which the destination Hudi table belongs.

- **Destination Table**

  Set the name of the destination Hudi table.

- **Data Storage Path**

  Warehouse path when tables are automatically created in Hudi. A subdirectory is created in the warehouse path for each table. You can enter an HDFS or OBS path. The path format is as follows:

  – OBS path: obs://bucket/warehouse

  – HDFS path: /tmp/warehouse

- Global Hudi Table Attribute Configuration

  Some advanced functions can be configured using parameters. For details, see Hudi advanced parameters.

Table 7-114 Hudi advanced parameters

Parameter	Type	DefaultValue	Unit	Description
index.type	string	BLOOM	N/A	Index type of the Hudi table BLOOM and BUCKET indexes are supported. If a large amount of data need to be migrated, BUCKET indexes are recommended for better performance.

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Parameter	Type	Default Value	Unit	Description
hoodie.bucket.index.num.buckets	int	256	Count	Number of buckets within a Hudi table partition **NOTE** When using Hudi BUCKET tables, you need to set the number of buckets for a table partition. The number of buckets affects the table performance. – Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4) – Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1) Pay attention to the following: – The total data volume of a table, instead of the compressed size, is used. – An even number of buckets is recommended. The minimum number of buckets should be 4 for a non-partitioned table and 1 for a partitioned table.
changelog.enabled	boolean	false	N/A	Whether to enable the Hudi ChangeLog function. If this function is enabled, the migration job can output DELETE and UPDATE BEFORE data.
logical.delete.enabled	boolean	true	N/A	Whether to enable logical deletion. If the ChangeLog function is enabled, logical deletion must be disabled.
hoodie.write.liststatus.optimized	boolean	true	N/A	Whether to enable liststatus optimization when log files are written. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.

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Parameter	Type	DefaultValue	Unit	Description
hoodie.index.liststatus.optimized	boolean	false	N/A	Whether to enable liststatus optimization during data locating. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.
compaction.async.enabled	boolean	true	N/A	Whether to enable asynchronous compaction. The compaction operation affects the writing performance of real-time jobs. If you use an external compaction operation, you can set this parameter to **false** to disable compaction for real-time processing migration jobs.
compaction.schedule.enabled	boolean	true	N/A	Whether to generate compaction plans. Compaction plans must be generated by this service and can be executed by Spark.
compaction.delta_commits	int	5	Count	Compaction request generation frequency Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If there is a small volume of incremental data to be synchronized to Hudi, you can set a larger value for this parameter. **NOTE** For example, if this parameter is set to **40**, a compaction request is generated for every 40 commits. Since DataArts Migration generates a commit every minute, the interval between compaction requests is 40 minutes.
clean.async.enabled	boolean	true	N/A	Whether to clear data files of historical versions

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Parameter	Type	Default Value	Unit	Description
clean.retain_commits	int	30	Count	Number of commits to retain Data files related to these commits will be retained for a period calculated by multiplying the number of specified commits by the interval between commits. You are advised to set this parameter to twice the value of **compaction.delta_commits**. **NOTE** For example, if this parameter is set to **80** and since DataArts Migration generates a commit every minute, data files related to commits generated 80 minutes earlier are cleaned, and data files related to the recent 80 commits are retained.
hoodie.archive.automatic	boolean	true	N/A	Whether to age Hudi commit files
archive.min_commits	int	40	Count	Number of recent commits to keep when historical commits are archived to log files You are advised to set this parameter to one greater than **clean.retain_commits**. **NOTE** For example, if this parameter is set to **81**, the files related to the recent 81 commits are retained when an archive operation is triggered.
archive.max_commits	int	50	Count	Number of commits that triggers an archive operation You are advised to set this parameter to 20 greater than **archive.min_commits**. **NOTE** For example, if the parameter is set to **101**, an archive operation is triggered when the files of 101 commits are generated.

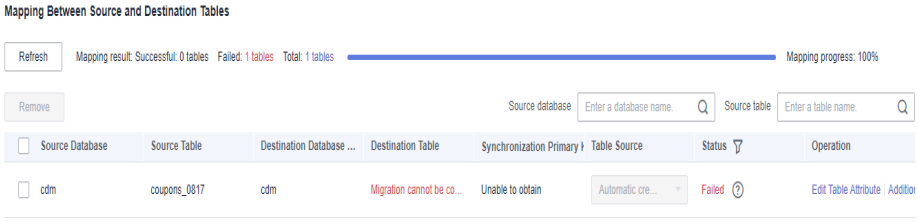
NOTE

- To achieve optimal performance for the migration job, you are advised to use an MOR table that uses Hudi BUCKET indexes and configure the number of buckets based on the actual data volume.
- To ensure the stability of the migration job, you are advised to split the Hudi Compaction job into Spark jobs and execute them by MRS, and enable compaction plans to be generated for this migration job. For details, see

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Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination Hudi database.

Figure 7-217 Mapping between source and destination tables



- **Synchronization Primary Key**

  The primary key must be set for Hudi tables. If the source table has no primary key, you must manually select the primary key during field mapping.

- **Partition Field**

  If no Hudi table is available at the destination, you can select a maximum of five mapped destination fields as partition fields. DataArts Migration automatically specifies partitions for a Hudi table when creating the table, and directories are automatically generated for the partitions when data is written to the Hudi table.

  NOTE

  The field selection sequence affects the partition level. For example, if **par1** and **par2** are selected as partition fields, **par1** is a level-1 partition and **par2** is a level-2 partition. A maximum of five levels of partitions are supported.

- **Edit Destination Field**

  DataArts Migration automatically parses source messages based on the selected source message format and generates corresponding fields. You can customize the names, types, and values of the fields.

  - **Field Name**: name of the new field in the destination Hudi table
  - **Field Type**: Type of the new field in the destination Hudi table
  - **Field Value**: Value source of the new field in the destination Hudi table

  Table 7-115 Destination field value obtaining mode

Type	Example
Manually assigned value	Any character
Built-in variable	Kafka metadata, including six fields: **__key__**, **__value__**, **__Topic__**, **__partition__**, **__offset__**, and **__timestamp__**.
Field variable	Any field parsed from the source Kafka topic message

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Type	Example
UDF	Flink built-in function used to transform data. The following are examples: ▪ CONCAT(CAST(NOW() as STRING), `col_name`) ▪ DATE_FORMAT(NOW(), 'yy') The field name must be enclosed in backquotes. For details about the built-in functions of Flink, see the **official Flink documentation**.

Step 8 Configure task parameters.

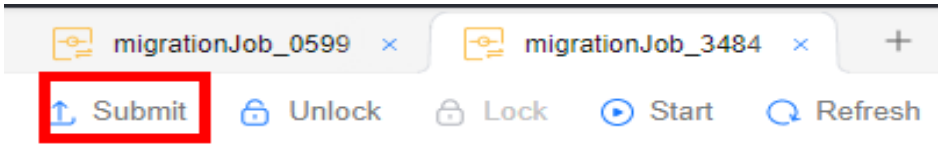
Table 7-116 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-218 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

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Figure 7-219 Starting the job

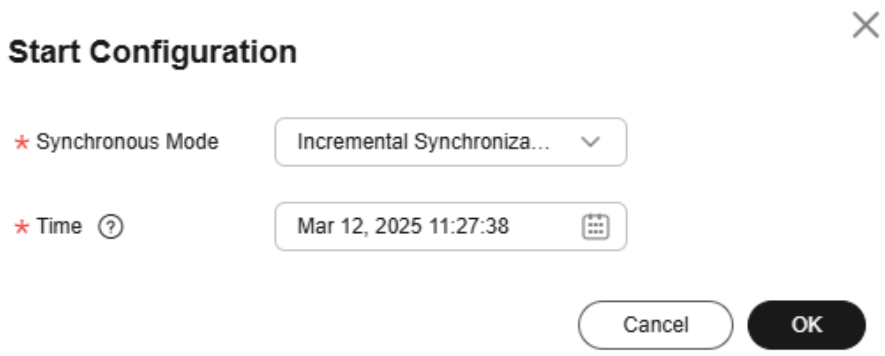


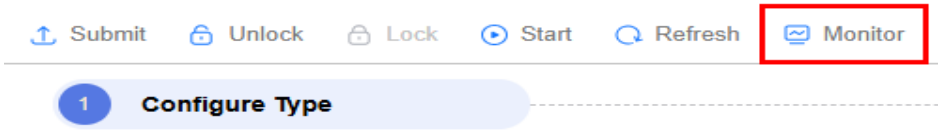
Table 7-117 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Earliest**: Data consumption starts from the earliest offset of the Kafka topic. • **Latest**: Data consumption starts from the latest offset of the Kafka topic. • **Time Range**: Data consumption starts from the offset of the Kafka topic obtained based on the time.
Minimum Timestamp	This parameter is required if **Offset Parameter** is set to **Time Range**. It specifies the start time of synchronization. **NOTE** If you set a time earlier than the earliest offset of Kafka messages, data consumption starts from the earliest offset by default.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-220 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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7.11.9 Configuring a Job for Synchronizing Data from SQL Server to MRS Hudi

Supported Source and Destination Database Versions

Table 7-118 Supported database versions

Source Database	Destination Database
SQL Server database (Enterprise Edition 2016, 2017, 2019, and 2022; Standard Edition 2016 SP2 and later, 2017, 2019, and 2022)	• MRS cluster (3.2.0-LTS.*x* and 3.5.*x*) • Hudi (0.11.0)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

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Table 7-119 Database account permissions

Type	Required Permissions

Source database account	sysadmin or view server state permissions, and db_datareader or db_owner permissions of the database to be synchronized
	• Enable CDC for a database and a table.
	1. Enable CDC for a database.
	`USE YourDatabaseName;`
	`EXEC sys.sp_cdc_enable_db;`
	`-- Check whether CDC is enabled for a database.`
	`SELECT is_cdc_enabled, name FROM sys.databases WHERE name = 'YourDatabaseName'`
	2. Enable CDC for a table.
	`EXEC sys.sp_cdc_enable_table`
	`@source_schema = N'dbo', -- Schema`
	`@source_name = N'YourTable',-- Table name`
	`@role_name = NULL,-- (Optional) CDC access role name`
	`@supports_net_changes = 0;`
	`-- Check whether CDC is enabled for the table.`
	`SELECT name,is_tracked_by_cdc FROM sys.tables WHERE name = 'YourTable';`
	• The following permissions for the SQL Server must be granted to the user configured in the data connection:
	– Grant the CONNECT and VIEW DATABASE STATE permissions to the user.
	`USE YourDatabaseName;`
	`GRANT CONNECT, VIEW DATABASE STATE TO [YourUserName];`
	– Grant the SELECT permissions on the CDC schema to the user.
	`USE YourDatabaseName;`
	`GRANT SELECT ON SCHEMA::[cdc] TO [YourUserName];`
	– Grant the SELECT permissions on the table to the user.
	`USE YourDatabaseName;`
	`GRANT SELECT ON OBJECT::[YourSchema].[YourTable] TO [YourUserName];`

Destination database account	The MRS user must have read and write permissions for the Hadoop and Hive components. You are advised to assign the roles and user groups shown in the following figure to the MRS user. **Figure 7-221** Minimal permissions for MRS Hudi  For details, see .

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NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-120 Synchronization objects

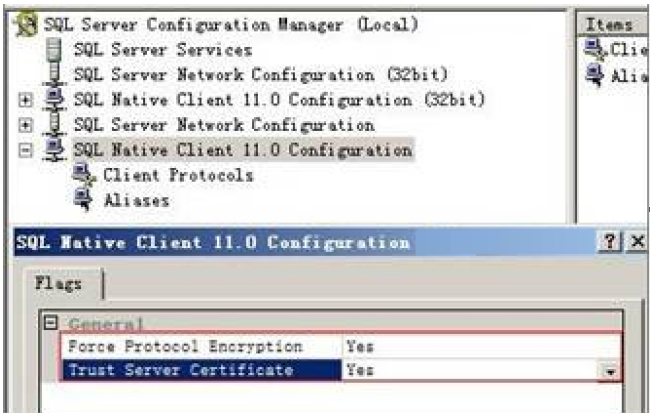
Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Transparent Data Encryption (TDE) encrypted databases in the source instance cannot be synchronized. • Column encryption is not supported. • Auto-increment columns cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

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Table 7-121 Important notes

Type	Restriction
Database	• The names of the destination databases, tables, and fields can only contain digits, letters, and underscores (_). Field names must start with a letter or an underscore (). You are advised to use common characters in names. • If **Force Protocol Encryption** is set to **Yes** for the source database, **Trust Server Certificate** also must be set to **Yes**. **Figure 7-222** Client configuration 

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Type	Restriction
Usage	General: ● During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. ● If a Hudi table uses bucket indexes, the partition key cannot be updated. Otherwise, duplicate data may be generated. ● If a Hudi table uses bucket indexes, ensure that the primary key is unique in a single partition. ● Every Hudi table in this task must contain three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi tables. If an existing table is used, these three audit fields must also be configured for it. Otherwise, the task may fail. – **cdc_last_update_date**: time when migration task processes CDC data – **logical_is_deleted**: logical deletion flag – **_hoodie_event_time**: timestamp of data in SQL Server CDC Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: ● DML operations INSERT, UPDATE, and DELETE can be synchronized. ● DDL operations performed on the source database will not be synchronized to the destination database. ● The IMAGE, TEXT, and NTEXT big data types cannot be deleted. ● Tables in a job cannot be modified during synchronization. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• Tables in the source database can contain more or less columns than those in the destination database. However, task failures may occur in the following scenarios: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • Do not perform primary/standby switchover on the source database. Otherwise, the synchronization task will fail. • Source Microsoft SQL Server databases using TLS 1.0 or TLS 1.1 cannot be synchronized. To enable synchronization of such databases, you are advised to upgrade the protocol used by the databases to TLS 1.2 or later.

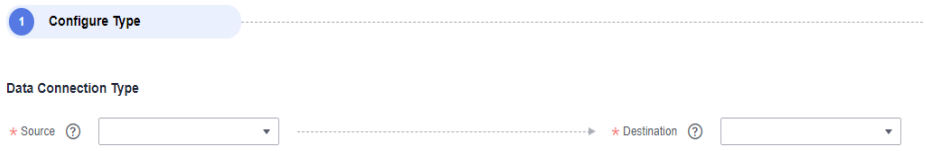
Procedure

This section uses real-time synchronization from Microsoft SQL Server to MRS Hudi as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **SQLServer** for **Source** and **Hudi** for **Destination**.

Figure 7-223 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

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Figure 7-224 Setting the migration job type

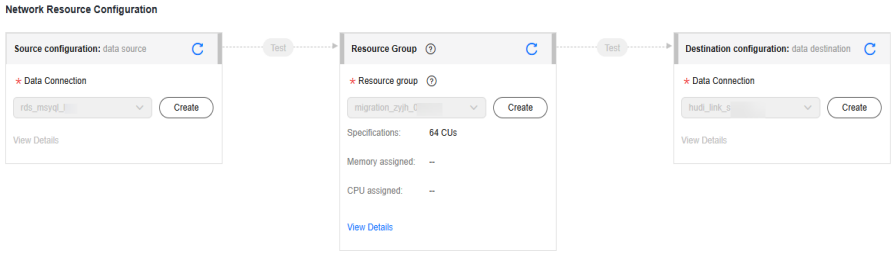


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created SQL Server and MRS Hudi data connections and the migration resource group for which the network connection has been configured.

Figure 7-225 Selecting data connections and a migration resource group



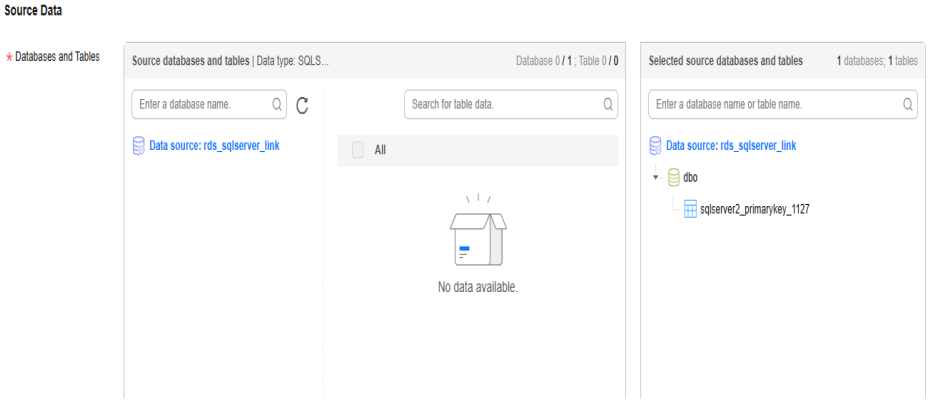
NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

- Select the SQL Server databases and tables to be migrated.

  Figure 7-226 Selecting databases and tables

  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

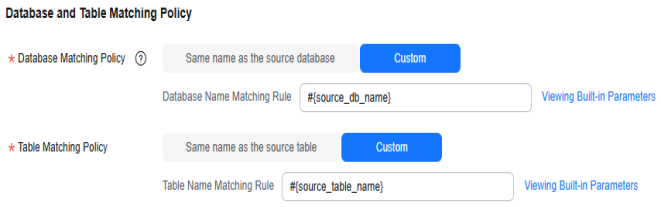
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Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

  Table 7-122 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Database Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the Hudi database with the same name as the source SQL Server schema. ▪ **Custom**: Data will be synchronized to the Hudi database you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the Hudi table with the same name as the source SQL Server schema. ▪ **Custom**: Data will be synchronized to the Hudi table you specify. **Figure 7-227** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

- Set Hudi parameters.

  For details, see the following table.

Figure 7-228 Hudi destination parameters



Table 7-123 Hudi destination parameters

Parameter	Default Value	Unit	Description
Data Storage Path	N/A	N/A	Warehouse path when tables are automatically created in Hudi. A subdirectory is created in the warehouse path for each table. You can enter an HDFS or OBS path. The path format is as follows: – OBS path: obs://bucket/warehouse – HDFS path: /tmp/warehouse
Global Configuration of Hudi Table Attributes	N/A	N/A	Some advanced functions can be configured using parameters. For details, see Hudi advanced parameters.

Table 7-124 Hudi advanced parameters

Parameter	Type	Default Value	Unit	Description
index.type	string	BLOOM	N/A	Index type of the Hudi table BLOOM and BUCKET indexes are supported. If a large amount of data need to be migrated, BUCKET indexes are recommended for better performance.

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Parameter	Type	Default Value	Unit	Description
hoodie.bucket.index.num.buckets	int	256	Count	Number of buckets within a Hudi table partition **NOTE** When using Hudi BUCKET tables, you need to set the number of buckets for a table partition. The number of buckets affects the table performance. – Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4) – Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1) Pay attention to the following: – The total data volume of a table, instead of the compressed size, is used. – Setting an even number of buckets is recommended. The minimum number of buckets should be 4 for a non-partitioned table and 1 for a partitioned table.
changelog.enabled	boolean	false	N/A	Whether to enable the Hudi ChangeLog function. If this function is enabled, the migration job can output DELETE and UPDATE BEFORE data.
logical.delete.enabled	boolean	true	N/A	Whether to enable logical deletion. If the ChangeLog function is enabled, logical deletion must be disabled.
hoodie.write.liststatus.optimized	boolean	true	N/A	Whether to enable liststatus optimization when log files are written. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.

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Parameter	Type	DefaultValue	Unit	Description
hoodie.index.liststatus.optimized	boolean	false	N/A	Whether to enable liststatus optimization during data locating. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.
compaction.async.enabled	boolean	true	N/A	Whether to enable asynchronous compaction. The compaction operation affects the writing performance of real-time jobs. If you use an external compaction operation, you can set this parameter to **false** to disable compaction for real-time processing migration jobs.
compaction.schedule.enabled	boolean	true	N/A	Whether to generate compaction plans. Compaction plans must be generated by this service and can be executed by Spark.
compaction.delta_commits	int	5	Count	Frequency of generating compaction requests. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If there is a small volume of incremental data to be synchronized to Hudi, you can set a larger value for this parameter. **NOTE** For example, if this parameter is set to **40**, a compaction request is generated every 40 commits. Since DataArts Migration generates a commit every minute, the interval between compaction requests is 40 minutes.
clean.async.enabled	boolean	true	N/A	Whether to clear data files of historical versions

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Parameter	Type	Default Value	Unit	Description
clean.retain_commits	int	30	Count	Number of recent commits to retain. Data files related to these commits will be retained for a period calculated by multiplying the number of specified commits by the interval between commits. You are advised to set this parameter to twice the value of **compaction.delta_commits**. **NOTE** For example, if this parameter is set to **80** and since DataArts Migration generates a commit every minute, data files related to commits generated 80 minutes earlier are cleaned, and data files related to the recent 80 commits are retained.
hoodie.archive.automatic	boolean	true	N/A	Whether to age Hudi commit files
archive.min_commits	int	40	Count	Number of recent commits to keep when historical commits are archived to log files You are advised to set this parameter to one greater than **clean.retain_commits**. **NOTE** For example, if this parameter is set to **81**, the files related to the recent 81 commits are retained when an archive operation is triggered.
archive.max_commits	int	50	Count	Number of commits that triggers an archive operation You are advised to set this parameter to 20 greater than **archive.min_commits**. **NOTE** For example, if the parameter is set to **101**, an archive operation is triggered when the files of 101 commits are generated.

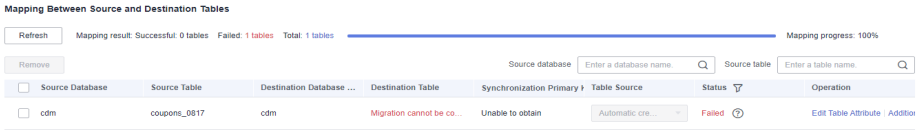
NOTE

- To achieve optimal performance for the migration job, you are advised to use an MOR table that uses Hudi BUCKET indexes and configure the number of buckets based on the actual data volume.
- To ensure the stability of the migration job, you are advised to split the Hudi Compaction job into Spark jobs and execute them by MRS, and enable compaction plans to be generated for this migration job. For details, see

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Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination Hudi database.

Figure 7-229 Mapping between source and destination tables



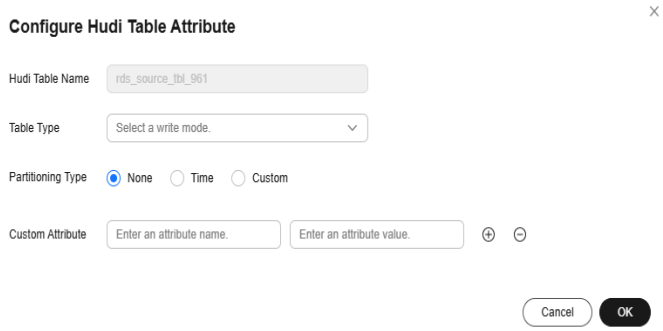
- **Synchronization Primary Key**

  The primary key must be set for Hudi tables. If the source table has no primary key, you must manually select the primary key during field mapping.

- **Edit Table Attribute**

  Click **Edit Table Attributes** in the **Operation** column to configure Hudi table attributes, including the table type, partition type, and custom attributes.

  Figure 7-230 Configuring the Hudi table attributes

  - **Table Type**: Hudi table type. Select **MERGE_ON_READ** or **COPY_ON_WRITE**.
  - **Partition Type**: partition type of the Hudi table. Select **No partition**, **Time**, or **Custom**.

    NOTE

    - For **Time**, you need to specify a source field name and select a time conversion format.

      For example, you can specify the source field name **src_col_1** and select a time conversion format, for example, day(yyyyMMdd), month(yyyyMM), or year(yyyy). During automatic table creation, a **cdc_partition_key** field is created in the Hudi table by default. The system formats the value of the source field (**src_col_1**) based on the configured time conversion format and writes the value to **cdc_partition_key**.

    - Custom partitions do not support timestamp fields. If you use timestamp fields, the job will fail.

  - Customize table attributes. Some advanced functions of a single table can be configured using parameters. For details about the parameters, see the table that lists Hudi advanced configurations.

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- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination Hudi table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination Hudi table
  - **Field Type**: Type of the new field in the destination Hudi table
  - **Field Value**: Value source of the new field in the destination Hudi table

  Table 7-125 Additional field value obtaining mode

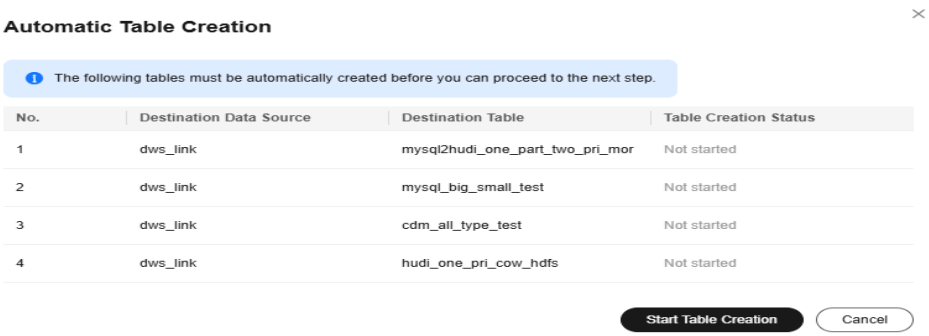
Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.
Built-in variable	▪ Source host IP address: source.host ▪ Source schema name: source.schema ▪ Source table name: source.table ▪ Destination schema name: target.schema ▪ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.

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Type	Example
UDF	▪ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ▪ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ▪ now([tz]): obtains the current time in a specified time zone. ▪ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ▪ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ▪ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ▪ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

Figure 7-231 Automatic table creation



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NOTE

- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.
- An automatically created Hudi table contains three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi table.

Step 8 Configure task parameters.

Table 7-126 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Adding custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	N/A

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-232 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

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Figure 7-233 Starting the job

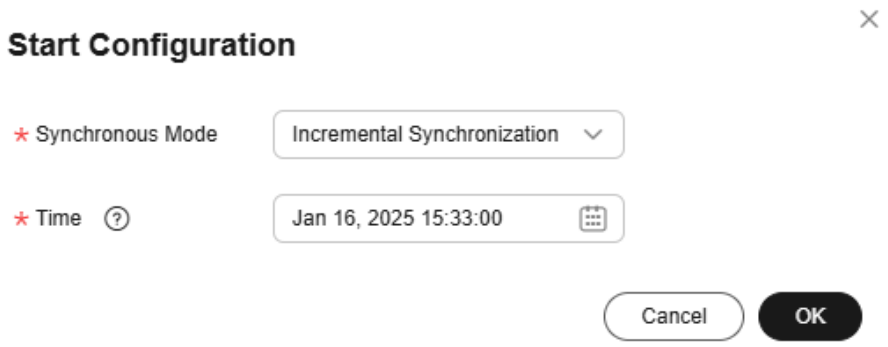


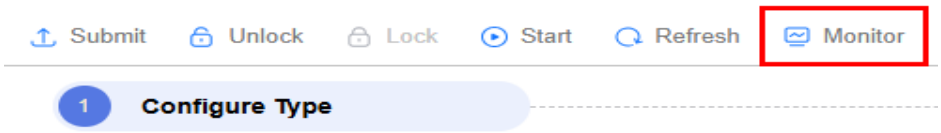
Table 7-127 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest CDC log time, the latest log time is used.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-234 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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7.11.10 Configuring a Job for Synchronizing Data from SQL Server to GaussDB(DWS)

Supported Source and Destination Database Versions

Table 7-128 Supported database versions

Source Database	Destination Database
SQL Server database (Enterprise Edition 2016, 2017, 2019, and 2022; Standard Edition 2016 SP2 and later, 2017, 2019, and 2022)	GaussDB(DWS) cluster of version 8.1.3, 8.2.0, or a later version, except GaussDB(DWS) 3.0

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

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Table 7-129 Database account permissions

Type	Required Permissions

Source database connection account	sysadmin or view server state permissions, and db_datareader or db_owner permissions of the database to be synchronized
	• Enable CDC for a database and a table.
	1. Enable CDC for a database.
	`USE YourDatabaseName;`
	`EXEC sys.sp_cdc_enable_db;`
	`-- Check whether CDC is enabled for a database.`
	`SELECT is_cdc_enabled, name FROM sys.databases WHERE name = 'YourDatabaseName'`
	2. Enable CDC for a table.
	`EXEC sys.sp_cdc_enable_table`
	`@source_schema = N'dbo', -- Schema`
	`@source_name = N'YourTable',-- Table name`
	`@role_name = NULL,-- (Optional) CDC access role name`
	`@supports_net_changes = 0;`
	`-- Check whether CDC is enabled for the table.`
	`SELECT name,is_tracked_by_cdc FROM sys.tables WHERE name = 'YourTable';`
	• The following permissions for the SQL Server must be granted to the user configured in the data connection:
	– Grant the CONNECT and VIEW DATABASE STATE permissions to the user.
	`USE YourDatabaseName;`
	`GRANT CONNECT, VIEW DATABASE STATE TO [YourUserName];`
	– Grant the SELECT permissions on the CDC schema to the user.
	`USE YourDatabaseName;`
	`GRANT SELECT ON SCHEMA::[cdc] TO [YourUserName];`
	– Grant the SELECT permissions on the table to the user.
	`USE YourDatabaseName;`
	`GRANT SELECT ON OBJECT::[YourSchema].[YourTable] TO [YourUserName];`

Destination database connection account	The account must have the following permissions for each table in the destination database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

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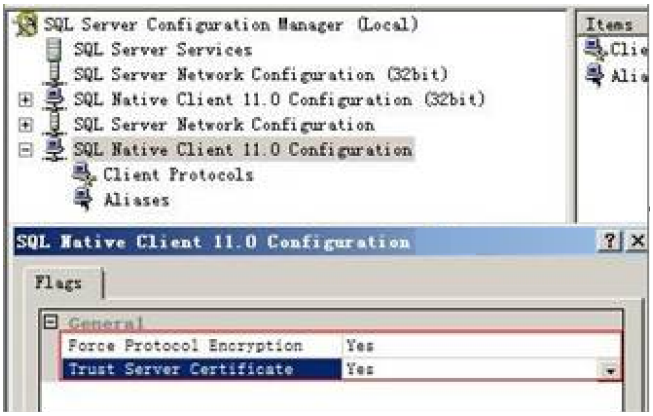
Table 7-130 Synchronization objects

Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Transparent Data Encryption (TDE) encrypted databases in the source instance cannot be synchronized. • Column encryption is not supported. • Auto-increment columns cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-131 Important notes

Type	Restriction
Database	• The names of the destination databases, tables, and fields can only contain digits, letters, and underscores (_). Field names must start with a letter or an underscore (). You are advised to use common characters in names. • If **Force Protocol Encryption** is set to **Yes** for the source database, **Trust Server Certificate** also must be set to **Yes**. **Figure 7-235** Client configuration 

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Type	Restriction
Usage	General: During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: ● DML operations INSERT, UPDATE, and DELETE can be synchronized. ● DDL operations performed on the source database will not be synchronized to the destination database. ● The IMAGE, TEXT, and NTEXT big data types cannot be deleted. ● Tables in a job cannot be modified during synchronization. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	● Tables in the source database can contain more or less columns than those in the destination database. However, task failures may occur in the following scenarios: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. ● Do not perform primary/standby switchover on the source database. Otherwise, the synchronization task will fail. ● Source Microsoft SQL Server databases using TLS 1.0 or TLS 1.1 cannot be synchronized. To enable synchronization of such databases, you are advised to upgrade the protocol used by the databases to TLS 1.2 or later. ● The **block_size** value of the destination database must be greater than that of the source database. ● During automatic table creation, the length of the char, varchar, and nvarchar characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database.

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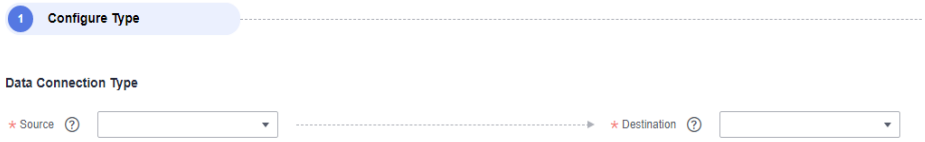
Procedure

This section uses real-time synchronization from Microsoft SQL Server to GaussDB(DWS) as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

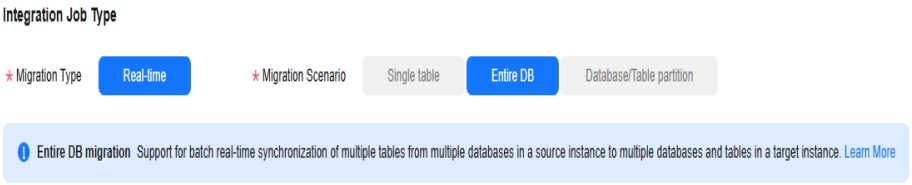
Step 2 Select the data connection type. Select **SQLServer** for **Source** and **DWS** for **Destination**.

Figure 7-236 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

Figure 7-237 Setting the migration job type

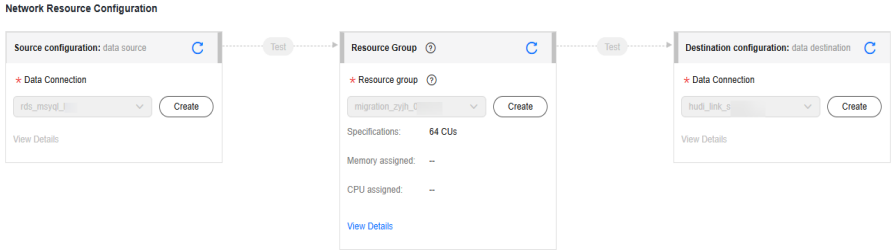


NOTE

For details about synchronization scenarios, see **Synchronized Scenarios**.

Step 4 Configure network resources. Select the created SQL Server and GaussDB(DWS) data connections and the migration resource group for which the network connection has been configured.

Figure 7-238 Selecting data connections and a migration resource group



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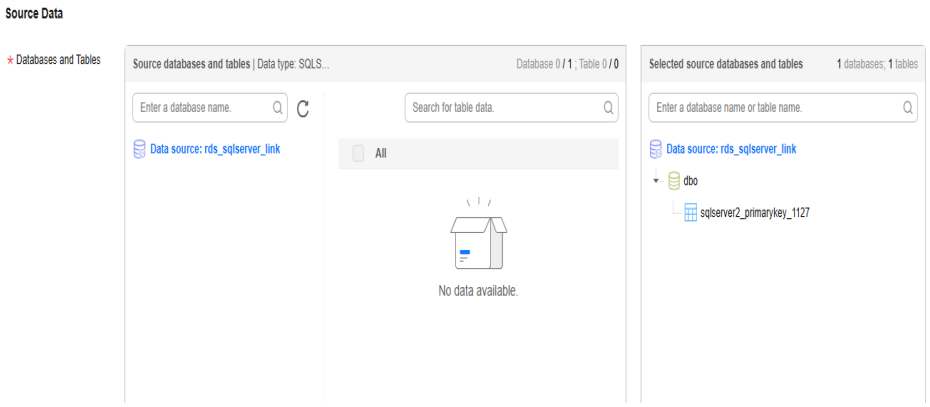
NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the SQL Server databases and tables to be migrated.

Figure 7-239 Selecting databases and tables



Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

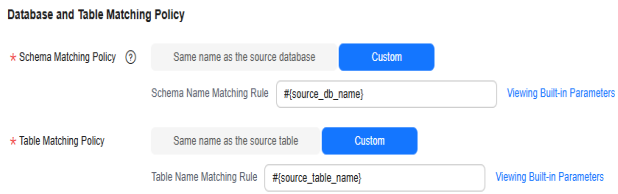
Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

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Table 7-132 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Schema Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the GaussDB(DWS) schema with the same name as the source SQL Server database. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) schema you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the GaussDB(DWS) table with the same name as the source SQL Server table. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) table you specify. **Figure 7-240** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

- Configure GaussDB(DWS) parameters.
  For details, see the following table.

  Figure 7-241 GaussDB(DWS) parameters

Table 7-133 GaussDB(DWS) parameters

Parameter	Default Value	Unit	Description
Write Mode	UPSERT	N/A	– **UPSERT MODE**: batch update – **COPY MODE**: DWS-dedicated high-performance batch import
Maximum Data Volume for Batch Write	50000	Count	Number of data records written to GaussDB(DWS) in a batch. You can adjust the value based on the table data size and job memory usage.
Scheduled Batch Write Interval	3	Second	Interval at which data is written to GaussDB(DWS)
Advanced Settings	N/A	N/A	Some advanced functions can be configured using parameters. For details, see GaussDB(DWS) advanced parameters.

Table 7-134 GaussDB(DWS) advanced parameters

Parameter	Type	Default Value	Unit	Description
sink.buffer-flush.max-size	int	512	MB	Maximum number of bytes in each batch of data written to GaussDB(DWS). You can adjust the value based on the memory and data size configured for the job.
sink.keyby.enable	boolean	true	N/A	Whether to enable data distribution. If this function is enabled in multi-concurrency scenarios, data can be distributed to different processes based on specific rules and written to the destination, which improves the write performance.

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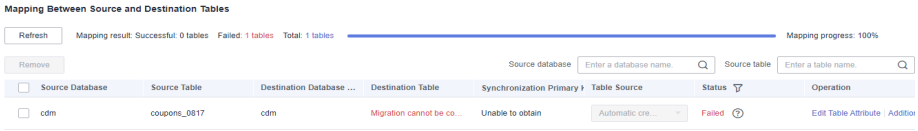
Parameter	Type	DefaultValue	Unit	Description
sink.keyby.mode	string	table	N/A	Data distribution mode. The following modes are available: – **pk**: Data is distributed by primary key value. – **table**: Data is distributed by table name. **NOTE** ■ In multi-concurrency scenarios, if DDL is enabled, data can be distributed only by table name. Otherwise, data may be inconsistent. ■ If there is no DDL, you can select **pk**, which improves the write performance in multi-concurrency scenarios.
sink.field.name.case-sensitive	boolean	true	N/A	Whether to enable case sensitivity for data synchronization. If this function is enabled, the database names, table names, and field names are case sensitive during data synchronization.
sink.verify.column-number	boolean	false	N/A	Whether to verify the number of data columns. By default, the link synchronizes data in the same-name mapping mode. The system does not check whether all columns are synchronized. If this function is enabled and the number of columns at the source is different from that at the destination, the system determines that data is inconsistent. As a result, the job is abnormal.
sink.server.timezone	string	Localtimezone	N/A	Session time zone specified for connecting to the destination database. The standard time zone format is supported, for example, UTC +08:00.
logical.delete.enabled	boolean	false	N/A	Whether to enable logical deletion

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Parameter	Type	Default Value	Unit	Description
logical.delete.column	string	logical_is_deleted	N/A	Name of the logical deletion column. The default value is **logical_is_deleted**. You can customize the value.

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination GaussDB(DWS) database.

Figure 7-242 Mapping between source and destination tables



- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination GaussDB(DWS) table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination GaussDB(DWS) table
  - **Field Type**: type of the new field in the destination GaussDB(DWS) table
  - **Field Value**: Value source of the new field in the destination GaussDB(DWS) table

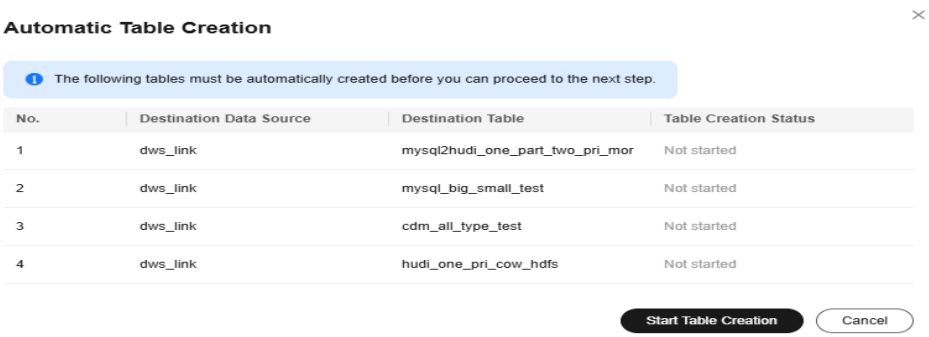
  Table 7-135 Additional field value obtaining mode

Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

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Figure 7-243 Automatic table creation



NOTE

- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.

Step 8 Configure task parameters.

Table 7-136 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Adding custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	N/A

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-244 Submitting the job



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After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-245 Starting the job

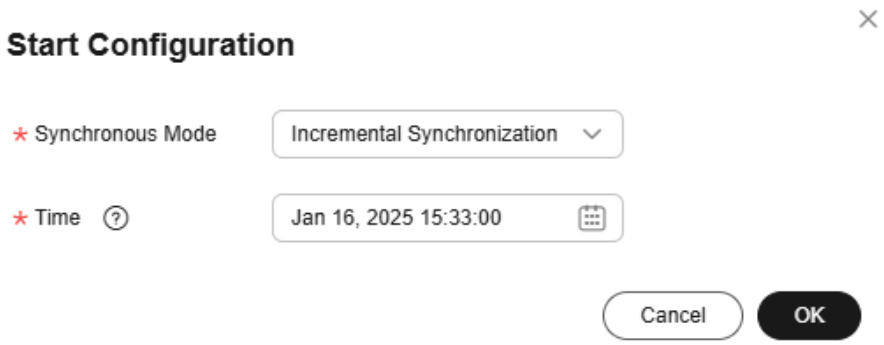


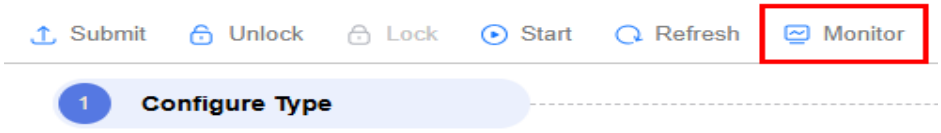
Table 7-137 Parameters for starting the job

Parameter	Description
Synchronous Mode	• **Incremental Synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest CDC log time, the latest log time is used.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-246 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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7.11.11 Configuring a Job for Synchronizing Data from PostgreSQL to GaussDB(DWS)

Supported Source and Destination Database Versions

Table 7-138 Supported database versions

Source Database	Destination Database
PostgreSQL database of version 9.4, 9.5, 9.6, 10, 11, 12, 13, 14, 15, or 16	GaussDB(DWS) cluster of version 8.1.3, 8.2.0, or a later version, except GaussDB(DWS) 3.0

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-139 Database account permissions

Type	Required Permissions
Source database account	• Database CONNECT permission, schema USAGE permission, table SELECT permission, sequence SELECT permission, and REPLICATION connection permission **NOTE** To add the permission to create replication connections, perform the following steps: • Add **host replication <src_user_name> <drs_instance_ip>/32** *<Authentication mode>* before all configurations in the **pg_hba.conf** file of the source database. For details about the authentication mode, see **pg_hba.conf**. Common authentication modes include scram-sha-256. • Run **select pg_reload_conf();** in the source database as user SUPERUSER, or restart the DB instance to apply the changes. • If PostgreSQL is the source and Hudi is the destination, you need to change the replica identity of source tables to FULL using DDL, for example, **alter table table_name REPLICA IDENTITY FULL**. Otherwise, the **logical.delete.enabled=false** configuration of Hudi does not take effect.
Destination database account	The destination database account must have the following permissions for each table in the database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

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NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-140 Synchronization objects

Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

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Table 7-141 Important notes

Type	Restriction
Database	• The database name cannot contain +"%'\<>. The schema name and table name cannot contain "."<>. The column name cannot contain " or '. The column name cannot be CTID, XMIN, CMIN, XMAX, CMAX, TABLEOID, XC_NODE_ID, TID, or any other field forbidden by GaussDB(DWS). You are advised to use common characters to avoid task failures. • The name of an object in the destination database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($). • The partition table trigger of the source database cannot be set to **disable**. • If incremental synchronization is required, the **pg_hba.conf** file of the source database contains the following configuration: `host replication all 0.0.0.0/0 md5`
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The WAL logs of the PostgreSQL database should be retained for more than three days. • Source tables must be published in dbz_publiction. Use "select * from pg_publication_tables;" to query the PUBLICATION of all tables and use "ALTER PUBLICATION name ADD TABLE [ONLY] table_name [*] [, ...]" to add the tables to the publish list. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: • Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. • Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. • When the number of replication slots of the PostgreSQL data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting max_replication_slots or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• The **block_size** value of the destination database must be greater than that of the source database. • Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. • After the job is started, the active/standby switchover is not allowed for the source database. • Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • During automatic table creation, the length of the char, varchar, nvarchar, enum, and set characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database.

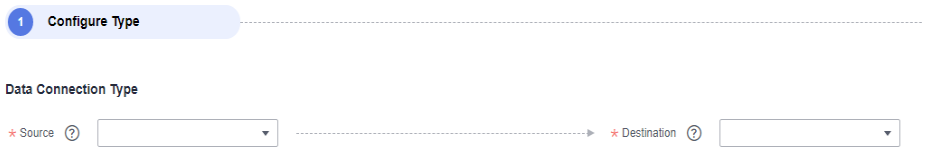
Procedure

This section uses real-time synchronization from PostgreSQL to GaussDB(DWS) as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **PostgreSQL** for **Source** and **DWS** for **Destination**.

Figure 7-247 Selecting the data connection type



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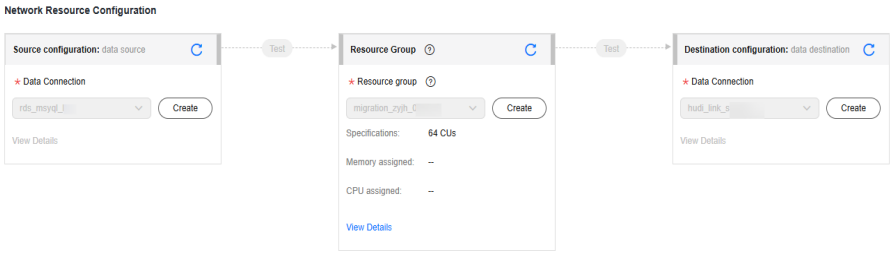
Step 3 Select a job type. The default migration type is **Real-time**. The migration scenarios include **Entire DB** and **Database/Table partition**.

NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created PostgreSQL and GaussDB(DWS) data connections and the migration resource group for which the network connection has been configured.

Figure 7-248 Selecting data connections and a migration resource group



NOTE

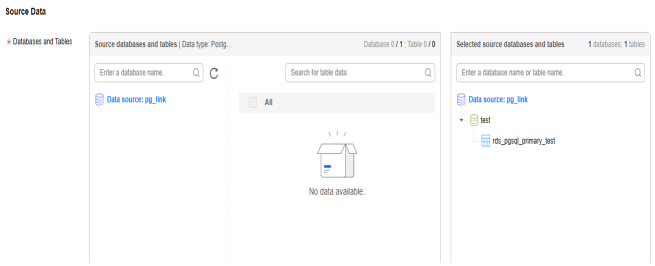
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

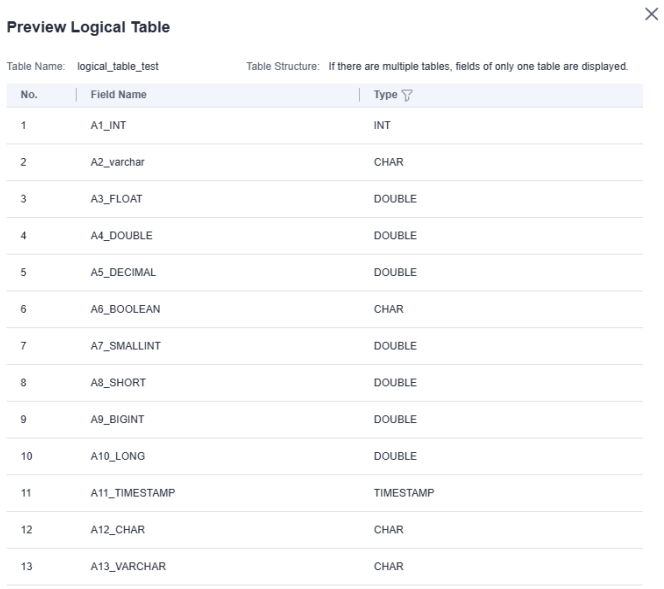
Select the databases and tables to be synchronized based on the following table.

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Table 7-142 Selecting the Kafka topics to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the PostgreSQL databases and tables to be migrated. **Figure 7-249** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

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Synchronization Scenario	Configuration Method
Database/Table shard	Add a logical table. • **Logical Table Name**: Enter the name of the table to be written to DWS. • **Source Database Filter**: You can enter a regular expression to filter all the database shards in the PostgreSQL instance to be written to the destination GaussDB(DWS) aggregation table. • **Source Table Filter**: You can enter a regular expression to filter all the table shards in the source database shard to be written to the destination GaussDB(DWS) aggregation table. **Figure 7-250** Adding a logical table  You can click **Preview** in the **Operation** column to preview an added logical table. When you preview a logical table, the more the source tables, the longer the waiting time. **Figure 7-251** Previewing the logical table 

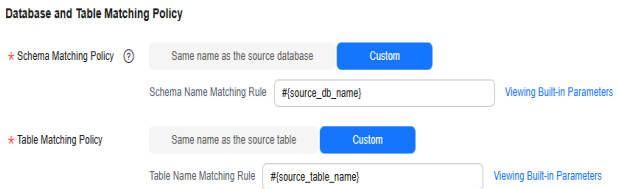
Step 6 Configure destination parameters.

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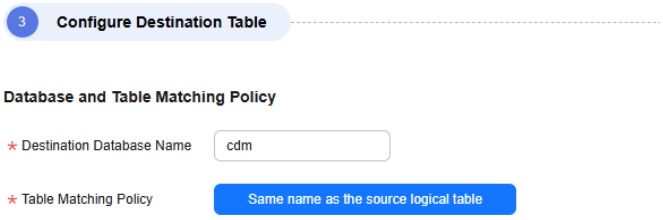
- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

  Table 7-143 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Schema Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the GaussDB(DWS) schema with the same name as the source PostgreSQL database. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) schema you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the GaussDB(DWS) table with the same name as the source PostgreSQL table. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) table you specify. **Figure 7-252** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

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Synchronization Scenario	Configuration Method
Database/ Table shard	– **Destination Database Name**: Data will be synchronized to the specified GaussDB(DWS) schema. – **Table Matching Policy**: By default, the value is the same as the name of the logical table entered in the source configuration. **Figure 7-253** Database and table matching policy in the sharding scenario 

- Configure GaussDB(DWS) parameters.

  For details, see the following table.

  Figure 7-254 GaussDB(DWS) parameters

  Table 7-144 GaussDB(DWS) parameters

Parameter	Default Value	Unit	Description
Write Mode	UPSERT	N/A	– **UPSERT MODE**: batch update – **COPY MODE**: DWS-dedicated high-performance batch import
Maximum Data Volume for Batch Write	50000	Count	Number of data records written to GaussDB(DWS) in a batch. You can adjust the value based on the table data size and job memory usage.
Scheduled Batch Write Interval	3	Second	Interval at which data is written to GaussDB(DWS)

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Parameter	Default Value	Unit	Description
Advanced Settings	N/A	N/A	Some advanced functions can be configured using parameters. For details, see GaussDB(DWS) advanced parameters.

Table 7-145 GaussDB(DWS) advanced parameters

Parameter	Type	Default Value	Unit	Description
sink.buffer-flush.max-size	int	512	MB	Maximum number of bytes in each batch of data written to GaussDB(DWS). You can adjust the value based on the memory and data size configured for the job.
sink.keyby.enable	boolean	true	N/A	Whether to enable data distribution. If this function is enabled in multi-concurrency scenarios, data can be distributed to different processes based on specific rules and written to the destination, which improves the write performance.
sink.keyby.mode	string	table	N/A	Data distribution mode. The following modes are available: – **pk**: Data is distributed by primary key value. – **table**: Data is distributed by table name. **NOTE** ■ In multi-concurrency scenarios, if DDL is enabled, data can be distributed only by table name. Otherwise, data may be inconsistent. ■ If there is no DDL, you can select **pk**, which improves the write performance in multi-concurrency scenarios.
sink.field.name.case-sensitive	boolean	true	N/A	Whether to enable case sensitivity for data synchronization. If this function is enabled, the database names, table names, and field names are case sensitive during data synchronization.

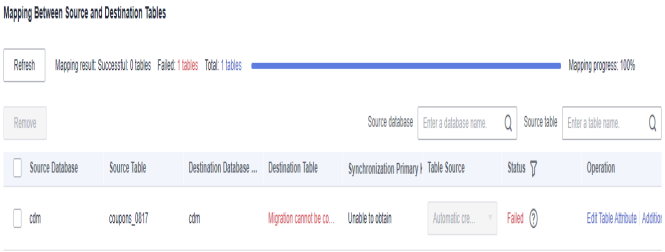
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Parameter	Type	DefaultValue	Unit	Description
sink.verify.column-number	boolean	false	N/A	Whether to verify the number of data columns. By default, the link synchronizes data in the same-name mapping mode. The system does not check whether all columns are synchronized. If this function is enabled and the number of columns at the source is different from that at the destination, the system determines that data is inconsistent. As a result, the job is abnormal.
sink.server.timezone	string	Local timezone	N/A	Session time zone specified for connecting to the destination database. The standard time zone format is supported, for example, UTC +08:00.
logical.delete.enabled	boolean	false	N/A	Whether to enable logical deletion
logical.delete.column	string	logical_is_deleted	N/A	Name of the logical deletion column. The default value is **logical_is_deleted**. You can customize the value.

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination GaussDB(DWS) database.

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Figure 7-255 Mapping between source and destination tables



- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination GaussDB(DWS) table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination GaussDB(DWS) table
  - **Field Type**: type of the new field in the destination GaussDB(DWS) table
  - (Optional) **Field Type Length**: length of the new field type in the destination GaussDB(DWS) table
  - **Field Value**: Value source of the new field in the destination GaussDB(DWS) table

    Table 7-146 Additional field value obtaining mode

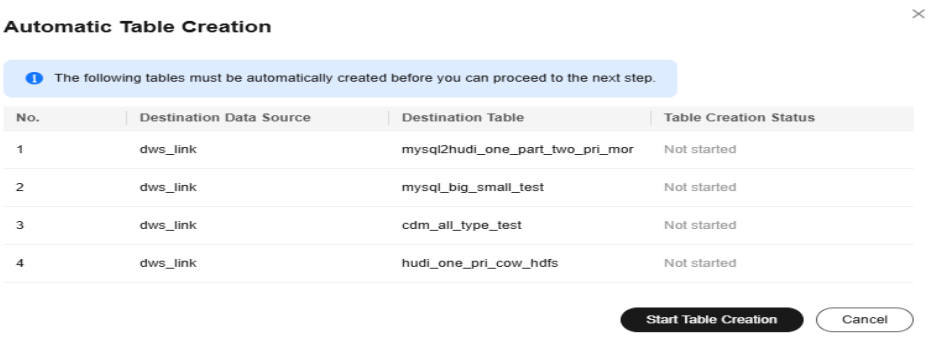
Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.
Built-in variable	■ Source host IP address: source.host ■ Source schema name: source.schema ■ Source table name: source.table ■ Destination schema name: target.schema ■ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.

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Type	Example
UDF	■ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ■ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ■ now([tz]): obtains the current time in a specified time zone. ■ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ■ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ■ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ■ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

Figure 7-256 Automatic table creation



NOTE

- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.

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Step 8 Configure task parameters.

Table 7-147 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

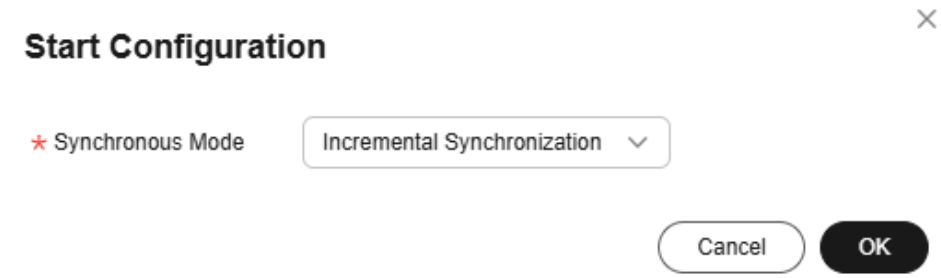
After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-257 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-258 Starting the job



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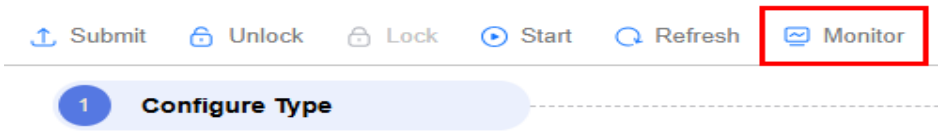
Table 7-148 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-259 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.12 Configuring a Job for Synchronizing Data from PostgreSQL to MRS Hudi

Supported Source and Destination Database Versions

Table 7-149 Supported database versions

Source Database	Destination Database
PostgreSQL database of version 9.4, 9.5, 9.6, 10, 11, 12, 13, 14, 15, or 16	MRS cluster (3.2.0-LTS.*x* and 3.5.*x*) Hudi (0.11.0)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

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Table 7-150 Database account permissions

Type	Required Permissions
Source database account	• Database CONNECT permission, schema USAGE permission, table SELECT permission, sequence SELECT permission, and REPLICATION connection permission **NOTE** To add the permission to create replication connections, perform the following steps: • Add **host replication <src_user_name> <drs_instance_ip>/32** *<Authentication mode>* before all configurations in the **pg_hba.conf** file of the source database. For details about the authentication mode, see **pg_hba.conf**. Common authentication modes include scram-sha-256. • Run **select pg_reload_conf();** in the source database as user SUPERUSER, or restart the DB instance to apply the changes. • If PostgreSQL is the source and Hudi is the destination, you need to change the replica identity of source tables to FULL using DDL, for example, **alter table table_name REPLICA IDENTITY FULL**. Otherwise, the **logical.delete.enabled=false** configuration of Hudi does not take effect.
Destination database account	The destination database account must have the following permissions for each table in the database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

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Table 7-151 Synchronization objects

Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-152 Important notes

Type	Restriction
Database	• The names of the destination databases, tables, and fields can only contain digits, letters, and underscores (_). Field names must start with a letter or an underscore (). You are advised to use common characters in names. • The partition table trigger of the source database cannot be set to **disable**. • If incremental synchronization is required, the **pg_hba.conf** file of the source database contains the following configuration: `host replication all 0.0.0.0/0 md5`

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Type	Restriction
Usage	General: ● During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. ● The WAL logs of the PostgreSQL database should be retained for more than three days. ● Source tables must be published in dbz_publiction. Use "select * from pg_publication_tables;" to query the PUBLICATION of all tables and use "ALTER PUBLICATION name ADD TABLE [ONLY] table_name [*] [, ...]" to add the tables to the publish list. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: ● Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. ● Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. ● When the number of replication slots of the PostgreSQL data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting max_replication_slots or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	● Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. ● After the job is started, the active/standby switchover is not allowed for the source database. ● Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail.

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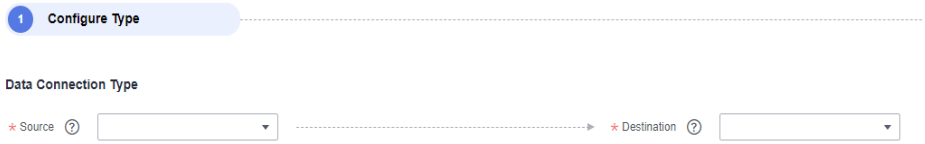
Procedure

This section uses real-time synchronization from PostgreSQL to Hudi as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **PostgreSQL** for **Source** and **Hudi** for **Destination**.

Figure 7-260 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

Figure 7-261 Setting the migration job type

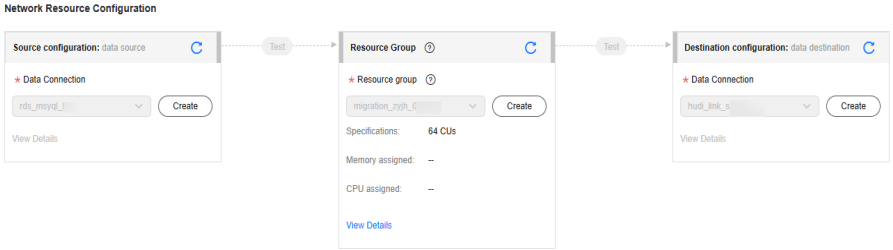


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created PostgreSQL and Hudi data connections and the migration resource group for which the network connection has been configured.

Figure 7-262 Selecting data connections and a migration resource group



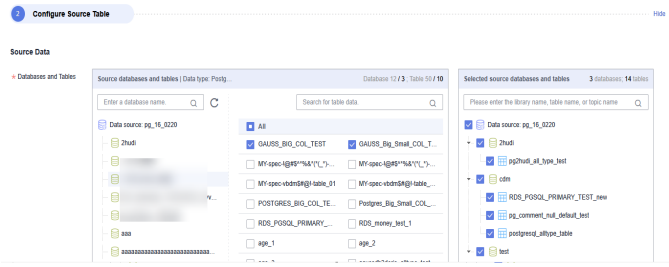
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> **NOTE**
>
> If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

Table 7-153 Selecting the databases and tables to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the PostgreSQL databases and tables to be migrated. **Figure 7-263** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

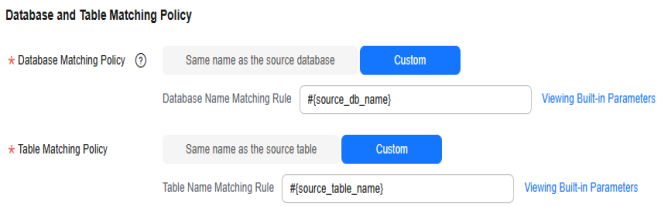
Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

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Table 7-154 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Database Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the Hudi database with the same name as the source PostgreSQL database. ▪ **Custom**: Data will be synchronized to the Hudi database you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the Hudi table with the same name as the source PostgreSQL database. ▪ **Custom**: Data will be synchronized to the Hudi table you specify. **Figure 7-264** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

- Set Hudi parameters.

  For details, see the following table.

  Figure 7-265 Hudi destination parameters

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Table 7-155 Hudi destination parameters

Parameter	Default Value	Unit	Description
Data Storage Path	N/A	N/A	Warehouse path when tables are automatically created in Hudi. A subdirectory is created in the warehouse path for each table. You can enter an HDFS or OBS path. The path format is as follows: – OBS path: obs://bucket/warehouse – HDFS path: /tmp/warehouse
Global Configuration of Hudi Table Attributes	N/A	N/A	Some advanced functions can be configured using parameters. For details, see Hudi advanced parameters.

Table 7-156 Hudi advanced parameters

Parameter	Type	Default Value	Unit	Description
index.type	string	BLOOM	N/A	Index type of the Hudi table BLOOM and BUCKET indexes are supported. If a large amount of data need to be migrated, BUCKET indexes are recommended for better performance.

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Parameter	Type	Default Value	Unit	Description
hoodie.bucket.index.num.buckets	int	256	Count	Number of buckets within a Hudi table partition **NOTE** When using Hudi BUCKET tables, you need to set the number of buckets for a table partition. The number of buckets affects the table performance. – Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4) – Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1) Pay attention to the following: – The total data volume of a table, instead of the compressed size, is used. – An even number of buckets is recommended. The minimum number of buckets should be 4 for a non-partitioned table and 1 for a partitioned table.
changelog.enabled	boolean	false	N/A	Whether to enable the Hudi ChangeLog function. If this function is enabled, the migration job can output DELETE and UPDATE BEFORE data.
logical.delete.enabled	boolean	true	N/A	Whether to enable logical deletion. If the ChangeLog function is enabled, logical deletion must be disabled.
hoodie.write.liststatus.optimized	boolean	true	N/A	Whether to enable liststatus optimization when log files are written. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.

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Parameter	Type	DefaultValue	Unit	Description
hoodie.index.liststatus.optimized	boolean	false	N/A	Whether to enable liststatus optimization during data locating. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.
compaction.async.enabled	boolean	true	N/A	Whether to enable asynchronous compaction. The compaction operation affects the writing performance of real-time jobs. If you use an external compaction operation, you can set this parameter to **false** to disable compaction for real-time processing migration jobs.
compaction.schedule.enabled	boolean	true	N/A	Whether to generate compaction plans. Compaction plans must be generated by this service and can be executed by Spark.
compaction.delta_commits	int	5	Count	Compaction request generation frequency Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If there is a small volume of incremental data to be synchronized to Hudi, you can set a larger value for this parameter. **NOTE** For example, if this parameter is set to **40**, a compaction request is generated for every 40 commits. Since DataArts Migration generates a commit every minute, the interval between compaction requests is 40 minutes.
clean.async.enabled	boolean	true	N/A	Whether to clear data files of historical versions

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Parameter	Type	Default Value	Unit	Description
clean.retain_commits	int	30	Count	Number of commits to retain Data files related to these commits will be retained for a period calculated by multiplying the number of specified commits by the interval between commits. You are advised to set this parameter to twice the value of **compaction.delta_commits**. **NOTE** For example, if this parameter is set to **80** and since DataArts Migration generates a commit every minute, data files related to commits generated 80 minutes earlier are cleaned, and data files related to the recent 80 commits are retained.
hoodie.archive.automatic	boolean	true	N/A	Whether to age Hudi commit files
archive.min_commits	int	40	Count	Number of recent commits to keep when historical commits are archived to log files You are advised to set this parameter to one greater than **clean.retain_commits**. **NOTE** For example, if this parameter is set to **81**, the files related to the recent 81 commits are retained when an archive operation is triggered.
archive.max_commits	int	50	Count	Number of commits that triggers an archive operation You are advised to set this parameter to 20 greater than **archive.min_commits**. **NOTE** For example, if the parameter is set to **101**, an archive operation is triggered when the files of 101 commits are generated.

NOTE

- To achieve optimal performance for the migration job, you are advised to use an MOR table that uses Hudi BUCKET indexes and configure the number of buckets based on the actual data volume.
- To ensure the stability of the migration job, you are advised to split the Hudi Compaction job into Spark jobs and execute them by MRS, and enable compaction plans to be generated for this migration job. For details, see

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Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination Hudi database.

Figure 7-266 Mapping between source and destination tables



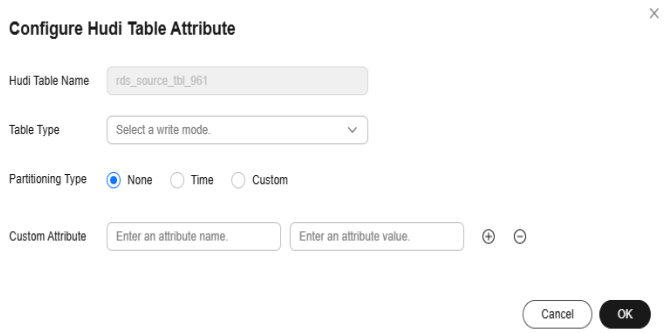
- **Synchronization Primary Key**

  A synchronization primary key must be set for a Hudi table. If the source table has no primary key, table mapping will fail.

- **Edit Table Attribute**

  Click **Edit Table Attributes** in the **Operation** column to configure Hudi table attributes, including the table type, partition type, and custom attributes.

  Figure 7-267 Configuring the Hudi table attributes

  - **Table Type**: Hudi table type. Select **MERGE_ON_READ** or **COPY_ON_WRITE**.
  - **Partition Type**: partition type of the Hudi table. Select **No partition**, **Time**, or **Custom**.

    NOTE

    - For **Time**, you need to specify a source field name and select a time conversion format.

      For example, you can specify the source field name **src_col_1** and select a time conversion format, for example, day(yyyyMMdd), month(yyyyMM), or year(yyyy). During automatic table creation, a **cdc_partition_key** field is created in the Hudi table by default. The system formats the value of the source field (**src_col_1**) based on the configured time conversion format and writes the value to **cdc_partition_key**.

    - Custom partitions do not support timestamp fields. If you use timestamp fields, the job will fail.

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  - Customize table attributes. Some advanced functions of a single table can be configured using parameters. For details about the parameters, see the table that lists Hudi advanced configurations.

- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination Hudi table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination Hudi table
  - **Field Type**: Type of the new field in the destination Hudi table
  - **Field Value**: Value source of the new field in the destination Hudi table

    Table 7-157 Additional field value obtaining mode

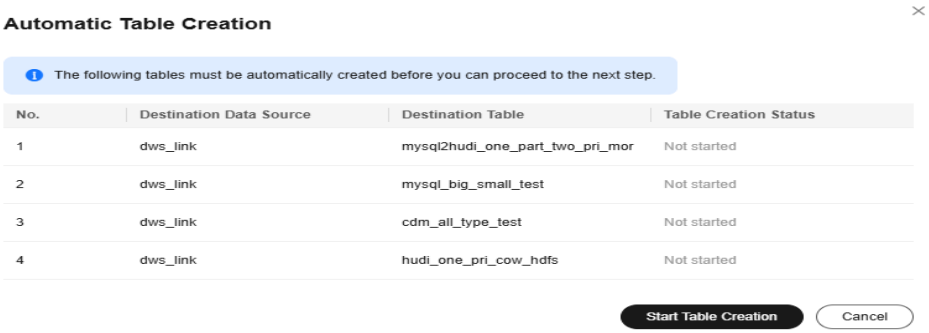
Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.
Built-in variable	▪ Source host IP address: source.host ▪ Source schema name: source.schema ▪ Source table name: source.table ▪ Destination schema name: target.schema ▪ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.

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Type	Example
UDF	▪ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ▪ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ▪ now([tz]): obtains the current time in a specified time zone. ▪ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ▪ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ▪ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ▪ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

Figure 7-268 Automatic table creation



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NOTE

- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.
- An automatically created Hudi table contains three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi table.

Step 8 Configure task parameters.

Table 7-158 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-269 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

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Figure 7-270 Starting the job

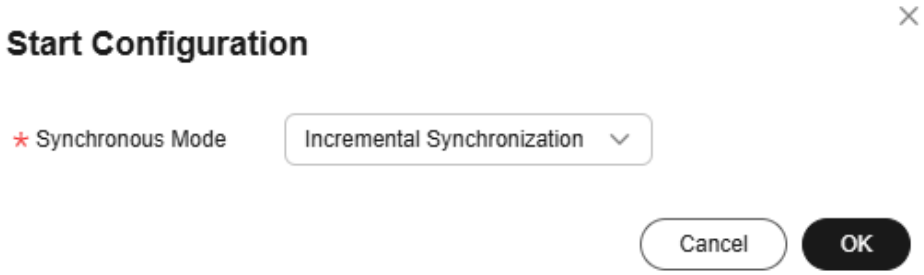


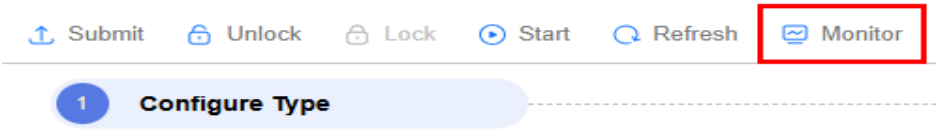
Table 7-159 Parameters for starting the job

Parameter	Description
Synchronous Mode	• **Incremental Synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-271 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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7.11.13 Configuring a Job for Synchronizing Data from PostgreSQL to

Supported Source and Destination Database Versions

Table 7-160 Supported database versions

Source Database	Destination Database
PostgreSQL database of version 9.4, 9.5, 9.6, 10, 11, 12, 13, 14, 15, or 16	Kafka cluster (2.7 and 3.*x*)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-161 Database account permissions

Type	Required Permissions
Source database connection account	Database CONNECT permission, schema USAGE permission, table SELECT permission, sequence SELECT permission, and REPLICATION connection permission **NOTE** To add the permission to create replication connections, perform the following steps: • Add **host replication <src_user_name> <drs_instance_ip>/32** *<Authentication mode>* before all configurations in the **pg_hba.conf** file of the source database. For details about the authentication mode, see **pg_hba.conf**. Common authentication modes include scram-sha-256. • Run **select pg_reload_conf();** in the source database as user SUPERUSER, or restart the DB instance to apply the changes.
Destination database connection account	The MRS user must have the read and write permissions on corresponding Kafka topics, that is, the user must belong to the kafka/kafkaadmin/kafkasuperuser user group. **NOTE** A common Kafka user can access a topic only after being granted the read and write permissions on the topic by the Kafka administrator.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

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Table 7-162 Synchronization objects

Type	Note
Synchronization objects	• DML and DDL can be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-163 Important notes

Type	Restriction
Database	• The database name cannot contain +"%'\<>. The schema name and table name cannot contain ".'<>. The column name cannot contain " or '. The column name cannot be CTID, XMIN, CMIN, XMAX, CMAX, TABLEOID, XC_NODE_ID, TID, or any other field forbidden by GaussDB(DWS). You are advised to use common characters to avoid task failures. • The name of an object in the destination database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($). • The partition table trigger of the source database cannot be set to **disable**. • If incremental synchronization is required, the **pg_hba.conf** file of the source database contains the following configuration: `host replication all 0.0.0.0/0 md5`

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The WAL logs of the PostgreSQL database should be retained for more than three days. • Source tables must be published in dbz_publiction. Use "select * from pg_publication_tables;" to query the PUBLICATION of all tables and use "ALTER PUBLICATION name ADD TABLE [ONLY] table_name [*] [, ...]" to add the tables to the publish list. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: • Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. • Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. • When the number of replication slots of the PostgreSQL data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting max_replication_slots or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	• Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. • After the job is started, the active/standby switchover is not allowed for the source database.

Procedure

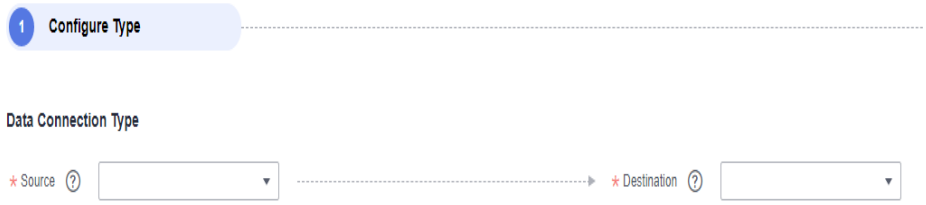
This section uses real-time synchronization from PostgreSQL to MRS Kafka as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

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Step 2 Select the data connection type. Select **PostgreSQL** for **Source** and **MRS Kafka** for **Destination**.

Figure 7-272 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

Figure 7-273 Setting the migration job type

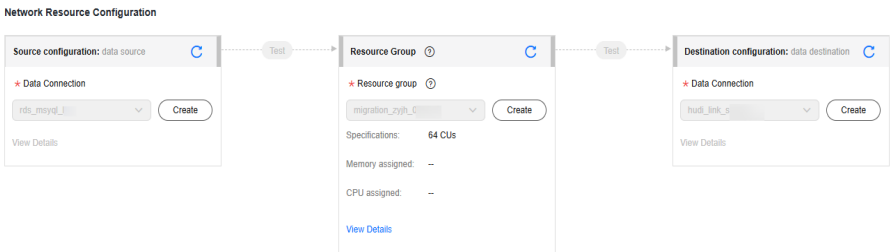


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created PostgreSQL and MRS Kafka data connections and the migration resource group for which the network connection has been configured.

Figure 7-274 Selecting data connections and a migration resource group



NOTE

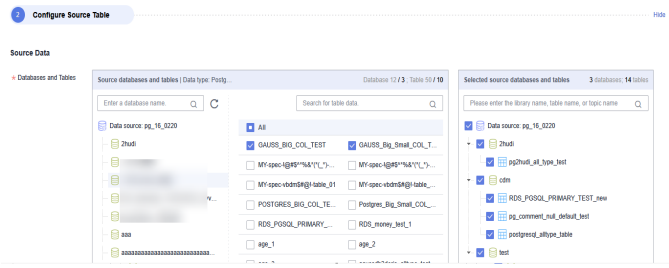
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

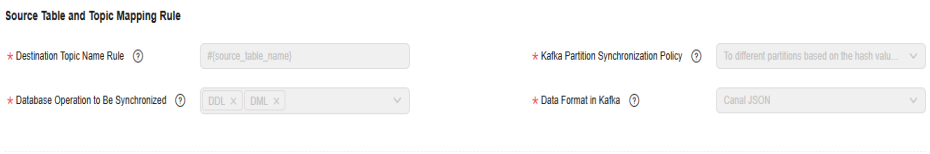
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Table 7-164 Selecting the databases and tables to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the PostgreSQL databases and tables to be migrated. **Figure 7-275** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

Step 6 Configure destination parameters.

Figure 7-276 Kafka destination parameters



- **Destination Topic Name Rule**

  Configure the rule for mapping source database tables to destination Kafka topics. You can specify a fixed topic or use built-in variables to synchronize data from source tables to destination topics.

  The following built-in variables are available:

  - Source database name: **#{source_db_name}**
  - Source table name: **#{source_table_name}**

- **Kafka Partition Synchronization Policy**

  The following three policies are available for synchronizing source data to specified partitions of destination Kafka topics:

  - **To Partition 0**
  - **To different partitions based on the hash values of database names/table names**
  - **To different partitions based on the hash values of table primary keys**

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> **NOTE**
>
> If the source has no primary key, data is synchronized to partition 0 at the destination by default.

- Partitions of New Topic

  If the destination Kafka does not have the corresponding topic, the topic automatically created by DataArts Migration has three partitions.

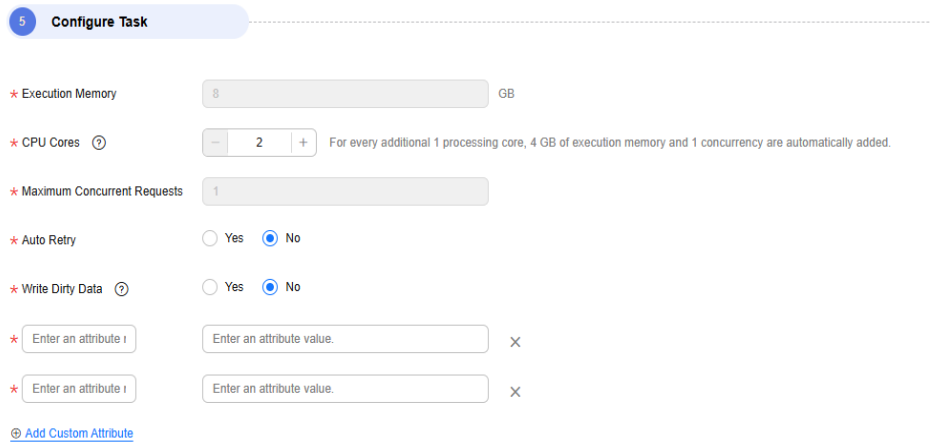
- **Destination Kafka Attributes**

  You can set Kafka attributes and add the **properties.** prefix. The job will automatically remove the prefix and transfer the attributes to the Kafka client. For details about the parameters, see the configuration descriptions in the **Kafka documentation**.

- Advanced settings

  You can add custom attributes in the **Configure Task** area to enable some advanced functions. For details about the parameters, see the following table.

Figure 7-277 Adding custom attributes



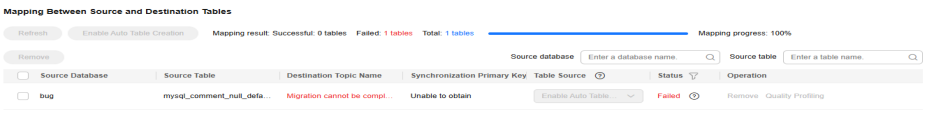
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Table 7-165 Advanced parameters of the job for migrating data from PostgreSQL to Kafka

Parameter	Type	Default Value	Unit	Description
sink.delivery-guarantee	string	at-least-once	N/A	Semantic assurance when Flink writes data to Kafka – **at-least-once**: At a checkpoint, the system waits for all data in the Kafka buffer to be confirmed by the Kafka producer. No message will be lost due to events that occur on the Kafka broker. However, duplicate messages may be generated when Flink is restarted because Flink processes old data again. – **exactly-once**: In this mode, the Kafka sink writes all data through the transactions submitted at a checkpoint. Therefore, if the consumer reads only submitted data, duplicate data will not be generated when Flink is restarted. However, data is visible only when a checkpoint is complete, so you need to adjust the checkpoint interval as needed.

Step 7 Update the mapping between the source table and destination table and check whether the mapping is correct.

Figure 7-278 Mapping between source and destination tables



Step 8 Configure task parameters.

Table 7-166 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2

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Parameter	Description	Default Value
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Adding custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	N/A

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-279 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-280 Starting the job

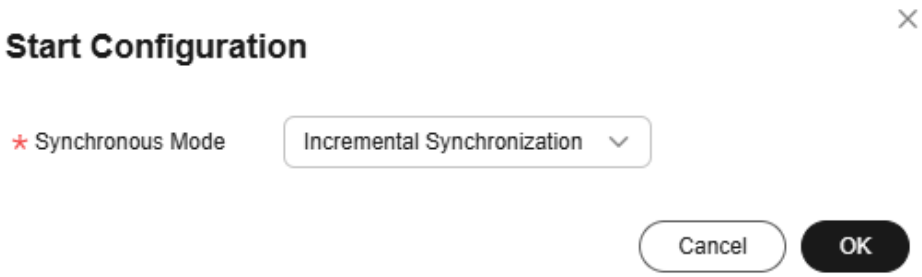


Table 7-167 Parameters for starting the job

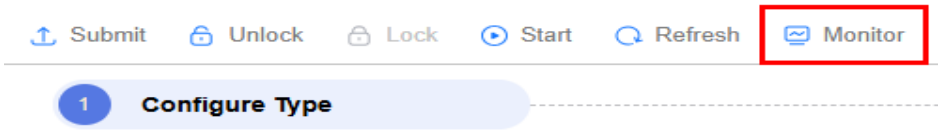
Parameter	Description
Synchronous Mode	• **Incremental Synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.

Step 10 Monitor the job.

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On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-281 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.14 Configuring a Job for Synchronizing Data from Oracle to GaussDB(DWS)

Supported Source and Destination Database Versions

Table 7-168 Supported database versions

Source Database	Destination Database
Oracle database (versions 10, 11, 12, and 19)	GaussDB(DWS) cluster of version 8.1.3, 8.2.0, or a later version, except GaussDB(DWS) 3.0

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-169 Database account permissions

Type	Required Permissions
Source database account	The account must have the permissions to archive logs, query tables, and parse logs of the Oracle database. For details about how to grant the permissions, see .
Destination database account	The destination database account must have the following permissions for each table in the database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

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NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-170 Synchronization objects

Type	Note
Synchronization objects	• The following DML operations can be synchronized: INSERT, UPDATE, and DELETE. • The DDL operation of adding columns can be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-171 Important notes

Type	Restriction
Database	• The names of the source databases, tables, and fields cannot contain periods (.), hyphens (-), or non-ASCII characters. You are advised to use common characters to avoid a failure. • The name of an object in the destination database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($).

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • It is recommended that Oracle archive logs be retained for more than three days. Otherwise, the task may fail because logs cannot be obtained. In some special cases, data may be inconsistent or lost. • resetlogs operations cannot be performed on the source Oracle database. Otherwise, data cannot be synchronized, and the job cannot be recovered. • The username (schema name) of the source Oracle database cannot be changed, neither by modifying the **USER$** dictionary table in versions earlier than 11.2.0.2 nor by running the **ALTER USER username RENAME TO new_username** command in 11.2.0.2 and later versions. • If the source is an Oracle database, CLOB, NCLOB, and BLOB data cannot be migrated. • Oracle RAC clusters cannot be the source. • If the source is an Oracle database, it can connect to the standby Oracle database of a single instance but cannot connect to a standby database in an RAC cluster. Only archive logs can be read from the standby database, and standby logs cannot be read from the standby database. When connecting to the standby database, you are advised to configure scheduled archiving to reduce the data synchronization latency. • It is recommended that the network bandwidth be greater than 100 Mbit/s. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: • DML operations INSERT, UPDATE, and DELETE can be synchronized. • The DDL operation of adding columns can be synchronized. • Mixed partitioned tables are not supported. When data in the external partition of a mixed partitioned table changes, no DML log is generated. As a result, the change information cannot be obtained during incremental data synchronization, which may cause data inconsistency. • The table name and column name can contain a maximum of 30 characters. Oracle LogMiner is used to read Oracle logs. The table name and column name can contain a maximum of 30 characters. For details, see **Using LogMiner to Analyze Redo Log Files**. • During incremental startup, select a time point. Ensure that the Oracle database is in the same time zone as the host where the

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Type	Restriction
	database is located to ensure the accuracy of the incremental time point. • Distributed transactions (XA transactions) and PARALLEL DML on Oracle cannot be incrementally synchronized. • During incremental synchronization, Oracle extended characters are not supported. The standard character set cannot parse Oracle customized extended characters. • During incremental synchronization, triggers cannot be synchronized or migrated. You must disable the triggers on the destination Oracle database. • Data with foreign key constraints cannot be incrementally synchronized or migrated. • Data imported to the source database using Oracle Data Pump cannot be incrementally synchronized or migrated. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • During automatic table creation, the length of the char, varchar, nvarchar, enum, and set characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database. • For a full and incremental job or an incremental job that migrates data from an Oracle database, if you want to synchronize tables in the PDB database, you need to enter the username and password of the CDB database in the Oracle connection. This is because Oracle logs are stored in the CDB database and Oracle LogMiner can run only in the CDB database. • To delete a table using DDL, run the **drop table test_table_name purage** command. Deleting a table in the Oracle database is a high-risk operation by default. When the **drop table test_table_name** command is executed, the Oracle database converts the command to **rename table test_table_name as** *xxxxx*. That is, the table is renamed as a table to be processed in the Oracle temporary tablespace. The original table is not deleted, and DataArts Migration ignores the syntax by default. The data deletion statement **drop table test_table_name purage** of the Oracle database completely deletes the table. DataArts Migration automatically identifies and delivers the deleted table to the downstream. • During incremental synchronization from the PDB database, all PDBs must be enabled due to restrictions of Oracle LogMiner. • Tables with no primary keys are not supported. • Data control language (DCL) operations are not supported. • Consecutive RENAME TABLE operations cannot be synchronized or migrated. Otherwise, the task may fail. • Global temporary tables cannot be synchronized or migrated (the task runs properly). • Tables that contain default value functions cannot be synchronized or migrated. Otherwise, data will be inconsistent.

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Type	Restriction
	• Tables with default values that contain expressions cannot be synchronized or migrated. • Foreign tables cannot be synchronized or migrated. • Compute columns and encrypted columns cannot be synchronized or migrated. • Virtual private databases (VPDs) cannot be synchronized or migrated. • Jobs created by dbms_scheduler and dbms_job cannot be synchronized or migrated. • Schema name changes cannot be synchronized or migrated. • Nested tables cannot be synchronized or migrated. Otherwise, an error will occur. • Materialized views cannot be synchronized or migrated. • DDL operations with attribute names that contain keywords or special characters cannot be synchronized or migrated. • ROWID change operations (such as split partition, table move, table shrink, and move partition key) are not supported. Otherwise, data inconsistency or task failures may occur. • The Secure Sockets Layer (SSL) encrypted transmission mode is not supported. • The Oracle Label Security mode is not supported.

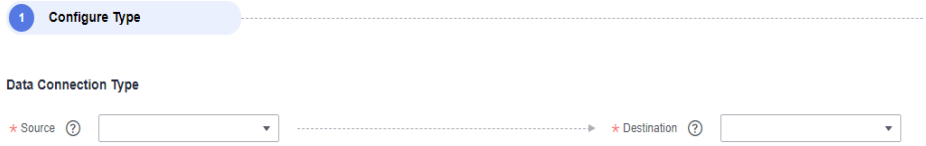
Procedure

This section uses real-time synchronization from Oracle to GaussDB(DWS) as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **Oracle** for **Source** and **DWS** for **Destination**.

Figure 7-282 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

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Figure 7-283 Setting the migration job type

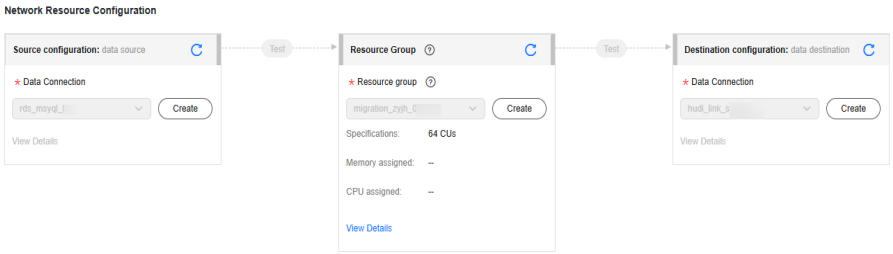


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created Oracle and GaussDB(DWS) data connections and the migration resource group for which the network connection has been configured.

Figure 7-284 Selecting data connections and a migration resource group



NOTE

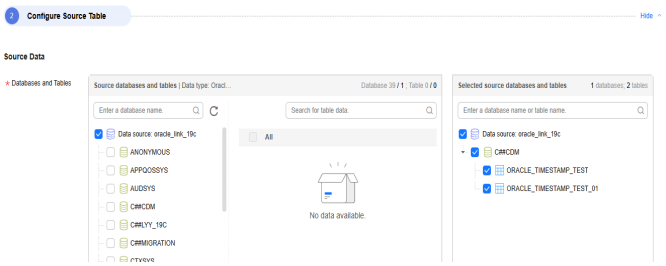
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

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Table 7-172 Selecting the Kafka topics to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the Oracle databases and tables to be migrated. **Figure 7-285** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

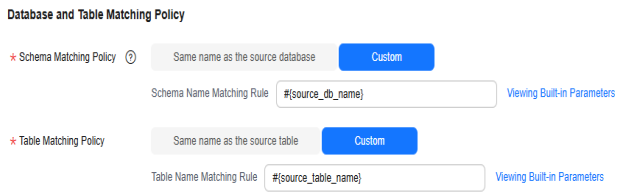
Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

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Table 7-173 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Schema Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the GaussDB(DWS) schema with the same name as the source Oracle database. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) schema you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the GaussDB(DWS) table with the same name as the source Oracle table. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) table you specify. **Figure 7-286** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

- Configure GaussDB(DWS) parameters.
  For details, see the following table.

  Figure 7-287 GaussDB(DWS) parameters

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Table 7-174 GaussDB(DWS) parameters

Parameter	Default Value	Unit	Description
Write Mode	UPSERT	N/A	– **UPSERT MODE**: batch update – **COPY MODE**: DWS-dedicated high-performance batch import
Maximum Data Volume for Batch Write	50000	Count	Number of data records written to GaussDB(DWS) in a batch. You can adjust the value based on the table data size and job memory usage.
Scheduled Batch Write Interval	3	Second	Interval at which data is written to GaussDB(DWS)
Advanced Settings	N/A	N/A	Some advanced functions can be configured using parameters. For details, see GaussDB(DWS) advanced parameters.

Table 7-175 GaussDB(DWS) advanced parameters

Parameter	Type	Default Value	Unit	Description
sink.buffer-flush.max-size	int	512	MB	Maximum number of bytes in each batch of data written to GaussDB(DWS). You can adjust the value based on the memory and data size configured for the job.
sink.keyby.enable	boolean	true	N/A	Whether to enable data distribution. If this function is enabled in multi-concurrency scenarios, data can be distributed to different processes based on specific rules and written to the destination, which improves the write performance.

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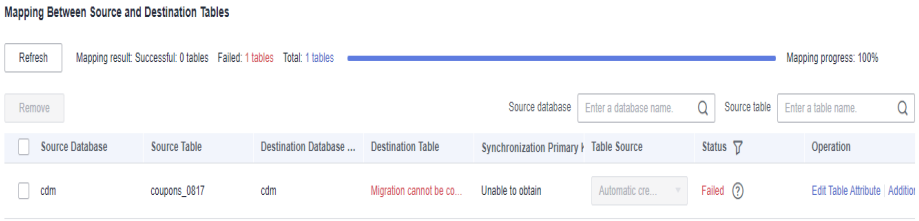
Parameter	Type	DefaultValue	Unit	Description
sink.keyby.mode	string	table	N/A	Data distribution mode. The following modes are available: – **pk**: Data is distributed by primary key value. – **table**: Data is distributed by table name. **NOTE** ■ In multi-concurrency scenarios, if DDL is enabled, data can be distributed only by table name. Otherwise, data may be inconsistent. ■ If there is no DDL, you can select **pk**, which improves the write performance in multi-concurrency scenarios.
sink.field.name.case-sensitive	boolean	true	N/A	Whether to enable case sensitivity for data synchronization. If this function is enabled, the database names, table names, and field names are case sensitive during data synchronization.
sink.verify.column-number	boolean	false	N/A	Whether to verify the number of data columns. By default, the link synchronizes data in the same-name mapping mode. The system does not check whether all columns are synchronized. If this function is enabled and the number of columns at the source is different from that at the destination, the system determines that data is inconsistent. As a result, the job is abnormal.
sink.server.timezone	string	Localtimezone	N/A	Session time zone specified for connecting to the destination database. The standard time zone format is supported, for example, UTC +08:00.
logical.delete.enabled	boolean	false	N/A	Whether to enable logical deletion

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Parameter	Type	Default Value	Unit	Description
logical.delete.column	string	logical_is_deleted	N/A	Name of the logical deletion column. The default value is **logical_is_deleted**. You can customize the value.

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination GaussDB(DWS) database.

Figure 7-288 Mapping between source and destination tables



- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination GaussDB(DWS) table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination GaussDB(DWS) table
  - **Field Type**: type of the new field in the destination GaussDB(DWS) table
  - **Field Value**: Value source of the new field in the destination GaussDB(DWS) table

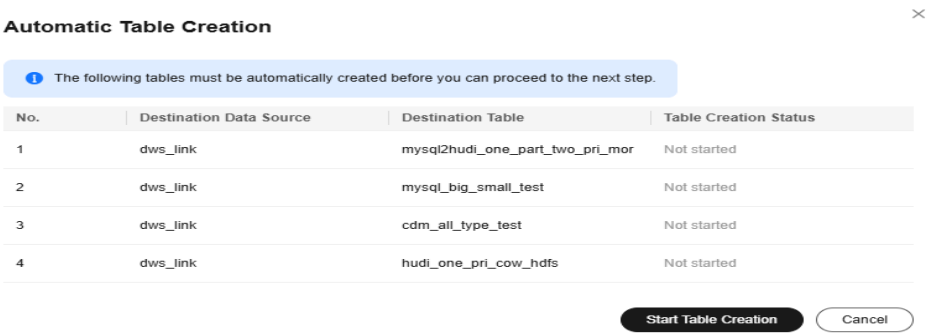
  Table 7-176 Additional field value obtaining mode

Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

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Figure 7-289 Automatic table creation



NOTE

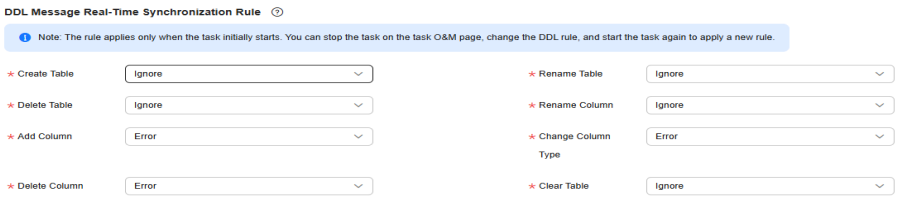
- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.

Step 8 Configure DDL message processing rules.

Real-time migration jobs can synchronize data manipulation language (DML) operations, such as adding, deleting, and modifying data, as well as some table structure changes using the data definition language (DDL). You can set the processing policy for a DDL operation to **Normal processing**, **Ignore**, or **Error**.

- **Normal processing**: When a DDL operation on the source database or table is detected, the operation is automatically synchronized to the destination.
- **Ignore**: When a DDL operation on the source database or table is detected, the operation is ignored and not synchronized to the destination.
- **Error**: When a DDL operation on the source database or table is detected, the migration job throws an exception.

Figure 7-290 DDL configuration



Step 9 Configure task parameters.

Table 7-177 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB

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Parameter	Description	Default Value
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 10 Submit and run the job.

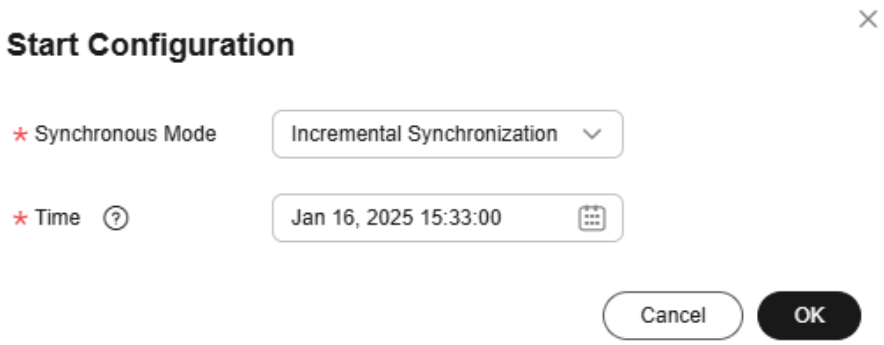
After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-291 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-292 Starting the job



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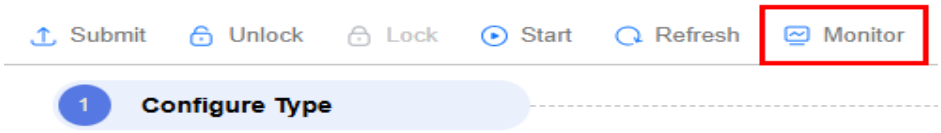
Table 7-178 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest binlog time, the latest log time is used.

Step 11 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-293 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.15 Configuring a Job for Synchronizing Data from Oracle to MRS Hudi

Supported Source and Destination Database Versions

Table 7-179 Supported database versions

Source Database	Destination Database
Oracle database (versions 10, 11, 12, and 19)	• MRS cluster (3.2.0-LTS.*x* and 3.5.*x*) • Hudi (0.11.0)

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Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-180 Database account permissions

Type	Required Permissions
Source database account	The account must have the permissions to archive logs, query tables, and parse logs of the Oracle database. For details about how to grant the permissions, see .
Destination database account	The MRS user must have read and write permissions for the Hadoop and Hive components. You are advised to assign the roles and user groups shown in the following figure to the MRS user. **Figure 7-294** Minimal permissions for MRS Hudi  For details, see .

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

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Table 7-181 Synchronization objects

Type	Note
Synchronization objects	• The following DML operations can be synchronized: INSERT, UPDATE, and DELETE. • The DDL operation of adding columns can be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, unique indexes, foreign key indexes, and check constraints cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-182 Important notes

Type	Restriction
Database	• The names of the source databases, tables, and fields cannot contain periods (.), hyphens (-), or non-ASCII characters. You are advised to use common characters to avoid a failure. • The names of the destination databases, tables, and fields can only contain digits, letters, and underscores (_). Field names must start with a letter or an underscore (). You are advised to use common characters in names.

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • It is recommended that Oracle archive logs be retained for more than three days. Otherwise, the task may fail because logs cannot be obtained. In some special cases, data may be inconsistent or lost. • resetlogs operations cannot be performed on the source Oracle database. Otherwise, data cannot be synchronized, and the job cannot be recovered. • The username (schema name) of the source Oracle database cannot be changed, neither by modifying the **USER$** dictionary table in versions earlier than 11.2.0.2 nor by running the **ALTER USER username RENAME TO new_username** command in 11.2.0.2 and later versions. • If the source is an Oracle database, CLOB, NCLOB, and BLOB data cannot be migrated. • Oracle RAC clusters cannot be the source. • If the source is an Oracle database, it can connect to the standby Oracle database of a single instance but cannot connect to a standby database in an RAC cluster. Only archive logs can be read from the standby database, and standby logs cannot be read from the standby database. When connecting to the standby database, you are advised to configure scheduled archiving to reduce the data synchronization latency. • It is recommended that the network bandwidth be greater than 100 Mbit/s. • If a Hudi table uses bucket indexes, the partition key cannot be updated. Otherwise, duplicate data may be generated. • If a Hudi table uses bucket indexes, ensure that the primary key is unique in a single partition. • Every Hudi table in this task must contain three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi tables. If an existing table is used, these three audit fields must also be configured for it. Otherwise, the task may fail. – **cdc_last_update_date**: time when migration task processes CDC data – **logical_is_deleted**: logical deletion flag – **_hoodie_event_time**: timestamp of data in Oracle CDC Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase:

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Type	Restriction
	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • The DDL operation of adding columns can be synchronized. • Mixed partitioned tables are not supported. When data in the external partition of a mixed partitioned table changes, no DML log is generated. As a result, the change information cannot be obtained during incremental data synchronization, which may cause data inconsistency. • The table name and column name can contain a maximum of 30 characters. Oracle LogMiner is used to read Oracle logs. The table name and column name can contain a maximum of 30 characters. For details, see **Using LogMiner to Analyze Redo Log Files**. • During incremental startup, select a time point. Ensure that the Oracle database is in the same time zone as the host where the database is located to ensure the accuracy of the incremental time point. • Distributed transactions (XA transactions) and PARALLEL DML on Oracle cannot be incrementally synchronized. • During incremental synchronization, Oracle extended characters are not supported. The standard character set cannot parse Oracle customized extended characters. • During incremental synchronization, triggers cannot be synchronized or migrated. You must disable the triggers on the destination Oracle database. • Data with foreign key constraints cannot be incrementally synchronized or migrated. • Data imported to the source database using Oracle Data Pump cannot be incrementally synchronized or migrated. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – If extra columns in the destination database are not null and have no default values, when newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • If the length of a table structure in the Oracle database exceeds 65,535 bytes, the synchronization may fail. The length of a table structure is the total length of all columns. The length of the char or varchar2 type is related to the code. • During incremental synchronization from the PDB database, all PDBs must be enabled due to restrictions of Oracle LogMiner. • During incremental synchronization to Oracle 12.2 or later, the table name or column name cannot contain more than 30 characters due to restrictions of Oracle LogMiner. • For a full and incremental job or an incremental job that migrates data from an Oracle database, if you want to synchronize tables in the PDB database, you need to enter the username and password of the CDB database in the Oracle connection. This is because Oracle logs are stored in the CDB database and Oracle LogMiner can run only in the CDB database. • To delete a table using DDL, run the **drop table test_table_name purage** command. Deleting a table in the Oracle database is a high-risk operation by default. When the **drop table test_table_name** command is executed, the Oracle database converts the command to **rename table test_table_name as** *xxxxx*. That is, the table is renamed as a table to be processed in the Oracle temporary tablespace. The original table is not deleted, and DataArts Migration ignores the syntax by default. The data deletion statement **drop table test_table_name purage** of the Oracle database completely deletes the table. DataArts Migration automatically identifies and delivers the deleted table to the downstream. • Tables with no primary keys are not supported. • Data control language (DCL) operations are not supported. • Consecutive RENAME TABLE operations cannot be synchronized or migrated. Otherwise, the task may fail. • Global temporary tables cannot be synchronized or migrated (the task is running properly).

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Type	Restriction
	• Tables that contain default value functions cannot be synchronized or migrated. Otherwise, data will be inconsistent. • Tables with default values that contain expressions cannot be synchronized or migrated. • Foreign tables cannot be synchronized or migrated. • Compute columns and encrypted columns cannot be synchronized or migrated. • Virtual private databases (VPDs) cannot be synchronized or migrated. • Jobs created by dbms_scheduler and dbms_job cannot be synchronized or migrated. • Schema name changes cannot be synchronized or migrated. • Nested tables cannot be synchronized or migrated. Otherwise, an error will occur. • Materialized views cannot be synchronized or migrated. • DDL operations with attribute names that contain keywords or special characters cannot be synchronized or migrated. • ROWID change operations (such as split partition, table move, table shrink, and move partition key) are not supported. Otherwise, data inconsistency or task failures may occur. • The Secure Sockets Layer (SSL) encryption transmission mode is not supported. • The Oracle Label Security mode is not supported.

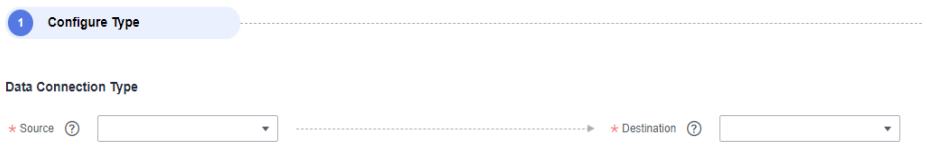
Procedure

This section uses real-time synchronization from Oracle to MRS Hudi as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **Oracle** for **Source** and **Hudi** for **Destination**.

Figure 7-295 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

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Figure 7-296 Setting the migration job type

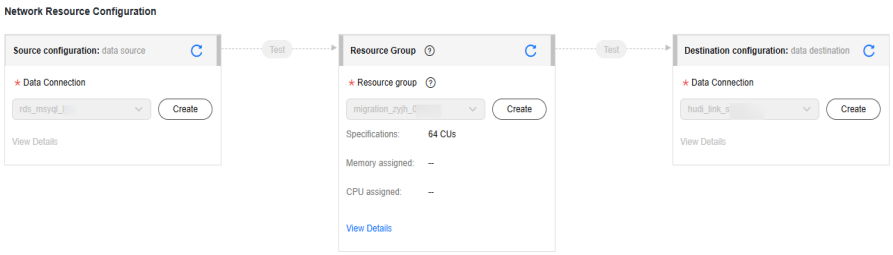


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created Oracle and MRS Hudi data connections and the migration resource group for which the network connection has been configured.

Figure 7-297 Selecting data connections and a migration resource group



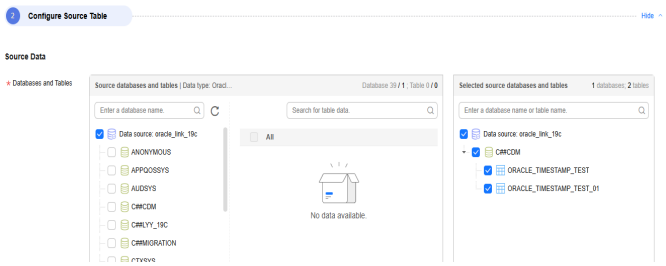
NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the Oracle databases and tables to be migrated.

Figure 7-298 Selecting databases and tables



Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

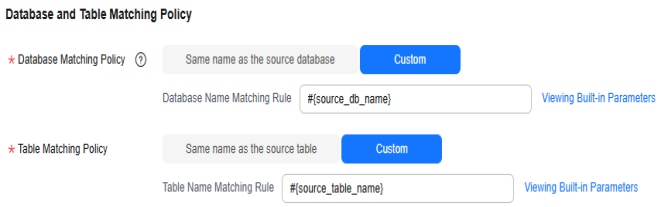
Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

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For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

Table 7-183 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Database Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the Hudi database with the same name as the source Oracle database. ▪ **Custom**: Data will be synchronized to the Hudi database you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the Hudi table with the same name as the source Oracle database. ▪ **Custom**: Data will be synchronized to the Hudi table you specify. **Figure 7-299** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

- Set Hudi parameters.
  For details, see the following table.

  Figure 7-300 Hudi destination parameters

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Table 7-184 Hudi destination parameters

Parameter	Default Value	Unit	Description
Data Storage Path	N/A	N/A	Warehouse path when tables are automatically created in Hudi. A subdirectory is created in the warehouse path for each table. You can enter an HDFS or OBS path. The path format is as follows: – OBS path: obs://bucket/warehouse – HDFS path: /tmp/warehouse
Global Configuration of Hudi Table Attributes	N/A	N/A	Some advanced functions can be configured using parameters. For details, see Hudi advanced parameters.

Table 7-185 Hudi advanced parameters

Parameter	Type	Default Value	Unit	Description
index.type	string	BLOOM	N/A	Index type of the Hudi table BLOOM and BUCKET indexes are supported. If a large amount of data need to be migrated, BUCKET indexes are recommended for better performance.

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Parameter	Type	DefaultValue	Unit	Description
hoodie.bucket.index.num.buckets	int	256	Count	Number of buckets within a Hudi table partition **NOTE** When using Hudi BUCKET tables, you need to set the number of buckets for a table partition. The number of buckets affects the table performance. – Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4) – Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1) Pay attention to the following: – The total data volume of a table, instead of the compressed size, is used. – Setting an even number of buckets is recommended. The minimum number of buckets should be 4 for a non-partitioned table and 1 for a partitioned table.
changelog.enabled	boolean	false	N/A	Whether to enable the Hudi ChangeLog function. If this function is enabled, the migration job can output DELETE and UPDATE BEFORE data.
logical.delete.enabled	boolean	true	N/A	Whether to enable logical deletion. If the ChangeLog function is enabled, logical deletion must be disabled.
hoodie.write.liststatus.optimized	boolean	true	N/A	Whether to enable liststatus optimization when log files are written. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.

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Parameter	Type	DefaultValue	Unit	Description
hoodie.index.liststatus.optimized	boolean	false	N/A	Whether to enable liststatus optimization during data locating. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.
compaction.async.enabled	boolean	true	N/A	Whether to enable asynchronous compaction. The compaction operation affects the writing performance of real-time jobs. If you use an external compaction operation, you can set this parameter to **false** to disable compaction for real-time processing migration jobs.
compaction.schedule.enabled	boolean	true	N/A	Whether to generate compaction plans. Compaction plans must be generated by this service and can be executed by Spark.
compaction.delta_commits	int	5	Count	Frequency of generating compaction requests. Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If there is a small volume of incremental data to be synchronized to Hudi, you can set a larger value for this parameter. **NOTE** For example, if this parameter is set to **40**, a compaction request is generated every 40 commits. Since DataArts Migration generates a commit every minute, the interval between compaction requests is 40 minutes.
clean.async.enabled	boolean	true	N/A	Whether to clear data files of historical versions

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Parameter	Type	Default Value	Unit	Description
clean.retain_commits	int	30	Count	Number of recent commits to retain. Data files related to these commits will be retained for a period calculated by multiplying the number of specified commits by the interval between commits. You are advised to set this parameter to twice the value of **compaction.delta_commits**. **NOTE** For example, if this parameter is set to **80** and since DataArts Migration generates a commit every minute, data files related to commits generated 80 minutes earlier are cleaned, and data files related to the recent 80 commits are retained.
hoodie.archive.automatic	boolean	true	N/A	Whether to age Hudi commit files
archive.min_commits	int	40	Count	Number of recent commits to keep when historical commits are archived to log files You are advised to set this parameter to one greater than **clean.retain_commits**. **NOTE** For example, if this parameter is set to **81**, the files related to the recent 81 commits are retained when an archive operation is triggered.
archive.max_commits	int	50	Count	Number of commits that triggers an archive operation You are advised to set this parameter to 20 greater than **archive.min_commits**. **NOTE** For example, if the parameter is set to **101**, an archive operation is triggered when the files of 101 commits are generated.

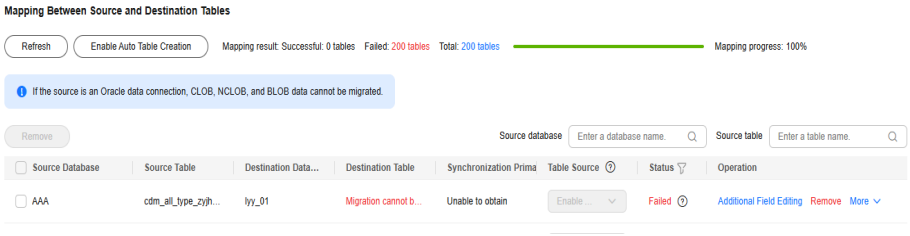
NOTE

- To achieve optimal performance for the migration job, you are advised to use an MOR table that uses Hudi BUCKET indexes and configure the number of buckets based on the actual data volume.
- To ensure the stability of the migration job, you are advised to split the Hudi Compaction job into Spark jobs and execute them by MRS, and enable compaction plans to be generated for this migration job. For details, see

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Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination Hudi database.

Figure 7-301 Mapping between source and destination tables



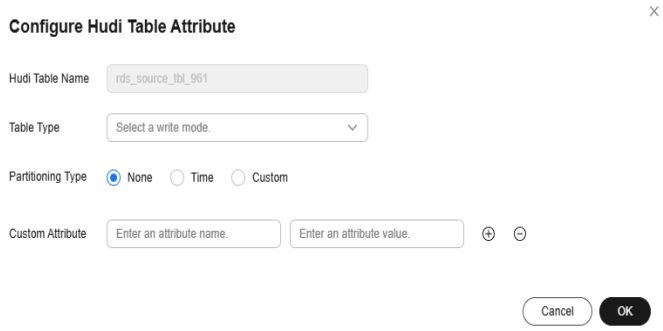
- **Synchronization Primary Key**

  A synchronization primary key must be set for a Hudi table. If the source table has no primary key, table mapping will fail.

- **Edit Table Attribute**

  Click **Edit Table Attributes** in the **Operation** column to configure Hudi table attributes, including the table type, partition type, and custom attributes.

  Figure 7-302 Configuring the Hudi table attributes

  - **Table Type**: Hudi table type. Select **MERGE_ON_READ** or **COPY_ON_WRITE**.
  - **Partition Type**: partition type of the Hudi table. Select **No partition**, **Time**, or **Custom**.

    NOTE

    - For **Time**, you need to specify a source field name and select a time conversion format.

      For example, you can specify the source field name **src_col_1** and select a time conversion format, for example, day(yyyyMMdd), month(yyyyMM), or year(yyyy). During automatic table creation, a **cdc_partition_key** field is created in the Hudi table by default. The system formats the value of the source field (**src_col_1**) based on the configured time conversion format and writes the value to **cdc_partition_key**.

    - Custom partitions do not support timestamp fields. If you use timestamp fields, the job will fail.

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  - Customize table attributes. Some advanced functions of a single table can be configured using parameters. For details about the parameters, see the table that lists Hudi advanced configurations.

- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination Hudi table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination Hudi table
  - **Field Type**: Type of the new field in the destination Hudi table
  - **Field Value**: Value source of the new field in the destination Hudi table

    Table 7-186 Additional field value obtaining mode

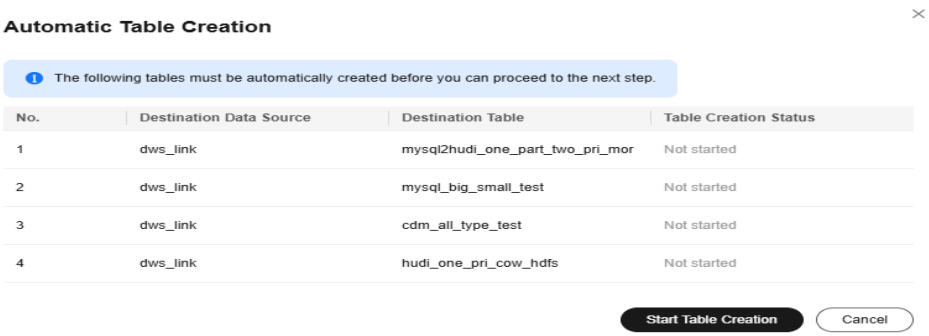
Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.
Built-in variable	▪ Source host IP address: source.host ▪ Source schema name: source.schema ▪ Source table name: source.table ▪ Destination schema name: target.schema ▪ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.

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Type	Example
UDF	▪ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ▪ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ▪ now([tz]): obtains the current time in a specified time zone. ▪ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ▪ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ▪ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ▪ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

Figure 7-303 Automatic table creation



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NOTE

- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.
- An automatically created Hudi table contains three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi table.

Step 8 Configure task parameters.

Table 7-187 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-304 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

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Figure 7-305 Starting the job

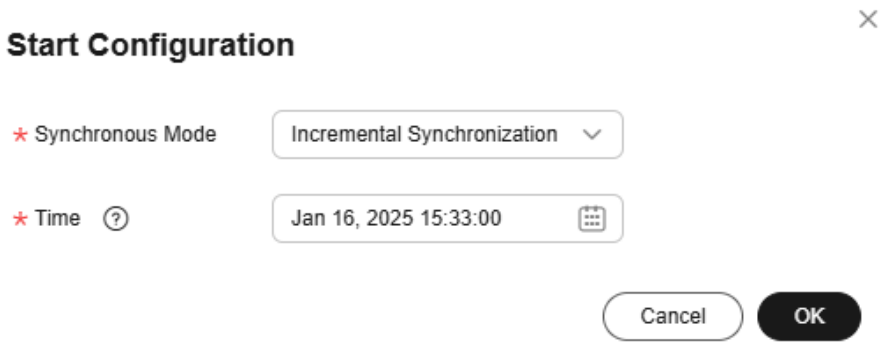


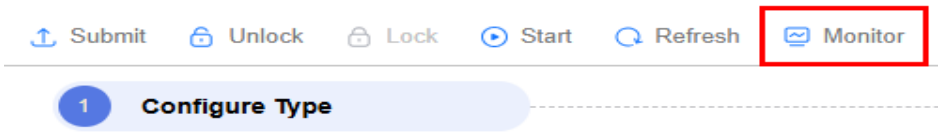
Table 7-188 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest CDC log time, the latest log time is used.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-306 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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7.11.16 Configuring a Job for Synchronizing Data from Oracle to

Supported Source and Destination Database Versions

Table 7-189 Supported database versions

Source Database	Destination Database
Oracle database (versions 10, 11, 12, and 19)	Kafka cluster (2.7 and 3.*x*)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-190 Database account permissions

Type	Required Permissions
Source database connection account	The account must have the permissions to archive logs, query tables, and parse logs of the Oracle database. For details about how to grant the permissions, see .
Destination database connection account	The MRS user must have the read and write permissions on corresponding Kafka topics, that is, the user must belong to the kafka/kafkaadmin/kafkasuperuser user group. **NOTE** A common Kafka user can access a topic only after being granted the read and write permissions on the topic by the Kafka administrator.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

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Table 7-191 Synchronization objects

Type	Note
Synchronization objects	• The following DML operations can be synchronized: INSERT, UPDATE, and DELETE. • The DDL operation of adding columns can be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-192 Important notes

Type	Restriction
Database	The names of the source databases, tables, and fields cannot contain periods (.), hyphens (-), or non-ASCII characters. You are advised to use common characters to avoid a failure.

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The archived logs of the Oracle database should be retained for more than three days. • resetlogs operations cannot be performed on the source Oracle database. Otherwise, data cannot be synchronized, and the job cannot be recovered. • The username (schema name) of the source Oracle database cannot be changed, neither by modifying the **USER$** dictionary table in versions earlier than 11.2.0.2 nor by running the **ALTER USER username RENAME TO new_username** command in 11.2.0.2 and later versions. • If the source is an Oracle database, CLOB, NCLOB, and BLOB data cannot be migrated. • Oracle RAC clusters cannot be the source. • If the source is an Oracle database, it can connect to the standby Oracle database of a single instance but cannot connect to a standby database in an RAC cluster. Only archive logs can be read from the standby database, and standby logs cannot be read from the standby database. When connecting to the standby database, you are advised to configure scheduled archiving to reduce the data synchronization latency. • It is recommended that the network bandwidth be greater than 100 Mbit/s. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: • DML operations INSERT, UPDATE, and DELETE can be synchronized. • The DDL operation of adding columns can be synchronized. • Mixed partitioned tables are not supported. When data in the external partition of a mixed partitioned table changes, no DML log is generated. As a result, the change information cannot be obtained during incremental data synchronization, which may cause data inconsistency. • The table name and column name can contain a maximum of 30 characters. Oracle LogMiner is used to read Oracle logs. The table name and column name can contain a maximum of 30 characters. For details, see **Using LogMiner to Analyze Redo Log Files**. • During incremental startup, select a time point. Ensure that the Oracle database is in the same time zone as the host where the database is located to ensure the accuracy of the incremental time point.

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Type	Restriction
	• Distributed transactions (XA transactions) and PARALLEL DML on Oracle cannot be incrementally synchronized. • During incremental synchronization, Oracle extended characters are not supported. The standard character set cannot parse Oracle customized extended characters. • During incremental synchronization, triggers cannot be synchronized or migrated. You must disable the triggers on the destination Oracle database. • Data with foreign key constraints cannot be incrementally synchronized or migrated. • Data imported to the source database using Oracle Data Pump cannot be incrementally synchronized or migrated. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• During automatic table creation, the length of the char, varchar, nvarchar, enum, and set characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database. • For a full and incremental job or an incremental job that migrates data from an Oracle database, if you want to synchronize tables in the PDB database, you need to enter the username and password of the CDB database in the Oracle connection. This is because Oracle logs are stored in the CDB database and Oracle LogMiner can run only in the CDB database. • To delete a table using DDL, run the **drop table test_table_name purage** command. Deleting a table in the Oracle database is a high-risk operation by default. When the **drop table test_table_name** command is executed, the Oracle database converts the command to **rename table test_table_name as** *xxxxx*. That is, the table is renamed as a table to be processed in the Oracle temporary tablespace. The original table is not deleted, and DataArts Migration ignores the syntax by default. The data deletion statement **drop table test_table_name purage** of the Oracle database completely deletes the table. DataArts Migration automatically identifies and delivers the deleted table to the downstream. • During incremental synchronization from the PDB database, all PDBs must be enabled due to restrictions of Oracle LogMiner. • Tables with no primary keys are not supported. • Data control language (DCL) operations are not supported. • Consecutive RENAME TABLE operations cannot be synchronized or migrated. Otherwise, the task may fail. • Global temporary tables cannot be synchronized or migrated (the task is running properly). • Tables that contain default value functions cannot be synchronized or migrated. Otherwise, data will be inconsistent. • Tables with default values that contain expressions cannot be synchronized or migrated. • Foreign tables cannot be synchronized or migrated. • Compute columns and encrypted columns cannot be synchronized or migrated. • Virtual private databases (VPDs) cannot be synchronized or migrated. • Jobs created by dbms_scheduler and dbms_job cannot be synchronized or migrated. • Schema name changes cannot be synchronized or migrated. • Nested tables cannot be synchronized or migrated. Otherwise, an error will occur. • Materialized views cannot be synchronized or migrated.

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Type	Restriction
	• DDL operations with attribute names that contain keywords or special characters cannot be synchronized or migrated. • ROWID change operations (such as split partition, table move, table shrink, and move partition key) are not supported. Otherwise, data inconsistency or task failures may occur. • The Secure Sockets Layer (SSL) encryption transmission mode is not supported. • The Oracle Label Security mode is not supported.

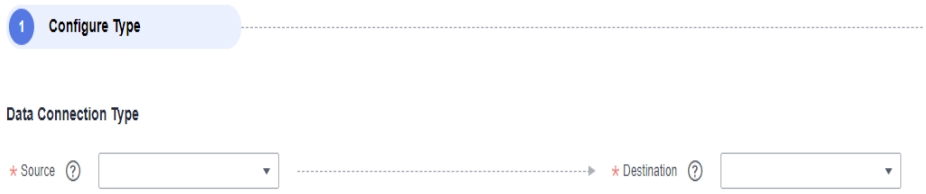
Procedure

This section uses real-time synchronization from Oracle to as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **Oracle** for **Source** and for **Destination**.

Figure 7-307 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

Figure 7-308 Setting the migration job type



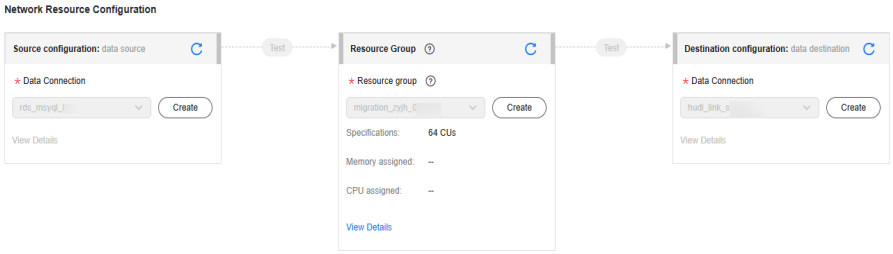
NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created Oracle and data connections and the migration resource group for which the network connection has been configured.

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Figure 7-309 Selecting data connections and a migration resource group



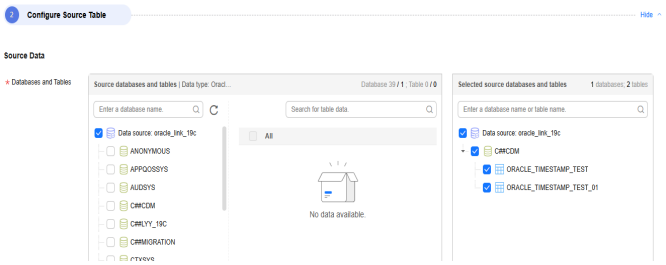
NOTE

If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

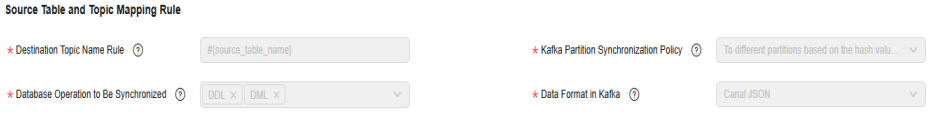
Select the databases and tables to be synchronized based on the following table.

Table 7-193 Selecting the databases and tables to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the Oracle databases and tables to be migrated. **Figure 7-310** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

Step 6 Configure destination parameters.

Figure 7-311 Kafka destination parameters



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- **Destination Topic Name Rule**

  Configure the rule for mapping source Oracle database tables to destination Kafka topics.

- **Kafka Partition Synchronization Policy**

  The following three policies are available for synchronizing source data to specified partitions of destination Kafka topics:

  - **To partition 0**
  - **To different partitions based on the hash values of database names/table names**
  - **To different partitions based on the hash values of table primary keys**

    NOTE

    If the source has no primary key, data is synchronized to partition 0 at the destination by default.

- **Partitions of New Topic**

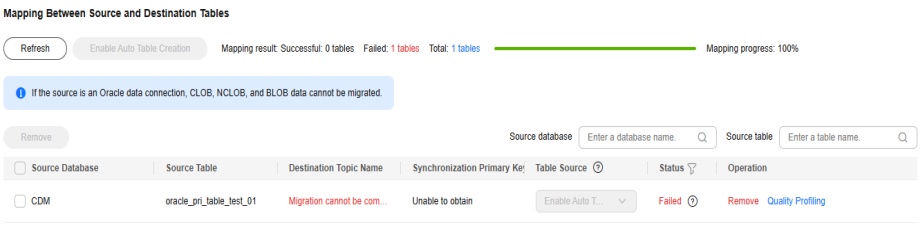
  If the destination Kafka does not have the corresponding topic, the topic automatically created by DataArts Migration has three partitions.

- **Destination Kafka Attributes**

  You can add Kafka configuration items with the properties. prefix. The job automatically removes the prefix and transfers configuration items to the underlying Kafka client. For details about the parameters, see the configuration descriptions in **Kafka documentation**.

Step 7 Update the mapping between the source table and destination table and check whether the mapping is correct.

Figure 7-312 Mapping between source and destination tables



Step 8 Configure task parameters.

Table 7-194 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2

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Parameter	Description	Default Value
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-313 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-314 Starting the job

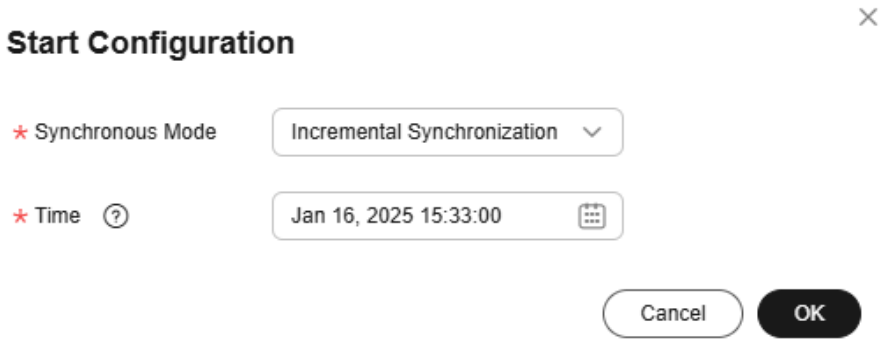


Table 7-195 Parameters for starting the job

Parameter	Description
Synchronous Mode	• **Incremental Synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.

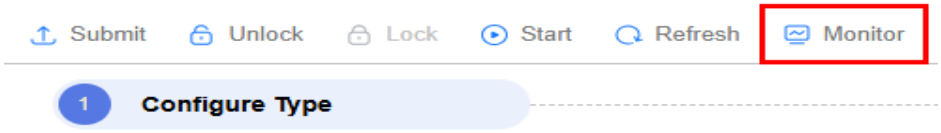
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Parameter	Description
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest binlog time, the latest log time is used.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-315 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.17 Configuring a Job for Synchronizing Data from MongoDB to GaussDB(DWS)

Supported Source and Destination Database Versions

Table 7-196 Supported database versions

Source Database	Destination Database
MongoDB database (version 4.0.0 and later)	GaussDB(DWS) cluster of version 8.1.3, 8.2.0, or a later version, except GaussDB(DWS) 3.0

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

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Table 7-197 Database account permissions

Type	Required Permissions
Source database account	The read and readwrite role of the destination database user has the permissions to grant the changeStream and find permissions to the destination collection.
Destination database account	The destination database account must have the following permissions for each table in the database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-198 Synchronization objects

Type	Note
Synchronization objects	• The following DML operations can be synchronized: INSERT, UPDATE, and DELETE. • For the DDL operations that are not involved and cannot be synchronized, field mapping must be specified during synchronization. • Only primary key tables can be synchronized. The default primary key of MongoDB is _id. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, unique indexes, foreign key indexes, and check constraints are not involved and cannot be synchronized. • Automatic table creation is not supported. You need to manually create tables at the destination. • Time to live (TTL) indexes cannot be synchronized. • Data in the admin and local databases cannot be synchronized or migrated.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

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Table 7-199 Important notes

Type	Restriction
Database	• The source database name must comply with the naming rules of open-source MongoDB. – Database name constraints: Do not distinguish databases by letter case. For example, you cannot name a database **salesData** and another database **SalesData**. When referencing a MongoDB database, you must use the same letter case. For example, if you want to reference the **salesData** database, do not use **salesdata** or **SalesData**. The name of a database running on Windows cannot contain any of the following characters: /\."$*<>:\|? The name of a database running on Unix or Linux cannot contain any of the following characters: /\."$ The database name can contain a maximum of 63 bytes. – Collection name constraints: A collection name must start with an underscore (_) or a letter. A collection name cannot contain null or a dollar sign ($), and cannot be an empty string (for example, ""). A collection name cannot start with **system.** The name of an unsharded collection or view can contain a maximum of 255 bytes, and that of a sharded collection can contain a maximum of 235 bytes. – Field name constraints: A field name can contain a maximum of 255 bytes, and cannot contain null, periods (.), or dollar sign ($). • The name of an object in the destination database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($).

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • Real-time MongoDB data synchronization does not support data sources with a single backup. • The MongoDB database name and collection name cannot be changed during migration. • Automatic table creation is not supported. You need to manually create a receiving table in GaussDB(DWS). • When setting field mapping, you can select the default source field **extraColumn** to determine a specified destination field and receive all the source MongoDB fields that have not been mapped to the destination in the job. • Field mapping can be customized in advance. During data synchronization, source fields are transferred if destination fields with the same names are detected and are not transferred if no destination fields with the same names are detected. • DML operations INSERT, UPDATE, and DELETE can be synchronized. Full synchronization phase: DataArts Migration traverses all chunks in the table. If the source table contains too many preset chunks, the full synchronization takes a long time. Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	N/A

Procedure

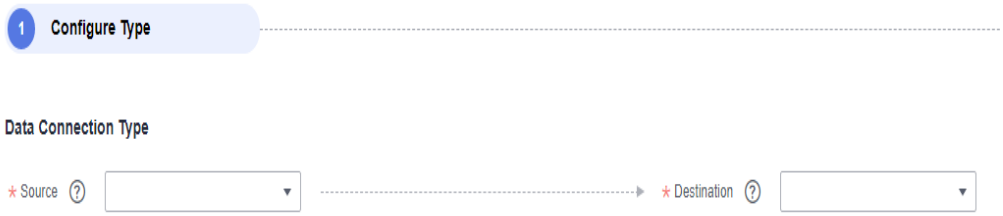
This section uses real-time synchronization from MongoDB to GaussDB(DWS) as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **MongoDB** for **Source** and **DWS** for **Destination**.

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Figure 7-316 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenarios include **Entire DB** and **Database/Table partition**.

Figure 7-317 Setting the migration job type

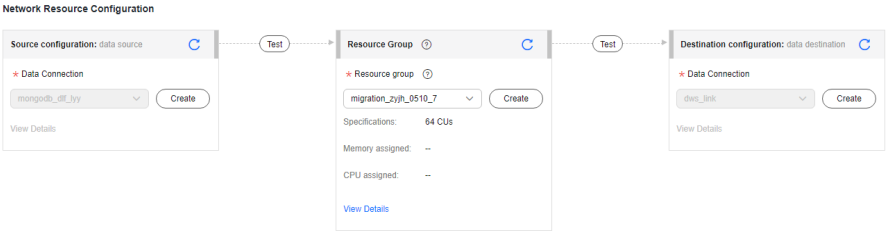


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created MongoDB and GaussDB(DWS) data connections and the migration resource group for which the network connection has been configured.

Figure 7-318 Selecting data connections and a migration resource group



NOTE

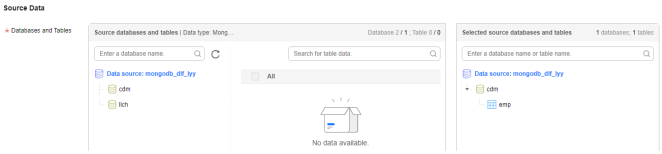
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

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Table 7-200 Selecting the Kafka topics to be synchronized

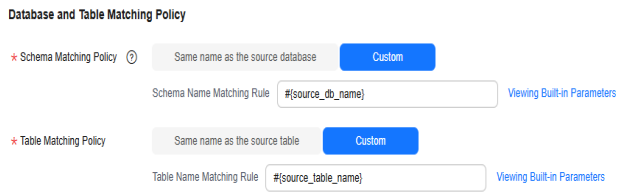
Synchronization Scenario	Configuration Method
Single table	Select the MongoDB databases and tables to be migrated. **Figure 7-319** Selecting databases and tables 

Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

Table 7-201 Database and table matching policy

Synchronization Scenario	Configuration Method
Single table	– **Schema Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the GaussDB(DWS) schema with the same name as the source MongoDB database. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) schema you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the GaussDB(DWS) table with the same name as the source PostgreSQL table. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) table you specify. **Figure 7-320** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source MySQL database name and table name. The table matching policy must contain **#{source_table_name}**.

- Configure GaussDB(DWS) parameters.
  For details, see the following table.

  Figure 7-321 GaussDB(DWS) parameters

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Table 7-202 GaussDB(DWS) parameters

Parameter	Default Value	Unit	Description
Write Mode	UPSERT MODE	N/A	– **UPSERT MODE**: batch update – **COPY MODE**: DWS-dedicated high-performance batch import
Maximum Data Volume for Batch Write	50000	Count	Number of data records written to GaussDB(DWS) in a batch. You can adjust the value based on the table data size and job memory usage.
Scheduled Batch Write Interval	3	Second	Interval at which data is written to GaussDB(DWS)
Advanced Settings	N/A	N/A	Some advanced functions can be configured using parameters. For details, see **Table 7-203**.

Table 7-203 GaussDB(DWS) advanced parameters

Parameter	Type	Default Value	Unit	Description
sink.buffer-flush.max-size	int	512	MB	Maximum number of bytes in each batch of data written to GaussDB(DWS). You can adjust the value based on the memory and data size configured for the job.
sink.keyby.enable	boolean	true	N/A	Whether to enable data distribution. If this function is enabled in multi-concurrency scenarios, data can be distributed to different processes based on specific rules and written to the destination, which improves the write performance.

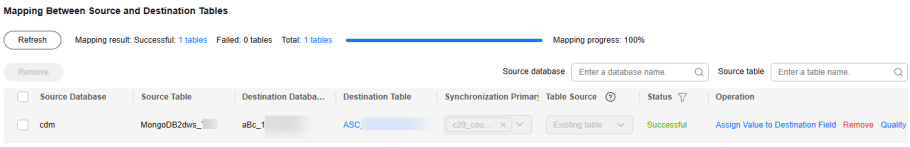
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Parameter	Type	DefaultValue	Unit	Description
sink.keyby.mode	string	table	N/A	Data distribution mode. The following modes are available: – **pk**: Data is distributed by primary key value. – **table**: Data is distributed by table name. **NOTE** ■ In multi-concurrency scenarios, if DDL is enabled, data can be distributed only by table name. Otherwise, data may be inconsistent. ■ If there is no DDL, you can select **pk**, which improves the write performance in multi-concurrency scenarios.
sink.field.name.case-sensitive	boolean	true	N/A	Whether to enable case sensitivity for data synchronization. If this function is enabled, the database names, table names, and field names are case sensitive during data synchronization.
sink.verify.column-number	boolean	false	N/A	Whether to verify the number of data columns. By default, data is synchronized from MySQL to GaussDB(DWS) in the same-name mapping mode. The system does not check whether all columns are synchronized. If this function is enabled and the number of columns at the source is different from that at the destination, the system determines that data is inconsistent. As a result, the job is abnormal.
sink.server.timezone	string	Localtimezone	N/A	Session time zone specified for connecting to the destination database. The standard time zone format is supported, for example, UTC +08:00.

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination GaussDB(DWS) database.

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Figure 7-322 Mapping between source and destination tables



- Assign values to fields: Click **Assign Value to Destination Field** in the **Operation** column to customize the field mapping from MongoDB to GaussDB(DWS). In addition, you can set the source table fields to be mapped to all the fields in the destination GaussDB(DWS) table, or set the values to be manually assigned to the fields.
  - **Column Name**: name of a field in the destination GaussDB(DWS) table
  - **Type**: type of the field in the destination GaussDB(DWS) table
  - **Field Value**: Value source of the field in the destination GaussDB(DWS) table

  Table 7-204 Method of obtaining a field value

Type	Example
Manually assigned value	Any character
Source table field	**Preset source table field**: name of a field that is obtained from the drop-down list or manually entered, and complies with the MongoDB field restrictions. For details, see the database restrictions in Table 4. **extraColumns**: special field name. If this field is used, all MongoDB source fields that have not been mapped will be written to this field and transmitted to GaussDB(DWS).

  NOTE

  - Automatic table creation is not supported if the source is MongoDB.
  - For details about the field type mapping for automatic table creation, see **Field Type Mapping**.

Step 8 Configure task parameters.

Table 7-205 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB

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Parameter	Description	Default Value
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

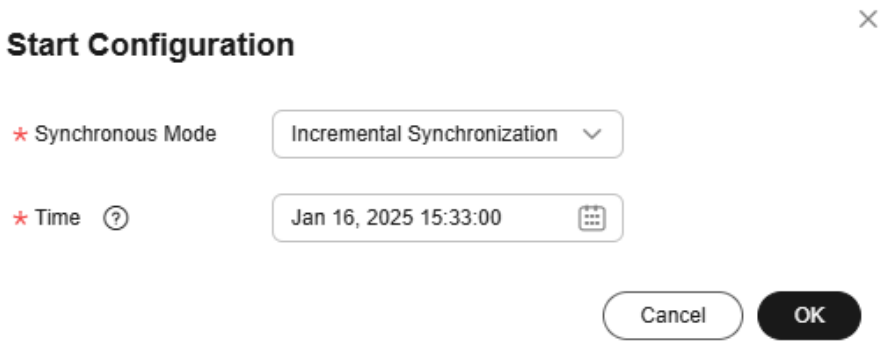
After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-323 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-324 Starting the job



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Table 7-206 Parameters for starting the job

Parameter	Description
Offset Parameter	• **Incremental synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.
Time	This parameter must be set for incremental synchronization, and it specifies the start time of incremental synchronization. **NOTE** If you set a time that is earlier than the earliest binlog time, the latest log time is used.

Step 10 Pause and modify the migration job.

You can pause a migration job, modify the job, and submit a job version again to resume synchronization.

The following modification operations are supported:

- Add or delete field mapping rules for destination field values.
- Modify global parameters, such as the number of vCPUs and whether to enable automatic retry.
- Modify the advanced properties of the data source.

The following modification operations are not supported:

- Change the existing field mapping rule for destination field values. For example, you can change the rule from source field assignment to manual assignment.
- Change the source collection or destination table.

----End

7.11.18 Configuring a Job for Migrating Data from a Centralized/Distributed GaussDB to GaussDB(DWS)

This section describes how to configure a job for migrating data from a centralized/distributed GaussDB to GaussDB(DWS).

Supported Source and Destination Database Versions

Table 7-207 Supported database versions

Source Database	Destination Database
Centralized/Distributed GaussDB (kernel engine versions: 505.1.0, 505.1.0.SPC0100, and 505.2.0)	GaussDB(DWS) cluster of version 8.1.3, 8.2.0, or a later version, except GaussDB(DWS) 3.0

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Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

Table 7-208 Database account permissions

Type	Required Permissions
Source database connection account	1. The REPLICATION permission or the permissions inherited from the built-in role gs_role_replication, the CONNECT permission of databases, USAGE permission of schemas, and SELECT permission of tables and sequences 2. Remote connection permission To add the remote connection permission, perform the following steps: • Centralized: Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the source database. • Distributed: Add **host all <user> 0.0.0.0/0 sha256** to the gs_hba.conf configuration file of the CN node of the source database. Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the DN node of the source database. • Run **select pg_reload_conf();** in the source database as the system administrator, or restart the DB instance to apply the changes. 3. Ensure that the corresponding connection ports are enabled in the security group and firewall policies. Security group and firewall policies: Common and replication connection ports are enabled for database connections. Centralized: The replication connection port number is the common connection port number plus 1. Distributed: The replication connection port number is the CN/DN connection port number plus 1. You can run the **select * from pgxc_node** statement in the source database to obtain the DN connection port.
Destination database connection account	The account must have the following permissions for each table in the destination database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

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NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-209 Synchronization objects

Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

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Table 7-210 Important notes

Type	Restriction
Database	• Source database parameter requirements: – The **password_encryption_type** parameter is set to **1**. Change the password to make it take effect. – The **wal_level** parameter is set to **logical**. – The value of parameter **max_replication_slots** must be greater than the number of used replication slots. You can determine the value based on the number of real-time jobs to be created. • The names of the source databases, schemas, and tables to be synchronized cannot contain /<.>\\'`|\? or !. Column names cannot be CTID, XMIN, CMIN, XMAX, CMAX, TABLEOID, XC_NODE_ID, or TID, which are forbidden by GaussDB(DWS). You are advised to use common characters to avoid task failures. • The name of an object in the destination database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($). • The partition table trigger of the source database cannot be set to **disable**.
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The WAL logs of the GaussDB database should be retained for more than three days. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: • Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. • Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. • When the number of replication slots of the GaussDB data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting **max_replication_slots** or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• The **block_size** value of the destination database must be greater than that of the source database. • Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. • After the job is started, the active/standby switchover is not allowed for the source database. • Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: – Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail. – Assume that extra columns in the destination database must be fixed at a default value and have a unique constraint. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will contain default values. That does not meet the requirements of the destination database. • During automatic table creation, the length of the char, varchar, nvarchar, enum, and set characters in the source database is automatically increased by byte in the destination GaussDB(DWS) database.

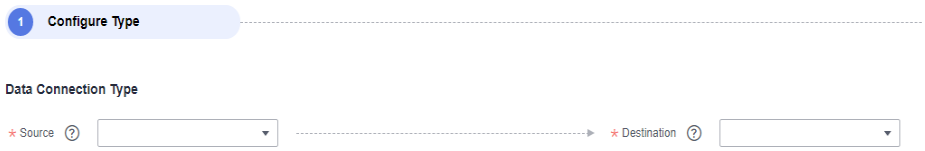
Procedure

This section uses real-time synchronization from GaussDB to GaussDB(DWS) as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **PostgreSQL** for **Source** and **DWS** for **Destination**.

Figure 7-325 Selecting the data connection type



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Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

Figure 7-326 Setting the migration job type

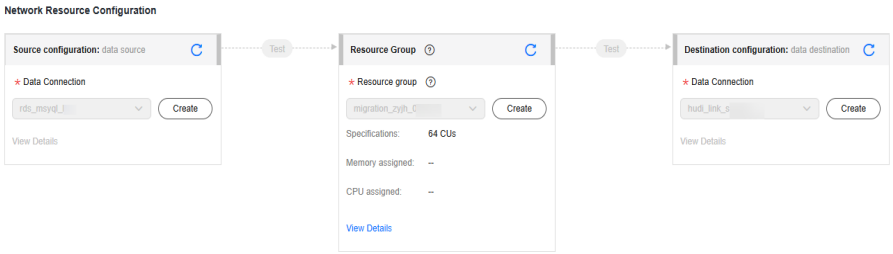


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created GaussDB(RDS PostgreSQL) and GaussDB(DWS) data connections and the migration resource group for which the network connection has been configured.

Figure 7-327 Selecting data connections and a migration resource group



NOTE

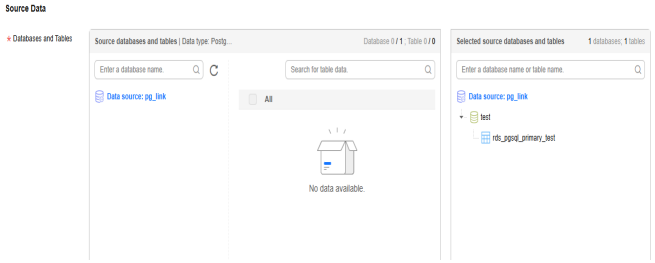
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

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Table 7-211 Selecting the databases and tables to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the GaussDB databases and tables to be migrated. **Figure 7-328** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

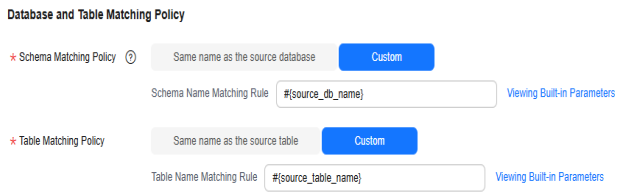
Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

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Table 7-212 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Schema Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the GaussDB(DWS) schema with the same name as the source GaussDB. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) schema you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the GaussDB(DWS) table with the same name as the source GaussDB table. ▪ **Custom**: Data will be synchronized to the GaussDB(DWS) table you specify. **Figure 7-329** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

- Configure GaussDB(DWS) parameters.
  For details, see the following table.

  Figure 7-330 GaussDB(DWS) parameters

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Table 7-213 GaussDB(DWS) parameters

Parameter	Default Value	Unit	Description
Write Mode	UPSERTMODE	N/A	– **UPSERT MODE**: batch update – **COPY MODE**: DWS-dedicated high-performance batch import
Max. data volume for batch writing	50,000	Pieces	Number of data records written to GaussDB(DWS) in a batch. You can adjust the value based on the table data size and job memory usage.
Scheduled Batch Write Interval	3	Second	Interval at which data is written to GaussDB(DWS)
Advanced Settings	N/A	N/A	Some advanced functions can be configured using parameters. For details, see GaussDB(DWS) advanced parameters.

Table 7-214 GaussDB(DWS) advanced parameters

Parameter	Type	Default Value	Unit	Description
sink.buffer-flush.max-size	int	512	MB	Maximum number of bytes in each batch of data written to GaussDB(DWS). You can adjust the value based on the memory and data size configured for the job.
sink.keyby.enable	boolean	true	-	Whether to enable data distribution. If this function is enabled in multi-concurrency scenarios, data can be distributed to different processes based on specific rules and written to the destination, which improves the write performance.

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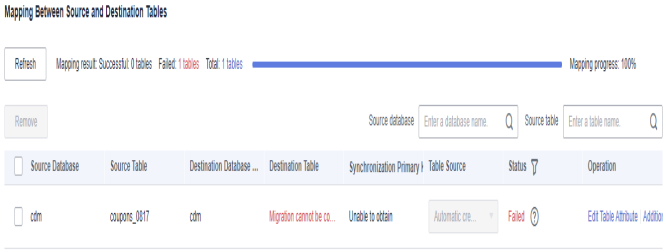
Parameter	Type	Default Value	Unit	Description
sink.keyby.mode	string	table	-	Data distribution mode. The following modes are available: – **pk**: Data is distributed by primary key value. – **table**: Data is distributed by table name. **NOTE** ▪ In multi-concurrency scenarios, if DDL is enabled, data can be distributed only by table name. Otherwise, data may be inconsistent. ▪ If there is no DDL, you can select **pk**, which improves the write performance in multi-concurrency scenarios.
sink.field.name.case-sensitive	boolean	true	-	Whether to enable case sensitivity for data synchronization. If this function is enabled, the database names, table names, and field names are case sensitive during data synchronization.
sink.verify.column-number	boolean	false	-	Whether to verify the number of data columns. By default, data is synchronized from GaussDB to GaussDB(DWS) in the same-name mapping mode. The system does not check whether all columns are synchronized. If this function is enabled and the number of columns at the source is different from that at the destination, the system determines that data is inconsistent. As a result, the job is abnormal.
sink.server.timezone	string	Local time zone	-	Session time zone specified for connecting to the destination database. The standard time zone format is supported, for example, UTC+08:00.
logical.delete.enabled	boolean	false	-	Whether to enable logical deletion

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Parameter	Type	Default Value	Unit	Description
logical.delete.column	string	logical_is_deleted	-	Name of the logical deletion column. The default value is **logical_is_deleted**. You can customize the value.

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination GaussDB(DWS) database.

Figure 7-331 Mapping between source and destination tables



- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination GaussDB(DWS) table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination GaussDB(DWS) table
  - **Field Type**: type of the new field in the destination GaussDB(DWS) table
  - (Optional) **Field Type Length**: length of the new field type in the destination GaussDB(DWS) table
  - **Field Value**: Value source of the new field in the destination GaussDB(DWS) table

    Table 7-215 Additional field value obtaining mode

Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.

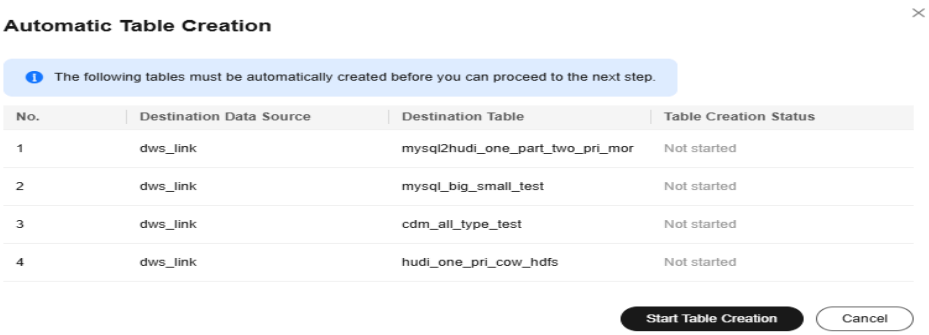
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Type	Example
Built-in variable	▪ Source host IP address: source.host ▪ Source schema name: source.schema ▪ Source table name: source.table ▪ Destination schema name: target.schema ▪ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.
UDF	▪ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ▪ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ▪ now([tz]): obtains the current time in a specified time zone. ▪ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ▪ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ▪ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ▪ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

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Figure 7-332 Automatic table creation



NOTE

- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.

Step 8 Configure task parameters.

Table 7-216 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-333 Submitting the job



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After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-334 Starting the job

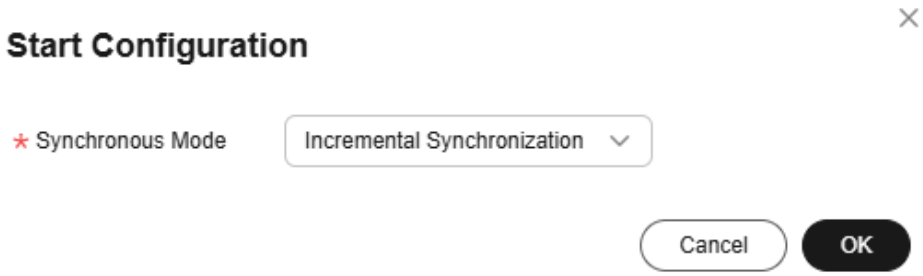


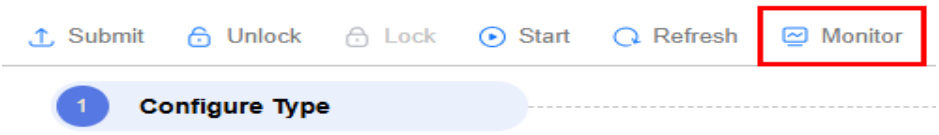
Table 7-217 Parameters for starting the job

Parameter	Description
Synchronous Mode	• **Incremental Synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-335 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

7.11.19 Configuring a Job for Migrating Data from a Centralized/Distributed GaussDB to MRS Hudi

This section describes how to configure a job for migrating data from a centralized/distributed GaussDB to GaussDB(DWS).

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Supported Source and Destination Database Versions

Table 7-218 Supported database versions

Source Database	Destination Database
Centralized/Distributed GaussDB (kernel engine versions: 505.1.0, 505.1.0.SPC0100, and 505.2.0)	MRS cluster (3.2.0-LTS.*x* and 3.5.*x*) Hudi (0.11.0)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

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Table 7-219 Database account permissions

Type	Required Permissions
Source database connection account	1. The REPLICATION permission or the permissions inherited from the built-in role gs_role_replication, the CONNECT permission of databases, USAGE permission of schemas, and SELECT permission of tables and sequences 2. If GaussDB is the source and Hudi is the destination, you need to change the replica identity of source tables to FULL using DDL, for example, **alter table table_name REPLICA IDENTITY FULL**. Otherwise, the **logical.delete.enabled=false** configuration of Hudi does not take effect. 3. Remote connection permission To add the remote connection permission, perform the following steps: • Centralized: Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the source database. • Distributed: Add **host all <user> 0.0.0.0/0 sha256** to the gs_hba.conf configuration file of the CN node of the source database. Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the DN node of the source database. • Run **select pg_reload_conf();** in the source database as the system administrator, or restart the DB instance to apply the changes. 4. Ensure that the corresponding connection ports are enabled in the security group and firewall policies. Security group and firewall policies: Common and replication connection ports are enabled for database connections. Centralized: The replication connection port number is the common connection port number plus 1. Distributed: The replication connection port number is the CN/DN connection port number plus 1. You can run the **select * from pgxc_node** statement in the source database to obtain the DN connection port.
Destination database connection account	The account must have the following permissions for each table in the destination database: INSERT, SELECT, UPDATE, DELETE, CONNECT, and CREATE.

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

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Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-220 Synchronization objects

Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

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Table 7-221 Important notes

Type	Restriction
Database	• Source database parameter requirements: – The **password_encryption_type** parameter is set to **1**. Change the password to make it take effect. – The **wal_level** parameter is set to **logical**. – The value of parameter **max_replication_slots** must be greater than the number of used replication slots. You can determine the value based on the number of real-time jobs to be created. • The names of the source databases, schemas, and tables to be synchronized cannot contain /<.>\\'`|\? or !. Column names cannot be CTID, XMIN, CMIN, XMAX, CMAX, TABLEOID, XC_NODE_ID, or TID, which are forbidden by GaussDB(DWS). You are advised to use common characters to avoid task failures. • The name of an object in the destination database must contain 1 to 63 characters, start with a letter or underscore (_), and can contain letters, digits, underscores (_), and dollar signs ($). • The partition table trigger of the source database cannot be set to **disable**.
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The WAL logs of the GaussDB database should be retained for more than three days. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: • Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. • Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. • When the number of replication slots of the GaussDB data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting **max_replication_slots** or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .

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Type	Restriction
Other	• Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. • After the job is started, the active/standby switchover is not allowed for the source database. • Tables in the destination database can contain more columns than those in the source database. The following failures must be avoided: Assume that extra columns in the destination database cannot be null and have no default values. If newly inserted data records are synchronized from the source database to the destination database, the extra columns will become null, which does not meet the requirements of the destination database and will cause the task to fail.

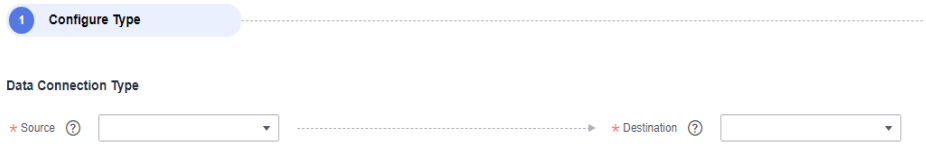
Procedure

This section uses real-time synchronization from GaussDB to Hudi as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

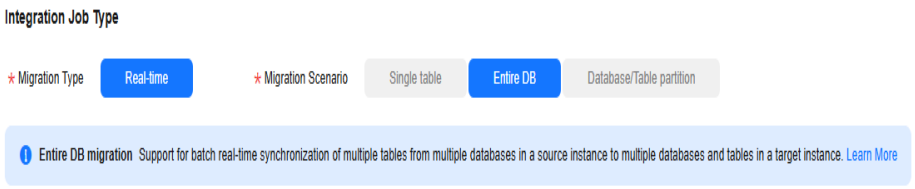
Step 2 Select the data connection type. Select **PostgreSQL** for **Source** and **Hudi** for **Destination**.

Figure 7-336 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

Figure 7-337 Setting the migration job type

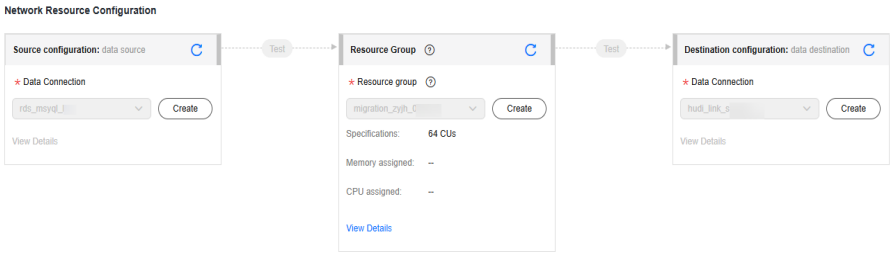


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> **NOTE**
>
> For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created GaussDB(RDS PostgreSQL) and Hudi data connections and the migration resource group for which the network connection has been configured.

Figure 7-338 Selecting data connections and a migration resource group

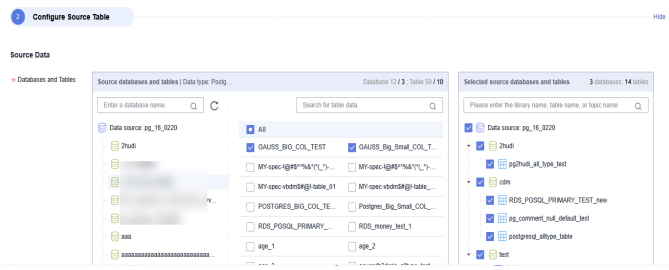


> **NOTE**
>
> If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

Table 7-222 Selecting the databases and tables to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the GaussDB databases and tables to be migrated. **Figure 7-339** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

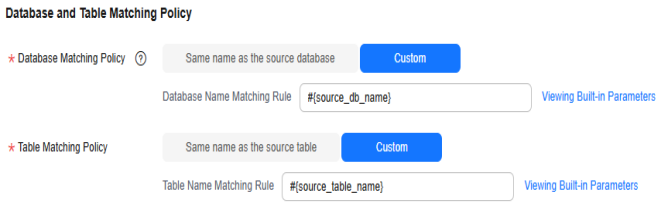
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Step 6 Configure destination parameters.

- Set **Database and Table Matching Policy**.

  For details about the matching policy between source and destination databases and tables in each synchronization scenario, see the following table.

  Table 7-223 Database and table matching policy

Synchronization Scenario	Configuration Method
Entire DB	– **Database Matching Policy** ▪ **Same name as the source database**: Data will be synchronized to the Hudi database with the same name as the source GaussDB database. ▪ **Custom**: Data will be synchronized to the Hudi database you specify. – **Table Matching Policy** ▪ **Same name as the source table**: Data will be synchronized to the Hudi table with the same name as the source GaussDB table. ▪ **Custom**: Data will be synchronized to the Hudi table you specify. **Figure 7-340** Database and table matching policy in the entire database migration scenario  **NOTE** When you customize a matching policy, you can use built-in variables **#{source_db_name}** and **#{source_table_name}** to identify the source database name and table name. The table matching policy must contain **#{source_table_name}**.

- Set Hudi parameters.

  For details, see **Table 7-224**.

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Figure 7-341 Hudi destination parameters



Table 7-224 Hudi destination parameters

Parameter	Description
Data Storage Path	Warehouse path when tables are automatically created in Hudi. A subdirectory is created in the warehouse path for each table. You can enter an HDFS or OBS path. The path format is as follows: – OBS path: obs://bucket/warehouse – HDFS path: /tmp/warehouse
Global Configuration of Hudi Table Attributes	Some advanced functions can be configured using parameters. For details, see **Hudi advanced parameters**.

Table 7-225 Hudi advanced parameters

Parameter	Type	DefaultValue	Unit	Description
index.type	string	BLOOM	N/A	Index type of the Hudi table BLOOM and BUCKET indexes are supported. If a large amount of data need to be migrated, BUCKET indexes are recommended for better performance.

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Parameter	Type	Default Value	Unit	Description
hoodie.bucket.index.num.buckets	int	256	Count	Number of buckets within a Hudi table partition **NOTE** When using Hudi BUCKET tables, you need to set the number of buckets for a table partition. The number of buckets affects the table performance. – Number of buckets for a non-partitioned table = MAX(Data volume of the table (GB)/2 GB x 2, rounded up, 4) – Number of buckets for a partitioned table = MAX(Data volume of a partition (GB)/2 GB x 2, rounded up, 1) Pay attention to the following: – The total data volume of a table, instead of the compressed size, is used. – An even number of buckets is recommended. The minimum number of buckets should be 4 for a non-partitioned table and 1 for a partitioned table.
changelog.enabled	boolean	false	N/A	Whether to enable the Hudi ChangeLog function. If this function is enabled, the migration job can output DELETE and UPDATE BEFORE data.
logical.delete.enabled	boolean	true	N/A	Whether to enable logical deletion. If the ChangeLog function is enabled, logical deletion must be disabled.
hoodie.write.liststatus.optimized	boolean	true	N/A	Whether to enable liststatus optimization when log files are written. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.

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Parameter	Type	DefaultValue	Unit	Description
hoodie.index.liststatus.optimized	boolean	false	N/A	Whether to enable liststatus optimization during data locating. If the migration job involves large tables or a large amount of partitioned data, the list operation is time-consuming during startup, which may cause job startup timeout. You are advised to disable this function.
compaction.async.enabled	boolean	true	N/A	Whether to enable asynchronous compaction. The compaction operation affects the writing performance of real-time jobs. If you use an external compaction operation, you can set this parameter to **false** to disable compaction for real-time processing migration jobs.
compaction.schedule.enabled	boolean	true	N/A	Whether to generate compaction plans. Compaction plans must be generated by this service and can be executed by Spark.
compaction.delta_commits	int	5	Count	Compaction request generation frequency Lowering the compaction request generation frequency reduces the compaction frequency and improves job performance. If there is a small volume of incremental data to be synchronized to Hudi, you can set a larger value for this parameter. **NOTE** For example, if this parameter is set to **40**, a compaction request is generated for every 40 commits. Since DataArts Migration generates a commit every minute, the interval between compaction requests is 40 minutes.
clean.async.enabled	boolean	true	N/A	Whether to clear data files of historical versions

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Parameter	Type	Default Value	Unit	Description
clean.retain_commits	int	30	Count	Number of recent commits to retain. Data files related to these commits will be retained for a period calculated by multiplying the number of specified commits by the interval between commits. You are advised to set this parameter to twice the value of **compaction.delta_commits**. **NOTE** For example, if this parameter is set to **80** and since DataArts Migration generates a commit every minute, data files related to commits generated 80 minutes earlier are cleaned, and data files related to the recent 80 commits are retained.
hoodie.archive.automatic	boolean	true	N/A	Whether to age Hudi commit files
archive.min_commits	int	40	Count	Number of recent commits to keep when historical commits are archived to log files You are advised to set this parameter to one greater than **clean.retain_commits**. **NOTE** For example, if this parameter is set to **81**, the files related to the recent 81 commits are retained when an archive operation is triggered.
archive.max_commits	int	50	Count	Number of commits that triggers an archive operation You are advised to set this parameter to 20 greater than **archive.min_commits**. **NOTE** For example, if the parameter is set to **101**, an archive operation is triggered when the files of 101 commits are generated.

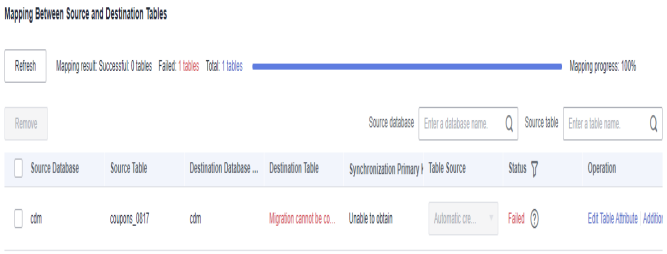
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NOTE

- To achieve optimal performance for the migration job, you are advised to use an MOR table that uses Hudi BUCKET indexes and configure the number of buckets based on the actual data volume.
- To ensure the stability of the migration job, you are advised to split the Hudi Compaction job into Spark jobs and execute them by MRS, and enable compaction plans to be generated for this migration job. For details, see

Step 7 Refresh and check the mapping between the source and destination tables. In addition, you can modify table attributes, add additional fields, and use the automatic table creation capability to create tables in the destination Hudi database.

Figure 7-342 Mapping between source and destination tables



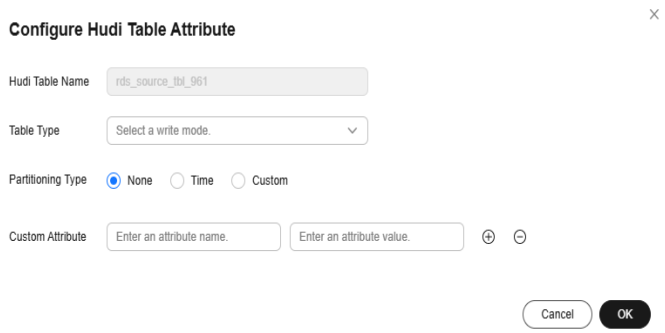
- **Synchronization Primary Key**

  The primary key must be set for Hudi tables. If the source table has no primary key, you must manually select the primary key during field mapping.

- **Edit Table Attribute**

  Click **Edit Table Attributes** in the **Operation** column to configure Hudi table attributes, including the table type, partition type, and custom attributes.

Figure 7-343 Configuring the Hudi table attributes



  - **Table Type**: Hudi table type. Select **MERGE_ON_READ** or **COPY_ON_WRITE**.
  - **Partition Type**: partition type of the Hudi table. Select **No partition**, **Time**, or **Custom**.

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NOTE

- For **Time**, you need to specify a source field name and select a time conversion format.

  For example, you can specify the source field name **src_col_1** and select a time conversion format, for example, day(yyyyMMdd), month(yyyyMM), or year(yyyy). During automatic table creation, a **cdc_partition_key** field is created in the Hudi table by default. The system formats the value of the source field (**src_col_1**) based on the configured time conversion format and writes the value to **cdc_partition_key**.

- Custom partitions do not support timestamp fields. If you use timestamp fields, the job will fail.

  - Customize table attributes. Some advanced functions of a single table can be configured using parameters. For details about the parameters, see the table that lists Hudi advanced configurations.

- Edit additional fields: Click **Additional Field** in the **Operation** column to add custom fields to the destination Hudi table. For a new table, you can add additional fields to the existing fields in the source table. You can customize the field name, select the field type, and enter the field value.
  - **Field Name**: name of the new field in the destination Hudi table
  - **Field Type**: Type of the new field in the destination Hudi table
  - **Field Value**: Value source of the new field in the destination Hudi table

Table 7-226 Additional field value obtaining mode

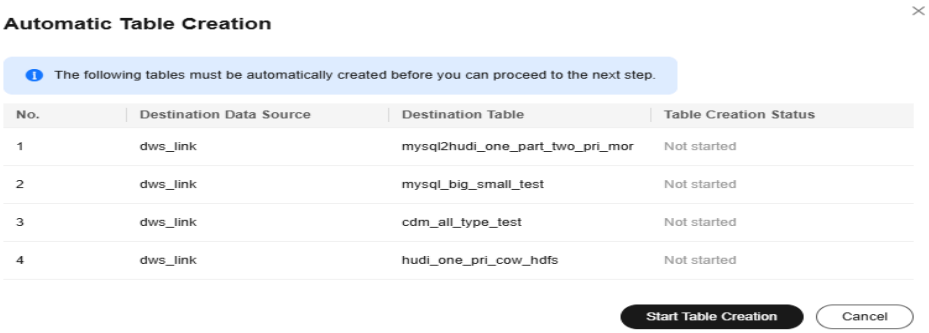
Type	Example
Constant	Digits, letters, and special characters are supported. Color emoticons may cause a job submission failure.
Built-in variable	■ Source host IP address: source.host ■ Source schema name: source.schema ■ Source table name: source.table ■ Destination schema name: target.schema ■ Destination table name: target.table
Source table field	Any field in the source table Do not change the name of the source table field when the job is running. Otherwise, the job may be abnormal.

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Type	Example
UDF	▪ substring(#col, pos[, len]): obtains a substring of a specified length from the source column name. The substring range is [pos, pos+len). ▪ date_format(#col, time_format[, src_tz, dst_tz]): formats the source column name based on a specified time format. The time zone can be converted using src_tz and dst_tz. ▪ now([tz]): obtains the current time in a specified time zone. ▪ if(cond_exp, str1, str2): returns str1 if the condition expression cond_exp is met and returns str2 otherwise. ▪ concat(#col[, #str, ...]): concatenates multiple parameters, including source columns and strings. ▪ from_unixtime(#col[, time_format]): formats a Unix timestamp based on a specified time format. ▪ unix_timestamp(#col[, precision, time_format]): converts a time into a Unix timestamp of a specified time format and precision. **time_format** must be the same as that in the source data.

- Automatic table creation: Click **Auto Table Creation** to automatically create tables in the destination database based on the configured mapping policy. After the tables are created, **Existing table** is displayed for them.

Figure 7-344 Automatic table creation



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NOTE

- DataArts Migration supports only automatic table creation. You need to manually create databases and schemas at the destination before using this function.
- For details about the field type mapping for automatic table creation, see **Field Type Mapping**.
- An automatically created Hudi table contains three audit fields: **cdc_last_update_date**, **logical_is_deleted**, and **_hoodie_event_time**. The **_hoodie_event_time** field is used as the pre-aggregation key of the Hudi table.

Step 8 Configure task parameters.

Table 7-227 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	-

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-345 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

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Figure 7-346 Starting the job

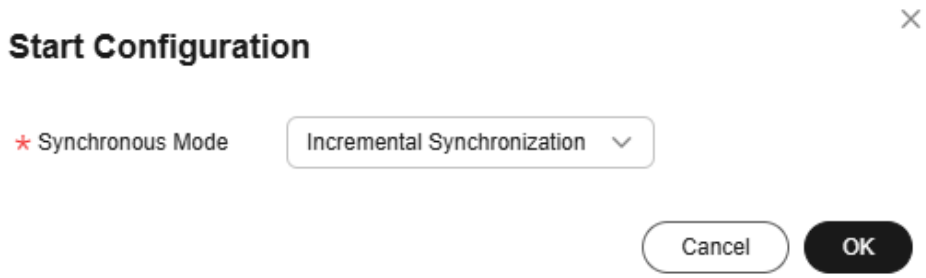


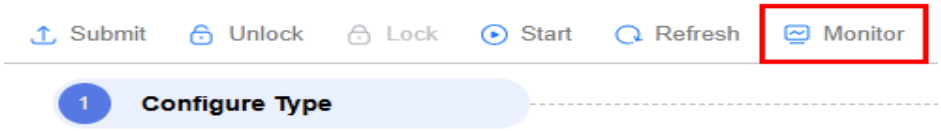
Table 7-228 Parameters for starting the job

Parameter	Description
Synchronous Mode	• **Incremental Synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.

Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-347 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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7.11.20 Configuring a Job for Synchronizing Data from a Centralized/Distributed GaussDB to

Supported Source and Destination Database Versions

Table 7-229 Supported database versions

Source Database	Destination Database
Centralized/Distributed GaussDB (kernel engine versions: 505.1.0, 505.1.0.SPC0100, and 505.2.0)	Kafka cluster (2.7 and 3.*x*)

Database Account Permissions

Before you use DataArts Migration for data synchronization, ensure that the source and destination database accounts meet the requirements in the following table. The required account permissions vary depending on the synchronization task type.

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Table 7-230 Database account permissions

Type	Required Permissions
Source database connection account	1. The REPLICATION permission or the permissions inherited from the built-in role gs_role_replication, the CONNECT permission of databases, USAGE permission of schemas, and SELECT permission of tables and sequences 2. Remote connection permission To add the remote connection permission, perform the following steps: • Centralized: Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the source database. • Distributed: Add **host all <user> 0.0.0.0/0 sha256** to the gs_hba.conf configuration file of the CN node of the source database. Add **host all <user> 0.0.0.0/0 sha256** and **host replication <user> 0.0.0.0/0 sha256** to the **gs_hba.conf** configuration file of the DN node of the source database. • Run **select pg_reload_conf();** in the source database as the system administrator, or restart the DB instance to apply the changes. 3. Ensure that the corresponding connection ports are enabled in the security group and firewall policies. Security group and firewall policies: Common and replication connection ports are enabled for database connections. Centralized: The replication connection port number is the common connection port number plus 1. Distributed: The replication connection port number is the CN/DN connection port number plus 1. You can run the **select * from pgxc_node** statement in the source database to obtain the DN connection port.
Destination database connection account	The MRS user must have the read and write permissions on corresponding Kafka topics, that is, the user must belong to the kafka/kafkaadmin/kafkasuperuser user group. **NOTE** A common Kafka user can access a topic only after being granted the read and write permissions on the topic by the Kafka administrator.

NOTE

- You are advised to create independent database accounts for DataArts Migration task connections to prevent task failures caused by password modification.
- After changing the account passwords for the source or destination databases, modify the connection information in Management Center as soon as possible to prevent automatic retries after a task failure. Automatic retries will lock the database accounts.

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Supported Synchronization Objects

The following table lists the objects that can be synchronized using different links in DataArts Migration.

Table 7-231 Synchronization objects

Type	Note
Synchronization objects	• DML operations INSERT, UPDATE, and DELETE can be synchronized. • DDL operations cannot be synchronized. • Only primary key tables can be synchronized. • Views, foreign keys, stored procedures, triggers, functions, events, virtual columns, unique constraints, and unique indexes cannot be synchronized. • Unlogged tables, temporary tables, system schemas, and system tables cannot be synchronized. • Table structures, common indexes, constraints (primary key, null, and non-null), and comments cannot be synchronized during automatic table creation.

Important Notes

In addition to the constraints on supported data sources and versions, connection account permissions, and synchronization objects, you also need to pay attention to the notes in the following table.

Table 7-232 Important notes

Type	Restriction
Database	• Source database parameter requirements: – The **password_encryption_type** parameter is set to **1**. Change the password to make it take effect. – The **wal_level** parameter is set to **logical**. – The value of parameter **max_replication_slots** must be greater than the number of used replication slots. You can determine the value based on the number of real-time jobs to be created. • The names of the source databases, schemas, and tables to be synchronized cannot contain /<.>\\'`|\? or !. Column names cannot be CTID, XMIN, CMIN, XMAX, CMAX, TABLEOID, XC_NODE_ID, or TID, which are forbidden by GaussDB(DWS). You are advised to use common characters to avoid task failures. • The partition table trigger of the source database cannot be set to **disable**.

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Type	Restriction
Usage	General: • During real-time synchronization, the IP addresses, ports, accounts, and passwords cannot be changed. • The WAL logs of the GaussDB database should be retained for more than three days. Full synchronization phase: During task startup and full data synchronization, do not perform DDL operations on the source database. Otherwise, the task may fail. Incremental synchronization phase: • Do not change the primary key or unique key (if the primary key does not exist) of the source database table. Otherwise, incremental data may be inconsistent or the task may fail. • Do not modify the replica identity attribute of tables in the source database. Otherwise, incremental data may be inconsistent or the task may fail. • When the number of replication slots of the GaussDB data source has reached the upper limit, new jobs cannot be executed. You can increase the upper limit of the number of replication slots by setting max_replication_slots or manually delete replication slots (automatic deletion is not supported). For details about how to delete replication slots, see Troubleshooting: If any problem occurs during task creation, startup, full synchronization, incremental synchronization, or completion, rectify the fault by referring to .
Other	• Before starting the job, ensure that no long transaction is started in the source database. If a long transaction is started in the source database, the creation of the logical replication slot will be blocked. As a result, the task fails. • After the job is started, the active/standby switchover is not allowed for the source database.

Procedure

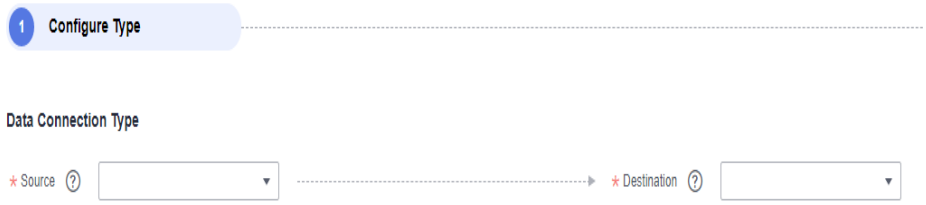
This section uses real-time synchronization from GaussDB to as an example to describe how to configure a real-time data migration job. Before that, ensure that you have read the instructions described in **Check Before Use** and completed all the preparations.

Step 1 Create a real-time migration job by following the instructions in **Creating a Real-Time Migration Job** and go to the job configuration page.

Step 2 Select the data connection type. Select **PostgreSQL** for **Source** and **MRS Kafka** for **Destination**.

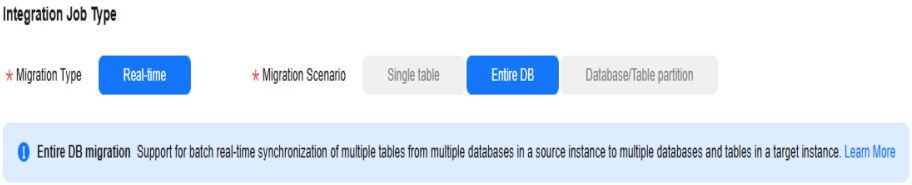
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Figure 7-348 Selecting the data connection type



Step 3 Select a job type. The default migration type is **Real-time**. The migration scenario is **Entire DB**.

Figure 7-349 Setting the migration job type

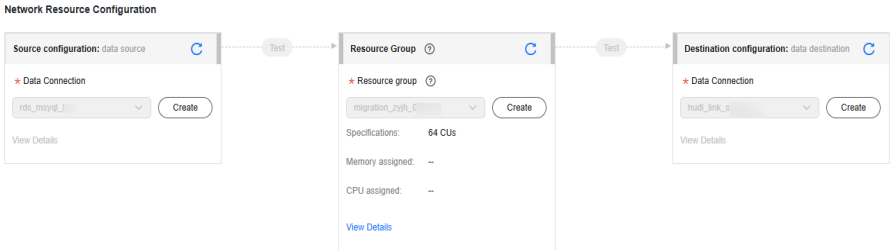


NOTE

For details about synchronization scenarios, see **Synchronization Scenarios**.

Step 4 Configure network resources. Select the created GaussDB(RDS PostgreSQL) and MRS Kafka data connections and the migration resource group for which the network connection has been configured.

Figure 7-350 Selecting data connections and a migration resource group



NOTE

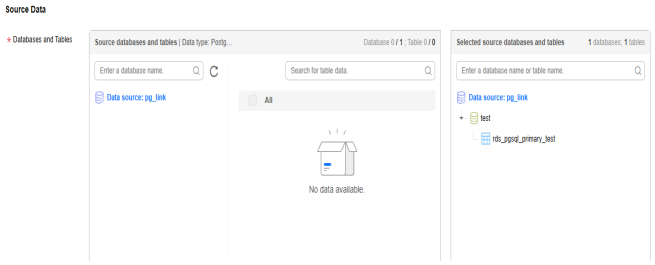
If no data connection is available, click **Create** to go to the **Manage Data Connections** page of the Management Center console and click **Create Data Connection** to create a connection. For details, see **Configuring DataArts Studio Data Connection Parameters**.

Step 5 Configure source parameters.

Select the databases and tables to be synchronized based on the following table.

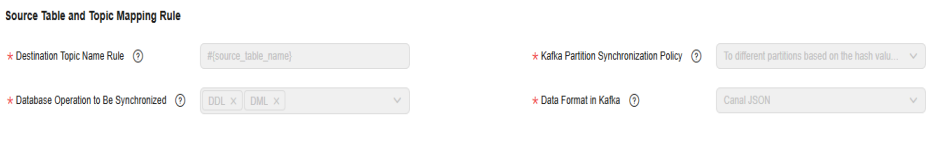
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Table 7-233 Selecting the databases and tables to be synchronized

Synchronization Scenario	Configuration Method
Entire DB	Select the GaussDB databases and tables to be migrated. **Figure 7-351** Selecting databases and tables  Both databases and tables can be customized. You can select one database and one table, or multiple databases and tables.

Step 6 Configure destination parameters.

Figure 7-352 Kafka destination parameters



- **Destination Topic Name Rule**

  Configure the rule for mapping source database tables to destination Kafka topics. You can specify a fixed topic or use built-in variables to synchronize data from source tables to destination topics.

  The following built-in variables are available:

  - Source database name: **#{source_db_name}**
  - Source table name: **#{source_table_name}**

- **Kafka Partition Synchronization Policy**

  The following three policies are available for synchronizing source data to specified partitions of destination Kafka topics:

  - **To Partition 0**
  - **To different partitions based on the hash values of database names/table names**
  - **To different partitions based on the hash values of table primary keys**

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NOTE

If the source has no primary key, data is synchronized to partition 0 at the destination by default.

- Partitions of New Topic

  If the destination Kafka does not have the corresponding topic, the topic automatically created by DataArts Migration has three partitions.

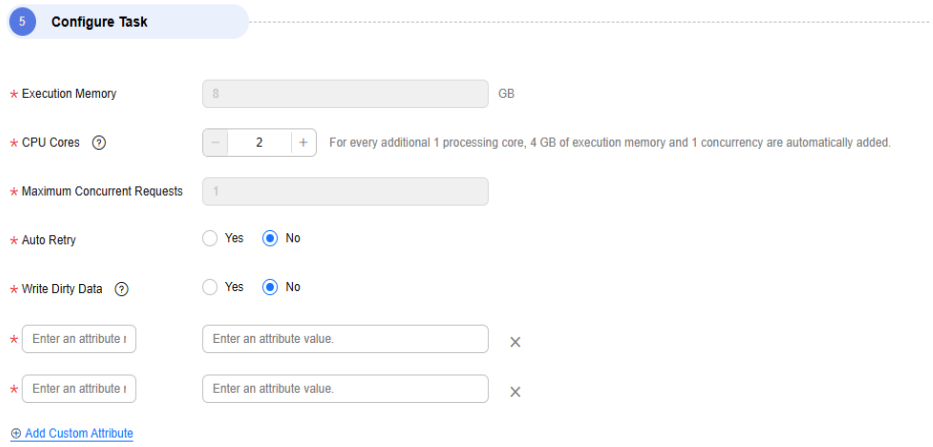
- **Destination Kafka Attributes**

  You can set Kafka attributes and add the **properties.** prefix. The job will automatically remove the prefix and transfer the attributes to the Kafka client. For details about the parameters, see the configuration descriptions in the **Kafka documentation**.

- Advanced settings

  You can add custom attributes in the **Configure Task** area to enable some advanced functions. For details about the parameters, see the following table.

Figure 7-353 Adding custom attributes



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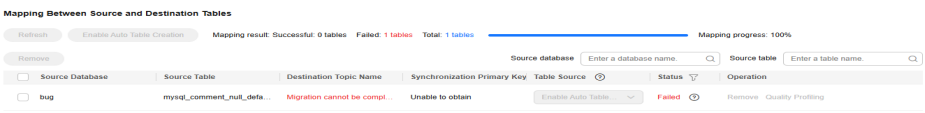
Table 7-234 Advanced parameters of the job for migrating data from GaussDB to Kafka

Parameter	Type	Default Value	Unit	Description
sink.delivery-guarantee	string	at-least-once	N/A	Semantic assurance when Flink writes data to Kafka – **at-least-once**: At a checkpoint, the system waits for all data in the Kafka buffer to be confirmed by the Kafka producer. No message will be lost due to events that occur on the Kafka broker. However, duplicate messages may be generated when Flink is restarted because Flink processes old data again. – **exactly-once**: In this mode, the Kafka sink writes all data through the transactions submitted at a checkpoint. Therefore, if the consumer reads only submitted data, duplicate data will not be generated when Flink is restarted. However, data is visible only when a checkpoint is complete, so you need to adjust the checkpoint interval as needed.

Step 7 Update the mapping between the source table and destination table and check whether the mapping is correct.

You can change the names of mapped destination topics as needed. You can map one source topic to one destination topic or map multiple source topics to one destination topic.

Figure 7-354 Mapping between source and destination tables



Step 8 Configure task parameters.

Table 7-235 Task parameters

Parameter	Description	Default Value
Execution Memory	Memory allocated for job execution, which automatically changes with the number of CPU cores	8GB

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Parameter	Description	Default Value
CPU Cores	Value range: 2 to 32 For each CPU core added, 4 GB execution memory and one concurrency are automatically added.	2
Maximum Concurrent Requests	Maximum number of jobs that can be concurrently executed. This parameter does not need to be configured and automatically changes with the number of CPU cores.	1
Adding custom attributes	You can add custom attributes to modify some job parameters and enable some advanced functions. For details, see **Job Performance Optimization**.	N/A

Step 9 Submit and run the job.

After configuring the job, click **Submit** in the upper left corner to submit the job.

Figure 7-355 Submitting the job



After submitting the job, click **Start** on the job development page. In the displayed dialog box, set required parameters and click **OK**.

Figure 7-356 Starting the job

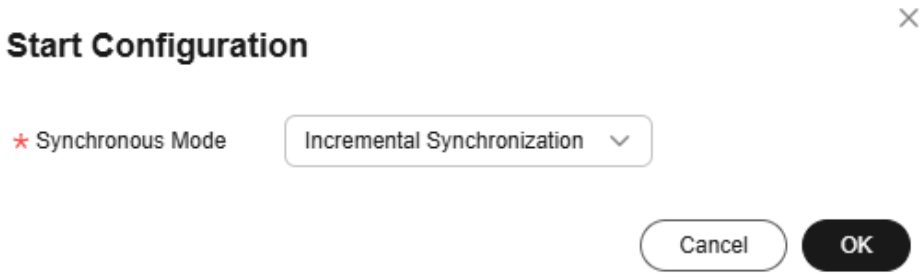


Table 7-236 Parameters for starting the job

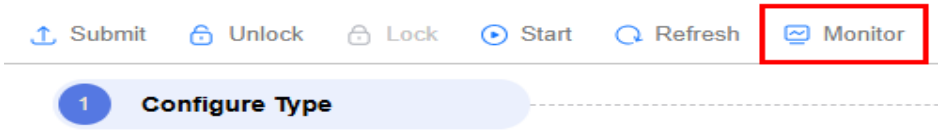
Parameter	Description
Synchronous Mode	• **Incremental Synchronization**: Incremental data synchronization starts from a specified time point. • **Full and incremental synchronization**: All data is synchronized first, and then incremental data is synchronized in real time.

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Step 10 Monitor the job.

On the job development page, click **Monitor** to go to the **Job Monitoring** page. You can view the status and log of the job, and configure alarm rules for the job. For details, see **Real-Time Migration Job O&M**.

Figure 7-357 Monitoring the job



----End

Performance Optimization

If the synchronization speed is too slow, rectify the fault by referring to **Job Performance Optimization**.

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8 DataArts Architecture

8.1 Overview

Model Design Method Overview

A data model can reflect the relationships between objects. It incorporates the key information features extracted based on business requirements. It visually represents how the internal information of an enterprise is organized. A data model must be capable of simulating scenarios, easy-to-understand, and easily implemented in the IT system.

DataArts Architecture provides the following modeling methods:

- **ER modeling**

  ER modeling describes the business processes within an enterprise. Compliant with the third normal form (3NF), ER modeling is designed for data integration. It is used for combining and merging data with similarities by subject. ER modeling results cannot be used directly for decision-making, but they are a useful tool.

  During ER modeling, you can design physical models in data warehouse planning.

  - **Physical model**: An advanced version of the logic model and used to design the database architecture for data storage with a full consideration of various technical factors. For example, the selected data warehouse is DWS or MRS_Hive.

- **Dimensional modeling**

  Dimensional modeling is the construction of models based on analysis and decision-making requirements. It is mainly used for data analysis. Dimensional modeling is focused on how to quickly analyze user requirements and respond rapidly to complicated, large-scale queries.

  A multidimensional model is a fact table consisting of numeric metrics. The fact table is associated with a group of dimensional tables containing description attributes with primary or foreign keys. Typical dimensional models include star models and snowflake models used in some special scenarios.

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- **Data mart**

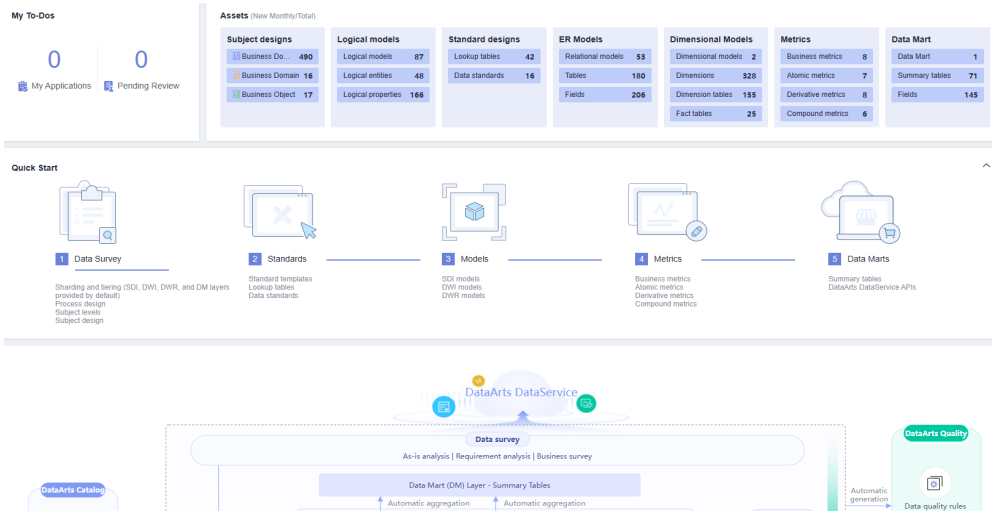
  A data mart (DM) aggregates data from multiple layers and consists of a specific analysis object and its related metrics. The DM provides all statistical data by subject.

In the DataArts Architecture module of DataArts Studio, dimensional modeling involves abstracting facts and dimensions for model creation, and abstracting and sorting out report requirements for constructing metric systems and creating summary models using the data mart.

DataArts Architecture Overview Page

On the DataArts Studio console, locate a workspace and click **DataArts Architecture**. The **Overview** page is displayed.

Figure 8-1 DataArts Architecture Overview page



- **My To-Dos**
  - The **My To-Dos** area displays the quantity of **My Applications** and **Pending Review**.
  - Click the numbers above **My Applications** and **Pending Review** to access the **My Applications** and **Pending Review** pages, respectively.
- **Assets**
  - The **Assets** area displays all the objects in DataArts Architecture.
  - Click the number next to each object name to access the object management page.
- **Quick Start**

  The **Quick Start** area displays the overall process for data governance. You can click a specific operation under the process to go to the corresponding page.
- **DataArts Architecture Process**
  - This area displays the DataArts Architecture process and how the DataArts Architecture module interacts with other modules of DataArts Studio. For details about the DataArts Architecture process, see **DataArts Architecture Use Process**.

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  - You can move the cursor over the name of an object to view its description.
  - You can click the name of any object supported by DataArts Studio to access the object management page.

Information Architecture of DataArts Architecture

An information architecture is a set of component specifications that describe various types of information required for business operations and management decision-making as well as the relationships of business entities. On the **Information Architecture** page, you can view and manage all tables, including logical entities, physical tables, dimension tables, fact tables, and summary tables.

On the DataArts Studio console, locate a workspace and click **DataArts Architecture**. In the navigation pane, choose **Information Architecture**.

Perform the following operations on the **Information Architecture** page.

- **Search**

  On the top of the **Information Architecture** page, click **Advanced Search**, set the table name, type, data source, and other filters, and click **Search** to search for a specific table. Then click the table name to access its details page.

- **Create**

  Click **Create** to create logical entities, physical tables, dimensions, fact tables, and summary tables. For details, see **Logical Models**, **ER Modeling**, **Creating Dimensions**, **Creating Fact Tables**, or **Data Mart**.

- **Synchronize**

  Choose **More** > **Synchronize** to synchronize tables to DataArts Catalog as technical assets or synchronize logical models to DataArts Catalog as logical assets. In enterprise mode, you can choose to synchronize the table to the production or development environment. By default, they are synchronized to the production environment.

- **Modify Subject**

  Choose **More** > **Modify Subject** to change the selected table to another subject.

- **Delete**

  Choose **More** > **Delete** to delete a data table. A data table in publishing review, published, or suspension review state cannot be deleted. A referenced data table cannot be deleted either.

- **Suspend**

  Choose **More** > **Suspend** to suspend a published data table. A referenced data table cannot be suspended.

  NOTE

  Edited versions refer to the data that is re-edited after the publishing review.

- **Publish**

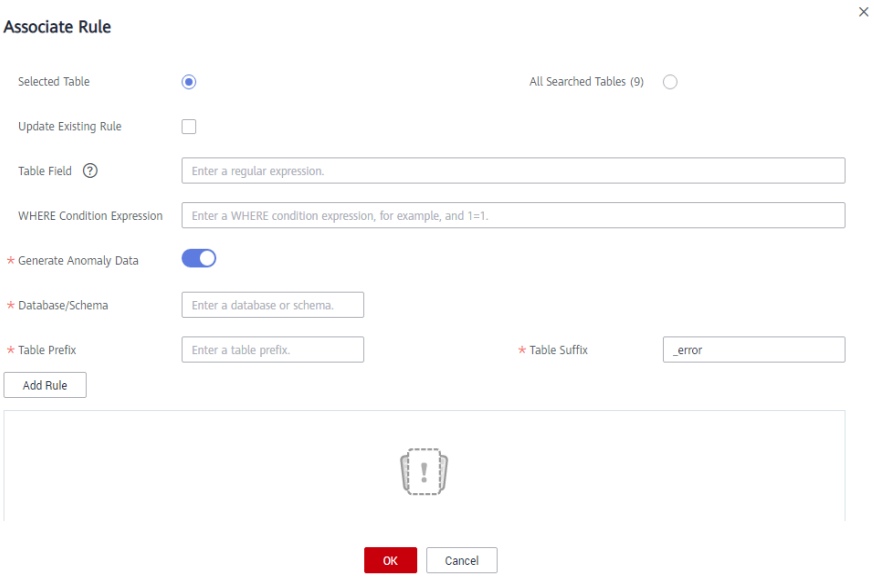
  Click **Publish** to publish a data table. Data tables in publishing review, suspension review, or published (without edited versions) state cannot be published. In enterprise mode, you can choose to publish the table to the production or development environment. By default, they are synchronized to the production environment.

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- **Associate Rule**

  Click **Associate Rule** and set the parameters to associate a quality rule with the object you select. For details, see **Associating Quality Rules**.

  Figure 8-2 Associating a quality rule with an object

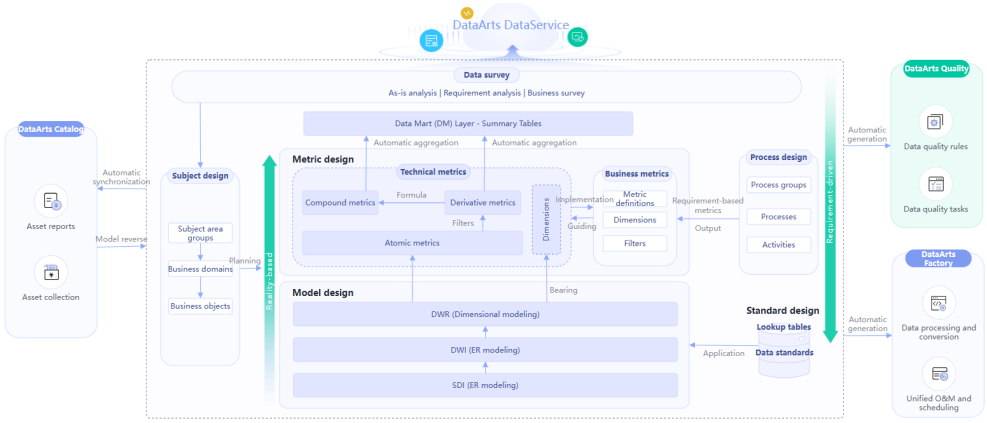


  Generate Anomaly Data: If this function is enabled, anomaly data is stored in the specified database based on the configured parameters.

8.2 DataArts Architecture Use Process

The process of using DataArts Architecture is as follows.

Figure 8-3 DataArts Architecture use process



1. **Preparations**
   - **Add reviewers**: In the DataArts Architecture module, all business processes must be approved. Therefore, add reviewers first before conducting any operations. Only the workspace admin has the permissions required to add reviewers.

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- **Configuration Center** provides abundant custom options. You can customize the configuration to meet your demands.

2. **Data Survey**: A data survey involves collecting data that is generated when sorting business requirements, creating business processes, and classifying data subjects based on the existing business data and industry status.
   - **Subject design** is a hierarchical architecture that classifies and defines data to help clarify data assets and specify relationships between business domains and business objects.
     - **Subject area group** is used to group business domains based on scenarios.
     - **Subject area** is the high-level data classification that does not overlap and is used to manage business objects.
     - **Business object** includes important information about people, events, and things that are indispensable to enterprise operations and management.
   - **Process design** is used to generate a structured framework of process. It describes the categories, levels, boundaries, scopes, and input/output relationships of an enterprise's processes, and reflects the business models and characteristics of the enterprise.
   - **Data warehouse planning**: Manage data warehouse layers and modeling in a unified manner. You can customize data warehouse layers.
3. **Standards**: Create lookup tables and data standards.
   - A **lookup table** includes a series of allowed values and additional text descriptions that are generally associated with data standards to generate a range of values for the verification of quality monitoring rules.
   - **Data standards** refer to the description of attribute data meanings and business rules that enterprises must comply with. It describes the common understanding of certain data at the company level.
4. **Model design:** Perform hierarchical modeling using logical models, ER modeling, dimensional modeling, and data mart.
   - **Logical models**: Create, modify, and delete logical models, and convert logical models into physical models. You can also create and publish logical entities and perform operations such as reversing databases.
   - **ER modeling**: Create SDI and DWI models based on ER modeling.
     - **SDI** stands for Source Data Integration and is the source data layer. SDI is a simple implementation of source system data.
     - **DWI** stands for Data Warehouse Integration, also called the data consolidation layer. DWI integrates and cleans data from multiple source systems, and implements entity relationship modeling based on the three normal forms.
   - **Dimensional modeling**: Create DWR models and release dimensions and fact tables based on ER modeling.
     - **Data Warehouse Report (DWR)** is based on the multi-dimensional model and its data granularity is the same as that of the DWI layer.

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    - **Dimension** is the perspective to observe and analyze business data and assist in data aggregation, drilling, slicing, and analysis, and used as a GROUP BY condition in SQL statements.
    - A **fact table** that belongs to a business process can enrich the affair information corresponding to the specific business process.
  - **Data mart**: Create a DM layer and publish summary tables.
    - **Data Mart (DM)** is where multiple types of data are summarized. DM is designed to display the summarized data.
    - A **summary table** consists of specific analysis objects (for example, members) and related statistical metrics. The statistical metrics included in a summary table have the same statistical granularity (for example, members). The summary table provides users with all statistics-granularity-themed data (such as a member theme market).
5. **Metrics**: Create business and technical metrics. Technical metrics include atomic, derivative, and compound metrics.
  - A **business metric** consists of a name and a value. The metric name and its definition reflect the quality and quantity of the metric. The metric value reflects the quantifiable values of the specified time, location, and condition of the metric.

    Business metrics are used to guide technical metrics, and technical metrics are used to implement business metrics.
  - **Atomic metrics** are generated based on dimension tables and fact tables of a multidimensional model. The objects and the finest data granularity of an atomic metric are consistent with those of the multidimensional model.

    An atomic metric usually consists of measures and attributes related with measures and business objects, all of which aim to support agile self-service consumption of the metric.
  - **Derivative metrics** are aggregated from the definitions, modifiers, and dimensions of atomic metrics. Therefore, their definitions, modifiers, and dimensions are derived from the attributes of atomic metric associated tables as well.
  - **Compound metrics** are generated by adding one or more derivative metrics. The dimensions and modifiers of a compound metric are the same as those of the derivative metrics.

    New dimensions and modifiers cannot be generated outside the scope of derivative metrics, dimensions, and modifiers.

8.3 Adding Reviewers

In the DataArts Architecture module, all business processes must be approved. Therefore, add reviewers first before conducting any operations. Only the workspace admin has the permissions required to add reviewers.

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Adding a Reviewer

A reviewer must be a member who has the review permissions in the current workspace. You can edit and add workspace members in **Workspaces** on the DataArts Studio homepage.

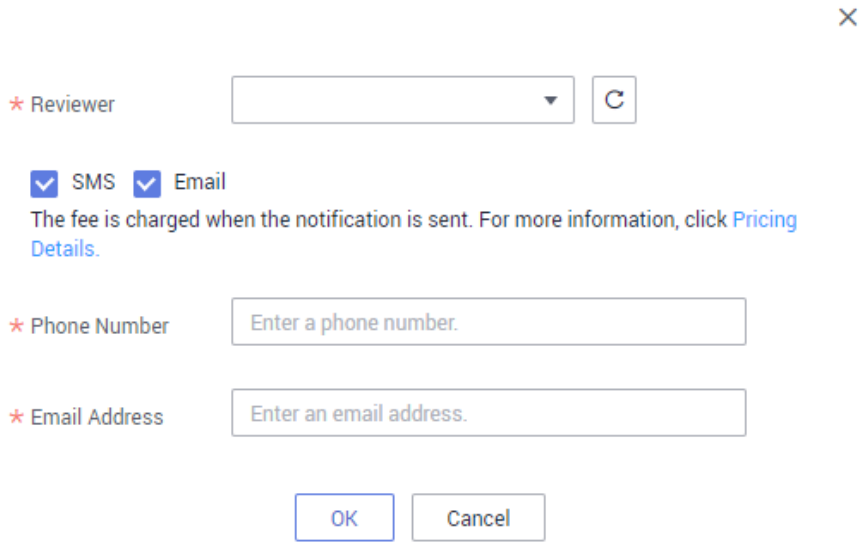
1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
3. In the navigation pane, choose **Configuration Center**. On the displayed page, click **Reviewers**.
4. On the **Reviewer Management** tab page, click **Add**.
5. Select a reviewer, enter their mobile number and email address, and click **OK**.

   The reviewer must be admins and developers of the current workspace, because only admins and developers have the review permissions of the workspace.

   NOTE

   - You can only select reviewers from the given list. To enable a user to be available in the given list, add the user as a workspace member in **Workspaces** on the DataArts Studio homepage.
   - If you select **SMS** or **Email** for **Notification Type**, DataArts Studio automatically creates a topic in SMN after the reviewer is added.
     - The topic name is in the following format: DataArts_Subject_Reviewer_***Project name_Project ID***-dlg_ds_***Reviewer name***.

Figure 8-4 Adding a reviewer



NOTE

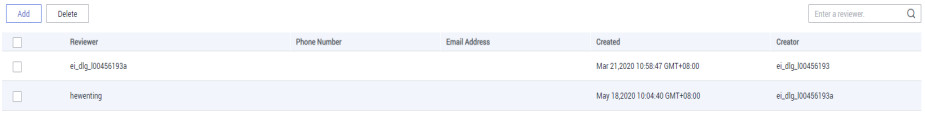
You can add multiple reviewers if needed.

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Related Operations

On the DataArts Architecture page, choose **Configuration Center** in the left navigation pane. On the displayed page, click the **Reviewers** tab to manage reviewers.

Figure 8-5 Reviewer Management page



- **Searching for a reviewer**
  In the upper right corner of the reviewer list, enter the name of the reviewer you are looking for and click .
- **Deleting a reviewer**
  In the reviewer list, select the reviewer you want to delete, and click **Delete**.

8.4 Data Survey

8.4.1 Designing Processes

Business Process Architecture (BPA) is developed based on value streams, and is used to guide and standardize the management of requirements and ensure the efficiency of business requirement handling, analysis, and delivery. BPA prioritizes high-value requirements, which maximizes the business value, assists in business operations, and facilitates goal achievement.

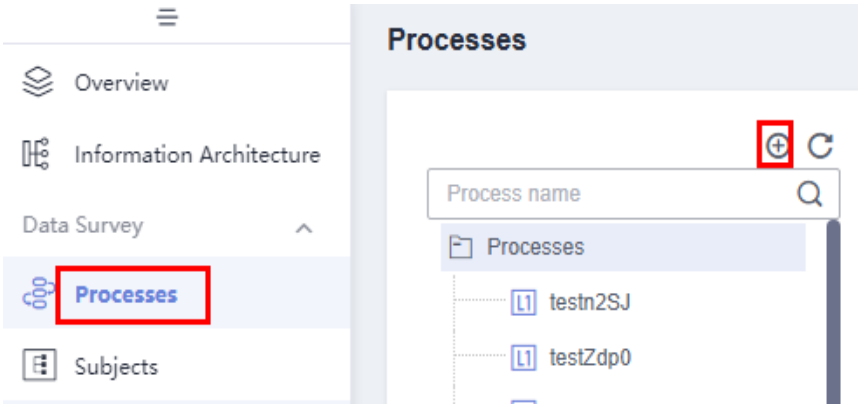
Creating a Process

Design a process that consists of three to seven levels. For details about how to change the process levels, see **Process Levels**.

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. Choose **Data Survey** > **Processes** in the left navigation bar. Click to create a process. When creating a process for the first time, perform the operation under the root node.

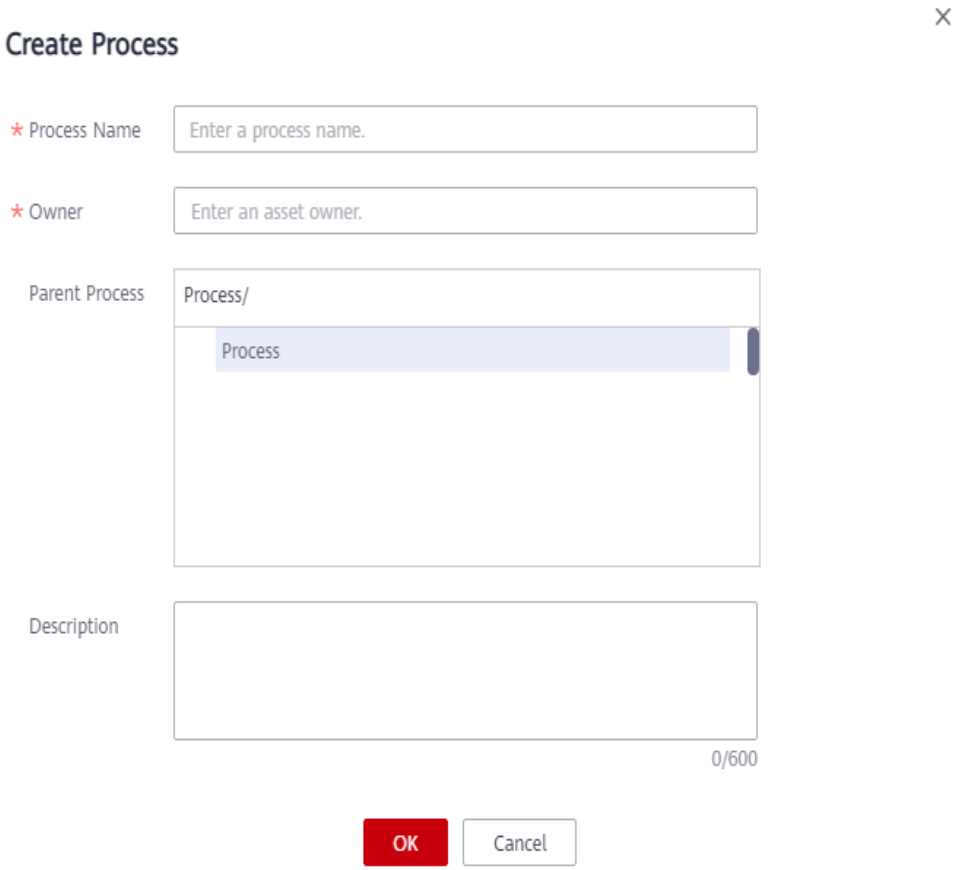
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Figure 8-6 Process design



3. In the dialog box displayed, set the parameters and click **OK**.

Figure 8-7 Creating a process



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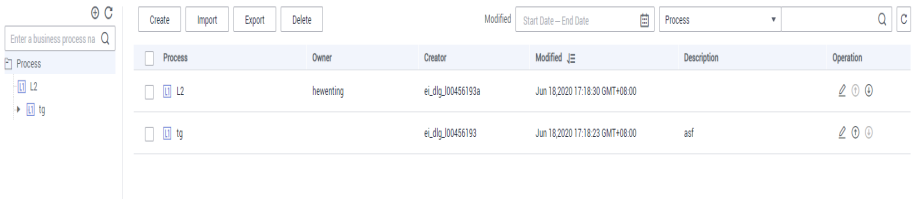
Table 8-1 Parameters for creating a process

Parameter	Description
Process	Process name. Newline characters and the following characters are not allowed: / \ < > % " ' ;
Owner	Process owner. You can enter the name of an owner or select an existing owner.
Parent Process	Parent process of the process
Description	A description of the process.

4. Repeat the preceding steps in sequence to create more processes or subprocesses. Generally, you must design processes from L1 to L3. The first layer is identified as L1, the second layer as L2, and the third layer as L3.

   The following figure shows an example.

Figure 8-8 Process design example



Exporting a Process

You can export the processes that have been created in DataArts Architecture to files.

Step 1 On the DataArts Architecture page, choose **Data Survey** > **Processes** in the left navigation pane.

Step 2 Click **Export** above the process list. After a few seconds, a message is displayed in the upper right corner of the page, indicating that the process is exported. You can view the export process.

NOTE

A **process** has a hierarchy. You can export only data of all levels. All processes rather than the ones you select will be exported.

----End

Importing a Process

Step 1 On the DataArts Architecture page, choose **Data Survey** > **Processes** in the left navigation pane.

Step 2 Click **Import** above the process list.

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Step 3 In the dialog box displayed, set **Update Existing Data**, click **Select File**, and click **Upload**.

Figure 8-9 Importing a process

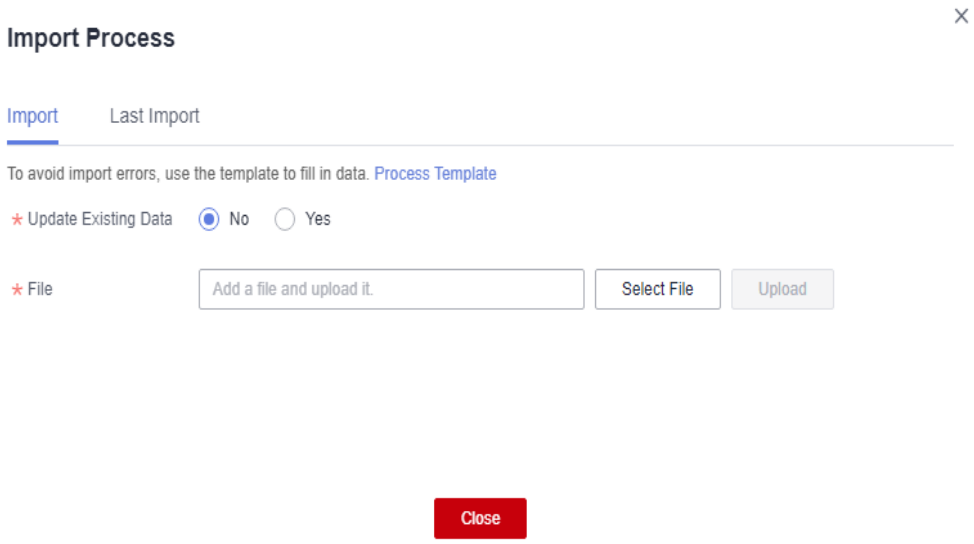


Table 8-2 Parameters for importing a process

Parameter	Description
Update Existing Data	Whether to update the existing processes of DataArts Architecture. The options are as follows: • **No**: If you select this option, the existing process will not be updated. • **Yes**: If you select this option, the existing process will be updated. During the import, only process creation and update are allowed.
Upload File	Select the file to import. You can use either of the following methods to obtain the file to import: • **Downloading the process template and filling in it** On the **Import** tab page, click **Process Template** to download the template, set related parameters in the template based on service requirements, save the settings, and upload the file. See **Table 8-3** for template parameter details. • **Exporting a process** You can export the processes created in DataArts Architecture of a DataArts Studio instance to an Excel file. Then, import the Excel file. For details, see **Exporting a Process**.

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Table 8-3 describes the parameters in the downloaded template. Parameters whose names start with an asterisk (*) are mandatory, and parameters whose names do not start with an asterisk (*) are optional. One record is required for one process.

Table 8-3 Parameters in the process import template

Parameter	Description
Process	If it is a level 1 process, this field can be left blank. If it is not, this field is mandatory. If there are multiple processes, separate them with slashes (/), for example, **Integrated Product Development/Development Lifecycle**.
*Name	Process name.
*Owner	Process owner. You can enter the name of an owner or select an existing owner.
Description	A description of the process.

Step 4 The import result is displayed on the **Last Import** tab page in the **Import Process** dialog box. If the import is successful, click **Close**. If the import fails, you can view the failure cause, correct the template file, and upload it again.

----End

Deleting a Process

You can delete the processes that are no longer used. Deleted processes cannot be recovered. Exercise caution when performing this operation. If a process has subdirectories or subprocesses, you must delete the subdirectories or subprocesses first.

Step 1 On the DataArts Architecture page, choose **Data Survey** > **Processes** in the left navigation pane.

Step 2 In the process list, select the target process and click **Delete** above the process list.

Step 3 In the **Delete Process** dialog box displayed, confirm the process information and click **Yes**.

----End

8.4.2 Designing Subjects

A subject is a hierarchical architecture that classifies and defines data to help clarify data assets and specify relationships between subject areas and business objects.

You can design subjects in either of the following ways:

- **Creating and Publishing a Subject**

  Create and publish a subject.

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- **Importing a Subject**

  If the subject information is complex, you are advised to import subjects in batches.

  - You can download the provided subject design template, fill in the content, and upload the file to import the subjects in batches.
  - You can export the subjects created in DataArts Architecture of a DataArts Studio instance to an Excel file. Then, import the Excel file. For details on how to export subjects, see **Exporting a Subject**.

You can search for, edit, or delete subjects. For details, see **Managing a Subject**.

Subject Design Overview

By default, the system provides three subject levels: Subject Area Group (L1), Subject Area (L2), and Business Object (L3).

- **Subject Area Group**: used to group business domains based on scenarios
- **Subject Area**: A data domain is a dataset, in which data is of the same property.
- **Business Object** includes important information about people, events, and things that are indispensable to enterprise operations and management.

You can also customize the subject levels by referring to **Subject Processes**.

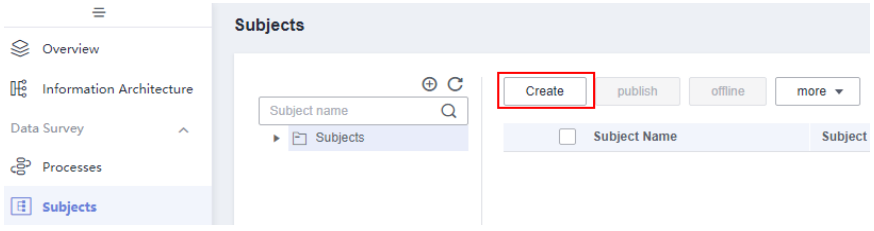
Constraints

A maximum of 5,000 subjects can be created in a workspace.

Creating and Publishing a Subject

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the **DataArts Architecture** page, choose **Data Survey** > **Subjects** in the left navigation bar. On the page displayed, click **Create** in the upper left corner.

   Figure 8-10 Designing a subject



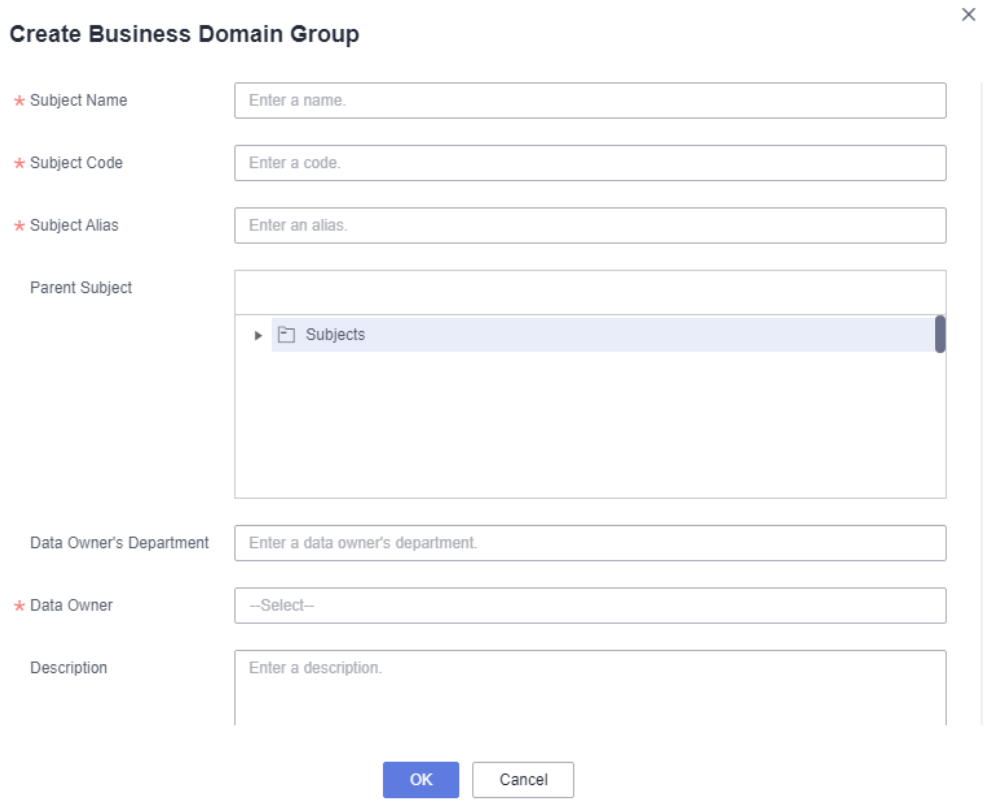
3. In the dialog box displayed, set the parameters and click **OK**.

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Table 8-4 Parameters for creating a subject area group

Parameter	Description
* Subject Name	The following characters are not allowed: / \ < >.
* Subject Code	The code of the subject area group to create. Only letters, digits, spaces, underscores (_), hyphens (-), parentheses, and ampersands (&) are allowed.
Alias	The following characters are not allowed: \ < >. **NOTE** Before configuring an alias, choose **Metrics** > **Configuration Center**, click the **Model Settings** tab, and select **Subjects** for **Use Alias**.
Parent Subject	Parent subject of the subject area group
Data Owner's Department	The department that the data owner belongs to.
* Data Owner	Select a data owner from the drop-down list box. You can select multiple data owners or enter custom data owners.
Description	A description of the subject area group to create.

Figure 8-11 Creating a subject



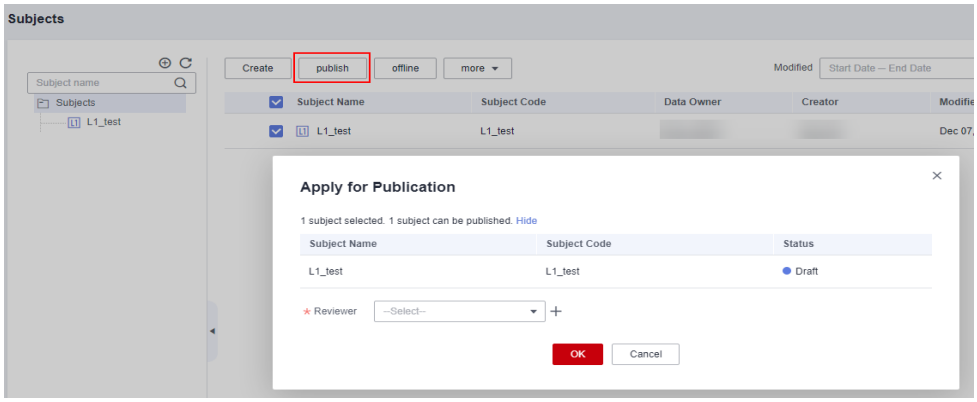
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4. Select the created subject area group and click **Publish**. In the displayed dialog box, select a reviewer and click **OK**. After the application is approved, the **Subjects** page is displayed. You can view the created subject area group in the list, and the status of the subject area group is **Published**. Only published subject area groups can be used.

   NOTE

   If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the application is approved, the subject area group status changes to **Published**.

   Figure 8-12 Publishing a subject

5. You can create multiple subjects in a subject. Note that a subject can be published only if its upper-layer subjects have been published.

   NOTE

   When you are creating a L3 subject, that is, a business object, parameter **Subject Code** is displayed in the **Create Business Object** dialog box. You can select **Auto Generate** or **Custom**.

   - **Auto Generate**: A code is automatically generated based on the **encoding rule** in the Configuration Center.
   - **Custom**: Enter a code.

   In subject design, business objects at different L1 levels can have the same name.

   The number of subject levels is defined by users on the **Subject Levels** tab page on the **Configuration Center** page. By default, there are three levels in the system, Subject Area Group (L1), Subject Area (L2), and Business Object (L3).

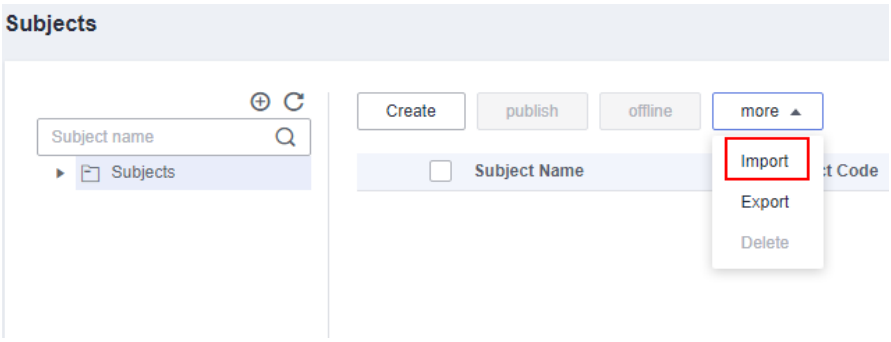
Importing a Subject

Step 1 On the DataArts Architecture page, choose **Data Survey** > **Subjects** in the left navigation pane.

Step 2 Click **More** above the subject list and select **Import**.

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Figure 8-13 Importing a subject



Step 3 In the dialog box displayed, set **Update Existing Data**, click **Select File**, and click **Upload**.

Figure 8-14 Importing a subject

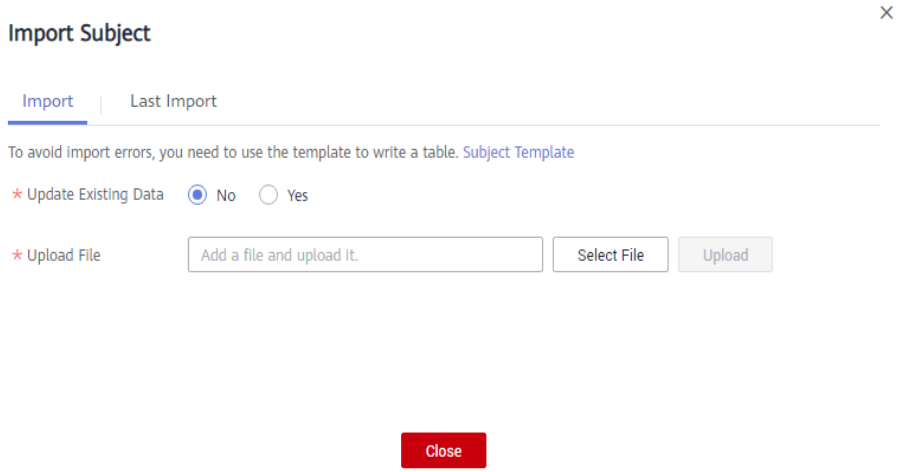


Table 8-5 Parameters for importing subjects

Parameter	Description
Update Existing Data	Whether to update existing subject information (subject area group, subject area, or business object) during the import. When a subject is imported, the system checks whether the subject exists according to its code. • **No**: If you select this option, the subject information will not be updated. • **Yes**: If you select this option, the subject information will be updated. During the import, only subject creation and update are allowed.

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Parameter	Description
Upload File	Select the file to import. You can use either of the following methods to obtain the file to import: • **Downloading the subject import template and filling in it** In the **Import Subject** dialog box, click **Subject Template** to download the template, fill in the content, and save the settings. See **Table 8-6** for template parameter details. • **Exporting subjects to files** You can export the subjects created in DataArts Architecture of a DataArts Studio instance to an Excel file. Then, import the Excel file. See **Exporting a Subject** for details.

Table 8-6 describes the parameters in the downloaded template. Parameters whose names start with an asterisk (*) are mandatory, and other parameters are optional. Enter the information about a subject in a line.

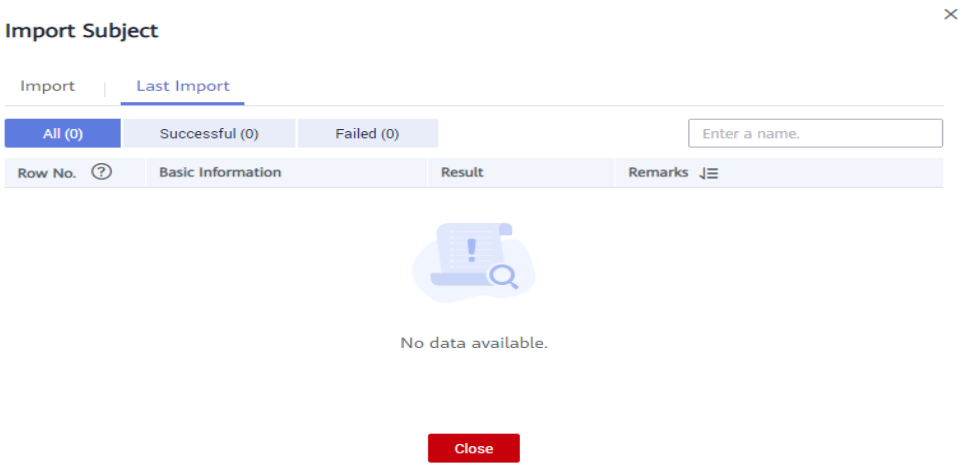
Table 8-6 Parameters

Parameter	Description
Parent Subject	Encoding path of the upper-level subject, which is separated by slashes (/).
*Name	The following characters are not allowed: / \ < >.
*Code	Code of the subject to create. Only letters, digits, spaces, underscores (_), hyphens (-), parentheses, and ampersands (&) are allowed.
Alias	Alias of the subject.
Description	A description of the subject. This parameter is mandatory for the lowest-level subject. You must add the description of the lowest-level subject in the file to be imported.
Data Owner's Department	The department that the data owner belongs to. This parameter is mandatory for the lowest-level subject. You must add the department of the owner of the lowest-level subject in the file to be imported.
Data Owner	The owner of the data. Multiple owners are supported. Separate owner names with commas (,)

Step 4 View the import result on the **Last Import** tab page. If the import is successful, click **Close**. If the import fails, you can view the failure cause, correct the template file, and upload it again.

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Figure 8-15 Last Import tab page



----End

Exporting a Subject

Step 1 On the DataArts Architecture page, choose **Data Survey** > **Subjects** in the left navigation pane.

Step 2 Click **More** above the subject list and select **Export** to export the subjects to an Excel file. Then, import the Excel file.

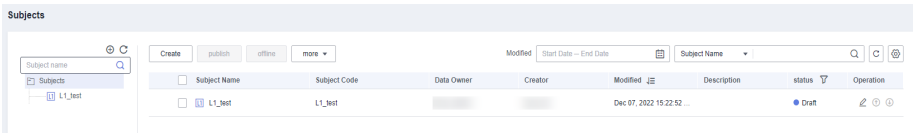
NOTE

- If you select subjects and click **Export**, the system recursively exports the selected subjects and their child subjects.
- If you select subjects in the directory tree and click **Export** without selecting subjects in the subject list, the selected subjects are exported recursively. If you select a topic name on the right, the selected topic and all its subtopics are exported recursively.

----End

Managing a Subject

Figure 8-16 Subject design area



- Search

  You can enter a keyword in the search box to search for all subjects in the public workspace.

- Edit

  Locate a subject in the list and click  in the **Operation** column to edit the subject. To make a published subject take effect after you have edited it, select the draft and publish it.

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- Delete

  Select a subject in the list and click **More** and select **Delete** above the list to delete the subject.

- Move Up/Down

  Locate a subject in the list and click  or  in the **Operation** column to move down or up the subject.

8.4.3 Logical Models

A logical model is an entity relationship diagram that accurately describes business rules based on entities and their relationships. Logical models must ensure the correctness and consistency of the data structure required by services and use a series of standard rules to reflect the features of various objects, and accurately define the relationships between entities.

In addition, logical models provide a reliable reference for constructing physical models and can be converted into physical models. Logical models are key to a successful database design.

The following parts are included in this topic:

- **Considerations in Logical Model Design**
- **Creating a Logical Model**
- **Creating and Publishing a Logical Entity**
- **Converting a Logical Model to a Physical Model**
- **Importing Logical Entities by Reversing a Database**

Considerations in Logical Model Design

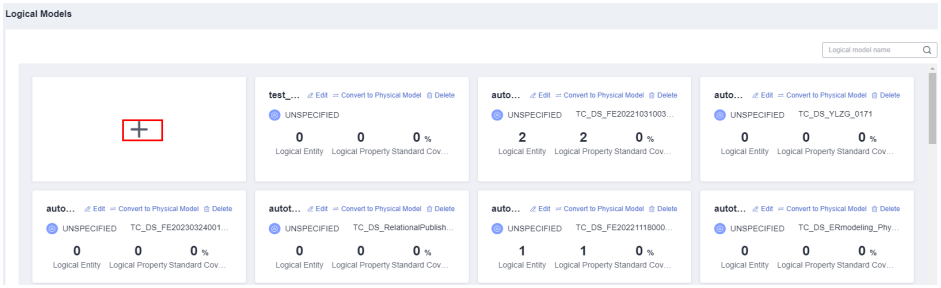
- You must consider not only the current business status, but also the future business development.
- Personnel who are familiar with the businesses must participate in the modeling. In this way, the business requirements can be fully integrated into the models.
- Converting the logical model to the physical model must be efficient.
- You must consider physical features during physical modeling.
- Each entity, attribute, and relationship must be consistent with the information in the actual business.

Creating a Logical Model

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Data Survey** > **Logical Models** in the left navigation pane.
3. On the **Logical Models** page, click  to create a logical model.

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Figure 8-17 Creating a Logical Model



4. In the dialog box displayed, set the parameters and click **OK**.

Figure 8-18 Configuring the logical model

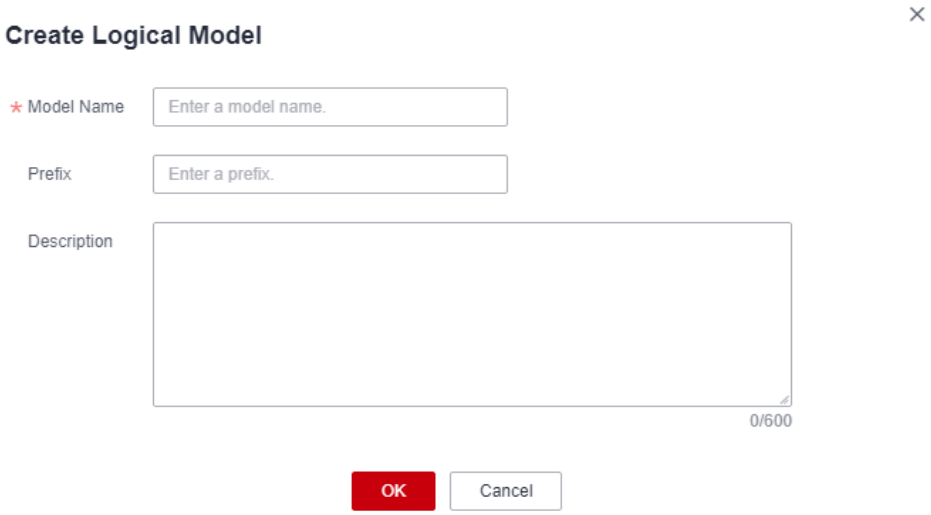


Table 8-7 Parameters for creating a logical model

Parameter	Description
*Name	Only letters, numbers, and underscores (_) are allowed.
Prefix	Only letters, numbers, and underscores (_) are allowed. Dimension codes must start with letters. **NOTE** Model prefix verification: When a physical (relational) table in ER modeling, fact table in dimensional modeling, or summary table in the data mart is created, modified, or imported, the system checks whether there is a prefix. If there is no prefix, the verification fails. When a reversing operation is performed, the system also checks for a prefix.
Description	A description of the logical model.

5. You can perform the following operations on logical models:
   - Click **Edit** on the right of a logical model to modify its parameters.

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- Click **Delete** on the right of a logical model to delete it. Deleted models cannot be recovered. Exercise caution when performing this operation. Models containing tables cannot be deleted.
- Click **Convert to Physical Model** on the right of a logical model to convert it into a physical model. For details, see **Converting a Logical Model to a Physical Model**.
- Click **Logical Entity**, **Logical Property**, or **Standard Coverage** to go to the logical entity list page and view details about the logical model.

Creating and Publishing a Logical Entity

A logical entity is a logical table. After creating a logical model, you can create a logical entity in the model.

Step 1 On the DataArts Architecture page, choose **Logical Models** in the left navigation pane.

Step 2 On the displayed page, click a logical model to access its management page. Then, click **Create**.

Step 3 On the displayed page, configure parameters as prompted.

1. Set the basic parameters.

Figure 8-19 Basic settings

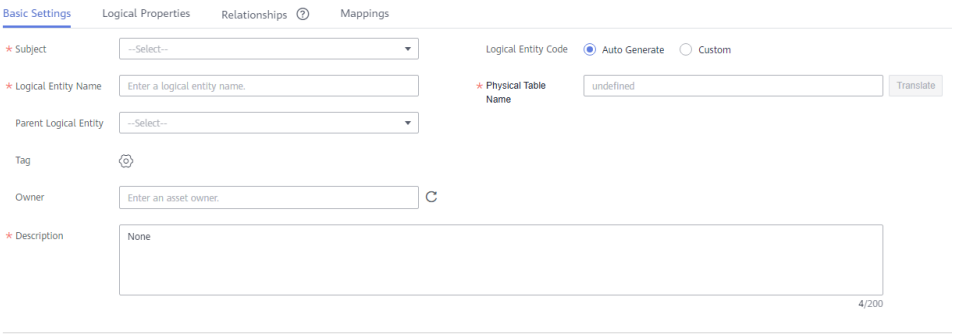


Table 8-8 Parameters on the Basic Settings tab page

Parameter	Description
* Subject	Select a subject from the drop-down list box.
Logical Entity Code	You can select **Auto Generate** or **Custom**.
* Table Name	Logic entity name. Newline characters and the following characters are not allowed: \ < > % " ' ;

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Parameter	Description
*Table Code	Name of the physical table converted from the logical entity. Table codes cannot start with numbers. Only letters, numbers, and the following special characters are allowed: _${} The system can automatically generate the table code through translation based on a configured naming dictionary.
Parent Logical Entity	Set a parent logical entity, which is inherited by child logical entities. Common logical entities and attributes can be logically abstracted as a parent logical entity. After specific attributes are added to the parent logical entity, a child logical entity is generated. The modifications to the attributes in a parent logical entity affect all child logical entities that inherit it.
Tag	Tags are custom identifiers that help you classify and search for data assets. After adding a tag, you can search for related data assets in the DataArts Catalog module with ease. Click . In the dialog box displayed, select one or more existing tags, or enter a new tag name and press **Enter**. You can also go to the **Tags** page of the DataArts Catalog module to add a tag. Then, return to this page and select the newly added tag from the drop-down list box. For details, see **Managing Asset Tags**. If you want to modify the tag of a table in ER modeling, you must suspend the table first. After modifying the tag, you can publish the table again.
Owner	You can enter an owner name or select an existing owner.
* Description	A description of the table to create. It allows 1 to 200 characters.

2. On the **Logical Entity Attributes** page, add required attributes. **Table 8-9** lists the parameters for logical entity attributes.

Figure 8-20 Adding a logical entity attribute

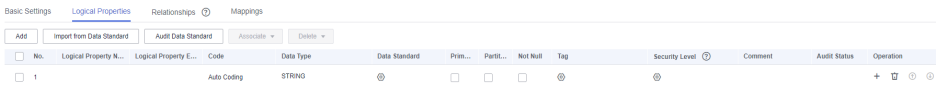


Table 8-9 Parameters for logical entity attributes

Parameter	Description
*Field Name	Newline characters and the following characters are not allowed: \ < > % " ' ;

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Parameter	Description
*Field English Name	Only letters, numbers, and underscores (_) are allowed. A field code must start with a letter.
*Code	Code of the logical attribute. If the logical entity uses a custom code, the code of the logical attribute can be customized or automatically generated.
Data Type	Data type of the attribute. If you cannot find a desired data type from the drop-down list box, you can add a data type by referring to **Field Types**.
Data Standard	If you have created data standards, click  to select one to associate with the logical entity attribute. If **Create Data Quality Jobs** is selected for **Model Design Process** on the **Function Settings** tab page in Configuration Center and a logical entity attribute is associated with a data standard, a quality job is automatically generated after a logical entity attribute is published. A quality rule is generated for each logical entity attribute associated with the data standard. The quality of the logical entity attribute is monitored based on the data standard. You can access the **Quality Job** page of DataArts Quality to view the job details. If no data standard is available, create one. See **Creating Data Standards** for details. **NOTE** – After a logical entity is published, if the data standard code is modified, you must synchronize the dimension tables of the data standard to DataArts Catalog. Otherwise, the data standard code in the logical entity details cannot be updated.
Primary Key	If this parameter is selected, the attribute is a primary key. **NOTE** If you want to convert a logical model into a physical model, note the following restrictions for this parameter: If an MRS Spark connection is used to connect to MRS Hudi data sources, data can be written to the database only if fields have primary keys. Otherwise, table synchronization fails.
Partition	If this parameter is selected, the attribute is a partition field.
Not Null	Whether the parameter value can be left empty.

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Parameter	Description
Tag	You can click to add a tag for the logical entity attribute. – In the dialog box displayed, select one or more existing tags. If no tag has been added, you can go to the **Tags** page of the DataArts Catalog module to add a tag. For details, see **Managing Asset Tags**. – In the dialog box displayed, enter a new tag name and press **Enter**. Tag names can contain letters, numbers, and underscores (_), but cannot start with underscores (_).
Security Level	You can click to add a security level for the logical entity attribute. If you cannot find the security level you want, click **go to** to go to the DataArts Security console and create a security level. You can disable this function on the **Models** tab page on the **Configuration Center** page.
Description	A description of the table to create.

3. On the **Relationships** tab page, click **Add** to create a relationship.

   A relationship refers to the association between a parent and a child entity (also called a primary and a secondary entity). It describes how an entity is associated with another entity, or the impact of an entity's behavior on another entity. Relationships between entities in a data model are particularly important and must be accurately defined. Otherwise, the actual business rules cannot be accurately described in the data model, and data consistency is greatly damaged.

   For example, if the **student ID** attribute of a score table is the primary key for a student table, the relationship between the two tables designed according to the third normal form (3NF) is as follows:

   – Child logical entity: score table
   – Child logical entity attribute FK: student ID
   – Child to parent: 1
   – Parent logical entity: student table
   – Parent logical entity attribute PK: student ID
   – Parent to child: 1

   Figure 8-21 Adding a relationship

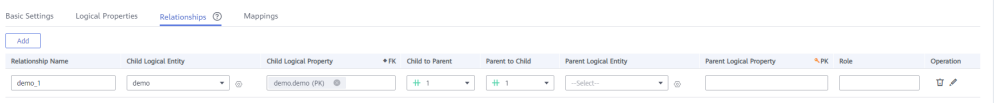
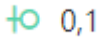


Table 8-10 Parameters on the Relationships tab page

Parameter	Description
Name	Name of the relationship
Child Logical Entity	Select a child logical entity from the drop-down list box. Click to set the current logical entity as a child logical entity. For example, if the **student ID** attribute of a score table is the primary key for a student table, the child logical entity is the score table, and the corresponding parent logical entity is the student table.
Child Logical Entity Attribute FK	Foreign key of the child logical entity attribute. The attribute of the child logical entity must be the foreign key of the parent logical entity. For example, if the **student ID** attribute of a score table is the primary key for a student table, the foreign key of the child logical entity attribute is the student ID in the score table.
Child to Table	1 indicates that each piece of data in the child logical entity corresponds to only one piece of data in the parent logical entity. 0,1 indicates that each piece of data in the child logical entity corresponds to at most one piece of data in the parent logical entity. 0..n indicates that one piece of data in the child logical entity corresponds to multiple pieces of data in the parent logical entity. 1..n indicates that one piece of data in the child logical entity corresponds to one piece of data in the parent logical entity at least.

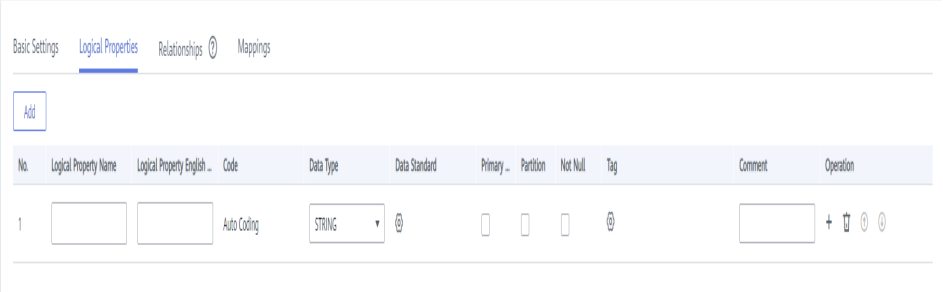
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Parameter	Description
Parent to Child	 indicates that the data in the parent logical entity is in one-to-one relationship with the data in the child logical entity.  indicates that each piece of data in the parent logical entity corresponds to at most one piece of data in the child logical entity.  indicates that one piece of data in the parent logical entity corresponds to multiple pieces of data in the child logical entity.  indicates that each piece of data in the parent logical entity corresponds to at least one piece of data in the child logical entity.
Parent Logical Entity	Select a logical entity that has a logical relationship with the selected child logical entity. For example, if the **student ID** attribute of a score table is the primary key for a student table, the parent logical entity is the student table, and the corresponding child logical entity is the score table.
Parent Logical Entity Attribute PK	Primary key of the parent logical entity attribute. The attribute of the parent logical entity must be the primary key of the parent logical entity. For example, if the **student ID** attribute of a score table is the primary key for a student table, the primary key of the parent logical entity attribute is the student ID in the student table.
Role	You can customize a role name to identify the relationship.
Operation	Click  to delete a relationship. Click  to edit the relationship.

4. On the **Mappings** page, click **Create** to create a mapping. Then click **Save**. Mapping means setting up a mapping relationship between the source and destination logical entity.

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Figure 8-22 Creating a mapping



- **Mapping** is automatically generated when a mapping is created. You can change the value.
- **Source Logical Entity**: If data comes from multiple logical entities of a model, you can click ⊕ next to a logical entity to establish a JOIN relationship between the logical entity and another logical entity.

Figure 8-23 Setting the JOIN condition for the source table

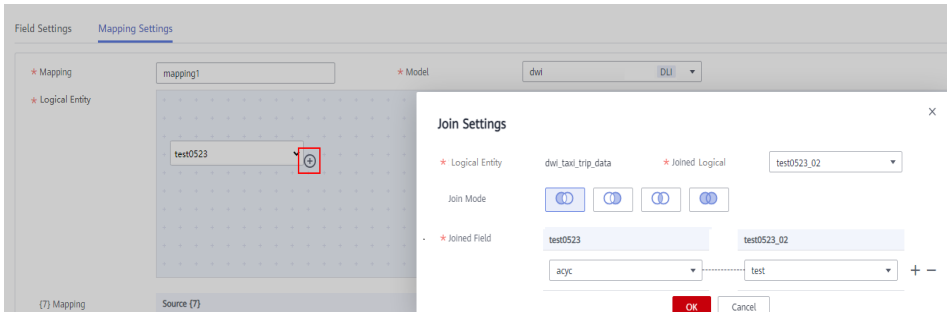


Table 8-11 JOIN conditions

Parameter	Description
*Joined Logical Entity	Select a logical entity for which you want to establish a JOIN relationship with the source logical entity.
Joined Mode	Left JOIN, right JOIN, inner JOIN, and outer JOIN are represented from left to right.
*Joined Attribute	Generally, the JOIN attribute in the source logical entity is the same as that in the joined logical entity. You can click + or − to add or delete a JOIN attribute. The relationship between JOIN attributes is AND.

- **Logical Attribute Mapping**: Select a source attribute with the same meaning as the current attribute.

Step 4 Click **Publish**, select a reviewer, and click **Submit**.

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> **NOTE**
>
> In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the logical model cannot be published.
>
> If you select multiple reviewers, the status of the lookup table changes to **Published** only after all reviewers have approved the publishing application. If any reviewer rejects the application, the status is **Rejected**.

Wait for the reviewer to approve the application. After the application is approved, return to the model list and view the created logical entity in the list.

> **NOTE**
>
> By default, **Synchronize logical assets** is selected for **Model Design Process** on the **Functions** tab page of the **Configuration Center** page.
>
> - For new logical entities, you can click **Publish** to synchronize them to the logical assets of the DataArts Catalog module.
> - For historical logical entities, you can click **More** and select **Synchronize** from the drop-down list box to synchronize them to the logical assets in the DataArts Catalog module.

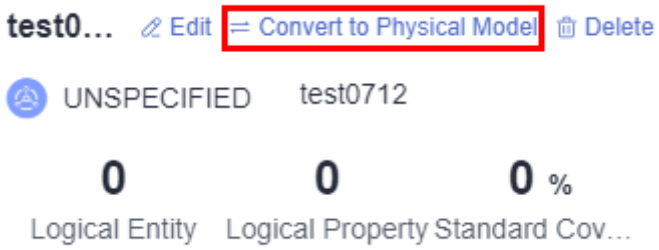
----End

Converting a Logical Model to a Physical Model

After a logical model is created, you can convert it to an existing physical model.

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Logical Models** in the left navigation pane.
3. Find the required logical model and click the conversion button on the model. Logical models can only be converted into a relational model.

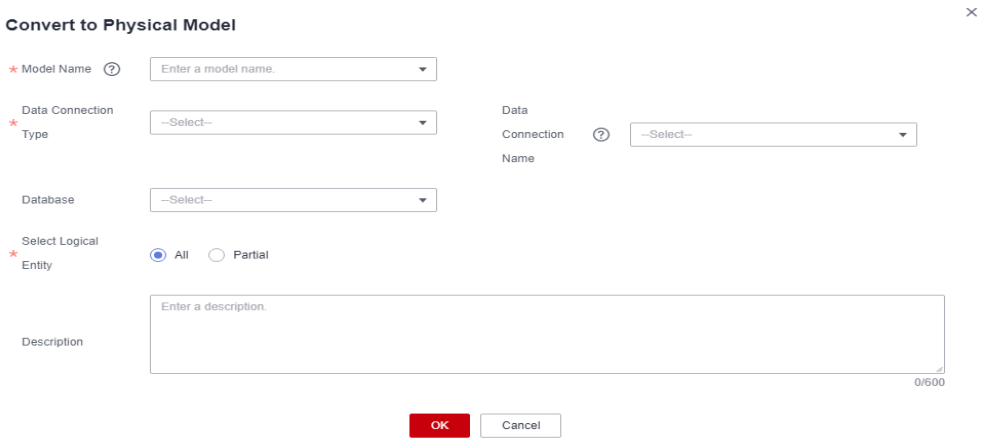
   Figure 8-24 Converting a logical model to a physical model

4. In the **Convert to Physical Model** dialog box, set the parameters and click **OK**.

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Figure 8-25 Convert to Physical Model dialog box



NOTE

When a logical model is converted into a physical model, the system checks for a prefix.

Table 8-12 Parameters

Parameter	Description
*Model Name	The name of the physical model to be converted from a logical model. Select a model from the drop-down list box.
*Update Existing Table	This parameter is displayed when a model name is selected. • No • Yes If you select **Yes**, you need to set **Physical Table Update Mode**. – Retain unnecessary fields – Delete unnecessary fields
*Data Connection Type	Select a data connection type from the drop-down list box.
Data Connection	The name of the data connection. Select the required data connection. You are advised to use the same data connection for an ER model. If no data connection is available, access Management Center to create one. For details, see **Configuring DataArts Studio Data Connection Parameters**.
Database	The name of the database. Select a database from the drop-down list box. If no database is available, access DataArts Factory to create one. For details, see **Creating a Database**.

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Parameter	Description
Select Logical Entity	• **All**: Convert all logical entities into physical tables. • **Partial**: Convert the selected logical entities into physical tables.
Queue	DLI queue. This parameter is available only for DLI data connections.
Schema	Schema of DWS or POSTGRESQL. This parameter is available only for DWS and PostgreSQL data connections.
Description	A description of the model. Up to 600 characters are supported.

Importing Logical Entities by Reversing a Database

By reversing databases, you can import one or more created database tables from other data sources into a logical entity directory to turn them into logical entities.

Step 1 On the DataArts Architecture console, choose **Logical Models** in the left navigation pane. Click a logical model to go to the logical entity list page.

Step 2 Above the logical entity list, click **Reverse Database**.

Step 3 In the displayed dialog box, set required parameters and click **OK**.

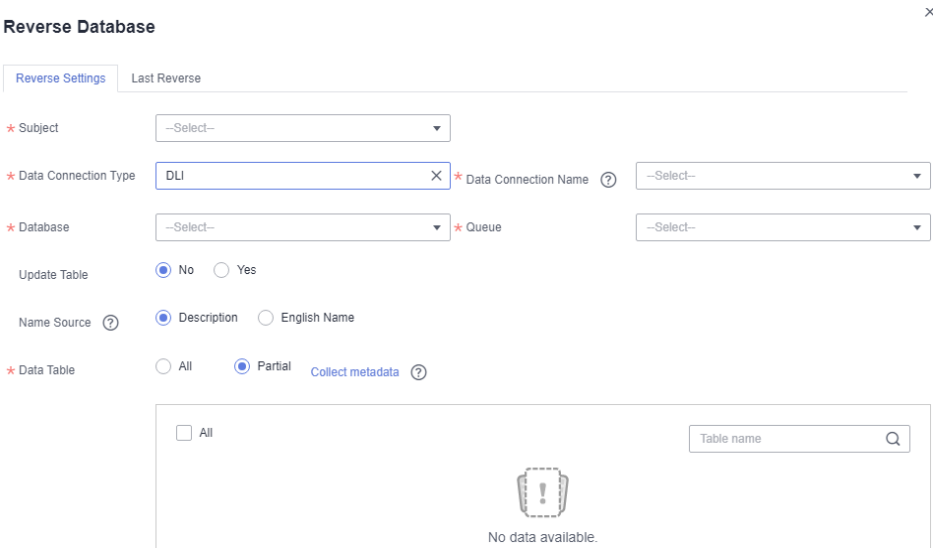
Table 8-13 Parameters for reversing the database

Parameter	Description
*Subject	Select a subject from the drop-down list.
*Data Connection Type	The data connection types supported by the reverse database are displayed in the drop-down list box. Select the required data connection type.
*Data Connection Name	Select a data connection. If you want to reverse a database from other data sources to a logical entity directory, you must create a data connection in Management Center to connect to the data source. For details on how to create data connections, see **Configuring DataArts Studio Data Connection Parameters**.
*Database	Select a database.
*Schema	Select a value from the drop-down list box. This parameter is available only for DWS and PostgreSQL tables.
Queue	DLI queue. This parameter is available only when **Data Connection Type** is set to **DLI**.

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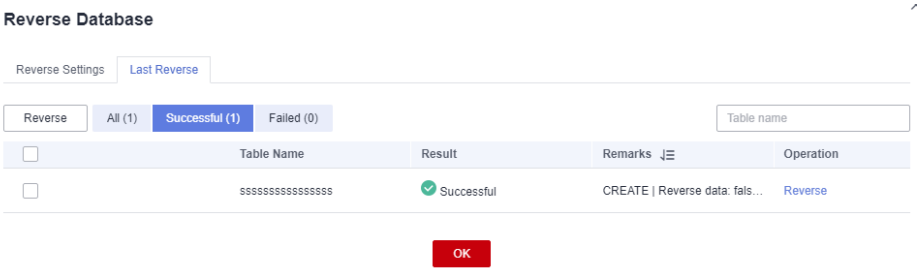
Parameter	Description
Update Table	When **Yes** is selected, if the name of the reversed table is the same as that of an existing table in the logical entity list, the logical entity is updated.
Name Source	Source of the table name or field name after the reverse. The value can be **Description** or **English name**. If no description is specified for a table or field, the English name is used. • **Description** • **English name** **NOTE** If you select **Description**, field comments of a table must be unique.
*Data Table	You can select **All** or **Partial**.

Figure 8-26 Reverse Database dialog box



Step 4 You can view the result on the **Last Reverse** tab page. If the reverse operation is successful, click **Close**. If the reverse operation fails, you can view the failure cause. After the fault is rectified, select the table again and click **Reverse** to retry.

Figure 8-27 Last Reverse tab page



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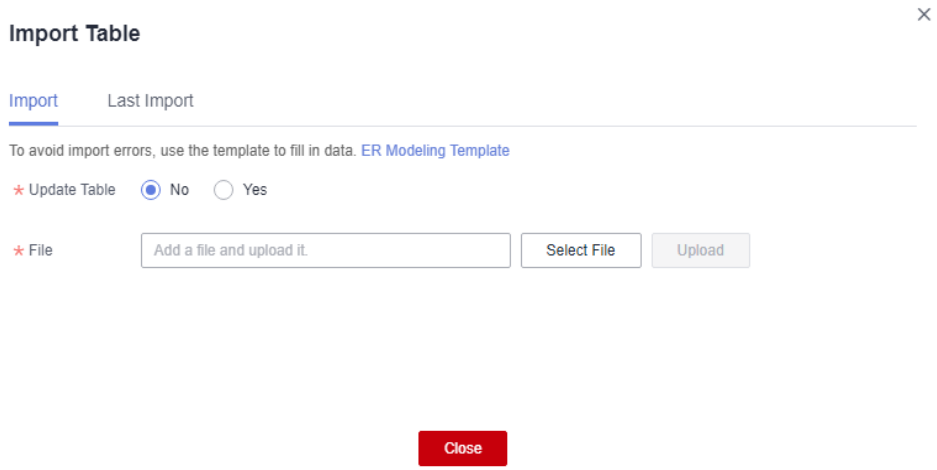
----End

Importing Logical Entities

Importing an Excel file

1. Above the logical entity list, click **Import** and select **Import EXCEL**. In the **Import Table** dialog box, click the **Import** tab and then **ER Modeling Template**.

   Figure 8-28 Importing an Excel file

2. Edit and save the downloaded template.
3. Choose whether to update existing data.

   NOTE

   If a code in the template already exists in the system, the data is considered duplicate.

   - **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
   - **Yes**: If the data to be imported already exists in the system:
     - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.
     - If the existing data in the system is in published state, expanded data will be generated.
4. Click **Select File** and select the template you have edited and saved.
5. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.
6. Click **Close** to exit the page.

Importing an LDM model

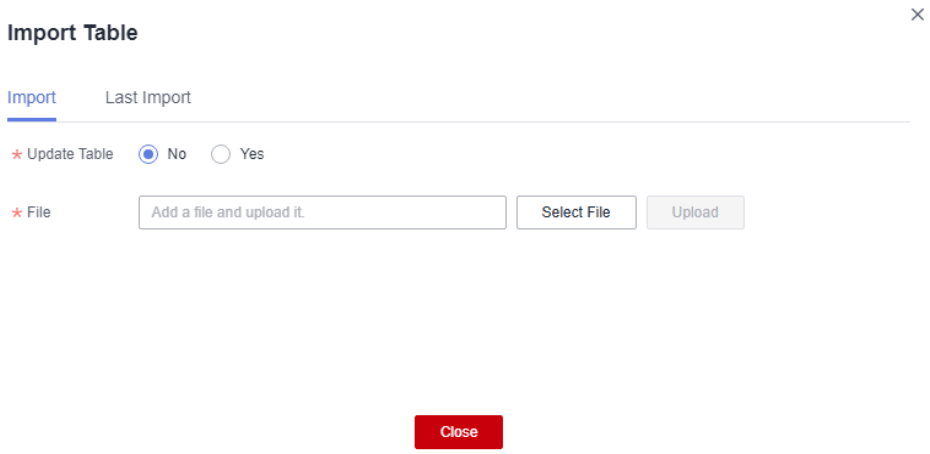
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NOTE

- Before importing an LDM model, select a theme. Otherwise, the model cannot be imported.
- Logical models can be imported.
- Prepare an .ldm logical model exported from the third-party system Power Designer in advance.
- LDM models of version 16.x can be imported.

1. Above the logical entity list, click **Import** and select **Import LDM**. In the **Import Table** dialog box, click the **Import** tab.

   Figure 8-29 Importing an LDM model

2. Choose whether to update existing data.
   - **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
   - **Yes**: If the data to be imported already exists in the system:
     - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.
     - If the existing data in the system is in published state, expanded data will be generated.
3. Click **Select File** and select the prepared .ldm logical model.
4. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.
5. Click **Close** to exit the page.

Exporting Logical Entities

1. Above the logical entity list, click **Export**.
2. Select the object to be exported.

   Select **Table** or **DDL**.

   If you select **DDL**, select **ALL** or **Partial** for **Scope**. If you select **Partial**, select the tables to be exported.
3. Click **OK**.

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More Operations on Logical Entities

- Synchronizing logical entities

  In the logical entity list, select logical entities, click **Synchronize** above the list, and click **OK**. This operation can be performed only on published tables.

  NOTE

  After a logical entity is associated with a quality rule and published, you can click **Synchronize Subjects from DataArts Architecture as Directories** on the **Quality Jobs** page on the DataArts Quality console. The quality jobs automatically generated in DataArts Architecture will be synchronized to the corresponding directories in DataArts Quality based on the subject structure.

- Publishing logical entities

  In the logical entity list, select logical entities and click **Publish** above the list or in the **Operation** column. In the displayed dialog box, select a reviewer and click **Submit**. The logical entities will be published when the publishing request is approved.

  NOTE

  In enterprise mode, you can choose to publish the table to the production or development environment. By default, logical entities are published to the production environment. If you do not choose an environment, logical entities cannot be published.

  If you select multiple reviewers, the logical entities will be published only after all reviewers have approved the publishing request. If any reviewer rejects the request, the logical entities will not be published.

  If you select **Auto-review**, the request will be automatically approved. This function is for trial use only and not recommended.

- Suspending logical entities

  In the logical entity list, select logical entities and click **Suspend** above the list or click **More** in the **Operation** column and select **Suspend**. This operation can be performed only on published tables.

- Changing the subject of a logical entity

  In the logical entity list, select a logical entity and click **Change Subject** above the list to change the subject of the logical entity.

- Deleting a logical entity

  In the logical entity list, select logical entities and click **Delete** above the list to delete them. This operation can be performed only on draft, rejected, and suspended jobs.

- Adding a tag to a logical entity

  In the logical entity list, select a logical entity and click **Tag** above the list. In the displayed dialog box, add a tag and click **OK**.

  NOTE

  Enter your text and press **Enter** to temporarily add a tag. A tag can be created only after the information on the entire page is submitted. A maximum of 20 tags can be added.

  Logical entities can be queried in fuzzy mode by tag.

- Editing a logical entity

  In the logical entity list, locate a logical entity and click **Edit** in the **Operation** column. To associate the logical entity with a quality rule, click **Associate**

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Quality Rule, set parameters of the quality rule on the displayed page, and click **OK**.

- Viewing the publishing history

  In the logical entity list, locate a logical entity, click **More** in the **Operation** column, and select **View History** to view the publishing history and version comparison of the logical entity.

- Previewing SQL information of a logical entity

  In the logical entity list, locate a logical entity, click **More** in the **Operation** column, and select **Preview SQL** to preview the SQL information of the logical entity.

8.5 Standards Design

8.5.1 Creating a Lookup Table

A lookup table is also called a data dictionary table. It consists of enumerable data names and codes and stores the relationships between them. A lookup table provides the following functions:

- Standardizes business data and supplements mapping fields during data cleansing.
- Monitors the value range of business data during data quality monitoring.
- Enumerates dimensions during dimensional modeling.

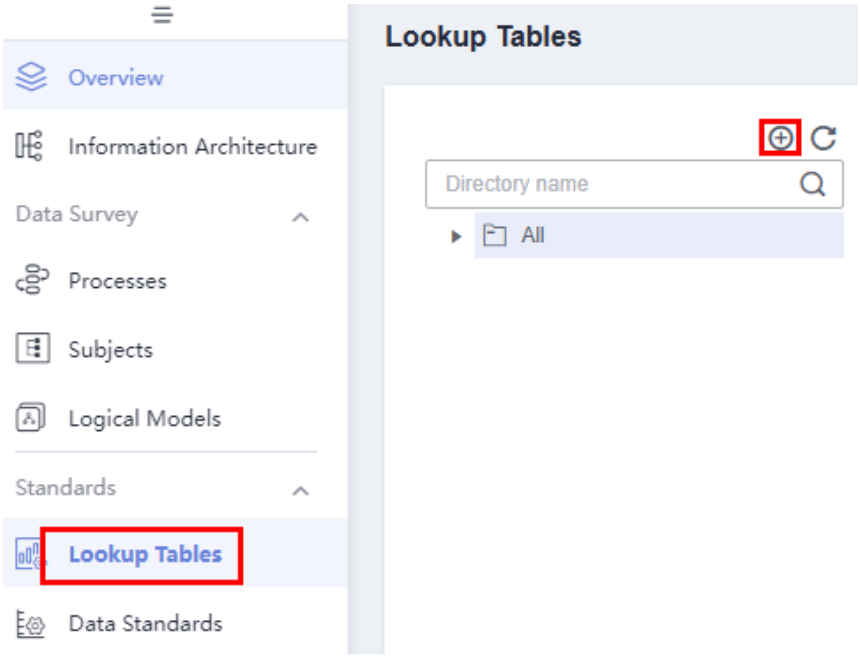
Creating and Publishing a Lookup Table

Manually create a lookup table. You can also add table records after creating a lookup table. For details, see **Filling in a Lookup Table**.

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane.
3. Select a directory from the directory tree on the **Lookup Tables** page, and then click  to create a directory under the selected directory. When creating a directory for the first time, you can create a directory under the root directory.

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Figure 8-30 Lookup Tables page



4. In the dialog box displayed, set the parameters and click **OK**.

Figure 8-31 Create Directory dialog box

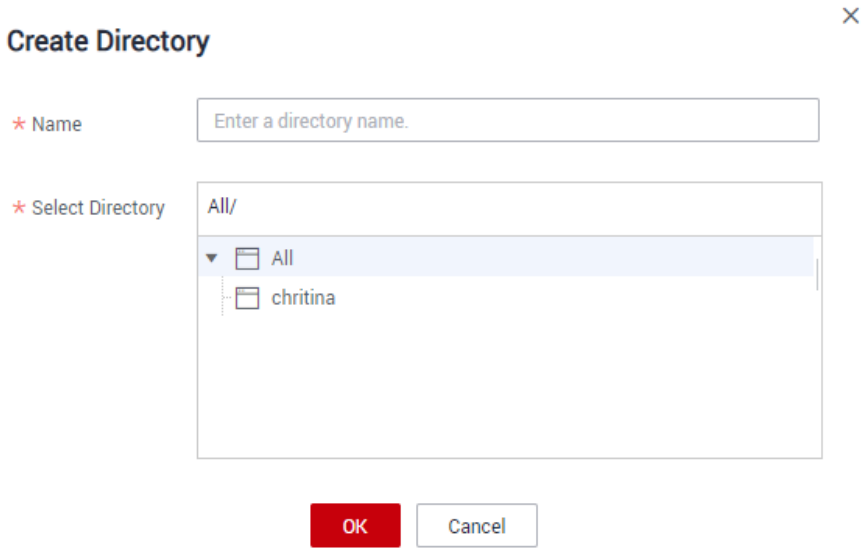


Table 8-14 Directory parameters

Parameter	Description
*Name	The following characters are not allowed: / \ < > .
*Select Directory	Select an existing directory, and create a subdirectory under it.

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5. Select the directory you created in the directory tree and click **Add** to create a lookup table.
6. On the **Create Lookup Table** page displayed, configure the parameters.

   In the **Table Details** area, set the parameters.

Figure 8-32 Table Details area

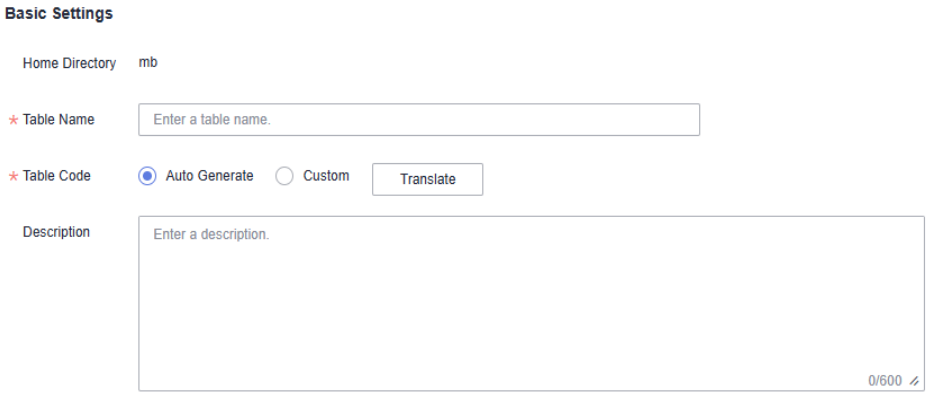
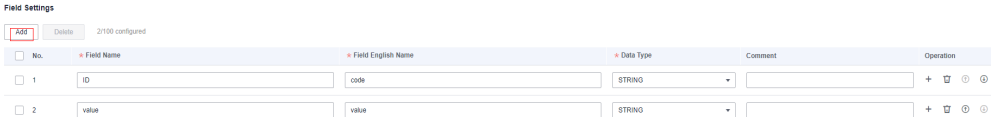


Table 8-15 Parameters

Parameter	Description
*Table Name	Name of the lookup table to create. Newline characters and the following characters are not allowed: \ < > % " ' ;
*Table Code	The code of the lookup table to create. You can select **Auto Generate** or **Custom** (enter a custom code). It must start with a letter. Only letters, digits, and underscores (_) are allowed. The system can automatically generate the table code through translation based on a configured naming dictionary.
Description	A description of the lookup table. Up to 600 characters are supported.

In the **Field Inputs** area, click **Add** or + to add new fields, and click to delete unnecessary fields.

Figure 8-33 Field Inputs area



7. Click **Publish**. In the **Apply for Publication** dialog box displayed, select a reviewer and click **OK**. After the application is approved, the **Lookup Tables**

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page is displayed. You can view the created lookup table in the list, and the status of the table is **Published**. Only published lookup tables can be used.

NOTE

If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the application is approved, the lookup table status changes to **Published**.

If you select multiple reviewers, the logical entities will be published only after all reviewers have approved the publishing request. If any reviewer rejects the request, the logical entities will not be published.

Filling in a Lookup Table

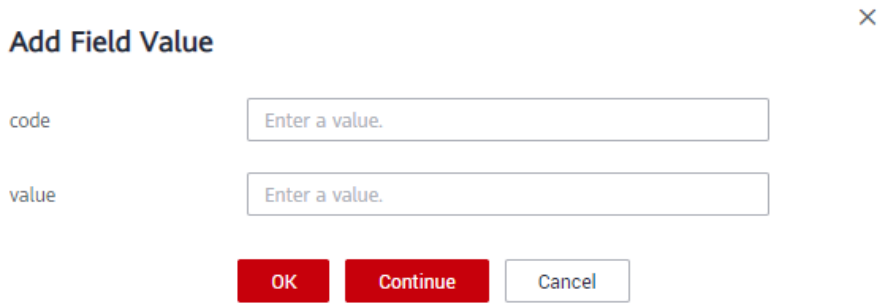
Input values in the created lookup tables.

Step 1 On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane.

Step 2 In the list of lookup tables, find the target table and choose **More** > **Manage Value** in the **Operation** column.

Step 3 On the page displayed, click **Add**. In the dialog box displayed, set the parameters.

Figure 8-34 Inputting a value



Step 4 Click **OK**. You can also click **Continue** to add more records.

----End

Importing a Lookup

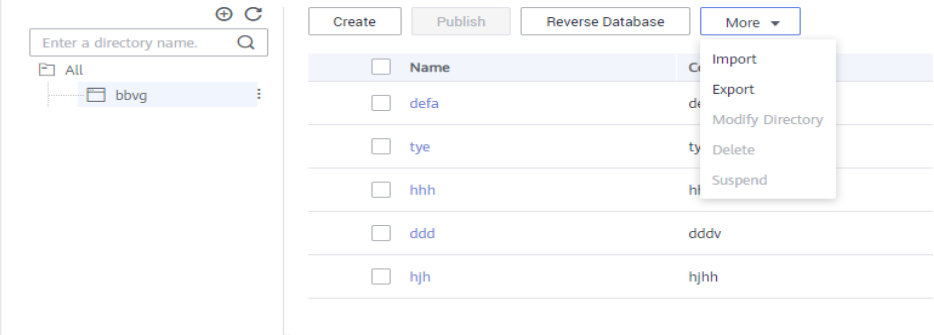
You can import a new lookup table or import lookup table records in batches to an existing lookup table. If you have a large number of lookup table records, you are advised to import them in batches.

Step 1 On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane.

Step 2 On the page displayed, select a directory, and choose **More** > **Import**. You can also right-click the selected directory and choose **Import**.

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Figure 8-35 Lookup Tables page



Step 3 In the **Import Lookup Table** dialog box displayed, set the parameters, and click **Upload**.

Figure 8-36 Import Lookup Table dialog box

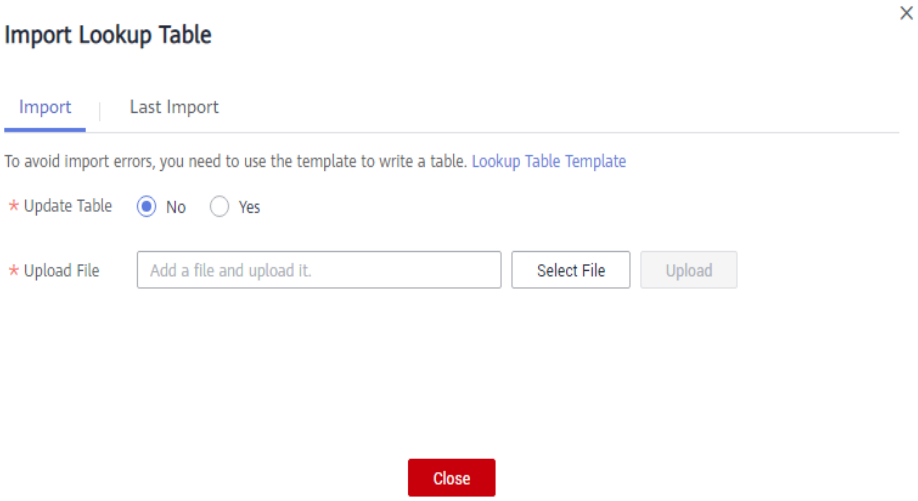


Table 8-16 Parameters for importing a lookup table

Parameter	Description
*Update Table	Whether to update the existing lookup table. When a lookup table is imported, the system checks whether the lookup table exists according to its code. The options are as follows: • **No**: If you select this option, the existing lookup table will not be updated. • **Yes**: If you select this option, the existing lookup table will be updated. If a lookup table is in the **Published** state, you must publish the lookup table again after updating it so that the updated lookup table can take effect. The import can create a lookup table or update an existing lookup table. It will not delete a lookup table.

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Parameter	Description
*Upload File	Select the file to import. You can use either of the following methods to obtain the file to import: • **Downloading the lookup table template and filling in it** In the **Import Lookup Table** dialog box, click **Lookup Table Template** to download the template, fill in the content, and save the settings. See **Table 8-17** for template parameter details. Instructions for filling in the lookup table template: – Parameters whose names start with an asterisk (*) are mandatory, and other parameters are optional. – Multiple fields can be added to a lookup table. – To import multiple lookup tables, you can add multiple sheets to the template file. The sheet name can be the lookup table name or code. – If the name of a lookup table already exists and **Update Table** is set to **Yes**, the existing lookup table will be updated during the import. – If the table name does not exist, a lookup table with that name is created during the import. • **Exporting lookup tables to files** You can export the lookup tables created in DataArts Architecture of a DataArts Studio instance to an Excel file. Then, import the Excel file. For details on how to export lookup tables, see **Managing a Lookup Table**.

Table 8-17 Parameters

Parameter	Description
Directory	The directory that a lookup table belongs to. Multi-level directories are separated with slashes (/), for example, **dir01/dir02**.
*Table Name	The name of the lookup table to create. Newline characters and the following characters are not allowed: \ < > % " ' ;
*Table Code	The code of the lookup table to create. Only letters, numbers, and underscores (_) are allowed. A table code must start with a letter.
Table Description	A description of the lookup table. Up to 600 characters are supported.
*Field Name	The name of a field. Field names must start with letters. Only letters, numbers, spaces, and the following special characters are allowed: ()-_

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Parameter	Description
*Field English Name	Field name in English. Only letters, numbers, and underscores (_) are allowed. A field code must start with a letter.
*Field Data Type	The possible values are **STRING**, **BIGINT**, **DOUBLE**, **TIMESTAMP**, **DATE**, **BOOLEAN**, and **DECIMAL**.
Field Description	The supplementary information about a field. Up to 600 characters are supported.
Generate Standard	• **true** indicates to generate a data standard. • **false** indicates not to generate a data standard. The default value is **false**. Note: To enable automatic generation of the data standard, choose **Configuration Center** in the navigation pane, click the **Standard Templates** tab, and select **Lookup table**.

If the lookup table records need to be imported, create a sheet named by the lookup table name or code in the template and add table fields to the sheet. Each field occupies a column. The column name includes the code and value. Enter the lookup table values to be imported. If the template contains a sheet named after the lookup table, you do not need to create the sheet. You can directly enter the table values to be imported in the sheet.

NOTE

If a sheet name is too long, it will be automatically truncated.

Step 4 View the import result on the **Last Import** tab page. If the import is successful, click **Close**. If the import fails, you can view the failure cause, correct the template file, and upload it again.

----End

Importing a Lookup Table Through a Reverse Database

With reverse databases, you can import one or more created database tables from other data sources into a lookup table directory to turn them into lookup tables.

Step 1 On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane.

Step 2 On the page displayed, select a directory and click **Reverse Database** above the lookup table list.

Step 3 In the dialog box displayed, set the parameters and click **OK**.

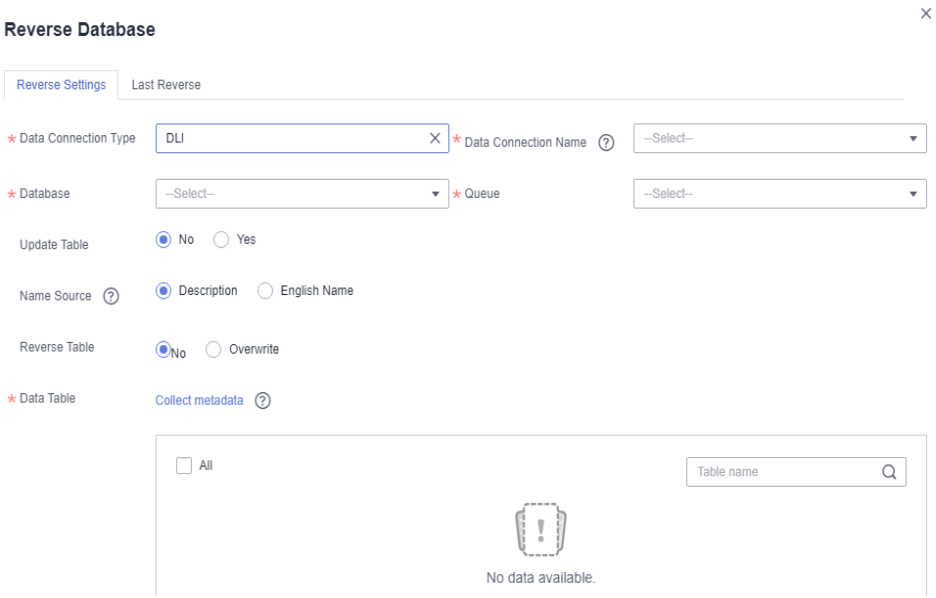
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Table 8-18 Parameters for reversing a database

Parameter	Description
*Data Connection Type	The data connection types supported by the reverse database are displayed in the drop-down list box. Select the required data connection type.
*Data Connection	Select a data connection. If you want to reverse a database from other data sources to a lookup table directory, you must create a data connection in Management Center to connect to the data source. For details on how to create data connections, see **Configuring DataArts Studio Data Connection Parameters**.
*Database	The name of the database. Select a database from the drop-down list box.
*Schema	Select a value from the drop-down list box. This parameter is available only for DWS and PostgreSQL tables.
Queue	DLI queue. This parameter is available only when **Data Connection Type** is set to **DLI**.
Update Table	When **Yes** is selected, if the name of the reversed table is the same as that of an existing table in the lookup table list, the existing table is updated.
Name Source	Source of the table name or field name after the reverse. The value can be **Description** or **Name**. If no description is specified for a table or field, the name is used. • Description • Name **NOTE** If you select **Description**, field comments of a table must be unique.
Reverse Table	• **No**: If you select this option, tables are imported to the lookup table directory but table data is not imported during database reverse. After reversing a database, you can add records to the lookup table. Refer to **Filling in a Lookup Table** for details. • **Overwrite**: If you select this option, tables are imported to the lookup table directory and table data is imported as well during database reverse.
*Data Table	You can select one or more data tables to import.

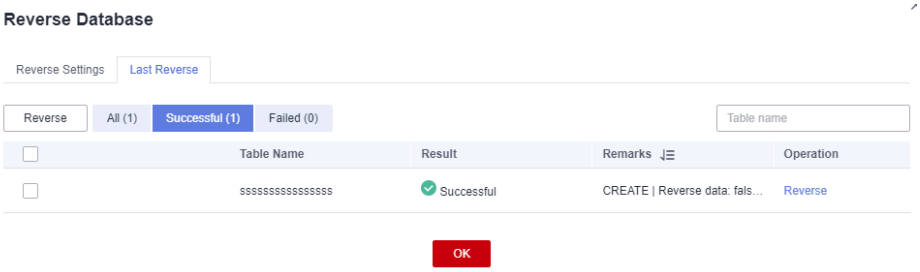
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Figure 8-37 Reverse Database dialog box



Step 4 You can view the result on the **Last Reverse** tab page. If the reverse operation is successful, click **Close**. If the reverse operation fails, you can view the failure cause. After the fault is rectified, select the table again and click **Reverse** to retry.

Figure 8-38 Last Reverse tab page



----End

Exporting a Lookup Table

When exporting a lookup table, ensure that the table name contains no more than 32 characters.

Step 1 On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane.

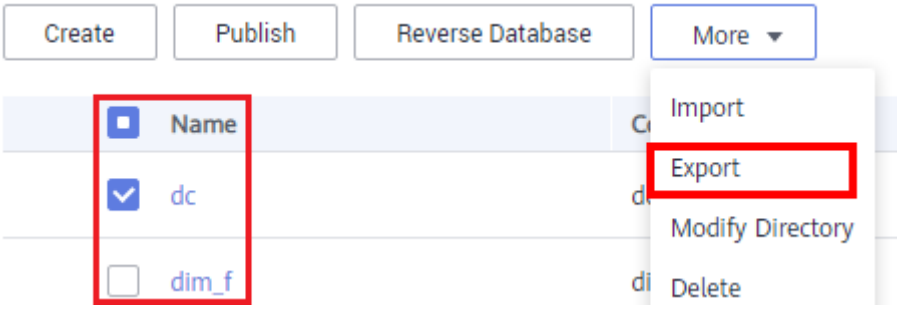
Step 2 Export a lookup table.

- **Export a single lookup table.**

  In the lookup table list, select the target lookup table and choose **More** > **Export**.

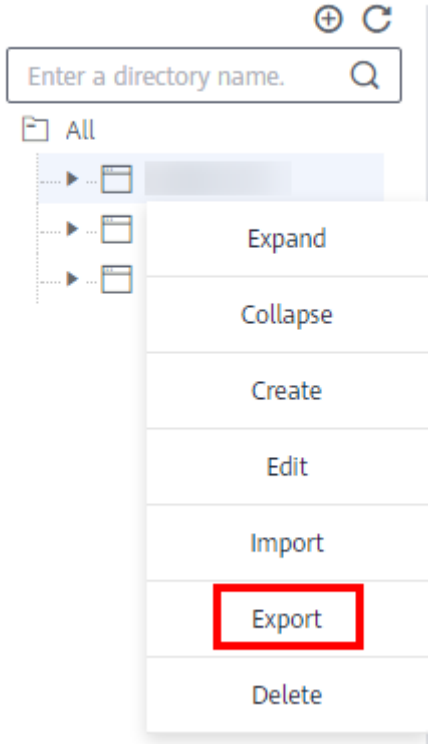
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Figure 8-39 Lookup table list



- **Export all tables in the list.**
  Right-click a directory in the directory tree and choose **Export**.

  Figure 8-40 Directories storing exported lookup tables



----End

Deleting a Lookup Table

Deleted lookup tables cannot be recovered. Exercise caution when performing this operation. A lookup table in publishing review, published, or suspension review state cannot be deleted.

Step 1 On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane.

Step 2 In the lookup table list, select the target lookup table and choose **More** > **Delete** above the list.

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Step 3 In the dialog box displayed, click **Yes**.

----End

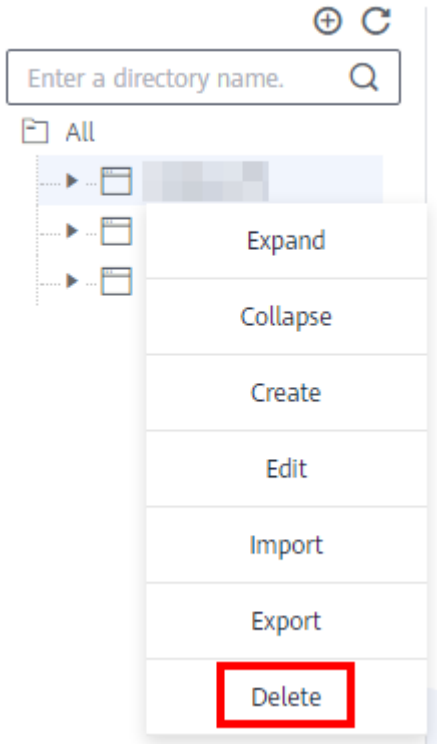
Deleting a Lookup Table Directory

A directory or its subdirectories that contain a lookup table cannot be deleted. You must delete the lookup table before deleting the directory.

Step 1 On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane.

Step 2 Right-click a directory in the directory tree and choose **Delete**.

Figure 8-41 Managing lookup table directories



Step 3 In the dialog box displayed, click **Yes**.

----End

Managing a Lookup Table

You can query, edit, suspend, or publish a lookup table.

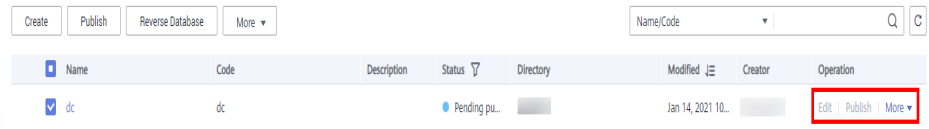
On the DataArts Architecture page, choose **Standards** > **Lookup Tables** in the left navigation pane. You can manage the lookup tables as required.

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NOTE

- The lookup tables created in the **public workspace** can be queried in a common workspace, but the lookup tables created in a common workspace cannot be queried in the **public workspace**.
- A common workspace has the edit permission of only the lookup tables and directories created in the same workspace, and can view indexes in the **public workspace** rather than perform any operation on the lookup tables and directories in the **public workspace**.

Figure 8-42 Managing lookup tables



- **Edit**

  In the lookup table list, select a table you want to edit and click **Edit** in the **Operation** column.

- **Publish**

  In the lookup table list, click **Publish** in a row containing a table in the **Draft** or **Rejected** state, select a reviewer in the dialog box displayed, and click **OK**. After the application is approved, the lookup table is published. If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the application is approved, the lookup table status changes to **Published**.

- **Suspend**

  In the lookup table list, locate a published lookup table you want to suspend, click **More** in the **Operation** column, and select **Suspend** from the drop-down list. In the displayed dialog box, select a reviewer and click **OK**. After the application is approved, the lookup table is suspended.

- **Manage Value**

  In the lookup table list, locate a lookup table, click **More** in the **Operation** column, and select **Manage Value** from the drop-down list. Then you can edit the value of each field.

- **View History**

  In the lookup table list, locate a lookup table, click **More** in the **Operation** column, and select **View History** from the drop-down list. Then you can view the publish history and changes of the lookup table, and compare different versions of it.

8.5.2 Creating Data Standards

Data standards describe data meanings and business rules that are stipulated and commonly recognized by enterprises and that those enterprises must comply with.

A data standard, also called a data element, is the smallest unit of data used. It cannot be further divided. A data standard is a data unit whose definition, identifiers, representations, and allowed values are specified by a group of properties. You can associate data standards with databases of a wide range of businesses. The identifier, data type, expression format, and value range are the

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basis of data exchange. They are used to describe field metadata of a table and standardize data information stored in a field.

This topic describes how to create a data standard. A created data standard can be associated with fields in a business table created during ER modeling, ensuring that fields in the business table comply with the specified data standards.

Constraints

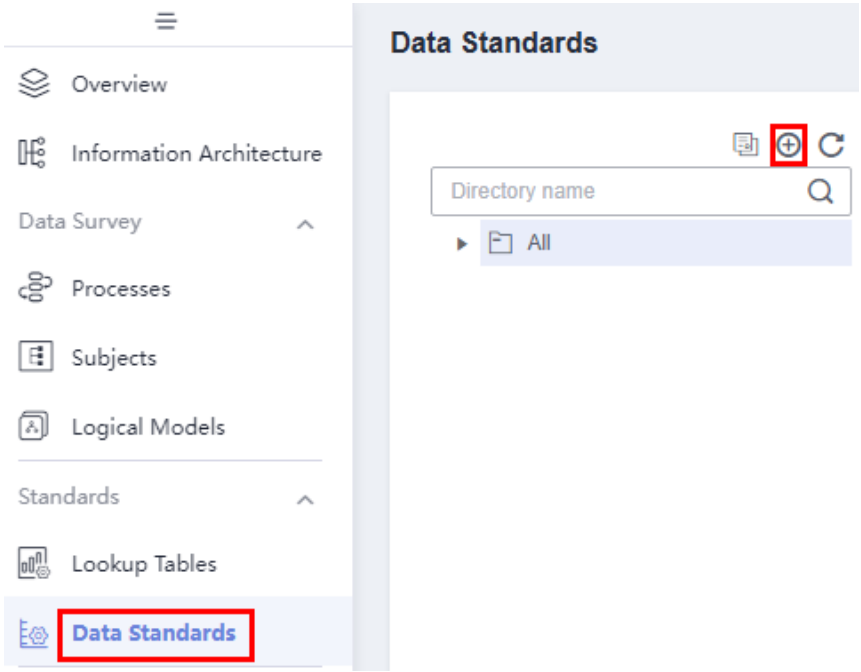
A maximum of 500 data standard directories and 20,000 standards can be created in a workspace.

Creating a Data Standard Directory

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Standards** > **Data Standards** in the left navigation pane.
3. When you access the **Data Standards** page for the first time, the page where you can customize a standard template is displayed. Select the required options for **Optional**, add custom items, and click **Update**.

   After saving the template settings, you can modify it on the **Standard Templates** tab page of **Configuration Center**. For details, see **Standard Templates**. When creating a data standard, you must set the selected options in the template.
4. On the **Data Standards** page, select a directory and click ⊕ to create a directory under the selected one. When creating a directory for the first time, you can create a directory under the root directory.

Figure 8-43 Data Standards page



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5. In the dialog box displayed, set the parameters and click **OK**.

Figure 8-44 Create Directory dialog page

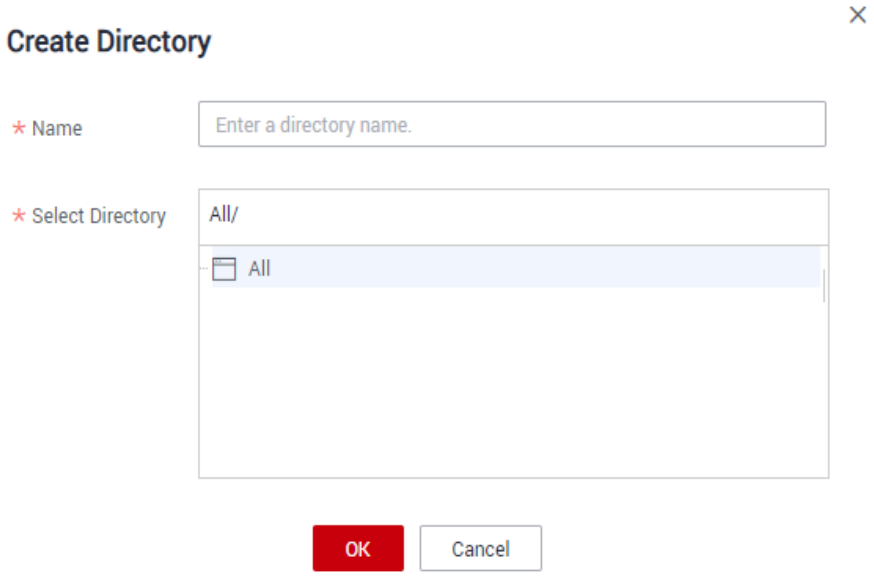


Table 8-19 Parameters for creating directories

Parameter	Description
*Name	The following characters are not allowed: / \ < > .
*Select Directory	Select an existing directory, and create a subdirectory under it.

Click to refresh the directories.

Click to refresh the directories and synchronize subject directories to data standard directories.

NOTE

- Before synchronizing subject directories, check whether there are released subjects in the current workspace. If there are no released subjects, an error will occur during the synchronization.
- A maximum of five levels of subject directories can be synchronized to data standard directories. Subject directories beyond this range will not be synchronized. The number of directories after the synchronization cannot exceed the upper limit (generally 500). Otherwise, an error will occur and the synchronization will be canceled. Before a synchronization, the system checks for and deletes empty data standard directories. These directories and their subdirectories do not contain any data standard.
- The synchronized subject directories are displayed as L1 to L5 icons, and the existing data standard directories are displayed as their original icons.

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Creating a Data Standard

Step 1 On the **Data Standards** page, select a directory and click **Create**.

Step 2 Set the parameters based on **Table 8-20**.

On the page for creating a data standard, only the selected parameters and custom parameters that have been added on the **Standard Templates** tab page of the **Configuration Center** are displayed. **Table 8-20** lists all parameters that are available in a data standard template. For details on how to configure a data standard template, see **Standard Templates**.

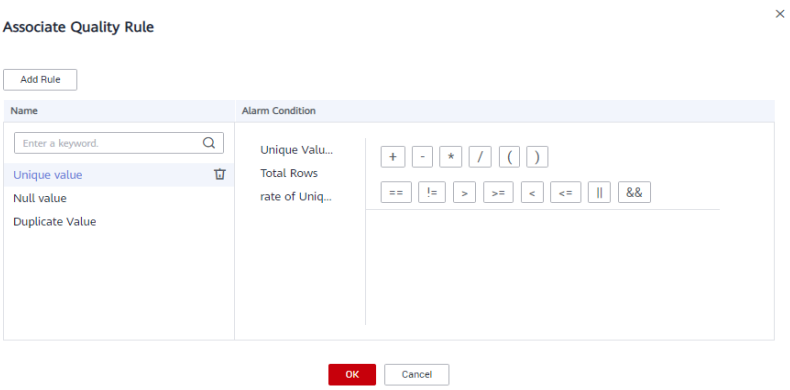
Table 8-20 Parameters for creating a data standard

Parameter	Description
*Standard Name	Newline characters and the following characters are not allowed: \ < > % " ' ; If **Data Standard Allows Duplicate Names** is disabled, ensure that the standard name is unique in the current workspace. To check whether **Data Standard Allows Duplicate Names** is enabled, go to **DataArts Architecture** > **Configuration Center** > **Functions**.
*Standard Code	The value can be **Auto Generate** or **Custom**. The value must be unique in the current workspace. It is used to identify a data standard record. For details, see **Table 8-65**.
Name (EN)	This parameter is displayed when **Name (EN)** is enabled on the **Configuration Center** page. You can manually configure the English name of the data standard. The system can automatically generate the English name through translation based on a configured naming dictionary.
*Data Type	The possible values are **STRING**, **BIGINT**, **DOUBLE**, **TIMESTAMP**, **DATE**, **BOOLEAN**, and **DECIMAL**. The data type varies according to the system. The system converts the data type internally. If the required data type does not exist, you can add one. See **Field Types**.
Name (EN)	English name of the data standard It must start with a letter. Only letters, digits, brackets, spaces, and underscores (_) are allowed.

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Parameter	Description
Data Length	Data length • You can leave this parameter blank. If it is left blank, there is no limit to the data length. • Select = and enter a number ranging from 1 to 10000. • Select ≤ and set a range from 1 to 10000. If you set this parameter and select **STRING** for **Data Type**, a data quality job will be created for the attribute matching the data standard. If you select any other data type, no data quality job will be created.
Allowed Value Exist	If **Allowed Value Exist** is enabled, you can specify one or more allowed values.
Allowed Value	This parameter is displayed when **Allowed value exist** is enabled on the **Configuration Center** page. You can type a value and press **Enter** to add it. You can add up to 20 allowed values.
Lookup Table	This parameter is displayed when **Lookup table** is enabled on the **Configuration Center** page. • Select a created lookup table and the corresponding table fields. In this way, the lookup table fields can be associated with data standard. If no lookup table is created, create one. See **Creating a Lookup Table**. If **Create Data Quality Jobs** is selected for **Model Design Process** on the **Function Settings** tab page of **Configuration Center**, and the data standard of the referenced lookup tables is associated with the business tables in ER modeling, the system will automatically create quality jobs in DataArts Quality when the business tables are published, and generate quality rules based on the associated data standard and lookup tables. If the quality jobs have already been published, the system will automatically update the quality jobs and add the quality rules generated based on the data standard and lookup tables. • If a public workspace is available, you need to manually set the reference lookup table source to **Public workspace** or **Current workspace** when selecting a lookup table in a common workspace. When **Public workspace** is enabled, lookup tables of the public workspace can be referenced in common workspace.
Lookup Table Field	Select a field in the lookup table.

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Parameter	Description
Quality Rule	This parameter is available if **Quality rule** is selected on the **Standard Templates** tab page on the **Configuration Center** page. You can associate a system quality rule or a quality rule you have created. Click  . In the dialog box displayed, click **Add Rule**. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**. An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. The alarm parameters of each data quality rule are listed as buttons. **Figure 8-45** Associate Quality Rule dialog box 
Rule Designer	Select a rule designer from the drop-down list box. This owner is responsible for making quality rules. You can enter an owner name or select an existing owner.
Rule Implementer	Select a rule implementer from the drop-down list box. This owner is responsible for implementing quality rules. You can enter an owner name or select an existing owner.
Level	• **global** indicates the global level. • **domain** indicates non-global level.
Custom Item	A custom item added on the **Standard Templates** tab page in **Metrics** > **Configuration Center**. You can add one or more custom items based on project requirements. For more information about adding custom items, see **Standard Templates**.

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Parameter	Description
Description	A description of the data standard to create. Up to 600 characters are supported.

Step 3 Click **Save**.

Step 4 Select the standard and click **Publish**. In the displayed dialog box, select a reviewer and click **OK**. After the application is approved, the **Data Standards** page is displayed. You can view the created data standard in the list, and the status of the data standard is **Published**. Only published data standards can be used.

NOTE

If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the application is approved, the status changes to **Published**.

If you select multiple reviewers, the logical entities will be published only after all reviewers have approved the publishing request. If any reviewer rejects the request, the logical entities will not be published.

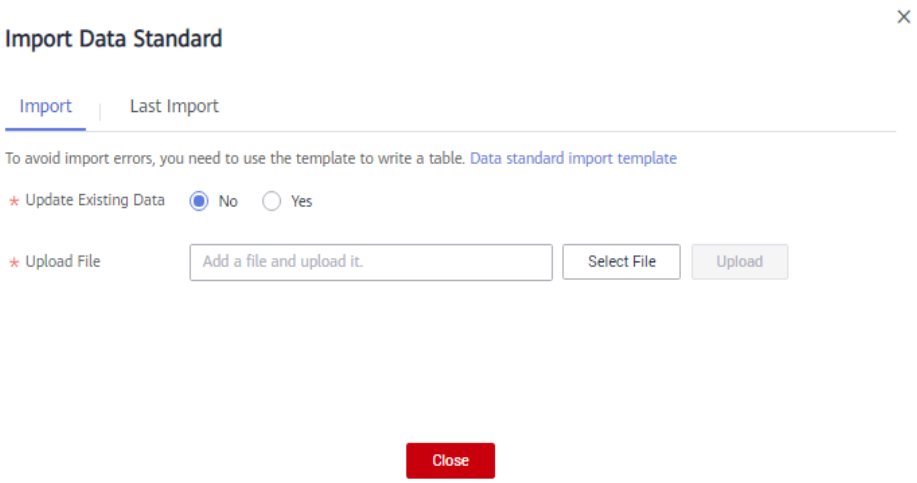
----End

Importing a Data Standard

Step 1 On the DataArts Architecture page, choose **Standards** > **Data Standards** in the left navigation pane.

Step 2 In the directory structure of data standards, select a directory and choose **More** > **Import**.

Figure 8-46 Import Data Standard dialog box



Step 3 In the **Import Data Standard** dialog box, determine whether to update the existing data. Existing data is uniquely identified by a standard code. If a standard code in the import template already exists in the current workspace, the system considers that the group of data to which the standard code in the import template belongs already exists.

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Step 4 On the **Import** tab page, click **Data standard import template** to download the template. Open the template, set the parameters in the template based on service requirements, and save the settings.

Table 8-21 and **Table 8-22** describe the parameters required for importing a data standard. Parameters whose names start with an asterisk (*) are mandatory, and other parameters are optional.

Table 8-21 Parameters in the Standards sheet

Parameter	Description
*Directory	The directory that the imported data standard belongs to.
*Standard Name	The name of the data standard to import. Newline characters and the following characters are not allowed: \ < > % " ' ;
*Standard Code	You can select **Auto Generate** or **Custom**. The value must be unique in the workspace. It is used to identify a data standard record. For details, see **Table 8-65**.
*Data Type	The possible values are **STRING**, **BIGINT**, **DOUBLE**, **TIMESTAMP**, **DATE**, **BOOLEAN**, and **DECIMAL**. The data type varies according to the system. The system converts the data type internally. If the required data type does not exist, you can add one. See **Field Types**.
Data Length	Data length • You can leave this parameter blank. If it is left blank, there is no limit to the data length. • Enter a number ranging from 1 to 10000. • Set a range from 1 to 10000, for example **(1,20)**. If you enter a value and select **STRING** for **Data Type**, a data quality job will be created for the attribute matching the data standard. If you select any other data type, no data quality job will be created.
Allowed Value	The value **true** indicates that there are allowed values, and the value **false** indicates that there are no allowed values.
Allowed Value List	If you select **true** for **Allowed Value**, you must enter an allowed value. You can add up to 20 values. Multiple values must be separated by commas (,), for example, **1,2,3**.
Lookup Table	Set this parameter to the name of a created lookup table.
Lookup Table Field	If **Lookup Table** is not left blank, you must set **Lookup Table Field**. In this way, the code table field can be associated with the data standard.

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Parameter	Description
Owner of Business Rules	Enter the business rule owner. You can enter the name of an owner or select an existing owner.
Owner of Data Monitoring	Enter the data monitoring owner. You can enter the name of an owner or select an existing owner.
Standard Level	• **global** indicates the global level. • **domain** indicates non-global level.
Description	A description of the data standard to import. Up to 600 characters are supported.
(Optional) Custom Item	If you have added one or more custom fields when customizing a data standard template, you must also fill in the corresponding fields in the import template. If no custom field is added, you do not need to fill in the fields. For details on how to customize a data standard template, see **Standard Templates**.

If **Quality rule** is selected on the **Standard Templates** tab page on the **Configuration Center** page, the downloaded template contains the **Quality Rules** sheet on which you can add quality rules for the data standard.

Table 8-22 Parameters in the Quality Rules sheet

Parameter	Description
*Code	The code of the data standard that a quality rule is added to.
Rule Name	Enter an existing rule name. In the upper left corner of the DataArts Studio console, select **DataArts Quality** from the drop-down list box. Then, you can view the existing rule names on the **Rule Templates** page.

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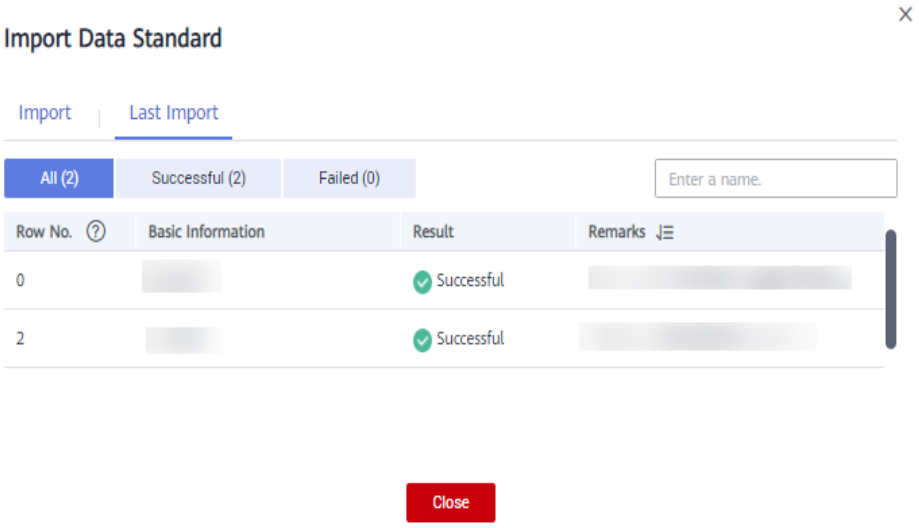
Parameter	Description
Alarm Config	An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the alarm condition expression, alarm parameters are represented by variables such as *${1}*, *${2}*, and *${3}*. The variable name indicates the alarm parameter of the specified quality rule. The variable *$1* indicates the first alarm parameter, *$2* indicates the second alarm parameter, and so on. In the upper left corner of the DataArts Studio console, select **DataArts Quality** from the drop-down list box. Access the **Rule Templates** page and view the alarm parameters supported by the data quality rule in the **Result Description** column. Example: ${1} > 100
Expression	This parameter must be configured when **Rule Name** is set to **Expression** or **Validity Verification**.

Step 5 Return to the **Import Data Standard** dialog box, select the data standard template file configured in the previous step, and click **Upload**.

If the uploaded template file fails the verification, modify the file and upload it again.

Step 6 In the **Import Data Standard** dialog box, the import result is displayed on the **Last Import** tab page. If the import is successful, click **Close**. If the import fails, you can view the failure cause, correct the template file, and upload it again.

Figure 8-47 Last Import tab page



----End

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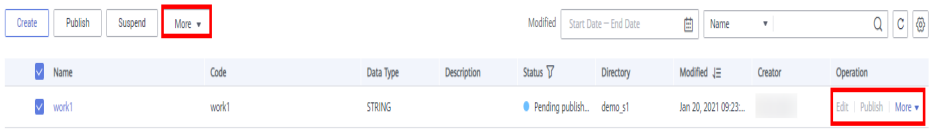
Managing a Data Standard

On the DataArts Architecture page, choose **Standards** > **Data Standards** in the left navigation pane. On the page displayed, you can manage data standards as required.

NOTE

- The data standards created in the **public workspace** can be queried in a common workspace, but the data standards created in a common workspace cannot be queried in the **public workspace**.
- A common workspace has the edit permission of only the data standards and directories created in the same workspace, and can view indexes in the **public workspace** rather than perform any operation on the data standards and directories in the **public workspace**.

Figure 8-48 List of data standards



On the **Data Standards** page, you can perform the following operations:

- **Search**

  Above the data standard list, select a filter such as the standard name, data type, creator, and reviewer, and click the search icon to search for data standards.

  After locating the specified data standards, you can perform the following operations:

  - Edit
  - Publish
  - Suspend

- **Import**

  Choose **More** > **Import** to import a data standard. Download the template, fill in it and upload it, and click **Close**.

- **Export**

  - Export data standards from a specified directory.

    In the data standard directory structure, select a directory and choose **More** > **Export** above the data standard list to export all data standards in the directory.

  - Export specified data standards.

    In the data standard list, select the data standards you want to export and choose **More** > **Export** above the list to export the selected data standards.

- **Delete**

  Select a data standard, and choose **More** > **Delete**. A data standard in publishing review, published, or suspension review state cannot be deleted. Referenced data standards cannot be deleted as well.

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- **Publish**

  Select a data standard and click **Publish**. In the displayed dialog box, perform either of the following operations:

  – Select a reviewer. If no reviewer is available in the drop-down list, click + to add one.
  – Select **Auto-review**.

  NOTE

  Auto-review is available only when the current account is in the reviewer list.

  Click **OK**. If a reviewer is selected, the data standard is published after the application is approved. If **Auto-review** is selected, the data standard will be published immediately.

Exporting a Data Standard

Step 1 On the DataArts Architecture page, choose **Standards** > **Data Standards** in the left navigation pane.

Step 2 In the data standard directory structure, right-click a directory name and choose **Export**.

----End

8.6 Model Design

8.6.1 Data Warehouse Planning

Data warehouse planning enables you to manage data warehouse layers and models in a unified manner. The system provides four default data warehouse layers, including Source Data Integration (SDI), Data Warehouse Integration (DWI), Data Warehouse Report (DWR), and Data Mart (DM). You can also customize data warehouse layers.

- ER modeling consists of the SDI and DWI layers. Physical models belong to one of the two layers.
  – SDI stands for Source Data Integration and is the source data layer. SDI is a simple implementation of source system data.
  – DWI stands for Data Warehouse Integration, also called the data consolidation layer. DWI integrates and cleans data from multiple source systems, and implements entity relationship modeling based on the three normal forms.

  NOTE

  When designing physical models, take the following aspects into consideration:
  - Physical models must ensure that the required functions are available and their performance is as good as expected.
  - Physical models must ensure data consistency and quality.
  - Few or no changes are made to the physical models when new services or functions are added.

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- In dimensional modeling, DWR-layer models are created based on dimensions, and data is aggregated into DM-layer models.
  - Data Warehouse Report (DWR) is based on the multi-dimensional model and its data granularity is the same as that of the DWI layer.
- DM: Multiple types of data are summarized and displayed.
  - DM is where multiple types of data are summarized. DM is designed to display the summarized data.

The administrator can rename the four default data warehouse layers by clicking Edit next to the names of the layers. The model name can contain only letters, digits, and underscores (_), and must start with a letter.

Physical models, dimensional models, and data marts are managed in a unified manner in data warehouse planning.

Creating a Data Warehouse Layer

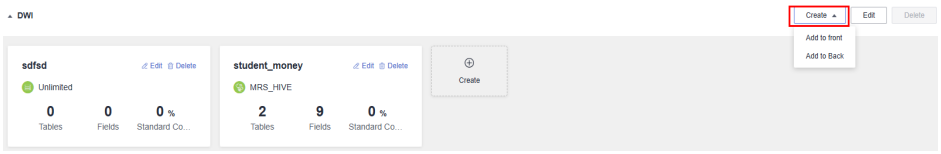
You can create data warehouse layers that suit your business scenarios. The procedure is as follows:

1. Access the DataArts Architecture console.
2. In the left navigation pane, choose **Models** > **Data Warehouse Layer**.
3. On the right of a data warehouse layer, click **Create** and select **Add to front** or **Add to Back**.

   NOTE

   Add to front or **Add to Back** indicates that the new data warehouse layer is in front of or after the current data warehouse layer.

   Figure 8-49 Creating a data warehouse layer

4. Set parameters for the data warehouse layer.

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Figure 8-50 Setting parameters for the data warehouse layer

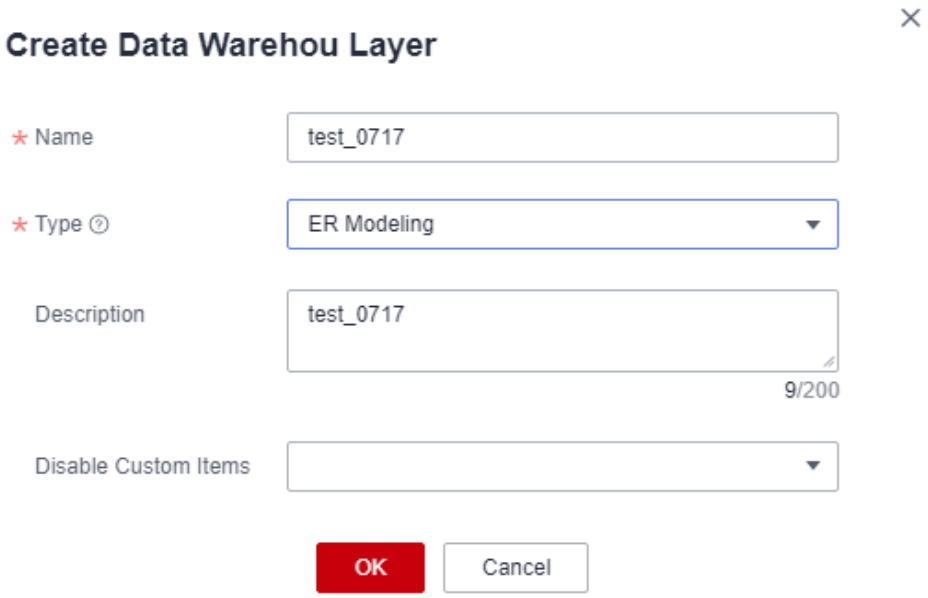


Table 8-23 Parameters for the data warehouse layer

Parameter	Description
*Name	Name of the data warehouse layer. It must start with a letter and can contain only letters, digits, and underscores (_). A maximum of 10 characters are allowed.
*Type	Type of the layer. It cannot be changed after the layer is created. • **ER Modeling** • **ER Modeling** • **ER Modeling** **NOTE** 1. ER modeling is used for service systems, the SDI layer, and DWI layer. 2. Dimensional modeling is used for the data warehouse public layer or DWR layer. 3. Data mart is used for modeling summary tables and application tables.
Description	Description of the data warehouse layer. A maximum of 200 characters are allowed.

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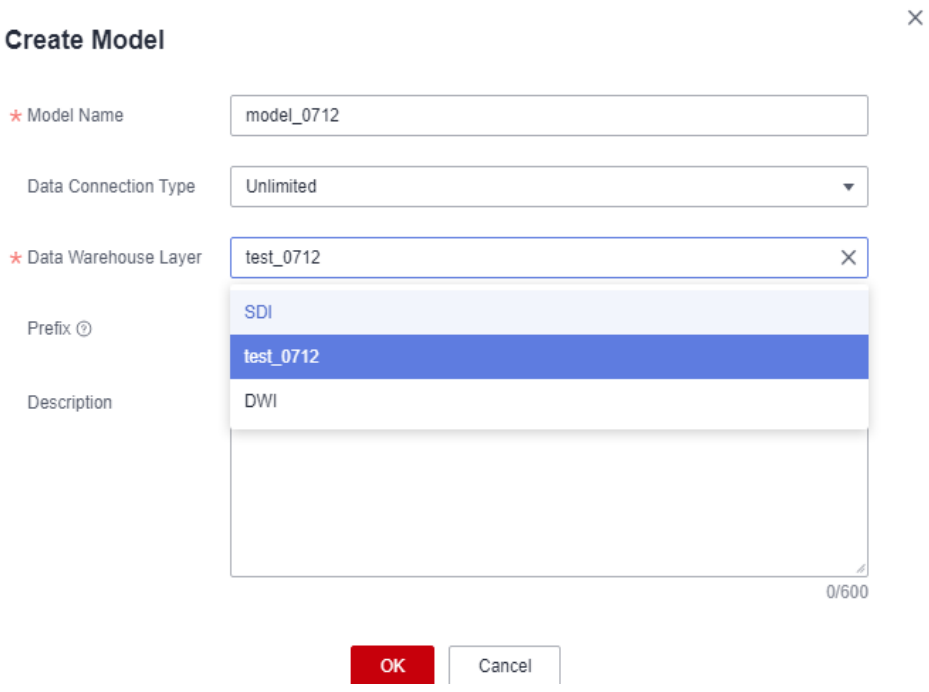
Parameter	Description
Disable Custom Items	Whether to disable custom items. If there is no custom item, no custom item can be disabled.

5. Click **OK**.
6. You can perform the following operations on the created data warehouse layer:
   - Click **Edit** to modify its parameters except **Type**.
   - Click **Delete** to delete it. If the layer contains models, it cannot be deleted.

Creating a Model

1. Access the DataArts Architecture console.
2. In the left navigation pane, choose **Models** > **Data Warehouse Layer**.
3. Locate a data warehouse layer and click **Create**.
4. In the displayed **Create Model** dialog box, set required parameters.

Figure 8-51 Creating a model



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Table 8-24 Model parameters

Parameter	Description
*Model Name	Name of the model. Only letters, digits, and underscores (_) are allowed.
Data Connection Type	Data connection type • **Unlimited** • Select a data connection.
*Data Warehouse Layer	• To create the model at the DWI layer, SDI layer, or a custom ER modeling data warehouse layer, you can select **DWI**, **SDI**, or a custom data warehouse layer. **NOTE** • **SDI** stands for Source Data Integration and is the source data layer. SDI is a simple implementation of source system data. • **DWI** stands for Data Warehouse Integration, also called the data consolidation layer. DWI integrates and cleans data from multiple source systems, and implements entity relationship modeling based on the three normal forms. • To create the model at the DWR layer or a custom dimensional modeling data warehouse layer, you can select **DWR** or a custom data warehouse layer. • To create the model at the DM layer or a custom DM data warehouse layer, you can select **DM** or a custom data warehouse layer.
Prefix	Verification prefix. It must start with letters. Only letters, digits, and underscores (_) are allowed. **NOTE** When you create, modify, or import a physical (relational) table in ER modeling, fact table in dimensional modeling, or summary table in the data mart, the system checks whether there is a prefix. If there is no prefix, the verification fails. When a reversing operation is performed, the system also checks for a prefix.

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Parameter	Description
Description	Description of the data warehouse model. A maximum of 600 characters are allowed.

5. Click **OK**.
6. You can perform the following operations on the created model:
   - Click **Edit** to modify its parameters except **Data Connection Type**.
   - Click **Delete** to delete it. Deleted models cannot be recovered. Exercise caution when performing this operation. The model cannot be deleted if it contains tables.
   - Click **Tables**, **Fields**, or **Standard Coverage** to go to the corresponding data warehouse layer page. For example, if you click **Tables** of a DWI model, you will be redirected to the **ER Modeling** page.
   - Click **Expand More** to view more data warehouse models and click **Collapse More** to collapse them.
   - Unlayered data warehouse models are displayed in the upper area of the page. You can edit or delete them.
     - Click **Edit** to modify the parameters of a data warehouse model. For example, you can set **Data Warehouse Layer** of a model to **DWI**, **SDI**, or a custom data warehouse layers. **Data Connection Type** cannot be modified.
     - Click **Delete** to delete a data warehouse model. Deleted models cannot be recovered. Exercise caution when performing this operation. The model cannot be deleted if it contains tables.

8.6.2 ER Modeling

A physical model is a physical description about the conversion of elements such as entities, attributes, attribute constraints, and relationships from a logical model to a table relationship diagram that can be identified by database software using certain rules and methods.

On the **ER Modeling** page, you can create an SDI and a DWI layer. The models are implemented through physical modeling. In addition to converting a logical model to a physical model, you can directly create a physical model.

The following parts are included in this topic:

- **Considerations in Physical Model Design**
- **Creating a Physical Model**
- **Creating and Publishing a Table**
- **Importing a Physical Table by Reversing a Database**

Considerations in Physical Model Design

- Physical models must ensure that the required functions are available and their performance is as good as expected.

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- Physical models must ensure data consistency and quality.
- Few or no changes are made to the physical models when new services or functions are added.

Creating a Physical Model

Functions related to data warehouse layers and model management have been migrated to the **Data Warehouse Layer** page. For details about how to create a physical model, see **Data Warehouse Planning**.

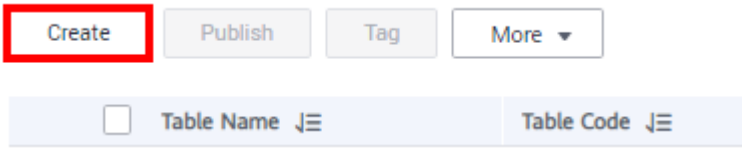
Creating and Publishing a Table

After creating an ER model on the **Data Warehouse Layer** page, you can create physical tables on the **ER Modeling** page.

Step 1 On the DataArts Architecture page, choose **Models** > **ER Modeling** in the left navigation pane.

Step 2 In the middle of the page, select a physical model from the drop-down list box on the top or click a physical model in data warehouse planning to go to the physical model list page. Then click **Create**.

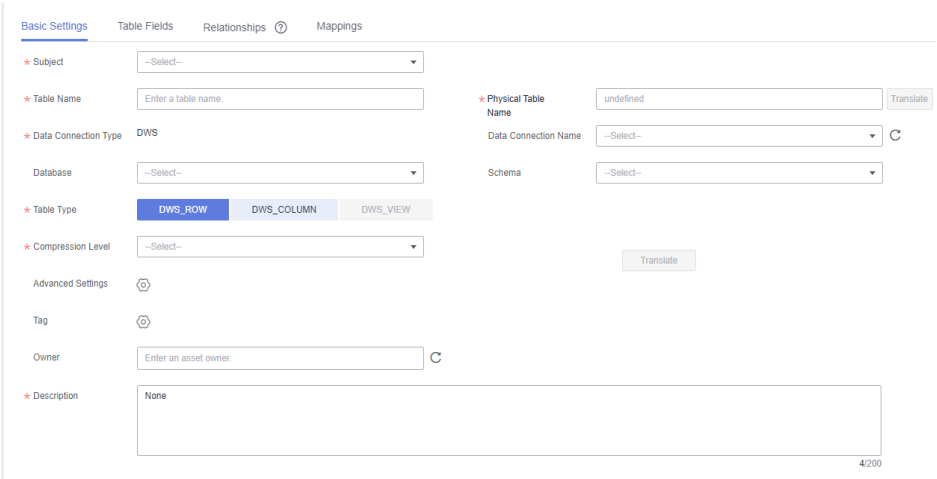
Figure 8-52 Entry for creating a table



Step 3 On the **Create Table** page, set the parameters as required.

1. Set the basic parameters.

Figure 8-53 Basic Settings tab page



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Table 8-25 Parameters on the Basic Settings tab page

Parameter	Description
*Subject	Select a subject from the drop-down list box.
*Table Name	The name of the table to create. Newline characters and the following characters are not allowed: \ < > % " ' ; **NOTE** The name of a physical model table can contain a maximum of 200 characters.
*Table Code	Code of the table to create. Table codes cannot start with numbers. Only letters, numbers, and the following special characters are allowed: _${} The system can automatically generate the table code through translation based on a configured naming dictionary.
*Data Connection Type	Data connection type configured in the data warehouse layer by default. The value cannot be changed.
Data Connection	The name of the data connection. Select the required data connection. You are advised to use the same data connection for an ER model. If no data connection is available, access Management Center to create one. For details, see **Configuring DataArts Studio Data Connection Parameters**.
Database	The name of the database. Select a database from the drop-down list box.
Queue	DLI queue. This parameter is available only for DLI tables.
Schema	Schema of DWS or PostgreSQL This parameter is available only for DWS and PostgreSQL tables.

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Parameter	Description
*Table Type	DLI models support the following table types: – **MANAGED**: Data is stored in a DLI table. – **EXTERNAL**: Data is stored in an OBS table. When **Table Type** is set to **EXTERNAL**, you must set **OBS Path**. The OBS path format is ***/bucket_name/filepath***. DWS models support the following table types: – **DWS_ROW**: Tables are stored to disk partitions by row. – **DWS_COLUMN**: Tables are stored to disk partitions by column. – **DWS_VIEW**: Tables are stored to disk partitions by view. The MRS Hive model supports **HIVE_TABLE** and **HIVE_EXTERNAL_TABLE**. The MRS Spark model supports **HUDI_COW** and **HUDI_MOR**. The PostgreSQL model supports only **POSTGRESQL_TABLE**. The MRS_CLICKHOUSE model supports only **CLICKHOUSE_TABLE**. The Oracle model supports only **ORACLE_TABLE**. The MySQL model supports only **MYSQL_TABLE**. The Doris model supports only **DORIS_TABLE**.
Path	This parameter is available only when the data source is MRS Hive and table type is HIVE_EXTERNAL_TABLE. The path can contain only letters, digits, slashes (/), periods (.), hyphens (-), underscores (_), and colons (:).
Compression Level	This parameter is available when the data connection type is DWS. The following compression levels are available for different table types: – **DWS_ROW**: **NO** and **YES** – **DWS_COLUMN**: **NO**, **LOW**, **MIDDLE**, and **HIGH**. – **DWS_VIEW**: The compression level is not supported.

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Parameter	Description
Data Format	This parameter is available only for DLI tables. DLI models support the following table types: – **Parquet**: DLI can read non-compressed data or Parquet data that is compressed using Snappy and GZIP. – **CSV**: DLI can read non-compressed data or CSV data that is compressed using GZIP. – **ORC**: DLI can read non-compressed data or ORC data that is compressed using Snappy. – **JSON**: DLI can read non-compressed data or JSON data that is compressed using GZIP. – **Carbon**: DLI can read non-compressed Carbon data. – **Avro**: DLI can read non-compressed Avro data.
Advanced Settings	Set custom items to describe the table. The custom items can be viewed in the table details. For example, if you want to identify the source of the table, you can add item **source** and set its value to the table source information. Then you can view the table source information in the table details.
Tag	Tags are custom identifiers that help you classify and search for data assets. After adding a tag, you can search for related data assets in the DataArts Catalog module with ease. Click  . In the dialog box displayed, select one or more existing tags, or enter a new tag name and press **Enter**. Then press **OK**. You can also go to the **Tags** page of the DataArts Catalog module to add a tag. Then, return to this page and select the newly added tag from the drop-down list box. For details, see **Managing Asset Tags**. If you want to modify the tag of a table in ER modeling, you must suspend the table first. After modifying the tag, you can publish the table again.
Owner	You can enter an owner name or select an existing owner.
*Description	A description of the table. It allows 1 to 200 characters.
Associated Logical Entity	Select the logical entity to be associated with the table and the source model of the logical entity. You can also click the refresh button on the right. The system will automatically synchronize the source model with the same name as the physical table subject and the logical entity with the same name as the physical table. A logical entity can be associated with multiple physical tables.

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2. Click **Add** to add required fields on the **Table Fields** page.

Figure 8-54 Adding required table fields

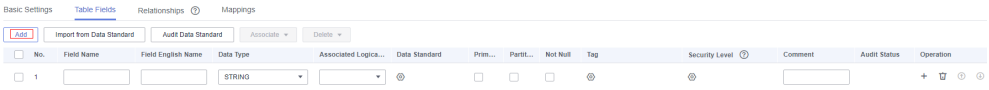


Table 8-26 Parameters on the Table Fields tab page

Parameter	Description
Name	Newline characters and the following characters are not allowed: \ < > % " ' ;
Code	Only letters, numbers, and underscores (_) are allowed. A field code must start with a letter.
Data Type	Field data type. If the required data type does not exist, you can add one. See **Field Types**.
Associated Logical Attribute	If the table configuration has been associated with a logical entity, you can select a logical attribute from the drop-down list box to associate it with the table field.
Data Standard	If you have created data standards, click to select one to associate with the field. If **Create Data Quality Jobs** is selected for **Model Design Process** on the **Function Settings** tab page in Configuration Center and a field is associated with a data standard, a quality job is automatically generated after a table is published. A quality rule is generated for each field associated with the data standard. The quality of the field is monitored based on the data standard. You can access the **Quality Job** page of DataArts Quality to view the job details. If no data standard is available, create one. See **Creating Data Standards** for details.
Primary Key	If this parameter is selected, the field is a primary key. **NOTE** If an MRS Spark connection is used to connect to MRS Hudi data sources, data can be written to the database only if fields have primary keys. Otherwise, table synchronization fails.
Partition	If this parameter is selected, the field is a partition field.
Not Null	Whether the parameter value can be left empty.

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Parameter	Description
Tag	Click to add a tag. – In the dialog box displayed, select one or more existing tags. If no tag has been added, you can go to the **Tags** page of the DataArts Catalog module to add a tag. For details, see **Managing Asset Tags**. – In the dialog box displayed, enter a new tag name and press **Enter**. Tag names can contain letters, numbers, and underscores (_), but cannot start with underscores (_).
Security Level	You can click to add a security level for the logical entity attribute. If you cannot find the security level you want, click **go to** to go to the DataArts Security console and create a security level. You can disable this function on the **Models** tab page on the **Configuration Center** page.
Description	A description of the field to add.
Audit Status	Whether to audit the data standard Click **Audit Data Standard** to audit data standards.
Operation	Related operations

3. (Optional) On the **Relationships** tab page, click **Add** to create a relationship.

   A relationship refers to the association between a parent and a child table (also called a primary and a secondary table). It describes how a table is associated with another table, or the impact of a table's behavior on another table. Relationships between tables in a data model are particularly important and must be accurately defined. Otherwise, the actual business rules cannot be accurately described in the data model, and data consistency is greatly damaged.

   For example, if the **student ID** attribute of a score table is the primary key for a student table, the relationship between the two tables designed according to the third normal form (3NF) is as follows:

   – Child table: score table
   – Child table field FK: student ID
   – Child to parent: 1
   – Parent table: student table
   – Parent table field PK: student ID
   – Parent to child: 1

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Figure 8-55 (Optional) Adding a relationship



Table 8-27 Parameters on the Relations tab page

Parameter	Description
Name	Name of the relationship
Child Table	Select a table from the drop-down list box. Click to set the current table as a child table. For example, if the **student ID** attribute of a score table is the primary key for a student table, the child table is the score table, and the corresponding parent table is the student table.
Child Table Field FK	Foreign key of the child table. The field of the child table must be the foreign key of the parent table. For example, if the **student ID** attribute of a score table is the primary key for a student table, the child table field FK is the student ID in the score table.
Child to Table	1 indicates that each piece of data in the child table corresponds to only one piece of data in the parent table. 0,1 indicates that each piece of data in the child table corresponds to at most one piece of data in the parent table. 0..n indicates that one piece of data in the child table corresponds to multiple pieces of data in the parent table. 1..n indicates that each piece of data in the child table corresponds to at least one piece of data in the parent table.

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Parameter	Description
Parent to Child	 indicates that each piece of data in the parent table corresponds to only one piece of data in the child table.  indicates that each piece of data in the parent table corresponds to at most one piece of data in the child table.  indicates that one piece of data in the parent table corresponds to multiple pieces of data in the child table.  indicates that one piece of data in the parent table corresponds to at least one piece of data in the child table.
Parent Table	Select the parent table corresponding to the selected child table. For example, if the **student ID** attribute of a score table is the primary key for a student table, the parent table is the student table, and the corresponding child table is the score table.
Parent Table Field PK	Primary key of the parent table. The field of the parent table must be the primary key of the parent table. For example, if the **student ID** attribute of a score table is the primary key for a student table, the parent table field PK is the student ID in the student table.
Role	You can customize a role name to identify the relationship.
Operation	Click  to delete a relationship. Click  to edit the relationship.

4. (Optional) On the **Mappings** tab page, click **Create** to create a mapping and design a data source based on the created mapping.
   - If the table field comes from different relationship models, you must create multiple mappings.

     Currently, table data can be obtained from ER models of different connection types. In each mapping, you only need to set the source field for the field that comes from the current mapping. Other fields do not need to be set.

     For example, if the data of the first five fields and the last five fields in the current table comes from two different models, create the following mappings:

     - **map1**: Create a table named **table01** from ER model A. In the **Field Mapping** area, set the source fields of the first to fifth fields to the

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corresponding fields with the same meaning in **table01**. The last five fields do not need to be set.

- **map2**: Create a table named **table02** from ER model B. In the **Field Mapping** area, set the source fields of the sixth to tenth fields to the corresponding fields with the same meaning in **table02**. The first five fields do not need to be set.

– If the field data in a table comes from multiple tables in the same ER model, you can create a mapping.

  In the source table of the mapping, you can set JOIN conditions for multiple tables, and then set source fields for the fields in the table. The selected source fields must have the same meanings as the fields in the table.

  For example, all fields in the current table come from ER model **d1**, the first, second, and third fields come from the **vendor**, **payment_type**, and **rate** tables respectively, and other fields come from the **dwd_taxi_trip_data** table.

  You can create a mapping, as shown in **Figure 8-56**. Join the **dwd_taxi_trip_data** table with the **vendor**, **payment_type**, and **rate** tables, and set the source fields in sequence in the field mapping.

For details on the parameters for creating a mapping, see **Table 8-28**.

Figure 8-56 Configuring a mapping

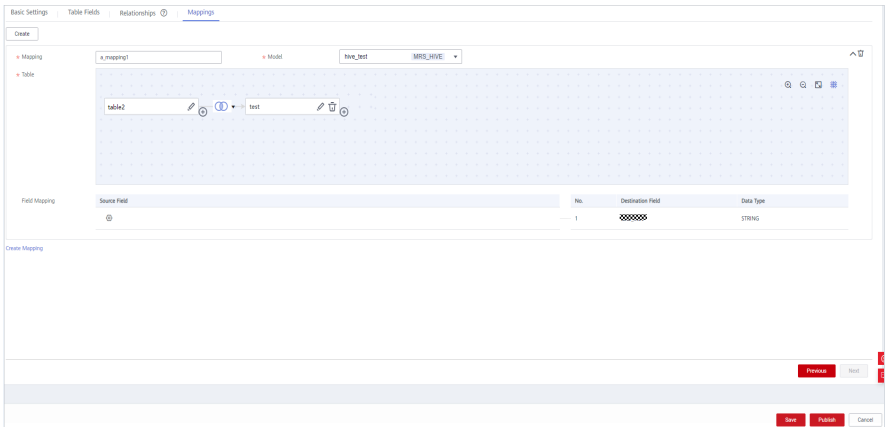
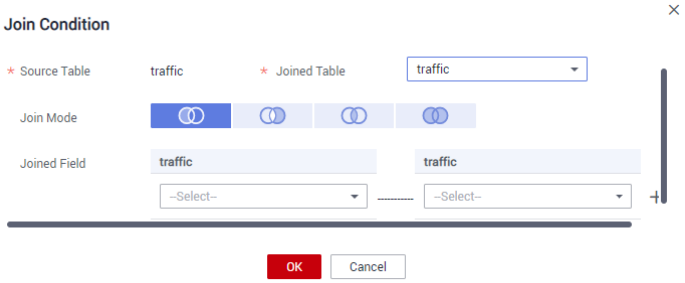


Table 8-28 Parameters of mappings

Parameter	Description
*Mapping	Only letters, numbers, and underscores (_) are allowed.
*Model	Select a created relationship model from the drop-down list box. If no relationship model has been created, create one. See **ER Modeling**.

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Parameter	Description
*Table	Select a table from which data is obtained. If data is obtained from multiple tables, click next to the table name to set the JOIN condition between the table and other tables. 1. Select a JOIN mode. The JOIN mode includes left JOIN, right JOIN, inner JOIN, and outer JOIN from left to right. 2. Set the JOIN condition in the JOIN field. Generally, select the fields with the same meaning in the source table and joined table. Click + or − to add or delete a JOIN condition. The relationship between JOIN conditions is AND. 3. Click **OK**. 4. If you want to delete a joined table after setting the JOIN condition, click next to the table name. **Figure 8-57** Join Condition dialog box 
Field Mapping	Select a source field with the same meaning as the current mapping field. If a table field comes from multiple models, you must create multiple mappings. In each mapping, you only need to set the source field for the field that comes from the current mapping. Other fields do not need to be set.

In the upper right corner of the **Mappings** area, click to delete a mapping or click to collapse the mapping area.

5. (Optional) If the type of the new table is **DWS_VIEW**, click **Create** to create a view.

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Figure 8-58 Creating a view

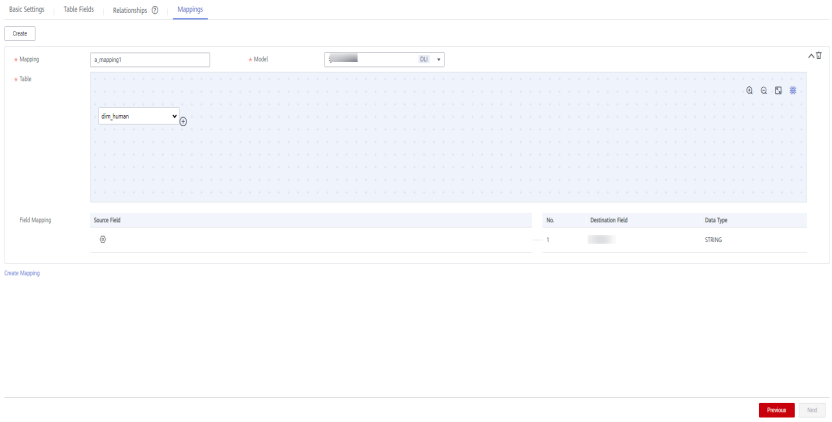
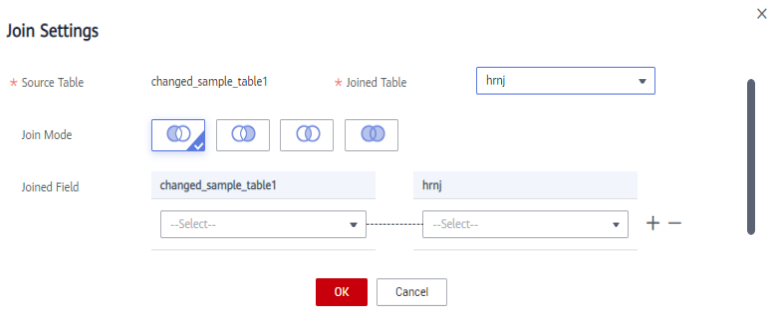


Table 8-29 Parameters

Parameter	Description
Mapping	Only letters, numbers, and underscores (_) are allowed.
Table	Select a table from which data is obtained. If data is obtained from multiple tables, click next to the table name to set the JOIN condition between the table and other tables. 1. Select a JOIN mode. The JOIN mode includes left JOIN, right JOIN, inner JOIN, and outer JOIN from left to right. 2. Set the JOIN condition in the JOIN field. Generally, select the fields with the same meaning in the source table and joined table. Click + or − to add or delete a JOIN condition. The relationship between JOIN conditions is AND. 3. Click **OK**. 4. If you want to delete a joined table after setting the JOIN condition, click next to the table name. **Figure 8-59** Join Settings dialog box 

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Parameter	Description
Field Mapping	Select a source field with the same meaning as the current mapping field. If a table field comes from multiple models, you must create multiple mappings. In each mapping, you only need to set the source field for the field that comes from the current mapping. Other fields do not need to be set.

In the upper right corner of the **Mappings** area, click to delete a mapping or click to collapse the mapping area.

Step 4 Click **Publish**, select a reviewer, and click **Submit**.

NOTE

In enterprise mode, you can choose to publish tables to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the table cannot be published.

If you select multiple reviewers, the status of the table changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

Step 5 Wait for the reviewer to approve the application. After the application is approved, return to the **ER Modeling** page to view the table status and synchronization status.

Publishing is an asynchronous operation. You can click to refresh the status. After table publishing application is approved, the system performs operations such as creating tables and synchronizing technical assets and business assets based on the configurations of **Model Design Process** on the **Function Settings** tab page in **Configuration Center**. The synchronization status is displayed in the **Sync Status** column of the table on the **Information Architecture** page.

- If the synchronization is successful, the table is successfully published. Move the cursor to in the **Sync Status** column. If the message indicating "creation succeeded" is displayed, the table has been successfully created in the corresponding data source.
- If one or more items fail to be synchronized, you can refresh the status. If the fault persists, choose **More** > **View History** and click the **Publish Log** tab to view logs.

  Troubleshoot the problem based on the logs. After the error is rectified, click **Resynchronize** on the **History** tab page to issue the synchronization command again. If the synchronization still fails, contact technical support for assistance.
- If **Synchronize logical assets** is enabled and **Physical Table Synchronize Logical Assets** is disabled, when you move the cursor to the icon for synchronizing logical assets in **Sync Status**, **Unsynchronized** is displayed.

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> NOTE
>
> In enterprise mode, you can choose to synchronize tables to the production or development environment. By default, it is synchronized to the production environment. If you do not choose an environment, the table cannot be synchronized.

----End

Importing a Physical Table by Reversing a Database

By reversing databases, you can import one or more created database tables from other data sources into a physical table directory to turn them into physical tables.

Step 1 In the left navigation pane on the DataArts Architecture console, choose **Models** > **ER Modeling**. In the middle of the page, select a physical model from the drop-down list box on the top or click a physical model in data warehouse planning to go to the physical model list page.

Step 2 Above the physical table list, click **Reverse Database**.

Step 3 In the displayed dialog box, set required parameters and click **OK**.

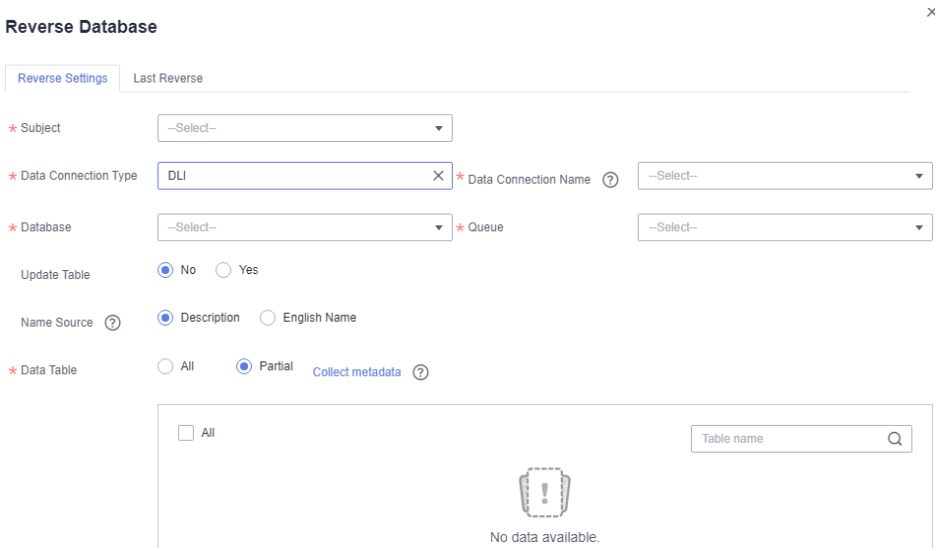
Table 8-30 Parameters for reversing the database

Parameter	Description
*Subject	Select a subject from the drop-down list.
*Data Connection Type	The data connection types supported by the reverse database are displayed in the drop-down list box. Select the required data connection type.
*Data Connection Name	Select a data connection. If you want to reverse a database from other data sources to a physical table directory, you must create a data connection in Management Center to connect to the data source. For details on how to create data connections, see **Configuring DataArts Studio Data Connection Parameters**.
*Database	Select a database.
*Schema	Select a value from the drop-down list box. This parameter is available only for DWS and PostgreSQL tables.
*Queue	DLI queue. This parameter is available only when **Data Connection Type** is set to **DLI**.
Update Table	When **Yes** is selected, if the name of the reversed table is the same as that of an existing physical table, the existing physical table is updated.

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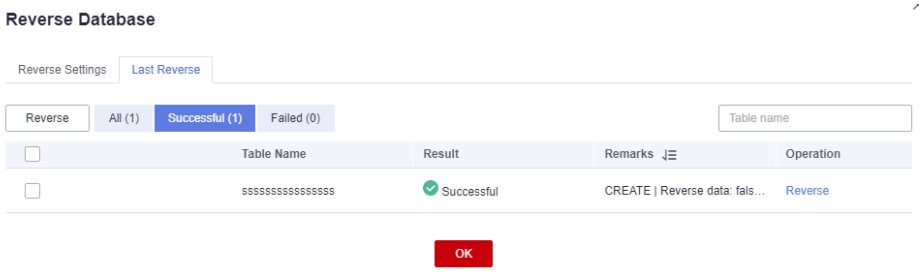
Parameter	Description
Name Source	Source of the table name or field name after the reverse. The value can be **Description** or **Name**. If no description is specified for a table or field, the name is used. • Description • Name **NOTE** If you select **Description**, field comments of a table must be unique.
*Data Table	You can select **All** or **Partial**.

Figure 8-60 Reverse Database dialog box



Step 4 You can view the result on the **Last Reverse** tab page. If the reverse operation is successful, click **Close**. If the reverse operation fails, you can view the failure cause. After the fault is rectified, select the table again and click **Reverse** to retry.

Figure 8-61 Last Reverse tab page



----End

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More Operations on Physical Tables

- Synchronizing physical tables

  In the physical table list, select physical tables, click **More** above the list, select **Synchronize**, and click **OK**. This operation can be performed only on published tables.

  NOTE

  After a physical table is associated with a quality rule and published, you can click **Synchronize Subjects from DataArts Architecture as Directories** on the **Quality Jobs** page on the DataArts Quality console. The quality jobs automatically generated in DataArts Architecture will be synchronized to the corresponding directories in DataArts Quality based on the subject structure.

- Publishing physical tables

  In the physical table list, select physical tables and click **Publish** above the list or in the **Operation** column. In the displayed dialog box, select a reviewer and click **Submit**. The physical tables will be published when the publishing request is approved.

  NOTE

  In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the table cannot be published.

  If you select multiple reviewers, the statuses of the physical tables change to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the statuses are **Rejected**.

  If you select **Auto-review**, the request will be automatically approved. This function is for trial use only and not recommended.

- Suspending physical tables

  In the physical table list, select physical tables, click **More** above the list, and select **Suspend**. Alternatively, click **More** in the **Operation** column and select **Suspend**. This operation can be performed only on published tables.

- Changing the subject of physical tables

  In the physical table list, select physical tables, click **More** above the list, and select **Modify Subject** to change the subject of the physical tables.

- Deleting physical tables

  In the physical table list, select physical tables, click **More** above the list, and select **Delete**. This operation can be performed only on draft, rejected, and suspended tables.

- Adding tags

  In the physical table list, select physical tables and click **Tag** above the list. In the displayed dialog box, add tags and click **OK**.

  NOTE

  Enter your text and press **Enter** to temporarily add a tag. A tag can be created only after the information on the entire page is submitted. A maximum of 20 tags can be added.

  Physical tables can be queried in fuzzy mode by tag.

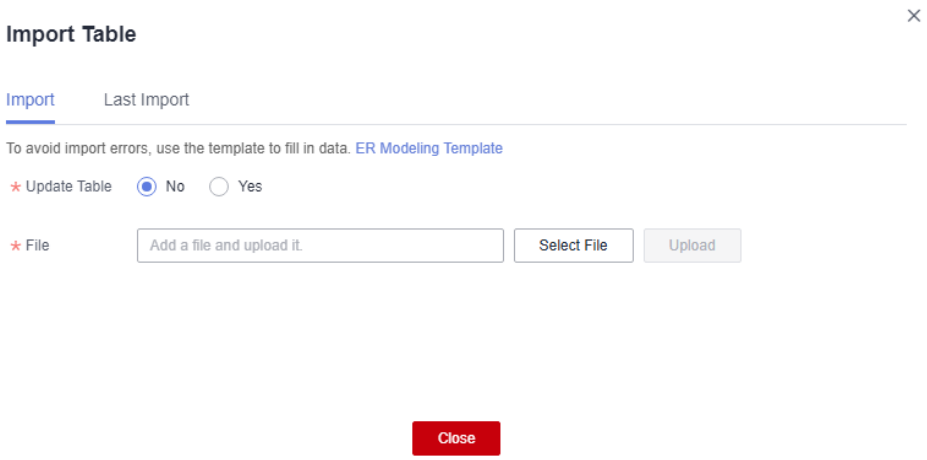
- Importing physical tables

  Importing an Excel file

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Click **Import** above the physical table list and select **Import EXCEL**. In the displayed **Import Table** dialog box, set **Update Table**, select and upload a file, and click **Close**. You can click the **Last Import** tab to view the import result.

Figure 8-62 Importing an Excel file



- Exporting physical tables

  In the physical table list, select tables and click **Export** above the list. In the displayed **Export Model** dialog box, select **Table** or **DDL** for **Export**. If you select **DDL**, select **ALL** or **Partial** for **Scope**. **Database name** is selected by default. Then click **OK**.

- Editing a physical table

  In the physical table list, locate a physical table and click **Edit** in the **Operation** column.

- Viewing the publishing history

  In the physical table list, locate a physical table, click **More** in the **Operation** column, and select **View History** to view the publishing history and version comparison of the physical table.

- Previewing SQL information of a physical table

  In the physical table list, locate a physical table, click **More** in the **Operation** column, and select **Preview SQL** to preview the SQL information of the physical table.

8.6.3 Dimensional Modeling

8.6.3.1 Creating Dimensions

Dimensional modeling involves dimensions, dimension tables, and fact tables.

A dimension is the perspective to observe and analyze business data and assist in data aggregation, drilling, slicing, and analysis, and used as a GROUP BY condition in SQL statements. Most dimensions have hierarchical structures, such as geographic dimensions (including countries, regions, provinces/states, and cities) and time dimensions (including annually, quarterly, and monthly dimensions).

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Impact on the System

After a dimension is published and approved, the system automatically creates a dimension table corresponding to the dimension. The name and code of the dimension table are the same as those of the dimension.

Creating and Publishing a Dimension

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture console, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Dimensions** tab.
3. Select an object in the subject directory on the left and click **Create**.

   Before creating a dimension, ensure that a subject is available. For details on how to add a subject, see **Designing Subjects**.
4. On the page displayed, set the parameters.

   Set the basic settings and physicalization settings as described below.

Figure 8-63 Dimension parameters

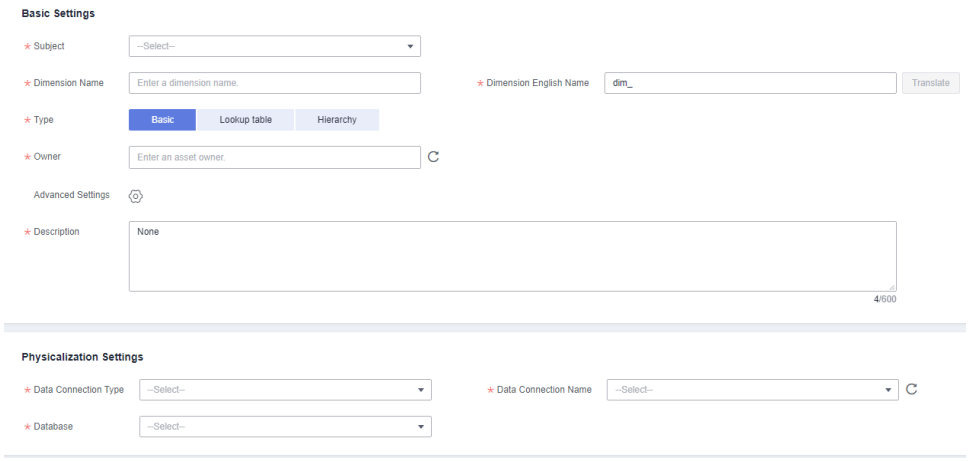


Table 8-31 Parameters in the Basic Settings area

Parameter	Description
*Subject	Select a subject from the drop-down list box.
*Dimension Name	Newline characters and the following characters are not allowed: \ < > % " ' ;
*Dimension English Name	It can contain only letters, digits, and underscores (_), and must start with **dim_**. The system can automatically generate the English dimension name through translation based on a configured naming dictionary.

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Parameter	Description
*Type	• **Basic**: a dimension that does not have a hierarchical structure. • **Lookup Table**: a dimension created based on a lookup table. The field information and data of the dimension are the same as those of the lookup table, indicating that the content is an enumerable dimension. • **Hierarchy**: a dimension with a hierarchical structure between attributes.
Advanced Settings	Set custom items to describe the table. The custom items can be viewed in the table details. For example, if you want to identify the source of the table, you can add item **source** and set its value to the table source information. Then you can view the table source information in the table details.
*Owner	You can enter an owner name or select an existing owner.
*Description	A description of the dimension to create. It allows 1 to 600 characters.

Table 8-32 Parameters in the Physicalization Settings area

Parameter	Description
*Data Connection Type	Select a data connection type from the drop-down list box.
*Data Connection Name	The name of the data connection. Select the required data connection. If no data connection is available, access Management Center to create one. For details, see **Configuring DataArts Studio Data Connection Parameters**.
*Database	The name of the database. Select a database from the drop-down list box. If no database is available, access DataArts Factory to create one. For details, see **Creating a Database**.
Queue	DLI queue. This parameter is displayed only for DLI data connections.
Schema	DWS or POSTGRESQL mode. This parameter is displayed only for DWS and POSTGRESQL data connections.

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Parameter	Description
Table Type	DLI models support the following table types: • **MANAGED**: Data is stored in a DLI table. • **EXTERNAL**: Data is stored in an OBS table. When **Table Type** is set to **EXTERNAL**, you must set **OBS Path**. The OBS path format is ***/bucket_name/filepath***. DWS models support the following table types: • **DWS_ROW**: row-store table. Tables are stored to disk partitions by row. • **DWS_COLUMN**: column-store table. Tables are stored to disk partitions by column. • **DWS_VIEW**: view-store table. Tables are stored to disk partitions by view. The MRS Hive model supports **HIVE_TABLE** and **HIVE_EXTERNAL_TABLE**. The MRS Spark model supports **HUDI_COW** and **HUDI_MOR**. The PostgreSQL model supports only **POSTGRESQL_TABLE**. The MRS ClickHouse model supports only **CLICKHOUSE_TABLE**. The Oracle model supports only **ORACLE_TABLE**. The MySQL model supports only **MYSQL_TABLE**. The Doris model supports only **DORIS_TABLE**.
Compression Level	This parameter is available when the data connection type is DWS. The following compression levels are available for different table types: • **DWS_ROW**: **NO** and **YES** • **DWS_COLUMN**: **NO**, **LOW**, **MIDDLE**, and **HIGH**. • **DWS_VIEW**: The compression level is not supported.

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Parameter	Description
Distributed By	This parameter is displayed only for DWS data connections. You can select multiple fields. • **REPLICATION**: A full table is stored on each DN. The advantage of this option is that each DN has all the data of a table. During the join operation, data redistribution can be avoided, reducing network overhead. The disadvantage is that each DN retains the complete data of a table, resulting in data redundancy. Generally, this option is recommended for small dimension tables. • **HASH**: If you select this option, you must specify a distribution key for the user table. When a record is inserted, the system performs hash computing based on values in the distribute keys and then stores data on the corresponding DN. In a Hash table, I/O resources on each node can be used during data read/write, which improves the read/write speed of a table. Generally, this option is recommended for large dimension tables (a large dimension table contains over 1 million records).
PreCombineField	This parameter is available only for Spark data connections.
Path	This parameter is available only when the data source is MRS Hive and table type is HIVE_EXTERNAL_TABLE. The path can contain only letters, digits, slashes (/), periods (.), hyphens (-), underscores (_), and colons (:).

Add dimension fields in the **Attribute Settings** area. You can click **Add** to add multiple dimension fields.

Figure 8-64 Field configuration

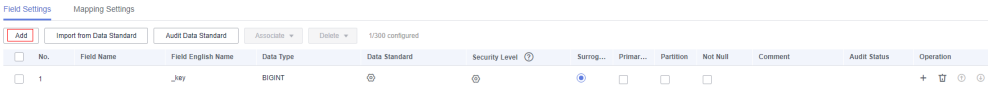


Table 8-33 Parameters in the Attribute Settings area

Parameter	Description
Name	Newline characters and the following characters are not allowed: \ < > % " ' ;
Field Code	Field codes must start with letters. Only letters, numbers, and underscores (_) are allowed.
Data Type	Type of data defined based on the original data.

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Parameter	Description
Data Standard	Click  to select a data standard to be associated with the field. If **Create Data Quality Jobs** is selected for **Model Design Process** on the **Function Settings** tab page in Configuration Center and a field is associated with a data standard, a quality job is automatically generated after a dimension is published. A quality rule is generated for each field associated with the data standard. The quality of the field is monitored based on the data standard. You can access the **Quality Job** page of DataArts Quality to view the job details. If no data standard is available, create one. See **Creating Data Standards** for details.
Security Level	You can click  to add a security level for the logical entity attribute. If you cannot find the security level you want, click **go to** to go to the DataArts Security console and create a security level. You can disable this function on the **Models** tab page on the **Configuration Center** page.
Surrogate Key	Select a field as the surrogate key based on project requirements. By default, the first dimension attribute is the surrogate key.
Primary Key	Select a field as the primary key based on project requirements. **NOTE** If an MRS Spark connection is used to connect to MRS Hudi data sources, data can be written to the database only if fields have primary keys. Otherwise, table synchronization fails.
Partition	Whether to be set as a partition field.
Not Null	Whether the parameter value can be left empty.
Description	A description of the dimension field you add.
Audit Status	Whether to audit the data standard Click **Audit Data Standard** to audit data standards.
Operation	Related operations

On the **Mapping Settings** tab page, click **Create** to create a mapping between dimensions and physical tables. Set the parameters.

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Figure 8-65 Mapping settings

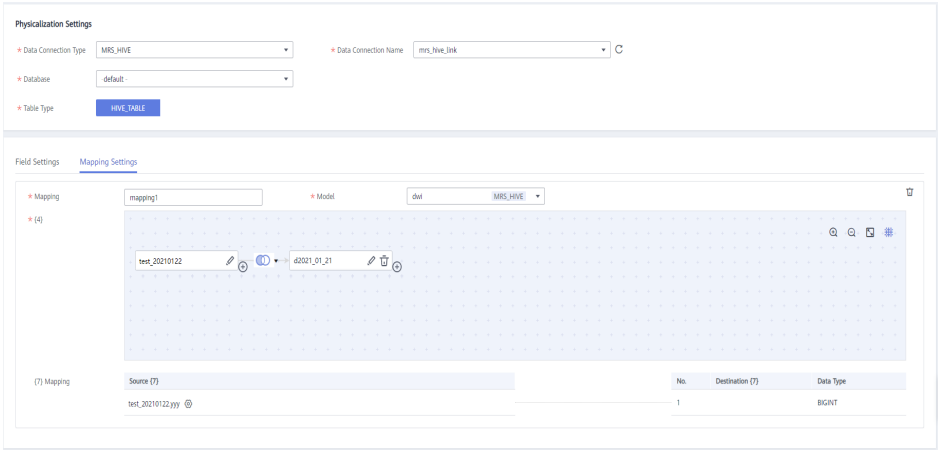
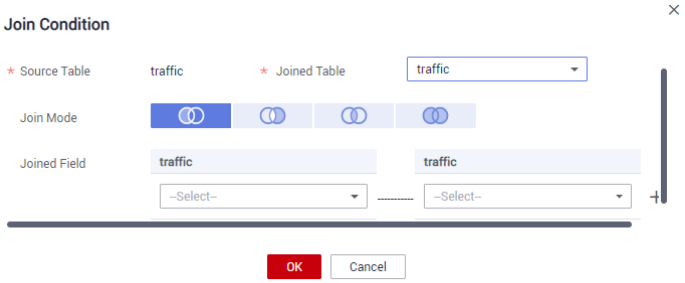


Table 8-34 Parameters of mappings

Parameter	Description
*Mapping	Only letters, numbers, and underscores (_) are allowed.
*Model	Select a created relationship model from the drop-down list box. If no relationship model has been created, create one. See **ER Modeling**.

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Parameter	Description
*Table	Select a table from which data is obtained. If data is obtained from multiple tables, click next to the table name to set the JOIN condition between the table and other tables. 1. Select a JOIN mode. The JOIN mode includes left JOIN, right JOIN, inner JOIN, and outer JOIN from left to right. 2. Set the JOIN condition in the JOIN field. Generally, select the fields with the same meaning in the source table and joined table. Click + or − to add or delete a JOIN condition. The relationship between JOIN conditions is AND. 3. Click **OK**. 4. If you want to delete a joined table after setting the JOIN condition, click next to the table name. **Figure 8-66** Join Condition dialog box 
Field Mapping	Select a source field with the same meaning as the current mapping field. If a table field comes from multiple models, you must create multiple mappings. In each mapping, you only need to set the source field for the field that comes from the current mapping. Other fields do not need to be set.

In the upper right corner of the **Mappings** area, click to delete a mapping or click to collapse the mapping area.

5. Click **Publish**.

   NOTE

   In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the dimension cannot be published.

6. In the displayed dialog box, select a reviewer and click **OK** to submit a request for publishing the dimension.

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NOTE

If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.

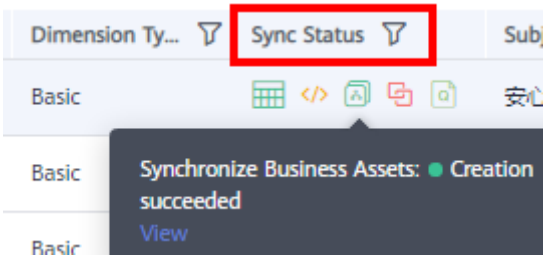
If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

7. Repeat **3** to **6** to create other dimensions.
8. All dimensions need reviewing.

   After the application is approved, the system automatically creates a dimension table corresponding to the dimension. The name and code of the dimension table are the same as those of the dimension. On the **Dimensional Modeling** page, click the **Dimension Tables** tab to view the created dimension table.

   In the dimension table list, you can view the synchronization status of the dimension table in the **Sync Status** column.

   Figure 8-67 Sync Status of the dimension table



   - If the synchronization is successful, the dimension is successfully published and the dimension table is successfully created in the database.
   - If the synchronization failed, click **View History** in the row where the dimension table is located. On the page displayed, click the **History** tab to view logs. Troubleshoot the problem based on the logs. After the error is rectified, go back to the dimension table list and click **Synchronize** above the dimension table list to issue the synchronization command again. If the problem persists, contact technical support personnel.

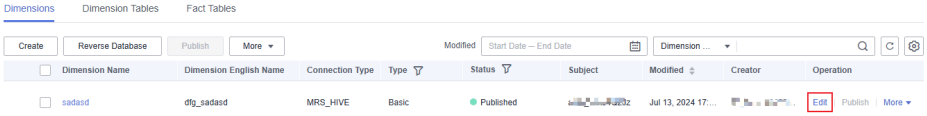
     NOTE

     In enterprise mode, you can choose to synchronize the table to the production or development environment. By default, it is synchronized to the production environment. If you do not choose an environment, the table cannot be synchronized.

Editing a Dimension

Step 1 On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Dimensions** tab.

Step 2 Locate a dimension and click **Edit** in the **Operation** column.



Step 3 Edit the dimension information based on service requirements. For details about how to set parameters, see **Dimension parameters**.

Step 4 Click **Save**. Alternatively, click **Publish** to publish the edited dimension.

NOTE

In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the dimension cannot be published.

----End

Publishing a Dimension

If a dimension is created but not published, perform the following steps to publish the dimension:

Step 1 On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Dimensions** tab.

Step 2 In the dimension list, find the target dimension and click **Publish** in the **Operation** column.

Step 3 In the displayed dialog box, select a reviewer and click **OK**. After the request is approved, the dimension is published.

NOTE

In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the dimension cannot be published.

----End

You can also perform the following steps to publish multiple dimensions:

Step 1 On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Dimensions** tab.

Step 2 Select the dimensions you want to publish and click **Publish** above the dimension list.

Step 3 In the displayed dialog box, select a reviewer, set the job scheduling time, and click **OK**.

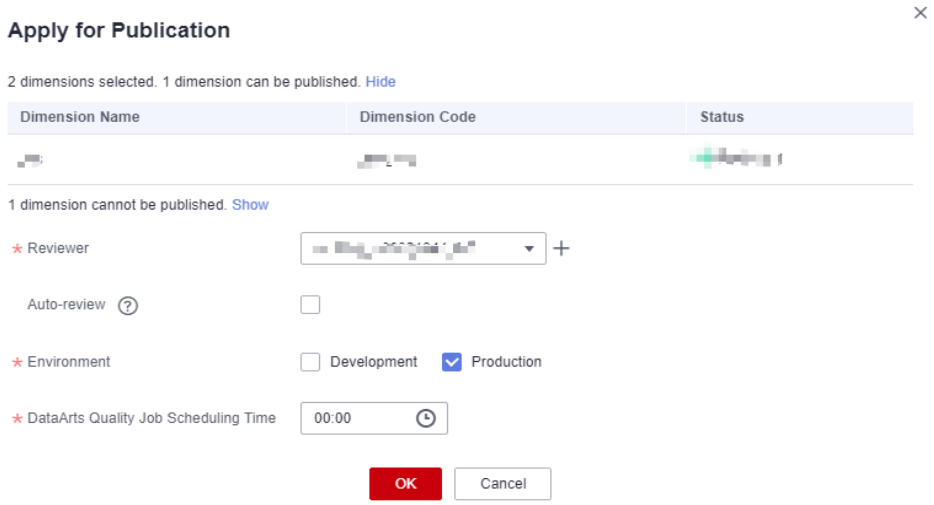
NOTE

In enterprise mode, you can choose to publish the table to the production or development environment. By default, they are published to the production environment. If you do not choose an environment, the dimensions cannot be published.

DataArts Quality Job Scheduling Time refers to the scheduling time for automatic quality job creation after the dimension is published.

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Figure 8-68 Publishing multiple dimensions



----End

Suspending a Dimension

To suspend a published dimension, perform the following steps:

Step 1 On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Dimensions** tab.

Step 2 In the dimension list, find the target dimension and choose **More** > **Suspend** in the **Operation** column.

Step 3 In the displayed dialog box, select a reviewer and click **OK**. After the request is approved, the dimension is suspended.

----End

You can also perform the following steps to publish multiple dimensions:

Step 1 On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Dimensions** tab.

Step 2 Select dimensions, click **More** above the dimension list, and select **Suspend**.

Step 3 In the displayed dialog box, select a reviewer and click **OK**. After the request is approved, the dimension is suspended.

----End

Deleting a Dimension

If a dimension is no longer needed, you can delete it. However, if the dimension has been published, you must suspend the dimension before deleting it. For details, see **Suspending a Dimension**.

Step 1 On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Dimensions** tab.

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Step 2 In the dimension list, find the target dimension and choose **More** > **Delete** above the list.

Step 3 In the **Delete Dimension** dialog box, confirm the information and click **Yes**.

If you select **Delete physical tables** in the dialog box, the physical tables in the database are also deleted when you delete the dimension.

----End

Importing a Dimension by Reversing a Database

By reversing databases, you can import one or more created database tables from other data sources into a dimension directory to turn them into dimensions.

Step 1 On the DataArts Architecture console, choose **Models** > **Dimensional Modeling** in the navigation pane on the left.

Step 2 Above the dimension list, click **Reverse Database**.

Step 3 In the displayed dialog box, set required parameters and click **OK**.

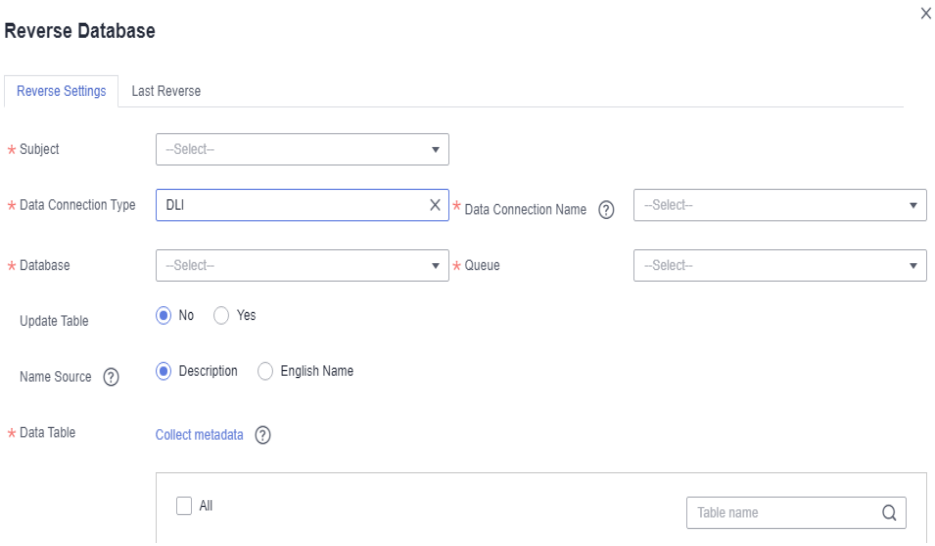
Table 8-35 Parameters for reversing the database

Parameter	Description
*Subject	Select a subject from the drop-down list.
*Data Connection Type	The data connection types supported by the reverse database are displayed in the drop-down list box. Select the required data connection type.
*Data Connection Name	Select a data connection. If you want to reverse a database from other data sources to a dimension directory, you must create a data connection in Management Center to connect to the data source. For details on how to create data connections, see **Configuring DataArts Studio Data Connection Parameters**.
*Database	Select a database.
*Schema	Select a value from the drop-down list box. This parameter is available only for DWS and PostgreSQL tables.
Queue	DLI queue. This parameter is available only when **Data Connection Type** is set to **DLI**.
Update Table	When **Yes** is selected, if the name of the reversed table is the same as that of an existing table in the dimension, the existing dimension is updated.

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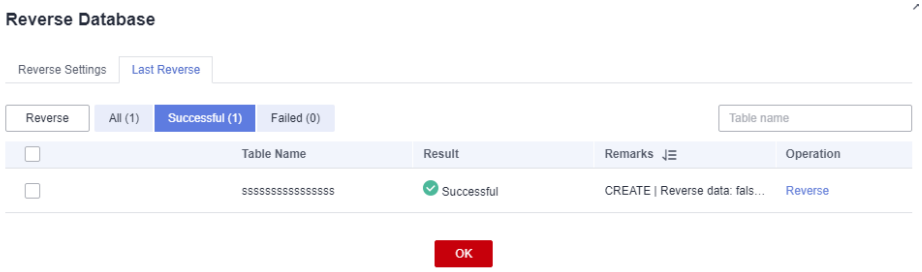
Parameter	Description
Name Source	Source of the table name or field name after the reverse. The value can be **Description** or **Name**. If no description is specified for a table or field, the name is used. • Description • Name **NOTE** If you select **Description**, field comments of a table must be unique.
*Data Table	You can select **All** or **Partial**.

Figure 8-69 Reverse Database dialog box



Step 4 You can view the result on the **Last Reverse** tab page. If the reverse operation is successful, click **Close**. If the reverse operation fails, you can view the failure cause. After the fault is rectified, select the table again and click **Reverse** to retry.

Figure 8-70 Last Reverse tab page



----End

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8.6.3.2 Managing Dimension Tables

A dimension table corresponds to a dimension and consists of a wide range of dimension fields. Creating, publishing, editing, and suspending a dimension table highly relate to the corresponding dimension. After a dimension is published, the system automatically creates and publishes the corresponding dimension table.

Viewing the Publish History of a Dimension Table

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Dimension Tables** tab.
3. Select a dimension table in the list and click **View History** in the **Operation** column.
4. On the page displayed, you can view the publish history, version comparison information, and publish log of the dimension table.

   If the publish log includes error logs, the publishing has failed. You can click **Resynchronize** to synchronize the table to other DataArts Studio modules.

Previewing SQL

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Dimension Tables** tab.
3. Select a dimension table in the list and click **Preview SQL** in the **Operation** column.
4. On the page displayed, you can view or copy the SQL statement.

Synchronizing a Dimension Table

After you create or edit a dimension, you can manually synchronize the dimension table if the synchronization fails.

NOTE

- The system performs the synchronization based on the data table update mode on the **Function Settings** tab page of **Configuration Center**. For details, see **Functions**.
- After a dimension table is associated with a quality rule and published, you can click **Synchronize Subjects from DataArts Architecture as Directories** on the **Quality Jobs** page on the DataArts Quality console. The quality jobs automatically generated in DataArts Architecture will be synchronized to the corresponding directories in DataArts Quality based on the subject structure.

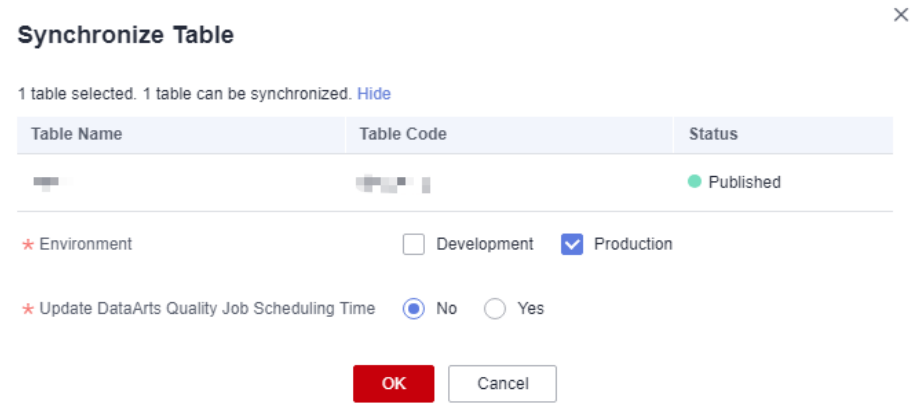
1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Dimension Tables** tab.
3. In the dimension table list, select the target dimension table and click **Synchronize** above the list. The dialog box for synchronizing the dimension table is displayed.

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NOTE

In enterprise mode, you can choose to synchronize the table to the production or development environment. By default, they are synchronized to the production environment. If you do not choose an environment, the tables cannot be synchronized.

Figure 8-71 Synchronizing dimension tables



4. After confirming that the information is correct, click **OK**. The synchronization result is displayed.

   After the synchronization, you can view the synchronization status of the dimension table in the dimension table list. You can also click above the list to refresh the status. You can switch between the production environment and development environment to view the synchronization result.

Associating a Dimension Table with a Quality Rule

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Dimension Tables** tab.
3. In the dimension table list, select the target dimension table, and click **Associate Rule**.

Figure 8-72 Associating a dimension table with a quality rule



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4. On the page displayed, set the parameters. After the configuration is complete, click **OK**.
   - **Update Existing Rule**: If this option is selected, the newly added rule will overwrite the old rule.
   - **Table Field**: This parameter applies to all fields by default. You can enter a regular expression to filter fields as required.
   - **WHERE Clause**: This parameter can be used to filter fields.
   - **Generate Anomaly Data**: If this option is enabled, anomaly data is stored in the specified database based on the configured parameters.
   - **Database/Schema**: database or schema that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Table Prefix**: prefix of the table that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Table Suffix**: suffix of the table that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Add Rule**: You can click **Add Rule** to add a rule. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**.
   - An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the **Associate Quality Rule** dialog box, the alarm parameters of each quality rule are displayed as buttons.

Associating a Single Field with a Quality Rule

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Dimension Tables** tab.
3. In the dimension table list, click the name of the target dimension table.
4. In the field list on the dimension table details page, click  in the row of the target field to associate the field with a quality rule.

   Figure 8-73 Associating a single field with a quality rule

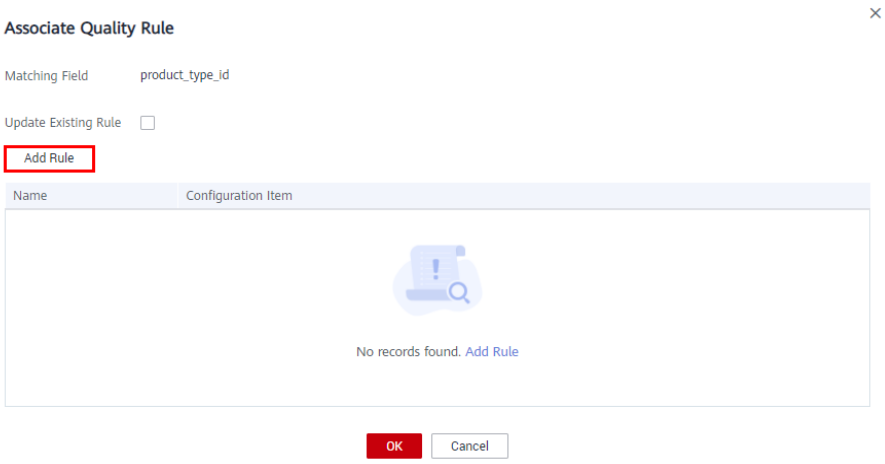
5. After the configuration is complete, click **OK**.
   - **Update Existing Rule**: If this option is selected, the newly added rule will overwrite the old rule.
   - **Add Rule**: You can click **Add Rule** to add a rule. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition

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expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**.

- An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the **Associate Quality Rule** dialog box, the alarm parameters of each quality rule are displayed as buttons.

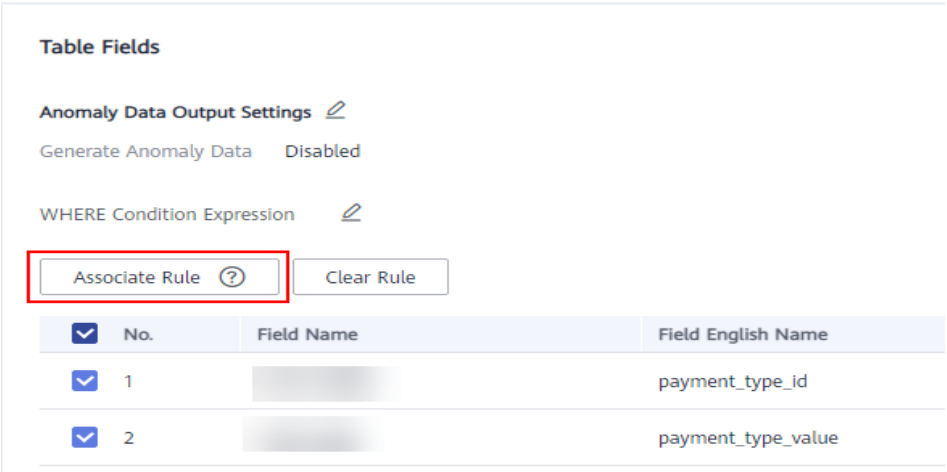
Figure 8-74 Adding a rule



Associating Table Fields with a Quality Rule in Batches

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Dimension Tables** tab.
3. In the dimension table list, click the name of the target dimension table.
4. In the table field list on the dimension table details page, select the target table fields and click **Associate Rule**.

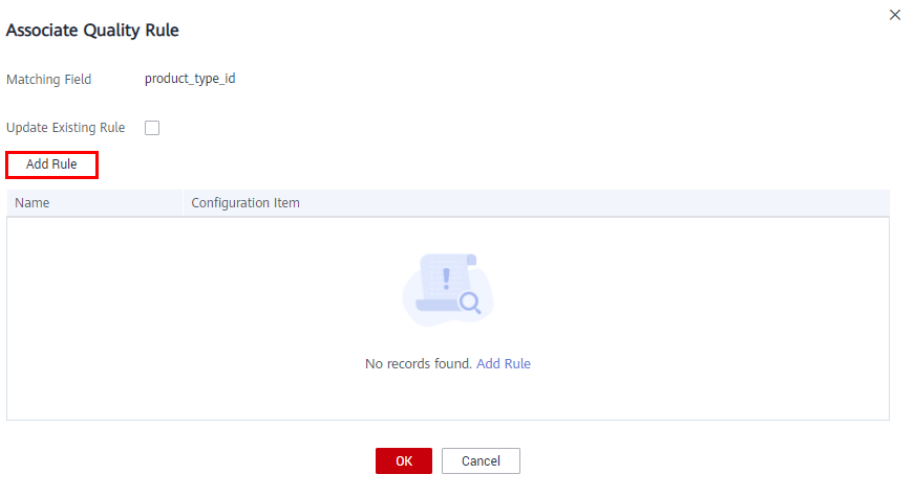
Figure 8-75 Associating table fields with a quality rule



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5. On the page displayed, add a rule and set the rule parameters.
   - **Update Existing Rule**: If this option is selected, the newly added rule will overwrite the old rule.
   - **Add Rule**: You can click **Add Rule** to add a rule. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**.
   - An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the **Associate Quality Rule** dialog box, the alarm parameters of each quality rule are displayed as buttons.

Figure 8-76 Associating table fields with a quality rule



6. (Optional) If you want to store anomaly data that does not comply with the preset rules in the exception table, enable **Anomaly Data Output Settings**.

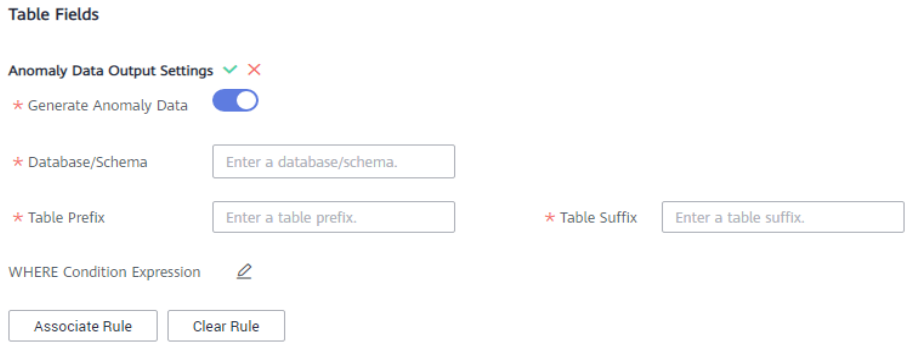
Figure 8-77 Enabling Anomaly Data Output Settings



Click the pen icon next to **Anomaly Data Output Settings** and enable **Generate Anomaly Data**. The anomaly data will be stored in the specified database based on the settings.

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Figure 8-78 Anomaly Data Output Settings



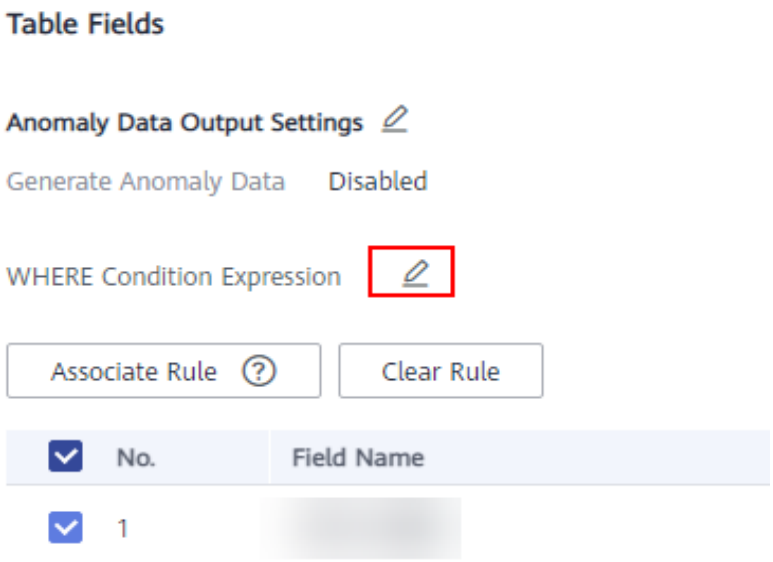
The parameters are as follows:

- **Database/Schema**: database or schema that stores anomaly data
- **Table Prefix**: prefix of the table that stores anomaly data
- **Table Suffix**: suffix of the table that stores anomaly data

Click to save the settings.

7. (Optional) By default, the quality rule applies to the entire table. If you want to query data in specified partitions, set the where condition.

Figure 8-79 Where condition



8. After the configuration is complete, click **OK**.

Deleting a Dimension Table

Dimensions in publishing review, published, or suspension review state cannot be deleted. You can delete a dimension table on the **Dimensions** page.

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.

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2. Click the **Dimension Tables** tab.
3. In the dimension table list, select the target dimension table and click **Delete** above the list.

Figure 8-80 Deleting a dimension table



4. Confirm the dimension table to delete, and click **Yes**.

Viewing Dimension Table Details

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Dimension Tables** tab.
3. Click the name of a dimension table to go to its details page.
4. View the basic information and fields of the dimension table. You can also configure anomaly data output settings.
   a. Click **Modify** and enable **Generate Anomaly Data**. Anomaly data will be stored in the specified database based on the configured parameters.
   b. **Database/Schema**: Enter the database or schema to which anomaly data will be stored.
   c. Set **Table Prefix** and **Table Suffix**, which indicate the prefix and suffix of the table to which anomaly data will be stored.

      NOTE

      The prefix and suffix of the table can contain only letters, digits, and underscores (_).

   d. Click ✓ to save the settings.
5. You can configure a where condition expression to filter fields.

8.6.3.3 Creating Fact Tables

A fact table for a business process can provide a wealth of information about specific business processes. After a fact table is created, the public affair details are accumulated to facilitate data extraction.

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Creating and Publishing a Fact Table

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane. On the displayed page, click the **Fact Tables** tab.
3. Select a subject from the subject tree on the left and click **Create**, or click **Create a** directly.
4. On the **Create Fact Table** page, perform the following operations:
   a. Set the parameters in the **Basic Settings** area.

Figure 8-81 Basic Settings area

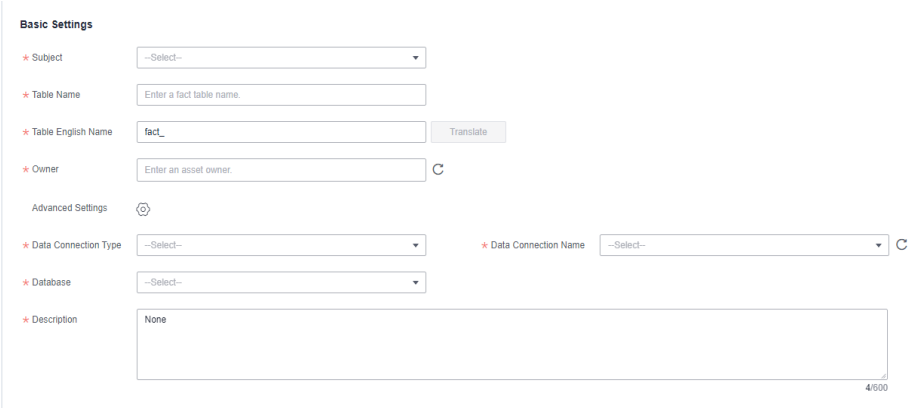


Table 8-36 Parameters in the Basic Settings area

Parameter	Description
*Subject	Select a subject (business domain group > business domain > business object) where you can place the fact table.
*Table Name	Newline characters and the following characters are not allowed: \ < > % " ' ;
*Table English Name	It must start with **fact_**. Only letters, digits, and underscores (_) are allowed. The system can automatically generate the table code through translation based on a configured naming dictionary.
*Data Connection Type	Select a data connection type from the drop-down list box.
*Data Connection Name	Select a data connection from the drop-down list box. It is recommended that the same data connection be used for dimension modeling.
*Database	Select a database from the drop-down list box.

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Parameter	Description
Queue	DLI queue. This parameter is displayed only for DLI data connections.
Schema	DWS or POSTGRESQL mode. This parameter is displayed only for DWS and POSTGRESQL data connections.
Table Type	DLI models support the following table types: • **MANAGED**: Data is stored in a DLI table. • **EXTERNAL**: Data is stored in an OBS table. When **Table Type** is set to **EXTERNAL**, you must set **OBS Path**. The OBS path format is ***/bucket_name/filepath***. DWS models support the following table types: • **DWS_ROW**: row-store table. Tables are stored to disk partitions by row. • **DWS_COLUMN**: column-store table. Tables are stored to disk partitions by column. • **DWS_VIEW**: view-store table. Tables are stored to disk partitions by view. The MRS Hive model supports **HIVE_TABLE** and **HIVE_EXTERNAL_TABLE**. The MRS Spark model supports **HUDI_COW** and **HUDI_MOR**. The PostgreSQL model supports only **POSTGRESQL_TABLE**. The MRS_CLICKHOUSE model supports only **CLICKHOUSE_TABLE**. The Oracle model supports only **ORACLE_TABLE**. The MySQL model supports only **MYSQL_TABLE**. The Doris model supports only **DORIS_TABLE**.
Compression Level	This parameter is available when the data connection type is DWS. The following compression levels are available for different table types: • **DWS_ROW**: **NO** and **YES** • **DWS_COLUMN**: **NO**, **LOW**, **MIDDLE**, and **HIGH**. • **DWS_VIEW**: The compression level is not supported.

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Parameter	Description
Distributed By	This parameter is displayed only for DWS data connections. You must add a table field before selecting a table field from the drop-down list as a **Distributed By** field. Multiple table fields can be selected. Currently, only **REPLICATION** and **HASH** are supported. ● **REPLICATION**: A full table is stored on each DN. The advantage of this option is that each DN has all the data of a table. During the join operation, data redistribution can be avoided, reducing network overhead. The disadvantage is that each DN retains the complete data of a table, resulting in data redundancy. Generally, this option is recommended for small dimension tables. ● **HASH**: If you select this option, you must specify a distribution key for the user table. When a record is inserted, the system performs hash computing based on values in the distribute keys and then stores data on the corresponding DN. In a Hash table, I/O resources on each node can be used during data read/write, which improves the read/write speed of a table. Generally, this option is recommended for large dimension tables (a large dimension table contains over 1 million records).
PreCombineField	This parameter is available only for Spark data connections.
Path	This parameter is available only when the data source is MRS Hive and table type is HIVE_EXTERNAL_TABLE. The path can contain only letters, digits, slashes (/), periods (.), hyphens (-), underscores (_), and colons (:).
*Owner	You can enter an owner name or select an existing owner.
Advanced Settings	Set custom items to describe the table. The custom items can be viewed in the table details. For example, if you want to identify the source of the table, you can add item **source** and set its value to the table source information. Then you can view the table source information in the table details.
*Description	A description of the fact table. It allows 1 to 600 characters.

b. On the **Field Settings** page, click **Create** and select **Dimension** or **Measure** to add a dimension or measure field.

   - If you select **Dimension**, the **Select Dimension** page is displayed. Select a dimension (from the public workspace or current workspace), select a model for dimensional modeling, select one or

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more created dimension tables, and click **OK**. The dimension tables and their attribute values are added to the list.

- If you select **Measure**, set required parameters to add a measure field.

For details about the field parameters, see **Table 8-37**. After adding a field, you can click or to move the field up or down.

Figure 8-82 Adding a dimension or measure field

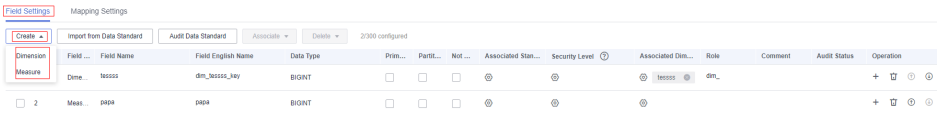


Table 8-37 Field parameters

Parameter	Description
Type	Two types are available: **Measure** and **Dimension**.
Name	Newline characters and the following characters are not allowed: \ < > % " ' ; The added dimension tables and their attribute values are automatically displayed for the dimension attribute field. Generally, you do not need to modify them.
Field Code	Table codes must start with letters. Only letters, numbers, and underscores (_) are allowed.
Data Type	Data type of the created dimension
Primary Key	If this parameter is selected, the field is a primary key. **NOTE** If an MRS Spark connection is used to connect to MRS Hudi data sources, data can be written to the database only if fields have primary keys. Otherwise, table synchronization fails.
Partition	If this parameter is selected, the field is a partition field.
Not Null	Whether the parameter value can be left empty.

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Parameter	Description
Associate Standard	If you have created data standards, click  to select one to associate with the field. If **Create Data Quality Jobs** is selected for **Model Design Process** on the **Function Settings** tab page in Configuration Center and a field is associated with a data standard, a quality job is automatically generated after a table is published. A quality rule is generated for each field associated with the data standard. The quality of the field is monitored based on the data standard. You can access the **Quality Job** page of DataArts Quality to view the job details. Alternatively, click **Import from Data Standard** and select a data standard to associate with the field. If no data standard is available, create one. See **Creating Data Standards** for details.
Security Level	You can click  to add a security level for the logical entity attribute. If you cannot find the security level you want, click **go to** to go to the DataArts Security console and create a security level. You can disable this function on the **Models** tab page on the **Configuration Center** page.
Associate Dimension	Only dimension fields need to be associated with dimensions. Name of the associated dimension and field. Click  to replace the associated dimension. If the public workspace is enabled, you can select the public workspace dimension.
Role	Roles need to be assigned to dimension fields which are added for multiple times. This is not required for measure fields. If a field of a dimension is added multiple times, set different roles to distinguish the dimensions.
Description	A description of the dimension.
Audit Status	Whether to audit the data standard Click **Audit Data Standard** to audit data standards.
Operation	Related operations

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c. On the **Mapping Settings** tab page, click **Create Mapping** and set mapping parameters.

Figure 8-83 Configuring mapping parameters

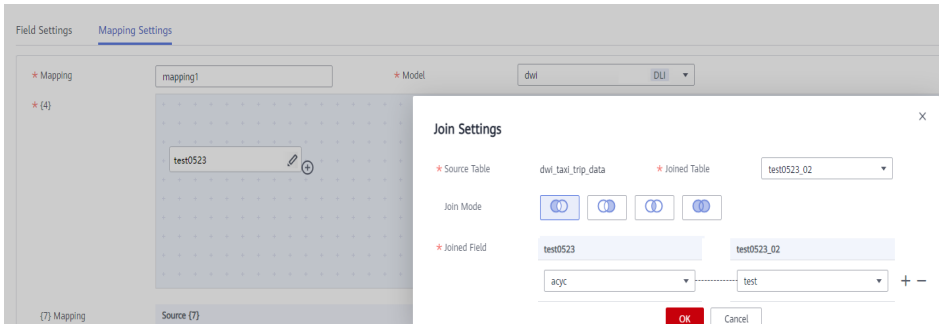
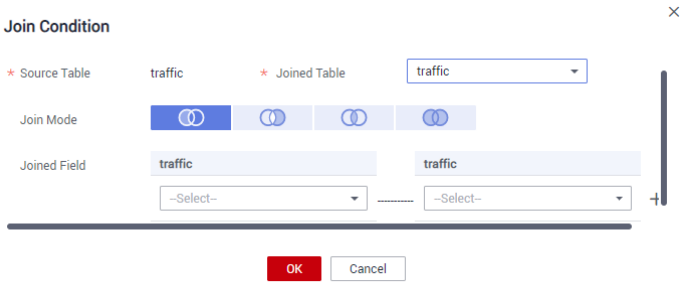


Table 8-38 Parameters of mappings

Parameter	Description
*Mapping	Only letters, numbers, and underscores (_) are allowed.
*Model	Select a created relationship model from the drop-down list box. If no relationship model has been created, create one. See **ER Modeling**.

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Parameter	Description
*Table	Select a table from which data is obtained. If data is obtained from multiple tables, click next to the table name to set the JOIN condition between the table and other tables. 1. Select a JOIN mode. The JOIN mode includes left JOIN, right JOIN, inner JOIN, and outer JOIN from left to right. 2. Set the JOIN condition in the JOIN field. Generally, select the fields with the same meaning in the source table and joined table. Click + or − to add or delete a JOIN condition. The relationship between JOIN conditions is AND. 3. Click **OK**. 4. If you want to delete a joined table after setting the JOIN condition, click next to the table name. **Figure 8-84** Join Condition dialog box 
Field Mapping	Select a source field with the same meaning as the current mapping field. If a table field comes from multiple models, you must create multiple mappings. In each mapping, you only need to set the source field for the field that comes from the current mapping. Other fields do not need to be set.

5. Click **Publish**. In the displayed dialog box, select a reviewer and click **OK** to submit a request for publishing the fact table.

   NOTE

   In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the fact table cannot be published.

   If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.

   If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

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6. Wait for the reviewer to approve the fact table.

   After the fact table is approved, it is automatically created in the database.

7. Go back to the fact table list and locate the table just published. View its synchronization status in the **Sync Status** column. You can switch between the production environment and development environment to view the synchronization result.
   - If the synchronization is successful, the fact table is successfully published and created in the database.
   - If the synchronization failed, choose **More** > **View History** in the row where the fact table is located. On the page displayed, click the **History** tab to view logs. Troubleshoot the problem based on the logs. After the error is rectified, choose **More** > **Synchronize** above the fact table list to issue the synchronization command again. If the problem persists, contact technical support personnel.

     NOTE

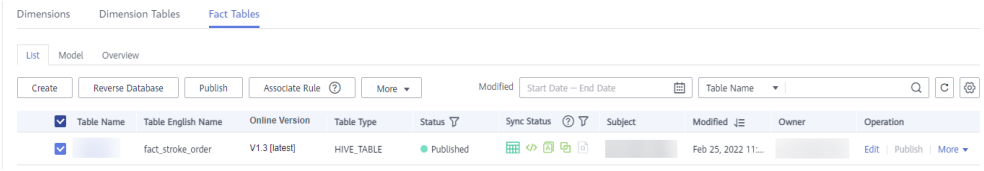
     In enterprise mode, you can choose to synchronize the table to the production or development environment. By default, it is synchronized to the production environment. If you do not choose an environment, the fact table cannot be synchronized.

     After a fact table is associated with a quality rule and published, you can click **Synchronize Subjects from DataArts Architecture as Directories** on the **Quality Jobs** page on the DataArts Quality console. The quality jobs automatically generated in DataArts Architecture will be synchronized to the corresponding directories in DataArts Quality based on the subject structure.

Managing a Fact Table

After a fact table is created, you can access the **Fact Tables** page of **Dimensional Modeling** in DataArts Architecture. On the page displayed, you can edit, publish, suspend, and delete the fact table, as well as view the publish logs.

Figure 8-85 Fact table management



- **Editing a fact table**
  a. In the fact table list, select a fact table and click **Edit** to the right of it. The page for editing the fact table is displayed.
  b. Edit the table as required.
  c. Click **Save** to save the settings, or click **Publish** to publish the settings.

     NOTE

     In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the fact table cannot be published.

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- **Publishing a fact table**
  a. In the fact table list, select a fact table and click **Publish**. The dialog box for publishing the fact table is displayed.
  b. Select a reviewer from the drop-down list.

     NOTE

     In enterprise mode, you can choose to publish the table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the fact table cannot be published.

  c. Click **OK**.
- **Viewing the publish history**
  a. Select a fact table in the list and choose **More** > **View History** on the right.
  b. On the page displayed, you can view the publish history and version comparison information of the fact table.

     If the publish log includes error logs, the publishing has failed. You can click **Resynchronize** to synchronize the table to other DataArts Studio modules.
- **Associating a fact table with a quality rule**
  a. Select a fact table in the fact table list and click **Associate Rule** above the list.
  b. In the **Associate Quality Rule** dialog box, you can add rules to the fields in the fact table in batches and associate the rules with the fields.
  c. Click **OK**.
- **Previewing an SQL statement**
  a. Select a fact table in the list and choose **More** > **Preview SQL** on the right.
  b. On the page displayed, you can view or copy the SQL statement.
- **Create a conversion**
  a. **DWS_COLUMN**: **NO**, **LOW**, **MIDDLE**, and **HIGH**.
  b. For details about how to create a derivative metric, see **Creating and Publishing a Derivative Metric**.
- **Suspending a fact table**
  a. In the fact table list, select a fact table and click **Suspend**. The dialog box for suspending a fact table is displayed.
  b. Select a reviewer from the drop-down list box.
  c. Click **OK**.

     NOTE

     - You can suspend or delete a fact table only when it is not referenced. For example, a fact table can be deleted only when it is not used by atomic metrics.
- **Deleting a fact table**

  If you no longer need a fact table, you can delete it. Fact tables in publishing review, published, or suspension review state cannot be deleted.

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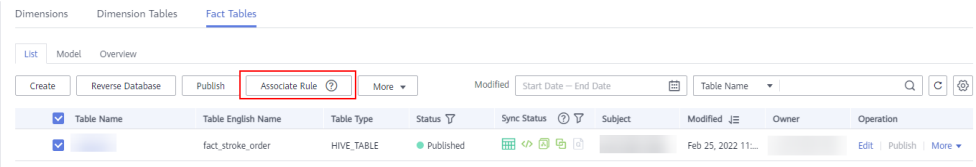
a. In the fact table list, select a fact table and choose **More** > **Delete** above the list.

b. In the dialog box displayed, click **Yes**.

Associating a Fact Table with a Quality Rule

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Fact Tables** tab.
3. In the fact table list, click the name of the target fact table. Click **Associate Rule**.

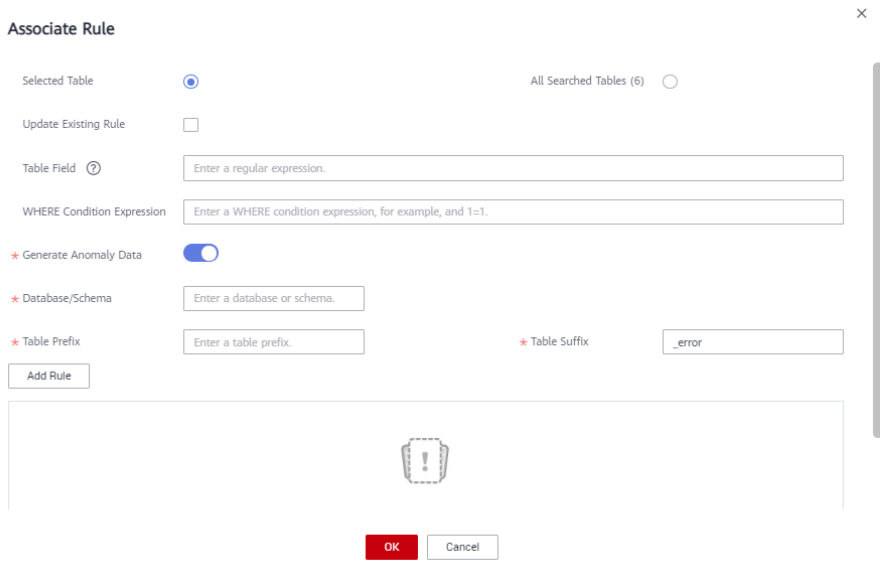
   Figure 8-86 Associating a fact table with a quality rule

4. On the page displayed, set the parameters. After the configuration is complete, click **OK**.
   - **Update Existing Rule**: If this option is selected, the newly added rule will overwrite the old rule.
   - **Table Field**: This parameter applies to all fields by default. You can enter a regular expression to filter fields as required.
   - **WHERE Clause**: This parameter can be used to filter fields.
   - **Generate Anomaly Data**: If this option is enabled, anomaly data is stored in the specified database based on the configured parameters.
   - **Database/Schema**: database or schema that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Table Prefix**: prefix of the table that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Table Suffix**: suffix of the table that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Add Rule**: You can click **Add Rule** to add a rule. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**.
   - An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the **Associate Quality Rule** dialog box, the alarm parameters of each quality rule are displayed as buttons.

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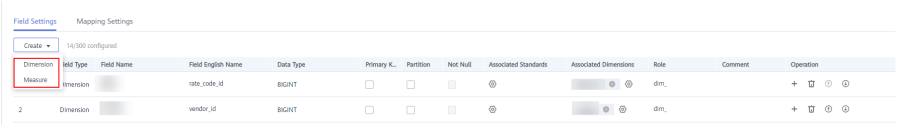
Figure 8-87 Associating a fact table with a quality rule



Creating a Field in the Fact Table

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Fact Tables** tab.
3. In the fact table list, click the name of the target table and click **Edit** in the **Operation** column.
4. Click **Create** in the **Table Fields** area, select a new field type from the drop-down list, and set the related parameters.

   Figure 8-88 Creating a field

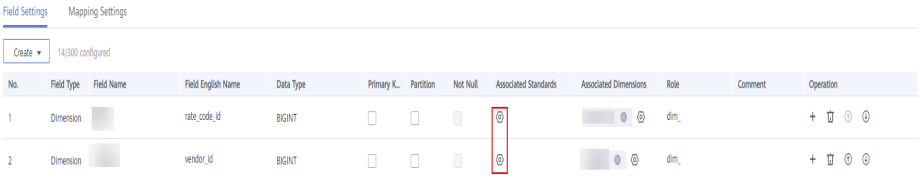
5. After the configuration is complete, click **OK**.

Associating a Fact Table Field with a Data Standard

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Fact Tables** tab.
3. Click the name of the target fact table in the list.
4. In the table field list on the details page of the fact table, search for the target field, click corresponding to the field to configure the association between the field and the data standard. For details on the sources of data standards, see **Creating a Data Standard**.

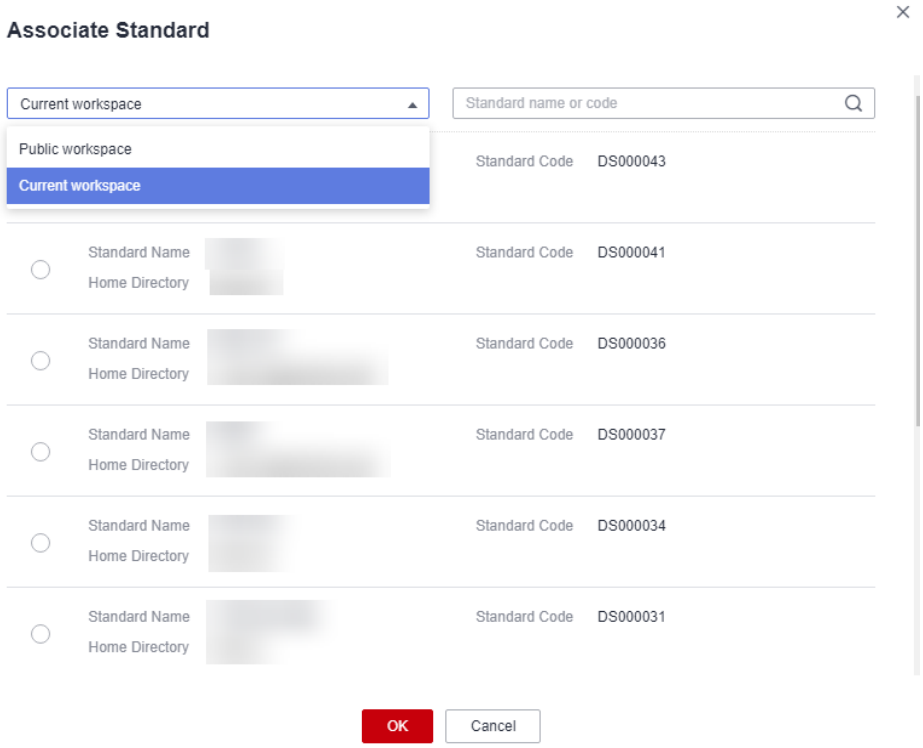
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Figure 8-89 Associating a fact table field with a data standard



5. After the configuration is complete, click **OK**. If a public workspace is available, you need to manually set the data standard source to the public workspace or the current workspace when selecting a data standard in a common workspace. When **Public workspace** is enabled, the data standards of the public workspace can be referenced in common workspaces.

Figure 8-90 Associating a data standard

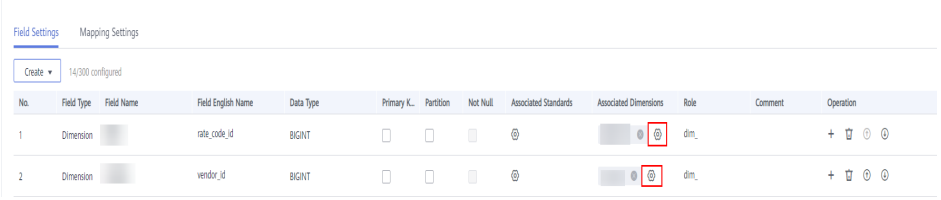


Associating a Fact Table Field with a Quality Rule

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Fact Tables** tab.
3. In the fact table list, click the name of the target fact table.
4. In the table field list on the fact table details page, locate the target field and click to associate the field with a quality rule.

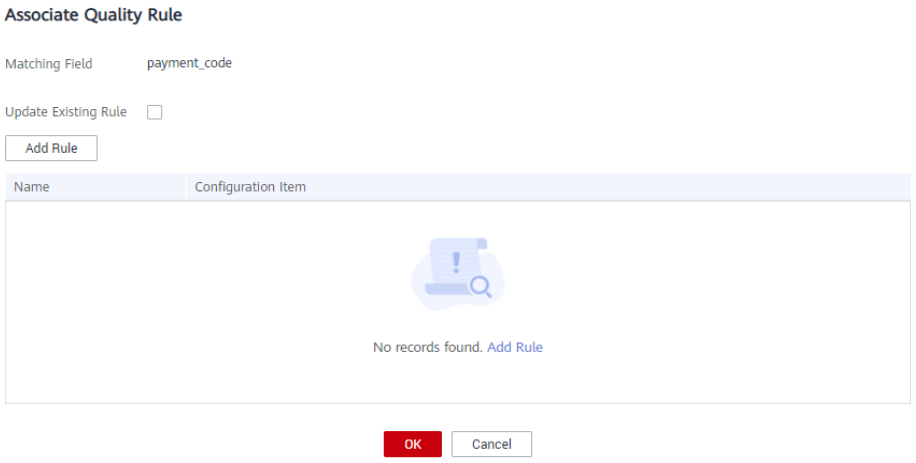
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Figure 8-91 Associating a fact table field with a quality rule



5. After the configuration is complete, click **OK**.

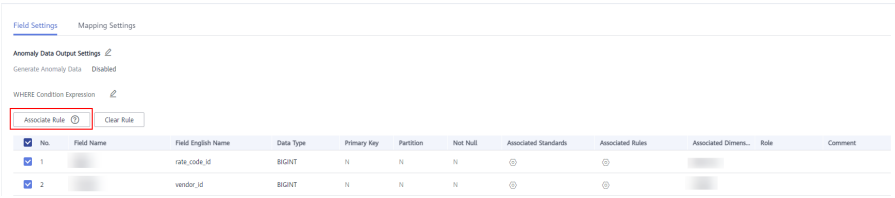
Figure 8-92 Adding a rule



Associating Fact Table Fields with a Quality Rule in Batches

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Fact Tables** tab.
3. In the fact table list, click the name of the target fact table.
4. In the table field list on the fact table details page, select the target table fields and click **Associate Rule**.

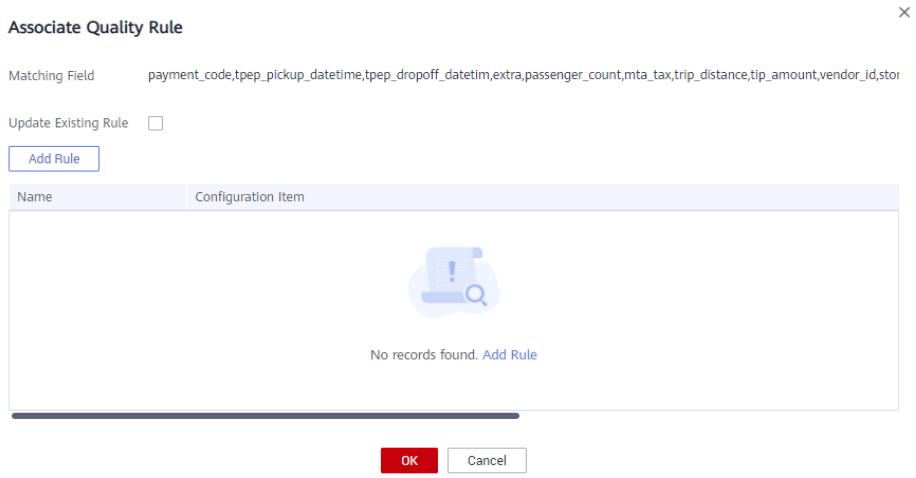
Figure 8-93 Associating fact table fields with a quality rule



5. On the page displayed, add a rule and set the rule parameters.

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Figure 8-94 Adding a rule



6. After the configuration is complete, click **OK**.

Importing a Fact Table by Reversing a Database

By reversing databases, you can import one or more created database tables from other data sources into a fact table directory to turn them into fact tables.

Step 1 On the DataArts Architecture console, choose **Models** > **Dimensional Modeling** in the navigation pane on the left.

Step 2 Above the fact table list, click **Reverse Database**.

Step 3 In the displayed dialog box, set required parameters and click **OK**.

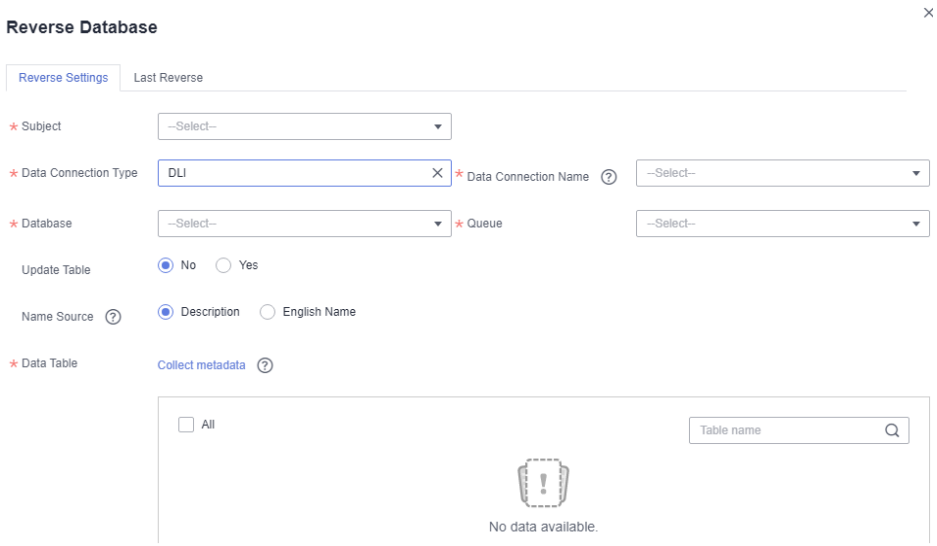
Table 8-39 Parameters for reversing the database

Parameter	Description
*Subject	Select a subject from the drop-down list.
*Data Connection Type	The data connection types supported by the reverse database are displayed in the drop-down list box. Select the required data connection type.
*Data Connection Name	Select a data connection. If you want to reverse a database from other data sources to a fact table directory, you must create a data connection in Management Center to connect to the data source. For details on how to create data connections, see **Configuring DataArts Studio Data Connection Parameters**.
*Database	Select a database.
*Schema	Select a value from the drop-down list box. This parameter is available only for DWS and PostgreSQL tables.
Queue	DLI queue. This parameter is available only when **Data Connection Type** is set to **DLI**.

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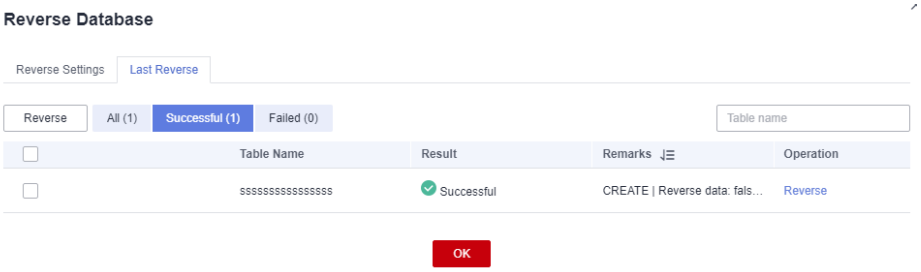
Parameter	Description
Update Table	When **Yes** is selected, if the name of the reversed table is the same as that of an existing fact table, the existing fact table is updated.
Name Source	Source of the table name or field name after the reverse. The value can be **Description** or **Name**. If no description is specified for a table or field, the name is used. • Description • Name **NOTE** If you select **Description**, field comments of a table must be unique.
*Data Table	You can select **All** or **Partial**.

Figure 8-95 Reverse Database dialog box



Step 4 You can view the result on the **Last Reverse** tab page. If the reverse operation is successful, click **Close**. If the reverse operation fails, you can view the failure cause. After the fault is rectified, select the table again and click **Reverse** to retry.

Figure 8-96 Last Reverse tab page



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----End

Viewing Fact Table Details

1. On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.
2. Click the **Fact Tables** tab.
3. Click the name of a fact table to go to its details page.
4. View the basic information and fields of the fact table. You can also configure anomaly data output settings.
   a. Click **Modify** and enable **Generate Anomaly Data**. Anomaly data will be stored in the specified database based on the configured parameters.
   b. **Database/Schema**: Enter the database or schema that stores anomaly data.
   c. Set **Table Prefix** and **Table Suffix**, which indicate the prefix and suffix of the table that stores anomaly data.

      NOTE

      The prefix and suffix of the table can contain only letters, digits, and underscores (_).
   d. Click ✓ to save the settings.
5. You can configure a where condition expression to filter fields.

8.6.4 Data Mart

A data mart is also called a DM model. It refers to a summary table. A summary table consists of specific analysis objects (such as members) and related statistical metrics. The metrics included in a summary table all have the same level of granularity (such as members). A summary table provides users with all of the available statistics on themed data (such as a member theme market), sorted by levels of granularity.

A summary table can be manually or automatically aggregated. This topic describes how to manually create a summary table.

NOTE

On the DataArts Architecture page, choose **Metrics** > **Configuration Center** in the left navigation pane, and click the **Functions** tab. On the page displayed, if **Create data development jobs** is selected for **Model Design Process**, the system creates a data development job with a name starting with *Database name_Table code*. Choose **DataArts Factory** > **Develop Job** to view the created job. By default, this job has no scheduling configuration. You need to configure scheduling for the job in the DataArts Factory module.

Prerequisites

A dimension, a dimension table, a fact table, and a derivative metric have been created, published, and reviewed.

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Creating and Publishing a Summary Table

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. In the left navigation pane, choose **Models** > **Data Mart**.
3. Select a subject in the subject directory on the left and click **Create**.
4. On the **Create Summary Table** page, perform the following operations:
   a. Set the parameters in the **Basic Settings** area.

Figure 8-97 Basic Settings area

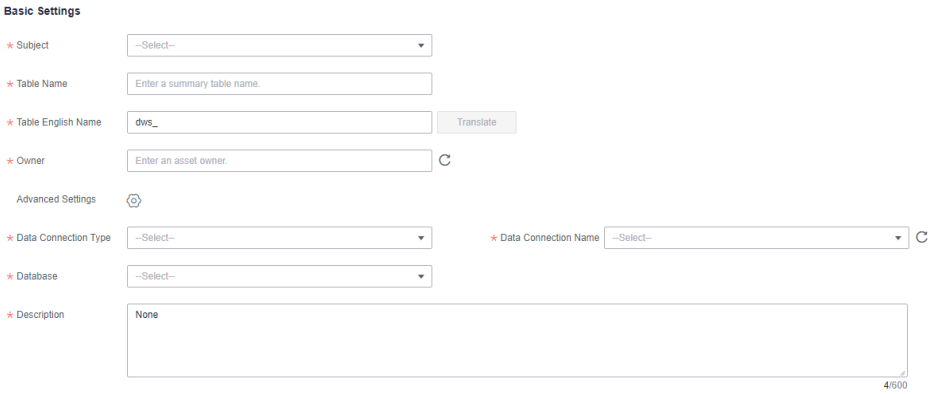


Table 8-40 Parameters in the Basic Settings area

Parameter	Description
*Subject	Select a subject catalog (business domain group > business domain > business object) where you can place the summary table.
*Table Name	The name of the table to create. Newline characters and the following characters are not allowed: \ < > % " ' ;
*Table Code	The code of the table to create. It can contain only letters, digits, and underscores (_), and must start with **dws_**. The system can automatically generate the table code through translation based on a configured naming dictionary.
*Owner	You can enter an owner name or select an existing owner.
Advanced Settings	Set custom items to describe the table. The custom items can be viewed in the table details. For example, if you want to identify the source of the table, you can add item **source** and set its value to the table source information. Then you can view the table source information in the table details.

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Parameter	Description
*Data Connection Type	The parameter value must be the same as that of the dimension table and fact table.
*Data Connection Name	It is recommended that the same data connection be used for data mart.
*Database	The name of the database. Select a database from the drop-down list box.
Queue	DLI queue. This parameter is available only for DLI data connections.
Schema	DWS or POSTGRESQL mode. This parameter is displayed only for DWS and POSTGRESQL data connections.
Table Type	DLI models support the following table types: • **MANAGED**: Data is stored in a DLI table. • **EXTERNAL**: Data is stored in an OBS table. When **Table Type** is set to **EXTERNAL**, you must set **OBS Path**. The OBS path format is ***/bucket_name/filepath***. DWS models support the following table types: • **DWS_ROW**: row-store table. Tables are stored to disk partitions by row. • **DWS_COLUMN**: column-store table. Tables are stored to disk partitions by column. • **DWS_VIEW**: view-store table. Tables are stored to disk partitions by view. The MRS Hive model supports **HIVE_TABLE** and **HIVE_EXTERNAL_TABLE**. The MRS Spark model supports **HUDI_COW** and **HUDI_MOR**. The PostgreSQL model supports only **POSTGRESQL_TABLE**. The MRS_CLICKHOUSE model supports only **CLICKHOUSE_TABLE**. The Oracle model supports only **ORACLE_TABLE**. The MySQL model supports only **MYSQL_TABLE**. The Doris model supports only **DORIS_TABLE**.

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Parameter	Description
Compression Level	This parameter is available when the data connection type is DWS. The following compression levels are available for different table types: • **DWS_ROW**: **NO** and **YES** • **DWS_COLUMN**: **NO**, **LOW**, **MIDDLE**, and **HIGH**. • **DWS_VIEW**: The compression level is not supported.
Distributed By	This parameter is displayed only for DWS data connections. Currently, only **REPLICATION** and **HASH** are supported. You can select multiple fields. • **REPLICATION**: A full table is stored on each DN. The advantage of this option is that each DN has all the data of a table. During the join operation, data redistribution can be avoided, reducing network overhead. The disadvantage is that each DN retains the complete data of a table, resulting in data redundancy. Generally, this option is recommended for small dimension tables. • **HASH**: If you select this option, you must specify a distribution key for the user table. When a record is inserted, the system performs hash computing based on values in the distribute keys and then stores data on the corresponding DN. In a Hash table, I/O resources on each node can be used during data read/write, which improves the read/write speed of a table. Generally, this option is recommended for large dimension tables (a large dimension table contains over 1 million records).
* Description	A description of the summary table to create. It allows 1 to 600 characters.

b. Click the **Field Settings** tab and configure attributes for the summary table.

Click **Add** to add one or more associated attributes, for example, derivative metrics.

Click **Import Field** and select **From metrics**, **From dimension attributes**, or **Import from Data Standard**.

NOTE

If you select **From dimension attributes**, you must associate fields with metrics or import fields from metrics before associating fields with dimension attributes or importing fields from dimension attributes.

Fuzzy search is supported when **From metrics** is selected.

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Click **Audit Data Standard** to audit the data standards of the attributes of the summary table. The audit status is ✔.

Click **Associate** to associate data standards or security levels with multiple attributes.

Click **Delete** to delete data standards or security levels from multiple attributes.

Figure 8-98 Configuring attributes

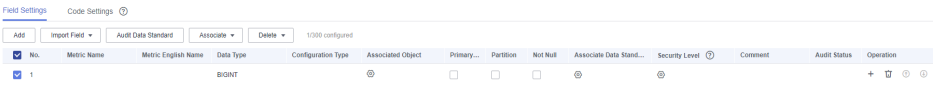


Table 8-41 Parameters on the Field Settings page

Parameter	Description
Name	Newline characters and the following characters are not allowed: \ < > % " ' ; The added dimension tables and their attribute values are automatically displayed for the dimension attribute field. Generally, you do not need to modify them.
Name (EN)	It must start with letters. Only letters, numbers, and underscores (_) are allowed.
Data Type	Data type of the field name
Configuration Type	Configuration type corresponding to the field name, for example, derivative metric.
Associated Object	Associated object corresponding to the configuration type of the field name, for example, the derivative metric name
Primary Key	If this parameter is selected, the field is a primary key. **NOTE** If an MRS Spark connection is used to connect to MRS Hudi data sources, data can be written to the database only if fields have primary keys. Otherwise, table synchronization fails.
Partition	If this parameter is selected, the field is a partition field.
Not Null	Whether the parameter value can be left empty.

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Parameter	Description
Data Standard	If you have created data standards, click to select one to associate with the field. If **Create Data Quality Jobs** is selected for **Model Design Process** on the **Function Settings** tab page in Configuration Center and a field is associated with a data standard, a quality job is automatically generated after a table is published. A quality rule is generated for each field associated with the data standard. The quality of the field is monitored based on the data standard. You can access the **Quality Job** page of DataArts Quality to view the job details. If no data standard is available, create one. See **Creating Data Standards** for details.
Security Level	You can click to add a security level for the logical entity attribute. If you cannot find the security level you want, click **go to** to go to the DataArts Security console and create a security level. You can disable this function on the **Models** tab page on the **Configuration Center** page.
Description	Description
Audit Status	Whether to audit the data standard Click **Audit Data Standard** to audit data standards.
Operation	Related operations

c. Click the **Code Settings** tab to view the code generated by the system and format the metric code.

   You can click **Generate Code** to refresh the generated code, click **Copy to Metric Code** to copy the code to the metric code, and click **Format** to format the metric code.

5. Click **Publish**. In the displayed dialog box, select a reviewer and click **OK** to submit a request for publishing the summary table.

   NOTE

   In enterprise mode, you can publish the summary table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the summary table cannot be published.

   If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.

   If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

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6. Select a reviewer to approve the summary table.

   After the summary table is approved, it is automatically created in the database.

7. Go back to the summary table list and locate the table just published. View its synchronization status in the **Sync Status** column. You can switch between the production environment and development environment to view the synchronization result.
   - If the synchronization is successful, the summary table is successfully published and created in the database.
   - If the synchronization failed, choose **More** > **View History** in the row where the summary table is located. On the page displayed, click the **History** tab to view logs. Troubleshoot the problem based on the logs. After the error is rectified, choose **More** > **Synchronize** above the summary table list to issue the synchronization command again. If the problem persists, contact technical support personnel.

     NOTE

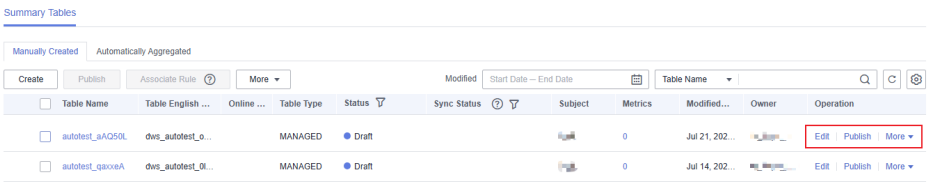
     In enterprise mode, you can synchronize the summary table to the production or development environment. By default, it is synchronized to the production environment. If you do not choose an environment, the summary table cannot be synchronized.

     After a summary table is associated with a quality rule and published, you can click **Synchronize Subjects from DataArts Architecture as Directories** on the **Quality Jobs** page on the DataArts Quality console. The quality jobs automatically generated in DataArts Architecture will be synchronized to the corresponding directories in DataArts Quality based on the subject structure.

Managing a Summary Table

1. On the DataArts Architecture page, choose **Models** > **Data Mart** in the left navigation pane. On the displayed page, click the **Summary Tables** tab.

   Figure 8-99 Summary Tables page



2. Manage your summary tables as required. Refer to the following table for details.

Operation	Helpful Link
Create	Creating and Publishing a Summary Table
Edit	3
Publish	4
View History	5

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Operation	Helpful Link
Preview SQL	6
Suspend	7
Associate Rule	8
Delete	9
Import	10
Export	11

3. Edit a summary table.
   a. Click **Edit** to the right of the target summary table.
   b. Edit the summary table as required.
   c. Click **Publish**.

      NOTE

      In enterprise mode, you can publish the summary table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the summary table cannot be published.
4. Publish a summary table.
   a. Click **Publish** to the right of the target summary table.
   b. In the **Submit for Publication** dialog box displayed, select a reviewer from the drop-down list box.

      NOTE

      In enterprise mode, you can publish the summary table to the production or development environment. By default, it is published to the production environment. If you do not choose an environment, the summary table cannot be published.
   c. Click **OK**.
5. View the publish history.
   a. Select the target summary table in the list and choose **More** > **View History** on the right.
   b. On the page displayed, you can view the publish history and version comparison information of the summary table.

      If the publish log includes error logs, the publishing has failed. You can click **Resynchronize** to retry.
6. Previewing an SQL statement.
   a. Select the target summary table in the list and choose **More** > **Preview SQL** on the right.
   b. On the page displayed, you can view or copy the SQL statement.
7. Suspend a summary table.
   a. Click **More** in the **Operation** column and select **Suspend** to the right of the target summary table.

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b. In the **Submit for Suspension** dialog box displayed, select a reviewer from the drop-down list box.

c. Click **OK**.

NOTE

After a summary table is suspended, you can determine how to process APIs based on the actual situation in DataArts DataService. DataArts Architecture does not process the APIs.

8. Associate a summary table with a quality rule.

a. Select the target summary table in the summary table list and click **Associate Rule** above the list.

b. In the **Associate Quality Rule** dialog box, you can add rules to the fields in the summary table in batches and associate the rules with the fields.

c. Click **OK**.

9. Delete a summary table.

a. Select the target summary table and choose **More** > **Delete** above the list.

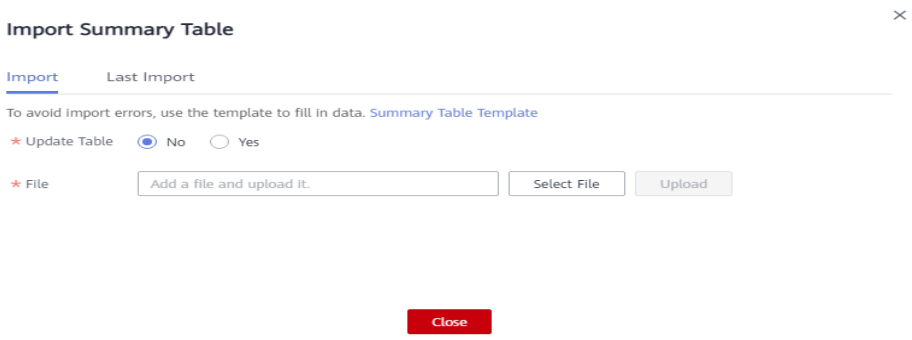
b. In the dialog box displayed, click **Yes**.

10. Import

You can import summary tables to the system quickly.

a. Above the summary table list, choose **More** > **Import**.

Figure 8-100 Import Summary Table



b. Download the summary table template, and edit and save it.

c. Choose whether to update existing data.

NOTE

If a table English name in the template already exists in the system, the data is considered duplicate.

- **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
- **Yes**: If the data to be imported already exists in the system:
  - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.

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- If the existing data in the system is in published state, expanded data will be generated.

d. Click **Select File** and select the edited template to import.

e. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.

f. Click **Close**.

11. Export summary tables.

    You can export summary tables to a local file.

    a. Select the summary tables to export on the **Manually Created** or **Automatically Aggregated** page.

    b. Above the summary table list, choose **More** > **Export**.

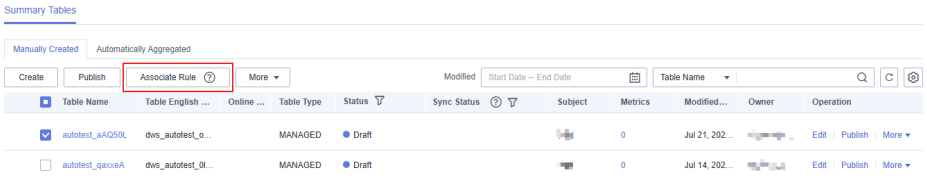
    NOTE

    - You can export all the summary tables of a subject by selecting the subject in the subject list on the left.
    - You can export all the summary tables of a workspace, as long as there are no more than 500 summary tables in the workspace.

Associating a Summary Table with a Quality Rule

1. On the DataArts Architecture console, choose **Models** > **Data Mart**.
2. Click the **Summary Tables** tab.
3. Select the target summary table in the list, and click **Associate Rule**.

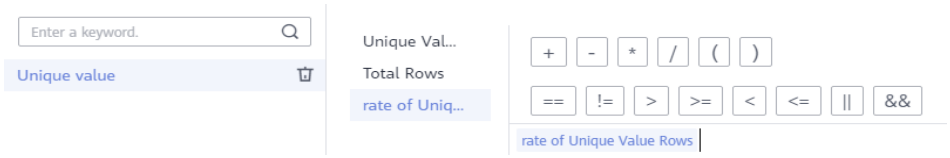
   Figure 8-101 Associating a summary table with a quality rule



4. On the page displayed, set the parameters. After the configuration is complete, click **OK**.
   - **Update Existing Rule**: If this option is selected, the newly added rule will overwrite the old rule.
   - **Table Field**: This parameter applies to all fields by default. You can enter a regular expression to filter fields as required.
   - **WHERE Clause**: This parameter can be used to filter fields.
   - **Generate Anomaly Data**: If this option is selected, anomaly data is stored in the specified database based on the configured parameters.
   - **Database/Schema**: database or schema that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Table Prefix**: prefix of the table that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.
   - **Table Suffix**: suffix of the table that stores anomaly data. This parameter is displayed when **Generate Anomaly Data** is enabled.

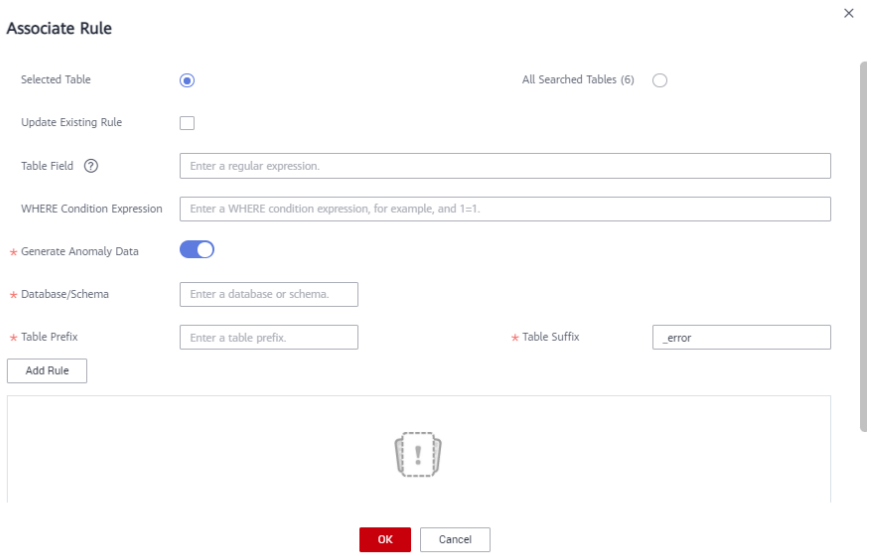
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- **Add Rule**: You can click **Add Rule** to add a rule. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**. An example alarm expression is as follows:



- An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the **Associate Quality Rule** dialog box, the alarm parameters of each quality rule are displayed as buttons.

Figure 8-102 Associating a summary table with a quality rule



Associating a Summary Table Field with a Data Standard

1. On the DataArts Architecture console, choose **Models** > **Data Mart**.
2. Click the **Summary Tables** tab.
3. Click the name of the target summary table in the list.
4. In the table field list on the details page of the summary table, search for the target field, click corresponding to the field to configure the association between the field and the data standard.

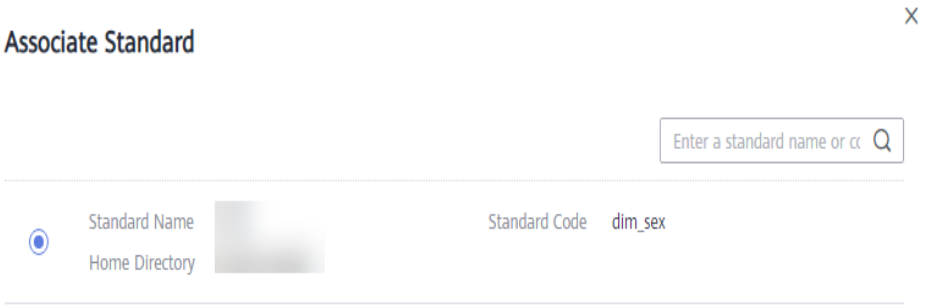
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Figure 8-103 Associating a summary table field with a data standard



5. After the configuration is complete, click **OK**. For details on the sources of data standards, see **Creating a Data Standard**.

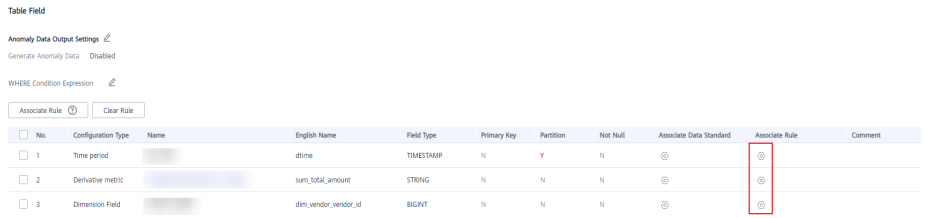
Figure 8-104 Associating a data standard



Associating a Single Field with a Quality Rule

1. On the DataArts Architecture console, choose **Models** > **Data Mart**.
2. Click the **Summary Tables** tab.
3. In the summary table list, click the name of the target summary table.
4. In the table field list on the summary table details page, locate the target field and click to associate the field with a quality rule.

Figure 8-105 Associating a single table field with a quality rule

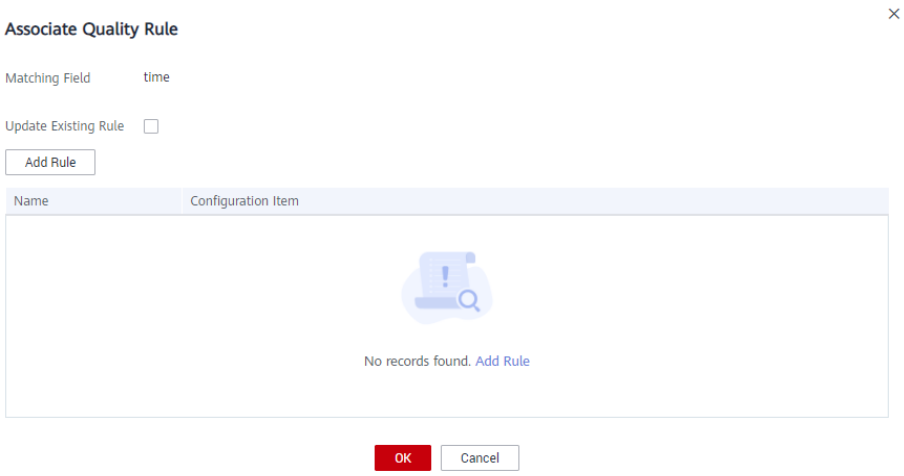


5. After the configuration is complete, click **OK**.
   - **Update Existing Rule**: If this option is selected, the newly added rule will overwrite the old rule.
   - **Add Rule**: You can click **Add Rule** to add a rule. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**.
   - An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is

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true, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the **Associate Quality Rule** dialog box, the alarm parameters of each quality rule are displayed as buttons.

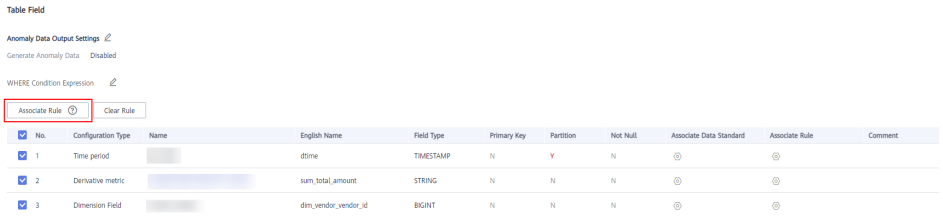
Figure 8-106 Associating a quality rule



Associating Table Fields with a Quality Rule in Batches

1. On the DataArts Architecture console, choose **Models** > **Data Mart**.
2. Click the **Summary Tables** tab.
3. In the summary table list, click the name of the target summary table.
4. In the table field list on the summary table details page, select the target table fields and click **Associate Rule**.

Figure 8-107 Associating fields with a quality rule

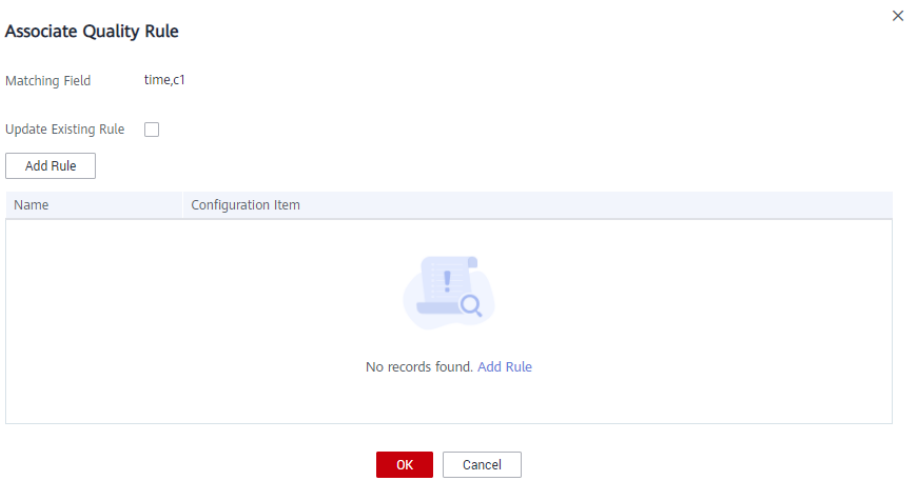


5. On the page displayed, add a rule and set the rule parameters.
   - **Update Existing Rule**: If this option is selected, the newly added rule will overwrite the old rule.
   - **Add Rule**: You can click **Add Rule** to add a rule. For example, add a rule named **Unique value**, select the rule, click **OK**, enter an alarm condition expression in the **Alarm Condition** text box, add other rules in the same way, and click **OK**.
   - An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be

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triggered. In the **Associate Quality Rule** dialog box, the alarm parameters of each quality rule are displayed as buttons.

Figure 8-108 Adding a rule



6. After the configuration is complete, click **OK**.

Viewing Summary Table Details

1. On the DataArts Architecture console, choose **Models** > **Data Mart** in the navigation pane on the left.
2. Click the **Summary Tables** tab.
3. Click the name of a summary table to go to its details page.
4. View the basic information and fields of the summary table. You can also configure anomaly data output settings.
   a. Click **Modify** and enable **Generate Anomaly Data**. Anomaly data will be stored in the specified database based on the configured parameters.
   b. **Database/Schema**: Enter the database or schema that stores anomaly data.
   c. Set **Table Prefix** and **Table Suffix**, which indicate the prefix and suffix of the table that stores anomaly data.

      NOTE

      The prefix and suffix of the table can contain only letters, digits, and underscores (_).
   d. Click ✓ to save the settings.
5. You can configure a where condition expression to filter fields.

8.7 Metric Design

8.7.1 Business Metrics

After data survey and requirement analysis, you must implement metrics. A metric is a statistical value that measures the overall characteristic of a target and

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reflects the business situation in a business activity of an enterprise. A metric consists of its name and value. The metric name and its definition reflect the quality and quantity of the metric. The metric value reflects the quantifiable values of the specified time, location, and condition of the metric.

Business metrics define the purposes and calculation formulas of technical metrics and are not used to perform actual calculation. Business metrics can be associated with technical metrics. Technical metrics implement business metrics and define calculation methods.

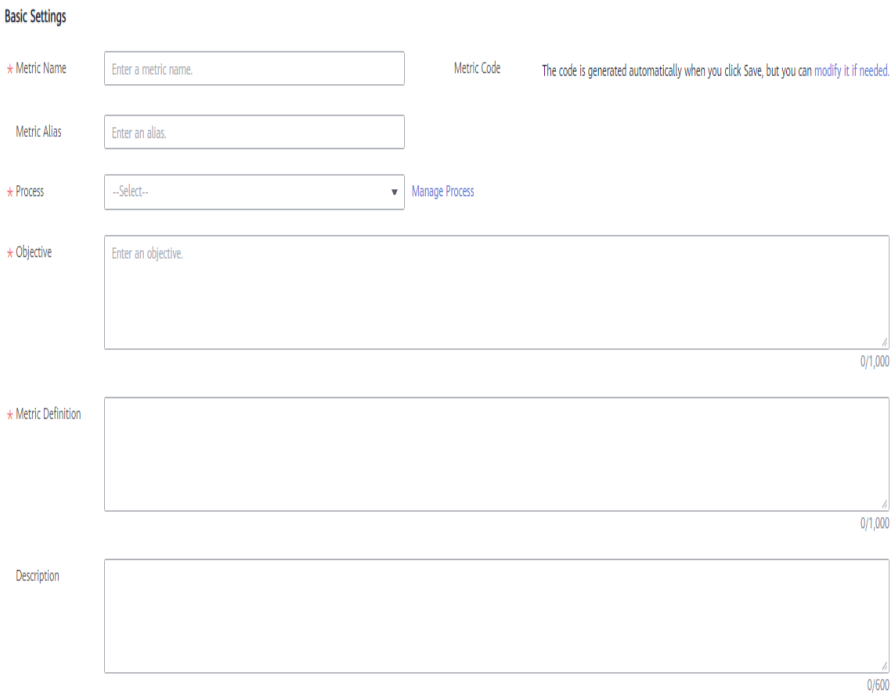
Prerequisites

You have designed a process. For details, see **Designing Processes**.

Creating and Publishing a Business Metric

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.
3. In the process tree on the left, select a process and click **Create**.
4. On the page displayed, set the parameters and click **Publish**.
   a. Configure basic settings.

Figure 8-109 Basic Settings area



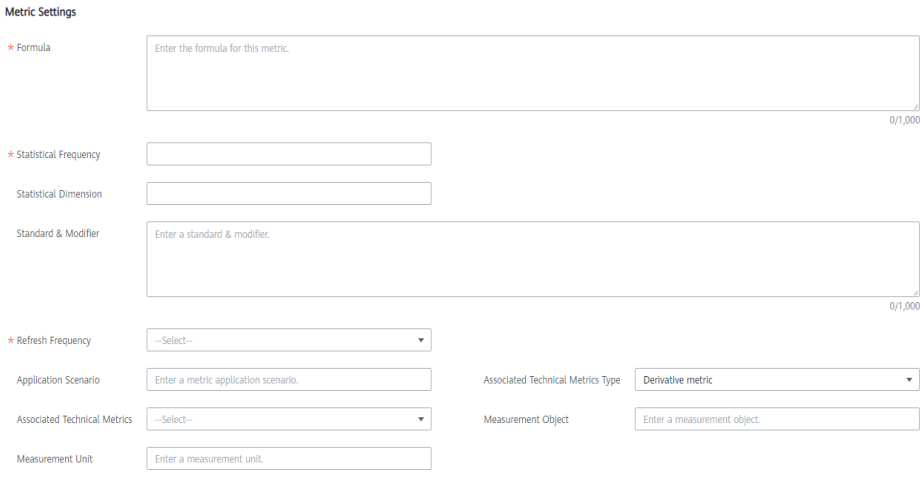
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Table 8-42 Parameters in the Basic Settings area

Parameter	Description
*Metric Name	The name of the business metric to create. Newline characters and the following characters are not allowed: \ < > % " ' ;
Code	• The metric code is automatically generated. You can configure the generation rule on the **Configuration Center** page of DataArts Architecture. For details, see **Encoding Rules**.
Alias	This parameter is optional.
*Process	Select the process that the metric belongs to. If no process is available, create one. Refer to **Designing Processes** for details.
*Objective	Your purpose of setting the metric.
*Metric Definition	The definition of the metric must be accurately described.
Remarks	Remarks for the metric to create.
Custom metric	If a custom metric is configured on the **Metrics** tab page of the configuration center, the metric is displayed as a parameter on this page. For how to create a custom field, see **Metric Settings**.

b. Configure the metric information.

Figure 8-110 Metric Information area



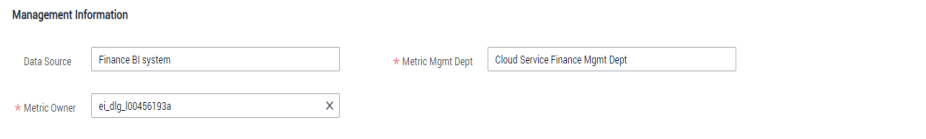
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Table 8-43 Parameters in the Metric Information area

Parameter	Description
*Formula	The computing logic of the business metric, which guides developers to design atomic and derivative metrics. Business metrics are used to guide the implementation of technical metrics only and are not calculated.
*Statistical Frequency	The statistical period of a metric, which helps developers set the time limits.
Statistical Dimension	You can select an existing dimension from the drop-down list For details on how to create a dimension, see **Creating Dimensions**.
Standard & Modifier	Modifiers are abstract definitions of scenarios and are used to determine the measurement scope.
*Refresh Frequency	The interval for updating a metric. Developers or operators can set the scheduling frequency of derivative metrics based on the metric update frequency.
Metric Application Scenario	The application scenarios of the metric.
Associated Technical Metrics Type	Select the type of the technical metric associated with the business metric. Available options include **Derivative metric**, **Compound metric**, and **Atomic metric**.
Associated Technical Metrics	Select a technical metric associated with the business metric.
Measurement Object	The field for measuring a metric.
Measurement Unit	The measurement unit of a metric.

c. Configure the management information.

Figure 8-111 Management Information area



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Table 8-44 Parameters in Management Information area

Parameter	Description
Data Source	The generator of data.
*Metric Mgmt Dept	The department that manages the metric.
*Metric Owner	Metric owner. You can enter the name of an owner or select an existing owner.

5. In the displayed dialog box, select a reviewer and click **OK** to submit an application.

   NOTE

   If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.

   If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

6. Repeat **3** to **5** to create and publish other business metrics.
7. All the business metrics need reviewing.

   If the applications are approved, the business metrics are created.

   Click the name of a business metric to view its details, relationship diagram, publishing history, and review history.

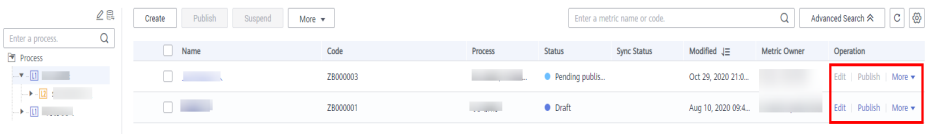
   In the relationship diagram, you can view the lineage diagram of the business metric.

   In the release history, you can view the differences between historical versions.

Editing a Business Metric

1. On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.

   Figure 8-112 Managing business metrics



2. In the business metric list, select the target metric and click **Edit** on the right.
3. Edit the business metric information as required.
4. Click **Save** to save the settings. Alternatively, click **Publish** to publish the edited business metric.

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Publishing a Business Metric

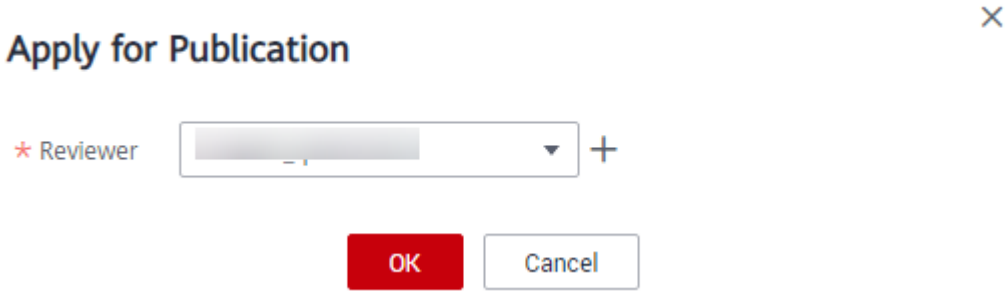
If a business metric is created but not published, perform the following steps to publish it:

Step 1 On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.

Step 2 In the business metric list, select the target metric and click **Publish**.

Step 3 In the dialog box displayed, select a reviewer and click **OK**.

Figure 8-113 Submit for Publication dialog box



----End

Suspending a Business Metric

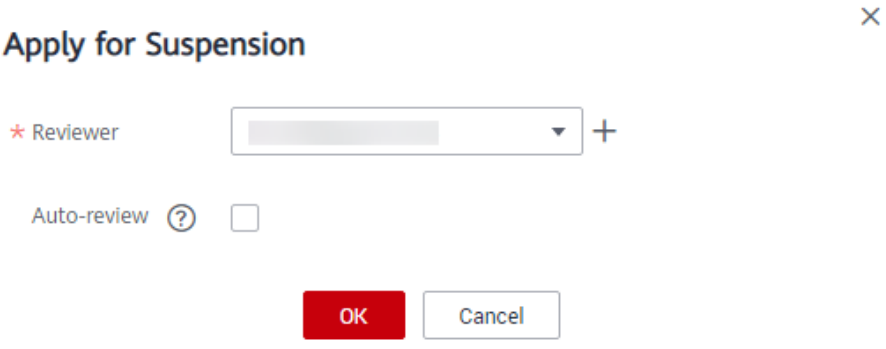
You can perform the following steps to suspend a published business metric:

Step 1 On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.

Step 2 In the business metric list, select the target business metric and click **Suspend** in the **Operation** column.

Step 3 In the dialog box displayed, select a reviewer and click **OK**. The business metric is suspended after the reviewer approves it.

Figure 8-114 Apply for Suspension dialog box



----End

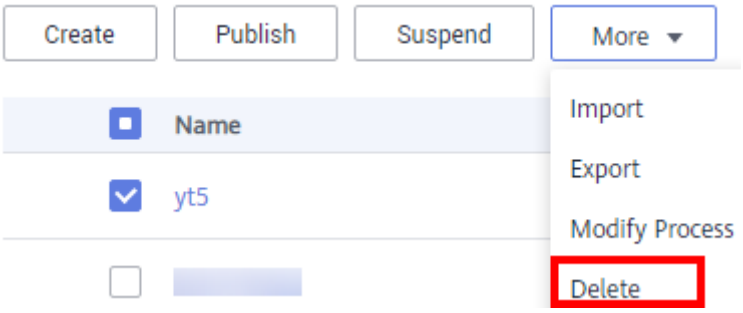
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Deleting a Business Metric

If a business metric is no longer needed, you can delete it. A business metric in the **Published** state can be deleted only after it is suspended.

1. On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.
2. In the business metric list, select the target business metric and choose **More** > **Delete** above the list.

Figure 8-115 Deleting a business metric



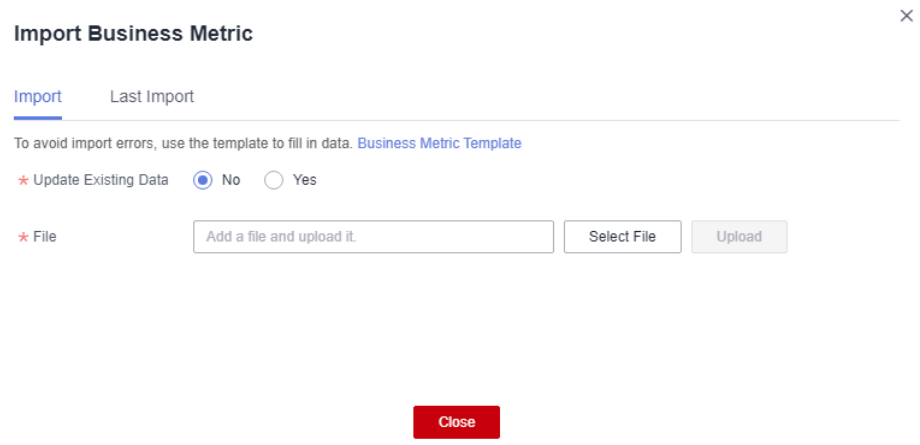
3. In the dialog box displayed, confirm the information and click **Yes**.

Importing/Exporting Business Metrics

Importing metrics: You can import business metrics in batches.

1. On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.
2. Above the business metric list, click **More** and select **Import**. In the displayed **Import Business Metric** dialog box, click **Business Metric Template**.

Figure 8-116 Importing business metrics



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Table 8-45 Parameters for importing business metrics

Parameter	Description
Update Existing Data	Whether to update the existing table if the table to be imported already exists. The system determines whether the table to import exists based on the table code. The import operation can be used to create a table or update an existing table. It does not delete a table. The options are as follows: • **No**: If you select this option, the existing tables will not be updated. • **Yes**: If you select this option, the existing tables will be updated. If a table is in the **Published** state, you must publish the table again after updating it so that the updated table can take effect.
File	Select the file to import. You can use the following method to obtain the file to import: **Downloading the ER modeling template and fill in the template** On the **Import** tab page, click **Business Metric Template** to download the template, fill in the template, and save the settings.

3. Open the downloaded template, set the parameters in the template, and save the template. The **Description** sheet in the template is for reference only.

   Parameters whose names start with an asterisk (*) are mandatory, and other parameters are optional.

   The table below describes the parameters in the **Business Metric** sheet.

Table 8-46 parameters in the Business Metric sheet

Parameter	Description
*Process	Level-1 process corresponding to the metric
*Name	Standard name of the metric, which must be unique.
Code	It is automatically generated by the system.
Alias	Simplified name of the metric used in specific scenarios such as reports
*Objective	Objective of the metric
*Metric Definition	Accurate meaning of the metric that can help related personnel understand the content measured by the metric
*Calculation Formula	Clear rule for calculating the metric data
Data Source	System from which data comes. If possible, the specific data table name and field should be specified.

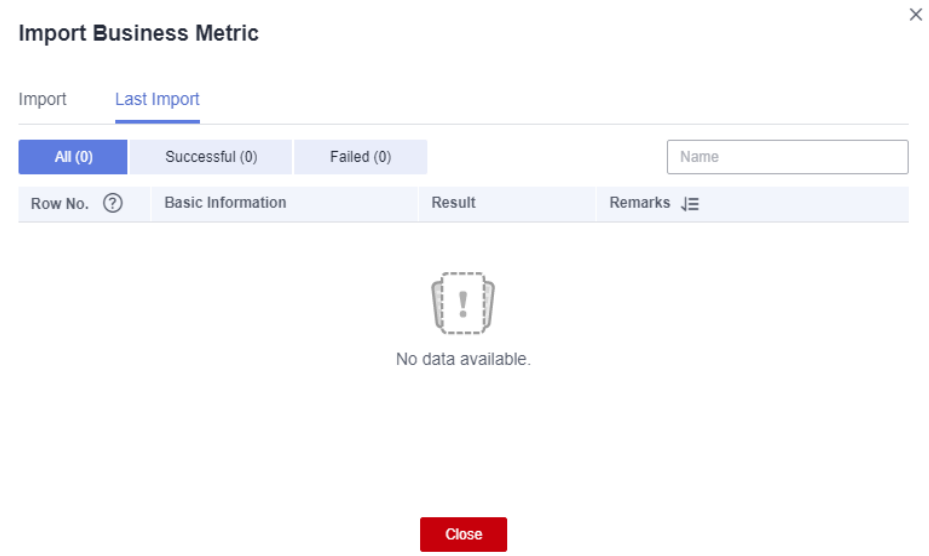
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Parameter	Description
Measurement Unit	Basic measurement unit of the metric
*Statistical Period	Statistical period of the metric
Statistical Dimension	Common statistical dimension. Dimensions are generally hierarchical.
*Refresh Frequency	Minimum frequency at which the metric data is updated
Statistical Standard & Modifier	Statistical standard and modifier the metric usually uses in addition to the statistical period and dimension. The statistical standard and modifier restrict the scope of metric data.
Metric Application Scenario	Important application scenarios of the metric, such as online reports, routine reports, and reporting materials
Remarks	Additional information that helps understand and use the metric
Measurement Object	Field for measuring the metric. If this parameter is not involved, leave it blank.
*Metric Mgmt Dept	Department responsible for defining, maintaining, and interpreting the metric and providing metric data.
*Metric Owner	Metric owner (Huawei account name)
Related Tech Metric	Implementation of the business metric in the specifications design

4. View the result on the **Last Import** tab page. If the import is successful, click **Close**. If the import fails, you can view the failure cause, correct the template file, and upload it again.

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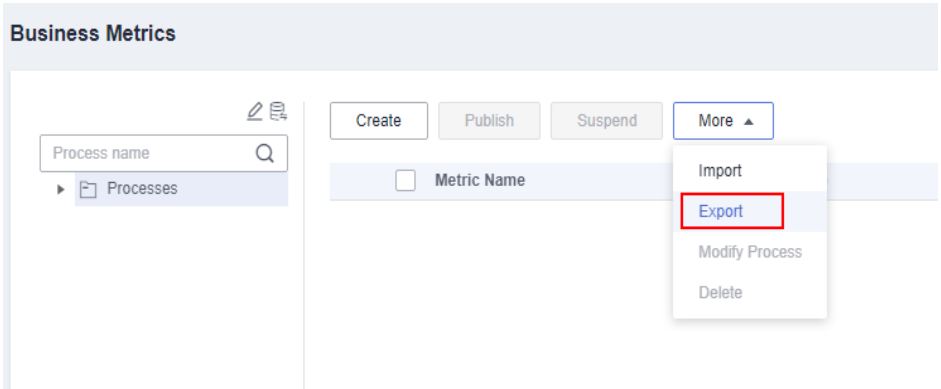
Figure 8-117 Last Import tab page



Exporting metrics: You can export created business metrics.

1. On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.
2. On the **Business Metrics** page, select a business metric, click **More**, and select **Export**.

Figure 8-118 Exporting a business metric



NOTE

If a custom metric was created on the **Metrics** tab page in the configuration center, the custom metric is displayed in the exported table.

8.7.2 Technical Metrics

8.7.2.1 Creating Atomic Metrics

An atomic metric is an abstract set of the statistical logic and specific algorithms. To ensure consistency between definitions and R&D, metric definitions determine

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the statistical logic (or the computing logic), without using ETLs to perform secondary R&D. This improves R&D efficiency and ensures consistency of statistical results.

Atomic metrics are generated based on dimension tables and fact tables of a multidimensional model. The objects and the finest data granularity of an atomic metric are consistent with those of the multidimensional model.

An atomic metric usually consists of one measure and attributes related to this measure, all of which aim to support agile self-service consumption of the metric. Agile self-service consumption means that business users can access and use metrics fast by themselves without relying on the IT department or data team for complex query and computation. Atomic metrics are basic and easy to understand. You can use them to create reports, query requests, and analysis requests. Using atomic metrics, you can flexibly combine and compute existing basic data to meet your requirements.

Context

Atomic metrics come from fact tables and dimension tables.

- An atomic metric is a data component defined for constructing a derivative metric required by application statistical analysis. An atomic metric can be created based on fact table details or dimension tables.
- A derivative metric does not have a direct source table. It belongs to the source table of the original atomic metrics that are combined into the derivative metric.

Atomic metrics and derivative metrics interact in specific ways.

- After the computing logic of an atomic metric takes effect, the related derivative metric is updated directly.
- An atomic metric referenced by any derivative metrics cannot be deleted.
- The code of an atomic metric referenced by any derivative metrics can be changed.
- The change of an atomic metric affects related derivative metrics.

Constraints

A maximum of 5,000 atomic metrics can be created in a workspace.

Prerequisites

You have created and published a fact table, and the fact table has been approved. For details, see **Creating Fact Tables**.

Creating and Publishing an Atomic Metric

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Atomic Metrics** tab.
3. Select a subject from the subject tree on the left and click **Create**.

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4. On the **Create Atomic Metric** page, set the parameters described in **Table 8-47** and click **Publish**.

Figure 8-119 Creating an atomic metric

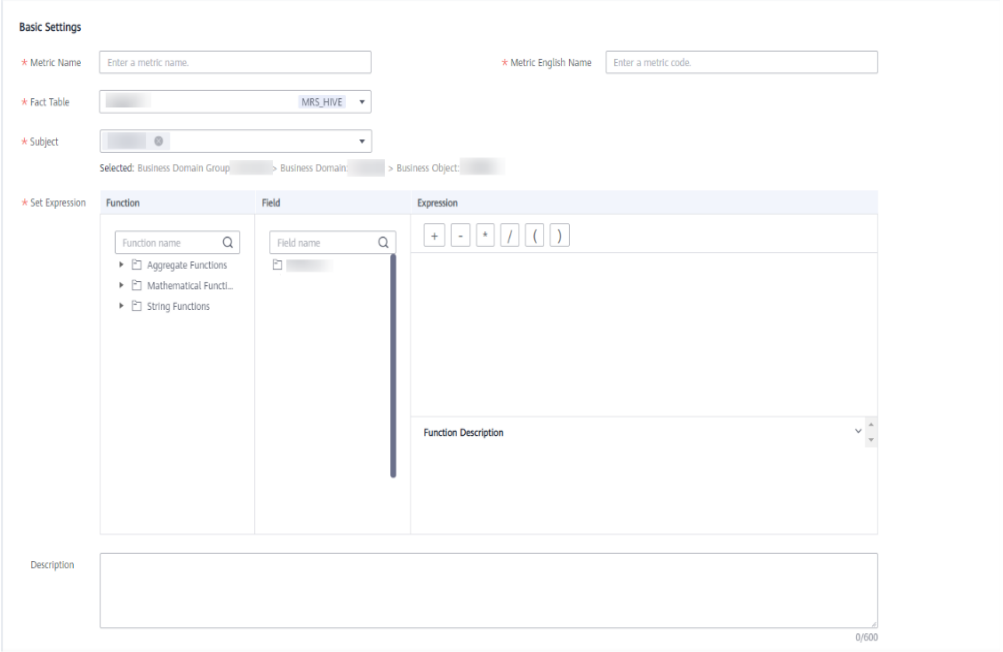


Table 8-47 Parameters for creating an atomic metric

Parameter	Description
*Metric Name	Newline characters and the following characters are not allowed: \ < > % " ' ;
*Metric Code	Metric codes must start with letters. Only letters, numbers, and underscores (_) are allowed.
*Data Table	Select a published fact table from the drop-down list box. If there are many tables, you can enter a table name in the text box to search for the desired fact table. If no fact table is available, create one. See **Creating and Publishing a Fact Table**.
*Subject	The subject to which the atomic metric belongs. After a fact table is selected, the information about the subject to which the fact table belongs is automatically displayed. You can also click **Select** to select a subject.
*Set Expression	Select the required functions and fields and set the expression. For details about the functions, see **Functions**.
Description	A description of the atomic metric to create. Up to 600 characters are supported.

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5. In the displayed dialog box, select a reviewer and click **OK** to submit a request.

   NOTE

   If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.

   If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

6. (Optional) Create and publish other atomic metrics by repeating **3** to **5**.
7. Wait for the reviewer to approve the application.

   After the application is approved, the atomic metric is created.

   Click the name of an atomic metric to view its details, relationship diagram, publishing history, and review history.

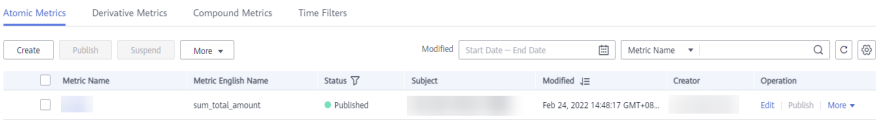
   In the relationship diagram, you can view the lineage diagram of the atomic metric.

   In the release history, you can view the differences between historical versions.

Managing an Atomic Metric

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Atomic Metrics** tab.

   Figure 8-120 Managing an atomic metric

2. Manage your atomic metrics as required. Refer to the following table for details.

   Table 8-48 Operations

Operation	Helpful Link
Create	**Creating and Publishing an Atomic Metric**
Edit	**3**
Publish	**4**
View Publish History	**5**
Suspend	**6**
Delete	**7**
Import	**8**
Export	**9**

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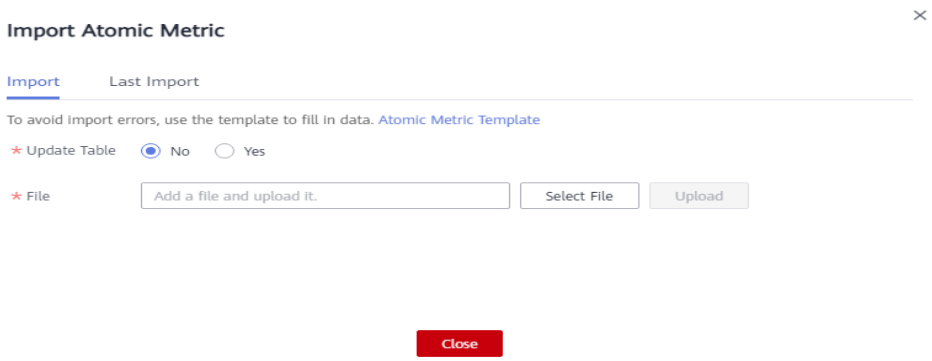
3. Edit an atomic metric.
   a. Click **Edit** to the right of the target atomic metric.
   b. On the page displayed, edit the atomic metric as required.
   c. Click **Publish**. If you do not want to immediately publish the atomic metric that you edited, click **Save** and you can publish it later.
4. Publish an atomic metric.
   a. Click **Publish** to the right of the target atomic metric.
   b. In the **Submit for Publication** dialog box displayed, select a reviewer from the drop-down list box.
   c. Click **OK**.
5. View the publish history.
   a. Select the target atomic metric in the list and choose **More** > **View History**.
   b. On the **History** tab page, you can view the publish history and version comparison information of the metric.
6. Suspend an atomic metric.
   a. Click **Suspend** to the right of the target atomic metric.
   b. In the **Submit for Suspension** dialog box displayed, select a reviewer from the drop-down list box.
   c. Click **OK**.

   NOTE

   Atomic metrics cannot be suspended or deleted if they are referenced by any derivative metrics.
7. Delete an atomic metric.
   a. Select the target atomic metric and choose **More** > **Delete** in the upper left corner.
   b. In the dialog box displayed, confirm the information and click **Yes**.
8. Import

   You can import atomic metrics to the system quickly.
   a. Above the atomic metric list, click **More** and select **Import**.

   Figure 8-121 Importing atomic metrics



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b. Download the atomic metric template, and edit and save it.

c. Choose whether to update existing data.

NOTE

If a code in the template already exists in the system, the data is considered duplicate.

- **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
- **Yes**: If the data to be imported already exists in the system:
  - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.
  - If the existing data in the system is in published state, expanded data will be generated.

d. Click **Select File** and select the edited template to import.

e. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.

f. Click **Close**.

9. Export atomic metrics.

You can export atomic metrics to a local file.

a. In the atomic metric list, select the metric to be exported.

b. Above the atomic metric list, click **More** and select **Export**.

NOTE

- You can export all the atomic metrics of a subject by selecting the subject in the subject list on the left.
- You can export all the atomic metrics of a workspace, as long as there are no more than 5,000 atomic metrics in the workspace.

Functions

When creating an atomic metric, you need to set an expression based on functions. **Table 8-49** lists some aggregate functions.

Table 8-49 Aggregate functions

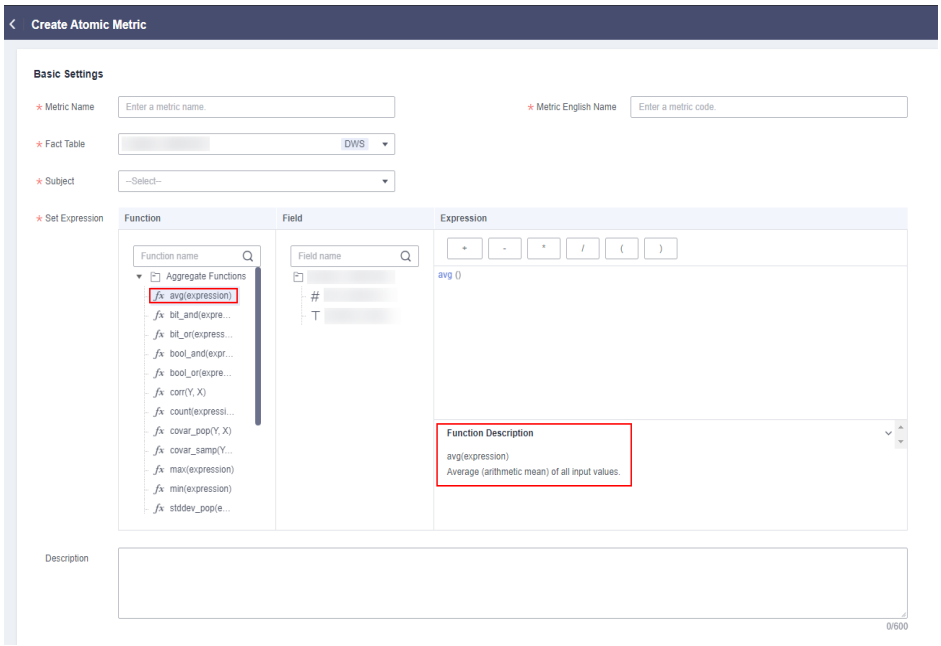
Function	Expression	Description
avg(col)	avg()	Returns the average value.
corr(col1, col2)	corr()	Returns the coefficient of correlation of a pair of numeric columns.
count(*)	count()	Returns the total number of records.
covar_pop(col1, col2)	covar_pop()	Returns the covariance of a pair of numeric columns.
covar_samp(col1, col2)	covar_samp()	Returns the sample covariance of a pair of numeric columns.

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Function	Expression	Description
max(col)	max()	Returns the maximum value.
min(col)	min()	Returns the minimum value.
stddev_pop(col)	stddev_pop()	Returns the deviation of a specified column.
stddev_samp(col)	stddev_samp()	Returns the sample deviation of a specified column.
sum(col)	sum()	Returns the sum of the values in a column.
var_samp(col)	var_samp()	Returns the sample variance of a specified column.

You can click functions in the **Function** column next to **Set Expression** on the **Basic Settings** page on the **Create Atomic Metric** page.

Figure 8-122 Functions



8.7.2.2 Creating Derivative Metrics

Derivative metrics are aggregated from the modifiers and dimensions of atomic metrics. Therefore, their modifiers and dimensions are derived from the attributes of atomic metrics as well. When a derivative metric is published, a summary table is automatically generated, which can be viewed in the **Automatically Aggregated** area on the **Summary Table** tab page.

Derivative metric = Atomic metric + Dimension + Time filter + General filter

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- **Atomic metric** specifies the statistical standards, namely, the computing logic.
- **Dimension** is the perspective to observe and analyze business data and assist in data aggregation, drilling, slicing, and analysis, and used as a GROUP BY condition in SQL statements.
- **Time filter** is a standard definition of a time condition.
- **General filter** collects statistics on the business scope and select the records that meet the business rules (similar to the WHERE clause in SQL statements, excluding the time range).

Prerequisites

- An atomic metric has been created and approved.
- A dimension and time filter have been created and approved. This prerequisite is required only if the derivative metric will use the statistical dimension or time filter.

Constraints

A maximum of 5,000 derivative metrics can be created in a workspace.

Creating and Publishing a Derivative Metric

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Derivative Metrics** tab.
3. Select a subject from the subject tree on the left and click **Create**.
4. On the page displayed, set the parameters.

Figure 8-123 Creating a derivative metric

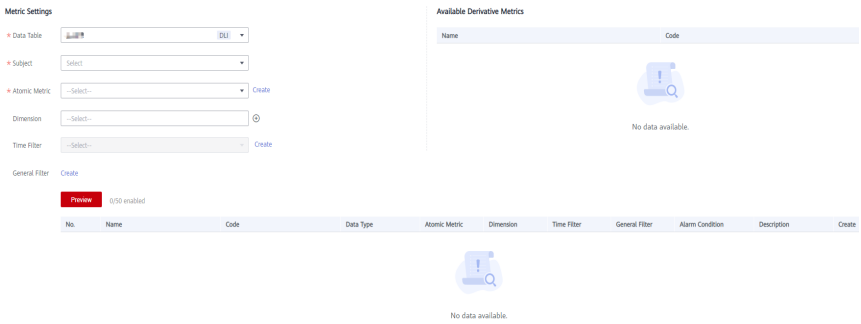
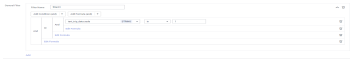


Table 8-50 Parameters for creating a derivative metric

Parameter	Description
*Data Table	Select an asset table from the drop-down list box.

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Parameter	Description
*Subject	Subject information.
*Atomic Metric	Select an atomic metric.
Dimension	Select one or more dimensions from the drop-down list box. Only the attributes in the fact table associated with the atomic metrics can be selected.
Time Filter	Select the required time filter from the drop-down list and select the associated field. Some time filters are preconfigured in the system. If the available time filters cannot meet the requirements, customize one. See **Creating Time Filters** for details.
General Filter	To set general filters, click **Create**. It must start with a letter. Only letters, digits, and underscores (_) are allowed. In the **General Filter** area shown in **Figure 8-124**, set the parameters as follows: • **Name** specifies the name of a general filter. • Under **Add Condition (and)**, you can select **And condition** or **Or condition** to add a condition. After you specify the condition, select a field from the field drop-down list and set the parameters as prompted. You can add multiple conditions. If the selected field is of the string type (for example, string or varchar) and the condition is set to **in** or **not in**, data can be imported from a lookup table. Click **From lookup tables**, set **lookup tables** and **lookup table field**, and click **OK**. A maximum of 50 fields can be imported from a lookup table. You can click  to delete unwanted conditions. • Under **Add Formula (and)**, you can select **And formula** or **OR formula** to add a formula. Click **Edit Formula** if needed. In the dialog box displayed, select the required functions and fields and set the expression. You can click  to delete unwanted formulas. **Figure 8-124** Setting a general filter 

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Parameter	Description
Alarm Triggering Condition	An alarm triggering condition consists of derivative metrics and expressions. An expression consists of alarm parameters and logical operators. When a metric is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered.

5. After setting the parameters, click **Preview** to view the information about the derivative metric and define the name, code, data type, alarm condition, and description for the metric.

   Table 8-51 Parameters for previewing a derivative metric

Parameter	Description
Metric Name	It is automatically generated by the system based on parameters such as atomic metrics, statistical dimensions, and time filters. You can also customize it.
Metric Code	It is automatically generated by the system based on parameters such as atomic metrics, statistical dimensions, and time filters. You can also customize it.
Data Type	It is automatically generated by the system based on the data type of the atomic metric. You can also customize it.
Alarm Condition	An alarm condition expression consists of alarm parameters and logical operators. When a metric is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered.
Description	A description of the derivative metric to create. Up to 600 characters are supported.

6. In the lower part of the page, click **Trial Run**. In the dialog box displayed, click **Trial Run** to check whether the derivative metric can run properly.

   If the trial run fails, locate the fault based on the error message, correct the configurations, and click **Trial Run** to try again.

7. If the trial run is successful, click **Publish**.
8. In the displayed dialog box, select a reviewer and click **OK** to submit a request.

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NOTE

If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.

If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

9. (Optional) Create and publish other derivative metrics by repeating 2 to 8.
10. Wait for the reviewer to approve the application.

    After the application is approved, the derivative metric is created.

    Click the name of a derivative metric to view its details, relationship diagram, publishing history, and review history.

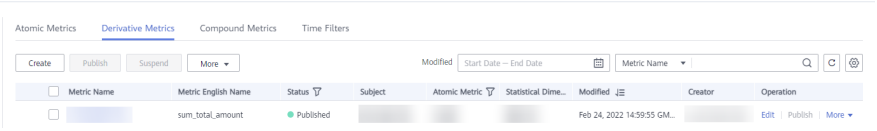
    In the relationship diagram, you can view the lineage diagram of the derivative metric.

    In the release history, you can view the differences between historical versions.

Managing a Derivative Metric

On the **Derivative Metrics** tab page, you can edit, publish, suspend, or delete derivative metrics.

Figure 8-125 Managing derivative metrics



1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Derivative Metrics** tab.
2. Manage your derivative metrics as required. Refer to the following table for details.

Operation	Helpful Link
Create	Creating and Publishing a Derivative Metric
Edit	3
Publish	4
View Publish History	5
Preview SQL	6
Suspend	7
View Summary Table	8
Delete	9
Import	10

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Operation	Helpful Link
Export	11

3. Edit a derivative metric.
   a. Click **Edit** to the right of the target derivative metric.
   b. On the page displayed, edit the derivative metric as required.
   c. In the lower part of the page, click **Trial Run**. In the dialog box displayed, click **Trial Run** to check whether the derivative metric can run properly.

      If the trial run fails, locate the fault based on the error message, correct the configurations, and click **Trial Run** to try again.
   d. If the trial run is successful, click **Publish**.
4. Publish a derivative metric.
   a. Click **Publish** to the right of the target derivative metric.
   b. In the **Submit for Publication** dialog box displayed, select a reviewer from the drop-down list box.
   c. Click **OK**.
5. View the publish history.
   a. Select the target derivative metric and choose **More** > **View History**.
   b. On the page displayed, you can view the publish history and version comparison information of the metric.
6. Preview an SQL statement.
   a. Select the target derivative metric and choose **More** > **Preview SQL**.
   b. On the page displayed, you can view or copy the SQL statement.
7. Suspend a derivative metric.

   NOTE

   The prerequisite for suspending a derivative metric is that the derivative metric is not referenced to any compound metrics.
   a. Choose **More** > **Suspend** on the right of the target derivative metric.
   b. In the **Submit for Suspension** dialog box displayed, select a reviewer from the drop-down list box.
   c. Click **OK**.
8. View a summary table.

   Currently, only details about automatically generated summary tables can be viewed. Choose **More** > **View Summary Table** on the right of the target derivative metric. The **Summary Tables** page is displayed.
9. Delete a derivative metric.

   NOTE

   The prerequisite for deleting a derivative metric is that the derivative metric is not referenced to any compound metrics.
   a. Select the target derivative metric and choose **More** > **Delete** above the list.

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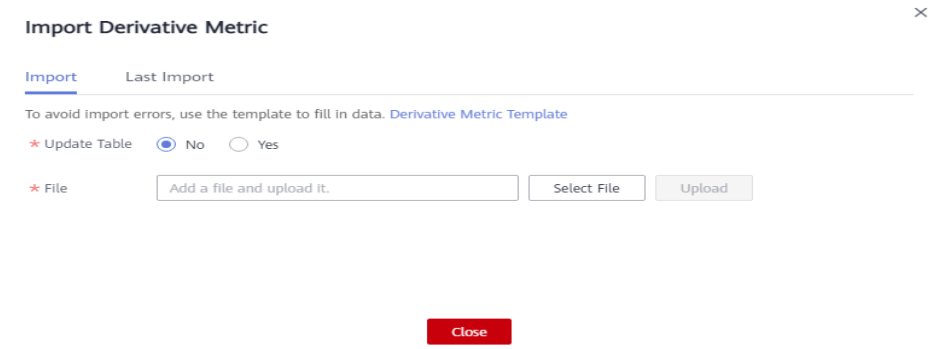
b. In the dialog box displayed, confirm the information and click **Yes**.

10. Import derivative metrics.

    You can import derivative metrics to the system quickly.

    a. Above the summary table list, choose **More** > **Import**.

    Figure 8-126 Importing derivative metrics

    b. Download the derivative metric template, and edit and save it.

    c. Choose whether to update existing data.

    NOTE

    If a code in the template already exists in the system, the data is considered duplicate.

    - **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
    - **Yes**: If the data to be imported already exists in the system:
      - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.
      - If the existing data in the system is in published state, expanded data will be generated.

    d. Click **Select File** and select the edited template to import.

    e. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.

    f. Click **Close**.

11. Exporting derivative metrics.

    You can export derivative metrics to a local file.

    a. In the derivative metric list, select the metric to be exported.

    b. Above the derivative metric list, choose **More** > **Export**.

    NOTE

    - You can export all the derivative metrics of a subject by selecting the subject in the subject list on the left.
    - You can export all the derivative metrics of a workspace, as long as there are no more than 5,000 derivative metrics in the workspace.

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8.7.2.3 Creating Compound Metrics

A compound metric is generated by adding one or more derivative metrics. The dimensions and modifiers of a compound metric are the same as those of the derivative metrics. New dimensions and modifiers cannot be generated outside the scope of derivative metrics, dimensions, and modifiers.

Constraints

A maximum of 5,000 compound metrics can be created in a workspace.

Prerequisites

A derivative metric has been created and approved. For details, see **Creating Derivative Metrics**.

Creating a Compound Metric

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Compound Metrics** tab.
3. Select a subject from the subject tree on the left and click **Create**.
4. On the page displayed, set the parameters.

Figure 8-127 Creating a compound metric

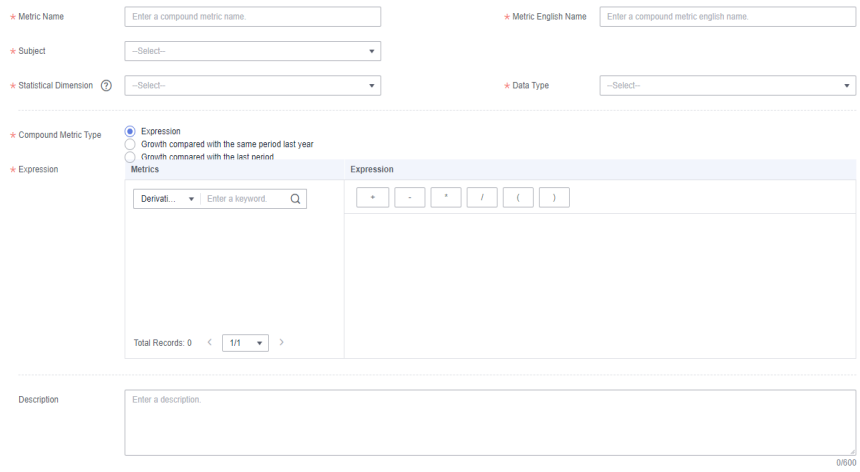


Table 8-52 Parameters for creating a compound metric

Parameter	Description
*Metric Name	Newline characters and the following characters are not allowed: \ < > % " ' ;

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Parameter	Description
*Metric Code	Metric code names must start with letters. Only letters, numbers, and underscores (_) are allowed.
*Subject	Subject information. Select a subject.
*Statistical Dimension	The available options are those configured on the **Derivative Metrics** page.
*Data Type	Select a data type for the compound metric.
*Compound Metric Type	The following options are available: • Expression • Growth compared with the same period last year • Growth compared with the last period
Description	A description of the compound metric to create. Up to 600 characters are supported.
Expression	
*Expression	Select the required derivative metrics or compound metrics and set the expression as required.
Growth compared with the same period last year	
*Period Type	Select **Year**, **Month**, or **Week**.
*Derivative Metric	Select derivative metrics (only derivative metrics with time filters are displayed). The system automatically calculates the growth compared with the same period last year based on the time filter.
Growth compared with the last period	
*Derivative Metric	Select derivative metrics (only derivative metrics with time filters are displayed). The system automatically calculates the growth compared with the last period based on the time filter.

5. In the lower part of the page, click **Trial Run**. In the dialog box displayed, click **Trial Run** to check whether the compound metric can run properly.

   If the trial run fails, locate the fault based on the error message, correct the configurations, and click **Trial Run** to try again.
6. If the trial run is successful, click **Publish**.
7. In the displayed dialog box, select a reviewer and click **OK** to submit a request.

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> **NOTE**
>
> If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.
>
> If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

8. Wait for the reviewer to approve the application.

   After the application is approved, the compound metric is created.

   Click the name of a compound metric to view its details, relationship diagram, publishing history, and review history.

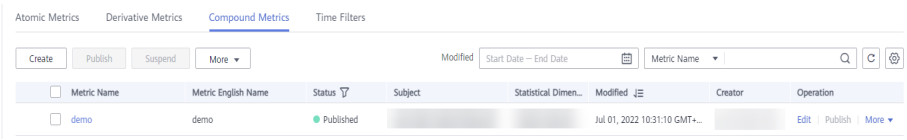
   In the relationship diagram, you can view the lineage diagram of the compound metric.

   In the release history, you can view the differences between historical versions.

Editing a Compound Metric

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Compound Metrics** tab.

   Figure 8-128 Compound metrics

2. In the compound metric list, select the target metric and click **Edit** on the right.
3. On the page displayed, set the parameters as prompted. For details, see **Table 8-52**.
4. In the lower part of the page, click **Trial Run**. In the dialog box displayed, click **Trial Run** to check whether the compound metric can run properly.

   If the trial run fails, locate the fault based on the error message, correct the configurations, and click **Trial Run** to try again.
5. If the trial run is successful, click **Publish**.
6. In the dialog box displayed, select a reviewer and click **OK**.

Publishing a Compound Metric

After creating or editing a compound metric, it takes effect only after it is published. Compound metrics in publishing review, published, or suspension review state cannot be published.

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Compound Metrics** tab.
2. In the compound metric list, select the target compound metric and click **Publish**.

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3. In the dialog box displayed, click **OK**.

Viewing the Publish History

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Compound Metrics** tab.
2. Select the target compound metric in the list and choose **More** > **View History**.
3. On the page displayed, you can view the publish history and version comparison information of the metric.

Previewing an SQL Statement

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Compound Metrics** tab.
2. Locate the target compound metric and choose **More** > **Preview SQL**.
3. In the dialog box displayed, you can view or copy the SQL statement.

Suspending a Compound Metric

You can bring a published compound metric offline if it is no longer used.

NOTE

The prerequisite for suspending a compound metric is that the metric is not referenced to any summary table.

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Compound Metrics** tab.
2. In the compound metric list, select the target compound metrics and click **Suspend** above the list.
3. In the dialog box displayed, click **OK**.

Deleting a Compound Metric

NOTE

The prerequisite for deleting a compound metric is that the metric is not referenced to any summary table.

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Compound Metrics** tab.
2. Select the target compound metric and choose **More** > **Delete** above the list.
3. In the dialog box displayed, confirm the information and click **Yes**.

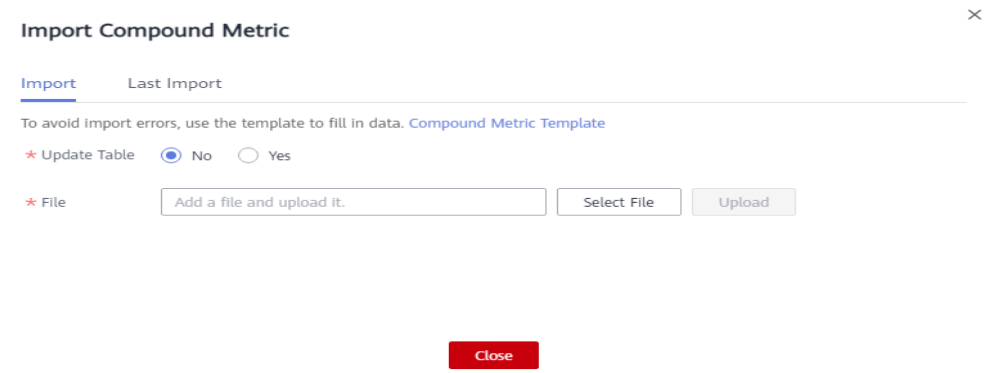
Importing Compound Metrics

You can import compound metrics to the system quickly.

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1. Above the compound metric list, choose **More** > **Import**.

   Figure 8-129 Importing Compound Metrics

2. Download the compound metric template, and edit and save it.
3. Choose whether to update existing data.

   NOTE

   If a code in the template already exists in the system, the data is considered duplicate.

   - **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
   - **Yes**: If the data to be imported already exists in the system:
     - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.
     - If the existing data in the system is in published state, expanded data will be generated.
4. Click **Select File** and select the edited template to import.
5. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.
6. Click **Close**.

Exporting Compound Metrics

You can export compound metrics to a local file.

1. In the compound metric list, select the metric to be exported.
2. Above the compound metric list, choose **More** > **Export**.

NOTE

- You can export all the compound metrics of a subject by selecting the subject in the subject list on the left.
- You can export all the compound metrics of a workspace, as long as there are no more than 5,000 compound metrics in the workspace.

8.7.2.4 Creating Time Filters

Atomic metrics are standard definitions for computing logic. Time filters are standard definitions for conditional limits. To ensure that all statistical metrics are

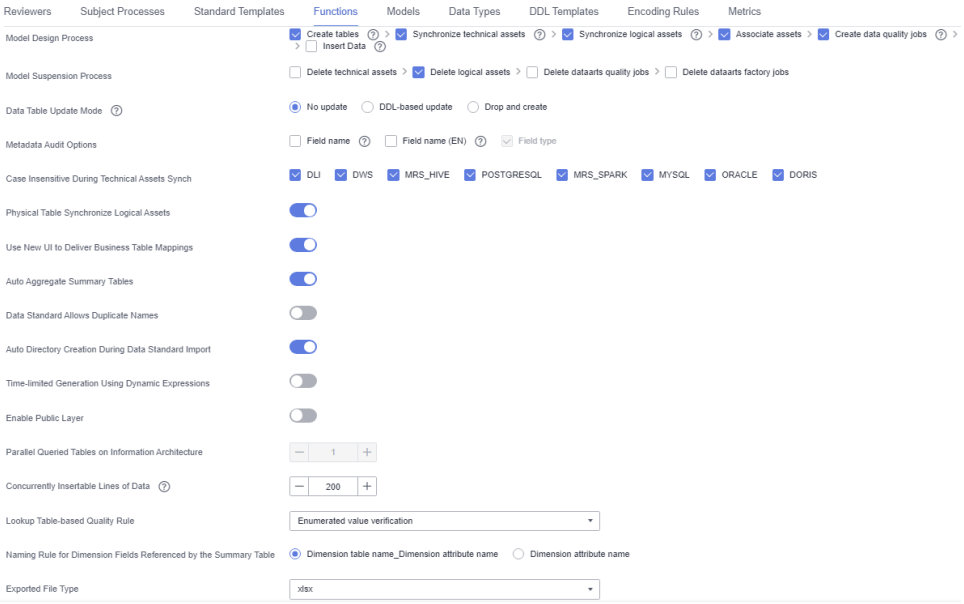
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unified, standard, and unambiguous, time filters must be unique within a business domain and each filter can belong to a single source logic table. The computing logic is defined based on the fields of the source logic table model. A time filter may come from multiple logic tables that belong to different data domains. Therefore, a time filter may belong to multiple data domains as well.

Creating and Publishing a Time Filter

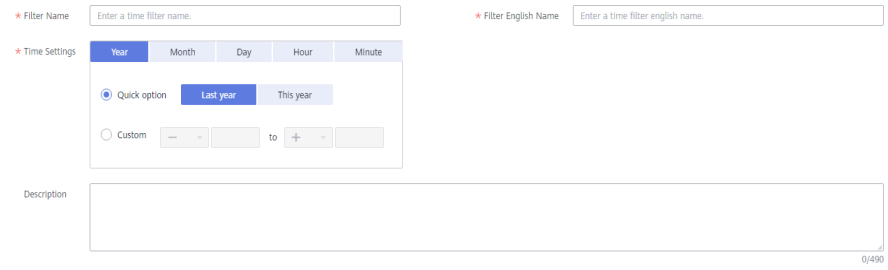
1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. (Optional) On the DataArts Architecture console, choose **Configuration Center** in the left navigation pane, click the **Functions** tab, and determine whether to enable **Time-Limited Generation Using Dynamic Expressions** (disabled by default).

Figure 8-130 Functions



3. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Time Filters** tab.
4. On the **Time Filters** tab page, click **Create**.
5. On the **Create Time Filter** page, set the parameters described in **Table 8-53** and click **Publish**.

Figure 8-131 Creating a time filter



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Table 8-53 Parameters for creating a time filter

Parameter	Description
*Filter Name	Newline characters and the following characters are not allowed: \ < > % " ' ;
*Filter English name	Only letters, digits, and underscores (_) are allowed.
*Time Settings	You can select **Year**, **Month**, **Day**, **Hour**, or **Minute**, and then select **Quick option** or **Custom** to set the time condition. If you select **Custom**, **+** and **-** form a time range, in which **+** indicates a later time and **-** indicates an earlier time. For example, if you want to set a time range from the past year to the next three years, set this parameter to **-1 to +3** or **+3 to -1**.
Description	A description of the time filter to create. Up to 490 characters are supported.

6. In the displayed dialog box, select a reviewer and click **OK** to submit an application.

   NOTE

   If you have been added as a reviewer, you can select **Auto-review** and click **OK**. After the request is approved, the status changes to **Published**.

   If you select multiple reviewers, the status changes to **Published** only after all reviewers have approved the publishing request. If any reviewer rejects the request, the status is **Rejected**.

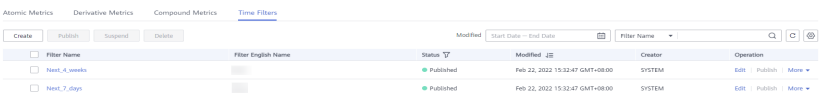
7. Wait for the reviewer to approve the application.

   After the application is approved, the time filter is created.

Managing a Time Filter

1. On the DataArts Architecture page, choose **Metrics** > **Technical Metrics** in the left navigation pane. On the displayed page, click the **Time Filters** tab.

   Figure 8-132 Time Filters tab page

2. Manage your time filters as required. Refer to the following table for details.

Operation	Helpful Link
Create	**Creating and Publishing a Time Filter**
Edit	**3**
Publish	**4**

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Operation	Helpful Link
View Publish History	5
Suspend	6
Delete	7

3. Edit a time filter.
   a. Click **Edit** to the right of the target time filter.
   b. On the page displayed, edit the time filter as required.
   c. Click **Save** to save the time filter information, or click **Publish** to publish the edited time filter.
4. Publish a time filter.
   a. Click **Publish** to the right of the target time filter.
   b. In the **Submit for Publication** dialog box displayed, select a reviewer from the drop-down list box.
   c. Click **OK**.
5. View the publish history.
   a. Select the target time filter in the list and choose **More** > **View History**.
   b. On the page displayed, you can view the publish history and version comparison information of the time filter.
6. Suspend a time filter.
   a. Select the target time filter in the list and choose **More** > **Suspend**.
   b. In the **Submit for Suspension** dialog box displayed, select a reviewer from the drop-down list box.
   c. Click **OK**.

   NOTE

   Time filters cannot be suspended or deleted if they are referenced by any derivative metrics.
7. Delete a time filter.
   a. Select the target time filter and click **Delete** above the list.
   b. In the dialog box displayed, confirm the information and click **Yes**.

8.8 Common Operations

8.8.1 Reversing a Database (ER Modeling)

You can import tables from databases of other data sources to a specific model.

Prerequisites

You have collected metadata from databases in DataArts Catalog so that the system can synchronize tables to DataArts Catalog later. Otherwise, the

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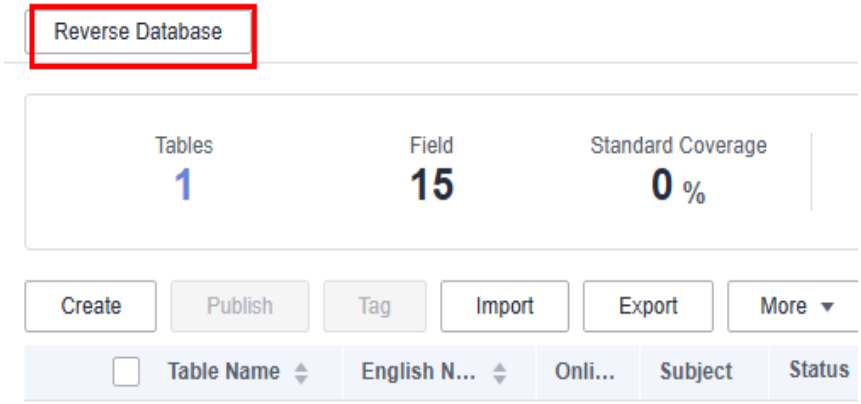
synchronization tasks may fail. See **Configuring a Metadata Collection Task** for details.

Importing a Table to a Model by Reversing the Database

Step 1 On the DataArts Architecture page, choose **Models** > **ER Modeling** in the left navigation pane.

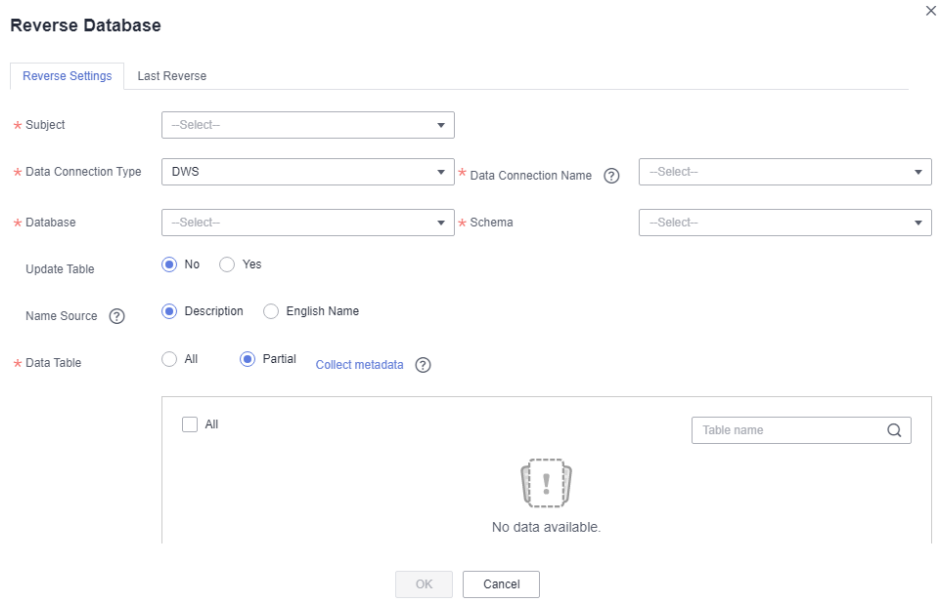
Step 2 In the middle of the page, select a physical model from the drop-down list box on the top. Alternatively, click a physical model on the **Data Warehouse Layer** page to go to the physical table list page. Click **Reverse Database**.

Figure 8-133 Reverse Database dialog box



Step 3 In the **Reverse Database** dialog box, set the parameters.

Figure 8-134 Setting parameters for reversing the database



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Table 8-54 Parameters for reversing a database

Parameter	Description
*Subject	Select a subject from the drop-down list box.
Data Connection Type	If you reverse tables to a logical model, select a required data connection type from the drop-down list box. If you reverse tables to a physical model, the data connection type of the current model is displayed.
Data Connection	The name of the data connection. Select the required data connection. If you want to reverse a database from other data sources to an ER model, you must create a data connection in Management Center to connect to the data source. For details on how to create data connections, see **Configuring DataArts Studio Data Connection Parameters**.
Database	The name of the database. Select a database from the drop-down list box.
Queue	This parameter is displayed only for DLI data connections. Select a DLI queue.
Schema	Select a value from the drop-down list box. This parameter is available only for DWS and PostgreSQL tables.
Update Table	Whether to update the existing table if the table to be imported already exists in the ER model. When a table is imported, the system checks whether the table exists according to the table code. During the import, only table creation and update are allowed. • **No**: If you select this option, the existing tables will not be updated. • **Yes**: If you select this option, the existing tables will be updated. If a table is in the **Published** state, you must publish the table again after updating it so that the updated table can take effect.
Name Source	Source of the table name or field name after the reverse. The value can be **Description** or **Name**. If no description is specified for a table or field, the name is used. • Description • Name **NOTE** If you select **Description**, field comments of a table must be unique.
Data Table	If you select **All**, all tables in the database are imported to the ER model. If you select **Partial**, not all tables in the database are imported to the ER model.
Start Page	This parameter is mandatory when **Data Table** is set to **All**.

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Step 4 Click **Yes** to start reversing the database.

----End

8.8.2 Reversing a Database (Dimensional Modeling)

You can import tables from databases of other data sources to a specific model.

Prerequisites

You have collected metadata from databases in DataArts Catalog so that the system can synchronize tables to DataArts Catalog later. Otherwise, the synchronization tasks may fail. See **Configuring a Metadata Collection Task** for details.

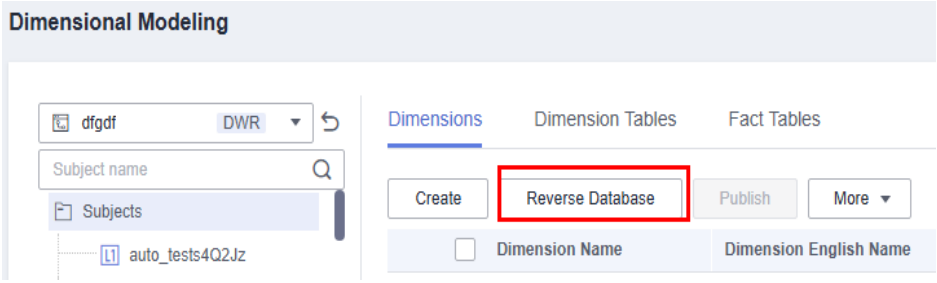
Importing a Table to a Model by Reversing the Database

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.

Step 2 On the DataArts Architecture page, choose **Models** > **Dimensional Modeling** in the left navigation pane.

Step 3 Click the dimension or table tab, select a dimension or table from the drop-down list, and click **Reverse Database** above the list.

Figure 8-135 Selecting an object



Step 4 In the **Reverse Database** dialog box, set the parameters.

Table 8-55 Parameters for reversing a database

Parameter	Description
Subject	Select a subject from the drop-down list box.
Data Connection Type	Type of the database to reverse.

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Parameter	Description
Data Connection	The name of the data connection. If you want to reverse a database from other data sources to an ER model, you must create a data connection in Management Center to connect to the data source. For details on how to create data connections, see **Configuring DataArts Studio Data Connection Parameters**.
Database	The name of the database. Select a database from the drop-down list box.
Queue	This parameter is displayed only for DLI data connections. Select a DLI queue.
Schema	DWS or POSTGRESQL mode. This parameter is displayed only for DWS and POSTGRESQL data connections.
Update Existing Table	The import operation can be used to create a table or update an existing table. It does not delete a table. • **No**: If you select this option, the existing tables will not be updated. • **Yes**: If you select this option, the existing tables will be updated. If a table is in the **Published** state, you must publish the table again after updating it so that the updated table can take effect.
Name Source	Source of the table name or field name after the reverse. The value can be **Description** or **Name**. If no description is specified for a table or field, the name is used. • Description • Name **NOTE** If you select **Description**, field comments of a table must be unique.
Data Table	If you select **All**, all tables in the database are imported. If you select **Partial**, not all tables in the database are imported.

Step 5 Click **Yes** to start reversing the database. After the operation is complete, you can view the result on the **Last Reverse** tab page or perform the reverse operation again.

----End

8.8.3 Importing/Exporting Data

DataArts Architecture allows you to import and export processes, subjects, lookup tables, data standards, ER modeling tables (physical tables), logical entities, dimensions and fact tables in dimensional modeling, business metrics, technical metrics, and summary tables in data mart. You cannot import or export time filters or data in the configuration center and review center.

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This section describes how to import and export an ER modeling table. The operations for importing and exporting other data are similar. For details about how to import and export other data, see **DataArts Architecture Data Migration**.

Constraints

- Before importing tables and logical entities in ER modeling, dimensions and fact tables in dimensional modeling, and summary tables in Data Mart, ensure that a data connection has been created in Management Center and is available.
- Time filters, and data in the Review Center and Configuration Center cannot be imported or exported. You must synchronize them manually before migrating other data.
- The maximum size of a file to be imported is 4 MB. A maximum of 3,000 metrics can be imported. A maximum of 500 tables can be exported at a time.

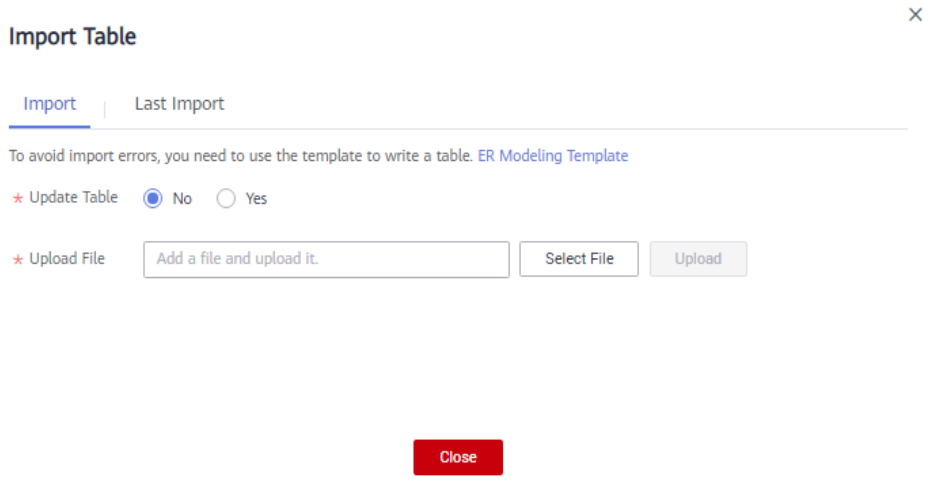
Importing a Table to a Logical Model

Step 1 On the DataArts Architecture page, choose **Logical Models** in the left navigation pane.

Step 2 On the displayed page, click the card of the target logical model, select an object in the subject directory, and choose **More** > **Import**.

Step 3 In the dialog box displayed, click **ER Modeling Template**.

Figure 8-136 Import Table dialog box



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Table 8-56 Parameters for importing a table

Parameter	Description
Update Table	Whether to update the existing table if the table to be imported already exists in the ER model. The system determines whether the table to import exists in the ER model based on the table code. The import operation can be used to create a table or update an existing table. It does not delete a table. The options are as follows: • **No**: If you select this option, the existing tables will not be updated. • **Yes**: If you select this option, the existing tables will be updated. If a table is in the **Published** state, you must publish the table again after updating it so that the updated table can take effect.
Upload File	Select the file to import. You can use either of the following methods to obtain the file to import: • **Downloading the ER modeling template and fill in the template** In the **Import Table** dialog box, click **ER Modeling Template** to download the template, fill in the template, and save the settings. • **Exporting tables to files** You can export the lookup tables created in DataArts Architecture of a DataArts Studio instance to an Excel file. Then, import the Excel file. See **Exporting a Table or DDL** for details.

Step 4 Open the downloaded template, set the parameters in the template, and save the template. The **Description** sheet in the template is for reference only.

Parameters whose names start with an asterisk (*) are mandatory, and other parameters are optional.

The table below describes the parameters in the **Tables** sheet.

Table 8-57 Parameters in the Tables sheet

Parameter	Description
Subject	Enter the encoding paths of existing subjects, which are separated by slashes (/). If no subject is available, create one by referring to **Designing Subjects**.
*Logical Entity Name	Table name. Newline characters and the following characters are not allowed: \ < > % " ' ;
*Table Name	Name of the table. Table codes cannot start with numbers. Only letters, numbers, and the following special characters are allowed: _${}

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Parameter	Description
Table Alias	Alias of a table. This parameter is displayed when you have enabled **Table Alias** on the **Configuration Center** page.
Table Tags	Tags to be added to the table. Enter an existing or a new tag. You can add a tag on the **Tags** page of DataArts Catalog and go back to this page to select the tag. For details on how to add a tag, see **Managing Asset Tags**.
*Table Description	A description of the table.
Owner	You can enter an owner name or select an existing owner in the current workspace of the DataArts Studio instance.
Parent Table	You can enter only the names of other tables in this template.
DWS DISTRIBUTE BY	This field is required only for DWS data connections. The HASH and REPLICATION modes are supported.
*Field Name	The name of a field in the table. Newline characters and the following characters are not allowed: \ < > % " ' ;
Field Code	The code of the field in the table. It must start with letters. Only letters, digits, and underscores (_) are allowed.
Code	Code of an attribute field in a table, which is automatically generated by the system
Field Alias	Alias of a field. This parameter is displayed when you have enabled **Field Alias** on the **Configuration Center** page.
Field Ordinal	Sequence number of the field in the table. The value starts from 1. This parameter is optional. If this parameter is left blank, fields are sorted in the sequence in the template by default.
Field Description	A description of the field.
*Field Data Type	Data type of the logical model. For details, see the DEFAULT group in **Field Types**.
Field Data Length	Data length. For a variable-length data type, specify the data length if a data connection type supports the data length. For example, for the DWS data connection type, if the field type is **CHAR(10)**, set **Field Data Type** to **CHAR** and **Field Data Length** to **10**.
Partition	The value **Y** indicates that the field is a partition field, and the value **N** indicates that the field is not a partition field.
Primary Key	The value **Y** indicates that the field is a primary key, and the value **N** indicates that the field is not a primary key.

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Parameter	Description
Not Null	The value **Y** indicates that the field is not empty, and the value **N** indicates that the field can be empty.
Associate Data Standard	The code of the data standard to be associated. If no data standard is available, create one. See **Creating Data Standards** for details.
Field Tags	Tags to add to the field. Enter an existing tag or a new tag. You can add a tag on the **Tags** page of DataArts Catalog and go back to this page to select the tag. For details on how to add a tag, see **Managing Asset Tags**.
configs	Enter the name and value of the custom item in **Advanced Settings**.

Step 5 The table below describes the parameters in the **Relations** sheet.

Table 8-58 Parameters in the Relations sheet

Parameter	Description
Relation Name	Name of the relation. It must start with letters. Only letters, digits, and the following special characters are allowed: ()-_
*Child Table	Name of the child table in the relationship
*Child Table Field	Name of a field in the child table in the relationship. The field must be a foreign key of the child table and mapped to the primary key of the parent table.
*Child to Parent	Mapping of a child table to a parent table. The following values are available: • **1**: Each piece of data in the child table corresponds to only one piece of data in the parent table. • **0,1**: Each piece of data in the child table corresponds to at most one piece of data in the parent table. • **0..n**: One piece of data in the child table corresponds to multiple pieces of data in the parent table. • **1..n**: Each piece of data in the child table corresponds to at least one piece of data in the parent table.

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Parameter	Description
*Parent to Child	Mapping of a parent table to a child table. The following values are available: • **1**: Each piece of data in the parent table corresponds to only one piece of data in the child table. • **0,1**: Each piece of data in the parent table corresponds to at most one piece of data in the child table. • **0..n**: One piece of data in the parent table corresponds to multiple pieces of data in the child table. • **1..n**: One piece of data in the parent table corresponds to at least one piece of data in the child table.
*Parent Table	Name of the parent table in the relationship
*Parent Table Field	Name of a field in the parent table in the relationship. The field must be a primary key of the parent table and mapped to the foreign key of the child table.
Role Name	Name of a custom role that identifies the relationship. It must start with letters. Only letters, digits, and the following special characters are allowed: ()-_

Step 6 Enter the names of the associated tables and fields in the **Associated Rules** sheet.

The table below describes the parameters in the **Associated Rules** sheet.

Table 8-59 Parameters in the Associated Rules sheet

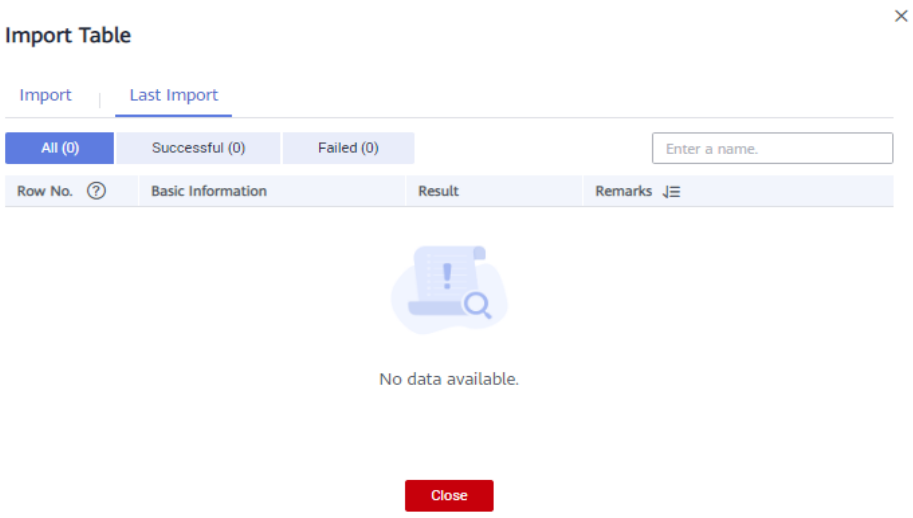
Parameter	Description
*Table Name	Name of the table. It cannot start with digits. Only letters, digits, and the following special characters are allowed: _${}
*Field Name	The code of the field in the table. It must start with letters. Only letters, digits, and underscores (_) are allowed.
Rule Name	Enter an existing rule name. In the upper left corner of the DataArts Studio console, select **DataArts Quality** from the drop-down list box. Then, you can view the existing rule names on the **Rule Templates** page.

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Parameter	Description
Alarm Triggering Condition	An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the alarm condition expression, alarm parameters are represented by variables such as *${1}*, *${2}*, and *${3}*. The variable name indicates the alarm parameter of the specified quality rule. The variable *$1* indicates the first alarm parameter, *$2* indicates the second alarm parameter, and so on. In the upper left corner of the DataArts Studio console, select **DataArts Quality** from the drop-down list box. Access the **Rule Templates** page and view the alarm parameters supported by the data quality rule in the **Result Description** column. Example: ${1} > 100
Expression	This parameter must be configured when **Rule Name** is set to **Expression** or **Validity Verification**.

Step 7 View the result on the **Last Import** tab page. If the import is successful, click **Close**. If the import fails, you can view the failure cause, correct the template file, and upload it again.

Figure 8-137 Last Import tab page



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NOTE

- If the standard code associated with the imported logical entity does not exist or is not published, the system displays an error and the code name. In this case, change the code and try again.
- If the data to be imported does not exist, an error message in the format of *Table name*:*Field name* is displayed in the **Remarks** column on the **Last Import** tab page.

----End

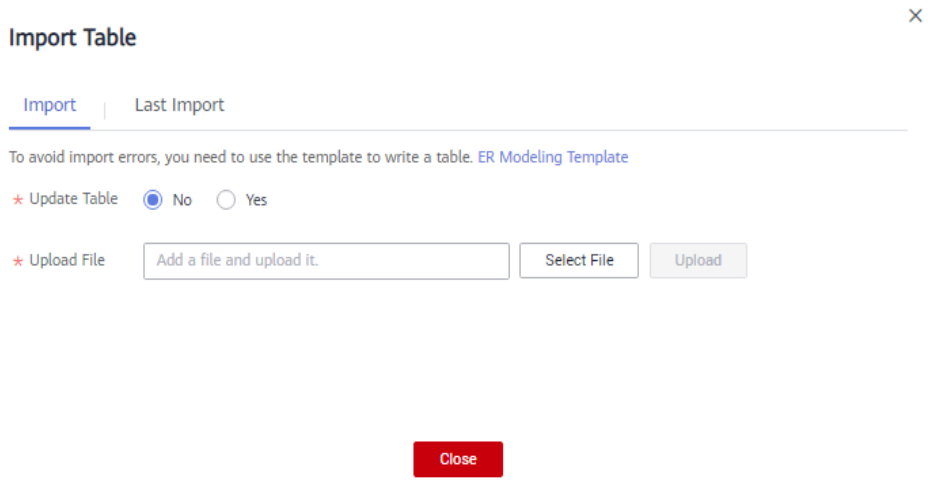
Importing a Table to a Physical Model

Step 1 On the DataArts Architecture page, choose **Models** > **ER Modeling** in the left navigation pane.

Step 2 In the middle of the page, find the required physical model from the drop-down list box on the top, or click a physical model in data warehouse planning to access the physical model page. Select an object in the subject directory and click **Import**.

Step 3 In the dialog box displayed, click **ER Modeling Template**.

Figure 8-138 Import Table dialog box



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Table 8-60 Parameters for importing a table

Parameter	Description
Update Table	Whether to update the existing table if the table to be imported already exists in the ER model. The system determines whether the table to import exists in the ER model based on the table code. The import operation can be used to create a table or update an existing table. It does not delete a table. The options are as follows: • **No**: If you select this option, the existing tables will not be updated. • **Yes**: If you select this option, the existing tables will be updated. If a table is in the **Published** state, you must publish the table again after updating it so that the updated table can take effect.
Upload File	Select the file to import. You can use either of the following methods to obtain the file to import: • **Downloading the ER modeling template and fill in the template** In the **Import Table** dialog box, click **ER Modeling Template** to download the template, fill in the template, and save the settings. • **Exporting tables to files** You can export the lookup tables created in DataArts Architecture of a DataArts Studio instance to an Excel file. Then, import the Excel file. See **Exporting a Table or DDL** for details.

Step 4 Open the downloaded template, set the parameters in the template, and save the template. The **Description** sheet in the template is for reference only.

Parameters whose names start with an asterisk (*) are mandatory, and other parameters are optional.

The table below describes the parameters in the **Tables** sheet.

Table 8-61 Parameters in the Tables sheet

Parameter	Description (Importing DLI/ POSTGRESQL/DWS/MRS Hive Tables)
Subject	Enter the encoding paths of existing subjects, which are separated by slashes (/). If no subject is available, create one. For details, see **Designing Subjects**.
*Logical Entity Name	Table name. Newline characters and the following characters are not allowed: \ < > % " ' ;
*Table Name	Name of the table. Table codes cannot start with numbers. Only letters, numbers, and the following special characters are allowed: _${}

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Parameter	Description (Importing DLI/ POSTGRESQL/DWS/MRS Hive Tables)
Table Alias	Alias of a table. This parameter is displayed when you have enabled **Table Alias** on the **Configuration Center** page.
Table Tags	Tags to be added to the table. Enter an existing or a new tag. You can add a tag on the **Tags** page of DataArts Catalog and go back to this page to select the tag. For details on how to add a tag, see **Managing Asset Tags**.
*Table Description	A description of the table.
Asset Owner	Enter the username for entering the current workspace. Only the workspace admin, developer, or O&M personnel can be set as the designer.
Data Connection Type	The following connection types are supported: DWS, DLI, POSTGRESQL, and MRS Hive.
*Table Type	DLI models support the following table types: • **DLI_MANAGED**: Data is stored in a DLI table. • **DLI_EXTERNAL**: Data is stored in an OBS table. When **Table Type** is set to **DLI_EXTERNAL**, you must set **OBS Path**. • **DLI_VIEW** is available for import only. DWS models support the following table types: • DWS_ROW: row type • DWS_COLUMN: column type • DWS_VIEW: view type This parameter is unavailable for the tables created in MRS Hive models.
OBS Path	Enter an OBS path for storing the source data associated with the table if **Table Type** is set to **DLI_EXTERNAL**. The OBS path format is ***bucket_name/filepath***.
Data Format	This parameter is available only for tables created in DLI models. If the table type is **DLI_MANAGED**, the options of the data format are **Parquet** and **Carbon**. If the table type is **DLI_EXTERNAL**, the options of the data format are **Parquet**, **Carbon**, **CSV**, **ORC**, **JSON**, and **Avro**.
Data Connection	Enter the name of a created data connection.
Database	Enter the name of a created database.

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Parameter	Description (Importing DLI/ POSTGRESQL/DWS/MRS Hive Tables)
Connection Extra	If **Data Connection Type** is **DLI**, enter a DLI queue name. If **Data Connection Type** is **DWS** or **POSTGRESQL**, enter a schema name.
DWS DISTRIBUTE BY	This field is required only for DWS data connections. The HASH (attribute name) and REPLICATION modes are supported.
HUDI PreCombineField	Version field. This field is mandatory only for the Hudi table.
*Field Name	The name of a field in the table. Newline characters and the following characters are not allowed: \ < > % " ' ;
*Field Code	The code of the field in the table. It must start with letters. Only letters, digits, and underscores (_) are allowed.
Field Alias	Alias of a field. This parameter is displayed when you have enabled **Field Alias** on the **Configuration Center** page.
Field Ordinal	Sequence number of the field in the table. The value starts from 1. This parameter is optional. If this parameter is left blank, fields are sorted in the sequence in the template by default.
Field Description	A description of the field.
*Field Data Type	The supported data types vary depending on the data connection types. For details, see **Field Types**.
Field Data Length	For a variable-length data type, specify the data length if a data connection type supports the data length. For example, for the DWS data connection type, if the field type is **CHAR(10)**, set **Field Data Type** to **CHAR** and **Field Data Length** to **10**.
Partition	The value **Y** indicates that the field is a partition field, and the value **N** indicates that the field is not a partition field.
Primary Key	The value **Y** indicates that the field is a primary key, and the value **N** indicates that the field is not a primary key.
Not Null	The value **Y** indicates that the field is not empty, and the value **N** indicates that the field can be empty.

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Parameter	Description (Importing DLI/ POSTGRESQL/DWS/MRS Hive Tables)
Associate Data Standard	The code of the data standard to be associated. This field can be left blank. If no data standard is available, create one. For details, see **Creating Data Standards**.
Field Tags	Tags to add to the field. Enter an existing tag or a new tag. You can add a tag on the **Tags** page of DataArts Catalog and go back to this page to select the tag. For details on how to add a tag, see **Managing Asset Tags**.

configs	Additional table configuration details stored in JSON format. The format is as follows:
	{
	"option_name1": "value",
	"option_name2": "value"
	.....
	}
	Example:
	{
	"a1": "100",
	"a2": "30"
	}

Version	This parameter is optional.
configs	Enter the name and value of the custom item in **Advanced Settings**.

Step 5 The table below describes the parameters in the **Relations** sheet.

Table 8-62 Parameters in the Relations sheet

Parameter	Description
Relation Name	Name of the relation. It must start with letters. Only letters, digits, and the following special characters are allowed: ()-_
*Child Table	Name of the child table in the relationship
Child Table Database	Name of the database to which the child table in the relationship belongs.
*Child Table Field	Name of a field in the child table in the relationship. The field must be a foreign key of the child table and mapped to the primary key of the parent table.

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Parameter	Description
*Child to Parent	Mapping of a child table to a parent table. The following values are available: • **1**: Each piece of data in the child table corresponds to only one piece of data in the parent table. • **0,1**: Each piece of data in the child table corresponds to at most one piece of data in the parent table. • **0..n**: One piece of data in the child table corresponds to multiple pieces of data in the parent table. • **1..n**: Each piece of data in the child table corresponds to at least one piece of data in the parent table.
*Parent to Child	Mapping of a parent table to a child table. The following values are available: • **1**: Each piece of data in the parent table corresponds to only one piece of data in the child table. • **0,1**: Each piece of data in the parent table corresponds to at most one piece of data in the child table. • **0..n**: One piece of data in the parent table corresponds to multiple pieces of data in the child table. • **1..n**: One piece of data in the parent table corresponds to at least one piece of data in the child table.
*Parent Table	Name of the parent table in the relationship
Parent Table Database	Name of the database to which the parent table in the relationship belongs.
*Parent Table Field	Name of a field in the parent table in the relationship. The field must be a primary key of the parent table and mapped to the foreign key of the child table.
Role Name	Name of a custom role that identifies the relationship. It must start with letters. Only letters, digits, and the following special characters are allowed: ()-_

Step 6 Enter the names of the associated tables and fields in the **Associated Rules** sheet.

The table below describes the parameters in the **Associated Rules** sheet.

Table 8-63 Parameters in the Associated Rules sheet

Parameter	Description
*Table Name	Name of the table. It cannot start with digits. Only letters, digits, and the following special characters are allowed: _${}
*Field Name	The code of the field in the table. It must start with letters. Only letters, digits, and underscores (_) are allowed.

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Parameter	Description
Rule Name	Enter an existing rule name. In the upper left corner of the DataArts Studio console, select **DataArts Quality** from the drop-down list box. Then, you can view the existing rule names on the **Rule Templates** page.
Alarm Triggering Condition	An alarm condition expression consists of alarm parameters and logical operators. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered. In the alarm condition expression, alarm parameters are represented by variables such as *${1}*, *${2}*, and *${3}*. The variable name indicates the alarm parameter of the specified quality rule. The variable *$1* indicates the first alarm parameter, *$2* indicates the second alarm parameter, and so on. In the upper left corner of the DataArts Studio console, select **DataArts Quality** from the drop-down list box. Access the **Rule Templates** page and view the alarm parameters supported by the data quality rule in the **Result Description** column. Example: ${1} > 100
Expression	This parameter must be configured when **Rule Name** is set to **Expression** or **Validity Verification**.

Step 7 View the import result on the **Last Import** tab page. If the import is successful, click **Close**. If the import fails, you can view the failure cause, correct the template file, and upload it again.

NOTE

- If the standard code associated with the imported relational model does not exist or is not published, the system displays an error and the code name. In this case, change the code and try again.
- If the data to be imported does not exist, an error message in the format of *Table name*:*Field name* is displayed in the **Remarks** column on the **Last Import** tab page.

----End

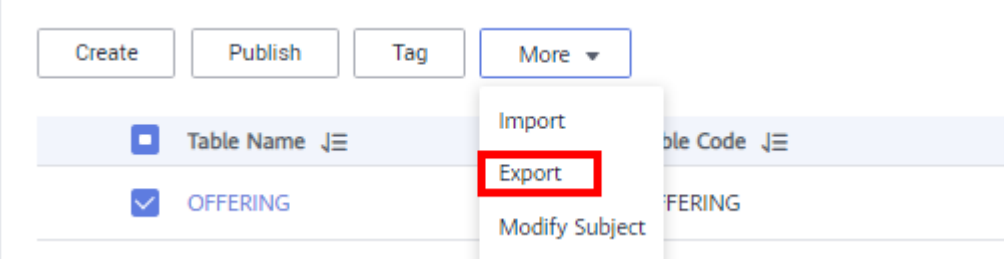
Exporting a Table or DDL

Step 1 On the DataArts Architecture page, choose **Logical Models** in the left navigation pane.

Step 2 On the displayed page, click the card of the target logical model, select an object in the subject directory, and choose **More** > **Import**.

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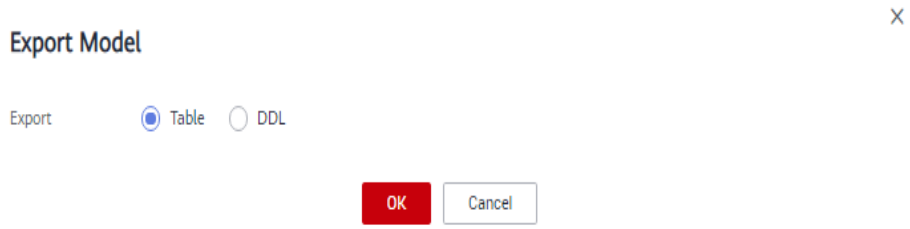
Figure 8-139 Exporting a table or DDL



Step 3 In the dialog box displayed, select the objects to export.

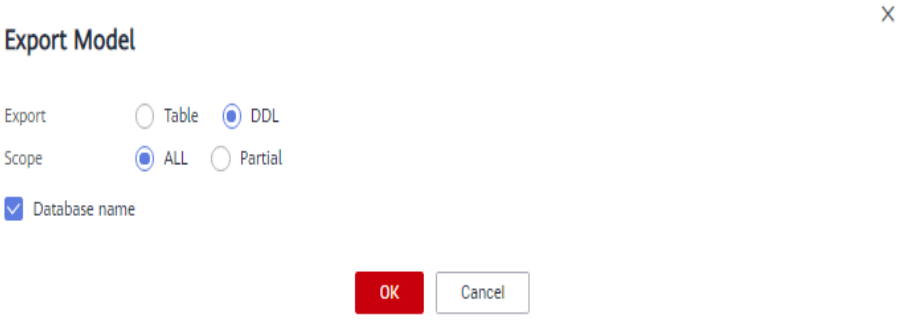
The exported Excel file can be imported.

Figure 8-140 Exporting a table



When a DDL is exported, the DDL statements of the selected table are exported to TXT files.

Figure 8-141 Exporting a DDL



Step 4 Click **OK**.

----End

Importing/Exporting Dimensions

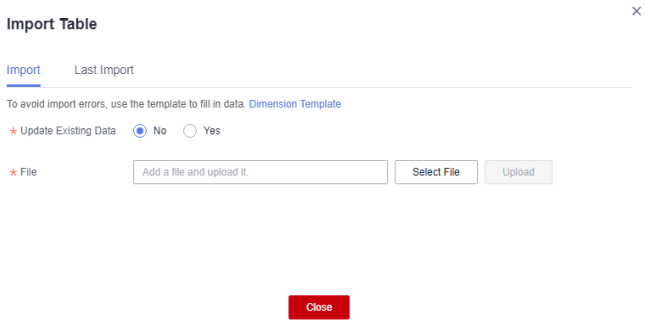
- **Importing dimensions**

  You can import dimensions to the system quickly.

  a. Above the dimension list, choose **More** > **Import**.

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Figure 8-142 Import Table dialog box



b. Download the dimension template, and edit and save it.

c. Choose whether to update existing data.

NOTE

If a code in the template already exists in the system, the data is considered duplicate.

- **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
- **Yes**: If the data to be imported already exists in the system:
  - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.
  - If the existing data in the system is in published state, expanded data will be generated.

d. Click **Select File** and select the edited template to import.

e. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.

f. Click **Close**.

NOTE

If the standard code associated with the imported dimension does not exist or is not published, the system displays an error and the code name. In this case, change the code and try again.

- **Exporting dimensions**

  You can export dimensions to a local file.

  Above the dimension list, choose **More** > **Export**.

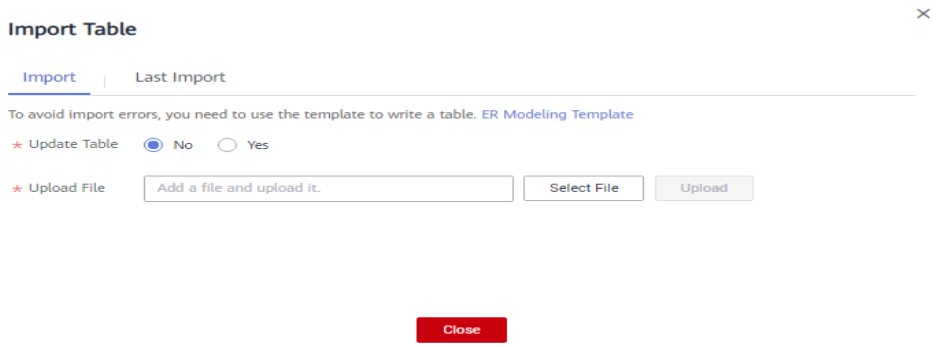
Importing/Exporting Fact Tables

- **Importing fact tables**

  You can import fact tables to the system quickly.

  a. Above the fact table list, choose **More** > **Import**.

Figure 8-143 Import Table dialog box



b. Download the fact table template, and edit and save it.

c. Choose whether to update existing data.

NOTE

If a code in the template already exists in the system, the data is considered duplicate.

- **No**: If the data to be imported already exists in the system, the existing data in the system will not be replaced.
- **Yes**: If the data to be imported already exists in the system:
  - If the existing data in the system is in draft state, the data will be replaced and new draft data will be generated.
  - If the existing data in the system is in published state, expanded data will be generated.

d. Click **Select File** and select the edited template to import.

e. Click **Upload**. When the template is uploaded, the **Last Import** page is displayed. You can view the imported data.

f. Click **Close**.

NOTE

If the standard code associated with the imported fact table does not exist or is not published, the system displays an error and the code name. In this case, change the code and try again.

- **Exporting fact tables**

  You can export fact tables to a local file.

  Above the fact table list, choose **More** > **Export**.

8.8.4 Associating Quality Rules

After creating and publishing a table, you can associate quality rules with the table. If **Create Data Quality Jobs** is selected for **Model Design Process** on the **Function Settings** tab page of **Configuration Center**, a quality job is automatically created in DataArts Quality after a quality rule is associated and the table is published. If the table has been published, the system automatically updates the corresponding quality job.

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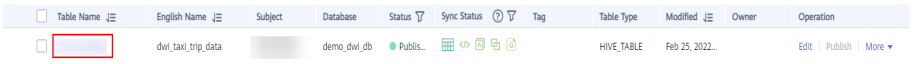
Associating a Quality Rule and Viewing a Quality Job

Step 1 On the DataArts Architecture page, choose **Models** > **ER Modeling** in the left navigation pane.

Step 2 On the page displayed, select the target model. All tables created in the model are listed on the right. You can also expand a topic structure and select an object. All tables of the object are listed on the right.

Step 3 In the table list, select a table and click its name to access the table details page.

Figure 8-144 ER model list



Step 4 In the **Table Field** area, select a field that you want to associate a quality rule with and click **Associate Rule**.

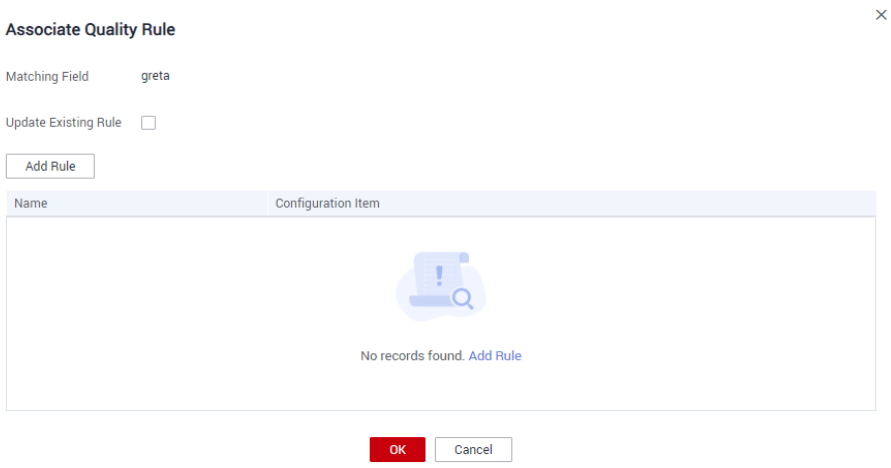
Figure 8-145 Associating Quality Rules



Anomaly Data Output Settings: If you select **Generate Anomaly Data**, the anomaly data is stored in the specified database based on the settings.

Step 5 In the dialog box displayed, click **Add Rule**.

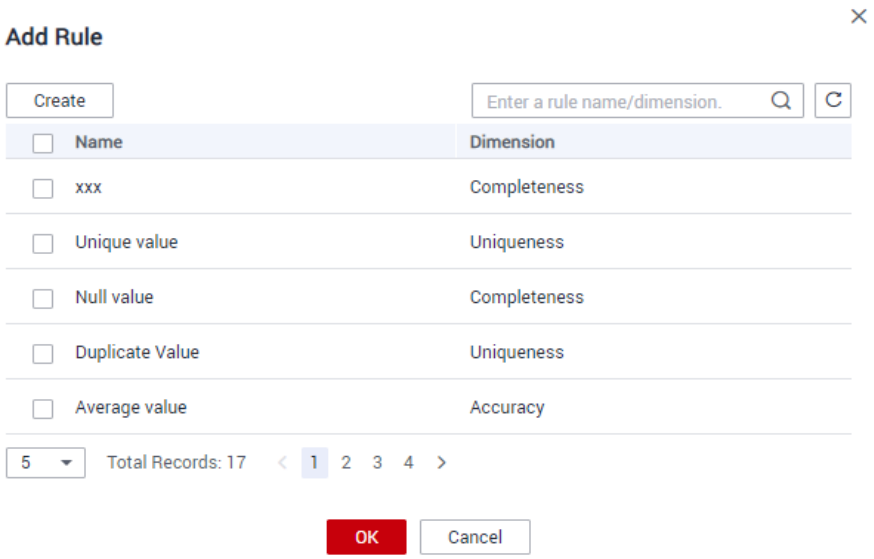
Figure 8-146 Adding a quality rule



The **Add Rule** dialog box lists all default quality rules supported by DataArts Quality. Select a rule and click **OK**. If these quality rules cannot meet your requirements, you can customize one. In the **Add Rule** dialog box, click **Create** to navigate to DataArts Quality and create a rule on the page displayed. See **Creating a Data Quality Rule**.

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Figure 8-147 Add Rule dialog box



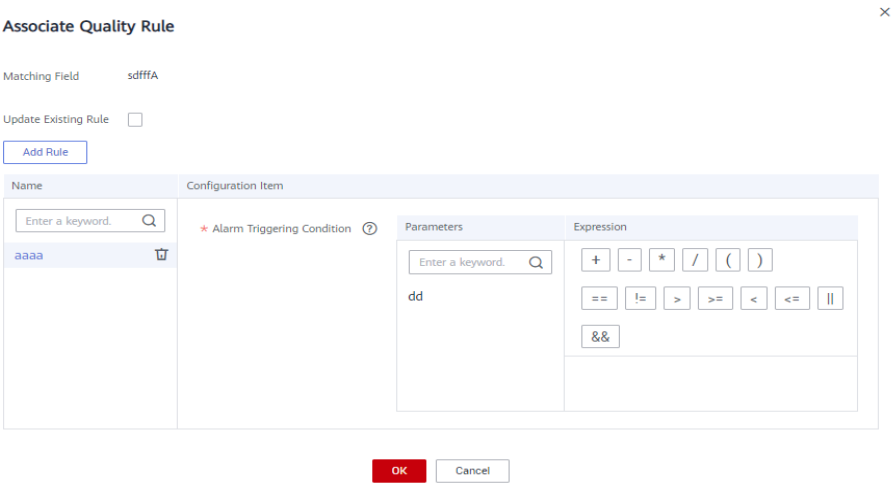
After a rule is added, the **Associate Quality Rule** dialog box is displayed. Select a rule from the rule name list, set **Alarm Condition**, and click **OK**.

- In the **Alarm Condition** text box, enter an expression. When a quality job is running, the system calculates the result of the alarm condition expression and determines whether to trigger the alarm based on the result of the expression. If the expression result is **true**, the alarm will be triggered. Otherwise, no quality alarm will be triggered.
- An alarm condition expression consists of alarm parameters and logical operators.

  The alarm parameters of each rule are displayed as buttons. If you click these buttons, the alarm conditions are expressed in the sequence of alarm parameters, such as *${1}*, *${2}*, and *${3}*. The variable names indicate the alarm parameters. In other words, when setting **Alarm Condition**, use the variable *${1}* to represent the first alarm parameter, *${2}* to represent the second alarm parameter, and so on.

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Figure 8-148 Setting an alarm triggering condition



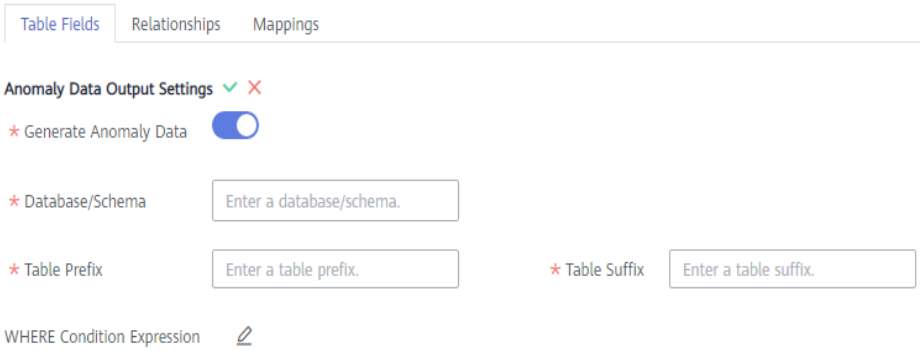
Step 6 (Optional) If you want to store anomaly data that does not comply with the preset rules in the exception table, enable **Anomaly Data Output Settings**.

Figure 8-149 Enabling Anomaly Data Output Settings



Click the pen icon next to **Anomaly Data Output Settings** and enable **Generate Anomaly Data**. The anomaly data will be stored in the specified database based on the settings.

Figure 8-150 Anomaly Data Output Settings



The parameters are as follows:

- **Database/Schema**: database or schema that stores anomaly data
- **Table Prefix**: prefix of the table that stores anomaly data
- **Table Suffix**: suffix of the table that stores anomaly data

Click ✓ to save the settings.

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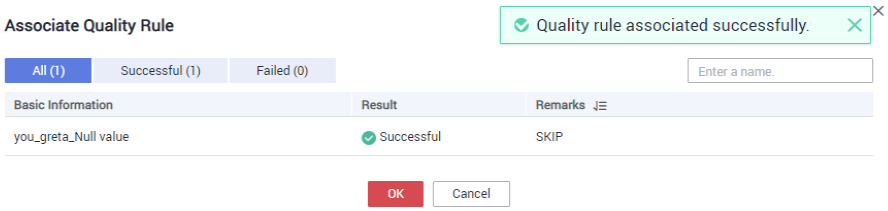
Step 7 (Optional) By default, the quality rule applies to the entire table. If you want to query data in specified partitions, set the where condition.

Figure 8-151 Where condition



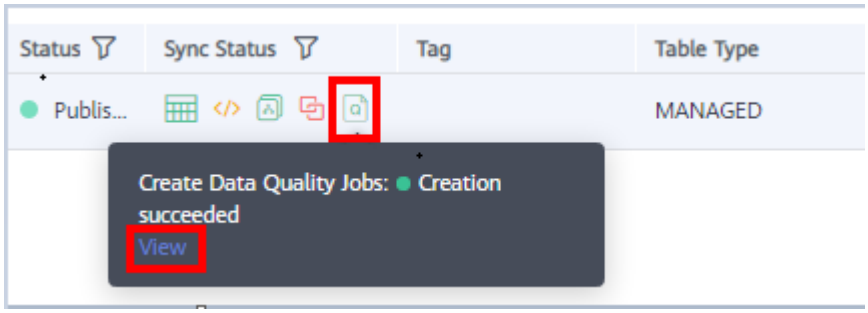
Step 8 View the association result. If the association is successful, click **OK**. If the association fails, find the failure cause, correct it, and associate the quality rule again.

Figure 8-152 Association results



Step 9 Go back to the ER model list, locate the table that you just associated with a quality rule. In the **Sync Status** column, move your pointer to  and click **View**.

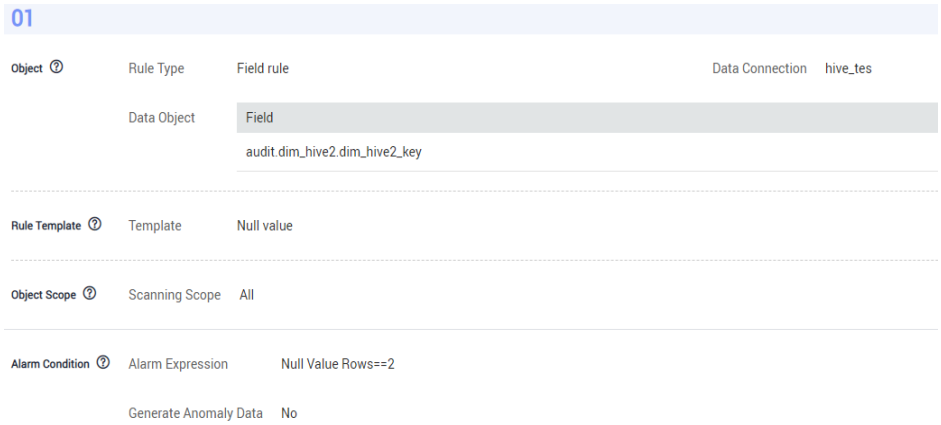
Figure 8-153 Quality job sync status



Step 10 On the page displayed, click the **Rule Configurations** tab to view the rule you just added.

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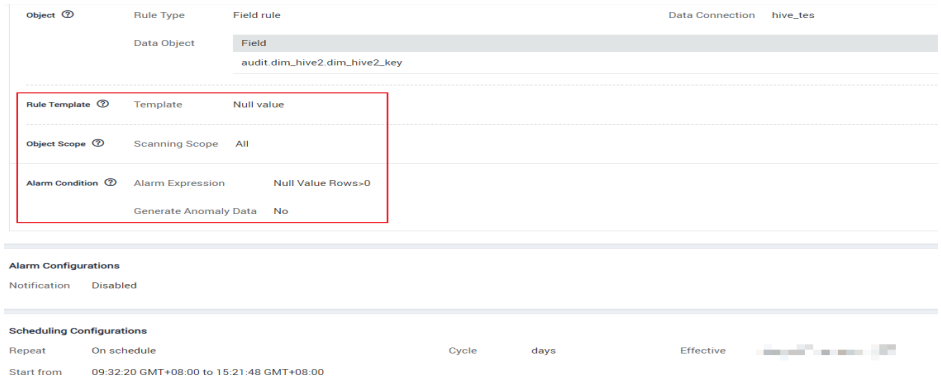
Figure 8-154 Quality rules



If a table is associated with a data standard when it is created, the corresponding quality rule is generated after the table is published. You can also view the rule on the **Quality Jobs** page.

The following provides an example of the quality rule generated based on the data standard associated with a field:

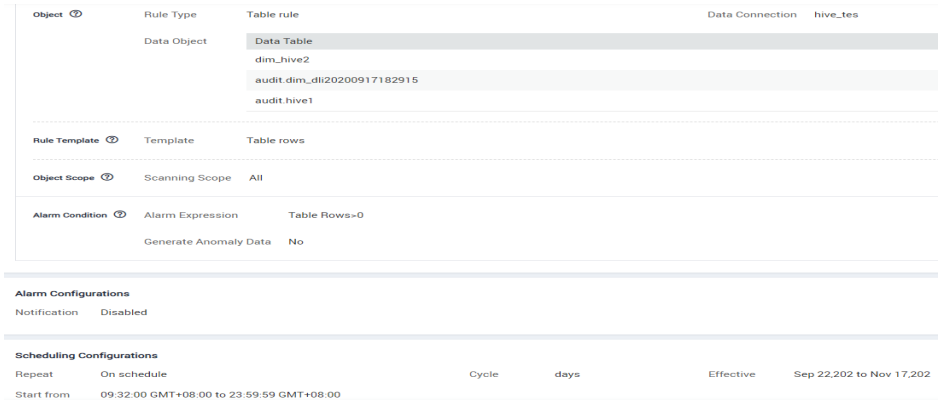
Figure 8-155 Quality rule associated with a field



The following provides an example of the quality rule generated based on the data standard associated with a lookup table:

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Figure 8-156 Quality rules for data standards



----End

8.8.5 Viewing Tables

Tables in ER modeling can be displayed in the model view or list view. You can view table details, relationship diagrams, and publish history, as well as preview SQL statements.

Querying the Model View

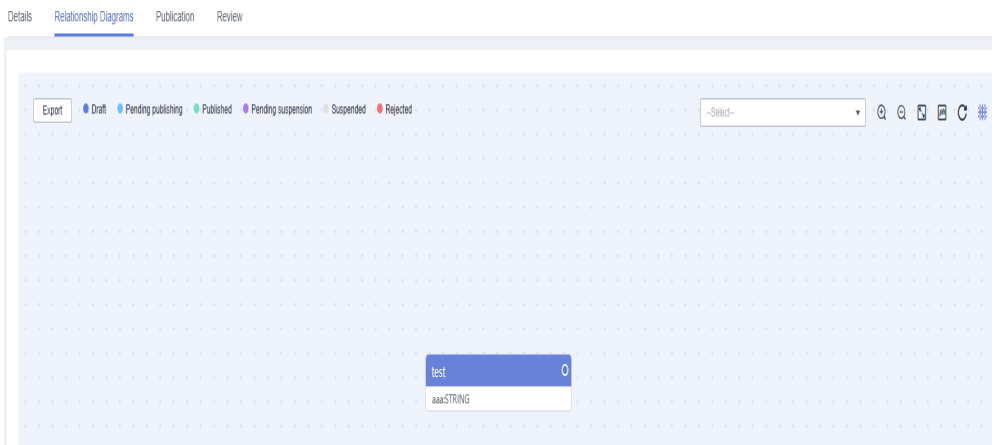
After creating a table in an ER model, you can query the table models in the list view or model view. The created tables are displayed in the list view by default. You can switch to the model view if you like.

Step 1 On the DataArts Architecture page, choose **Models** > **ER Modeling** in the left navigation pane.

Step 2 In the middle of the page, find the required physical model from the drop-down list box on the top, or click a physical model in data warehouse planning to access the physical model page. Select an object in the subject directory.

Step 3 Click the table name and click the **Relationship Diagrams** tab to view the model view.

Figure 8-157 Model view



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The following functions are supported in the model view:

- Double-click a table name to view the table details.
- Click **Export** in the upper left corner to export the model view as an image.
- Enter a table name in the search box in the upper right corner to quickly find the table you want to view.
-  represents zoom in, zoom out, full screen, switch between physical and logical models, refresh, and canvas display, respectively.

----End

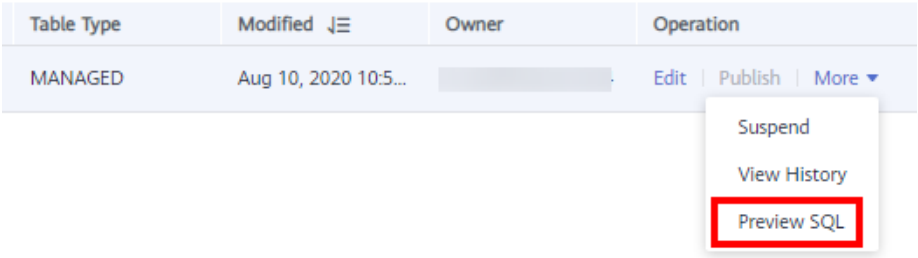
Viewing Table Details and Previewing an SQL Statement

Step 1 On the DataArts Architecture page, choose **Models** > **ER Modeling** in the left navigation pane.

Step 2 In the middle of the page, find the required physical model from the drop-down list box on the top, or click a physical model in data warehouse planning to access the physical model page. Select an object in the subject directory. All tables in the subject are displayed in the list on the right.

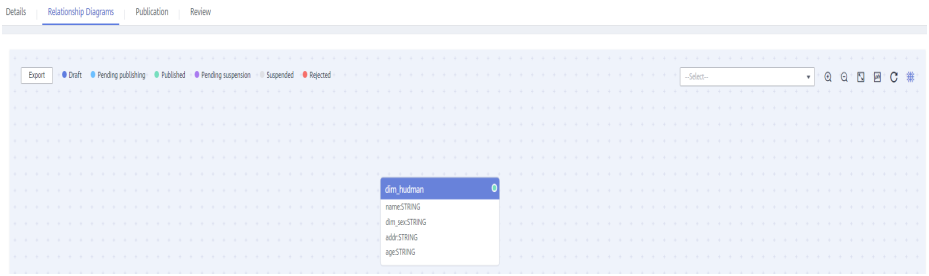
Step 3 In the table list, select a table, and choose **More** > **Preview SQL** in the **Operation** column to preview or copy the SQL statement. Then, click **OK** to return to the previous page.

Figure 8-158 ER model list



Step 4 In the table list, click a table name to access the table details page and view the table details, relationship diagrams, publish history, and review history.

Figure 8-159 Relationship diagrams



----End

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Viewing Publish History

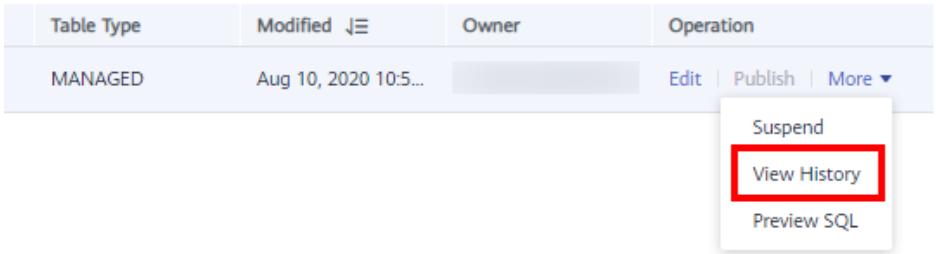
After a table is published, you can view its publish history, version comparisons, and publish logs. If a table fails to be published, or a data asset or data quality job fails to be synchronized, you can view the publish log to troubleshoot the fault and publish or synchronize it again.

Step 1 On the DataArts Architecture page, choose **Models** > **ER Modeling** in the left navigation pane.

Step 2 In the middle of the page, find the required physical model from the drop-down list box on the top, or click a physical model in data warehouse planning to access the physical model page. Select an object in the subject directory. All tables in the subject are displayed in the list on the right.

Step 3 In the table list, locate the target table, and choose **More** > **View History**. On the page displayed, you can view the table publish history, version comparisons, and publish logs.

Figure 8-160 Viewing publish history



----End

8.8.6 Modifying Subjects, Directories, and Processes

Modifying Subjects in Batches

Currently, only subjects of information architectures, ER models, logical models, dimensions, fact tables, summary tables, and technical metrics can be modified in batches. The modification procedure is similar.

This section describes how to modify the subject of information architecture in batches.

Step 1 On the DataArts Architecture page, choose **Information Architecture** in the left navigation pane.

Step 2 On the page displayed, select the targets whose subjects need to be modified, and choose **More** > **Modify Subject**. After the configuration is complete, click **OK**.

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Figure 8-161 Modifying subjects



----End

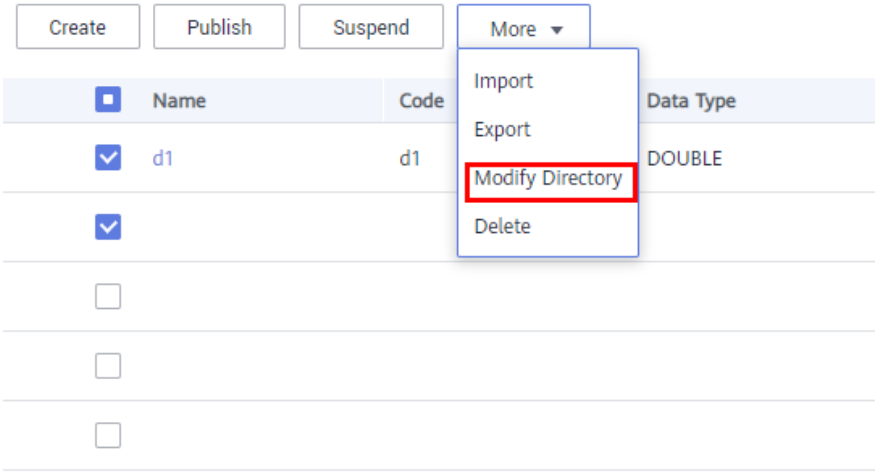
Modifying Directories in Batches

Currently, only directories of lookup tables and data standards can be modified in batches.

Step 1 On the DataArts Architecture page, choose **Standards** > **Lookup Tables** or **Standards** > **Data Standards** in the left navigation pane.

Step 2 On the page displayed, select the targets whose directories need to be modified, and choose **More** > **Modify Directory**.

Figure 8-162 Modifying directories of lookup tables in batches



----End

Modifying Processes in Batches

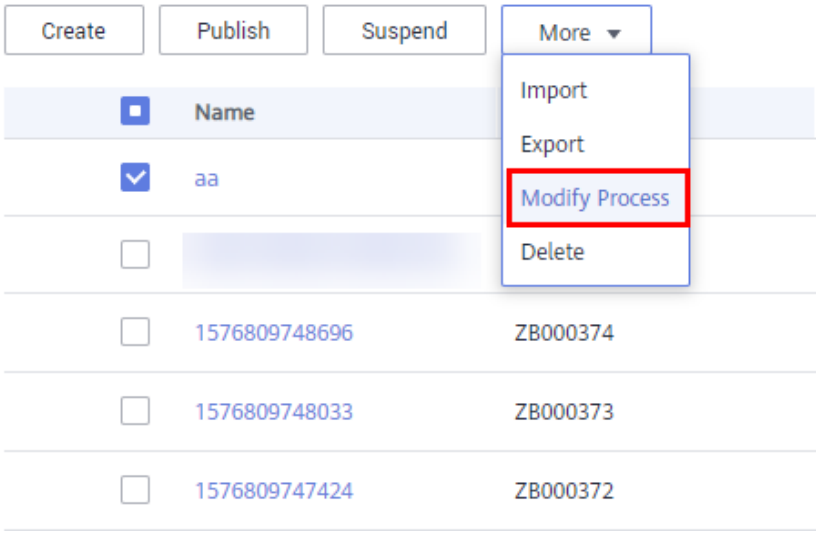
Currently, only the processes of business metrics can be modified in batches.

Step 1 On the DataArts Architecture page, choose **Metrics** > **Business Metrics** in the left navigation pane.

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Step 2 On the page displayed, select the metrics whose processes need to be modified, and choose **More** > **Modify Process**.

Figure 8-163 Modifying processes



----End

8.8.7 Managing the Configuration Center

Constraints

The quotas for different custom objects are as follows:

- Custom subjects: 10
- Custom tables: 30
- Custom attributes: 10
- Custom business metrics: 50

Subject Processes

You can customize the subject levels and attributes in the subject design. By default, there are three levels in the system, which are named Subject Area Group (L1), Subject Area (L2), and Business Object (L3) from top to bottom. You can define a maximum of seven levels and a minimum of two levels. You can configure a maximum of 10 custom attributes.

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. In the navigation pane, choose **Configuration Center**. On the displayed page, click the **Subject Processes** tab.
3. In the **Subject Level** area, you can add, delete, and edit subject levels.
   - Click + in the **Operation** column to add a custom subject level and click **Update**.

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- Click in the **Operation** column to delete a subject level and click **Update**.
- Except the business object at the last level, you can click the names of other levels to edit them.

4. In the **Custom Field** area, you can create, delete, and edit fields.
   - Click **Create** next to **Custom Field** to create a custom attribute. You can enter multiple optional values for a custom attribute at a time. Each optional value must be unique.
   - Click in the **Operation** column to delete a custom attribute.
   - Edit **Field (Local)**, **Field (Eng)**, **Optional Value**, **Mandatory**, and **Description**.
5. Set **Process Levels**. Enter a value from 3 to 7.

Standard Templates

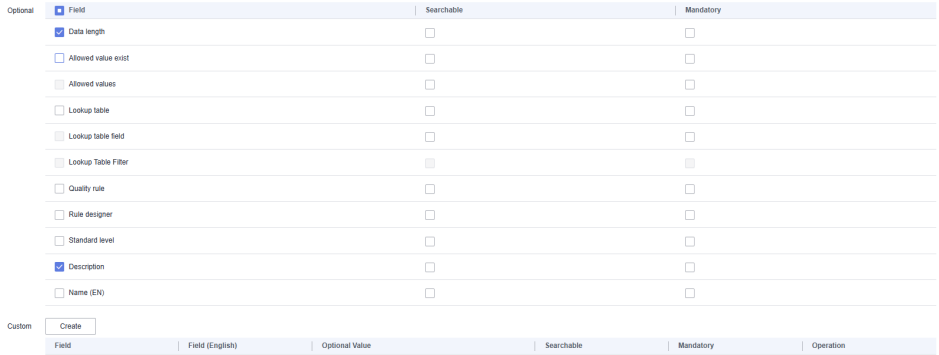
You can customize the default options of data standards. When you access the **Standard Templates** page for the first time, the page for creating a data standard template is also displayed.

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. In the navigation pane, choose **Configuration Center**. On the displayed page, click the **Standard Templates** tab.
3. In the **Optional** area, select the parameters as required. Click **Create** next to **Custom** to add custom properties. After the configuration is complete, click **Update**.

   NOTE

   - A standard template contains the following custom fields: **Searchable**, **Mandatory**, and **Optional Value**.
   - After saving the template, you must set values for the options selected in the template when creating a data standard.
   - When you access the **Standard Templates** page for the first time, **Data length** and **Description** are selected by default. You can select other options as needed.
   - When adding a customized item, you can add both Chinese and English items.

Figure 8-164 Standard Templates tab page

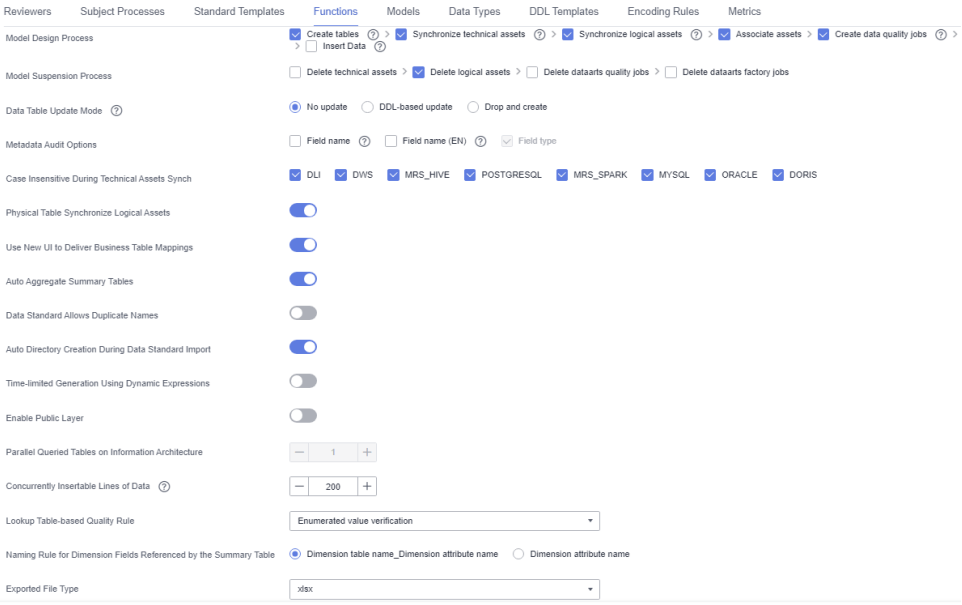


Functions

You customize functions for DataArts Architecture.

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. In the navigation pane, choose **Configuration Center**. On the displayed page, click the **Functions** tab.
3. On the page displayed, set the parameters and click **OK**. Click **Reset** to restore the default settings.

Figure 8-165 Functions



   - **Model Design Process**: The selected processes are automatically executed progressively when a table created in an ER or dimension model is published and suspended. You are advised to select all the options.
     - **Create tables**: After a table publishing application is approved in DataArts Architecture, the system creates a physical table in the corresponding data source. When a table is deleted, the system deletes the corresponding physical table.
     - **Synchronize technical assets**: After a table in **ER Modeling** or **Dimensional Modeling** is published, the table is synchronized to the DataArts Catalog module as a technical asset, and the tag is synchronized to the corresponding technical asset.

       NOTE

       To enable **Synchronize Technical Assets**, you must create a data asset collection task for the database to which the table belongs in DataArts Catalog. Otherwise, the technical asset synchronization will fail.
     - **Synchronize logical assets**: The system synchronizes logical models to DataArts Catalog as logical assets. After that, the system tags the logical assets accordingly.

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  - **Associate assets**: Associate logical assets with technical assets. After the logical assets and technical assets are synchronized, you can view the associated technical or logical asset when viewing the details of a logical or technical asset on the DataArts Catalog page. This function requires that the table information contains the data source information.
  - **Create data quality jobs**: After a table in **ER Modeling** or **Dimensional Modeling** is published and approved, the system automatically creates a quality job in the DataArts Quality module of DataArts Studio for a table that is associated with a data standard (including the data length or allowed value) or associated with a quality rule.
  - **Create data development jobs**: After a summary table is published, the system generates an E2E data development job.
  - **Publish DataArts DataService APIs**: After a summary table is published, a DataArts DataService API is automatically generated. This function takes effect only DataArts DataService supports data connections of the summary table.
  - **Insert data**: After a lookup table is published, values in the table are automatically written to the dimensional table.
- **Model Suspension Process**: Select whether to delete technical assets, logical assets, data quality jobs, and data development jobs when suspending the job.
- **Data Table Update Mode**: If a table in DataArts Architecture is modified after being published, you can choose whether to update the table in the database and how to update the table. By default, the table is not updated. However, you can set the update operation in the configuration center as required. To be more specific, configure the corresponding update statements in the DDL templates.
  - **No update**: The system does not update tables in a database.
  - **DDL-based update**: The system updates tables in the database based on the DDL update template configured in **DDL Templates**. The underlying data warehouse engine determines whether the update is successful. Different types of data warehouses support different table update modes. If the data warehouse does not support table update operations on the DataArts Architecture page, the tables in the database may be inconsistent with those in DataArts Architecture. For example, table fields cannot be deleted when DLI tables are updated. If table fields are deleted from the tables in DataArts Architecture, the corresponding table fields cannot be deleted from the database.

    If the offline database supports the syntax for updating the table architecture, you can configure the syntax in the DDL template. Then, the update operation can be performed. Otherwise, update the table by rebuilding it.
  - **Drop and create**: The system deletes an existing table in a database and then creates a table. This option ensures that the tables in the

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database are the same as those in DataArts Architecture. However, since the table is deleted first, you are advised to select this option only in the development and design phase or test phase. After the product is brought online, you are advised not to select this option.

- **Case Insensitive During Technical Assets Synch**: When a table, whose type is the same as the data connection, is published, the data connection name is case insensitive during technology asset synchronization. If the name is the same as an existing one, the connection exists.
- **Physical Table Synchronize Logical Assets**: If **Synchronize logical assets** is selected and no logical asset is available, you can disable this option to prevent physical tables from overwriting logical tables which have the same names as them. In this case, physical tables will only be associated with, but not synchronized to logical assets. If no logical asset is found, the association fails and an error is reported.
- **Use New UI to Deliver Business Table Mappings**: This function is enabled by default. The mapping function of the new version supports operations such as join. You are advised to use the mapping function of the new version.
- **Auto Aggregate Summary Tables**: When publishing a derivative or compound metric, the system automatically generates a summary table. A statistical dimension corresponds to a summary table. You can click the **Automatic Aggregation** tab on the summary table page to view the automatically generated summary tables.
- **Data Standard Allows Duplicate Names**: This function is disabled by default. If it is enabled, duplicate data standard names are allowed.
- **Auto Directory Creation During Data Standard Import**: This function is enabled by default.
- **Enable Public Layer**: If this option is enabled, the current workspace can be converted into a public workspace. The lookup tables and data standards of the public workspace are shared with all common workspaces. In a common workspace, you can query or reference the lookup tables and data standards of the public workspace, but cannot add, modify, or delete them.

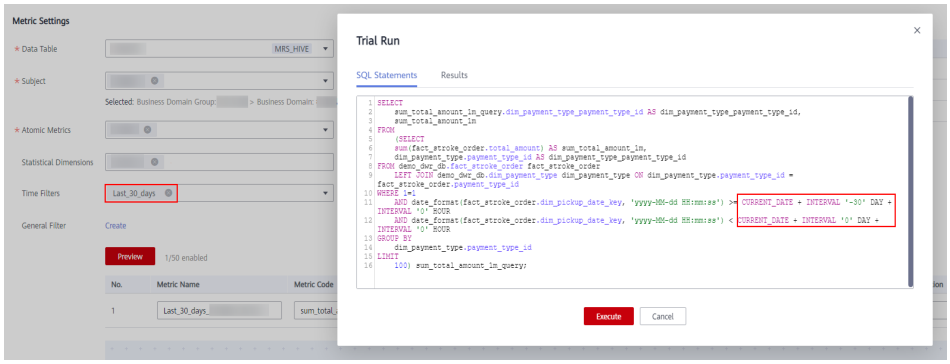
  NOTE

  - After the current workspace is converted to a public workspace, it cannot be rolled back to a common workspace, and no other common workspaces can be converted to a public workspace. Exercise caution when selecting your public workspace.
  - You cannot query, reference, or operate the data of a common workspace from a public workspace.
- **Time-limited Generation Using Dynamic Expressions**: If you enable this function, dynamic time expressions will be used; otherwise, the default static time expressions will be used. The dynamic expression automatically updates the generated time, while the static expression does not. For example, if the current month is September and a static expression is used, data generated for the last 30 days is the data in August. Even when the current month changes to October, data generated for the last 30 days is still the data in August. However, if a dynamic expression is used, data generated for the last 30 days will

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automatically change to the data in September if the current month has changed to October. The following figure shows an example time function using a dynamic expression.

Figure 8-166 Dynamic expression



NOTE

If you enable this function for the first time, you need to reset the derivative metrics in the DDL template. If you have made any change to the DDL template, back up the template before resetting it. Resetting the template will overwrite any change that has been made. After the template is reset, you must make the changes again.

- **Parallel Queried Tables on Information Architecture**: The default value is **1**. Currently, you cannot change the value.
- **Concurrently Insertable Lines of Data**: The value determines the number of lines of the dimensional table into which data of the lookup table is inserted. If the lookup table contains a large amount of data, the data may fail to be inserted into the dimensional table. In this case, you can reduce the value of this parameter.
- **Lookup Table-based Quality Rule**: Select a value from the drop-down list box. If the data volume of the lookup table is small, select **Enumerated value verification**; otherwise, select **Field value consistency verification**.

  NOTE

  You can select **Field value consistency verification** only if the database contains a lookup table. The following lookup tables are contained in the database:

  - Lookup tables obtained by database reversion
  - Lookup tables published during dimension creation
- **Naming Rule for Dimension Fields Referenced by the Summary Table**: Set the naming rule for a summary table during creation, editing, import, and generation. Select **Dimension table name_Dimension attribute name** or **Dimension attribute name**.
- **Exported File Type**: Two options are available: **xlsx** and **et**. Logical models, physical models, dimensions (dimension tables), fact tables, summary tables, and other data can be exported in both formats.
- **Generate DataArts DataService APIs**: Two options are available: **Table API** and **Metric APIs**.

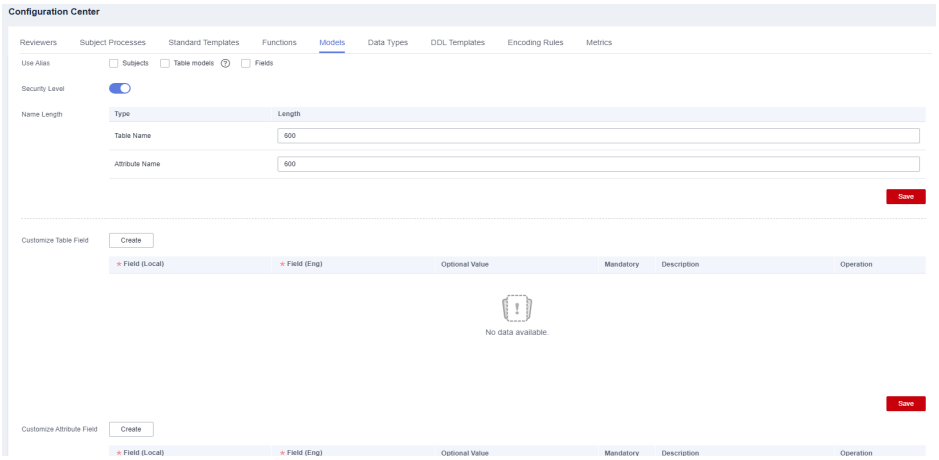
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Model Settings

You can perform the following operations during subject design and model design on the **Model Settings** page.

- Add the subject alias, table model alias, and field alias.
- Enable **Security Level**.
- Set the length.
- Add custom fields to a table.
- Add custom fields to an attribute.

Figure 8-167 Model Settings tab page



In the navigation pane, choose **Configuration Center**. On the displayed page, click the **Models** tab.

- **Use Alias**: You can enable or disable alias.
  - The options are as follows:
    - If you select **Subjects**, you must enter an alias when creating or editing subject.
    - If you select **Table models**, you must enter an alias when creating or editing a table. Business tables, dimension tables, fact tables, and summary tables are affected when the **Table models** option is selected.
    - If you select **Fields**, you must enter an alias when creating or editing a table field.
- **Security Level**: Enable it. It is enabled by default.
- **Name Length**: Set the length of the table name and attribute name.
- **Customize Table Property**: When creating or editing a table, you can set custom fields in the basic settings of the table. Business tables, dimension tables, fact tables, and summary tables are affected.
- **Customize Attribute Field**: When creating or editing a table field, you can set custom attributes in the table field. Business tables, dimension tables, fact tables, and summary tables are affected.

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Field Types

When you create a table, reverse a database, or convert a model, if the default data type or the data type mappings between different data sources cannot meet your requirements, you can add, delete, or modify data types. The default data type cannot be deleted.

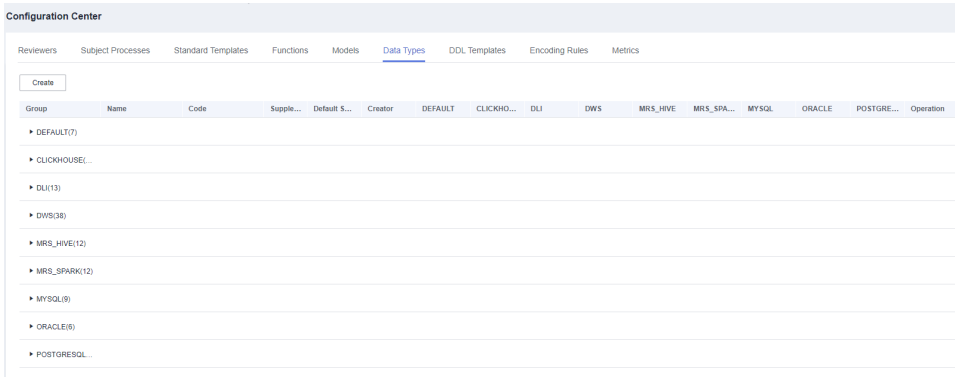
Step 1 In the navigation pane, choose **Configuration Center**. On the displayed page, click the **Data Types** tab.

Step 2 On the page displayed, you can view the data type and the data type mappings between different data sources. The type whose creator is **SYSTEM** is the default field type.

The types are described as follows:

- **DEFAULT** indicates the common data type which is used for creating a table when the data source type is not specified. For example, when you create a table of a logical model, the data type in the DEFAULT group is used.
- **DLI** indicates the data type of the table with the DLI data connection.
- **DWS** indicates the data type of the table with the DWS data connection.
- **MRS_HIVE** indicates the data type of the table with the MRS_HIVE data connection.
- **MRS_SPARK**: indicates the data type of the Hudi table with the MRS_SPARK connection.
- **POSTGRESQL**: indicates the data type of the table with the PostgreSQL connection.
- **CLICKHOUSE**: indicates the data type of the table with the ClickHouse connection.
- **MYSQL**: indicates the data type of the table with the MySQL connection.
- **ORACLE**: indicates the data type of the table with the Oracle connection.
- **DORIS**: indicates the data type of the table with the Doris connection.

Figure 8-168 Data Types tab page



Step 3 Manage field types.

- **Create**

To add a field type, click **Create**. In the dialog box displayed, set the parameters and click **OK**.

Figure 8-169 Creating a field type

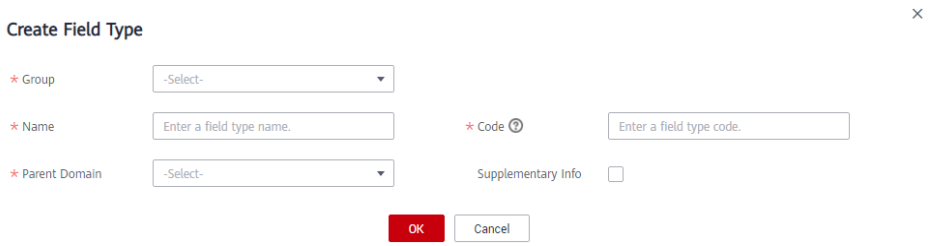


Table 8-64 Parameters for creating a field type

Parameter	Description
Group	Group that the new field type belongs to.
Name	Name of the field type to create. Field type names must start with letters. Only letters, numbers, brackets, spaces, and underscores (_) are allowed.
Code	Data type code, which must be supported by the data warehouse. The code can contain uppercase letters, underscores (_), and digits, and must start with an uppercase letter or underscore (_).
Parent Domain	Select the domain that the new field type belongs to.
Supplementary Info	You can enable this function if you want to set the data length range for some data types. For example, you can enter **(10,2)** for the DECIMAL(p,s) data type, indicating that the total number of digits in the value is 10, and the number of digits after the decimal point is 2. You can also enter **10** for the VACHAR data type, indicating that the maximum number of characters is 10.
Data Types in Data Sources	Select the data type of the mapping connection of the new field type.
DEFAULT	Data type of the default data connection that the new field type is mapped to.
CLICKHOUSE	Data type of the ClickHouse data connection that the new field type is mapped to.
DLI	Data type of the DLI data connection that the new field type is mapped to.
GaussDB(DWS)	Data type of the DWS data connection that the new field type is mapped to.
MRS_HIVE	Data type of the MRS Hive data connection that the new field type is mapped to.

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Parameter	Description
MRS_SPARK	Data type of the MRS Spark data connection that the new field type is mapped to.
MYSQL	Data type of the MySQL data connection that the new field type is mapped to.
ORACLE	Data type of the Oracle data connection that the new field type is mapped to.
POSTGRESQL	Data type of the PostgreSQL data connection that the new field type is mapped to.
DORIS	Data type of the Doris data connection that the new field type is mapped to.

- **Edit**

  In the field type list, specify a field type and click  to edit the field type. For details on the parameters, see **Table 8-64**.

- **Delete**

  You can delete new field types. The field type whose creator is **SYSTEM** is the default field type and cannot be deleted.

  In the field type list, specify a field type and click  to delete it. Then click **OK**.

- **Reset**

  Click **Reset** at the bottom of the **Field Type** tab page to restore the default settings.

----End

DDL Templates

On the DataArts Architecture page, you can modify diversified types of tables (such as DWS, DLI, POSTGRESQL, Hive, Doris, and Spark). If you need to generate DDL statements of other data sources for a created table of a certain type, you can modify the DDL template of the table based on the DDL syntax of the target data source.

1. In the navigation pane, choose **Configuration Center**. On the displayed page, click the **DDL Templates** tab.
2. On the page displayed, you can configure DDL templates for DLI views or diversified types of tables. You can modify the DDL templates by referring to the parameter description on this page. After the modification is complete, click **OK**. Click **Reset All** to restore the default settings.

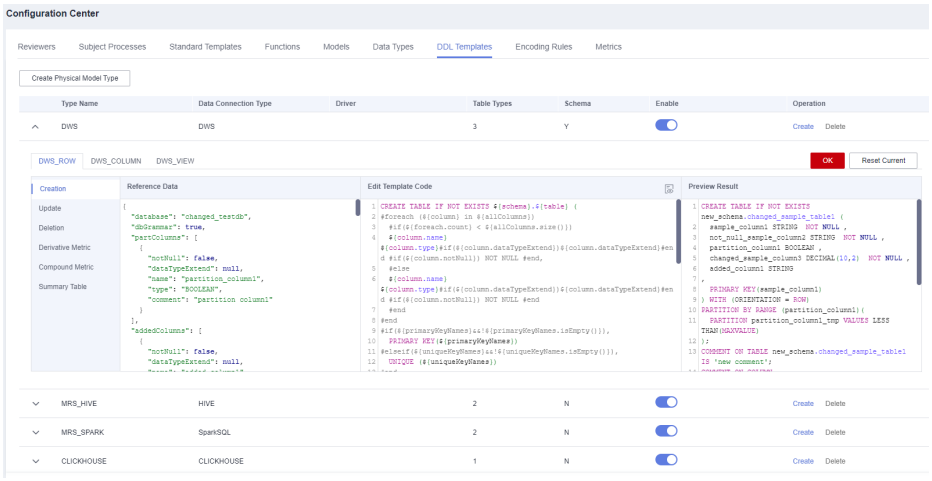
   As shown in **Figure 8-170**, the process is described as follows:

   - **Creation** allows you to view or edit a new table or a DDL template of a DLI view.
   - **Update** allows you to view or edit an updated table or a DDL template of a DLI view.

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- **Deletion** allows you to view or edit a deleted table or a DDL template of a DLI view.
- **Derivative Metric** allows you to view or edit the SQL template of a derivative metric.
- **Compound Metric** allows you to view or edit the SQL template of a compound metric.
- **Summary Table** allows you to view or edit the SQL template of a summary table.
- The **Reference Data** area shows an example of table details. Variables in the example define table details.
- The **Edit Code Template** area allows you to edit DDL templates. If you need to generate DDL statements for other types of databases, you can modify the DDL template based on the DDL syntax of the target data source.
- The **Preview Result** area allows you can preview the DDL statements generated based on the edited template.

Figure 8-170 DDL Templates tab page



Encoding Rules

1. In the navigation pane, choose **Configuration Center**. On the displayed page, click the **Encoding Rules** tab.
2. Manage encoding rules.
   - Add an encoding rule.

     Click **Add** above the encoding rule list. In the displayed dialog box, set required parameters, and click **OK**.

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Figure 8-171 Adding an encoding rule

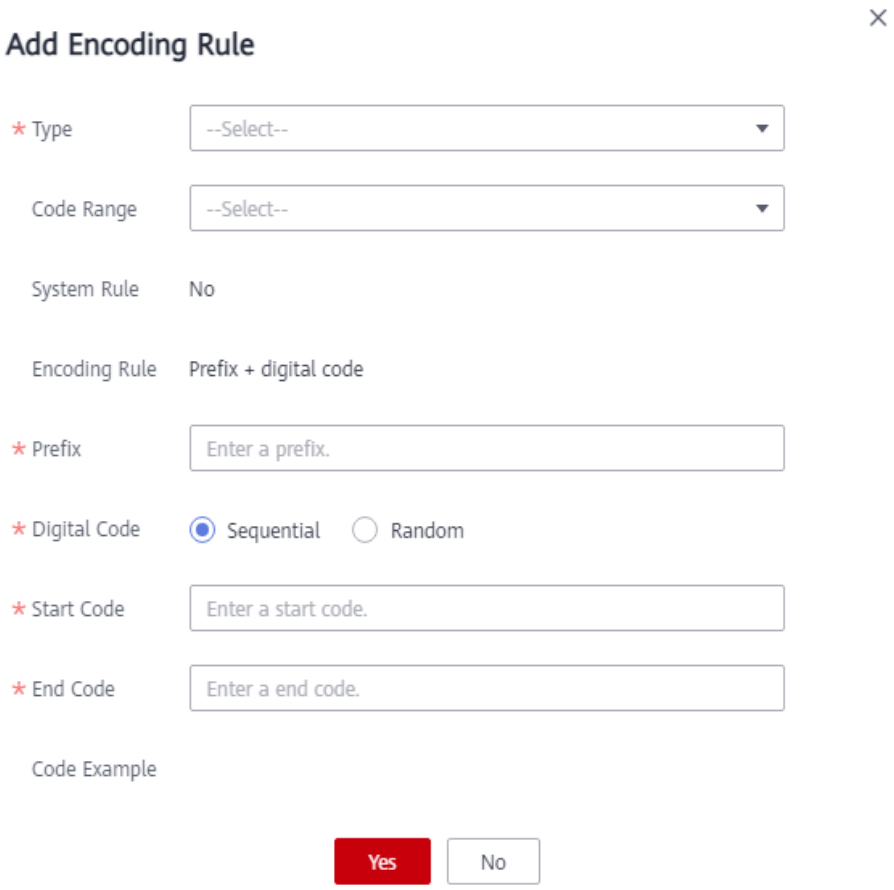


Table 8-65 Parameters for adding an encoding rule

Parameter	Description
Type	Encoding rule type. The following options are available: **Business metric**, **Logical entity**, **Logical property**, **Data standard**, and **Code Table**, and **Business Object**.
Code Range	By default, the encoding rule takes effect globally. You can select subjects, processes, lookup tables, or data standards.
System Rule	Whether this rule is a system rule. The value is **No** and cannot be changed.
Encoding Rule	The value consists of a prefix and a digit code and cannot be changed.
Prefix	The value can contain characters and digits but cannot end with a digit. It cannot be changed.
Digital Code	You can select **Sequential** or **Random**.

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Parameter	Description
Start Code	Start value of the digital code range
End code	End value of the digital code range
Code Example	The configured encoding rule is displayed.

- Deleting an Encoding Rule

  Select an encoding rule and click **Delete** above the list. In the displayed dialog box, click **Yes**.

  NOTE

  The six preset encoding rules cannot be deleted, including the logical entity, data standard, logical property, business metric, code table, and business object rules.

- Editing an Encoding Rule

  Locate an encoding rule, click **Edit** in the **Operation** column, modify parameters, and click **OK**.

Metric Settings

1. In the navigation pane on the DataArts Architecture console, choose **Configuration Center**. On the displayed page, click the **Metrics** tab.
2. Manage business metrics.

   a. Create a metric.

   Click **Create** next to **Business Metric Customize Field** or + in the **Operation** column of an existing metric. Set the following parameters and click **Save**.

Figure 8-172 Creating a metric

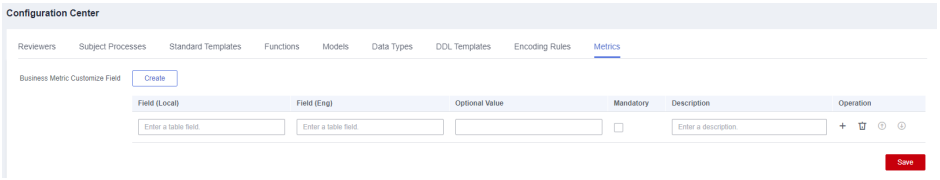


Table 8-66 Parameters for creating a metric

Parameter	Description
Field (Local)	Metric name. Enter a maximum of 100 characters.

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Parameter	Description
Field (Eng)	Metric name in English. Enter a maximum of 100 characters.
Optional Value	Optional values of the custom metric for creating a business metric
Mandatory	Whether the custom metric is mandatory for creating a business metric
Description	Description of the custom metric Enter a maximum of 200 characters.

b. Adjust the metric sequence.

You can adjust the sequence of metrics by clicking the up or down arrow in the **Operation** column. You can also double-click the up or down arrow and enter a No. to move a metric to a specified row.

Figure 8-173 Adjusting the metric sequence

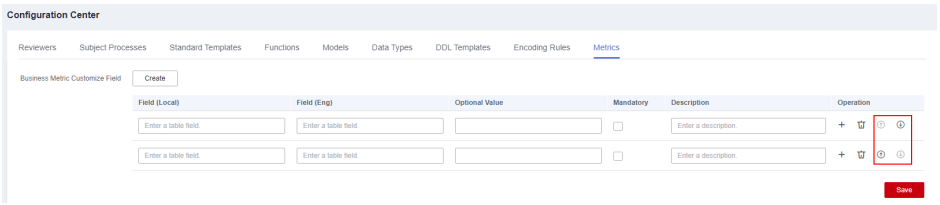
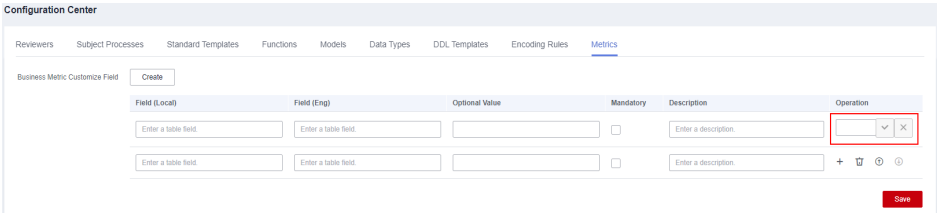


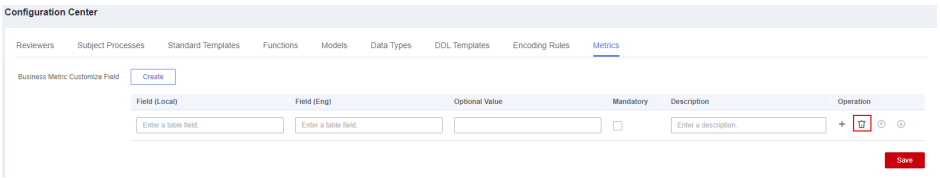
Figure 8-174 Moving a metric to a specified row



c. Delete a metric.

To delete a custom metric, click  in the **Operation** column.

Figure 8-175 Delete a metric.



3. After a custom metric is set, the metric is displayed on the page for creating a business metric and the **Basic Settings** page of the business metric.

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Figure 8-176 Page for creating a business metric

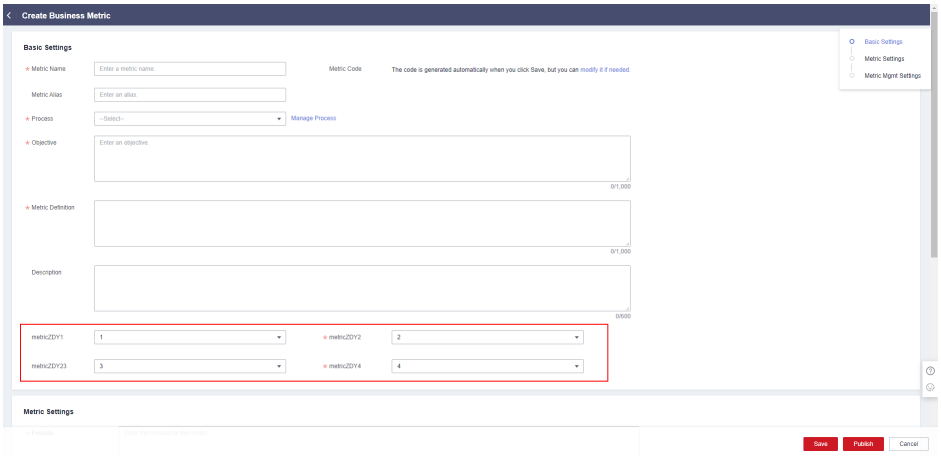
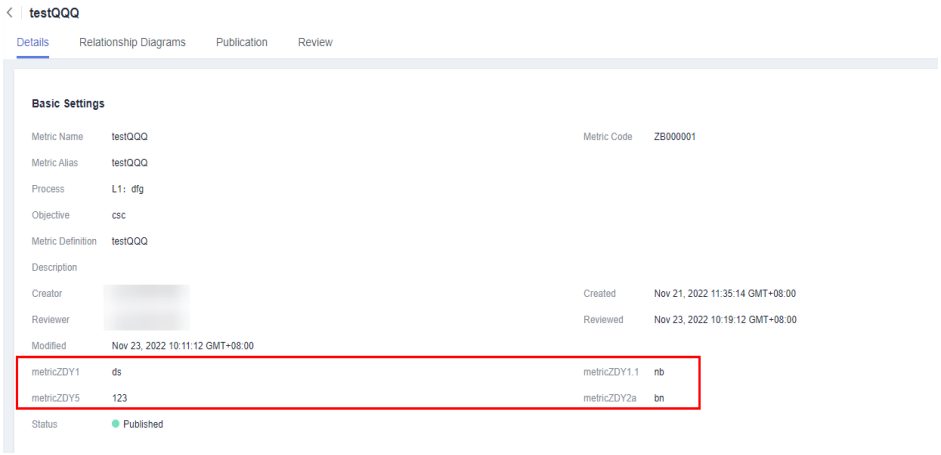


Figure 8-177 Basic Settings page of a business metric



8.8.8 Review Center

After the modeling and data processing tasks generated in the development environment are submitted, they are stored in the review center. After the tasks are approved on the **Review Center** page, these tasks are available in the production environment.

Reviewer's Audit Objects

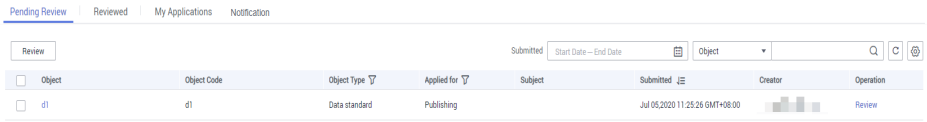
If you are a reviewer, use the reviewer account with caution.

1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.
2. Choose **Metrics** > **Review Center** in the left navigation bar, click the **Pending Review** tab, find the object to be reviewed in the list, and click **Review** on the right.

   You can also select multiple objects to be reviewed and click **Review** in the upper left corner to review them in batches.

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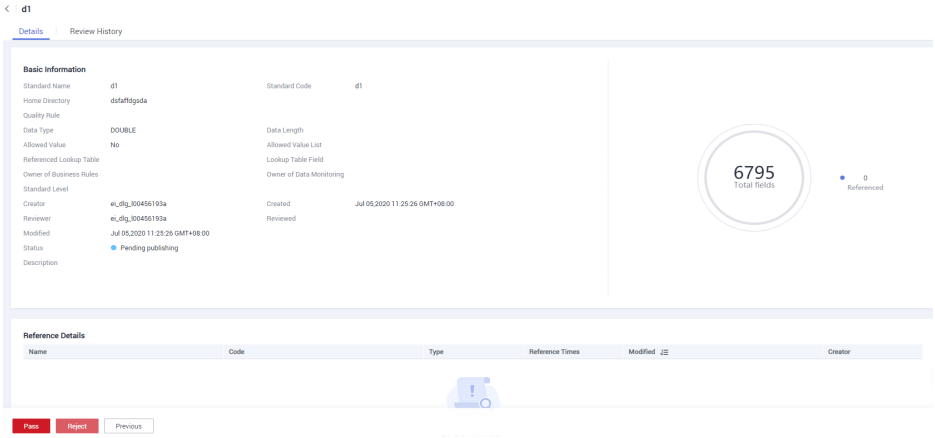
Figure 8-178 Pending Review tab page



3. On the page displayed, confirm the information and click **Accept**. In the dialog box displayed, enter the review comments and click **OK**.

   If the information is incorrect, click **Reject**. In the dialog box displayed, enter the reasons for rejecting the application and click **OK**.

Figure 8-179 Review Information area



Pending Review, Reviewed, and My Applications Tab Pages

- **Pending Review** tab page

  On the DataArts Architecture console, choose **Metrics** > **Review Center** in the left navigation pane and click the **Pending Review** tab. On the page displayed, you can view the applications to be reviewed.

- **Reviewed** tab

  On the DataArts Architecture console, choose **Metrics** > **Review Center** in the left navigation pane and click the **Reviewed** tab. On the page displayed, you can view the applications that have been approved.

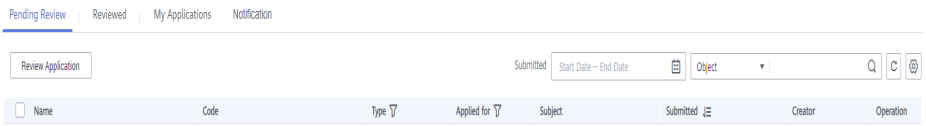
- **My Applications** tab

  On the DataArts Architecture console, choose **Metrics** > **Review Center** in the left navigation pane and click the **My Applications** tab. On the page displayed, you can view the applications that you have submitted.

Pending Review

Step 1 On the DataArts Architecture console, choose **Metrics** > **Review Center** in the left navigation pane. The **Pending Review** tab page is displayed by default.

Figure 8-180 Pending Review tab page



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Function Area	Description
1	Batch Review 1. Select multiple pieces of information to be reviewed. 2. Click **Review Application**. 3. In the dialog box displayed, enter the valid review comments. 4. Click **Accept** to approve the selected targets in batches, or click **Reject** to reject the selected targets in batches.
2	Single Review 1. Click **Review** in the **Operation** column. The page for reviewing the information is displayed. 2. Select the review result (approved or rejected) and enter valid review comments. 3. Click **OK**.
3	• Submitted Start Date – End Date allows you to specify a time range during which the information to be viewed is displayed. • Object allows you to query the to-be-reviewed information about objects and creators. • allows you to set the headers of tables to be reviewed. • allows you to refresh the current page.

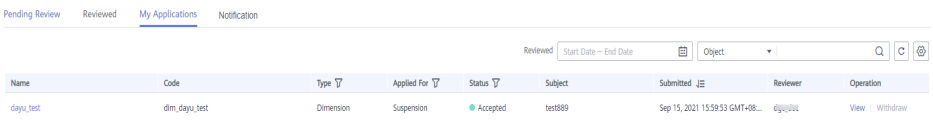
----End

My Applications

Step 1 On the DataArts Architecture console, choose **Metrics** > **Review Center** in the left navigation pane.

Step 2 Click **My Applications**.

Figure 8-181 My Applications tab page



You can perform the following operations:

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- Click **View** in the **Operation** column to view information about a specified row.
- Click **Withdraw** in the **Operation** column to withdraw the application.

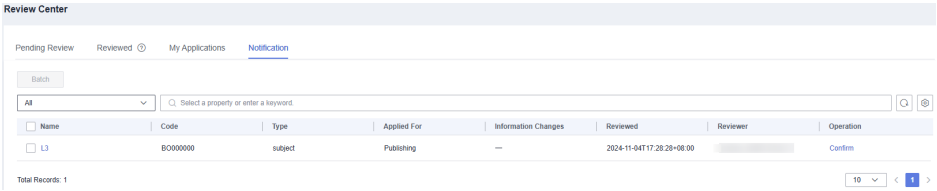
----End

Notification

Step 1 On the DataArts Architecture console, choose **Metrics** > **Review Center** in the left navigation pane.

Step 2 On the displayed page, click the **Notifications** tab.

Figure 8-182 Notification page



You can perform the following operations:

- Click **Confirm** in the **Operation** column to confirm a notification. You can also confirm multiple notifications at a time. When a data standard changes, the owner of the object (logical model, physical model, dimension table, fact table, or summary table) associated with the data standard will receive a notification of the change.
- You can filter notifications by attribute or query notifications using a keyword.

----End

8.9 Tutorials

8.9.1 DataArts Architecture Example

DataArts Architecture can be used to create entity-relationship (ER) models and dimensional models to standardize and visualize data development and output data governance methods that can guide development personnel to work with ease.

This section covers the following scenarios:

- Design a data model for the taxi travel data in an MRS Hive data lake.
- The original taxi travel data table **sdi_taxi_trip_data** is stored in the **demo_sdi_db** database.
- The following table lists the data fields in the original data table **sdi_taxi_trip_data**.

  The following table lists the taxi trip data:

Table 8-67 Taxi trip data

No.	Field Name	Field Description
1	VendorID	Vendor ID. Possible values are: 1=A Company 2=B Company
2	tpep_pickup_datetime	Time when a passenger gets on a taxi.
3	tpep_dropoff_datetime	Time when a passenger gets off a taxi.
4	passenger_count	Number of passengers.
5	trip_distance	Driving distance.
6	ratecodeid	Charge rate code. Possible values are: 1=Standard rate 2=JFK 3=Newark 4=Nassau or Westchester 5=Negotiated fare 6=Group ride
7	store_fwd_flag	Store-and-forward flag.
8	PULocationID	Location at which a passenger gets on a taxi.
9	DOLocationID	Location at which a passenger gets off a taxi.
10	payment_type	Payment type. Possible values are: 1=Credit card 2=Cash 3=No charge 4=Dispute 5=Unknown 6=Voided trip
11	fare_amount	Fare amount.
12	extra	Extra fee.
13	mta_tax	MTA tax.
14	tip_amount	Tip amount.

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No.	Field Name	Field Description
15	tolls_amount	Toll amount.
16	improvement_surcharge	Improvement surcharge.
17	total_amount	Total amount.

The process of using DataArts Architecture is as follows:

1. **Preparations**
   - **Add reviewers**: In the DataArts Architecture module, all business processes must be approved. Therefore, add reviewers first before conducting any operations. Only the workspace admin has the permissions required to add reviewers.
   - **Configuration Center** provides abundant custom options. You can customize the configuration to meet your demands.
2. **Data Survey**: A data survey involves collecting data that is generated when sorting business requirements, creating business processes, and classifying data subjects based on the existing business data and industry status.
   - **Subject design** is a hierarchical architecture that classifies and defines data to help clarify data assets and specify relationships between business domains and business objects.
   - **Process design**: This example does not contain this. Process design is to generate a structured framework of data processing process, including the categories, levels, boundaries, scope, and input/output relationships, and reflect the business models and characteristics of your enterprise.
3. **Standards**: Create lookup tables and data standards.
   - **Create and publish a lookup table**: A lookup table includes a series of allowed values and additional text descriptions that are generally associated with data standards to generate a range of values for the verification of quality monitoring rules.
   - **Create and publish a data standard**: A data standard refers to the description of attribute data meanings and business rules that enterprises must comply with. It describes the common understanding of certain data at the company level.
4. **Models**: Use ER modeling and dimensional modeling methods to perform hierarchical modeling.
   - **Data warehouse planning: Create a model at the SDI and DWI layers, respectively.**
     - **SDI** stands for Source Data Integration and is the source data layer. SDI is a simple implementation of source system data.
     - **DWI** stands for Data Warehouse Integration, also called the data consolidation layer. DWI integrates and cleans data from multiple source systems, and implements entity relationship modeling based on the three normal forms.
   - **Dimensional modeling: Create and publish a dimension at the DWR layer. & Creating and Publishing a Fact Table for the DWR Layer.**

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- **Data Warehouse Report (DWR)** is based on the multi-dimensional model and its data granularity is the same as that of the DWI layer.
- **Dimension** is the perspective to observe and analyze business data and assist in data aggregation, drilling, slicing, and analysis, and used as a GROUP BY condition in SQL statements.
- A **fact table** that belongs to a business process can enrich the affair information corresponding to the specific business process.

5. **Metric design: Create and publish a technical metric**: Create and publish a business metric (not involved in this example) and a technical metric. Technical metrics are classified into atomic, derivative, and compound metrics.
   - A **metric** consists of its name and value. The metric name and its definition reflect the quality and quantity of the metric. The metric value reflects the quantifiable values of the specified time, location, and condition of the metric.

     Business metrics are used to guide technical metrics, and technical metrics are used to implement business metrics.
   - **Atomic metrics** are generated based on dimension tables and fact tables of a multidimensional model. The objects and the finest data granularity of an atomic metric are consistent with those of the multidimensional model.

     An atomic metric usually consists of measures and attributes related with measures and business objects, all of which aim to support agile self-service consumption of the metric.
   - **Derivative metrics** are aggregated from the definitions, modifiers, and dimensions of atomic metrics. Therefore, their definitions, modifiers, and dimensions are derived from the attributes of atomic metric associated tables as well.
   - **Compound metrics** are generated by adding one or more derivative metrics. The dimensions and modifiers of a compound metric are the same as those of the derivative metrics.

     New dimensions and modifiers cannot be generated outside the scope of derivative metrics, dimensions, and modifiers.
6. **Data mart: Create and publish a summary table at the DM layer**.
   - **Data Mart (DM)** is where multiple types of data are summarized. DM is designed to display the summarized data.
   - A **summary table** consists of specific analysis objects (for example, members) and related statistical metrics. The statistical metrics included in a summary table have the same statistical granularity (for example, members). The summary table provides users with all statistics-granularity-themed data (such as a member theme market).

Adding Reviewers

In the DataArts Architecture module, all modeling steps must be reviewed. Therefore, you need to add a reviewer first. **DAYU Administrator** or the workspace administrator has the permission to add reviewers.

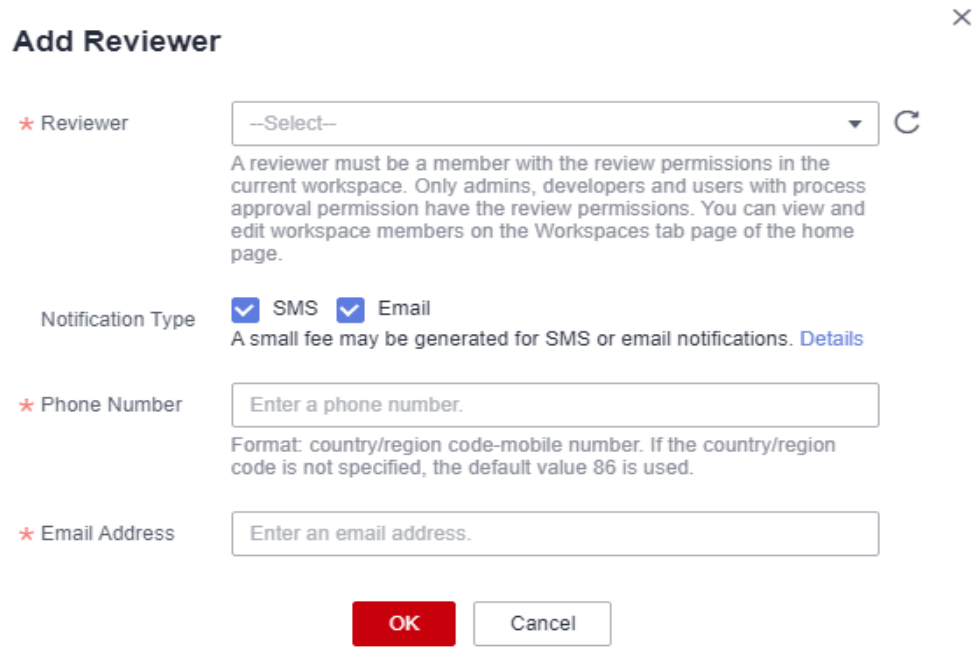
1. On the DataArts Studio console, locate a workspace and click **DataArts Architecture**.

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2. In the navigation pane on the left, choose **Configuration Center**. On the displayed **Reviewers** page, click **Add**.
3. Select a reviewer (workspace administrator, developer, or custom role with the review permission), enter the correct email address and phone number, and click **OK**.

   You can also add your current account as a reviewer. In this way, auto review is supported in subsequent operations. Add more reviewers, if required.

   Figure 8-183 Adding a reviewer



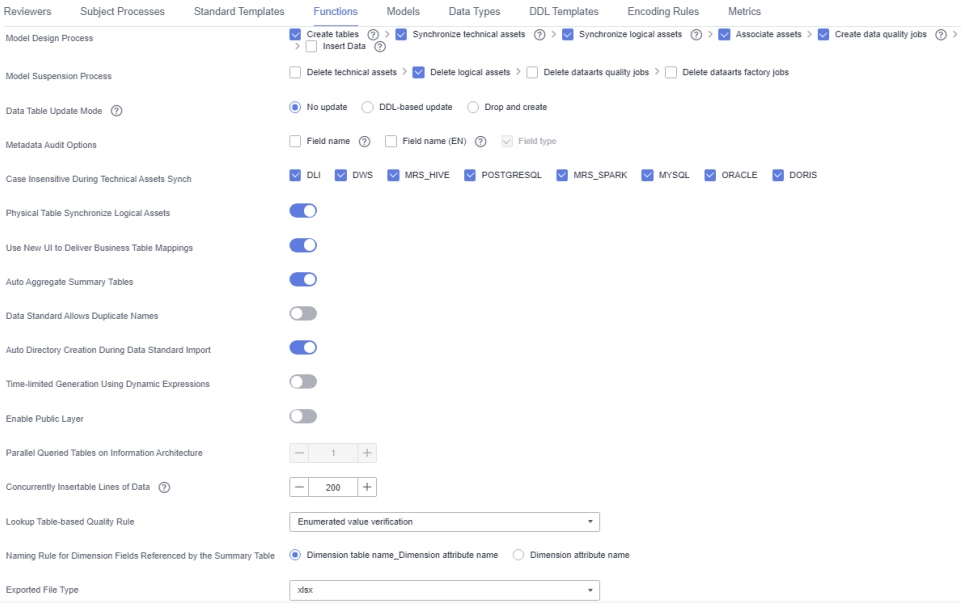
Configuration Center Management

DataArts Architecture configuration center provides abundant custom options. You can customize the configuration to meet your demands.

1. On the DataArts Architecture console, choose **Configuration Center** in the navigation pane on the left.
2. Click the **Functions** tab and set **Model Design Process**.

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Figure 8-184 Functions



3. Click **OK**.

Designing a Subject

This section uses the subjects listed in **Table 8-68** as an example.

- There is a subject area group named **City transportation**.
- Under **City transportation**, there are four subject areas: **Trip records**, **Corporation**, **Time&Space**, and **Public dimensions**.
- Under **Trip records**, there are four business objects: **Original records**, **Standard records**, **Trip facts**, and **Record statistics**.
- Under **Corporation**, there is one business object: **Suppliers**.
- Under **Time&Space**, there is one business object: **Time**.
- Under **Public dimensions**, there is one business object: **Public dimensions**.

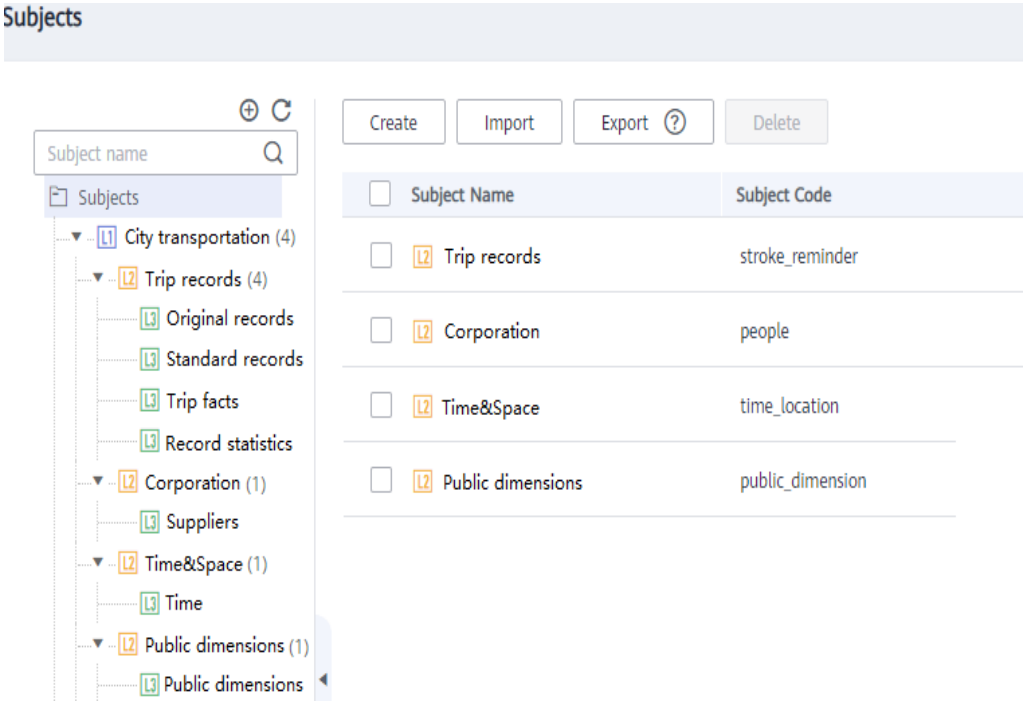
Table 8-68 Subject design

Subject Area Group Name (L1)	Subject Area Group Code (L1)	Subject Area Name (L2)	Subject Area Code (L2)	Business Object Name (L3)	Business Object Code (L3)
City transportation	city_traffic	Trip records	stroke_reminder	Original records	origin_stroke
				Standard records	stand_stroke
				Trip facts	stroke_fact

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Subject Area Group Name (L1)	Subject Area Group Code (L1)	Subject Area Name (L2)	Subject Area Code (L2)	Business Object Name (L3)	Business Object Code (L3)
				Record statistics	stroke_statistic
		Corporation	people	Suppliers	vendor
		Time&Space	time_location	Time	date
		Public dimensions	public_dimension	Public dimensions	public_dimension

Figure 8-185 Designing a subject



Procedure

Step 1 Log in to the DataArts Studio console. Locate the created DataArts Studio instance and click **Access**.

Step 2 In the workspace list, locate the target workspace and click **DataArts Architecture**.

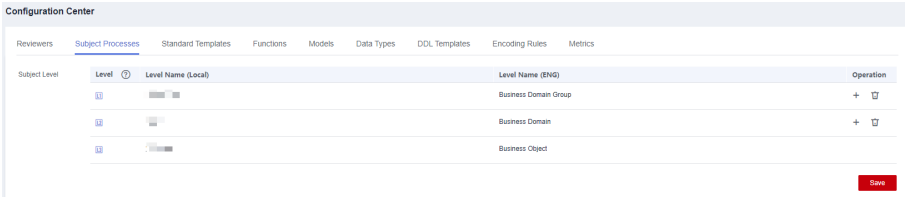
Step 3 Choose **Configuration Center** in the navigation pane on the left. Click the **Subject Processes** tab, and use the default three levels.

There can be a maximum of seven subject levels, a minimum of two subject levels, and three subject levels by default. L1 to L7 are used to represent the layers. The

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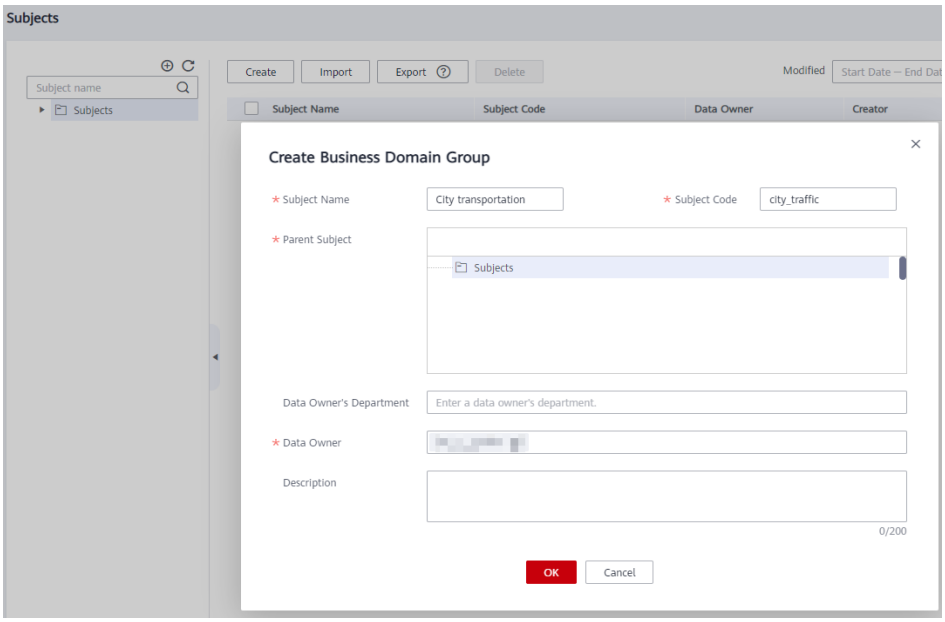
last level is **Business Object** and cannot be customized. The names of other levels can be customized. The levels configured in **Configuration Center** take effect on the **Subjects** page.

Figure 8-186 Configuring the subject levels



Step 4 On the DataArts Architecture console, choose **Data Survey** > **Subjects** in the left navigation pane. On the page displayed, click **Create** to create an L1 subject, which is a subject area group.

Figure 8-187 Creating an L1 subject

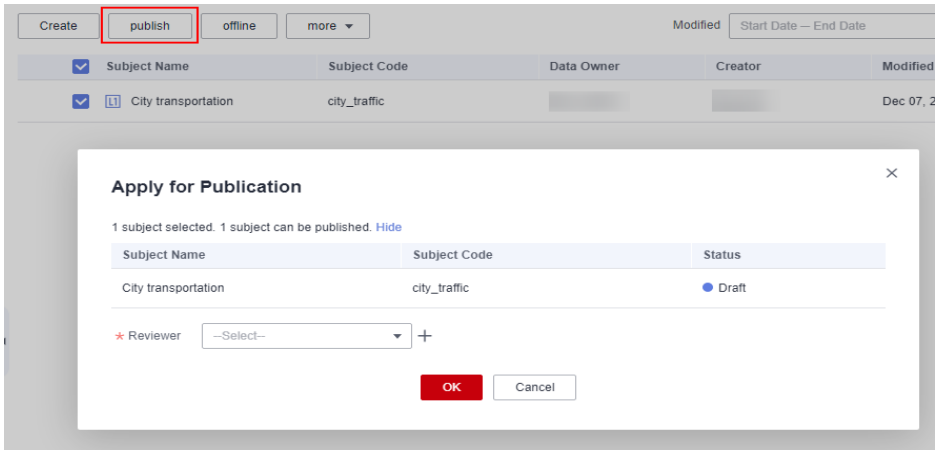


In the dialog box displayed, set the parameters as shown in **Figure 8-187** and click **OK**.

Step 5 Select the created subject area group and click **publish**. In the **Apply for Publication** dialog box, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

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Figure 8-188 Publishing a subject area group

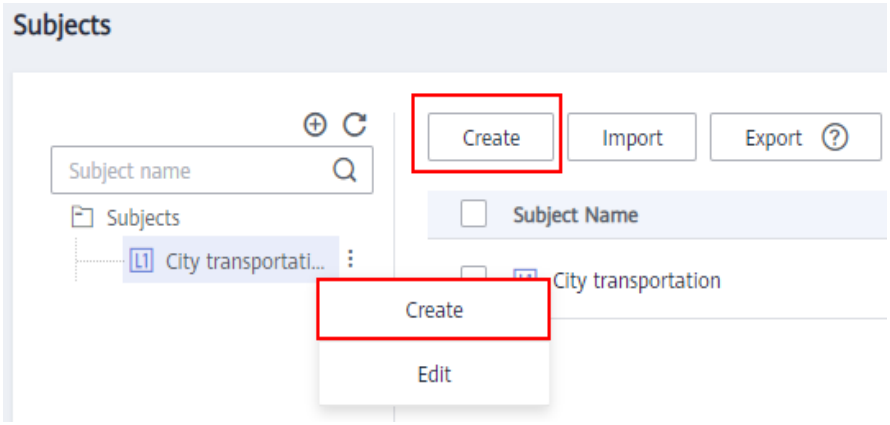


Step 6 Create four L2 subjects under the L1 subject **City transportation**: **Trip records**, **Corporation**, **Time&Space**, and **Public dimensions**.

Perform the following procedure to create a subject area named **Trip records**. The procedure for creating other subject areas is similar.

1. Right-click the L1 subject **City transportation** in the subject tree, and select **Create** from the shortcut menu. Alternatively, click **Create** in the right pane.

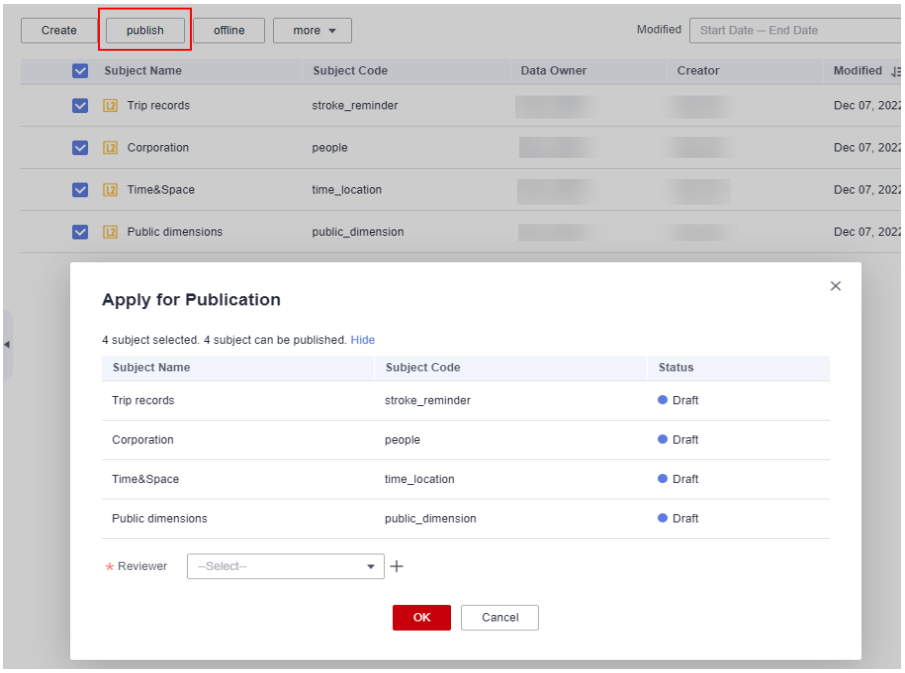
   Figure 8-189 Creating an L2 subject

2. In the dialog box displayed, set **Subject Name** and **Subject Code** to the values of **Subject Area Name** and **Subject Area Code** in **Table 8-68**, set other parameters based on project requirements, and click **OK**.
3. Select the created subject area and click **publish**. In the **Apply for Publication** dialog box, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

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Figure 8-190 Publishing a subject area



Step 7 Create business objects.

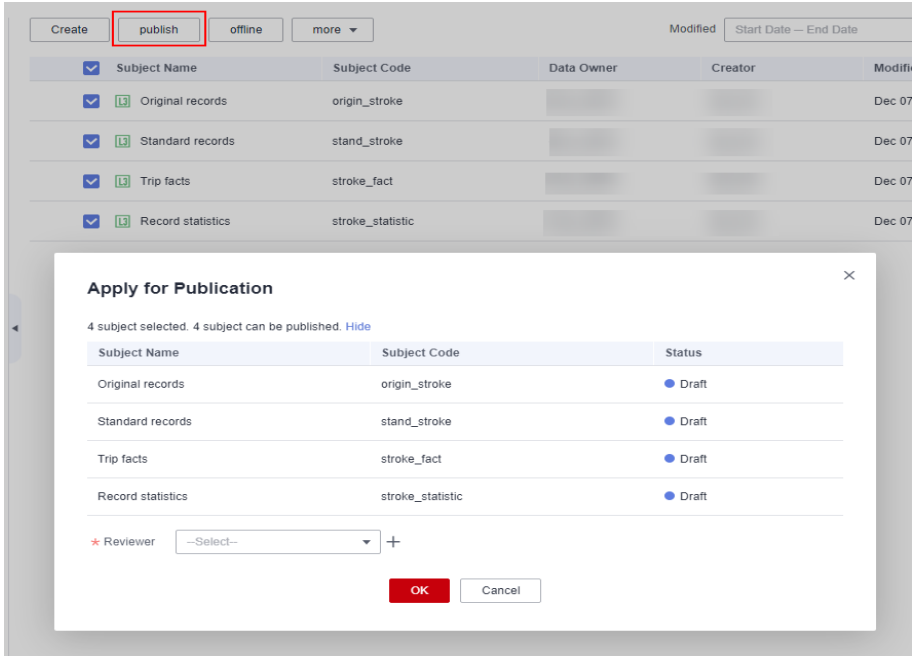
- Under **Trip records**, create four business objects: **Original records**, **Standard records**, **Trip facts**, and **Record statistics**.
- Under **Corporation**, create one business object: **Suppliers**.
- Under **Time&Space**, create one business object: **Time**.
- Under **Public dimensions**, create one business object: **Public dimensions**.

Perform the following procedure to create a business object named **Original records** in the subject area **Trip records**. The procedure for creating other business objects is similar.

1. Right-click the L2 subject **Trip records** in the subject tree, and select **Create** from the shortcut menu. Alternatively, click **Create** in the right pane.
2. In the dialog box displayed, set **Subject Name** and **Subject Code** to the values of **Business Object Name** and **Business Object Code** in **Table 8-68**, set other parameters based on project requirements, and click **OK**.
3. Select the created business object and click **publish**. In the **Apply for Publication** dialog box, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

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Figure 8-191 Publishing a business object



----End

Creating and Publishing Lookup Tables

This section uses the lookup tables listed in **Table 8-69** as an example.

Table 8-69 Lookup tables

Directory	*Table Name	* Table English Name	Table Description	* Field Name	* Field Code	* Data Type	Field Description
payment_type	payment_type	payment_type	None	payment_type_id	payment_type_id	BIGINT	None
				payment_type_value	payment_type_value	STRING	None
vendor	vendor	vendor	None	vendor_id	vendor_id	BIGINT	None
				vendor_value	vendor_value	STRING	None
rate	rate_code	rate_code	None	rate_code_id	rate_code_id	BIGINT	None

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Directory	*Table Name	* Table English Name	Table Description	* Field Name	* Field Code	* Data Type	Field Description
				rate_code_value	rate_code_value	STRING	None

Procedure

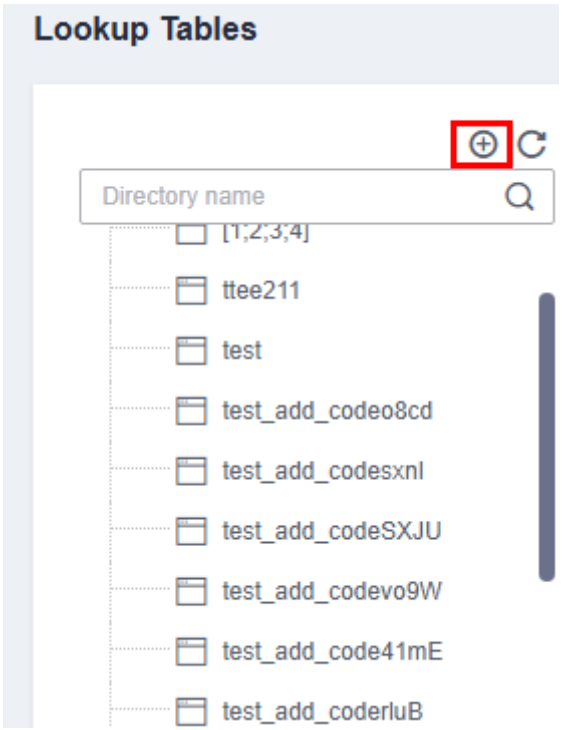
Step 1 On the DataArts Architecture console, choose **Standards** > **Lookup Tables** in the navigation pane on the left.

Step 2 Create three lookup table directories: **payment_type**, **vendor**, and **rate**.

Perform the following procedure to create a directory named **payment_type**. The procedure for creating other directories is similar.

1. On the **Lookup Tables** page, click ⊕ above the directory tree to create a directory.

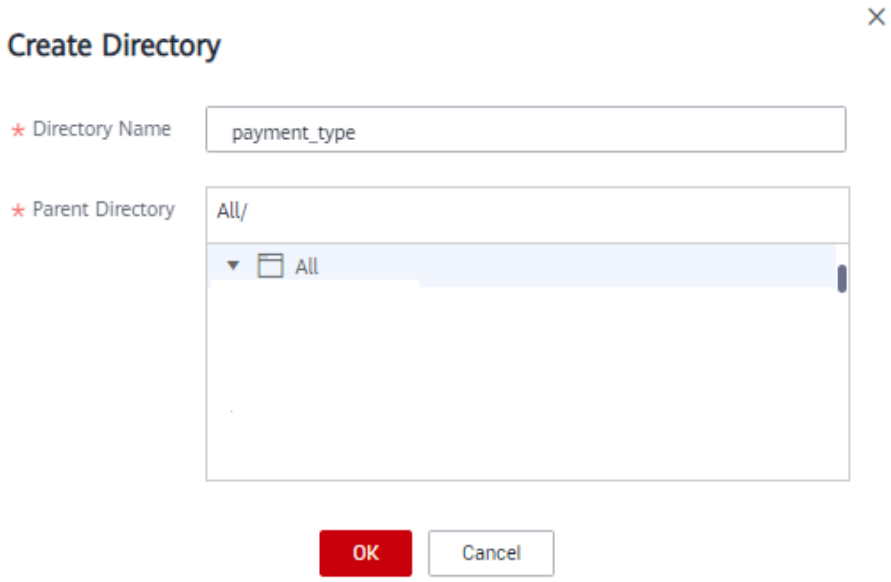
   Figure 8-192 Lookup table directory tree



2. In the dialog box displayed, enter a directory name, select a parent directory, and click **OK**.

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Figure 8-193 Creating a directory for lookup tables

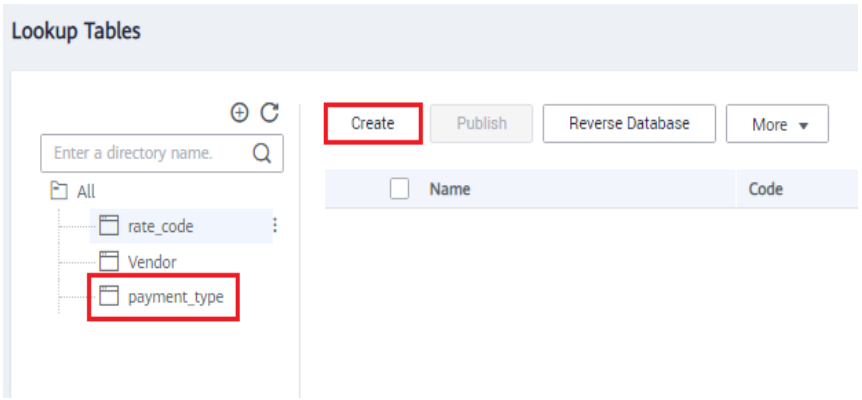


Step 3 Create three lookup tables: **payment_type**, **vendor**, and **rate_code**.

Perform the following procedure to create a lookup table named **payment_type**. The procedure for creating other lookup tables is similar.

1. On the **Lookup Tables** page, click **payment_type** in the directory tree, and click **Create** on the page displayed.

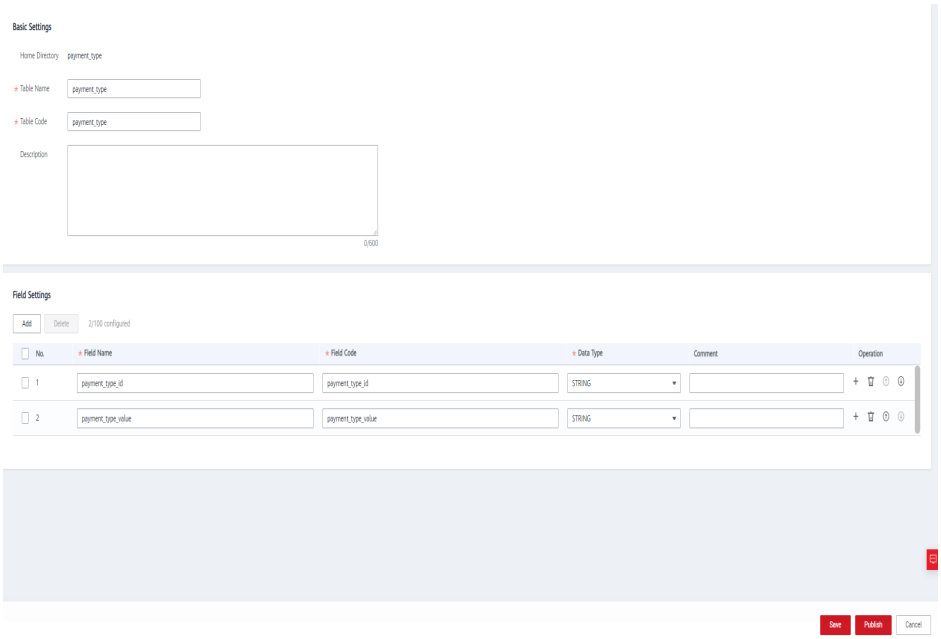
   Figure 8-194 Lookup Tables page

2. Set the parameters based on **Table 8-69** and click **Save**.

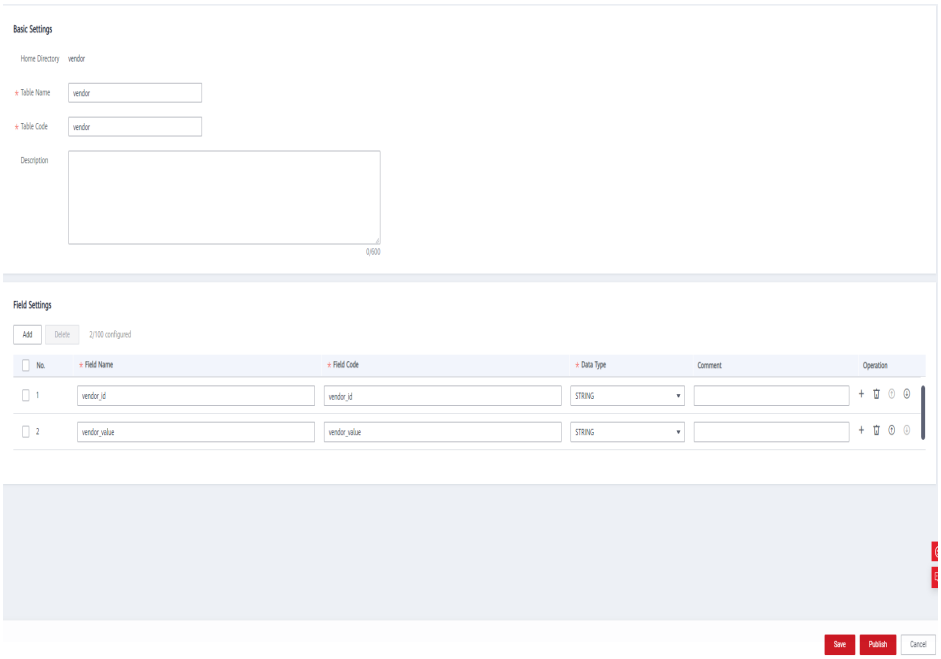
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Figure 8-195 Creating a lookup table



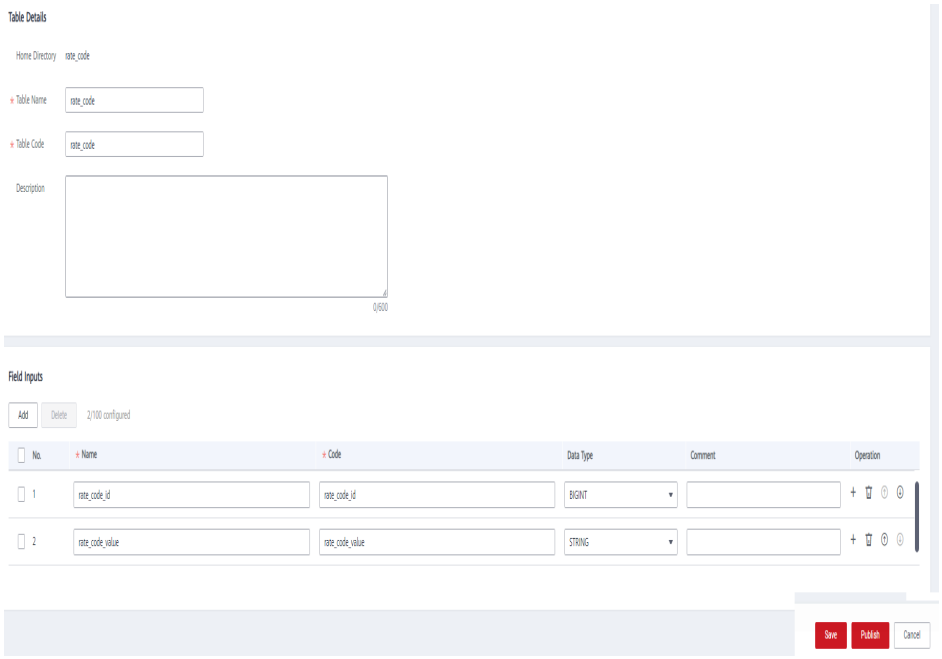
3. Refer to **Step 3.1** to **Step 3.2** to create the lookup table **vendor** in the **vendor** directory and the lookup table **rate_code** in the **rate** directory.

Figure 8-196 Creating a lookup table named vendor



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Figure 8-197 Creating a lookup table named rate_code



Step 4 Enter values for the three lookup tables **payment_type**, **vendor**, and **rate_code**.

On the **Lookup Tables** page, locate the row that contains the lookup table **payment_type**, and choose **More** > **Manage Value** in the **Operation** column. On the page displayed, click **Add** to add the values listed in **Table 8-70**.

Table 8-70 Values to be added for the lookup table payment_type

payment_type_id	payment_type_value
1	Credit card
2	Cash
3	No charge
4	Dispute
5	Unknown
6	Voided trip

Return to the **Lookup Tables** page, locate the row that contains the lookup table **vendor**, and choose **More** > **Manage Value** in the **Operation** column. On the page displayed, click **Add** to add the values listed in **Table 8-71**.

Table 8-71 Values to be added for the lookup table vendor

vendor_id	vendor_value
1	A Company

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vendor_id	vendor_value
2	B Company

Return to the **Lookup Tables** page, locate the row that contains the lookup table **rate_code**, and choose **More** > **Manage Value** in the **Operation** column. On the page displayed, click **Add** to add the values listed in **Table 8-72**.

Table 8-72 Values to be added for the lookup table rate_code

rate_code_id	rate_code_value
1	Standard rate
2	JFK
3	Newark
4	Nassau or Westchester
5	Negotiated fare
6	Group ride

Step 5 Return to the **Lookup Tables** page, select the three lookup tables, and click **Publish**.

Step 6 In the **Apply for Publication** dialog box, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

----End

Creating and Publishing Data Standards

In this example, you need to create the three data standards listed in **Table 8-73**.

Table 8-73 Data standards

Directory	*Standard Name	* Standard Code (Custom)	*Data Type	Data Length	Lookup Table	*Lookup Table Field	Description
payment_type	payment_type	payment_type	Long integer (BIGINT)	None	payment_type	payment_type_id	None

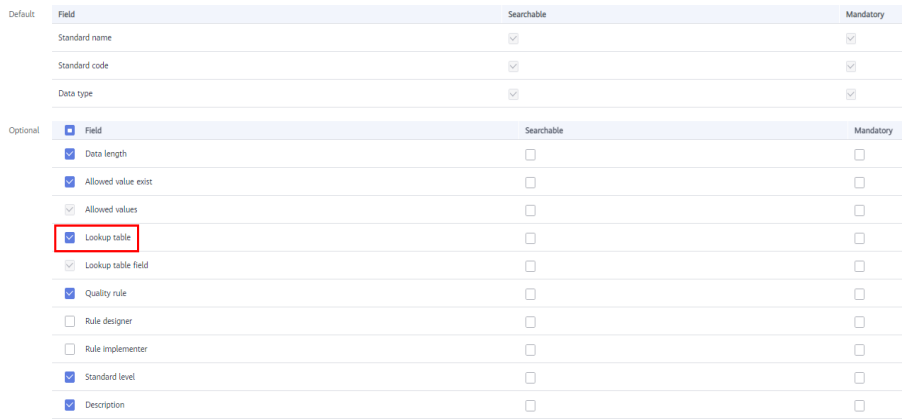
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Directory	*Standard Name	* Standard Code (Custom)	*Data Type	Data Length	Lookup Table	*Lookup Table Field	Description
vendor	vendor	vendor	Long integer (BIGINT)	None	vendor	vendor_id	None
rate	rate_code	rate_code	Long integer (BIGINT)	None	rate_code	rate_code_id	None

Step 1 On the DataArts Architecture console, choose **Standards** > **Data Standards** in the navigation pane on the left.

Step 2 If you access the Data Standards page for the first time, you must customize a template. The custom template can be modified in Configuration Center. Additionally, select **Lookup table**, as shown in the following figure.

Figure 8-198 Customize Template

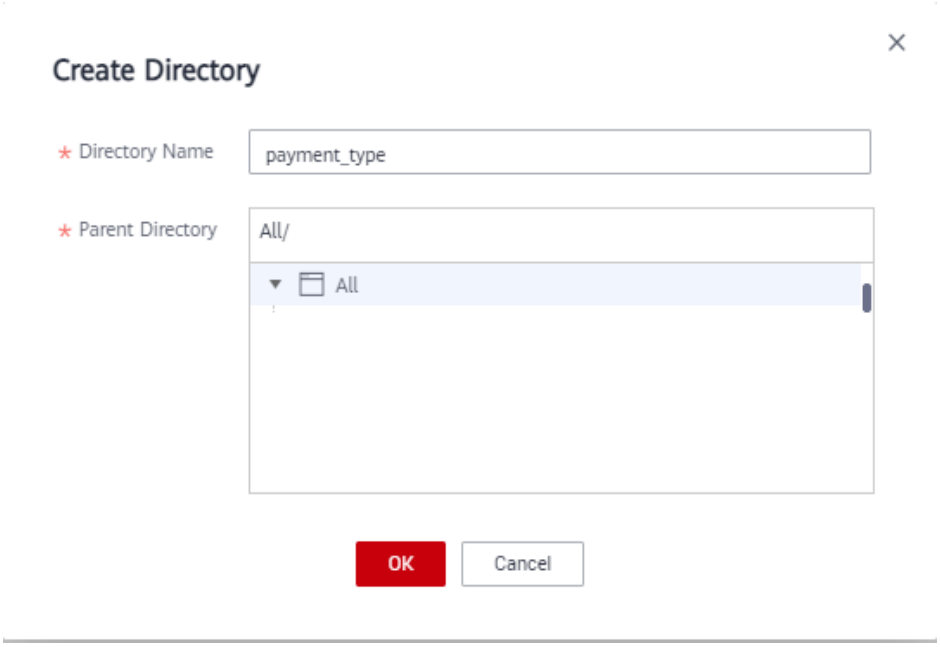


Step 3 Create three directories for data standards: **payment_type**, **vendor**, and **rate_code**.

In the upper part of the directory tree on the **Data Standards** page, click . In the dialog box displayed, enter the directory name as **payment_type**, select a parent directory, and click **OK**.

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Figure 8-199 Creating a directory for data standards



Step 4 Create three data standards: **payment_type**, **vendor**, and **rate_code**.

1. In the directory tree on the **Data Standards** page, select the required directory and click **Create** on the page displayed on the right.
2. On the **Create Data Standard** page, configure the three data standards by referring to the following figures, and click **Save**. In this example, only a few parameters are selected for the data standard template. You can customize a data standard template by referring to **Configuration Center**.

Figure 8-200 Creating a data standard named payment_type

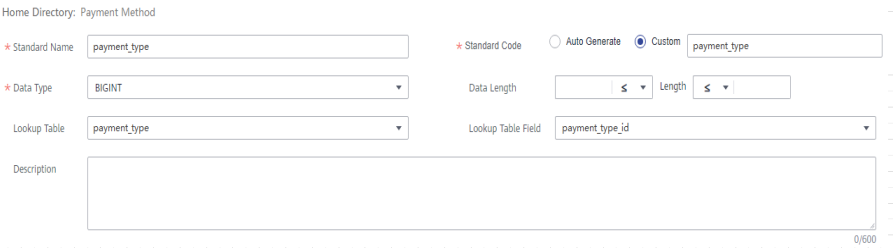
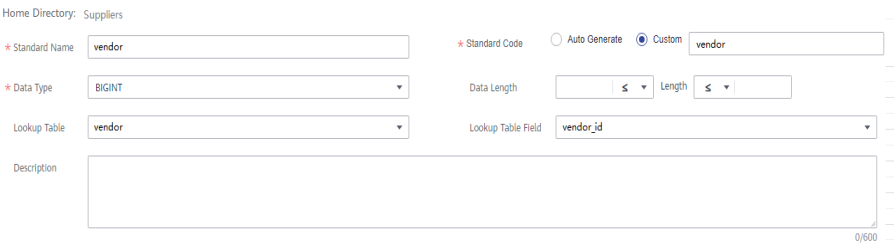
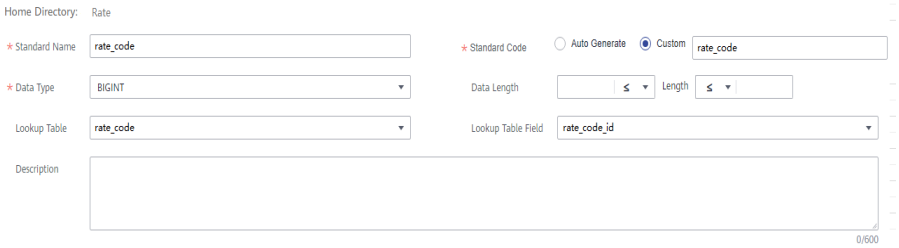


Figure 8-201 Creating a data standard named vendor



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Figure 8-202 Creating a data standard named rate_code



Step 5 Return to the **Data Standards** page, select the three data standards in the list, and click **Publish**.

Step 6 In the **Apply for Publication** dialog box, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

----End

Data Warehouse Planning: Creating Two ER Models for the SDI and DWI Layers

During data warehouse planning, create two models for the SDI and DWI layers, import the source table to the ER model for the SDI layer by reversing the database, and create a standard business table to record trip data for the DWI layer.

Step 1 On the DataArts Architecture page, choose **Data Warehouse Layer** in the left navigation pane.

In the **SDI** area, click **Create** to create an SDI model named **sdi**. In the **DWI** area, click **Create** to create a DWI model named **dwi**. Click **OK**.

Figure 8-203 Creating an SDI model

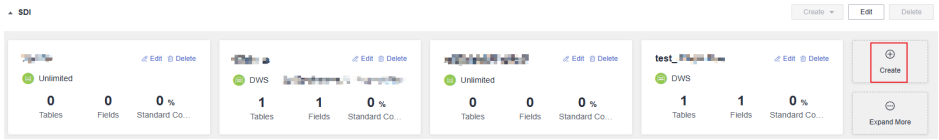
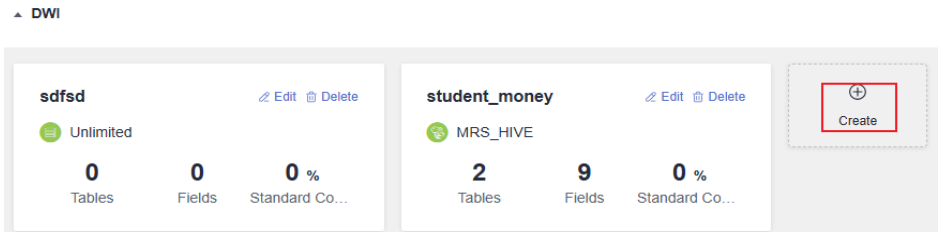


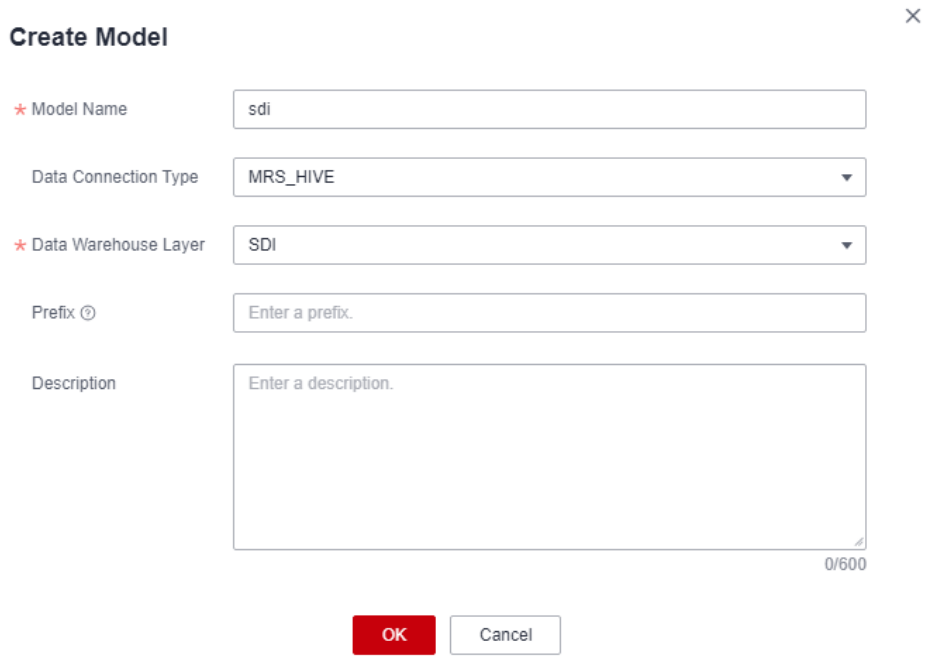
Figure 8-204 Creating a DWI model



1. Create an SDI ER model named **sdi**. In the **SDI** area, click **Create**. In the displayed **Create Model** dialog box, set the following parameters and click **OK**.

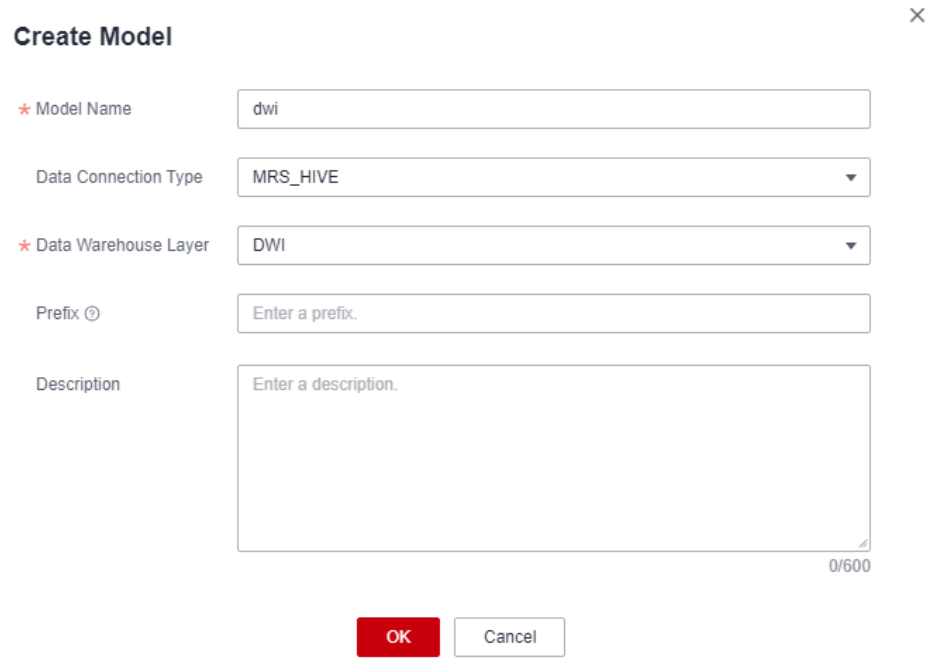
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Figure 8-205 Creating a physical model named sdi



2. Create a DWI ER model named **dwi**. In the **DWI** area, click **Create**. In the displayed **Create Model** dialog box, set the following parameters and click **OK**.

Figure 8-206 Creating a physical model named dwi



Step 2 On the **Data Warehouse Layer** page, click the newly created SDI model to go to the **ER Modeling** page. Choose **City transportation** > **Trip records** > **Original**

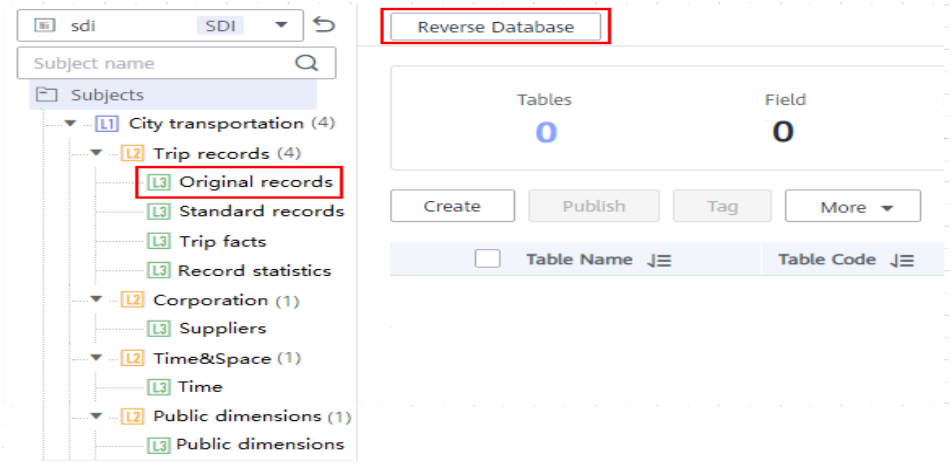
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records, and click **Reverse Database** on the page displayed on the right to import the source table.

NOTE

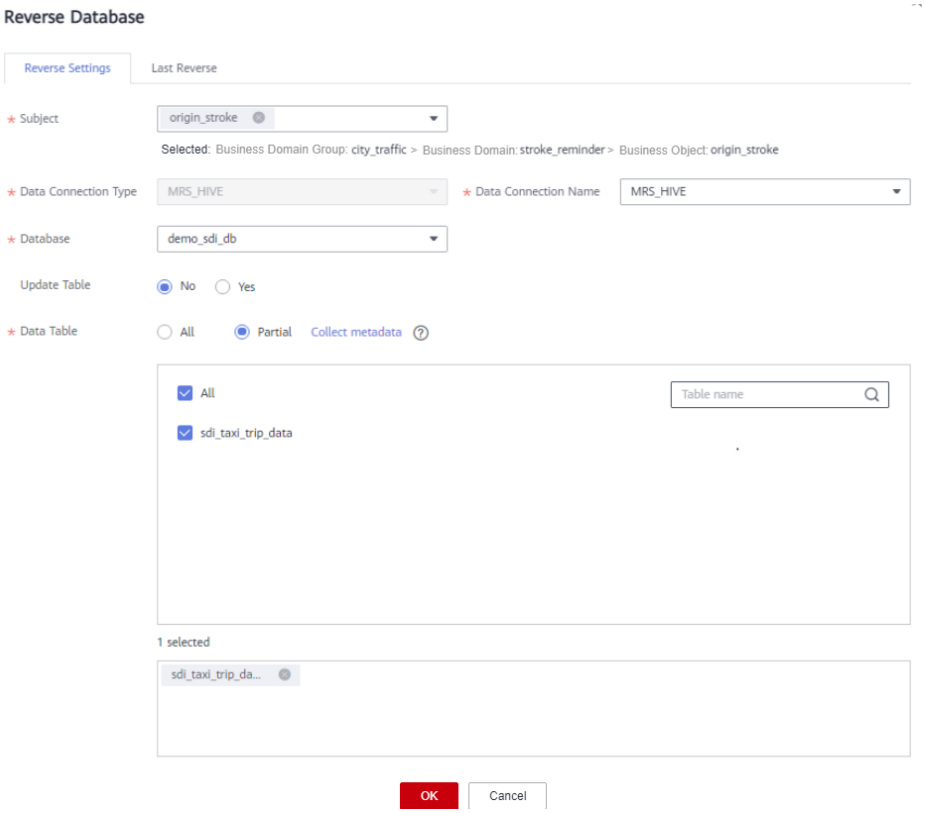
Before reversing a database, ensure that you have collected the data assets of the database.

Figure 8-207 Model directory



In the **Reverse Database** dialog box, set the parameters and click **Yes**. In this example, select the source table in the SDI layer database **demo_sdi_db**.

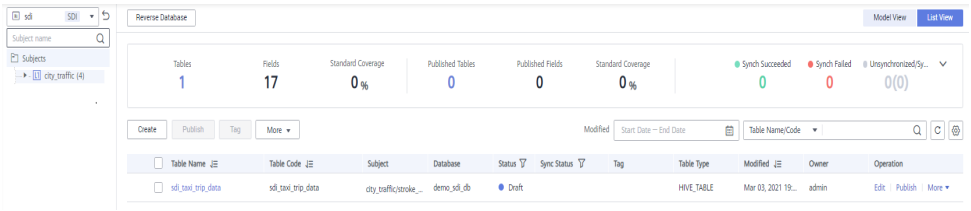
Figure 8-208 Reversing a database



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After the database is reversed, click **Close**. The table is in the draft state. Click **Publish** in the **Operation** column, and you can view the imported and published table.

Figure 8-209 Viewing a table



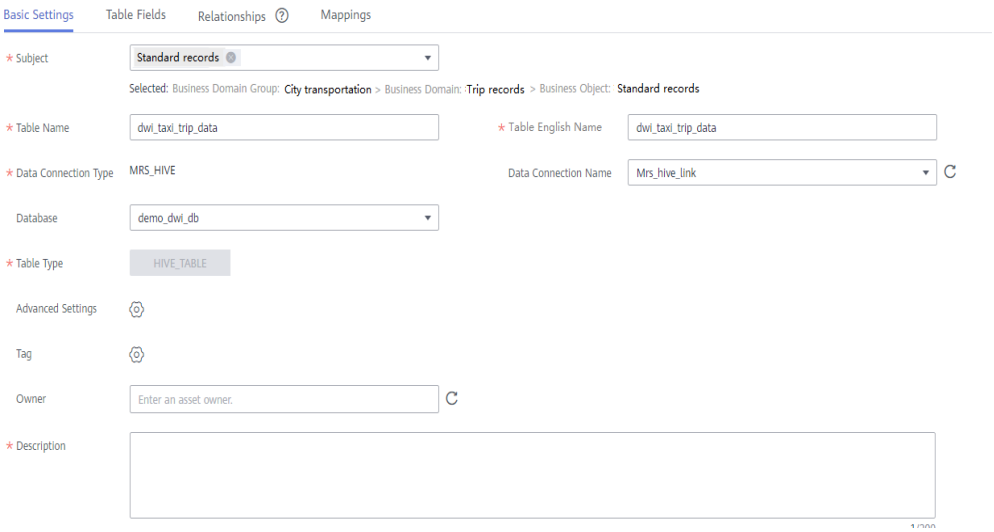
Step 3 Create a standard business table to record trip data.

1. On the **Data Warehouse Layer** area, click the newly created DWI model to go to the **ER Modeling** page. Expand subjects, choose **City transportation** > **Trip records** > **Standard records**, and click **Create** on the page displayed on the right.
2. On the **Basic Settings** tab page, set the parameters as shown in the figure below.

Table 8-74 Standard trip data table

*Subject	*Table Name	* Table English Name	*Data Connection Name	Database	*Description
Standard records	dwi_taxi_trip_data	dwi_taxi_trip_data	mrs_hive_link	demo_dwi_db	None

Figure 8-210 Basic settings of the table named dwi_taxi_trip_data



3. Click **Next** to go to the **Table Fields** page. Click **Add**. Add the fields listed in **Table 8-75**. Then click  in the **Data Standard** column of the rows where

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the vendor ID, rate code ID, and payment type reside to associate with the **Vendor**, **Rate Code ID**, and **Payment Type** standards, respectively. **Figure 8-211** shows the configuration after the fields are added.

Table 8-75 Fields to be added to the table named dwi_table_trip_data

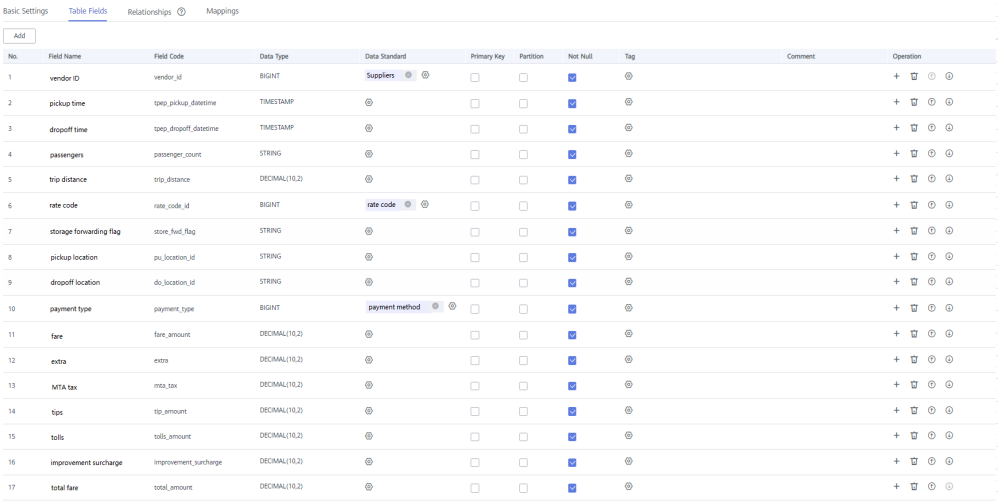
No.	Field Name	Field Code	Data Type	Data Standard	Primary Key	Partition	Not Null	Tag
1	vendor_id	vendor_id	BIGINT	vendor	Not selected	Not selected	Selected	-
2	tpep_pickup_datetime	tpep_pickup_datetime	TIMESTAMP	-	Not selected	Not selected	Selected	-
3	tpep_dropoff_datetime	tpep_dropoff_datetime	TIMESTAMP	-	Not selected	Not selected	Selected	-
4	passenger_count	passenger_count	STRING	-	Not selected	Not selected	Selected	-
5	trip_distance	trip_distance	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-
6	rate_code_id	rate_code_id	BIGINT	rate_code	Not selected	Not selected	Selected	-
7	store_fwd_flag	store_fwd_flag	STRING	-	Not selected	Not selected	Selected	-
8	pu_location_id	pu_location_id	STRING	-	Not selected	Not selected	Selected	-

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No.	Field Name	Field Code	Data Type	Data Standard	Primary Key	Partition	Not Null	Tag
9	do_location_id	do_location_id	STRING	-	Not selected	Not selected	Selected	-
10	payment_type	payment_type	BIGINT	payment_type	Not selected	Not selected	Selected	-
11	fare_amount	fare_amount	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-
12	extra	extra	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-
13	mta_tax	mta_tax	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-
14	tip_amount	tip_amount	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-
15	tolls_amount	tolls_amount	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-
16	improvement_surcharge	improvement_surcharge	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-
17	total_amount	total_amount	DECIMAL(10,2)	-	Not selected	Not selected	Selected	-

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Figure 8-211 Fields to be added to the table named dwi_table_trip_data



You can perform the following operations on the fields.

- **Associating with data standards**

  When creating or editing a table, click the **Table Fields** tab. In the **Data Standard** column of the row where the field is located, click to select a data standard to be associated with the field. After a field is associated with a data standard, a quality job is automatically generated after the table is published. A quality rule is generated for each field associated with the data standard. You can monitor the quality of fields based on the data standard. You can view the quality job on the **Quality Jobs** page of DataArts Quality. For more information about associating data standards, see **Designing Physical Models**.

- **Adding a tag**

  A tag is a custom identifier. After adding a tag, you can search for data assets in the DataArts Studio DataArts Catalog module with ease.

  When creating or editing a table, click the **Table Fields** tab. In the **Tag** column of the row where the field is located, click to select a tag. In the dialog box displayed, enter a new tag name and press **Enter**. Alternatively, select an existing tag from the drop-down list. Then click **OK**.

- **Associating with quality rules**

  After a table is created, you can associate fields in the table with quality rules. After the association, a quality job is automatically created in the DataArts Quality module after the table is published. If the table has been published, the system automatically updates the quality job. For more information about associating quality rules, see **Associating with Quality Rules**.

4. Click **Next** to go to the **Relationships** page. In this example, you do not need to perform any operation on this page.
5. Click **Next** to go to the **Mappings** page and create mappings to design data sources of the table.

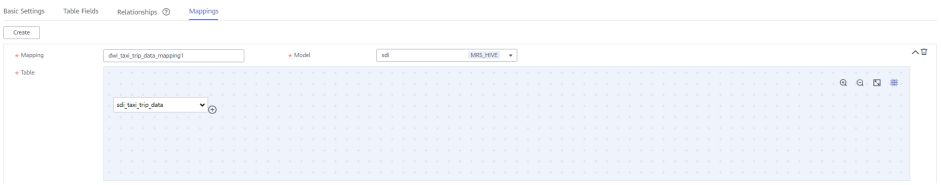
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- If the table fields come from different ER models, you must create multiple mappings. In each mapping, you only need to set the source field for the field that comes from the current mapping.
- If the table fields come from multiple tables in the same ER model, you can create a mapping. In the **Table** field of the mapping, you can join multiple tables and then set source fields for the fields in the table.

In this example, you only need to create one mapping. Click **Create** and set a mapping as shown in **Figure 8-212**.

- **Mapping** is automatically generated. You can customize the name.
- Select **sdi** for **Model**.
- Select the source table **sdi_taxi_trip_data** for **Table**. All data in the **dwi_taxi_trip_data** table comes from this source table.

Figure 8-212 Creating a mapping



- **Field Mapping**

  In the **Field Mapping** area, set source fields for the fields in the table in sequence. The selected source fields must have the same meaning as the fields in the table. As shown in **Figure 8-213**, an SQL statement is displayed at the bottom of **Field Mapping** for reference.

  NOTE

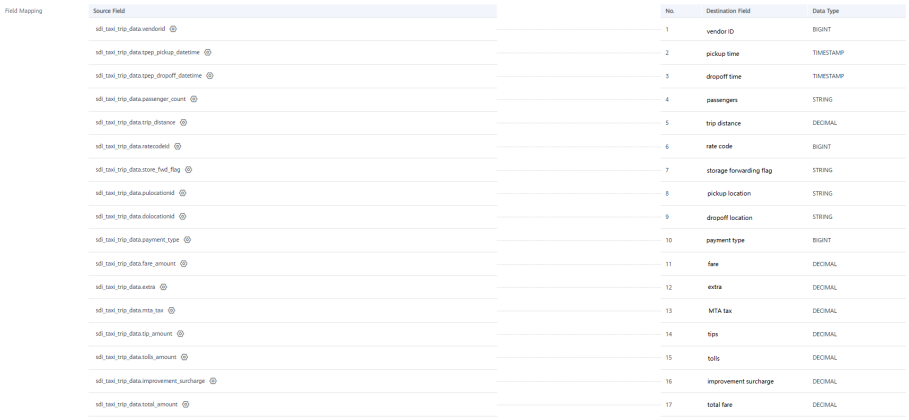
  - On the **DataArts Architecture** page, choose **Metrics** > **Configuration Center** in the navigation pane on the left, and click the **Functions** tab. On the **Functions** page, if **Create data development jobs** is selected (unselected by default) for **Model Design Process**, the system can create an ETL job during data development based on the table mapping information during table release. An ETL node is generated for each mapping, and the job name starts with *Database name_Table code*. Currently, this function is in the internal test stage. Only DLI-to-DLI and DLI-to-DWS mapping jobs can be created.

    You can choose **DataArts Factory** > **Job Development** to view the created ETL jobs. By default, ETL jobs are scheduled at 00:00 every day.

  - In this example, the function of automatically creating ETL jobs is not enabled. The function provides only the data flow direction for data development. During data development, you can refer to the mapping to write SQL scripts.

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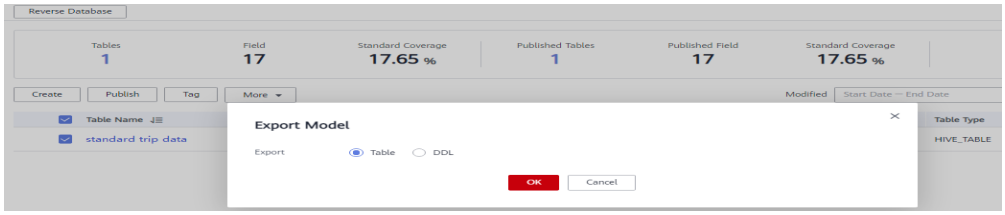
Figure 8-213 Mapping fields



6. After the mappings are configured, click **Save**.

Step 4 Select the created model and choose **More** > **Export**. In the dialog box displayed, select **Table** for **Export** and click **OK**. Export the **sdi** model in the same way. You can use the exported model as a backup and import it.

Figure 8-214 Export dialog box



Step 5 Publish the table model.

1. Publish the source table imported to the SDI ER model in **Step 2**. After the table is published, you can use DataArts Studio to manage and monitor the source table.

   Return to the **ER Modeling** page, select the **sdi** model in the model directory. Select the **sdi_taxi_trip_data** table in the list on the right, and click **Publish**. In the dialog box displayed, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

2. Publish a table of the DWI ER model.

   Return to the **ER Modeling** page, select the **dwi** model in the model directory. Select the **dwi_table_trip_data** table in the list on the right, and click **Publish**. In the dialog box displayed, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

Step 6 After the application is approved, you can view **Status** and **Sync Status** of the corresponding model on the **ER Modeling** page.

Publication is an asynchronous operation. You can click  to refresh the status. After an application for publishing a table is approved, the system performs operations such as creating tables and synchronizing technical assets and logical assets based on the configurations of **Model Design Process** on the **Functions** tab

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page in **Configuration Center**. The synchronization status is displayed in the **Sync Status** column of the table.

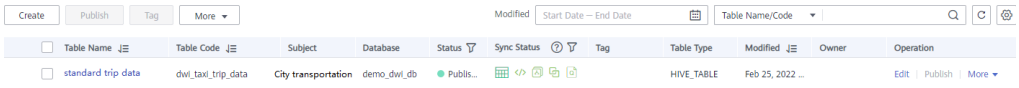
- If all items in **Sync Status** are displayed as **Succeeded**, the table is published.

  Move your mouse pointer to  in **Sync Status**. If **Creation succeeded** is displayed, the table is created in the corresponding data source.

- If an item in **Sync Status** is displayed as **Failed**, you can refresh the status. If the fault persists, choose **More** > **View History** to view logs.

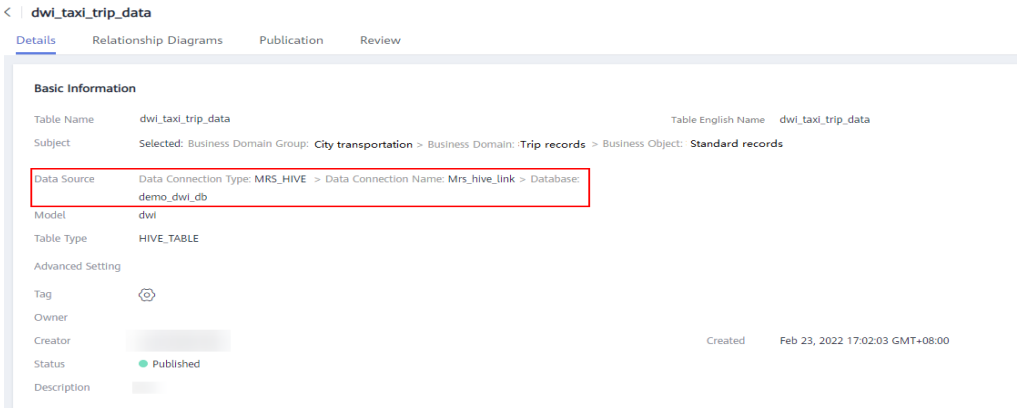
  Locate the failure cause based on the logs. After the fault is rectified, return to the **ER Modeling** page, select the table to be synchronized in the list, choose **More** > **Synchronize** and click **OK** in the dialog box displayed. If the synchronization fails again, contact technical support for assistance.

Figure 8-215 Checking the table status



Click a table name in the list to view the table details. **Data Source** shows the table location.

Figure 8-216 Table details



----End

Creating and Publishing Dimensions for the DWR Layer

During dimension modeling, create three lookup table dimensions (**vendor**, **rate_code**, and **payment_type**) and one hierarchy dimension (**date**) for the DWR layer.

Step 1 On the DataArts Architecture console, choose **Models** > **Dimensional Modeling** in the navigation pane on the left.

Step 2 Create the three lookup table dimensions listed in **Table 8-76**.

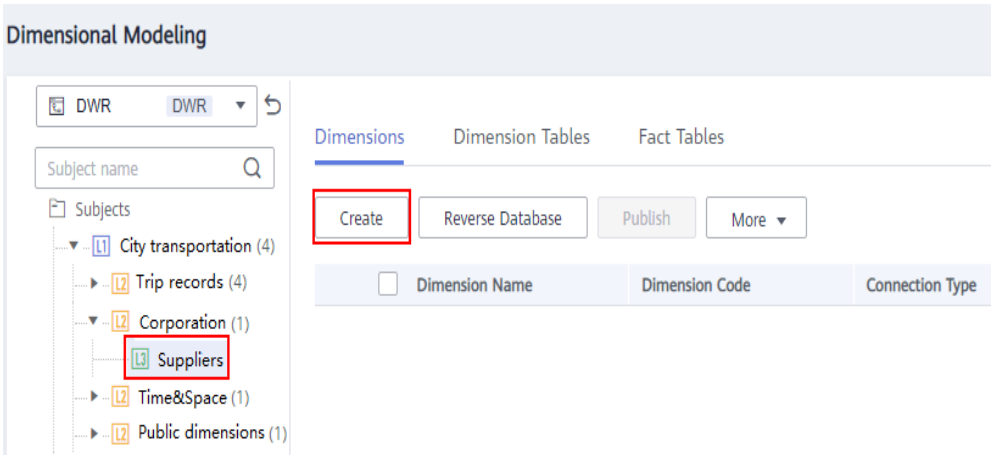
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Table 8-76 Lookup table dimensions

*Subject	*Dimension Name	* Dimension Code	*Type	*Owner	Description	*Data Connection Type	*Data Connection Name	*Database	Lookup Table
vendor	dim_vendor	dim_vendor	Lookup table	-	None	MRS_HIVE	mrs_hive_link	demo_dwr_db	vendor
public_dimension	dim_rate_code	dim_rate_code	Lookup table	-	None	MRS_HIVE	mrs_hive_link	demo_dwr_db	rate
public_dimension	dim_payment_type	dim_payment_type	Lookup table	-	None	MRS_HIVE	mrs_hive_link	demo_dwr_db	payment_type

1. Click the **Dimensions** tab, choose **City transportation** > **Corporation** > **Suppliers** in the subject tree, and click **Create** to create a dimension named **dim_vendor**.

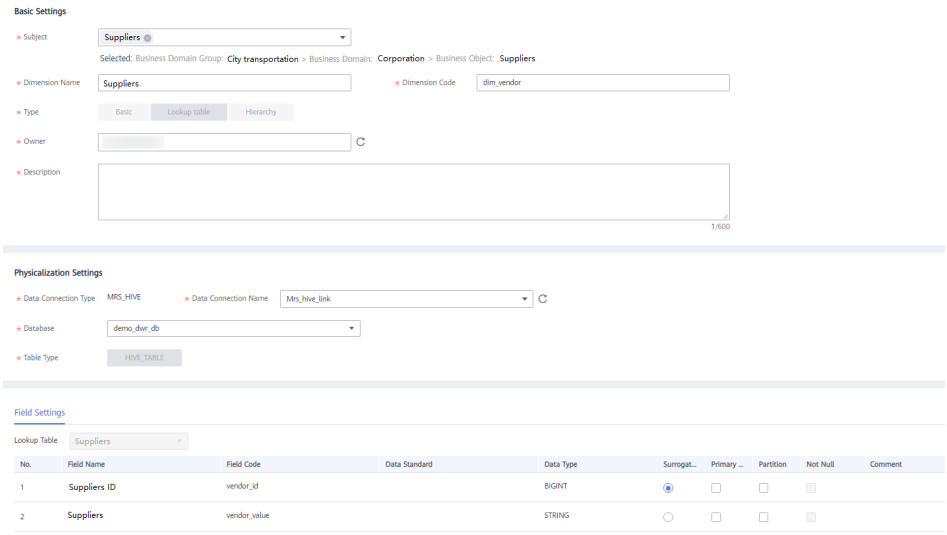
   Figure 8-217 Dimensional modeling

2. On the **Create Dimension** page, set the parameters as shown in the figure below and click **Save**.

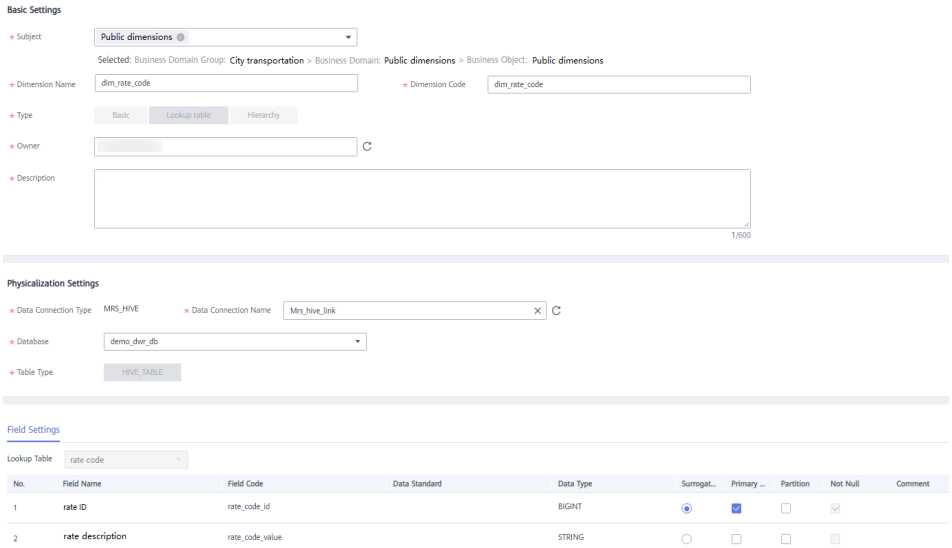
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Figure 8-218 Creating a dimension named dim_vendor



3. Click the **Dimensions** tab, choose **City transportation** > **Public dimensions** > **Public dimensions** in the subject tree, and click **Create** to create a dimension named **dim_rate_code**. On the **Create Dimension** page, set the parameters as shown in the figure below and click **Save**.

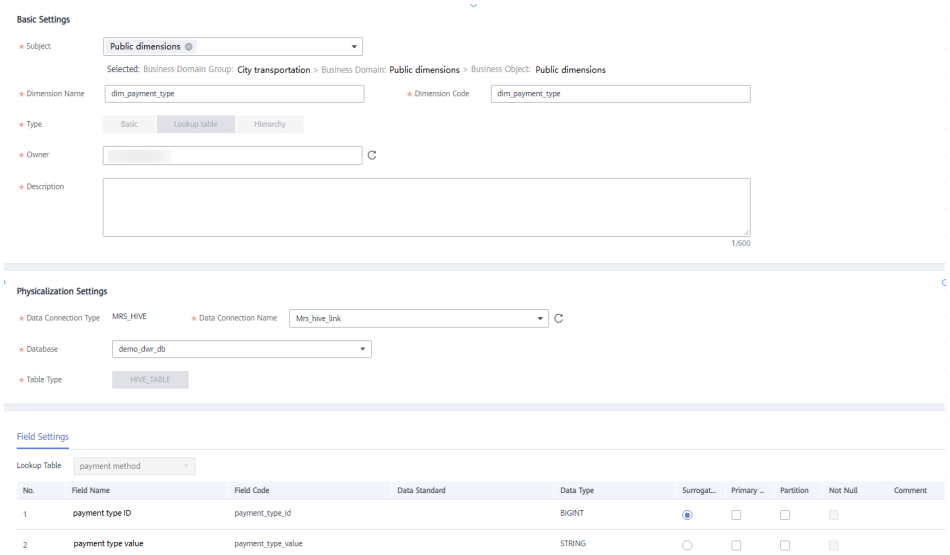
Figure 8-219 Creating a dimension named dim_rate_code



4. Click the **Dimensions** tab, choose **City transportation** > **Public dimensions** > **Public dimensions** in the subject tree, and click **Create** to create a dimension named **dim_payment_type**. On the **Create Dimension** page, set the parameters as shown in the figure below and click **Save**.

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Figure 8-220 Creating a dimension named dim_payment_type



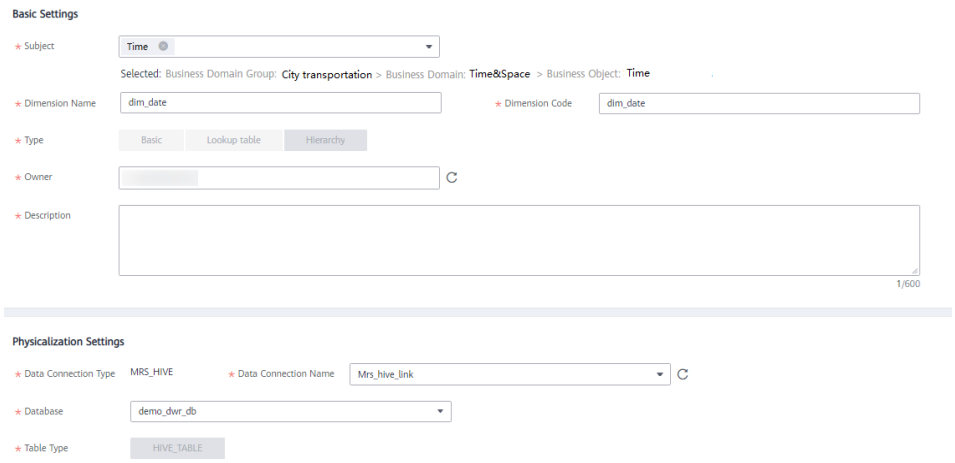
Step 3 Create a hierarchy dimension named **dim_date**.

1. On the **Dimensional Modeling** tab page, choose **City transportation** > **Time&Space** > **Time** in the subject tree. Then click **Create** on the **Dimensions** tab page to create a dimension named **dim_date**.
2. Configure the basic settings and physicalization settings as shown in the figure below.

Table 8-77 Date dimension

*Subject	*Dimension Name	* Dimension English Name	*Type	*Owner	Description	*Data Connection Type	*Data Connection Name	*Database
date	dim_date	dim_date	Hierarchy	-	None	MRS_HIVE	mrs_hive_link	demo_dwr_db

Figure 8-221 Date dimension



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3. In the **Field Settings** area, add fields as described in the table below.

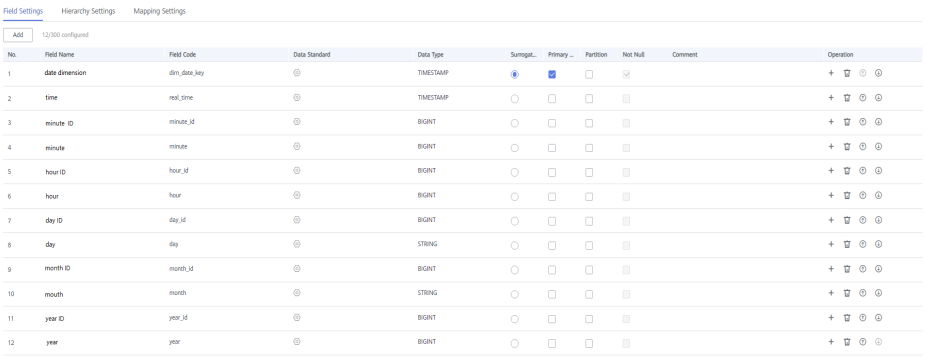
Table 8-78 Field settings

No.	Field Name	Field Code	Data Standard	Data Type	Surrogate Key	Primary Key	Partition	Not Null
1	dim_date_key	dim_date_key	-	TIMESTAMP	Selected	Selected	Not selected	Selected
2	real_time	real_time	-	TIMESTAMP	Not selected	Not selected	Not selected	Not selected
3	minute_id	minute_id	-	BIGINT	Not selected	Not selected	Not selected	Not selected
4	minute	minute	-	BIGINT	Not selected	Not selected	Not selected	Not selected
5	hour_id	hour_id	-	BIGINT	Not selected	Not selected	Not selected	Not selected
6	hour	hour	-	BIGINT	Not selected	Not selected	Not selected	Not selected
7	day_id	day_id	-	BIGINT	Not selected	Not selected	Not selected	Not selected
8	day	day	-	STRING	Not selected	Not selected	Not selected	Not selected

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No.	Field Name	Field Code	Data Standard	Data Type	Surrogate Key	Primary Key	Partition	Not Null
9	month_id	month_id	-	BIGINT	Not selected	Not selected	Not selected	Not selected
10	month	month	-	STRING	Not selected	Not selected	Not selected	Not selected
11	year_id	year_id	-	BIGINT	Not selected	Not selected	Not selected	Not selected
12	year	year	-	BIGINT	Not selected	Not selected	Not selected	Not selected

Figure 8-222 Field settings



4. In the **Hierarchy Settings** area, click **Add** to create two layers as shown in the figures below.

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Figure 8-223 Layer 1

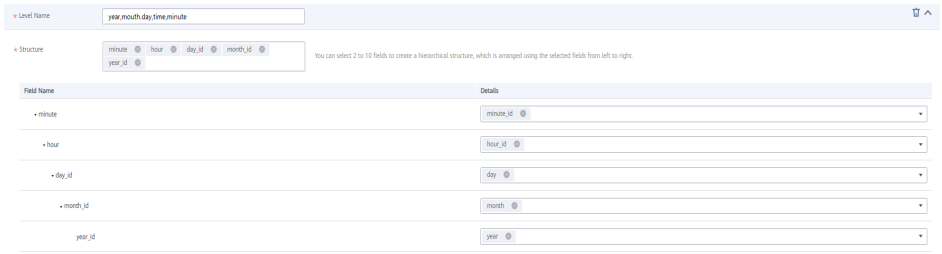
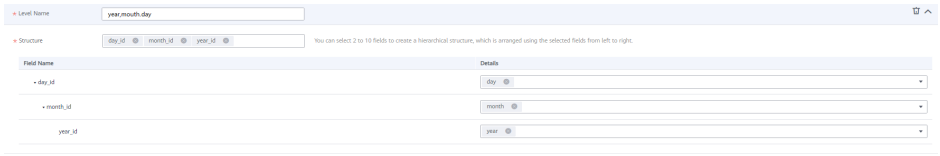


Figure 8-224 Layer 2



5. Click **Save**.

Step 4 Return to the **Dimensions** tab page, select the four new dimensions in the dimension list, and click **Publish**.

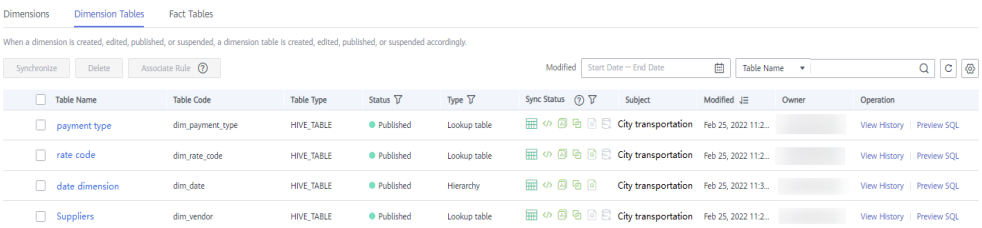
Step 5 In the **Apply for Publication** dialog box, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

Step 6 After a dimension is published and approved, the system automatically creates a dimension table for the dimension. The name and code of the dimension table are the same as those of the dimension. On the **Dimensional Modeling** page, click the **Dimension Tables** tab to view the created dimension table.

In the dimension table list, you can view **Sync Status** of the dimension tables.

- If all items in **Sync Status** are displayed as **Succeeded**, the dimension is published and the dimension table is created in the database.
- If an item in **Sync Status** is displayed as **Failed**, click **View History** in the row. On the page displayed, click the **History** tab to view logs. Troubleshoot the fault based on the logs. After the fault is rectified, select the dimension table, click **Synchronize** above the dimension table list, and click **OK** in the dialog box displayed. If the fault persists, contact technical support for assistance.

Figure 8-225 Sync Status of the dimension tables



----End

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Creating and Publishing a Fact Table for the DWR Layer

During dimensional modeling, create a fact table named **stroke_order** for the DWR layer.

Step 1 On the DataArts Architecture console, choose **Models** > **Dimensional Modeling** in the navigation pane on the left.

Step 2 Click the **Fact Tables** tab, choose **City transportation** > **Trip records** > **Trip facts** in the subject tree, and click **Create** to create a fact table named **stroke_order**.

In the **Basic Settings** area on the **Create Fact Table** page, set the following parameters:

- **Subject**: **Subject Area Group: City transportation > Subject Area: Trip records > Business Object: Trip facts**
- **Table Name**: **stroke_order**
- **Table English Name**: **fact_stroke_order**
- **Data Connection Type**: **MRS_HIVE**
- **Data Connection Name**: **mrs_hive_link**
- **Database**: **demo_dwr_db**
- **Table Type**: **HIVE_TABLE**
- **Owner**: an owner in the drop-down list box
- **Description**: None

In the **Field Settings** area, choose **Create** > **Dimension**. In the dialog box displayed, select the dimensions **rate_code**, **vendor**, **payment_type**, and **date**, and click **OK**. Choose **Create** > **Dimension**. In the dialog box displayed, select the dimension **date** and click **OK**. In the dimension field list, adjust the sequence of the dimension fields and modify the information about the two **date** dimensions, as listed in **Table 8-79**.

Table 8-79 Dimension fields

No.	Field Name	Field Code	Data Type	Primary Key	Partition	Not Null	Associated Standard	Associated Dimension	Role	Description
1	rate_code_id	rate_code_id	BIGINT	Not selected	Not selected	Not selected	-	rate_code	dim_	-
2	vendor_id	vendor_id	BIGINT	Not selected	Not selected	Not selected	-	vendor	dim_	-

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No.	Field Name	Field Code	Data Type	Primary Key	Partition	Not Null	Associated Standard	Associated Dimension	Role	Description
3	payment_type_id	payment_type_id	BIGINT	Not selected	Not selected	Not selected	-	payment_type	dim_	-
4	pickup_date_key	dim_pickup_date_key	TIMESTAMP	Not selected	Not selected	Not selected	-	Date	dim_pickup	Date dimension table
5	tpep_dropoff_datetime	dim_dropoff_date_key	TIMESTAMP	Not selected	Not selected	Not selected	-	Date	dim_dropoff	Date dimension table

In the **Field Settings** area, choose **Create** > **Measure** and create the fields listed in **Table 8-80** in sequence.

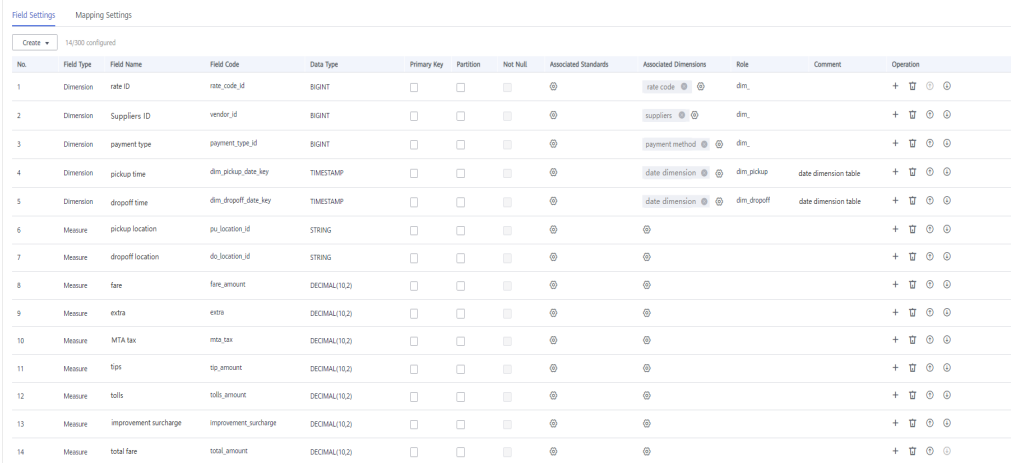
Table 8-80 Measure fields

No.	Field Name	Field Code	Data Type	Primary Key	Partition	Not Null	Associated Standard
6	pu_location_id	pu_location_id	STRING	Not selected	Not selected	Not selected	-
7	do_location_id	do_location_id	STRING	Not selected	Not selected	Not selected	-
8	fare_amount	fare_amount	DECIMAL (10,2)	Not selected	Not selected	Not selected	-

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No.	Field Name	Field Code	Data Type	Primary Key	Partition	Not Null	Associated Standard
9	extra	extra	DECIMAL (10,2)	Not selected	Not selected	Not selected	-
10	mta_tax	mta_tax	DECIMAL (10,2)	Not selected	Not selected	Not selected	-
11	tip_amount	tip_amount	DECIMAL (10,2)	Not selected	Not selected	Not selected	-
12	tolls_amount	tolls_amount	DECIMAL (10,2)	Not selected	Not selected	Not selected	-
13	improvement_surcharge	improvement_surcharge	DECIMAL (10,2)	Not selected	Not selected	Not selected	-
14	total_amount	total_amount	DECIMAL (10,2)	Not selected	Not selected	Not selected	-

Figure 8-226 Fact table fields



Step 3 After the configuration, click **Publish**.

Step 4 In the dialog box displayed, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

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Step 5 Return to the **Fact Tables** tab page, find the new fact table in the list, and view **Sync Status**.

- If all items in **Sync Status** are displayed as **Succeeded**, the fact table is published and created in the database.
- If an item in **Sync Status** is displayed as **Failed**, choose **More** > **View History**. On the page displayed, click the **History** tab to view logs. Troubleshoot the fault based on the logs. After the fault is rectified, choose **More** > **Synchronize** above the fact table list, and click **OK** in the dialog box displayed. If the fault persists, contact technical support for assistance.

----End

Creating and Publishing Technical Metrics

In this example, you need to create the technical metrics listed in **Table 8-81** and **Table 8-82**.

Table 8-81 Atomic metrics

*Metric Name	* Metric Code	Data Table	*Subject	*Expression	Description
sum_total_amount	sum_total_amount	Itinerary order	stroke_fact	sum (total amount)	None

Table 8-82 Derivative metrics

Metric	*Data Table	*Subject	*Atomic Metric	Statistical Dimension	Time Filter	General Filter
total_amount_(payment_type)	Itinerary order	stroke_statistic	total_amount	payment_type	None	None
total_amount_(rate_code)	Itinerary order	stroke_statistic	total_amount	rate_code	None	None
total_amount_(vendor,stroke_order.dim_dropoff_date_key)	Itinerary order	stroke_statistic	total_amount	**vendor** and **stroke_order.dim_dropoff_date_key**	None	None

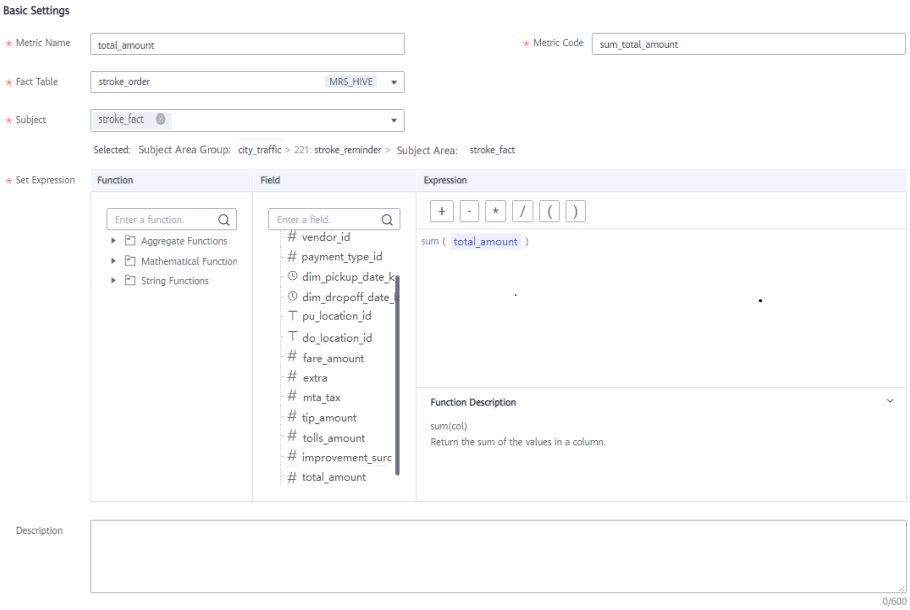
Step 1 On the DataArts Architecture console, choose **Metrics** > **Technical Metrics** in the navigation pane on the left.

Step 2 Create an atomic metric named **total_amount** to collect statistics on fares.

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1. Click the **Atomic Metrics** tab and click **Create**.
2. On the **Create Atomic Metric** page, set the parameters as shown in the figure below and click **Publish**.

Figure 8-227 Creating an atomic metric



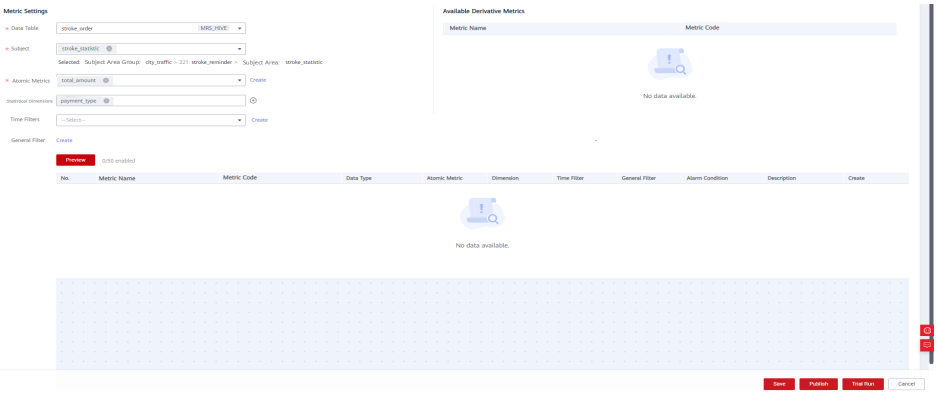
3. Wait for the reviewer to review the application. After the application is approved, the atomic metric will be created.

Step 3 Create three derivative metrics.

- Create **total_amount_(payment_type)** to collect statistics on the total fares based on **payment_type**.

  On the **Technical Metrics** page, click the **Derivative Metrics** tab and click **Create**. On the **Create Derivative Metric** page, set the parameters as shown in the figure below. After the configuration is complete, click **Trial Run**. In the dialog box displayed, click **Execute**. If the trial running is successful, click **Save**.

Figure 8-228 Creating a derivative metric named total_amount_(payment_type)

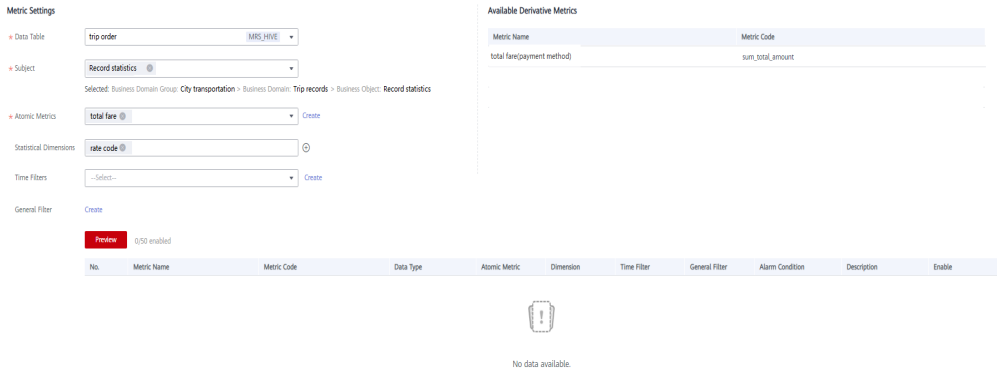


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- Create **total_amount_(rate_code)** to collect statistics on the total fares based on **rate_code**.

  On the **Technical Metrics** page, click the **Derivative Metrics** tab and click **Create**. On the **Create Derivative Metric** page, set the parameters as shown in the figure below. After the configuration is complete, click **Trial Run**. In the dialog box displayed, click **Execute**. If the trial running is successful, click **Save**.

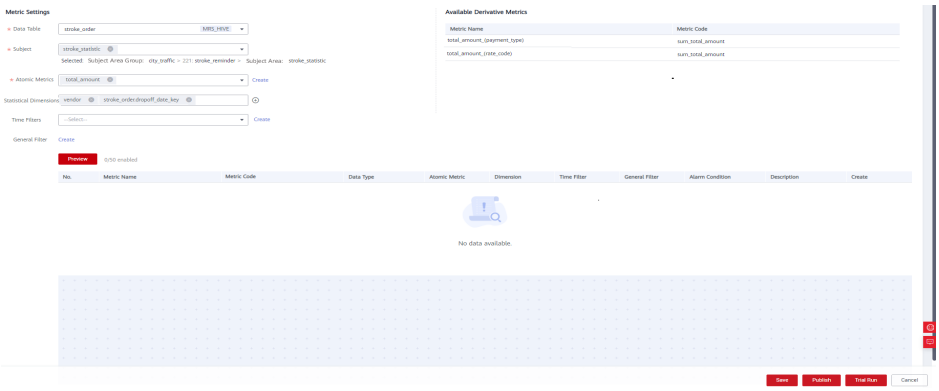
  Figure 8-229 Creating a derivative metric named total_amount_(rate_code)

- Create **total_amount_(vendor,stroke_order.dim_dropoff_date_key)** to collect statistics on the total fares based on **vendor**.

  On the **Technical Metrics** page, click the **Derivative Metrics** tab and click **Create**. On the **Create Derivative Metric** page, set the parameters as shown in the figure below. After the configuration is complete, click **Trial Run**. In the dialog box displayed, click **Execute**. If the trial running is successful, click **Save**.

  Figure 8-230 Creating a derivative metric named total_amount_(vendor,stroke_order.dim_dropoff_date_key)

Step 4 Return to the **Derivative Metrics** tab page, select the three derivative metrics and click **Publish**. In the dialog box displayed, select a reviewer and click **OK**. Wait for the reviewer to review the application. If you have the reviewer permissions, select **Auto-review** and click **OK**.

----End

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Data Mart: Creating and Publishing Summary Tables for the DM Layer

Create the three summary tables listed in **Table 8-83** for the DM layer.

Table 8-83 Summary tables

*Subject	*Table Name	* Table English Name	Statistical Dimension	Data Connection Type	*Data Connection Name	*Database	Owner	Description
stroke_statistic	dws_payment_type	dws_payment_type	payment_type	MRS_HIVE	mrs_hive_link	demo_dm_db	-	None
stroke_statistic	dws_rate_code	dws_rate_code	rate_code	MRS_HIVE	mrs_hive_link	demo_dm_db	-	None
stroke_statistics	dws_vendor	dws_vendor	**vendor** and **stroke_order.dim_dropoff_date_key**	MRS_HIVE	mrs_hive_link	demo_dm_db	-	None

Step 1 On the DataArts Architecture console, choose **Data Mart** in the navigation pane on the left.

Step 2 Click the **Summary Tables** tab.

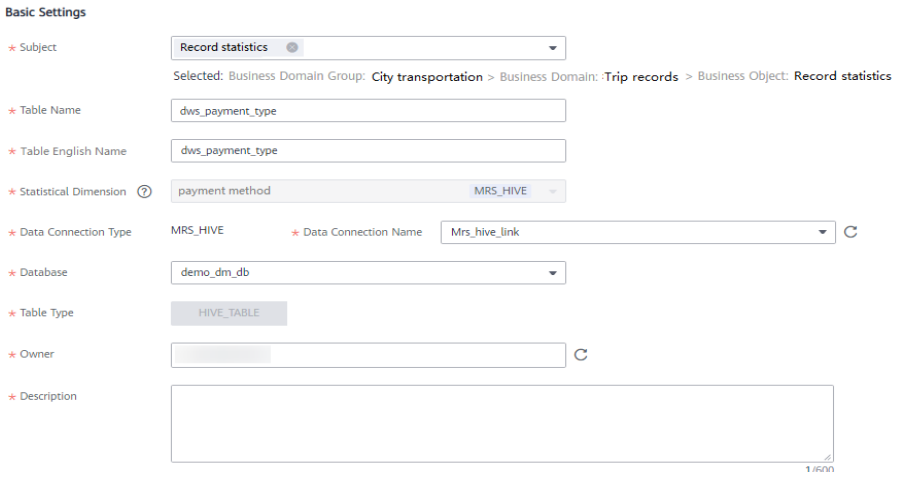
Step 3 Create three summary tables: **payment_type**, **rate_code**, and **vendor**.

1. On the **Summary Tables** page, choose **City transportation** > **Trip records** > **Record statistics** in the directory tree, and click **Create** to create a summary table named **dws_payment_type**. On the **Create Summary Table** page, set the parameters and click **Save**.

   Set the basic settings as shown in the figure below.

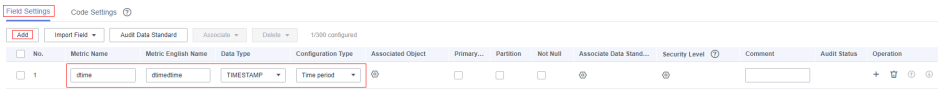
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Figure 8-231 Creating a summary table named dws_payment_type



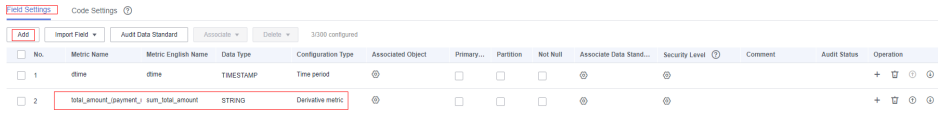
On the **Field Settings** tab page, click **Add**, enter the time field name, and select the data type.

Figure 8-232 Field settings



On the **Field Settings** tab page, click **Add** to add the derivative metric **total_amount_(payment_mode)**. Set associated objects and select corresponding metrics. You can add only published derivative or compound metrics that are associated with the specified statistical dimension.

Figure 8-233 Field settings



Click **Save**.

2. On the **Summary Tables** page, choose **City transportation** > **Trip records** > **Record statistics** in the directory tree, and click **Create** to create a summary table named **dws_rate_code**. On the **Create Summary Table** page, set the parameters and click **Save**.

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Figure 8-234 Creating a summary table named dws_rate_code (Basic Settings)

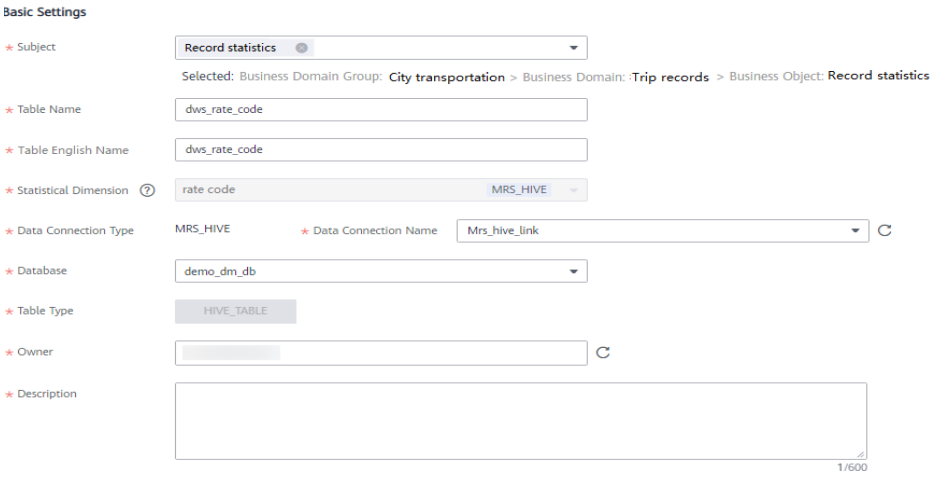
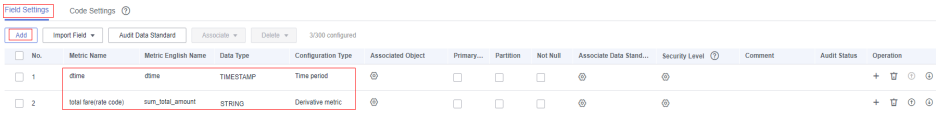
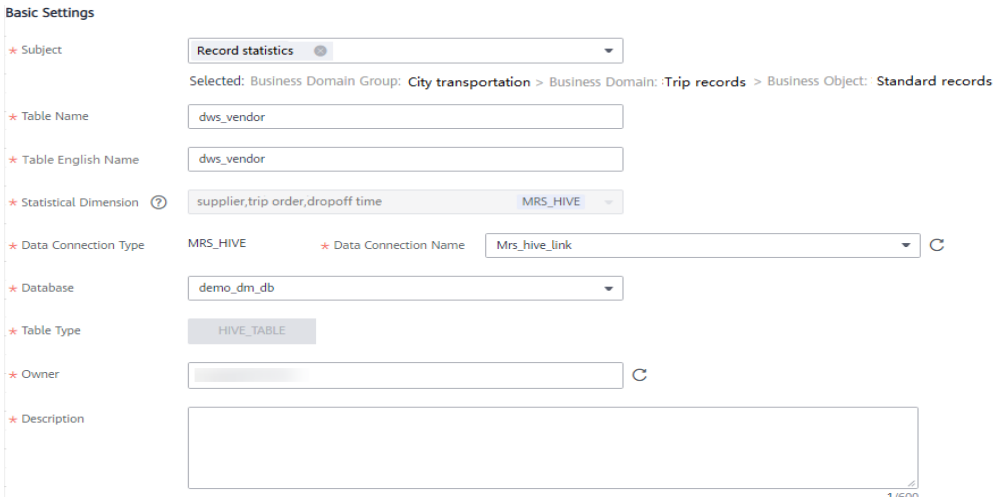


Figure 8-235 Creating a summary table named dws_rate_code (Field Settings)



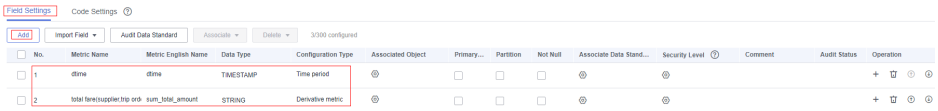
3. On the **Summary Tables** page, choose **City transportation** > **Trip records** > **Record statistics** in the directory tree, and click **Create** to create a summary table named **dws_vendor**. On the **Create Summary Table** page, set the parameters and click **Save**.

Figure 8-236 Creating a summary table named dws_vendor (Basic Settings)



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Figure 8-237 Creating a summary table named dws_vendor (Field Settings)



Step 4 Return to the **Summary Tables** tab page, select the three new summary tables, and click **Publish**.

Step 5 In the dialog box displayed, select a reviewer and click **OK**. After the reviewer approves the publishing application, the summary table is automatically created. If you have the reviewer permissions, select **Auto-review** and click **OK**.

Step 6 Return to the **Summary Tables** tab page, find the new summary tables in the list, and view **Sync Status**.

- If all items in **Sync Status** are displayed as **Succeeded**, the summary tables are published and created in the database.
- If an item in **Sync Status** is displayed as **Failed**, choose **More** > **View History** in the row. On the page displayed, click the **History** tab to view logs. Troubleshoot the fault based on the logs. After the fault is rectified, choose **More** > **Synchronize** above the summary table list, and click **OK** in the dialog box displayed. If the fault persists, contact technical support for assistance.

----End

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9 DataArts Factory

9.1 Overview

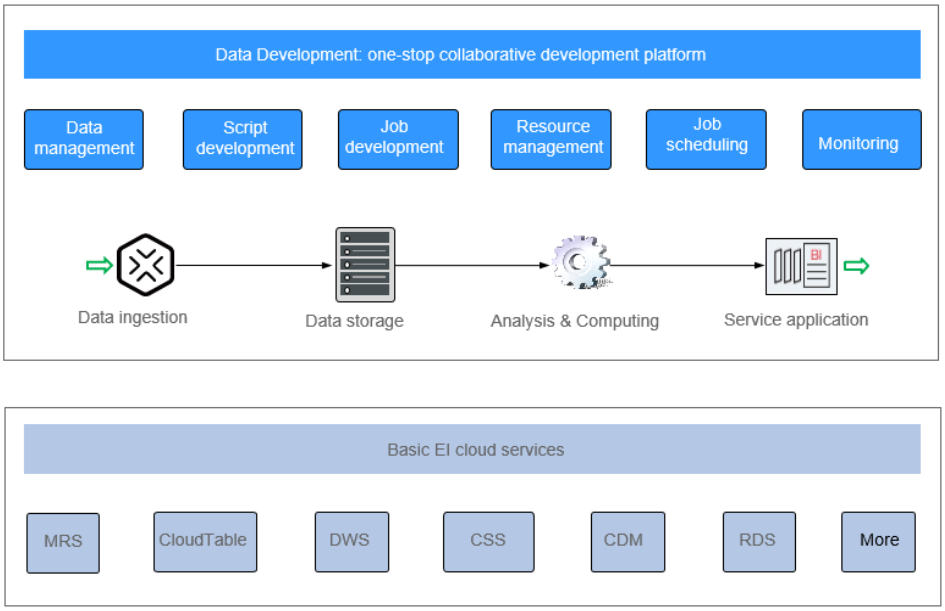
DataArts Factory is a one-stop big data collaborative development platform that provides fully managed big data scheduling capabilities. It manages various big data services, making big data more accessible than ever before and helping you effortlessly build big data processing centers.

DataArts Factory used to be Data Lake Factory (DLF). Therefore, in this document, both Data Lake Factory and DLF can be used to refer to DataArts Factory.

Introduction to DataArts Factory

DataArts Factory enables a variety of operations such as data management, script development, job development, job scheduling, and monitoring, facilitating data analysis and processing.

Figure 9-1 DataArts Factory architecture



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Main Functions

Table 9-1 Main functions of DataArts Factory

Function	Description
Data management	• Manages multiple data warehouses, such as GaussDB(DWS), DLI and MRS Hive. • Manages data tables using the GUI or data definition language (DDL).
Script development	• Provides an online script editor that allows more than one operator to collaboratively develop and debug SQL, Python, and Shell scripts online. • Allows use of variables and functions.
Job development	• Provides a graphical designer that allows you to quickly build a data processing workflow by drag-and-drop. • Presets multiple task types such as data integration, SQL, and Shell, and completes data analysis and processing by dependency between tasks. • Supports job import and export.
Resource management	Supports unified management of file, jar, and archive resources used during script and job development.
Job scheduling	Schedules jobs to run once or recursively and use events to trigger scheduling jobs. If the scheduling frequency is set to hour, the scheduling period can be based on interval hour or discrete hour.
Monitoring	• You can run, suspend, restore, or terminate a job. • You can view the operation details of each job and each node in the job. • You can use various methods to receive notifications when a job or task error occurs.

Objects in DataArts Factory

- Data connection: A data connection is a collection of information required for accessing data storage (computing) space, including the connection type, name, and login information.
- Solution: A solution provides users with convenient and systematic management operations to better meet service requirements and objectives. Each solution can contain one or more business-related jobs, and one job can be used by multiple solutions.
- Job: A job is composed of one or more nodes and can be executed to complete data operations.
- Script: A script is an extension of a batch processing file. It is a program that stores text. Generally, a computer script program is a combination of a series

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of operations that control computers to perform operations. In the script program, certain logic branches can be implemented.

- Node: A node defines the operations performed on data.
- Resource: Resources refer to self-defined codes or text files that are uploaded by users and scheduled when node tasks are executed.
- Expression: Node parameter values in a node job can be dynamically generated based on the running environment by using Expression Language (EL). EL uses simple arithmetic and logic to calculate and reference embedded objects, including job objects and tool objects.
- Environment variable: An environment variable is an object with a specific name in the operating system. It contains information to be used by one or more applications.
- PatchData: PatchData refers to the instance that is generated in a period of time by a periodically scheduled job.

9.2 Data Management

9.2.1 Data Management Process

The data management function helps you quickly establish data models and provides you with data entities for script and job development. With data management, you can:

- Manage multiple types of data lakes, such as GaussDB(DWS), DLI and MRS Hive.
- Use the GUI and DDL to manage database tables.

  NOTE

  If an MRS API connection is used, you cannot view or manage the databases, data tables, and fields of the connection in a visualized manner.

- Click  to view the databases, data tables, and fields in the data connection directory tree. The directory tree is only available for DWS SQL, DLI SQL and MRS Hive SQL connections using an agent.

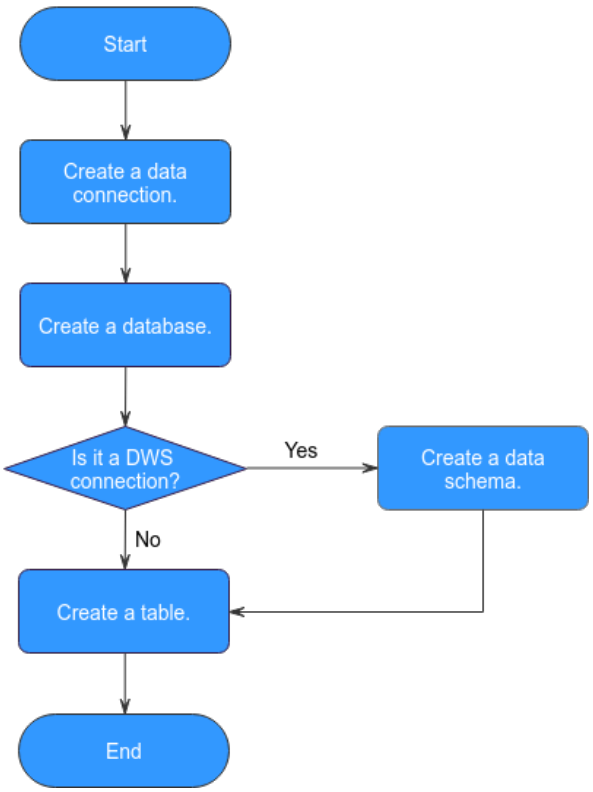
NOTE

If you have created a data connection and a corresponding database and data table before using DataArts Factory, you can skip data management operations and directly go to **Script Development** or **Job Development**.

The following figure shows the process for using the data management function.

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Figure 9-2 Data management process



1. Create a data connection to connect to a data lake base service. For details, see **Creating a Data Connection**.
2. Create a database based on the service type. For details, see **Creating a Database**.
3. If the connection type is DWS, create a database schema and a table. If the connection type is not DWS, create a table. For details, see **(Optional) Creating a Database Schema**.
4. Create a table. For details, see **Creating a Table**.

9.2.2 Creating a Data Connection

After creating a data connection, you can perform data operations on DataArts Factory, for example, managing databases, namespaces, database schema, and tables.

With one data connection, you can run multiple jobs and develop multiple scripts. If the connection information saved in the data connection changes, you only need to modify the corresponding information in Connection Management.

Creating a Data Connection

The data connection of DataArts Factory is created based on the data connection of Management Center. For details about how to create a data connection, see **Configuring DataArts Studio Data Connection Parameters**.

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Viewing Connection References

To view the references of a connection, perform the following steps:

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. Click  to display the connection list.
5. Right-click a connection in the list and select **View Reference**.
6. In the displayed **Reference List** dialog box, view the jobs or scripts that use the connection.

Figure 9-3 Reference List



9.2.3 Creating a Database

After creating a data connection, you can create a database on the console or using a SQL script.

- (Recommended) Console: You can directly create a database on the DataArts Studio DataArts Factory console with no code.
- SQL script: You can also develop and execute a SQL script for creating a database in the SQL editor of DataArts Studio's DataArts Factory module or a data lake product, and then use the script to create a database.

This section describes how to create a database on the DataArts Factory console.

Prerequisites

- You have already enabled the corresponding cloud services. for example, the MRS service.
- A data connection has been created. For details, see **Creating a Data Connection**.
- MRS API connections cannot be used to manage databases in a visualized mode. You are advised to create a database using SQL scripts.
- Before deleting a database, ensure that the database is not in use and is not associated with any data tables.

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Creating a Database on the DataArts Factory Console

1. Log in to the DataArts Studio console by following the instructions in **Accessing the Data**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script development menu, click  . Right-click the data connection for which you want to create a database, and choose **Create Database** from the shortcut menu. Set the parameters based on **Table 9-2**.

   Table 9-2 Creating a database

Parameter	Mandatory	Description
Database Name	Yes	Name of a database. The naming rules are as follows: • DLI: The value must contain only numbers, letters, and underscores (_). It cannot start with an underscore (_) or contain only numbers. • DWS: The value must contain only numbers, letters, and underscores (_). It cannot start with an underscore (_) or contain only numbers. • MRS Hive: The value must contain 1 to 128 characters, including only letters, numbers, and underscores (_). It must start with a number or letter and cannot contain only numbers.
Description	No	Descriptive information about the database. The requirements are as follows: • DLI: The value contains a maximum of 256 characters. • DWS: The value contains a maximum of 1,024 characters. • MRS Hive: The value contains a maximum of 1,024 characters.

5. Click **OK**.

Related Operations

- Modify a database: In the script development menu, click  . Expand a data connection, right-click a database name, select **Edit**, and modify the database information.
- Delete a database: In the script development menu, click  . Expand a data connection, right-click a database name, select **Delete**, and click **OK** in the displayed dialog box.

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NOTE

Deleted databases cannot be recovered. Exercise caution when performing this operation.

9.2.4 (Optional) Creating a Database Schema

After creating a DWS data connection, you can manage the database schemas under the DWS data connection.

NOTE

If existing database schemas meet your requirements, skip this section. Otherwise, create a database schema by following the instructions in this section.

Prerequisites

- A DWS data connection has been created. For details, see **Creating a Data Connection**.
- A DWS database has been created. For details, see **Creating a Database**.

Creating a Database Schema

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script development menu, click  . Expand a DWS data connection, select the database to be configured, and expand the directory level to **schemas**. Then right-click **schemas** and select **Create Schema** from the shortcut menu.
5. In the displayed dialog box, set the schema parameters based on **Table 9-3**.

   Table 9-3 Creating a database schema

Parameter	Mandatory	Description
Mode Name	Yes	Name of a database schema.
Description	No	Descriptive information about the database schema.

6. Click **OK**.

Related Operations

- Modify a database schema: In the script development menu, click  . Expand a data connection to the target database schema, right-click the database schema name, select **Edit**, and modify the database schema information.

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- Delete a database schema: In the script development menu, click . Expand a data connection to the target database schema, right-click the database schema name, select **Delete**, and click **OK** in the displayed dialog box.

  NOTE

  - The default database schema cannot be deleted.
  - Deleted database schemas cannot be recovered. Exercise caution when performing this operation.

9.2.5 Creating a Table

You can create a table on the DataArts Factory console, in DDL mode, or using a SQL script.

- (Recommended) Console: You can directly create a table on the DataArts Studio DataArts Factory console with no code.
- (Recommended) DDL mode: You can select the DDL mode in DataArts Studio's DataArts Factory module to create a table using a SQL script.
- SQL script: You can also develop and execute a SQL script for creating a table in the SQL editor of DataArts Studio's DataArts Factory module or a data lake product, and then use the script to create a table.

This section describes how to create a table on the DataArts Factory console and in DDL mode.

Prerequisites

- You have created a database and a DWS database schema. For details, see **Creating a Database** and **(Optional) Creating a Database Schema**.
- A data connection that matches the table type has been created in DataArts Factory. For details, see **Creating a Data Connection**.

Creating a Table (GUI Mode)

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script development menu, click , expand the data connection to **tables**, and right-click **Create Table** or click to create a table.
5. In the displayed dialog box, configure parameters based on **Table 9-4** on the **Basic property configuration** tab page.

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Table 9-4 Basic property parameters

Data Connection Type	Description
DLI	For details, see the **Basic Property** part in **Table 9-8**.
GaussDB(DWS)	For details, see the **Basic Property** part in **Table 9-9**.
MRS Hive	For details, see the **Basic Property** part in **Table 9-10**.

6. Click **Next**. On the **Configure Table Structure** page, configure tbe table structure parameters based on **Table 9-5**.

Table 9-5 Table structure

Data Connection Type	Description
DLI	For details, see the **Table Structure** part in **Table 9-8**.
GaussDB(DWS)	For details, see the **Table Structure** part in **Table 9-9**.
MRS Hive	For details, see the **Table Structure** part in **Table 9-10**.

7. Click **OK**.

Creating a Table (DDL Mode)

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script development menu, click  , expand the data connection to **tables**, and right-click **Create Table** or click  to create a table.
5. Click **DDL-based Table Creation** and enter SQL statements in the displayed editor. (Default values are set for the parameters listed in **Table 9-6**.) The following is an example:

```
CREATE TABLE userinfo ( id INT, name STRING);
```

NOTE

The SQL syntax varies depending on the data source. Before developing an SQL statement, learn about the syntax of the data source from its documentation.

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Table 9-6 Data table parameters

Parameter	Description
Data Connection Type	Type of data connection to which the table belongs
Data Connection	Data connection to which the table belongs
Database	Database where the data table is located

6. Click **Save**.

Related Operations

- View table details: In the script development menu, click . Expand the data connection to the data table level, right-click a table name, and select **View Details** from the shortcut menu to view the table details shown in **Table 9-7**.

  Table 9-7 Table details

Tab Name	Description
Table Information	Displays the basic information and storage information about the table.
Field Information	Displays the field information about the table.
Data Preview	Displays 10 records in the table.
DDL	Displays the DDL of the DLI, DWS or MRS Hive data table.

- Delete a table: In the script development menu, click . Expand a data connection, right-click a table name, select **Delete**, and click **OK** in the displayed dialog box.

  NOTE

  Deleted tables cannot be recovered. Exercise caution when performing this operation.

Parameter Description

Table 9-8 DLI data table

Parameter	Mandatory	Description
Basic Property		
Table Name	Yes	Name of a table. It can contain only letters, digits, and underscores (_). It cannot contain only digits or start with an underscore (_) or a digit.

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Parameter	Mandatory	Description
Alias	No	Alias of the data table. It can contain only letters, digits, and underscores (_). It cannot contain only digits or start with an underscore (_).
Data Connection Type	Yes	Type of the data connection to which the table belongs. The default value is used and cannot be changed.
Data Connection	Yes	Data connection to which the table belongs. The default value is used and cannot be changed.
Database	Yes	Database where the data table is located. The default value is used and cannot be changed.
Data Location	Yes	Location to save data. Possible values: ● OBS ● DLI
Data Format	Yes	Format of data. This parameter is available only when **Data Location** is set to **OBS**. Possible values: ● **parquet**: DataArts Factory can read non-compressed parquet data and parquet data compressed using Snappy or gzip. ● **csv**: DataArts Factory can read non-compressed CSV data and CSV data compressed using gzip. ● **orc**: DataArts Factory can read non-compressed ORC data and ORC data compressed using Snappy. ● **json**: DataArts Factory can read non-compressed JSON data and JSON data compressed using gzip.

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Parameter	Mandatory	Description
Path	Yes	OBS path where the data is stored. This parameter is available only when **Data Location** is set to **OBS**. If no OBS path or OBS bucket is available, the system automatically creates an OBS directory. **NOTE** If the number of OBS buckets has reached the upper limit, the system automatically displays the following message: "Failed to create the OBS directory. Error cause: [Create OBS Bucket failed:TooManyBuckets:You have attempted to create more buckets than allowed]".
Table Description	No	Descriptive information about the table.
Table Structure		
Column Type	Yes	Type of the column. Available options include **Partition Column** and **Common Column**. The default value is **Common Column**.
Column Name	Yes	Name of the column. The name must be unique.
Type	Yes	Type of data.
Column Description	No	Descriptive information about the column.
Operation	No	To add a column, click  . To delete a column, click  .

Table 9-9 DWS data table

Parameter	Mandatory	Description
Basic Property		
Table Name	Yes	Name of a table. It can contain only letters, digits, and underscores (_). It cannot contain only digits or start with an underscore (_) or a digit.
Alias	No	Alias of the data table. It can contain only letters, digits, and underscores (_). It cannot contain only digits or start with an underscore (_).

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Parameter	Mandatory	Description
Data Connection Type	Yes	Type of the data connection to which the table belongs. The default value is used and cannot be changed.
Data Connection	Yes	Data connection to which the table belongs. The default value is used and cannot be changed.
Database	Yes	Database where the data table is located. The default value is used and cannot be changed.
Schema	Yes	Schema of the database.
Table Description	No	Descriptive information about the table.
Advanced Settings	No	The following advanced options are available: ● Storage method of a table. Possible values: – **Row store** – **Column store** ● Compression level of a table – Available values when the storage method is row store: **YES** or **NO**. – Available values when the storage method is column store: **YES**, **NO**, **LOW**, **MIDDLE**, or **HIGH**. For the same compression level in column store mode, you can configure compression grades from 0 to 3. Within any compression level, the higher the grade, the greater the compression ratio.
Table Structure		
Column Name	Yes	Name of the column. The name must be unique.

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Parameter	Mandatory	Description
Data Classification	Yes	Classification of data. Possible values: • **Value** • **Currency** • **Boolean** • **Binary** • **Character** • **Time** • **Geometric** • **Network address** • **Bit string** • **Text search** • **UUID** • **JSON** • **OID**
Data Type	Yes	Type of data.
Column Description	No	Descriptive information about the column.
Create ES Index	No	If you click the check box, an ES index needs to be created. When creating the ES index, select the created CSS cluster from the **CloudSearch Cluster Name** drop-down list. For details about how to create a CSS cluster, see *Cloud Search Service User Guide*.
Index Data Type	No	Data type of the ES index. The options are as follows: • text • keyword • date • long • integer • short • byte • double • boolean • binary
Operation	No	To add a column, click . To delete a column, click  .

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Table 9-10 MRS Hive data table

Parameter	Mandatory	Description
Basic Property		
Table Name	Yes	Name of a table. It can contain only letters, digits, and underscores (_). It cannot contain only digits or start with an underscore (_) or a digit.
Alias	No	Alias of the data table. It can contain only letters, digits, and underscores (_). It cannot contain only digits or start with an underscore (_).
Data Connection Type	Yes	Type of the data connection to which the table belongs. The default value is used and cannot be changed.
Data Connection	Yes	Data connection to which the table belongs. The default value is used and cannot be changed.
Database	Yes	Database to which the table belongs. The default value is used and cannot be changed.
Table Description	No	Descriptive information about the table.
Table Structure		
Column Name	Yes	Name of the column. The name must be unique.
Data Classification	Yes	Classification of data. Possible values: • Original type • ARRAY • MAP • STRUCT • UNION
Data Type	Yes	Type of data. See **LanguageManual DDL**.
Column Description	No	Descriptive information about the column.
Operation	No	To add a column, click  . To delete a column, click  .

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9.3 Script Development

9.3.1 Script Development Process

The script development function provides the following capabilities:

- Provides an online script editor for developing and debugging SQL, Python, and Shell scripts.
- Supports script import and export.
- Allows use of variables and functions.
- Provides editing locks for collaborative development.
- Supports script version management and generation of saved and submitted versions.

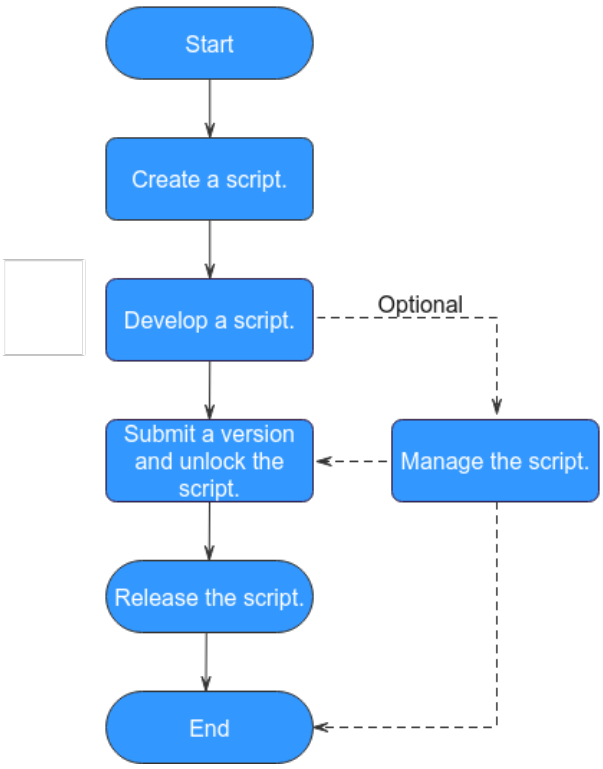
  NOTE

  If you save a script multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.
- Allows you to right-click a script to quickly copy the script name and to quickly close an opened script tab page.
- Provides a link in the execution results of MRS Spark SQL and MRS Hive SQL scripts that use a connection of the MRS API type. Through this link, you can switch to MRS Yarn to view execution logs.
- Allows you to filter submitted and unsubmitted scripts. Unsubmitted scripts are marked in red.
- Displays script parameters in a dialog box. Parameter values can be changed, but parameter names cannot. You can click **Test Parameters** to view (but not modify) the parameters referenced by the script and the environment variables configured in the environment. Parameters in the SQL statement can be sorted by name.
- Supports configuration of the SQL editor style. Move the cursor to ☰ and click **Style Configuration** to configure the editor, icon display, annotation templates, and shortcut keys that can be used in the SQL script editor.
- Allows you to view SQL query results in a table or list. You can click **Style Configuration** and set **SQL Query Result Display Mode** on the **Configure Editor** tab page.
- Allows you to go to the release page from the script development page in enterprise mode. Click **Release** to go to the task release page.
- Allows you to view tables of Hive SQL, DLI SQL, RDS SQL, Impala SQL, and DWS SQL scripts. You can expand a table name to view the column names, field types, and descriptions in the table.
- You can filter out the latest scripts by owner or update time.
- Fine-grained permission control is available for script development. You can configure permission control policies for the script directories in DataArts Factory.

The following figure shows the process of script development.

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Figure 9-4 Script development process



1. Create a script of the corresponding type. For details, see **Creating a Script**.
2. Develop the script: Develop, debug, and execute the script online. For details, see **Developing Scripts**.
3. Submit a version and unlock the script: After performing this step, the script can be scheduled by jobs and modified by other developers. For details, see **Submitting a Version**.
4. (Optional) Manage the script: After the script development is complete, you can manage the script as required. For details, see **(Optional) Managing Scripts**.
5. Release the script. This step is required in enterprise mode. For details, see **Releasing a Script Task**.

9.3.2 Creating a Script

DataArts Factory allows you to create, edit, debug, and run SQL, Python, and Shell scripts. Before developing a script, you must create one.

Prerequisites

- You have completed operations in **Creating a Data Connection** and **Creating a Database**.
- A workspace can contain a maximum of 10,000 scripts, 5,000 script directories, and 10 directory levels. Ensure that these upper limits are not reached.

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Procedure

Creating a Directory (If a directory already exists, you do not need to create one.)

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script directory list, right-click a directory and choose **Create Directory** from the shortcut menu.
5. In the displayed dialog box, configure directory parameters. **Table 9-11** describes the directory parameters.

   Table 9-11 Script directory parameters

Parameter	Description
Directory Name	Name of the script directory. The name must contain 1 to 64 characters, including only letters, numbers, underscores (_), and hyphens (-).
Select Directory	Parent directory of the script directory. The parent directory is the root directory by default.

6. Click **OK**.

Creating a Script

1. In the script directory list, right-click a directory and select **Create** *Script type* **Script** from the shortcut menu.
2. Go to the script development page. For details, see **Developing an SQL Script**, **Developing a Shell Script**, and **Developing a Python Script**.

   NOTE

   A maximum of five temporary scripts of the same type can be created. If you close a temporary script without saving it and create a script of the same type, the closed temporary script will be opened again.

9.3.3 Developing Scripts

9.3.3.1 Developing an SQL Script

DataArts Factory allows you to develop, debug, and run SQL scripts online. You can run developed scripts in jobs. For details, see **Developing a Pipeline Job**.

DataArts Factory supports the following types of SQL scripts. The SQL syntax varies depending on the data source. Before developing an SQL statement, learn about the syntax of the corresponding data source.

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- DLI SQL scripts: For details, see **Spark SQL Syntax**.
- Hive SQL scripts: For details, see **Hive SQL**.
- DWS SQL scripts: For details, see **About GaussDB(DWS) SQL**.
- Spark SQL scripts: For details, see **Spark2x Basic Principles**.
- ClickHouse SQL scripts: For details, see **Common ClickHouse SQL Syntax**.
- Impala SQL scripts: For details, see **Impala**.
- Flink SQL scripts: For details, see **Stream SQL Join**.
- RDS SQL scripts: For details, see **Syntax**.
- Presto SQL scripts: For details, see **Presto**.
- Spark Python scripts: For details, see **Configuring the Spark Python3 Sample Project**.
- Doris SQL scripts: For details, see **Doris Basic Principles**.

Prerequisites

- A corresponding cloud service has been enabled and a database has been created in the cloud service.
- A data connection that matches the data connection type of the created script. For details, see **Configuring DataArts Studio Data Connection Parameters**. The Flink SQL script does not involve this operation.
- You have locked the script. Otherwise, you must click **Lock** so that you can develop the script. A script you create or import is locked by you by default. For details, see the **lock function**.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script directory, double-click a script to access the script development page.
5. In the upper part of the editor, select script properties. **Table 9-12** describes the script properties. Skip this step when creating a Flink SQL script.

Table 9-12 SQL script properties

Property	Description
Data Connection	Select a data connection.
DLI Data Directory	Select the DLI data directory. • Default DLI data directory **dli** • Metadata catalog that has been created in LakeFormation associated with DLI.

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Property	Description
Database	Name of the database. If you select the default DLI data directory **dli**, select a DLI database and tables. If you select a metadata catalog that has been created in LakeFormation associated with DLI, select a LakeFormation database and tables.

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Property	Description
Resource Queue	Enter a resource queue for executing a job. You can only enter rather than select a queue for Impala SQL and Hive SQL scripts. Selects a resource queue for executing a DLI job. Set this parameter when a DLI or SQL script is created. After you select a queue, you can click to view the queue performance, including the number of running jobs and CU usage, in the last 24 hours. **NOTE** • If you select the default queue, a message is displayed, indicating that the performance of the default queue cannot be displayed. • If no queue is selected, is unavailable. You can create a resource queue using either of the following methods: • Click . The **Buy Queue** page of DLI is displayed. • Go to the DLI console. **NOTE** The default resource queue **default** provided by DLI is only used for trial. It may be occupied by multiple users at a time. Therefore, it is possible that you fail to obtain the resource for related operations. If the execution takes a long time or fails, you are advised to try again during off-peak hours or use a self-built queue to run the job. In addition, the **default** queue does not support the insert, load, or cat commands. To set properties for submitting SQL jobs in the form of **key/value**, click . A maximum of 10 properties can be set. The properties are described as follows: **NOTE** • The environment variable must start with **hoodie.**, **dli.sql.**, **dli.ext.**, **dli.jobs.**, **spark.sql.**, or **spark.scheduler.pool**. • If the environment variable is **dli.sql.autoBroadcastJoinThreshold**, the value must be an integer. If the environment variable is **dli.sql.shuffle.partitions**, the value must be a positive integer. • If the key of the environment variable is **dli.sql.shuffle.partitions** or **dli.sql.autoBroadcastJoinThreshold**, the environment variable cannot contain the greater than (>) or less than (<) sign. • If a parameter with the same name is configured in both a job and a script, the parameter value configured in the job will overwrite that configured in the script. • **dli.sql.autoBroadcastJoinThreshold**: specifies the data volume threshold to use BroadcastJoin. If the data volume exceeds the threshold, BroadcastJoin will be automatically enabled. • **dli.sql.shuffle.partitions**: specifies the number of partitions during shuffling.

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Property	Description
	• **dli.sql.cbo.enabled**: specifies whether to enable the CBO optimization policy. • **dli.sql.cbo.joinReorder.enabled**: specifies whether join reordering is allowed when CBO optimization is enabled. • **dli.sql.multiLevelDir.enabled**: specifies whether to query the content in subdirectories if there are subdirectories in the specified directory of an OBS table or in the partition directory of an OBS partition table. By default, the content in subdirectories is not queried. • **dli.sql.dynamicPartitionOverwrite.enabled**: specifies that only partitions used during data query are overwritten and other partitions are not deleted. **NOTE** When you run a DLI SQL script or test a DLI SQL single-task job in non-scheduling scenarios, the following parameters are enabled by default: • **spark.sql.adaptive.enabled**: Adaptive Query Execution (AQE) is enabled so that Spark can dynamically optimize the query execution plan based on the characteristics of the data being processed and improve the performance by reducing the amount of data to be processed. • **spark.sql.adaptive.join.enabled**: AQE is enabled for join operations. The optimal join algorithm is selected based on the data being processed to improve performance. • **spark.sql.adaptive.skewedJoin.enabled**: AQE is enabled for skewed join operations. Skewed data can be automatically detected and the join algorithm is optimized accordingly to improve performance. • **spark.sql.mergeSmallFiles.enabled**: Merging of small files is enabled. Small files can be merged into large ones, improving performance and shortening the processing time. In addition, fewer files need to be read from remote storage, and more local files can be used. If you do not want to use these functions, you can set the values of the preceding parameters to **false**.

6. Enter an SQL statement in the editor. You can enter multiple SQL statements.

   The SQL syntax varies depending on the data source. Before developing an SQL statement, learn about the syntax of the corresponding data source.

   - DLI SQL scripts: For details, see **Spark SQL Syntax**.
   - Hive SQL scripts: For details, see **Hive SQL**.
   - DWS SQL scripts: For details, see **About GaussDB(DWS) SQL**.
   - Spark SQL scripts: For details, see **Spark2x Basic Principles**.
   - ClickHouse SQL scripts: For details, see **Common ClickHouse SQL Syntax**.
   - Impala SQL scripts: For details, see **Impala**.
   - Flink SQL scripts: For details, see **Stream SQL Join**.

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- RDS SQL scripts: For details, see **Syntax**.
- Presto SQL scripts: For details, see **Presto**.
- Spark Python scripts: For details, see **Configuring the Spark Python3 Sample Project**.
- Doris SQL scripts: For details, see **Doris Basic Principles**.

NOTE

- SQL statements are separated by semicolons (**;**). If semicolons are used in other places but not used to separate SQL statements, escape them with backslashes (\). For example:
  ```
  select 1;
  select * from a where b="dsfa\;";  --example 1\;example 2.
  ```
- RDS SQL does not support the begin ... commit transaction syntax. If necessary, use the start transaction ... commit transaction syntax.
- The script cannot be larger than 16 MB.
- The system date obtained by using an SQL statement is different from that obtained by using the database tool. The query result is stored in the database in the YYYY-MM-DD format, but the query result displayed on the page is in the converted format.
- When a user submits a Spark SQL script to MRS, the script is submitted to the tenant queue bound to the user by default. The bound queue is the queue corresponding to tenant role of the user. If there are multiple queues, the system preferentially selects a queue based on the queue priorities. To set a fixed queue for the user to submit scripts, log in to FusionInsight Manager, choose **Tenant Resources** > **Dynamic Resource Plan**, and click the **Global User Policy** tab. For details, see **Managing Global User Policies**.
- Flink SQL, Hive SQL, and Spark SQL scripts support syntax check. After the check is complete, you can view the check result in the lower part of the page.

To facilitate script development, DataArts Factory provides the following capabilities:

- The script editor supports the following shortcut keys, which improve the script development efficiency:
  - **F8**: Run a script.
  - **F9**: Stop running a script.
  - **Ctrl** + **/**: Comment out or uncomment the line or code block where the cursor resides.
  - **Ctrl** + **S**: Save a script.
  - **Ctrl** + **Z**: Undo an action.
  - **Ctrl** + **F**: Search for information.
  - **Ctrl** + **Shift** + **R**: Replace
  - **Ctrl** + **X**: Cut (Cut a line when the cursor selects nothing.)
  - **Alt** + mouse dragging: Select columns to edit a block.
  - **Ctrl** + mouse click: Select multiple lines to edit or indent them together.

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- **Ctrl** + → (or ←): Move the cursor rightwards (or leftwards) by word.
- **Ctrl** + **Home** or **Ctrl** + **End**: Navigate to the beginning or end of the current file.
- **Home** or **End**: Navigate to the beginning or end of the current line.
- **Ctrl** + **Shift** + **L**: Double-click all the same character strings and add cursors to them to implement batch modification.
- **Ctrl** + **D**: Delete a line.
- **Shift** + **Ctrl** + **U**: Unlock a script.
- **Ctrl** + **Alt** + **K**: Select the word where the cursor resides.
- **Ctrl** + **B**: Format
- **Ctrl** + **Shift** + **Z**: Redo
- **Ctrl** + **Enter**: Execute the selected line or content.
- **Ctrl** + **Alt** + **F**: Flag
- **Ctrl** + **Shift** + **K**: Search for the previous one.
- **Ctrl** + **K**: Search for the next one.
- **Ctrl** + **Backspace**: Delete the word to the left of the cursor.
- **Ctrl** + **Delete**: Delete the word to the right of the cursor.
- **Alt** + **Backspace**: Delete all content from the beginning of the line to the cursor.
- **Alt** + **Delete**: Delete all content from the cursor to the end of the line.
- **Alt** + **Shift**-**Left**: Select all content from the beginning of the line to the cursor.
- **Alt** + **Shift**-**Right**: Select all content from the cursor to the end of the line.

– System functions (Flink SQL, Spark SQL, ClickHouse SQL, and Presto SQL do not support system functions.)

  To view the functions supported by this type of data connection, click **System Functions** on the right of the editor. You can double-click a function to the editor to use it.

– Data tables can be read to generate SQL statements. This function is unavailable for Flink SQL, Spark Python, Presto SQL, and ClickHouse SQL.

  Click **Data Tables** on the right of the editor to display all the tables in the current database or schema. You can select tables and columns and click **Generate SQL Statement** in the lower right corner to generate an SQL statement, which you need to manually format.

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- Script parameters (Currently, only Flink SQL does not support script parameters.)

  You can directly write script parameters in SQL statements. When debugging scripts, you can enter parameter values in the script editor. If the script is referenced by a job, you can set parameter values on the job development page. The parameter values can use EL expressions (see **Expression Overview**).

  NOTE

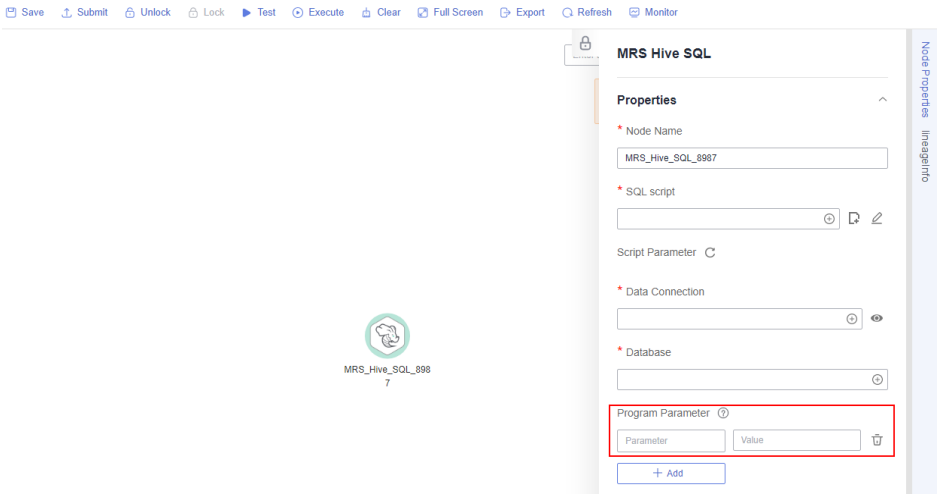
  If a parameter in an SQL script involves a variable, the format of the variable must be the same as that set in **Configuring Script Variables**. If they are different, the variable cannot be identified.

  In the following script example, *str1* indicates the parameter name. It can contain only letters, digits, hyphens (-), underscores (_), greater-than signs (>), and less-than signs (<), and can contain a maximum of 16 characters. The parameter name must be unique.

  ```
  select ${str1} from data;
  ```

  For MRS Spark SQL and MRS Hive SQL scripts, you set a program parameter by referring to **set hive.exec.parallel=true;** in the SQL statements or configure this parameter by setting **Program Parameter** on **Node Properties** of the job.

  Figure 9-5 Program Parameter

- Owner

  Click **Basic Info** to set the script owner and description.

- Allows you to go to the release page from the script development page in enterprise mode. Place the cursor over ☰ and click **Release**.

- For MRS API connections, parameters and values can be configured for Spark SQL and Hive SQL scripts. For proxy connections, this function is not supported.

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NOTE

Click in the upper right corner to set environment variables for scripts. The following are some examples:

Set environment variables for a Hive SQL script:

--hiveconf hive.merge.mapfiles=true;

--hiveconf mapred.job.queue.name=queue1

Set environment variables for a Spark SQL script:

--num-executors 1

--executor-cores 4

--queue queue2

The former indicates the parameter name, and the latter indicates the parameter value.

After the script is executed, view the execution details on the MRS management plane.

7. (Optional) In the upper part of the editor, click **Format** to format SQL statements. When developing a Flink SQL script, skip this step.
8. In the upper part of the editor, click **Execute**. If you need to execute some SQL statements separately, select the SQL statements first. After executing the SQL statements, view the execution history and result of the script in the lower part of the editor. When developing a Flink SQL script, skip this step.

   NOTE

   - A maximum of 1,000 SQL statement execution results can be displayed. A maximum of 10,000 DLI SQL statement execution results can be displayed. To view more execution results, download or dump them by following the instructions in **Downloading or Dumping a Script Execution Result**.
   - You can perform the following operations on execution results:
     - Double-click or right-click the name of an execution result tab to rename it. The name can contain a maximum of 16 characters.
     - Right-click the name of an execution result tab to close the current tab, all the tabs to the left or right of the current tab, all the other tabs, or all the tabs.
   - If the MRS cluster is a non-security cluster and the command whitelist is not restricted, you can easily find the corresponding task on the Yarn management page of MRS based on the script name and execution time after adding the application name information during Hive SQL execution. Note that if the default engine is **tez**, you need to set the engine to **mr** to disable the tez engine.
   - You can control display of the script execution history by setting **Script Execution History** in **Default Configuration** to **Myself** or **All users**.
9. Above the editor, click **Save** to save the script.

   If the script is created but not saved, set the parameters listed in **Table 9-13**.

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Table 9-13 Script parameters

Parameter	Mandatory	Description
Script Name	Yes	Name of the script. The name contains a maximum of 128 characters, including only letters, numbers, hyphens (-), underscores (_), and periods (.).
Owners	No	Owner of the script. By default, the creator of the script is the owner.
Description	No	Descriptive information about the script.
Select Directory	Yes	Directory to which the script belongs. The root directory is selected by default.

NOTE

If you open an unsaved script, you can restore its content from the local cache.

After the script is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a script multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

Downloading or Dumping a Script Execution Result

After a script is executed successfully, you can download or dump the execution result. By default, all users can download and dump the execution results of SQL scripts. If you do not want all users to have this permission, configure the permission by referring to **Configuring a Data Export Policy**.

- After executing a script, you can click **Download** on the **Result** tab page to download a CSV result file to a local path. You can view the download record on the **Download Center** page.
- After executing a script, you can click **Dump** on the **Result** tab page to dump a CSV and a JSON result file to OBS. For details, see **Table 9-14**.

  NOTE

  - The dump function is supported only if the OBS service is available.
  - Only the execution results of SQL script query statements can be dumped.
  - If the execution result of a download or dump SQL statement contains commas (,), newline characters, or other special characters, data may be disordered, the number of rows may increase, or other issues may occur.

Table 9-14 Dump parameters

Parameter	Mandatory	Description
Data Format	Yes	Format of the data to be exported. CSV and JSON formats are supported.

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Parameter	Mandatory	Description
Resource Queue	No	DLI queue where the export operation is to be performed. Set this parameter when a DLI or SQL script is created.
Compression Format	No	Format of compression. Set this parameter when a DLI or SQL script is created. • none • bzip2 • deflate • gzip
Storage Path	Yes	OBS path where the result file is stored. After selecting an OBS path, customize a folder. Then, the system will create it automatically for storing the result file. You can also go to the **Download Center** page to set the default OBS path, which will be automatically set for **Storage Path** in the **Dump Result** dialog box.
Cover Type	No	If a folder that has the same name as your custom folder exists in the storage path, select a cover type. Set this parameter when a DLI or SQL script is created. • **Overwrite**: The existing folder will be overwritten by the customized folder. • **Report**: The system reports an error and suspends the export operation.
Export Column Name	No	**Yes**: Column names will be exported. **No**: Column names will not be exported.
Character Set	No	• **UTF-8**: default character set • **GB2312**: recommended when the data to be exported contains Chinese character sets • **GBK**: expanded based on and compatible with GB2312

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Parameter	Mandatory	Description
Quotation Character	No	This parameter is available and can be set only when **Data Format** is **csv**. Quotation characters are used to identify the beginning and end of text fields when exporting job results, and are used to separate fields. Only one character can be set. The default value is double quotation marks ("). This is mainly used to handle data that contains spaces, special characters, or characters that are the same as the delimiter. For details about the examples of using quotation characters and escape characters, see **Example of Using Quotation Characters and Escape Characters**.
Escape Character	No	This parameter is available and can be set only when **Data Format** is **csv**. If special characters, such as quotation marks, need to be included in the exported results, they can be represented using escape characters (backslash \). Only one character can be set. The default value is a backslash (\). Common scenarios for using escape characters are: • If there is a third quotation mark between two quotation marks, add an escape character before the third quotation mark to prevent the field content from being split. • If there is already an escape character in the data content, add another escape character before the existing one to avoid the original character being used as an escape character. For details about the examples of using quotation characters and escape characters, see **Example of Using Quotation Characters and Escape Characters**.

Download or dump allows you to view more SQL script execution results. **Table 9-15** lists the maximum number of results that can be viewed, dumped, and downloaded for different types of SQL scripts.

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Table 9-15 Maximum number of results that can be viewed, dumped, and downloaded

SQL Type	Maximum Number of Results That Can Be Viewed Online	Maximum Number/Size of Results That Can Be Downloaded	Maximum Number/Size of Results That Can Be Dumped
DLI	10,000	1,000 records, less than 3MB	Unlimited
Hive	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
GaussDB(DWS)	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
Spark	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
RDS	1,000	1,000 records, less than 3MB	Not supported
Presto	1,000	The downloaded results are directly dumped to OBS. The number of results is unlimited.	Unlimited
ClickHouse	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
HetuEngine	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
Impala	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
Doris	1,000	1,000 records, less than 3MB	1,000 records or 3 MB

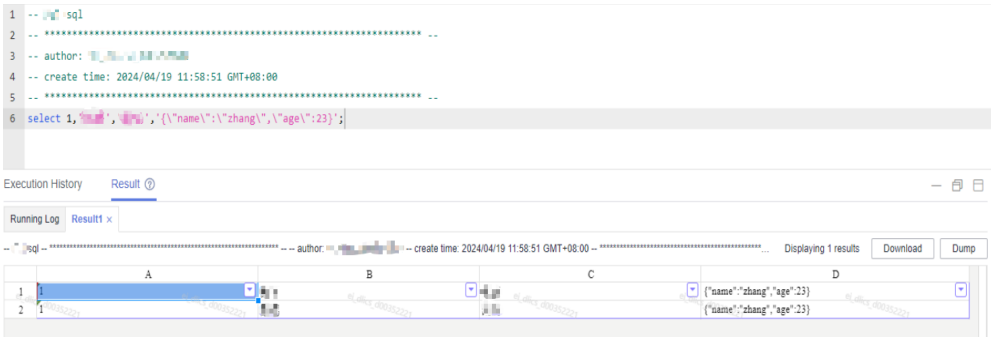
Example of Using Quotation Characters and Escape Characters

- Usage of quotation characters and escape characters:
  - Quotation character: used to identify and separate fields. The default value is double quotation marks (").
  - Escape character: If special characters, such as quotation marks, need to be included in the exported results, they can be represented using escape characters (backslash \). The default value is a backslash (\).
    i. To prevent the content of a field from being split when there is a third quotation character between two quotation characters, add an escape character before the third quotation character.

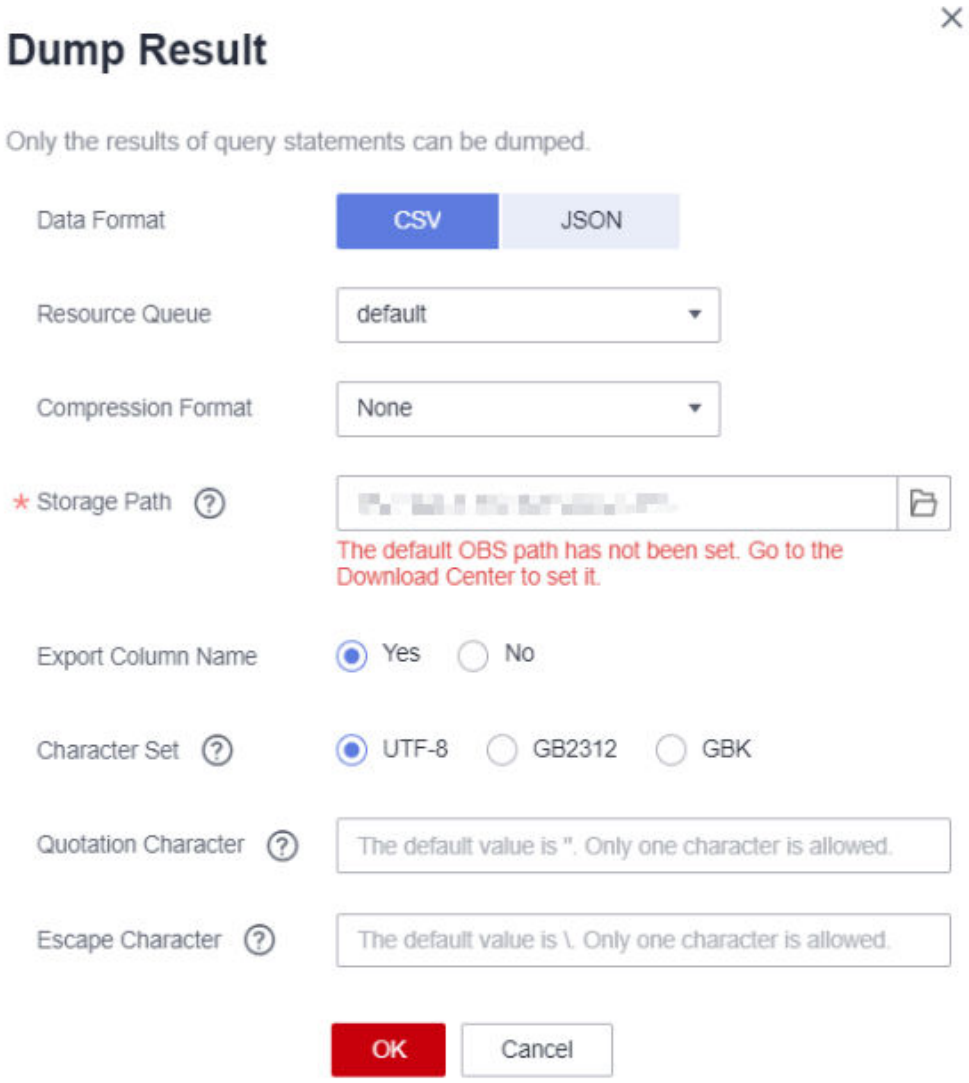
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ii. If there is already an escape character in the data content, add another escape character before the existing one to avoid the original character being used as an escape character.

- Example:



You can leave **Quotation Character** and **Escape Character** empty.



If you leave them empty, the downloaded .csv file contains two rows in Excel.

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D	E
{\name\":\"zhang\"	\"age\":23}"
{\name\":\"zhang\"	\"age\":23}"

If you specify both of them, for example, enter double quotation marks ("), the downloaded file is as follows.

D	E
{"name":"zhang","age":23}	
{"name":"zhang","age":23}	

9.3.3.2 Developing a Shell Script

DataArts Factory allows you to develop, debug, and run Shell scripts online. You can run developed scripts in jobs. For details, see **Developing a Pipeline Job**.

Prerequisites

- A shell script has been added. For details, see **Creating a Script**.
- A host connection has been created. The Linux host is used to execute shell scripts. For details, see **Host Connection Parameters**.
- You have the permission to create and execute files in the **/tmp** directory on the host.
- The maximum number of shell or Python scripts that can run concurrently on the ECS is determined by the value of **MaxSessions** in the **/etc/ssh/sshd_config** file on the ECS. Set **MaxSessions** based on the scheduling frequency of shell or Python scripts.
- You have locked the script. Otherwise, you must click **Lock** so that you can develop the script. A script you create or import is locked by you by default. For details, see the **lock function**.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script directory list, double-click a script that you want to develop. The script development page is displayed.
5. In the upper part of the editor, select script properties. **Table 9-16** describes the script properties.

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Table 9-16 Shell script properties

Parameter	Description
Host Connection	Selects the host where a shell script is to be executed.

Click **Input Parameters** and enter the parameter and interactive parameter for executing the shell script.

Table 9-17 Shell script parameters

Parameter	Description
Parameter	Parameter transferred to the Shell script when it is executed. Parameters are separated by spaces, for example, **a b c**. The parameter must be referenced by a location variable (for example, $1, $2, or $3) in the Shell script. Otherwise, the parameter is invalid. The location variable starts from 0. Variable 0 is reserved for storing the actual script name, variable 1 corresponds to the first parameter of the script, and so on. For example, $1, $2, and $3 reference parameters **a**, **b**, and **c**, respectively. Note: If a variable is referenced in the shell script, use the *$args* format instead of the *${args}* format. Otherwise, the variable will be replaced by a parameter with the same name in the job. For example, if you enter **a b c** and run the following Shell script, **b** is displayed: `echo $2`

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Parameter	Description

Interactive Parameter	Interactive information (for example, passwords) provided during shell script execution. Interactive parameters are separated by spaces. The shell script reads parameter values in sequence according to the interaction situation.
	For example, run the following interactive Shell script. Interaction parameters **1**, **2**, and **3** correspond to **begin**, **end**, and **exit**, respectively.
	● When the interaction parameter is set to **1**, the execution result is **start something**.
	● When the interaction parameter is set to **2**, the execution result is **stop something**.
	● When the interaction parameter is set to **3**, the execution result is **exit**.
	`#!/bin/bash`
	`select Actions in "begin" "end" "exit"`
	`do`
	`case $Actions in`
	`"begin")`
	`echo "start something"`
	`break`
	`;;`
	`"end")`
	`echo "stop something"`
	`break`
	`;;`
	`"exit")`
	`echo "exit"`
	`break`
	`;;`
	`*)`
	`echo "Ignorant"`
	`;;`
	`esac`
	`done`
	The following is an example of using the read -p syntax:
	`read -p "Parameter 1 and parameter 2"Variable 1 Variable 2`

6. Edit shell statements in the editor. To facilitate script development, DataArts Factory provides the following capabilities:
   - The script editor supports the following shortcut keys, which improve the script development efficiency:
     - **F8**: Run a script.
     - **F9**: Stop running a script.
     - **Ctrl** + **/**: Comment out or uncomment the line or code block where the cursor resides.
     - **Ctrl** + **S**: Save a script.
     - **Ctrl** + **Z**: Undo an action.
     - **Ctrl** + **F**: Search for information.

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- **Ctrl** + **Shift** + **R**: Replace
- **Ctrl** + **X**: Cut (Cut a line when the cursor selects nothing.)
- **Alt** + mouse dragging: Select columns to edit a block.
- **Ctrl** + mouse click: Select multiple lines to edit or indent them together.
- **Ctrl** + → (or ←): Move the cursor rightwards (or leftwards) by word.
- **Ctrl** + **Home** or **Ctrl** + **End**: Navigate to the beginning or end of the current file.
- **Home** or **End**: Navigate to the beginning or end of the current line.
- **Ctrl** + **Shift** + **L**: Double-click all the same character strings and add cursors to them to implement batch modification.
- **Ctrl** + **D**: Delete a line.
- **Shift** + **Ctrl** + **U**: Unlock a script.
- **Ctrl** + **Alt** + **K**: Select the word where the cursor resides.
- **Ctrl** + **B**: Format
- **Ctrl** + **Shift** + **Z**: Redo
- **Ctrl** + **Enter**: Execute the selected line or content.
- **Ctrl** + **Alt** + **F**: Flag
- **Ctrl** + **Shift** + **K**: Search for the previous one.
- **Ctrl** + **K**: Search for the next one.
- **Ctrl** + **Backspace**: Delete the word to the left of the cursor.
- **Ctrl** + **Delete**: Delete the word to the right of the cursor.
- **Alt** + **Backspace**: Delete all content from the beginning of the line to the cursor.
- **Alt** + **Delete**: Delete all content from the cursor to the end of the line.
- **Alt** + **Shift**-**Left**: Select all content from the beginning of the line to the cursor.
- **Alt** + **Shift**-**Right**: Select all content from the cursor to the end of the line.

– Script parameter function. Use this function in either of the following ways:

  i. Write the script parameter name and parameter value in the shell statement. When the shell script is referenced by a job, if the

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parameter name configured for the job is the same as the parameter name of the shell script, the parameter value of the shell script is replaced by the parameter value of the job.

An example is as follows:

```
a=1
echo ${a}
```

In the preceding command, *a* indicates the parameter name. It can contain only letters, digits, hyphens (-), underscores (_), greater-than signs (>), and less-than signs (<), and can contain a maximum of 16 characters. The parameter name must be unique.

ii. Configure parameters in the upper part of the editor. When you execute the shell script, the configured parameters are transferred to the script. Separate parameters by spaces, for example, **a b c**. The parameter must be referenced by the shell script. Otherwise, the parameter is invalid.

Note: If a variable is referenced in the shell script, use the *$args* format instead of the *${args}* format. Otherwise, the variable will be replaced by a parameter with the same name in the job.

- Owner

  Click **Basic Info** to set the script owner and description.
- The script cannot be larger than 16 MB.
- Allows you to go to the release page from the script development page in enterprise mode. Place the cursor over ☰ and click **Release**.

7. In the lower part of the editor, click **Execute**. After executing the shell statement, view the execution history and result of the script in the lower part of the editor.

   NOTE

   You can perform the following operations on execution results:

   - Double-click or right-click the name of an execution result tab to rename it. The name can contain a maximum of 16 characters.
   - Right-click the name of an execution result tab to close the current tab, all the tabs to the left or right of the current tab, all the other tabs, or all the tabs.
   - The execution result of a Shell script cannot be larger than 30 MB. Otherwise, an error is reported.
   - You can control display of the script execution history by setting **Script Execution History** in **Default Configuration** to **Myself** or **All users**.

8. Above the editor, click **Save** to save the script.

   If the script is created but not saved, set the parameters listed in **Table 9-18**.

Table 9-18 Script parameters

Parameter	Mandatory	Description
Script Name	Yes	Name of the script. The name contains a maximum of 128 characters, including only letters, numbers, hyphens (-), underscores (_), and periods (.).

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Parameter	Mandatory	Description
Description	No	Description of the script
Select Directory	Yes	Directory to which the script belongs. The root directory is selected by default.

NOTE

If you open an unsaved script, you can restore its content from the local cache.

After the script is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a script multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

9.3.3.3 Developing a Python Script

DataArts Factory allows you to develop, debug, and run Python scripts online. You can run developed scripts in jobs. For details, see **Developing a Pipeline Job**.

For details about how to develop a Python scripts, see **Developing a Python Script**.

Prerequisites

- A Python script has been added. For details, see **Creating a Script**.
- A host connection has been created. The Linux host is used to execute Python scripts. For details about how to create a host connection, see **Host Connection Parameters**.
- You have the permission to create and execute files in the **/tmp** directory on the host.
- The maximum number of shell or Python scripts that can run concurrently on the ECS is determined by the value of **MaxSessions** in the **/etc/ssh/sshd_config** file on the ECS. Set **MaxSessions** based on the scheduling frequency of shell or Python scripts.
- You have locked the script. Otherwise, you must click **Lock** so that you can develop the script. A script you create or import is locked by you by default. For details, see the **lock function**.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script directory list, double-click a script that you want to develop. The script development page is displayed.

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5. In the upper part of the editor, configure the Python version and the host connection for executing the Python script.

   Table 9-19 Python script properties

Parameter	Description
Python Version	Select a Python version. • **Python2**: indicates Python 2. • **Python3**: indicates Python 3.
Host Connection	Select the host where a Python script is to be executed.

   Click **Input Parameters** and enter the parameter and interactive parameter for executing the Python script.

   Table 9-20 Python script parameters

Parameter	Description
Parameter	Parameter transferred to the Python script when the script is executed. Parameters are separated by spaces, for example, **a b c**. The parameter must be referenced by the Python script. Otherwise, the parameter is invalid.
Interactive Parameter	Interactive information (for example, passwords) provided during Python script execution. Interactive parameters are separated by spaces. The Python statement reads parameter values in sequence according to the interaction situation.

6. Edit Python statements in the editor. To facilitate script development, DataArts Factory provides the following capabilities:
   - The script editor supports the following shortcut keys, which improve the script development efficiency:
     - **F8**: Run a script.
     - **F9**: Stop running a script.
     - **Ctrl** + **/**: Comment out or uncomment the line or code block where the cursor resides.
     - **Ctrl** + **S**: Save a script.
     - **Ctrl** + **Z**: Undo an action.
     - **Ctrl** + **F**: Search for information.
     - **Ctrl** + **Shift** + **R**: Replace

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- **Ctrl** + **X**: Cut (Cut a line when the cursor selects nothing.)
- **Alt** + mouse dragging: Select columns to edit a block.
- **Ctrl** + mouse click: Select multiple lines to edit or indent them together.
- **Ctrl** + → (or ←): Move the cursor rightwards (or leftwards) by word.
- **Ctrl** + **Home** or **Ctrl** + **End**: Navigate to the beginning or end of the current file.
- **Home** or **End**: Navigate to the beginning or end of the current line.
- **Ctrl** + **Shift** + **L**: Double-click all the same character strings and add cursors to them to implement batch modification.
- **Ctrl** + **D**: Delete a line.
- **Shift** + **Ctrl** + **U**: Unlock a script.
- **Ctrl** + **Alt** + **K**: Select the word where the cursor resides.
- **Ctrl** + **B**: Format
- **Ctrl** + **Shift** + **Z**: Redo
- **Ctrl** + **Enter**: Execute the selected line or content.
- **Ctrl** + **Alt** + **F**: Flag
- **Ctrl** + **Shift** + **K**: Search for the previous one.
- **Ctrl** + **K**: Search for the next one.
- **Ctrl** + **Backspace**: Delete the word to the left of the cursor.
- **Ctrl** + **Delete**: Delete the word to the right of the cursor.
- **Alt** + **Backspace**: Delete all content from the beginning of the line to the cursor.
- **Alt** + **Delete**: Delete all content from the cursor to the end of the line.
- **Alt** + **Shift**-**Left**: Select all content from the beginning of the line to the cursor.
- **Alt** + **Shift**-**Right**: Select all content from the cursor to the end of the line.

– Script parameter function. Use this function in either of the following ways:

  i. Write the script parameter name and parameter value in the Python statement. When the Python script is referenced by a job, if the parameter name configured for the job is the same as the parameter

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name of the Python script, the parameter value of the Python script is replaced by the parameter value of the job.

Transfer parameters in the script. The following is an example script:

```
a=1
print (a)
or
a= 'qqq'
print (a)
```

Transfer parameters outside the script. For example, if you want to transfer parameters of the Python script to a Python job which uses the Python script, enclose string parameters in single quotation marks. The following is an example script:

```
a= 'zhang'
print (${a})
```

In the preceding command, *a* indicates the parameter name. It can contain only letters, digits, hyphens (-), underscores (_), greater-than signs (>), and less-than signs (<), and can contain a maximum of 16 characters. The parameter name must be unique.

ii. Click **Input Parameters** and set parameters, which will be transferred to the Python script during execution of the script. Separate parameters by spaces, for example, **a b c**. The parameter must be referenced by the Python script. Otherwise, the parameter is invalid.

- Owner

  Click **Basic Info** to set the script owner and description.

- The script cannot be larger than 16 MB.
- Allows you to go to the release page from the script development page in enterprise mode. Place the cursor over ☰ and click **Release**.

7. In the upper part of the editor, click **Execute**. After executing the Python statement, view the execution history and result of the script in the lower part of the editor.

   NOTE

   You can perform the following operations on execution results:

   - Double-click or right-click the name of an execution result tab to rename it. The name can contain a maximum of 16 characters.
   - Right-click the name of an execution result tab to close the current tab, all the tabs to the left or right of the current tab, all the other tabs, or all the tabs.
   - The execution result of a Python script cannot be larger than 30 MB. Otherwise, an error is reported.
   - You can control display of the script execution history by setting **Script Execution History** in **Default Configuration** to **Myself** or **All users**.

8. Above the editor, click **Save** to save the script.

   If the script is created but not saved, set the parameters listed in **Table 9-21**.

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Table 9-21 Script parameters

Parameter	Mandatory	Description
Script Name	Yes	Name of the script. The name contains a maximum of 128 characters, including only letters, numbers, hyphens (-), underscores (_), and periods (.).
Description	No	Description of the script
Select Directory	Yes	Directory to which the script belongs. The root directory is selected by default.

NOTE

If you open an unsaved script, you can restore its content from the local cache.

After the script is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a script multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

9.3.4 Submitting a Version

Submitting a version depends on the version management function of DataArts Factory.

Version management traces script and job changes, and supports version comparison and rollback. The system retains 100 latest version records. In addition, version management can be used to distinguish the development state and production state.

- Development state: Scripts or jobs have not been submitted and are used for debugging. In the development state, you can edit, save, and run scripts or jobs without affecting those being scheduled. In addition, when a job is being associated with a script or job dependency is being configured, the associated script or job will read the configuration in the development state.
- Production state: Script or jobs have been submitted and are used for formal scheduling. In formal scheduling, the latest submitted versions of scripts or jobs will be used in scenarios such as script invocation, instance rerunning, and job dependency and patch data configuration.

Prerequisites

A script has been developed.

Submitting a Script Version

If you submit a version, the latest script in the development state will be saved and submitted and overwrite the previous script version.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

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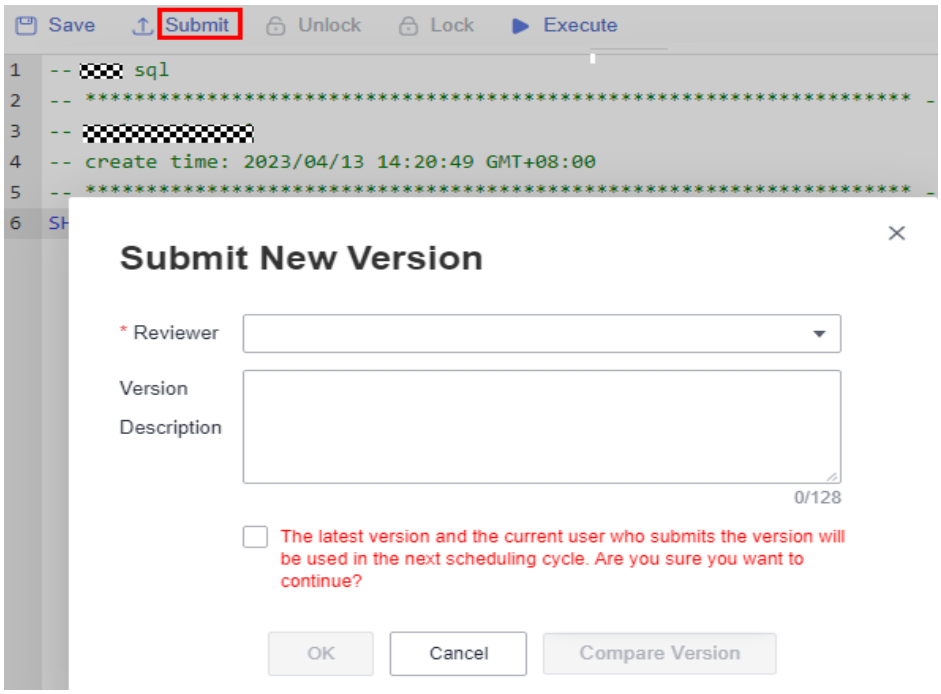
Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.

Step 4 In the script directory, double-click the developed script to access the script development page.

Step 5 Above the script editor, click **Submit** to submit a version. In the displayed dialog box, select the reviewer, enter the change description (a maximum of 128 characters allowed), and select the check box below. If you do not select this option, you cannot click **OK**. When submitting a version, you can click **Compare Version** to view the differences between the current version and the last version.

Figure 9-6 Submitting a version



NOTE

- If review is enabled on the **Review Center** page, your submitted version will be reviewed by the reviewer on the **Pending Review** tab page on the **Review Center** page. The version is submitted successfully only after it is approved by the reviewer. For details, see **Approval Settings**. If review is disabled, the version can be directly submitted.

  To revoke a submitted request, go to the **Review Center** page and click the **My Applications** tab. Then you can submit an application again.
- If review is enabled, the following operations need to be reviewed: submitting scripts, deleting scripts, and importing submitted scripts.
- Before disabling the review function, ensure that there are no requests pending review in the current workspace.
- The enterprise mode does not support the review function.

----End

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Version Rollback

After submitting the version, you can view it in the version list. (Currently, a maximum of 100 latest versions are saved.) Click **Roll Back** to roll back to any submitted version.

The rollback involves the following contents:

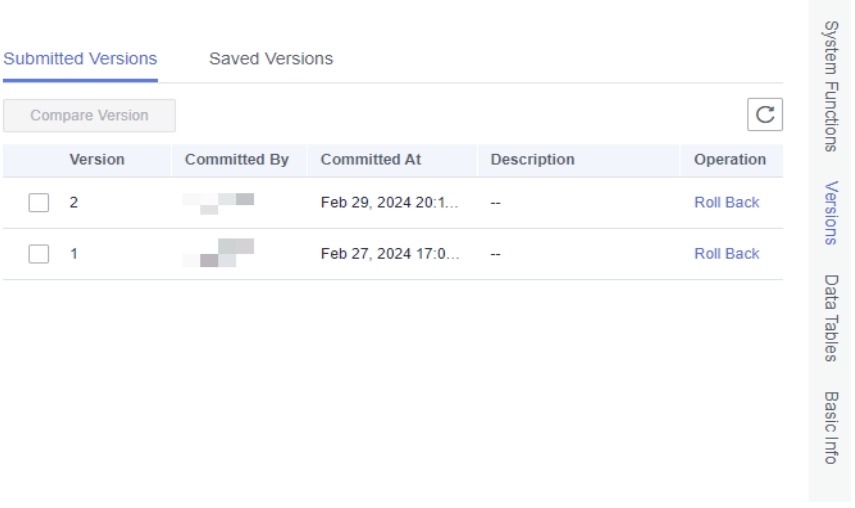
- DLI: data connections, databases, resource queues, and script contents
- DWS: data connections, databases, and script contents
- HIVE: data connections, databases, resource queues, and script contents
- SPARK: data connections, databases, and script contents
- SHELL: host connections, parameters, interactive parameters, and script contents
- RDS: data connections, databases, and script contents
- PRESTO: data connections, modes, and script contents
- PYTHON: host connections, parameters, interactive parameters, and script content
- FLINK: script content

The procedure is as follows:

1. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
2. In the script directory list, double-click a script that you want to develop. The script development page is displayed.
3. On the right of the page, click the **Versions** tab and view the version submission records. Select the version to be rolled back and click **Roll Back**.

   If the content in the development state is not submitted, the content will be overwritten after the rollback. In this case, you must submit the rollback version again to make it take effect. By default, the latest submitted version is used for scheduling.

Figure 9-7 Rolling back a version



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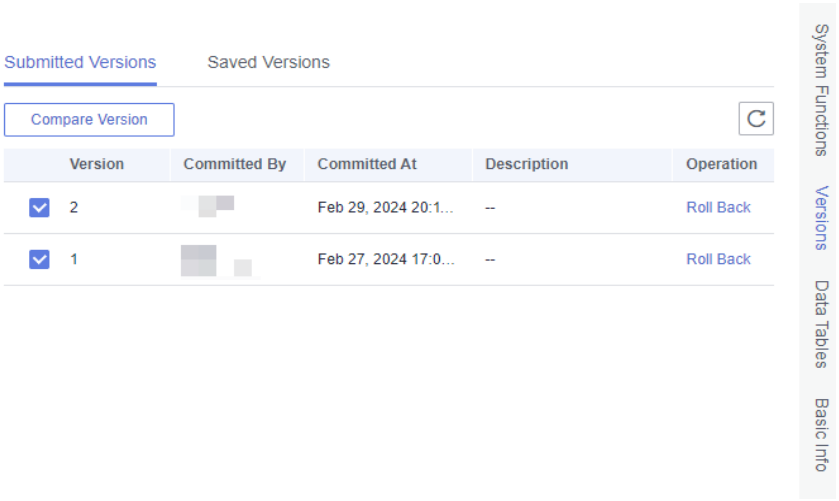
Version Comparison

You can compare the script contents of two different versions. If you select only one version, the system compares the script content of the selected version with that in the development state. If you select two versions, the system compares the script contents of two different versions.

The procedure is as follows:

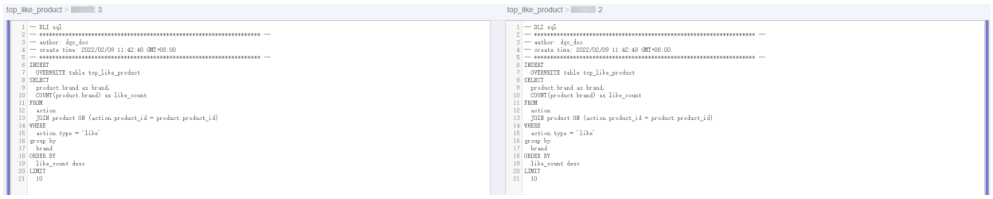
1. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
2. In the script directory list, double-click a script that you want to develop. The script development page is displayed.
3. On the right of the page, click the **Versions** tab and view the version submission records. Select the versions to be compared and click **Compare Version**.

Figure 9-8 Comparing versions



4. A new page is displayed, showing the script content of different versions on the left and right separately. The differences between the two versions have been marked. You can use the ^ and v buttons in the upper right corner to go to the previous or next change.

Figure 9-9 Version comparison details



9.3.5 Releasing a Script Task

In enterprise mode, when a developer submits a script version, the system generates a script release task. After the developer confirms releasing a package and the admin, deployer, a user with the DAYU Administrator or Tenant

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Administrator permission approves the package release request, the modified script is synchronized to the production environment.

NOTICE

- If the admin imported a submitted script, a release task will be generated.
- If the admin imported a released script, no release task will be generated.

Prerequisites

You have submitted a version. For details, see **Submitting a Version**.

Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the left navigation pane, choose **Data Development** > **Task Release**.

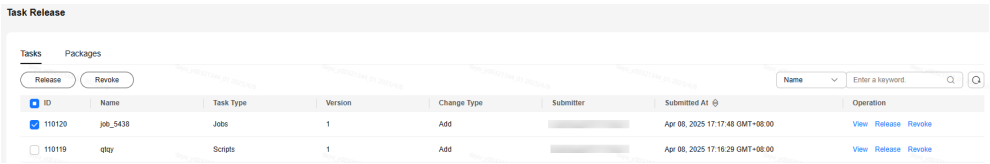
Step 4 On the **Tasks** page, the tasks generated for version submission are displayed. You can click **View** in the **Operation** column to view the modifications of a script compared with its previous version. After confirming that the modifications are correct, click **Release** to release the task.

You can filter tasks by name or submitter, and perform fuzzy search using a task name.

NOTE

- If you have only the developer permission, the script will be synchronized to the production environment only when the task is approved by the admin or deployer.
- After clicking **Release**, set the reviewer. The reviewer must be a workspace admin, deployer, or a user with the DAYU Administrator or Tenant Administrator permission. Set at least one reviewer and do not set yourself as the reviewer. Click **Reviewer Information** to go to the **Workspaces** page. Click **Edit** to configure reviewers.
- You can release a maximum of 100 tasks at a time. The tasks are released asynchronously. You can view the task release process.
- You can revoke tasks not to be released as a developer, deployer, or admin.

Figure 9-10 Clicking Release

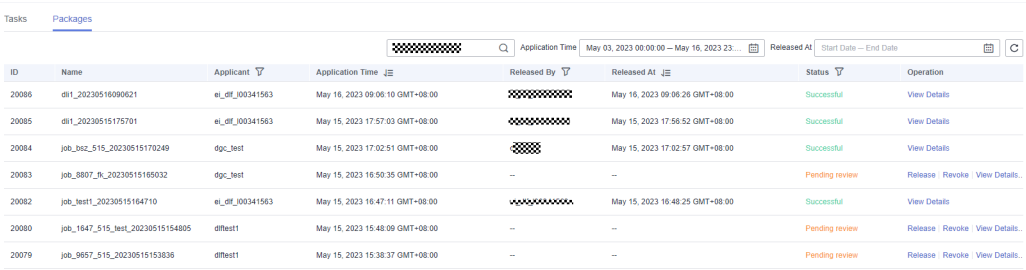


Step 5 After the task is released, you can view the release status of the task on the **Packages** tab page. After approved, the task is released successfully.

You can filter packages by **Applicant**, **Application Time**, **Release At**, or **Released By**, and perform fuzzy search using a package name.

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Figure 9-11 Viewing the task status

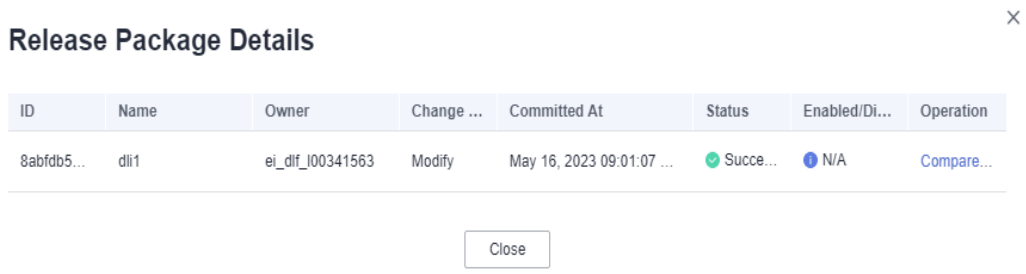


NOTE

You can revoke tasks not to be released as a developer, deployer, or admin.

After the task is released, you can click **View Details** in the **Operation** column to view the release status and startup status of the task. You can also click **Compare Version** in the **Operation** column to view the differences between different versions of release packages.

Figure 9-12 Viewing release package details



----End

9.3.6 (Optional) Managing Scripts

9.3.6.1 Copying a Script

This section describes how to copy a script.

Prerequisites

A script has been developed based on **Developing Scripts**.

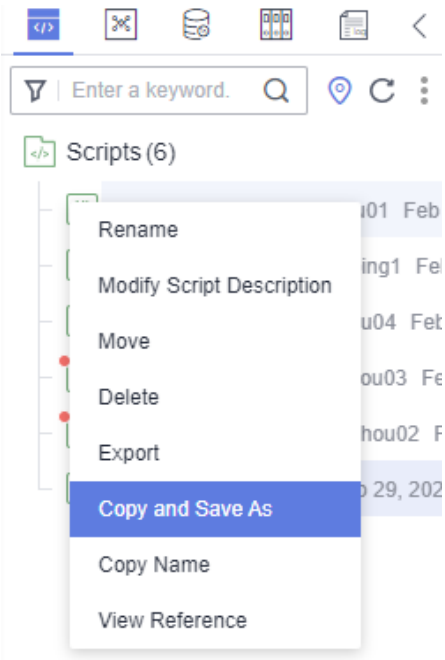
Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the Da**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.

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4. In the script directory, select the script to be copied, right-click the script name, and choose **Copy Save As**.

Figure 9-13 Copying a script



5. In the displayed dialog box, configure related parameters. **Table 9-22** describes the parameters.

Table 9-22 Script directory parameters

Parameter	Description
Script Name	Name of the script. It contains a maximum of 128 characters. Only letters, digits, hyphens (-), underscores (_), and periods (.) are allowed. **NOTE** The name of the copied script cannot be the same as the name of the original script.
Select Directory	Parent directory of the script directory. The parent directory is the root directory by default.

6. Click **OK**.

9.3.6.2 Copying the Script Name and Renaming a Script

You can copy the name of a script and rename a script.

Prerequisites

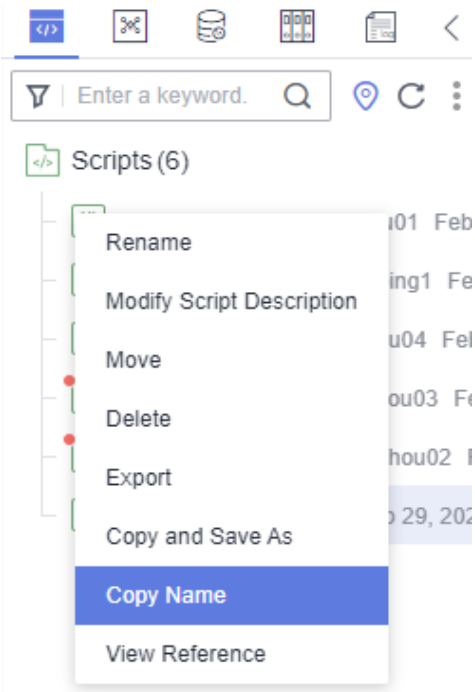
A script has been developed based on **Developing Scripts**.

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Copying the Script Name

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. Locate the target script in the script directory, right-click the script name, and select **Copy Name** to copy the script name to the clipboard.

Figure 9-14 Copying the script name

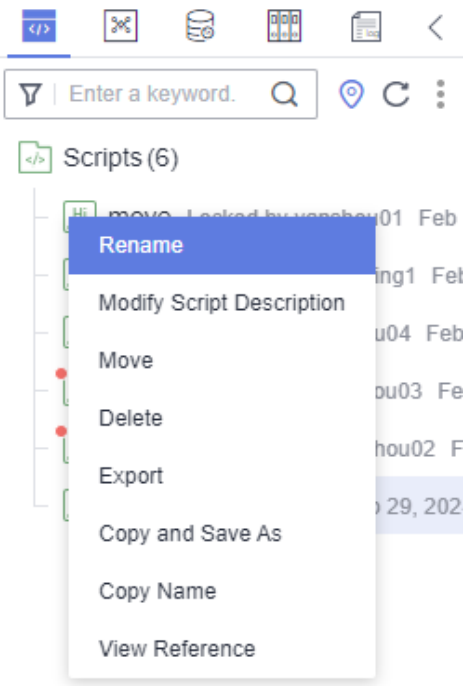


Renaming a Script

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. Locate the target script In the script directory, right-click the script name, and select **Rename**.

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Figure 9-15 Renaming a script

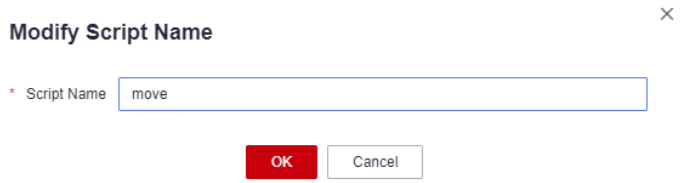


NOTE

An opened script file cannot be renamed.

5. In the displayed **Modify Script Name** dialog box, change the script name.

Figure 9-16 Renaming a script



6. Click **OK**.

9.3.6.3 Moving a Script or Script Directory

You can move a script file from one directory to another or move a script directory to another directory.

Prerequisites

A script has been developed based on **Developing Scripts**.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

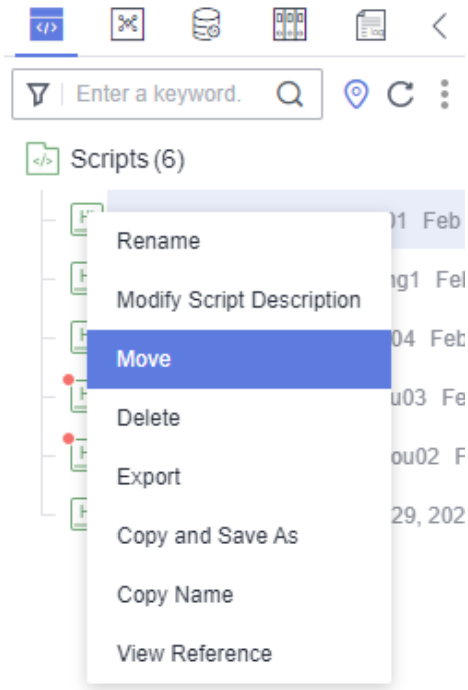
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2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. Move a script or script directory.

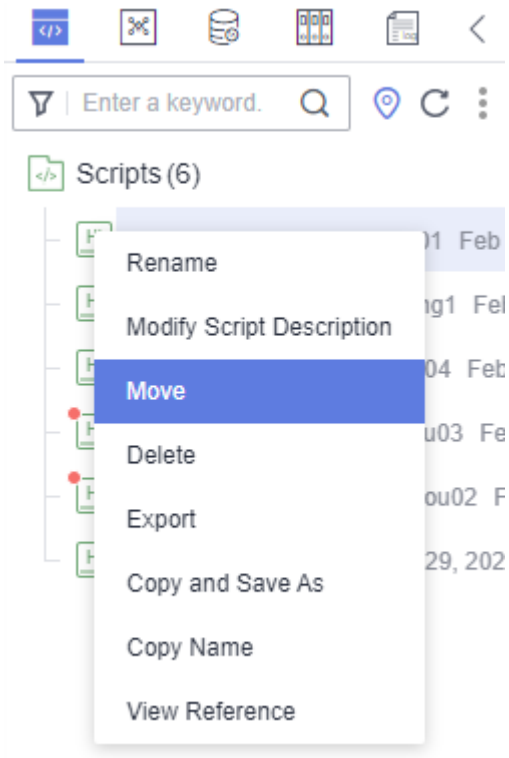
   Method 1: right-click

   a. In the script directory, right-click a script or script folder and select **Move**.

Figure 9-17 Selecting Move

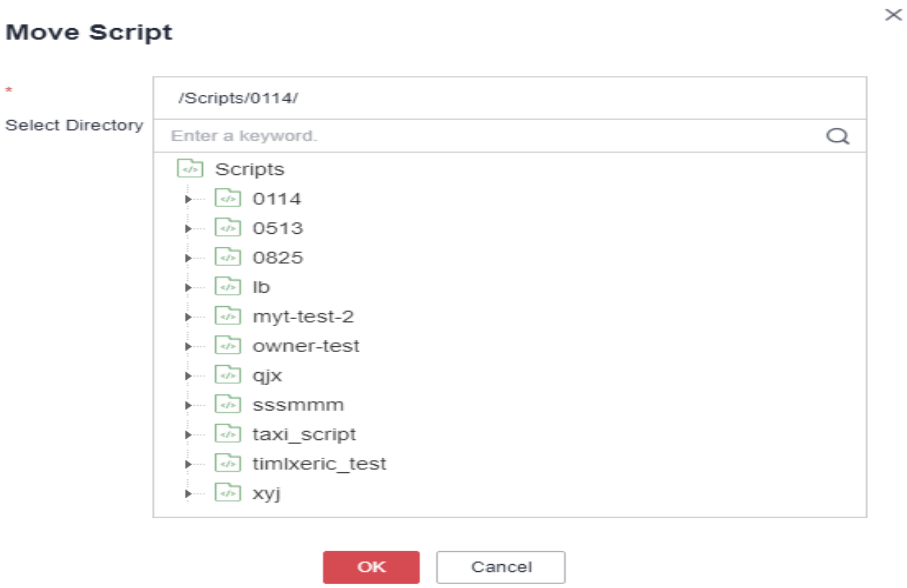


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b. In the displayed dialog box, configure related parameters. **Table 9-23** describes the parameters.

Figure 9-18 Moving a script



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Figure 9-19 Move a directory

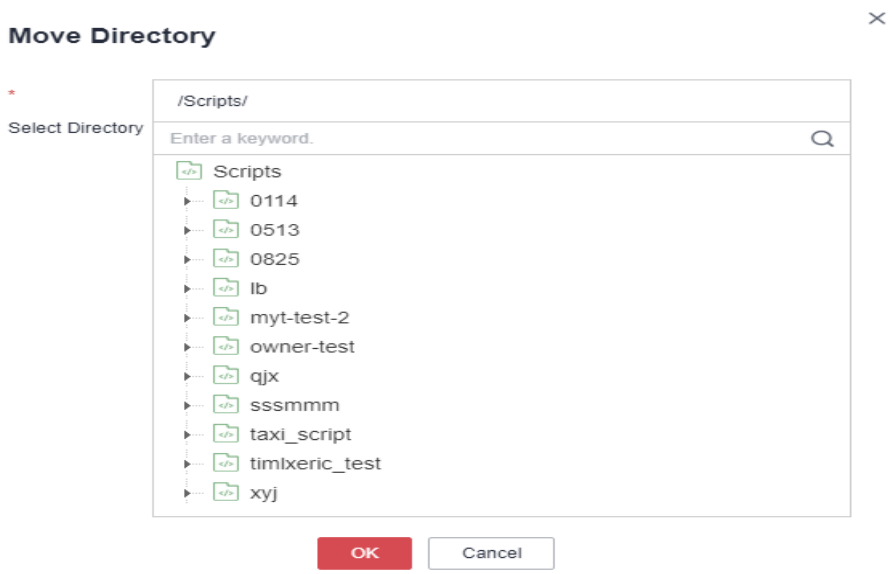


Table 9-23 Parameters for moving a script or directory

Parameter	Description
Select Directory	Directory to which the script or script directory is to be moved. The parent directory is the **root** directory by default.

c. Click **OK** to move the script or directory.

Method 2: drag-and-drop

Select a script or script folder and drag and drop it to the target folder.

9.3.6.4 Exporting and Importing Scripts

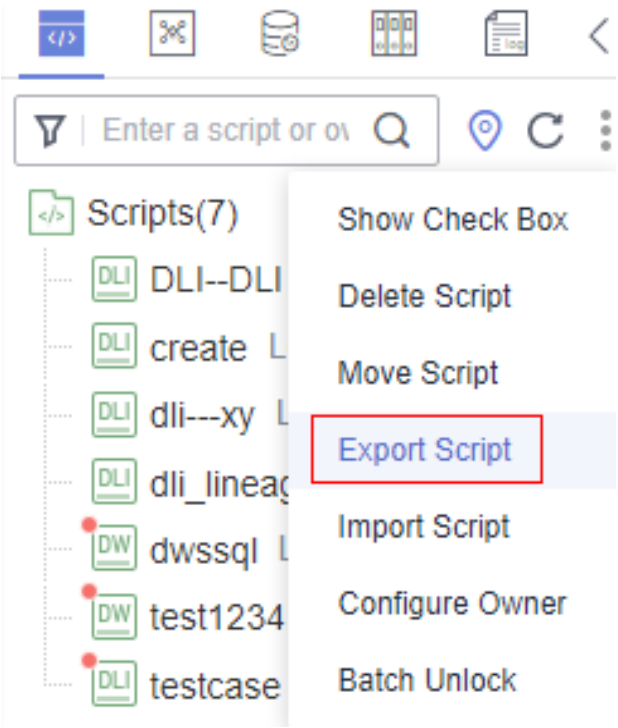
Exporting Scripts

You can export one or more script files from the script directory. The exported files store the latest content in the development state.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. Click in the script directory and select **Show Check Box**.
5. Select scripts, click , and select **Export Script**. After the export is successful, you can obtain the exported .zip file.

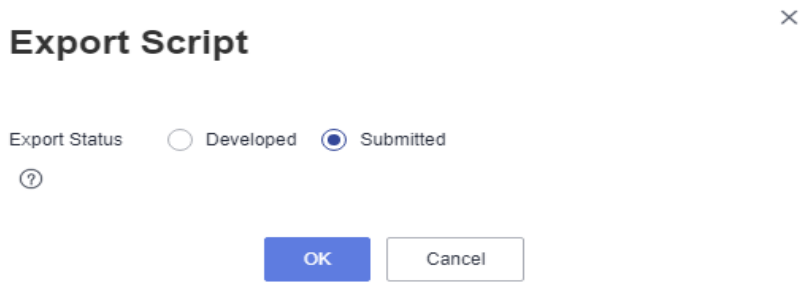
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Figure 9-20 Selecting and exporting scripts



6. In the displayed **Export Script** dialog box, set **Export Status** and click **OK**.

Figure 9-21 Exporting scripts



Importing Scripts

This function is available only if the OBS service is available. If OBS is unavailable, scripts can be imported from the local PC.

You can import one or more script files in the script directory. After a job is imported, the content in the development state is overwritten and a new version is automatically submitted.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

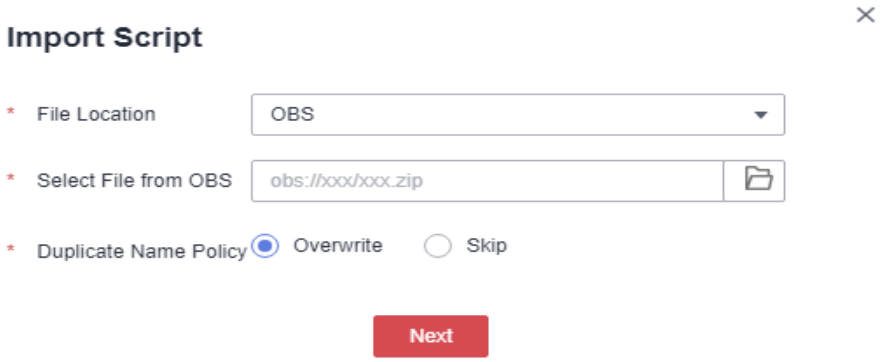
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3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. Click and select **Import Script**. In the displayed dialog box, select the file to import and set **Duplicate Name Policy**.

   NOTE

   If you select **Overwrite** for **Duplicate Name Policy** but the hard lock policy is used and the script is locked by another user, the overwriting will fail. For details about soft and hard lock policies, see **Configuring the Hard and Soft Lock Policy**.

   Figure 9-22 Importing scripts



5. Click **Next**.

9.3.6.5 Viewing Script References

This section describes how to view the references of a script or all the scripts in a folder.

Prerequisites

A script has been developed based on **Developing Scripts**.

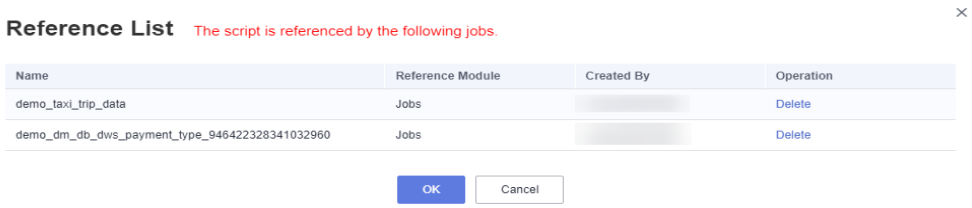
Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. To view the references of a script, right-click the script and select **View Reference**.

   To view the references of all the scripts in a folder, right-click the folder and select **View Reference**.
5. In the displayed dialog box, you can view the references of a script or all the scripts in the folder.

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Figure 9-23 References of a script



9.3.6.6 Deleting a Script

If you do not need to use a script any longer, perform the following operations to delete it.

When you delete a script, the system checks whether the script is being referenced by some jobs. **Version** in the reference list lists the job versions that reference the script. After you click **Delete**, the job will be deleted as well as all version information about the job.

NOTE

If a script to be deleted is being associated with a job, ensure that services are not affected after the script is forcibly deleted. If you want to continue to use the job, go to the **Develop Job** page and associate the job with an available script.

Prerequisites

The script that you want to delete is not used by any jobs.

Deleting a Script

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. In the script directory, right-click the script that you want to delete and choose **Delete** from the shortcut menu.
5. In the displayed dialog box, click **OK**.

Batch Deleting Scripts

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. On the top of the script directory, click and select **Show Check Box**.

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5. Select the scripts to be deleted, click , and select **Batch Delete**.
6. In the displayed dialog box, click **OK**.

9.3.6.7 Unlocking a Script

Script and job unlocking depends on the lock function of DataArts Factory.

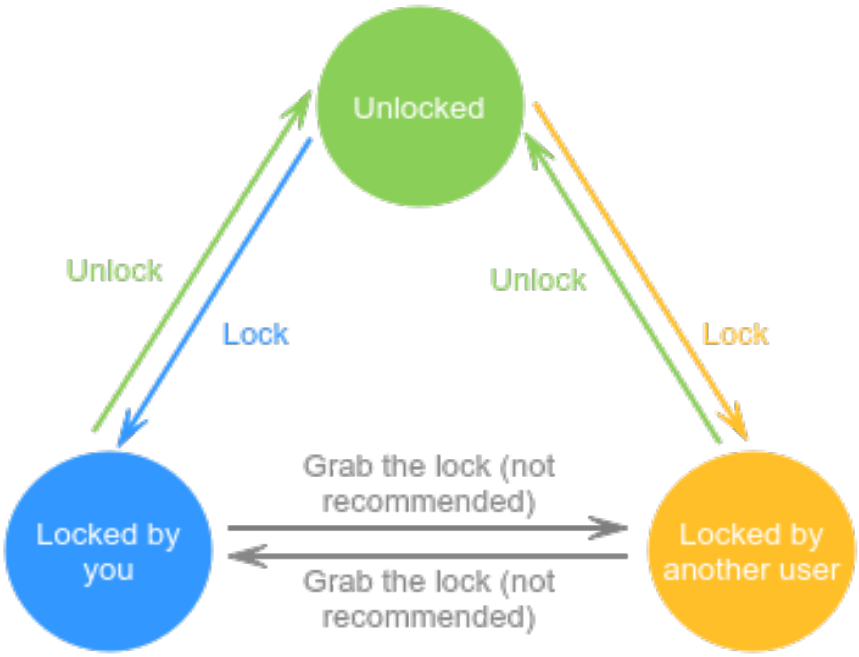
The lock function prevents conflict caused by collaborative script or job development. If you create or import a script or job, it is locked by you by default. You can only edit, save, or submit a script or job you have locked. To edit, save, or submit a script or job that is locked by another user or not locked by any user, you must lock the script or job first.

NOTICE

- You can view the lock status of a script or job in the script or job directory tree.
- To view the latest version of an opened script or job locked by another user, you need to re-open the script or job because it is not updated in real time.
- Scripts or jobs that were created before the lock function was available are now unlocked by default. To edit, save, or submit these scripts or jobs, you need to lock them first.
- The locking operation depends on the soft and hard lock policies. For details about how to configure soft and hard lock policies, see **Configuring a Default Item**.
  - **Soft lock**: You can lock or unlock jobs or scripts, regardless of whether they are locked by others.
  - **Hard Lock**: You can lock jobs or scripts only after they have been unlocked by other users. The space administrator and the DAYU Administrator user can lock and unlock jobs or scripts without any limitations.
- Do not lock a script or job that is locked by another user because if you do so, changes to the script or job made by the user will be lost. If you want to modify the script or job, contact the user to unlock the script or job, and lock it by yourself.

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Figure 9-24 Lock statuses



Prerequisites

A script has been developed.

Unlocking a Script

If you submit a version, the latest script in the development state will be saved and submitted and overwrite the previous script version. You are advised to unlock the script after submitting the version so that other developers can modify the script as needed.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

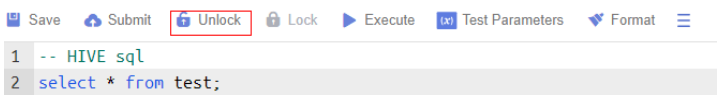
Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.

Step 4 In the script directory, double-click the developed script to access the script development page.

Step 5 In the upper part of the script editor, click **Unlock** to unlock the script.

Figure 9-25 Unlocking a script



----End

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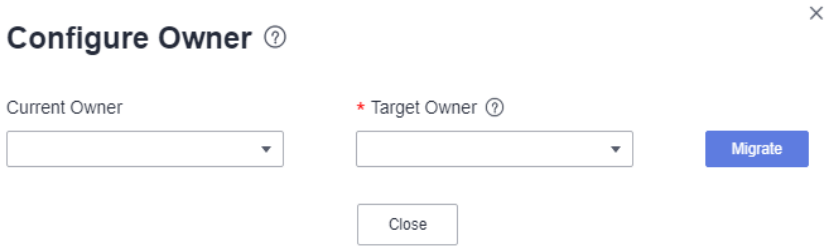
9.3.6.8 Changing the Script Owner

DataArts Factory allows you to change the script owner with a few clicks.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. At the top of the script directory, click and select **Configure Owner**.

   Figure 9-26 Changing the owner

5. Set **Current Owner** and **Target Owner** and click **Migrate**.
6. When the owner is changed, click **Close**.

9.3.6.9 Unlocking Scripts

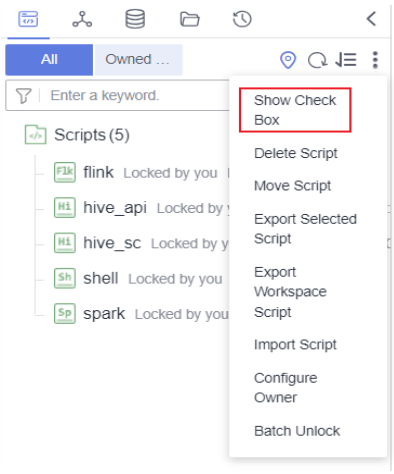
This section describes how to unlock scripts in batches.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
4. Click in the script directory and select **Show Check Box**.

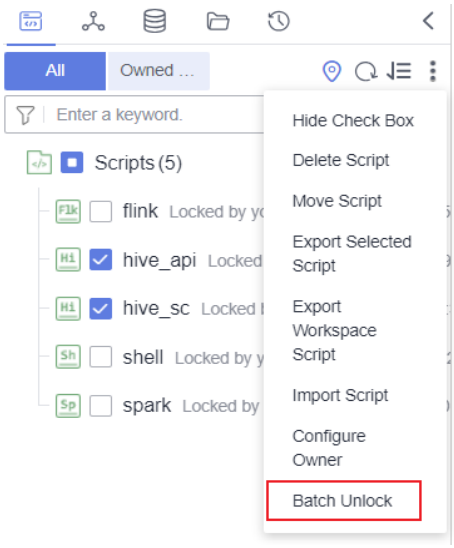
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Figure 9-27 Clicking Show Check Box



5. Select the scripts to unlock, click , and select **Batch Unlock**. The message "Unlocked." is displayed.

Figure 9-28 Batch Unlock



9.4 Job Development

9.4.1 Job Development Process

The job development function provides the following capabilities:

- Provides a graphical designer that allows you to quickly build a data processing workflow by drag-and-drop.
- Presets multiple job types, such as data integration, computing and analysis, data monitoring, and resource management, and completes complex data analysis and processing based on dependencies between jobs.

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- Supports various scheduling modes.
- Supports job import and export.
- Monitors job status and sends job result notifications.
- Provides editing locks for collaborative development.
- Supports job version management and generation of saved and submitted versions.

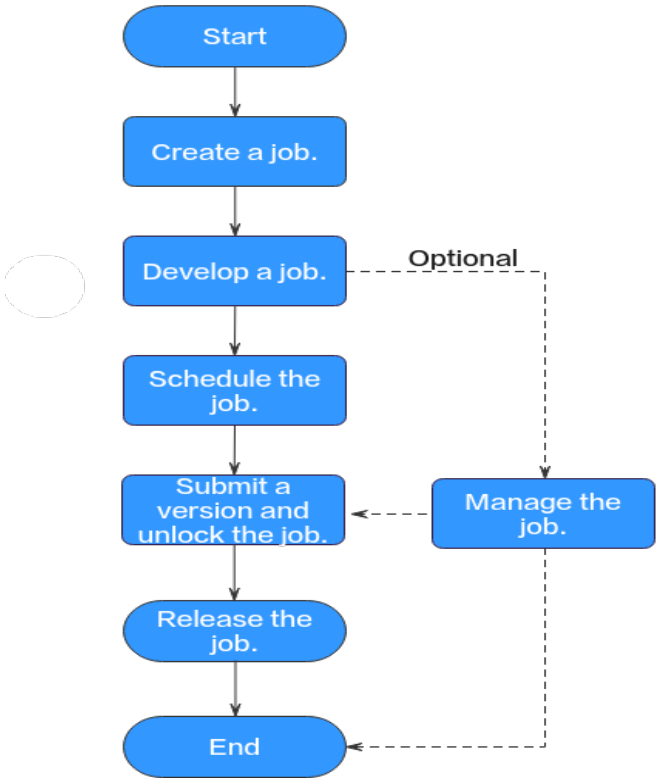
  NOTE

  If you save a script multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.
- Allows you to right-click a job to quickly copy the job name and to quickly close an opened job tab page.
- Provides a link in the execution results of single-task MRS Spark SQL and MRS Hive SQL jobs that use a connection of the MRS API type. Through this link, you can switch to MRS Yarn to view execution logs.
- Allows you to switch to the task release page by clicking **Release** when developing a job in enterprise mode.
- Allows you to filter submitted, unsubmitted, scheduled, and unscheduled jobs. Unsubmitted jobs are marked in red, and unscheduled jobs are marked in yellow.
- Allows you to configure the SQL editor style for single-task jobs. Click **Style Configuration** to configure the editor, icon display, annotation templates, and shortcut keys that can be used in the SQL script editor.
- Allows you to view single-task SQL query results in a table or list. You can click **Style Configuration** and set **SQL Query Result Display Mode** on the **Configure Editor** tab page.
- You can filter out the latest jobs by owner or update time.
- Fine-grained permission control is available for job development. You can configure permission control policies for the job directories in DataArts Factory.
- You can click **Baseline Link** to view the baseline link to which a job belongs. If a job is not associated with any baseline, **Baseline Link** is unavailable.

Before developing a job, you can learn about the basic job development process.

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Figure 9-29 Job development process



1. Create a job: Currently, two job types are available: batch and real-time, which are used for batch data processing and real-time connection data processing, respectively. Batch jobs support pipeline and single-node modes. For details, see **Creating a Job**.
2. Develop the job: Develop the created job. You can orchestrate and configure nodes. For details, see **Developing a Pipeline Job**.
3. Schedule the job: Configure job scheduling tasks. For details, see **Setting Up Scheduling for a Job**.
   - If the processing mode of a job is batch processing, configure scheduling types for jobs. Three scheduling types are supported: run once, run periodically, and event-based. For details, see **Setting Up Scheduling for a Job Using the Batch Processing Mode**.
   - If the processing mode of a job is real-time processing, configure scheduling types for nodes. Three scheduling types are supported: run once, run periodically, and event-based. For details, see **Setting Up Scheduling for Nodes of a Job Using the Real-Time Processing Mode**.
4. Submit a version and unlock the script: After performing this step, the job can be scheduled and modified by other developers. For details, see **Submitting a Version**.
5. (Optional) Manage the job: After the job development is complete, you can manage the job as required. For details, see **(Optional) Managing Jobs**.
6. Release the job. This step is required in enterprise mode. For details, see **Releasing a Job Task**.

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9.4.2 Creating a Job

A job is composed of one or more nodes that are performed collaboratively to complete data operations. Before developing a job, create a new one.

Prerequisites

A workspace can contain a maximum of 10,000 jobs, 5,000 job directories, and 10 directory levels. Ensure that these upper limits are not reached.

Creating a Common Directory

If a directory is available, skip this step.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory list, right-click a directory and choose **Create Directory** from the shortcut menu.
5. In the **Create Directory** dialog box, configure directory parameters based on **Table 9-24**.

   Table 9-24 Job directory parameters

Parameter	Description
Directory Name	Name of a job directory. The name must contain 1 to 64 characters, including only letters, numbers, underscores (_), and hyphens (-).
Select Directory	Parent directory of the job directory. The parent directory is the root directory by default.

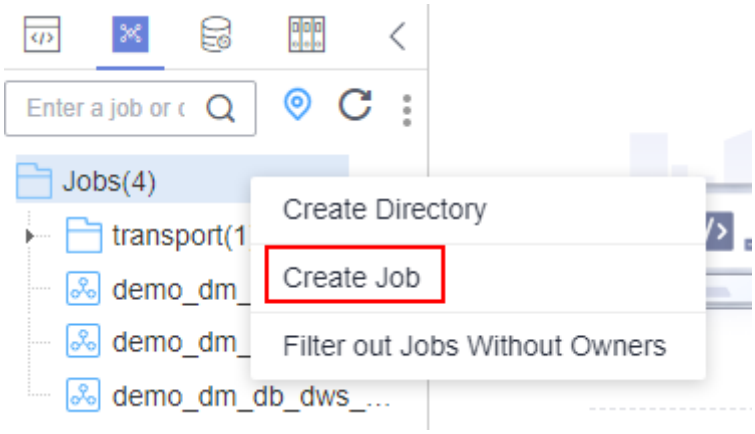
6. Click **OK**.

Creating a Job

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory list, right-click a directory and select **Create Job**.

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Figure 9-30 Creating a job



5. In the displayed dialog box, configure job parameters. **Table 9-25** describes the job parameters.

Table 9-25 Job parameters

Parameter	Description
Job Name	Name of the job. The name must contain 1 to 128 characters, including only letters, numbers, hyphens (-), underscores (_), and periods (.).
Processing Mode	Type of the job. • **Batch processing**: Data is processed periodically in batches based on the scheduling plan, which is used in scenarios with low real-time requirements. This type of job is a pipeline that consists of one or more nodes and is scheduled as a whole. It cannot run for an unlimited period of time, that is, it must end after running for a certain period of time. You can configure job-level scheduling tasks for this type of job. That is, the job is scheduled as a whole. For details, see **Setting Up Scheduling for a Job Using the Batch Processing Mode**. • **Real-time processing**: Data is processed in real time, which is used in scenarios with high real-time performance. This type of job is a business relationship that consists of one or more nodes. You can configure scheduling policies for each node, and the tasks started by nodes can keep running for an unlimited period of time. In this type of job, lines with arrows represent only service relationships, rather than task execution processes or data flows. You can configure node-level scheduling tasks for this type of job, that is, each node can be independently scheduled. For details, see **Setting Up Scheduling for Nodes of a Job Using the Real-Time Processing Mode**.

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Parameter	Description
Mode	• **Pipeline**: You drag and drop one or more nodes to the canvas to create a job. The nodes are executed in sequence like a pipeline. **NOTE** In enterprise mode, real-time processing jobs do not support the pipeline mode. • **Single task**: The job contains only one node. Currently, this mode supports DLI SQL, DWS SQL, RDS SQL, MRS Hive SQL, MRS Spark SQL, DLI Spark, Flink SQL, and Flink JAR nodes. Instead of creating a script and referencing the script in the node of a job, you can debug the script and configure scheduling in the SQL editor of a single-task job. **NOTE** Currently, jobs with a single Flink SQL node support MRS 3.2.0-LTS.1 and later versions.
Select Directory	Directory to which the job belongs. The root directory is selected by default.
Owner	Owner of the job.
Priority	Priority of the job. The value can be **High**, **Medium**, or **Low**. **NOTE** Job priority is a label attribute of the job and does not affect the scheduling and execution sequence of the job.
Agency	After an agency is configured, the job interacts with other services as an agency during job execution. If an agency has been configured for the workspace (for details, see **Configuring a Public Agency**), the job uses the workspace-level agency by default. You can also change the agency to a job-level agency by referring to **Configuring a Job-Level Agency**. **NOTE** Job-level agency takes precedence over workspace-level agency.
Log Path	Selects the OBS path to save job logs. By default, logs are stored in a bucket named **dlf-log-**{*Projectid*}. **NOTE** • If you want to customize a storage path, select the bucket that you have created in OBS by following the instructions in **(Optional) Changing the Job Log Storage Path**. • Ensure that you have the read and write permissions on the OBS path specified by this parameter. Otherwise, the system cannot write logs or display logs.
Job Description	Descriptive information about the job.

6. Click **OK**.

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9.4.3 Developing a Pipeline Job

This section describes how to develop and configure a job.

For details about how to develop a batch processing job or real-time processing job in pipeline mode, see **Compiling Job Nodes**, **Configuring Basic Job Information**, **Configuring Job Parameters**, and **Testing and Saving the Job**.

Prerequisites

- A job has been created. For details, see **Creating a Job**.
- You have locked the job. Otherwise, you must click **Lock** so that you can develop the job. A job you create or import is locked by you by default. For details, see the **lock function**.

Compiling Job Nodes

This part applies to batch processing jobs and real-time processing jobs in pipeline mode.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, double-click the name of a batch processing job or real-time processing job in pipeline mode to access the job development page.
5. Drag a desired node to the canvas, move the mouse over the node, and select the  icon and drag it to connect to another node.

   NOTE

   It is recommended that each job contain a maximum of 200 nodes.

   Figure 9-31 Compiling a job

6. Configure node functions. Right-click a node icon on the canvas and select a function as needed. **Table 9-26** lists the available functions.

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Table 9-26 Node functions

Function	Description
Configure	Goes to the **Node Property** page of the node.
Delete	Deletes one or more nodes at the same time. • Deleting one node: Right-click the node icon in the canvas and choose **Delete** or press the **Delete** shortcut key. • Deleting multiple nodes: Click the icons of the nodes to be deleted in the canvas while holding on **Ctrl**, right-click the blank area of the current job canvas, and choose **Delete** or press the **Delete** shortcut key.
Copy	Copies one or more nodes to any job. • Single-node copy: You can either right-click the node icon in the canvas, choose **Copy**, and paste the node to a target location, or click the node icon in the canvas and press **Ctrl +C** and **Ctrl+V** to paste the node to a target location. The copied node carries the configuration information of the original node. • Multi-node copy: Click the icons of the nodes to be copied in the canvas while holding on **Ctrl**. Then you can either right-click the blank area of the canvas, choose **Copy**, and paste the nodes to a target location, or press **Ctrl+C** and **Ctrl+V** to paste the nodes to a target location. The copied node carries the configuration information of the original node, but does not contain the connection relationship between nodes.
Test Run	Runs the node for a test. **NOTE** You can view the test run logs of the job node by clicking **View Log**.
Test from Current Node	This option is available only for batch processing jobs. It tests the current and subsequent nodes.
Add/ Delete Connection	Adds or deletes a connection between two nodes.
Edit CDM Job	This option is available only for CDM jobs. After selecting a CDM cluster and a job, you can go to the CDM job editing page to modify the job.
View Job Log	This option is available only for CDM jobs. When a CDM job is running, you can right-click the CDM job node and select **View Job Log** from the shortcut menu to go to the job monitoring page and view logs to help developers demarcate and locate job running exceptions.

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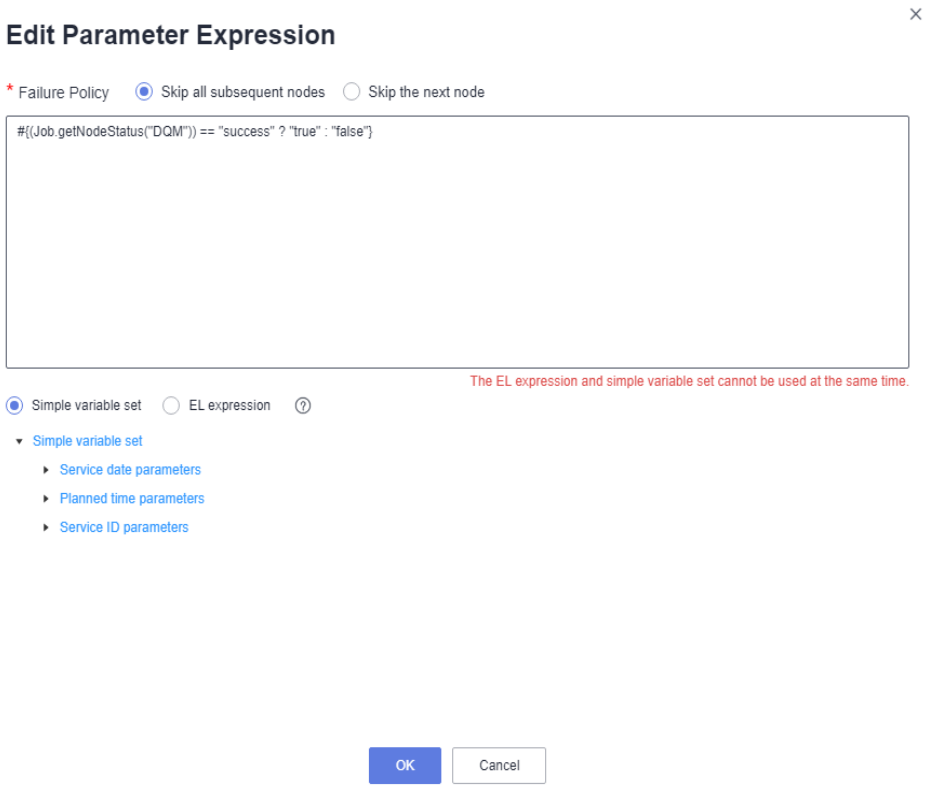
Function	Description
Edit Script	This option is available only for the node associated with a script. Goes to the script editing page and edits the associated script.
Add Note	Adds a note to the node. Each node can have multiple notes. Creating, displaying, or hiding a note on a job node takes effect only for this node. Creating, displaying, or hiding a note on the top of the canvas takes effect for the entire job.

7. (Optional) Configure line functions. Right-click the line connecting two nodes on the canvas. **Delete** and **Set Condition** are displayed. You can select them as needed.
   - **Delete**: Deletes the line connecting the nodes.
   - **Set Condition**: In the displayed dialog box, you can enter a ternary expression using the EL expression syntax. If the result of the ternary expression is **true**, subsequent nodes will be connected. Otherwise, subsequent nodes will be skipped.

     The following figure shows a typical ternary expression. If the execution result of the DQM node is **true**, subsequent nodes will be connected. If the execution result is **false** and the **Failure Policy** is **Skip all subsequent nodes**, the next node A and all nodes following node A will be skipped.

     ```
     #{(Job.getNodeStatus("DQM")) == "success" ? "true" : "false"}
     ```

     Figure 9-32 Set Condition

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For details about the EL expression syntax, see **Expression Overview**. For details about how to use IF conditions, see **IF Condition Judgment**.

8. Configure node properties Click a node in the canvas. On the displayed **Node Properties** page, configure node properties. For details, see **Node Overview**.

Configuring Basic Job Information

After you configure the owner and priority for a job, you can search for the job by the owner and priority. The procedure is as follows:

Click the **Basic Info** tab on the right of the canvas to expand the configuration page and configure job parameters, as listed in **Table 9-27**.

Table 9-27 Basic job information

Parameter	Description
Owner	An owner configured during job creation is automatically matched. This parameter value can be modified.
Executor	This parameter is available when **Scheduling Identities** is set to **Yes**. User that executes the job. When you enter an executor, the job is executed by the executor. If the executor is left unspecified, the job is executed by the user who submitted the job for startup. **NOTE** You can configure execution users only after you apply for the whitelist membership. To enable it, contact customer service or technical support.
Job Agency	This parameter is available when **Scheduling Identities** is set to **Yes**. After an agency is configured, the job interacts with other services as an agency during job execution.
Priority	Priority configured during job creation is automatically matched. This parameter value can be modified.
Execution Timeout	Timeout of the job instance. If this parameter is set to 0 or is not set, this parameter does not take effect. If the notification function is enabled for the job and the execution time of the job instance exceeds the preset value, the system sends a specified notification, and the job keeps running.
Exclude Waiting Time from Instance Timeout Duration	Whether to exclude the wait time from the instance execution timeout duration If you select this option, the time to wait before an instance starts running is excluded from the timeout duration. You can modify this setting in **Default Configuration > Exclude Waiting Time from Instance Timeout Duration**. If you do not select this option, the time to wait before an instance starts running is included in the timeout duration.

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Parameter	Description
Custom Parameter	Set the name and value of the parameter.
Job Tag	Configure job tags to manage jobs by category. Click **Add** to add a tag to the job. You can also select a tag configured in **Managing Job Tags**.
Job Description	Description of the job

Configuring Job Parameters

Job parameters can be globally used in any node in jobs. The procedure is as follows:

For batch and real-time processing jobs in pipeline mode: Click the blank area in the canvas and then the **Parameter Setup** tab on the right, and configure the parameters listed in **Table 9-28**.

Table 9-28 Job parameter setup

Function	Description
Variables	
Add	Click **Add** and enter the variable parameter name and parameter value in the text boxes. • Parameter Name Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter Value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **${***Parameter name***}** in the job. **NOTE** • If a job has two nodes, the first Rest Client node returns a body, and the second node uses the returned data. If the data contains more than 1,000,000 characters, it will be truncated. When configuring job parameters, ensure that the value of a job parameter contains no more than 1,000,000 characters.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.

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Function	Description
Modify	Change the parameter name or value in the corresponding text boxes.
Mask	If the parameter value is a key, click  to mask the value for security purposes.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Constant Parameter	
Add	Click **Add** and enter the constant parameter name and parameter value in the text boxes. • Parameter name Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*Parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modify	Modify the parameter name and parameter value in text boxes and save the modifications.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Workspace Environment Variables	
View the variables and constants that have been configured in the workspace.	

Click the **Parameter Preview** tab and configure the parameters listed in **Table 9-29**.

NOTE

The script parameters of the following types of operators can be previewed: MRS Flink Job, DLI Flink Job, DLI SQL, DWS SQL, MRS HetuEngine, MRS ClickHouse SQL, MRS Hive SQL, MRS Impala SQL, MRS Presto SQL, RDS SQL, DORIS SQL, and MRS Spark SQL.

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Table 9-29 Job parameter preview

Function	Description
Current Time	This parameter is displayed only when **Scheduling Type** is set to **Run once**. The default value is the current time.
Event Triggering Time	This parameter is displayed only when **Scheduling Type** is set to **Event-based**. The default value is the time when an event is triggered.
Scheduling Period	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The default value is the scheduling period.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the configured job execution time.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the time when the periodic job scheduling starts.
Subsequent Instances	Number of job instances scheduled. ● The default value is **1** when **Scheduling Type** is set to **Run once**. ● The default value is **1** when **Scheduling Type** is set to **Event-based**. ● When **Scheduling Type** is set to **Run periodically**: If the number of instances exceeds 10, a maximum of 10 instances can be displayed, and the system displays message "A maximum of 10 instances are supported."

NOTE

In **Parameter Preview**, if a job parameter has a syntax error, the system displays a message.

If a parameter depends on the data generated during job execution, such data cannot be simulated and displayed in **Parameter Preview**.

Testing and Saving the Job

After a job is configured, complete the following operations:

Batch processing job

Step 1 Click **Test** above the canvas. In the displayed dialog box, the job variables are displayed. Click **OK** to test the job. If the test fails, view the logs of the job node and locate and rectify the fault.

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NOTE

- You can view the test run logs of the job by clicking **View Log**.
- If you test the job before submitting a version, the version of the generated job instance is 0 on the **Job Monitoring** page.
- You can control access to the test run logs. For example, after user A performs a test, user A can view the test run logs on the **Monitor Instance** page, but user B cannot.

Step 2 When the test is successful, click **Save** to save the job configuration.

After the job is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a job multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

----End

Processing jobs in real time

Step 1 Click **Save** to save the job configuration.

After the job is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a job multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

Step 2 After **submitting** the job version, click **Start** above the canvas to run the job. After the job is executed, go to the **Job Monitoring** page to view the job execution result.

----End

9.4.4 Developing a Batch Processing Single-Task SQL Job

This section describes how to develop and configure a job.

For details about how to develop a batch processing job in single-task mode, see sections **Developing an SQL Script**, **Configuring job parameters**, **Monitoring Quality**, **Data Table**, **Testing and Saving the Job**, and **Downloading or Dumping a Script Execution Result**.

Prerequisites

- A job has been created. For details, see **Creating a Job**.
- You have locked the job. Otherwise, you must click **Lock** so that you can develop the job. A job you create or import is locked by you by default. For details, see the **lock function**.

Developing an SQL Script

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.

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4. In the job directory, double-click the name of a single-task job to access the job development page.
5. On the right of the SQL editor, click **Basic Info** to configure basic information, properties, and advanced settings of the job. **Table 9-30** lists the basic information, **Table 9-31** lists the properties, and **Table 9-32** lists the advanced settings.

Table 9-30 Basic job information

Parameter	Description
Owner	An owner configured during job creation is automatically matched. This parameter value can be modified.
Executor	This parameter is available when **Scheduling Identities** is set to **Yes**. User that executes the job. When you enter an executor, the job is executed by the executor. If the executor is left unspecified, the job is executed by the user who submitted the job for startup. **NOTE** You can configure execution users only after you apply for the whitelist membership. To enable it, contact customer service or technical support.
Job Agency	This parameter is available when **Scheduling Identities** is set to **Yes**. After an agency is configured, the job interacts with other services as an agency during job execution.
Priority	Priority configured during job creation is automatically matched. This parameter value can be modified.
Execution Timeout	Timeout of the job instance. If this parameter is set to 0 or is not set, this parameter does not take effect. If the notification function is enabled for the job and the execution time of the job instance exceeds the preset value, the system sends a specified notification, and the job keeps running.
Exclude Waiting Time from Instance Timeout Duration	Whether to exclude the wait time from the instance execution timeout duration If you select this option, the time to wait before an instance starts running is excluded from the timeout duration. You can modify this setting in **Default Configuration > Exclude Waiting Time from Instance Timeout Duration**. If you do not select this option, the time to wait before an instance starts running is included in the timeout duration.
Custom Parameter	Set the name and value of the parameter.

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Parameter	Description
Job Tag	Configure job tags to manage jobs by category. Click **Add** to add a tag to the job. You can also select a tag configured in **Managing Job Tags**.
Job Description	Description of the job

Table 9-31 Attributes of a batch processing single-task SQL job

Property	Description
DLI SQL properties	
DLI Data Directory	Select the DLI data directory. • Default DLI data directory **dli** • Metadata catalog that has been created in LakeFormation associated with DLI.
Database Name	Select a database. If you select the default DLI data directory **dli**, select a DLI database and tables. If you select a metadata catalog that has been created in LakeFormation associated with DLI, select a LakeFormation database and tables.
Queue Name	The queue set in the SQL script is selected by default. You can change another one. You can create a resource queue using either of the following methods: • Click . On the displayed **Queue Management** page of DLI, create a resource queue. • Go to the DLI console to create a resource queue.
Record Dirty Data	Click to specify whether to record dirty data. • If you select , dirty data will be recorded. • If you do not select , dirty data will not be recorded.

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Property	Description
DLI Environmental Variable	• The environment variable must start with **hoodie.**, **dli.sql.**, **dli.ext.**, **dli.jobs.**, **spark.sql.**, or **spark.scheduler.pool**. • If the environment variable is **dli.sql.autoBroadcastJoinThreshold**, the value must be an integer. If the environment variable is **dli.sql.shuffle.partitions**, the value must be a positive integer. • If the key of the environment variable is **dli.sql.shuffle.partitions** or **dli.sql.autoBroadcastJoinThreshold**, the environment variable cannot contain the greater than (>) or less than (<) sign. • If a parameter with the same name is configured in both a job and a script, the parameter value configured in the job will overwrite that configured in the script. **NOTE** When you run a DLI SQL script or test a DLI SQL single-task job in non-scheduling scenarios, the following parameters are enabled by default: • **spark.sql.adaptive.enabled**: Adaptive Query Execution (AQE) is enabled so that Spark can dynamically optimize the query execution plan based on the characteristics of the data being processed and improve the performance by reducing the amount of data to be processed. • **spark.sql.adaptive.join.enabled**: AQE is enabled for join operations. The optimal join algorithm is selected based on the data being processed to improve performance. • **spark.sql.adaptive.skewedJoin.enabled**: AQE is enabled for skewed join operations. Skewed data can be automatically detected and the join algorithm is optimized accordingly to improve performance. • **spark.sql.mergeSmallFiles.enabled**: Merging of small files is enabled. Small files can be merged into large ones, improving performance and shortening the processing time. In addition, fewer files need to be read from remote storage, and more local files can be used. If you do not want to use these functions, you can set the values of the preceding parameters to **false**.
DWS SQL properties	
Data Connection	Select a data connection.
Database	Select a database.
Dirty Data Table	Name of the dirty data table defined in the SQL script. The dirty data attributes cannot be edited. They are automatically recommended by the SQL script content.

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Property	Description
Matching Rule	Enter a Java regular expression used to match the DWS SQL result. For example, if the expression is (?<=\()(-*\d+?)(?=,) and the SQL result is (1,"error message"), then the matched result is "1".
Failure Matching Value	If the matched content equals the set value, the node fails to be executed.
RDS SQL properties	
Data Connection	Select a data connection.
Database	Select a database.
Spark SQL properties	
MRS Job Name	MRS job name. The system automatically sets this parameter based on the job name. If the MRS job name is not set and the direct connection mode is selected, the node name can contain only letters, digits, hyphens (-), and underscores (_). A maximum of 64 characters are allowed, and Chinese characters are not allowed. **NOTE** If you select an MRS API data connection, you cannot set the job name.
Data Connection	Select a data connection.
MRS Resource Queue	Select a created MRS resource queue. **NOTE** Select a queue you configured in the queue permissions of DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.
Database	Select a database. If you select an MRS API connection, you cannot select a database.

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Property	Description
Program Parameter	Set program parameters. The following is an example: Set **Parameter** to **--queue** and **Value** to **default_cr**, indicating that a specified queue of the MRS cluster is configured. You can also go to the MRS console, click the name of the MRS cluster and then the **Jobs** tab, locate the job, click **More** in the **Operation** column, and select View **Details** to view the job details. **NOTE** Configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. This configuration is unavailable if a Spark proxy connection is used. Spark SQL jobs with a single operator and using a connection of the MRS API type support program parameters.
Hive SQL properties	
MRS Job Name	MRS job name. The system automatically sets this parameter based on the job name. If the MRS job name is not set and the direct connection mode is selected, the node name can contain only letters, digits, hyphens (-), and underscores (_). A maximum of 64 characters are allowed, and Chinese characters are not allowed.
Data Connection	Select a data connection.
Database	Select a database.
MRS Resource Queue	Select a created MRS resource queue.
Program Parameter	Set program parameters. The following is an example: Set **Parameter** to **--hiveconf** and **Value** to **mapreduce.job.queuename=default_cr**, indicating that a specified queue of the MRS cluster is configured. You can also go to the MRS console, click the name of the MRS cluster and then the **Jobs** tab, locate the job, click **More** in the **Operation** column, and select View **Details** to view the job details. **NOTE** Configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. This configuration is unavailable if a Hive proxy connection is used. Hive SQL jobs with a single operator and using a connection of the MRS API type support program parameters.

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Property	Description
Doris SQL properties	
Data Connection	Select a data connection.
Database	Select a database.

Table 9-32 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system checks whether the node execution is complete. The value ranges from 1 to 60 seconds. During the node execution, the system checks whether the node execution is complete at the configured interval.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. ● **Yes**: The node will be re-executed, and the following parameters must be configured: – Retry upon Timeout – **Maximum Retries** – **Retry Interval (seconds)** ● **No**: The node will not be re-executed. This is the default value. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current node Fails	Yes	Policy for handling subsequent nodes if the current node fails • **End the current job execution plan**: Execution of the current job will stop, and the job instance status will become **Failed**. If the job is scheduled periodically, subsequent periodic scheduling will run properly. • **Ignore the failure and set the job execution result to success**: The failure of the current node will be ignored. The job instance status will become **Successful**. If the job is scheduled periodically, subsequent periodic scheduling will run properly.

6. Enter one or more SQL statements in the SQL editor.

   NOTE

   - SQL statements are separated by semicolons (**;**). If semicolons are used in other places but not used to separate SQL statements, escape them with backslashes (\). The following is an example:
     ```
     select 1;
     select * from a where b="dsfa\;";  --example 1\;example 2.
     ```
   - RDS SQL does not support the begin ... commit transaction syntax. If necessary, use the start transaction ... commit transaction syntax.
   - The script cannot be larger than 16 MB.
   - The system date obtained by using an SQL statement is different from that obtained by using the database tool. The query result is stored in the database in the YYYY-MM-DD format, but the query result displayed on the page is in the converted format.
   - When a user submits a Spark SQL script to MRS, the script is submitted to the tenant queue bound to the user by default. The bound queue is the queue corresponding to tenant role of the user. If there are multiple queues, the system preferentially selects a queue based on the queue priorities. To set a fixed queue for the user to submit scripts, log in to FusionInsight Manager, choose **Tenant Resources** > **Dynamic Resource Plan**, and click the **Global User Policy** tab. For details, see **Managing Global User Policies**.
   - You can click **Check Syntax** to check the syntax of a Spark SQL or Hive SQL script. After the check is complete, you can view the check result in the lower part of the page.

   To facilitate script development, DataArts Factory provides the following capabilities:

   – The script editor supports the following shortcut keys, which improve the script development efficiency:

     ▪ **F8**: Run a script.

     ▪ **F9**: Stop running a script.

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- **Ctrl** + **/**: Comment out or uncomment the line or code block at the cursor.
- **Ctrl** +**Z**: Cancel
- **Ctrl** + **F**: Search
- **Ctrl** + **Shift** + **R**: Replace
- **Ctrl** + **X**: Cut
- **Ctrl** + **S**: Save a script.
- **Alt** + mouse dragging: Select columns to edit a block.
- **Ctrl** + mouse click: Select multiple lines to edit or indent them together.
- **Ctrl** + → (or ←): Move the cursor rightwards (or leftwards) by word.
- **Ctrl** + **Home** or **Ctrl** + **End**: Navigate to the beginning or end of the current file.
- **Home** or **End**: Navigate to the beginning or end of the current line.
- **Ctrl** + **Shift** + **L**: Double-click all the same character strings and add cursors to them to implement batch modification.
- **Ctrl** + **D**: Delete a line.
- **Shift** + **Ctrl** + **U**: Unlock a script.
- **Ctrl** + **Alt** + **K**: Select the word where the cursor resides.
- **Ctrl** + **B**: Format
- **Ctrl** + **Shift** + **Z**: Redo
- **Ctrl** + **Enter**: Execute the selected line or content.
- **Ctrl** + **Alt** + **F**: Flag
- **Ctrl** + **Shift** + **K**: Search for the previous one.
- **Ctrl** + **K**: Search for the next one.
- **Ctrl** + **Backspace**: Delete the word to the left of the cursor.
- **Ctrl** + **Delete**: Delete the word to the right of the cursor.
- **Alt** + **Backspace**: Delete all content from the beginning of the line to the cursor.
- **Alt** + **Delete**: Delete all content from the cursor to the end of the line.
- **Alt** + **Shift**-**Left**: Select all content from the beginning of the line to the cursor.

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- **Alt** + **Shift**-**Right**: Select all content from the cursor to the end of the line.

– System functions

To view the functions supported by this type of data connection, click **System Functions** on the right of the editor. You can double-click a function to the editor to use it.

– Script parameters

Enter script parameters in the SQL statement and click **Parameter Setup** in the right pane of the editor and then click **Update from Script**. You can also directly configure parameters and constants for the job script.

In the following script example, *str1* indicates the parameter name. It can contain only letters, digits, hyphens (-), underscores (_), greater-than signs (>), and less-than signs (<), and can contain a maximum of 16 characters. The parameter name must be unique.

```
select ${str1} from data;
```

– Visualized reading of data tables to generate SQL statements

Click **Data Tables** on the right of the editor to display all the tables in the current database or schema. You can select tables and columns and click **Generate SQL Statement** in the lower right corner to generate an SQL statement, which you need to manually format.

7. (Optional) In the upper part of the editor, click **Format** to format SQL statements.
8. In the upper part of the editor, click **Execute**. If you need to execute some SQL statements separately, select the SQL statements first. After executing the SQL statements, view the execution history and result of the script in the lower part of the editor.

   NOTE

   - You can click **View Log** to view logs of the job.
   - You can control display of the script execution history by setting **Script Execution History** in **Default Configuration** to **Myself** or **All users**.
9. Above the editor, click **Save** to save the job.

Configuring job parameters

Click **Parameter Setup** on the right of the editor and set the parameters described in **Table 9-33**.

Table 9-33 Job parameter setup

Module	Description
Variables	

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Module	Description
Add	Click **Add** and enter the variable parameter name and parameter value in the text boxes. • Parameter Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter Value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*Parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modifying a Job	Change the parameter name or value in the corresponding text boxes.
Mask	If the parameter value is a key, click  to mask the value for security purposes.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Constant Parameter	
Add	Click **Add** and enter the constant parameter name and parameter value in the text boxes. • Parameter Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter Value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*Parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.

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Module	Description
Modifying a Job	Modify the parameter name and parameter value in text boxes and save the modifications.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Workspace Environment Variables	
View the variables and constants that have been configured in the workspace.	

Click the **Parameter Preview** tab and configure the parameters listed in **Table 9-34**.

Table 9-34 Job parameter preview

Module	Description
Current Time	This parameter is displayed only when **Scheduling Type** is set to **Run once**. The default value is the current time.
Event Triggering Time	This parameter is displayed only when **Scheduling Type** is set to **Event-based**. The default value is the time when an event is triggered.
Scheduling Period	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The default value is the scheduling period.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the configured job execution time.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the time when the periodic job scheduling starts.
Subsequent Instances	Number of job instances scheduled. • The default value is **1** when **Scheduling Type** is set to **Run once**. • The default value is **1** when **Scheduling Type** is set to **Event-based**. • When **Scheduling Type** is set to **Run periodically**: If the number of instances exceeds 10, a maximum of 10 instances can be displayed, and the system displays message "A maximum of 10 instances are supported."

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NOTE

In **Parameter Preview**, if a job parameter has a syntax error, the system displays a message.

If a parameter depends on the data generated during job execution, such data cannot be simulated and displayed in **Parameter Preview**.

Monitoring Quality

Data migration and single-task real-time jobs that have been orchestrated cannot be associated with quality jobs.

Two execution modes are available: parallel and serial. Click the **Quality Monitoring** tab on the right of the canvas to expand the slide-out panel and configure the parameters listed in **Table 9-35**.

Table 9-35 Quality monitoring parameters

Parameter	Description
Execution Mode	Execution mode of quality monitoring. The options are as follows: • **Parallel**: All the upstream operators of the quality job operator are set as primary operators. • **Serial**: Quality jobs are connected in series from top to bottom. The quality job on the top depends on the primary operator.

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Parameter	Description
Quality job	Quality jobs to be associated with the single-task job 1. Click **Add**. The **Data Quality Monitor** slide-out panel is displayed. 2. Set a node name. 3. Set **Job Type** to **Quality job**. **NOTE** **Comparison job** is not supported. 4. Select the quality job to be associated and set other parameters based on the site requirements. If no quality job is available, create a quality job by referring to **Creating a Data Quality Job**. **NOTE** • Click **Add** to add multiple quality jobs. • Click to modify an added quality job. • Click to delete an added quality job. 5. Ignore Quality Job Alarm **Yes**: Quality job alarms can be ignored. **No**: Quality job alarms cannot be ignored. When an alarm is generated, it will be reported. 6. Configure advanced settings. a. **Max. Node Execution Duration**: indicates the execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again. b. **Retry upon Failure**: specifies whether to re-execute a node if it fails to be executed. **Yes**: The node will be re-executed, and the following parameters must be configured: Retry upon Timeout **Maximum Retries** **Retry Interval (seconds)** **No**: The node will not be re-executed. This is the default value. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**. c. Policy for Handling Subsequent Nodes If the Current Node Fails

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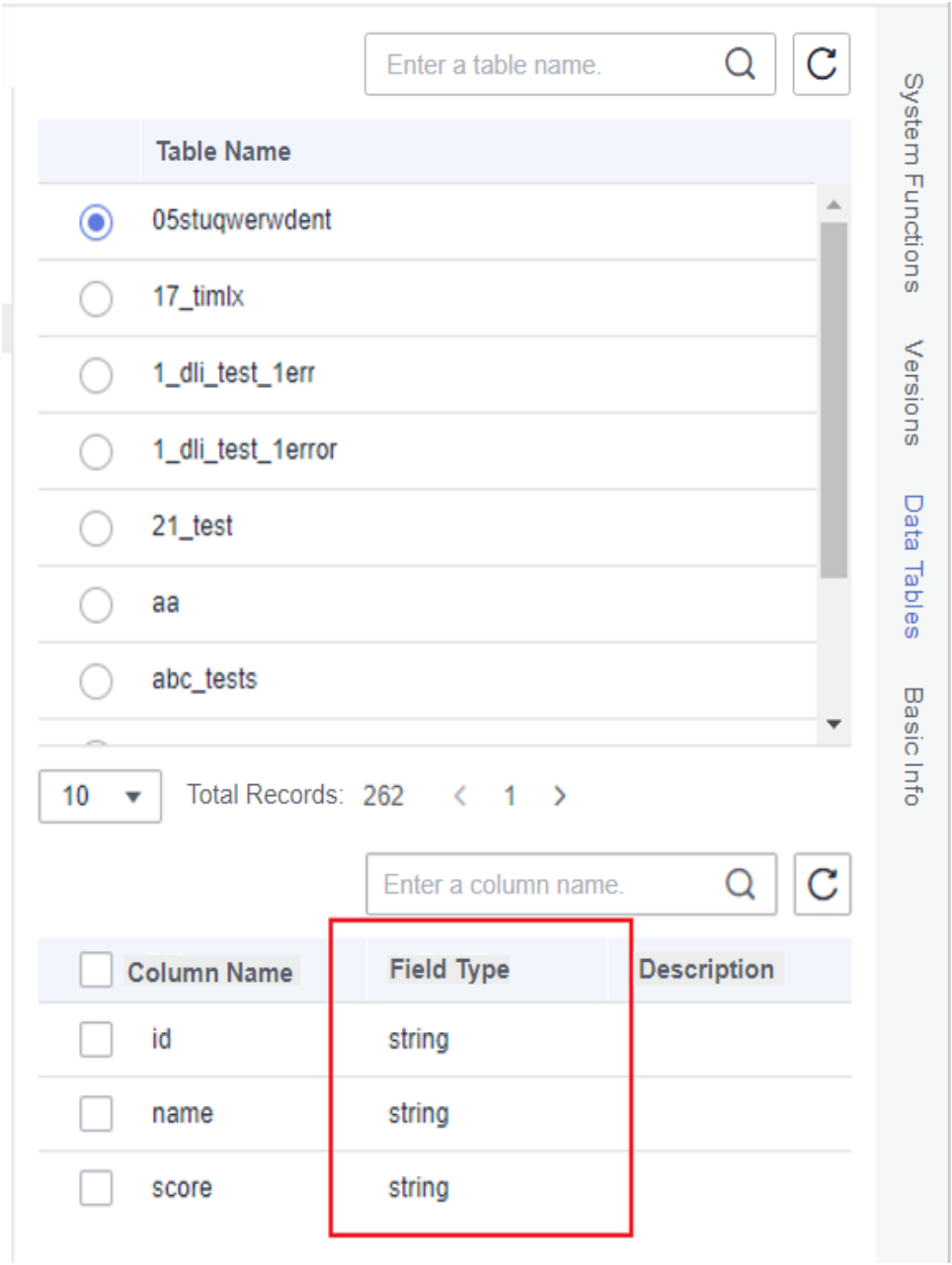
Parameter	Description
	End the current job execution plan: stops running the current job. The job instance status is **Failed**. **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. **Suspend current job execution plan**: suspends running the current job. The job instance status is **Waiting**. **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. 7. Click **OK** to complete the quality monitoring configuration.

Data Table

You can view tables of Hive SQL, Spark SQL, DLI SQL, Doris SQL, RDS SQL, and DWS SQLsingle-task batch processing jobs. On the **Data Tables** slide-out panel, you can select a table name to view the column names, field types, and descriptions in the table.

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Figure 9-33 Viewing a data table



Testing and Saving the Job

After configuring the job, perform the following operations:

Step 1 Click ▶ to execute the job.

NOTE

You can view the run logs of the job by clicking **View Log**.

Step 2 After the job is executed, click 💾 to save the job configuration.

After the job is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a job multiple times within a

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minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

----End

Downloading or Dumping Script Execution Results

After a script is executed successfully, you can download or dump the execution result. By default, all users can download and dump the execution results of SQL scripts. If you do not want all users to have this permission, configure the permission by referring to **Configuring a Data Export Policy**.

- After executing a script, you can click **Download** on the **Result** tab page to download a CSV result file to a local path. You can view the download record on the **Download Center** page.
- After executing a script, you can click **Dump** on the **Result** tab page to dump a CSV and a JSON result file to OBS. For details, see **Table 9-36**.

  NOTE

  - The dump function is supported only if the OBS service is available.
  - Only the execution results of SQL script query statements can be dumped.
  - If the execution result of a download or dump SQL statement contains commas (,), newline characters, or other special characters, data may be disordered, the number of rows may increase, or other issues may occur.

Table 9-36 Dump parameters

Parameter	Mandatory	Description
Data Format	Yes	Format of the data to be exported. CSV and JSON formats are supported.
Resource Queue	No	DLI queue where the export operation is to be performed. Set this parameter when a DLI or SQL script is created.
Compression Format	No	Format of compression. Set this parameter when a DLI or SQL script is created. • none • bzip2 • deflate • gzip
Storage Path	Yes	OBS path where the result file is stored. After selecting an OBS path, customize a folder. Then, the system will create it automatically for storing the result file. You can also go to the **Download Center** page to set the default OBS path, which will be automatically set for **Storage Path** in the **Dump Result** dialog box.

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Parameter	Mandatory	Description
Cover Type	No	If a folder that has the same name as your custom folder exists in the storage path, select a cover type. Set this parameter when a DLI or SQL script is created. • **Overwrite**: The existing folder will be overwritten by the customized folder. • **Report**: The system reports an error and suspends the export operation.
Export Column Name	No	**Yes**: Column names will be exported. **No**: Column names will not be exported.
Character Set	No	• **UTF-8**: default character set • **GB2312**: recommended when the data to be exported contains Chinese character sets • **GBK**: expanded based on and compatible with GB2312
Quotation Character	No	This parameter is available and can be set only when **Data Format** is **csv**. Quotation characters are used to identify the beginning and end of text fields when exporting job results, and are used to separate fields. Only one character can be set. The default value is double quotation marks ("). This is mainly used to handle data that contains spaces, special characters, or characters that are the same as the delimiter. For details about the examples of using quotation characters and escape characters, see **Example of Using Quotation Characters and Escape Characters**.

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Parameter	Mandatory	Description
Escape Character	No	This parameter is available and can be set only when **Data Format** is **csv**. If special characters, such as quotation marks, need to be included in the exported results, they can be represented using escape characters (backslash \). Only one character can be set. The default value is a backslash (\). Common scenarios for using escape characters are: • If there is a third quotation mark between two quotation marks, add an escape character before the third quotation mark to prevent the field content from being split. • If there is already an escape character in the data content, add another escape character before the existing one to avoid the original character being used as an escape character. For details about the examples of using quotation characters and escape characters, see **Example of Using Quotation Characters and Escape Characters**.

Download or dump allows you to view more SQL script execution results. **Table 9-37** lists the maximum number of results that you can view, dump, and downloaded for different types of SQL scripts.

Table 9-37 Maximum number of results that you can view, dump, and download

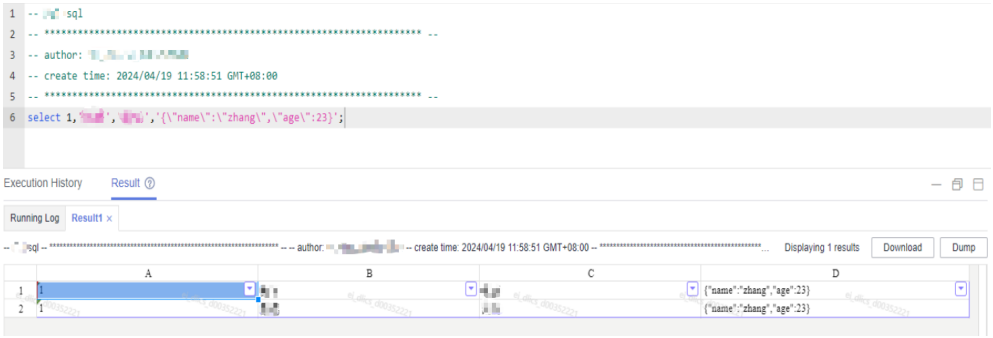
SQL Type	Maximum Number of Results That You Can View Online	Maximum Number/Size of Results That Can Be Downloaded	Maximum Number/Size of Results That Can Be Dumped
DLI	1,000	1,000 records, less than 3MB	Unlimited
Hive	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
GaussDB(DWS)	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
Spark	1,000	1,000 records, less than 3MB	10,000 records or 3 MB
RDS	1,000	1,000 records, less than 3MB	Not supported

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SQL Type	Maximum Number of Results That You Can View Online	Maximum Number/Size of Results That Can Be Downloaded	Maximum Number/Size of Results That Can Be Dumped
Doris	1,000	1,000 records, less than 3MB	1,000 records or 3 MB

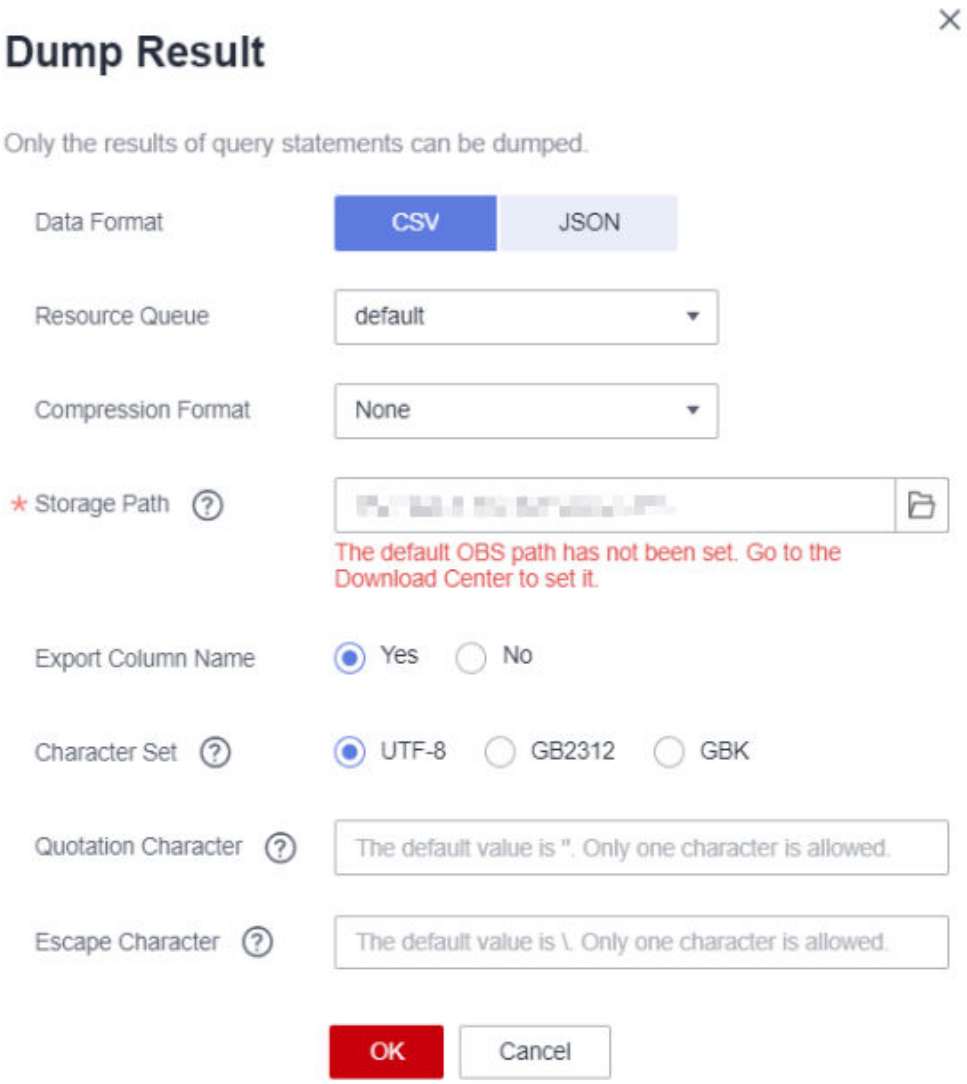
Example of Using Quotation Characters and Escape Characters

- Usage of quotation characters and escape characters:
  - Quotation character: used to identify and separate fields. The default value is double quotation marks (").
  - Escape character: If special characters, such as quotation marks, need to be included in the exported results, they can be represented using escape characters (backslash \). The default value is a backslash (\).
    i. To prevent the content of a field from being split when there is a third quotation character between two quotation characters, add an escape character before the third quotation character.
    ii. If there is already an escape character in the data content, add another escape character before the existing one to avoid the original character being used as an escape character.
- Example:



You can leave **Quotation Character** and **Escape Character** empty.

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If you leave them empty, the downloaded .csv file contains two rows in Excel.

D	E
{\name\":\"zhang\"	\"age\":23}"
{\name\":\"zhang\"	\"age\":23}"

If you specify both of them, for example, enter double quotation marks ("), the downloaded file is as follows.

D	E
{"name":"zhang","age":23}	
{"name":"zhang","age":23}	

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9.4.5 Developing a Real-Time Processing Single-Task MRS Flink SQL Job

This section describes how to develop and configure a job.

For details about how to develop a real-time processing Flink SQL job in single-task mode, see sections **Developing an SQL Script**, **Configuring Job Parameters**, **Saving a Job**, and **Templates**.

Prerequisites

- You have created a job by referring to **Creating a Job**.
- You have locked the job. Otherwise, you must click **Lock** so that you can develop the job. A job you create or import is locked by you by default. For details, see the **lock function**.

Developing an SQL Script

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, double-click the name of a single-task job to access the job development page.
5. On the right of the SQL editor, click **Basic Info** to configure basic information of the job. **Table 9-38** provides the basic information about the single-task MRS Flink SQL job.

Table 9-38 Basic job information

Parameter	Description
Owner	An owner configured during job creation is automatically matched. This parameter value can be modified.
Executor	This parameter is available when **Scheduling Identities** is set to **Yes**. User that executes the job. When you enter an executor, the job is executed by the executor. If the executor is left unspecified, the job is executed by the user who submitted the job for startup. **NOTE** You can configure execution users only after you apply for the whitelist membership. To enable it, contact customer service or technical support.

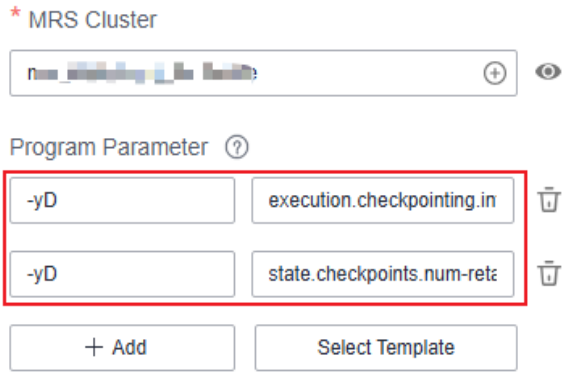
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Parameter	Description
Job Agency	This parameter is available when **Scheduling Identities** is set to **Yes**. After an agency is configured, the job interacts with other services as an agency during job execution.
Priority	Priority configured during job creation is automatically matched. This parameter value can be modified.
Execution Timeout	Timeout of the job instance. If this parameter is set to 0 or is not set, this parameter does not take effect. If the notification function is enabled for the job and the execution time of the job instance exceeds the preset value, the system sends a specified notification, and the job keeps running.
Exclude Waiting Time from Instance Timeout Duration	Whether to exclude the wait time from the instance execution timeout duration If you select this option, the time to wait before an instance starts running is excluded from the timeout duration. You can modify this setting in **Default Configuration > Exclude Waiting Time from Instance Timeout Duration**. If you do not select this option, the time to wait before an instance starts running is included in the timeout duration.
Custom Parameter	Set the name and value of the parameter.
Job Tag	Configure job tags to manage jobs by category. Click **Add** to add a tag to the job. You can also select a tag configured in **Managing Job Tags**.
Job Description	Description of the job

Table 9-39 Attributes of the real-time processing single-task MRS Flink SQL job

Property	Description
Flink SQL properties	
Flink Job Name	Enter the Flink job name. The name is automatically generated in *Workspace-Job name* format. **NOTE** It can contain only letters, digits, hyphens (-), and underscores. A maximum of 64 characters are allowed, and Chinese characters are not allowed.

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Property	Description
MRS Cluster	Select an MRS cluster. **NOTE** Currently, jobs with a single Flink SQL node support MRS 3.2.0-LTS.1 and later versions.
Program Parameter	Set the job running parameters. This parameter is displayed only after an MRS cluster is selected. (Optional) Configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **CAUTION** You can query historical checkpoints and select a specified checkpoint to start a real-time Flink SQL job. To make a Flink checkpoint take effect, configure the following two parameters: **Figure 9-34** Configuring program parameters  • Checkpoint interval: **-yD: execution.checkpointing.interval=1000** • Number of reserved checkpoints: **-yD: state.checkpoints.num-retained=10** When querying the checkpoint list, enter parameter **-s** and click the parameter value text box. The parameter value will be automatically displayed. **NOTE** This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1. Click **Select Template** and select a parameter template. You can also select multiple templates. For details about how to create templates, see **Configuring a Template**. For details about the program parameters of MRS Spark jobs, see **Running a Flink Job** in the *MapReduce Service User Guide*.
Flink Job Parameter	Set the parameters for the Flink job. Variables required for executing the Flink job. These variables are specified by the functions in the Hive script. Multiple parameters are separated by spaces.

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Property	Description
MRS Resource Queue	Select a created MRS resource queue. Select a queue you configured in the queue permissions of DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.
Rerun Policy	• Rerun from the previous checkpoint • Rerun the job
Input Data Path	Set the input data path. You can select an HDFS or OBS path.
Output Data Path	Set the output data path. You can select an HDFS or OBS path.

Table 9-40 Advanced Settings

Parameter	Mandatory	Description
Job Status Polling Interval (s)	Yes	Set the interval at which the system checks whether the job is complete. The interval can range from 30s to 60s, or 120s, 180s, 240s, or 300s. During job execution, the system checks the job status at the configured interval.
Maximum Wait Time	Yes	Set the timeout interval for the job. If the job is not complete within the timeout interval and retry is enabled, the job will be executed again. **NOTE** If the job is in starting state and fails to start, it will fail upon timeout.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute the job if it fails • **Yes**: The job will be re-executed if it fails. Configure the following parameters: – Retry upon Timeout – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The job will not be re-executed if it fails. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

6. Enter one or more SQL statements in the SQL editor.

   NOTE

   - SQL statements are separated by semicolons (**;**). If semicolons are used in other places but not used to separate SQL statements, escape them with backslashes (\). The following is an example:
     ```
     select 1;
     select * from a where b="dsfa\;";  --example 1\;example 2.
     ```
   - The script cannot be larger than 16 MB.
   - The system date obtained by using an SQL statement is different from that obtained by using the database tool. The query result is stored in the database in the YYYY-MM-DD format, but the query result displayed on the page is in the converted format.
   - You can click **Check Syntax** to check the syntax of Flink SQL jobs. Above the editor, click **Check Syntax** to verify the semantics of SQL statements. After the check is complete, you can view the check result in the lower part of the page.
   - You can control display of the script execution history by setting **Script Execution History** in **Default Configuration** to **Myself** or **All users**.

   To facilitate script development, DataArts Factory provides the following capabilities:

   – The script editor supports the following shortcut keys, which improve the script development efficiency:

     ▪ **F8**: Run a script.

     ▪ **F9**: Stop running a script.

     ▪ **Ctrl** + **/**: Comment out or uncomment the line or code block where the cursor resides.

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- **Ctrl** + **Z**: Undo an action.
- **Ctrl** + **F**: Search for information.
- **Ctrl** + **Shift** + **R**: Replace
- **Ctrl** + **X**: Cut
- **Ctrl** + **S**: Save a script.
- **Alt** + mouse dragging: Select columns to edit a block.
- **Ctrl** + mouse click: Select multiple lines to edit or indent them together.
- **Ctrl** + → (or ←): Move the cursor rightwards (or leftwards) by word.
- **Ctrl** + **Home** or **Ctrl** + **End**: Navigate to the beginning or end of the current file.
- **Home** or **End**: Navigate to the beginning or end of the current line.
- **Ctrl** + **Shift** + **L**: Double-click all the same character strings and add cursors to them to implement batch modification.
- **Ctrl** + **D**: Delete a line.
- **Shift** + **Ctrl** + **U**: Unlock a script.
- **Ctrl** + **Alt** + **K**: Select the word where the cursor resides.
- **Ctrl** + **B**: Format
- **Ctrl** + **Shift** + **Z**: Redo
- **Ctrl** + **Enter**: Execute the selected line or content.
- **Ctrl** + **Alt** + **F**: Flag
- **Ctrl** + **Shift** + **K**: Search for the previous one.
- **Ctrl** + **K**: Search for the next one.
- **Ctrl** + **Backspace**: Delete the word to the left of the cursor.
- **Ctrl** + **Delete**: Delete the word to the right of the cursor.
- **Alt** + **Backspace**: Delete all content from the beginning of the line to the cursor.
- **Alt** + **Delete**: Delete all content from the cursor to the end of the line.
- **Alt** + **Shift**-**Left**: Select all content from the beginning of the line to the cursor.
- **Alt** + **Shift**-**Right**: Select all content from the cursor to the end of the line.

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- Script parameters

  Enter script parameters in the SQL statement and click **Parameter Setup** in the right pane of the editor and then click **Update from Script**. You can also directly configure parameters and constants for the job script.

  In the following script example, *str1* indicates the parameter name. It can contain only letters, digits, hyphens (-), underscores (_), greater-than signs (>), and less-than signs (<), and can contain a maximum of 16 characters. The parameter name must be unique.

  ```
  select ${str1} from data;
  ```

7. (Optional) In the upper part of the editor, click **Format** to format SQL statements.
8. Above the editor, click **Save** to save the job and submit it.

Configuring Job Parameters

Click **Parameters** on the right of the editor and set the parameters described in **Table 9-41**.

Table 9-41 Job parameters

Function	Description
Variables	
Add	Click **Add** and enter the variable parameter name and parameter value in the text boxes. • Parameter name Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **${***parameter name***}** in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modify	Change the parameter name or value in the corresponding text boxes.
Mask	If the parameter value is a key, click  to mask the value for security purposes.

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Function	Description
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Constant Parameter	
Add	Click **Add** and enter the constant parameter name and parameter value in the text boxes. • Parameter name Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modify	Modify the parameter name and parameter value in text boxes and save the modifications.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Workspace Environment Variables	
View the variables and constants that have been configured in the workspace.	

Click the **Parameter Preview** tab and configure the parameters listed in **Table 9-42**.

Table 9-42 Job parameter preview

Function	Description
Current Time	This parameter is displayed only when **Scheduling Type** is set to **Run once**. The default value is the current time.
Event Triggering Time	This parameter is displayed only when **Scheduling Type** is set to **Event-based**. The default value is the time when an event is triggered.

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Function	Description
Scheduling Period	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The default value is the scheduling period.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the configured job execution time.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the time when the periodic job scheduling starts.
Subsequent Instances	Number of job instances scheduled. • The default value is **1** when **Scheduling Type** is set to **Run once**. • The default value is **1** when **Scheduling Type** is set to **Event-based**. • When **Scheduling Type** is set to **Run periodically**: If the number of instances exceeds 10, a maximum of 10 instances can be displayed, and the system displays message "A maximum of 10 instances are supported."

NOTE

In **Parameter Preview**, if a job parameter has a syntax error, the system displays a message.

If a parameter depends on the data generated during job execution, such data cannot be simulated and displayed in **Parameter Preview**.

Saving a Job

After configuring the job, perform the following operations:

Step 1 Click **Start** to execute the job.

NOTE

A maximum of 1,000 records can be displayed in the execution result. The size of the execution result cannot exceed 3 MB. If the size exceeds 3 MB, the result will be truncated.

Step 2 After the job is executed, click  to save the job configuration.

After the job is saved, a version is automatically generated and displayed in **Versions**. The version can be rolled back. If you save a job multiple times within a minute, only one version is recorded. If the intermediate data is important, you can click **Save new version** to save and add a version.

----End

Templates

When developing a real-time processing, single-task Flink SQL job, you can use a public script template. For details about how to create a template, see

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Configuring a Template. For details about how to use a script template, see **Using Script Templates and Parameter Templates**.

9.4.6 Developing a Real-Time Processing Single-Task MRS Flink Jar Job

Prerequisites

A single-task real-time processing Flink Jar job has been created. For details, see **Creating a Job**.

Configuring the MRS Flink Jar Job

Table 9-43 MRS Flink Jar job parameters

Parameter	Mandatory	Description
Flink Job Name	Yes	Enter the Flink job name. The name is automatically generated in *Workspace-Job name* format. The job name can contain 1 to 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. Chinese characters are not allowed.
MRS Cluster	Yes	Select an MRS cluster. **NOTE** Currently, jobs with a single Flink Jar node support MRS 3.2.0-LTS.1 and later versions.

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Parameter	Mandatory	Description
Program Parameter	No	Set job running parameters. This parameter is displayed only after an MRS cluster is selected. (Optional) Configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **CAUTION** You can query historical checkpoints and select a specified checkpoint to start a Flink JAR job. To make a Flink checkpoint take effect, configure the following two parameters: • Checkpoint interval: **-yD: execution.checkpointing.interval=1000** • Number of reserved checkpoints: **-yD: state.checkpoints.num-retained=10** When querying the checkpoint list, enter parameter **-s** and click the parameter value text box. The parameter value will be automatically displayed. **NOTE** This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1. Click **Select Template** and select a parameter template. You can also select multiple templates. For details on how to create data connections, see **Configuring a Template**. For details about the program parameters of MRS Spark jobs, see **Running a Flink Job** in the *MapReduce Service User Guide*.
Job Execution Parameter	No	Set the parameters for the Flink job. Variables required for executing the Flink job. These variables are specified by the functions in the Hive script. Multiple parameters are separated by spaces.
MRS Resource Queue	No	Select a created MRS resource queue. Select a queue you configured in the queue permissions of DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.
Flink job resource package	Yes	Select a JAR package. Before selecting a JAR package, upload the JAR package to the OBS bucket, create a resource on the **Manage Resource** page, and add the JAR package to the resource management list. For details, see **Creating a Resource**.
Rerun Policy	No	• Rerun from the previous checkpoint • Rerun the job

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Parameter	Mandatory	Description
Input Data Path	No	Set the input data path. You can select an HDFS or OBS path.
Output Data Path	No	Set the output data path. You can select an HDFS or OBS path.

Table 9-44 Advanced settings

Parameter	Mandatory	Description
Job Status Polling Interval (s)	Yes	Set the interval at which the system checks whether the job is complete. The interval can range from 30s to 60s, or 120s, 180s, 240s, or 300s. During job execution, the system checks the job status at the configured interval.
Maximum Wait Time	Yes	Set the timeout interval for the job. If the job is not complete within the timeout interval and retry is enabled, the job will be executed again. **NOTE** If the job is in starting state and fails to start, it will fail upon timeout.
Retry upon Failure	No	Whether to re-execute a node if it fails to be executed. • **Yes**: The node task will be re-executed, and the following parameters must be configured: – Retry upon Timeout – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

After setting the parameters, click **Save** and submit the job.

Click **Start** to run the job.

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Configuring Basic Job Information

Table 9-45 Basic job information

Parameter	Description
Owner	An owner configured during job creation is automatically matched. This parameter value can be modified.
Executor	This parameter is available when **Scheduling Identities** is set to **Yes**. User that executes the job. When you enter an executor, the job is executed by the executor. If the executor is left unspecified, the job is executed by the user who submitted the job for startup. **NOTE** You can configure execution users only after you apply for the whitelist membership. To enable it, contact customer service or technical support.
Job Agency	This parameter is available when **Scheduling Identities** is set to **Yes**. After an agency is configured, the job interacts with other services as an agency during job execution.
Priority	Priority configured during job creation is automatically matched. This parameter value can be modified.
Execution Timeout	Timeout of the job instance. If this parameter is set to 0 or is not set, this parameter does not take effect. If the notification function is enabled for the job and the execution time of the job instance exceeds the preset value, the system sends a specified notification, and the job keeps running.
Exclude Waiting Time from Instance Timeout Duration	Whether to exclude the wait time from the instance execution timeout duration If you select this option, the time to wait before an instance starts running is excluded from the timeout duration. You can modify this setting in **Default Configuration > Exclude Waiting Time from Instance Timeout Duration**. If you do not select this option, the time to wait before an instance starts running is included in the timeout duration.
Custom Parameter	Set the name and value of the parameter.
Job Tag	Configure job tags to manage jobs by category. Click **Add** to add a tag to the job. You can also select a tag configured in **Managing Job Tags**.
Job Description	Description of the job

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Configuring Job Parameters

Click **Parameters** on the right of the editor and set the parameters described in **Table 9-46**.

Table 9-46 Job parameters

Function	Description
Variables	
Add	Click **Add** and enter the variable parameter name and parameter value in the text boxes. • Parameter name Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modify	Change the parameter name or value in the corresponding text boxes.
Mask	If the parameter value is a key, click  to mask the value for security purposes.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Constant Parameter	

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Function	Description
Add	Click **Add** and enter the constant parameter name and parameter value in the text boxes. • Parameter name Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modify	Modify the parameter name and parameter value in text boxes and save the modifications.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Workspace Environment Variables	
View the variables and constants that have been configured in the workspace.	

Click the **Parameter Preview** tab and configure the parameters listed in **Table 9-47**.

Table 9-47 Job parameter preview

Function	Description
Current Time	This parameter is displayed only when **Scheduling Type** is set to **Run once**. The default value is the current time.
Event Triggering Time	This parameter is displayed only when **Scheduling Type** is set to **Event-based**. The default value is the time when an event is triggered.
Scheduling Period	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The default value is the scheduling period.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the configured job execution time.

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Function	Description
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the time when the periodic job scheduling starts.
Subsequent Instances	Number of job instances scheduled. • The default value is **1** when **Scheduling Type** is set to **Run once**. • The default value is **1** when **Scheduling Type** is set to **Event-based**. • When **Scheduling Type** is set to **Run periodically**: If the number of instances exceeds 10, a maximum of 10 instances can be displayed, and the system displays message "A maximum of 10 instances are supported."

NOTE

In **Parameter Preview**, if a job parameter has a syntax error, the system displays a message.

If a parameter depends on the data generated during job execution, such data cannot be simulated and displayed in **Parameter Preview**.

9.4.7 Developing a Real-Time Processing Single-Task DLI Spark Job

Prerequisites

A single-task real-time processing DLI Spark job has been created. For details, see **Creating a Job**.

Configuring a DLI Spark job

Table 9-48 Properties

Parameter	Mandatory	Description
Job Name	Yes	Enter the DLI Spark job name. The job name can contain 1 to 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed.
DLI Queue	Yes	Select a DLI queue.

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Parameter	Mandatory	Description
Spark Version	No	• 2.3.2 • 2.4.5 • 3.1.1 • 3.3.1
Job Type	No	Type of the Spark image used by the job. The following options are available: • Basic • AI-enhanced • Image If you select this option, select an image, and its version is automatically displayed. You can create images by following the instructions in **Image Management**.
Job Running Resource	No	• 8 vCPUs, 32 GB memory • 16 vCPUs, 64 GB memory • 32 vCPUs, 128 GB memory
Major Job Class	No	Java/Scala main class of the job
Spark program resource package	Yes	Resource package on which the Spark program depends
Resource Type	Yes	• OBS path • DLI program package **DLI program package**: The resource package file will not be uploaded to the DLI resource management system before the job is executed. **OBS path**: The resource package file will not be uploaded to DLI resource management system before the job is executed. The OBS path where the file is located is part of the message body for starting the job. This type is recommended.

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Parameter	Mandatory	Description
Group	No	This parameter is required when **Resource Type** is set to **DLI program package**. A Spark program resource package is uploaded to a specified group. The main JAR package and dependency package are uploaded to the same group. • **Use Existing**: Select an existing group. • **Create New**: Create a group. The group name can contain only letters, digits, periods (.), hyphens (-), and underscores (_). • **Do not use**
Major-Class Entry Parameters	No	Press **Enter** to separate parameters.
Spark program resource package	No	Enter parameters in key=value format and separate parameters by pressing **Enter**.
Module Name	No	Select one or more module names.
Metadata Access	No	Whether metadata can be accessed To access the OBS table created by the DLI SQL job in the DLI Spark job, enable metadata access.

Table 9-49 Advanced settings

Parameter	Mandatory	Description
Job Status Polling Interval (s)	Yes	Set the interval at which the system checks whether the job is complete. The interval can range from 30s to 60s, or 120s, 180s, 240s, or 300s. During job execution, the system checks the job status at the configured interval.
Maximum Wait Time	Yes	Set the timeout interval for the job. If the job is not complete within the timeout interval and retry is enabled, the job will be executed again. **NOTE** If the job is in starting state and fails to start, it will fail upon timeout.

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Parameter	Mandatory	Description
Retry upon Failure	No	Whether to re-execute a node if it fails to be executed. • **Yes**: The node task will be re-executed, and the following parameters must be configured: – Retry upon Timeout – Maximum Retries – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

After setting the parameters, click **Save** and submit the job.

Click **Start** to run the job.

Configuring Basic Job Information

Table 9-50 Basic job information

Parameter	Description
Owner	An owner configured during job creation is automatically matched. This parameter value can be modified.
Executor	This parameter is available when **Scheduling Identities** is set to **Yes**. User that executes the job. When you enter an executor, the job is executed by the executor. If the executor is left unspecified, the job is executed by the user who submitted the job for startup. **NOTE** You can configure execution users only after you apply for the whitelist membership. To enable it, contact customer service or technical support.
Job Agency	This parameter is available when **Scheduling Identities** is set to **Yes**. After an agency is configured, the job interacts with other services as an agency during job execution.

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Parameter	Description
Priority	Priority configured during job creation is automatically matched. This parameter value can be modified.
Execution Timeout	Timeout of the job instance. If this parameter is set to 0 or is not set, this parameter does not take effect. If the notification function is enabled for the job and the execution time of the job instance exceeds the preset value, the system sends a specified notification, and the job keeps running.
Exclude Waiting Time from Instance Timeout Duration	Whether to exclude the wait time from the instance execution timeout duration If you select this option, the time to wait before an instance starts running is excluded from the timeout duration. You can modify this setting in **Default Configuration > Exclude Waiting Time from Instance Timeout Duration**. If you do not select this option, the time to wait before an instance starts running is included in the timeout duration.
Custom Parameter	Set the name and value of the parameter.
Job Tag	Configure job tags to manage jobs by category. Click **Add** to add a tag to the job. You can also select a tag configured in **Managing Job Tags**.
Job Description	Description of the job

Configuring job parameters

Click **Parameter Setup** on the right of the editor and set the parameters described in **Table 9-51**.

Table 9-51 Job parameter setup

Module	Description
Variables	

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Module	Description
Add	Click **Add** and enter the variable parameter name and parameter value in the text boxes. • Parameter Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter Value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*Parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.
Modifying a Job	Change the parameter name or value in the corresponding text boxes.
Mask	If the parameter value is a key, click  to mask the value for security purposes.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Constant Parameter	
Add	Click **Add** and enter the constant parameter name and parameter value in the text boxes. • Parameter Only letters, numbers, periods (.), hyphens (-), and underscores (_) are allowed. • Parameter Value – The string type of parameter value is a character string, for example, **str1**. – The numeric type of parameter value is a number or operation expression. After the parameter is configured, it is referenced in the format of **$**{*Parameter name*} in the job.
Edit Parameter Expression	Click  next to the parameter value text box. In the displayed dialog box, edit the parameter expression. For more expressions, see **Expression Overview**.

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Module	Description
Modifying a Job	Modify the parameter name and parameter value in text boxes and save the modifications.
Delete	Click next to the parameter name and value text boxes to delete the job parameter.
Workspace Environment Variables	
View the variables and constants that have been configured in the workspace.	

Click the **Parameter Preview** tab and configure the parameters listed in **Table 9-52**.

Table 9-52 Job parameter preview

Module	Description
Current Time	This parameter is displayed only when **Scheduling Type** is set to **Run once**. The default value is the current time.
Event Triggering Time	This parameter is displayed only when **Scheduling Type** is set to **Event-based**. The default value is the time when an event is triggered.
Scheduling Period	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The default value is the scheduling period.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the configured job execution time.
Start Time	This parameter is displayed only when **Scheduling Type** is set to **Run periodically**. The value is the time when the periodic job scheduling starts.
Subsequent Instances	Number of job instances scheduled. • The default value is **1** when **Scheduling Type** is set to **Run once**. • The default value is **1** when **Scheduling Type** is set to **Event-based**. • When **Scheduling Type** is set to **Run periodically**: If the number of instances exceeds 10, a maximum of 10 instances can be displayed, and the system displays message "A maximum of 10 instances are supported."

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NOTE

In **Parameter Preview**, if a job parameter has a syntax error, the system displays a message.

If a parameter depends on the data generated during job execution, such data cannot be simulated and displayed in **Parameter Preview**.

9.4.8 Setting Up Scheduling for a Job

This section describes how to set up scheduling for an orchestrated job.

- If the processing mode of a job is batch processing, configure scheduling types for jobs. Three scheduling types are supported: run once, run periodically, and event-based. For details, see **Setting Up Scheduling for a Job Using the Batch Processing Mode**.
- If the processing mode of a job is real-time processing, configure scheduling types for nodes. Three scheduling types are supported: run once, run periodically, and event-based. For details, see **Setting Up Scheduling for Nodes of a Job Using the Real-Time Processing Mode**.

Prerequisites

- You have performed the operations in **Developing a Pipeline Job** or **Developing a Batch Processing Single-Task SQL Job**.
- You have locked the job. Otherwise, you must click **Lock** so that you can develop the job. A job you create or import is locked by you by default. For details, see the **lock function**.

Constraints

- Set an appropriate value for this parameter. A maximum of five instances can be concurrently executed in a job. If the start time of a job instance is later than the configured job execution time, the job instances in the subsequent batch will be queued. As a result, the job execution costs a longer time than expected. For CDM and ETL jobs, the recurrence must be at least 5 minutes. In addition, the recurrence should be adjusted based on the data volume of the job table and the update frequency of the source table.
- If you use DataArts Studio DataArts Factory to schedule a CDM migration job and configure a scheduled task for the job in DataArts Migration, both configurations take effect. To ensure unified service logic and avoid scheduling conflicts, enable job scheduling in DataArts Factory and do not configure a scheduled task for the job in DataArts Migration.

Setting Up Scheduling for a Job Using the Batch Processing Mode

Three scheduling types are available: **Run once**, **Run periodically**, and **Event-based**. The procedure is as follows:

Click the **Scheduling Setup** tab on the right of the canvas to expand the configuration page and configure the scheduling parameters listed in **Table 9-53**.

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Table 9-53 Job scheduling parameters

Parameter	Description
Scheduling Type	Scheduling type of the job. Available options include: • **Run once**: You need to manually execute the job. • **Run periodically**: The job is executed periodically. For details about the parameters, see **Table 9-54**. – **Manual confirmation**: If this option is selected, the job instance can be executed only after manual confirmation. If manual confirmation is not performed, the job instance cannot be executed. **NOTE** **In job instance execution scenarios**, job instances are in waiting confirmation state on the **Monitor Instance** page. When you click **Execute**, the job instances are in waiting execution state. When you **rerun instances**, they are in waiting confirmation state. When you click **Execute**, the instances are in waiting execution state. In **PatchData scenarios**, PatchData job instances are in waiting confirmation state on the **Monitor PatchData** page. When you click **Execute** on the **Monitor Instance** page, PatchData job instances are in waiting execution state. **In batch job monitoring scenarios**, job instances are in waiting confirmation state on the **Batch Jobs** page. When you click **Execute**, the job instances are in waiting execution state. • **Event-based**: The job will be executed when certain external conditions are met. For details about the parameters, see **Table 9-55**.
Enable Dry Run	If you select this option, the job will not be executed, and a success message will be returned.

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Parameter	Description
Task Groups	Select a configured task group. For details, see **Configuring Task Groups**. **Do not select** is selected by default. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning. Example 1: The maximum number of concurrent tasks in the task group is set to 2, and a job has five nodes. When the job runs, only two nodes are running and the other nodes are waiting. Example 2: The maximum number of concurrent tasks in the task group is set to 2, and the number of concurrent periods for a PatchData job is set to 5. When the PatchData job runs, two PatchData job instances are running, and the other job instances are waiting to run. The waiting instances can be delivered normally after a period of time. Example 3: If the same task group is configured for multiple jobs, and the maximum number of concurrent tasks in the task group is set to 2, only two jobs are running and the other jobs are waiting. If the same task group is configured for multiple job nodes, the maximum number of concurrent tasks in the task group is set to 2, and there are five job nodes in total, two nodes are running and the other nodes are waiting. **NOTE** For a pipeline job, you can configure a task group for each node or for the job. A task group configured for a node is prior to one configured for the job.

Table 9-54 Parameters for jobs that are executed periodically

Parameter	Description
From and to	The period during which a scheduling task takes effect. You can set it to today or tomorrow by clicking the time box and then **Today** or **Tomorrow**.

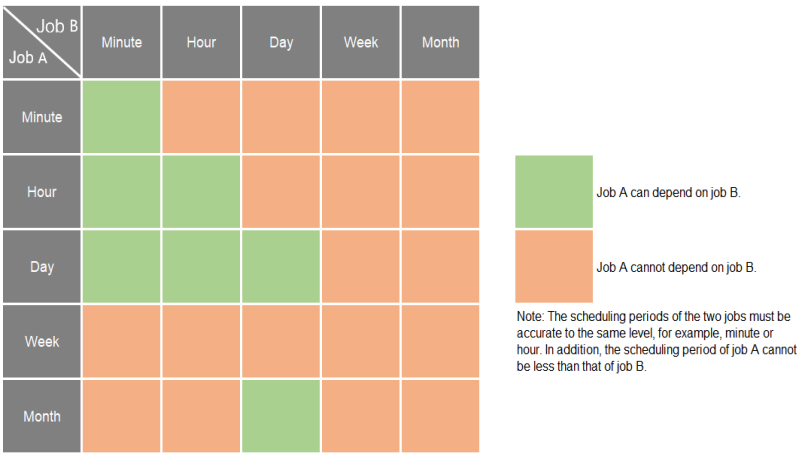
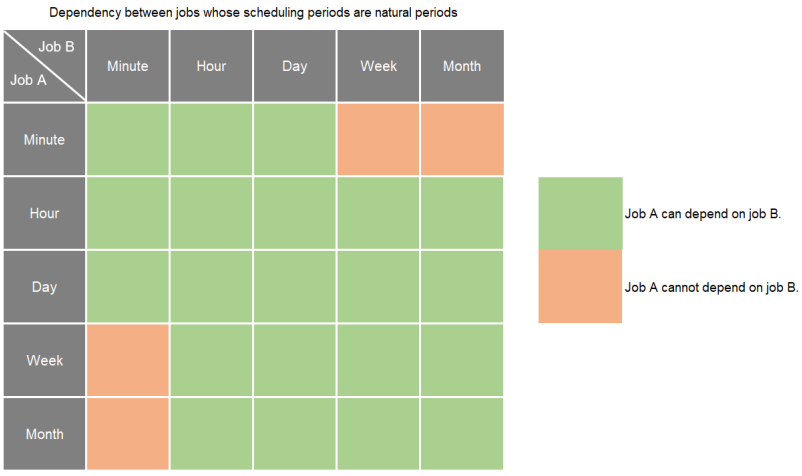
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Parameter	Description
Recurrence	The frequency at which the scheduling task is executed, which can be: Set an appropriate value for this parameter. A maximum of five instances can be concurrently executed in a job. If the start time of a job instance is later than the configured job execution time, the job instances in the subsequent batch will be queued. As a result, the job execution costs a longer time than expected. For CDM and ETL jobs, the recurrence must be at least 5 minutes. In addition, the recurrence should be adjusted based on the data volume of the job table and the update frequency of the source table. You can modify the scheduling period of a running job. • **Minutes**: The job starts at the top of the hour. The interval is accurate to minute. After the scheduling ends at the end time of the current day, the scheduling automatically starts on the next day. **NOTE** If you select **Minutes** for **Scheduling Frequency**, the job cannot be scheduled based on the configured interval, that is, the job cannot be executed at a fixed frequency across hours. For example: • A scheduling policy is configured at 14:20 on June 19, 2024. According to the policy, the scheduling starts at 00:30 and ends at 23:59, at an interval of 30 minutes. The job is actually scheduled at 14:30:00, 15:30:00, 16:30:00, 17:30:00, 18:30:00, and more on June 19, 2024. • A scheduling policy is configured at 14:20 on June 19, 2024. According to the policy, the scheduling starts at 00:00 and ends at 23:59, at an interval of 50 minutes. The job is actually scheduled at 14:50:00, 15:00:00, 15:50:00, 16:00:00, 16:50:00, 17:00:00, 17:50:00, and more on June 19, 2024. • **Hours**: You can select **Interval Hour**, indicating that the job starts at a specified time point and that the interval is accurate to hour. After the scheduling ends at the end time of the current day, the scheduling automatically starts on the next day. You can also select **Discrete Hour** and specify any hour in a day to schedule the job. • **Every day**: The job starts at a specified time on a day. The scheduling period is one day. • **Every week**: You can select a specified time point of one or more days in a week. • **Every month**: You can select a specified time point of one or more days in a month. In addition, you can select **Last day of each month**. **NOTE** DataArts Studio does not support concurrent running of PatchData instances and periodic job instances of underlying services (such as CDM and DLI). To prevent PatchData instances from affecting periodic job instances and avoid exceptions, ensure that they do not run at the same time.

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Parameter	Description
Scheduling Calendar	Select a scheduling calendar. The default value is **Do not use**. For details about how to configure a scheduling calendar, see **Configuring a Scheduling Calendar**. • The job is scheduled on the custom working days in the calendar. On non-working days, a dry run occurs. Examples: periodic job scheduling and PatchData tasks. • Changes to the working days of the scheduling calendar do not take effect for the job instances that are being executed, but can take effect immediately for those that have not been generated.
OBS Listening	If you enable this function, the system automatically listens to the OBS path for new job files. If you disable this function, the system no longer listens to the OBS path. Configure the following parameters: • **OBS File**: An EL expression is supported. • **Listening Interval**: Set a value ranging from 1 to 60, in minutes. • **Timeout**: Set a value ranging from 1 to 1440, in minutes.

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Parameter	Description
Dependency job	You can select jobs that are executed periodically in different workspaces as dependency jobs. The current job starts only after the dependency jobs are executed. You can click **Parse Dependency** to automatically identify job dependencies. **NOTE** For details about job dependency rules across workspaces, see **Job Dependency Rule**. Currently, DataArts Factory supports two types of job dependency policies, that is, dependency between jobs whose scheduling periods are traditional periods and dependency between jobs whose scheduling periods are natural periods. You can select either of them. The scheduling periods for new DataArts Studio instances are natural periods. **Figure 9-35** Dependency between jobs whose scheduling periods are traditional periods  **Figure 9-36** Dependency between jobs whose scheduling periods are natural periods 

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Parameter	Description
	For details about the conditions for setting dependency jobs and how jobs run after dependency jobs are set, see **Dependency Policies for Periodic Scheduling**.
Policy for Current job If Dependency job Fails	Policy for processing the current job when one or more instances of its dependency job fail to be executed in its period. • Pending Waits to execute the current job, which affects the execution of subsequent jobs. You can force the dependency job to be executed successfully. • Continue Continues to execute the current job. • Cancel Cancels the current job. Its status becomes **Canceled**. For example, the recurrence of the current job is 1 hour and that of its dependency jobs is 5 minutes. • If the value of this parameter is set to **Cancel**, the current job will be canceled as long as one of the 12 instances of its dependency job fails. • If the value of this parameter is set to **Continue**, the current job will be executed after the 12 instances of its dependency job are executed. **NOTE** You can set this parameter for multiple jobs in a batch. For details, see **Configuring a Default Item**. This parameter takes effect only for new jobs.
Run After Dependency job Ends	If a job depends on other jobs, the job is executed only after its dependency job instances are executed within a specified time range. If the dependency job instances are not successfully executed, the current job is in waiting state. If you select this option, the system checks whether all job instances in the previous cycle have been executed before executing the current job.
Dependency Job	When configuring job dependencies, you can filter dependent jobs based on whether they are being scheduled. This prevents downstream job failures caused by upstream dependent jobs not being scheduled. • All jobs • Running jobs
Dependency Cycle	• Same Cycle • Previous N Cycle. N range is from 1 to 30.

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Parameter	Description
Cross-Cycle Dependency	Dependency between job instances • **Independent on the previous schedule cycle**: You can set **Concurrency** to set the number of job instances that are concurrently executed. If you set it to **1**, a batch is executed only after the previous batch is executed (the execution is successful, cancelled, or failed). • **Self-dependent**: The job can be rescheduled only after it is executed in the current schedule cycle. Before that, the job is in **Waiting** state. • **Skip waiting instances and run the latest instance**: Skipped job instances will be canceled and not executed. If the execution of a job instance takes a long time, multiple subsequent job instances may be skipped. However, if these job instances need to be executed, skipping them may cause service logic errors. For example, if partitioned tables are required but redundant job instances are skipped, some partitioned tables may go missing. Exercise caution when selecting this option. **NOTE** • **Skip waiting instances and run the latest instance** is only supported for jobs scheduled by minute or hour. • If the number of concurrent jobs is small and no instance has been generated, blocked instances will not be skipped. • If a job with a shorter period depends on a job with a longer period, some instances may not be skipped and still be executed.
Clear Waiting Instances	• No • Yes If this parameter is not set, expired waiting job instances will be cleared based on the workspace-level configuration by default. You can set whether to clear waiting job instances based on the site requirements.
Enable Dry Run	If you select this option, the job will not be executed, and a success message will be returned.
Task Groups	Select a configured task group. For details, see **Configuring Task Groups**. **Do not select** is selected by default. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning. **NOTE** For a pipeline job, you can configure a task group for each node or for the job. A task group configured for a node is prior to one configured for the job.

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Table 9-55 Parameters for event-based jobs

Parameter	Description
Event Type	Type of the event that triggers job running • **KAFKA**
Enable Dry Run	If you select this option, the job will not be executed, and a success message will be returned.
Task Groups	Select a configured task group. For details, see **Configuring Task Groups**. **Do not select** is selected by default. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning. **NOTE** For a pipeline job, you can configure a task group for each node or for the job. A task group configured for a node is prior to one configured for the job.
Parameters for KAFKA event-triggered jobs	
Connection Name	Before selecting a data connection, ensure that a Kafka data connection has been created in the **Management Center**.
Topic	Topic of the message to be sent to the Kafka.
Concurrent Events	Number of jobs that can be concurrently processed. The maximum number of concurrent events is 128.
Event Detection Interval	Interval at which the system detects the stream for new messages. The unit of the interval can be **Seconds** or **Minutes**.
Access Policy	Select the location where data is to be accessed: • **Access from the last location**: For the first access, data is accessed from the most recently recorded location. For the subsequent access, data is accessed from the previously recoded location. • **Access from a new location**: Data is accessed from the most recently recorded location each time.
Failure Policy	Select a policy to be performed after scheduling fails. • Suspend • Ignore the failure and proceed with the next event
Enable Dry Run	If you select this option, the job will not be executed, and a success message will be returned.

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Parameter	Description
Task Groups	Select a configured task group. For details, see **Configuring Task Groups**. **Do not select** is selected by default. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning. **NOTE** For a pipeline job, you can configure a task group for each node or for the job. A task group configured for a node is prior to one configured for the job.
Enable Dry Run	If you select this option, the job will not be executed, and a success message will be returned.
Task Groups	Select a configured task group. For details, see **Configuring Task Groups**. **Do not select** is selected by default. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning. **NOTE** For a pipeline job, you can configure a task group for each node or for the job. A task group configured for a node is prior to one configured for the job.

Setting Up Scheduling for Nodes of a Job Using the Real-Time Processing Mode

Three scheduling types are available: **Run once**, **Run periodically**, and **Event-based**. The procedure is as follows:

Select a node. On the node development page, click the **Scheduling Parameter Setup** tab. On the displayed page, configure the parameters listed in **Table 9-56**.

Table 9-56 Parameters for setting up node scheduling

Parameter	Description
Scheduling Type	Scheduling type of the job. Available options include: • **Run once**: You need to manually run the job. • **Run periodically**: The job runs automatically and periodically. • **Event-based**: The job runs when certain external conditions are met.
Parameters displayed when Scheduling Type is Run periodically	

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Parameter	Description
From and to	The period during which a scheduling task takes effect.
Recurrence	The frequency at which the scheduling task is executed, which can be: • Minutes • Hours • Every day • Every week • Every month For CDM and ETL jobs, the recurrence must be at least 5 minutes. In addition, the recurrence should be adjusted based on the data volume of the job table and the update frequency of the source table. You can modify the scheduling period of a running job.
Cross-Cycle Dependency	Dependency between job instances • **Independent on the previous schedule cycle** Set **Concurrency**. Number of job instances that are concurrently executed. If you set it to **1**, a batch is executed only after the previous batch is executed (the execution is successful, cancelled, or failed). • **Self-dependent**: The job can be rescheduled only after it is executed in the current schedule cycle. Before that, the job is in Waiting state.
Parameters displayed when Scheduling Type is Event-based	
Event Type	Type of the event that triggers job running
Connection Name	Before selecting a data connection, ensure that a Kafka data connection has been created in the **Management Center**. This parameter is mandatory only when **Event Type** is set to **KAFKA**.
Topic	Topic of the message to be sent to the Kafka. This parameter is mandatory only when **Event Type** is set to **KAFKA**.

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Parameter	Description
Consumer Group	A scalable and fault-tolerant group of consumers in Kafka. Consumers in a group share the same ID. They collaborate with each other to consume all partitions of subscribed topics. A partition in a topic can be consumed by only one consumer. **NOTE** 1. A consumer group can contain multiple consumers. 2. The group ID is a string that uniquely identifies a consumer group in a Kafka cluster. 3. Each partition of each topic subscribed to by a consumer group can be consumed by only one consumer. Consumer groups do not affect each other. If you select **KAFKA** for **Event Type**, the consumer group ID is automatically displayed. You can also manually change the consumer group ID.
Concurrent Events	Number of jobs that can be concurrently processed. The maximum number of concurrent events is 10.
Event Detection Interval	Interval at which the system detects the stream for new messages. The unit of the interval can be **Seconds** or **Minutes**.
Access Policy	• Access from the last location • Access from a new location This parameter is mandatory only when **Event Type** is set to **KAFKA**.
Failure Policy	Select a policy to be performed after scheduling fails. • Suspend • Ignore failure and proceed

9.4.9 Submitting a Version

Submitting a version depends on the version management function of DataArts Factory.

Version management traces script and job changes, and supports version comparison and rollback. The system retains 100 latest version records. In addition, version management can be used to distinguish the development state and production state.

- Development state: Scripts or jobs have not been submitted and are used for debugging. In the development state, you can edit, save, and run scripts or jobs without affecting those being scheduled. In addition, when a job is being associated with a script or job dependency is being configured, the associated script or job will read the configuration in the development state.
- Production state: Script or jobs have been submitted and are used for formal scheduling. In formal scheduling, the latest submitted versions of scripts or

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jobs will be used in scenarios such as script invocation, instance rerunning, and job dependency and patch data configuration.

Prerequisites

A job has been developed.

Submitting a Job Version

If you submit a version, the latest job in the development state will be saved and submitted and overwrite the previous job version.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

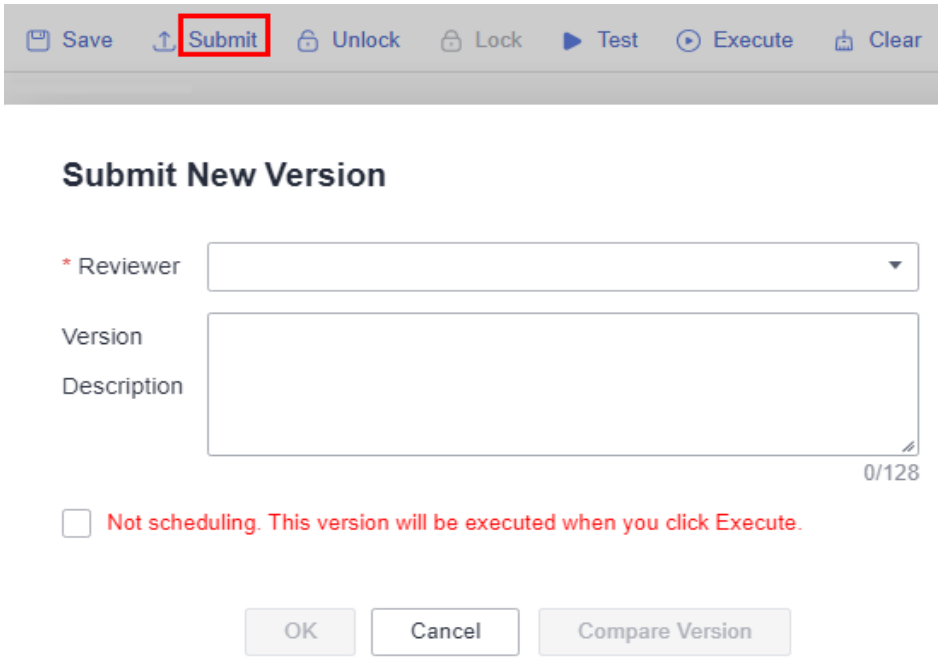
Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.

Step 4 In the job directory, double-click the developed job to access the job development page.

Step 5 Above the job canvas or editor, click **Submit** to submit a version. In the displayed dialog box, select the reviewer, enter the change description (a maximum of 128 characters allowed), and select the check box below. If you do not select this option, you cannot click **OK**. When submitting a version, you can click **Compare Version** to view the differences between the current version and the last version.

Figure 9-37 Submitting a version



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NOTE

- If review is enabled on the **Review Center** page, your submitted version will be reviewed by the reviewer on the **Pending Review** tab page on the **Review Center** page. The version is submitted successfully only after it is approved by the reviewer. For details, see **Approval Settings**. If review is disabled, the version can be directly submitted.

  To revoke a submitted request, go to the **Review Center** page and click the **My Applications** tab. Then you can submit an application again.
- If review is enabled, the following operations need to be reviewed: submitting jobs, deleting jobs, and importing submitted jobs.
- Before disabling the review function, ensure that there are no requests pending review in the current workspace.
- The enterprise mode does not support the review function.

----End

Version Rollback

After submitting the version, you can view it in the version list. (Currently, a maximum of 100 latest versions are saved.) Click **Roll Back** to roll back to any submitted version.

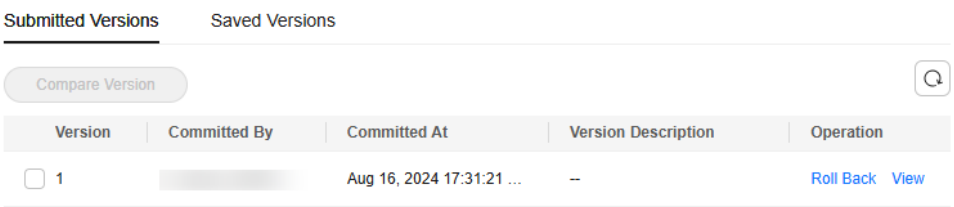
The rollback involves the following contents:

- Job definition (such as operator properties and connection lines)
- Basic job information, job scheduling configuration, job parameters, and lineage

The procedure is as follows:

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, double-click a job to access the job development page.
5. On the right of the page, click the **Versions** tab and view the version submission records. Select the version to be rolled back and click **Roll Back**.

Figure 9-38 Rolling back the version



Viewing Version Details

You can view the submitted version information in the version list.

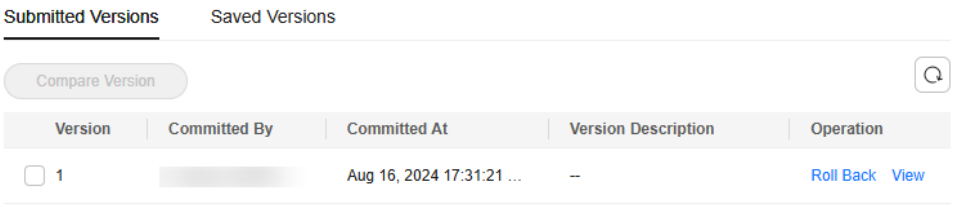
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The procedure is as follows:

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, double-click a job to access the job development page.
5. On the right of the page, click the **Versions** tab and view the version submission records. Select the desired version and click **View** to view its details.

   A new page is displayed, showing the job definition of the version. You cannot modify any job attributes in this window.

Figure 9-39 Viewing version details

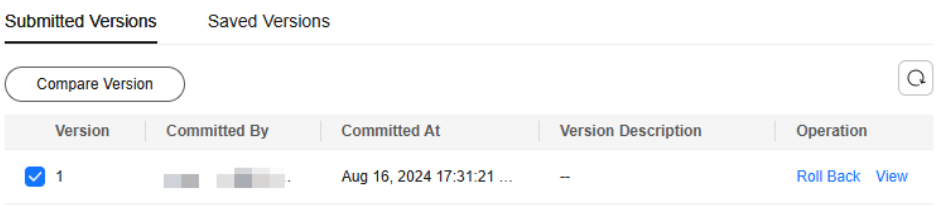


Version Comparison

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, double-click a job to access the job development page.
5. On the right of the page, click the **Versions** tab and view the version submission records. Select the versions to be compared and click **Compare Version**.

   If you select only one version, the selected version is compared with the JSON of the development-state job. If you select two versions, the JSON of the two versions is compared.

Figure 9-40 Comparing versions



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9.4.10 Releasing a Job Task

In enterprise mode, when a developer submits a job version, the system generates a job release task. After the developer confirms releasing a package and the admin, deployer, a user with the DAYU Administrator or Tenant Administrator permission approves the package release request, the modified job is synchronized to the production environment.

NOTICE

- When the admin selects **Submitted** for **Job Status** during job import, a release task is generated.
- When the admin imports jobs in released state, no release task is generated.
- When a developer creates a real-time single-task job, a release task is generated for the job, and no release task is generated for the subjobs of the job.

Prerequisites

You have submitted a version. For details, see **Submitting a Version**.

Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the left navigation pane, choose **Data Development** > **Task Release**.

Step 4 On the **Tasks** page, the tasks generated for version submission are displayed. You can click **View** in the **Operation** column to view the modifications of a script compared with its previous version. After confirming that the modifications are correct, click **Release** to release the task.

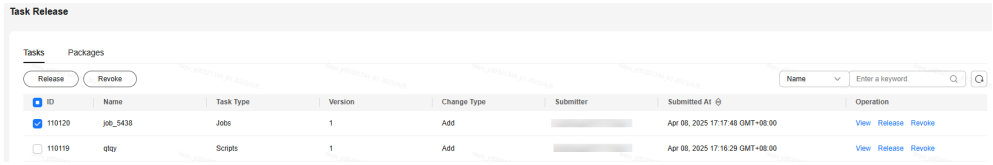
You can filter release tasks by name or submitter. and perform fuzzy search using a task name.

NOTE

- If you have only the developer permission, the script will be synchronized to the production environment only when the task is approved by the admin or deployer.
- After clicking **Release**, set the reviewer. The reviewer must be a workspace admin, deployer, or a user with the DAYU Administrator or Tenant Administrator permission. Set at least one reviewer and do not set yourself as the reviewer. Click **Reviewer Management** to go to the **WorkSpaces** page. Click **Edit** to configure reviewers.
- You can release a maximum of 100 tasks at a time. The tasks are released asynchronously. You can view the task release process.
- After you click **Release**, the following message is displayed: "Execute jobs in the package immediately after it is released."
- You can revoke tasks not to be released as a developer, deployer, or admin.

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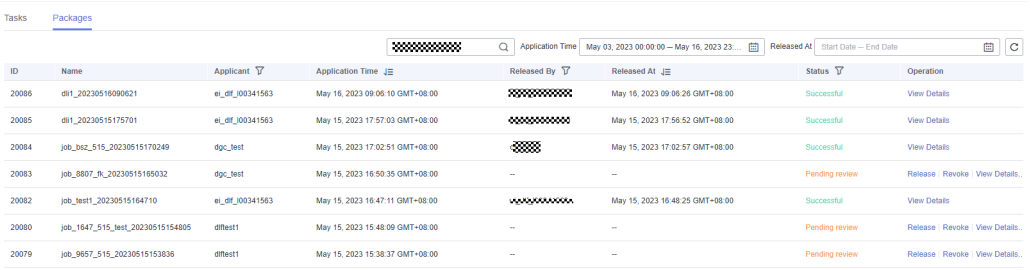
Figure 9-41 Clicking Release



Step 5 After the task is released, you can view the release status of the task on the **Packages** tab page. After approved, the task is released successfully.

You can filter release tasks by **Applicant**, **Application Time**, **Release At**, or **Released By**, and perform fuzzy search using a package name.

Figure 9-42 Viewing the task status

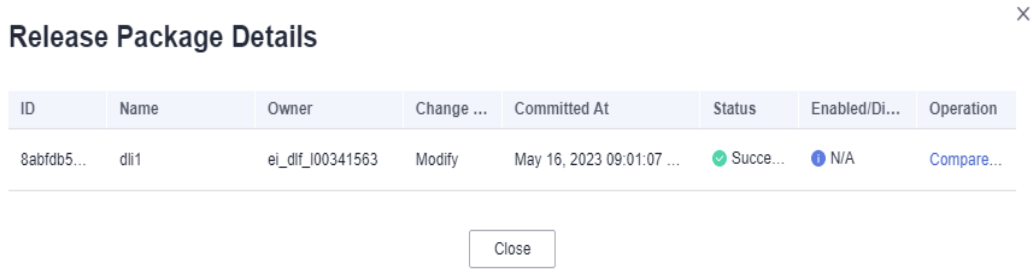


NOTE

You can revoke tasks not to be released as a developer, deployer, or admin.

After the task is released, you can click **View Details** in the **Operation** column to view the release status and startup status of the task. You can also click **Compare Version** in the **Operation** column to view the differences between different versions of release packages.

Figure 9-43 Viewing release package details



----End

9.4.11 (Optional) Managing Jobs

9.4.11.1 Copying a Job

This section describes how to copy a job.

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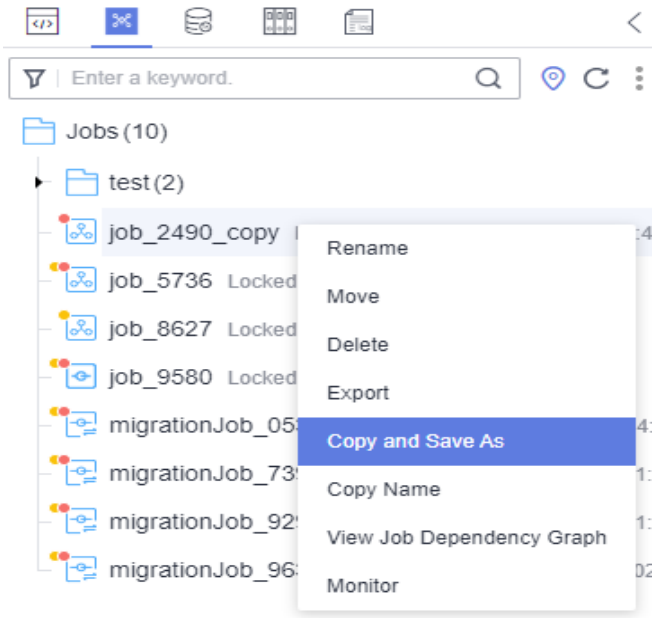
Prerequisites

A job has been developed. For details about how to develop a job, see **Developing a Pipeline Job**.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, select the job to be copied, right-click the job name, and choose **Copy Save As**.

Figure 9-44 Copying a job



5. In the displayed dialog box, configure related parameters. **Table 9-57** describes the parameters.

Table 9-57 Job and directory parameters

Parameter	Description
Job Name	Name of the job. Must consist of 1 to 128 characters and contain only letters, digits, hyphens (-), underscores (_), and periods (.).
Select Directory	Parent directory of the job directory. The parent directory is the root directory by default.

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6. Click **OK**.

9.4.11.2 Copying the Job Name and Renaming a Job

You can copy the name of a job and rename a job.

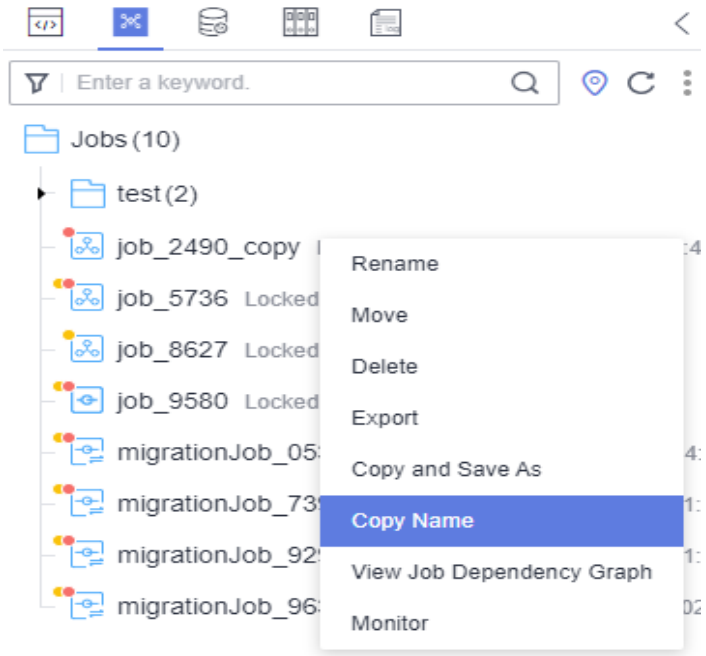
Prerequisites

A job has been developed. For details about how to develop a job, see **Developing a Pipeline Job**.

Copying the Job Name

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. Locate the target job in the job directory, right-click the job name, and select **Copy Name** to copy the job name to the clipboard.

Figure 9-45 Copying the job name



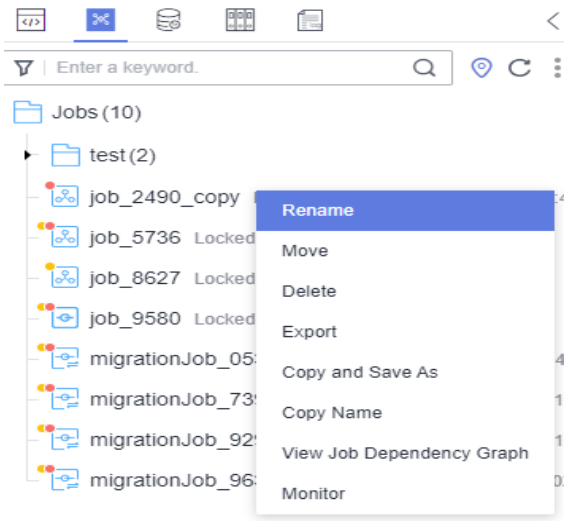
Renaming a job

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

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3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, select the job to be renamed. Right-click the job name and choose **Rename** from the shortcut menu.

Figure 9-46 Renaming a job



5. In the displayed **Modify Job Name** dialog box, change the job name.

Figure 9-47 Renaming a job

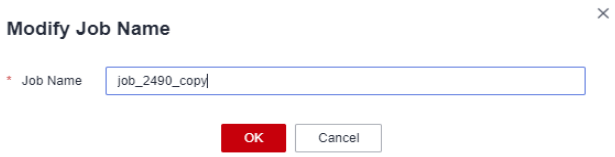


Table 9-58 Job renaming parameters

Parameter	Description
Job Name	Name of the job. Must consist of 1 to 128 characters and contain only letters, digits, hyphens (-), underscores (_), and periods (.).

6. Click **OK**.

9.4.11.3 Moving a Job or Job Directory

You can move a job file from one directory to another or move a job directory to another directory.

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Prerequisites

A job has been developed. For details about how to develop a job, see **Developing a Pipeline Job**.

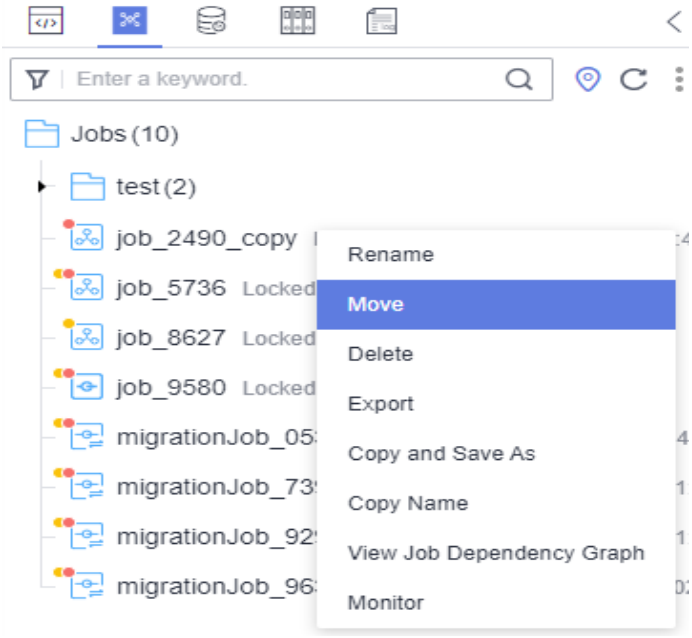
Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. Move a job or job directory.

   Method 1: right-click

   a. In the job directory, right-click a job or job folder and select **Move**.

   Figure 9-48 Selecting a job to be moved

   b. In the displayed dialog box, configure the target directory.

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Figure 9-49 Moving a job

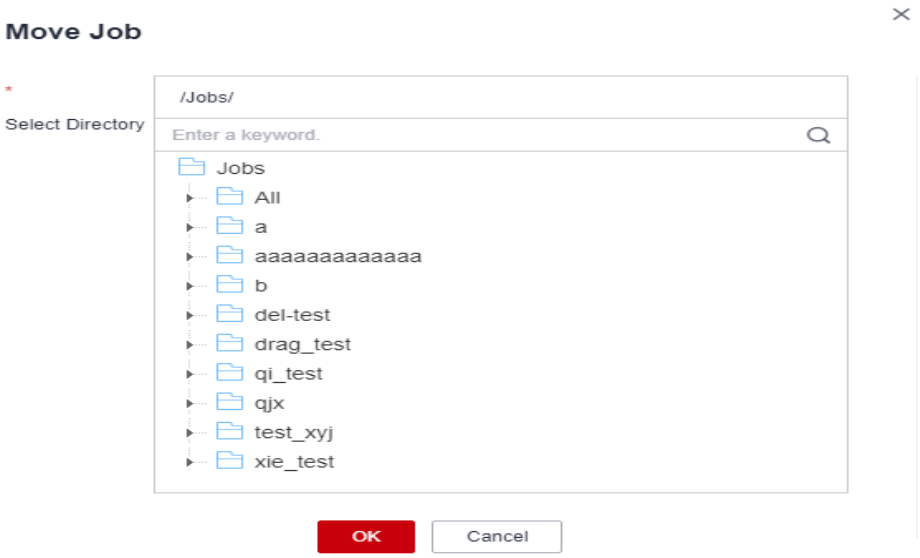


Figure 9-50 Move a directory

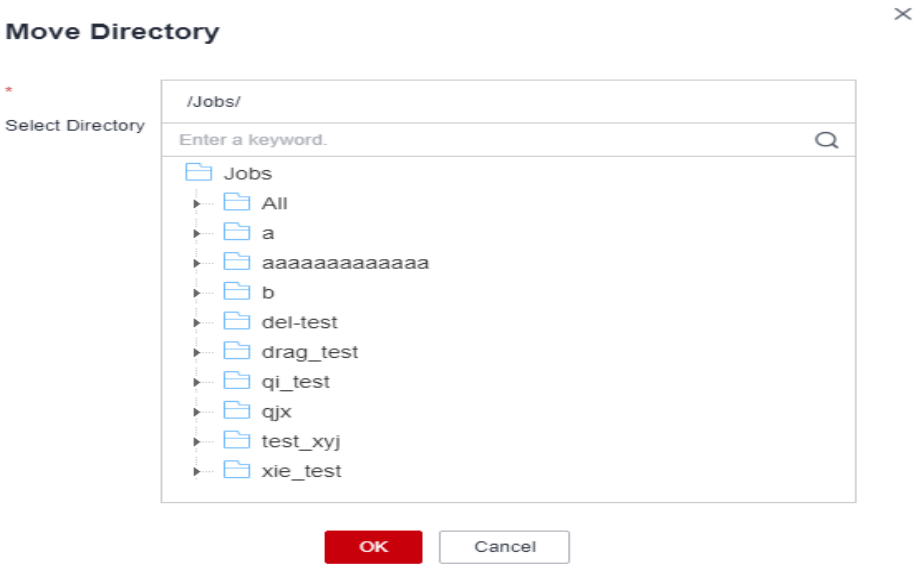


Table 9-59 Parameters for moving a job or job directory

Parameter	Description
Select Directory	Directory to which the job or job directory is to be moved. The parent directory is the **root** directory by default.

c. Click **OK**.

Method 2: drag-and-drop

Select a job or job folder and drag and drop it to the target folder.

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Method 3: batch selection and move

Select multiple jobs and move them to the target folder.

9.4.11.4 Exporting and Importing Jobs

- Exporting jobs is to export the latest saved content in the development state.
- After a job is imported, the content in the development state is overwritten and a new version is automatically submitted.

NOTE

When exporting or importing jobs across time zones in DataArts Factory, you need to change the value of **expressionTimeZone** to the target time zone.

Exporting Jobs

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

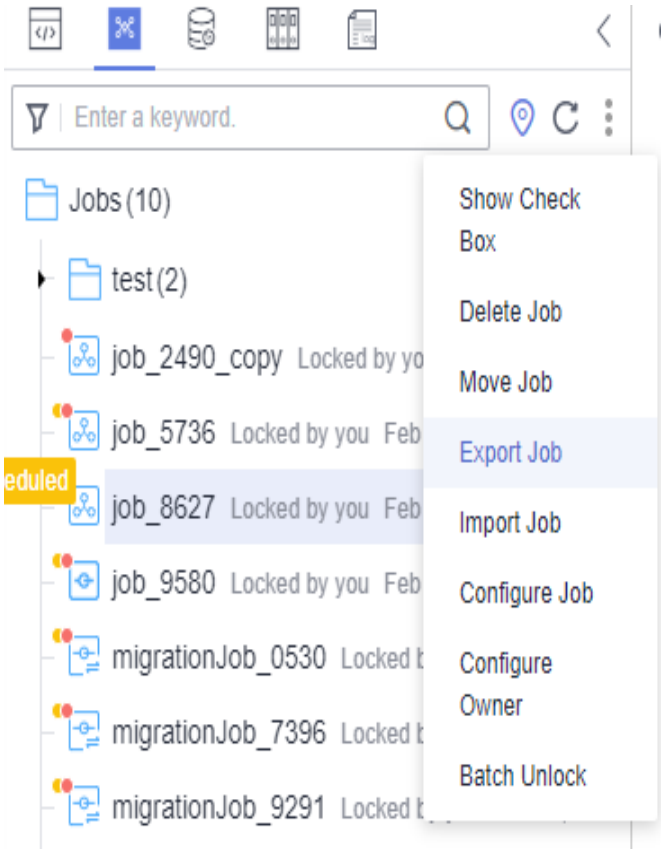
Step 3 In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.

Step 4 Click in the job directory and select **Show Check Box**.

Step 5 Select jobs, click  , and select Export Job. In the displayed dialog box, select **Export jobs only** or **Export jobs and their dependency scripts and resource definitions**. After the export is successful, you can obtain the exported .zip file.

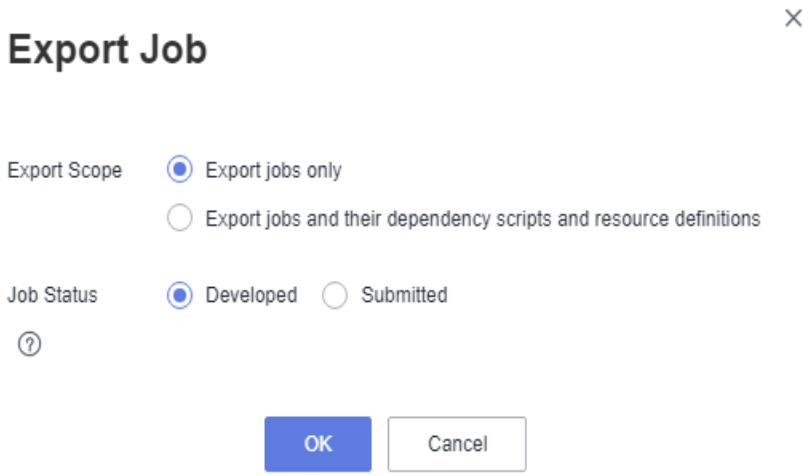
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Figure 9-51 Selecting and exporting jobs



Step 6 In the displayed **Export Job** dialog box, set **Export Scope** and **Job Status** and click **OK**. You can view the result in the download center.

Figure 9-52 Exporting jobs



----End

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Importing Jobs

This function is available only if the OBS service is available. If OBS is unavailable, jobs can be imported from the local PC.

NOTE

- The maximum size of a job file imported from OBS is 10 MB. The maximum size of a job file imported from a local PC is 10 MB. The maximum size of a job file imported from a local PC cannot be larger than 10 MB after decompression.
- If the name of a job to be imported already exists in the system, ensure that the job is in the stopped state. Otherwise, the import fails.

Import one or more jobs from the job directory.

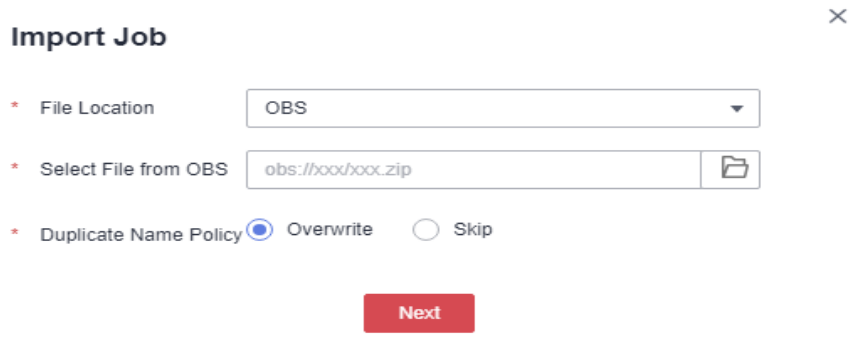
Step 1 In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.

Step 2 Click > **Import Job** in the job directory, select the job file that has been uploaded to OBS or local directory, and rename the policy.

NOTE

If you select **Overwrite** for **Duplicate Name Policy** but the hard lock policy is used and the script is locked by another user, the overwriting will fail. For details about soft and hard lock policies, see **Configuring the Hard and Soft Lock Policy**.

Figure 9-53 Importing jobs and their dependencies



Step 3 Click **Next** to import the job as instructed.

NOTE

- If a job contains a tag in the locked state, the job fails to be imported.
- When a job fails to be imported and a tag needs to be automatically generated, if the tag already exists and is locked, it will not be added to the job.
- During the import, if the data connection, DLI queue, or GES graph associated with the job does not exist in DataArts Factory, the system prompts you to select one again.

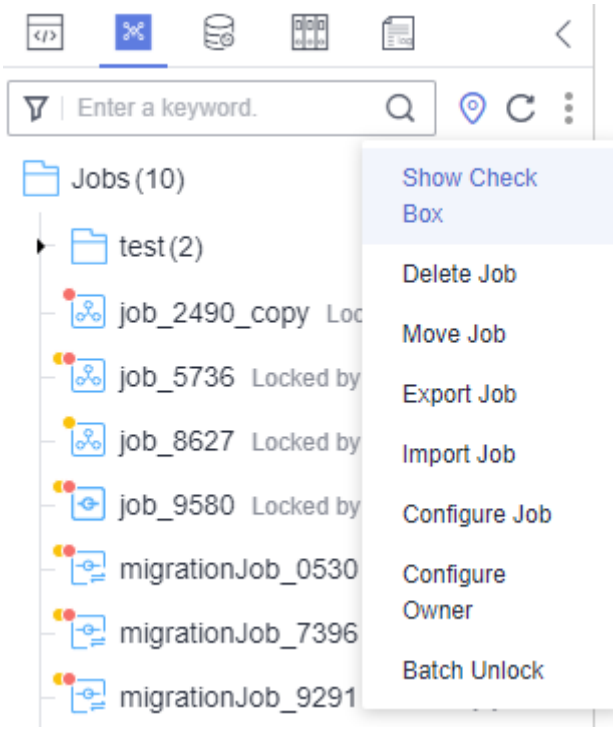
----End

9.4.11.5 Configuring Jobs

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1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataA**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. Click in the job directory and select **Show Check Box**.

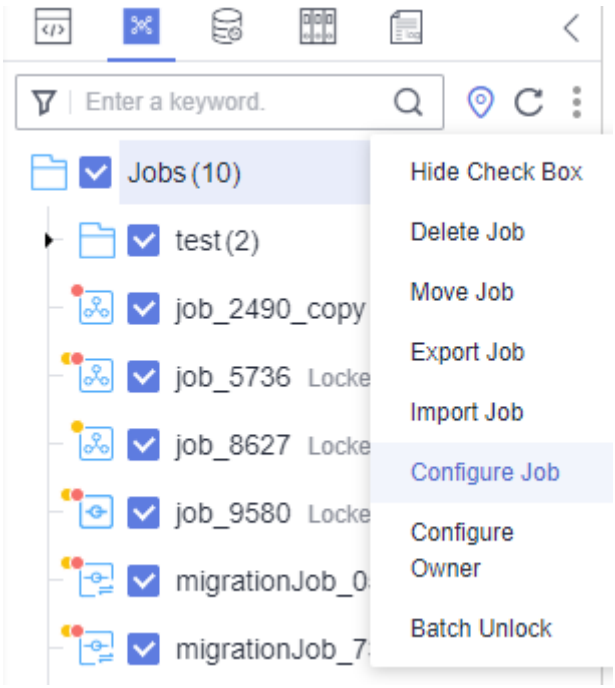
   Figure 9-54 Clicking Show Check Box

5. Select jobs, click , and select **Configure Job**.

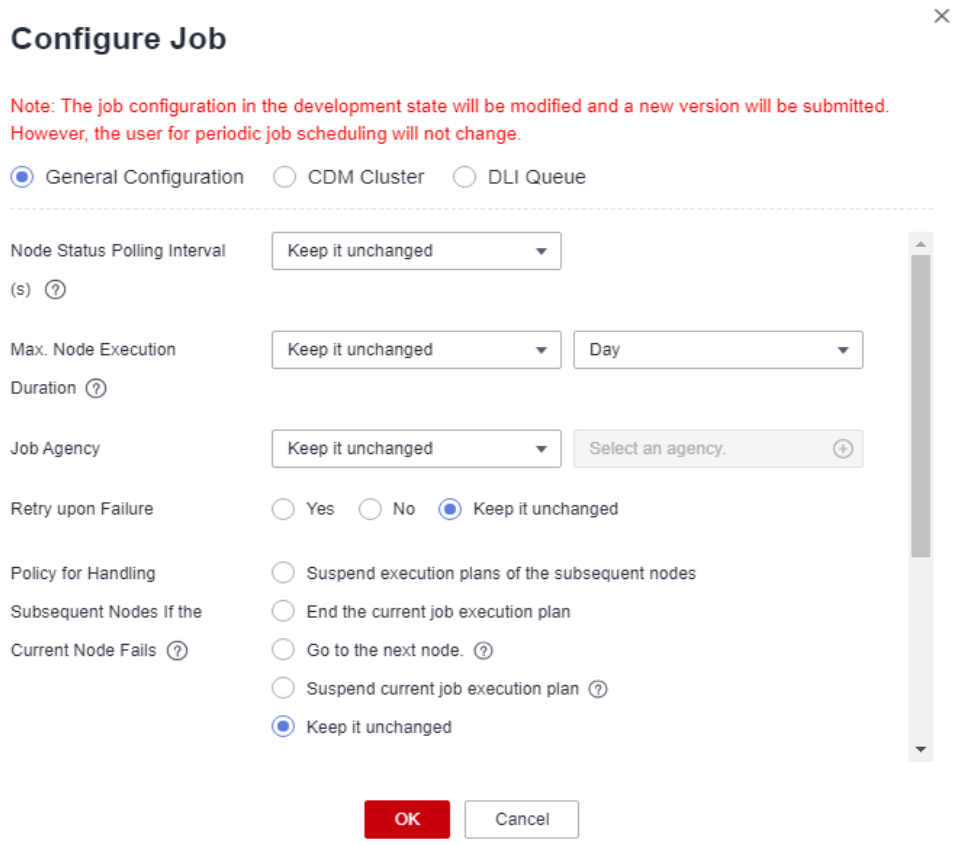
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Figure 9-55 Configure Job



6. Configure general parameters for the jobs.

Figure 9-56 General Configuration



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Table 9-60 General Configuration

Parameter	Description
Node Status Polling Interval	How often the system checks whether all the nodes are executed. The value ranges from 1 to 60 seconds. If you select **Keep it unchanged**, the poll interval remains unchanged for the nodes.
Max. Node Execution Duration	Maximum duration of executing the nodes of a job. When **Retry upon Failure** is set to **Yes** for a node, the node will be re-executed upon an execution failure. If you select **Keep it unchanged**, the maximum execution duration remains unchanged for the nodes.
Job Agency	During execution of the jobs, the agency is used to communicate with other services. If you select **Keep it unchanged**, the agency remains unchanged for the jobs.
Retry upon Failure	Whether to re-execute the nodes of the selected jobs if the nodes fail to be executed. If you select **Keep it unchanged**, the retry policy remains unchanged for the nodes.
Retry upon Timeout	This parameter is displayed only when **Retry upon Failure** is set to **Yes**. Whether to re-execute the nodes of the selected jobs if the nodes time out. If you select **Keep it unchanged**, the retry policy remains unchanged for the nodes.
Maximum Retries	This parameter is displayed only when **Retry upon Failure** is set to **Yes**. Maximum number of node retries The value range is 1 to 100, and the default value is **1**.
Retry Interval	This parameter is displayed only when **Retry upon Failure** is set to **Yes**. Interval at which a retry is performed upon a failure The value range is 5 to 600, and the default value is **120**. The unit is second.
Policy for Handling Subsequent Nodes If the Current Node Fails	Operation to be performed if all nodes of the selected jobs fail to be executed. If you select **Keep it unchanged**, the failure policy remains unchanged for the nodes.

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Parameter	Description
Action After Dependency Job Failure	Action to be taken if the dependency jobs of the selected jobs fail. This parameter is invalid if no dependency jobs have been configured for the selected jobs. If you select **Keep it unchanged**, the failure policy remains unchanged for the selected jobs.
Owner	Owner of the selected jobs, which can only be a member of the current workspace. If you select **Keep it unchanged**, the own remains unchanged for the jobs.
Concurrent Periodic Job Instances	Number of jobs that can be handled concurrently If you select **Keep it unchanged**, the number of concurrent periodic job instances remains unchanged.
Cancel Expired Job Instances	If you select **Yes**, you need to set **Days Overdue**. If the waiting time before a job instance starts running exceeds the configured **Days Overdue**, the job instance will be canceled and cleared. If you select **No**, waiting job instances will not be cleared. If you select **Keep it unchanged**, the original timeout duration rule for job instances is retained.
Days Overdue	This parameter is displayed only when **Cancel Expired Job Instances** is set to **Yes**. The value range is 2 to 271, and the default value is **60**. The unit is day. The minimum value is **2**, that is, a job instance can be canceled only after two days.
Remarks	Enter the remarks.

7. Select **CDM Cluster** and configure the CDM cluster for the CDM Job node of the selected jobs.

   Select the current CDM cluster from the drop-down list box on the left, and select the target CDM cluster from the drop-down list box on the right.

   NOTE

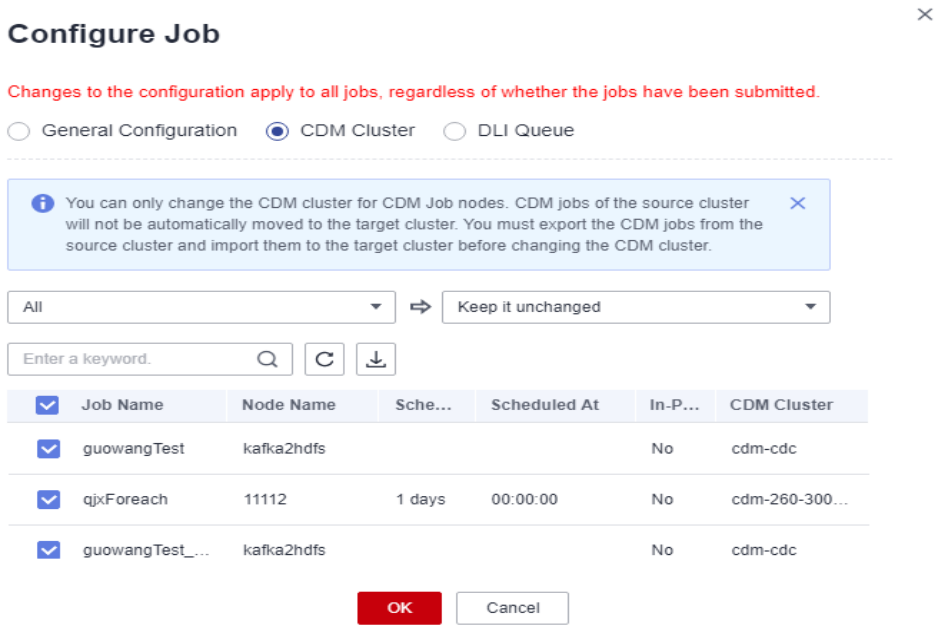
   1. Before migrating a CDM cluster, you must create a job with the same name in the new cluster.
   2. Configure two CDM clusters for a CDM job.
      - If you select one of the source clusters, only the selected cluster will be migrated.
      - If you select both source clusters, they will be both migrated to the destination cluster.

– Search: Enter a job name and click  to filter out the jobs that contain the CDM Job node.

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- Refresh: Click to refresh the list of jobs that contain the CDM Job node.
- Download: Click to download the selected jobs.

Figure 9-57 CDM Cluster



8. Select **DLI Queue** and configure the DLI queue of the DLI SQL node of the selected jobs.

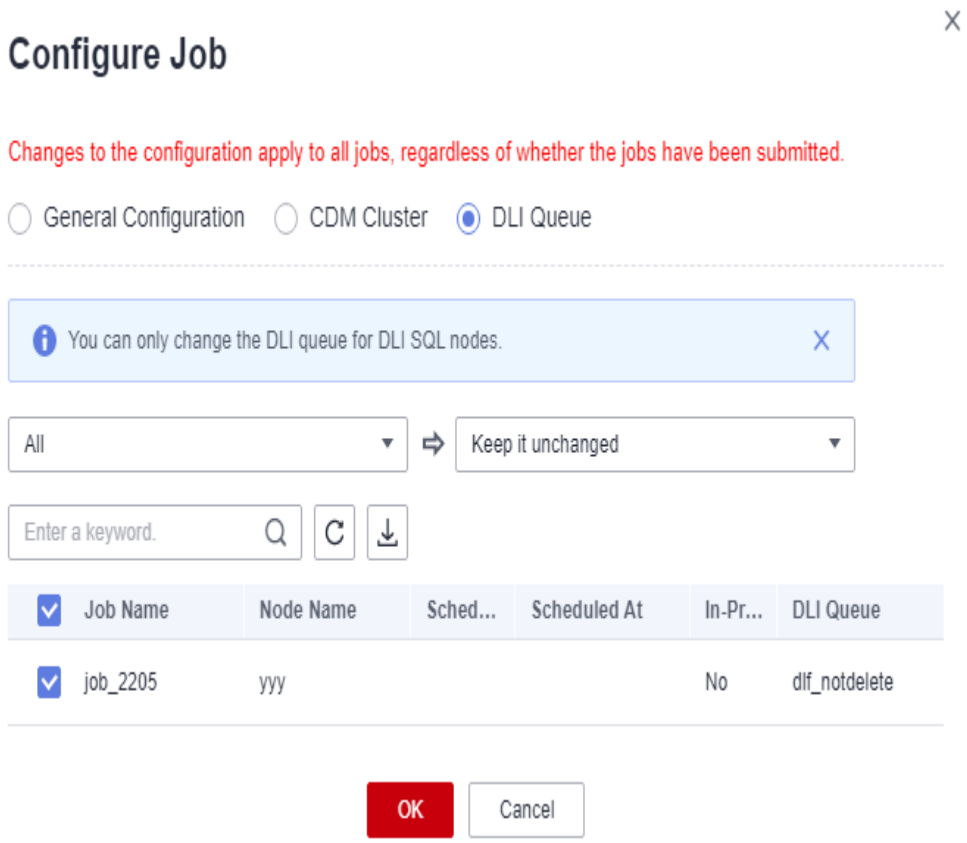
   Select the current DLI queue from the drop-down list box on the left, and select the target DLI queue from the drop-down list box on the right.

   NOTE

   - Search: Enter a job name and click to filter out the jobs that contain the DLI SQL node.
   - Refresh: Click to refresh the list of jobs that contain the DLI SQL node.
   - Download: Click to download the selected jobs.

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Figure 9-58 DLI Queue



9. Click **OK**.

9.4.11.6 Deleting a Job

If you do not need to use a job any longer, perform the following operations to delete it to reduce the quota usage of the job.

NOTE

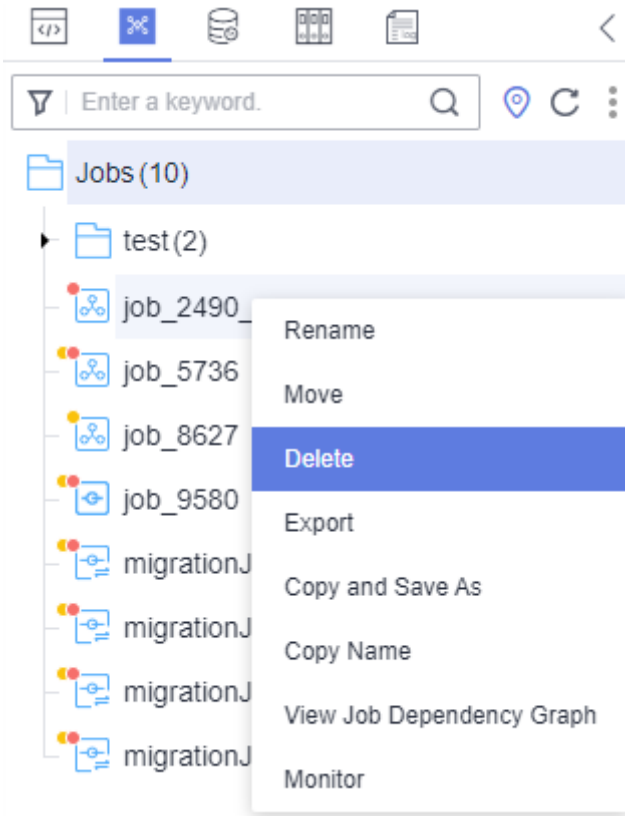
Deleted jobs cannot be recovered. Exercise caution when performing this operation.

Deleting a Script

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, right-click the job that you want to delete and choose **Delete** from the shortcut menu.

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Figure 9-59 Deleting a job



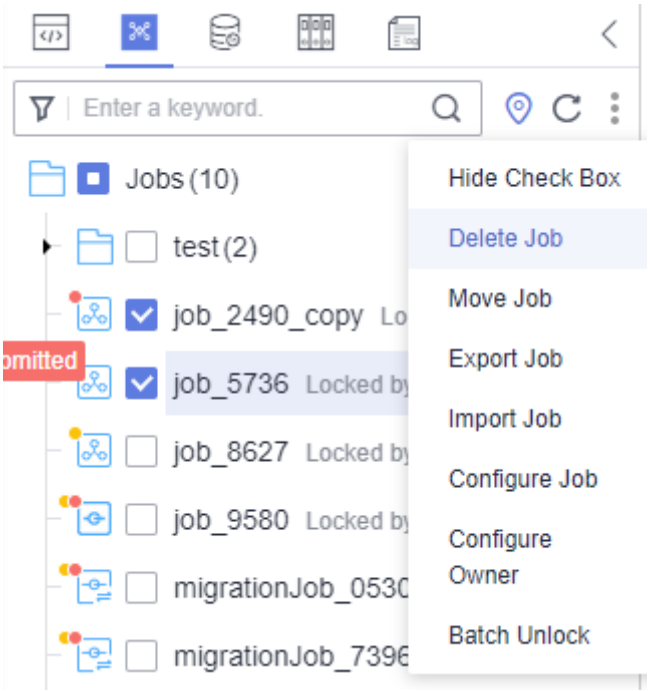
5. In the displayed dialog box, click **OK**.

Batch Deleting Scripts

1. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
2. On the top of the job directory, click and select **Show Check Box**.
3. Select the jobs to be deleted, click , and select **Batch Delete**.

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Figure 9-60 Deleting jobs



4. In the displayed dialog box, click **OK**.

9.4.11.7 Unlocking a Job

Script and job unlocking depends on the lock function of DataArts Factory.

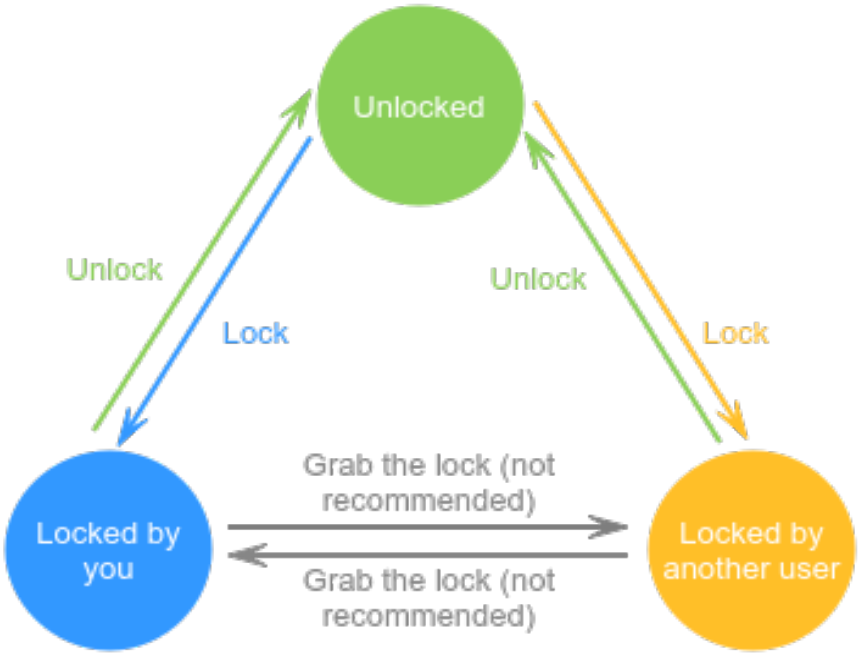
The lock function prevents conflict caused by collaborative script or job development. If you create or import a script or job, it is locked by you by default. You can only edit, save, or submit a script or job you have locked. To edit, save, or submit a script or job that is locked by another user or not locked by any user, you must lock the script or job first.

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NOTICE

- You can view the lock status of a script or job in the script or job directory tree.
- To view the latest version of an opened script or job locked by another user, you need to re-open the script or job because it is not updated in real time.
- Scripts or jobs that were created before the lock function was available are now unlocked by default. To edit, save, or submit these scripts or jobs, you need to lock them first.
- The locking operation depends on the soft and hard lock policies. For details about how to configure soft and hard lock policies, see **Configuring a Default Item**.
  - **Soft lock**: You can lock or unlock jobs or scripts, regardless of whether they are locked by others.
  - **Hard Lock**: You can lock jobs or scripts only after they have been unlocked by other users. The space administrator and the DAYU Administrator user can lock and unlock jobs or scripts without any limitations.
- Do not lock a script or job that is locked by another user because if you do so, changes to the script or job made by the user will be lost. If you want to modify the script or job, contact the user to unlock the script or job, and lock it by yourself.

Figure 9-61 Lock statuses



Prerequisites

A job has been developed.

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Procedure

If you submit a version, the latest job in the development state will be saved and submitted and overwrite the previous job version. You are advised to unlock the job after submitting the version so that other developers can modify the job as needed.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.

Step 4 In the job directory, double-click the developed job to access the job development page.

Step 5 Above the job canvas or editor, click **Unlock** to unlock the job.

Figure 9-62 Unlocking a job



----End

9.4.11.8 Viewing a Job Dependency Graph

You can view a job dependency graph to learn the upstream and downstream jobs associated with the job.

Prerequisites

Dependent jobs have been configured in the job scheduling configuration in **Developing a Pipeline Job**. Otherwise, only the current job node can be displayed in the view, and the associated upstream and downstream job nodes cannot be displayed.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio In**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. In the job directory, right-click the job you want to view and choose **View Job Dependency Graph** from the shortcut menu.

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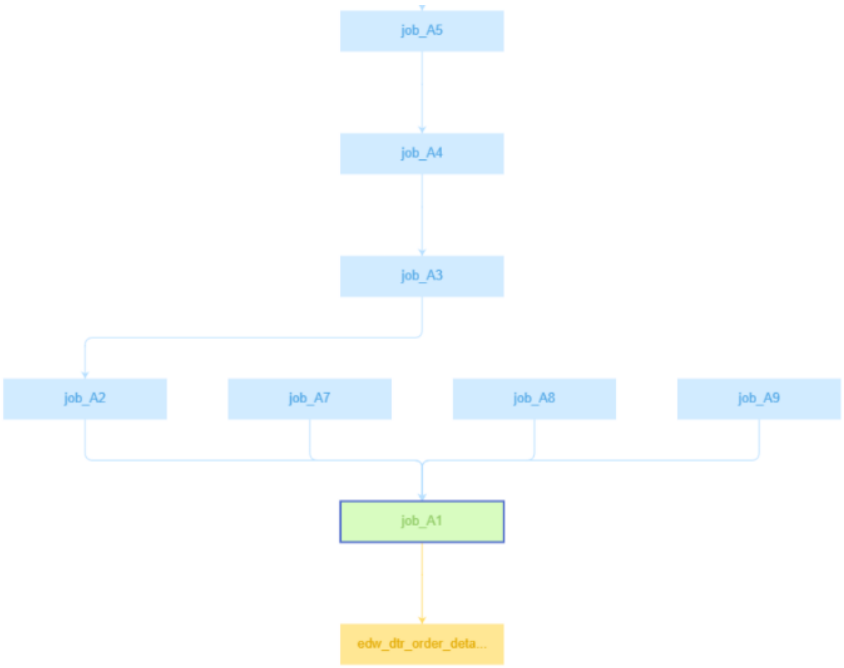
Figure 9-63 Job Dependency page



5. On the displayed **Job Dependency** page, perform any of the following operations:
   - In the upper right corner, select **Display complete dependency graphs**, **Display the current job and its upstream and downstream jobs**, or **Display the current job and its directly connected jobs**.
   - In the search box in the upper right corner, you can enter the name of a node to search for the node. The node found will be highlighted.
   - Click **Download** to download the job dependency file.
   - Scroll your mouse wheel to zoom in or zoom out the dependency graph.
   - Drag the blank area to view the complete relationship graph.
   - When the cursor is hovered on a job node, the node is marked green, its upstream job is marked blue, and its downstream job is marked yellow.

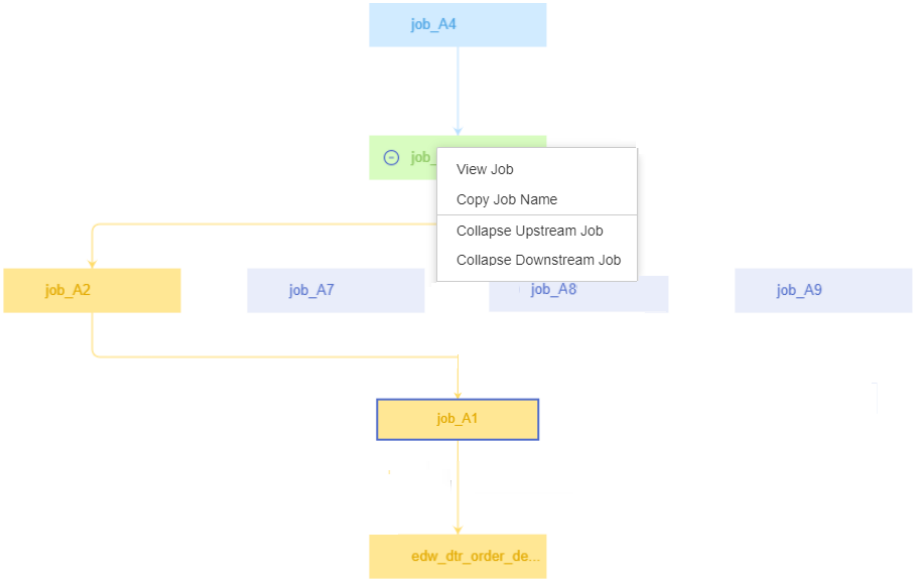
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Figure 9-64 Marking upstream and downstream job nodes of a node



– Right-click a job node to view the job, copy the job name, and collapse upstream or downstream jobs.

Figure 9-65 Job node operations

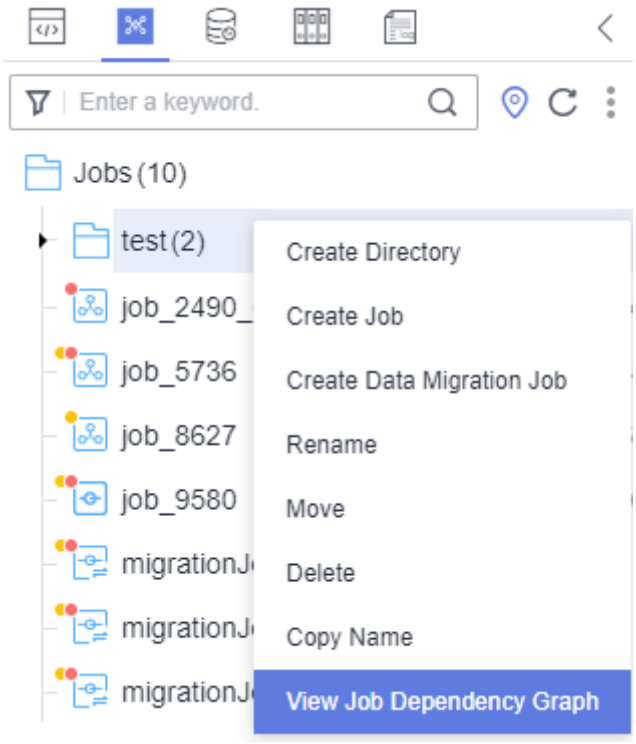


Viewing a Job Dependency Graph

1. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
2. Right-click the job directory and select **View Job Dependency Graph**.

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Figure 9-66 Viewing the job dependency graph



3. The system displays the dependencies between all the jobs in the directory. You can search for jobs by name. The matched jobs will be highlighted.

   NOTE

   - If you click a node in the dependency graph, its upstream jobs are marked blue and its downstream jobs are marked yellow.
   - You can drag to view the full dependency graph.
   - Scroll the mouse wheel to zoom in or out the dependency graph.

9.4.11.9 Changing the Job Owner

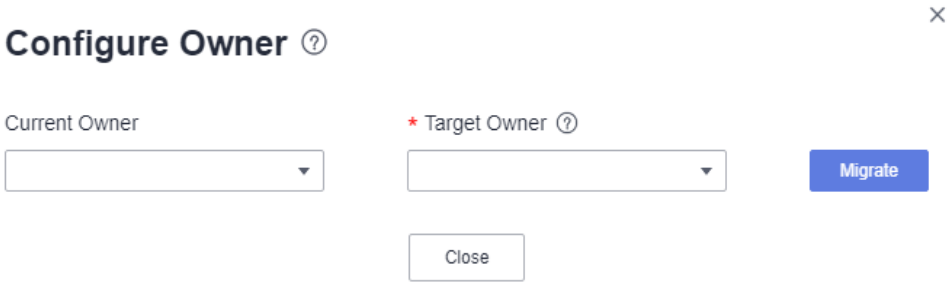
DataArts Factory allows you to change the job owner with a few clicks.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. At the top of the job directory, click and select **Configure Owner**.

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Figure 9-67 Changing the owner



5. Set **Current Owner** and **Target Owner** and click **Migrate**.
6. When the owner is changed, click **Close**.

9.4.11.10 Unlocking Jobs

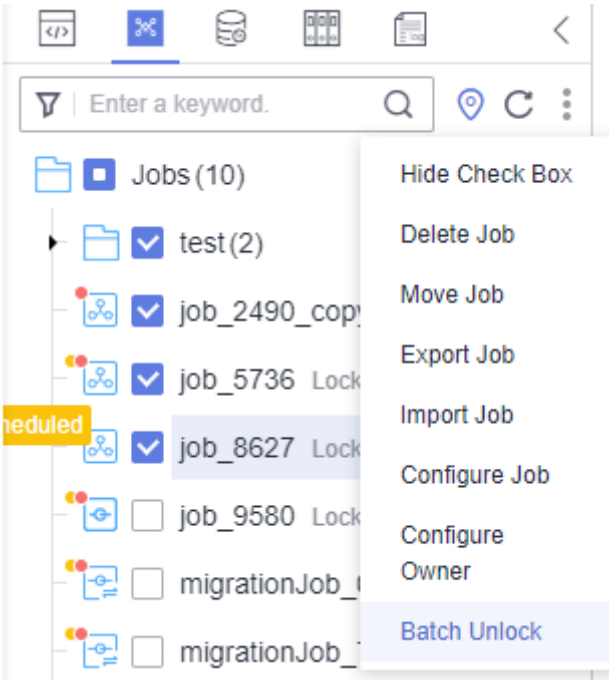
This section describes how to unlock jobs in batches.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. Click in the job directory and select **Show Check Box**.
5. Select the jobs to unlock, click , and select **Batch Unlock**. The message "Unlocked." is displayed.

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Figure 9-68 Batch Unlock



9.4.11.11 Going to Monitor Job page

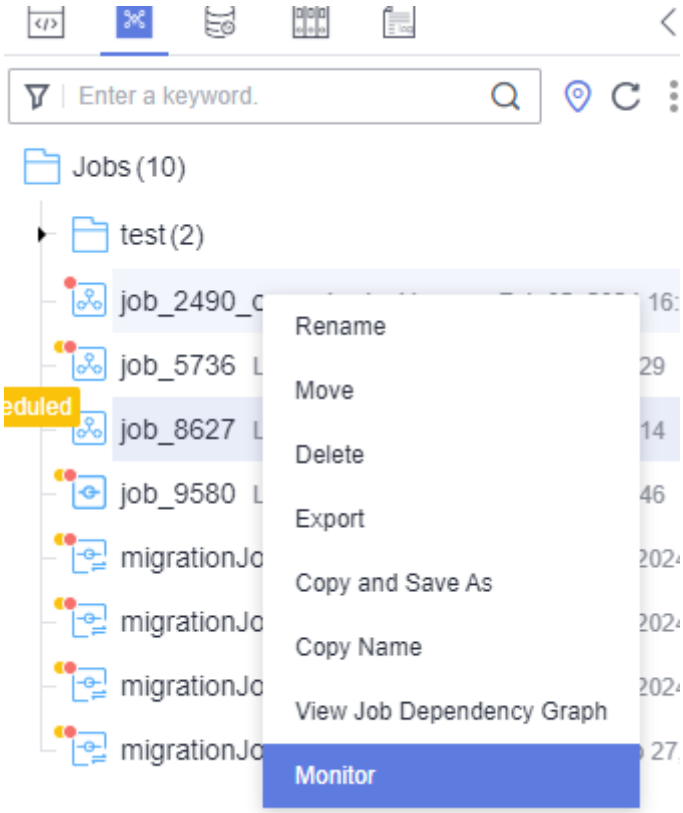
From the job directory tree, you can quickly switch to the job monitoring page to view the monitoring details of the job.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
4. Right-click a job in the directory tree and select **Monitor**.

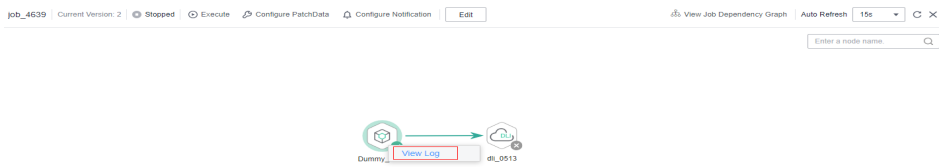
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Figure 9-69 Going to Monitor Job page



5. On the **Monitor Job** page, you can view the logs of the job nodes and the job version. You can also execute the job or click the job name or **Edit** to go to the job development page and modify job configurations.

Figure 9-70 Monitor Job page



9.5 Migration Job Development

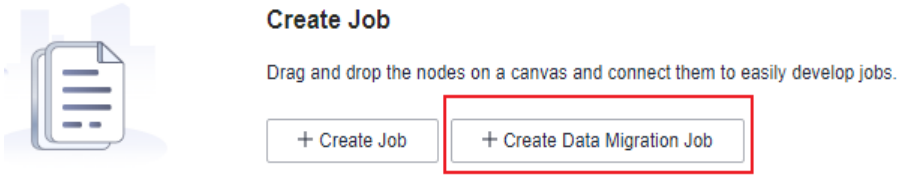
Migration jobs include offline and real-time jobs. You can develop migration jobs on the DataArts Factory console.

You can create a migration job using either of the following methods:

Method 1: On the **Develop Job** page, click **Create Data Migration Job**.

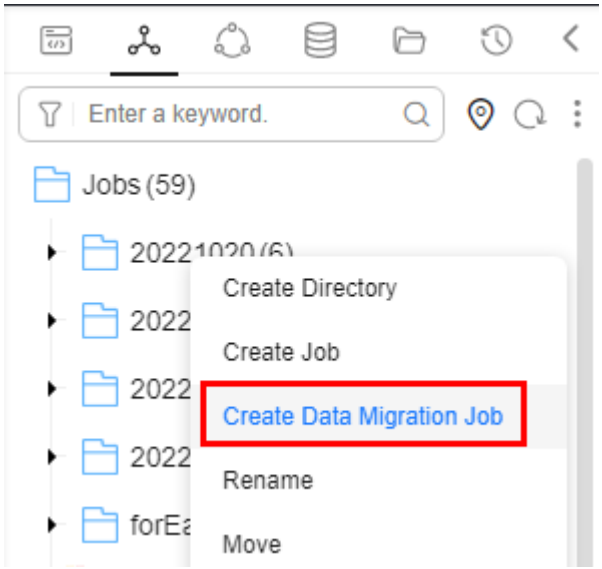
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Figure 9-71 Creating a migration job (method 1)



Method 2: In the directory list, right-click a directory and select **Create Data Migration Job**.

Figure 9-72 Creating a migration job (method 2)



For detailed operations on offline jobs, see **DataArts Migration (Offline Jobs)**.

For detailed operations on real-time jobs, see **DataArts Migration (Real-Time Jobs)**.

9.6 Solution

Context

The solution aims to provide users with convenient and systematic management operations and better meet service requirements and objectives. Each solution can contain one or more business-related jobs, and one job can be used by multiple solutions.

You can perform the following operations on a solution:

- **Creating a Solution**
- **Editing a Solution**
- **Exporting a Solution**

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- Importing a Solution
- Upgrading a Solution
- Deleting a Solution

Creating a Solution

On the development page of DLF, create a solution, set the solution name, and select business-related jobs.

1. Log in to the DataArts Studio console by following the instructions in Accessing the DataArts Studio Instance Console.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation tree on the left of the data development page, choose **Development** > **Develop Script** or **Data Development** > **Develop Job**.
4. Above the directory on the left, click  to show the solution directory.
5. Click  in the upper part of the solution directory. The **Create Solution** page is displayed. Table 9-61 describes the solution parameters.

   Table 9-61 Solution Parameters

Parameter	Description
Name	Name of the solution.
Select Job	Select the jobs contained in the solution.

6. Click **OK**. The new solution is displayed in the directory on the left.

Editing a Solution

In the solution directory, right-click the solution name and select **Edit** to change the name and job.

Exporting a Solution

In the solution directory, right-click the solution name and choose **Export** from the shortcut menu to export the solution file in ZIP format to the local host.

Importing a Solution

This solution is available only if the OBS service is available. If OBS is unavailable, data can be imported from the local PC.

In the solution directory, right-click a solution and choose **Import Solution** from the shortcut menu to import the solution file that has been uploaded to OBS or from a local directory.

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NOTE

If you select **Overwrite** for **Duplicate Name Policy** but the hard lock policy is used and the script is locked by another user, the overwriting will fail. For details about soft and hard lock policies, see **Configuring the Hard and Soft Lock Policy**.

Upgrading a Solution

In the solution directory, right-click the solution name and choose **Upgrade** from the shortcut menu to import the solution file that has been uploaded to OBS. During the solution upgrade, the running jobs are stopped. The system determines whether to restart the jobs after the upgrade based on the configured upgrade restart policy.

Deleting a Solution

In the solution directory, right-click the solution name and choose **Delete** from the shortcut menu. A deleted solution cannot be restored. Exercise caution when performing this operation.

9.7 Execution History

This section describes how to view the execution history of scripts, jobs, and nodes over a week.

Prerequisites

This function depends on OBS buckets. For details about how to configure OBS buckets, see **Configuring an OBS Bucket**.

Script Execution History

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation pane of the DataArts Factory homepage, choose **Data Development** > **Develop Script**.
4. Above the directory, click  to display the script and job execution history in the past seven days.
5. Select **Scripts** from the drop-down list box to filter out the script execution history.
6. Click a record to view the script information and execution result.
7. Download the historic script execution result.

   NOTE

   - By default, all users can download the historic execution results of scripts.
   - You can click **Download** on the **Result** tab page.
   - You can download the result file in CSV format. A maximum of 1,000 results can be queried and downloaded.

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Job Execution History

1. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
2. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Job**.
3. Above the directory, click  to display the script and job execution history in the past seven days.
4. Select **Jobs** from the drop-down list box to filter out the job execution history.
5. Click a record to view the job and log information.

   NOTE

   If only some nodes of the job were tested, the execution history only displays information and logs for these nodes.

9.8 O&M and Scheduling

9.8.1 Overview

Choose **Monitoring** > **Overview**. On the **Overview** page, you can view the statistics of job instances in charts. Currently, you can view seven types of statistics:

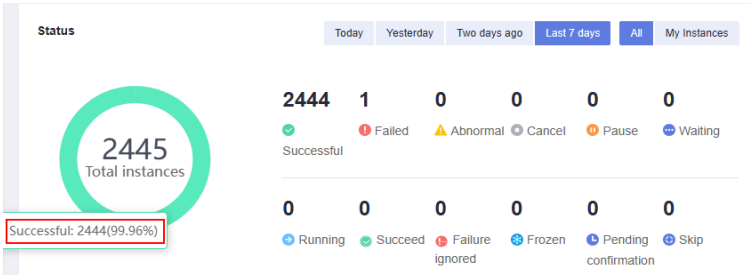
- Status
  - You can filter out your or all job instances by selecting **My Instances** or **All**, and filter out job instances of the current day by selecting **Today**.
  - You can filter out your or all job instances by selecting **My Instances** or **All**, and filter out job instances of the current day by selecting **Yesterday**.
  - You can filter out your or all job instances by selecting **My Instances** or **All**, and filter out job instances of the current day by selecting **Two days ago**.
  - You can filter out your or all job instances by selecting **My Instances** or **All**, and filter out job instances of the current day by selecting **Last 7 days**.
  - You can click a status to go to the **Monitor Instance** page and view details about all jobs in the status.

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NOTE

- The statistics include the monitoring data of the instances of real-time jobs. When you click a status, you will not be redirected to the **Monitor Instance** page of real-time jobs. Instead, you can only view the details of the instances of batch jobs.
- By default, the system displays all job instances of the current day.
- You can view the total number of instances that meet the filter criteria, the total number of instances that were successfully executed, and the percentage of such instances.

Figure 9-73 Status



- Completed Tasks

  NOTE

  Successfully executed instances of the current day are collected once an hour. A task is a job node.

  - You can specify a date and view the number of **all** job nodes successfully executed on the **previous day**, on the **selected day**, and **over the last seven days on average**.
  - You can specify a date and view the number of different types of job nodes successfully executed on the **previous day**, on the **selected day**, and **over the last seven days on average**.

- Tasks

  NOTE

  Number of tasks (operators in jobs) started in five minutes. Data of 30 days is available.

  - You can filter the operators started on each day within 30 days.
  - You can view the curve of the number of **all** operators that have been started.
  - You can view the curve of the number of different types of operators that have been started.

- Running DLI Jobs/Queue CU Usage

  You can filter the number of running DLI jobs and the CU usage of a specified queue.

  NOTE

  - You can view data of the last seven days by default, and view data of one month at most.
  - You can only view data of non-default queues. You can click the name of a queue to pin the queue to top.

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- Number of Jobs and Number of Tasks Scheduled Daily

  NOTE

  This area displays the trend of the total number of jobs in a long period and the number of tasks scheduled each day. A task indicates an operator in a job.

  Number of jobs: total number of batch processing jobs and real-time jobs

  Number of tasks scheduled daily: number of tasks scheduled everyday, including both real-time and offline tasks. The number is calculated based on the nodes that are successfully scheduled.

  – By default, the system displays the number of jobs and the number of tasks scheduled each day in one month. You can filter data by time range.

- Task Type Distribution

  You can view the number of job nodes of different types.

  NOTE

  A task indicates an operator in a job.

  The system collects statistics on the number of nodes in all submitted jobs, including real-time jobs and batch processing jobs.

- Top 100 in Instance Running Time
  – You can filter out the top 100 instances of yours or all users with the longest running duration by time and owner.
  – You can click a job name to go to the **Monitor Instance** page and view the job running details.
  – By default, the system displays top 100 job instances in one month.
- Top 100 in Instance Failed to Run
  – You can filter out the top 100 instances of yours or all users with the most failures by time and owner.
  – You can click a job name to go to the **Monitor Instance** page, view the logs of the failed job instances, and analyze the causes.
  – By default, the system displays top 100 job instances in one month.
- End of scheduling in the next week

  You can view the jobs that are expected to be completed in the following week, including their names, owners, and end time.

  NOTE

  - Jobs that are expected to be completed in two days or less are displayed in red.
  - Jobs that are expected to be completed in three to five days are displayed in orange.
  - Jobs that are expected to be completed in six to seven days are displayed in black.

9.8.2 Monitoring a Job

9.8.2.1 Monitoring a Batch Job

In the batch processing mode, data is processed periodically in batches based on the job-level scheduling plan, which is used in scenarios with low real-time

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requirements. This type of job is a pipeline that consists of one or more nodes and is scheduled as a whole. It cannot run for an unlimited period of time, that is, it must end after running for a certain period of time.

You can choose **Monitor Job** and click the **Batch Job Monitoring** tab to view the scheduling status, scheduling period, and start time of a batch job, and perform the operations listed in **Table 9-62**.

Figure 9-74 Monitoring batch jobs

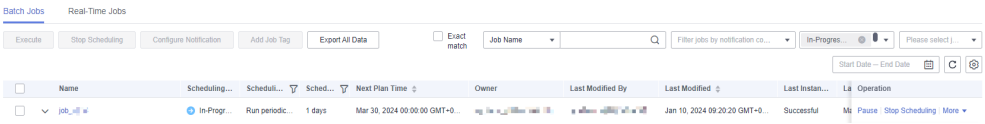


Table 9-62 Operations supported by batch job monitoring

Operation	Description
Filtering jobs by **Job Name**, **Owner**, **CDM Job**, **Scheduling Identity**, or **Node Type**	N/A
Filtering jobs by whether notifications have been configured, scheduling status, job tag, or next plan time	You can filter jobs for which no notification has been configured by notification type (such as exception or failure) so that you can set alarm notifications in batches.
Performing operations on jobs in a batch	Select multiple jobs and perform operations on them.

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Operation	Description
Viewing job instance status	Click in front of the job name. The **Last Instance** information is displayed. You can view information about the last instance of the job. In the **Operation** column of the last instance, you can view the run logs of the instance and rerun the instance. **NOTE** • The rerun job may run at the same time as a normally scheduled job. Check whether the job supports concurrent running. If the number or names of nodes in the job change, the rerunning starts from the first node. If you rerun a job instance in successful state, the rerunning starts from the first node. • When rerunning a job instance, you need to set **Parameters to Use** and **Ignore OBS Listening**. You can set **Parameters to Use** to **Parameters of the original job** or **Parameters of the latest job**. **Ignore OBS Listening** is set to **Yes** by default. • In enterprise mode, developers cannot rerun job instances.
Viewing node information of the job	Click a job name. On the displayed page, click the job node and view its associated jobs/scripts and monitoring information. Click a job name. On the displayed page, view the job instance. For details, see **Batch Job Monitoring: Job Instances**.
Job scheduling operations	You can run, pause, recover, stop, and configure scheduling. For details, see **Batch Job Monitoring: Scheduling a Job**.
Configuring notifications	In the **Operation** column of a job, choose **More** > **Configuration Notification**. In the displayed dialog box, configure notification parameters. **Table 9-71** describes the notification parameters.
Monitoring instances	In the **Operation** column of a job, choose **More** > **Monitor Instance** to view the running records of all instances of the job.
Configuring scheduling information	In the **Operation** column of a job, click **More** and select **Scheduling Setup**. On the displayed job development page, you can view and configure the job scheduling information. **NOTE** You cannot configure scheduling information for a running job.
PatchData	In the **Operation** column of a job, choose **More** > **PatchData**. For details, see **Batch Job Monitoring: PatchData**. This function is available only for jobs that are scheduled periodically.

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Operation	Description
Adding a job tag	In the **Operation** column of a job, choose **More** > **Add Job Tag**. For details, see **Batch Job Monitoring: Adding a Job Tag**.
Viewing a job dependency graph	In the **Operation** column of a job, click **More** and select **View Job Dependency Graph**. For details, see **Batch Job Monitoring: Viewing a Job Dependency Graph**.
Exporting all data	Click **Export All Data**. In the displayed **Export All Data** dialog box, click **OK**. After the export is complete, go to the **Download Center** page to view the exported data. If the default storage path is not configured, you can set a storage path and select **Set as default OBS path** in the **Export to OBS** dialog box. A maximum of 30 MB data can be exported. If there are more than 30 MB data, the data will be automatically truncated. The exported job instances map job nodes. You cannot export data by selecting job names. Instead, you can select the data to be exported by setting filter criteria.

Click a job name. On the displayed page, view the job parameters, properties, and instances.

Click a node of a job to view the node properties, script content, and node monitoring information.

In addition, you can view the current job version and job scheduling status, schedule, stop, or pause a job, configure patch data, notification, or update frequency for a job.

Batch Job Monitoring: Job Instances

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. Click the **Batch Job Monitoring** tab.
5. Click a job name. On the displayed page, click the **Job Instances** tab to view job instances. You can perform the following operations:
   - Select **Show Instances to Be Generated** and set the time range to filter job instances that are expected to be generated in the future.

     NOTE

     A maximum of 100 instances expected to be generated can be displayed.

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- Freeze or unfreeze job instances that are expected to be generated in the future. You can click **Freeze** or **Unfreeze** above the job instance list, or click **More** in the **Operation** column and select **Freeze** or **Unfreeze**.

  NOTE

  Freeze: You can only freeze job instances that have not been generated or are in waiting state.

  You cannot freeze jobs instances that have been frozen.

  When a job is frozen, it is considered to be failed and its downstream jobs will be suspended, executed, or canceled based on the failure policy configured for the job.

  When job instances that have not been generated are frozen, you can view them on the **Batch Job Monitoring** page or filter them by status on the **Monitor Instance** page.

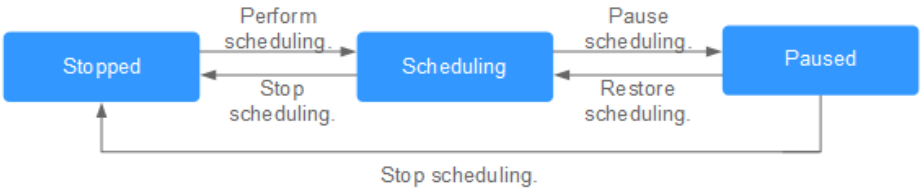
  Unfreeze: You can unfreeze a job instance that has not been scheduled and has been frozen.

- Perform other operations on job instances, such as stopping, rerunning, and retrying job instances, continuing running job instances, making job instances succeed, viewing waiting job instances, and viewing job configuration. When viewing waiting job instances, you can click **Remove Dependency** in the **Operation** column to remove dependency on an upstream instance.
- If jobs need manual confirmation before they are executed, they are in waiting confirmation state on the **Batch Jobs** page. When you click **Execute**, the jobs are in waiting execution state.

Batch Job Monitoring: Scheduling a Job

After developing a job, you can manage job scheduling tasks on the **Monitor Job** page. Specific operations include to run, pause, restore, or stop scheduling.

Figure 9-75 Scheduling a job



1. Log in to the DataArts Studio console by following the instructions in [Accessing the DataArts Studio Instance].
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. Click the **Batch Job Monitoring** tab.

   NOTE

   You can filter batch processing jobs by scheduling type or scheduling frequency.

5. In the **Operation** column of the job, click **Execute**, **Pause**, **Restore**, or **Stop Scheduling**.

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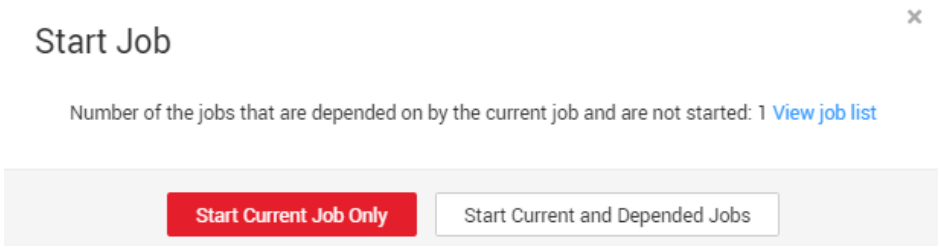
If a dependent job has been configured for a batch job, you can select either **Start Current Job Only** or **Start Current and Depended Jobs** when submitting the batch job. For details about how to configure dependent jobs, see **Setting Up Scheduling for a Job Using the Batch Processing Mode**.

NOTE

If the job is on the baseline task link, the system automatically displays a dialog box indicating that the baseline is associated when the scheduling is paused or stopped.

If the job is on the baseline task link or is depended on by other jobs, the system automatically displays a dialog box when the scheduling is paused or stopped.

Figure 9-76 Starting a job



Batch Job Monitoring: PatchData

A job executes a scheduling task to generate a series of instances in a certain period of time. This series of instances are called PatchData. PatchData can be used to fix the job instances that have data errors in the historical records or to build job records for debugging programs.

Only the periodically scheduled jobs support PatchData. For details about the execution records of PatchData, see **Monitoring PatchData**.

NOTE

Do not modify the job configuration when PatchData is being performed. Otherwise, job instances generated during PatchData will be affected.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. Click the **Batch Job Monitoring** tab.
5. In the **Operation** column of the job, choose **More** > **Configure PatchData**.
6. Configure PatchData parameters based on **Table 9-63**.

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Figure 9-77 PatchData parameters

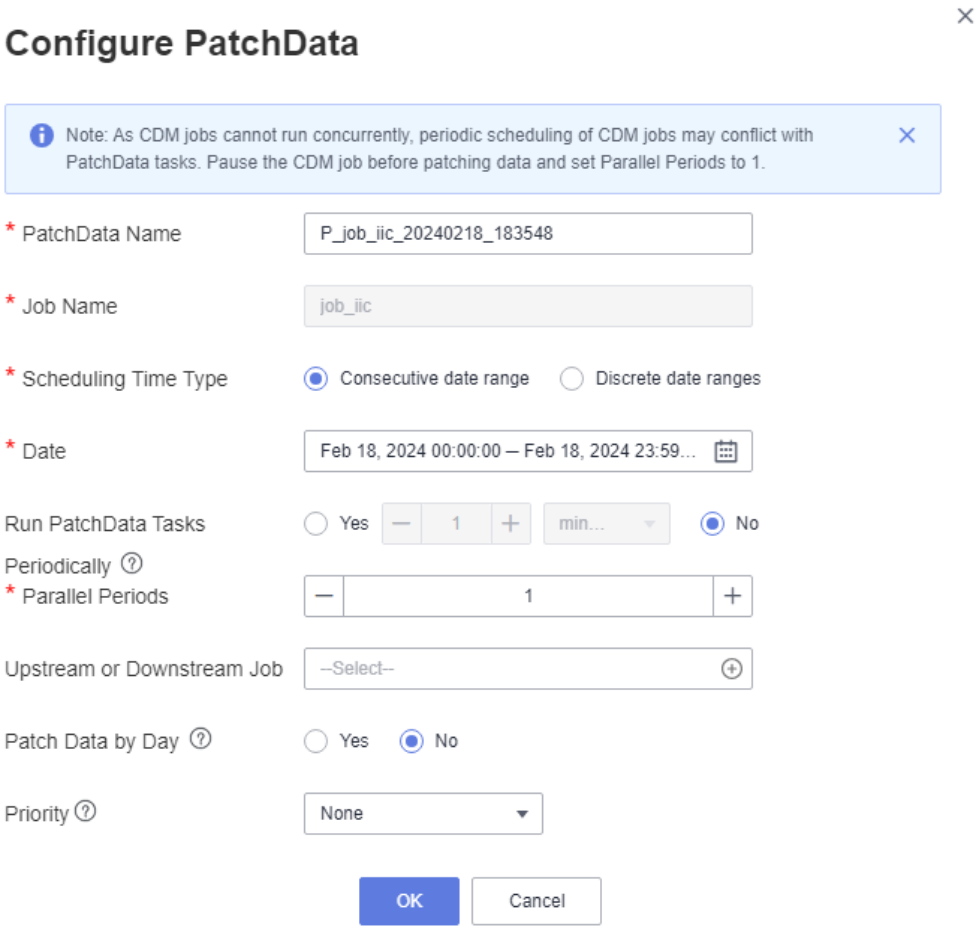


Table 9-63 Parameters

Parameter	Description
PatchData Name	Name of the automatically generated PatchData task. The value can be modified.
Job Name	Name of the job that requires PatchData.
Scheduling Time Type	• Consecutive date range The PatchData time is a continuous date range. • Discrete date ranges The PatchData time consists of discrete date ranges.

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Parameter	Description
Date	**If Scheduling Time Type is set to Consecutive date range:** Period of time when PatchData is required. If the date is later than the current time, the current time is displayed by default. **NOTE** PatchData can be configured for a job multiple times. However, avoid configuring PatchData multiple times on the same date to prevent data duplication or disorder. If you select **Patch data in reverse order of date**, the patch data of each day is in positive sequence. **NOTE** • This function is applicable when the data of each day is not coupled with each other. • The PatchData job will ignore the dependencies between the job instances created before this date. **If Scheduling Time Type is set to Discrete date ranges:** You also need to set the following PatchData parameters: You can click **Add Date Range** to add multiple discrete date ranges for PatchData. You must set at least one date range. You can click **Delete** to delete discrete date ranges. **NOTE** DataArts Studio does not support concurrent running of PatchData instances and periodic job instances of underlying services (such as CDM and DLI). To prevent PatchData instances from affecting periodic job instances and avoid exceptions, ensure that they do not run at the same time.

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Parameter	Description
Run PatchData Tasks Periodically	• **Yes**: PatchData jobs will be executed based on the configured period. **The first value** indicates a specific value. **The second value** indicates that data is patched based on a specified period, for example, hours, days, weeks, or months. **NOTE** If you set a period, PatchData tasks will be scheduled based on that period. If the job is scheduled every few minutes, hours, or days, PatchData tasks will be scheduled based on the period you set. For example, if you want to patch data from 00:00 on Jan 1, 2023 to 00:00 on Feb 1, 2023 for an hourly job that starts at 01:00 every day, and set the PatchData period to two days, PatchData tasks will be scheduled at 00:00 on Jan 1, 2023, 00:00 on Jan 3, 2023, 00:00 on Jan 5, 2023, and so on. If the PatchData task scheduling period is in months and the first scheduling date falls on the last day of a month, PatchData tasks will be scheduled on the last day of each month. • **No**: PatchData jobs will not be executed periodically. Instead, the system executes PatchData jobs based on the existing rule.
Cycle	This parameter is required when **Scheduling Time Type** is set to **Discrete date ranges**. It specifies the PatchData cycle. You can click **Viewing Scheduling Details** to view the execution time of the task instances in the current time segment. **NOTE** This parameter is required only when a job is scheduled by hour or minute and **Scheduling Time Type** is set to **Discrete date ranges**.
Parallel Instances	Number of instances to be executed at the same time. A maximum of five instances can be executed at the same time. If you select **Yes** for **Patch Data by Day**, **Parallel Instances** means the number of concurrent job instances on the same day. If you select **No** for **Patch Data by Day**, **Parallel Instances** means the number of concurrent job instances in the scheduling cycle. **NOTE** Set this parameter based on the site requirements. For example, if a CDM job instance is used, data cannot be supplemented at the same time. The value of this parameter can only be set to **1**.

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Parameter	Description
Upstream or Downstream Job	Select the upstream and downstream jobs (jobs that depend on the current job) that require PatchData. The job dependency graph is displayed. For details about the operations on the job dependency graph, see **Batch Job Monitoring: Viewing a Job Dependency Graph**. **NOTE** If you set **Run PatchData Tasks Periodically** to **Yes**, you can only select an upstream or downstream job with the same scheduling period as the job.
Patch Data by Day	If you select **Yes**, PatchData instances on the same day can be executed concurrently for a job, but those on different days cannot be executed concurrently. For example, a job instance scheduled at 5:00 and one scheduled at 6:00 can be executed concurrently, but a job instance scheduled on 1st of a month and one scheduled on 2nd of the month cannot be executed concurrently. **Yes**: Data is patched by day. **No**: Data is not patched by day.
Stop Upon Failure	This parameter is mandatory if **Patch Data by Day** is set to **Yes**. **Yes**: If a daily PatchData task fails, subsequent PatchData tasks stop immediately. **No**: If a daily PatchData task fails, subsequent PatchData tasks continue. **NOTE** If data is patched by day and a PatchData task fails on a day, no PatchData task will be executed on the next day. This function is supported only by daily PatchData tasks, and not by hourly PatchData tasks.
Priority	Select a PatchData priority. You can set the priority of a workspace-level PatchData job in **Default Configuration**. **NOTE** The priority of PatchData is higher than that of PatchData in the workspace. Currently, only the priorities of DLI SQL operators can be set.
Ignore OBS Listening	• **Yes**: OBS listening is ignored in PatchData scenarios. • **No**: The system listens to the OBS path in PatchData scenarios.

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Parameter	Description
Set Running Period	Whether a running period can be set for the PatchData task. • Yes You can set the time period for running the PatchData task every day. • No

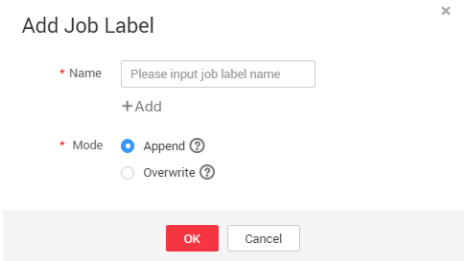
7. Click **OK**. The system starts to perform PatchData and the **PatchData Monitoring** page is displayed.

Batch Job Monitoring: Adding a Job Tag

Tags can be added to jobs to facilitate job instance filtering.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. Click the **Batch Job Monitoring** tab.
5. In the **Operation** column of a job, choose **More** > **Add Job Tag**.
6. In the **Add Job Tag** dialog box displayed, set the job tag parameters.

Figure 9-78 Parameters for adding a job tag



7. Click **OK**.

Batch Job Monitoring: Viewing a Job Dependency Graph

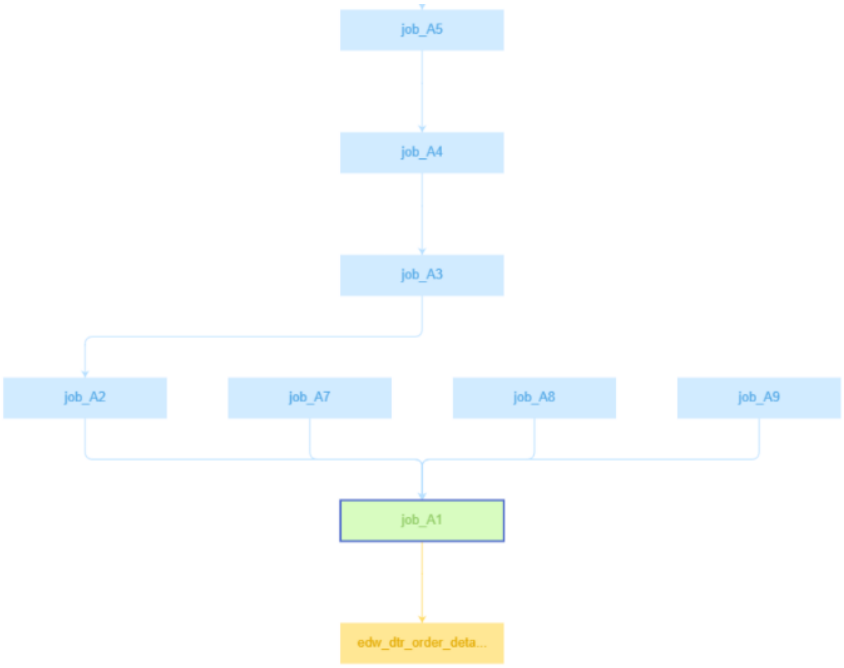
In the job dependency graph, you can view the dependencies between jobs.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. Click the **Batch Job Monitoring** tab.

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5. In the **Operation** column of a job, choose **More** > **View Job Dependency Graph**.
6. On the displayed **Job Dependency** page, perform any of the following operations:
   - In the upper right corner, select **Display complete dependency graphs**, **Display the current job and its upstream and downstream jobs**, or **Display the current job and its directly connected jobs**.
   - In the search box in the upper right corner, you can enter the name of a node to search for the node. The node found will be highlighted.
   - Click **Download** to download the job dependency file.
   - Scroll your mouse wheel to zoom in or zoom out the dependency graph.
   - Drag the blank area to view the complete relationship graph.
   - When the cursor is hovered on a job node, the node is marked green, its upstream job is marked blue, and its downstream job is marked orange.

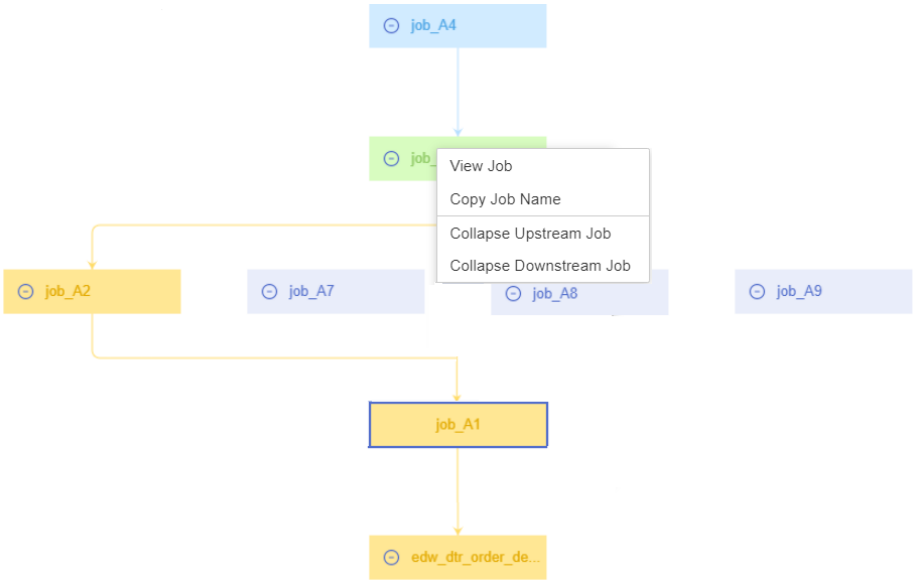
     Figure 9-79 Marking upstream and downstream job nodes of a node

   - Right-click a job node to view the job, copy the job name, and collapse upstream or downstream jobs.

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Figure 9-80 Job node operations



You can also view the node monitoring information of a job on the job details page.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. Click the **Batch Job Monitoring** tab.
5. Click a job name and then a node to view monitoring information of the node.

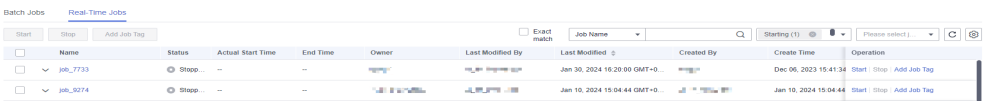
   Click **Edit** to access the job development page.

9.8.2.2 Monitoring a Real-Time Job

In the real-time processing mode, data is processed in real time, which is used in scenarios with high real-time performance. This type of job is a pipeline that consists of one or more nodes. You can configure scheduling policies for each node, and the tasks started by nodes can keep running for an unlimited period of time. In this type of job, lines with arrows represent only service relationships, rather than task execution processes or data flows.

You can choose **Monitor Job** and click the **Real-Time Job Monitoring** tab to view the job status, start time, and end time, and perform the operations listed in **Table 9-64**.

Figure 9-81 Real-time job monitoring page



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Table 9-64 Operations supported by real-time job monitoring

No.	Operation	Description
1	Filtering jobs by **Job Name**, **Owner**, **CDM Job**, or **Node Type**	N/A
2	Filtering jobs based on the job status or job tag	N/A
3	Perform operations on jobs in a batch	Select jobs and perform batch operations on them, including starting, stopping, and adding tags to them.
4	Viewing job instance status	Click job in front of the name. The **Last Instance** page is displayed. You can view information about the last instance of the job.
5	Job status-related operations	In the **Operation** column of a job, you can start, pause, recover, stop, rerun, and add tags to it.
6	Adding a job tag	Click **Add Job Tag**. The **Add Job Tag** dialog box is displayed.
7	Viewing node information of a job	Click a job name. On the displayed page, click a node to view its associated job/scripts and monitoring information. **NOTE** If event-driven scheduling is configured for a node in the job, the subjob monitoring page is displayed when you click the node.
8	Disabling and restoring a node	Click a job name. On the displayed page, right-click a node and select **Disable**. After the node is disabled, you can right-click it and select **Restore** to restore it on another location. For details, see **Real-Time Job Monitoring: Disabling and Restoring a Node**.
9	Viewing the boot log	Click a job name. On the displayed page, right-click a node and select **View Run Log** to view logs of the node.
10	Configuring scheduling	Click a job name. On the displayed page, right-click the node where event-driven scheduling is configured and select **Configure Scheduling** to modify the scheduling information about the node. For details, see **Real-Time Job Monitoring: Configuring Scheduling for a Node Where Event-driven Scheduling Is Configured**.

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No.	Operation	Description
11	Clearing stream messages	Click a job name. On the displayed page, right-click the node where event-driven scheduling is configured and select **Clear Stream Message**.
12	Viewing logs	For real-time processing single-task Flink SQL and Flink JAR jobs, you can Click **More** and select **View Log** to view the logs of the jobs. **NOTE** This function is unavailable if the MRS cluster version is not supported.

Click a job name. On the displayed page, view the job parameters, properties, and instances.

Click a node of a job to view the node properties, script content, and node monitoring information. On the **Nodes** tab page, you can view the run logs of the real-time job.

In addition, you can view the current job version and status, start, rerun, and develop jobs, determine whether to display metric monitoring, and set the job refresh frequency.

Real-Time Job Monitoring: Disabling and Restoring a Node

You can disable a node in a real-time job and restore it in another location.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. On the **Real-Time Job Monitoring** tab page, click a job name.
5. On the displayed page, right-click the node and select **Disable**.
6. Right-click the node and choose **Resume** from the shortcut menu. The **Resume Node Running** dialog box is displayed, as shown in **Table 9-65**.

Table 9-65 Resumption parameters

Parameter	Description
Last Paused	Start time when a node is suspended.
Tasks Not Run	Number of tasks that are not running during node suspension.

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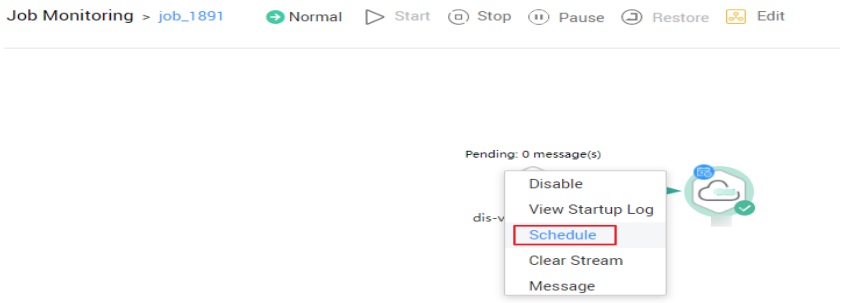
Parameter	Description
Run From	Parameters for performing the tasks generated during the pause period. Position from which running restarts. • Paused node • The first node of the subjob
Concurrent Tasks	Parameters for performing the tasks generated during the pause period. Number of tasks to be processed.
Task Name	Parameters for performing the tasks generated during the pause period. Task to be resumed.

Real-Time Job Monitoring: Configuring Scheduling for a Node Where Event-driven Scheduling Is Configured

If event-driven scheduling is configured for a node in a real-time job, right-click the node on the job monitoring details page and choose **Configure Scheduling** from the shortcut menu to view and modify the scheduling information about the node.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.
4. On the **Real-Time Job Monitoring** tab page, click a job name.
5. On the displayed page, right-click the node where event-driven scheduling is configured, select **Configure Scheduling**, and configure the parameters shown in **Table 9-66**.

Figure 9-82 Configuring scheduling



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Table 9-66 Policy parameters

Parameter	Description
Concurrent Events	Number of jobs that can be concurrently processed. The maximum number of concurrent events is 10.
Event Detection Interval	Interval for event detection. The unit of the interval can be **Seconds** or **Minutes**.
Failure Policy	Select a policy to be performed after scheduling fails. • Stop scheduling • Ignore failure and proceed

9.8.3 Instance Monitoring

Each time a job is executed, a job instance record is generated. In the navigation pane of the DataArts Factory console, choose **Monitoring**. On the Monitor Instance page, you can view the job instance information and perform more operations on instances as required.

You can search for instances by **Job Name**, **Created By**, **Owner**, **CDM Job**, **Node Type**, and **Job Tag**. Search by CDM job is to search for job instances by node. In addition, you can filter job instances by status or scheduling mode.

Performing Job Instance Operations

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation pane on the left of the DataArts Factory page, choose **Monitoring** > **Monitor Instance**
4. You can stop, rerun, or continue to execute instances or make instances succeed. For details, see **Table 9-67**.

   When multiple instances are rerun in batches, the sequence is as follows:

   – If a job does not depend on the previous schedule cycle, multiple instances run concurrently.

   – If jobs are dependent on their own, multiple instances are executed in serial mode. The instance that first finishes running in the previous schedule cycle is the first one to rerun.
5. **Table 9-67** describes the operations that can be performed on the instance.

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Table 9-67 Instance monitoring operations

Operation	Description
Searching for jobs by **Job Name**, **Created By**, or **Owner**	If you select **Exact search**, exact search by job name is supported. If you do not select **Exact search**, fuzzy search by job name is supported.
Filtering jobs by **CDM Job**, **Job Tag**, or **Node Type**	N/A
Stop	Stop an instance that is in the **Waiting**, **Running**, or **Abnormal** state.
Rerun	Rerun a subjob instance that is in the **Succeed** or **Canceled** state. For details, see **Rerunning Job Instances**. **NOTE** • Manually scheduled jobs cannot be rerun. • In enterprise mode, developers cannot rerun job instances. If instances need manual confirmation before they are executed, they are in waiting confirmation state when they are being rerun. When you click **Execute**, the instances are in waiting execution state.
Manual Retry	Retry abnormal instances.
Continue	Continue to run subsequent nodes in instances which are in abnormal state.
Succeed	Change the statuses of instances in **Abnormal**, **Canceled**, or **Failed** state to **Forcibly successful**.
Confirm Execution	Confirm executing instances in pending confirmation state.
Execute Job Without Dependency	Select job instances that have dependency relationships and execute them.
More > Manual Retry	Retry abnormal instances.
More > View Waiting Job Instance	When the instance is in the waiting state, you can view the waiting job instance. Click **Remove Dependency** in the **Operation** column to remove dependency on an upstream instance.
More > Confirm Execution	Confirm executing instances in pending confirmation state.

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Operation	Description
More > Continue	If an instance is in the **Abnormal** state, you can click **Continue** to begin running the subsequent nodes in the instance. **NOTE** This operation can be performed only when **Failure Policy** is set to **Suspend the current job execution plan**. To view the current failure policy, click a node and then click **Advanced Settings** on the **Node Properties** page.
More > Succeed	Forcibly change the status of an instance from **Abnormal**, **Canceled**, or **Failed** to **Succeed**.
More > Execute Job Without Dependency	Execute job instances that have dependency relationships.
More > View	Go to the job development page and view job information.
More > History performance	You can view the historical performance of a job instance.
More > View Rerun History	You can view the job instance rerun records. This is possible only if the job instance has rerun at least once.
More > Execute Preferentially	Preferentially execute job instances.
DAG	Display the DAG so that you can view the dependency between job instances and perform O&M operations on the DAG. For details, see **Viewing the DAG**.
Export All Data	Click **Export All Data**. In the displayed **Export All Data** dialog box, click **OK**. After the export is complete, go to the **Download Center** page to view the exported data. If the default storage path is not configured, you can set a storage path and select **Set as default OBS path** in the **Export to OBS** dialog box. A maximum of 30 MB data can be exported. If there are more than 30 MB data, the data will be automatically truncated. The exported job instances map job nodes. You cannot export data by selecting job names. Instead, you can select the data to be exported by setting filter criteria.

6. Click in front of an instance. The running records of all nodes in the instance are displayed.
7. **Table 9-68** describes the operations that can be performed on the node.

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Table 9-68 Operations (node)

Operation	Description
View Log	View the log information of a node. You can control access to the test run logs. For example, after user A performs a test, user A can view the test run logs on the **Monitor Instance** page, but user B cannot.
Manual Retry	Retry a failed node. Retry an abnormal node. **NOTE** This operation can be performed only when **Failure Policy** is set to **Suspend the current job execution plan**. To view the current failure policy, click a node and then click **Advanced Settings** on the **Node Properties** page.
Succeed	Change the status of a node from **Failed** to **Succeed**. **NOTE** This operation can be performed only when **Failure Policy** is set to **Suspend the current job execution plan**. To view the current failure policy, click a node and then click **Advanced Settings** on the **Node Properties** page.
More > Skip	To skip a node that is to be run or that has been paused, click **Skip**. **NOTE** Instance with only one node cannot be skipped. Only instances with multiple nodes can be skipped.
More > Pause	When a job instance is in running state and a node is in waiting execution state, you can pause the node. Subsequent nodes will be blocked.
More > Resume	To resume a paused node, click **Resume**.
More > History performance	You can view the historical performance of a job node.

Rerunning Job Instances

NOTE

In enterprise mode, developers cannot rerun job instances.

You can rerun a job instance that is successfully executed or fails to be executed by setting its rerun position.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

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3. In the navigation pane on the left of the DataArts Factory page, choose **Monitoring** > **Monitor Instance**
4. Locate a job and click **Rerun** in the **Operation** column to rerun a job instance. Alternatively, select the check boxes to the left of job names and click **Rerun** above the job list to rerun multiple job instances.

Figure 9-83 Rerunning a job instance

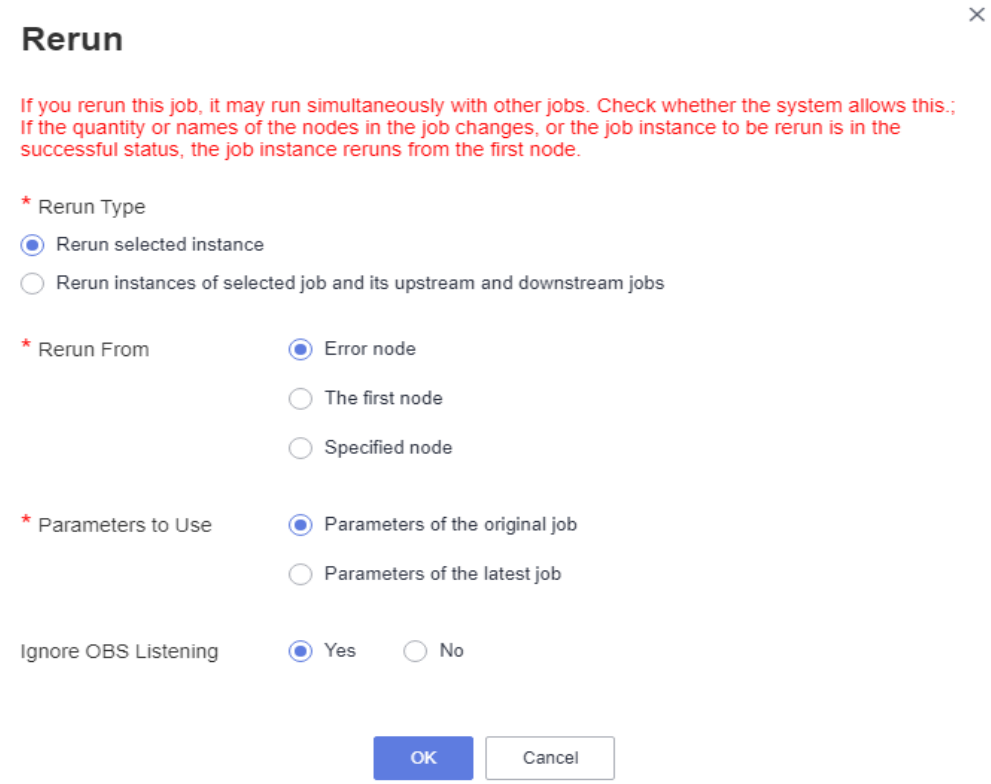
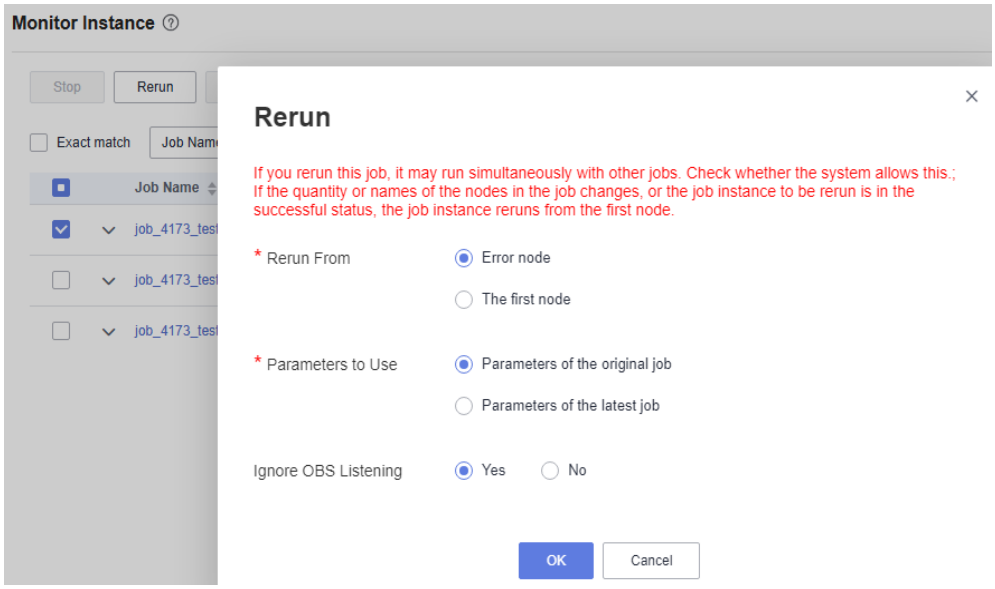


Figure 9-84 Rerunning job instances



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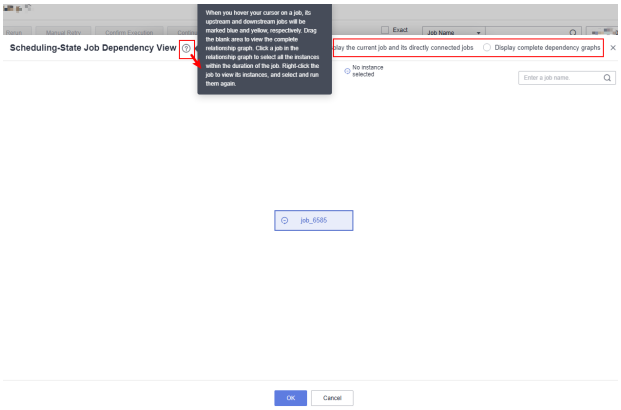
NOTE

When rerunning multiple job instances, you only need to set **Rerun From**, **Parameters to Use**, and **Ignore OBS Listening**.

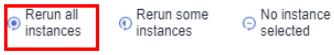
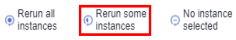
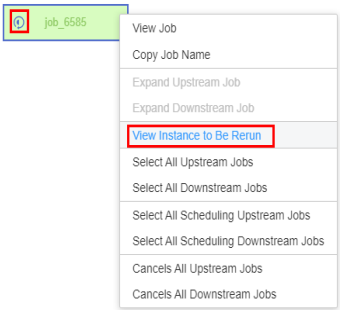
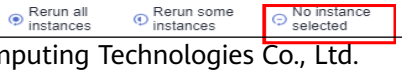
Table 9-69 Parameters for rerunning a job

Parameter	Description
Rerun Type	Type of the instance that you want to rerun. • Rerun selected instance • Rerun instances of selected job and its upstream and downstream jobs
Start Time	This parameter is required only when **Rerun Type** is set to **Rerun instances of selected job and its upstream and downstream jobs**. After you set the start time and end time, the system will rerun all the job instances in the specified period. **NOTE** If no job instance can be rerun in the specified period, error message "Job xxx have no instances to rerun" will be displayed.

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Parameter	Description
List of Rerun Job Instances	This parameter is required only when **Rerun Type** is set to **Rerun instances of selected job and its upstream and downstream jobs**. You can select **Display the current job and its directly connected jobs** or **Display complete dependency graphs** in the **Scheduling-State Job Dependency View** dialog box. The job dependency view is displayed. You can enter a job name to query the job dependency. **Figure 9-85** Job Dependency page  Select the job to rerun and its upstream and downstream jobs. You can select multiple jobs at a time.

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Parameter	Description
	NOTE If you hover over the question mark on the right of **Scheduling-State Job Dependency View**, the following information is displayed: • When you hover your cursor on a job, its upstream and downstream jobs will be marked blue and yellow, respectively. • Drag the blank area to view the complete relationship graph. • Click a job in the relationship graph to select all the instances within the duration of the job. **Figure 9-86** Rerunning all instances   • Right-click the job to view its instances, and select and run them again. **Figure 9-87** Rerunning some instances   • If no job instance is selected, **No instance selected** is displayed. **Figure 9-88** No instance selected 

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Parameter	Description
	For detailed operations on the job dependency graph, see **Batch Job Monitoring: Viewing a Job Dependency Graph**.
Rerun From	Start position from which the job instance reruns. • **Error node**: When a job instance fails to be run, it reruns since the error node of the job instance. • **The first node**: When a job instance fails to be run, it reruns since the first node of the job instance. • **Specified node**: When a job instance fails to run, it reruns since the node specified in the job instance. This option is available only if **Rerun Type** is set to **Rerun selected instance**. **NOTE** A job instance reruns from its first node if either of the following cases occurs: • The quantity or name of a node in the job changes. • The job instance has been successfully run.
Parameters to Use	• Parameters of the original job • Parameters of the latest job
Concurrent Instances	This parameter is required only when **Rerun Type** is set to **Rerun instances of selected job and its upstream and downstream jobs**. It indicates the number of job instances that can be concurrently processed. The value cannot be less than 1. The default value is **1**.
Ignore OBS Listening	The default value is **Yes**. • **Yes**: The system does not listen to the OBS path when rerunning the job instance. • **No**: The system listens to the OBS path when rerunning the job instance. **NOTE** If this parameter is not used, ignore it.

Viewing the DAG

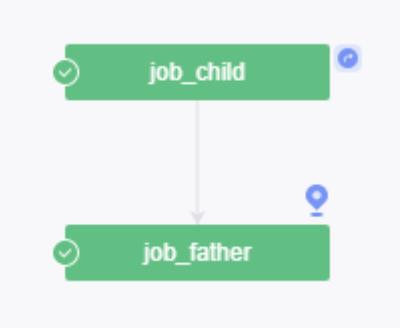
You can view the dependency between job instances and perform O&M operations on the DAG.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

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2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation pane on the left of the DataArts Factory page, choose **Monitoring** > **Monitor Instance**
4. Locate the row that contains a job and click **DAG** in the **Operation** column.

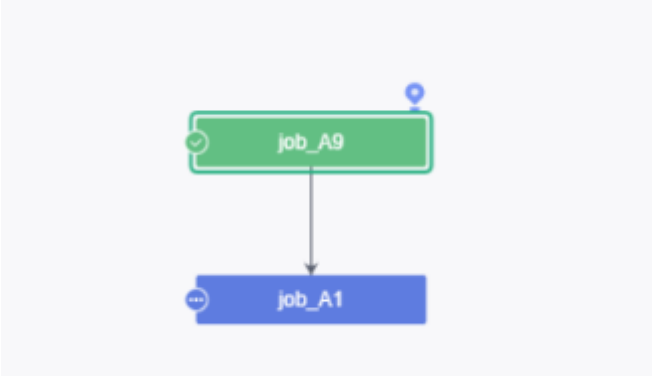
Figure 9-89 DAG



By default, the DAG displays the current job instance and its upstream and downstream job instances. It supports the following operations:

- Click  in the upper right corner of the DAG to restore the DAG to the initial state, and click  to close the DAG. Drag  in the upper left corner of the DAG to change its width.
- Click a job instance to select it.

Figure 9-90 Selecting a job instance



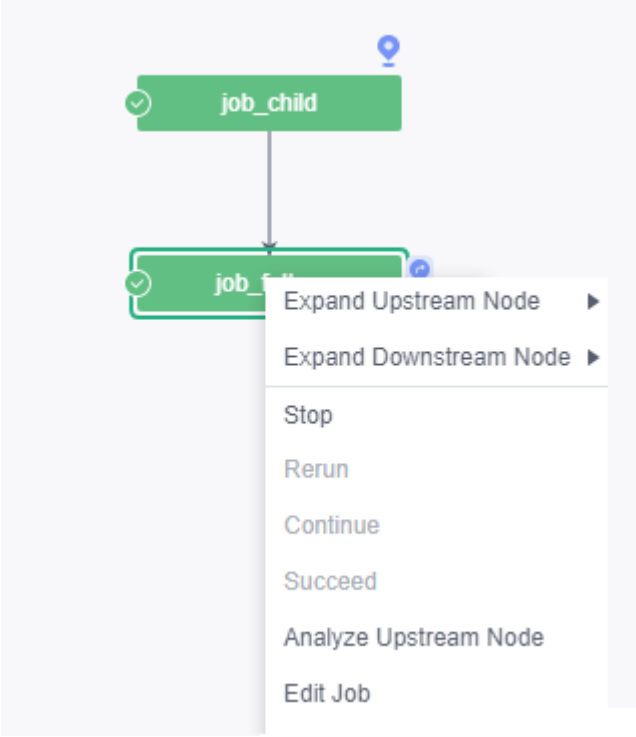
  - When a job instance is selected, the background colors of the job instance and its upstream and downstream instances are darkened.
  - Brief information about the instance is displayed in the lower right corner of the DAG. The instance name and ID can be directly copied.
  - Click **Show Details** to open the details panel, which displays information such as the instance attributes, job parameters, node list, and historical instances. You can adjust the height of the panel or close it.

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- Click the blank area to deselect the job instance.

– Right-click a job instance to expand its upstream and downstream job instances. You can stop, rerun, continue to execute instances, forcibly make instances succeed, analyze the upstream node, and edit the job.

Figure 9-91 Performing operations on job instances

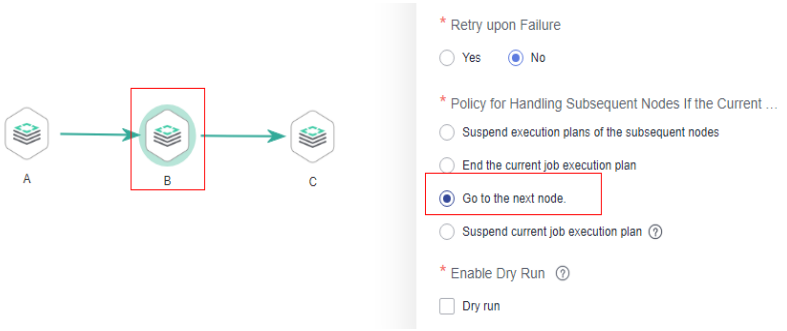
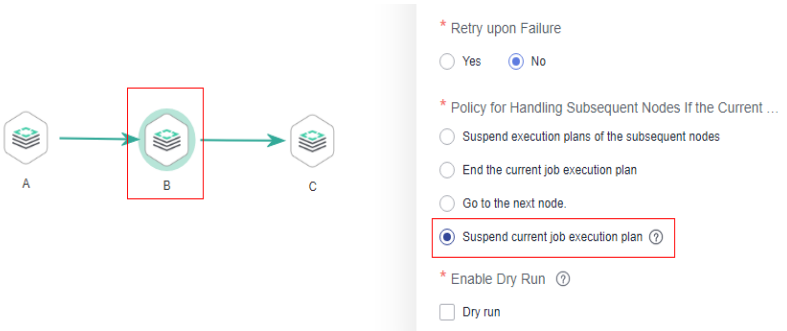


Job Instance Statuses

Table 9-70 Job instance statuses

Status	Description
Waiting	A job instance is in waiting state if the execution of its dependent job instances is not complete, for example, no instance has been generated, instances are waiting to be executed, or instances fail to be executed.
Running	A job is running. All of its dependent jobs have been executed successfully.
Successful	The service logic of a job is successfully executed (including the success of retry upon failure). Successful execution statuses include **Successful**, **Forcibly successful**, and **Failure ignored**.
Forcibly successful	A job instance in failed or canceled state is made successful.

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Status	Description
Failure ignored	As shown in the following figure, a failure handling policy is configured to skip node B and continue to execute node C if node B fails. When the job is executed successfully, the job instance is in **Failure ignored** state. **Figure 9-92** Failure handling policy – Go to the next node 
Abnormal	There are few scenarios where this status is displayed. As shown in the following figure, a failure handling policy is configured to suspend the job instance immediately without continuing to execute node C. In this case, the job instance is in **Abnormal** state. **Figure 9-93** Failure handling policy – Suspend current job execution plan 
Paused	There are few scenarios where this status is displayed. When a running job instance is suspended by the test personnel, the instance is in **Paused** state.
Canceled	• If you manually stop a job instance in **Waiting** state, the job instance status becomes **Canceled**. • If you stop scheduling the upstream job on which a job instance depends, the job instance status becomes **Canceled**. For example, job A depends on job B. If you stop scheduling job B, the instance generated for job A is automatically canceled.

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Status	Description
Frozen	If a job instance is expected to be generated in the future, the job instance is in frozen state after being frozen.
Failed	A job fails to be executed. If a job fails to be executed, you can view the failure cause, for example, a node of the job fails to be executed.

9.8.4 Monitoring PatchData

In the navigation tree of the DataArts Factory console, choose **Monitoring** > **Monitor PatchData**.

On the , you can view the PatchData job status, date, number of parallel periods, PatchData job name, creator, creation time, and stop a running job. You can filter jobs by PatchData name, creator, date, and status.

On the , click PatchData name. On the displayed page, you can view the PatchData execution status. For more information, see **Batch Job Monitoring: PatchData**.

NOTE

- PatchData can be sorted by plan time, start time, and end time. Note that only one of the three sorting modes takes effect at a time.
- Click the sorting icon once to sort PatchData in ascending order, click the sorting icon twice to sort PatchData in descending order, and click the sorting icon three times to cancel sorting.
- When viewing a waiting job instance, click **Remove Dependency** in the **Operation** column to remove dependency on an upstream instance.
- If a PatchData task fails, you can click **Operation** and select **Stop** to stop the task.
- On the PatchData details page, you can perform a fuzzy search of PatchData jobs by job name.
- If job instances need manual confirmation before they are executed, they are in waiting confirmation state on the **Monitor PatchData** page. When you click **Execute**, the job instances are in waiting execution state.

9.8.5 Notification Management

DataArts Studio uses Simple Message Notification (SMN) to send push notifications based on your subscription requirements, so that you can receive immediate notifications when a job encounters an exception or runs successfully.

9.8.5.1 Managing Notifications

You can configure job notification tasks to notify you of job success or failures.

Configuring a Notification

Before configuring a notification for a job:

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- Message notification has been enabled and a topic has been configured.
- A job not in **Not Activated** status has been submitted.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation pane on the DataArts Factory page, choose **Monitoring** > **Manage Notification**.
4. On the **Manage Notification** tab page, click **Configure Notification**. In the displayed dialog box, configure parameters. **Table 9-71** describes the parameters.

Figure 9-94 Configuring notifications

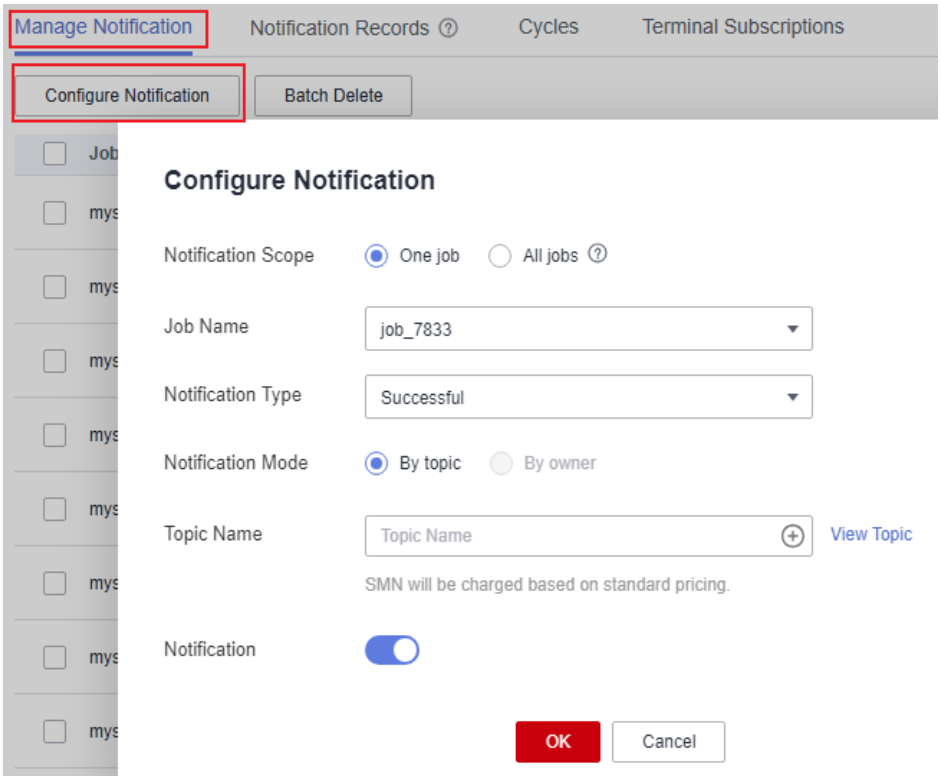


Table 9-71 Notification parameters

Parameter	Mandatory	Description
Notification Scope	Yes	Notification scope. Available options include: • **One job**: Notifications are sent for a single job. • **All jobs**: Notifications are sent for all jobs. All jobs include existing jobs and new jobs.
Job Name	Yes	Name of the job.

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Parameter	Mandatory	Description
Notification Type	Yes	Type of the notification. • When **Notification Scope** is **One job**, available options for this parameter include: – **Abnormal**: When a job is not running properly or fails, a notification is sent to notify the user of the abnormality. You can set **Max. Notifications** and **Min. Notification Interval (min)**. After a job encounters an exception or fails and before it is recovered, you can send the interval for sending alarm notifications. **NOTE** You can set **Max. Notifications** to a value from 1 to 50. If the default value **1** is used, **Min. Notification Interval (min)** is unavailable. You can set **Min. Notification Interval (min)** to a value from 5 to 60. – **Successful**: When a job runs successfully, a notification is sent to notify the user of the success. – **Uncompleted**: This function supports only the jobs scheduled by day. If the job execution time is later than the configured time by which the job has not finished, a notification is sent. – **Cancellation**: When a job is canceled, a notification is sent. **NOTE** An alarm notification is sent when a job being scheduled or a running job instance is manually stopped. If a user except the job executor cancels a job, a job cancellation alarm notification is sent. – **Successful rerun of a failed job** **NOTE** A notification will be sent after the successful rerun of a failed job only when a failure alarm was sent when the job failed. – Job modification A notification is sent when a job is modified or deleted, or the script used by the job is modified or deleted by a user except the job owner. If the job owner is empty, no alarm notification will be sent if the job is modified.

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Parameter	Mandatory	Description
		– **Busy resources**: If the DLI resource queue is busy during job execution, the job execution takes a long time or fails. As a result, an alarm is generated and a notification is sent. • When **Notification Scope** is **All jobs**, available options for this parameter include: – **Abnormal**: When a job is not running properly or fails, a notification is sent to notify the user of the abnormality. You can set **Max. Notifications** and **Min. Notification Interval (min)**. After a job encounters an exception or fails and before it is recovered, you can send the interval for sending alarm notifications. **NOTE** You can set **Max. Notifications** to a value from 1 to 50. If the default value **1** is used, **Min. Notification Interval (min)** is unavailable. You can set **Min. Notification Interval (min)** to a value from 5 to 60. – **Cancellation**: When a job is canceled, a notification is sent. **NOTE** An alarm notification is sent when a job being scheduled or a running job instance is manually stopped. If a user except the job executor cancels a job, a job cancellation alarm notification is sent. – **Successful rerun of a failed job** **NOTE** A notification will be sent after the successful rerun of a failed job only when a failure alarm was sent when the job failed. – Job modification A notification is sent when a job is modified or deleted, or the script used by the job is modified or deleted by a user except the job owner. If the job owner is empty, no alarm notification will be sent if the job is modified. – **Busy resources**: If the DLI resource queue is busy during job execution, the job execution takes a long time or fails. As a result, an alarm is generated and a notification is sent.

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Parameter	Mandatory	Description
		NOTE • For a real-time job, a notification is allowed to be sent only when the real-time job is in the **Run abnormally** or **Failed** state. For a batch job, a notification can be sent no matter when the batch job is in the **Run normally**, **Run abnormally**, or **Failed** state. • If you choose the default DLI resource queue, you may not be able to obtain the resources needed to perform operations because the queue is busy and other users may preempt resources. If this occurs, you may try again during off-peak hours or create a queue to run your workloads. • When a PatchData or test job is successfully executed, no notification is sent to avoid email or SMS bombing. In addition, no notification is sent when a PatchData job instance is recovered. • If a job is re-executed and succeeds after it fails, a job instance recovery notification is sent.
Notification Mode	Yes	• By topic • By owner **NOTE** If you select **By owner** but the job does not have an owner, notifications will be sent to the last modifier of the job by default. You are advised to select **By topic** or configure an owner for the job.
Topic Name	Yes	This parameter is mandatory only when **Notification Mode** is set to **By topic**. Select a notification topic. Click **View Topic** to go to the SMN page and view topics. **NOTE** Currently, only SMS, email, or HTTP are supported to subscribe to topics.

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Parameter	Mandatory	Description
Terminal Protocol	Yes	Before setting this parameter, ensure that a **job alarm notification topic** has been configured in the workspace default configuration. This parameter is mandatory only when **Notification Mode** is set to **By owner**. • SMS • Email • Phone Click **Verify Contact Information**. The system will check whether the job owner has been configured. If the job owner has not been configured, configure it by referring to **Managing Terminal Subscriptions**. Click **View Subscription**. The **Terminal Subscriptions** page is displayed, on which you can view the terminal subscriptions that have been configured. **NOTE** If the **Terminal Protocol** is **Phone** or **SMS**, the login user must be added to the SMN whitelist. Otherwise, the subscription cannot be added, and alarm notifications may fail to be sent.
Cc	Yes	This parameter is mandatory only when **Notification Mode** is set to **By owner**. You can select up to 10 options.
Notification	Yes	Whether to enable the notification function. The function is enabled by default.

5. Click **OK**.

   NOTE

   - The DataArts Factory module sends notifications through SMN. Using SMN may incur fees. For pricing details, contact the SMN support personnel.
   - Multiple message topics can be configured for a job. When the job is successfully executed or fails to be executed, notifications can be sent to multiple subscribers.

Editing a Notification

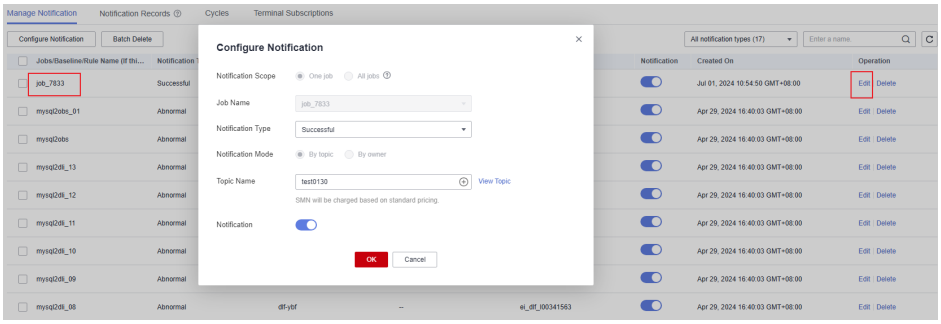
After a notification is created, you can modify the notification parameters as required.

1. In the navigation pane on the DataArts Factory page, choose **Monitoring** > **Manage Notification**.
2. Click the **Manage Notification** tab.

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3. In the **Operation** column of a notification, click **Edit**. In the displayed dialog box, edit notification parameters. **Table 9-71** lists the notification parameters.

Figure 9-95 Editing a Notification



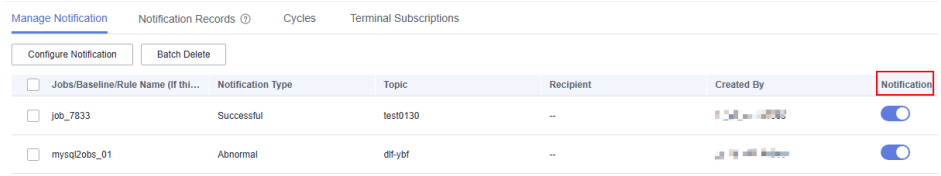
4. Click **Yes**.

Disabling a Notification

You can disable the notification function on the **Edit Notification** page or in the notification list.

1. In the navigation pane on the DataArts Factory page, choose **Monitoring** > **Manage Notification**.
2. Click the **Manage Notification** tab.
3. In the **Notification** column, click  . When it changes to  , the notification function is disabled.

Figure 9-96 Disabling a Notification



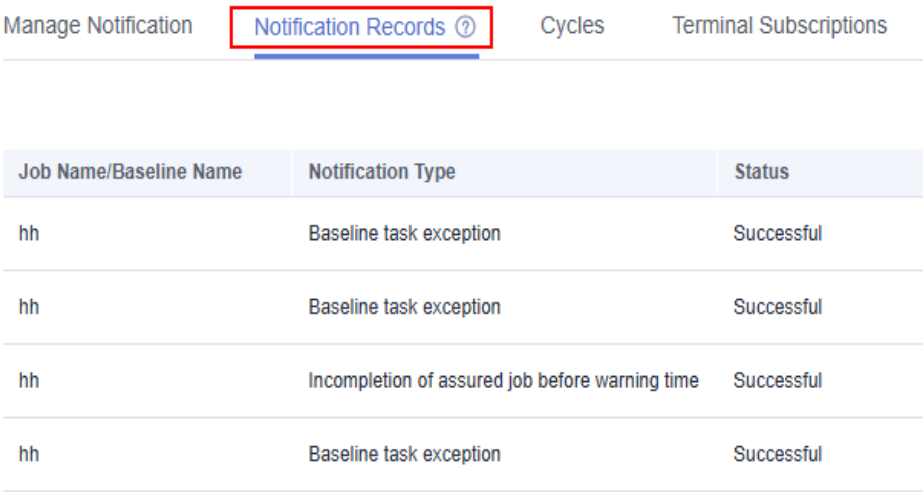
Viewing a Notification

You can view all notification information on the **Notification Records** tab page.

1. In the navigation pane on the DataArts Factory page, choose **Monitoring** > **Manage Notification**.
2. Click the **Notification Records** tab. You can only view data of the last 30 days.

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Figure 9-97 Viewing notification records

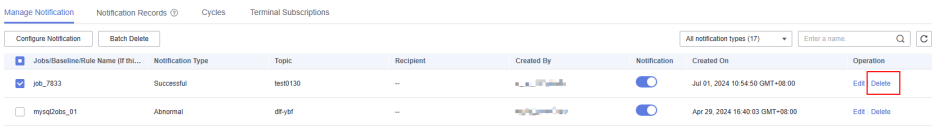


Deleting a Notification

If you no longer need a notification, perform the following operations to delete it:

1. In the navigation pane on the DataArts Factory page, choose **Monitoring** > **Manage Notification**.
2. Click the **Manage Notification** tab.
3. You can delete a notification in either of the following ways:

   Figure 9-98 Deleting a notification

   - In the **Operation** column of a notification, click **Delete**.
   - Select the notifications to delete and click **Batch Delete** above the notification list.
4. In the displayed dialog box, click **OK**.

9.8.5.2 Cycle Overview

Scenarios

Notifications can be set to specified personnel by day, week, or month, allowing related personnel to regularly understand job scheduling information about the quantity of successfully/unsuccessfully scheduled jobs and failure details.

Constraints

This function depends on OBS.

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Prerequisites

- Simple Message Notification (SMN) has been enabled, topics have been configured, and subscriptions have been added to the topics.
- Jobs are not in **Not started** status and have been submitted.
- OBS has been enabled and a folder has been created in OBS.

Creating a Notification

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation pane on the DataArts Factory page, choose **Monitoring** > **Manage Notification**.
4. On the **Cycles** tab page, click **Create Notification**. In the displayed dialog box, configure parameters. **Table 9-72** describes the notification parameters.

Figure 9-99 Create a notification

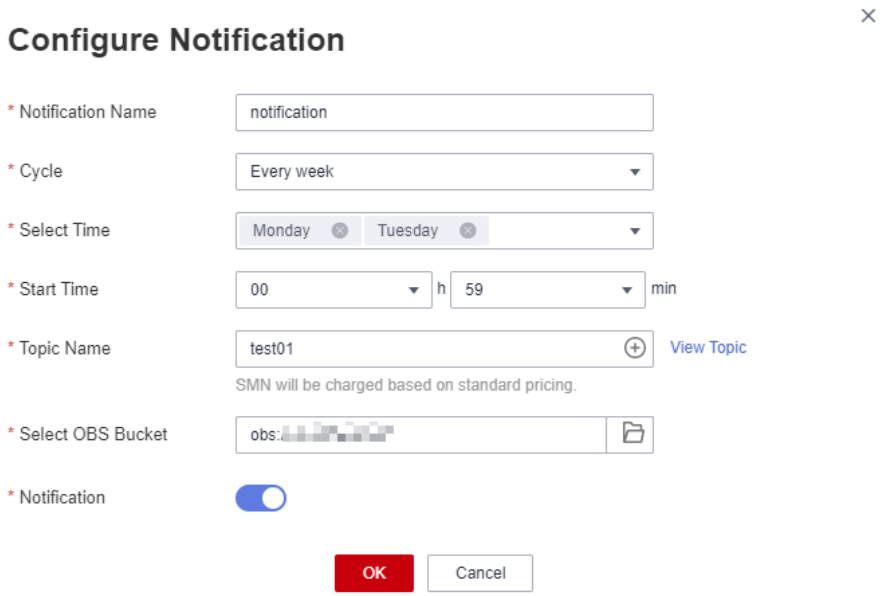


Table 9-72 Notification parameters

Parameter	Mandatory	Description
Notification Name	Yes	Name of the notification to be sent.

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Parameter	Mandatory	Description
Cycle	Yes	Interval for sending notifications, which can be set to **Daily**, **Weekly**, or **Monthly**. **NOTE** When **Cycle** is set to **Daily**, **Weekly**, or **Monthly**, a notification is sent every day, week, or month, and the notification content comes from the data generated from the last 24 hours, seven days, or 30 days.
Select Time	Yes	This parameter is mandatory when **Cycle** is set to **Weekly** or **Monthly**. Time when the notification is sent. • If **Cycle** is set to **Weekly**, the value can be any day or any several days from Monday to Sunday in a week. • If **Cycle** is set to **Monthly**, the value can be any day or any several days from 1st to 31st in a month.
Start Time	Yes	Point in time when the notification is sent. The value can be accurate to hour or minute.
Topic Name	Yes	Notification topic
OBS Bucket	Yes	OBS bucket for storing notification records
Notification	Yes	Whether to enable the notification function. The function is enabled by default.

5. Click **OK**.

   NOTE

   DataArts Factory sends notifications through SMN. Using SMN may incur fees. For pricing details, contact the SMN support personnel.

6. After the notification is created, you can perform the following operations on the notification:
   - Click **Edit**. In the **Create Notification** dialog box, edit the notification again.
   - Click **View Record**. In the **View Record** dialog box, view the job scheduling details.
   - Click **Delete**. In the **Delete Notification** dialog box, click **OK** to delete the notification.

9.8.5.3 Managing Terminal Subscriptions

Scenario

You can configure terminal subscriptions (SMS messages, emails, and phone calls) by owner. After configuring a subscription, you can use the Manage Notification

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function to configure a job notification task. When a job runs abnormally or successfully, notifications are sent to the configured owners.

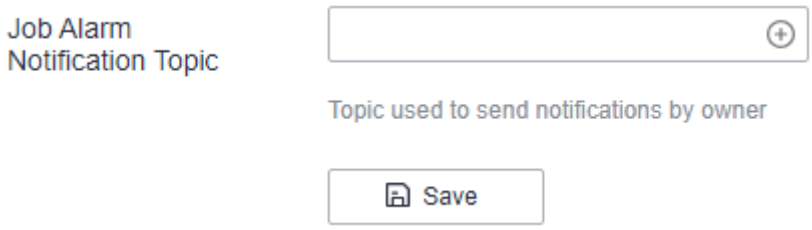
Prerequisites

Message notification has been enabled and a topic has been configured. Before configuring subscriptions by owner, ensure that you have set a **job alarm notification topic** for the workspace.

Creating a Notification

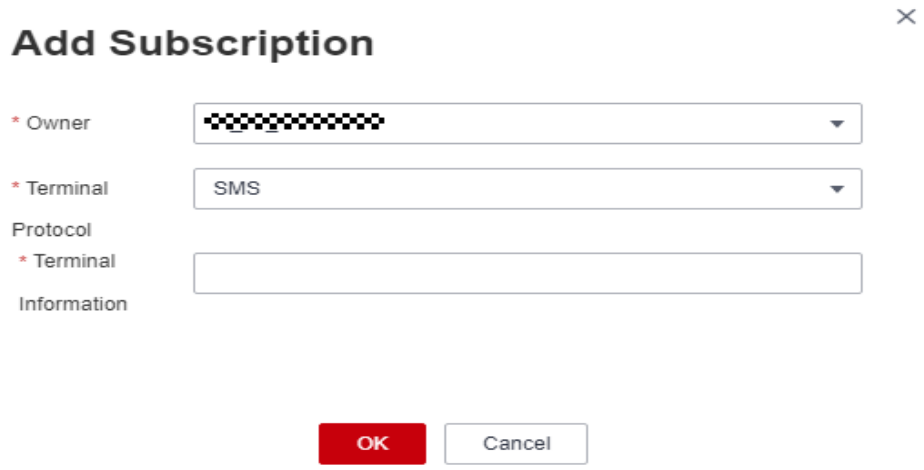
1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**. Choose **Default Configuration**. For details about how to configure alarm notification topics for workspace jobs by owner, see **Job Alarm Notification Topic**. If you have configured an alarm notification topic, skip this step.

   Figure 9-100 Setting Job Alarm Notification Topic

4. In the navigation pane on the DataArts Factory page, choose **Monitoring** > **Manage Notification**.
5. Click the **Terminal Subscriptions** tab and click **Add Subscription**. In the displayed dialog box, set required parameters.

   Figure 9-101 Adding a subscription

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Table 9-73 Parameters for adding a subscription

Parameter	Mandatory	Description
Owner	Yes	Set the subscription owner, which was configured during job creation.
Terminal Protocol	Yes	• SMS • Email • Phone
Terminal information	Yes	Set the information about the terminal.

6. Click **OK**.
7. After the terminal subscription is created, you can perform the following operations on the notification:
   - Click **Request Subscription**. In the displayed dialog box, the subscription status is **Unconfirmed**. After you click **OK**, the subscription status becomes **Confirmed**.
   - Click **Delete**. In the **Delete Subscription** dialog box, click **OK** to delete the subscription.

     NOTE

     You can request or delete subscriptions, but cannot edit them.
8. After the preceding operations are complete, configure job alarm notifications by owner on the **Managing Notifications** page.

9.8.6 Managing Backups

You can back up all jobs, scripts, resources, and environment variables at a specified interval.

You can also restore assets that have been backed up, including jobs, scripts, resources, and environment variables.

Constraints

- This function depends on OBS.
- Backup files cannot be automatically aged. You need to manually delete backup files on a regular basis.

Prerequisites

OBS has been enabled and a folder has been created in OBS.

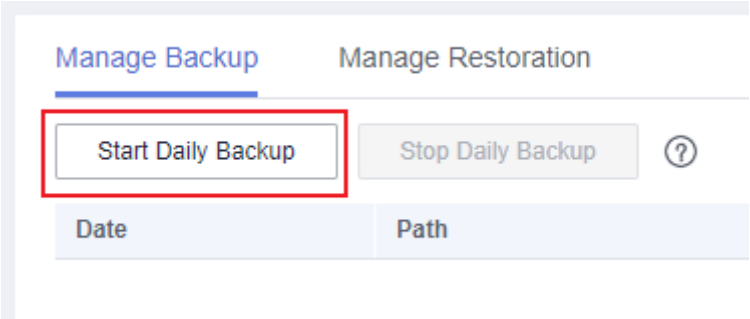
Backing Up Assets

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

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2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation tree on the left, choose **Manage Backup**.
4. Click **Start Daily Backup**. In the **Browse OBS File** dialog box, select an OBS folder.

Figure 9-102 Managing backup



NOTE

- Daily Backup starts at 00:00 every day to back up all jobs, scripts, resources, and environment variables of the previous day. The jobs, scripts, resources, and environment variables of the previous day are not backed up on the current day.
- If you select only the bucket name as the OBS storage path, the backup object is automatically stored in the folder named after the backup date. Environment variables, resources, scripts, and jobs are stored in the **1_env**, **2_resources**, **3_scripts**, and **4_jobs** folders, respectively.
- After the backup is successful, the **backup.json** file is automatically generated in the folder named after the backup date. The file stores job information based on the node type and can be modified before job restoration.
- To stop daily backup, click **Stop Daily Backup**.

Restoring Assets

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 2 In the navigation tree of the DataArts Factory console, choose **Manage Backup**.

Step 3 On the **Manage Restoration** tab, click **Restore Backup**.

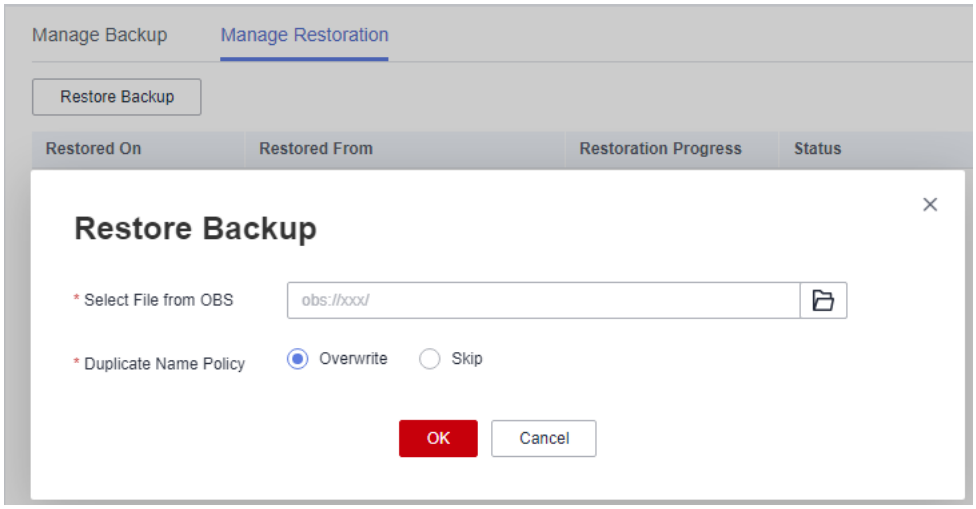
In the **Restore Backup** dialog box, select the storage path of the asset to be restored from the OBS bucket and set the duplicate name policy.

NOTE

- The storage path is the file path generated in **Backing Up Assets**.
- Before restoring assets, you can modify the **backup.json** file in the backup path. You can change the connection name (connectionName), database name (database), and cluster name (clusterName).

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Figure 9-103 Restoring assets



Step 4 Click **OK**.

----End

9.8.7 Operation History

You can view historical operations on the **Operation History** page. The system stores data for a maximum of three months and automatically deletes older data.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane of the DataArts Factory console, choose **Monitoring** > **Operation History**.
4. You can perform the following operations on this page:
   - Filter out historical operations in a specified time period.
   - Filter out historical operations related to job names or node names by involved object.
   - Perform a fuzzy search of historical operations.
   - Filter out historical operations by operation object, operation type, operators, or status.

9.9 Configuration and Management

9.9.1 Configuring Resources

9.9.1.1 Configuring Environment Variables

This topic describes how to configure and use environment variables.

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Application Scenario

Configure job parameters. If a parameter belongs to multiple jobs, you can extract this parameter as an environment variable. Environment variables can be imported and exported.

NOTE

The roles that can configure workspace environment variables in the simple and enterprise mode are as follows:

Simple mode: Both developers and administrators can create and edit environment variables in a workspace. This mode does not distinguish the development environment from the production environment. Developers can modify environment variables.

Enterprise mode: Only administrators can create or edit environment variables in a workspace.

Importing Environment Variables

This function is available only if the OBS service is available. If OBS is unavailable, variables can be imported from the local PC.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

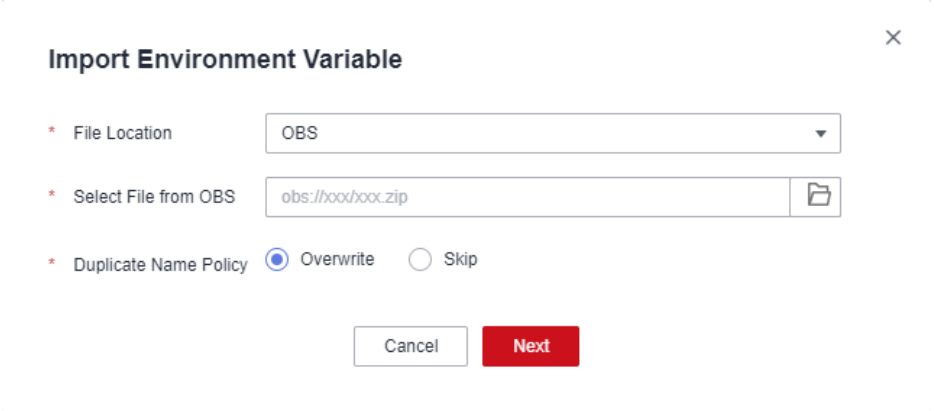
Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation tree on the left, choose **Specifications**.

Step 4 Click **Environment Variables**. On the **Environment Variables** page, click **Import**.

Step 5 In the **Import Environment Variable** dialog box, select an environment variable file from OBS or a local path and the duplicate name policy.

Figure 9-104 Importing Environment Variables



----End

Exporting Environment Variables

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

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Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation tree on the left, choose **Specifications**.

Step 4 Click **Environment Variable**. On the **Environment Variable** page, click **Export** to export environment variables.

----End

Configuration Method

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation tree on the left, choose **Specifications**.

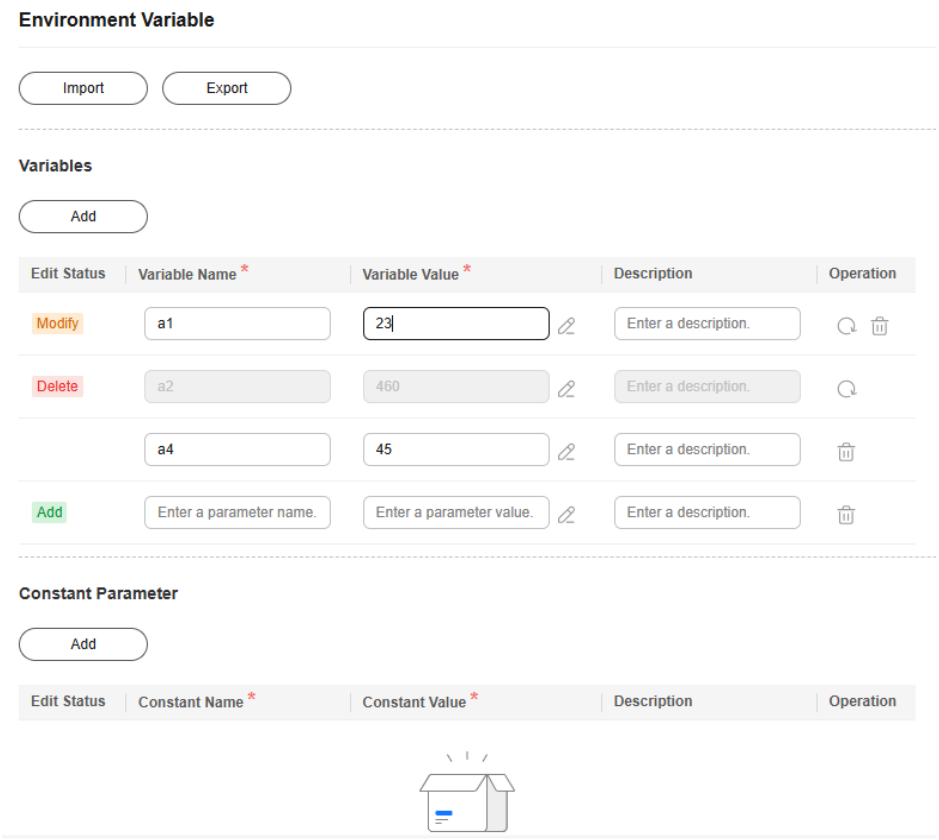
Step 4 On the **Environment Variable** page, set the variables or constants listed in **Table 9-74** and click **Save**.

NOTE

The difference between a variable and a constant lies in whether their values need to be reconfigured when they are imported to another workspace or project.

- The value of a variable (such as **workspace name**) varies depending on the workspace. When exporting a variable from a workspace and import it to another workspace, you must reconfigure its value.
- The value of a constant in different workspaces is the same. When importing a constant to another workspace, you do not need to reconfigure its value.

Figure 9-105 Configuring environment variables



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Table 9-74 Configuring environment variables

Parameter	Mandatory	Description
Parameter	Yes	The parameter name must be unique, consist of 1 to 64 characters, and contain only letters, digits, underscores (_), and hyphens (-). The parameter name must be in the format set in **Configuring Script Variables**. For example, if the format set in the script variable definition is **${dlf.}**, the parameter name must be set to **dlf.***xxx*.
Value	Yes	Parameter values support constants and EL expressions but do not support system functions. For example, **123** and **abc** are supported. If the parameter value is a string, add double quotation marks (""), for example, **"05"**. For details about how to use EL expressions, see **Expression Overview**.
Description	No	Parameter description

You can add, modify, delete, and reset environment variables.

- Add an environment variable: Click **Add**. After an environment variable is added, **Add** is displayed for it.
- Edit an environment variable: If the parameter value is a constant, change the parameter value in the text box. If the parameter value is an EL expression, click  next to the text box to edit the EL expression. Click **Save**. After an environment variable is modified, **Modify** is displayed for it.
- Delete an environment variable: Click **Delete** next to the parameter value text box. After an environment variable is deleted, **Delete** is displayed for it.
- Reset an environment variable: When modifying or deleting an environment variable, you can click **Reset** in the **Operation** column to reset the variable value to the original value.

----End

How-Tos

The configured environment variables can be used in either of the following ways:

1. ${Environment variable}
2. #{Evn.get("Environment variable")}

Example

Context:

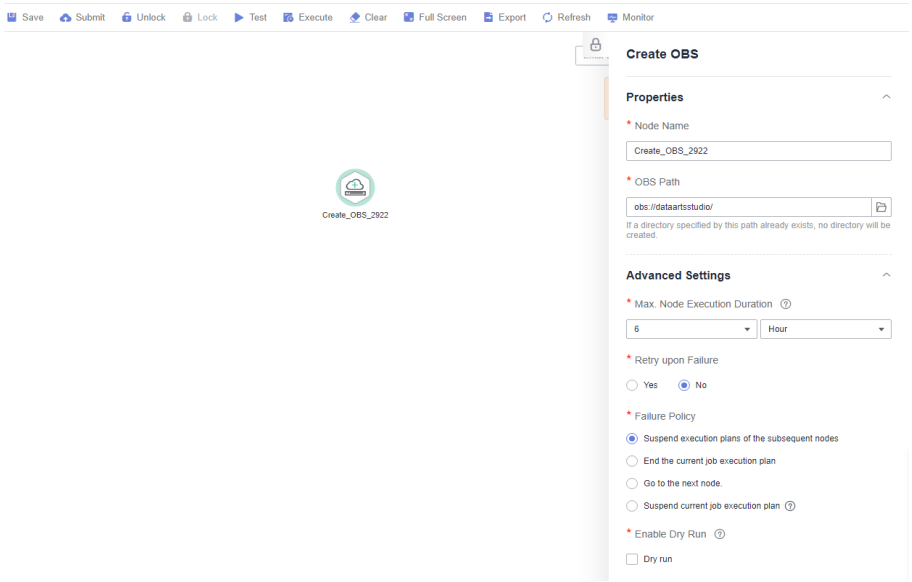
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- A job named **test** has been created in the DataArts Factory module.
- An environment variable has been added. The parameter name is **job** and the parameter value is **123**.

Step 1 Open **test** and drag a **Create OBS** node from the node library.

Step 2 On the **Node Properties** tab page, configure the node properties.

Figure 9-106 Configuring parameters for the Create OBS node



Step 3 Click **Save** and then **Monitor** to monitor the running status of the job.

----End

9.9.1.2 Configuring an OBS Bucket

The execution history of scripts, jobs, and nodes is stored in OBS buckets. If no OBS bucket is available, you cannot view the execution history. This section describes how to configure an OBS bucket.

Constraints

The OBS path is only supported for OBS buckets and not for parallel file systems.

Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

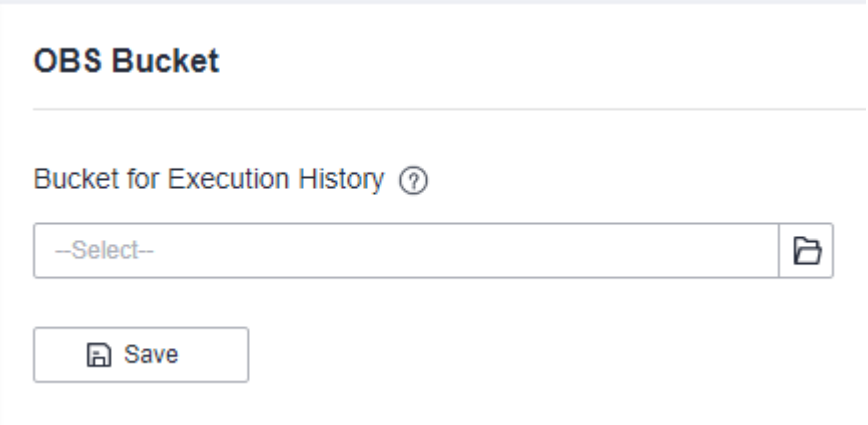
Step 3 In the navigation pane, choose **Configuration** > **Configure**.

Step 4 Choose **OBS Bucket**.

Step 5 Select an OBS bucket.

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Figure 9-107 Configuring an OBS bucket



Step 6 Click **Save**.

----End

9.9.1.3 Managing Job Tags

Job tags are used to label jobs of the same or similar purposes to facilitate job management and query. This section describes how to manage job tags, including adding, deleting, importing, and exporting tags.

Adding a Job Tag

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation pane, choose **Configuration** > **Configure**.

Step 4 Choose **Job Tag**.

Step 5 Click **Add**. In the displayed dialog box, enter a tag name and click **OK**.

NOTE

You can add a maximum of 100 job tags.

----End

Deleting a Job Tag

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Job Tag**.

Step 3 Locate the tag you want to delete and click **Delete** in the **Operation** column. In the displayed dialog box, click **OK**.

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NOTE

A locked tag cannot be deleted. For details about how to unlock a tag, see **Locking and Unlocking a Job Tag**.

----End

Monitoring Jobs with a Specified Tag

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Job Tag**.

Step 3 Locate a tag and click **Monitor** in the **Operation** column. The **Monitor Job** page is displayed, on which all the jobs with the tag are displayed.

----End

Locking and Unlocking a Job Tag

To perform these operations, you must have the **DAYU Administrator**, **Tenant Administrator**, or workspace administrator permission.

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Job Tag**.

Step 3 Locate a tag and click **Lock** or **Unlock** in the **Operation** column.

NOTE

- A locked job tag cannot be deleted.
- Importing a locked tag will fail.
- A locked tag cannot be added to or removed from a job.
- Importing a job with a locked tag will fail.
- When a job fails to be imported and a tag needs to be automatically generated, if the tag already exists and is locked, it will not be added to the job.

----End

Importing Job Tags

To perform these operations, you must have the **Administrator**, **Tenant Administrator**, or workspace administrator permission.

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Job Tag**.

Step 3 Click **Import Job Tag**.

Step 4 In the displayed dialog box, set the following parameters:

- **File Location**: Select **Local** or **OBS**.
- **Select File from Local/OBS**: Select a local path or an OBS bucket path.

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NOTE

- You are advised to obtain a file to import by exporting tags. The first row of the file is the tag name, and the first column is the job name. If a job has a specified tag, the value in the corresponding cell is 1. Otherwise, the value is 0. If a cell is empty, the system uses value 0 for the cell.
- The maximum size of the file to be imported is 10 MB.
- If the file to be imported contains two tags with the same name, and the ID of one tag is 0 and that of the other tag is 1, the system uses 1 as the tag ID.
- If the file to be imported contains two jobs with the same name, the system identifies the job in the latter row and uses the tag ID in this row.

- **Mode**: Select **Append** or **Overwrite**.
  - **Append**: The new tag will not overwrite the existing one.
  - **Overwrite**: The new tag will overwrite the existing one.

Step 5 Click **OK**.

----End

Exporting Job Tags

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Job Tag**.

Step 3 Export tags.

- To export all tags, click **Export All Tags** above the tag list.
- To export some tags, select them and click **Export Selected Tags** above the tag list.

The following figure shows the exported job tags.

Figure 9-108 Exporting job tags

	A	B	C	D	E	F
1	jobName	DWS_TRANSFORM	Invalid clust	The MRS cluster na	The cluster associated w	The cluster associat
2	job_foreach	1	0	1	0	1
3	job_real	0	0	1	1	0
4	job_weituo	0	1	0	0	1
5	job_subjob	1	1	0	1	0
6	job_ETL_dli2dws	0	0	1	1	1
7	job_foreach_copy	1	0	0	1	1
8	job_ETL_copy	0	0	1	0	0
9	guowangTest	1	1	0	0	1
10	guowangTest_qjxtest	1	0	0	0	0
11	qjxForeach	1	0	1	1	1
12	job_timlx_1	0	1	1	0	0
13	job_timlx_2	0	0	0	0	1
14	guowangTest_copy_hdfs2hiv	0	0	1	0	0

NOTE

- In the exported file, the first row is the tag name, and the first column is the job name. If a job has a specified tag, the value in the corresponding cell is 1. Otherwise, the value is 0.
- The first column displays names of all the jobs in the workspace, including real-time job nodes, For Each subjobs, and Subjob subjobs.

----End

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9.9.1.4 Configuring a Scheduling Identity

The following problems may occur during job execution in DataArts Factory:

- The job execution mechanism of the DataArts Factory module is to execute the job as the user who starts the job. For a job that is executed in periodic scheduling mode, if the IAM account used to start the job is suspended or deleted during the scheduling period, the system cannot obtain the user identity authentication information. As a result, the job fails to be executed.
- If a job is started by a low-privilege user, the job fails to be executed due to insufficient permissions.

To address these issues, you can configure an identity for scheduling jobs. During job scheduling, this identity interacts with other services, preventing the above job execution failures.

NOTE

During the periodic scheduling of a job, if the default user of the job is deleted and another user submits a version and schedules the job, the user who submits the version is considered as the executor of the job by default.

Classification of Scheduling Identities

Scheduling identities are classified into agencies and IAM accounts.

- Agencies: Cloud services interwork with each other, and some cloud services are dependent on other services. You can create an agency to delegate cloud services to access other services and perform resource O&M on your behalf.

  Agencies are classified into the following types:

  - Public agencies: They apply to all jobs in the workspace. For details about how to configure a public agency, see **Configuring a Public Agency**.
  - Job agencies: They apply only to a single job. For details about how to configure a job agency, see **Configuring a Job-Level Agency**.
- IAM accounts: You can configure IAM accounts through user groups in a unified manner and manage permissions in an easier way than agencies. IAM accounts also have better compatibility and support MRS nodes (MRS Presto SQL, MRS Spark, MRS Spark Python, MRS Flink Job, and MRS MapReduce), directly connected nodes (MRS Spark SQL and MRS Hive SQL), and ETL Job nodes whose destination is DWS, so IAM accounts can be used to submit jobs for some MRS clusters and ETL Job nodes that cannot be submitted through agencies.

  IAM accounts are classified into the following types:

  - Public IAM accounts: They apply to all jobs in the workspace. For details about how to configure a public IAM account, see **Configuring a Public IAM Account**.
  - Execution users: They apply only to a single job. For details about how to configure an execution user, see **Configuring an Executor**.

    NOTE

    You can configure execution users only after apply for the whitelist membership. To use this feature, contact customer service or technical support.

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Priorities of Scheduling Identities

The system obtains permissions for the job agency, public agency, execution user, and public IAM account in sequence, and then executes jobs with the permissions.

By default, a job is executed by the user who starts the job. If a job is started by a user without the required permissions, the job fails to be executed due to insufficient permissions. You can configure a scheduling identity to resolve this issue.

Constraints

- To create or modify an agency, you must have the **Security Administrator** permissions.
- To configure a workspace-level scheduling identity, you must have the **DAYU Administrator** or **Tenant Administrator** policy.
- To configure a job-level agency, you must have the permission to view the list of agencies.

Configuring a Public Agency

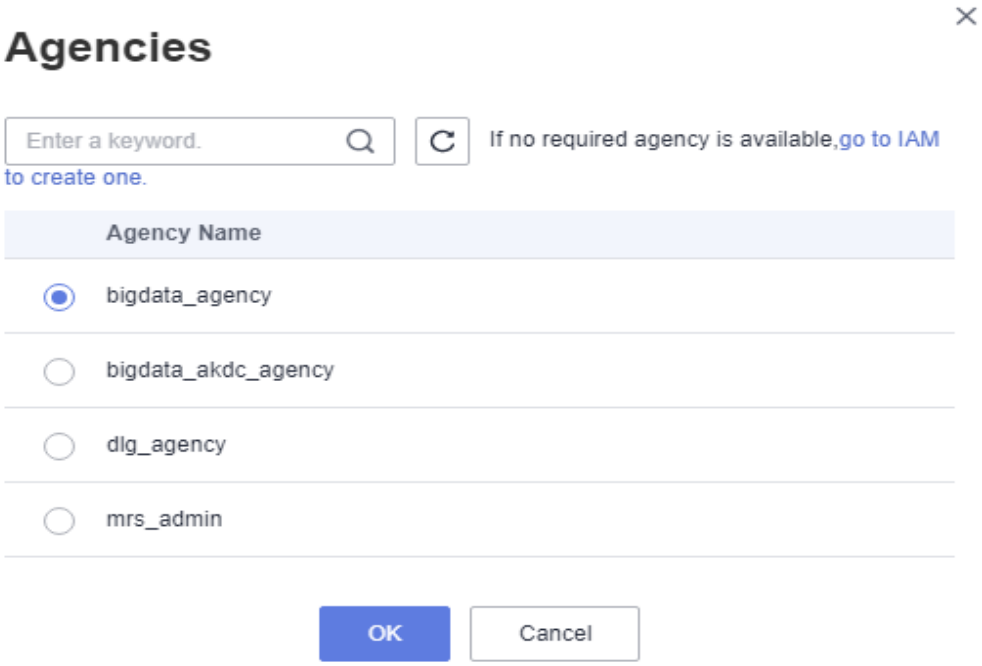
CAUTION

A public agency applies to all jobs in the workspace, especially those that contain MRS nodes. Exercise caution when performing this operation.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the navigation pane, choose **Configuration** > **Configure**.
4. Choose **Scheduling Identities** and set **Public Scheduling Identity** to **Public agency**.
5. Click **+** to select an agency or create one. For how to create an agency and configure permissions, see **Reference: Creating an Agency** and **Reference: Configuring Agency Permissions**.

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Figure 9-109 Configuring a workspace-level agency



6. Click **OK** to return to the **Scheduling Identities** page and click .

   NOTE

   For a batch processing job, a public agency takes effect in the next cycle. For a real-time processing job, you must restart the job for a public agency to take effect.

Configuring a Job-Level Agency

NOTE

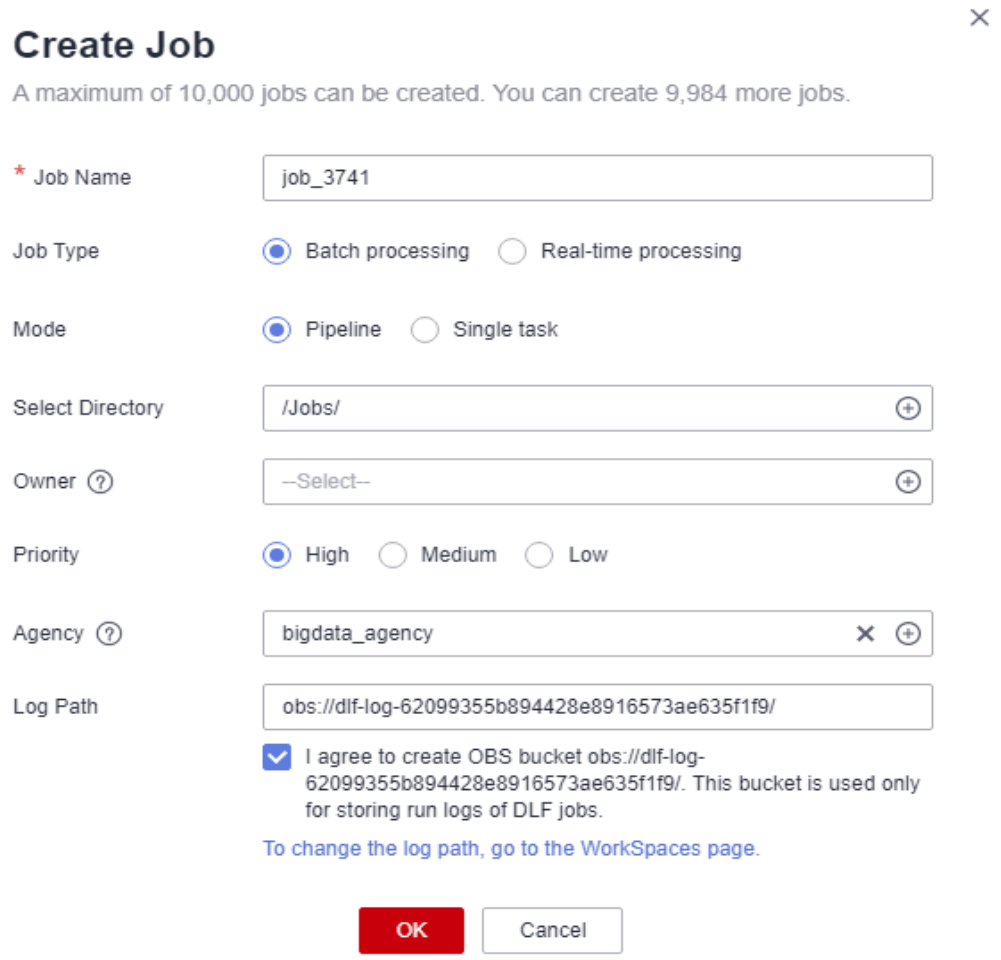
You can create a job-level agency when creating a job. You can also modify the agency of an existing job.

Configuring an agency when creating a job

1. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
2. In the navigation pane of the DataArts Factory homepage, choose **Development** > **Develop Job**.
3. Right-click the job directory and choose **Create Job** from the shortcut menu. The **Create Job** dialog box is displayed. If a workspace-level agency has been configured, it is used for the job by default. You can also select another agency from the agency list. For how to create an agency and configure permissions, see **Reference: Creating an Agency** and **Reference: Configuring Agency Permissions**.

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Figure 9-110 Configuring an agency for a job



Modifying the agency of an existing job

1. In the navigation pane of the DataArts Factory homepage, choose **Development** > **Develop Job**.
2. In the job directory, double-click an existing job. On the far right of the displayed page, click **Basic Info**. The dialog box of the job's basic settings is displayed. If a workspace-level agency has been configured, it is used by default. You can also select another agency from the agency list.

Configuring a Public IAM Account

1. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
2. In the navigation pane, choose **Configuration** > **Configure**.
3. Choose **Scheduling Identities** and set **Public Scheduling Identity** to **Public IAM account**.
4. Enter the public IAM account in the text box.
5. Click .

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Configuring an Executor

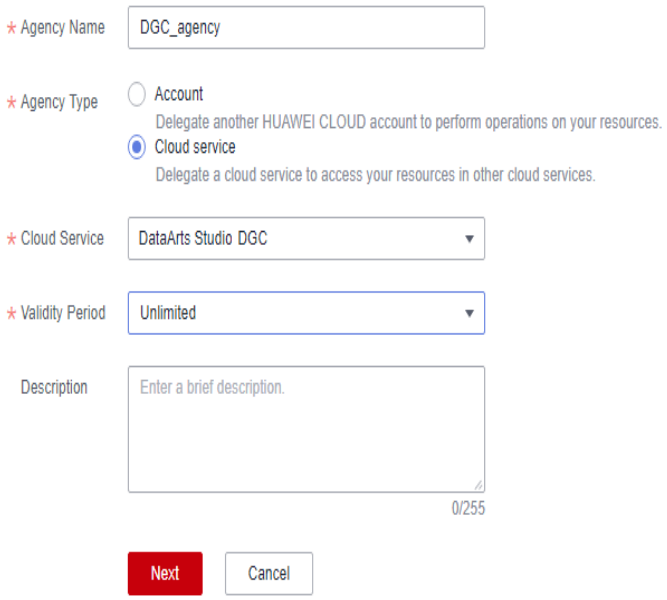
Configuring a Job Executor

1. In the job directory, double-click a job.
2. Click the **Basic Info** tab and set the executor for the job.

Reference: Creating an Agency

1. Log in to the IAM console.
2. In the navigation pane, choose **Agencies** and click **Create Agency**.
3. Enter an agency name, for example, **DGC_agency**.
4. On the displayed page, select **Cloud service** for **Agency Type** and **Data Lake Governance Center (DGC)** for **Cloud Service**. This grants operation permissions to DataArts Studio so that DataArts Studio can use cloud services and perform O&M for you.

   Figure 9-111 Creating an agency

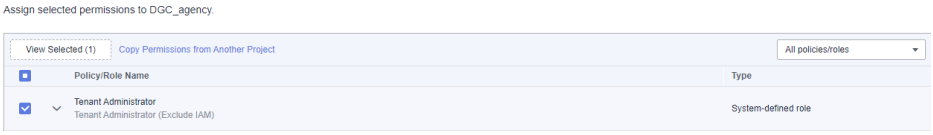


5. Click **Next**.
6. On the **Authorize Agency** page, search for and select the **Tenant Administrator** policy. Then click **Next**.
   - Users assigned the **Tenant Administrator** policy have all permissions on all services except on IAMIAM. Therefore, delegate the **Tenant Administrator** policy to DataArts Studio so that DataArts Studio can access all related services.
   - If you want to meet the security control requirements for fewer permissions, you only need to configure the **OBS OperateAccess** permissions (During job execution, execution log information needs to be written to OBS. Therefore, you need to add the **OBS OperateAccess** permissions.) Then, configure different agency permissions based on the

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node type in the job. For example, if a job contains only the **Import GES** node, you can configure the **GES Administrator** and **OBS OperateAccess** permissions. For details, see **Reference: Configuring Agency Permissions**.

Figure 9-112 Assigning permissions



7. Click **OK**.

Reference: Configuring Agency Permissions

After the operation permissions of an account are delegated to DataArts Studio, you must configure the permissions of the agency identity so that DataArts Studio can interact with other services.

For purposes of permissions minimization, you can configure the **Admin** permissions for services based on the node types in jobs. For details, see **Table 9-75**.

The **Admin** permissions can also be configured based on the operations, resources, and request conditions for a specific service. Based on the node types in jobs, permissions are defined by service APIs to allow for more fine-grained, secure access control of cloud resources. Configure the permissions according to **Table 9-76**. For example, for a job containing the **Import GES** node, you only need to create a custom policy and select **ges:graph:getDetail** (viewing graph details), **ges:jobs:getDetail** (querying task status), and **ges:graph:access** (using graphs).

NOTICE

- An MRS cluster supports job submission through an agency if either of the following conditions is met:
  - It is a non-security cluster.
  - It is a security cluster whose version is later than 2.1.0 and which has MRS 2.1.0.1 or later installed.
- If an MRS cluster does not support job submission through an agency, agencies cannot be configured for the jobs that contain the following nodes:

  MRS-related nodes (MRS Presto SQL, MRS Spark, MRS Spark Python, MRS Flink Job, and MRS MapReduce) and MRS Spark SQL and MRS Hive SQL nodes connected through APIs.

- Configure the service-level **Admin** permissions.

  During job execution, execution log information needs to be written to OBS. Therefore, the **OBS OperateAccess** permissions must be added for all jobs during coarse-grained authorization.

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Table 9-75 The admin permissions for related nodes

Node Name	System Permission	Description
CDM Job	DAYU Administrator	All DataArts Studio permissions
Import GES	GES Administrator	Permissions required to perform all operations on GES. This role depends on the **Tenant Guest** and **Server Administrator** roles in the same project.
• MRS Presto SQL, MRS Spark, MRS Spark Python, MRS Flink Job, and MRS MapReduce • MRS Spark SQL and MRS Hive SQL (connecting to MRS clusters through MRS APIs)	MRS Administrator MRS Fullaccess KMS Administrator	MRS Administrator: all execute permissions of MRS specified in the RBAC policy This role depends on the **Tenant Guest** and **Server Administrator** roles in the same project. MRS Fullaccess: MRS administrator permission specified in the fine-grained policy Users assigned the **KMS Administrator** role have the administrator permissions for encryption keys in DEW.
MRS Spark SQL, MRS Hive SQL, MRS Kafka, and Kafka Client (connecting to the clusters in proxy mode)	DAYU Administrator KMS Administrator	DAYU Administrator has all permissions required for DataArts Studio. Users assigned the **KMS Administrator** policy have the administrator permissions for encryption keys in DEW.
DLI Flink Job, DLI SQL, and DLI Spark	DLI Service Admin	All operation permissions for DLI.
DWS SQL, RDS SQL (connecting to data sources in proxy mode), and Shell	DAYU Administrator KMS Administrator	DAYU Administrator has all permissions required for DataArts Studio. Users assigned the **KMS Administrator** policy have the administrator permissions for encryption keys in DEW.

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Node Name	System Permission	Description
CSS	DAYU Administrator Elasticsearch Administrator	DAYU Administrator has all permissions required for DataArts Studio. Users assigned the **Elasticsearch Administrator** policy have all permissions for CSS. This role depends on the **Tenant Guest** and **Server Administrator** roles in the same project.
Create OBS, Delete OBS, and OBS Manager	OBS OperateAccess	Basic object operation permissions, such as viewing buckets, uploading objects, obtaining objects, deleting objects, and obtaining object ACLs.
SMN	SMN Administrator	All operation permissions for SMN.

- Configure fine-grained permissions. (Create custom policies based on the actions supported by each service.)

  For details on how to create a custom policy, see **Creating a Custom Policy**.

  NOTE

  - During job execution, you must write execution logs to OBS. When the fine-grained authorization mode is used, the following OBS permissions need to be added for all types of jobs:
    - obs:bucket:GetBucketLocation
    - obs:object:GetObject
    - obs:bucket:CreateBucket
    - obs:object:PutObject
    - obs:bucket:ListAllMyBuckets
    - obs:bucket:ListBucket
  - CDM Job nodes belong to the DataArts Studio module. DataArts Studio does not support fine-grained authorization. Therefore, only the **DataArts Studio Administrator** policy can be configured for jobs containing these types of nodes.
  - CSS does not support fine-grained authorization and requires a proxy. Therefore, the **DataArts Studio Administrator** and **Elasticsearch Administrator** policies can be configured for jobs containing these nodes.
  - SMN does not support fine-grained authorization. Therefore, jobs containing these nodes require the **SMN Administrator** permissions.

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Table 9-76 Creating a custom policy

Node Name	Action
Import GES	• ges:graph:access • ges:graph:getDetail • ges:jobs:getDetail
• MRS Presto SQL, MRS Spark, MRS Spark Python, MRS Flink Job, and MRS MapReduce • MRS Spark SQL and MRS Hive SQL (connecting to MRS clusters through MRS APIs)	• mrs:job:delete • mrs:job:stop • mrs:job:submit • mrs:cluster:get • mrs:cluster:list • mrs:job:get • mrs:job:list • kms:dek:crypto • kms:cmk:get
MRS Spark SQL, MRS Hive SQL, MRS Kafka, and Kafka Client (connecting to the clusters in proxy mode)	• kms:dek:crypto • kms:cmk:get • DataArts Studio Administrator (role)
DLI Flink Job, DLI SQL, and DLI Spark	• dli:jobs:get • dli:jobs:update • dli:jobs:create • dli:queue:submit_job • dli:jobs:list • dli:jobs:list_all
DWS SQL, RDS SQL (connecting to data sources in proxy mode), and Shell	• kms:dek:crypto • kms:cmk:get • DataArts Studio Administrator (role)
Create OBS, Delete OBS, and OBS Manager	• obs:bucket:GetBucketLocation • obs:bucket:ListBucketVersions • obs:object:GetObject • obs:bucket:CreateBucket • obs:bucket:DeleteBucket • obs:object:DeleteObject • obs:object:PutObject • obs:bucket:ListAllMyBuckets • obs:bucket:ListBucket

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9.9.1.5 Configuring the Number of Concurrently Running Nodes

This section describes how to configure the maximum number of job nodes that can run concurrently in a workspace.

Constraints

The number of concurrently running nodes in the workspace cannot exceed that in the instance.

Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation pane, choose **Configuration** > **Configure**.

Step 4 Choose **Nodes Concurrently Running**.

Step 5 Set **Nodes Concurrently Running in the Workspace**. Ensure that the value is less than or equal to the maximum number of nodes that can run concurrently in the DataArts Studio instance.

Table 9-77 lists the maximum number of nodes that can run concurrently in the DataArts Studio instance. To view the quota of the job node scheduling times per day, click **More** of a DataArts Studio instance and select **Quota Usage**.

Table 9-77 Maximum number of nodes that can run concurrently in a DataArts Studio instance

Job Node Scheduling Times/Day of a DataArts Studio Instance	Maximum Number of Nodes That Can Run Concurrently in a DataArts Studio Instance
<=500	10
<=5000	50
<=20000	100
<=40000	200
<=80000	300
> 80000	400

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Figure 9-113 Configuring the number of concurrently running nodes



Step 6 Click **Save**.

----End

Viewing the Number of Historical Nodes Concurrently Running

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Nodes Concurrently Running**.

Step 3 In the **Historical Nodes Concurrently Running** area, set the time range.

Step 4 Click **OK**.

NOTE

The maximum time range is 24 hours.

----End

9.9.1.6 Configuring a Template

This section describes how to create and use a template. When writing code, you can use an SQL template for repeated service logic. In addition, you can use a job parameter template when configuring job parameters.

Constraints

This function applies to the following scenarios:

- Use a script template for a Flink SQL script.
- During pipeline job development, use a Fink SQL script which uses a script template for the MRS Flink Job node and use a parameter template for **Program Parameter** of the MRS Flink Job node.
- Use a script template in a single-task Flink SQL job.
- Use template parameters in a single-task Flink JAR job.
- You can use parameter templates for Spark SQL and Hive SQL scripts and single-task jobs. For details about how to use a template, see **Configuring a Default Item**.

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Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

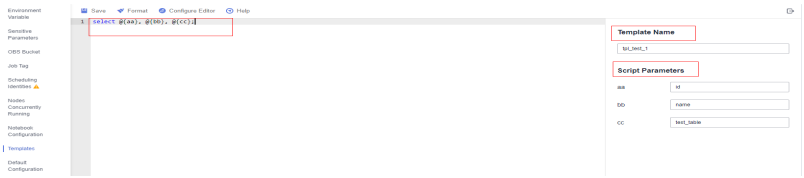
Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation pane, choose **Configuration** > **Configure**.

Step 4 Choose **Templates**.

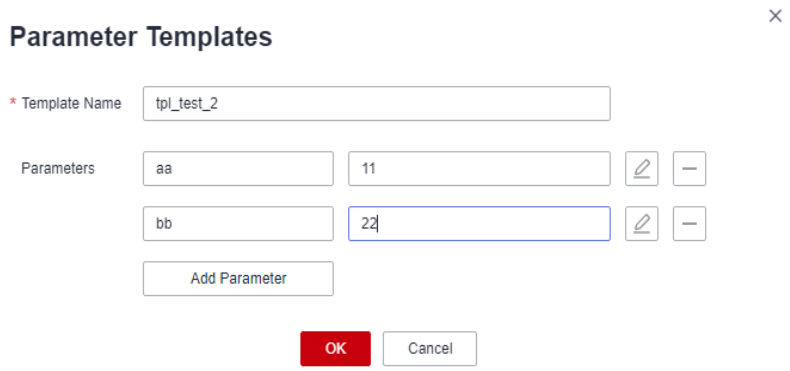
- Create a script template.
  a. On the **Script Templates** page, click **Add**.
  b. Set **Template Name**.
  c. Enter an SQL statement and reference script parameters.
  d. Configure the script template parameters. The parameter names cannot be changed, and the parameter values can be changed.

  Figure 9-114 Creating a script template

  e. Click **Save**.
  You can view, modify, or delete the created script template.
- Create a parameter template.
  a. On the **Parameter Templates** page, click **Add**.
  b. Set **Template Name**.
  c. Click **Add Parameter** Set parameter names and values. You can modify or delete parameters.

  Figure 9-115 Creating a parameter template

  d. Click **OK**.
  You can view, modify, or delete the created parameter template.

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For details about the application scenarios of script templates and parameter templates, see **Using Script Templates and Parameter Templates**.

----End

9.9.1.7 Configuring a Scheduling Calendar

- You can configure a scheduling calendar and specify the working days for scheduling a job.
- After creating a scheduling calendar, you can go to the DataArts Factory console, open a job, click **Scheduling Setup**, select **Run periodically** for **Scheduling Type**, and select the calendar you have created for **Scheduling Calendar**. **A dry run is performed beyond the calendar, and the job is executed normally within the calendar range.**

  NOTE

  If the scheduling calendar function is used, the system checks whether the planned execution time of a job instance is a working day during data job scheduling or patching.

  - If the planned execution time of the instance is a working day in the calendar, the instance is executed normally.
  - If the planned execution time of the instance is not a working day in the calendar, a dry run is performed.

Constraints

This function is available for batch processing jobs but not for real-time processing jobs.

Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

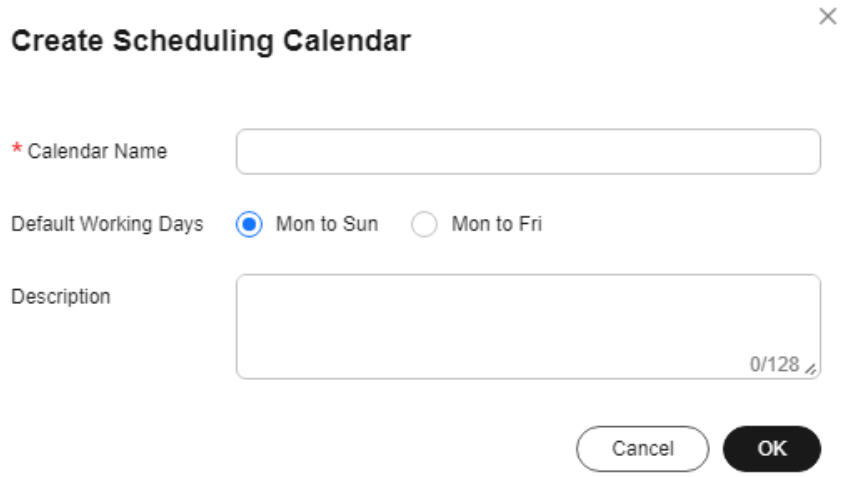
Step 3 In the left navigation pane, choose **Configuration** > **Configure**.

Step 4 Choose **Scheduling Calendars**.

Step 5 Click **Add**. The **Create Scheduling Calendar** dialog box is displayed.

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Figure 9-116 Create Scheduling Calendar dialog box



Step 6 Set parameters for the scheduling calendar.

Set **Calendar Name**, **Default Working Days**, and **Description**.

You can select **Mon to Fri** or **Mon to Sun** for **Default Working Days**. By default, **Mon to Fri** is selected.

Step 7 Click **OK**.

After creating the calendar, you can use it for jobs. Go to the DataArts Factory console, open a job, click **Scheduling Setup**, select **Run periodically** for **Scheduling Type**, and select the calendar you have created for **Scheduling Calendar**. A dry run is performed beyond the calendar, and the job is executed normally within the calendar range.

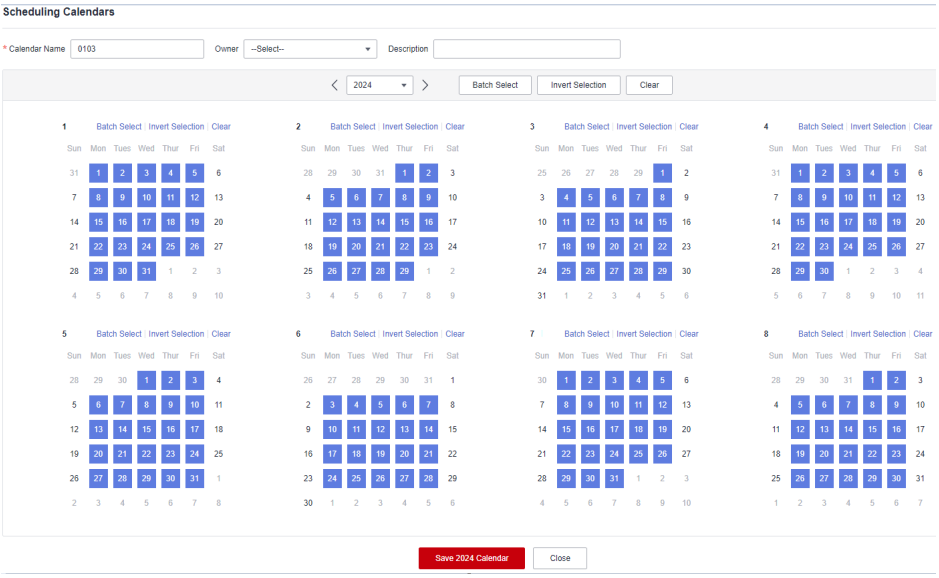
----End

More Operations

- Modify a calendar: Click **Modify** in the **Operation** column.
  - **Batch Select**: Select all Mondays to Fridays of the current month.
  - **Invert Selection**: Select all non-working days.
  - **Clear**: Clear selected working days.

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Figure 9-117 Modifying a scheduling calendar



- Delete a calendar: Click **Delete** in the **Operation** column.

9.9.1.8 Configuring a Default Item

This section describes how to configure a default item. You can perform the operations in this section only if you have the permissions of **DAYU Administrator** or **Tenant Administrator**.

Scenario

If a parameter is invoked by multiple jobs, you can use this parameter as the default configuration item. In this way, you do not need to set this parameter for each job.

Table 9-78 Configuration items

Configuration Item	Affected Module	Main Usage
Periodic Scheduling	Job scheduling	• Default action on the **current job** when the job it depends on fails
Multi-IF Policy	Job scheduling	Policy for executing nodes with multiple IF conditions
Hard and Soft Lock Policy	Script/Job development	Policy for grabbing the lock of a job or script
Script Variable Definition	Script development	Format definition of script variables. Two formats are available: ${} and ${dlf.}.

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Configuration Item	Affected Module	Main Usage
Data Export Policy	Script/Job development	Policy for downloading or dumping the SQL execution result • All users • No user • Only workspace administrator
Disable Auto Node Name Change	Job Development	When a node in a DataArts Studio job is associated with a script or a job of another service, the node name does not change accordingly.
Use Simple Variable Set	Job development	A simple variable set provides a series of custom variables that automatically replace parameters during job scheduling.
Notification Policy for Jobs in Failure Ignored Status	O&M and scheduling	Notification type for jobs whose status is failure ignored
Retry Node upon Timeout	Job execution	Whether a node will be re-executed if it fails upon timeout
Exclude Waiting Time from Instance Timeout Duration	Job execution	If you select **Yes**, the waiting time before an instance starts running is excluded from the instance timeout duration.
Rules for Splitting MRS JAR Package Parameters	Job development	Rules for splitting string parameters (parameters enclosed by "") in the JAR packages of MRS MapReduce and MRS Spark operators
Synchronization of Job Version by Waiting Instance	O&M and scheduling	Whether a waiting instance synchronizes the latest job version when it runs
Execution Mode for Hive SQL and Spark SQL Statements	Script/Job development	• **In OBS**: The OBS path is returned to MRS. • **In the request message body**: The script content is returned to MRS.
PatchData Job Priority	O&M – PatchData	Priority of a PatchData job. If system resources are insufficient, computing resources are preferentially allocated to jobs with higher priorities. A larger value indicates a higher priority. Priorities can be set only for DLI SQL operators.

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Configuration Item	Affected Module	Main Usage
Historical Job Instance Cancellation Policy	O&M and scheduling	Days to wait before job instances are canceled. If the wait time of a job instance exceeds the value of this parameter, the instance will be canceled. The minimum value is 2, that is, a job instance can be canceled only after two days. The default value is **60** days.
Historical Job Instance Alarm Policy	O&M and scheduling	Days in which alarms can be reported for job instances. The default value is **7**, that is, alarms can be reported for the job instances created within the last seven days, but not for those created before that.
Job Alarm Notification Topic	Notification configuration	Topic used to send notifications by owner
Default Retry Policy upon Job Operator Failure	O&M and scheduling	Default policy for retrying a failed job operator
Generate Alarm Upon Job Retry Failure	O&M and scheduling	If you select **All jobs**, **Real-time jobs**, or **Batch jobs**, an alarm is generated each time a job fails to be retried. If you select **Disable**, an alarm is generated only when the maximum number of retries has been reached for the job.
Automatic Script Name Transfer During Job Execution	Job development (job execution)	If this function is enabled, set mapreduce.job.name=Script name of the Hive SQL script is automatically transferred to MRS during job execution in the current workspace.
Job Dependency Rule	Job scheduling	Jobs can be depended on by jobs in other workspaces (requires the permission to query the job list in the workspace). All default roles in the workspace have this permission. Custom roles must have the job query permission in DataArts Factory.

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Configuration Item	Affected Module	Main Usage
Script Execution History	Script/Job development	Which script execution results are displayed • **Myself**: The script execution history for only myself is displayed. • **All users**: The script execution history for all users is displayed.
Identity for Job Tests	Job development (job test)	Identity for testing jobs. • **Public agency or IAM account**: A public agency or IAM account is used to execute jobs. • **Personal account**: The user who clicks **Test** is used to execute jobs.
SparkSqlJob/Script Default Template Configuration	Spark SQL script/job development	Whether any parameters can be set for Spark SQL jobs and scripts
HiveSqlJob/Script Default Template Configuration	Spark SQL script/job development	Whether any parameters can be set for Hive SQL jobs and scripts
Job/Script Change Management	Job/Script import and export	Whether to enable job/script change management for the workspace • **Yes**: Events are recorded for job and script changes. All the changed jobs and scripts can be incrementally exported and imported by time. • **No**: No events are recorded for job and script changes. Only selected jobs and scripts can be exported and imported.
Log Open Mode	Viewing logs	Whether to open logs on a new tab or in a pop-up window

Configuring Periodic Scheduling

- To configure the default action on the **current job** when the job it depends on fails, perform the following operations:
  a. In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.
  b. Choose **Default Configuration**.

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NOTE

Three options are available. The default value is **Terminate**.

- **Suspend**: The current job is suspended.
- **Continue**: The current job continues to be executed.
- **Cancel**: The current job is canceled.

c. Click **Save** to save the settings. This parameter takes effect only for new jobs.

Configuring the Multi-IF Policy

To configure the policy for executing nodes with multiple IF conditions, perform the following operations:

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration**.

NOTE

The following two options are available:

- **OR**: Nodes are executed if an IF condition is met.
- **AND**: Nodes are executed if all IF conditions are met.

For details, see **Configuring the Policy for Executing a Node with Multiple IF Statements**.

Step 3 Click **Save** to save the settings.

----End

Configuring the Hard and Soft Lock Policy

The policy determines how you can grab the lock of a job or script. If you use a soft lock, you can grab the lock of a job or script regardless of whether you have the lock. If you use a hard lock, you can only unlock or grab the lock of a job or script for which you have the lock. Operations such as publish, execution, and scheduling are not restricted by locks.

You can configure the hard/soft policy based on your needs.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration**.

NOTE

The default policy is **Soft Lock**.

- **Soft lock**: You can lock or unlock jobs or scripts, regardless of whether they are locked by others.
- **Hard Lock**: You can lock jobs or scripts only after they have been unlocked by other users. The space administrator and the DAYU Administrator user can lock and unlock jobs or scripts without any limitations.

Step 3 Click **Save** to save the settings.

----End

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Configuring Script Variables

Variables of an SQL script can be in ${} or ${dlf.} format. You can configure either type as needed. The configured variable format applies to SQL scripts, SQL statements in jobs, single-node jobs, and environment variables.

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Click **Default Configuration** and set **Script Variable Definition**.

NOTE

The default variable format is **${}**.

- **${}**: Identify the definition of the ${} format in the script and parse the field as the variable name. For example, variable name *xxx* is identified from **${***xxx***}**.
- **${dlf.}**: Identify the definition of the ${dlf.} format in the script and parse the **dlf.** field as the variable name. Other ${} format definitions are not recognized as variables. For example, variable name **dlf.***xxx* is identified from **${dlf.***xxx***}**.

Step 3 Click **Save** to save the settings.

----End

Configuring a Data Export Policy

By default, all users can download and dump the execution results of SQL scripts. If you do not want all users to have this permission, perform the following steps to configure a data export policy:

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration** and set **Data Export Policy**.

NOTE

The default data export policy is **All User Can**.

- **All User Can**: All users can download and dump SQL execution results.
- **All User Cannot**: No user can download or dump SQL execution results.
- **Only Workspace Manager Can**: Only workspace administrators can download and dump SQL execution results.

Step 3 Click **Save**.

----End

Disabling Auto Node Name Change

On the **Develop Job** page, when you select a script for a node or associate a node with the function of another cloud service, the node name will be automatically changed to the script name or function name. You can disable this function.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration**. Find **Disable Auto Node Name Change** and select job nodes.

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NOTE

- You can disable automatic name change for the following nodes: CDM Job, DLI SQL, DWS SQL, MRS Spark SQL, MRS Hive SQL, MRS Presto SQL, MRS HetuEngine, MRS ClickHouse, MRS Impala SQL, Shell, RDS SQL, Subjob, For Each, Doris SQL, or Python.
- No job nodes are selected by default.
- Names of the selected nodes will not be automatically changed when a script is selected or a function is associated with them.

Step 3 Click **Save**.

----End

Use Simple Variable Set

The simple variable set provides a series of customized variables to dynamically replace parameters during task scheduling.

Step 1 In the navigation pane on the **Data Development** page, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration** and set **Use Simple Variable Set**.

NOTE

- **Yes**: Simple variable sets are supported. A series of customized variables provided by the simple variable set. Customized parameters are automatically replaced with specific values based on the service date, plan time, and parameter value format of task scheduling. In this way, parameters can be dynamically replaced during task scheduling.
- **No**: Simple variable sets are not supported.

Step 3 Click **Save** to save the settings.

----End

Notification Policy for Jobs in Failure Ignored Status

To configure the notification type for jobs whose status is failure ignored, perform the following steps:

Step 1 In the navigation pane on the **Data Development** page, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration** and set **Notification Policy for Jobs in Failure Ignored Status**.

Step 3 Select a notification type for jobs whose status is failure ignored.

NOTE

- Jobs whose status is failure ignored are those whose **Policy for Handling Subsequent Nodes If the Current Node Fails** is set to **Go to the next node**. By default, such jobs are deemed successful by the system.
- You can configure either of the following notification types for such jobs:

  Abnormal

  Successful (default)

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Step 4 Click **Save**.

----End

Setting Retry Node upon Timeout

You can set this parameter to specify whether a node will be re-executed if it fails upon timeout.

Step 1 In the navigation pane on the **Data Development** page, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Retry Node upon Timeout**.

NOTE

- **No**: A node will not be re-executed if it fails upon timeout.
- **Yes**: A node will be re-executed if it fails upon timeout.

Step 4 Click **Save** to save the settings.

----End

Exclude Waiting Time from Instance Timeout Duration

You can specify whether to exclude waiting time from instance timeout duration.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration** and set **Exclude Waiting Time from Instance Timeout Duration**.

Step 3 Select **Yes** or **No**.

NOTE

Yes: The waiting time before an instance starts running is excluded from the instance timeout duration.

No: The waiting time before an instance starts running is included in the instance timeout duration.

Step 4 Click **Save** to save the settings.

----End

Rules for Splitting MRS JAR Package Parameters

You can set the rule for splitting the string parameters (enclosed by "") in the JAR package parameters of MRS MapReduce and MRS Spark operators.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration** and set **Rules for Splitting MRS JAR Package Parameters**.

Step 3 Select a rule.

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NOTE

Split String Arguments by Space: For example, **"select * from table"** is split into four parameters by space: **select**, *****, **from**, and **table**.

Do not split string arguments: For example, **"select * from table"** is regarded as one parameter and is not split.

Step 4 Click **Save** to save the settings.

----End

Synchronization of Job Version by Waiting Instance

You can specify whether a waiting instance can synchronize the latest job version.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration** and set **Synchronization of Job Version by Waiting Instance**.

Step 3 Select **Yes** or **No**.

NOTE

Yes: The waiting instance uses the latest job version.

No: The waiting instance still uses the existing job version.

Step 4 Click **Save** to save the settings.

----End

Execution Mode for Hive SQL and Spark SQL Statements

When Hive SQL and Spark SQL statements are executed, DataArts Studio can place SQL statements in OBS or in the request body.

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Execution Mode for Hive SQL and Spark SQL Statements**.

NOTE

In OBS: Hive SQL and Spark SQL statements are put in OBS, and the OBS is returned to MRS.

In the request message body: Hive SQL and Spark SQL statements are put in the request message body, and the script content is returned to MRS.

Step 4 Click **Save** to save the settings.

NOTE

This configuration supports Hive SQL and Spark SQL scripts, and pipeline and single-task jobs.

----End

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Setting PatchData Priority

You can set the priority of a PatchData job. When system resources are insufficient, computing resources are preferentially allocated to jobs with higher priorities. A larger number indicates a higher priority. Currently, only the priorities of DLI SQL operators can be set.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration** and set **PatchData Job Priority**.

Step 3 Set the patch data priority policy.

Step 4 Click **Save** to save the settings.

NOTE

The mapping between the **PatchData Job Priority** and **spark.sql.dli.job.priority** of DLI is as follows:

If **PatchData Job Priority** is set to **1**, **spark.sql.dli.job.priority** of DLI is **1**.

If **PatchData Job Priority** is set to **2**, **spark.sql.dli.job.priority** of DLI is **3**.

If **PatchData Job Priority** is set to **3**, **spark.sql.dli.job.priority** of DLI is **5**.

If **PatchData Job Priority** is set to **4**, **spark.sql.dli.job.priority** of DLI is **8**.

If **PatchData Job Priority** is set to **5**, **spark.sql.dli.job.priority** of DLI is **10**.

----End

Historical Job Instance Cancellation Policy

You can set the number of retention days for waiting job instances. If the waiting time of a job instance exceeds the configured retention days, the job instance is canceled. The minimum number of retention days is 2, that is, a job instance which is not executed can be canceled after at least two days. The default number of retention days is 60.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set the number of retention days for waiting job instances.

Step 4 Click **Save** to save the settings.

----End

Send Alarm Upon Instance Cancellation If you select **Yes** for this parameter and configure a cancellation notification for a job, an alarm notification will be sent when a historical job instance is canceled upon timeout. If you select **No**, no alarm notification will be sent.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Send Alarm Upon Instance Cancellation**.

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Step 4 Click **Save** to save the settings.

----End

Historical Job Instance Alarm Policy

You can set the number of days during which alarms can be generated for monitored job instances. The default value is seven days. Alarms cannot be sent for job instances beyond the seven-day period.

For example, if you set the value of this parameter to **2**, alarms can be generated for the job instances of yesterday and today, but cannot be generated for the job instances of the day before yesterday and of an earlier time even if the triggering conditions are met.

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration** and locate **Historical Job Instance Alarm Policy**.

Step 3 Set the number of days during which alarms can be generated for monitored job instances.

NOTE

The default value is **7**. Set a value from 1 to 270.

After you set this parameter, alarms are generated only for the job instances which are created after this parameter is set and not for historical instances.

Step 4 Click **Save** to save the settings.

----End

Job Alarm Notification Topic

You can set the topic used to send notifications by owner.

Step 1 In the navigation pane, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Job Alarm Notification Topic**. Click **View Topic** to go to the SMN console to view available topics.

NOTE

You can only select a topic that you created on the SMN console (to prevent conflict with any existing topic). Only the workspace administrator can configure topic.

Step 4 Click **Save** to save the settings.

----End

Default Retry Policy upon Job Operator Failure

This policy takes effect only for new job operators in the current workspace. The default policy for the operators in historical jobs is not affected. The default value is **No**.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

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Step 2 Choose **Default Configuration**.

Step 3 Set **Default Retry Policy upon Job Operator Failure**.

NOTE

If this parameter is set to **Yes**, new job operators can be retried once, and the retry interval is 120 seconds by default.

Step 4 Click **Save** to save the settings.

----End

Generate Alarm Upon Job Retry Failure

If you enable this function, an alarm is generated each time a job fails to be retried.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Generate Alarm Upon Job Retry Failure**.

NOTE

- If you select **All jobs**, **Real-time jobs**, or **Batch jobs**, an alarm is generated each time a job fails to be retried.
- If you select **Disable**, an alarm is generated only when the maximum number of retries has been reached for the job.

Step 4 Click **Save** to save the settings.

----End

Automatic Script Name Transfer During Job Execution

If this function is enabled, **set mapreduce.job.name="*Script name*"** of the Hive SQL script is automatically transferred to MRS during job execution in the current workspace.

NOTE

This function takes effect only if the preceding parameter value has not been set for the script. If the parameter value has been set for the script, the value set is preferentially read and transferred to MRS. This function is unavailable for MRS clusters in security mode. To enable this function for such clusters, set them to non-security mode.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Automatic Script Name Transfer During Job Execution**.

NOTE

- **Yes**: The system automatically transfers the Hive SQL script name to MRS during job execution.
- No: The system does not automatically transfer the Hive SQL script name to MRS during job execution.

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Step 4 Click **Save** to save the settings.

----End

Job Dependency Rule

Jobs can be depended on by jobs in other workspaces (requires the permission to query the job list in the workspace). All default roles in the workspace have this permission. Custom roles must have the job query permission in DataArts Factory.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Configure **Job Dependency Rule**.

NOTE

- **Jobs cannot be depended on by jobs in other workspaces**: Jobs in this workspace cannot be depended on by jobs in other workspaces.
- **Jobs can be depended on by jobs in other workspaces**: Jobs in this workspace can be depended on by jobs in other workspaces, without requiring the permissions of this workspace.
- **Jobs can be depended on by jobs in other workspaces (requires the permission to query the job list in the workspace)**: Jobs in this workspace can be depended on by jobs in other workspaces, requiring the permissions of this workspace. If you do not have the permissions, the system displays a message indicating that you do not have the permission to obtain the job list in workspace *xxx* when you configure job dependencies across workspaces.

Step 4 Click **Save** to save the settings.

----End

Script Execution History

You can set this parameter to control the permissions to view the script execution history.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Script Execution History**.

NOTE

- **Myself**: The script execution history for only myself is displayed.
- **All users**: The script execution history for all users is displayed.

Step 4 Click **Save** to save the settings.

----End

Identity for Job Tests

After configuring this parameter, you can specify the identity used to test jobs.

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Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration**.

Step 3 Set **Identity for Job Tests**.

NOTE

- **Public agency or IAM account**: A public agency or IAM account is used to execute jobs.
- **Personal account**: The user who clicks **Test** is used to execute jobs.

  If no workspace agency or IAM account is available, a personal account is used for job tests.

  If you are using a federated account, you must set this parameter to **Public agency or IAM account**.

Step 4 Click **Save** to save the settings.

----End

SparkSqlJob/Script Default Template Configuration

You can set this parameter to determine whether any parameters can be set to overwrite the default parameters of the template.

In the MRS API connection mode, default parameters can be configured for Spark SQL scripts. For proxy connections, this function is not supported.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

Step 2 Choose **Default Configuration**.

Step 3 Set **SparkSqlJob/Script Default Template Configuration**.

NOTE

- **Yes**: You can set any parameters for jobs and scripts.
- **No**: You must select a template for jobs and scripts. The parameters in the template cannot be overwritten during job and script configuration. If you select **No**, select a default parameter template that has been configured. For details about how to configure a template, see **Configuring a Template**.

  Then go to the **basic information page of the Spark SQL job or Spark SQL script page and click** **in the upper right corner** to view the configured default program parameters. The preset default parameters are unavailable and cannot be modified.

  You can also customize program parameters, which can replace the template parameters during the execution of Spark SQL jobs or scripts.

----End

HiveSqlJob/Script Default Template Configuration

You can set this parameter to determine whether parameters can be set to overwrite the default parameters of the template.

In the MRS API connection mode, default parameters can be configured for Hive SQL scripts. For proxy connections, this function is not supported.

Step 1 In the navigation pane, choose **Configuration** > **Specifications**.

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Step 2 Choose **Default Configuration**.

Step 3 Set **HiveSqlJob/Script Default Template Configuration**.

NOTE

- **Yes**: You can set any parameters for jobs and scripts.
- **No**: You must select a template for jobs and scripts. The parameters in the template cannot be overwritten during job and script configuration. If you select **No**, select a default parameter template that has been configured. For details about how to configure a template, see **Configuring a Template**.

  Then go to the **basic information page of the Hive SQL job or Hive SQL script page and click in the upper right corner** to view the configured default program parameters. The preset default parameters are unavailable and cannot be modified.

  You can also customize program parameters, which can replace the template parameters during the execution of Hive SQL jobs or scripts.

Step 4 Click **Save** to save the settings.

----End

Job/Script Change Management

If you enable this function, you can export job/script changes (addition, modification, and deletion) in a workspace to a .zip file, and import the file to another workspace.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Click **Default Configuration**.

Step 3 Set **Job/Script Change Management**.

NOTE

- **Yes**: Events are recorded for job and script changes. All the changed jobs and scripts can be incrementally exported and imported by time.
- **No**: No events are recorded for job and script changes. Only selected jobs and scripts can be exported and imported.

Step 4 Click **Save** to save the settings.

NOTE

You can export and import jobs and scripts in the workspace only if you have set **Job/Script Change Management** to **Yes**.

----End

Log Open Mode

You can configure whether to open logs on a new tab or in a pop-up window.

Step 1 In the left navigation pane on the DataArts Factory console, choose **Configuration** > **Configure**.

Step 2 Choose **Default Configuration** and locate **Log Open Mode**.

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Step 3 Select **New tab** or **Pop-up**.

NOTE

- **New tab**: Logs are opened on a new page.
- **Pop-up**: Logs are opened in a pop-up window on the current page.

Step 4 Click **Save** to save the settings.

----End

9.9.1.9 Configuring Task Groups

By configuring a task group, you can control the maximum number of concurrent nodes in a task group in a more fine-grained manner.

Constraints

- This function is available only for batch processing jobs.
- Task groups cannot be used across workspaces.
- For a pipeline job, you can configure a task group for each node or for the job. A task group configured for a node is prior to one configured for the job.

Procedure

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the left navigation pane, choose **Configuration** > **Configure**.

Step 4 Choose **Task Groups**.

Step 5 Click **Create**.

Step 6 In the displayed dialog box, set required parameters.

Table 9-79 Parameters for creating a task group

Parameter	Description
Task Group Name	Name of the task group. It must be unique.

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Parameter	Description
Maximum number of concurrency	Maximum number of concurrent job nodes in the current task group The maximum number of concurrent nodes is the current number of concurrent DataArts Studio instances. The value cannot exceed the maximum number of concurrent nodes of the DataArts Studio instance, which is 1,000. The maximum number of concurrent nodes varies depending on the DataArts Studio instance specifications.
Description	Description of the task group

Step 7 Click **OK**.

After the task group is created, go to the job development page. On the canvas of a job, click **Scheduling Setup** and select the created task group. Then the number of concurrent nodes in the current task group can be controlled in a more fine-grained manner based on the selected task group.

----End

Follow-up Operations

Modifying a task group: Locate a task group and click **Modify** in the **Operation** column. The modification takes effect immediately.

Deleting a task group: Locate a task group and click **Delete** in the **Operation** column. A task group used by a job cannot be deleted.

Viewing references: Locate a task group and click **View Reference** in the **Operation** column to view the jobs that are using the task group.

9.9.2 Managing Resources

You can upload custom code or text files as resources on Manage Resource and schedule them when running nodes. Nodes that can invoke resources include DLI Spark, MRS Spark, DLI Flink Job, and MRS MapReduce.

After creating a resource, configure the file associated with the resource. Resources can be directly referenced in jobs. When the resource file is changed, you only need to change the resource reference location. You do not need to modify the job configuration. For details about resource usage examples, see **Developing a DLI Spark Job**.

Constraints

This function depends on OBS or MRS HDFS.

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(Optional) Creating a Directory

If a directory exists, you do not need to create one.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Factory**.
3. In the left navigation pane, choose **Configuration** > **Manage Resource**.
4. In the directory list, click  . In the displayed dialog box, configure directory parameters. **Table 9-80** describes the directory parameters.

   Table 9-80 Resource directory parameters

Parameter	Description
Directory Name	Name of the resource directory. The name must contain 1 to 32 characters, including only letters, numbers, underscores (_), and hyphens (-).
Select Directory	Parent directory of the resource directory. The parent directory is the root directory by default.

5. Click **OK**.

Creating a Resource

You have enabled OBS before creating a resource.

1. In the left navigation pane, choose **Configuration** > **Manage Resource**.
2. Click **Create Resource**. In the displayed dialog box, configure resource parameters. **Table 9-81** describes the resource parameters. Click **OK**.

   Table 9-81 Resource management parameters

Parameter	Mandatory	Description
Name	Yes	Name of the resource. The name must contain 1 to 32, including only letters, numbers, underscores (_), and hyphens (-).
Type	Yes	File type of the resource. Possible values: • jar: JAR file • pyFile: User Python file • file: User file • archive: User AI model file The supported file name extensions are **zip**, **tgz**, **tar.gz**, **tar**, and **jar**.

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Parameter	Mandatory	Description
Resource Location	Yes	Location of the resource. OBS and HDFS are supported. HDFS supports only MRS Spark, MRS Flink Job and MRS MapReduce nodes.
File Path	Yes	Select an OBS file path when **Resource Location** is set to **OBS**. Select an MRS cluster name when **Resource Location** is set to **HDFS**.
Depended Package	No	This parameter is available only for DLI Spark nodes. Depended JAR package that has been uploaded to OBS. This parameter is required when **Type** is set to **jar** or **pyFile**.
Select Directory	Yes	Directory to which the resource belongs. The root directory is selected by default.
Description	No	Descriptive information about the resource.

Editing a Resource

After a resource is created, you can modify resource parameters.

1. In the left navigation pane, choose **Configuration** > **Manage Resource**.
2. In the **Operation** column of the resource, click **Edit**. In the displayed dialog box, modify the resource parameters. For details, see **Table 9-81**.
3. Click **OK**.

Deleting a Resource

You can delete resources that are no longer needed.

Before deleting a resource, ensure that it is not used by any jobs.

NOTICE

If you are trying to delete a resource that is being used by jobs, the **Delete Resource** dialog box is displayed. When you click **OK**, the **Reference List** dialog box is displayed, in which you can view the jobs that are using the resource and click **View** in the **Operation** column to go to the job details page.

1. In the left navigation pane, choose **Configuration** > **Manage Resource**.
2. In the **Operation** column of the resource, click **Delete**. The **Delete Resource** dialog box is displayed.
3. Click **Yes**.

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Importing a Resource

To import a resource, perform the following operations:

1. In the left navigation pane, choose **Configuration** > **Manage Resource**.
2. In the resource directory, click and select **Import Resource**. The **Import Resource** dialog box is displayed.
3. Select the resource file that has been uploaded to OBS and click **Next**. After the import is complete, click **Close**.

Exporting a Resource

To export a resource, perform the following operations:

1. In the left navigation pane, choose **Configuration** > **Manage Resource**.
2. In the resource directory, select a resource, click , and select **Export Resource**. The system starts downloading the resource to the local PC.

Viewing Resource References

To view the references of a resource, perform the following operations:

1. In the left navigation pane, choose **Configuration** > **Manage Resource**.
2. Right-click a resource in the list and select **View Reference**.
3. In the displayed **Reference List** dialog box, view the references of the resource.

9.10 Review Center

For a workspace in simple mode, you can set the reviewer for the scripts and jobs you submit. In the review center, you can manage applications and configure and maintain reviewers for workspaces.

Constraints

- Only the administrator of the current workspace or users with the DAYU Administrator or Tenant Administrator permissions can create, modify, and delete reviewers.
- The reviewer must be the admin of the current workspace or a user with the DAYU Administrator or Tenant Administrator permission.
- If the current workspace is in enterprise mode, you can publish tasks for approval, but cannot submit scripts or jobs for approval.
- If the review function is enabled, the reviewer attribute must be added to the request body of related APIs. For details, see **Job Development APIs**.
- You can only set whether to enable the review function and review jobs and scripts on the console.
- If there are real-time pipeline jobs, review cannot be enabled.
- If the review function is enabled, the review center is visible to both reviewers and request submitters. If the review function is disabled, the review center is

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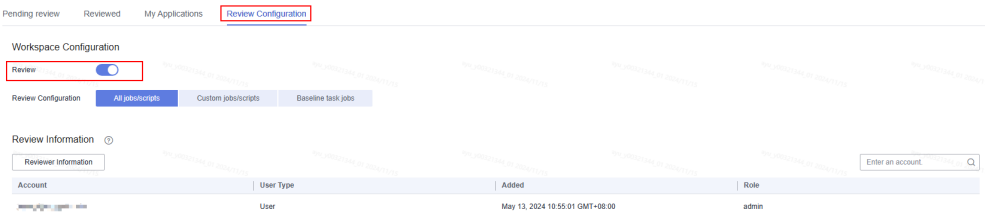
visible only to the administrator of the current workspace or users with the DAYU Administrator or Tenant Administrator permissions.

- The administrator of the current workspace or users with the DAYU Administrator or Tenant Administrator permissions cannot review their own service tickets.

Review Settings

Only the administrator of the current workspace or users with the DAYU Administrator or Tenant Administrator permissions can set review options. When the review function is enabled, you can configure review options for jobs or scripts.

Figure 9-118 Review Settings tab



1. In the left navigation pane, choose **Review Center**. In the right pane, click the **Review Configuration** tab.
2. Enable **Review**. Only the administrator of the current workspace or users with the DAYU Administrator or Tenant Administrator permissions can enable or disable the review function.

   NOTE

   - If you enable this function, you must specify a reviewer when submitting a job or script. If you disable this function, no jobs or scripts will need reviewing.
   - If the current workspace has applications that have not been reviewed, the review function cannot be disabled.

3. You can set **Review Configuration** to any of the following:
   - **All jobs/scripts**: Review is enabled for all the jobs and scripts in the workspace.
   - **Custom jobs/scripts**: You need to add the jobs or scripts that need to be reviewed.

     Click the **Jobs** tab and click **Add**. On the displayed page, select the jobs for which you want to enable review. When a job is added, its associated scripts are automatically added. If you select a directory, only existing jobs in the directory are added. If you want to enable review for newly created jobs in the directory, you need to add them. Click **OK**.

     You can delete the jobs that you have added.

     Click the **Scripts** tab and click **Add**. In the displayed dialog box, select the scripts for which you want to enable review. If you select a directory, only existing scripts in the directory are added. If you want to enable review for newly created scripts in the directory, you need to add them. Click **OK**.

     You can delete scripts that you have added.
   - **Baseline task jobs**: Add jobs to be reviewed from baseline tasks.

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Click the **Jobs** tab and then **Add**. On the displayed page, select the priority jobs of the baseline task as the jobs that require review. Then click **OK**. The upstream jobs of the baseline task also need to be reviewed.

Click the **Scripts** tab and select the jobs corresponding to the baseline. The scripts associated with the jobs will be displayed on this page.

4. In the **Review Information** area, you can configure the reviewer information on condition that you are the administrator of the current workspace or have the DAYU Administrator or Tenant Administrator permissions.
   a. Click **Manage Reviewer**.
   b. Locate the current workspace and click **Edit** in the **Operation** column.
   c. Next to **Workspace Members**, click **Add**.
   d. Search for and select a member account and select the **admin** role for it.
   e. Click **OK**. The configured reviewer information is automatically displayed.

Review Management

- If you have submitted a review application, you can view the review progress on the **Review Center** page.
  a. In the left navigation pane, choose **Review Center**. In the right pane, click the **My Applications** tab.
  b. Click **View Details** in the **Operation** column to view details about an application.
  c. Click **Withdraw** in the **Operation** column to withdraw an application. You can submit the application again after modifying it.
- You can view the applications pending your review.
  a. In the left navigation pane, choose **Review Center**. In the right pane, click the **Pending Review** tab. On this page, you can view the applications that need to be reviewed.
  b. Click **Review** in the **Operation** column to view the application details and review the application.
  c. Enter comments and approve or reject the application.
- You can view the applications that you have reviewed.
  a. In the left navigation pane, choose **Review Center**. In the right pane, click the **Reviewed** tab. On this page, you can view the applications that you have reviewed.
  b. Click **View Details** in the **Operation** column to view the review history and content of an application.

9.11 Download Center

You can download or dump SQL script execution results. After downloading or dumping the SQL execution results, you can view them on the **Download Center** page.

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Constraints

Records are generated on the **Download Center** page only when SQL scripts or single-task SQL jobs are executed, and results are downloaded or dumped.

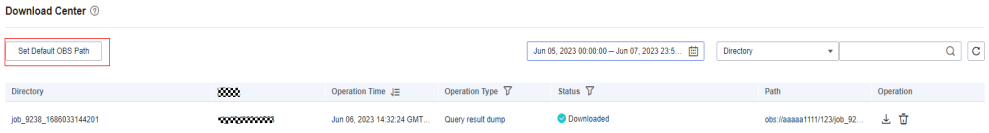
Download Center

NOTE

- The download records age out on a regular basis. When aged out, download records and the data dumped to OBS are deleted.
- Operators can view only their own download records. Workspace admins can view all download records in the current workspace.

On the **Download Center** page, you can centrally manage the execution results of SQL scripts. You can view and delete the download results, and view, download, and delete the dump results.

Figure 9-119 Download Center



- Set the default OBS path.

  NOTE

  The workspace admin can set the default OBS path for dump for the current workspace.

  a. In the left navigation pane on the DataArts Factory console, choose **Download Center**.
  b. Click **Set Default OBS Path**.
  c. Set the default OBS path.

     NOTE

     After you set the default OBS path, the test running results of scripts or single-task jobs will be dumped to this path by default. However, the paths where previous running results have been dumped will not change.

  d. Click **OK**.
- View the script execution result.
  a. In the left navigation pane on the DataArts Factory console, choose **Download Center**.
  b. View the file name, operator, operation time, operation type, task status, and OBS path of local download tasks and asynchronous dump tasks.

     You can view the dump task download failure records.
  c. Click in the **Operation** column to download data from the OBS path.
  d. Click in the **Operation** column to delete download and dump records.

     When you click **Delete**, a message is displayed indicating that the record cannot be downloaded after being deleted. Click **OK**.

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- Filter records by search criteria.

  You can filter records by operation time, job name, OBS path, operator, operation type, and task status. You can enter a keyword for fuzzy search.

9.12 Node Reference

9.12.1 Node Overview

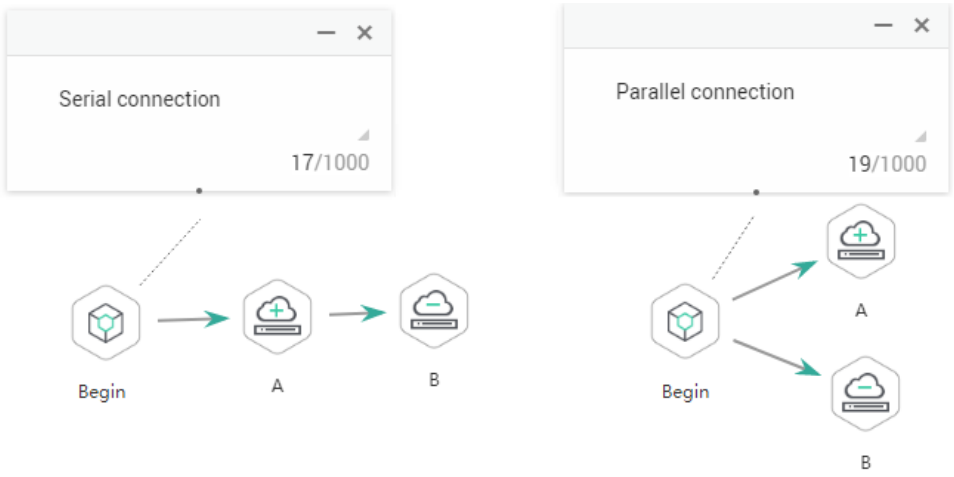
A node defines the operations performed on data. DataArts Factory provides nodes used for data integration, computing and analysis, database operations, and resource management. You can choose your desired nodes

- Node parameters can be presented using Expression Language (EL). For details about how to use EL, see **Expression Overview**.
- Nodes cannot be connected in serial or parallel mode.

  Serial connection: Nodes are run one by one. Specifically, node B runs only after node A is finished running.

  Parallel connection: Nodes are run at the same time.

  Figure 9-120 Connection diagram



9.12.2 Node Lineages

9.12.2.1 Data Lineage Overview

What Is Data Lineage?

In the era of big data, various types of data are rapidly generated due to explosive data growth. The massive and complex data information is converged, transformed, and transferred to generate new data and aggregate into an ocean of data.

During this process, a relationship is formed between the data, and these relationships are their lineages. They are analogous to the genetic relationships

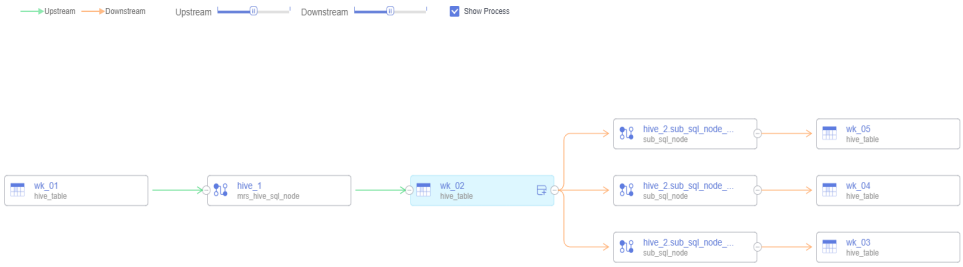
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between people. However, in contrast from our human lineages, data lineages have the following distinct features:

- **Belongingness**: Specific data belongs to a specific organization or individual.
- **Multi-source**: One piece of data can have multiple sources. One piece of data may be generated by processing multiple pieces of data, and there may be multiple such processes.
- **Traceability**: The data lineage is traceable. It reflects the data lifecycle and the entire process from data generation to data disappearance.
- **Hierarchy**: The data lineage is hierarchical. Data classification and summary form new data, and different levels of description result in data layers.

Figure 9-121 shows the lineage relationship graph for DataArts Studio.  indicates a data table, and  indicates a job node. They are orchestrated using arrows. As shown in the graph, the data in table **wk_01** is processed on the **hive_1** job node and then written to table **wk_02**. The data in table **wk_02** is processed on the **hive_2** job node and written to tables **wk_03**, **wk_04**, and **wk_05**, respectively.

Figure 9-121 Data lineage example



How DataArts Studio Data Lineage Is Implemented

- Generation of data lineages:

  The DataArts Studio data lineage parsing solution supports automatic lineage analysis and manual lineage configuration. Automatic lineage parsing is recommended. In this mode, lineages can be generated without manual configuration. If automatic lineage parsing is not supported, manually configure lineages.

  - Automatic lineage parsing: Lineages are automatically generated after the system parses the data processing and data migration nodes in data development jobs. No manual configuration is required. For details about the node types and scenarios that support automatic lineage parsing, see **Automatic Lineage Parsing**.
  - Manual lineage configuration: Customize the input and output tables of lineages in data development job nodes. If you configure lineages manually for a node, the automatic lineage parsing does not take effect for this node. For details about the node types that support manual lineage configuration, see **Manually Configuring a Lineage**.

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- Display of data lineages:

  You need to create a metadata collection task in DataArts Catalog first. When a data development job meets the **automatic lineage parsing requirements** or **lineages have been manually configured**, and when the job is successfully scheduled, you can view the data lineages in DataArts Catalog.

9.12.2.2 Configuring Data Lineages

The DataArts Studio data lineage parsing solution supports automatic lineage analysis and manual lineage configuration. Automatic lineage parsing is recommended. In this mode, lineages can be generated without manual configuration. If automatic lineage parsing is not supported, manually configure lineages.

- Automatic lineage parsing: Lineages are automatically generated after the system parses the data processing and data migration nodes in data development jobs. No manual configuration is required. For details about the node types and scenarios that support automatic lineage parsing, see **Automatic Lineage Parsing**.
- Manual lineage configuration: Customize the input and output tables of lineages in data development job nodes. If you configure lineages manually for a node, the automatic lineage parsing does not take effect for this node. For details about the node types that support manual lineage configuration, see **Manually Configuring a Lineage**.

Constraints

Currently, field-level lineage parsing is not supported.

Automatic Lineage Parsing

Automatic lineage parsing does not require manual configuration. When a data development job contains the nodes and scenarios listed in **Table 9-82**, the system can automatically parse lineages.

NOTE

The lineage of an SQL node can be parsed using multiple SQL statements, and column-level lineage parsing is supported. A single SQL statement cannot contain semicolons (;).

Table 9-82 Job nodes and scenarios that support automatic lineage parsing

Job Node	Supported Scenario
DLI SQL	• Lineages generated by data insertion between DLI tables • Lineages between OBS files generated by table creation statements and DLI tables
DWS SQL	Lineages between DWS tables generated by DML operations such as "Insert into"
MRS Hive SQL	Lineages between MRS tables generated by DML operations such as "Insert into/overwrite"

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Job Node	Supported Scenario
MRS Spark SQL	Lineages between MRS tables generated by DML operations such as "Insert into/overwrite"
CDM Job	Lineages generated during table file migration between MRS Hive, DLI, RDS, OBS, CSS, and GaussDB(DWS)
ETL Job	Data lineages generated by ETL tasks between DLI, OBS, MySQL, and DWS.

Manually Configuring a Lineage

In a DataArts Studio data development job, you can customize the input and output tables of lineages on the nodes of the job. If you configure lineages manually for a node, the automatic lineage parsing does not take effect for this node.

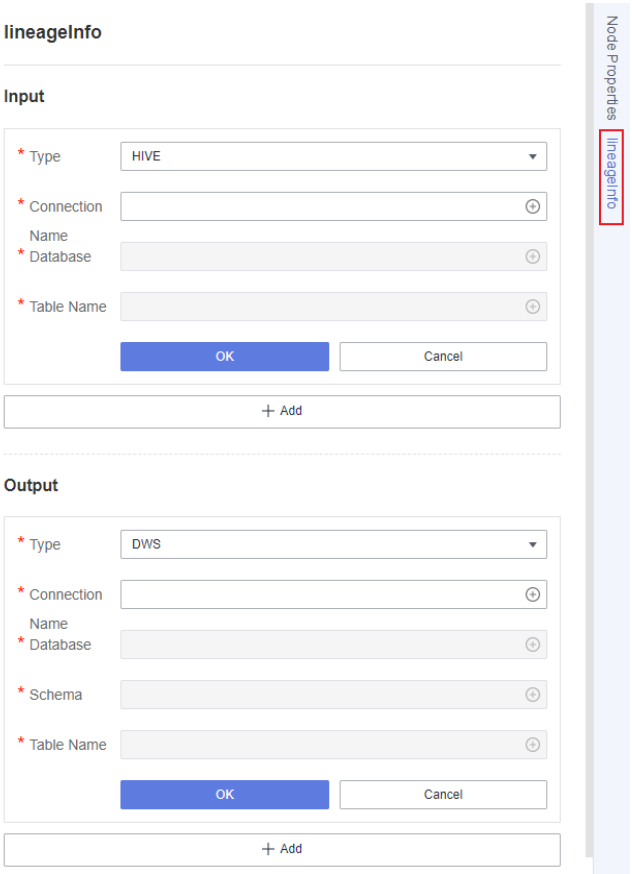
The following types of job nodes support manual lineage configuration.

- CDM Job
- Rest Client
- DLI SQL
- DLI Spark
- DWS SQL
- MRS Spark SQL
- MRS Hive SQL
- MRS Presto SQL
- MRS Spark
- MRS Spark Python
- ETL Job
- OBS Manager

When manually configuring the lineage, configure the input and output tables of the lineage on the Lineage tab page of the node. The data sources of the input and output tables can be DLI, DWS, Hive, CSS, OBS and CUSTOM. CUSTOM indicates a custom type. When manually configuring a lineage, you can add data sources that are not supported as custom types.

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Figure 9-122 Example of manual configuration of lineage relationships



For example, you need to manually configure a lineage for an MRS Spark node in a pipeline data development job because this node does not support automatic lineage parsing. The procedure is as follows:

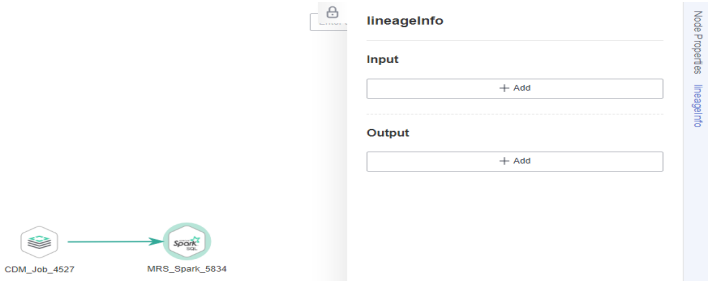
Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 On the DataArts Factory console, choose **Data Development** > **Develop Job**. Double-click the name of the job for which you want to configure a lineage to open the job canvas.

Step 4 Click the MRS Spark node in the job canvas and then the **lineageInfo** page.

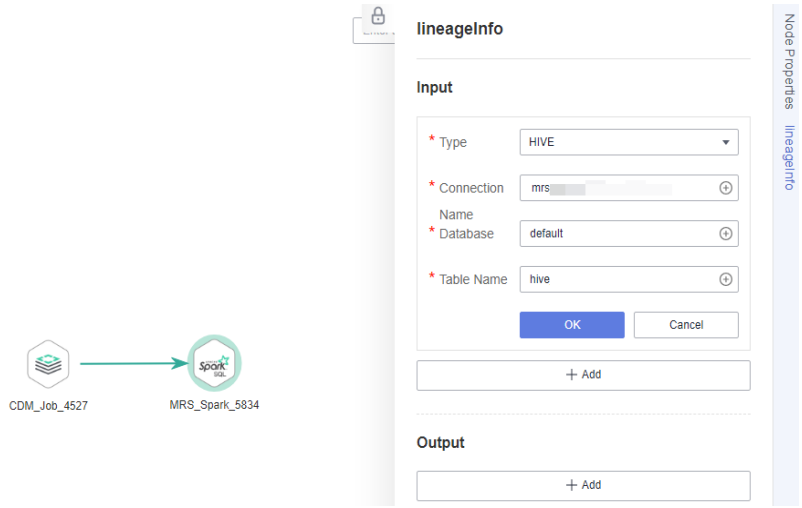
Figure 9-123 lineageInfo page



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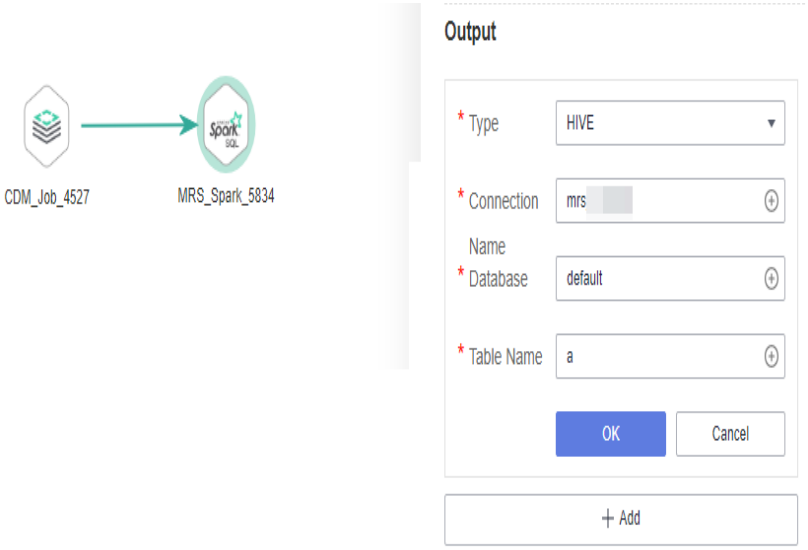
Step 5 Configure the lineage input table. For example, you can configure input table **hive**, as shown in **Figure 9-124**.

Figure 9-124 Configuring the lineage input



Step 6 Click **OK** and configure the lineage output table. For example, you can configure output table **a**, as shown in **Figure 9-125**.

Figure 9-125 Configuring the lineage output



Step 7 Click **OK**. The lineage for the MRS Spark node has been configured. If you want to view the lineage later, collect metadata by referring to **Viewing Data Lineages** and schedule the job. Then, you can view the manually configured lineage of the MRS Spark node in DataArts Catalog.

----End

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9.12.2.3 Viewing Data Lineages

You need to create a metadata collection task in DataArts Catalog first. When a data development job meets the **automatic lineage parsing requirements** or **lineages have been manually configured**, and when the job is successfully scheduled, you can view the data lineages in DataArts Catalog.

Constraints

- Data lineage updates depend on job scheduling. Data lineages are generated based on the latest job instances.

  NOTE

  After a data lineage is generated based on the latest instance of a data development job, the lineage will not be updated within the cooldown period (48 hours by default), as long as no new version is submitted for the job. If you want to update the lineage, wait until the cooldown period ends or submit another version of the job and schedule the job.

- To delete data lineages, you need to delete jobs or job metadata. Stopping jobs alone does not delete data lineages.

Creating and Running a Metadata Collection Task

Create and run a metadata collection task by referring to **Configuring a Metadata Collection Task**. When creating the task, select the tables whose lineages you want to view.

If a task for collecting the metadata of these tables has been created and run, skip this part.

Starting Job Scheduling

After metadata is collected, the system generates data lineages based on the latest job instances.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation pane, click  and double-click the job for which lineages have been configured to open it.

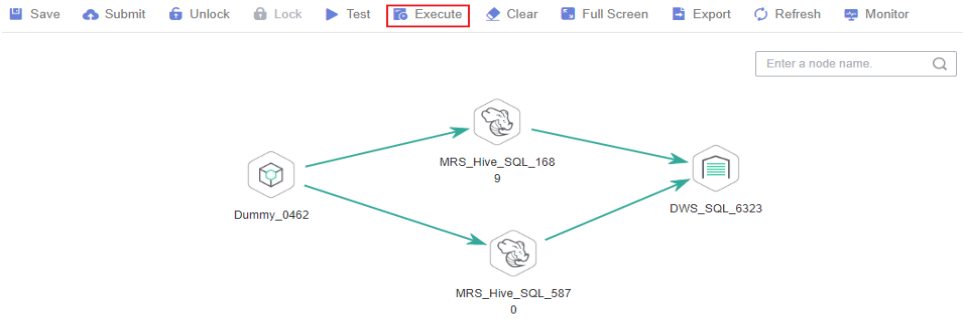
Step 4 Click **Execute**. The system starts parsing lineages of the job.

NOTE

If you click **Test**, the system will not parse lineages of the job.

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Figure 9-126 Starting job scheduling



Step 5 After the job is successfully executed, wait for about 1 minute. The data lineage is generated.

----End

Viewing Data Lineages

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.

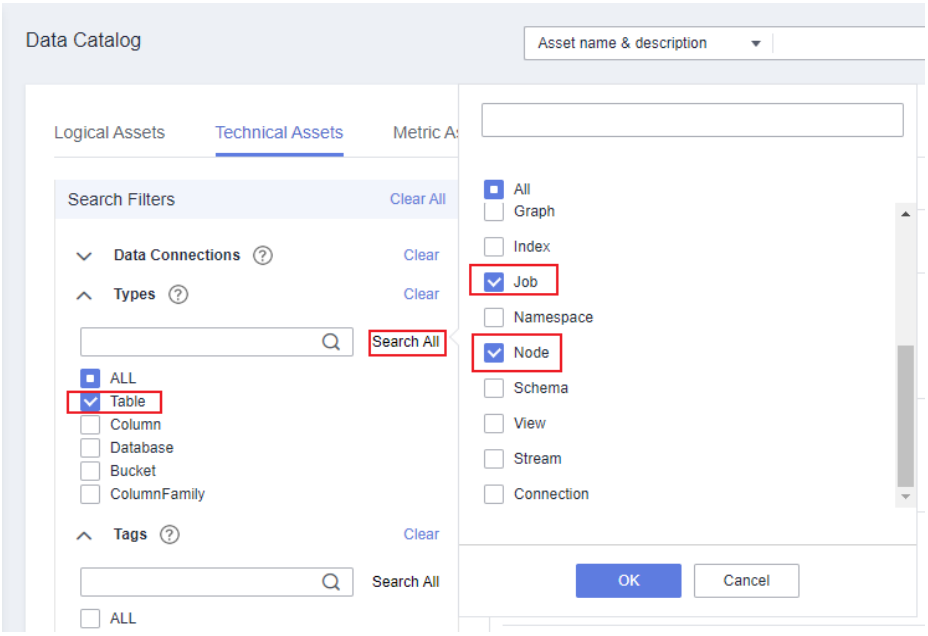
Step 2 In the navigation pane, choose **Data Catalog**. In the right pane, click the **Technical Assets** tab. On this page, you can query jobs, nodes, and tables.

In the **Types** area, click **Search All**, select **Job**, **Node**, and **Table**, and click **OK**.

NOTE

Jobs do not belong to any data connection. If you select a data connection in the search filters, no result will be returned.

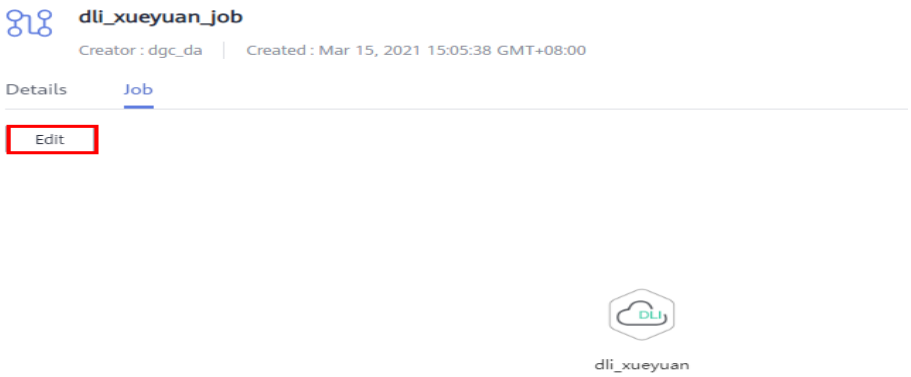
Figure 9-127 Selecting types



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Step 3 In the search result, click the name of an asset ending with **_job** to view its details. On the job details page, click the **Job** tab and then **Edit** to go to the job editing page.

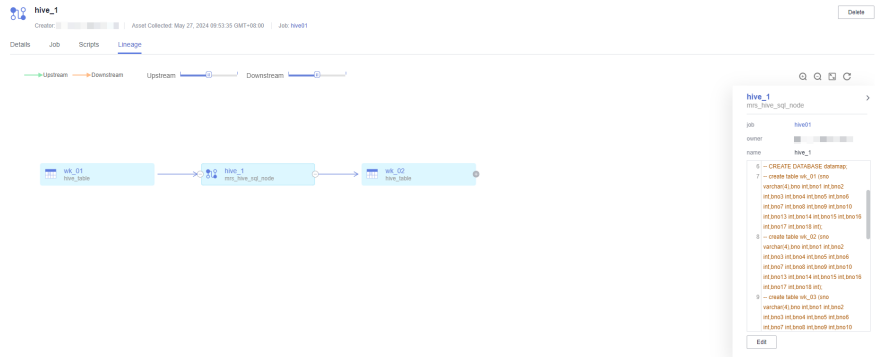
Figure 9-128 Viewing job details



Step 4 In the data asset search result, click the name of an asset ending with **_node** to view its details. On the node details page, you can view the node lineage information.

- Click the **+** or **-** icon beside the node to expand its upstream and downstream links.
- Click a node to view the its details.
- Click the **Job** tab and then **Edit** to go to the job editing page.

Figure 9-129 Viewing lineages of a node



Step 5 In the data asset search result, click the name of an asset whose icon is a table to view its details. On the table details page, you can view lineages of the table.

- Click the **+** or **-** icon beside the table to expand its upstream and downstream links.
- Click a table to view its details.

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Figure 9-130 Viewing lineages of a table



----End

9.12.3 CDM Job

Functions

The CDM Job node is used to run a predefined CDM job for data migration.

NOTE

If you have configured a macro variable of date and time in a CDM job and schedule the CDM job through DataArts Factory, the system replaces the macro variable of date and time with (*Planned start time of the data development job – Offset*) rather than (*Actual start time of the CDM job – Offset*).

Parameters

Table 9-83, **Table 9-84**, and **Table 9-85** describe the parameters of the CDM Job node. Configure the lineage to identify the data flow direction, which can be viewed in the DataArts Catalog module.

Table 9-83 Parameters of CDM Job nodes

Parameter	Mandatory	Description
CDM Cluster Name	Yes	Name of the CDM cluster to which the CDM job to be executed belongs. You can select two CDM clusters to improve job reliability. • If you select two clusters, they are delivered randomly to share load. If one cluster is abnormal, jobs are switched to the other cluster. • If you select two clusters, you are advised to set **Job Type** to **Existing jobs** rather than **New jobs** and ensure that the job exists in both clusters. You can create a CDM job in one cluster, export it, and import it to the other cluster to implement job synchronization. For details, see **Exporting and Importing CDM Jobs in Batches**.

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Parameter	Mandatory	Description

Job Type	Yes	• Existing jobs
		• New jobs
		NOTE
		• If **Job Type** is **Existing jobs**, the job node is not updated when the CDM job is modified. To update the job node, save the job where the node is located again to trigger a CDM job update.
		• If **Job Type** is **New jobs**, the system checks whether a CDM job with the same name is running.
		  • If the CDM job is not running, update the job with the same name based on the request body.
		  • If a CDM job with the same name is running, update the job after the job is run. During this period, the job may be started by other tasks. As a result, the extracted data may not be the same as expected (for example, the job configuration is not updated, or the macro of the running time is not correctly replaced). Therefore, do not create multiple jobs with the same name.

CDM Job Name	No	This parameter is required only when **Job Type** is set to **Existing jobs**. Name of the CDM job to be executed. If the CDM job uses the **job parameters** or **environment variables** configured during data development, data can be indirectly migrated based on the parameters or variables during node scheduling in the DataArts Factory module.
CDM Job Message Body	No	This parameter is required only when **Job Type** is set to **New jobs**. Enter the JSON message body of the CDM job. For convenience, you can choose **More** > **View Job JSON** in the **Operation** column of an existing CDM job, copy the JSON content, and modify the content here. If the CDM job uses the **job parameters** or **environment variables** configured during data development, data can be indirectly migrated based on the parameters or variables during node scheduling in the DataArts Factory module.
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected CDM job. If you want the node name to be different from the CDM job name, disable this function by referring to **Disabling Auto Node Name Change**.

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Table 9-84 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	Specifies how often the system check completeness of the node task. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	indicates the execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. ● **Yes**: The node task will be re-executed, and the following parameters must be configured: – Maximum Retries – Retry Interval (seconds) ● **No**: The node will not be re-executed. This is the default setting. **NOTE** ● You are advised to configure automatic retry for only file migration jobs or database migration jobs with **Import to Staging Table** enabled to avoid data inconsistency caused by repeated data writes. ● If parameter transfer is used for scheduling the CDM job, do not configure parameter **Retry upon Failure** in the CDM job. ● If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-85 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click  to modify the parameter settings. After the modification, save the settings.
Delete	Click  to delete the parameter settings.
View Details	Click  to view details about the table created based on the input lineage.

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Parameter	Description
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

9.12.4 Data Migration

Functions

This node is used to execute an offline or real-time processing migration job.

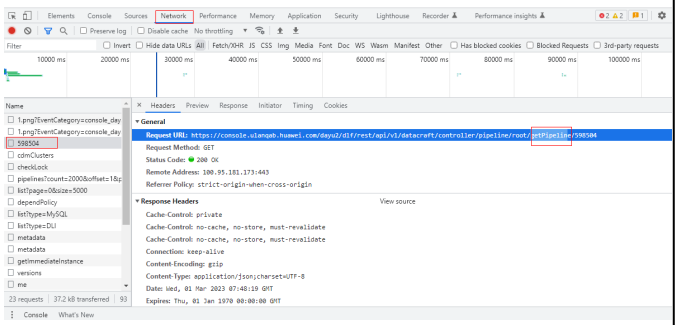
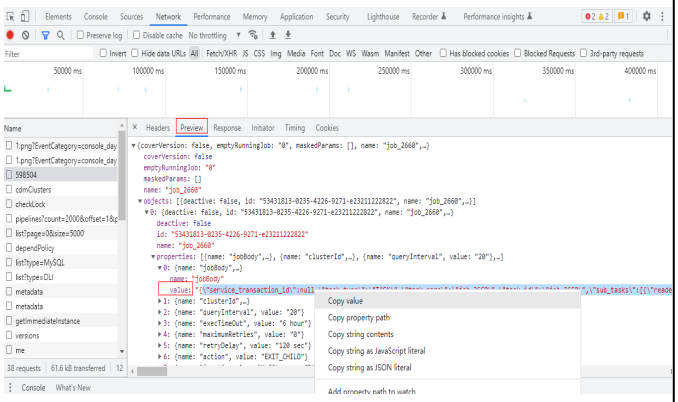
Parameters

Table 9-86 and Table 9-87 describe the parameters of the Data Migration node.

Table 9-86 Properties

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
CDM Cluster Name	Yes	Select CDM clusters. To view the cluster list, click on the right of the drop-down list box. You can select a maximum of 16 clusters.

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Parameter	Mandatory	Description
CDM Job Message Body	Yes	Enter the CDM job message body in JSON format. To obtain the JSON message body, perform the following steps: 1. Create a single-task data migration job by referring to **Creating an Offline Processing Migration Job**. 2. Press **F12** and click the **Network** tab. Check that the request mode of this job is **getPipeline**. **Figure 9-131** Request mode getPipeline  3. On the **Preview** tab page, obtain the JSON message body from the **value** field in **jobBody**. **Figure 9-132** JSON message body  4. Copy the obtained message body to **CDM Job Message Body**. You can edit the JSON message body. 5. Click **Save**.

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Table 9-87 Advanced parameters

Parameters	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system checks whether the node execution is complete. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. • **Yes**: The node task will be re-executed, and the following parameters must be configured: – Maximum Retries – Retry Interval (seconds) • **No**: The node will not be re-executed. This is the default setting. **NOTE** • You are advised to configure automatic retry for only file migration jobs or database migration jobs with **Import to Staging Table** enabled to avoid data inconsistency caused by repeated data writes. • If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: Execution of the current job will stop, and the job instance status will become **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameters	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.5 Rest Client

Functions

The Rest Client node is used to respond to RESTful requests in Huawei Cloud.

For details about how to use the Rest Client operator, see **Obtaining the Return Value of a Rest Client Node**.

NOTE

If some APIs of the Rest Client node cannot be called due to network restrictions, you can use a shell script to call the APIs. To call an API using a shell script, you must have an ECS that can communicate with the API. Create a host connection and run the curl command to call the API using the shell script.

Rest Client operators do not support response bodies larger than 30 MB.

Parameters

Table 9-88, **Table 9-89**, and **Table 9-90** describe the parameters of the Rest Client node.

Table 9-88 Parameters of Rest Client nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Agent Name	Yes	Name of a CDM cluster. The CDM cluster provides the agent connection function. If the selected CDM cluster is in the same VPC as the third-party service, the REST client can call APIs on the tenant plane. **NOTE** You can select multiple clusters and must ensure that at least one cluster can be connected. If multiple clusters can be connected, DataArts Factory randomly connects one.

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Parameter	Mandatory	Description
URL Address	Yes	IP address or domain name and port number of the request host. For example: https://192.160.10.10:8080
HTTP Method	Yes	Type of the request. Possible values: • **GET** • **POST** • **PUT** • **DELETE**
API Authentication Mode	Yes	• **IAM**: APIs can be accessed only by cloud users. The request header of a message sent by DataArts Studio to an API contains the authentication information of the current user. • **Non-authentication**: Authentication is not required for calling APIs.
Request Header	No	Click + to add a request header. The parameters are described as follows: • Parameter Name Name of a parameter. The options are **Content-Type** and **Accept-Language**. • Parameter Value Value of the parameter
URL Parameter	No	Enter a URL parameter. The value is a character string in **key=value** format. Character strings are separated by newlines. This parameter is available only when **HTTP Method** is set to **GET**. Set these parameters as follows: • Parameter The parameter contains a maximum of 32 characters, including only letters, numbers, hyphens (-), and underscores (_). • Value The value contains a maximum of 64 characters, including only letters, digits, hyphens (-), underscores (_), number signs (#), open braces ({), and close braces (}).
Request Body	Yes	The request body is in JSON format. This parameter is available only when **HTTP Method** is set to **POST** or **PUT**.

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Parameter	Mandatory	Description
Check Return Value	No	Checks whether the value of the returned message is the same as the expected value. This parameter is available only when **HTTP Method** is set to **GET**. Possible values: • **YES**: Check whether the return value is the same as the expected one. • **NO**: No need to check whether the return value is the same as the expected one. A 200 response code is returned (indicating that the node is successfully performed).

Property Path	Yes	Path of the property in the JSON response message. Each Rest Client node can have only one property path. This parameter is available only when **Check Returned Value** is set to **YES**.
		For example, the returned result is as follows:
		{
		"param1": "aaaa",
		"inner":
		{
		"inner":
		{
		"param4": 2014247437
		},
		"param3": "cccc"
		},
		"status": 200,
		"param2": "bbbb"
		}
		The **param4** path is **inner.inner.param4**.

Request Success Flag	Yes	Enter the request success flag. If the returned value of the response matches one of request success flags, the node is successfully performed. This parameter is available only when **Check Returned Value** is set to **YES**. The request success flag can contain only letters, numbers, hyphens (-), underscores (_), dollar signs ($), open braces ({), and close braces (}). Separate values with semicolons (;).
Request Failure Flag	No	Enter the request failure flag. If the returned value of the response matches one of request failure flags, the node is successfully performed. This parameter is available only when **Check Returned Value** is set to **YES**. The request failure flag can contain only letters, numbers, hyphens (-), underscores (_), dollar signs ($), open braces ({), and close braces (}). Separate values with semicolons (;).

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Parameter	Mandatory	Description
Retry Interval (seconds)	Yes	If the return value of the response message does not match the request success flag, the node keeps querying the matching status at a specified interval until the return value of the response message is the same as the request success flag. By default, the timeout interval of the node is one hour. If the return value of the response message does not match the request success flag within this period, the node status changes to **Failed**. This parameter is available only when **Check Returned Value** is set to **YES**.
The response message body parses the transfer parameter.	No	Specify the mapping between the job variable and JSON property path. Separate parameters by newline characters. For example: var4=inner.inner.param4 **var4** is a job variable. The job variable must contain 1 to 64 characters, including only letters and numbers. **inner.inner.param4** is the JSON property path. This parameter takes effect only when it is referenced by the subsequent node. When this parameter is referenced, the format is **${var4}** **NOTE** The variable name (for example, **var4**) must be unique in the current job.

Table 9-89 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-90 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.6 Import GES

Function

The Import GES node is used to import files from an OBS bucket to a GES graph.

Parameters

Table 9-91 and **Table 9-92** describe the parameters of the Import GES node.

Table 9-91 Parameters of Import GES nodes

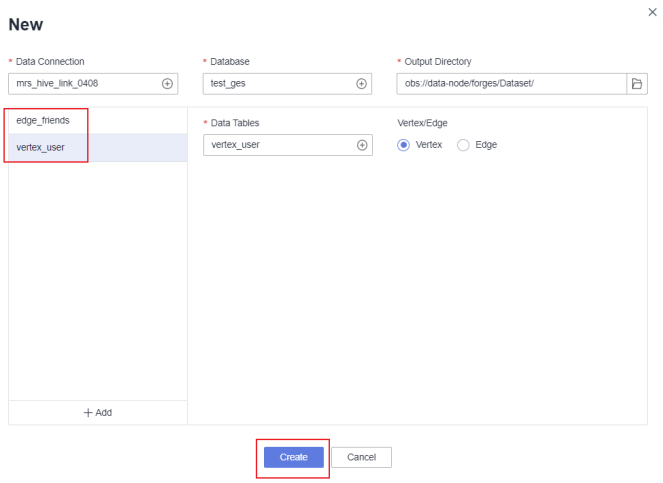
Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Graph Name	Yes	You can directly select the graph to import or manually enter the graph name. To create a GES graph, go to the GES console.
Metadata Source	Yes	Two types of metadata sources are available: • **Existing file**: Select an existing XML metadata file from an OBS bucket. • **New**: Generate an XML metadata file in an OBS bucket based on the vertex tables and edge tables in MRS Hive. **NOTE** Set at least one of the following parameters: **Metadata**, **Edge Data Set**, and **Vertex Data Set**.

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Parameter	Mandatory	Description

Metadata	No	Set this parameter based on the value you select for **Metadata Source**.
		• If you select **Existing file** for **Metadata Source**, click in the text box and select the corresponding metadata file.
		• If you select **New** for **Metadata Source**, click in the text box. In the displayed dialog box, select the vertex table and edge table in MRS Hive, enter the OBS path for storing the metadata, and click **Create**. Then the system automatically generates an XML metadata file and saves it to the OBS path you enter.
		The vertex table and edge table in MRS Hive are the edge data set and vertex data set normalized based on the GES graph data format. They must be consistent with the values of **Edge Data Set** and **Vertex Data Set**, respectively.
		The vertex and edge data sets must comply with the data format requirements of GES graphs. The graph data format requirements are briefed as follows. For details, see **Graph Data Formats**.
		– The vertex data set contains the data of each vertex. Each row is the data of a vertex. The format is as follows. **id** is the unique identifier of vertex data.
		`id,label,property 1,property 2,property 3,...`
		– The edge data set contains the data of each edge. Each row is the data of an edge. Graph specifications in GES are defined based on the edge quantity, for example, one million edges. The format is as follows. **id 1** and **id 2** are the IDs of the two endpoints of an edge.
		`id 1, id 2, label, property 1, property 2,...`

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Parameter	Mandatory	Description
		NOTE When creating metadata, note the following: 1. You can only select a vertex table and a edge table that use a single label. If you select a vertex table or a edge table that has multiple labels, the generated metadata may be missing. 2. The metadata XML file is generated after you click **Create**. If the structure of the vertex table and edge table changes during subsequent job scheduling, the metadata XML file will not be updated automatically. In this case, you need to open the **New** dialog box and click **Create** again to generate a new metadata XML file. 3. In the generated metadata XML file, the value of **Cardinality** (data composite type) in **Property** is **single** and cannot be changed. 4. You can generate metadata XML files for multiple pairs of vertex tables and edge tables at a time. However, only one table can be selected for the **Edge Data Set** and **Vertex Data Set** parameters of the Import GES node. If there are multiple pairs of vertex tables and edge tables, you are advised to create metadata XML files on multiple Import GES nodes. In this way, you can ensure that each piece of metadata corresponds to each pair of vertex tables and edge tables during the import of graph data. **Figure 9-133** New 

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Parameter	Mandatory	Description

Edge Data Set	No	You can select the edge data set CSV file in the corresponding OBS bucket or select the OBS path of the edge data set.
		The vertex and edge data sets must comply with the data format requirements of GES graphs. The graph data format requirements are briefed as follows. For details, see **Graph Data Formats**.
		• The vertex data set contains the data of each vertex. Each row is the data of a vertex. The format is as follows. **id** is the unique identifier of vertex data.
		`id,label,property 1,property 2,property 3,...`
		• The edge data set contains the data of each edge. Each row is the data of an edge. Graph specifications in GES are defined based on the edge quantity, for example, one million edges. The format is as follows. **id 1** and **id 2** are the IDs of the two endpoints of an edge.
		`id 1, id 2, label, property 1, property 2,...`

Vertex Data Set	No	You can directly select the corresponding Vertex data set or select the OBS path of the Vertex data set.
		The vertex and edge data sets must comply with the data format requirements of GES graphs. The graph data format requirements are briefed as follows. For details, see **Graph Data Formats**.
		• The vertex data set contains the data of each vertex. Each row is the data of a vertex. The format is as follows. **id** is the unique identifier of vertex data.
		`id,label,property 1,property 2,property 3,...`
		• The edge data set contains the data of each edge. Each row is the data of an edge. Graph specifications in GES are defined based on the edge quantity, for example, one million edges. The format is as follows. **id 1** and **id 2** are the IDs of the two endpoints of an edge.
		`id 1, id 2, label, property 1, property 2,...`

Edge Processing	Yes	The edge processing supports the following modes: • Allow repetitive edges • Ignore subsequent repetitive edges • Overwrite previous repetitive edges

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Parameter	Mandatory	Description
Offline	No	Whether offline import is used. The value is **Yes** or **No**, and the default value is **No**. • **true**: Offline import is selected. The import speed is high, but the graph is locked and cannot be read or written during the import. • **false**: Online import is selected. Online import is slower than offline import. However, during online import, the graph can be read (but cannot be written).
Ignore Labels on Repetitive Edges	No	Indicates whether to ignore labels on repetitive edges. The value is **Yes** or **No**, and the default value is **Yes**. • **Yes**: Indicates that the repetitive edge definition does not contain the label. That is, the <source vertex, target vertex> indicates an edge, excluding the label information. • **No**: Indicates that the repetitive edge definition contains the label. That is, the <source vertex, target vertex, label> indicates an edge.
Log Storage Path	No	Stores vertex and edge datasets that do not comply with the metadata definition, as well as detailed logs generated during graph import.

Table 9-92 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.7 MRS Kafka

Functions

The MRS Kafka node is used to query the number of messages that are not consumed by a topic.

Parameters

Table 9-93 and **Table 9-94** describe the parameters of the MRS Kafka node.

Table 9-93 Parameters of MRS Kafka nodes

Parameter	Mandatory	Description
Data Connection	Yes	Select the MRS Kafka connection created in the management center.
Topic Name	Yes	Select a topic that has been created in MRS Kafka. The SDK or command line can be used to create a topic. For details, see **Using Kafka from Scratch**.
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).

Table 9-94 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.8 Kafka Client

Functions

The Kafka Client node is used to send data to Kafka topics.

You can learn more about how to use the Kafka Client node in .

Parameters

Table 9-95 describes the parameters of the Kafka Client node.

Table 9-95 Parameters of Kafka Client nodes

Parameter	Mandatory	Description
Data Connection	Yes	Select the MRS Kafka connection created in the management center.
Topic Name	Yes	Select the topic to which data is to be uploaded. If there are multiple partitions, data is sent to partition 0 by default.
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Text	Yes	Text content sent to Kafka. You can directly enter text or click  to use the EL expression.

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Table 9-96 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.

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Parameter	Mandatory	Description
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.9 ROMA FDI Job

Functions

The ROMA FDI Job node executes a predefined ROMA Connect data integration task to implement data integration and conversion between the source and destination.

Working Principles

This node enables you to start an FDI task or query whether an FDI task is running.

Parameters

The following table describes the parameters of a ROMA FDI Job node.

Table 9-97 Property parameters

Parameter	Mandatory	Description
Node Name	Yes	Name of the node. The value must consist of 1 to 128 characters and contain only letters, digits, and the following special characters: _-/<>
Region	Yes	Region where an existing instance resides
ROMA Instance	Yes	Select an existing ROMA instance. You can select an ROMA instance in another resource space.
FDI Task	Yes	Select an existing ROMA FDI task. You can select an FDI task in another resource space.

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Table 9-98 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.10 DLI Flink Job

Function

The DLI Flink Job node is used to create and start jobs or check whether DLI jobs are running to analyze streaming big data in real time.

After a DLI Flink streaming job is submitted to DLI, if the job is in the running state, the node is successfully executed. If periodic scheduling is configured for the job, the system periodically checks whether the Flink job is still in the running state. If the Flink job is in the running state, the node is successfully executed.

Parameters

For details about how to configure the parameters of DLI Flink jobs, see the following:

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- Property parameters:

  If the job is a Flink SQL job, Flink OpenSource SQL job, or custom Flink job, the system creates and starts the job based on the job status configured on the node.

  - **Existing Flink job**: For details, see **Table 9-99**.
  - **Flink SQL job**: For details, see **Table 9-100**.
  - **Flink OpenSource SQL job**: For details, see **Table 9-101**.
  - **User-defined Flink job**: For details, see **Table 9-102**.
- Advanced parameter: **Table 9-103**

Table 9-99 Parameter parameters of an existing Flink job

Parameter	Mandatory	Description
Job Type	Yes	Select **Existing Flink job**.
Job Name	Yes	Name of an existing DLI Flink job.
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).

Table 9-100 Property parameters of a Flink SQL job

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Job Type	Yes	Select **Flink SQL job**. You can start a job by compiling SQL statements.
Job Name	Yes	Name of the DLI Flink job. It must consist of 1 to 64 characters and contain only letters, numbers, and underscores (_). The default value is the same as the node name.
Job name must be prefixed with workspace name	No	Whether to add a workspace prefix to the created job.
Script Path	Yes	Path to a Flink SQL script to be executed. If the script is not created, create and develop the Flink SQL script by referring to **Creating a Script** and **Developing an SQL Script**.

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Parameter	Mandatory	Description
Script Parameter	No	If the associated Flink SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be an **EL expression**. If the parameters of the associated Flink SQL script are changed, click to refresh the parameters.
UDF Jar	No	This parameter is valid only when you select a dedicated queue for **Queue**. Before selecting a UDF JAR resource package, upload the UDF JAR package to the OBS bucket and create resources on the **Manage Resource** page. For details, see **Creating a Resource**. In SQL, you can call a user-defined function that is inserted into a JAR package.
DLI Queue	Yes	**Shared queues** are selected by default. You can also select a dedicated custom queue. **NOTE** • During job creation, a sub-user can only select a queue that has been allocated to the user. • The version of the default Spark component of the default DLI queue is not up-to-date, and an error may be reported indicating that a table creation statement cannot be executed. In this case, you are advised to create a queue to run your tasks. To enable the execution of table creation statements in the default queue, contact the customer service or technical support of the DLI service. • The default queue **default** of DLI is only used for trial. It may be occupied by multiple users at a time. Therefore, it is possible that you fail to obtain the resource for related operations. If the execution takes a long time or fails, you are advised to try again during off-peak hours or use a self-built queue to run the job.
CUs	Yes	A CU consists of 1 vCPU compute and 4 GB memory.
Concurrency	Yes	The number of Flink SQL jobs that run at the same time. **NOTE** The value of **Concurrency** must not exceed the value obtained through the following formula: 4 x (Number of CUs – 1).
Auto Restart upon Exception	No	Indicates whether to enable automatic restart. If this function is enabled, any job that has become abnormal will be automatically restarted.

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Table 9-101 Property parameters of a Flink OpenSource SQL job

Parameters	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Job Type	Yes	Select **Flink OpenSource SQL job**. You can start a job by compiling SQL statements.
Job Name	Yes	Name of the DLI Flink job. It must consist of 1 to 64 characters and contain only letters, numbers, and underscores (_). The default value is the same as the node name.
Job name must be prefixed with workspace name	No	Whether to add a workspace prefix to the created job.
Script Path	Yes	Path to a Flink SQL script to be executed. If the script is not created, create and develop the Flink SQL script by referring to **Creating a Script** and **Developing an SQL Script**.
Script Parameter	No	If the associated Flink SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be an **EL expression**. If the parameters of the associated Flink SQL script are changed, click to refresh the parameters.
UDF Jar	No	This parameter is valid only when you select a dedicated queue for **Queue**. Before selecting a UDF JAR resource package, upload the UDF JAR package to the OBS bucket and create resources on the **Manage Resource** page. For details, see **Creating a Resource**. In SQL, you can call a user-defined function that is inserted into a JAR package.

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Parameters	Mandatory	Description
DLI Queue	Yes	**Shared queues** are selected by default. You can also select a dedicated custom queue. **NOTE** • During job creation, a sub-user can only select a queue that has been allocated to the user. • The default queue **default** of DLI is only used for trial. It may be occupied by multiple users at a time. Therefore, it is possible that you fail to obtain the resource for related operations. If the execution takes a long time or fails, you are advised to try again during off-peak hours or use a self-built queue to run the job.
CUs	Yes	A CU consists of 1 vCPU compute and 4 GB memory.
Concurrency	Yes	The number of Flink SQL jobs that run at the same time. **NOTE** The value of **Concurrency** must not exceed the value obtained through the following formula: 4 x (Number of CUs – 1).
Auto Restart upon Exception	No	Indicates whether to enable automatic restart. If this function is enabled, any job that has become abnormal will be automatically restarted.

Table 9-102 Property parameters of a user-defined Flink job

Parameter	Mandatory	Description
Job Type	Yes	Select **User-defined Flink job**.
JAR Package	Yes	User-defined package. Before selecting a package, upload the JAR package to the OBS bucket and create resources on the **Manage Resource** page. For details, see **Creating a Resource**.
Main Class	Yes	Name of the JAR package to be loaded, for example, **KafkaMessageStreaming**. • **Default**: Specified based on the **Manifest** file in the JAR package. • **Manually assign**: Enter the class name and confirm the class arguments (separate arguments with spaces). **NOTE** When a class belongs to a package, the package path must be carried, for example, **packagePath.KafkaMessageStreaming**.

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Parameter	Mandatory	Description
Main Class Parameter	Yes	List of parameters of a specified class. The parameters are separated by spaces.
DLI Queue	Yes	**Shared queues** are selected by default. You can also select a dedicated custom queue. **NOTE** • During job creation, a sub-user can only select a queue that has been allocated to the user. • The version of the default Spark component of the default DLI queue is not up-to-date, and an error may be reported indicating that a table creation statement cannot be executed. In this case, you are advised to create a queue to run your tasks. To enable the execution of table creation statements in the default queue, contact the customer service or technical support of the DLI service. • The default queue **default** of DLI is only used for trial. It may be occupied by multiple users at a time. Therefore, it is possible that you fail to obtain the resource for related operations. If the execution takes a long time or fails, you are advised to try again during off-peak hours or use a self-built queue to run the job.
Job Type	No	Select a custom image and the corresponding version. This parameter is available only when the DLI queue is a containerized queue. A custom image is a feature of DLI. You can use the Spark or Flink basic images provided by DLI to pack the dependencies (files, JAR packages, or software) required into an image using Dockerfile, generate a custom image, and release the image to SWR. Then, select the generated image and run the job. Custom images can change the container runtime environments of Spark and Flink jobs. You can embed private capabilities into custom images to enhance the functions and performance of jobs. For details about custom images, see **Overview of Custom Images**.
CUs	Yes	Compute Unit (CU) is the pricing unit for DLI. A CU consists of 1 vCPU compute and 4 GB memory.
Number of management node CUs	Yes	Set the number of CUs on a management unit. The value ranges from 1 to 4. The default value is **1**.

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Parameter	Mandatory	Description
Concurrency	Yes	The number of Flink SQL jobs that run at the same time. **NOTE** The value of **Concurrency** must not exceed the value obtained through the following formula: 4 x (Number of CUs – 1).
Auto Restart upon Exception	No	Indicates whether to enable automatic restart. If this function is enabled, any job that has become abnormal will be automatically restarted.
Job Name	Yes	Name of the DLI Flink job. It must consist of 1 to 64 characters and contain only letters, numbers, and underscores (_). The default value is the same as the node name.
Job name must be prefixed with workspace name	No	Whether to add a workspace prefix to the created job.
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).

Table 9-103 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.11 DLI SQL

Functions

The DLI SQL node is used to transfer SQL statements to DLI SQL for data source analysis and exploration.

Working Principles

This node enables you to execute DLI statements during periodical or real-time job scheduling. You can use parameter variables to perform incremental import and process partitions for your data warehouses.

Parameters

Table 9-104, **Table 9-105**, and **Table 9-106** describe the parameters of the DLI SQLnode node.

Table 9-104 Parameters of DLI SQL nodes

Parameter	Mandatory	Description
SQL Statement or Script	Yes	You can select **SQL statement** or **SQL script**. • SQL Statement Click the text box under **SQL statement** and enter the SQL statement to be executed. • SQL Script Select a script to be executed. If the script is not created, create and develop the script by repeating steps **Creating a Script** and **Developing an SQL Script**. **NOTE** If you select the SQL statement mode, the DataArts Factory module cannot parse the parameters contained in the SQL statement.

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Parameter	Mandatory	Description
DLI Data Directory	No	Select the DLI data directory. • Default DLI data directory **dli** • Metadata catalog that has been created in LakeFormation associated with DLI.
Database Name	Yes	If you select **SQL script**: Database that is configured in the SQL script. The value can be changed. If you select **SQL Statement**: • If you select the default DLI data directory **dli**, select a DLI database and tables. • If you select a metadata catalog that has been created in LakeFormation associated with DLI, select a LakeFormation database and tables.

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Parameter	Mandatory	Description
DLI Environmental Variable	No	• The environment variable must start with **hoodie.**, **dli.sql.**, **dli.ext.**, **dli.jobs.**, **spark.sql.**, or **spark.scheduler.pool**. • If the key of the environment variable is **dli.sql.shuffle.partitions** or **dli.sql.autoBroadcastJoinThreshold**, the environment variable cannot contain the greater than (>) or less than (<) sign. • If the key of the environment variable is **dli.sql.autoBroadcastJoinThreshold**, the value of the key must be an integer. If the key of the environment variable is **dli.sql.shuffle.partitions**, the value of the key must be a positive integer. • If a parameter with the same name is configured in both a job and a script, the parameter value configured in the job will overwrite that configured in the script. **NOTE** User-defined parameter that applies to the job. Currently, the following configuration items are supported: • **dli.sql.autoBroadcastJoinThreshold**: specifies the data volume threshold to use BroadcastJoin. If the data volume exceeds the threshold, BroadcastJoin will be automatically enabled. • **dli.sql.shuffle.partitions**: specifies the number of partitions during shuffling. • **dli.sql.cbo.enabled**: specifies whether to enable the CBO optimization policy. • **dli.sql.cbo.joinReorder.enabled**: specifies whether join reordering is allowed when CBO optimization is enabled. • **dli.sql.multiLevelDir.enabled**: specifies whether to query the content in subdirectories if there are subdirectories in the specified directory of an OBS table or in the partition directory of an OBS partition table. By default, the content in subdirectories is not queried. • **dli.sql.dynamicPartitionOverwrite.enabled**: specifies that only partitions used during data query are overwritten and other partitions are not deleted.

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Parameter	Mandatory	Description
Queue Name	Yes	Name of the DLI queue configured in the SQL script. The value can be changed. You can create a resource queue using either of the following methods: • Click  . On the **Queue Management** page of DLI, create a resource queue. • Go to the DLI console to create a resource queue. **NOTE** • During job creation, a sub-user can only select a queue that has been allocated to the user. • The version of the default Spark component of the default DLI queue is not up-to-date, and an error may be reported indicating that a table creation statement cannot be executed. In this case, you are advised to create a queue to run your tasks. To enable the execution of table creation statements in the default queue, contact the customer service or technical support of the DLI service. • The default queue **default** of DLI is only used for trial. It may be occupied by multiple users at a time. Therefore, it is possible that you fail to obtain the resource for related operations. If the execution takes a long time or fails, you are advised to try again during off-peak hours or use a self-built queue to run the job.
Script Parameter	No	If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**. If the parameters of the associated SQL script are changed, click  to refresh the parameters.
Node Name	Yes	Name of the SQL script. The value can be changed. The rules are as follows: Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

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Parameter	Mandatory	Description
Record Dirty Data	Yes	Click to specify whether to record dirty data. • If you select , dirty data will be recorded. • If you do not select , dirty data will not be recorded. **NOTE** Dirty data refers to bad records which cannot be loaded to DLI due to incompatible data types, empty data, or incompatible data formats. If you choose to record dirty data, bad records are imported to the OBS path for storing dirty data instead of the target table. • If no OBS path for storing DLI dirty data has been configured in the workspace, the dirty data generated during DLI SQL execution is written to the **dlf-log-{projectId}** bucket by default. • To set the path for storing DLI dirty data, go to the **Workspaces** page and edit the workspace. For details, see **Configuring an OBS Bucket**.

Table 9-105 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-106 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.12 DLI Spark

Functions

The DLI Spark node is used to execute a predefined Spark job.

For details about how to use the DLI Spark node, see **Developing a DLI Spark Job**.

Parameters

Table 9-107, **Table 9-108**, and **Table 9-109** describe the parameters of the DLI Sparknode node.

Table 9-107 Parameters of DLI Spark nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
DLI Queue	Yes	Select a queue from the drop-down list box. **NOTE** • During job creation, a sub-user can only select a queue that has been allocated to the user. • The version of the default Spark component of the default DLI queue is not up-to-date, and an error may be reported indicating that a table creation statement cannot be executed. In this case, you are advised to create a queue to run your tasks. To enable the execution of table creation statements in the default queue, contact the customer service or technical support of the DLI service. • The default queue **default** of DLI is only used for trial. It may be occupied by multiple users at a time. Therefore, it is possible that you fail to obtain the resource for related operations. If the execution takes a long time or fails, you are advised to try again during off-peak hours or use a self-built queue to run the job.
Spark Version	No	Select the version of the Spark component. If there is no specific requirement on the version, use the default version 2.3.2.

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Parameter	Mandatory	Description
Job Type	No	Type of the Spark image used by the job. The following options are available: **Basic**, **AI-enhanced**, and **Image**. If you select **Image**, you need to set the image name and version. This parameter is available only when the DLI queue is a containerized queue. A custom image is a feature of DLI. You can use the Spark or Flink basic images provided by DLI to pack the dependencies (files, JAR packages, or software) required into an image using Dockerfile, generate a custom image, and release the image to SWR. Then, select the generated image and run the job. Custom images can change the container runtime environments of Spark and Flink jobs. You can embed private capabilities into custom images to enhance the functions and performance of jobs.
Job Name	Yes	Name of the DLI Spark job. The name must contain 1 to 64 characters, including only letters, numbers, and underscores (_). The default value is the same as the node name.
Job Running Resources	No	Select the running resource specifications of the job. • 8-core, 32 GB memory • 16-core, 64 GB memory • 32-core, 128 GB memory
Major Job Class	Yes	Name of the major class of the Spark job. When the application type is **.jar**, the main class name cannot be empty.
Spark program resource package	Yes	JAR file on which the Spark job depends. You can enter the JAR package name or the corresponding OBS path. The format is as follows: **obs://*Bucket name/Folder name/Package name***. Before selecting a resource package, upload the JAR package and its dependency packages to the OBS bucket and create resources on the **Manage Resource** page. For details, see **Creating a Resource**.

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Parameter	Mandatory	Description
Resource Type	Yes	Select **OBS path** or **DLI program package**. • **OBS path**: The resource package file will not be uploaded to DLI resource management system before the job is executed. The OBS path where the file is located is part of the message body for starting the job. This type is recommended. • DLI package: The resource package file will be uploaded to the DLI resource management system before the job is executed.
Group	No	This parameter is mandatory when **Resource Type** is set to **DLI program package**. You can select **Use existing**, **Create new**, or **Do not use**.
Group Name	No	This parameter is mandatory when **Resource Type** is set to **DLI program package**. • **Use existing**: Select an existing group. • **Create new**: Enter a user-defined group name. • **Do not use**: Do not select or enter a group name.
Major-Class Entry Parameters	No	User-defined parameters. Separate multiple parameters by **Enter**. These parameters can be replaced by global variables. For example, if you create a global variable **batch_num** on the **Global Configuration** > **Global Variables** page, you can use **{{batch_num}}** to replace a parameter with this variable after the job is submitted.
Spark Job Running Parameters	No	Enter a parameter in the format of **key/value**. Press Enter to separate multiple key-value pairs. For details about the parameters, see **Spark Configuration**. These parameters can be replaced by global variables. For example, if you create a global variable **custom_class** on the **Global Configuration** > **Global Variables** page, you can use **"spark.sql.catalog"={{custom_class}}** to replace a parameter with this variable after the job is submitted. **NOTE** The JVM garbage collection algorithm cannot be customized for Spark jobs.

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Parameter	Mandatory	Description
Module Name	No	Dependency modules provided by DLI for executing datasource connection jobs. To access different services, you need to select different modules. • CloudTable/MRS HBase: sys.datasource.hbase • DDS: sys.datasource.mongo • CloudTable/MRS OpenTSDB: sys.datasource.opentsdb • DWS: sys.datasource.dws • RDS MySQL: sys.datasource.rds • RDS PostGre: sys.datasource.rds • DCS: sys.datasource.redis • CSS: sys.datasource.css DLI internal modules include: • sys.res.dli-v2 • sys.res.dli • sys.datasource.dli-inner-table
Metadata Access	Yes	Whether to access metadata through Spark jobs. For details, see **Using the Spark Job to Access DLI Metadata**.

Table 9-108 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-109 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.13 DWS SQL

Functions

The DWS SQL node is used to transfer SQL statements to DWS.

For details about how to use the DWS SQL operator, see **Developing a DWS SQL Script and Job**.

Context

This node enables you to execute DWS statements during batch or real-time job processing. You can use parameter variables to perform incremental import and process partitions for your data warehouses.

Parameters

Table 9-110, **Table 9-111**, and **Table 9-112** describe the parameters of the DWS SQLnode node.

Table 9-110 Parameters of DWS SQL nodes

Parameter	Mandatory	Description
SQL or Script	Yes	You can select **SQL statement** or **SQL script**. • SQL Statement Click the text box under **SQL statement** and enter the SQL statement to be executed. • SQL Script Select a script to be executed. If the script is not created, create and develop the script by repeating steps **Creating a Script** and **Developing an SQL Script**. **NOTE** If you select the SQL statement mode, the DataArts Factory module cannot parse the parameters contained in the SQL statement.
Data Connection	Yes	Data connection that is configured in the SQL script. The value can be changed.
Database	Yes	Database that is configured in the SQL script. The value can be changed.
Script Parameter	No	If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**. If the parameters of the associated SQL script are changed, click to refresh the parameters.

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Parameter	Mandatory	Description
Dirty Data Table	No	Name of the dirty data table defined in the SQL script. The dirty data attributes cannot be edited. They are automatically recommended by the SQL script content. Syntax for the DWS dirty data table: **with** table_name or **log into** table_name
Matching Rule	N/A	Enter a Java regular expression used to match the DWS SQL result. For example, if the expression is (?<=\()(-*\d+?)(?=,) and the SQL result is (1,"error message"), then the matched result is "1".
Failure Matching Value	N/A	If the matched content equals the set value, the node fails to be executed.
Node Name	Yes	Name of the SQL script. The value can be changed. The rules are as follows: Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

Table 9-111 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-112 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.14 MRS Spark SQL

Functions

The MRS Spark SQL node is used to execute a predefined SparkSQL statement on MRS.

Parameters

Table 9-113, **Table 9-114**, and **Table 9-115** describe the parameters of the MRS Spark SQLnode node.

Table 9-113 Parameters of MRS Spark SQL nodes

Parameter	Mandatory	Description
MRS Job Name	No	MRS job name. If the MRS job name is not set and the direct connection mode is selected, the node name can contain a maximum of 64 characters and can only consist of letters, digits, hyphens (-), and underscores (_). The system can automatically enter an MRS job name in *Job name_Node name* format.
SQL Script	Yes	Path of a script to be executed. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing an SQL Script**.
Data Connection	Yes	Data connection that is configured in the SQL script. The value can be changed.
MRS Resource Queue	No	Select a created MRS resource queue. **NOTE** • If you have selected an MRS API connection, you can configure resources (such as threads, memory, CPUs, and MRS resource queues) specially for the Spark SQL job. However, you cannot do so if you have selected a proxy connection. • Select a queue you configured based on **Configuring Queue Permissions** in DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.
Database	Yes	Database that is configured in the SQL script. The value can be changed. If you select an MRS API connection, you cannot select a database.

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Parameter	Mandatory	Description
Script Parameter	No	If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**. If the parameters of the associated SQL script are changed, click to refresh the parameters.
Program Parameter	No	Used to configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **NOTE** • If you have selected an MRS API connection, you can configure resources (such as threads, memory, CPUs, and MRS resource queues) specially for the Spark SQL job. However, you cannot do so if you have selected a proxy connection. • This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1. For details about the program parameters of MRS SparkSQL jobs, see **Running a SparkSql Job** > **Table 2 Program Parameter parameters** in the *MapReduce User Guide*.
Node Name	Yes	Name of the SQL script. The value can be changed. Node name. It contains 1 to 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. **NOTE** The node name cannot contain Chinese characters or more than 64 characters. If the node name does not meet requirements, the MRS job will fail to be submitted. By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

Table 9-114 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.

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Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.

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Parameter	Mandatory	Description
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-115 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.

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Parameter	Description
View Details	Click to view details about the table created based on the output lineage.

9.12.15 MRS Hive SQL

Functions

The MRS Hive SQL node is used to execute a predefined Hive SQL script in DataArts Factory.

For details about how to use the MRS Hive SQL node, see **Developing a Hive SQL Job**.

NOTE

MRS Hive SQL nodes do not support Hive transaction tables.

Parameters

Table 9-116, **Table 9-117**, and **Table 9-118** describe the parameters of the MRS Hive SQLnode node.

Table 9-116 Parameters of MRS Hive SQL nodes

Parameter	Mandatory	Description
MRS Job Name	No	MRS job name. If the MRS job name is not set and the direct connection mode is selected, the node name can contain a maximum of 64 characters and can only consist of letters, digits, hyphens (-), and underscores (_). The system can automatically enter an MRS job name in *Job name_Node name* format.
SQL Script	Yes	Path of a script to be executed. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing an SQL Script**.
Data Connection	Yes	Data connection that is configured in the SQL script. The value can be changed.
Database	Yes	Database that is configured in the SQL script. The value can be changed.

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Parameter	Mandatory	Description
MRS Resource Queue	No	Select a created MRS resource queue. **NOTE** Select a queue you configured in the queue permissions of DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.
Script Parameter	No	If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**. If the parameters of the associated SQL script are changed, click to refresh the parameters.
Program Parameter	No	Used to configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **NOTE** This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1. For details about the program parameters of MRS Hive SQL jobs, see **Running a HiveSql Job** > **Table 2 Program Parameter parameters** in the *MapReduce Service User Guide*.
Node Name	Yes	Name of the SQL script. The value can be changed. The rules are as follows: Node name. It contains 1 to 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. **NOTE** The node name cannot contain Chinese characters or more than 64 characters. If the node name does not meet requirements, the MRS job will fail to be submitted. By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

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Table 9-117 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-118 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click  to modify the parameter settings. After the modification, save the settings.

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Parameter	Description
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

9.12.16 MRS Presto SQL

Functions

The MRS Presto SQL node is used to execute the Presto SQL script predefined in DataArts Factory.

Parameters

Table 9-119, **Table 9-120**, and **Table 9-121** describe the parameters of the MRS Presto SQL node.

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Table 9-119 Property parameters

Parameters	Mandatory	Description
SQL or Script	Yes	You can select **SQL statement** or **SQL script**. • SQL Statement Click the text box under **SQL statement** and enter the SQL statement to be executed. • SQL Script Select a script to be executed. If the script is not created, create and develop the script by repeating steps **Creating a Script** and **Developing an SQL Script**. **NOTE** If you select the SQL statement mode, the DataArts Factory module cannot parse the parameters contained in the SQL statement.
Data Connection	Yes	Data connection that is configured in the SQL script. The value can be changed.
Schema	Yes	Database that is configured in the SQL script. The value can be changed.
Script Parameter	No	If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**. If the parameters of the associated SQL script are changed, click to refresh the parameters.
Node Name	Yes	Name of the SQL script. The value can be changed. Node name. It contains 1 to 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. **NOTE** The node name cannot contain Chinese characters or more than 64 characters. If the node name does not meet requirements, the MRS job will fail to be submitted. By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

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Table 9-120 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-121 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click  to modify the parameter settings. After the modification, save the settings.

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Parameter	Description
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

9.12.17 MRS Spark

Functions

The MRS Spark node is used to execute a predefined Spark job on MRS.

Parameters

Table 9-122, Table 9-123, and Table 9-124 describe the parameters of the MRS Sparknode node.

Table 9-122 Parameters of MRS Spark nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

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Parameter	Mandatory	Description
MRS Cluster Name	Yes	Name of the MRS cluster. To create an MRS cluster, use either of the following methods: • Click  . On the **Clusters** page, create an MRS cluster. • Go to the MRS console to create an MRS cluster.
MRS Resource Queue	No	Select a created MRS resource queue. **NOTE** Select a queue you configured in the queue permissions of DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.
Spark Job Name	Yes	MRS job name. It can contain a maximum of 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. The system can automatically enter a job name in *Job name_Node name* format. **NOTE** The job name cannot contain Chinese characters or more than 64 characters. If the job name does not meet requirements, the MRS job will fail to be submitted.
Process Type	Yes	Processing type of the Spark job • **Batch**: The node waits for the Spark job execution to complete. • **Stream**: The node is executed as long as the job is successfully started. Each time the job is scheduled in the future, the system checks whether the job is in running state. If the job is in running state, it is successfully executed. Note that this parameter only specifies the processing mode. You must set parameters for the selected mode.
JAR Package	Yes	Select a JAR package. Before selecting a JAR package, upload the JAR package to the OBS bucket, create a resource on the **Manage Resource** page, and add the JAR package to the resource management list. For details, see **Creating a Resource**.
JAR File Parameters	No	Parameters of the JAR package.

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Parameter	Mandatory	Description
Program Parameter	No	Used to configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **NOTE** This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1. For details about the program parameters of MRS Spark jobs, see **Running a Spark Job** in the *MapReduce Service User Guide*.
Input Data Path	No	Path where the input data resides.
Output Data Path	No	Path where the output data resides.

Table 9-123 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-124 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.18 MRS Spark Python

Functions

The MRS Spark Python node is used to execute a predefined Spark Python job on MRS.

For details about how to use the MRS Spark Python operator, see **Developing an MRS Spark Python Job**.

Parameters

Table 9-125, **Table 9-126**, and **Table 9-127** describe the parameters of the MRS Spark Pythonnode node.

Table 9-125 Parameters of MRS Spark Python nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Job Name	Yes	MRS job name. It can contain a maximum of 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. The system can automatically enter a job name in *Job name_Node name* format. **NOTE** The job name cannot contain Chinese characters or more than 64 characters. If the job name does not meet requirements, the MRS job will fail to be submitted.
Script Type	Yes	• Offline • Online
MRS Cluster Name	Yes	Select an MRS cluster that supports Spark Python. Only a specific version of MRS supports Spark Python. Test the cluster first to ensure that it supports Spark Python. To create an MRS cluster, use either of the following methods: • Click . On the **Clusters** page, create an MRS cluster. • Go to the MRS console to create an MRS cluster. For details about how to create a cluster, see **Buying a Custom Cluster** in *MapReduce Service (MRS) Usage Guide*.

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Parameter	Mandatory	Description
MRS Resource Queue	No	Select a created MRS resource queue. **NOTE** Select a queue you configured in the queue permissions of DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.
SQL Script	Yes	This parameter is available only when **Script Type** is set to **Online**. Select a Spark Python script.
Script Parameter	No	This parameter is available only when **Script Type** is set to **Online**. If the associated Spark Python script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name.
Program Parameter	No	This parameter is available only when **Script Type** is set to **Online**. Configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **NOTE** This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1. For details about the program parameters of MRS Spark jobs, see **Running a Spark Job** in the *MapReduce Service User Guide*.
Parameter	Yes	This parameter is available only when **Script Type** is set to **Offline**. Enter parameters. Press **Enter** between parameters.
Execution Program Parameter	No	Enter parameters of the MRS execution program. Use spaces to separate parameters. To prevent parameters from being saved as plaintext, add an at sign (@) before parameters.
Attribute	No	Enter parameters in the key=value format. Use **Enter** to separate multiple parameters.

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Table 9-126 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.

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Parameter	Mandatory	Description
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-127 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.

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Parameter	Description
View Details	Click to view details about the table created based on the output lineage.

9.12.19 MRS ClickHouse

Functions

The MRS ClickHouse node is used to execute the ClickHouse SQL script predefined in DataArts Factory.

Parameters

Table 9-128, **Table 9-129**, and **Table 9-130** describe the parameters of the MRS ClickHouse node.

Table 9-128 Parameters of MRS ClickHouse nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.
SQL Script	Yes	Path of a script to be executed. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing an SQL Script**.
Script Parameter	No	If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be an **EL expression**. If the parameters of the associated SQL script are changed, click to refresh the parameters.
Data Connection	Yes	Data connection that is configured in the SQL script. The value can be changed.
Database	Yes	Database that is configured in the SQL script. The value can be changed.

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Parameter	Mandatory	Description
Program Parameter	No	Used to configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **NOTE** This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1.

Table 9-129 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-130 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click  to modify the parameter settings. After the modification, save the settings.

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Parameter	Description
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

9.12.20 MRS Impala SQL

Functions

The MRS Impala SQL node is used to execute the Impala SQL script predefined in DataArts Factory.

Parameters

Table 9-131 and Table 9-132 describe the parameters of the MRS Impala node.

Table 9-131 Parameters

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

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Parameter	Mandatory	Description
SQL Script	Yes	Path of a script to be executed. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing an SQL Script**.
Data Connection	Yes	Data connection that is configured in the SQL script. The value can be changed.
Database	Yes	Database that is configured in the SQL script. The value can be changed.
Resource Queue	No	Enter the resource queue name.
Script Parameter	No	If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**. If the parameters of the associated SQL script are changed, click to refresh the parameters.

Table 9-132 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-133 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.21 MRS Flink Job

Functions

The MRS Flink Job node is used to execute the Flink SQL script and Flink job predefined in DataArts Factory.

For details about how to use the MRS Flink Job node, see **Developing an MRS Flink Job**.

Parameters

Table 9-134 and **Table 9-135** describe the parameters of the MRS Flink node.

Table 9-134 Parameters of the MRS Flink node

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Job Type	Yes	The following options are available: • Flink SQL job • User-defined Flink job
Script Path	Yes	This parameter is available when you select **Flink SQL job** for **Job Type**. Select the Flink SQL script to be executed. If no Flink SQL script is available, create and develop one by referring to **Creating a Script** and **Developing an SQL Script**.
Script Parameter	No	This parameter is available when you select **Flink SQL job** for **Job Type**. If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**. If the parameters of the associated SQL script are changed, click to refresh the parameters.

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Parameter	Mandatory	Description
Process Type	Yes	Set the mode of the Flink job. • **Batch**: The node waits for the Flink job execution to complete. • **Stream**: The node is executed as long as the job is successfully started. Each time the job is scheduled in the future, the system checks whether the job is in running state. If the job is in running state, it is successfully executed. Note that this parameter only specifies the processing mode. You must set parameters for the selected mode.
MRS Cluster Name	Yes	Select an MRS cluster. To create an MRS cluster, use either of the following methods: • Click . On the **Clusters** page, create an MRS cluster. • Go to the MRS console to create an MRS cluster. **NOTE** Currently, MRS Flink jobs support MRS 3.2.0-LTS.1 and later versions.
Job Name	Yes	MRS job name. It can contain a maximum of 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. The system can automatically enter a job name in *Job name_Node name* format. **NOTE** The job name cannot contain Chinese characters or more than 64 characters. If the job name does not meet requirements, the MRS job will fail to be submitted.
Job Resource Package	Yes	Select a JAR package. Before selecting a JAR package, upload the JAR package to the OBS bucket, create a resource on the **Manage Resource** page, and add the JAR package to the resource management list. For details, see **Creating a Resource**.
Job Execution Parameter	No	Key parameter of the program that executes the Flink job. This parameter is specified by a function in the user program. Multiple parameters are separated by space.
MRS Resource Queue	No	Select a created MRS resource queue. **NOTE** Select a queue you configured in the queue permissions of DataArts Security. If you set multiple resource queues for this node, the resource queue you select here has the highest priority.

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Parameter	Mandatory	Description
Program Parameter	No	Used to configure optimization parameters such as threads, memory, and vCPUs for the job to optimize resource usage and improve job execution performance. **NOTE** This parameter is mandatory if the cluster version is MRS 1.8.7 or later than MRS 2.0.1. For details about the program parameters of MRS Spark jobs, see **Running a Flink Job** in the *MapReduce Service User Guide*.
Input Data Path	No	Path where the input data resides.
Output Data Path	No	Path where the output data resides.

Table 9-135 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.22 MRS MapReduce

Functions

The MRS MapReduce node is used to execute a predefined MapReduce program on MRS.

Parameters

Table 9-136 and **Table 9-137** describe the parameters of the MRS MapReduce node.

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Table 9-136 Parameters of MRS MapReduce nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
MRS Cluster Name	Yes	Name of the MRS cluster. To create an MRS cluster, use either of the following methods: • Click . On the **Clusters** page, create an MRS cluster. • Go to the MRS console to create an MRS cluster.
MapReduce Job Name	Yes	MRS job name. It can contain a maximum of 64 characters. Only letters, digits, hyphens (-), and underscores (_) are allowed. **NOTE** The job name cannot contain Chinese characters or more than 64 characters. If the job name does not meet requirements, the MRS job will fail to be submitted.
JAR Package	Yes	Select a JAR package. Before selecting a JAR package, upload the JAR package to the OBS bucket, create a resource on the **Manage Resource** page, and add the JAR package to the resource management list. For details, see **Creating a Resource**.
JAR File Parameters	No	Parameters of the JAR package.
Input Data Path	No	Path where the input data resides.
Output Data Path	No	Path where the output data resides.

Table 9-137 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.23 CSS

Functions

The CSS node is used to process CSS requests and enable online distributed searching.

Parameters

Table 9-138 and **Table 9-139** describe the parameters of the CSS node.

Table 9-138 Parameters of CSS nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Cluster or Data Connection	Yes	Select **Cluster** or **Connection**. If you want to enable the security mode for CSS clusters, select **Connection**.
CloudSearch Cluster	Yes	This parameter is required when you select **Cluster** for **Cluster or Data Connection**. Connection to CloudSearch. A CloudSearch cluster has been created in CloudService. Currently, only clusters of version 5.5.1 is supported.
CDM Cluster Name	Yes	This parameter is required when you select **Cluster** for **Cluster or Data Connection**. Name of the selected CDM cluster. The CDM cluster functions as a proxy to forward requests. If there are no CDM clusters available in the drop-down list, create one on the CDM console.

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Parameter	Mandatory	Description
Data Connection	Yes	This parameter is required when you select **Connection** for **Cluster or Data Connection**. Select a data connection.
Request Type	Yes	Possible values: • **GET** • **POST** • **PUT** • **HEAD** • **DELETE**
Request Parameter	No	Parameter of the request. For example, to query the dlfdata mapping type in the dlf_search index, set this parameter to: **/dlf_search/dlfdata/_search**
Request Body	No	The request body is in JSON format. This parameter is mandatory when **Request Type** is **POST**, **PUT**, or **HEAD**.
CloudSearch Output Path	No	Path where output data is to be stored.

Table 9-139 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.24 Shell

Functions

The Shell node is used to execute a shell script.

NOTE

With EL expression **#{Job.getNodeOutput()}**, you can obtain the desired content (4000 characters at most and counted backwards) in the output of the shell script run by the Shell node.

Example:

To obtain **<name>jack<name1>** from a shell script (script name: shell_job1) output, enter the following EL expression:

```
#{StringUtil.substringBetween(Job.getNodeOutput("shell_job1"),"<name>","<name1>")}
```

Parameters

Table 9-140 and **Table 9-141** describe the parameters of the Shell node.

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Table 9-140 Parameters

Parameter	Mandatory	Description
Shell or Script	Yes	You can select **Shell statement** or **Shell script**. • Shell statement In the **Shell statement** text box, enter the Shell statement to be executed. • Shell script Select a script to be executed. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing an SQL Script**. **NOTE** If you select **Shell statement**, the DataArts Factory module cannot parse the parameters contained in the Shell statement. The execution result of a Shell node cannot be larger than 30 MB. Otherwise, an error is reported.
Host Connection	Yes	Selects the host where a shell script is to be executed. **NOTICE** • The maximum number of shell or Python scripts that can run concurrently on the ECS is determined by the value of **MaxSessions** in the **/etc/ssh/sshd_config** file on the ECS. Set **MaxSessions** based on the scheduling frequency of shell or Python scripts. • You have the permission to create and execute files in the **/tmp** directory on the host. • Shell and Python scripts are executed in the **/tmp** directory on an ECS. Ensure that the disk space of the **/tmp** directory is not used up.
Script Parameter	No	Parameter transferred to the script when the shell script is executed. Parameters are separated by spaces. For example: **a b c**. The parameter must be referenced by the shell script. Otherwise, the parameter is invalid.
Interactive Input	No	Interactive information (for example, passwords) provided during shell script execution. Interactive parameters are separated by spaces. The shell script reads parameter values in sequence according to the interaction situation. The following is an example of using the read -p syntax: `read -p "Parameter 1 and parameter 2"Variable 1 Variable 2`

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Parameter	Mandatory	Description
Node Name	Yes	Name of the node. It contains a maximum of 128 characters, including letters, digits, hyphens (-), underscores (_), slashes (/), angle brackets (<>), and periods (.). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

Table 9-141 Advanced settings

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system checks whether the node execution is complete. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Retry Condition	No	If **Retry upon Failure** is set to **Yes**, retry conditions can be set. Enable **Retry Condition** and set the return code range. The shell job can determine whether to retry a failed node based on the return code. You can define the return codes that can be used to determine whether to retry a failed node.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: Execution of the current job will stop, and the job instance status will become **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select **Dry run**, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.25 RDS SQL

Functions

The RDS SQL node is used to transfer SQL statements to RDS.

Parameters

Table 9-142 and **Table 9-143** describe the parameters of the RDS SQL node.

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Table 9-142 Parameters of RDS SQL nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.
Data Connection	Yes	Name of the data connection.
Database	Yes	Name of the database. The database has been created. You are advised not to use the default database.
SQL or Script	Yes	You can select **SQL statement** or **SQL script**. • SQL statement Click the text box under **SQL statement** and enter the SQL statement to be executed. • SQL script Select a script to be executed. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing an SQL Script**. **NOTE** If you select the SQL statement mode, the DataArts Factory module cannot parse the parameters contained in the SQL statement.

Table 9-143 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.26 ETL Job

Functions

The ETL Job node is used to extract data from a specified data source, preprocess the data, and import the data to the target data source.

NOTE

The destination is the ETL Job node of DWS and does not support scheduling using an agency. You are advised to use a public IAM account with better compatibility for scheduling. For details, see **Configuring a Scheduling Identity**.

Parameters

Table 9-144, **Table 9-145**, and **Table 9-146** describe the parameters of the ETL Job node.

Table 9-144 Parameters of Transform Load nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).

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Parameter	Mandatory	Description
ETL Configuration	Yes	Click  to edit the source and destination data to be transformed. The supported source data types are DLI, OBS and MySQL. • When the source data type is DLI, the supported destination data types are DWS, GES, CSS, OBS, and DLI. • When the source data type is MySQL, the supported destination data type is MySQL. • When the source data type is OBS, the supported destination data can be of the DLI type and the DWS type. **NOTICE** • Data transformation from DLI to DWS: Before importing data from DataArts Factory to DWS, ensure that a DWS data connection and a table have been created. Before importing data from DLI to DWS, ensure that a DWS table have been created. • Data transformation from DLI to CSS: Before importing data from DLI to CSS, ensure that a cross-source connection associated with CSS has been created on DLI. For details about how to create a cross-source connection on DLI, see *Data Lake Insight User Guide*.
Configure SQL Template	No	Click **Obtain Template** to obtain an SQL template.

Table 9-145 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-146 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.27 Python

NOTICE

Before using a Python node, ensure that the host connected to the node has an environment for executing Python scripts.

Functions

The Python node is used to execute Python statements.

For details about how to use the Python node, see **Developing a Python Script**.

NOTE

Python nodes support script parameters and job parameters.

Parameters

Table 9-147 and **Table 9-148** describe the parameters of the Python node.

Table 9-147 Parameters of the Python node

Parameter	Mandatory	Description
Python Statement or Script	Yes	You can select **Python statement** or **Python script**. • Python statement Click the text box under **Python Statement**. In the displayed **Python Statement** dialog box, enter the Python statement to be executed. • Python script In **Python Script**, select the Python script to be executed. The Python version is displayed by default, for example, **Python3**. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing a Python Script**. **NOTE** • If you select **Python statement**, the DataArts Factory module cannot parse the parameters contained in the Python statement. • If you select **Python script**, the system displays the Python version selected during Python script creation by default. • For existing jobs, **Python2** is used by default. • The execution result of a Python node cannot be larger than 30 MB. Otherwise, an error is reported.

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Parameter	Mandatory	Description
Host Connection	Yes	Select the host where the Python statement is to be executed. Ensure that the host has an environment for executing Python scripts. **NOTICE** • The maximum number of shell or Python scripts that can run concurrently on the ECS is determined by the value of **MaxSessions** in the **/etc/ssh/sshd_config** file on the ECS. Set **MaxSessions** based on the scheduling frequency of shell or Python scripts. • You have the permission to create and execute files in the **/tmp** directory on the host. • Shell and Python scripts are executed in the **/tmp** directory on an ECS. Ensure that the disk space of the **/tmp** directory is not used up.
Script Parameters	No	Parameter transferred to the script when the Python statement is executed. Parameters are separated by spaces. For example: **a b c**. The parameter must be referenced by the Python statement. Otherwise, the parameter is invalid.
Interactive Input	No	Interactive information (passwords, for example) provided during Python statement execution. Interactive parameters are separated by spaces. The Python statement reads parameter values in sequence according to the interaction situation.
Node Name	Yes	Name of the node. The value must consist of 1 to 128 characters and contain only letters, digits, and the following special characters: _-/<>. By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

Table 9-148 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.28 DORIS SQL

Functions

The Doris SQL node transfers SQL statements to Doris for execution.

Parameters

Table 9-149 and **Table 9-150** describe the parameters of the Doris SQL node.

Table 9-149 Parameters of the Doris SQL node

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>). By default, the node name is the same as that of the selected script. If you want the node name to be different from the script name, disable this function by referring to **Disabling Auto Node Name Change**.

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Parameter	Mandatory	Description
SQL or Script	Yes	• SQL statement Click the text box under **SQL statement** and enter the SQL statement to be executed. • SQL script Select a script to be executed. If no script is available, create and develop a script by referring to **Creating a Script** and **Developing an SQL Script**. If the associated SQL script uses a parameter, the parameter name is displayed. Set the parameter value in the text box next to the parameter name. **NOTE** If you select the SQL statement mode, the DataArts Factory module cannot parse the parameters contained in the SQL statement.
Data Connection	Yes	Select a data connection.
Database	Yes	Name of the database. The database has been created. You are advised not to use the default database.

Table 9-150 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.29 ModelArts Train

Function

You can orchestrate ModelArts Train operators to schedule the ModelArts workflow in DataArts Studio.

Parameters

Table 9-151 and Table 9-152 describe the parameters of the ModelArts Train node.

Table 9-151 Parameters of the ModelArts Train node

Parameter	Mandatory	Description
ModelArts Workspace	Yes	ModelArts workspace. The workspace must be in the same region as DataArts Studio.
Workflow Version	Yes	ModelArts workflow version • V1 • V2
ModelArts Workflow	Yes	ModelArts workflow. The workflow must be in the same region as DataArts Studio.
Node Name	Yes	Name of the node. The value must consist of 1 to 128 characters and contain only letters, digits, and the following special characters: _-/<>.

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Table 9-152 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.

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Parameter	Mandatory	Description
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.30 Create OBS

NOTE

The OBS path cannot be a log path starting with **s3a://**.

Constraints

This function depends on OBS.

Functions

The Create OBS node is used to create buckets and directories on OBS.

Parameters

Table 9-153 and **Table 9-154** describe the parameters of the Create OBS node.

Table 9-153 Parameters of Create OBS nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
OBS Path	Yes	Path to the OBS bucket or directory. • To create a bucket, enter **//***OBS bucket name*. The OBS bucket name must be unique • To create an OBS directory, select the path to the OBS directory to be created, and enter the /*Directory name* following the path. The directory name must be unique.

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Table 9-154 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.

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Parameter	Mandatory	Description
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.31 Delete OBS

Constraints

This function depends on OBS.

Functions

The Delete OBS node is used to delete a bucket or directory on OBS.

Parameters

Table 9-155 and **Table 9-156** describe the parameters of the Delete OBS node.

Table 9-155 Parameters of Delete OBS nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
OBS Path	Yes	Path to the OBS bucket or directory. **NOTE** If you delete an OBS bucket or directory, files stored in it are also deleted and cannot be restored. Before you delete a bucket or directory, back up the files stored in it if they need to be retained.

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Table 9-156 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.

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Parameter	Mandatory	Description
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.32 OBS Manager

Constraints

This function depends on OBS.

Function

The OBS Manager node is used to move or copy files from an OBS bucket to a specified directory.

Parameters

Table 9-157, **Table 9-158**, and **Table 9-159** describe the parameters of the OBS Managernode node.

Table 9-157 Parameters of OBS Manager nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).

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Parameter	Mandatory	Description
Operation Type	Yes	Operations that can be performed on the node. • **Move File**: moves a source file or directory to a new directory. • **Copy File**: copies the source file or directory. • **Rename File**: renames the last level of the directory or file. For example, you can rename the directory **obs://test/a/b/c/** as **obs://test/a/b/d/**, and rename the file **obs://test/a/b/hello.txt** as **obs://test/a/b/bye.txt**. • **Monitor File**: checks whether a file or directory exists. If the file or directory exists, the node is executed successfully. Otherwise, the node fails to be executed. If you want the job to be handled in different ways based on whether the file or directory exists, you can set an IF condition based on the execution status of the node. For details, see **IF Statements**.
Source File or Directory	Yes	OBS file or directory to be managed in the OBS bucket.
Target Directory	Yes	Directory for storing OBS files to be moved or copied from the OBS bucket.
File Filter	No	Wildcard for file filtering. Only the files that meet the filtering condition can be moved or copied. If this parameter is not specified, all source files are moved by default. For example, when you enter *.csv, files in this format will be moved or copied.

Table 9-158 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

Table 9-159 Lineage

Parameter	Description
Input	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the input lineage.
Output	
Add	Click **Add**. In the **Type** drop-down list, select the type to be created. The value can be **DWS**, **OBS**, **CSS**, **HIVE**, **DLI**, or **CUSTOM**.
OK	Click **OK** to save the parameter settings.
Cancel	Click **Cancel** to cancel the parameter settings.
Modify	Click to modify the parameter settings. After the modification, save the settings.
Delete	Click to delete the parameter settings.
View Details	Click to view details about the table created based on the output lineage.

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9.12.33 Open/Close Resource

Functions

You can use the Open/Close Resource node to enable or disable services as required.

Parameters

Table 9-160 and **Table 9-161** describe the parameters of the Open/Close Resource node.

Table 9-160 Parameters of Open/Close Resource nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Service	Yes	Service to be opened or closed. • **ECS** • **CDM**
Open/Close Resource	Yes	Possible values: • On • Off
Instance	Yes	Object to be opened or closed, for example, to open a CDM cluster.

Table 9-161 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.34 Data Quality Monitor

Functions

The Data Quality Monitor node is used to monitor the quality of running data.

Parameters

Table 9-162 and **Table 9-163** describe the parameters of the Data Quality Monitor node.

Table 9-162 Parameters of Data Quality Monitor nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Job Type	Yes	Data quality job. The following options are available: • Quality job • Comparison job
Quality Job Name	Yes	Name of a quality job created in DataArts Quality. This parameter is mandatory when **Job Type** is **Quality Job**. For details about how to create a quality job, see **Creating a Data Quality Job**.
Ignore Quality Job Alarm	Yes	This parameter is mandatory when **Job Type** is **Quality Job**. • **Yes**: If the quality job is in the alarm state, the status of the current node is set to successful and the subsequent nodes continue to be executed. • **No**: If the quality job is in the alarm state, the status of the current node is set to failed.

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Parameter	Mandatory	Description
Comparison Job Name	Yes	Name of a comparison job created in DataArts Quality. This parameter is mandatory when **Job Type** is **Comparison Job**. For details about how to create a comparison job, see **Creating a Data Comparison Job**.
Ignore Comparison Job Alarm	Yes	This parameter is mandatory when **Job Type** is **Comparison Job**. • **Yes**: If the comparison job is in the alarm state, the status of the current node is set to successful and the subsequent nodes continue to be executed. • **No**: If the comparison job is in the alarm state, the status of the current node is set to failed.

Table 9-163 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.35 Subjob

Function

The Subjob node is used to call the batch job that does not contain the subjob node.

Parameter

Table 9-164 and **Table 9-165** describe the parameters of the Subjob node.

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Table 9-164 Parameters of subjob nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Subjob Name	Yes	Select the name of the subjob to be called. **NOTE** You can only select the name of an existing batch job that does not contain the Subjob node.
Subjob Parameter	Yes/No	• If the subjob parameters are left unspecified, the subjob is executed with its own parameter variables. The **Subjob Parameter Name** of the parent job is not displayed. • If the subjob parameters are specified, the subjob is executed with the configured parameter values. In this case, the **Subjob Parameter Name** of the parent job is displayed, and the data or EL expression configured for the subjob is accessed and replaced according to the environment variable of the parent job.

Table 9-165 Advanced parameters

Parameter	Mandatory	Description
Node Status Polling Interval (s)	Yes	How often the system check completeness of the node. The value ranges from 1 to 60 seconds.
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.36 For Each

Functions

The For Each node specifies a subjob to be executed cyclically and assigns values to variables in a subjob with a dataset.

For details about how to use the For Each node, see **Introduction to the For Each Operator**.

NOTE

When a For Each node is executed once, a specified subjob can be cyclically executed for a maximum of 1,000 times.

If DLI SQL is used as a frontend node, the For Each node supports a maximum of 100 subjobs.

Parameters

Table 9-166 describes the parameters of the For Each node.

Table 9-166 Parameters of the For Each node

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Subjob in a Loop	Yes	Name of the subjob to be executed cyclically.

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Parameter	Mandatory	Description
Subjob Parameter Name	No	This parameter is available only when you set job parameters for a cyclic subjob. The parameter name is the variable defined in the subjob. Set the parameter value based on the following rules: • If the cyclic subjob needs to be read and replaced based on the variables of the parent job, set this parameter to an EL expression, for example, **#{Loop.current[0]}** or **#{Loop.current[1]}** which indicates obtaining the first or second value in the current row of the traversed dataset two-dimensional array. For details, see **Loop Embedded Objects**. After a job parameter name is configured for the cyclic subjob, the parameter value can be left empty. • If a cyclic subjob needs to use its own parameter variables, leave this parameter blank. In this case, set values for the parameters of the subjob.
Dataset	Yes	The For Each node needs to define a dataset. The dataset is a two-dimensional array used to cyclically replace variables in a subjob. A row of data in the dataset corresponds to a subjob instance. The dataset may come from the following sources: • Output from upstream nodes, such as the select statements of the Hive SQL, DLI SQL, or Spark SQL node, and echo of the shell node. The EL expression **#{Job.getNodeOutput('preNodeName')}** is used, which means the output of the previous node. • A specified array, for example, two-dimensional array **[['001'],['002'],['003']]** **NOTE** • To transfer **00** and **01** as numbers, set this parameter to **[["00"],["01"]];[[00],[01]];[['00'],['01']]**. • To transfer **00** and **01** as characters, add escape characters, for example, **[["\"00\""],["\"01\""]];[['\'00\''],['\'01\'']]**.
Concurrent Subjobs	Yes	Subjobs generated cyclically can be executed concurrently. You can set the number of concurrent subjobs. **NOTE** If a subjob contains a CDM Job node, set this parameter to 1.

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Parameter	Mandatory	Description
Subjob Instance Name Suffix	No	Name of the subjob generated by For Each: For Each node name + underscore (_) + suffix. The suffix is configurable. If the suffix is not configured, the suffix increases in ascending order based on the number.

Table 9-167 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.

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Parameter	Mandatory	Description
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.37 SMN

Functions

The SMN node is used to send notifications to users.

Parameters

Table 9-168 and **Table 9-169** describe the parameters of the SMN node.

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Table 9-168 Parameters of SMN nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).
Topic Name	Yes	Name of the topic. The topic has been created in SMN.
Message Title	No	Title of the message. The title cannot exceed 512 characters.
Message Type	Yes	Format of the message. ● **Text**: The message is sent in text format. ● **JSON**: The message is sent in JSON format. You can send different messages to types of subscribers. – Manual: You can enter a message in **Message Content**. – Automatic: Click **Generate JSON Message**. In the displayed dialog box, enter a message and select a protocol. ● **Template**: The message is sent in template format, that is, in fixed format. The variables can be processed by tags. – Manual: You can enter a message in **Message Content**. – Automatic: Click **Generate Template Message**. In the displayed dialog box, select a template name and set the value of **tag**.

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Parameter	Mandatory	Description

Message Content	Yes	Message content to be provided. The requirements for entering different types of messages are as follows:
		• **Text**: The size cannot exceed 10 KB.
		• **JSON**: The JSON message must contain the Default protocol and the size cannot exceed 10 KB. Example:
		{
		"default": "Dear Sir or Madam, this is a default message.",
		"email": "Dear Sir or Madam, this is an email message.",
		"http": "{'message':'Dear Sir or Madam, this is an HTTP message.'}",
		"https": "{'message':'Dear Sir or Madam, this is an HTTPS message.'}",
		"sms": "This is an SMS message."
		}
		• **Template**: The size cannot exceed 10 KB. Example:
		"message_template_name":"confirm_message",
		"tags":{
		"topic_urn":"urn:smn:regionId:xxxx:SMN_01"
		}
		In the preceding information, **message_template_name** indicates the template name, and **tags** indicates all tags in the template.
		For details about how to configure SMN, see section the *Simple Message Notification User Guide*.

Table 9-169 Advanced parameters

Parameter	Mandatory	Description
Max. Node Execution Duration	Yes	Execution timeout interval for the node. If retry is configured and the execution is not complete within the timeout interval, the node will be executed again.

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Parameter	Mandatory	Description
Retry upon Failure	Yes	Whether to re-execute a node if it fails to be executed. Possible values: • **Yes**: The node will be re-executed, and the following parameters must be configured: – **Retry upon Timeout** – **Maximum Retries** – **Retry Interval (seconds)** • **No**: The node will not be re-executed. This is the default setting. **NOTE** If retry is configured for a job node and the timeout duration is configured, the system allows you to retry a node when the node execution times out. If a node is not re-executed when it fails upon timeout, you can go to the **Default Configuration** page to modify this policy. **Retry upon Timeout** is displayed only when **Retry upon Failure** is set to **Yes**.
Policy for Handling Subsequent Nodes If the Current Node Fails	Yes	Operation that will be performed if the node fails to be executed. Possible values: • **Suspend execution plans of the subsequent nodes**: stops running subsequent nodes. The job instance status is **Failed**. • **End the current job execution plan**: stops running the current job. The job instance status is **Failed**. • **Go to the next node**: ignores the execution failure of the current node. The job instance status is **Failure ignored**. • **Suspend the current job execution plan**: If the current job instance is in abnormal state, the subsequent nodes of this node and the subsequent job instances that depend on the current job are in waiting state.
Enable Dry Run	No	If you select this option, the node will not be executed, and a success message will be returned.

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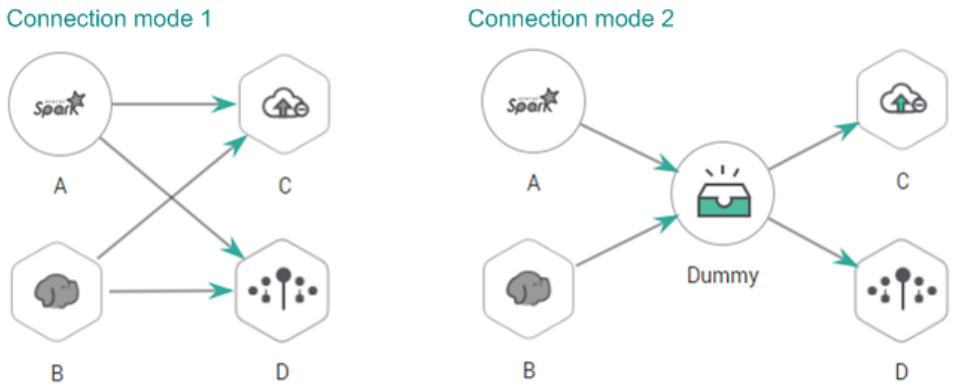
Parameter	Mandatory	Description
Task Groups	No	Select a task group. If you select a task group, you can control the maximum number of concurrent nodes in the task group in a fine-grained manner in scenarios where a job contains multiple nodes, a data patching task is ongoing, or a job is rerunning.

9.12.38 Dummy

Functions

The Dummy node is empty and does not perform any operations. It is used to simplify the complex connection relationships of nodes. **Figure 9-134** shows an example.

Figure 9-134 Connection modes



Parameters

Table 9-170 describes the parameter of Dummy nodes.

Table 9-170 Parameter of Dummy nodes

Parameter	Mandatory	Description
Node Name	Yes	Name of a node. The name must contain 1 to 128 characters, including only letters, numbers, underscores (_), hyphens (-), slashes (/), less-than signs (<), and greater-than signs (>).

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9.13 EL Expression Reference

9.13.1 Expression Overview

Node parameter values in a DataArts Factory job can be dynamically generated based on the running environment by using Expression Language (EL). You can determine whether to execute this node based on the input parameters of the pipeline and the output of the upstream node. EL uses simple arithmetic and logic to calculate and references embedded objects, including job objects and tool objects.

- Job object: provides properties and methods of obtaining the output message, job scheduling plan time, and job execution time of the previous node in a job.
- Tool job: Provides methods of operating character strings, time, and JSON. For example, truncating a substring from a string or formatting time.

Syntax

Expression syntax:

```
#{expr}
```

In the preceding information, **expr** indicates an expression. **#** and **{}** are common operators used in EL, allowing you to access job properties using embedded objects.

Example

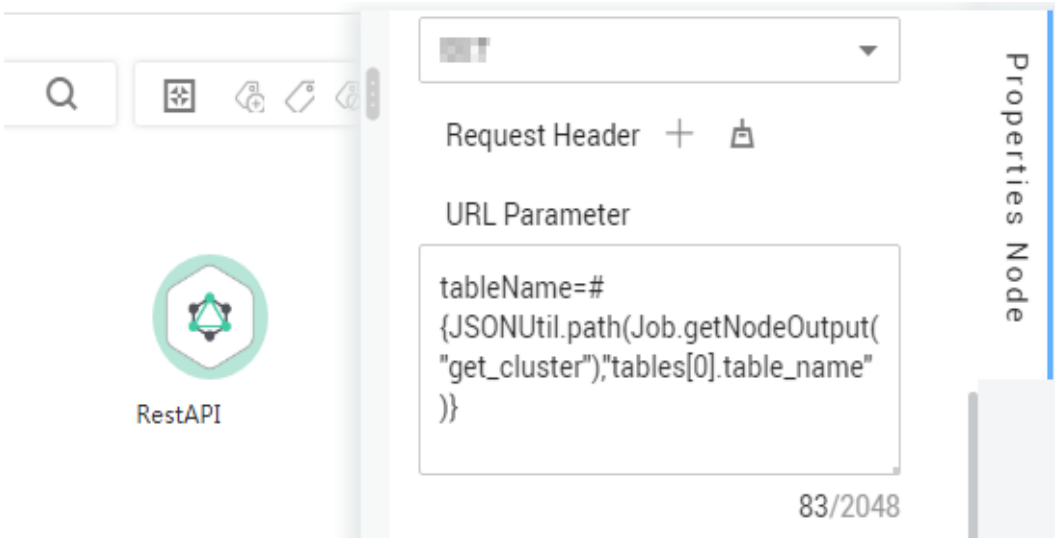
In the **URL** parameter of the Rest Client node, use expression **tableName=#{JSONUtil.path(Job.getNodeOutput("get_cluster"),"tables[0].table_name")}**, as shown in **Figure 9-135**.

Expression description:

1. **Job.getNodeOutput("get_cluster")** is used to obtain the execution result of the **get_cluster** node in the job. The execution result is a JSON character string.
2. **tables[0].table_name** is used to obtain the value of a field in the JSON character string.

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Figure 9-135 Expression example



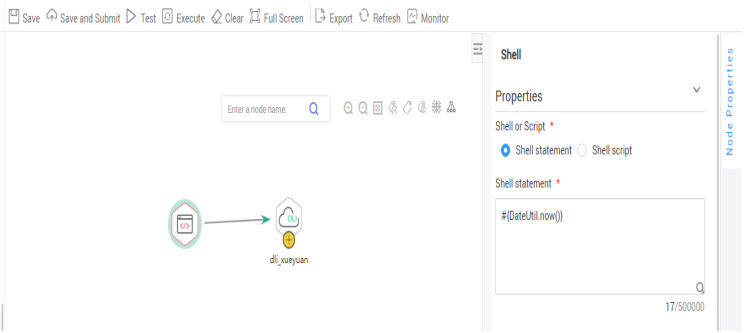
EL expressions are widely used in data development. For details, see **Best Practices**.

Debugging Methods

You can debug EL expressions using the following methods.

This section uses the #{DateUtil.now()} expression as an example.

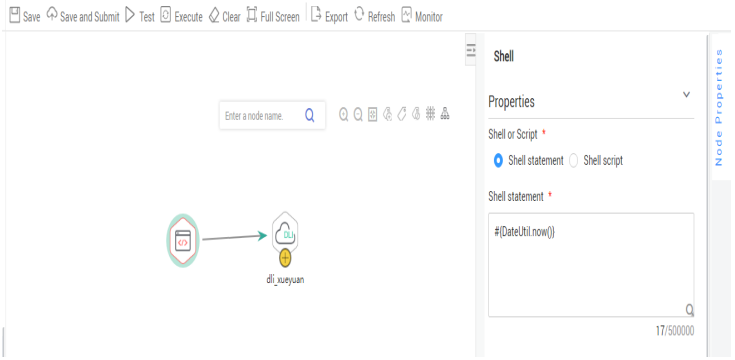
1. Use the Kafka Client node.
   - Prerequisites: An MRS cluster with the Kafka component is available.
   - Method: Select the Kafka Client node, write the EL expression in the data to be sent, and click **Test**. Then right-click the node to view the log. The value of the EL expression is printed in the log.

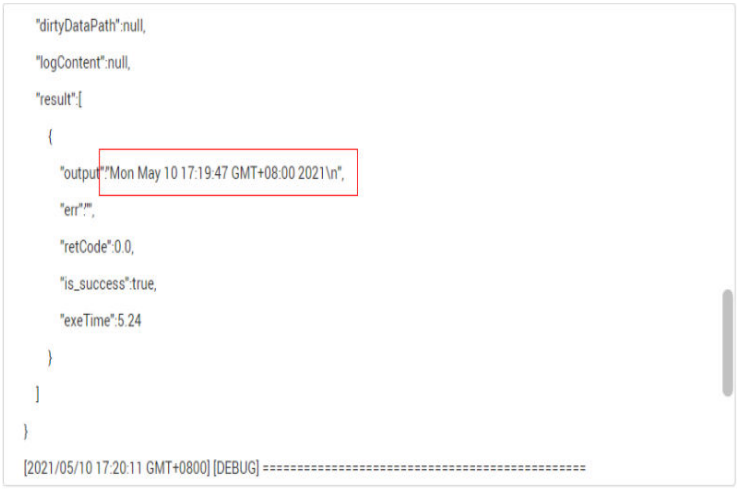


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2. Use the shell node.
   - Prerequisites: An ECS is available.
   - Method: Create a host connection, print the EL expression using echo, and click **Test**. Then view the log. The value of the EL expression is printed in the log.

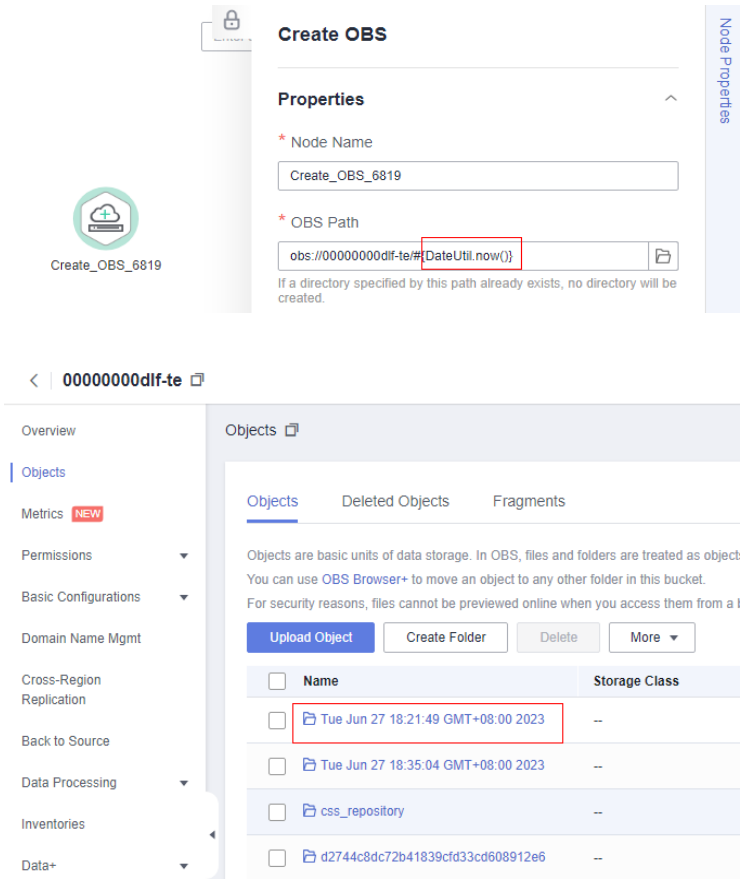




3. Use the Create OBS node.

   If the preceding methods are unavailable, use the Create OBS node and create an OBS path with the value of the EL expression as its name. You can click **Test** and go to the OBS console to view the name of the created path.

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9.13.2 Basic Operators

EL supports most of the arithmetic and logic operators provided by Java.

Operator List

Table 9-171 Basic operators

Operator	Description
.	Accesses a Bean property or a mapping entry.
[]	Accesses an array or linked list.
()	Organizes a subexpression to change priority.
+	Plus sign
-	Minus or negative sign
*	Multiplication sign
/ or div	Division sign
% or mod	Modulo
== or eq	Test whether equal to.

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Operator	Description
!= or ne	Test whether unequal to.
< or lt	Test whether less than.
> or gt	Test whether greater than.
<= or le	Check whether less than or equal to.
>= or ge	Test whether greater than or equal to.
&& or and	Test logic and.
|| or or	Test logic or.
! or not	Test negation.
empty	Test whether empty.
?:	The expression is similar to if else. If the statement in front of ? is true, the value of the expression between ? and : is returned. Otherwise, the value following : is returned.

Example

If variable a is empty, default is returned. If variable a is not empty, a itself is returned. The EL expression is as follows:

```
#{empty a?"default":a}
```

9.13.3 Date and Time Mode

The date and time in the EL expression can be displayed in a user-specified format. The date and time format is specified by the date and time mode character string. The date and time mode character string consists of letters from A to Z and from a to z, as shown in **Table 9-172**.

Table 9-172 Letter description

Letter	Description	Example
G	Epoch	AD
y (within one year)	Year	2001
Y (across years)	Year	2001
M	Month in a year	July or 07
d	Day in a month	10
h	Hour in the 12-hour clock (1 to 12)	12

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Letter	Description	Example
H	Hour in the 24-hour clock (0 to 23)	22
m	Minute	30
s	Second	55
S	Millisecond	234
E	Day of a week	Mon, Tue, Wed, Thu, Fri, Sat, or Sun
D	Date in the year	360
F	Day in a week of a month	2(second Wed. in July)
w	Week in a year	40
W	Week in a month	1
a	A.M. /P.M.	PM
k	Hour in the 24-hour clock (1 to 24)	24
K	Hour in the 12-hour clock (0 to 11)	10
z	Time zone	Eastern Standard Time
'	Text delimiter	None
''	Single quotation mark	No example

NOTE

The date and time mode is generally used in DateUtil embedded objects and Job embedded objects. For more examples of how the date and time mode is used, see **DateUtil Embedded Objects** and **Job Embedded Objects**.

Example

To obtain the date of the day before the planned scheduling time of a job, use the following EL expression:

```
#{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyy-MM-dd")}
```

9.13.4 Env Embedded Objects

An Env embedded object provides a method of obtaining an environment variable value.

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Method

Table 9-173 Method description

Method	Description	Example
String get(String name)	Obtains the value of a specified environment variable.	To obtain the value of the environment variable **test**, run the following command: #{Env.get("test")}

Example

The EL expression used to obtain the value of environment variable **test** is as follows:

```
#{Env.get("test")}
```

9.13.5 Job Embedded Objects

A job object provides properties and methods of obtaining the output message, job scheduling plan time, and job execution time of the previous node in a job.

Properties and Methods

Table 9-174 Property description

Property	Type	Description
name	String	Job name.
planTime	java.util.Date	Job scheduling plane time, that is, the time configured for periodic scheduling, for example, to schedule a job at 1:01 a.m. every day.
startTime	java.util.Date	Job execution time. It may be the same as or later than the planTime (because the job engine is busy).
eventData	String	Message obtained from the stream when the event-driven scheduling is used.
projectId	String	ID of the project where the DataArts Factory module is located.

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Table 9-175 Method description

Method	Description	Example
String getNodeStatus(String nodeName)	Obtains the running status of a specified node. If the node runs properly, success is returned. If the node fails to run, fail is returned. For example, to check whether a node is running successfully, you can use the following command, where **test** indicates the node name: **#{(Job.getNodeStatus("test")) == "success" }**	Obtains the running status of the test node: #{Job.getNodeStatus("test")}

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Method	Description	Example
String getNodeOutput(String nodeName)	Obtains the output of a specified node. This method can only obtain the output of the previous dependent node.	• Obtains the output of the test node: #{Job.getNodeOutput("test")} • If the previous node has no execution result, the output is null. • If the output of a node is a field, the output result is in the format like **[["000"]]**. In this case, you can use the EL expression to split the string result and obtain the field value output by the previous node. Note that the output result type is string. If you want to output the original data type, you need to use the EL expression of the For Each node and the loop embedded objects supported by the node. #{StringUtil.split(StringUtil.split(StringUtil.split(Job.getNodeOutput("Name of the previous node"),"]")[0],"[")[0],"\\"")[0]} • If the output of a node contains two or more fields, the output result is in the format like **[["000"], ["001"]]**. In this case, you need to obtain the output result using the EL expression of the For Each node and the loop embedded objects supported by the node, for example, **#{Loop.current[0]}**.

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Method	Description	Example
String getParam(String key)	Obtains job parameters. This method only obtains the parameter values configured for the current job, but not parameter values passed from the parent job or the global variables configured for the workspace. To obtain the parameter values passed from the parent job and the global variables configured for the workspace, you are advised to use the ${job_param_name} expression.	Obtains the value of the **test** parameter: #{Job.getParam("test")}
String getPlanTime(String pattern)	Obtains the plan time character string in a specified pattern. Pattern indicates the date and time mode. For details, see **Date and Time Mode**.	Obtains the planned job scheduling time, which is accurate to millisecond: #{Job.getPlanTime("yyyy-MM-dd HH:mm:ss:SSS")}
String getYesterday(String pattern)	Obtains the time character string of the day before the plan time. Pattern indicates the date and time mode. For details, see **Date and Time Mode**.	Obtains the time on the previous day of the planned job scheduling time, which is accurate to date: #{Job.getYesterday("yyyy-MM-dd HH:mm:ss:SSS")}
String getLastHour(String pattern)	Obtains the time character string of last hour before the plan time. Pattern indicates the date and time mode. For details, see **Date and Time Mode**.	Obtains the time one hour before the planned job scheduling time, which is accurate to hour: #{Job.getLastHour("yyyy-MM-dd HH:mm:ss:SSS")}

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Method	Description	Example
String getRunningData(String nodeName)	Obtains the data recorded during the running of a specified node. Currently, only the IDs of the jobs running using SQL statements on the DLI SQL node can be obtained. This method can only obtain the output of the previous dependent node. For example, to obtain the job ID of the third statement on DLI node **DLI_INSERT_DATA**, run the following command: **#{JSONUtil.path(Job.getRunningData("DLI_INSERT_DATA"),"jobIds[2]")}**.	Obtains the ID of the job run by the third statement in the test of the DLI SQL node: #{JSONUtil.path(Job.getRunningData("test"),"jobIds[2]")}
String getInsertJobId(String nodeName)	Returns the job ID in the first Insert SQL statement of the specified DLI SQL or Transform Load node. If the **nodeName** parameter is not specified, the job ID in the first DLI Insert SQL statement of the DLI SQL node is obtained. If the job ID cannot be obtained, the **null** value is returned.	Obtains the ID of job run by the first Insert SQL statement in the test of the DLI SQL node: #{Job.getInsertJobId("test")}
String getPreviousWorkday(Integer num, String pattern)	Returns the time string of the **num** working day before a planned time specified by **pattern**. The value of **num** must be a positive integer. If no result that meets the specified condition is found, null is returned. This EL expression is suitable for selecting custom dates in a calendar to schedule jobs.	Obtain the date of the fifth working day before a specified job scheduling day. #{Job.getPreviousWorkday(5, "yyyyMMdd")}

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Method	Description	Example
String getPreviousNonWorkday(Integer num, String pattern)	Returns the time string of the **num** non-working day before a planned time specified by **pattern**. The value of **num** must be a positive integer. If no result that meets the specified condition is found, null is returned. This EL expression is suitable for selecting custom dates in a calendar to schedule jobs.	Obtains the date of the first non-working day before a specified job scheduling day. #{Job.getPreviousNonWorkday(1, "yyyyMMdd")}

Example 1

The expression used to obtain the output of node **test** in the job is as follows:

```
#{Job.getNodeOutput("test")}
```

9.13.6 StringUtil Embedded Objects

A StringUtil embedded object provides methods of operating character strings, for example, truncating a substring from a character string.

StringUtil is implemented through org.apache.commons.lang3.StringUtils. For details about how to use the object, see the **Apache Commons documentation**.

Example 1

If variable a is character string No.0010, the substring after **.** is returned. The EL expression is as follows:

```
#{StringUtil.substringAfter(a,".")}
```

Example 2

If variable b is string No,0020, the substring after **,** is returned. The EL expression is as follows:

```
#{StringUtil.split(b,',')[1]}
```

Example 3

If the output of a node is a field, the output result is shown in [["000"]]. The second node references the output of the first node. In this case, the EL expression can be used to split the string result and obtain the field value output by the previous node.

```
#{StringUtil.split(StringUtil.split(StringUtil.split(Job.getNodeOutput("Name of the previous node"),"]")
[0],"[")[0],"\\"")[0]}
```

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Example 4

If the output of the previous SQL node is [["11"]], the following EL expression can be used to obtain value "11":

#{StringUtil.getDigits(Job.getNodeOutput("nodeName"))}

Example 5

Returns the digits extracted from a string.

String getDigits(String str)

For example, if str is "1123~45", "112345" is returned; if str is "abc", "" is returned; if str is "12345", "12345" is returned.

9.13.7 DateUtil Embedded Objects

A DateUtil embedded object provides methods of formatting time and calculating time.

Methods

Table 9-176 Method description

Method	Description	Example
String format(Date date, String pattern)	Formats Date to character strings according to the specified pattern.	Convert the planned job scheduling time to the millisecond format. #{DateUtil.format(Job.planTime,"yyyy-MM-dd HH:mm:ss:SSS")} Subtracts one day from the planned job scheduling time and convert the time to the week format. • #{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyyw")} If **Job.planTime** is January 7, 2024, value **20241** is returned. • #{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyyww")} If **Job.planTime** is January 7, 2024, value **202401** is returned.

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Method	Description	Example
Date addMonths(Date date, int amount)	After the specified number of months is added to Date, the new Date object is returned. The amount can be a negative number.	Subtract one month from the planned job scheduling time and convert the time to the month format. #{DateUtil.format(DateUtil.addMonths(Job.planTime,-1),"yyyy-MM")}

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Method	Description	Example
Date addDays(Date date, int amount)	After the specified number of days is added to Date, the new Date object is returned. The amount can be a negative number.	Subtracts one day from the planned job scheduling time and convert the time to the yyyy-MM-dd format. #{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyy-MM-dd")} Subtracts one day from the planned job scheduling time and convert the time to the week format. (y: within one year) ● #{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyyw")} If **Job.planTime** is January 7, 2024, value **20241** is returned. ● #{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyyww")} If **Job.planTime** is January 7, 2024, value **202401** is returned. Subtracts one day from the planned job scheduling time and convert the time to the week format. (Y: across years) ● #{DateUtil.format(DateUtil.addDays(Job.planTime,-7),"YYYYww")} If **Job.planTime** is January 7, 2024, value **202401** is returned.

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Method	Description	Example
		NOTE The differences between yyyy and YYYY are as follows: • YYYY indicates the week year. It can correctly process the number of weeks across years. • yyyy indicates the calendar year, which may cause an inaccurate number of weeks across years. • Therefore, YYYY is used for processing cross-year services. Except that, yyyy should be used. • Currently, the calendar week is from Sunday to Saturday, rather than from Monday to Sunday.
Date addHours(Date date, int amount)	After the specified number of hours is added to Date, the new Date object is returned. The amount can be a negative number.	Subtract one hour from the planned job scheduling time and convert the time to the hour format. #{DateUtil.format(DateUtil.addHours(Job.planTime,-1),"yyyy-MM-dd HH")}
Date addMinutes(Date date, int amount)	After the specified number of minutes is added to Date, the new Date object is returned. The amount can be a negative number.	Subtract one minute from the planned job scheduling time and convert the time to the minute format. #{DateUtil.format(DateUtil.addMinutes(Job.planTime,-1),"yyyy-MM-dd HH:mm")}
int getDay(Date date)	Obtains the day from the date. For example, if the date is 2018-09-14, 14 is returned.	Obtain the day from the job scheduling plan. #{DateUtil.getDay(Job.planTime)}
int getMonth(Date date)	Obtains the month from the date. For example, if the date is 2018-09-14, 9 is returned.	Obtain the month from the date. #{DateUtil.getMonth(Job.planTime)}
int getQuarter(Date date)	Obtains the quarter from the date. For example, if the date is 2018-09-14, 3 is returned.	Obtain the quarter from the date. #{DateUtil.getQuarter(Job.planTime)}

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Method	Description	Example
int getYear(Date date)	Obtains the year from the date. For example, if the date is 2018-09-14, 2018 is returned.	Obtain the year from the date. #{DateUtil.getYear(Job.planTime)}
Date now()	Returns the current time.	Return the current time accurate to second. #{DateUtil.format(DateUtil.now(),"yyyy-MM-dd HH:mm:ss")}
long getTime(Date date)	Converts a time of the date type to one of the long type.	Convert the planned job scheduling time to a timestamp. #{DateUtil.getTime(Job.planTime)}
Date parseDate(String str, String pattern)	Converts the character string to the date by pattern. The pattern is the date and time mode. For details, see **Date and Time Mode**.	Convert the job start time string to a time accurate to second. #{DateUtil.parseDate(Job.getPlanTime("yyyy-MM-dd HH:mm:ss:SSS"),"yyyy-MM-dd HH:mm:ss")}

Example

The previous day of the job scheduling plan time is used as the subdirectory name to generate an OBS path. The EL expression is as follows:

```
#{"obs://test/"+DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyy-MM-dd")}
```

9.13.8 JSONUtil Embedded Objects

A JSONUtil embedded object provides JSON object methods.

Methods

Table 9-177 Method description

Method	Description	Example
Object parse(String jsonStr)	Converts a JSON character string into an object.	Assume that variable a is a JSON string. Use the following EL expression to convert the JSON string into an object: #{JSONUtil.parse(a)}

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Method	Description	Example
String toString(Object jsonObject)	Converts an object to a JSON character string.	Assume that variable b is an object. Use the following EL expression to convert the object into a JSON string: #{JSONUtil.toString(b)}

Object path(String jsonStr,String jsonPath)	Returns the field value in a path specified by the JSON character string. This method is similar to XPath and can be used to retrieve or set JSON by path. You can use . or [] in the path to access members and values. For example, tables[0].table_name.	The content of variable str is as follows:
		{
		"cities": [{
		"name": "city1",
		"areaCode": "1000"
		},
		{
		"name": "city2",
		"areaCode": "2000"
		},
		{
		"name": "city3",
		"areaCode": "3000"
		}]
		}
		The expression for obtaining the area code of city1 is as follows:
		#{JSONUtil.path(str,"cities[0].areaCode")}

Example

The content of variable str is as follows:

```
{
	"cities": [{
		"name": "city1",
		"areaCode": "1000"
	},
	{
		"name": "city2",
		"areaCode": "2000"
	},
	{
		"name": "city3",
		"areaCode": "3000"
	}]
}
```

The expression for obtaining the area code of city1 is as follows:

```
#{JSONUtil.path(str,"cities[0].areaCode")}
```

9.13.9 Loop Embedded Objects

You can use Loop embedded objects to obtain data from the For Each node.

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Property

Table 9-178 Property description

Property	Type	Description	Example
dataArray	String	**Loop.dataArray** indicates the two-dimensional array defined in the dataset of the For Each node. Generally, the format is **#{Loop.dataArray[0][0]}** or **#{Loop.dataArray[0][1]}**. **[0][0]** indicates the first value in the first row of the array, and **[0][1]** indicates the second value in the first row, and so on.	The value of **Subjob Parameter** for the For Each node indicates that the first value in the second row of the two-dimensional array in the dataset is always used in the For Each loop. #{Loop.dataArray[1][0]}
current	String	For Each nodes process data in a dataset by row. **Loop.current** indicates a row of a two-dimensional array defined in the dataset of the For Each node. This row is a one-dimensional array. Generally, the format is similar to **#{Loop.current[0]}**, **#{Loop.current[1]}**, or others. **[0]** indicates the first value in the current row, **[1]** indicates the second value in the current row, and so on.	The value of **Subjob Parameter** for the For Each node indicates that the second value in the traversed row of the two-dimensional array in the dataset is always used in the loop traversal of the For Each node. #{Loop.current[1]}
offset	Int	Current offset of the For Each node, starting from 0. Loop.dataArray[Loop.offset] = Loop.current.	Obtain the current offset of the For Each loop, that is, the number of traversals, starting from 0. #{Loop.offset}

Example

To obtain the second value of a row that is being processed, use the following EL expression:

```
#{Loop.current[1]}
```

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9.13.10 OBSUtil Embedded Objects

The OBSUtil embedded objects provide a series of OBS operation methods, for example, checking whether an OBS file or directory exists.

Methods

Table 9-179 Method description

Method	Description	Example
boolean isExistOBSPath(String obsPath)	Check whether the OBS file or the OBS directory that ends with a slash (/) exists. If the file or directory exists, **true** is returned. If not, **false** is returned.	• The following is the EL expression for checking whether the OBS directory that ends with a slash (/) exists: #{OBSUtil.isExistOBSPath("obs://test/jobs/")} • The following is the EL expression for checking whether the OBS file exists: #{OBSUtil.isExistOBSPath("obs://test/jobs/job.log")}

Examples

- The following is the EL expression for checking whether the OBS directory that ends with a slash (/) exists:

  #{OBSUtil.isExistOBSPath("obs://test/jobs/")}

- The following is the EL expression for checking whether the OBS file exists:

  #{OBSUtil.isExistOBSPath("obs://test/jobs/job.log")}

9.13.11 Examples of Common EL Expressions

This section describes common EL expressions and examples.

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Table 9-180 Common EL expressions

Method	Description	Example
String getNodeStatus(String nodeName)	Obtains the running status of a specified node. If the node runs properly, success is returned. If the node fails to run, fail is returned. For example, to check whether a node is running successfully, you can use the following command, where **test** indicates the node name: **#{(Job.getNodeStatus("test")) == "success" }**	Obtains the running status of the test node: #{Job.getNodeStatus("test")}

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Method	Description	Example
String getNodeOutput(String nodeName)	Obtains the output of a specified node. This method can only obtain the output of the previous dependent node.	• Obtains the output of the test node: #{Job.getNodeOutput("test")} • If the previous node has no execution result, the output is null. • If the output of a node is a field, the output result is in the format like **[["000"]]**. In this case, you can use the EL expression to split the string result and obtain the field value output by the previous node. Note that the output result type is string. If you want to output the original data type, you need to use the EL expression of the For Each node and the loop embedded objects supported by the node. #{StringUtil.split(StringUtil.split(StringUtil.split(Job.getNodeOutput("Name of the previous node"),"]")[0],"[")[0],"\\"")[0]} • If the output of a node contains two or more fields, the output result is in the format like **[["000"], ["001"]]**. In this case, you need to obtain the output result using the EL expression of the For Each node and the loop embedded objects supported by the node, for example, **#{Loop.current[0]}**.

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Method	Description	Example
String getParam(String key)	Obtains job parameters. This method only obtains the parameter values configured for the current job, but not parameter values passed from the parent job or the global variables configured for the workspace. To obtain the parameter values passed from the parent job and the global variables configured for the workspace, you are advised to use the ${job_param_name} expression.	Obtains the value of the **test** parameter: #{Job.getParam("test")}
String getPlanTime(String pattern)	Obtains the plan time character string in a specified pattern. Pattern indicates the date and time mode. For details, see **Date and Time Mode**.	Obtains the planned job scheduling time, which is accurate to millisecond: #{Job.getPlanTime("yyyy-MM-dd HH:mm:ss:SSS")}
String getYesterday(String pattern)	Obtains the time character string of the day before the plan time. Pattern indicates the date and time mode. For details, see **Date and Time Mode**.	Obtains the time on the previous day of the planned job scheduling time, which is accurate to date: #{Job.getYesterday("yyyy-MM-dd HH:mm:ss:SSS")}
String getLastHour(String pattern)	Obtains the time character string of last hour before the plan time. Pattern indicates the date and time mode. For details, see **Date and Time Mode**.	Obtains the time one hour before the planned job scheduling time, which is accurate to hour: #{Job.getLastHour("yyyy-MM-dd HH:mm:ss:SSS")}
Date addDays(Date date, int amount)	After the specified number of days is added to Date, the new Date object is returned. The amount can be a negative number.	Subtracts one day from the planned job scheduling time and convert the time to the yyyy-MM-dd format. #{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyy-MM-dd")}
int getDay(Date date)	Obtains the day from the date. For example, if the date is 2018-09-14, 14 is returned.	Obtain the day from the job scheduling plan. #{DateUtil.getDay(Job.planTime)}

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Method	Description	Example
Date now()	Returns the current time.	Return the current time accurate to second. #{DateUtil.format(DateUtil.now(),"yyyy-MM-dd HH:mm:ss")}

Object path(String jsonStr,String jsonPath)	Returns the field value in a path specified by the JSON character string. This method is similar to XPath and can be used to retrieve or set JSON by path. You can use . or [] in the path to access members and values. For example, tables[0].table_name.	The content of variable str is as follows:
		{
		"cities": [{
		"name": "city1",
		"areaCode": "1000"
		},
		{
		"name": "city2",
		"areaCode": "2000"
		},
		{
		"name": "city3",
		"areaCode": "3000"
		}]
		}
		The expression for obtaining the area code of city1 is as follows:
		#{JSONUtil.path(str,"cities[0].areaCode")}

current	For Each nodes process data in a dataset by row. **Loop.current** indicates a row of a two-dimensional array defined in the dataset of the For Each node. This row is a one-dimensional array. Generally, the format is similar to **#{Loop.current[0]}**, **#{Loop.current[1]}**, or others. **[0]** indicates the first value in the current row, **[1]** indicates the second value in the current row, and so on.	The value of **Subjob Parameter** for the For Each node indicates that the second value in the traversed row of the two-dimensional array in the dataset is always used in the loop traversal of the For Each node. #{Loop.current[1]}

9.13.12 EL Expression Use Examples

With this example, you can understand how to use EL expressions in the following applications:

- Using variables in the SQL script of DataArts Factory
- Transferring parameters to SQL script variables?
- Using EL expressions in parameters?

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Context

Use the job orchestration and job scheduling functions to generate daily transaction statistics reports according to transaction details tables.

The tables involved in this example are as follows:

- trade_log: This table records data generated in each transaction.
- trade_report: This table is generated based on trade_log and records the daily transaction summary.

Prerequisites

- A DLI data connection named **dli_demo** has been created.

  If this data connection is not created, create one. For details, see **Configuring DataArts Studio Data Connection Parameters**.
- A database named **dli_db** has been created in DLI.

  If this database is not created, create one. For details, see **Creating a Database**.
- Tables **trade_log** and **trade_report** have been created in the **dli_db** database.

  If the tables are not created, create them. For details, see **Creating a Table**.

Procedure

Step 1 Create and develop a SQL script.

1. In the left navigation pane of the DataArts Factory console, choose **Data Development** > **Develop Script** and click **+ DLI**.
2. Go to the SQL script development page and set the data connection, database, and resource queue on the script property bar.

   Figure 9-136 Property bar

3. Enter the following SQL statements in the script editor:

   ```
   INSERT OVERWRITE TABLE trade_report
   SELECT
    sum(trade_count),
    '${yesterday}'
   FROM
    trade_log
   where
    date_format(trade_time, 'yyyy-MM-dd') = '${yesterday}'
   ```

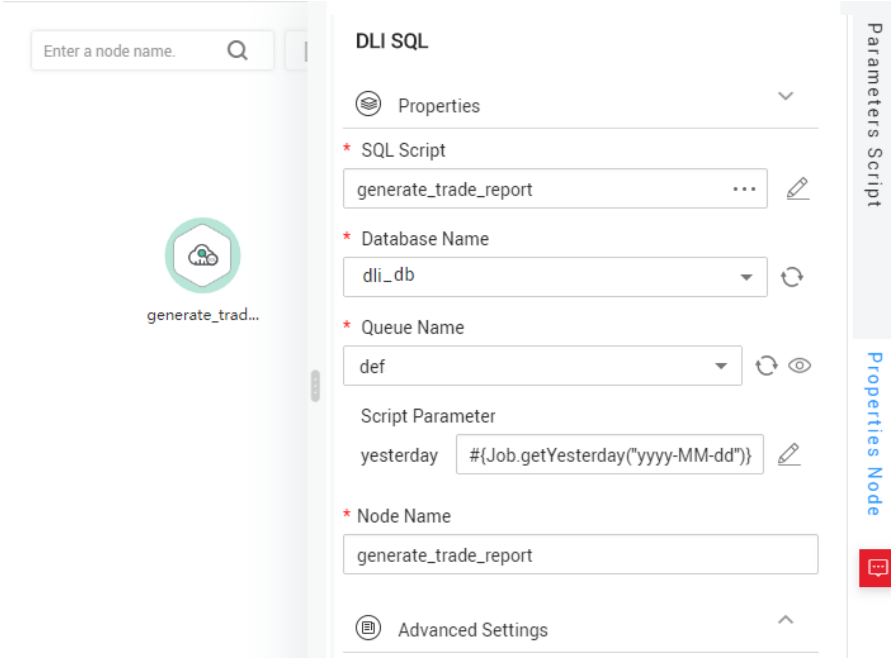
4. Click  and set the script name to **generate_trade_report**.

Step 2 Create and develop a job.

1. In the left navigation pane on the DataArts Factory console, choose **Data Development** > **Develop Job** and click **Create Job** to create an empty job named **job**.
2. Go to the job development page, drag the DLI SQL node to the canvas, click the icon, and configure node properties.

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Figure 9-137 Node properties



Description of key properties:

- SQL Script: SQL script **generate_trade_report** that is developed in **Step 1**.
- Database Name: Database configured in SQL script **generate_trade_report**.
- Queue Name: Resource queue configured in SQL script **generate_trade_report**.
- Script Parameter: Parameter **yesterday** configured in SQL script **generate_trade_report**. Enter the following EL expression as the parameter values:

  ```
  #{Job.getYesterday("yyyy-MM-dd")}
  ```

  Expression Description: The job object uses the getYesterday method to obtain the time of the day before the job plan execution time. The time format is yyyy-MM-dd.

  If the job plan time is 2018/9/26 01:00:00, the calculation result of this expression is 2018-09-25. The calculation result will replace the value of parameter ${yesterday} in the SQL script. The SQL statements after the replacement are as follows:

  ```
  INSERT OVERWRITE TABLE trade_report
  SELECT
    sum(trade_count),
    '2018-09-25'
  FROM
    trade_log
  where
    date_format(trade_time, 'yyyy-MM-dd') = '2018-09-25'
  ```

3. Click ▷ to test the running job.
4. After the job test is complete, click 💾 to save the job configuration.

----End

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More Examples

EL expressions are widely used in data development. For details, see **Best Practices**.

9.14 Simple Variable Set

The simple variable set provides a series of customized variables. Customized parameters are automatically replaced with specific values based on the service date, plan time, and parameter value format of task scheduling. In this way, parameters can be dynamically replaced during task scheduling.

Currently, the system supports the customization of three types of parameters: service date, plan time, and service ID.

- The business date refers to the day before the expected scheduling running time of a task within the scheduling time, that is, yesterday. The business date is accurate to day. You can obtain the service date from ${yyyymmdd}. Generally, the service date is the date when the plan time is located minus 1.
- The plan time refers to the time point (that is, the current day) when a task is expected to be scheduled within the scheduling time. The plan time is accurate to seconds. The planned time can be obtained through $[yyyymmddhh24miss].
- The service ID parameter includes the job ID and the instance ID generated by the job, which can be obtained through $job_id and $instance_id.

NOTICE

To use simple variable sets, you must enable this function by referring to **Configuring a Default Item > Use Simple Variable Set**.

Service Date Parameter

The service date refers to the day before the expected scheduling running time of a task within the scheduling time, that is, yesterday. For example, if the scheduling date is January 1, 2023, the service date is December 31, 2022. This parameter is a time parameter generated based on the combination of yyyy, yy, mm, and dd. The format of this parameter can be customized. for example, ${yyyy}, ${yyyymm}, ${yyyymmdd}, and ${yyyy-mm-dd}.

- yyyy: indicates a 4-digit year. The value is the year of the service date.
- yy: indicates a 2-digit year. The value is the last two digits of the year of the service date.
- mm: indicates the month. The value is the month of the service date.
- dd: indicates the day. The value is the day of the service date.

For details about how to obtain the time data N years ago, N months ago, and N days ago, see **Table 9-181**. The parameter can only be accurate to year, month, and day. The hour, minute, and second formats are not supported.

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Table 9-181 Parameters for obtaining the service date

Business Date Scenario	Method
Previous/Next N Years	${yyyy±N}
Previous/Next N Months	${yyyymm±N}
N weeks before/after	${yyyymmdd±7*N}
N days before/after	${yyyymmdd±N}
N years before/after (yy format)	${yy±N}

Plan Time Parameters

The planned time refers to the time when a task is expected to be scheduled and run within the scheduling time (that is, the current day). This parameter is a time parameter generated based on the combination of yyyy, yy, mm, dd, hh24, mi, and ss. The format of this parameter can be customized. For example, $[yyyymmdd], $[yyyy-mm-dd], $[hh24miss], $[hh24:mi:ss], and $[yyyymmddhh24miss].

- yyyy: indicates a 4-digit year. The value is the year of the plan time.
- yy: indicates a two-digit year. The value is the last two digits of the year of the plan time.
- mm: indicates the month. The value is the month of the plan time.
- dd: indicates the day. The value is the day of the plan time.
- hh: indicates the 12-hour format. The value is the hour of the plan time.
- hh24: indicates the 24-hour format. The value is the hour of the plan time.
- mi: indicates the minute. The value is the minute of the plan time.
- ss: indicates the second. The value is the second of the plan time.

For details about how to obtain data N hours and minutes ago, see **Table 9-182**. This parameter cannot be used to obtain data N years and months ago using $[yyyy-N] or $[mm-N].

Table 9-182 Parameters for obtaining the plan time

Planned Time Scenario	Method
Next N Years	$[add_months(yyyymmdd,12*N)]
First N Years	$[add_months(yyyymmdd,-12*N)]
Last N Months	$[add_months(yyyymmdd,N)]
Last N Months	$[add_months(yyyymmdd,-N)]
N weeks before/after	$[yyyymmdd±7*N]
N days before/after	$[yyyymmdd±N]

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Planned Time Scenario	Method
Before/After N Hours	You can obtain the time data in either of the following ways: ● $[hh24miss±N/24] ● $[User-defined time format ±N/24]. For example, to obtain the time format of the previous hour, run the following command: – Month: $[mm-1/24]. – Year: $[yyyy-1/24]. – Year and month: $[yyyymm-1/24]. – Obtain the year, month, and day: $[yyyymmdd-1/24]. – $[yyyymmdd-1-1/24]: indicates that the time of the previous day and the previous hour is used.
Before/After N minutes	You can obtain the time data in any of the following ways: ● $[hh24miss±N/24/60] ● $[yyyymmddhh24miss±N/24/60] ● $[mi±N/24/60] ● $[User-defined time format ±N/24/60] For example, to obtain the time format 15 minutes before the planned time, run the following command: – Year: $[yyyy-15/24/60] – Year and month: $[yyyymm-15/24/60] – Date: $[yyyymmdd-15/24/60] – Hour: $[hh24-15/24/60] – Minute: $[mi-15/24/60]

NOTE

- The replacement value of the scheduling parameter is determined when the instance is generated. Therefore, the replacement value of the scheduling parameter does not change with the actual running time of the instance.
- When the scheduling parameter is set to hour or minute, the parameter replacement value is determined by the planned scheduling time of the instance, that is, the planned scheduling time configured for the node scheduling. For example:
  - If the current node is a daily scheduling node and the planned scheduling time is 01:00, the value of Hour is 01.
  - If the current node is an hourly scheduling node, the planned scheduling time is set to 00:00-23:59, and the scheduling is performed every hour, the planned time of the first hourly instance is 00:00, and the value of the hour parameter is 00. The planned time of the second hourly instance is 01, and so on.

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Service Parameters

The service ID is replaced with the actual ID of the current service, including the job ID and the instance ID generated by the job.

Table 9-183 Parameters for obtaining the service ID

Methods	Description
$job_id	Data Development Job ID For details about how to obtain the ID, see **Viewing Job Details**.
$instance_id	Job instance ID. (The instance ID is not generated during the test running of a single-node job and is not supported.) For details about how to obtain the ID, see **Viewing a Job Instance List**.

9.15 Usage Guidance

9.15.1 Referencing Parameters in Scripts and Jobs

This section describes how to reference parameters in scripts and jobs, application scope of the referenced parameters, and whether EL expressions and simple variable sets are supported, helping you better understand how to use workspace-level, script-level, and job-level parameters.

NOTE

The application scopes of workspace environment variables, job parameters, and script parameters are different. If a workspace environment variable, a job parameter, and a script parameter have the same name, their priorities are as follows: **job parameter > workspace environment variable > script parameter**.

Table 9-184 Methods of using parameters

Type	Scenario	Scope	Calling Method
Environment variables/ constants	When configuring job parameters, you can extract a parameter that belongs to multiple jobs as an environment variable.	Current workspace	${*Environment variable*} ${*Environment constant*} For details about the configuration method, see **Environment Variable**.

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Type	Scenario	Scope	Calling Method
Job variables/ constants	Job parameters can be used in any node in jobs.	Current job	${*Job variable*} ${*Job constant*} For details about the configuration method, see **Configuring Job Parameters**.
Script parameters	Set the name and value of a custom field.	Current script	${*Script parameter*} For details about the configuration method, see **Script Parameter**.

NOTE

Variables of an SQL script can be in ${} or ${dlf.} format. You can configure either type as needed. The configured variable format applies to SQL scripts, SQL statements in jobs, single-node jobs, and environment variables. For details about how to configure the script variable format, see **Configuring Script Variables**.

The default variable format is **${}**.

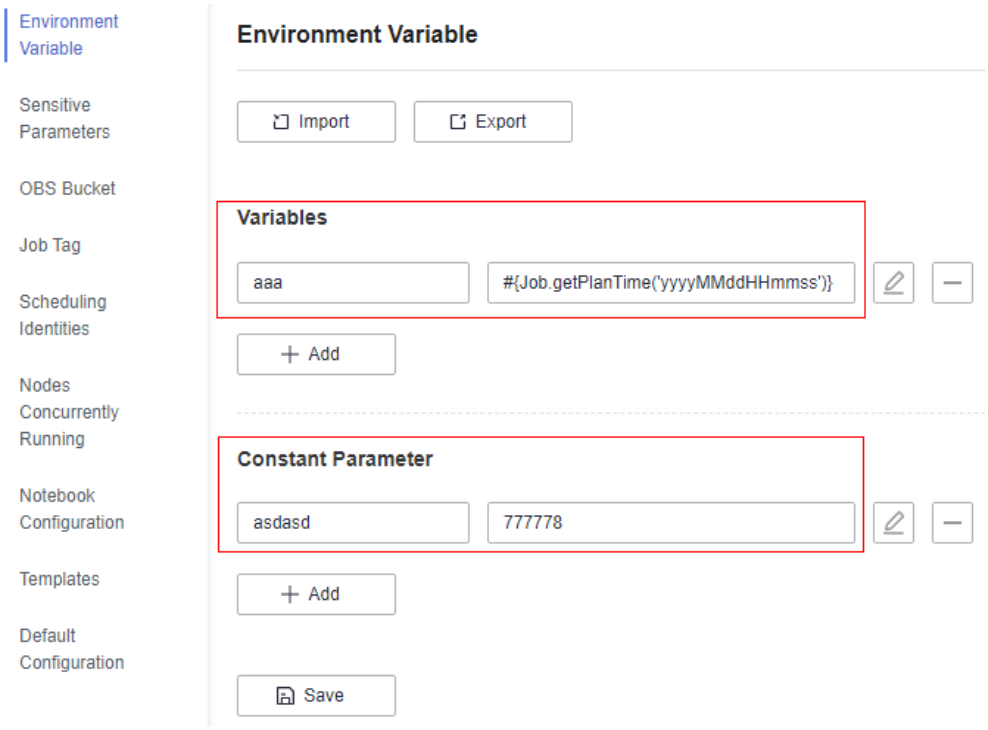
Environment Variable

Variables and constants can be defined in environment variables. Environment variables take effect in current workspace.

- The value of a variable (such as **workspace name**) varies depending on the workspace. When exporting a variable from a workspace and import it to another workspace, you must reconfigure its value.
- The value of a constant in different workspaces is the same. When importing a constant to another workspace, you do not need to reconfigure its value.

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Figure 9-138 Environment Variable



The specific application is as follows:

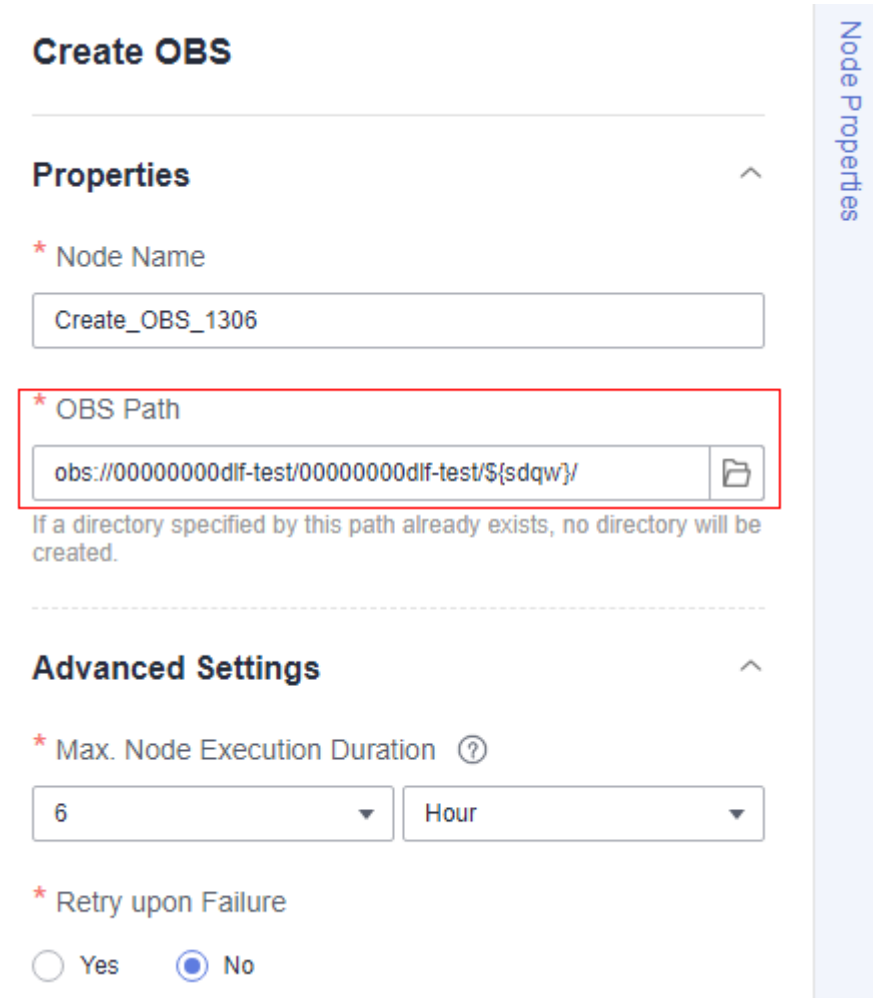
An environment variable has been added. The parameter name is **sdqw** and the parameter value is **wqewqewqe**.

Step 1 Open a created job and drag a **Create OBS** node from the node library to the canvas.

Step 2 On the **Node Properties** tab page, configure the node properties.

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Figure 9-139 Create OBS



Step 3 Click **Save** and then **Monitor** to monitor the running status of the job.

----End

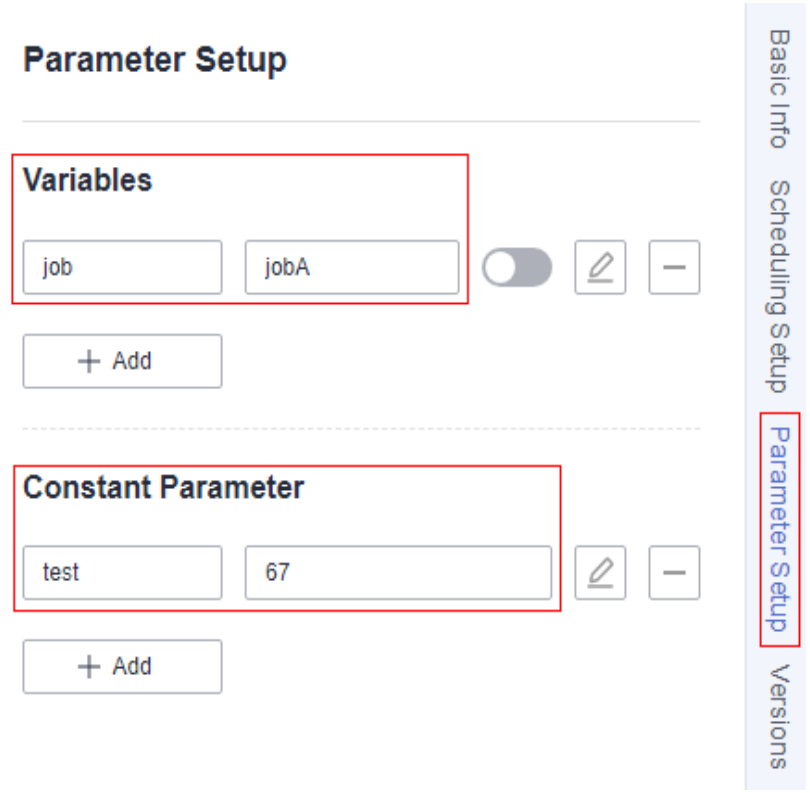
Configuring Job Parameters

Variables and constants can be defined in job parameters. Job parameters take effect in the current job.

- The value of a variable varies depending on the job. You need to configure a value for the variable in each job.
- The value of a constant in different jobs is the same. When importing a constant to another job, you do not need to reconfigure its value.

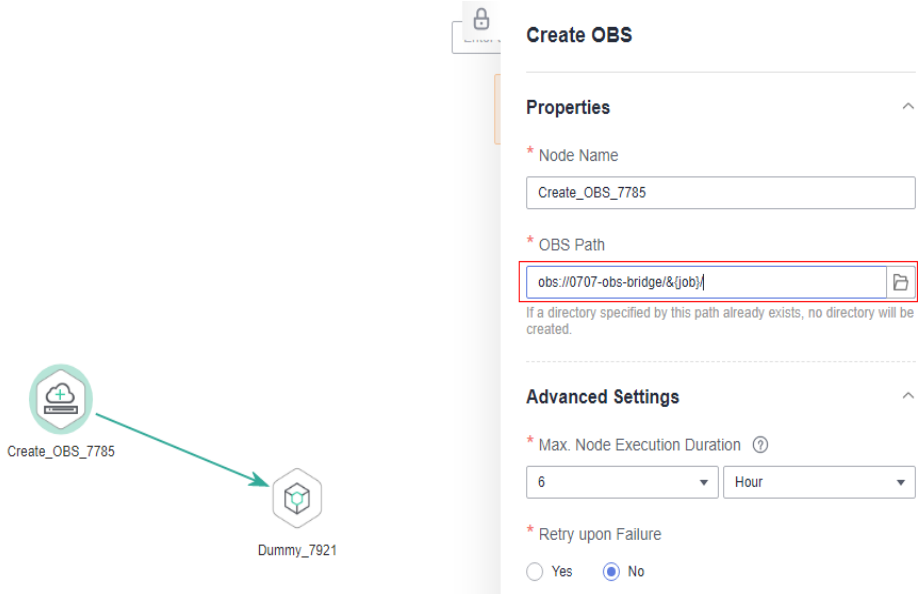
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Figure 9-140 Job parameter.



After a job parameter is defined, it can be referenced by a job node.

Figure 9-141 Using a Job Parameter Configuration



Script Parameter

- Script parameters take effect in current script and it can be used in the following ways.

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- For SQL scripts, you can directly enter parameters in the script editor (not supported for Flink SQL scripts). During job scheduling, you can assign values to parameters through node attributes, as shown in **2**.
- For Shell scripts, you can enter a parameter and an interactive parameter in the upper part of the editor to transfer the parameters.
- Python scripts support parameter transfer.
- For SQL scripts, you can directly enter parameters in the script editor (not supported for Flink SQL scripts). When executing a script independently, you can configure parameters in the lower part of the editor shown in **Figure 9-142**.

Figure 9-142 Configuring script parameters when executing a script independently

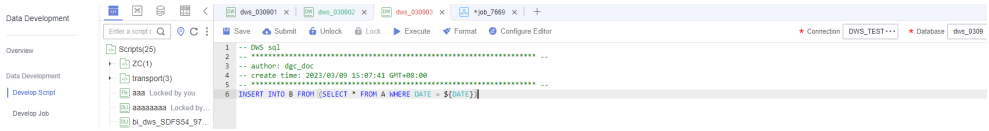


1. Developing a Python Script During script development, the script expression must contain variables. For example, if the variable in the SQL statement is DATE, set this parameter to ${DATE} in the script. In the job parameter configuration, you can compile the statement expression of the script parameter Date in **2**.

   On the **script development** page, enter development statements in the editor, as shown in the following figure.

   ```
   INSERT INTO B FROM (SELECT * FROM A WHERE DATE = ${DATE})
   ```

   Figure 9-143 Developing a script

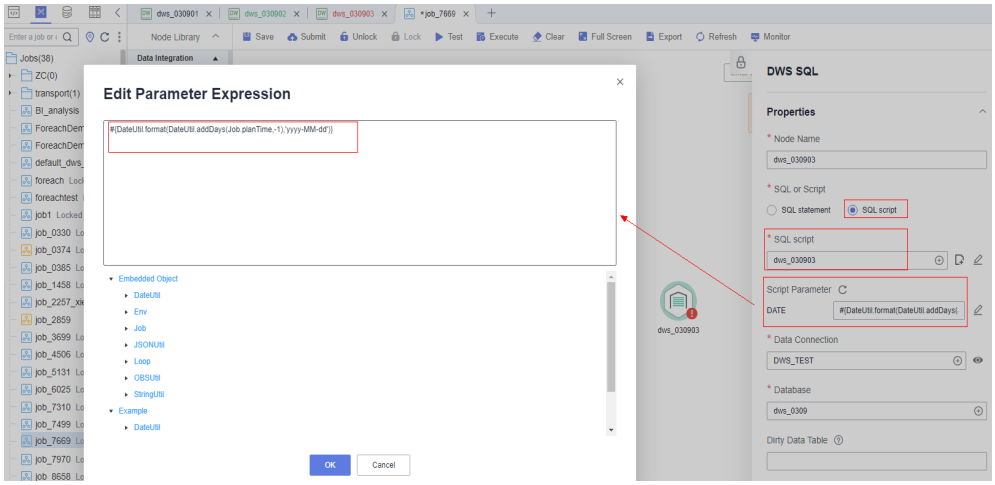
   

   After the dws_030903 script is compiled, save and submit the latest version of the script.

2. Develop batch jobs. When developing a job, you need to configure node attribute parameters.

   In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Job**.

Figure 9-144 Configuring script parameters when the script is executed by job scheduling



NOTE

- If the associated SQL script uses a parameter, the parameter name is displayed (**DATA** for example). Set the parameter value in the text box next to the parameter name. The parameter value can be **an EL expression**.
- If the associated SQL script or script parameters change, you can click to synchronize the changes or click to edit the changes.
- All nodes involving scripts, such as SQL scripts, shell scripts, and Python scripts, can use this method to reference script variables.

Simple Variable Set

The simple variable set provides a series of customized variables. Customized parameters are automatically replaced with specific values based on the service date, plan time, and parameter value format of task scheduling. In this way, parameters can be dynamically replaced during task scheduling. For details about the simple variable set, see **Simple Variable Set**.

9.15.2 Setting the Job Scheduling Time to the Last Day of Each Month

Scenario

When configuring job scheduling, you can set the scheduling time to the last day of each month using either of the two methods provided in the following table.

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Table 9-185 Setting the scheduling time to the last day of each month

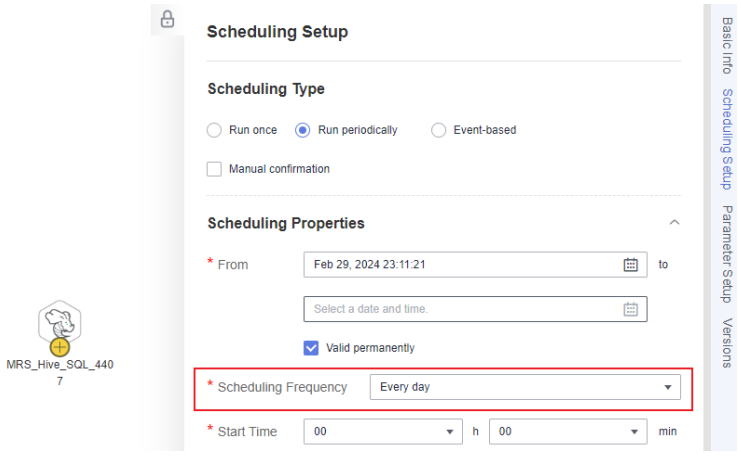
Method	Advantage	Procedure
Set the scheduling frequency to every day and use a condition expression to determine whether a day is the last day of each month.	This method applies to multiple scenarios. You can compile condition expressions to flexibly schedule jobs, for example, on the last day or 7th of each month.	**Method 1**
Set the scheduling frequency to every month and select the last day of each month.	You can set a specific job scheduling time instead of compiling any statements.	**Method 2**

Method 1

In DataArts Studio, create a job that is scheduled every day and add an empty Dummy node (which does not process data) to the job. You can set a condition expression on the connection line between the Dummy node and its subsequent node to check whether the current day is the last day of the current month. If it is the last day, the subsequent nodes are executed. Otherwise, the subsequent nodes are skipped.

1. In the left navigation pane of the DataArts Factory console, choose **Data Development** > **Develop Job**.
2. Set **Scheduling Frequency** to **Every day**.

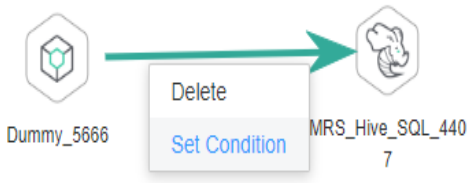
   Figure 9-145 Setting Scheduling Frequency to Every day



3. Right-click the connection line between the Dummy node and its subsequent node and select **Set Condition** to configure a condition expression that is used to determine whether to execute the subsequent node.

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Figure 9-146 Configuring a condition expression

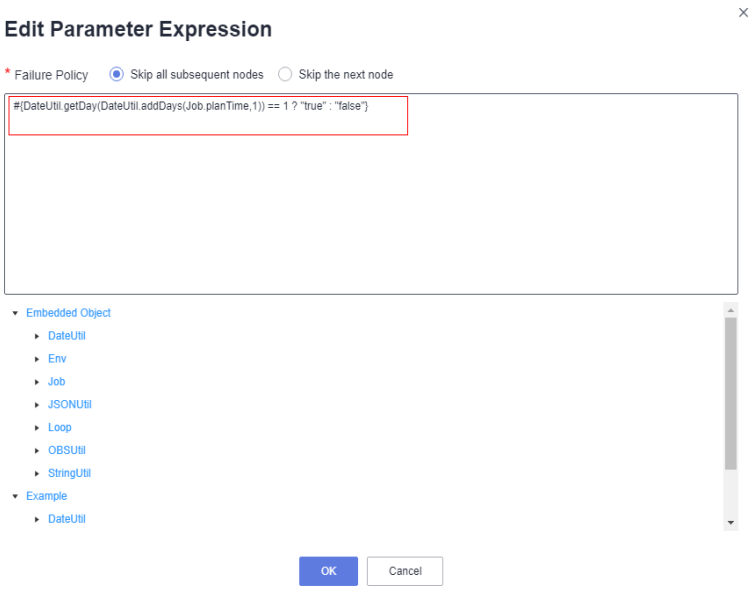


4. Configure the expression as follows:

```
#{DateUtil.getDay(DateUtil.addDays(Job.planTime,1)) == 1 ? "true" : "false"}
```

The expression is used to obtain the current time and check whether the next day is 1st of a month. If yes, the current day is the last day of the current month, and the subsequent node will be executed; if no, the subsequent node will be skipped.

Figure 9-147 Condition expression



For example, if you want a job to be executed on the last day of each month, perform the above operations.

For example, if you want a job to be executed on the seventh day of each month, perform the following operations:

Configure the following expression to check whether the current day is 7th:

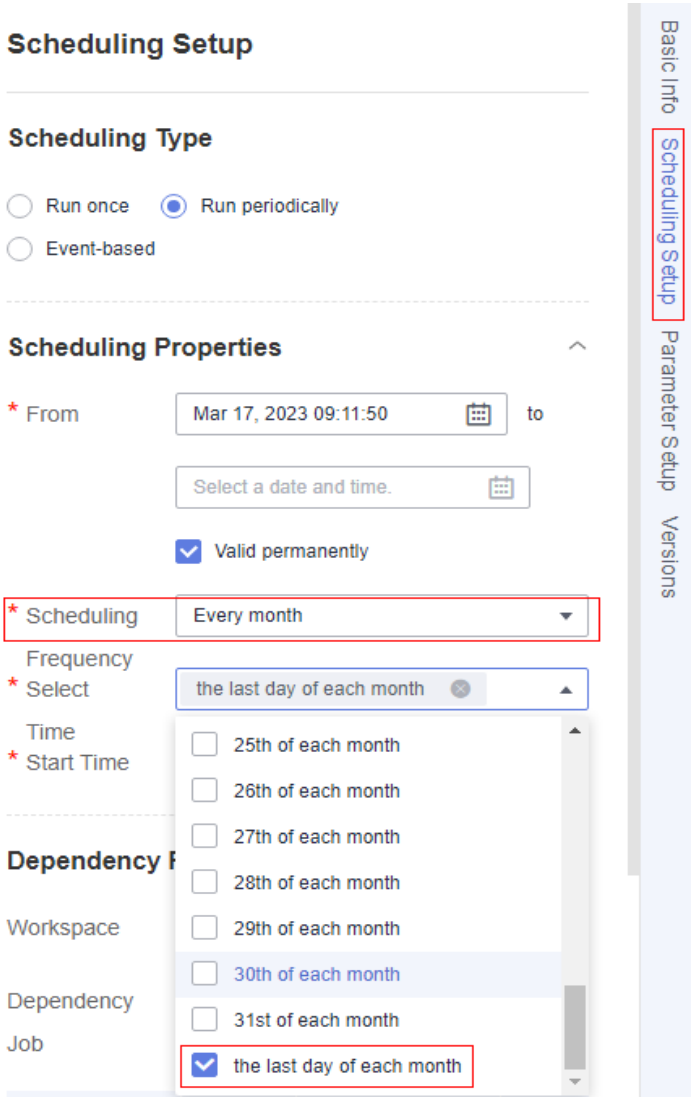
```
#{DateUtil.getDay(Job.planTime) == 7 ? "true" : "false"}
```

Method 2

1. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
2. Click **Scheduling Setup** on the right of the job canvas.
3. Set **Scheduling Type** to **Run periodically**, **Scheduling Frequency** to **Every month**, and **Select Time** to **the last day of each month**.

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Figure 9-148 Setting the scheduling time to the last day of each month



After the scheduling time is configured, the job will be automatically executed on the last day of each month.

9.15.3 Configuring a Yearly Scheduled Job

Scenario

This section describes how to configure a job that is scheduled at a specified time of a year.

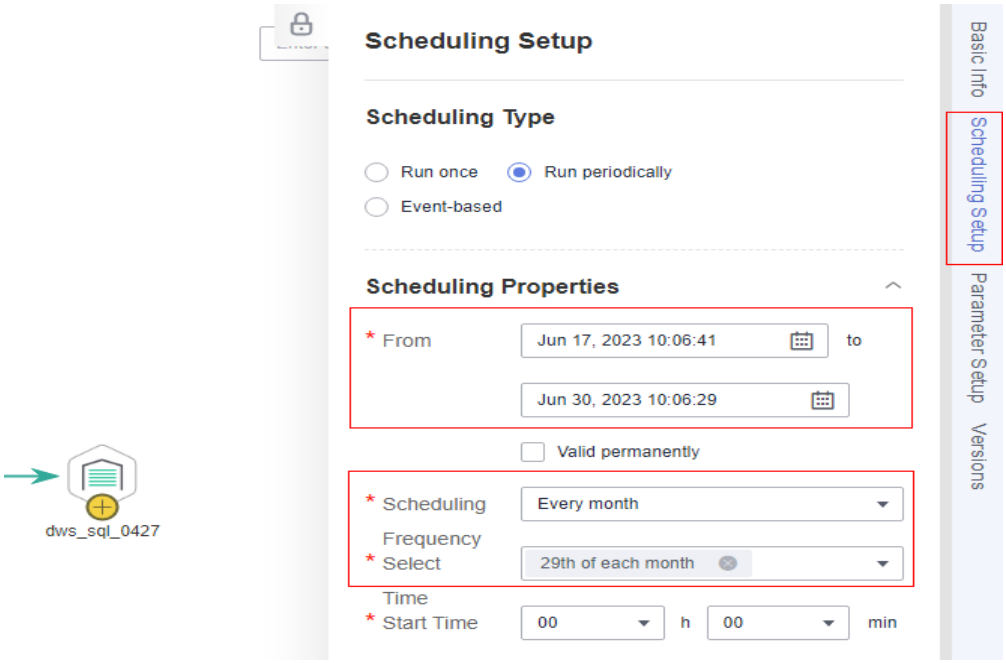
Procedure

In DataArts Studio, create a job that is scheduled every month and add an empty Dummy node (which does not process data) to the job. You can set a condition expression on the connection line between the Dummy node and its subsequent node to check whether the current time falls in the specified day (for example, June 29, 2023) for scheduling the job. If yes, the subsequent node is executed. Otherwise, the subsequent node is skipped.

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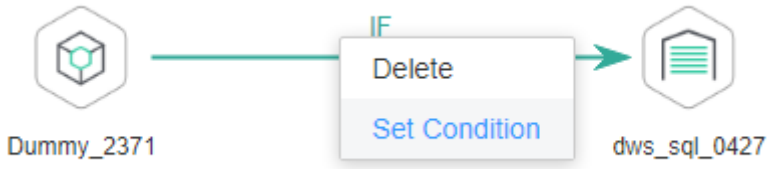
1. In the left navigation pane of the DataArts Factory console, choose **Data Development** > **Develop Job**.
2. Set **Scheduling Frequency** to **Every month**.

   Figure 9-149 Setting Scheduling Frequency to Every month



3. Right-click the connection line between the Dummy node and its subsequent node and select **Set Condition** to configure a condition expression that is used to determine whether to execute the subsequent node.

   Figure 9-150 Configuring a condition expression



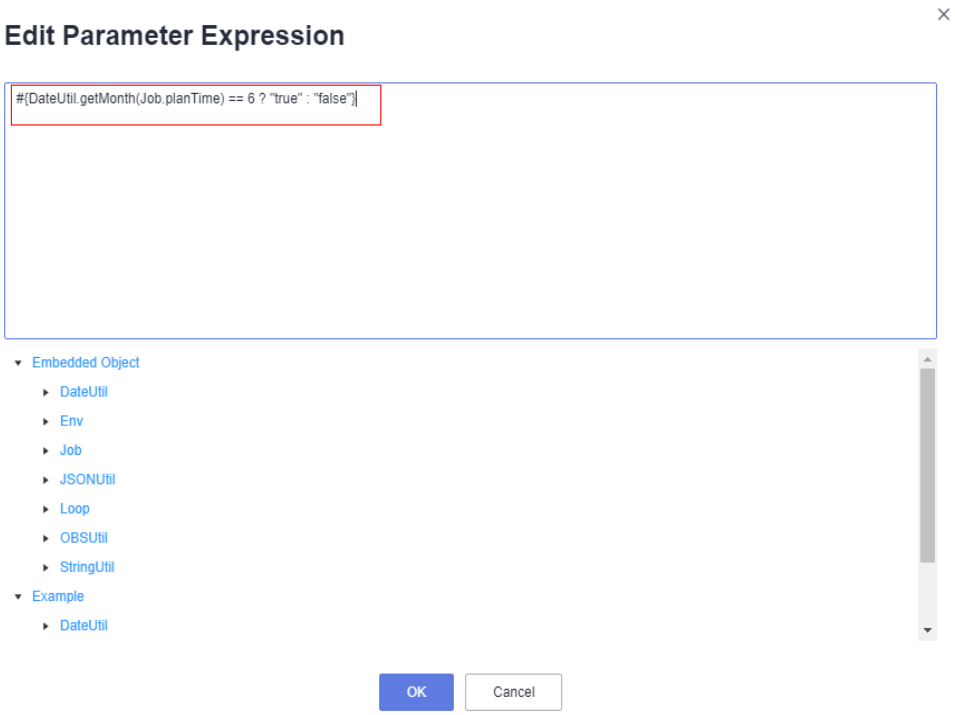
4. Configure the expression as follows:

```
#{DateUtil.getMonth(Job.planTime) == 6 ? "true" : "false"}
```

   The expression is used to obtain the current time and check whether it falls in June. If yes, the subsequent node will be executed; if no, the subsequent node will be skipped.

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Figure 9-151 Condition expression



9.15.4 Using PatchData

Scenario

In the migration of a project, if you want to supplement historical business data in a previous period and view details of the historical data, PatchData can meet your requirements.

A job executes a scheduling task to generate a series of instances in a certain period of time. This series of instances are called PatchData. PatchData can be used to fix the job instances that have data errors in the historical records or to build job records for debugging programs.

NOTE

- In addition to SQL scripts, PatchData supports other nodes.
- If the content of a SQL script changes, the PatchData job runs the latest script.
- When you use PatchData, if the variable in the SQL statement is **DATE**, enter **${DATE}** in the script. The script parameter **DATE** is then automatically added to the job parameters, and its value can be an EL expression. If the variable is a time variable, enter the expression of the **DateUtil** embedded object. The platform automatically converts the expression into a historical date. For details about how to use EL expressions, see **EL Expressions**.
- PatchData jobs support script parameters and global environment variables as well as job parameters.

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Constraints

PatchData is available only when periodic scheduling is configured for the data development job.

Example

Scenario

Among the product data tables of a company, there is a source data table A that records the product sales amount. To import the historical product sales amount to the destination table B, you can create a PatchData job.

Table 1 lists the source and destination tables.

Table 9-186 Source and destination tables

Source Table	Destination Table
A	B

Procedure

1. Prepare the source and destination tables. To facilitate subsequent job execution and verification, you need to create a source DWS table and a destination DWS table and insert data into the tables.
   a. Create a DWS table. You can create a DWS SQL script on the DataArts Factory console of DataArts Studio and run the following SQL statements:
   ```
   /* Create tables. */
   CREATE TABLE A (PRODUCT_ID INT, SALES INT, DATE DATE);
   CREATE TABLE B (PRODUCT_ID INT, SALES INT, DATE DATE);
   ```
   b. Insert sample data into the source data table. You can create a DWS SQL script on the DataArts Factory console of DataArts Studio and run the following SQL statements:
   ```
   /* Insert sample historical data into the source table. */
   INSERT INTO A VALUES ('1','60', '2022-03-01');
   INSERT INTO A VALUES ('2','80', '2022-03-01');
   INSERT INTO A VALUES ('1','50', '2022-02-28');
   INSERT INTO A VALUES ('2','55', '2022-02-28');
   INSERT INTO A VALUES ('1','60', '2022-02-27');
   INSERT INTO A VALUES ('2','45', '2022-02-27');
   ```
2. Develop a PatchData script. Ensure that the script expression contains a time variable. (For example, if the variable in the SQL statement is **DATE**, enter **${DATE}** in the script.) You can set the expression for script parameter **DATE** in job parameter settings in **3**.

   On the **Develop Script** page, enter following statement in the editor:
   ```
   INSERT INTO B (SELECT * FROM A WHERE DATE = ${DATE})
   ```

   Figure 9-152 Developing a script

   ```
   -- DWS sql
   -- ********************************************************************* --
   -- author: [redacted]
   -- create time: 2023/05/23 17:03:02 GMT+08:00
   -- ********************************************************************* --
   INSERT INTO B (SELECT * FROM A WHERE DATE = ${DATE})
   ```

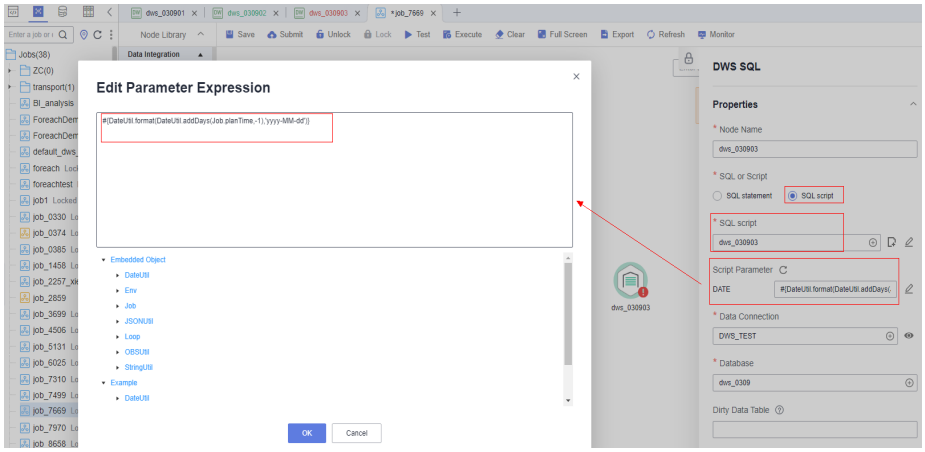
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After compiling the script, save it and submit the latest version.

3. Develop a PatchData batch processing job. When developing the job, you need to configure the node attributes and scheduling period.

   In the left navigation pane of the DataArts Factory console, choose **Data Development** > **Develop Job**.

Figure 9-153 Node parameters



NOTE

- If the job-associated SQL script uses a parameter, the parameter name (such as **DATE**) is displayed. Set the parameter value in the text box next to the parameter name. The parameter value can be an EL expression. For details about EL expressions, see **Expression Overview**.

  If the parameter is time, view the example expression of the DateUtil embedded object. The platform automatically replaces the parameter with the historical date of the patch data (determined by the service date of the patch data).

  You can also directly enter a SQL expression.

- If the parameters of the associated SQL script change, you can click to synchronize the change or click to edit the parameters.
- The following is an example of script parameters:

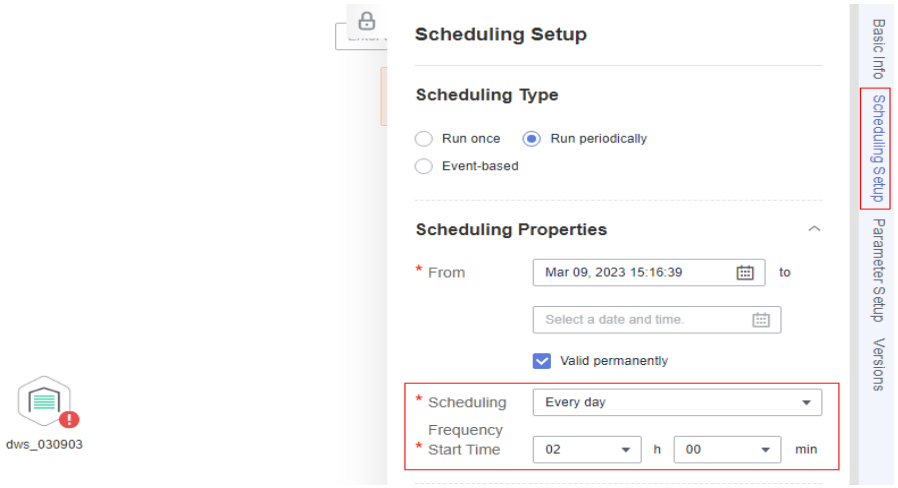
  Example: #{DateUtil.format(DateUtil.addDays(Job.planTime,-1),'yyyy-MM-dd')}

  - **Job.planTime** indicates the planned job time, and *yyyy-MM-dd* indicates the time format.
  - If the planned job time is March 2, the previous day is March 1. The planned job time will be replaced by the configured patch data service date.
  - The **Job.planTime** is converted into a time in the *yyyy-MM-dd* format using an expression.

Configure the scheduling period of the PatchData job. Click **Scheduling Setup** and set **Scheduling Frequency** to **Every day**.

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Figure 9-154 Configuring the scheduling period



NOTE

- If **Scheduling Frequency** is set to **Every day**, the job is scheduled every day, and a PatchData instance is generated. You can view the statuses of PatchData instances on the **Monitor Instance** page. On the **Monitor Instance** page, view the instance information about the job and perform more operations on instances as required.
- The job scheduling time takes effect from March 9, 2023, and the job is scheduled at 02:00 every day.
- Run the following SQL statement to check whether destination table B contains data of source table A:

  SELECT * FROM B

After configuring the parameters, save and submit the latest version of the job and test the job.

Click **Execute** to run the job.

4. Create a PatchData task.

   After creating a periodic job, you need to configure PatchData for the job.

   a. In the left navigation pane of DataArts Factory, choose **Monitoring** > **Job Monitoring**.

   b. Click the **Batch Job Monitoring** tab. In the **Operation** column of the job, choose **More** > **Configure PatchData**. The **Configure PatchData** page is displayed.

      If you want to supplement historical data from February 27, 2023 to March 1, 2023, set **Date** to **Feb 28, 2023 00:00:00 – Mar 02, 2023 23:59:59**. The system automatically transfers the configured date to the planned job time. In the expression of the script time variable **DATE**, the defined time is the planned job time minus one day. That is, the time of the day before the planned job time is the time range (**Feb 27, 2023 to Mar 1, 2023**) for PatchData.

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Figure 9-155 Configuring PatchData

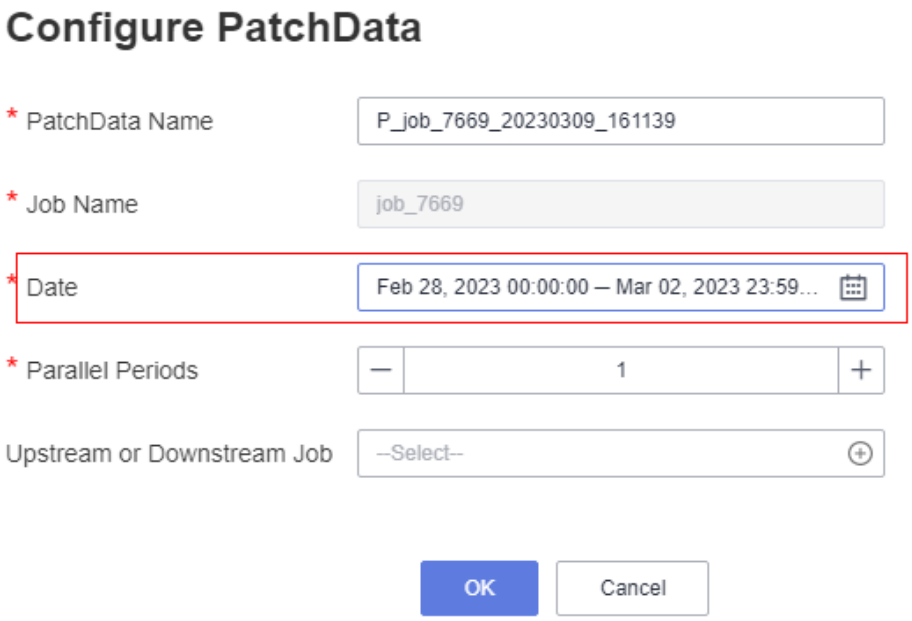


Table 9-187 Description

Parameter	Description
PatchData Name	Name of the automatically generated PatchData task. The value can be modified.
Job Name	Name of the job that requires PatchData, which is automatically displayed
Date	Period of time when PatchData is required. This date is transferred to the planned job time. When the job is executed, the planned job time is replaced by the time in the PatchData. **NOTE** PatchData can be configured for a job multiple times. However, avoid configuring PatchData multiple times on the same date to prevent data duplication or disorder. If you select **Patch data in reverse order of date**, the patch data of each day is in positive sequence. **NOTE** • This function is applicable when the data of each day is not coupled with each other. • The PatchData job will ignore the dependencies between the job instances created before this date.

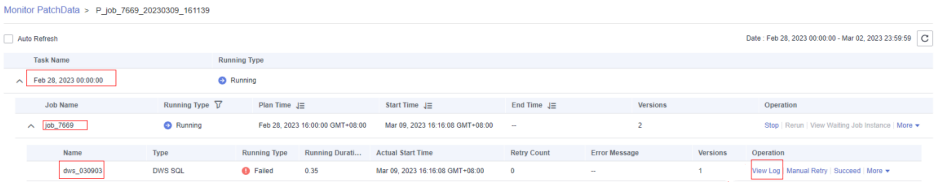
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Parameter	Description
Parallel Periods	Number of instances to be executed at the same time. A maximum of five instances can be executed at the same time. **NOTE** Set this parameter based on the site requirements. For example, if a CDM job instance is used, data cannot be supplemented at the same time. The value of this parameter can only be set to **1**.
Upstream or Downstream Job	This parameter is optional. Select the downstream jobs (jobs that depend on the current job) that require PatchData. You can select multiple jobs.

c. Click **OK**. The system starts to run the PatchData task based on the configured scheduling period.

d. On the **Monitor PatchData** page, you can view the PatchData task status, date, number of parallel periods, PatchData job name, and stopped tasks. You can also view logs of the PatchData task.

Figure 9-156 Querying PatchData details



e. Run the following SQL statement to check whether destination table B contains historical data of source table A:

```
SELECT * FROM B
```

9.15.5 Obtaining the Output of an SQL Node

This section describes how to obtain the output of an SQL node and apply the output to subsequent nodes or judgment in job development.

Scenario

When you use EL expression **#{Job.getNodeOutput("Name of the previous node")}** to obtain the output of the previous node, the output is a two-dimensional array, for example, **[["Dean",...,"08"],...,["Smith",...,"53"]]**. To obtain the values in the array, use either of the methods provided in **Table 9-188**.

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Table 9-188 Methods for obtaining output values

Method	Key Configuration	Application Scenario Requirements
Obtaining Output Value Using StringUtil	If the output of the SQL node contains only one field, for example **[["11"]]**, you can use the StringUtil EL expression with an embedded object to split the two-dimensional array and obtain the field value in the output of the previous node. #{StringUtil.split(StringUtil.split(StringUtil.split(Job.getNodeOutput("***Name of the previous node***"),"]")[0],"[")[0],"\\")[0]}	This method is easy to use but has the following requirements on application scenarios: • The output of the previous SQL node contains only one field, for example, **[["11"]]**. • The output value is a string. The application scenario must support the string data type. For example, if the IF condition needs to be used to judge the size of the output value, the string type is not supported. In this case, this method cannot be used.
Obtaining Output Values Using the For Each Node	Use the For Each node to cyclically obtain the values in the two-dimensional array in the dataset. • For Each node dataset: #{Job.getNodeOutput('***Name of the previous node***')} • Subjob parameters of the For Each node: #{Loop.current[***Index***]}	This method is applicable to more scenarios, though jobs need to be split into main jobs and subjobs.

Obtaining Output Value Using StringUtil

Scenario

The StringUtil EL expression with an embedded object is used to split the two-dimensional array result and obtain the output field value of the previous node, which is a string.

In this example, the MRS Hive SQL node returns a two-dimensional array that contains a single field. The data sent by the Kafka Client node is defined as the StringUtil EL expression with an embedded object. You can use this expression to split the two-dimensional array and obtain the output field value of the MRS Hive SQL node.

NOTE

To make it easy to view the obtained value, this example uses the Kafka Client node. In practice, you can select a subsequent node type as needed. By using a StringUtil EL expression with an embedded object on the node, you can obtain the data value returned by the previous node.

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Figure 9-157 Example job



The key configuration of the Kafka Client node is the **Sent Content** parameter. Set it as follows:

```
#{StringUtil.split(StringUtil.split(StringUtil.split(Job.getNodeOutput("count95"),"]")[0],"[")[0],"\\"")[0]}
```

Configuration Method

Step 1 Log in to the DataArts Studio console, locate the target DataArts Studio instance, and click **Access** on the instance card.

Step 2 Click the **Workspaces** tab. In the workspace list, locate the target workspace and click **DataArts Factory**.

Step 3 Create table **student_score**. Create a temporary Hive SQL script, select a Hive connection and database, paste the following SQL statement, and run the script. After the script is successfully executed, delete it.

```
CREATE TABLE `student_score` (`name` String COMMENT '', `score` INT COMMENT '');
INSERT INTO
    student_score
VALUES
    ('ZHAO', '90'),
    ('QIAN', '88'),
    ('SUN', '93'),
    ('LI', '94'),
    ('ZHOU', '85'),
    ('WU', '79'),
    ('ZHENG', '87'),
    ('WANG', '97'),
    ('FENG', '83'),
    ('CEHN', '99');
```

Step 4 Create the Hive SQL script to be invoked by the MRS Hive SQL node. Create a Hive SQL script named **count95**, select a Hive connection and database, paste the following SQL statement, and submit a version.

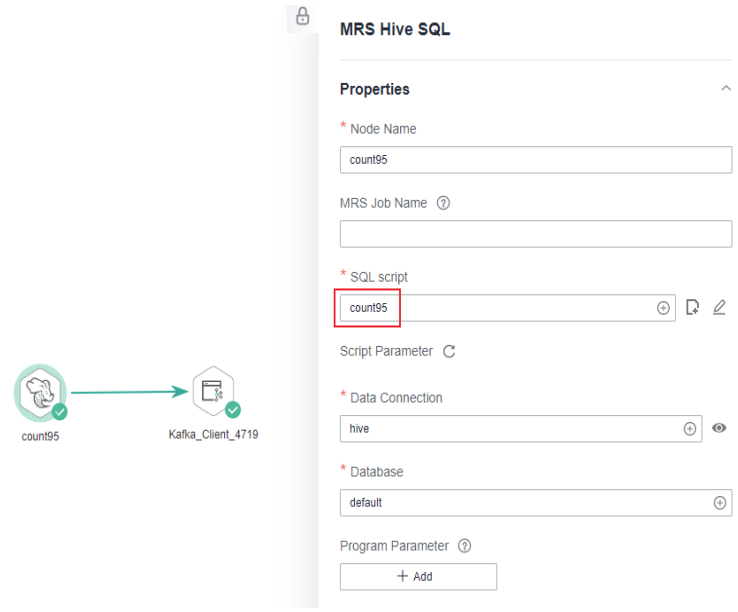
```
--Obtain the number of students whose scores are higher than 95 from the student_score table.--
SELECT count(*) FROM student_score WHERE score> "95" ;
```

Step 5 On the **Develop Job** page, create a data development job. Drag an MRS Hive SQL node and a Kafka Client node and drop them on the canvas. Click and hold to connect the nodes, as shown in **Figure 9-157**.

Step 6 Configuring parameters for an MRS Hive SQL node Select the **count95** script submitted in **Step 4** for **SQL script** and select a Hive connection and database.

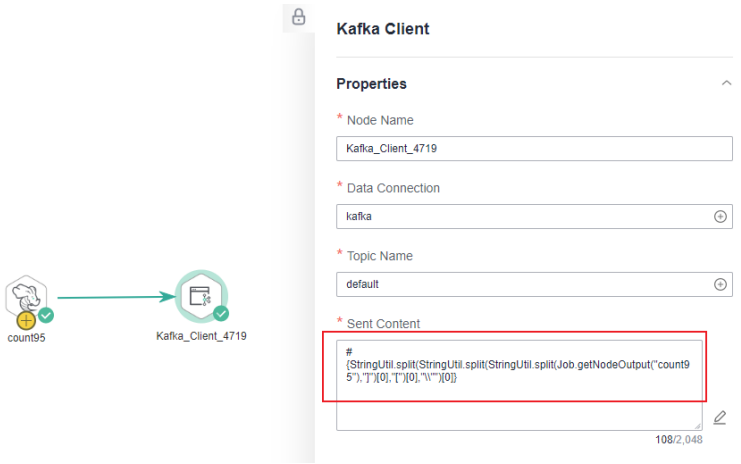
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Figure 9-158 Configuring parameters for an MRS Hive SQL node



Step 7 Configure parameters for the Kafka Client node. Set **Sent Content** to **#{StringUtil.split(StringUtil.split(StringUtil.split(Job.getNodeOutput("count95"),"]")[0],"[")[0],"\\"")[0]}** and select a Kafka connection and a topic name.

Figure 9-159 Configuring parameters for the Kafka Client node



Step 8 After the node configuration is complete, click **Test**. After the job test is successful, right-click the Kafka Client node to view its log. You can find that the two-dimensional array **[["2"]]** returned by the MRS Hive SQL node has been converted to **2**.

NOTE

You can set **Sent Content** of the Kafka Client node to **#{Job.getNodeOutput("count95")}** and run the job. Then you can view the log of the Kafka Client node to verify that the result returned by the MRS Hive SQL node is two-dimensional array **[["2"]]**.

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Figure 9-160 Check the Kafka Client node logs.



----End

Obtaining Output Values Using the For Each Node

Scenario

You can use the For Each node and the EL expression #{Loop.current[0]} with a Loop embedded object to cyclically obtain the output values of the previous node.

In this example, the MRS Hive SQL node returns a two-dimensional array that contains multiple fields. You can use the For Each node which cyclically invokes the subjobs of the Kafka Client node and set **Sent Content** of the Kafka Client node to **#{Loop.current[]}** to obtain the output values of the MRS Hive SQL node.

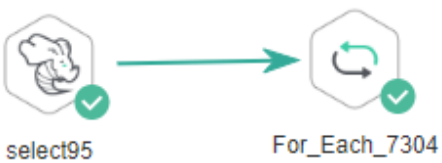
NOTE

To make it easy to view the obtained values, this example uses the Kafka Client node as the subjob node of the For Each node. In practice, you can select a subjob node type as needed. By using an EL expression with an embedded Loop object on the node, you can obtain the values returned by the previous node of the For Each node.

Orchestrate the main job shown in Figure 9-161. Key configurations of the For Each node are as follows:

- **Dataset**: Enter the execution result of the select statement on the Hive SQL node. Use the **#{Job.getNodeOutput("select95")}** expression, where **select95** is the name of the previous node.
- **Subjob Parameter Name**: Enter the parameter name defined in the subjob. Transfer the parameter value defined in the main job to the subjob. Set the subjob parameter names to **name** and **score**, whose values are those in the first and second columns in the dataset, respectively. EL expressions **#{Loop.current[0]}** and **#{Loop.current[1]}** are used.

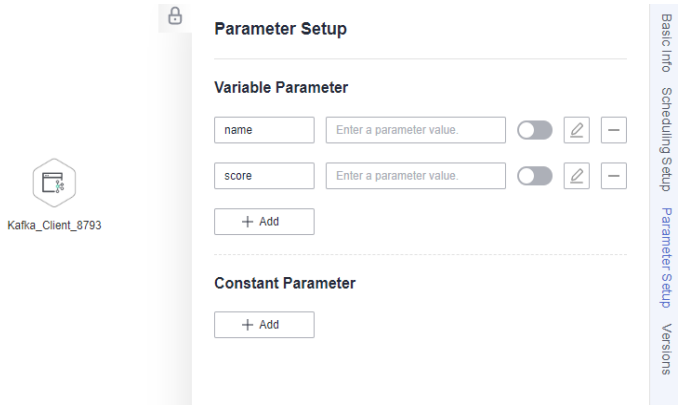
Figure 9-161 Example main job



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For the subjobs selected for the For Each node, you must set their parameter names so that the main job can identify the parameter definitions.

Figure 9-162 Example subjob



Configuration Method

Developing a Subjob

Step 1 Log in to the DataArts Studio console, locate the target DataArts Studio instance, and click **Access** on the instance card.

Step 2 Click the **Workspaces** tab. In the workspace list, locate the target workspace and click **DataArts Factory**.

Step 3 On the **Develop Job** page, create a data development subjob named **EL_test_slave**. Select a Kafka Client node, configure job parameters, and orchestrate the job shown in **Figure 9-162**.

Set the parameter name to **name** and **score**. This parameter is only used by the For Each node in the main job to identify subjob parameters. You do not need to set the parameter value.

Step 4 Configure parameters for the Kafka Client node. Set **Sent Content** to **${name}: ${score}** and select a Kafka connection and a topic name.

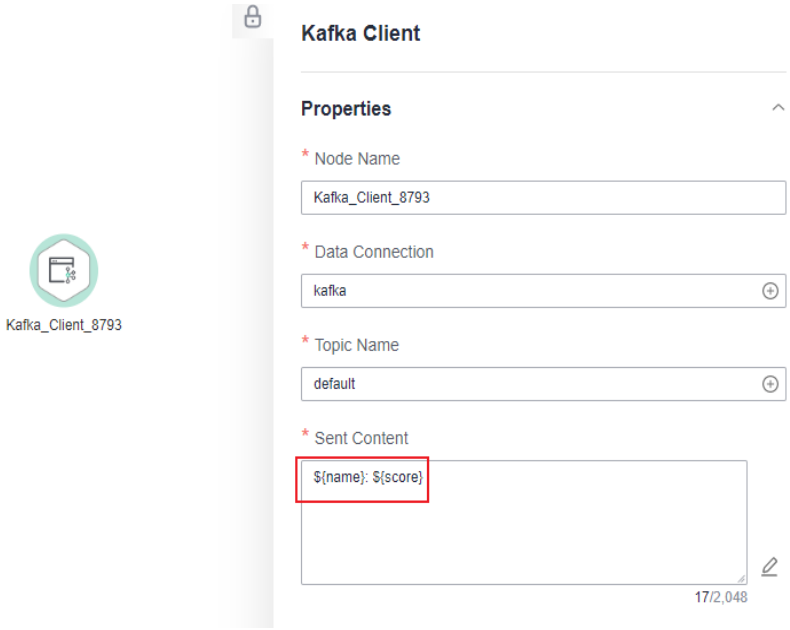
NOTE

Do not use the **#{Job.getParam("job_param_name")}** EL expression because this expression can only obtain the values of the parameters configured in the current job, but cannot obtain the parameter values transferred from the parent job or the global variables configured in the workspace. The expression only works for the current job.

To obtain the parameter values passed from the parent job and the global variables configured for the workspace, you are advised to use the **${job_param_name}** expression.

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Figure 9-163 Configuring parameters for the Kafka Client node



Step 5 Submit the subjob after the configuration is complete.

----End

Developing a Main Job

Step 1 Go to the **Develop Script** page.

Step 2 Create table **student_score**. Create a temporary Hive SQL script, select a Hive connection and database, paste the following SQL statement, and run the script. After the script is successfully executed, delete it.

```
CREATE TABLE `student_score` (`name` String COMMENT '', `score` INT COMMENT '');
INSERT INTO
   student_score
VALUES
   ('ZHAO', '90'),
   ('QIAN', '88'),
   ('SUN', '93'),
   ('LI', '94'),
   ('ZHOU', '85'),
   ('WU', '79'),
   ('ZHENG', '87'),
   ('WANG', '97'),
   ('FENG', '83'),
   ('CEHN', '99');
```

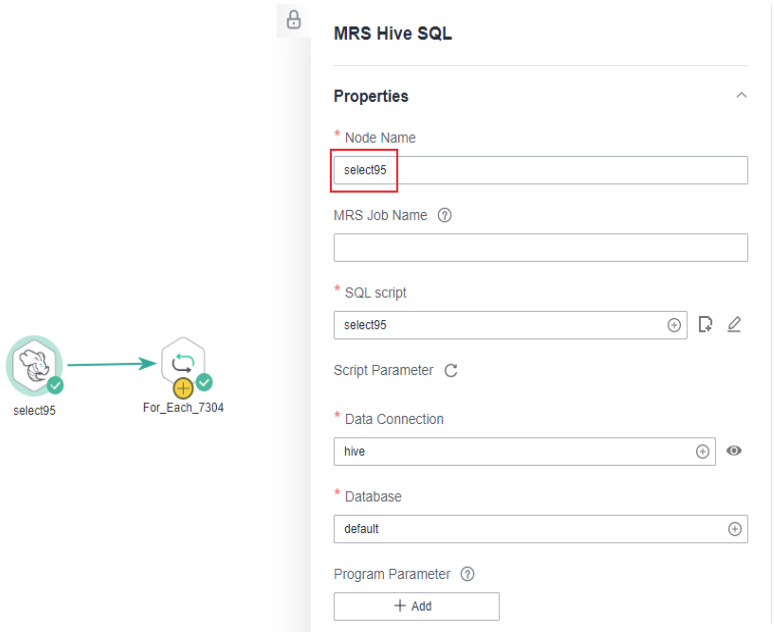
Step 3 Create the Hive SQL script to be invoked by the MRS Hive SQL node. Create a Hive SQL script named **select95**, select a Hive connection and database, paste the following SQL statement, and submit a version.

```
--Display the names and scores of students whose scores are higher than 95 in the student_score table.--
SELECT * FROM student_score WHERE score> "95" ;
```

Step 4 On the **Develop Job** page, create a data development job named **EL_test_master**. Drag a HIVE SQL node and a For Each node and drop them on the canvas. Click and hold to connect the nodes, as shown in **Figure 9-161**.

Step 5 Configure parameters for the MRS Hive SQL node. Select the **select95** script submitted in **Step 3** for **SQL script** and select a Hive connection and database.

Figure 9-164 Configuring parameters for an MRS Hive SQL node

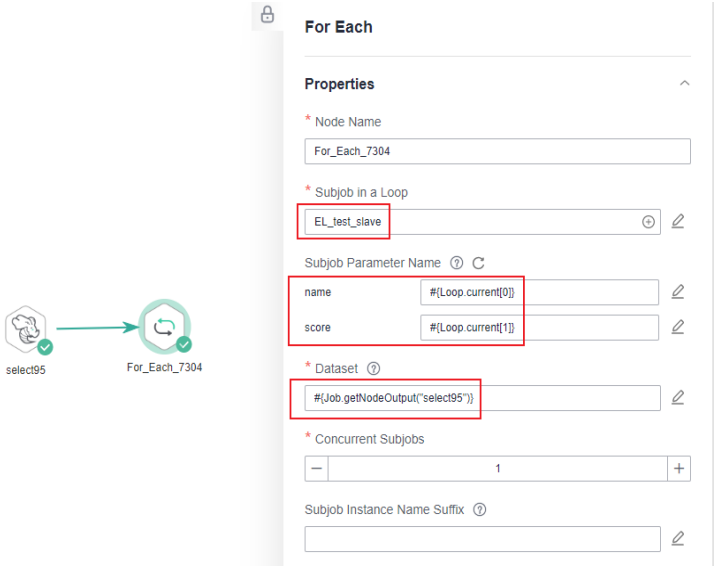


Step 6 Configure properties for the For Each node.

- **Subjob in a Loop**: Select **EL_test_slave**, the subjob that has been developed.
- **Dataset**: Enter the execution result of the select statement on the Hive SQL node. Use the **#{Job.getNodeOutput("select95")}** expression, where **select95** is the name of the previous node.
- **Subjob Parameter Name**: Enter the parameter name defined in the subjob. Transfer the parameter value defined in the main job to the subjob. Set the subjob parameter names to **name** and **score**, whose values are those in the first and second columns in the dataset, respectively. EL expressions **#{Loop.current[0]}** and **#{Loop.current[1]}** are used.

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Figure 9-165 Configuring properties for the For Each node



Step 7 Save the job.

----End

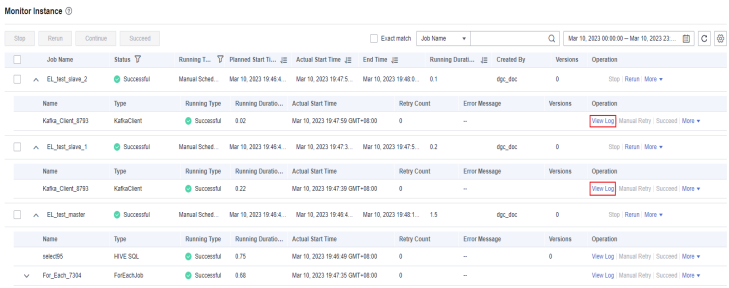
Testing the Main Job

Step 1 Click **Test** above the main job **EL_test_master** canvas to test the job. After the main job is executed, the subjob **EL_test_slave** is cyclically invoked through the For Each node and executed.

Step 2 In the navigation pane on the left, choose **Monitor Instance** to view the job execution result.

Step 3 After the job is executed, view the cyclic execution result of the subjob **EL_test_slave** on the **Monitor Instance** page.

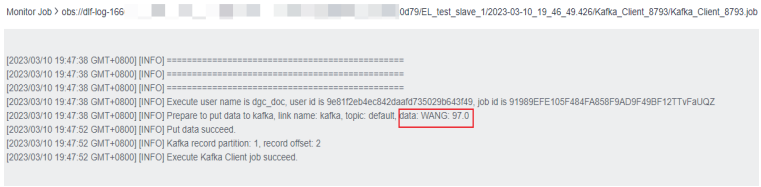
Figure 9-166 Execution result of the subjob



Step 4 View the log of the cyclic execution of subjob **EL_test_slave**. The log shows that the output values of the previous node of the For Each node was obtained through the For Each node and the EL expression with a Loop embedded object.

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Figure 9-167 Viewing the log



----End

9.15.6 Obtaining the Maximum Value and Transferring It to a CDM Job Using a Query SQL Statement

Scenario

You can run a query SQL statement to transfer the obtained maximum time value to a CDM job. In the advanced attributes of the CDM job, the where clause is used to determine the maximum time range to obtain the data to be migrated and complete the incremental data migration.

Constraints

1. You have completed operations in **Creating a Data Connection**.
2. You have completed operations in **Creating a Database**.

Examples

Creating an SQL Script

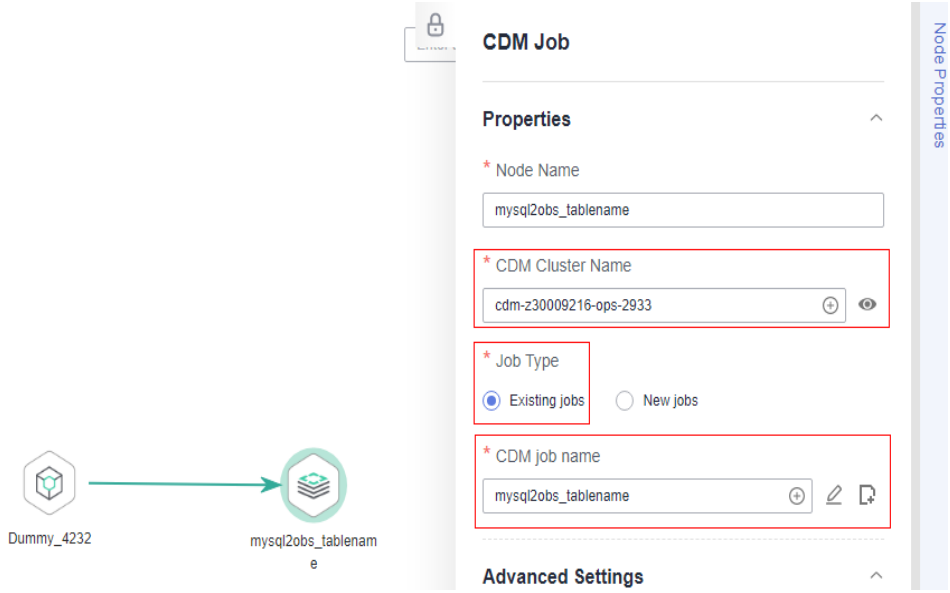
1. In the left navigation pane of DataArts Factory, choose **Data Development** > **Develop Script**.
2. Create an SQL script. This section uses the MRS Spark SQL script as an example.
3. Select a created data connection and database.
4. Compile the SQL script to obtain the maximum time data from table1.
   ```
   select max(time) from table1
   ```
5. Save and submit the version. The **maxtime** script is created.

Creating a Pipeline Subjob

1. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
2. Select a CDM Job node and configure the node properties.

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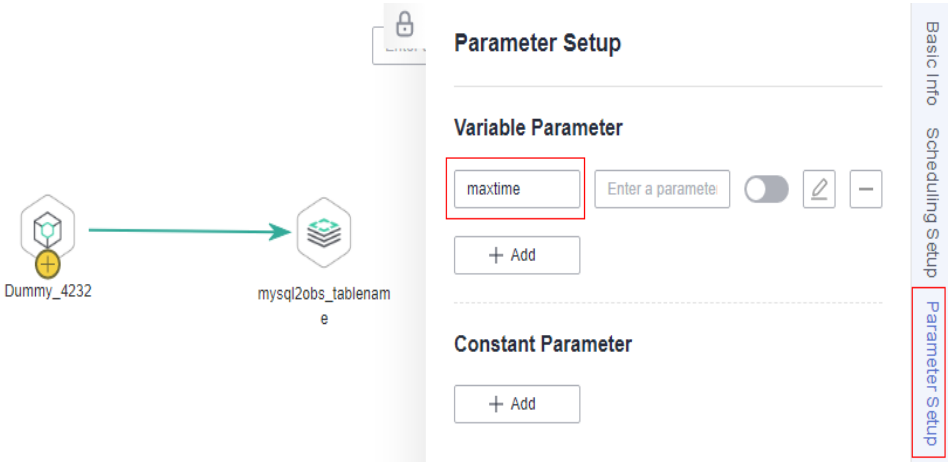
Figure 9-168 Configuring CDM Job node properties



Select a CDM cluster and associate the node with an existing CDM job.

Configure the job parameters and add job parameter **maxtime**.

Figure 9-169 Configuring job parameters



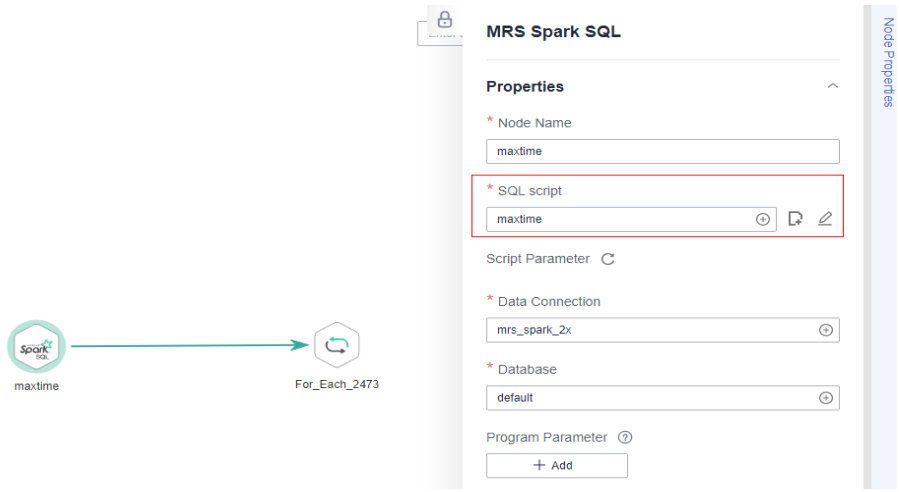
3. Save and submit the version. The subjob **sub** is created.

Creating a Pipeline Job

1. In the left navigation pane of DataArts Factory, choose **Development** > **Develop Job**.
2. Select an MRS Spark SQL node and a For Each node to execute the CDM subjob cyclically.
3. Configure properties of the MRS Spark SQL node and associate the node with the created **maxtime** script.

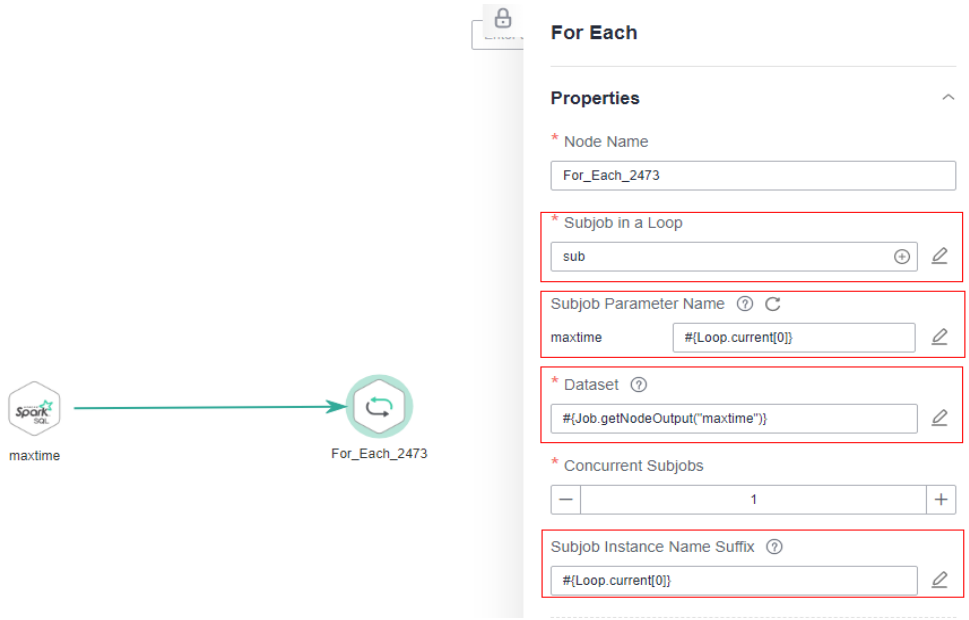
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Figure 9-170 Configuring properties for the MRS Spark SQL node



4. Configure properties of the For Each node and associate the node with the created CDM subjob.

Figure 9-171 Configuring properties for the For Each node



After associating the node with the created subjob **sub**, write a parameter expression.

```
#{Loop.current[0]}
```

Configure the data set, with an EL expression supported.

```
#{Job.getNodeOutput("maxtime")}
```

5. Save and submit the version. The job is created.

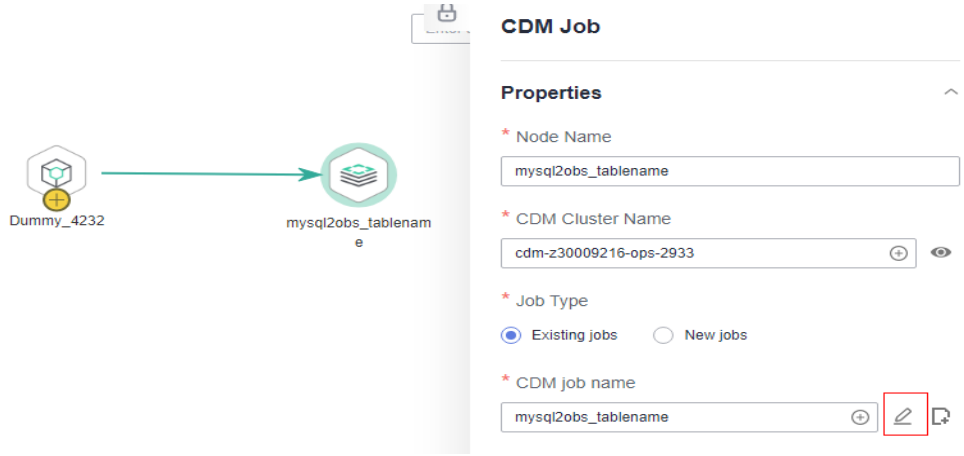
Obtaining the Maximum Time Value from the CDM Job Using a Where Clause and Transferring the Value to the Destination Job

1. Open the created subjob.

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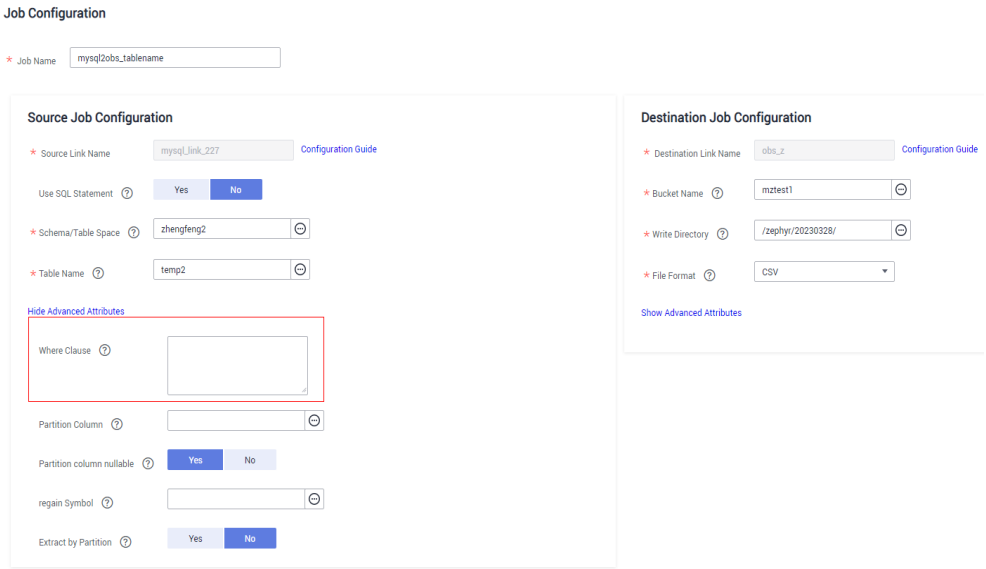
2. Click next to the job name to go to the job configuration page.

Figure 9-172 Editing the CDM job



3. In the advanced attributes of the source job configuration, configure a where clause to obtain the data to be migrated. When the job is executed, the migration data obtained from the source will be replicated, exported, and imported to the destination.

Figure 9-173 Configuring a where clause



The where clause is as follows:

```
dt > '${maxtime}'
```

9.15.7 IF Statements

When developing and orchestrating jobs in DataArts Factory, you can use IF statements to determine the branch to execute.

This section describes how to use IF statements in the following scenarios:

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- **Determining the IF Statement Branch to Be Executed Based on the Execution Status of the Previous Node**
- **Determining the IF Statement Branch to Be Executed Based on the Execution Result of the Previous Node**
- **Configuring the Policy for Executing a Node with Multiple IF Statements**

IF statements use EL expressions. You can select EL expressions and follow the instruction in this section to develop jobs.

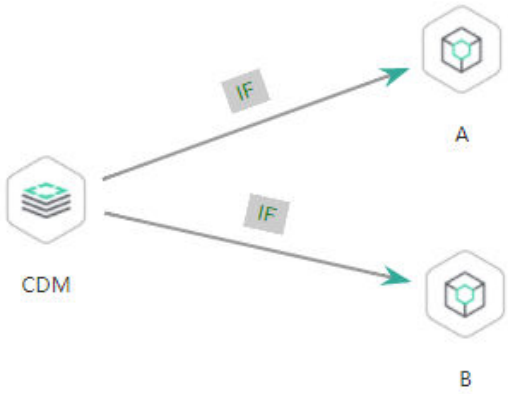
For details about how to use EL expressions, see **EL Expressions**.

Determining the IF Statement Branch to Be Executed Based on the Execution Status of the Previous Node

Scenario

Generally, you can determine the IF statement branch to be executed based on whether the previous CDM node is successfully executed. For details on how to set IF statements, see **Figure 9-174**.

Figure 9-174 Example job



Configuration Method

Step 1 Log in to the DataArts Studio console, locate the target DataArts Studio instance, and click **Access** on the instance card.

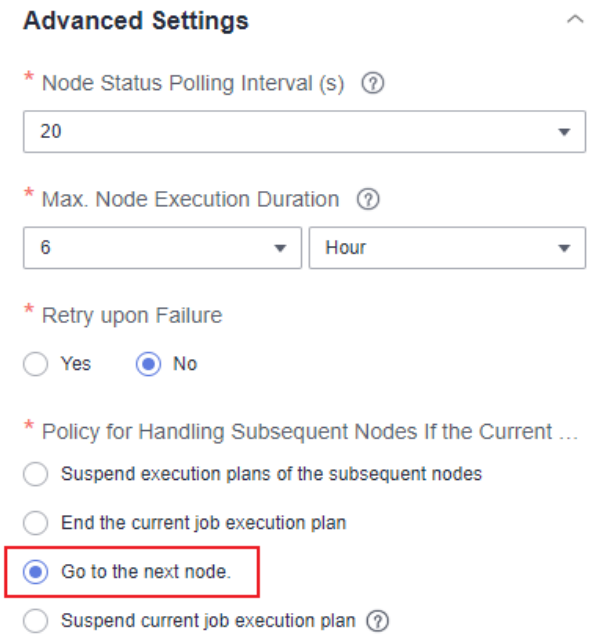
Step 2 Click the **Workspaces** tab. In the workspace list, locate the target workspace and click **DataArts Factory**. The DataArts Factory console is displayed.

Step 3 On the **Develop Job** page, create a job, drag a CDM node and two Dummy nodes and drop them on the canvas in the right pane. Click and hold to connect the CDM node to the Dummy nodes, as shown in **Figure 9-174**.

Set the **Failure Policy** for the CDM node to **Go to the next node**.

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Figure 9-175 Configuring the failure policy for the CDM node



Step 4 Right-click the connection line and select **Set Condition**. In the **Edit EL Expression** dialog box, enter the IF statement in the text box.

Each statement branch requires an IF statement. The IF statement is a ternary expression based on the EL expression syntax. If the result of the ternary expression is **true**, subsequent nodes will be connected. Otherwise, subsequent nodes will be skipped.

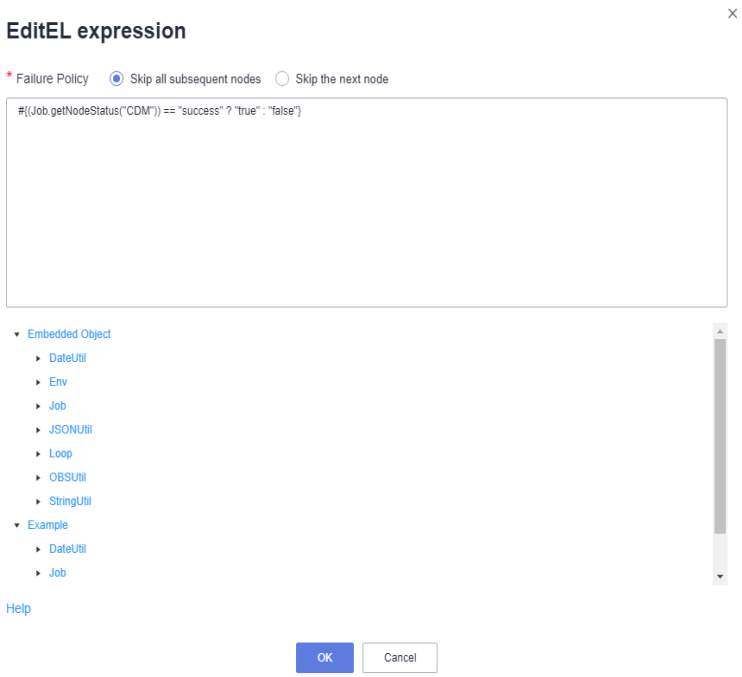
In this demo, the **#{Job.getNodeStatus("node_name")}** EL expression is used to obtain the execution status of a specified node. If the execution is successful, **success** is returned; otherwise, **fail** is returned. In this example, the IF statement expressions are as follows:

- The IF statement expression for branch A is **#{(Job.getNodeStatus("CDM")) == "success" ?**. "true" : "false"}
- The IF statement expression for branch B is **#{(Job.getNodeStatus("CDM")) == "fail" ?**. "true" : "false"}

After entering the IF statement expression, you can select either **Skip all subsequent nodes** or **Skip the next node** for **Failure Policy**. After the configuration is complete, click **OK** to save the job.

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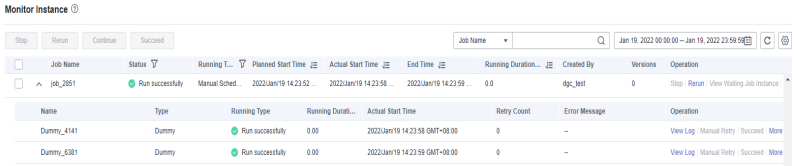
Figure 9-176 Configuring a failure policy



Step 5 Click **Test** to test the job and view the execution result on the **Monitor Instance** page.

Step 6 After the job is executed, view the job instance running result on the **Monitor Instance** page. The execution result meets the expectation. If the execution result is **fail**, branch A is skipped and branch B is executed.

Figure 9-177 Job execution result



----End

Determining the IF Statement Branch to Be Executed Based on the Execution Result of the Previous Node

Scenario Description

Scenario: Use the Hive SQLnode to collect statistics on the number of people whose score is higher than 85, transfer the execution result as a parameter to the next node, compare the result with the number of people who have passed the test, and determine the IF condition branch to be executed.

Analysis: The execution result of the select statement on the Hive SQL node is a two-dimensional array which contains a single field. Therefore, EL expression **#{Loop.dataArray[][]}** or **#{Loop.current[]}** can be used to obtain the value in the two-dimensional array. Currently, only the For Each node supports loop expressions, so the Hive SQL node needs to be connected to a For Each node.

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NOTE

In this scenario, the loop expression cannot be replaced by the StringUtil expression **#{StringUtil.split(StringUtil.split(StringUtil.split(Job.getNodeOutput("*Name of the previous node*"),"]")[0],"[")[0],"\\"")[0]}** because the StringUtil expression returns a string which cannot be compared with the standard data of the int type.

Figure 9-178 shows the job orchestration.

Figure 9-178 Example job

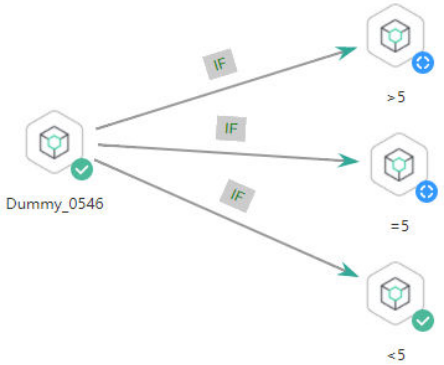


Key configurations of the For Each node are as follows:

- **Dataset**: Enter the execution result of the select statement on the Hive SQL node. Use the **#{Job.getNodeOutput('HIVE')}** expression, where **HIVE** is the name of the previous node.
- **Subjob Parameter Name**: Enter the parameter defined in the subjob. Transfer the output of the previous node of the main job to the sub-job for use. The variable name is **result**, and its value is a column in the dataset. The EL expression **#{Loop.dataArray[0][0]}** or **#{Loop.current[]}** is used. This example uses **{Loop.dataArray[0][0]}** as an example.

The sub-job selected on the For Each node determines the IF statement branch to be executed based on the subjob parameter transferred from the For Each node. **Figure 9-179** shows the job orchestration.

Figure 9-179 Example sub-job



The IF statement is the key configuration of the subjob. This example uses the expression **${result}** to obtain the value of the job parameter.

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> **NOTE**
>
> Do not use the **#{Job.getParam("job_param_name")}** EL expression because this expression can only obtain the values of the parameters configured in the current job, but cannot obtain the parameter values transferred from the parent job or the global variables configured in the workspace. The expression only works for the current job.
>
> To obtain the parameter values passed from the parent job and the global variables configured for the workspace, you are advised to use the **${job_param_name}** expression.

Configuration Method

Developing a Subjob

Step 1 Log in to the DataArts Studio console, locate the target DataArts Studio instance, and click **Access** on the instance card.

Step 2 Click the **Workspaces** tab. In the workspace list, locate the target workspace and click **DataArts Factory**. The DataArts Factory console is displayed.

Step 3 On the **Develop Job** page, create a data development subjob For Each. Drag four Dummy nodes and drop them on the canvas, click and hold to connect them, as shown in **Figure 9-179**.

Step 4 Right-click the connection line and select **Set Condition**. In the **Edit EL Expression** dialog box, enter the IF statement in the text box.

Each statement branch requires an IF statement. The IF statement is a ternary expression based on the EL expression syntax. If the result of the ternary expression is **true**, subsequent nodes will be connected. Otherwise, subsequent nodes will be skipped.

- For the **>5** branch, the IF statement expression is **#{${result} > 5 ? "true" : "false"}**.
- For the **=5** branch, the IF statement expression is **#{${result} == 5 ? "true" : "false"}**.
- For the **<5** branch, the IF statement expression is **#{${result} < 5 ? "true" : "false"}**.

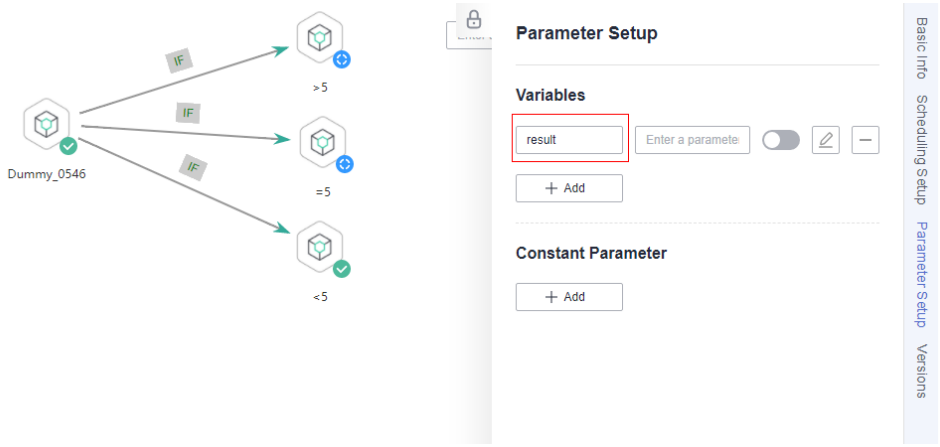
After entering the IF statement expression, you can select either **Skip all subsequent nodes** or **Skip the next node** for **Failure Policy**.

> **NOTE**
>
> If an expression contains multiple conditions, you can use || to combine them conditions. The following is an example:
>
> #{(${result} >= 19 || ${result} <=9) ? "true" : "false"}

Step 5 Configure job parameters. Set the parameter name to **result**. This parameter is only used by the For Each node in the main job **testif** to identify subjob parameters. You do not need to set the parameter value.

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Figure 9-180 Configuring job parameters



Step 6 Save the job.

----End

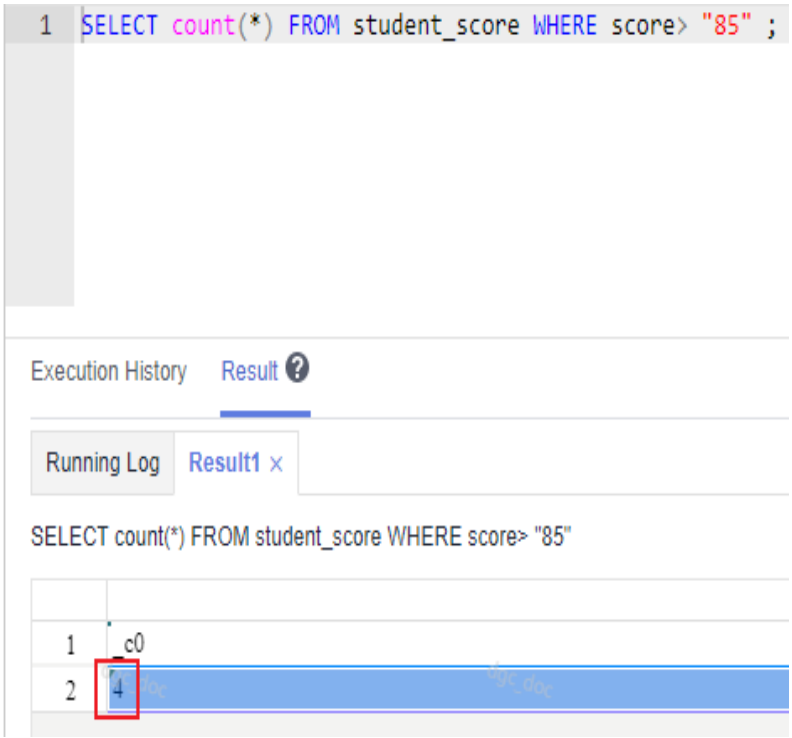
Developing a Job

Step 1 On the **Develop Job** page, create a data development job named **testif**. Drag a HIVE SQL node and a For Each node and drop them on the canvas. Click and hold to connect the nodes, as shown in **Figure 9-178**.

Step 2 Configure properties for the HIVE SQL node. Reference the following SQL script (there is no special requirement for other properties):

```
--Obtain the number of people whose scores are higher than 85 from the student_score table.
SELECT count(*) FROM student_score WHERE score> "85" ;
```

Figure 9-181 HIVE SQL script execution result

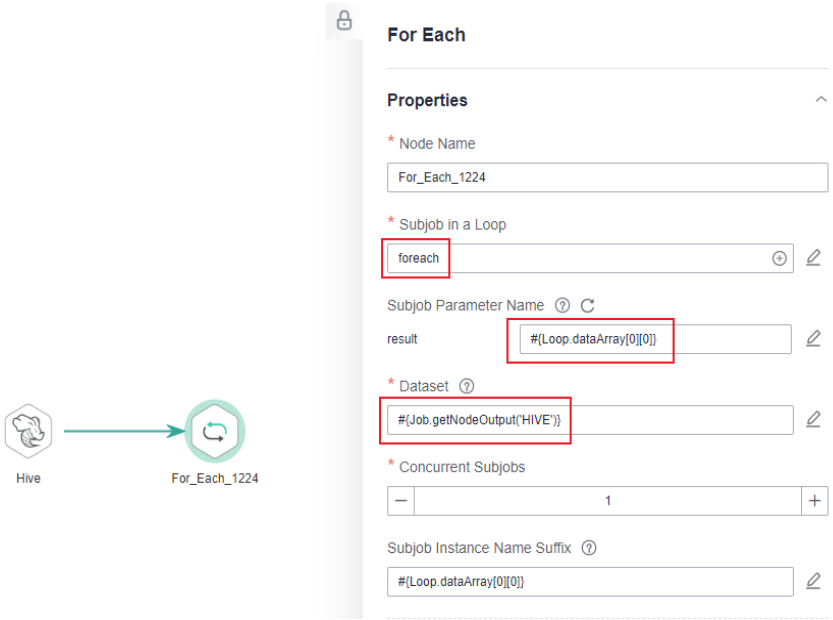


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Step 3 Configure properties for the For Each node.

- **Subjob in a Loop**: Select **foreach**, the subjob that has been developed.
- **Dataset**: Enter the execution result of the select statement on the Hive SQL node. Use the **#{Job.getNodeOutput('HIVE')}** expression, where **HIVE** is the name of the previous node.
- **Subjob Parameter Name**: Enter the parameter defined in the subjob. Transfer the output of the previous node of the main job to the sub-job for use. The variable name is **result** (parameter name of the subjob), and its value is a column in the dataset. The EL expression **#{Loop.dataArray[0][0]}** is used.

Figure 9-182 Properties of the For Each node



Step 4 Save the job.

----End

Testing the Main Job

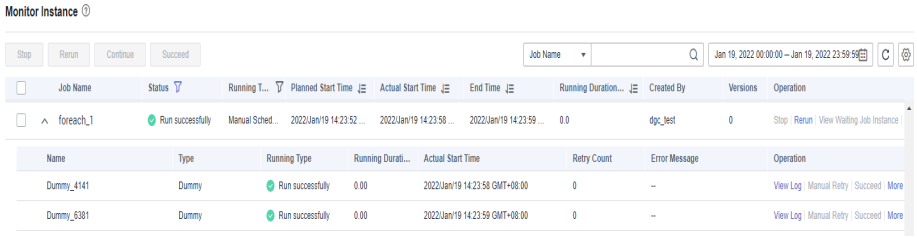
Step 1 Click **Test** above the canvas to test the main job. After the main job is executed, the subjob is automatically invoked through the For Each node and executed.

Step 2 In the navigation pane on the left, choose **Monitor Instance** to view the job execution result.

Step 3 After the job is executed, view the execution result of the subjob **foreach** on the **Monitor Instance** page. The execution result meets the expectation. Currently, the execution result of the Hive SQL statement is **4**. Therefore, the **>5** and **=5** branches are skipped, and the **<5** branch is successfully executed.

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Figure 9-183 Execution result of the subjob



----End

Configuring the Policy for Executing a Node with Multiple IF Statements

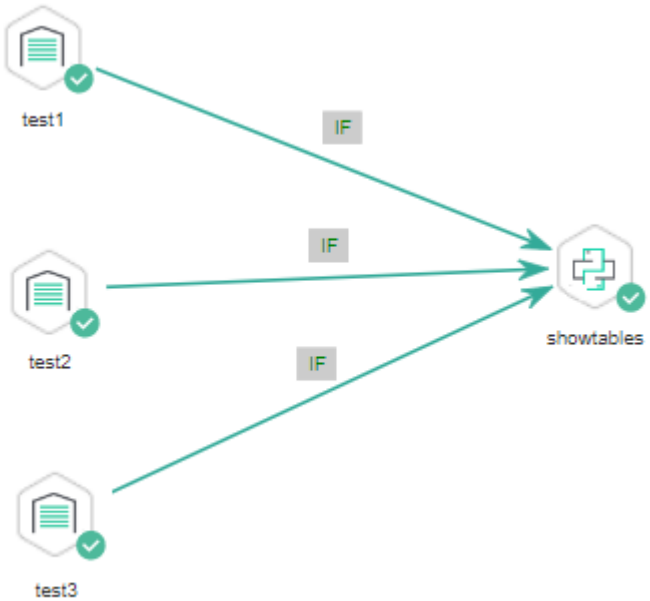
If the execution of a node depends on multiple IF statements, the policy for executing the node can be **AND** or **OR**.

If you choose the **OR** policy, the node will be executed if any one of the IF statements is met.

If you choose the **AND** policy, the node will be executed only if all of the IF statements are met.

If you choose neither, the **OR** policy will be used.

Figure 9-184 A job with multiple IF statements



Configuration Method

Configure the execution policy.

Step 1 Log in to the DataArts Studio console, locate the target DataArts Studio instance, and click **Access** on the instance card.

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Step 2 Click the **Workspaces** tab. In the workspace list, locate the target workspace and click **DataArts Factory**. The DataArts Factory console is displayed.

Step 3 On the DataArts Factory console, choose **Configuration** > **Configure** > **Default Configuration**.

Step 4 Select **AND** or **OR** for **Multi-IF Policy**.

Step 5 Click **Save**.

----End

Develop a job.

Step 1 On the **Develop Job** page, create a data development job.

Step 2 Drag three DWS SQL operators as parent nodes and one Python operator as a child node to the canvas. Click and hold to connect the nodes to orchestrate the job shown in **Figure 9-184**.

Step 3 Right-click the connection line and select **Set Condition**. In the **Edit EL Expression** dialog box, enter the IF statement in the text box.

Each statement branch requires an IF statement. The IF statement is a ternary expression based on the EL expression syntax.

- The IF statement expression for the test1 node is **#{(Job.getNodeStatus("test1")) == "success" ? "true" : "false"},**
- The IF statement expression for the test2 node is **#{(Job.getNodeStatus("test2")) == "success" ? "true" : "false"},**
- The IF statement expression for the test3 node is **#{(Job.getNodeStatus("test3")) == "success" ? "true" : "false"},**

The expression of each node is determined using the IF statement based on the execution status of the previous node.

After entering the IF statement expression, you can select either **Skip all subsequent nodes** or **Skip the next node** for **Failure Policy**.

----End

Test the job.

Step 1 Click **Save** above the canvas to save the job.

Step 2 Click **Test** above the canvas to test the job.

If **test1** is executed successfully, the corresponding IF statement is true.

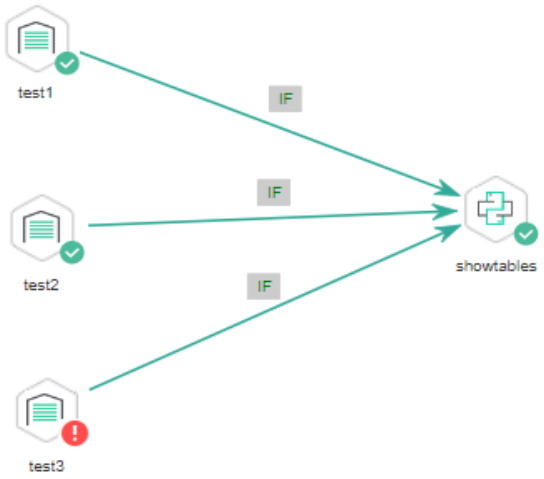
If **test2** is executed successfully, the corresponding IF statement is true.

If **test3** fails to be executed, the corresponding IF statement is false.

If **Multi-IF Policy** is set to **OR**, the **showtables** node is executed and the job execution is complete.

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Figure 9-185 How the job runs if Multi-IF Policy is OR



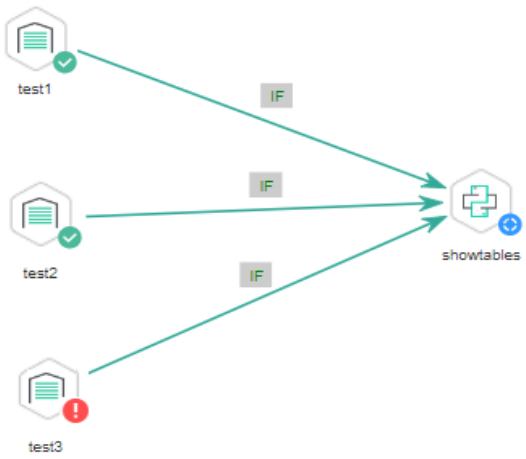
Logs

[INFO][Jul 04, 2022 17:28:23 GMT+08:00] : The job starts to run.
[INFO][Jul 04, 2022 17:30:31 GMT+08:00] : Node test1 started to run.
[INFO][Jul 04, 2022 17:30:31 GMT+08:00] : Node test2 started to run.
[INFO][Jul 04, 2022 17:30:31 GMT+08:00] : Node test3 started to run.
[ERROR][Jul 04, 2022 17:30:51 GMT+08:00] : Node test3 failed to run.
[INFO][Jul 04, 2022 17:30:51 GMT+08:00] : Node test1 finished to run.
[INFO][Jul 04, 2022 17:30:51 GMT+08:00] : Node test2 finished to run.
[INFO][Jul 04, 2022 17:30:51 GMT+08:00] : Node showtables started to run.
[INFO][Jul 04, 2022 17:30:51 GMT+08:00] : Node showtables finished to run.
[INFO][Jul 04, 2022 17:30:51 GMT+08:00] : Job running is completed.

If **Multi-IF Policy** is set to **AND**, the **showtables** node is skipped and the job execution is complete.

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Figure 9-186 How the job runs if Multi-IF Policy is AND



Logs

[INFO][Jul 05, 2022 09:05:33 GMT+08:00] : The job starts to run.
[INFO][Jul 05, 2022 09:07:42 GMT+08:00] : Node test1 started to run.
[INFO][Jul 05, 2022 09:07:42 GMT+08:00] : Node test2 started to run.
[INFO][Jul 05, 2022 09:07:42 GMT+08:00] : Node test3 started to run.
[ERROR][Jul 05, 2022 09:08:03 GMT+08:00] : Node test3 failed to run.
[INFO][Jul 05, 2022 09:08:03 GMT+08:00] : Node test1 finished to run.
[INFO][Jul 05, 2022 09:08:03 GMT+08:00] : Node test2 finished to run.
[INFO][Jul 05, 2022 09:08:03 GMT+08:00] : Node showtables finished to run.

----End

9.15.8 Obtaining the Return Value of a Rest Client Node

The Rest Client node can execute RESTful requests on Huawei Cloud.

This tutorial describes how to obtain the return value of the Rest Client node, covering the following two application scenarios:

- **Obtaining the Return Value Through Parameter "The response message body parses the transfer parameter"**
- **Obtaining the Return Value Using an EL Expression**

Obtaining the Return Value Through Parameter "The response message body parses the transfer parameter"

As shown in , the first Rest Client node invokes the API of MRS to query the cluster list. **Figure 9-187** shows the JSON message body returned by the API.

- Scenario: The ID of the first cluster in the cluster list needs to be obtained and transferred to other nodes as a parameter.

- Key configurations: Set **The response message body parses the transfer parameter** of the first Rest Client to **clusterId=clusters[0].clusterId**. Other Rest Client nodes can reference the ID of the first cluster in ${clusterId} mode.

  NOTE

  When setting **The response message body parses the transfer parameter**, ensure that the transferred parameter name (for example, **clusterId**) is unique among all node parameters of the job.

Figure 9-187 JSON message body


```
{
    "clusterTotal":31,
    "clusters":[
        {
            "clusterId":"6ea1b5c2-6526-4ef8-9c8f-4105b63fa893",
            "clusterName":"mrs_hbase22",
            "totalNodeNum":"2",
            "clusterState":"running",
            "stageDesc":null,
            "createAt":"1620378935",
            "updateAt":"1620611307",
            "chargingStartTime":"1620380067",
            "billingType":"Metered",
            "dataCenter":"cerxth-7",
            "vpc":"vpc-dlf",
            "vpcId":"f35aee01-c4a3-47c1-8d92-9df430537de4",
            "duration":"0",
            "fee":"0.0",
            "hadoopVersion":"",
            "componentList":[
                {
                    "id":"218051",
                    "componentId":"MRS_2.1.0_001",
                    "componentName":"Hadoop",
                    "componentVersion":"3.1.1",
                    "external_datasources":null,
                    "componentDesc":"A distributed data storage and processing framework for large data sets, including core components such as HDFS, YARN, and MapReduce.",
                    "componentDescEn":null,
                    "multi_service_name":null
                },
```


Obtaining the Return Value Using an EL Expression

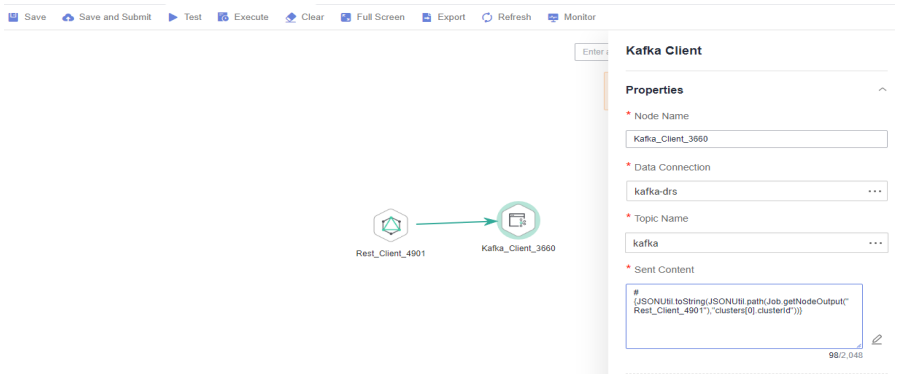
The Rest Client node can be used together with EL expressions. You can select different EL expressions based on scenarios. This section describes how to develop your own jobs based on your service requirements. For details about how to use EL expressions, see **EL Expressions**.

As shown in **Figure 9-188**, the Rest Client invokes the API of MRS to query the cluster list and then invokes the Kafka Client to send a message.

- Scenario: The Kafka Client sends a character string message. The message content is the ID of the first cluster in the cluster list.
- Key configurations: When you configure the Kafka Client, use the following EL expression to obtain a specific field in the message body returned by the REST API:
  #{JSONUtil.toString(JSONUtil.path(Job.getNodeOutput("Rest_Client_4901"),"clusters[0].clusterId"))}

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Figure 9-188 Rest Client job example 2



9.15.9 Using For Each Nodes

Scenario

During job development, if some jobs have different parameters but the same processing logic, you can use For Each nodes to avoid repeated job development.

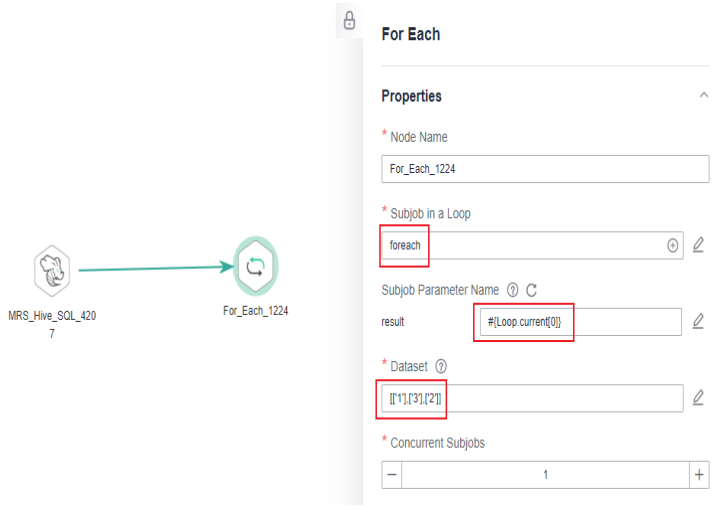
You can use a For Each node to execute a subjob in a loop and use a dataset to replace the parameters in the subjob. The key parameters are as follows:

- **Subjob in a Loop**: Select the subjob to be executed in a loop.
- **Dataset**: Enter a set of parameter values of the subjobs. The value can be a specified dataset such as **[['1'],['3'],['2']]** or an EL expression such as **#{Job.getNodeOutput('preNodeName')}**, which is the output value of the previous node.
- **Subjob Parameter Name**: The parameter name is the variable defined in the subjob. The parameter value is usually set to a group of data in the dataset. Each time the job is run, the parameter value is transferred to the subjob for use. For example, parameter value **#{Loop.current[0]}** indicates that the first value of each row of data in the dataset is traversed and transferred to the subjob.

Figure 9-189 shows an example For Each node. As shown in the figure, the parameter name of the **foreach** subjob is **result**, and the parameter value is the traversal of the one-dimensional array dataset **[['1'],['3'],['2']]** (that is, the value is **1**, **3**, and **2** in the first, second, and third loop, respectively).

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Figure 9-189 For Each node



For Each Nodes and EL Expressions

To use For Each nodes properly, you must be familiar with EL expressions. For details about how to use EL expressions, see **EL Expressions**.

For Each nodes use the following EL expressions most:

- #{Loop.dataArray}: dataset input by the For Each node. It is a two-dimensional array.
- #{Loop.current}: The For Loop node processes a dataset line by line. *Loop.current* indicates a line of data that is being processed. *Loop.current* is a one-dimensional array, and its format is #{Loop.current[0]}, #{Loop.current[1]}, or others. The value 0 indicates that the first value in the current line is traversed.
- #{Loop.offset}: current offset when the For Each node processes the dataset. The value starts from 0.
- #{Job.getNodeOutput('preNodeName')}: obtains the output of the previous node.

Examples

Scenario

To meet data normalization requirements, you need to periodically import data from multiple source DLI tables to the corresponding destination DLI tables, as listed in **Table 1**.

Table 9-189 Tables to be imported

Source Table	Destination Table
a_new	a
b_2	b
c_3	c

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Source Table	Destination Table
d_1	d
c_5	e
b_1	f

If you use SQL nodes to execute import scripts, a large number of scripts and nodes need to be developed, resulting in repeated work. In this case, you can use the For Each node to perform cyclic jobs to reduce the development workload.

Configuration Method

Step 1 Prepare the source and destination tables. To facilitate subsequent job execution and verification, you need to create a source DLI table and a destination DLI table and insert data into the tables.

1. Create a DLI table. You can create a DLI SQL script on the **DataArts Factory** page and run the following commands to create a DLI table. You can also run the following SQL commands in the SQL editor on the DLI console.

```
/* Create a data table. */
CREATE TABLE a_new (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE b_2 (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE c_3 (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE d_1 (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE c_5 (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE b_1 (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE a (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE b (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE c (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE d (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE e (name STRING, score INT) STORED AS PARQUET;
CREATE TABLE f (name STRING, score INT) STORED AS PARQUET;
```

2. Insert data into the source data table. You can create a DLI SQL script on the **DataArts Factory** page and run the following commands to create a DLI table. You can also run the following SQL commands in the SQL editor on the DLI console.

```
/* Insert data into the source data table. */
INSERT INTO a_new VALUES ('ZHAO','90'),('QIAN','88'),('SUN','93');
INSERT INTO b_2 VALUES ('LI','94'),('ZHOU','85');
INSERT INTO c_3 VALUES ('WU','79');
INSERT INTO d_1 VALUES ('ZHENG','87'),('WANG','97');
INSERT INTO c_5 VALUES ('FENG','83');
INSERT INTO b_1 VALUES ('CEHN','99');
```

Step 2 Prepare dataset data. You can obtain a dataset in any of the following ways:

1. Import the data in **Table 1** into the DLI table and use the result read by the SQL script as the dataset.
2. You can save the data in **Table 1** to a CSV file in the OBS bucket. Then use a DLI SQL or DWS SQL statement to create an OBS foreign table, associate it with the CSV file, and use the query result of the OBS foreign table as the dataset. For details about how to create a foreign table on DLI, see **OBS Source Stream**. For details about how to create a foreign table on DWS, see **Creating a Foreign Table**.
3. You can save the data in **Table 1** to a CSV file in the HDFS. Then use a Hive SQL statement to create a Hive foreign table, associate it with the CSV file,

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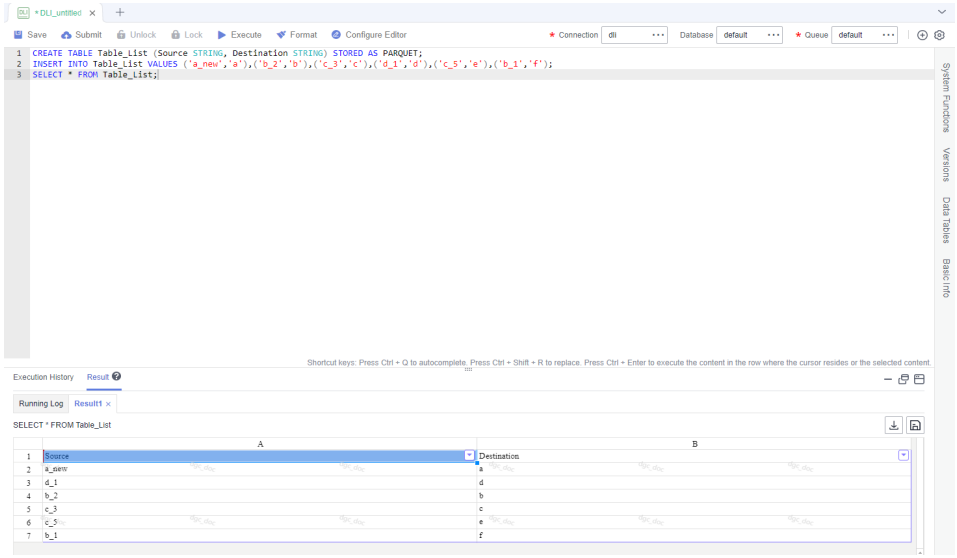
and use the query result of the Hive foreign table as the dataset. For details about how to create an MRS foreign table, see **Creating a Table**.

This section uses method 1 as an example to describe how to import data from **Table 1** to the DLI table (**Table_List**). You can create a DLI SQL script on the **DataArts Factory** page and run the following commands to import data into the table. You can also run the following SQL commands in the SQL editor on the DLI console.

```
/* Create the Table_List data table, insert data in Table 1 into the table, and check the generated data. */
CREATE TABLE Table_List (Source STRING, Destination STRING) STORED AS PARQUET;
INSERT INTO Table_List VALUES ('a_new','a'),('b_2','b'),('c_3','c'),('d_1','d'),('c_5','e'),('b_1','f');
SELECT * FROM Table_List;
```

The generated data in the **Table_List** table is as follows:

Figure 9-190 Data in the Table_List table



Step 3 Create a subjob named **ForeachDemo** to be executed cyclically. In this operation, a task containing the DLI SQL node is defined to be executed cyclically.

1. Access the DataArts Studio **DataArts Factory** page, choose **Develop Job**. Create a job named **ForeachDemo**, select the DLI SQL node, and configure the job as shown in **Figure 9-191**.

   In the DLI SQL statement, set the variable to be replaced to **${}**. The following SQL statement is used to import all data in the **${Source}** table to the **${Destination}** table. **${fromTable}** and **${toTable}** are the variables. The SQL statement is as follows:

   ```
   INSERT INTO ${Destination} select * from ${Source};
   ```

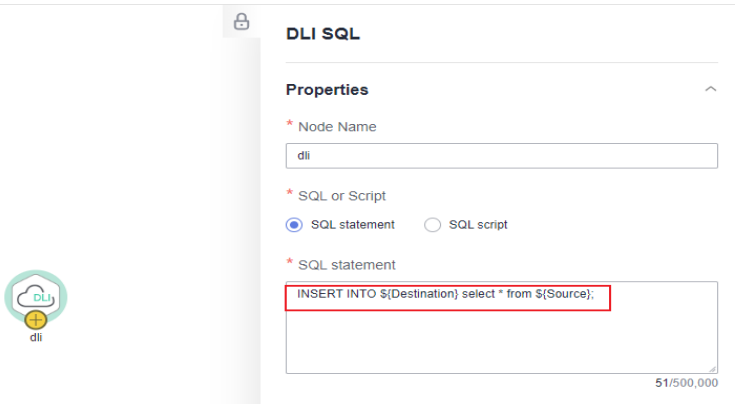
   NOTE

   Do not use the **#{Job.getParam("job_param_name")}** EL expression because this expression can only obtain the values of the parameters configured in the current job, but cannot obtain the parameter values transferred from the parent job or the global variables configured in the workspace. The expression only works for the current job.

   To obtain the parameter values passed from the parent job and the global variables configured for the workspace, you are advised to use the **${job_param_name}** expression.

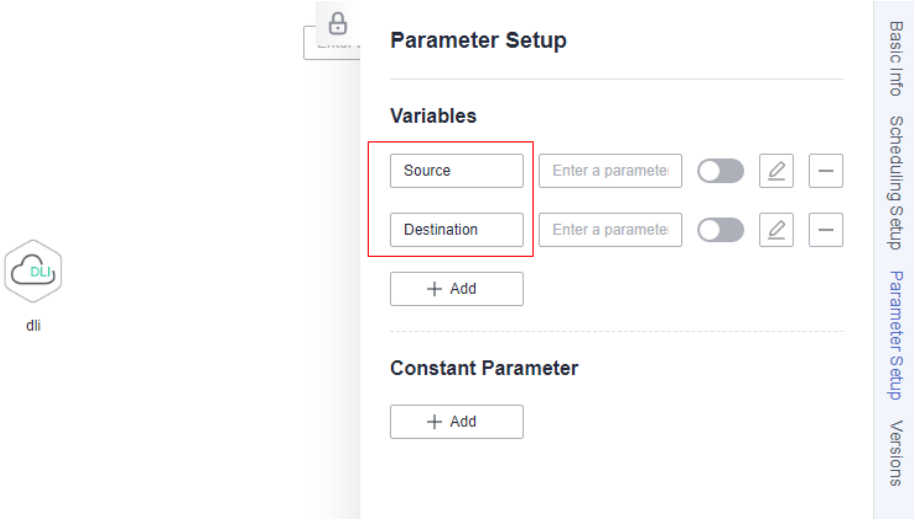
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Figure 9-191 Cyclically executing a subjob



2. After configuring the SQL statement, configure parameters for the subjob. You only need to set the parameter names, which are used by the For Each operator of the **ForeachDemo_master** job to identify subjob parameters.

Figure 9-192 Configuring subjob parameters



3. Save the job.

Step 4 Create a master job named **ForeachDemo_master** where the For Each node is located.

1. Access the DataArts Studio **DataArts Studio** page and choose **Develop Job**. Create a data development master job named **ForeachDemo_master**. Select the DLI SQL and For Each nodes and click and drag to compile the job shown in **Figure 9-193**.

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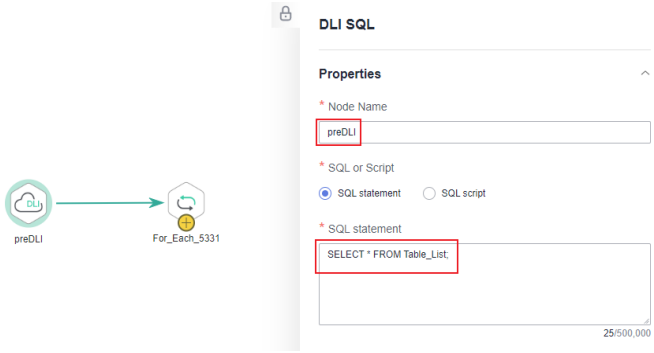
Figure 9-193 Compiling a job



2. Configure the properties of the DLI SQL node. Select **SQL statement** and and enter the following statement. The DLI SQL node reads data from the DLI table **Table_List** and uses it as the dataset.

```
SELECT * FROM Table_List;
```

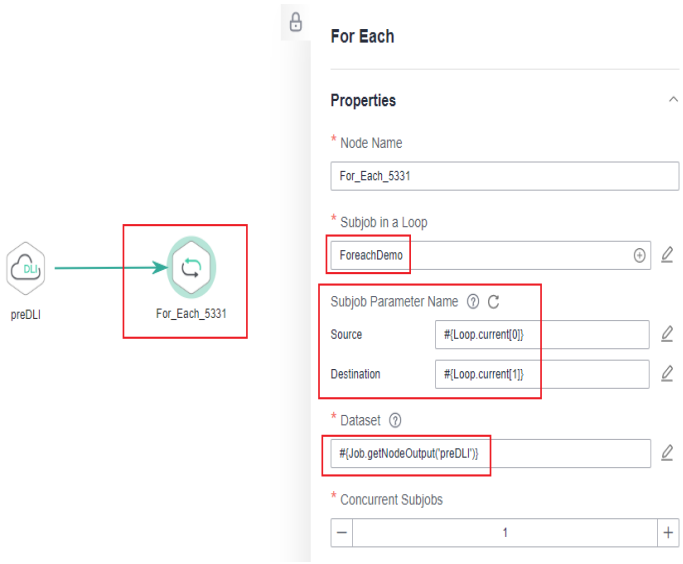
Figure 9-194 DLI SQL node configuration



3. Configure properties for the For Each node.
   - **Subjob in a Loop**: Select **ForeachDemo**, which is the subjob that has been developed in **step 2**.
   - **Dataset**: Enter the execution result of the select statement on the DLI SQL node. Use the **#{Job.getNodeOutput('preDLI')}** expression, where **preDLI** is the name of the previous node.
   - **Subjob Parameter Name**: used to transfer data in the dataset to the subjob **Source** corresponds to the first column in the **Table_List** table of the dataset, and **Destination** corresponds to the second column. Therefore, enter EL expression **#{Loop.current[0]}** for **Source** and **#{Loop.current[1]}** for **Destination**.

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Figure 9-195 Configuring properties for the For Each node

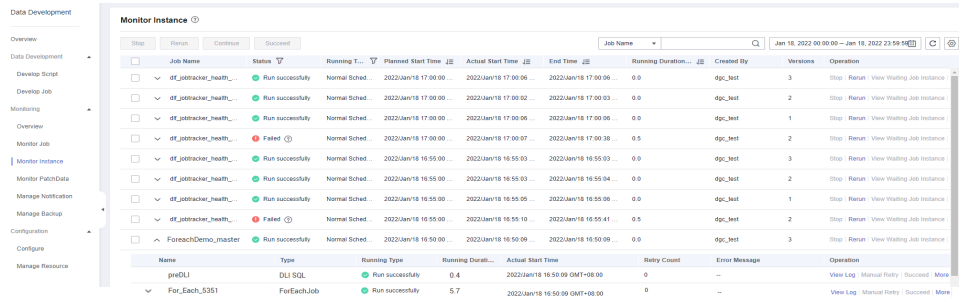


4. Save the job.

Step 5 Test the main job.

1. Click **Test** above the canvas to test the main job. After the main job is executed, the subjob is automatically invoked through the For Each node and executed.
2. In the navigation pane on the left, choose **Monitor Instance** to view the job execution status. After the job is successfully executed, you can view the subjob instances generated on the For Each node. Because the dataset contains six rows of data, six subjob instances are generated.

Figure 9-196 Viewing job instances



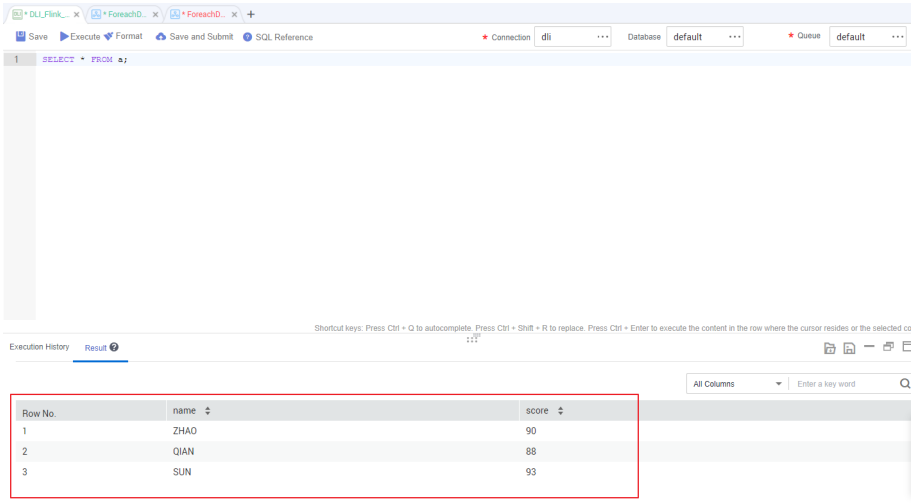
3. Check whether the data has been inserted into the six DLI destination tables. You can create a DLI SQL script on the **DataArts Factory** page and run the following commands to import data into the table. You can also run the following SQL commands in the SQL editor on the DLI console.

```
/* Run the following command to query the data in a table (table a is used as an example): */
SELECT * FROM a;
```

Compare the obtained data with the data in **Insert data into the source data table**. The inserted data meets the expectation.

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Figure 9-197 Destination table data



----End

More Cases for Reference

For Each nodes can work with other nodes to implement more functions. You can refer to the following cases to learn more about how to use For Each nodes.

- **Creating Table Migration Jobs in Batches Using CDM Nodes**
- **Determining the IF Statement Branch to Be Executed Based on the Execution Result of the Previous Node**

9.15.10 Using Script Templates and Parameter Templates

Scenario

This function applies to the following scenarios:

- Use a script template for a Flink SQL script.
- During pipeline job development, use a Fink SQL script which uses a script template for the MRS Flink Job node and use a parameter template for **Program Parameter** of the MRS Flink Job node.
- Use a script template in a single-task Flink SQL job.
- Use template parameters in a single-task Flink JAR job.

NOTE

When you use a script template in a script, ensure that the SQL statement is in **@@{Script template}** format.

Prerequisites

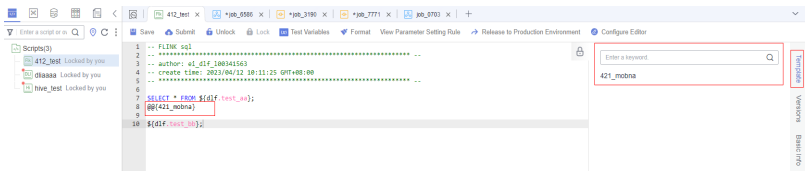
A template has been created. If no template is available, create one by referring to **Configuring a Template**.

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Using Templates

- Use a script template for a Flink SQL script.
  a. In the navigation pane on the DataArts Studio console, choose **Data Development** > **Develop Script**.
  b. Right-click a script directory and select **Create Flink SQL Script**.
  c. Click **Template**. In the slide-out pane, select a template, for example, **412_mobna**. You can select multiple templates.

     Figure 9-198 Using a script template

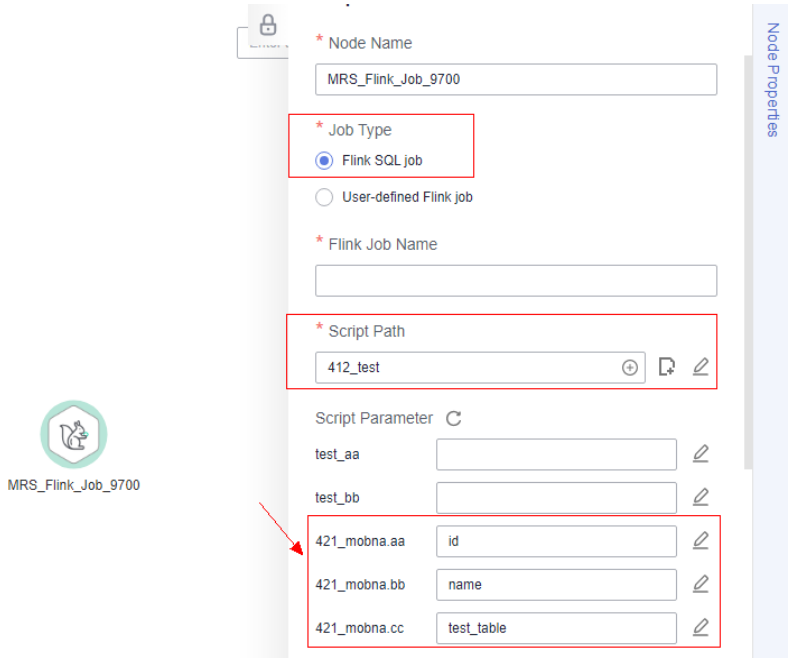
     

  d. Click **Save** to create the **412_test** script.
- During the development of a pipeline job, use the Flink SQL script which uses a script template for the MRS Flink Job node.
  a. In the navigation pane on the DataArts Factory console, choose **Data Development** > **Develop Job**.
  b. Right-click a job directory and select **Create Job** to create a batch processing job in pipeline mode.
  c. On the displayed data development page, drag an MRS Flink Job node to the canvas.
  d. Select **Flink SQL job** for **Job Type** and select the Flink SQL script for **Script Path**.

     After the script is selected, the template parameters and values used by the script are automatically displayed.

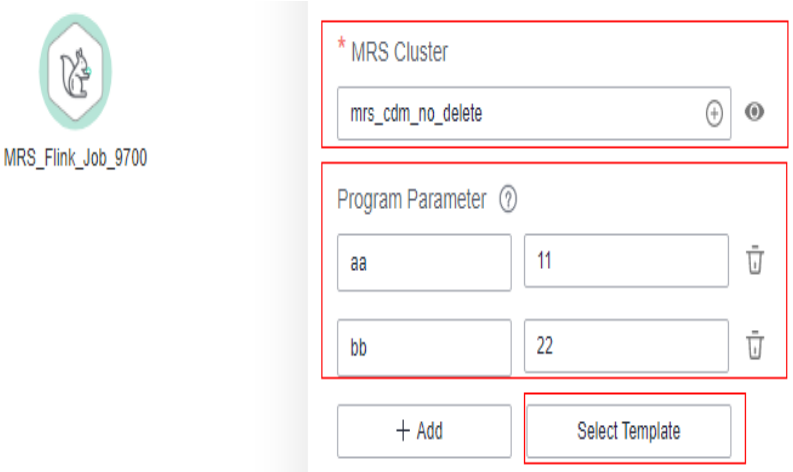
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Figure 9-199 Using the Flink SQL script



- During the development of a pipeline job, use a parameter template in **Program Parameter** of the MRS Flink Job node.
  a. Set **MRS Cluster**.
  b. Program parameters are automatically displayed. Click **Select Template** and select a parameter template. You can also select multiple templates.
  The parameter names and values are automatically displayed.

  Figure 9-200 Using a parameter template for program parameters

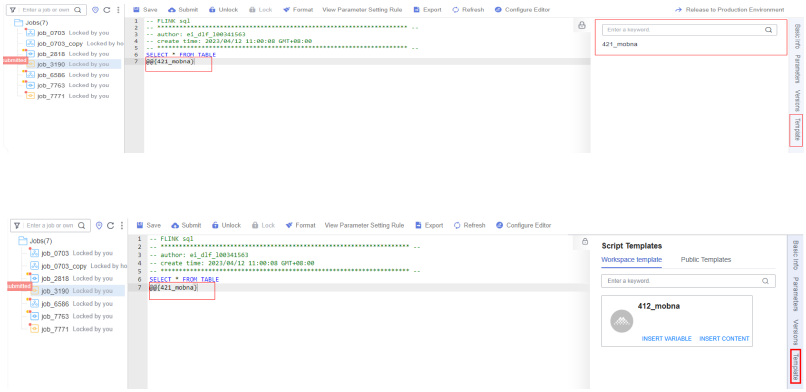


- Use a script template in a single-task Flink SQL job.
  a. In the navigation pane on the DataArts Factory console, choose **Data Development** > **Develop Job**.
  b. Right-click a job directory and select **Create Job** to create a real-time processing job in single-task Flink SQL mode.

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c. Click **Template**. In the slide-out pane, select a template, for example, **412_mobna**. You can select multiple templates.

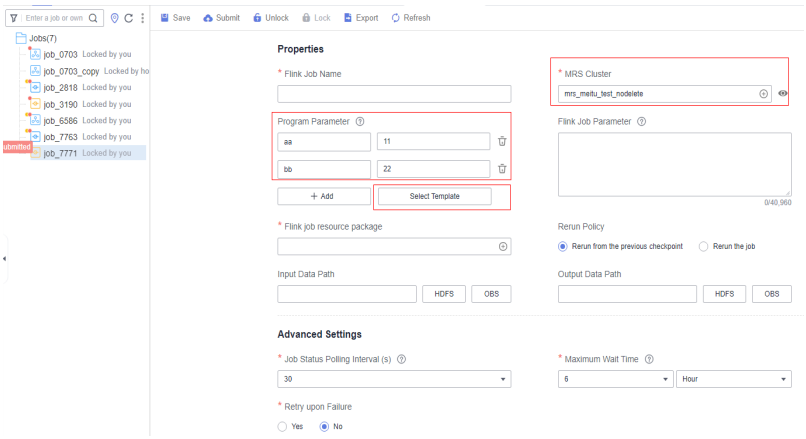
Figure 9-201 Using a script template in a single-task Flink SQL job



- Use template parameters in a single-task Flink JAR job.
  a. In the navigation pane on the DataArts Factory console, choose **Data Development** > **Develop Job**.
  b. Right-click a job directory and select **Create Job** to create a real-time processing job in single-task Flink JAR mode.
  c. Set **MRS Cluster**.
  d. Program parameters are automatically displayed. Click **Select Template** and select a parameter template. You can also select multiple templates.

     The parameter names and values are automatically displayed.

Figure 9-202 Using a script template in a single-task Flink JAR job.



9.15.11 Developing a Python Job

This section describes how to develop and execute a Python job using DataArts Factory.

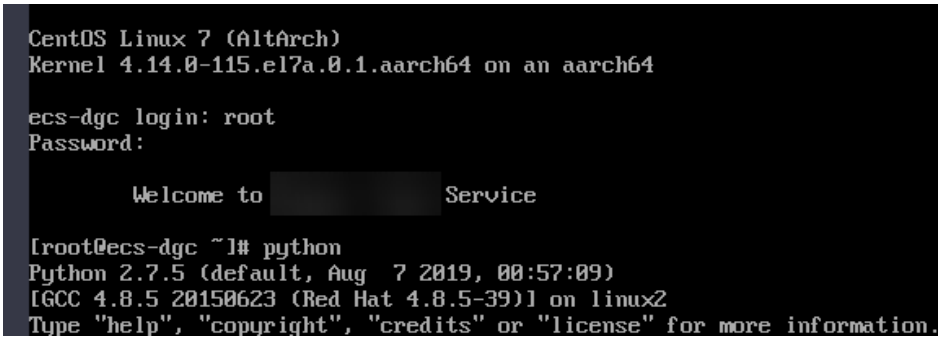
Preparing the Environment

- An ECS named **ecs-dgc** has been created.

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NOTE

In this example, the ECS uses the **CentOS 8.0 64bit with ARM (40 GB)** public image and the Python environment. You can log in to the ECS and run the **python** command to check the Python environment.



- You have enabled the DataArts Migration incremental package and created a CDM cluster named **cdm-dlfpyhthon**. The cluster provides an agent for the DataArts Factory module to communicate with the ECS.
- Ensure that the ECS can communicate with the CDM cluster, which depends on the following conditions:
  - If the CDM cluster and the ECS are in the same region, VPC, subnet, and security group, they can communicate with each other by default. If they are in the same VPC but in different subnets or security groups, you must configure routing rules and security group rules. For details about how to configure routing rules, see **Configuring Routing Rules**. For details about how to configure security group rules, see **Configuring Security Group Rules**.
  - If the CDM cluster and the ECS are in different regions, a public network or a dedicated connection is required for enabling communication between the CDM cluster and the cloud service. If the Internet is used for communication, ensure that an EIP has been bound to the CDM cluster, the host where the data source is located can access the Internet, and the port has been enabled in the firewall rules.
  - The ECS and the CDM cluster belong to the same enterprise project. If they do not, you can modify the enterprise project of the workspace.

Constraints

- Python nodes support script parameters and job parameters.
- This section uses Python3 as an example.

Creating an ECS Data Connection

Before developing a Python script, you need to create a connection to the ECS.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **Management Center**.

Step 3 On the displayed **Manage Data Connections** page, click **Create Data Connection**.

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Step 4 Configure parameters by referring to **Table 9-190** and create a data connection named **ecs**.

Table 9-190 Host Connection parameters

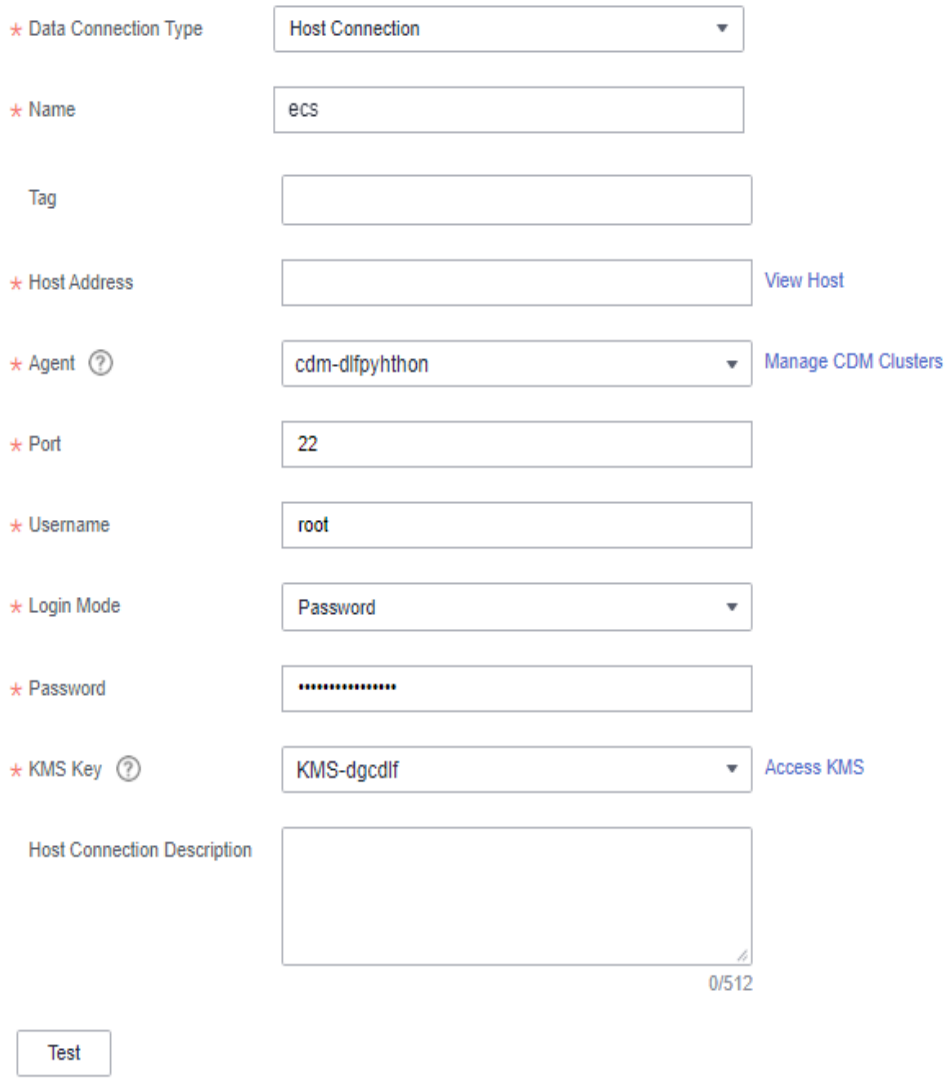
Parameter	Mandatory	Description
Data Connection Type	Yes	**Host Connection** is selected by default and cannot be changed.
Name	Yes	Name of the data connection to create. Data connection names can contain a maximum of 100 characters. They can contain only letters, digits, underscores (_), and hyphens (-).
Tag	No	Attribute of the data connection to create. Tags make management easier. **NOTE** The tag name can contain only letters, digits, and underscores (_) and cannot start with an underscore (_) or contain more than 100 characters.
Applicable Modules	Yes	Select the modules for which this connection is available.
Basic and Network Connectivity Configuration		
Host Address	Yes	IP address of the Linux host For details, see **Viewing Details About an ECS**.
Agent	Yes	CDM cluster used as an agent. If no CDM cluster is available, create one first by referring to **Creating a CDM Cluster**. **NOTE** • If a CDM cluster functions as the agent for a data connection in Management Center, the cluster supports a maximum of 200 concurrent active threads. If multiple data connections share an agent, a maximum of 200 SQL, Shell, and Python scripts submitted through the connections can run concurrently. Excess tasks will be queued. You are advised to plan multiple agents based on the workload. • When scheduling shell or Python scripts, the agent accesses the ECS. If shell and Python scripts are scheduled frequently, the ECS adds the private IP address of the agent to the blocklist. To ensure normal job scheduling, you are advised to use the **root** user of the ECS to add the private IP address bound to the agent (CDM cluster) to the **/etc/hosts.allow** file. For details about how to obtain the private IP address of the CDM cluster, see **Viewing and Modifying CDM Cluster Configurations**.

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Parameter	Mandatory	Description
Port	Yes	SSH port number of the host. By default, port 22 is used to log in to a Linux host. If the port number has been changed, you can obtain the new port number from the **port** field in the **/etc/ssh/sshd_config** file.
KMS Key	Yes	KMS key used to encrypt and decrypt data source authentication information. Select a default or custom key. **NOTE** • When you use KMS for encryption through DataArts Studio or KPS for the first time, the default key **dlf/default** or **kps/default** is automatically generated. For more information about default keys, see **What Is a Default Master Key?**. • Only symmetric keys are supported. Asymmetric keys are not supported.
Data Source Authentication and Other Function Configuration		
Username	Yes	Username for logging in to the host
Login Mode	Yes	Mode for logging in to the host • Key Pair • Password
Key Pair	Yes	This parameter is available only when **Login Mode** is set to **Key Pair**. If **Key Pair** is the login mode of the host, you need to obtain the private key file, upload it to OBS, and select an OBS path. **NOTE** The uploaded private key must match the public key configured on the host. For details, see **Application Scenarios for Using Key Pairs**.
Key Pair Password	Yes	If no password is set for the key pair, you do not need to set this parameter.
Password	Yes	This parameter is available only when **Login Mode** is set to **Password**. If the login mode of the host is to use a password, enter a login password.
Host Connection Description	No	Descriptive information about the host connection

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Figure 9-203 Creating a host connection



NOTE

The key parameters are as follows:

- **Host Address**: Enter the IP address of the **ECS**.
- **Agent**: Select the CDM cluster you have obtained from the **DataArts Migration incremental package**.

Step 5 Click **Test** to test connectivity of the data connection. If the test fails, the data connection cannot be created.

Step 6 After the test is successful, click **OK** to create the data connection.

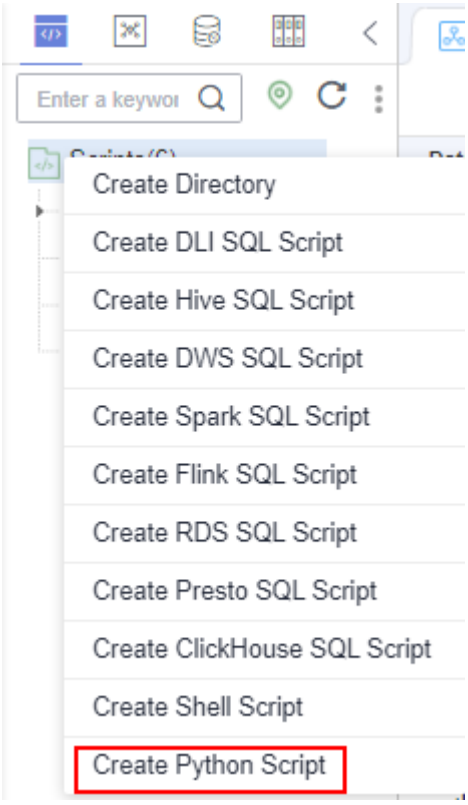
----End

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Developing a Python Script

Step 1 Choose **DataArts Factory** > **Develop Script** and create a Python script named **python_test**.

Figure 9-204 Creating a Python script



Step 2 Select a Python version (for example, **Python 3**) and host connection, and set input parameters as needed.

NOTE

The parameters will be transferred to the Python script when the script is executed. The parameters are separated by spaces, for example, **Microsoft Oracle**. The parameters must be referenced by the Python script. Otherwise, the parameters are invalid.

Step 3 Edit Python statements in the editor.

This example defines a string template for saving company information and uses the template to output information about different companies.

```
import sys
Company_Name1=sys.argv[1]
Company_Name2=sys.argv[2]
template='No.:{:0>9s} \t CompanyName: {:s} \t Website: https://www.{:s}.com'
context1=template.format('1',Company_Name1,Company_Name1.lower())
context2=template.format('2',Company_Name2,Company_Name2.lower())
print(context1)
print(context2)
```

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NOTE

- The script development area in **Figure 9-205** is a temporary debugging area. After you close the script tab, the development area will be cleared.
- **Connection**: Select the data connection created in **Creating an ECS Data Connection**.

Figure 9-205 Editing the Python statements

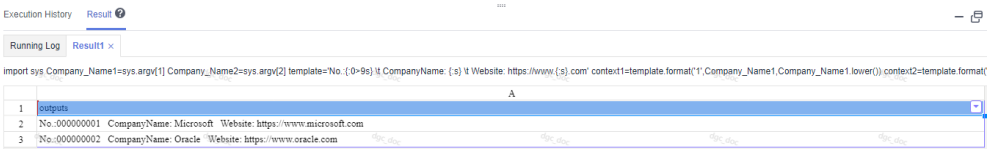


Step 4 Click **Save** and then **Submit**.

Step 5 Click **Execute** to execute the Python statements.

Step 6 View the script execution result.

Figure 9-206 Viewing the script execution result



----End

Referencing the Python Script in a Job

Step 1 Create a job.

Step 2 Select a Python node and configure the node properties.

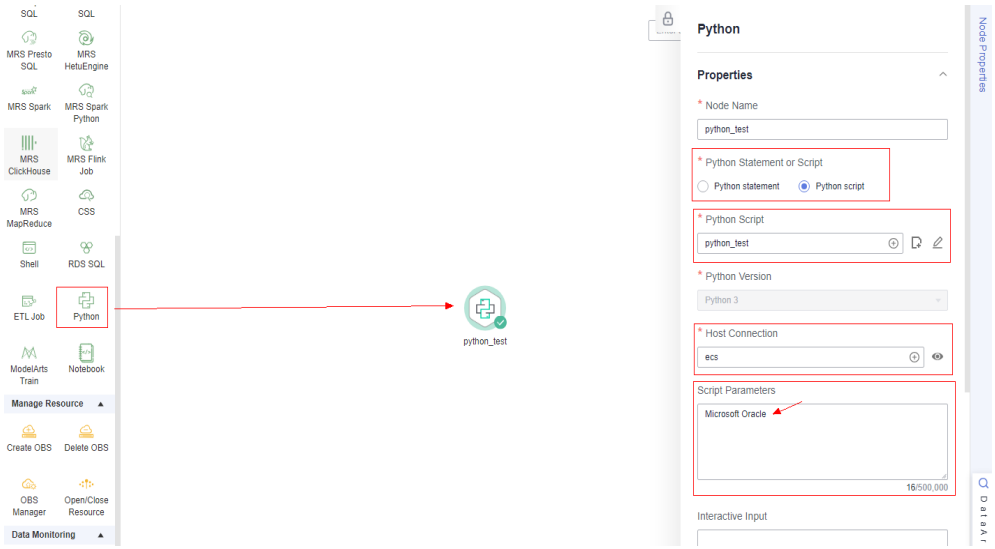
Select the created Python script and set the node parameters. Set **Script Parameters**.

NOTE

The parameters will be transferred to the Python statement when the statement is executed. The parameters are separated by spaces, for example, **Microsoft Oracle**. The parameters must be referenced by the Python statement. Otherwise, the parameters are invalid.

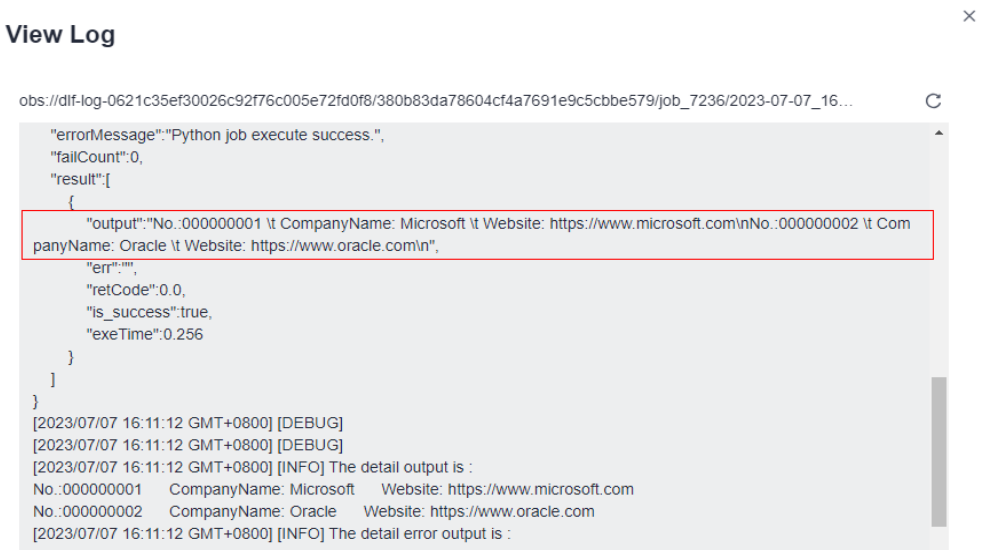
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Figure 9-207 Configuring properties of the Python node



Step 3 Click **Test** and view the job running result.

Figure 9-208 Checking the job execution result



Step 4 Click **Save**. The job configuration is complete.

Step 5 Click **Submit**. After a version is submitted, the job can be scheduled.

----End

9.15.12 Developing a DWS SQL Job

This section describes how to use the DWS SQL node to develop a job in DataArts Factory.

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Scenario

This tutorial describes how to develop a DWS job to collect the sales volume of a store on the previous day.

Preparing the Environment

- Enable DWS and create a DWS cluster for running DWS SQL jobs.
- Enable a CDM incremental package. Create a CDM cluster.

  Ensure that the VPC, subnet, and security group of the CDM cluster are the same as those of the DWS cluster so that the two clusters can communicate with each other.

Creating a DWS Data Connection

Before developing a DWS SQL job, you must create a data connection to DWS on the **Manage Data Connections** page of **Management Center**. The data connection name is **dws_link**. For how to create a DWS connections, see **DWS Connection Parameters**.

The key parameters are as follows:

- **Cluster Name**: Select the DWS cluster you have created when preparing the environment.
- **Agent**: Select the CDM cluster you have created when preparing the environment.

Creating a Database

Create a **gaussdb** database by following the instructions in **Creating a Database**.

Creating Data Tables

Create tables **trade_log** and **trade_report** in the **gaussdb** database. The following is an example script for creating the tables:

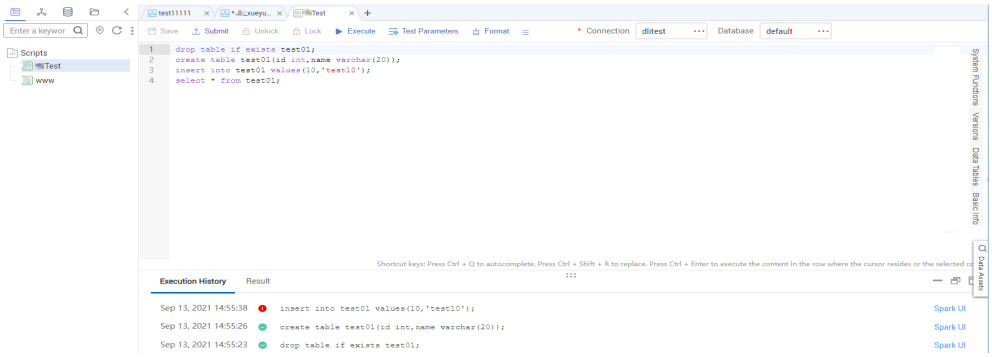
```
create schema store_sales;
set current_schema= store_sales;
drop table if exists trade_log;
CREATE TABLE trade_log
(
    sn          VARCHAR(16),
    trade_time   DATE,
    trade_count   INTEGER(8)
);
set current_schema= store_sales;
drop table if exists trade_report;
CREATE TABLE trade_report
(
    rq   DATE,
    trade_total   INTEGER(8)
);
```

Developing a DWS SQL Script

Choose **Development** > **Develop Script** and create a DWS SQL script named **dws_sql**. Enter an SQL statement in the editor to collect the sales amount of the previous day.

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Figure 9-209 Developing a script



Key notes:

- The script development area in **Figure 9-209** is a temporary debugging area. After you close the script tab, the development area will be cleared. You can click **Submit** to save and submit a script version.
- **Connection**: Select the data connection created in **Creating a DWS Data Connection**.

Developing a DWS SQL Job

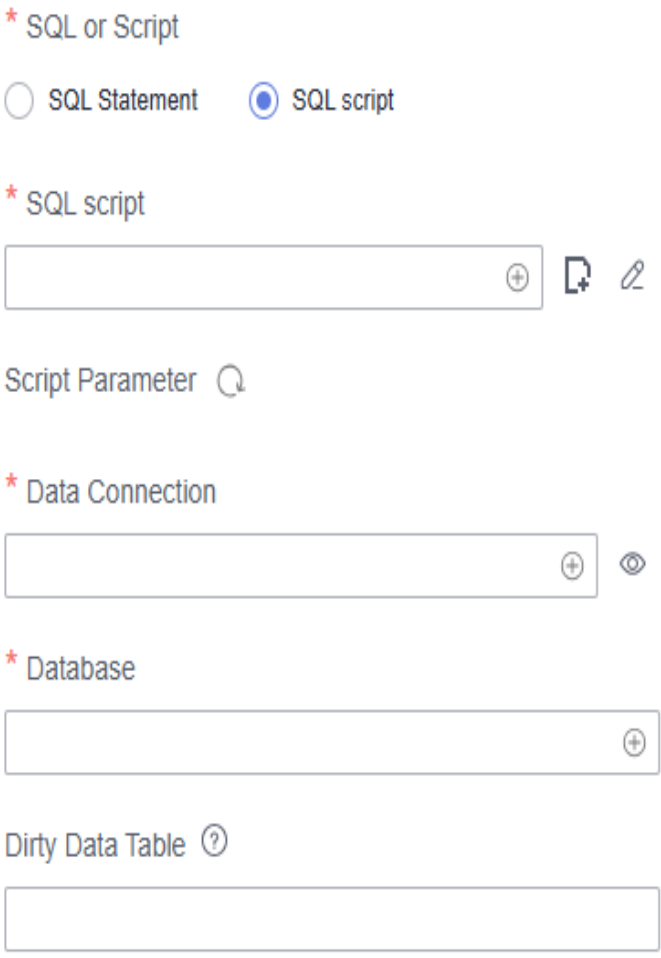
After developing the DWS SQL script, create a job for periodically executing the DWS SQL script.

Step 1 Create a batch job named **job_dws_sql**.

Step 2 Go to the job development page, drag the DWS SQL node to the canvas, and click the node to configure its properties.

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Figure 9-210 Configuring properties for the DWS SQL node



Key properties:

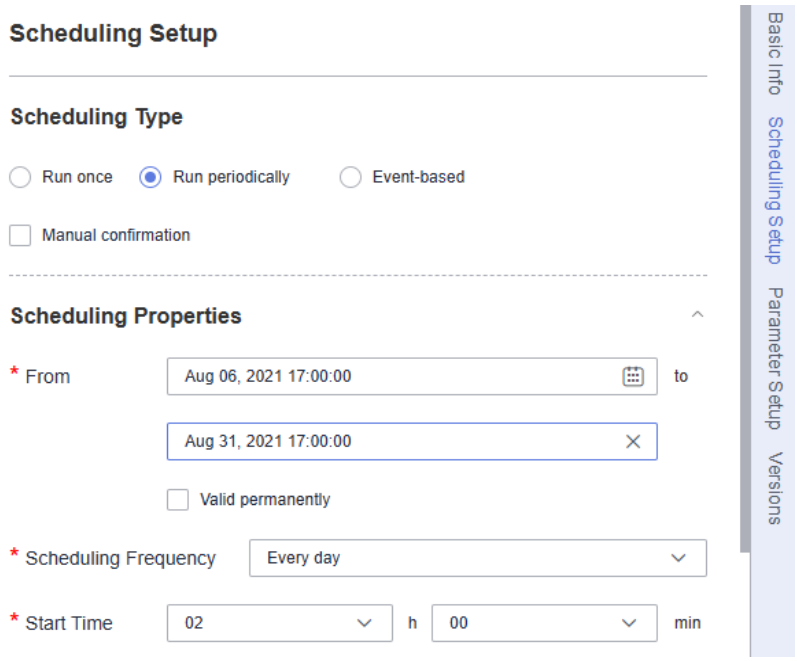
- **SQL script**: Associate with the **dws_sql** script developed in **Developing a DWS SQL Script**.
- **Data Connection**: Select the data connection configured in the **dws_sql** script. The data connection can be changed.
- **Database**: Select the database configured in the **dws_sql** script. The database can be changed.
- **Script Parameter**: Obtain the value of **yesterday** using the following EL expression:
  ```
  #{Job.getYesterday("yyyy-MM-dd")}
  ```
- **Node Name**: The name of the **dws_sql** script is displayed by default. The name can be changed.

Step 3 After configuring the job, click ▶ to test it.

Step 4 If the test is successful, click the blank area on the canvas and then the **Scheduling Setup** tab on the right. On the displayed page, configure the scheduling policy.

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Figure 9-211 Configuring the scheduling policy



Parameter descriptions:

From Aug 6 to Aug 31 in 2021, the job was executed once at 02:00 every day.

Step 5 Click **Submit** and then **Execute**. The job will be executed automatically every day.

----End

9.15.13 Developing a Hive SQL Job

This section introduces how to develop Hive SQL scripts on DataArts Factory.

Scenario Description

As a one-stop big data development platform, DataArts Factory supports development of multiple big data tools. Hive is a data warehouse tool running on Hadoop. It can map structured data files to a database table and provides a simple SQL search function that converts SQL statements into MapReduce tasks.

Preparations

- MRS has been enabled and an MRS cluster has been created for running Hive SQL jobs.

  The MRS cluster must contain the Hive component.

- Cloud Data Migration (CDM) has been enabled. A CDM cluster has been created for providing an agent for communication between DataArts Factory and MRS.

  Ensure that the VPC, subnet, and security group of the CDM cluster are the same as those of the MRS cluster so that the two clusters can communicate with each other.

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Creating a Hive Data Connection

Before developing a Hive SQL script, you must create a data connection to MRS Hive on the **Manage Data Connections** page of **Management Center**. The data connection name is **hive1009**. For how to create an MRS Hive connection, see **MRS Hive Connection Parameters**.

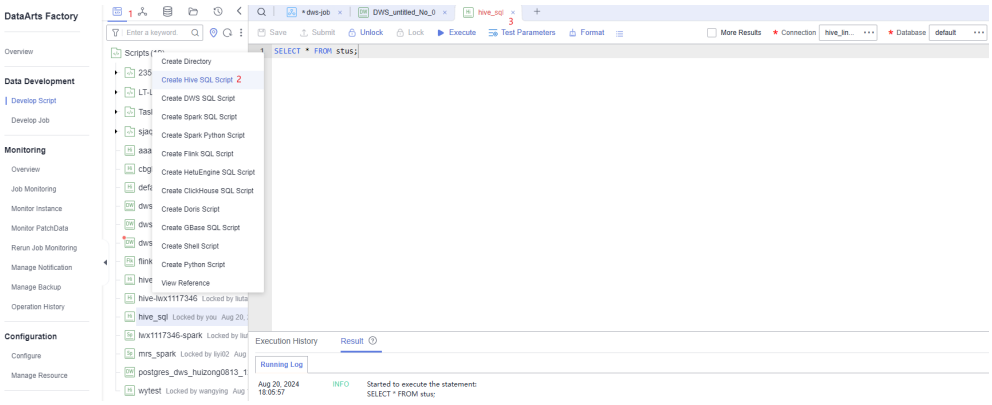
Description of key parameters:

- **Cluster Name**: Enter the name of the created MRS cluster.
- **Agent**: Select the created CDM cluster.

Developing a Hive SQL Script

Choose **Development** > **Develop Script** and create a Hive SQL script named **hive_sql**. Then enter SQL statements in the editor to fulfill business requirements.

Figure 9-212 Developing a script



Notes:

- The script development area in **Figure 9-212** is a temporary debugging area. After you close the tab page, the development area will be cleared. You can click **Submit** to save and submit a script version.
- Data Connection: Connection created in **Creating a Hive Data Connection**.

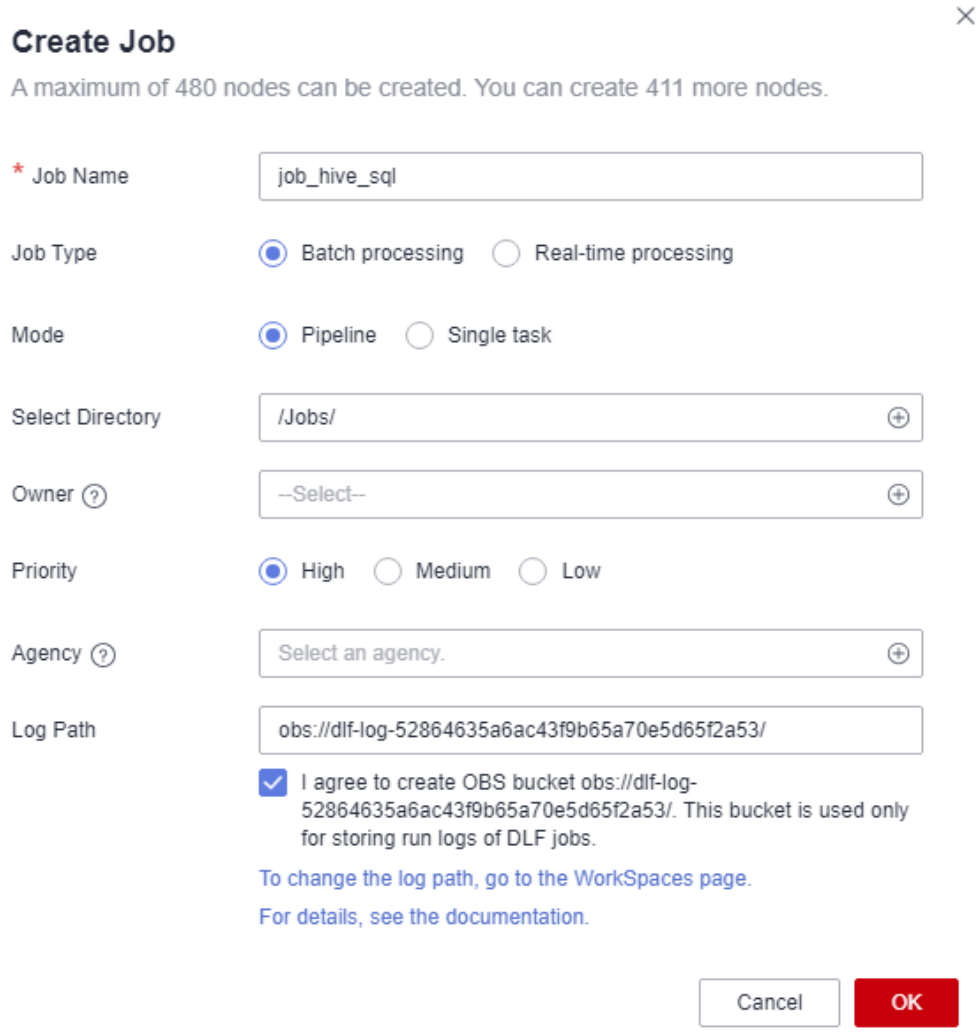
Developing a Hive SQL Job

After the Hive SQL script is developed, build a periodically deducted job for the Hive SQL script so that the script can be executed periodically.

Step 1 Create an empty DataArts Factory job named **job_hive_sql**.

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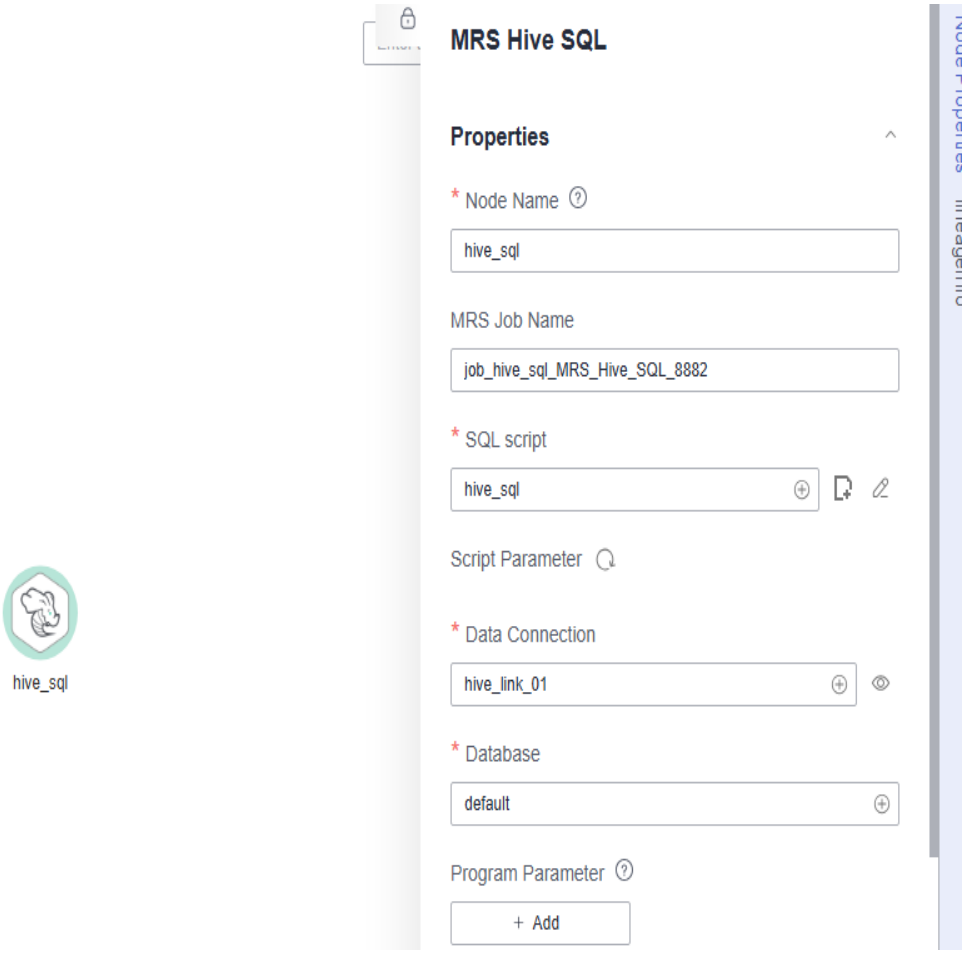
Figure 9-213 Creating a job named job_hive_sql



Step 2 Go to the job development page, drag the MRS Hive SQL node to the canvas, and click the node to configure node properties.

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Figure 9-214 Configuring properties for an MRS Hive SQL node



Description of key properties:

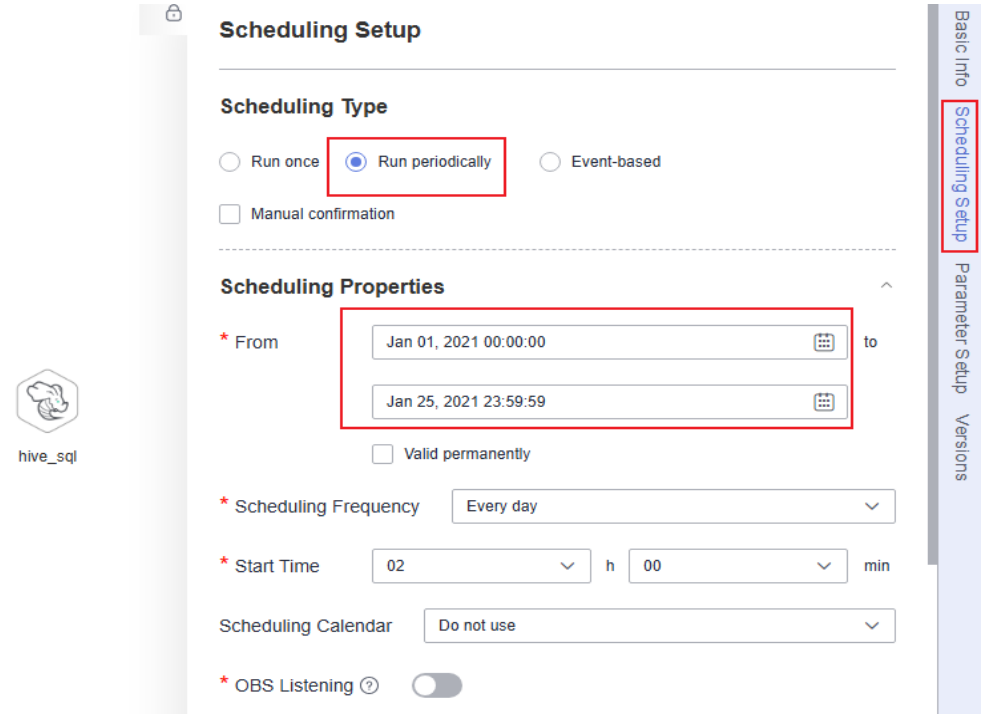
- **Node Name**: Name of the SQL script **hive_sql** by default. The value can be changed.
- **SQL Script**: Hive SQL script **hive_sql** that is developed in **Developing a Hive SQL Script**.
- **Data Connection**: Data connection that is configured in the SQL script **hive_sql** is selected by default. The value can be changed.
- **Database**: Database that is configured in the SQL script **hive_sql** and is selected by default. The value can be changed.

Step 3 After configuring the job, click ▶ to test it.

Step 4 If the job runs successfully, click the blank area on the canvas and configure the job scheduling policy on the scheduling configuration page on the right.

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Figure 9-215 Configuring the scheduling mode



NOTE

The job is executed at 02:00 every day from Jan 1, 2021 to Jan 25, 2021.

Step 5 Click **Submit** and **Execute**. The job will be automatically executed every day.

----End

9.15.14 Developing a DLI Spark Job

This section introduces how to develop a DLI Spark job on DataArts Factory.

Scenario Description

In most cases, SQL is used to analyze and process data when using Data Lake Insight (DLI). However, SQL is usually unable to deal with complex processing logic. In this case, Spark jobs can help. This section uses an example to demonstrate how to submit a Spark job on DataArts Factory.

The general submission procedure is as follows:

1. Create a DLI cluster and run a Spark job using physical resources of the DLI cluster.
2. Obtain a demo JAR package of the Spark job and associate with the JAR package on DataArts Factory.
3. Create a DataArts Factory job and submit it using the DLI Spark node.

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Preparations

- Object Storage Service (OBS) has been enabled and a bucket, for example, **obs://dlfexample**, has been created for storing the JAR package of the Spark job.
- DLI has been enabled, and the Spark cluster **spark_cluster** has been created for providing physical resources required for the Spark job.

Obtaining Spark Job Code

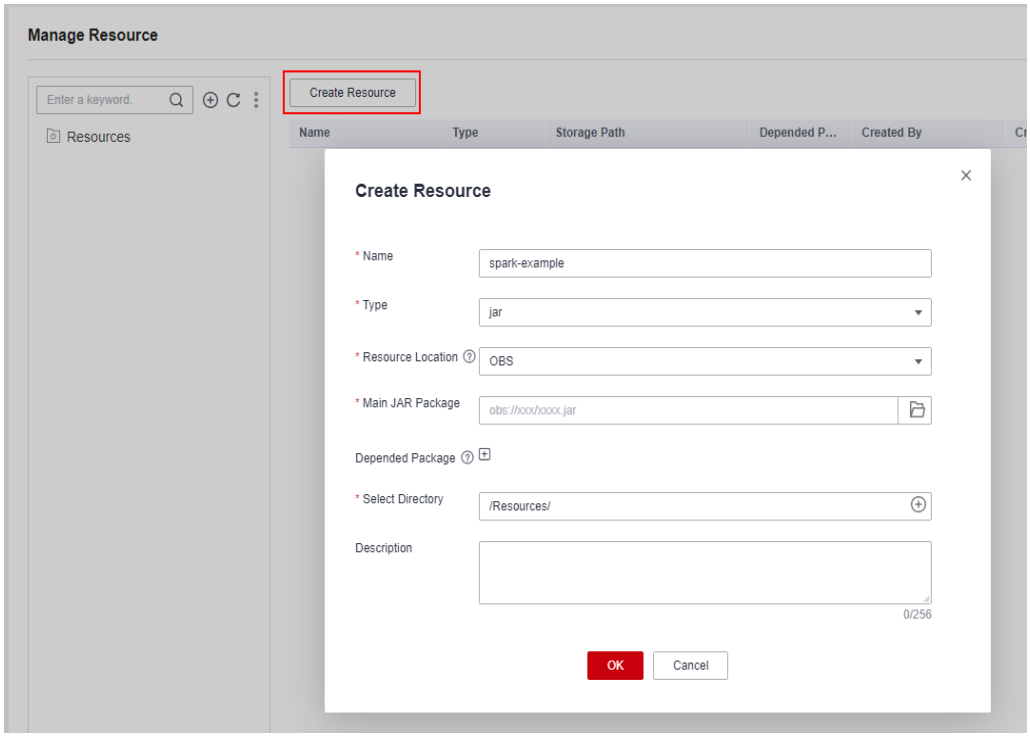
The Spark job code used in this example comes from the maven repository that can be download from **https://repo.maven.apache.org/maven2/org/apache/spark/spark-examples_2.10/1.1.1/spark-examples_2.10-1.1.1.jar**. This Spark job is to calculate the approximate value of π.

Step 1 After obtaining the JAR package of the Spark job codes, upload it to the OBS bucket. The save path is **obs://dlfexample/spark-examples_2.10-1.1.1.jar**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation tree on the left, choose **Configuration** > **Manage Resource**. Click **Create Resource** and create resource **spark-example** on DataArts Factory and associate it with the JAR package obtained in **Step 1**.

Figure 9-216 Creating a resource



----End

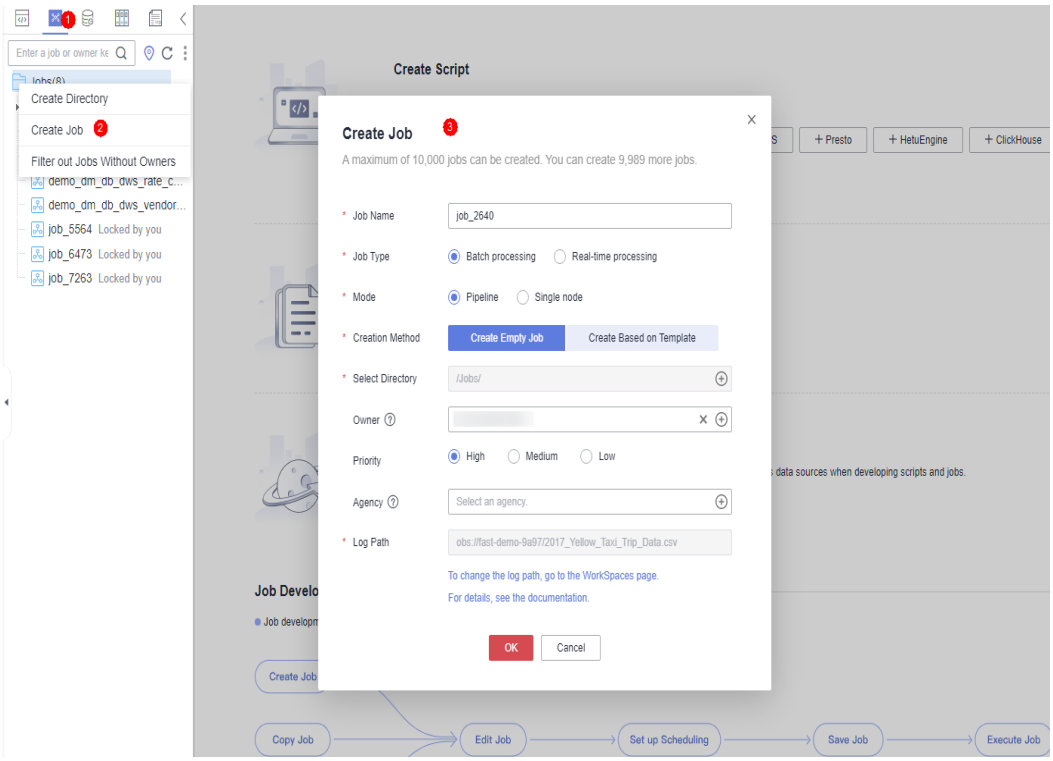
Submitting a Spark Job

You need to create a job on DataArts Factory and submit the Spark job using the DLI Spark node of the job.

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Step 1 Create a job named **job_DLI_Spark** for the DataArts Factory module.

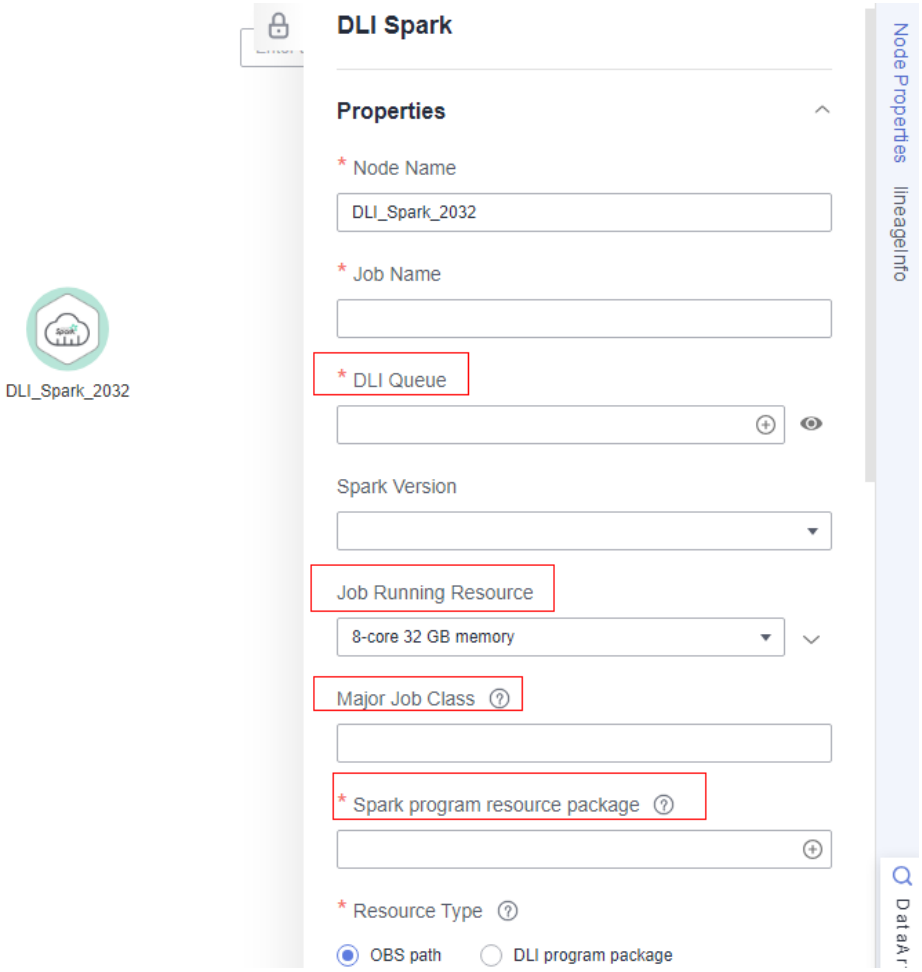
Figure 9-217 Creating a job



Step 2 Go to the job development page, drag the DLI Spark node to the canvas, and click the node to configure node properties.

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Figure 9-218 Configuring node properties

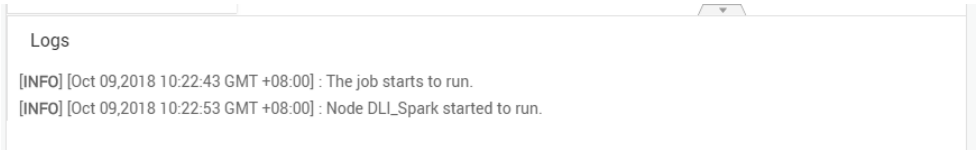


Description of key properties:

- **DLI Queue**: Select a DLI queue.
- Job Running Resource: Maximum CPU and memory resources that can be used when a DLI Spark node is running.
- Major Job Class: major class of a DLI Spark node. In this example, the major class is **org.apache.spark.examples.SparkPi**.
- **Spark program resource package**: Select the resources created in **Step 3**.

Step 3 After the job orchestration is complete, click ▷ to test the job.

Figure 9-219 Job logs (for reference only)



Step 4 If no error is recorded in logs, save and submit the job.

----End

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9.15.15 Developing an MRS Flink Job

This section describes how to develop an MRS Flink job on DataArts Factory.

Scenario

This tutorial describes how to develop an MRS Flink job to count the number of words.

Prerequisites

- You have the permission to access OBS paths.
- MRS has been enabled and an MRS cluster has been created.

Data Preparation

- Download the Flink job resource package **wordcount.jar** from **https://github.com/huaweicloudDocs/dgc/blob/master/WordCount.jar**.

  You must verify the integrity of the download Flink job resource package. In Windows, open the CLI and run the following command to generate the SHA-256 value of the downloaded JAR package. In the command, **D:\wordcount.jar** is an example local path and name of the JAR package. Replace it with the actual value.

  ```
  certutil -hashfile D:\wordcount.jar SHA256
  ```

  The following is an example command output:

  ```
  SHA-256 hash value of D:\wordcount.jar:
  0859965cb007c51f0d9ddaf7c964604eb27c39e2f1f56e082acb20c8eb05ccc4
  CertUtil: -hashfile command executed.
  ```

  Compare the SHA-256 value of the downloaded JAR package with that of the following JAR package: If they are the same, no tampering or packet loss occurred during the package download.

  SHA-256 value:
  0859965cb007c51f0d9ddaf7c964604eb27c39e2f1f56e082acb20c8eb05ccc4

- Prepare the data file **in.txt**, which contains some English words.

Procedure

Step 1 Upload the job resource package and data file to the OBS bucket.

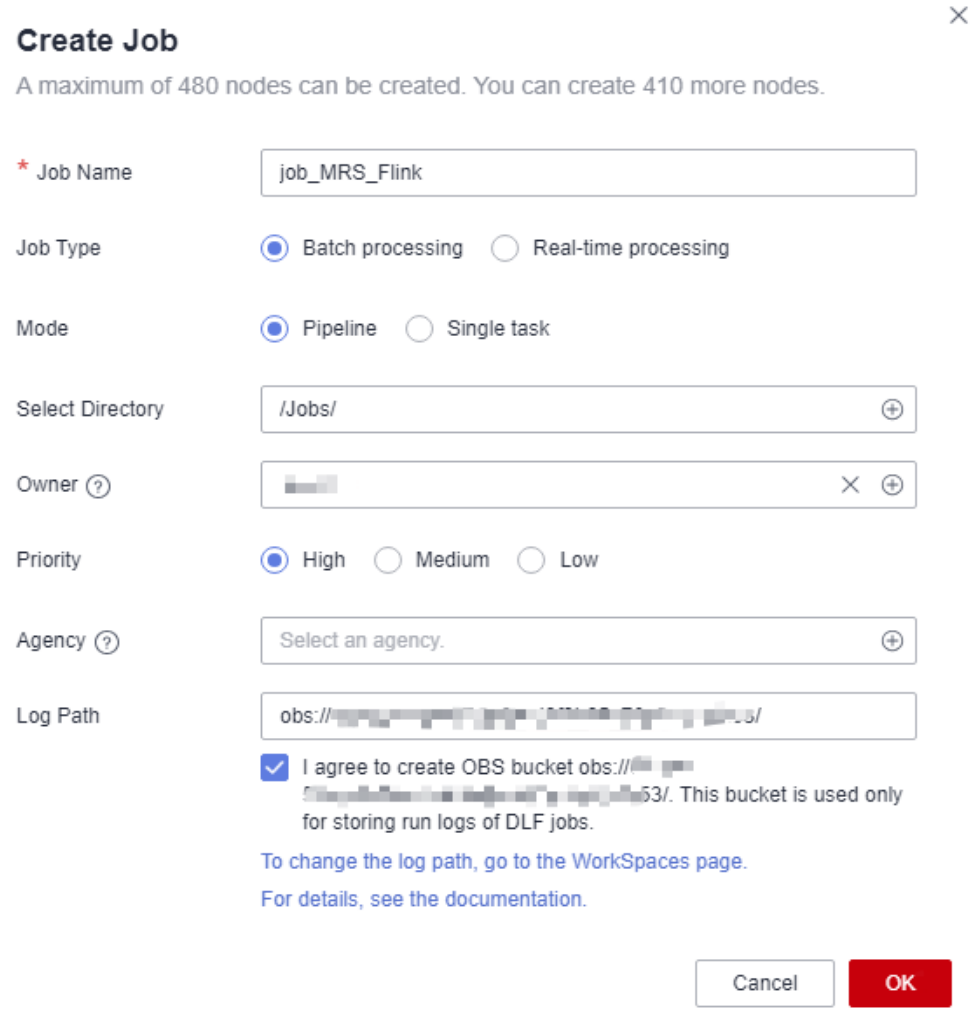
NOTE

In this example, upload **WordCount.jar** to **lkj_test/WordCount.jar** and **word.txt** to **lkj_test/input/word.txt**.

Step 2 Create an empty job named **job_MRS_Flink**.

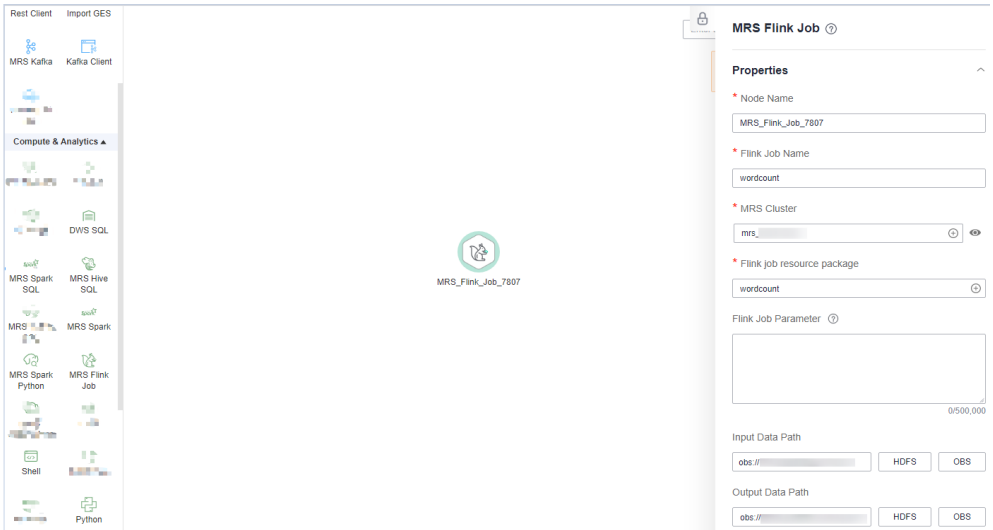
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Figure 9-220 Creating a job



Step 3 Go to the job development page, drag the **MRS Flink** node to the canvas, and click the node to configure its properties.

Figure 9-221 Configuring properties for an MRS Flink node



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Parameter descriptions:

```
--Flink job name
wordcount
--MRS cluster name
Select an MRS cluster.
--Program parameter
-c    org.apache.flink.streaming.examples.wordcount.WordCount
--Flink job resource package
wordcount
--Input data path
obs://dlf-test/lkj_test/input/word.txt
--Output data path
obs://dlf-test/lkj_test/output.txt
```

Specifically:

obs://dlf-test/lkj_test/input/word.txt is the directory where the **wordcount.jar** parameters are passed. You can pass the words to count.

obs://dlf-test/lkj_test/output.txt is the directory where the output parameter file is stored. (If the **output.txt** file already exists, an error is reported.)

Step 4 Click **Test** to execute the MRS Flink job.

Step 5 After the test is complete, click **Submit**.

Step 6 Choose **Monitor Job** in the navigation pane and view the job execution result.

Step 7 View the returned records in the OBS bucket. (Skip this step if the return function is not configured.)

----End

9.15.16 Developing an MRS Spark Python Job

This section describes how to develop an MRS Spark Python on DataArts Factory.

Case 1: Using an MRS Spark Python Job to Count the Number of Words

Prerequisites

You have the permission to access OBS paths.

Data preparation

- Prepare the script file **wordcount.py** with the following content:

```
# -*- coding: utf-8 -*
import sys
from pyspark import SparkConf, SparkContext
def show(x):
    print(x)
if __name__ == "__main__":
    if len(sys.argv) < 2:
        print ("Usage: wordcount <inputPath> <outputPath>")
        exit(-1)
    # Create SparkConf.
    conf = SparkConf().setAppName("wordcount")
    # Create SparkContext. Pass the conf=conf parameter.
    sc = SparkContext(conf=conf)
    inputPath = sys.argv[1]
    outputPath = sys.argv[2]
    lines = sc.textFile(name = inputPath)
    # Split each line of data by space to obtain words.
```

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```
words = lines.flatMap(lambda line:line.split(" "),True)
# Pair each word into a tuple count 1.
pairWords = words.map(lambda word:(word,1),True)
# Use three partitions (reduceByKey) for summarization.
result = pairWords.reduceByKey(lambda v1,v2:v1+v2)
# Print the result.
result.foreach(lambda t :show(t))
# Save the result to a file.
result.saveAsTextFile(outputPath)
# Stop SparkContext.
sc.stop()
```

NOTE

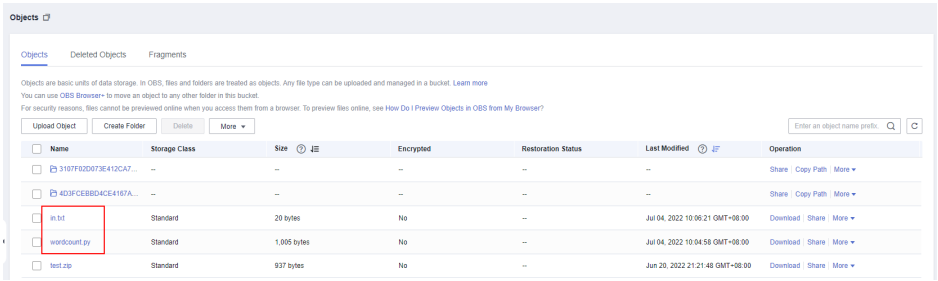
The encoding format must be set to UTF-8. Otherwise, an error will occur during script execution.

- Prepare the data file **in.txt**, which contains some English words.

Procedure

Step 1 Upload the script and data file to the OBS bucket.

Figure 9-222 Uploading files to an OBS bucket



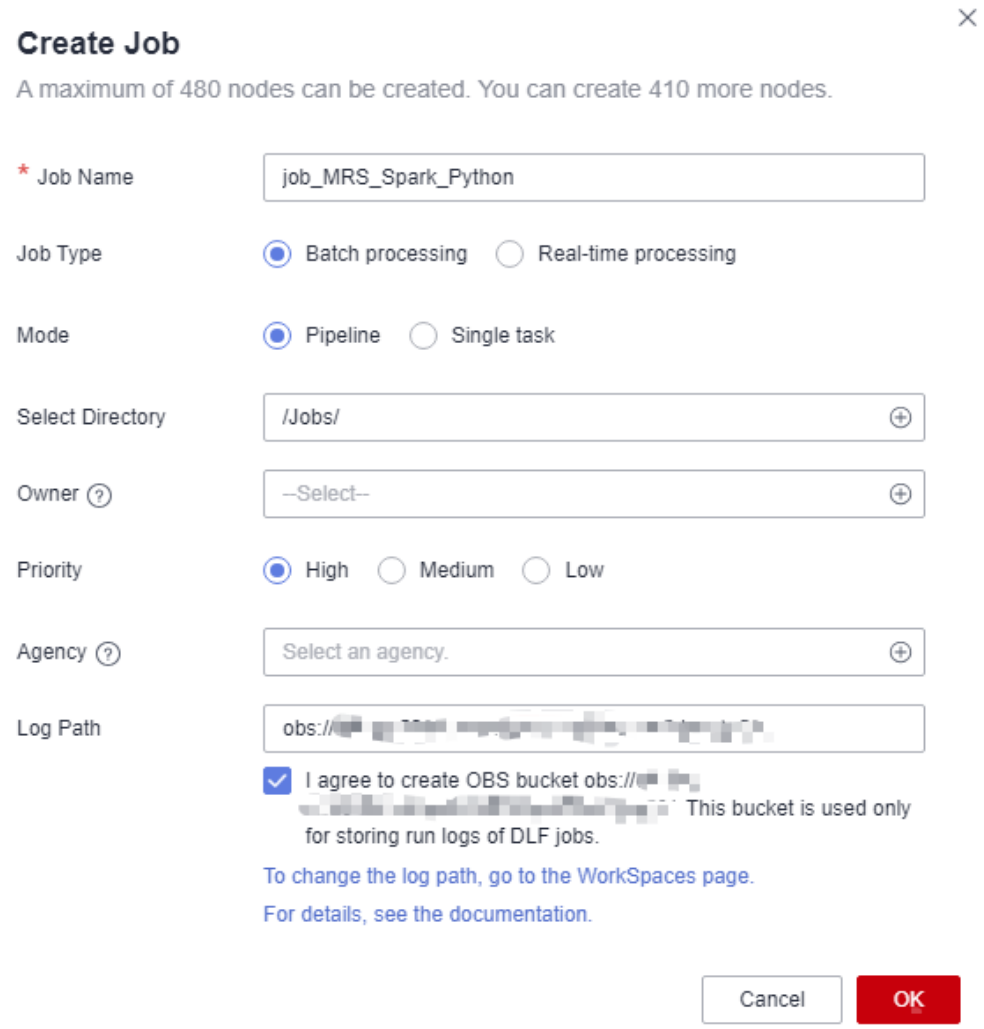
NOTE

In this example, upload **wordcount.py** and **in.txt** to **obs://obs-tongji/python/**.

Step 2 Create an empty job named **job_MRS_Spark_Python**.

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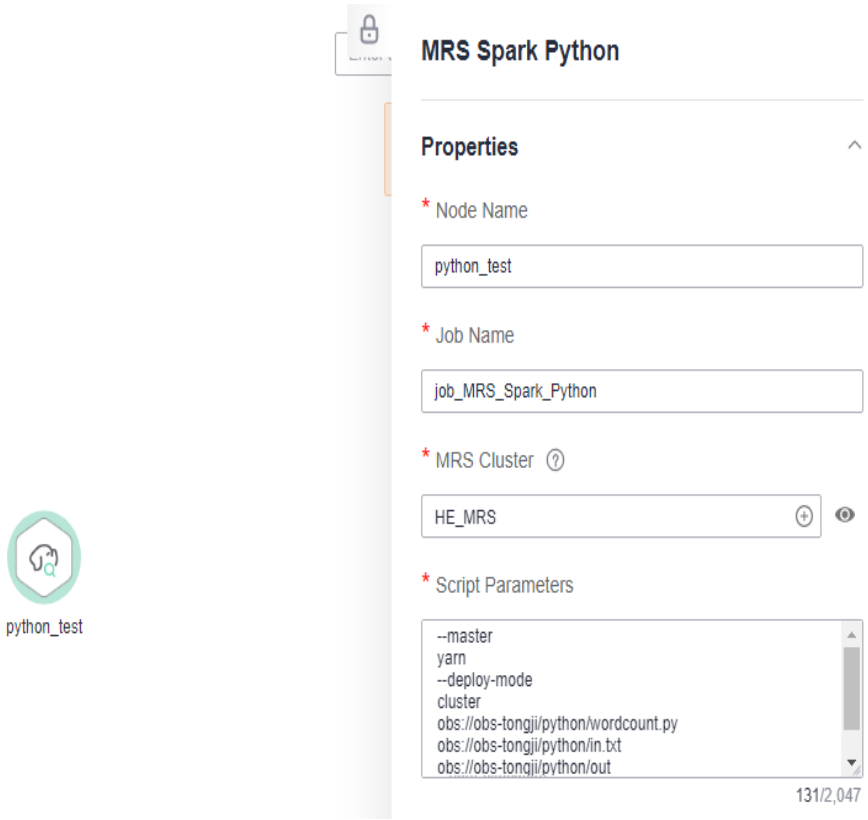
Figure 9-223 Creating a job



Step 3 Go to the job development page, drag the **MRS Spark Python** node to the canvas, and click the node to configure its properties.

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Figure 9-224 Configuring properties for an MRS Spark Python node



Parameter descriptions:

```
--master
yarn
--deploy-mode
cluster
obs://obs-tongji/python/wordcount.py
obs://obs-tongji/python/in.txt
obs://obs-tongji/python/out
```

Specifically:

obs://obs-tongji/python/wordcount.py is the directory where the script is stored.

obs://obs-tongji/python/in.txt is the directory where the **wordcount.py** parameters are passed. You can pass the words to count.

obs://obs-tongji/python/out is the directory where output parameters are stored. This directory will also be created in the OBS bucket automatically. If the **out** directory already exists in the OBS bucket, an error will occur.

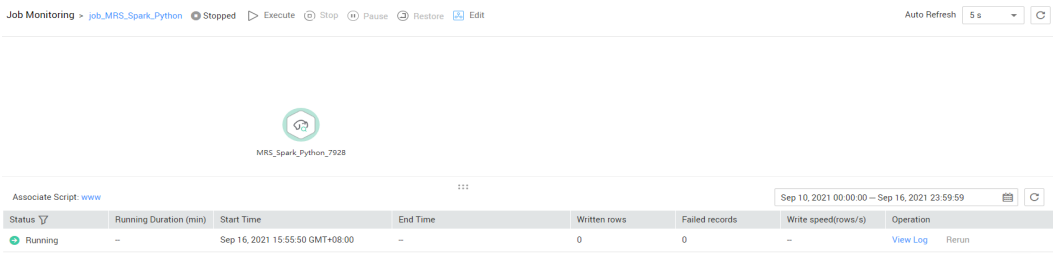
Step 4 Click **Test** to execute the script job.

Step 5 After the test is complete, click **Submit**.

Step 6 Choose **Monitor Job** in the navigation pane and view the job execution result.

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Figure 9-225 Viewing the job execution result



The job log shows that the job was successfully executed.

Figure 9-226 Job run logs

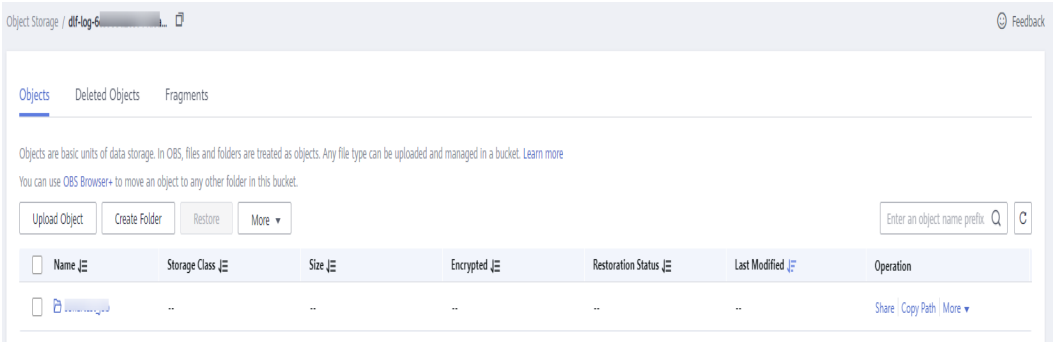


Figure 9-227 Job execution status



Step 7 View the returned records in the OBS bucket. (Skip this step if the return function is not configured.)

Figure 9-228 Viewing the returned records in the OBS bucket



----End

Case 2: Using an MRS Spark Python Job to Print hello python

Prerequisites

You have the permission to access OBS paths.

Data preparation

Prepare the script file **zt_test_sparkPython1.py** with the following content:

```
from pyspark import SparkContext, SparkConf
conf = SparkConf().setAppName("master"). setMaster("yarn")
sc = SparkContext(conf=conf)
print("hello python")
sc.stop()
```

Procedure

Step 1 Upload the script file to an OBS bucket.

Step 2 Create an empty job.

Step 3 Go to the job development page, drag the **MRS Spark Python** node to the canvas, and click the node to configure its properties.

Parameter descriptions:

```
--master
yarn
--deploy-mode
cluster
obs://obs-tongji/python/zt_test_sparkPython1.py
```

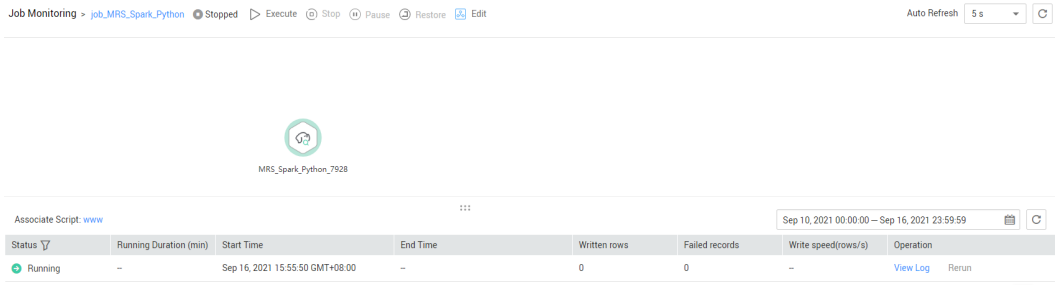
zt_test_sparkPython1.py indicates the directory where the script is stored.

Step 4 Click **Test** to execute the script job.

Step 5 After the test is complete, click **Submit**.

Step 6 Choose **Monitor Job** in the navigation pane and view the job execution result.

Figure 9-229 Viewing the job execution result

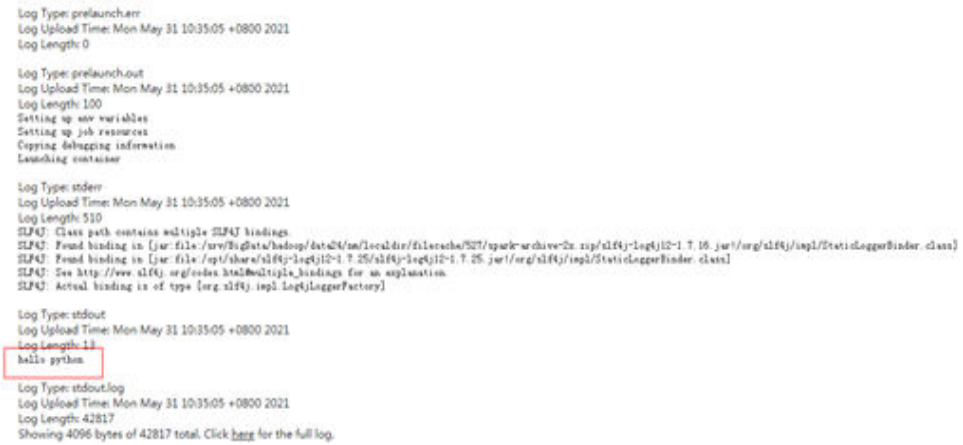


Step 7 Verify the log.

Log in to MRS Manager and check that the log on YARN contains **hello python**.

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Figure 9-230 Viewing logs on YARN



----End

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10 DataArts Quality

10.1 Metric Monitoring (Pending Offline)

10.1.1 Overview

NOTICE

The metric monitoring function of DataArts Quality will be unavailable soon. You are advised to use DataArts Architecture in the future, which provides comprehensive metric design and management capabilities.

The Metric Monitoring module manages business metrics.

To monitor a business metric, customize a SQL metric, define a rule based on the logical expression of the metric, and create and run a business scenario. Based on the running result of the business scenario, you can determine whether the business metric meets the quality rule. The running result of the business scenario may be any of the following:

- **Normal**: The instance stops normally and the running result meets the expectation.
- **Alarming**: The instance stops normally, but the running result does not meet the expectation.
- **Abnormal**: The instance stops unexpectedly.
- **--**: The instance is running, but no running result is displayed.

The following table describes modules under **Quality Monitoring**.

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Function	Description
Dashboard	Default homepage. This page contains the following parts: • **Quick Start** that demonstrates how you can use metric monitoring • Running and alarm statuses for the business scenario instance over the last seven days • Alarms, scenarios, and metrics in different time periods
Metrics	You can create metrics on this page.
Rules	You can create rules based on the logical expressions of metrics on this page.
Scenarios	A business scenario can be considered as a business metric quality job. On this page, you can schedule and run a created rule group.
O&M	You can view the running statuses of business scenario instances and handle O&M issues. The **Subscriptions** page displays the running statuses of all the tasks you have subscribed to.

10.1.2 Creating a Metric

You can manage all business metrics, including the metric sources and definitions. Business metrics are stored in directories.

Metrics in DataArts Quality are independent of business metrics and technical metrics in DataArts Architecture.

Prerequisites

You have created a home directory. To create a home directory, log in to the DataArts Studio console, click **Access** under a specific instance, choose **More** > **DataArts Quality** on the **Workspaces** tab page, choose **Metric Monitoring** > **Metric Management** from the left navigation bar on the page displayed, and create a directory. Before creating a metric for a data connection, select a directory to store the metric. For details, see **Figure 10-1**.

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Figure 10-1 Directory that stores the metric to create

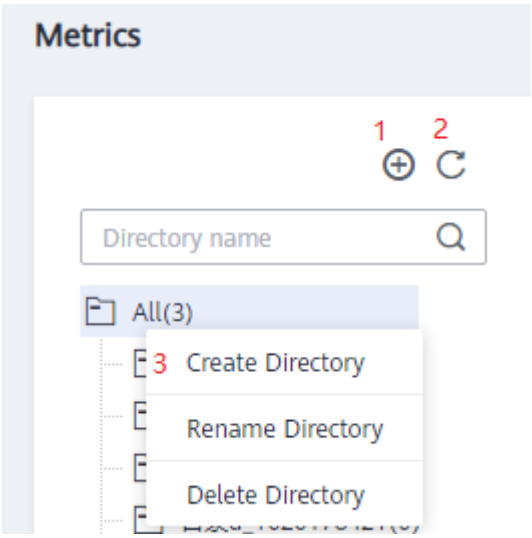


Table 10-1 Buttons in the navigation bar

No.	Description
1	Create Directory
2	Refresh Directory
3	Right-click **All** to create, rename, or delete a directory.

Creating a Metric

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Quality**.
3. Choose **Metric Monitoring** > **Metrics** from the left navigation bar.
4. Click **Create**. In the dialog box displayed, set the parameters based on **Table 10-2**.

   Table 10-2 Metric parameters

Parameter	Description
Metric Name	The name of a metric, which contains 1 to 64 characters and consists of only letters, numbers, and underscores (_).

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Parameter	Description
Data Connection	Select a created data connection from the drop-down list box. **NOTE** • Currently, only DWS, MRS Hive, DLI, MRS ClickHouse, and Doris are supported. • Metrics are closely connected based on data connections. Therefore, you must establish data connections in the metadata management module before creating metrics.
Database/ Queue	Select the database where the metric runs. **NOTE** If DLI is selected as the data connection, a running queue is required.
Description	Information to better identify a metric. It cannot exceed 4096 characters.
Directory	Directory for storing metrics. You can select a created directory. **Figure 10-1** shows the directory.
Metric Type	**Custom** is supported. You can customize an SQL statement to define the metric source.

10.1.3 Creating a Rule

You can manage all rules that define relationships between metrics or between metrics and values. Rules are stored in directories.

Prerequisites

You have created a home directory. To create a home directory, log in to the DataArts Studio console, click **Access** under a specific instance, choose **More** > **DataArts Quality** on the **Workspaces** tab page, choose **Metric Monitoring** > **Rule Management** from the left navigation bar on the page displayed, and create a directory. Before creating a rule for a metric, select a directory to store the rule. For details, see **Figure 10-2**.

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Figure 10-2 Directory that stores the rule to create

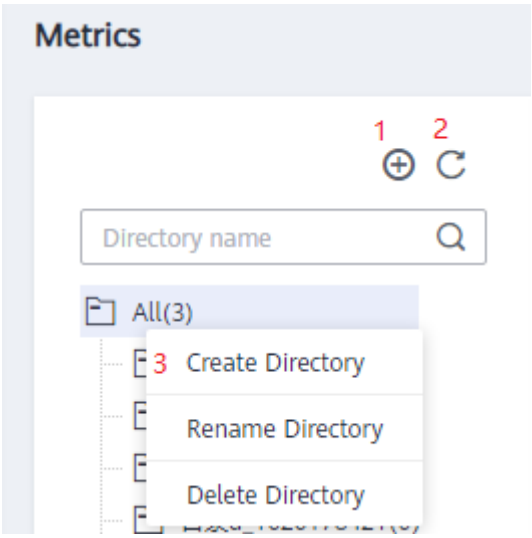


Table 10-3 Buttons in the navigation bar

No.	Description
1	Create Directory
2	Refresh Directory
3	Right-click **All** to create, rename, or delete a directory.

Creating a Rule

1. On the DataArts Studio console, locate a workspace and click **DataArts Quality**.
2. Choose **Metric Monitoring** > **Rule Management** from the left navigation bar.
3. Click **Create**. In the dialog box displayed, set the parameters based on **Table 10-4**.

Table 10-4 Rule parameters

Parameter	Description
Rule Name	The name of a rule, which contains 1 to 64 characters and consists of only letters, numbers, and underscores (_).
Description	Information to better identify a rule. It cannot exceed 4096 characters.
Directory	The directory that stores the rule. You can select a created directory. **Figure 10-2** shows the directory.

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Parameter	Description
Define Relationship	A relationship is a logical expression between a metric and a value or between metrics. The relationship can contain arithmetic operations. Metrics are abbreviated to lowercase letters a to z and are added in the alphabetic order of metric abbreviations. **NOTE** Only one valid logical expression and the simple four arithmetic operations are supported.

10.1.4 Creating a Scenario

You can manage all scenarios that define the logical relationships between rules. Scenarios are stored in directories.

Prerequisites

You have created a home directory. To create a home directory, log in to the DataArts Studio console, click **Access** under a specific instance, choose **More** > **DataArts Quality** on the **Workspaces** tab page, choose **Metric Monitoring** > **Business Scenario Management** from the left navigation bar on the page displayed, and create a directory. Before creating a scenario for rules, select a directory to store the scenario. For details, see **Figure 10-3**.

Figure 10-3 Directory that stores a scenario

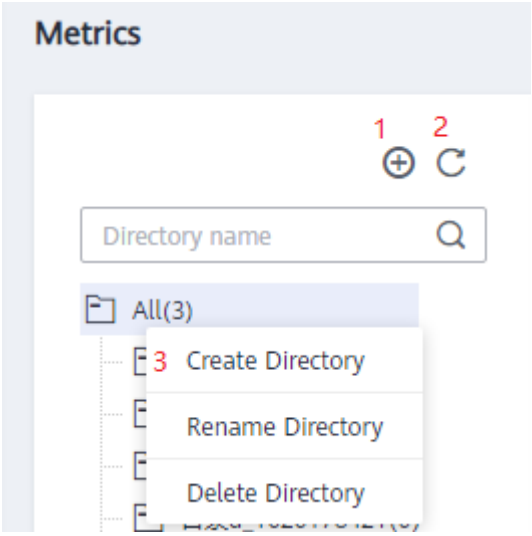


Table 10-5 Buttons in the navigation bar

No.	Description
1	Create Directory
2	Refresh Directory

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No.	Description
3	Right-click **All** to create, rename, or delete a directory.

Creating a Scenario

1. On the DataArts Studio console, locate a workspace and click **DataArts Quality**.
2. Choose **Metric Monitoring** > **Business Scenario Management** from the left navigation bar.
3. Click **Create**. In the dialog box displayed, set the parameters based on **Table 10-6**.

Table 10-6 Scenario parameters

Parameter	Description
Basic Configuration	
Scenario Name	The name of a scenario, which contains 1 to 64 characters and only consists of letters, numbers, and underscores (_).
Description	Information to better identify a scenario. It cannot exceed 256 characters.
Directory	The directory that stores the scenario. You can select a created directory. **Figure 10-3** shows the directory.
Business Level	The options are **Warning**, **Minor**, **Major**, and **Critical**. The business level determines the template for sending notification messages.
Rule Group Configuration	
Define Rule Group	Group of rules. Logical expressions are used between rules.
Rule A	You can select a rule from the drop-down list. You can also click ⊕ to add multiple rules.
Subscription Configuration	
Notification	Set this to  or  to enable or disable the notification function.
Notification Type	The options are as follows: • Trigger alarms • Run successfully

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Parameter	Description
Topic	Select a message notification topic. **NOTE** Currently, only SMS and email are available for subscribing to topics.

4. Click **Next** to go to the page where you can select a scheduling mode. Currently, **Schedule once** and **Schedule periodically** are supported. Set parameters for scheduling periodically by referring to **Table 10-7**.

Table 10-7 Scheduling parameters

Parameter	Description
Effective	The period during which a scheduling task takes effect.
Scheduling Cycle	The frequency at which a scheduling task is executed. Related parameters are: • Minute • Hour • Day • Week
Time Interval	Interval for two consecutive scheduling tasks.
Start from	Start time and end time of the scheduling task

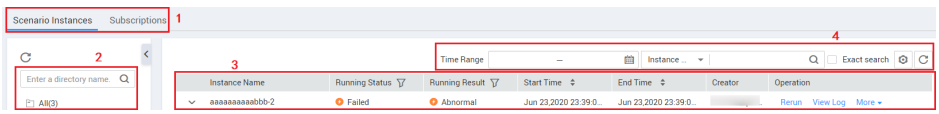
10.1.5 Viewing a Scenario Instance

You can manage all scenarios, view metric running statuses, query run logs, and handle issues on the **O&M Management** page.

GUI Description

The following figure shows the areas and buttons on the **O&M** page.

Figure 10-4 O&M Management page



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Table 10-8 Entry

No.	Area	Description
1	Menu bar	The menu bar on the **O&M Management** page includes **Scenario Instances** and **Subscriptions**. • The **Scenario Instances** tab page lists all scenario instances that you have created. • The **Subscriptions** tab page lists all scenarios that you have subscribed. **Notification Status** is available only on the **Subscriptions** tab page. **Notification Status** indicates whether the running result of a scenario instance is subscribed to, for example, sending an alarm email.
2	Navigation bar	Contains the directories that store scenario instances. You can store scenarios in different directories. The number next to each directory indicates the number of scenarios stored in that directory.
3	List of scenario instances	Displays the instance name, running status, and running result.
4	Search area	• Displays scenario instances selectively. For example, you can display scenario instances for a specified time range. • Displays a list of instances according to the handler, creator, or instance name. Fuzzy search is supported.

Table 10-9 Scenario instance parameters

Parameter	Description
Running Status	Displays the running status of a scenario instance. • **Successful**: The instance is successfully executed. • **Failed**: The instance fails to run. • **Running**: The instance is running.
Running Result	Displays whether the scenario instance is running properly. • **Normal**: The instance stops normally and the running result meets the expectation. • **Alarming**: The instance stops normally, but the running result does not meet the expectation. • **Abnormal**: The instance stops unexpectedly. • **--**: The instance is running, but no running result is displayed.
Rerun	Allows you to run the scenario instance again.
View Log	Allows you to view the running details of the scenario instance.

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Parameter	Description
More > Resolve Issue	Allows you to perform further processing on the scenario instance. You can **Provide handling suggestions**, **Close the issue**, or **Transfer to others**. The above operations can be performed only when you are the handler of the instance.
More > View Processing Log	Allows you to view historical processing records.

10.2 Monitoring Data Quality

10.2.1 Overview

DataArts Quality is a type of quality management tool used to manage the quality of data in databases. You can filter out unqualified data in a single column or across columns, rows, sources, and tables from the following perspectives: integrity, validity, timeliness, consistency, accuracy, and uniqueness. DataArts Quality can monitor offline data. When offline data changes, DataArts Quality verifies the data and blocks the production link to avoid the spread of the problem data. DataArts Quality also manages historical verification results so that you can analyze and grade data quality.

It can also automatically generate standardized quality rules based on the data standards in DataArts Architecture, and periodically monitor data.

The following table describes modules under **Quality Monitoring**.

Module	Description
Dashboard	The dashboard is the homepage that displays alarming and blocking information of tables. The following information is included: • Number of jobs, instances, and anomaly tables; distributions and changes of instance running statuses in a selected period. • Statistics about alarm classifications and table alarms of the current day, as well as the alarm trend and rule quantity of the latest seven days.
Rule Template	Rule template is a major function of DataArts Quality. You can configure rules on the **Rule Template** page. It mainly manages functions related to rule configuration and provides built-in and custom templates.
Quality Job	Quality jobs can apply rule templates or custom rules to tables for data monitoring.

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Module	Description
Comparison Job	You can create comparison jobs to apply the created rules to two existing tables to monitor their data and output the comparison results.
O&M Management	You can view the running status of rules and handle O&M problems.
Quality Report	The system automatically generates quality reports based on the job execution result.

10.2.2 Creating a Data Quality Rule

DataArts Quality can monitor offline data, in which quality rules play a vital role. There are 34 built-in rule templates, such as database-level, table-level, field-level, cross-source, and cross-field rule templates.

Table 10-10 System built-in rule templates

Rule Type	Dimension	Template	Applicable Engine	Description
Database-level	Integrity	Database null value scan	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, ORACLE, RDS, DORIS	Calculates the number of rows with empty field values in each table in the database. The result is displayed by field.
Table-level	Accuracy	Table rows	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Calculates the number of rows in a data table.
	Integrity	Data table null value scan	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Calculates the number of rows with empty field values in each table. The result is displayed by field.
	Validity	Fluctuation rate in the last day	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Calculates the size, field groups, and related fluctuation rate of a data table in the last day.

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Rule Type	Dimension	Template	Applicable Engine	Description
		Fluctuation rate in the last seven days		Calculates the size, field groups, and related fluctuation rate of a data table in the last seven days.
		Fluctuation rate in the last 30 days		Calculates the size, field groups, and related fluctuation rate of a data table in the last 30 days.
Field-level	Uniqueness	Field with a unique value	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Calculates the number of rows in a data table in which a specified field has a unique value.
		Field with duplicate values		Calculates the number of rows in a data table in which a specified field has duplicate values. If the field has multiple different duplicate values, the total number of duplicate values is the calculation result.
		Unique combination of multiple fields	HIVE, SparkSQL, DLI, DWS, HETUENGINE	Checks whether the combination of multiple fields in a table is unique. A maximum of 10 fields can be combined.
		Multi column uniqueness verification ignore null		Checks whether the combination of multiple fields in a table is unique. A maximum of 10 fields can be combined. Null values are counted in valid rows.
	Integrity	Field with a null value	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Calculates the number of rows in a data table in which a specified field has a null value.

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Rule Type	Dimension	Template	Applicable Engine	Description
	Accuracy	Average field value	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Calculates the average value of a specified field in a data table.
		Total field values		Calculates the total values of a specified field in a data table.
		Maximum field value		Calculates the maximum value of a specified field in a data table.
		Minimum field value		Calculates the minimum value of a specified field in a data table.
	Effectiveness	ID card verification	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Checks validity of a specified field in a data table based on built-in regular expression rules. If the field is empty, it is invalid.
		Mailbox verification		Checks validity of a specified field in a data table based on built-in regular expression rules.
		Regular expression verification		Checks validity of a specified field in a data table based on a custom regular expression.
		IP address verification		Checks validity of a specified field in a data table based on built-in regular expression rules.
		Phone number format verification		Checks validity of a specified field in a data table based on built-in regular expression rules.
		Postal code format verification		Checks validity of a specified field in a data table based on built-in regular expression rules.
		Date format verification		Checks validity of a specified field in a data table based on built-in regular expression rules.

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Rule Type	Dimension	Template	Applicable Engine	Description
		Validity verification		Checks validity of a specified field in a data table based on a custom regular expression.
		Enumerated value verification		Checks validity of a specified field in a data table based on a custom enumerated value.
		Field length verification	DLI, DWS, HETUENGINE	Checks whether the length of a field in the table is within the allowed range.
		Field value range verification		Checks whether the value of a field in the table is within the allowed range.
		Field time verification		Checks whether the time of a field in the table is within the allowed range. Currently, only fields of the date and timestamp types are supported. Fields of the time type are not supported.
		Ignoring of null values in enumerated value verification		Verifies the validity of a specified field in a data table based on a custom enumerated value. Null values are counted in valid rows.
		Ignoring of null values in regular expression verification		Checks validity of a specified field in a table based on a custom regular expression. Null values are counted in valid rows.
		Ignoring of case in enumerated value verification	DLI, DWS, HETUENGINE	Checks validity of a specified field in a table based on a custom enumerated value. Case-sensitive values are counted in valid rows.

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Rule Type	Dimension	Template	Applicable Engine	Description
		Ignoring of null values and case in enumerated value verification		Checks validity of a specified field in a table based on a custom enumerated value. Null and case-sensitive values are counted in valid rows.
Cross-field level	Consistency	Field consistency verification	DLI, DWS, HIVE, SparkSQL, CLICKHOUSE, HETUENGINE, ORACLE, RDS, DORIS	Checks whether the value of a specified field in a data table is the same as that of the reference field from the same source.
	Accuracy	Cross-field time verification	DLI, DWS, HETUENGINE	Checks whether the time relationship between a specified field in a table and the reference field meets the expectation. Currently, only fields of the date and timestamp types are supported. Fields of the time type are not supported.
Cross-source level	Consistency	Cross-source field consistency verification	HETUENGINE	Checks consistency between different fields from different data sources based on a Hetu connection.

You cannot edit built-in rule templates or view their release history.

If the built-in rule templates do not meet your requirements, you can create rules in either of the following ways:

NOTE

Developers cannot randomly modify custom rule templates because they may be used by many users. To modify custom rule templates, contact the administrator.

- Custom template: Choose **Quality Monitoring** > **Rule Templates** and click **Create**. The created rule template is automatically allocated the corresponding rule type (table level, field level, cross-field level, or multi-table and multi-field). The template type is custom. When creating a quality/comparison job, you can select **Table rule**, **Field rule**, **Cross-field rule**, or **Multi-table and multi-field rule** for **Rule Type**, and then you can select a custom template which supports export of abnormal data but does not support quality scoring.

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- Custom rule: When creating a quality job, set **Rule Type** to **Custom rule** and enter an SQL statement to define how to monitor the quality of data objects.

  NOTE

  An SQL statement can contain multiple tables in the same database, but not tables in different databases.

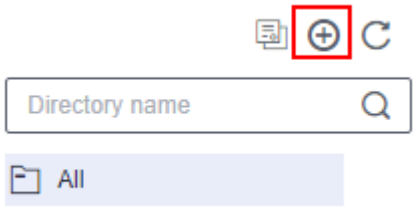
This section describes how to create a rule using a custom template. For details about how to create a custom rule, see **Creating a Data Quality Job**.

Step 1 (Optional) In the left navigation pane, choose **Quality Monitoring** > **Rule Templates** and create a directory. If a directory exists, you do not need to create one. Note that rule templates, quality jobs, and comparison job are in the same directory.

Currently, you can create a directory using either of the following methods:

Click ⊕ and enter a directory name in the displayed dialog box. In this way, you can create a maximum of seven layers of directories.

Figure 10-5 Creating a directory



You can also click to synchronize the **subjects in DataArts Architecture** as directories. (Only published subjects can be synchronized.) The synchronized directories are consistent with the published subjects in DataArts Architecture and are displayed by layer, such as L1 and L2.

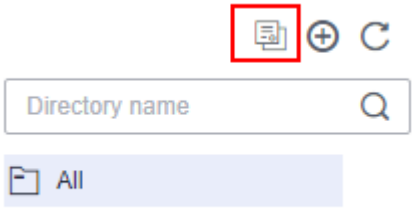
NOTE

1. The directories you create are not affected by the synchronization. If the name of a created directory conflicts with that of a subject:
   - If they conflict during the first synchronization, a subject layer (such as L1 and L2) is added to the name of the directory.
   - If they conflict after the subject is modified, the synchronization fails.
2. Changes to subjects or subject layers in DataArts Architecture cannot be automatically synchronized. You must click again to synchronize them.

   If a subject or subject layer in DataArts Architecture is deleted and synchronized to DataArts Quality, the corresponding directory will not be deleted. Instead, the subject attributes will be deleted from the directory.
3. After the synchronization is complete, the system automatically displays the synchronization result details. You can view the names of the subjects that fail to be synchronized.

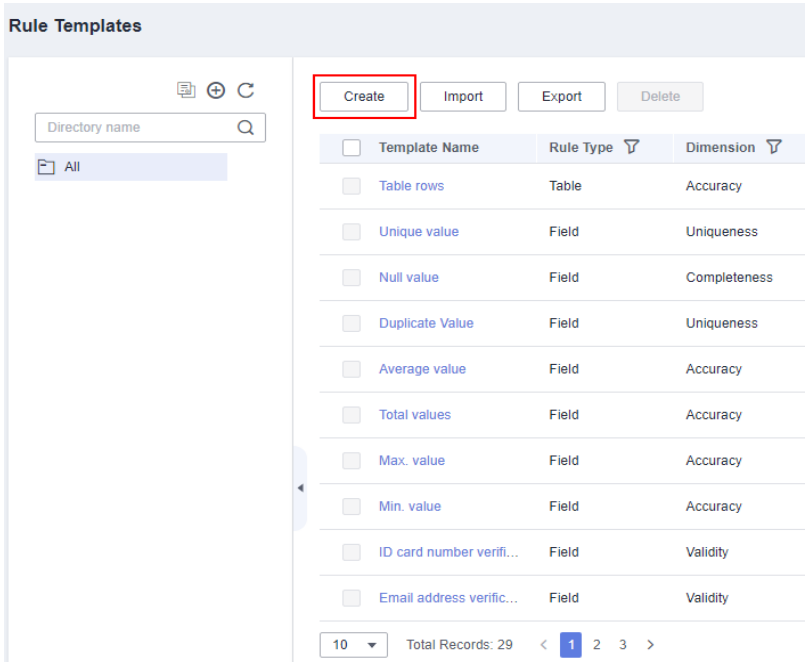
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Figure 10-6 Synchronizing subjects from DataArts Architecture



Step 2 On the **Rule Templates** page, click **Create**.

Figure 10-7 Rule Template page



Step 3 In the dialog box displayed, enter the rule template name, select the rule matching dimension, define the SQL template, and describe the output result.

- **Dimension**: You can complete single-column, cross-column, cross-row, and cross-table analysis from six dimensions: completeness, validity, timeliness, consistency, accuracy, and uniqueness. When customizing a quality rule, select a dimension for rule matching.
- **Directory**: Select the directory where the rule template is located.
- **Tag**: Select desired tags from the list of tags that were defined Data Map. If Data Map is disabled, tags do not take effect.
- **Description**: Enter the description of the custom template.
- **Relationship**: Enter an SQL statement to search for data. **${Schema_Table1}** is the table selected for the quality/comparison job. **${Column1}** is the field selected in **${Schema_Table1}**. **${Schema_Table2}** exists only when a cross-field rule is defined and indicates the reference table selected for the quality

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job. **${Column2}** is the field selected in **${Schema_Table2}**. The system can verify the semantics of the relationship.

NOTE

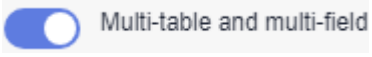
If you enter non-digit characters for the relationship, only the execution result is generated. Four arithmetic operations and logical operations cannot be performed, and absolute values cannot be calculated.

The relationship of a custom rule template can be defined for a maximum of 20 fields in 10 tables.

A custom SQL expression must meet the following requirements:

a. A relational expression supports a maximum of five columns.
b. The input parameters of a maximum of two tables and two fields are supported. Note: **${Column1}** is the input parameter of **${Schema_Table1}**, and **${Column2}** is the input parameter of **${Schema_Table2}**. They are specified by built-in logic.
c. If multiple rows are found, only the data in the first row is used.
d. Periods (.) cannot be used to connect tables or fields. For example, ${Schema_Table2}.${Column1}.${Input_String1} is incorrect.
e. A non-multi-table, non-multi-field expression supports parameters ${Schema_Table1}, ${Schema_Table2}, ${Column1}, and ${Column2}, but does not support table aliases.
f. A multi-table, multi-field expression supports parameters ${Schema_Table1}, ${Schema_Table2}, ${Schema_Table3}, ${Schema_Table4}, ${Schema_Table5}, ${Column1}, ${Column2}, ${Column3}, to until ${Column20}, ${Input_String1}, ${Input_String2}, ${Input_String3}, ${Input_String4}, and ${Input_String5}, but does not support table aliases.

For example, to count the number of rows in a table, enter **select count(${Column1}) from ${Schema_Table1}**. The value of **${Column1}** is generated by clicking **Add Field Parameter**, and the value of **${Schema_Table1}** is generated by clicking **Add Database/Table Parameter**.

Click 

and enable **Add Input Parameter** to flexibly configure input parameters in SQL statements.

For example, if a field matches the number of rows in the configuration table, enter **select count(1) from ${Schema_Table1} where ${Column1} regexp ${Input_String1}**. Click **Add Field Parameter** to generate **${Column1}** and click **Add Database/Table Parameter** to generate **${Schema_Table1}**.

NOTE

When creating a multi-table and multi-field rule template, you can add a maximum of five database/table parameters, 20 field parameters, and five input parameters.

- **Output Description**: Enter the description of each column in the SQL statement execution result, which corresponds to the output defined by the relationship in sequence. Column descriptions are separated by commas (,).

  For example, if the relationship is set to **select max(${Column1}),min(${Column2}) from ${Schema_Table1}**, the output result is **Maximum value,Minimum value** (pay attention to the input order).

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- **Scoring Formula**: Enter a scoring formula. After you enter a scoring formula, the template can be used for quality scoring. The score and rules are displayed in the quality report.

  For example,, you can enter **${1}/${2}**, where **${1}** indicates the output of the first column and **${2}** indicates that of the second column. The return value of the formula ranges from 0 to 1.

- **Abnormal Table Template**: You need to enter a complete SQL statement to specify the abnormal data to be exported. You can click **Add Database/Table Parameter** to generate **${Schema_Table1}** which indicates the name of the anomaly table. You can click **Add Field Parameter** to generate **${Column1}** which indicates a field in the anomaly table. You can click **Add Output Parameter** to generate **${Output_Columns}** which indicates the abnormal data to be output from the anomaly table. The system can verify the semantics of the abnormal table template.

  NOTE

  If you enable **Multi-table and multi-field rule**, **Abnormal Table Template** is unavailable.

For example, in a table involving amount, the **is_test** field identifies whether a piece of data is test data (**0** indicates formal data and **1** indicates test data). If you want to calculate the minimum, maximum, average, and total amount of formal data, you can define the custom template as follows:

- **Dimension**: Select **Accuracy**.
- **Directory**: Retain the default value **/All/**.
- **Description**: Enter **Calculate the minimum, maximum, average, and total amount of formal data**.
- **Relationship**: Enter the following SQL statement to calculate the minimum, maximum, average, and total amount of formal data. **${Schema_Table1}** indicates the table selected in the quality job, and **${Column1}** indicates the field selected in **${Schema_Table1}**.

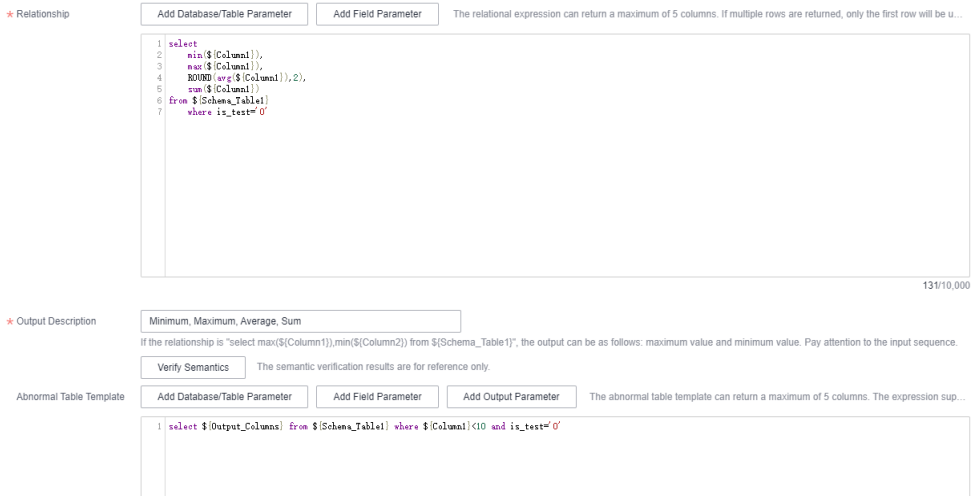
```
select
   min(${Column1}),
   max(${Column1}),
   ROUND(avg(${Column1}),2),
   sum(${Column1})
from ${Schema_Table1}
   where is_test='0'
```

- **Output Description**: Enter **minimum, maximum, average, and total amount**.
- **Abnormal Table Template**: Enter the following SQL statement to export the **${Output_Columns}** columns in which the amount is less than 10 as abnormal table data. **${Output_Columns}** indicates the field selected for the abnormal table parameter in the quality job.

```
select ${Output_Columns} from ${Schema_Table1} where ${Column1}<10 and is_test='0'
```

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Figure 10-8 Key parameters for a custom rule template



Step 4 After you click **Yes**, the system publishes the rule template by default. The default version is V1.0.

----End

Editing Rule Templates

NOTE

Developers cannot randomly modify custom rule templates because they may be used by many users. To modify custom rule templates, contact the administrator.

You can edit and publish rule templates. You can take a historical version offline and migrate the jobs associated with the historical version to be taken offline to the new version. The operations are as follows:

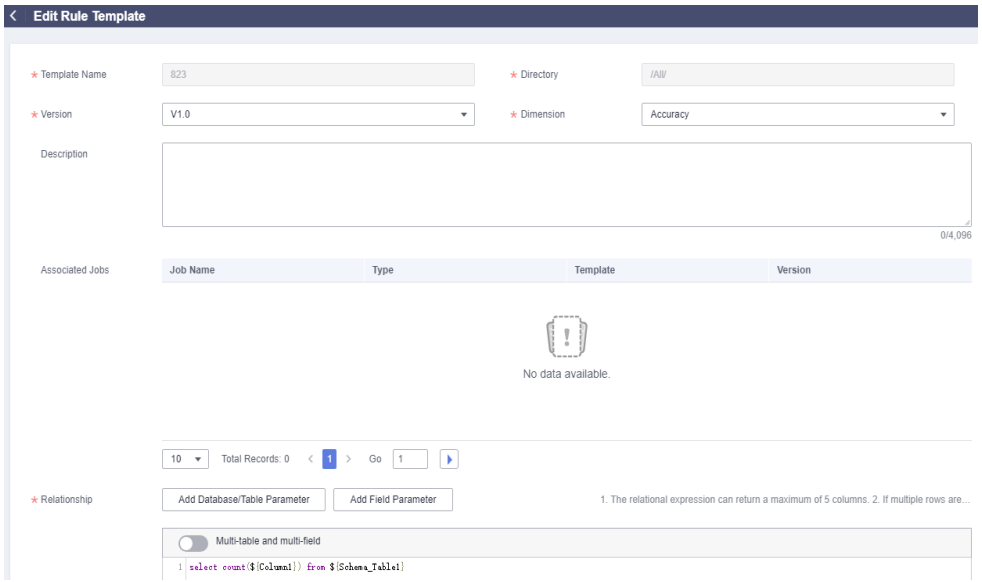
NOTE

The page for editing a rule template contains parameters **Version** and **Associated Jobs**.

Step 1 On the DataArts Quality console, choose **Quality Monitoring** > **Rule Templates** in the left navigation pane. Locate the target rule template in the displayed list and click **Edit** in the **Operation** column to enter the rule template editing page.

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Figure 10-9 Editing a rule template



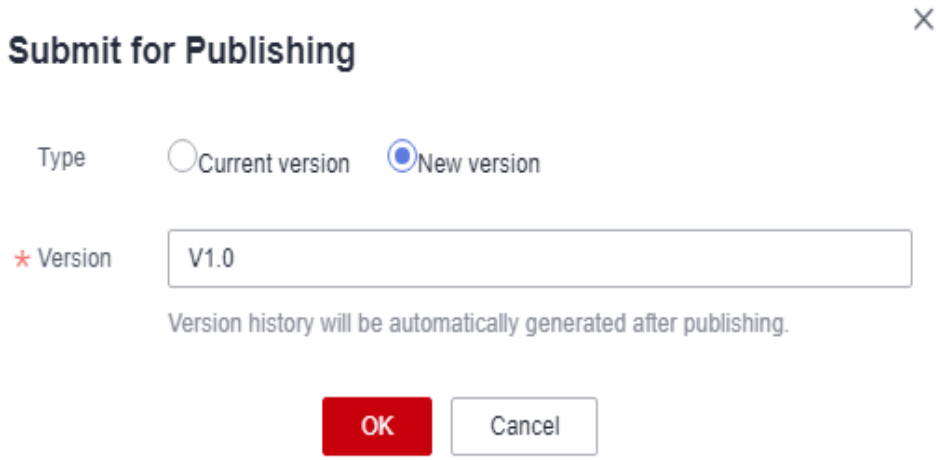
Step 2 Dimensions and output description can be modified, and relationships can be redefined.

Step 3 Click **Publish**. In the displayed dialog box, select the version type, set the version name, and click **OK**.

NOTE

- When publishing a new version, you must change the version name.
- When publishing the current version, you do not have to change the version name. The earlier version automatically becomes a historical version.

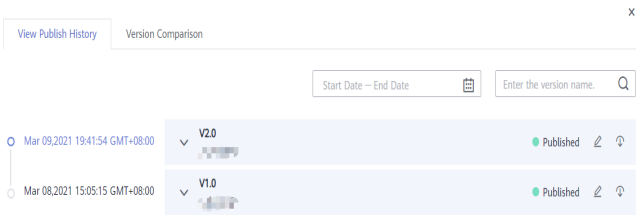
Figure 10-10 Publishing a new version



Step 4 After the rule template is submitted for publishing, you can click **View Publish History** in the **Operation** column. You can view the changes of versions, change version names, and suspend versions.

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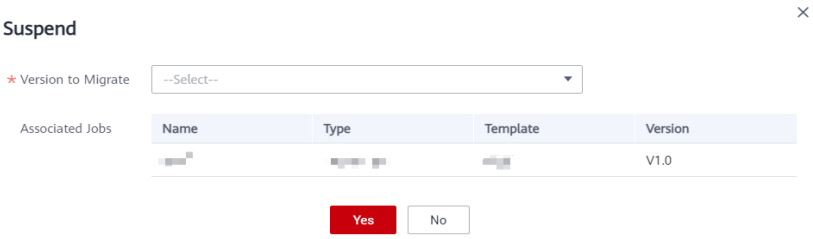
Figure 10-11 Publish History page



Step 5 To suspend a historical version, click **Suspend** on the right of the historical version.

- If the version is not associated with any job, click **OK** to suspend it.
- If the version has associated jobs, select a new version, associate the jobs with the new version, and click **OK**.

Figure 10-12 Migrating and suspending a version



Step 6 On the **Version Comparison** tab page, you can compare the versions to see their differences.

Figure 10-13 Version comparison



----End

Exporting Rule Templates

To export custom rule templates, perform the following steps (you can export a maximum of 200 rule templates at a time):

Step 1 In the left navigation pane, choose **Quality Monitoring** > **Rule Templates**, and select the templates to export in the right pane.

Step 2 Click **Export**. The **Export Rule Template** dialog box is displayed.

Step 3 Click **Export** to switch to the **Export Records** tab.

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Step 4 In the list of exported files, locate an exported template and click **Download** in the **Operation** column to download the Excel file of the rule template to the local PC.

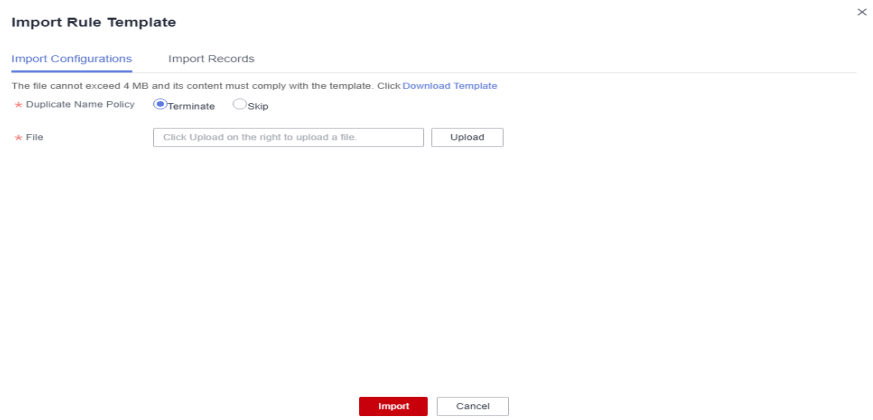
----End

Importing Rule Templates

You can import a file containing a maximum of 4 MB data.

Step 1 In the left navigation pane, choose **Quality Monitoring** > **Rule Templates**. In the right pane, click **Import**.

Figure 10-14 Importing rule templates



Step 2 On the **Import Configurations** tab page, set **Duplicate Name Policy**.

- **Terminate**: If template names repeat, all templates will fail to be imported.
- **Skip**: If template names repeat, the templates will still be imported.

Step 3 Click **Upload** and select the prepared data file.

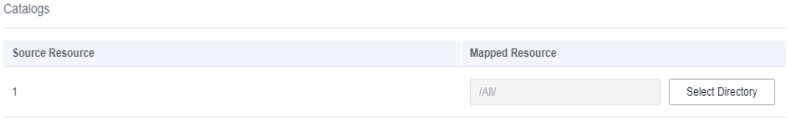
NOTE

Edit the data file using either of the following methods:

- (Recommended) Click **Export** to export data and import the data to the system directly or import it after modification.
- Click **Download Template**, fill in the template with the data to import, and import the data to the system.

Step 4 Configure the mapped resource for the catalog and select the directory where rule template has been imported. If you do not configure the resource mapping, the original mapping is used by default.

Figure 10-15 Configuring the resource mapping



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Step 5 Click **Import** to import the Excel template to the system.

Step 6 Click the **Import Records** tab to view the import records.

----End

10.2.3 Creating a Data Quality Job

You can create quality jobs to apply the created rules to existing tables.

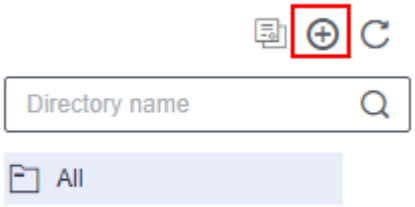
Procedure

1. On the DataArts Studio console, locate a workspace and click **DataArts Quality**.
2. (Optional) In the left navigation pane, choose **Quality Monitoring** > **Quality Jobs** and create a directory. If a directory exists, you do not need to create one. Note that rule templates, quality jobs, and comparison job are in the same directory.

   Currently, you can create a directory using either of the following methods:

   Click ⊕ and enter a directory name in the displayed dialog box. In this way, you can create a maximum of seven layers of directories.

   Figure 10-16 Creating a directory

   You can also click to synchronize the **subjects in DataArts Architecture** as directories. (Only published subjects can be synchronized.) The synchronized directories are consistent with the published subjects in DataArts Architecture and are displayed by layer, such as L1 and L2.

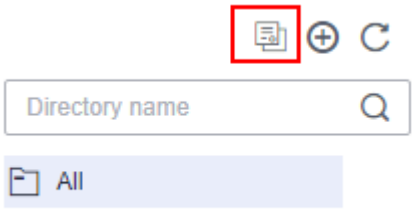
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NOTE

1. The directories you create are not affected by the synchronization. If the name of a created directory conflicts with that of a subject:
   - If they conflict during the first synchronization, a subject layer (such as L1 and L2) is added to the name of the directory.
   - If they conflict after the subject is modified, the synchronization fails.
2. Changes to subjects or subject layers in DataArts Architecture cannot be automatically synchronized. You must click again to synchronize them.

   If a subject or subject layer in DataArts Architecture is deleted and synchronized to DataArts Quality, the corresponding directory will not be deleted. Instead, the subject attributes will be deleted from the directory.
3. After the synchronization is complete, the system automatically displays the synchronization result details. You can view the names of the subjects that fail to be synchronized.

Figure 10-17 Synchronizing subjects from DataArts Architecture



3. On the **Quality Jobs** page, click **Create**. In the dialog box displayed, set the parameters based on **Table 10-11**.

Table 10-11 Quality job parameters

Parameter	Description
*Job Name	Quality job name
Description	Information to better identify the quality job. It cannot exceed 1,024 characters.
Tag	Select desired tags from the list of tags that were defined Data Map. If Data Map is disabled, tags do not take effect.
*Directory	Directory for storing the quality job. You can select a created directory. For details about how to create a directory, see **(Optional) Creating a Directory**.
*Job Level	The options are **Warning**, **Minor**, **Major**, and **Critical**. The job level determines the template for sending notification messages.
Issue Handler	Handler of the issues detected by the quality job

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Parameter	Description
Timeout	Timeout duration. Enter a value from 5 to 1440. The unit is minute. If this parameter is left empty or the default value 1440 is used, the timeout duration is 24 hours by default and can be changed.

4. Click **Next** to go to the **Define Rule** page, on which each rule card corresponds to a subjob. Click on the rule card and configure it based on **Table 10-12**. You can also add more quality rules and click **Next** to apply them to a created database or table.

Figure 10-18 Configuring rules for a quality job

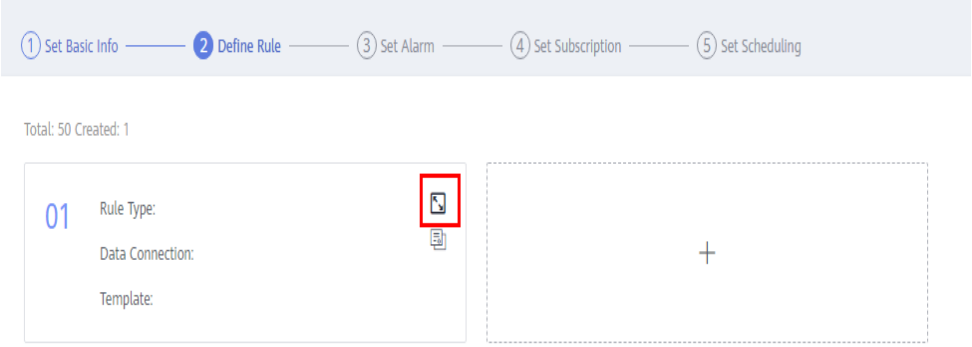


Table 10-12 Parameters for configuring a rule

Parameter	Sub-parameter	Description
Basic Information	Subjob Name	In the job execution result, each rule corresponds to a subjob. You are advised to set the subjob information so that you can view the job execution result and locate faults through logs more easily.
	Description	Information to better identify the subjob It cannot exceed 1,024 characters.

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Parameter	Sub-parameter	Description
Object	Rule Type	Database rule, table rule, field rule, cross-field rule, cross-source rule, multi-table and multi-field rule, or custom rule configured for specific fields in a table. **NOTE** ● If you select a cross-field rule, you need to configure both a data table and a reference table in **Object Scope**. ● Currently, cross-source rules support only field comparison jobs between MRS Hive and DWS based on Hetu connections. ● Before configuring cross-source rules, you need to create the MRS Hive and GaussDB data sources in MRS Hetu. For details, see Configuring the Hive Data Source and Configuring the GaussDB Data Source.

	Data Connection	Source and destination objects support the following data connection types: DWS, MRS Hive, MRS Spark, DLI, RDS (MySQL and PostgreSQL), Hetu, Oracle, Doris, MRS Spark (Hudi), and MRS ClickHouse.
		Select a created data connection from the drop-down list box.
		NOTE
		● Rules are based on data connections. Therefore, you must create data connections in **Management Center** before creating data quality rules. For MRS Hive and MRS Spark data sources, if **Rule Type** is set to **Table rule** or **Field rule**, **Connection Type** must be set to **Proxy connection** (**MRS API connection** is not supported) during the creation of connections to these data sources.
		● For MRS Hive connected through a proxy, select **MRS API connection** or **Proxy connection**.
		  ● **MRS API connection**: An MRS API is used for submission. By default, historical jobs are submitted through MRS APIs. You are advised to keep the default settings when editing the job.
		  ● **Proxy connection**: A username and a password are used for submission. You are advised to select this mode for new jobs to prevent job submission failures caused by permission issues.
		● The strict mode of the MRS Hive component is not supported.

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Parameter	Sub-parameter	Description
	Database	Select the database to which the configured data quality rules are applied. **NOTE** • The database is tailored to the created data connection. • When **Rule Type** is set to **Database rule** or **Table rule**, set the data object to the corresponding database. • When **Rule Type** is set to **Custom rule**, select the corresponding database.
	scheme	This parameter is displayed and needs to be set only when the data source has a scheme.
	Data Table	Select the table to which the configured data quality rules apply. **NOTE** • The table is closely related to the database. • When **Rule Type** is set to **Table rule**, set the data object to the corresponding table. • When **Rule Type** is set to **Custom rule**, select the corresponding table.
	SQL	This parameter is mandatory if you select **Custom rule** for **Rule Type**. Enter a complete SQL statement to define how to monitor the quality of data objects. The semantics of SQL statements can be verified. The verification result is for reference only.
	Default Value	Input parameters for the custom SQL statement. The sequence of the parameters must be consistent with that of the default parameter values (when a data quality job is executed in DataArts Factory). **NOTE** When a data quality operator is scheduled by a data development job, the parameter values defined in the data development job are preferentially used.
	Field	This parameter is used only for abnormal tables. Example: **column1**, **column2**, or **column3**
	Failure Policy	Select **Ignore rule errors** as required.
	Select Fields	This parameter is mandatory if you select **Field rule** for **Rule Type**. Select a field in the corresponding data table. **NOTE** Fields names containing only one letter (such as **a**, **b**, **c**, and **d**) cannot be verified.

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Parameter	Sub-parameter	Description
	Data Object	This parameter is not required if you select **Custom rule** for **Rule Type**. Otherwise, this parameter is mandatory. Select the data fields for reference. When you select a table name, the search box is case sensitive.
	Reference Data Object	This parameter is mandatory if you select **Cross-field rule** for **Rule Type**. Select a reference data field. When you select a table name, the search box is case sensitive.
	Dimension	This parameter is mandatory if you select **Custom rule** for **Rule Type**. It associates the custom rule with one of the six quality attributes, including completeness, validity, timeliness, consistency, accuracy, and uniqueness.
	Output Description	This parameter is mandatory if you select **Custom rule** for **Rule Type**. ● Description of each column in the SQL result. The description corresponds to the output result defined by the SQL relationship. If the number of fields in the output result description is different from the number of output parameters of the SQL, the configuration cannot be saved and an error message is displayed. ● The output description can contain only letters, digits, underscores (_), hyphens (-), and spaces. ● For example, if the SQL is set to **select max(${Column1}),min(${Column2}) from ${Schema_Table1}**, the output result is **Maximum value,Minimum value** (pay attention to the input order). If there are multiple fields in the output description, separate them with commas (,). If Chinese commas are used in the command output, they will be automatically replaced with English commas when you save the configuration.

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Parameter	Sub-parameter	Description
Quality Rule	Input Parameter	This parameter is mandatory when **Rule Type** is set to **Multi-table and multi-field**. For example, you can enter input parameter **Input_String1** and set the parameter value based on the site requirements. **NOTE** When **Rule Type** is set to **Multi-table and multi-field** and the rule template version is selected, the SQL statement is automatically displayed. The SQL statement contains the same number of parameters as the number of input parameters. If the SQL statement does not contain any parameters, you do not need to set input parameters.
Compute Engine	Queue Name	Select the engine for running the quality job. This parameter is valid only for Hive, DLI, or Hetu data connections. Enter a queue name. If the connection type is Hetu, and the rule type is not database rule, the queue name is the resource queue name of the Hetu engine. To view the resource queue name of the Hetu engine, log in to FusionInsight Manager of MRS and click HetuEngine in the navigation pane. In the Basic Information area, click the HSConsole WebUI link and view the resource queue name of the Hetu engine in the computing instance list.
Rule Template	Template	Select a system or custom rule template. **NOTE** The template type is closely related to the rule type. For details, see **Table 10-10**. In addition to system rule templates, you can select the custom rule template created in **Creating a Data Quality Rule**. If **Rule Type** is set to **Field rule** and **Rule Template** is set to **Regular expression verification** or **Regular expression verification ignore null**, the regular expression rule can contain a maximum of 1,024 characters.
	Version	This parameter is required only when you select a custom rule template. Select the version of the published custom rule template.
	SQL	After you select the template name and version, the SQL statement is automatically displayed.

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Parameter	Sub-parameter	Description
	Statistical Method	This parameter is mandatory when **Rule Type** is set to **Table rule** and a rule template related to volatility is selected for **Template**. You can select **Table Partition** or **Full Table**. If you select **Table Partition**, click **Edit** and select the partition fields of the required table. Select a date field in yyyyMMdd format from the table. You can delete the table partition fields that you have selected.
	Rule Weight	Set the weight for the rule based on the field level. The value is an integer from 1 to 9. The default value is **5**.
Object Scope	Scanning Scope	You can select **All** or **Partial**. The default value is **All**. If you want only part of data to be computed or quality jobs to be executed periodically based on a timestamp, you can set a WHERE condition for scanning. You can transfer environment variables to data quality jobs. If rules can be configured for multiple tables, the data range of each table can be set independently. If both **Data Object** and **Reference Data Object** are set, you need to configure the data to scan in the scanning scope.

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Parameter	Sub-parameter	Description

	WHERE Clause	Enter a WHERE clause. The system will scan the data that matches the clause.
		NOTE
		Add **and** at the beginning of the clause for syntax verification during SQL statement generation. Otherwise, a syntax error will be reported.
		For example, if you want to filter out the data for which the value range of the **age** field is (18, 60], enter the following WHERE clause:
		`and age > 18 and age <= 60`
		You can also enter a dynamic SQL expression. For example, if you want to filter out the data generated 24 hours ago based on the **time** field, enter the following WHERE clause:
		`and time >= (date_trunc('hour', now()) - interval '24 h') and time <= (date_trunc('hour', now()))`
		DataArts Quality allows you to transfer parameters. You can enter a condition expression to transfer environment variables. The following is an example:
		`and p_date=${target_date}`
		You can also transfer parameters from DataArts Factory to DataArts Quality. DataArts Quality can also proactively obtain parameters from DataArts Factory. This is supported for both system and custom rule templates.

	Default Value	This parameter is required when you select **Partial** for **Scanning Scope**. Enter the default values of the parameters in the where clause text box. **NOTE** The default parameter value is preferentially transferred by DataArts Factory. If the value is empty, the quality job may encounter an error. After DataArts Factory transfers parameters to DataArts Quality and the job is executed, you can click **View SQL** to view the parameters and their values transferred by DataArts Factory.

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Parameter	Sub-parameter	Description
Alarm Condition	Alarm Expression	Set this parameter if you want to set an alarm condition for the current rule. If you want to use the logical operations of multiple rules to set a unified alarm condition expression, you do not need to set this parameter. Instead, you can set it on the next **Set Alarm** page. After the alarm conditions are configured, the system determines whether to generate an alarm based on the value of **Parameter** and the alarm condition. Apart from a single alarm expression, you can also use more complex alarm conditions consisting of logical operators. The alarm expression supports the following logical operators, which can be enclosed by "(" and ")". ● **+**: addition ● **-**: subtraction ● ***:** multiplying ● **/**: division ● **==**: equal to ● **!=**: not equal to ● **>**: greater than ● **<**: less than ● **>=**: greater than or equal to ● **<=**: less than or equal to ● **!**: non ● **||**: or ● **&&**: and For example, if **Rule Template** is set to **Null value**, you can set this parameter as follows: ● If you want an alarm to be generated when the number of rows with a null value is greater than 10, enter **${1}>10** (**${1}** is the number of rows with a null value). ● If you want an alarm to be generated when the ratio of fields with a null value is greater than 80%, enter **${3}>0.8** (**${3}** is the ratio of fields with a null value). ● If you want an alarm to be generated when the number of rows with a null value is greater than 10 or the ratio of fields with a null value is greater than 80%, enter **(${1}>10)||(${3}>0.8)** (**${1}** is the number of rows with a null value, **${3}** is the ratio of fields with a null value, and **||**

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Parameter	Sub-parameter	Description
		indicates that an alarm will be generated if either of the conditions is met).
	Parameter	The value of this parameter is obtained from the output of the rule template. If you can click a parameter, the expression of the parameter is displayed in **Alarm Expression**. For example, if **Template** is set to **Null value**, **${1}** is displayed in **Alarm Expression** when you click alarm parameter **Null Value Rows**.
	Logical Operator	This parameter is optional. You can perform logical operations on the result of an alarm expression to generate more complex alarm conditions. You can move the cursor between two alarm expressions in **Alarm Expression** and click one of the following operators to insert them. You can also manually enter an operator. The current expression supports the following logical operators which can be enclosed by brackets (). ● **+**: addition ● **-**: subtraction ● ***:** multiplying ● **/**: division ● **==**: equal to ● **!=**: not equal to ● **>**: greater than ● **<**: less than ● **>=**: greater than or equal to ● **<=**: less than or equal to ● **!**: non ● **||**: or ● **&&**: and For example, if **Template** is set to **Null value** and you want an alarm to be generated when the number of rows with a null value is greater than 10 or the ratio of fields with a null value is greater than 80%, enter **(${1}>10)||(${3}>0.8)** for **Alarm Expression** (**${1}** is the number of rows with a null value, **${3}** is the ratio of fields with a null value, and **||** indicates that an alarm will be generated if either of the conditions is met).

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Parameter	Sub-parameter	Description
	Score Quality	This parameter is mandatory if you select **Custom rule** for **Rule Type**. If you enable quality scoring and set **Schema** (if the data source contains schemas) and **Table Name**, the name in the execution result is **<Database name>.<Table name>**, and the name of a subjob whose quality is not scored is **<Database name>.custom-sql**.
	Scoring Formula	This parameter is mandatory if you select **Custom rule** for **Rule Type**. Enter a scoring formula. You can try the scoring formula. For example, you can enter **${1}/${2}**. The parameters in the formula are the same as those in the alarm expression. The return value of the formula ranges from 0 to 1.
	Weight Rule	This parameter is mandatory if you select **Custom rule** for **Rule Type**. Set the weight of the rule. The value is an integer from 1 to 9. The default value is **5**.
	Generate Anomaly Data	Enable **Generate Anomaly Data** and click **Select** next to **Anomaly Table** to store the anomaly data that does not comply with the preset rules. **NOTE** • The following built-in templates cannot be used to generate anomaly data: the **Table rows** template for the **Table rule**, **Average value**, **Total values**, **Max. value**, and **Min. value** templates for the **Field rule**, and **Multi-table and multi-field** template. • If periodic scheduling or re-execution is configured for a quality job, abnormal data detected in each instance scan is inserted into the anomaly table. You are advised to periodically delete the data in the anomaly table to reduce cost and ensure good performance. • If **Rule Type** is set to **Cross-source rule**, you must enable **Generate Anomaly Data**.

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Parameter	Sub-parameter	Description
	Anomaly Table	Click **Select Database and Schema** and configure the prefix and suffix of the name of the table to export data to, select an existing table, and set abnormal fields. If no abnormal field is configured, all fields in the table are exported by default. **NOTE** You can set **Anomaly Table** to **Prefix and suffix**, **Prefix**, **Suffix**, or **Existing table**. The table prefix starts with a letter or underscore (_) and can only contain letters, digits, and underscores (_). The table suffix can contain only letters, digits, and underscores (_). If you select **Existing table** for **Anomaly Table**, you need to select a table name. The database and schema are set by default. If no table name is selected, *Database name*.**scheme.undefined** is displayed. When you set an anomaly table, the system adds suffix **err** to the table name by default.
	Output Settings	• **Output Rule Settings**: If you select this option, the quality job settings will show up in the anomaly tables so that you can view the anomaly data sources with ease. • **Output null**: If you select this option, and the preset rules are not complied, the null value will show up in anomaly tables. • **Clear abnormal data**: If you select this option, historical abnormal data of the current sub-rule will be deleted. Exercise caution when performing this operation. When the data quality job is rerun, historical data in the abnormal table is cleared.
	Anomaly Data Amount	You can choose to export all anomaly data or the specified amount of anomaly data.
	Anomaly Table SQL	This parameter is mandatory if you select **Custom rule** for **Rule Type**. You need to enter a complete SQL statement to specify the abnormal data to be exported. The system can verify the semantics of the anomaly table SQL statement.
	Viewing SQL Statement	You can click this to view the SQL statements of the anomaly table, including created and injected SQL statements.

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Parameter	Sub-parameter	Description
	View Duplicate Rules	Click it to view the following duplicate rules: • Determine the rule repetition based on tables and fields. • View the related sub-rules and quality jobs that already exist.

5. Click **Next** and set alarm information. If you have configured an alarm expression in the previous step, the configured expression is automatically displayed. If there are two or more sub-rules, you can use either of the following methods to configure alarms:

   a. Use the alarm conditions of sub-rules to report alarms.

   b. Perform mathematical and logical operations on the alarm parameter values to generate a universal alarm expression to specify whether to report alarms for jobs.

   The alarm expression supports the following logical operators, which can be enclosed by "(" and ")".

   - **+**: addition
   - **-**: subtraction
   - *****: multiplying
   - **/**: division
   - **==**: equal to
   - **!=**: not equal to
   - **>**: greater than
   - **<**: less than
   - **>=**: greater than or equal to
   - **<=**: less than or equal to
   - **!**: non
   - **||**: or
   - **&&**: and

6. Click **Next** and set the subscription information. If the SMN notification is required, enable **Notification**, and set **Notification Type** and **Topic**.

   The notification type can be **Alarm triggered** or **Run successfully**. Currently, only SMS and email are available for subscribing to topics.

   NOTE

   After notification is enabled, a notification is sent for all the subjobs of the configured notification type. If you enable alarming, you do not need to set the notifications for failures. Alarms will be automatically reported if a task fails.

   If you enable **Suppress Notifications**, you can set the condition for sending an alarm notification, that is, the number of consecutive alarms within a certain period of time (minutes). The period ranges from 1 minute to 360 minutes, and the number of consecutive times ranges from 1 to 10.

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7. Click **Next** to go to the page where you can select a scheduling mode. Currently, **Once** and **On schedule** are supported. Set parameters for scheduling periodically by referring to **Table 10-13**. Click **Submit**.

   NOTE

   1. If **Once** is selected, a manual task instance is generated. A manual task has no dependency on scheduling and must be manually triggered.
   2. If **On schedule** is selected, a periodic instance is generated. A periodic instance is an instance snapshot that is automatically scheduled when a periodic task reaches the scheduled execution time.
   3. When a periodic task is scheduled once, an instance workflow is generated. You can perform routine O&M on scheduled instance tasks, such as viewing the running status, stopping and rerunning the scheduled tasks.
   4. Only MRS clusters that support job submission through an agency support periodic scheduling of quality jobs. MRS clusters that support job submission through an agency are as follows:
      - MRS non-security cluster
      - MRS security cluster whose version is later than 2.1.0, and that has MRS 2.1.0.1 or later installed

Table 10-13 Parameters

Parameter	Description
Effective	Effective date of a scheduling task.
Cycle	The frequency at which a scheduling task is executed. Related parameters are: • Minutes • Hours • Days • Weeks **NOTE** • If **Cycle** is set to **Minutes** or **Hours**, set the start time, end time, and interval for the scheduling task. Currently, the start time is in minute for stagger scheduling. • If **Cycle** is set to **Days**, set a specified time when the scheduling task is enabled every day. • If **Cycle** is set to **Weeks**, set **Scheduling Time** and **Start from** for the scheduling task, that is, *XX* o'clock *XX* minutes on *XXX* every week.

After a quality job is created, you can view it in the job list. You can also filter jobs by job name, creator, owner, table name, and time range. The system supports fuzzy search.

After a quality job is created, you can edit, delete, run, start scheduling, and stop scheduling it.

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> **NOTE**
>
> You cannot start scheduling a one-off quality job.

Running a Quality Job

To run a quality job, perform the following operations:

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Quality Jobs**. In the right pane, locate a quality job.

Step 2 Click **Run** in the **Operation** column.

Step 3 In enterprise mode, select the development environment or production environment.

Step 4 Click **OK**.

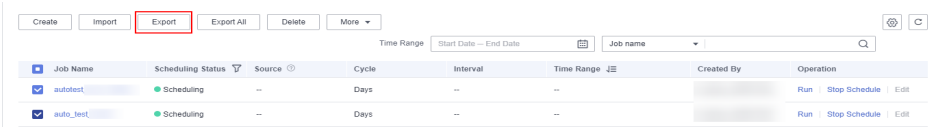
----End

Exporting Quality Jobs

You can export a maximum of 200 quality jobs. Each cell of the exported file can contain a maximum of 65,534 characters.

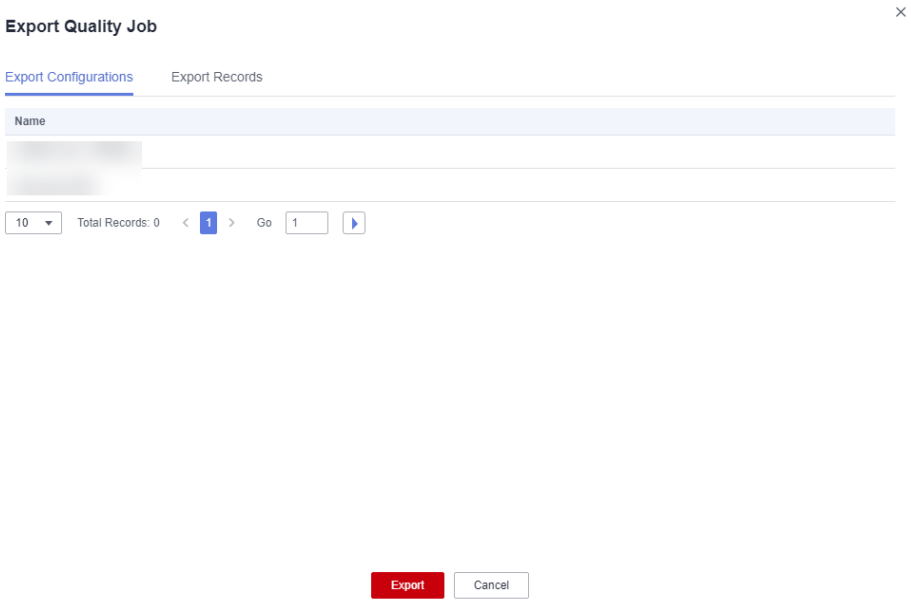
Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Quality Jobs**. In the right pane, select the quality jobs to export.

Figure 10-19 Export



Step 2 Click **Export**. The **Export Quality Job** dialog box is displayed.

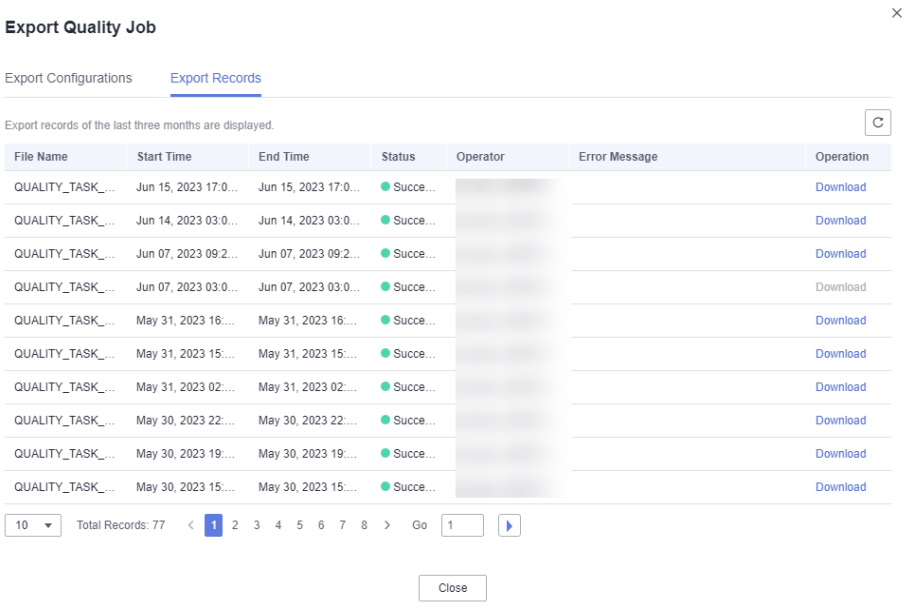
Figure 10-20 Exporting Quality Jobs



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Step 3 Click the **Export Records** tab to view the export result.

Figure 10-21 Export Records



Step 4 In the list of exported files, locate an exported quality job and click **Download** in the **Operation** column to download the Excel file of the job to the local PC.

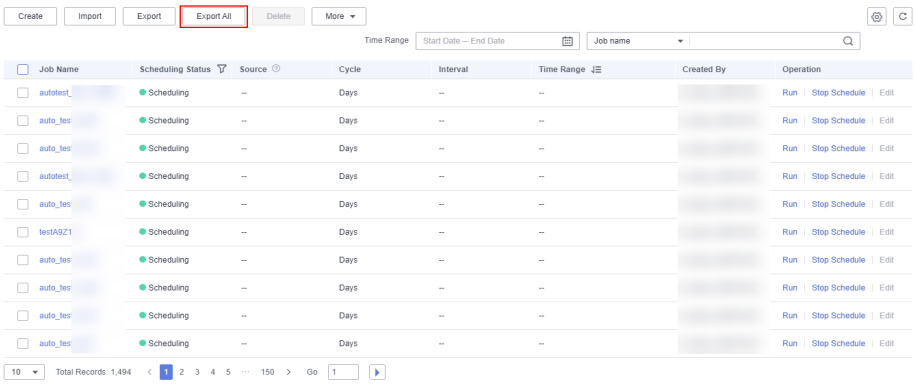
----End

Exporting All Quality Jobs

To export all quality jobs, perform the following operations: Each cell of the exported file can contain a maximum of 65,534 characters.

Step 1 Choose **Quality Monitoring** > **Quality Jobs** and click **Export All**.

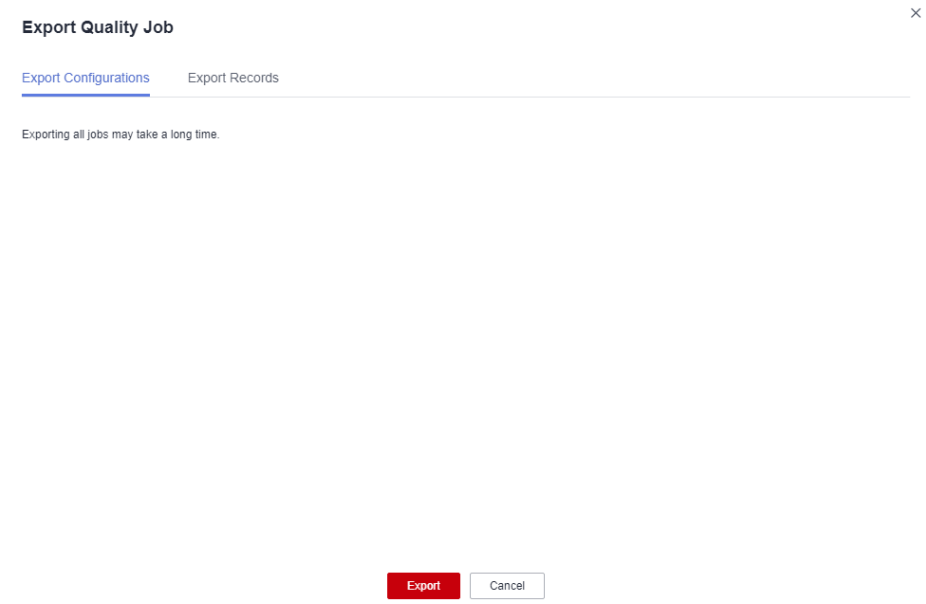
Figure 10-22 Export All



Step 2 In the displayed **Export Quality Job** dialog box, click **Export**.

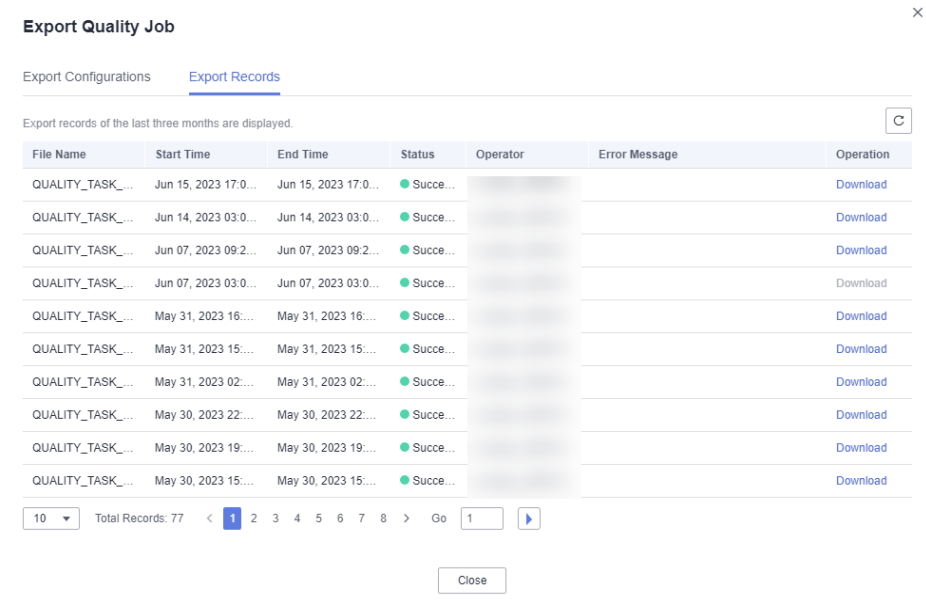
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Figure 10-23 Exporting all quality jobs



Step 3 Click the **Export Records** tab to view the export result.

Figure 10-24 Export Records



Step 4 In the list of exported files, locate an exported quality job and click **Download** in the **Operation** column to download the Excel file of the job to the local PC.

----End

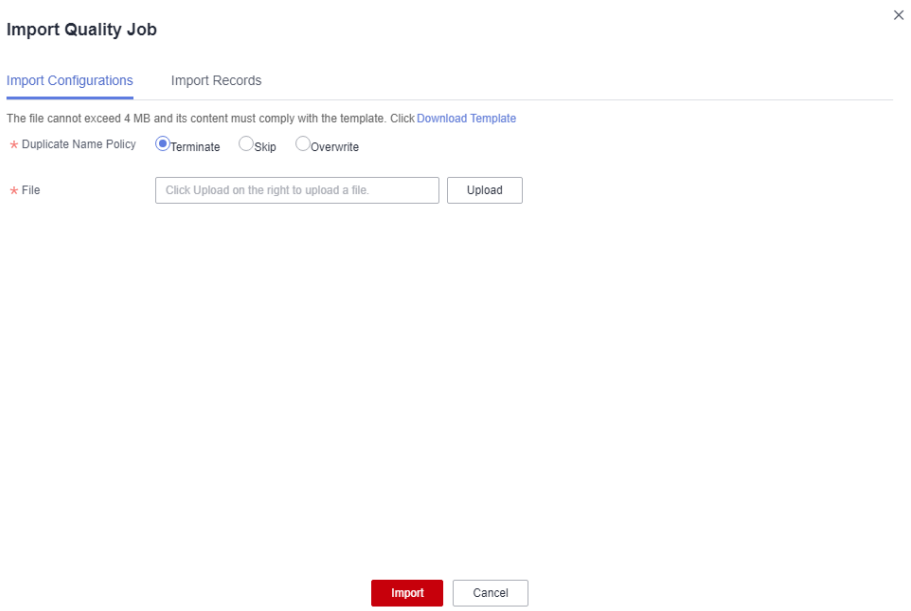
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Importing Quality Jobs

You can import a file containing a maximum of 4 MB data. Each cell of the file to be imported can contain a maximum of 65,534 characters.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Quality Jobs**. In the right pane, click **Import**. The **Import Quality Job** dialog box is displayed.

Figure 10-25 Importing quality jobs



Step 2 On the **Import Configurations** tab page, set **Duplicate Name Policy**.

- **Terminate**: If quality job names repeat, all quality jobs will fail to be imported.
- **Skip**: If quality job names repeat, the quality jobs will still be imported.
- **Overwrite**: If quality job names repeat, new jobs will replace existing ones with the same names.

  NOTE

  If you select **Overwrite**, stop job scheduling before uploading a file. Otherwise, the upload will fail.

Step 3 Click **Upload** and select the prepared data file.

NOTE

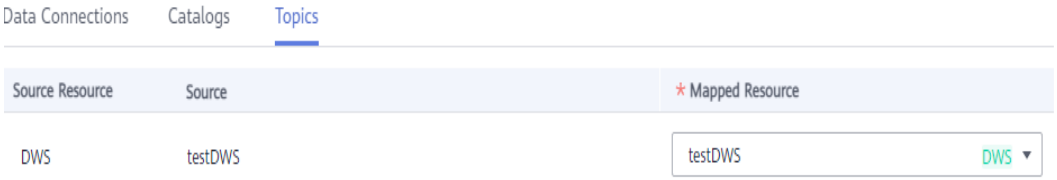
Edit the data file using either of the following methods:

- (Recommended) Click **Export** to export data and import the data to the system directly or import it after modification.
- Click **Download Template**, fill in the template with the data to import, and import the data to the system.

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Step 4 Configure resource mapping for the data connection, cluster, catalog, and topic. If you do not configure the resource mapping, the original mapping is used by default.

Figure 10-26 Configuring the resource mapping



- **Data Connection**: Select the type of the imported data connection.
- **Cluster**: If the data connection type is DLI, select the corresponding queue.
- **Directory**: Select the directory where the imported quality job is stored.
- **Topic**: If SMN is configured, you need to select a topic.

Step 5 Click **Import** to import the Excel template to the system.

Step 6 Click the **Import Records** tab to view the import records.

----End

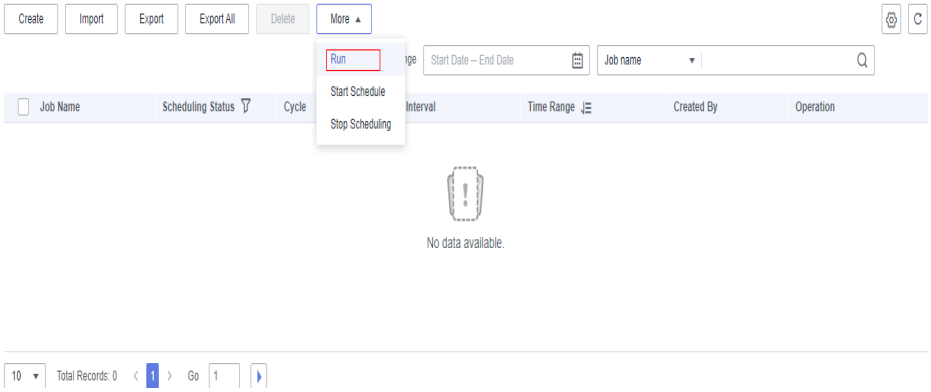
Running Quality Jobs

You can run a maximum of 200 quality jobs.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Quality Jobs**. In the right pane, select the quality jobs you want to run.

Step 2 Above the job list, click **More** and select **Run** to run the selected quality jobs.

Figure 10-27 Running jobs



Step 3 In enterprise mode, select the development environment or production environment.

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Step 4 Click **OK**.

----End

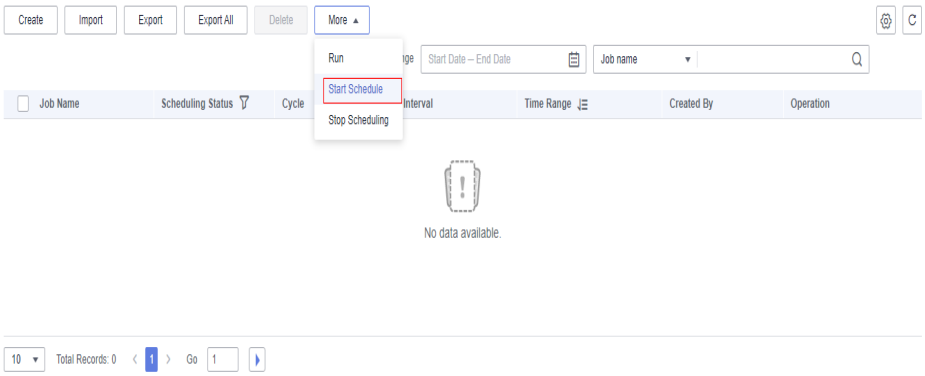
Scheduling Quality Jobs

You can schedule a maximum of 200 quality jobs at a time.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Quality Jobs**. In the right pane, select the quality jobs you want to schedule.

Step 2 Above the job list, click **More** and select **Start Schedule** to schedule the selected quality jobs.

Figure 10-28 Scheduling jobs



----End

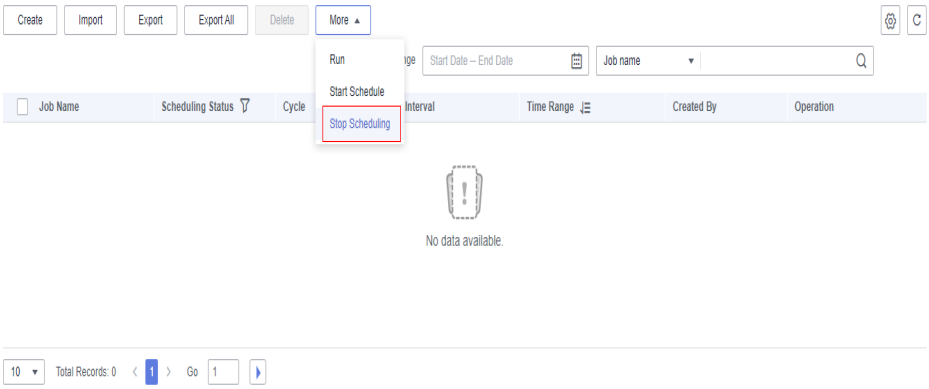
Stopping Scheduling Quality Jobs

You can stop scheduling a maximum of 200 quality jobs at a time.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Quality Jobs**. In the right pane, select the quality jobs you want to stop scheduling.

Step 2 Above the job list, click **More** and select **Stop Scheduling** to stop scheduling the selected quality jobs.

Figure 10-29 Stopping scheduling jobs



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----End

Stopping Quality Jobs

You can stop a maximum of 200 quality jobs at a time.

Only quality jobs in **Running** state can be stopped.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **O&M**. In the right pane, select the quality jobs you want to stop.

Step 2 Click **Stop**. In the displayed **Stop Instance** dialog box, confirm the instances to stop and click **Yes**.

Figure 10-30 Stopping instances

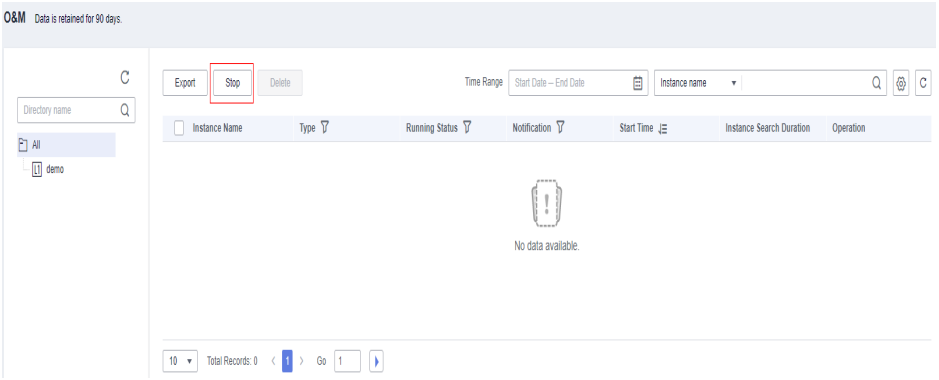
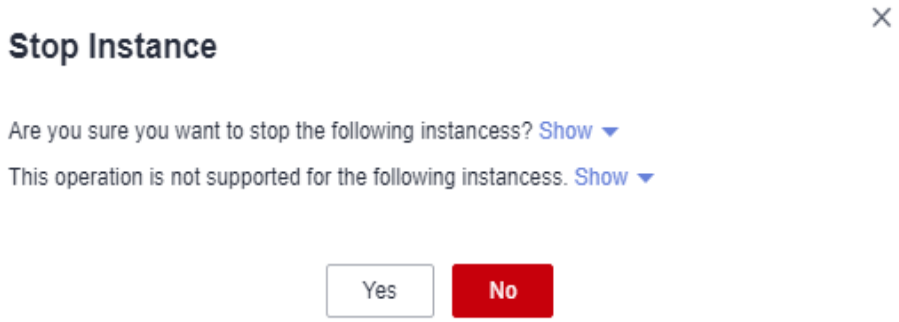


Figure 10-31 Stopping instances



----End

10.2.4 Creating a Data Comparison Job

Data comparison is critical to ensure data consistency in data development and migration. The cross-source data comparison capability is the key to checking consistency of the data before and after migration or processing.

Comparison jobs in Quality Monitoring support cross-source data comparison. You can apply created rules to two tables for quality monitoring and output the comparison result.

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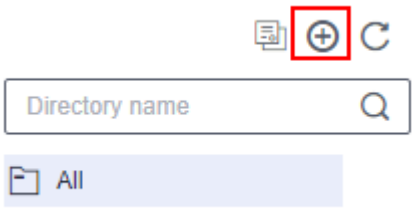
Creating a Job

1. On the DataArts Studio console, locate a workspace and click **DataArts Quality**.
2. (Optional) In the left navigation pane, choose **Quality Monitoring** > **Comparison Jobs** and create a directory. If a directory exists, you do not need to create one. Note that rule templates, quality jobs, and comparison job are in the same directory.

   Currently, you can create a directory using either of the following methods:

   Click ⊕ and enter a directory name in the displayed dialog box. In this way, you can create a maximum of seven layers of directories.

   Figure 10-32 Creating a directory

   You can also click to synchronize the **subjects in DataArts Architecture** as directories. (Only published subjects can be synchronized.) The synchronized directories are consistent with the published subjects in DataArts Architecture and are displayed by layer, such as L1 and L2.

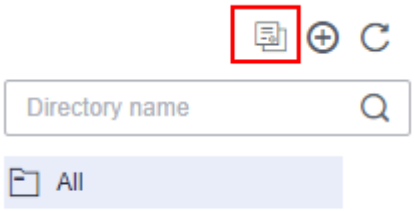
   NOTE

   1. The directories you create are not affected by the synchronization. If the name of a created directory conflicts with that of a subject:
      - If they conflict during the first synchronization, a subject layer (such as L1 and L2) is added to the name of the directory.
      - If they conflict after the subject is modified, the synchronization fails.
   2. Changes to subjects or subject layers in DataArts Architecture cannot be automatically synchronized. You must click again to synchronize them.

      If a subject or subject layer in DataArts Architecture is deleted and synchronized to DataArts Quality, the corresponding directory will not be deleted. Instead, the subject attributes will be deleted from the directory.
   3. After the synchronization is complete, the system automatically displays the synchronization result details. You can view the names of the subjects that fail to be synchronized.

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Figure 10-33 Synchronizing subjects from DataArts Architecture



3. On the **Quality Jobs** page, click **Create**. In the displayed dialog box, set the parameters listed in **Table 10-14**.

Table 10-14 Comparison job parameters

Parameter	Description
Name	Comparison job name
Description	Information to better identify a comparison job. It cannot exceed 1,024 characters.
Tag	Select desired tags from the list of tags that were defined Data Map. If Data Map is disabled, tags do not take effect.
Directory	The directory for storing the comparison job to create. You can select a created directory. For details about how to create a directory, see **(Optional) Creating a Directory**.
Job Level	The options are **Warning**, **Minor**, **Major**, and **Critical**. The job level determines the template for sending notification messages.
Timeout	Timeout duration. Enter a value from 5 to 1440. The unit is minute. If this parameter is left empty or the default value 1440 is used, the timeout duration is 24 hours by default and can be changed.

4. Click **Next** to go to the **Define Rule** page. Click on the rule card and configure it based on **Table 10-15**. You can also add comparison rules.

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Figure 10-34 Configuring rules for a comparison job

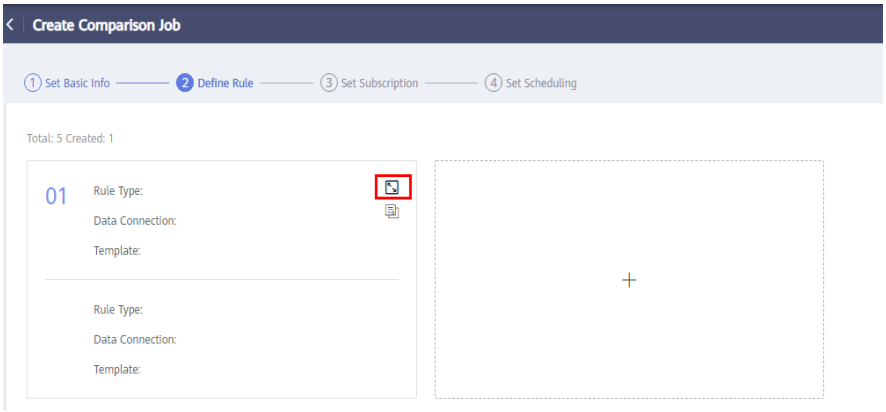


Table 10-15 Parameters for configuring a rule template

Module	Parameter	Description
Basic Information	Subjob Name	In the job execution result, each rule corresponds to a subjob. You are advised to set the subjob information so that you can view the job execution result and locate faults through logs more easily.
	Description	Information to better identify the subjob It can contain a maximum of 1,024 characters.
Object	Rule Type	The options are **Table rule**, **Field rule**, and **Custom rule**. Field-level rules can be used to configure monitoring rules for specific fields in tables. For example, set this parameter to **Table rule**, and set other configuration items on the page to table-level rule configuration items correspondingly. The rule type of the destination object is automatically generated based on that of the source object.

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Module	Parameter	Description

	Data Connection	Source and destination objects support the following data connection types: DWS, MRS Hive, MRS Spark, DLI, RDS (MySQL and PostgreSQL), Hetu, Oracle, Doris, MRS Spark (Hudi), and MRS ClickHouse.
		Select a created data connection from the drop-down list box.
		NOTE
		• Rules are based on data connections. Therefore, you must create data connections in **Management Center** before creating data quality rules. For MRS Hive and MRS Spark data sources, if **Rule Type** is set to **Table rule** or **Field rule**, **Connection Type** must be set to **Proxy connection** (**MRS API connection** is not supported) during the creation of connections to these data sources.
		• For MRS Hive and MRS Spark data sources, select **MRS API connection** or **Proxy connection**.
		  • **MRS API connection**: An MRS API is used for submission. By default, historical jobs are submitted through MRS APIs. You are advised to keep the default settings when editing the job.
		  • **Proxy connection**: A username and a password are used for submission. You are advised to select this mode for new jobs to prevent job submission failures caused by permission issues.
		• The strict mode of the MRS Hive component is not supported.

	Database	Select the database to which the configured data quality rules are applied. **NOTE** • The database is tailored to the created data connection. • When **Rule Type** is set to **Custom rule**, set the data object to the corresponding database.
	Data Object	The data table selected for the source object is compared with the data table of the destination object on the right. Select the table to which the configured comparison rule applies. **NOTE** The table is closely related to the database. The database is tailored to the created data connection.
	SQL	This parameter is mandatory if you select **Custom rule** for **Rule Type**. Enter a complete SQL statement to define how to monitor the quality of data objects.

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Module	Parameter	Description
	Default Parameter Value	Input parameters for the custom SQL statement. The sequence of the parameters must be consistent with that of the default parameter values (when a data quality job is executed in DataArts Factory). **NOTE** When a data quality operator is scheduled by a data development job, the parameter values defined in the data development job are preferentially used.
Compute Engine	Queue Name	Select the engine for running the comparison job. This parameter is valid only for Hive, DLI, or Hetu data connections. Enter a queue name. If the connection type is Hetu, and the rule type is not database rule, the queue name is the resource queue name of the Hetu engine. To view the resource queue name of the Hetu engine, log in to FusionInsight Manager of MRS and click HetuEngine in the navigation pane. In the Basic Information area, click the HSConsole WebUI link and view the resource queue name of the Hetu engine in the computing instance list.
Rule Template	Template	This parameter defines how to monitor the quality of data objects. The template name of the source object contains the system rule template and custom rule template. The template name of the destination object is automatically generated based on the rule type of the source object. **NOTE** The template type is closely related to the rule type. For details, see **Table 10-10**. In addition to system rule templates, you can select the custom rule template created in **Creating a Data Quality Rule**. If **Rule Type** is set to **Field rule** and **Rule Template** is set to **Regular expression verification** or **Regular expression verification ignore null**, the regular expression rule can contain a maximum of 1,024 characters.
	Version	This parameter is required only when you select a custom rule template. Select the version of the published custom rule template.
Object Scope	Scanning Scope	You can select **All** or **Partial**. The default value is **All**. If you want only part of data to be computed or comparison jobs to be executed periodically based on a timestamp, you can set a where clause for scanning.

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Module	Parameter	Description

	WHERE Clause	Enter a WHERE clause. The system will scan the data that matches the clause.
		NOTE
		Add **and** at the beginning of the clause for syntax verification during SQL statement generation. Otherwise, a syntax error will be reported.
		For example, if you want to filter out the data for which the value range of the **age** field is (18, 60], enter the following WHERE clause:
		`and age > 18 and age <= 60`
		You can also enter a dynamic SQL expression. For example, if you want to filter out the data generated 24 hours ago based on the **time** field, enter the following WHERE clause:
		`and time >= (date_trunc('hour', now()) - interval '24 h') and time <= (date_trunc('hour', now()))`

	Default Parameter Value	This parameter is required when you select **Partial** for **Scanning Scope**. Enter the default values of the parameters in the where clause text box. **NOTE** The default parameter value is preferentially transferred by DataArts Factory. If the value is empty, the quality job may encounter an error. After DataArts Factory transfers parameters to DataArts Quality and the job is executed, you can click **View SQL** to view the parameters and their values transferred by DataArts Factory.

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Module	Parameter	Description
Alarm Condition	Alarm Expression	Set this parameter if you want to set an alarm condition for the current rule. After the alarm conditions are configured, the system determines whether to generate an alarm based on the value of **Parameter** and the alarm condition. Apart from a single alarm expression, you can also use more complex alarm conditions consisting of logical operators. The alarm expression supports the following logical operators, which can be enclosed by "(" and ")". ● **+**: addition ● **-**: subtraction ● *****: multiplying ● **/**: division ● **==**: equal to ● **!=**: not equal to ● **>**: greater than ● **<**: less than ● **>=**: greater than or equal to ● **<=**: less than or equal to ● **!**: non ● **||**: or ● **&&**: and ● **abs**: absolute value For example, if **Rule Template** of the source and destination of the comparison job is set to **Table Rows**, you can configure the alarm expression as follows: ● To configure an alarm to be generated when the number of rows in the source table is less than 100, enter **${1_1}<100**, where **${1_1}** indicates the total number of rows in the source table. ● To configure an alarm to be generated when the number of rows in the source table is not equal to that in the destination table, enter **${1_1}!= ${2_1}**, where **${1_1}** indicates the total number of rows in the source table and **${2_1}** indicates the total number of rows in the destination table. ● To configure an alarm to be generated when the number of rows in the source table is less than 100 or when the number of rows in the source table is not equal to that in the destination

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Module	Parameter	Description
		table, enter **(${1_1}<100)\|\|(${1_1}!=${2_1})**, where **${1_1}** and **${2_1}** indicate the total number of rows in the source and destination tables, respectively, and **\|\|** indicates that an alarm is generated if either condition is met. • To configure an alarm to be generated when the absolute value of the number of rows in the source table minus the number of rows in the destination table divided by the number of rows in the source table is greater than 0.1, enter **abs(${1_1}-${2_1})/${1_1}>0.1**, where **${1_1}** and **${2_1}** indicate the total number of rows in the source and destination tables, respectively.
	Parameter	The value of this parameter is obtained from the output of the rule template. If you can click a parameter, the expression of the parameter is displayed in **Alarm Expression**. For example, if **Template** is set to **Table Rows**, **${1_1}** is displayed in **Alarm Expression** when you click alarm parameter **Table Rows**.

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Module	Parameter	Description
	Logical Operator	This parameter is optional. You can perform logical operations on the result of an alarm expression to generate more complex alarm conditions. You can move the cursor between two alarm expressions in **Alarm Expression** and click one of the following operators to insert them. You can also manually enter an operator. The current expression supports the following logical operators which can be enclosed by brackets (). ● **+**: addition ● **-**: subtraction ● ***:** multiplying ● **/**: division ● **==**: equal to ● **!=**: not equal to ● **>**: greater than ● **<**: less than ● **>=**: greater than or equal to ● **<=**: less than or equal to ● **!**: non ● **||**: or ● **&&**: and ● **abs**: absolute value For example, if **Template** is **Table Rows** and if you want to generate an alarm when the number of rows in the source table is less than 100 or when the number of rows in the source table is not equal to that in the destination table, enter **(${1_1}<100)||(${1_1}!=${2_1})**, where **${1_1}** and **${2_1}** indicate the total number of rows in the source and destination tables, respectively, and **||** indicates that an alarm is generated if either condition is met.

5. Click **Next** and set the subscription configuration. If the SMN notification is required, enable **Notification**, and set **Notification Type** and **Topic**. See **Figure 10-35**.

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Figure 10-35 Subscription configuration



NOTE

When notification is enabled, a notification is sent for all the subjobs of the configured notification type.

If you enable alarming, you do not need to set the notifications for failures. Alarms will be automatically reported if a task fails.

Currently, only SMS and email are available for subscribing to topics.

You can select **Alarm triggered** or **Run successfully** for **Notification Type**.

If you enable **Suppress Notifications**, you can set the condition for sending an alarm notification, that is, the number of consecutive alarms within a certain period of time (minutes). The period ranges from 1 minute to 360 minutes, and the number of consecutive times ranges from 1 to 10.

6. Click **Next** to go to the page where you can select a scheduling mode. Currently, **Once** and **On schedule** are supported. Set parameters for scheduling periodically by referring to **Table 10-16**. Click **Submit**.

NOTE

1. If **Once** is selected, a manual task instance is generated. A manual task has no dependency on scheduling and must be manually triggered.
2. If **On schedule** is selected, a periodic instance is generated. A periodic instance is an instance snapshot that is automatically scheduled when a periodic task reaches the scheduled execution time.
3. When a periodic task is scheduled once, an instance workflow is generated. You can perform routine O&M management on scheduled instance tasks, such as viewing the running status, stopping and rerunning the scheduled tasks.
4. Only MRS clusters that support job submission through an agency support periodic scheduling of comparison jobs. MRS clusters that support job submission through an agency are as follows:
   - Non-security MRS cluster
   - MRS security cluster whose version is later than 2.1.0, and that has MRS 2.1.0.1 or later installed

Table 10-16 Parameters for setting the scheduling mode

Parameter	Description
Effective	Effective date of a scheduling task.

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Parameter	Description
Cycle	The frequency at which a scheduling task is executed. Related parameters are: • Minutes • Hours • Days • Weeks **NOTE** • If **Cycle** is set to **Minutes** or **Hours**, set the start time, end time, and interval for the scheduling task. • If **Cycle** is set to **Days**, set the start time of the scheduling task. • If **Cycle** is set to **Weeks**, set **Scheduling Time** and **Start from** for the scheduling task, that is, *XX* o'clock *XX* minutes on *XXX* every week.

After a comparison job is created, you can view it in the job list. You can also filter jobs by job name, creator, and time range. The system supports fuzzy search.

After a comparison job is created, you can edit, delete, run, start scheduling, and stop scheduling it.

NOTE

You cannot start scheduling a one-off comparison job.

Running a Comparison Job

To run a comparison job, perform the following operations:

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Comparison Jobs**. In the right pane, locate a comparison job.

Step 2 Click **Run** in the **Operation** column.

Step 3 In enterprise mode, select the development environment or production environment.

Step 4 Click **OK**.

----End

Exporting Comparison Jobs

You can export a maximum of 200 comparison jobs. Each cell of the exported file can contain a maximum of 65,534 characters.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Comparison Jobs**. In the right pane, select the comparison jobs to export.

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Step 2 Click **Export**. The **Export Comparison Job** dialog box is displayed.

Step 3 Click **Export** to switch to the **Export Records** tab.

Step 4 In the list of exported files, locate an exported comparison job and click **Download** in the **Operation** column to download the Excel file of the job to the local PC.

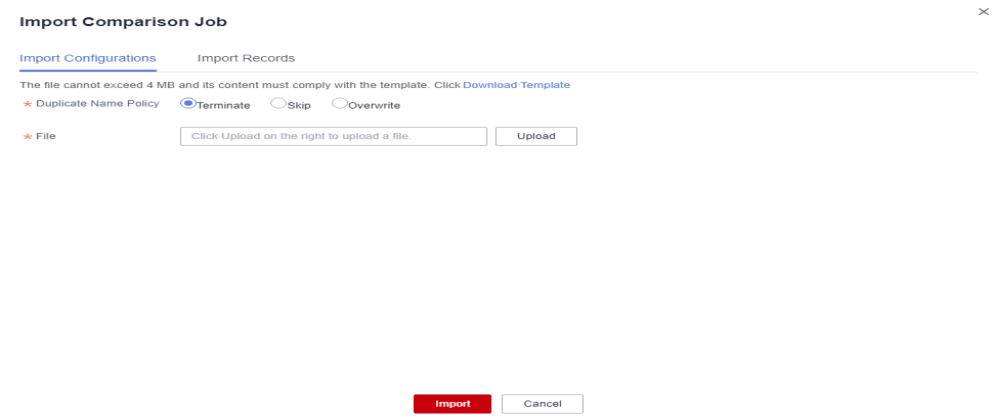
----End

Importing Comparison Jobs

You can import a file containing a maximum of 4 MB data. Each cell of the file to be imported can contain a maximum of 65,534 characters.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Comparison Jobs**. In the right pane, click **Import**. The **Import Comparison Job** dialog box is displayed.

Figure 10-36 Importing comparison jobs



Step 2 On the **Import Configurations** tab page, set **Duplicate Name Policy**.

- **Terminate**: If comparison job names repeat, all comparison jobs will fail to be imported.
- **Skip**: If comparison job names repeat, the comparison jobs will still be imported.
- **Overwrite**: If comparison job names repeat, new jobs will replace existing ones with the same names.

  NOTE

  If you select **Overwrite**, stop job scheduling before uploading a file. Otherwise, the upload will fail.

Step 3 Click **Upload** and select the prepared data file.

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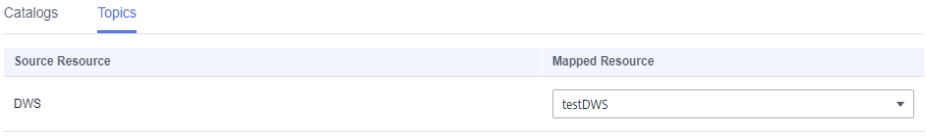
NOTE

Edit the data file using either of the following methods:

- (Recommended) Click **Export** to export data and import the data to the system directly or import it after modification.
- Click **Download Template**, fill in the template with the data to import, and import the data to the system.

Step 4 Configure resource mapping for the data connection, cluster, directory, and topic. If you do not configure the resource mapping, the original mapping is used by default.

Figure 10-37 Configuring the resource mapping



- **Data Connection**: Select the type of the imported data connection.
- **Cluster**: If the data connection type is DLI, select the corresponding queue.
- **Directory**: Select the directory where the imported comparison job is stored.
- **Topic**: If SMN is configured, you need to select a topic.

Step 5 Click **Import** to import the Excel template to the system.

Step 6 Click the **Import Records** tab to view the import records.

----End

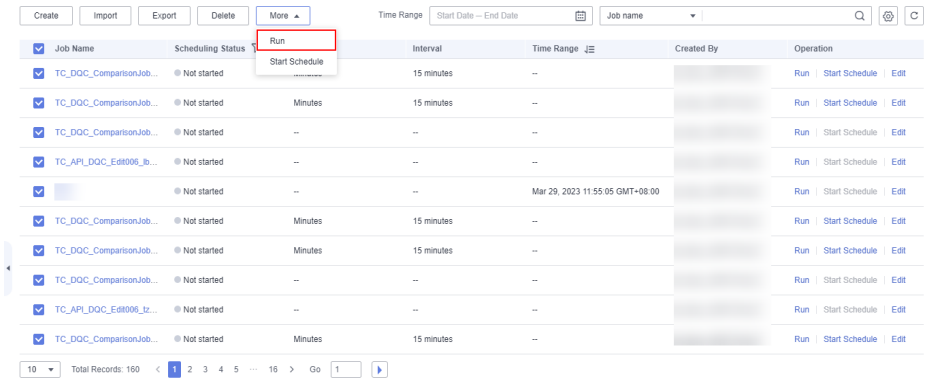
Running Comparison Jobs

You can run a maximum of 200 comparison jobs at a time.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Comparison Jobs**. In the right pane, select the comparison jobs you want to run.

Step 2 Above the job list, click **More** and select **Run** to run the selected comparison jobs.

Figure 10-38 Running jobs



Step 3 In enterprise mode, select the development environment or production environment.

Step 4 Click **OK**.

----End

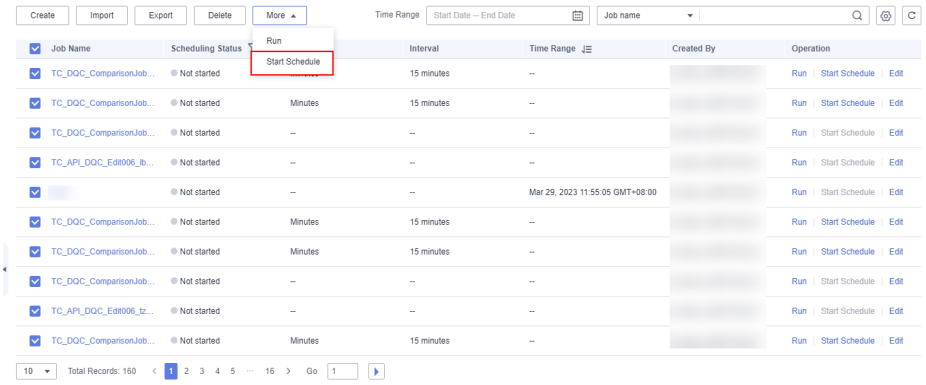
Scheduling Comparison Jobs

You can schedule a maximum of 200 comparison jobs at a time.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Comparison Jobs**. In the right pane, select the comparison jobs you want to schedule.

Step 2 Above the job list, click **More** and select **Start Schedule** to schedule the selected comparison jobs.

Figure 10-39 Scheduling jobs



----End

Stopping Scheduling Comparison Jobs

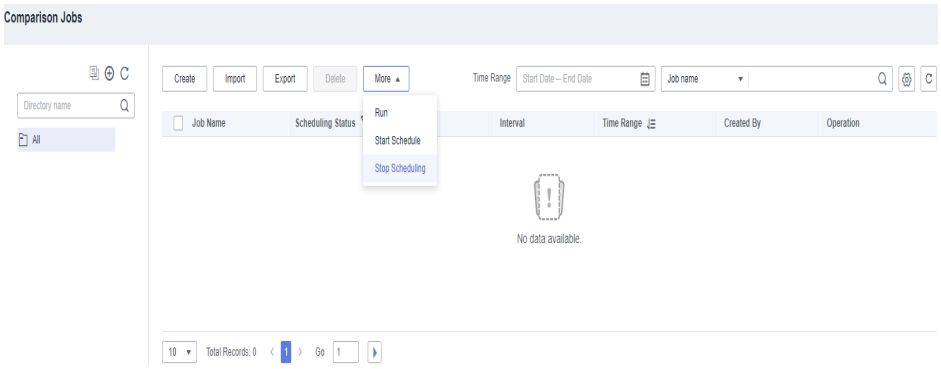
You can stop scheduling a maximum of 200 comparison jobs at a time.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **Comparison Jobs**. In the right pane, select the comparison jobs you want to stop scheduling.

Step 2 Above the job list, click **More** and select **Stop Scheduling** to stop scheduling the selected comparison jobs.

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Figure 10-40 Stopping scheduling jobs



----End

Stopping Comparison Jobs

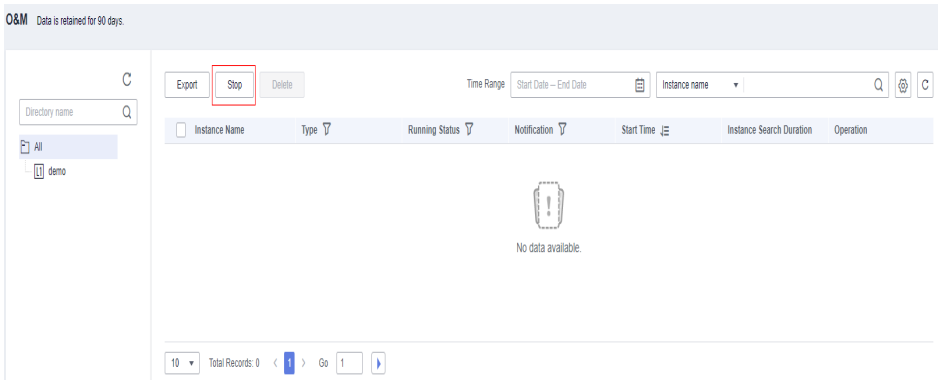
You can stop a maximum of 200 comparison jobs at a time.

Only comparison jobs in **Running** state can be stopped.

Step 1 In the left navigation pane on the **DataArts Quality** page, choose **Quality Monitoring** > **O&M**. In the right pane, select the comparison jobs you want to stop.

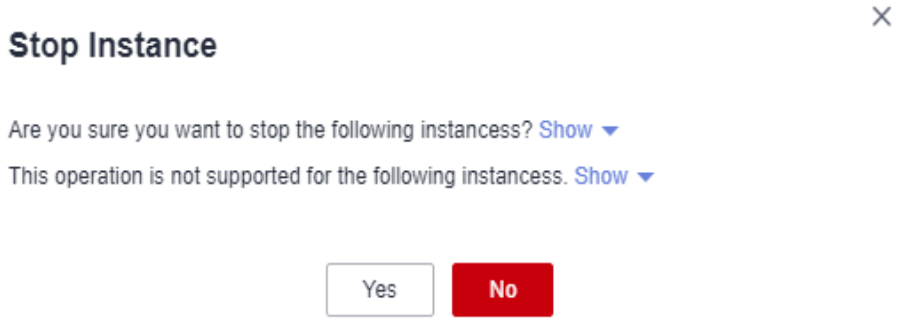
Step 2 Click **Stop**. In the displayed **Stop Instance** dialog box, confirm the instances to stop and click **Yes**.

Figure 10-41 Stopping instances



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Figure 10-42 Stopping instances



----End

10.2.5 Viewing Job Instances

GUI Description

The following figure shows the areas and buttons on the **O&M** page.

Figure 10-43 O&M page

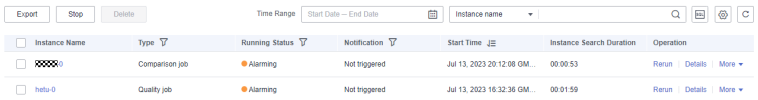


Table 10-17 O&M page

No.	Area	Description
1	Navigation bar	Contains the storage directory of data quality rules. You can store rules in different directories tailored to service requirements. The number next to each directory indicates the number of rule instances stored in the directory.
2	List of rule instances	Displays the instance name, type, running status, and running result.
3	Management area	Provides buttons for exporting, deleting, and stopping selected instances.
4	Search area	• Displays rule instances based on specified conditions. For example, you can display rule instances for a specified time range. • Displays a list of instances according to the handler or instance name. Fuzzy search is supported.

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No.	Area	Description
5	Concurrent SQL statements	Click **SQL**. In the displayed **Configure Concurrent SQL Statements for a Connection** dialog box, set the number of concurrent SQL statements. Enter a value from 10 to 1,000. Click **OK**. **NOTE** If the maximum number of SQL statements that can be executed for a data connection has been reached, the excess SQL statements will be queued.

Table 10-18 List of rule instances

Parameter	Description
Instance Name	Consists of a rule name and a number. The larger the number is, the later the instance is created.
Type	Displays the job type. The value can be **Quality Job** or **Comparison Job**.
Running Status	Displays the running status of an instance, such as **Successfully**, **Failed**, **Running**, and **Alarming**. In the right pane, you can view the detailed run logs of the rule instances. ● **Successfully**: The instance stops normally and the running result meets the expectation. ● **Failed**: The instance stops unexpectedly. ● **Alarming**: The instance stops normally, but the running result does not meet the expectation. ● **Running**: The instance is running, but no running result is displayed. ● **Timeout**: The instance has timed out and is in Failed state.
Notification	Displays the notification status of an instance, such as **Successfully**, **Failed**, and **Not triggered**.
Operator	Displays the operator of the instance.
Created	Displays the time when the instance was created.
Start Time	Displays the time when the instance starts to run. The start time can be sorted in ascending or descending order.
Running Duration	Displays the running duration of the instance.
End Time	Displays the time when the instance execution is complete. The end time can be sorted in ascending or descending order.
Handled By	Displays the handler of the instance.
Rerun	Allows you to run a rule instance again.

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Parameter	Description
Details	Displays the execution results and logs of job instances. • **Quality Job Result** In the running result of a quality job, you can query the running status (normal or alarming) of each rule. If the quality job status is alarming, you can view the rule that triggers the alarm. The quality job running result can contain statuses of subjobs, which can be filtered by name or status. The execution result of a custom SQL statement can display a maximum of 300 data records. The excess part will be automatically truncated. A maximum of 10,000 records can be exported. • **Comparison Job Result** In the running result, the left pane displays the execution result of the rule for source table rows, and the right pane displays the execution result of the rule for destination table rows. The error rate indicates the difference between the number of rows of the source and destination tables. If the error rate is 0, the source and destination tables have the same number of rows.
More > Rectify	Allows you to perform further processing on a rule instance. For example, you can **Provide defects directly**, **Close defects**, or **Specify a user to rectify fault**. The above operations can be performed only when you are the handler of the instance.
More > Refresh Job Status	Refresh the job status.

More Operations

- Exporting job instances

  Select job instances and click **Export**. In the displayed **Export Instance Running Results** dialog box, click **Export**. On the **Export Records** tab page, you can check whether the selected instances are successfully exported. You can also download the job instances that have been exported.
- Deleting job instances

  Select job instances and click **Delete**.
- Stopping job instances

  Select job instances and click **Stop**.
- Rerunning a job instance

  Locate a job instance and click **Rerun** in the **Operation** column.

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10.2.6 Viewing Data Quality Reports

You can query the quality reports of business metrics and data objects to determine whether their quality meets the requirements.

NOTE

Quality reports include technical reports and business reports.

Technical reports measure the execution results of quality jobs and contain data connections, databases, table names, and scores.

Business reports measure the execution results of quality jobs associated with subjects in DataArts Architecture and contain subject area groups, subject areas, business objects, table names, and scores.

Viewing Data Quality Scores in a Technical Report

The full quality score can be set to 5, 10, or 100 points. By default, a five-point scale is used for quality scoring based on table-associated rules. Scores in different dimensions, such as tables and databases, are calculated based on the weighted average values of rule scores in different dimensions.

You can query the scores of databases, tables, and table-associated rules. For details on the calculation formulas, see **Table 10-19**.

Table 10-19 Formulas for calculating scores

Object	Formula
Rule	When a quality job that contains a percentage-related rule (either built-in or custom) is created, a quality report can be generated. • Percentage-related rules can be classified into positive rules and negative rules. For a positive rule, the higher the percentage is, the better the data quality is. For a negative rule, the higher the percentage is, the poorer the data quality is. Rules that contain the unique value percentage, duplicate value percentage, and valid percentage are positive rules, and rules that contain the null value percentage are negative rules. • Positive rule score = Number of data rows that meet the rule/Total number of data rows x 5. • Negative rule score = (1 - Number of data rows that meet the rule/Total number of data rows) x 5.
Table	The table score is calculated as follows: ∑(Scores of all rules associated with the table x Rule weight)/∑Rule weight.
Database	Weighted average value of the scores of all data tables in the database, that is, ∑Scores of all data tables in the database/Number of tables.
Data connection	Weighted average value of the scores of all databases in the data connection, that is, ∑Scores of all databases in the data connection/Number of databases.

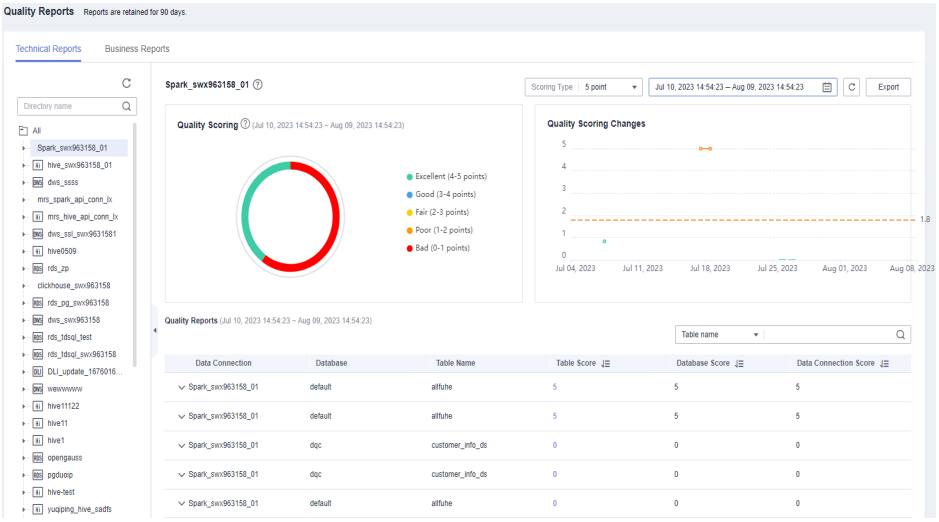
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Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Quality**.

Step 2 Choose **Quality Monitoring** > **Quality Job** in the left navigation bar.

Step 3 On the **Technical Reports** page, select a data connection and set a time range (a maximum of 30 days).

Figure 10-44 Selecting a data connection

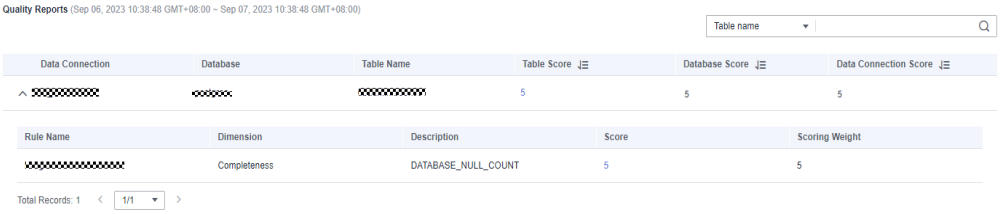


NOTE

- Take the full score 5 points as an example. Points 4 to 5: excellent; 3 to 4: good; 2 to 3: unqualified; 1 to 2: poor; 0 to 1: very poor.
- The quality score data of a day is generated in the early morning of the next day.
- In the **Quality Scoring Changes** area, the solid line consists of the quality scores of the end date and the previous seven days, and the dashed line indicates the average quality score of these days.
- If the job is executed multiple times on a day, the last score is used as the quality score of the day.

Step 4 Click the score link in the **Table Score** column to expand the scores of the rules associated with the table.

Figure 10-45 Viewing the rule score



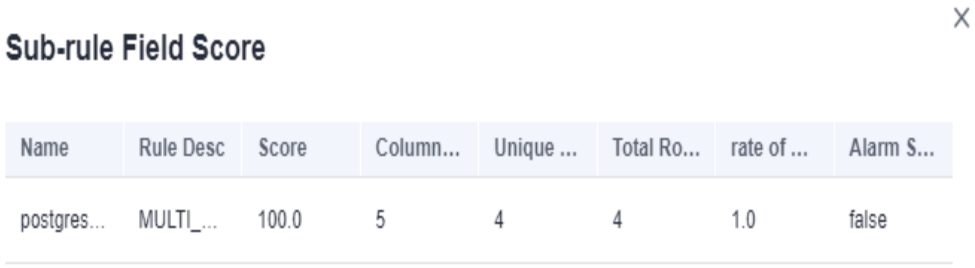
NOTE

The rule name is the name of the running instance. If a job runs multiple times, the name of the latest instance is used. If a running instance contains multiple sub-instances, each sub-instance has a record.

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Step 5 Click the score link in the **Rule Score** column to expand the scores of the fields associated with the rule.

Figure 10-46 Table-associated rule scores



----End

Viewing Business Quality Scores in a Business Report

The full quality score can be set to 5, 10, or 100 points. By default, a five-point scale is used for quality scoring based on table-associated rules. The scores in different dimensions, such as tables, business objects, and subject areas, are calculated based on the weighted average values of rule scores in different dimensions.

You can query the quality scores of subject area groups, subject areas, business objects, tables, and table-associated rules. For details on the calculation formulas, see **Table 10-20**.

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Table 10-20 Formulas for calculating scores

Object	Formula
Rule	When a quality job that contains a percentage-related rule (either built-in or custom) is created, a quality report can be generated. • Percentage-related rules can be classified into positive rules and negative rules. For a positive rule, the higher the percentage is, the better the data quality is. For a negative rule, the higher the percentage is, the poorer the data quality is. Rules that contain the unique value percentage, duplicate value percentage, and valid percentage are positive rules, and rules that contain the null value percentage are negative rules. • Positive rule score = Number of data rows that meet the rule/Total number of data rows x Full score (5, 10, or 100 points). • Negative rule score = (1 – Number of data rows that meet the rule/Total number of data rows) x Full score (5, 10, or 100 points). • If the table is empty (the total number of rows is 0), the positive rule score is fixed at the full score and the negative rule score is fixed at 0 points.
Table	The table score is calculated as follows: ∑(Scores of all rules associated with the table x Rule weight)/∑Rule weight.
Business object	Weighted average value of the scores of all tables under the business object, that is, ∑Scores of all tables under the business object/Number of tables.
Subject area	Weighted average value of scores of all business objects in the subject area, that is, ∑Scores of all business objects in the subject area/Number of business objects.
Subject area group	Average weighted value of the scores of all subject areas in the group, that is, ∑Scores of all subject areas in the group/Number of subject areas.

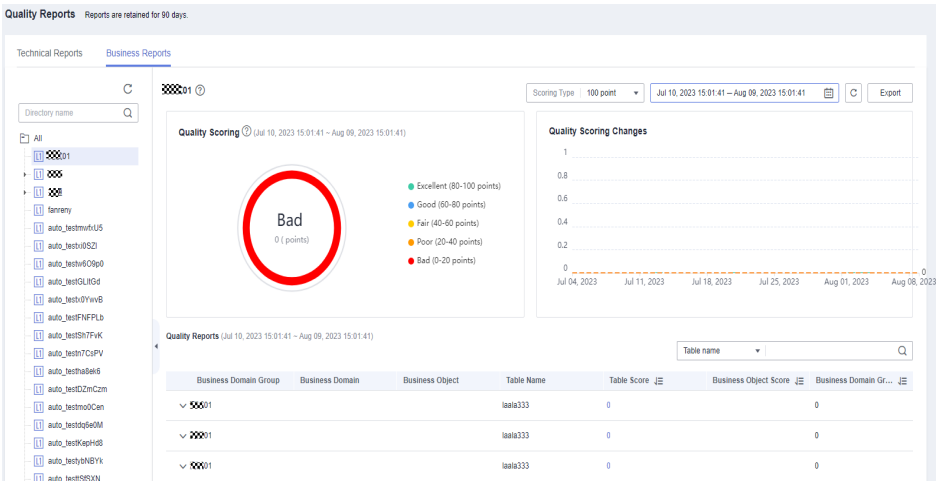
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Quality**.

Step 2 Choose **Quality Monitoring** > **Quality Job** in the left navigation bar.

Step 3 Click the **Business Reports** tab, and select a subject and an end date to query the quality scores of the end date and the previous seven days, as shown in **Figure 10-47**.

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Figure 10-47 Business object



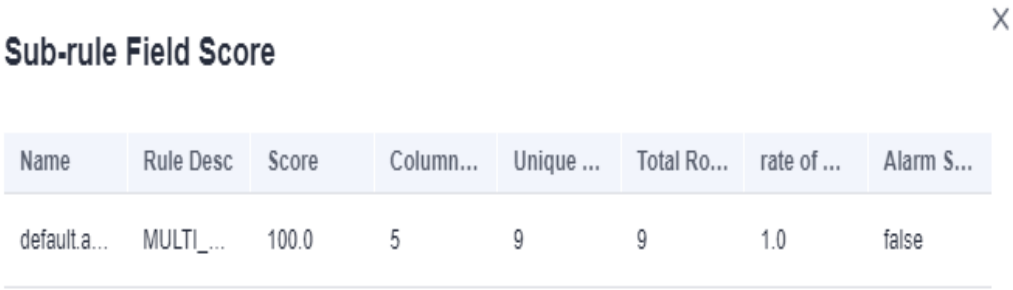
NOTE

- Take the full score 5 points as an example. Points 4 to 5: excellent; 3 to 4: good; 2 to 3: fair; 1 to 2: qualified; 0 to 1: unqualified.
- The quality score data of a day is generated in the early morning of the next day.
- In the **Quality Scoring Changes** area, the solid line consists of the quality scores of the end date and the previous seven days, and the dashed line indicates the average quality score of these days.
- If the job is executed multiple times on a day, the last score is used as the quality score of the day.

Step 4 Click the score link in the **Table Score** column to expand the scores of the rules associated with the table.

Step 5 Click the score link in the **Rule Score** column to expand the scores of the fields associated with the rule.

Figure 10-48 Table-associated rule scores



----End

Exporting Quality Reports

You can export a quality report in either of the following ways:

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- If the OBS service is available, the data is exported to the associated OBS bucket by default.

  NOTE

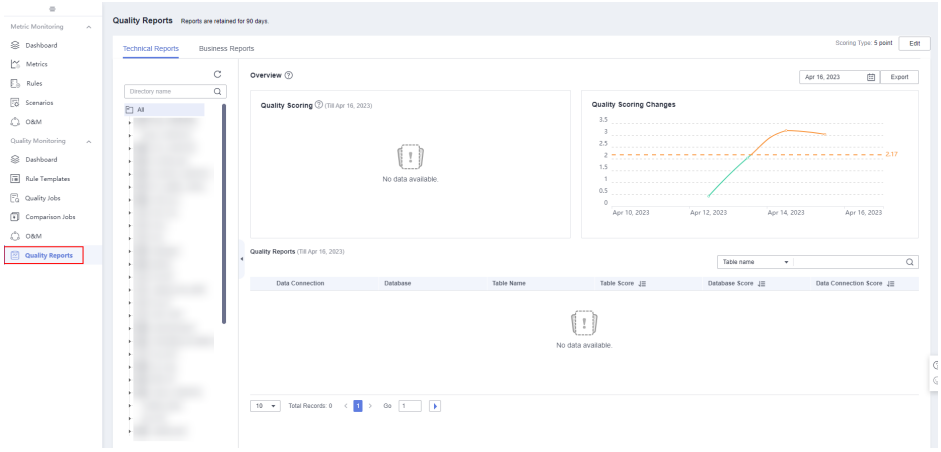
  - As quality reports contain a large amount of data, a single exported file can contain a maximum of 2,000 fields. Therefore, there may be multiple exported files in the OBS bucket.
  - The exported report is available only in the current workspace.

- If the OBS service is unavailable, the data is exported to a local path by default.

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Quality**.

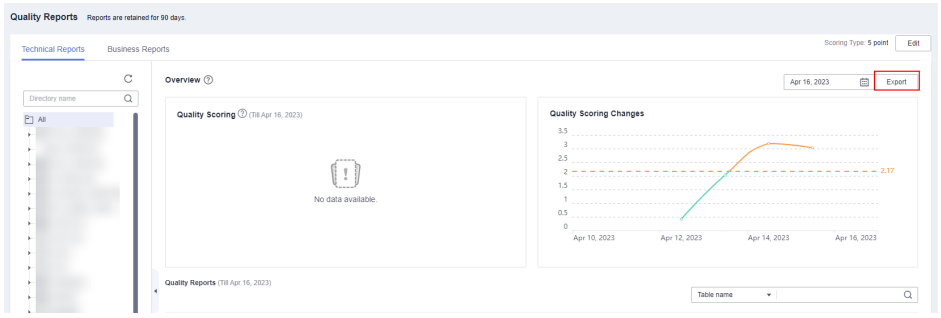
Step 2 Choose **Quality Monitoring** > **Quality Job** in the left navigation bar.

Figure 10-49 Quality Reports page



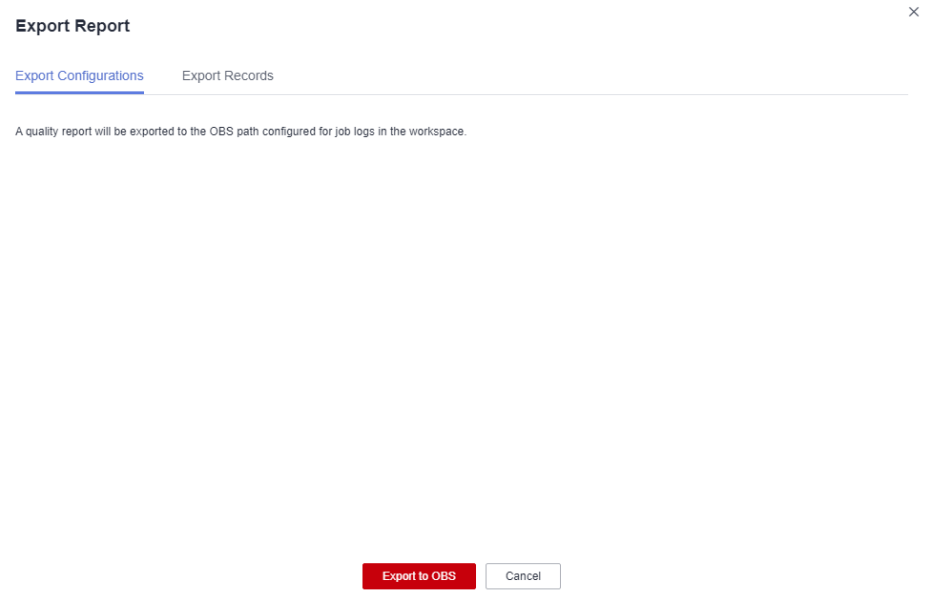
Step 3 In the upper right corner of the page, click **Export**.

Figure 10-50 Export



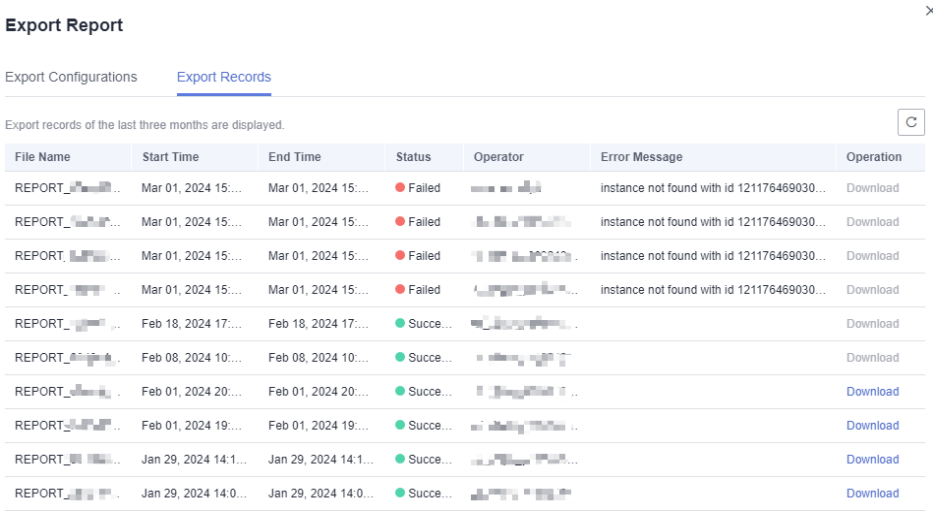
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Figure 10-51 Export to OBS



Step 4 Click the **Export Records** tab to view the export result. You can click **Download** to download a report. If the exported report file is too large, you can directly download the file.

Figure 10-52 Export Records



----End

Refreshing Data Immediately

After a quality job and a comparison job are complete, you can refresh data immediately to obtain the temporary data quality report from 00:00 to the current time. In the early morning of the next day, the quality report scheduling task starts to be executed, which generates the full data quality report for the previous day.

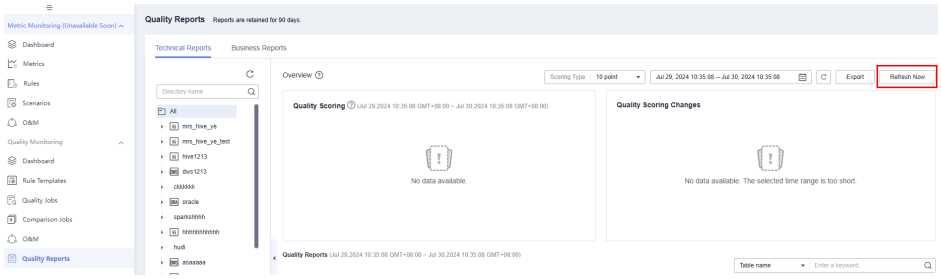
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Quality**.

Step 2 Choose **Quality Monitoring** > **Quality Job** in the left navigation bar.

Step 3 Click **Refresh Now** in the upper right corner. The page displays the temporary data generated from 00:00 to the current time. You can immediately obtain the data quality report of the current day.

Figure 10-53 Refresh Now



----End

10.3 Tutorials

10.3.1 Creating a Business Scenario

Scenario

Business scenarios are used to monitor business metrics. This section describes how to create a business scenario.

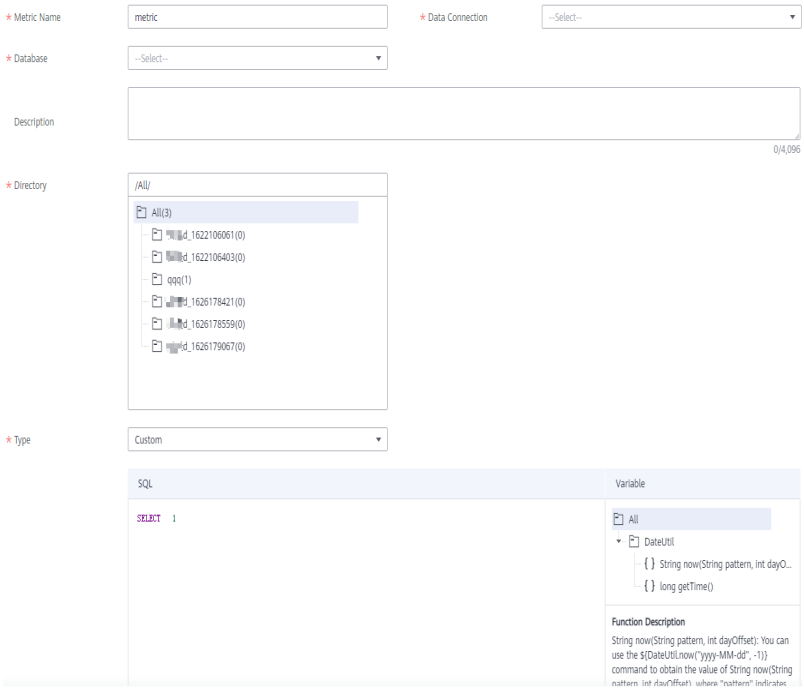
Procedure

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Quality**.

Step 2 Create a metric.

1. In the navigation pane on the left, choose **Metrics**.
2. On the **Metrics** page, click **Create**.

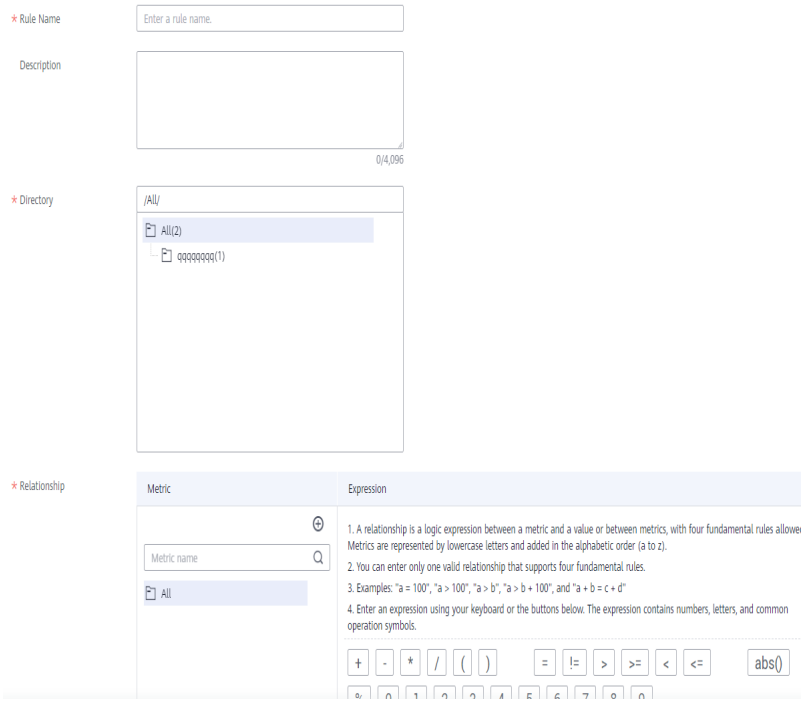
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3. Click **Trial Run** to check whether the metric runs properly.
4. Click **OK**.

Step 3 Create a rule.

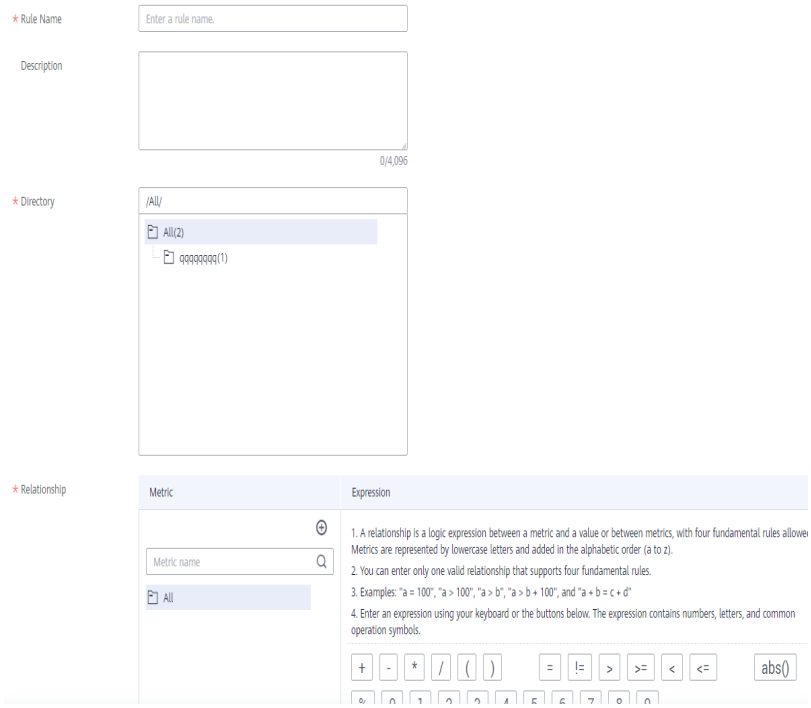
1. In the navigation pane on the left, choose **Rules**.
2. On the **Rules** page, click **Create**.
3. Set the parameters shown in the following figure.



4. Click **OK**.
5. On the **Rules** page, click **Create** to create another rule.

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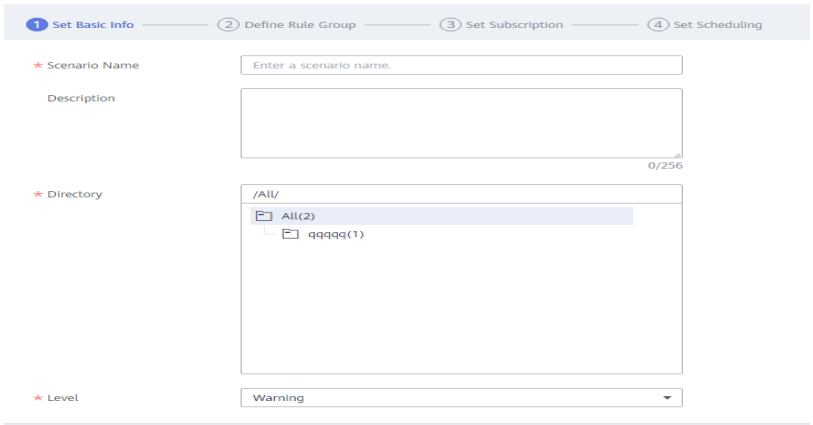
6. Set the parameters shown in the following figure.



7. Click **OK**.

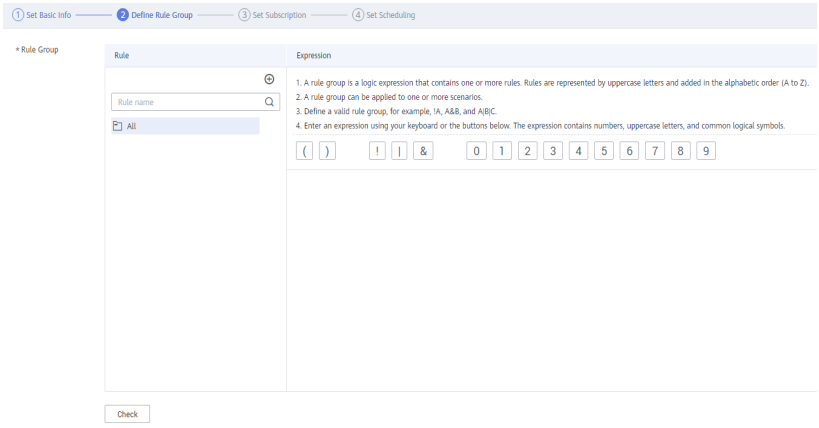
Step 4 Create a scenario.

1. In the navigation pane on the left, choose **Scenarios**.
2. On the **Scenarios** page, click **Create**. On the displayed **Create Scenario** page shown in the following figure, set the required parameters.

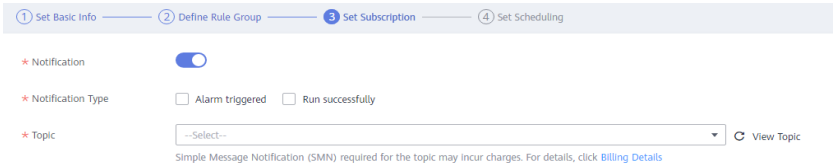


3. Click **Next** and set the parameters for the rule group.

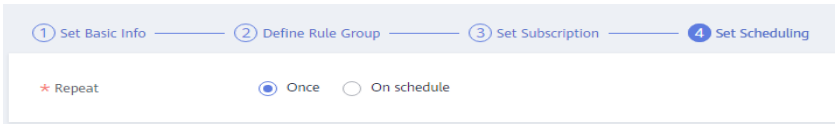
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4. Click **Next** and set subscription parameters.



5. Click **Next** and set scheduling parameters.



6. Click **Submit**.

Step 5 In the scenario list, locate the created scenario and click **Run** in the **Operation** column.

1. Click the refresh button in the upper right corner. The **Running Status** of the scenario is **Succeeded**.
2. Click the running result to view details.

----End

10.3.2 Creating a Quality Job

Scenario

You can use a quality job to monitor data quality. This section describes how to create a quality job.

Procedure

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Quality**.

Step 2 Create a rule template.

1. In the navigation pane on the left, choose **Rule Templates**. System templates are displayed. Rule templates have six dimensions: completeness, uniqueness, timeliness, validity, accuracy, and consistency.
2. **Optional:** Click **Create** to create a rule template.

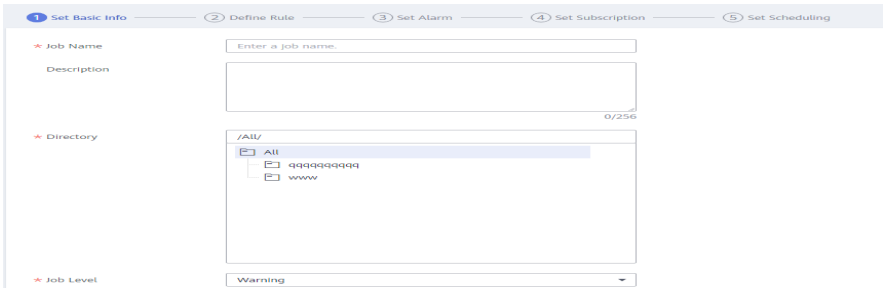
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

NOTE

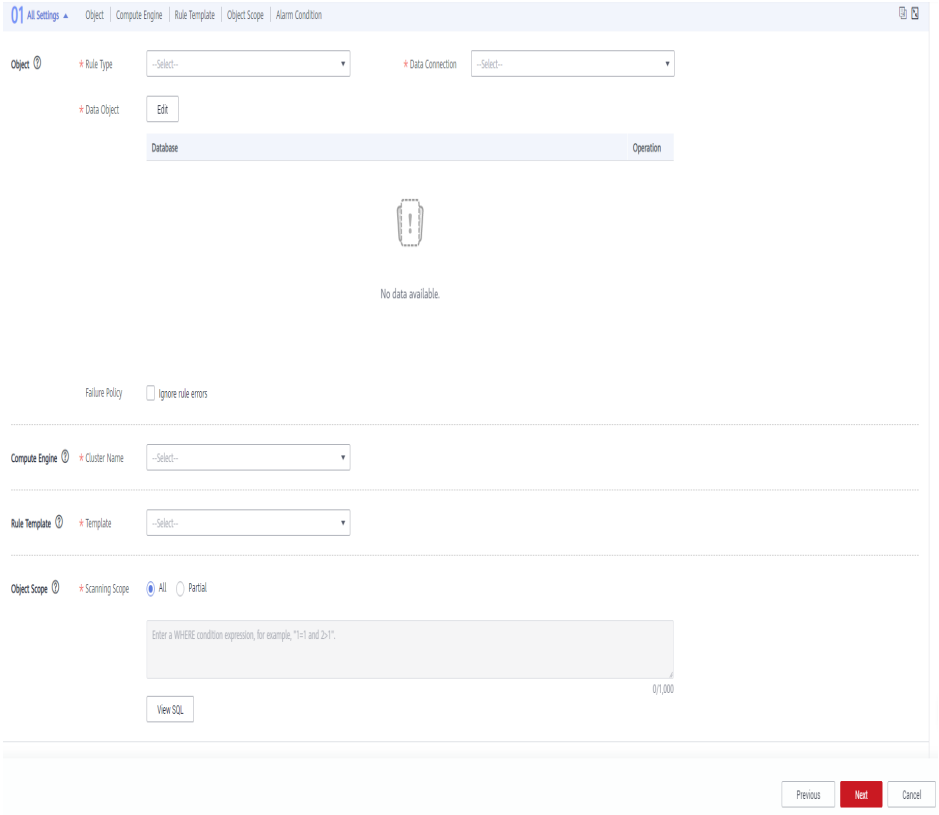
In this example, use a system rule.

Step 3 Create a quality job.

1. In the navigation pane on the left, choose **Quality Jobs**.
2. Click **Create**. On the **Create Quality Job** page, set basic information about the quality job.

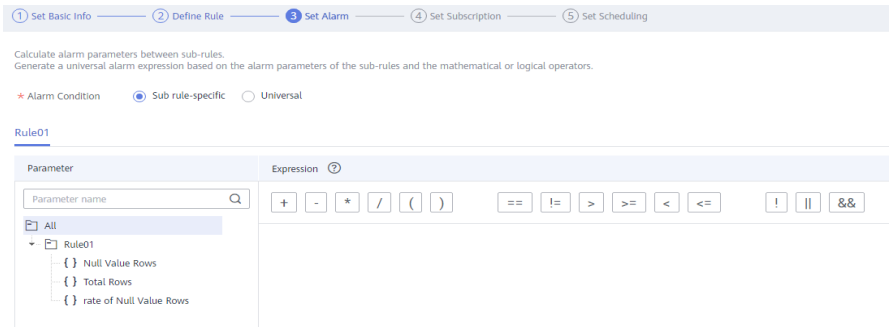


3. Click **Next** to go to the **Define Rule** page. Click on the rule card to configure the rule.

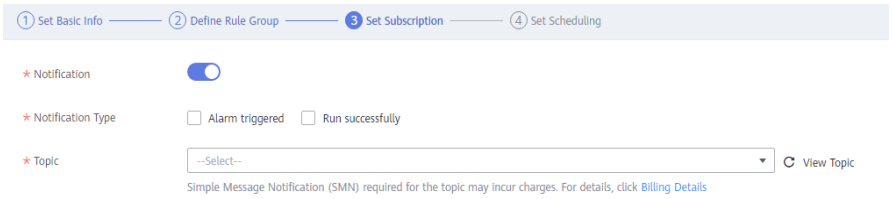


4. Click **Next** and set alarm parameters.

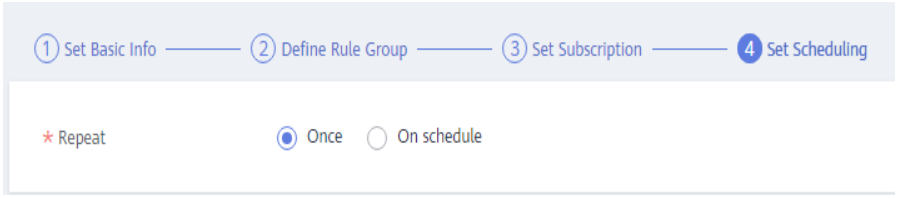
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5. Click **Next** and set subscription parameters.



6. Click **Next** and set scheduling parameters.



7. Click **Submit**.

Step 4 In the quality job list, locate the created job and click **Run** in the **Operation** column.

1. After the quality job is successfully run, choose **Quality Reports** in the navigation pane on the left.
2. The **Technical Reports** page is displayed by default.

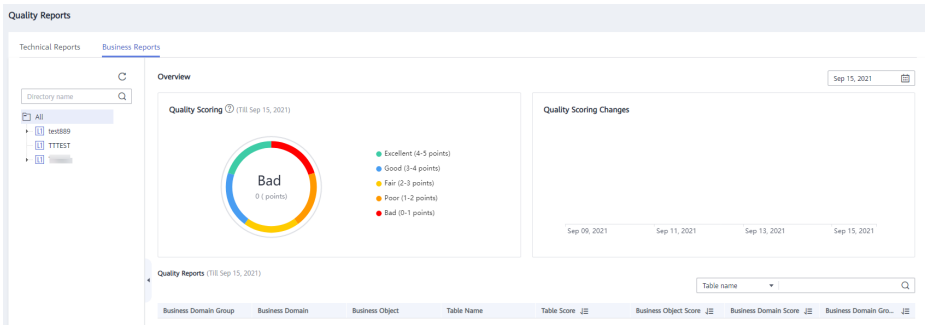
Figure 10-54 Technical report



3. Click the **Business Reports** tab and view the business reports.

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Figure 10-55 Business report



----End

10.3.3 Creating a Comparison Job

Scenario

Data comparison is critical to ensure data consistency in data development and migration. The cross-source data comparison capability is the key to checking consistency of the data before and after migration or processing. This section describes how to create a comparison job in the DataArts Quality module of DataArts Studio to verify consistency between a DLI and DWS connection.

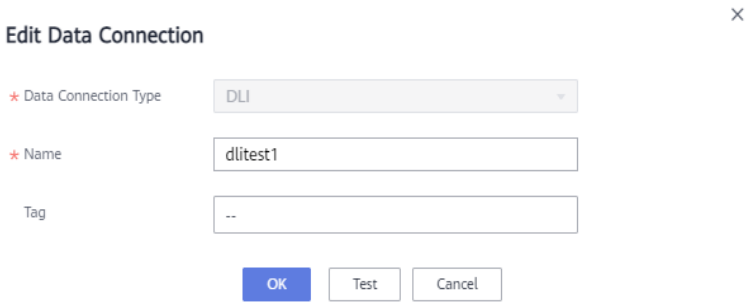
Environment Preparations

Create the data sources to compare, that is, create different types of data connections in the Management Center.

Procedure

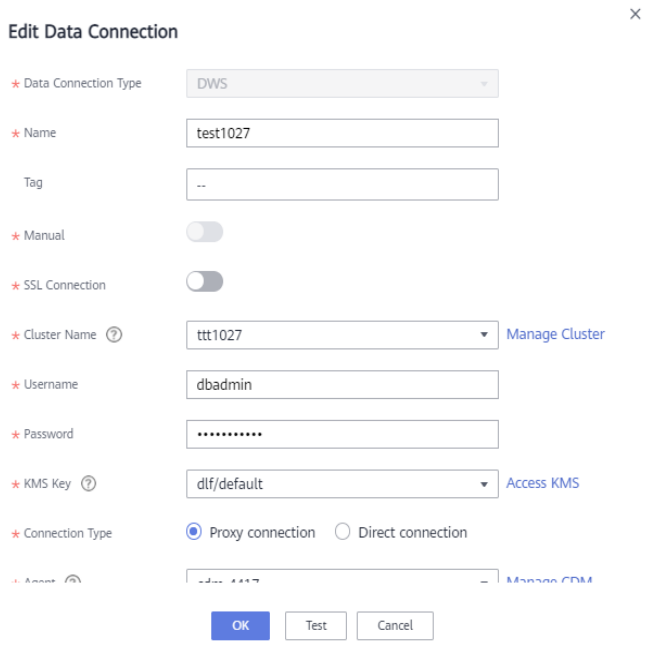
Step 1 Create different types of data connections.

1. Create a DLI data connection. On the **Management Center** page, click **Create Data Connection**. In the displayed dialog box, select **DLI** for **Data Connection Type**, enter a connection name, and click **Test**. If the message "Connected." is displayed, click **OK**.



2. Create a DWS data connection. On the **Management Center** page, click **Create Data Connection**. In the displayed dialog box, select **DWS** for **Data Connection Type**, enter a connection name, set other required parameters, and click **Test**. If the message "Connected." is displayed, click **OK**.

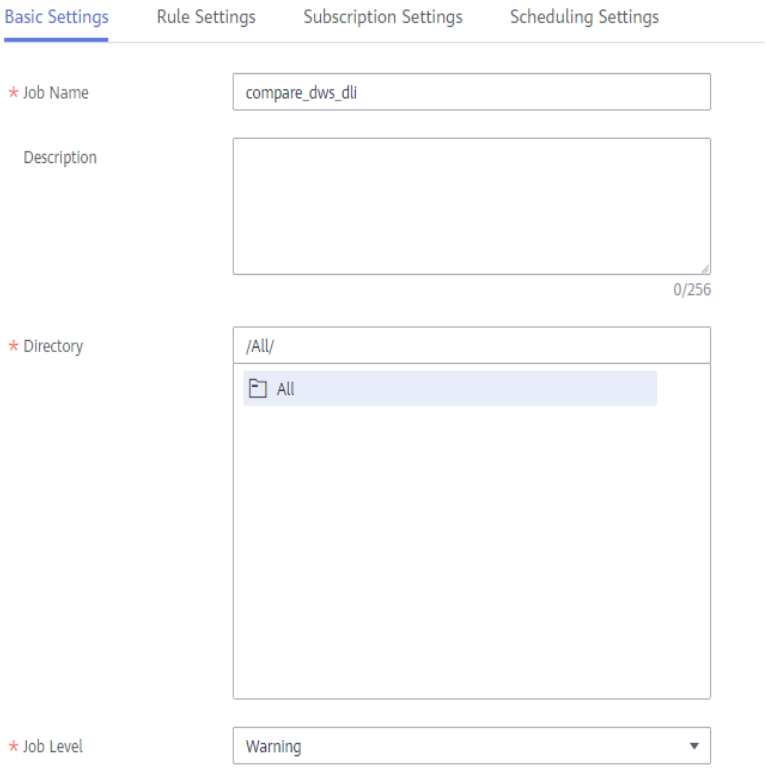
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Step 2 Create a comparison job.

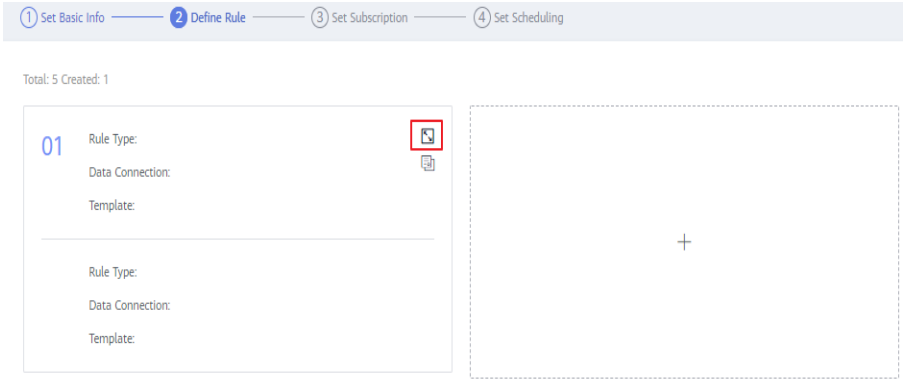
1. On the **DataArts Quality** page, choose **Comparison Jobs** in the navigation pane.
2. Click **Create**. On the **Create Comparison Job** page, set basic information about the comparison job.

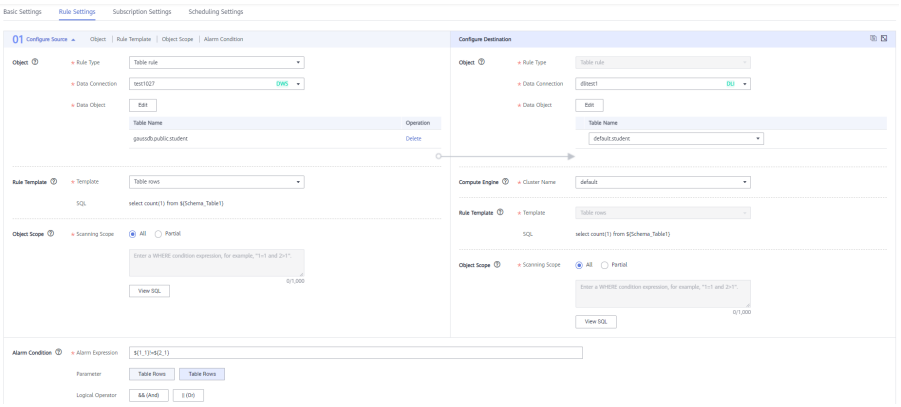
Figure 10-56 Configuring basic information



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3. Click **Next** to go to the **Define Rule** page. Click  on the rule card to configure the rule.

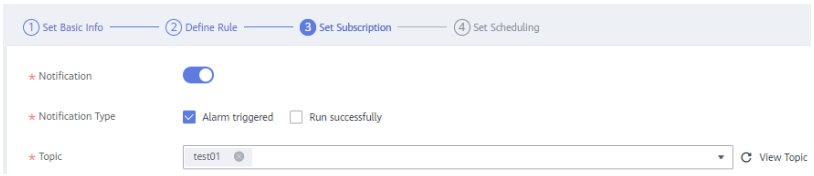




NOTE

- You need to configure information about both the source and destination. For how to configure the source connection, see **DWS Connection Parameters**. For how to configure the destination connection, see **DLI Connection Parameters**.
- When configuring **Alarm Condition**, **${1_1}** indicates the number of rows in the source table, and **${2_1}** indicates the number of rows in the destination table. In the preceding figure, the alarm condition **${1_1}!=${2_1}** indicates that an alarm is generated when the number of rows in the source table is inconsistent with that in the destination table.

4. Click **Next** and set subscription parameters.

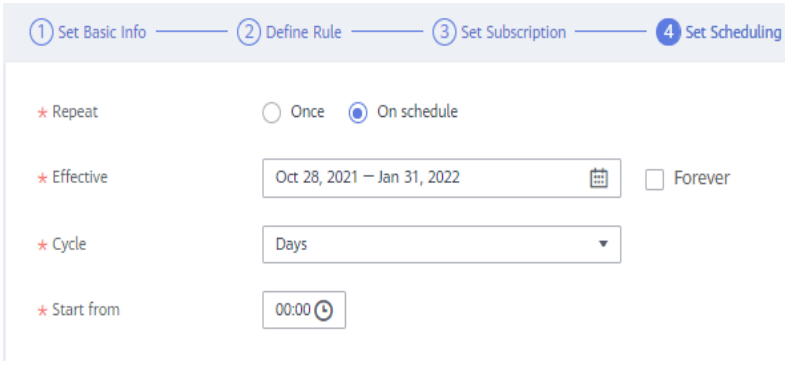


NOTE

If you enable notification, **Alarm triggered** indicates that a notification is sent to the SMN topic when an alarm is generated for the job, and **Run successfully** indicates that a notification is sent to the SMN topic when no alarm is generated for the job.

5. Click **Next** and set scheduling parameters.

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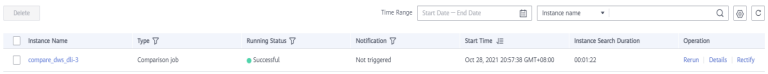
NOTE

Once indicates that the job needs to be manually executed, and **On schedule** indicates that the job is executed automatically based on your configuration. The configuration in the preceding figure indicates that the job is automatically executed every 15 minutes on Oct 27, 2020.

6. Click **Submit**.

Step 3 View the comparison job.

1. In the comparison job list, locate the created job and click **Run** in the **Operation** column.
2. On the displayed **O&M** page, locate the row that contains the comparison job and click **Details** in the **Operation** column to view the running results and logs.

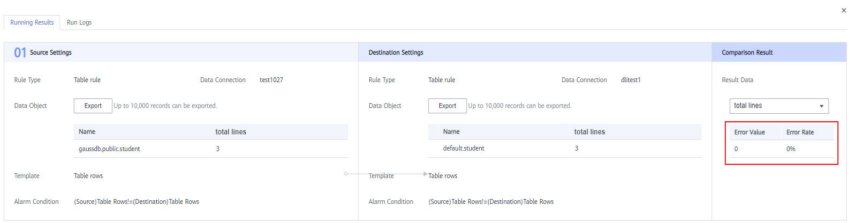


----End

Analyzing the Comparison Result

In the running result, the left pane displays the execution result of the rule for source table rows, and the right pane displays the execution result of the rule for destination table rows.

The error rate indicates the difference between the number of rows of the source and destination tables. If the error rate is 0, the source and destination tables have the same number of rows.



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11 DataArts Catalog

This module provides enterprise-class metadata management to clarify information assets. It uses a data map to display a data lineage and panorama of data assets for intelligent data search, operations, and monitoring.

11.1 Viewing the Workspace Data Map

11.1.1 Viewing Data Assets in a Workspace

Data map facilitates data search and powers data analysis, development, mining, and operations. With data map, you can search for data quickly and make lineage and impact analysis with ease.

- Before data analysis, a data map can be used to search for keywords to narrow down the scope of data to be analyzed.
- A data map can be used to query table details by table names, letting you know how to use a table.
- Through lineage analysis, a data map displays you how a table is generated and where it is applied, and the logic used for processing table fields.

11.1.2 Viewing the Asset Overview

The **Dashboard** page contains two tabs, **Assets** and **Asset Reports**.

- The **Assets** tab page displays information about logical assets, technical assets, and metric assets.
  - Logical assets come from logical entities and data tables defined and released in DataArts Catalog. The number and details of business objects, logical entities, and business attributes are displayed on the **Assets** page.
  - Technical assets come from data connections and metadata collection tasks. The number and details of databases, data tables, and data volumes are displayed on the **Assets** page.
  - Metric assets come from business metrics defined and released in DataArts Architecture. The number and details of business metrics and their details are displayed on the **Assets** page.

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- The **Asset Reports** tab page displays logical entities, data tables, asset associations, asset capacities, tags, security levels, top 100 tables by capacity and number of rows, and top 100 buckets by capacity.

Constraints

- Logical assets and metric assets come from DataArts Architecture and are updated if data is synchronized from DataArts Architecture. However, they cannot be deleted directly in DataArts Architecture. Instead, you must locate and delete them in DataArts Catalog.
- Data connections in technical assets come from Management Center and are updated if data is synchronized from Management Center. However, they cannot be deleted directly in Management Center. Instead, you must locate and delete them in DataArts Catalog.
- Information such as databases, tables, and columns in technical assets come from metadata collection tasks. Whether to update and automatically delete such information depends on the parameter settings of metadata collection tasks. For details, see **Configuring a Metadata Collection Task**.
- Data lineages in technical assets are updated by job scheduling. Data lineages are generated based on the latest job instances. To delete data lineages, you need to delete jobs or job metadata. Stopping jobs alone does not delete data lineages.

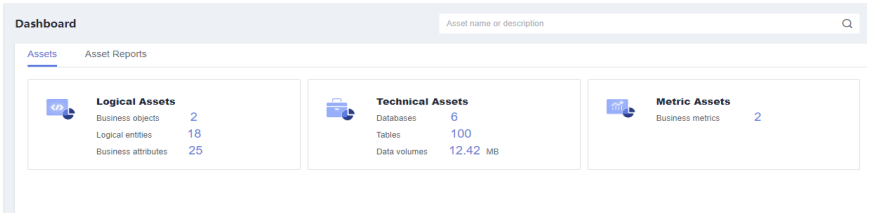
Prerequisites

- Logical entities, data tables, and business metrics have been defined and released in DataArts Architecture.
- A collection task has been created and executed successfully. For details about how to create a collection task, see **Creating a Collection Task**.

Assets

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
3. Choose **Data Map** > **Dashboard**.

   Figure 11-1 Assets

4. Click **Logical Assets** to view details about logical assets.

   Logical assets come from logical entities and data tables defined and released in DataArts Catalog. The number and details of business objects, logical entities, and business attributes are displayed on the **Assets** page.

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5. Click **Technical Assets** to view details about technical assets.

   Technical assets come from data connections and metadata collection tasks. The number and details of databases, data tables, and data volumes are displayed on the **Assets** page.

6. Click **Metric Assets** to view details about metric assets.

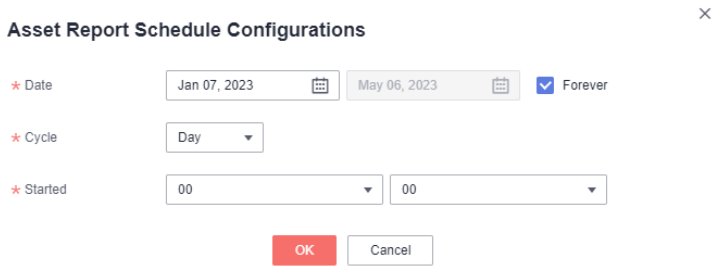
   Metric assets come from business metrics defined and released in DataArts Architecture. The number and details of business metrics and their details are displayed on the **Assets** page.

Asset Reports

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. Choose **Data Map** > **Dashboard** and click **Asset Reports**.
3. If you access the **Asset Reports** page for the first time, you need to configure asset report tasks. Click in the upper right corner. The **Asset Report Schedule Configurations** dialog box is displayed.

   Set **Date**, **Cycle**, and **Started**. The system will run asset report tasks based on the configuration and update the asset reports.

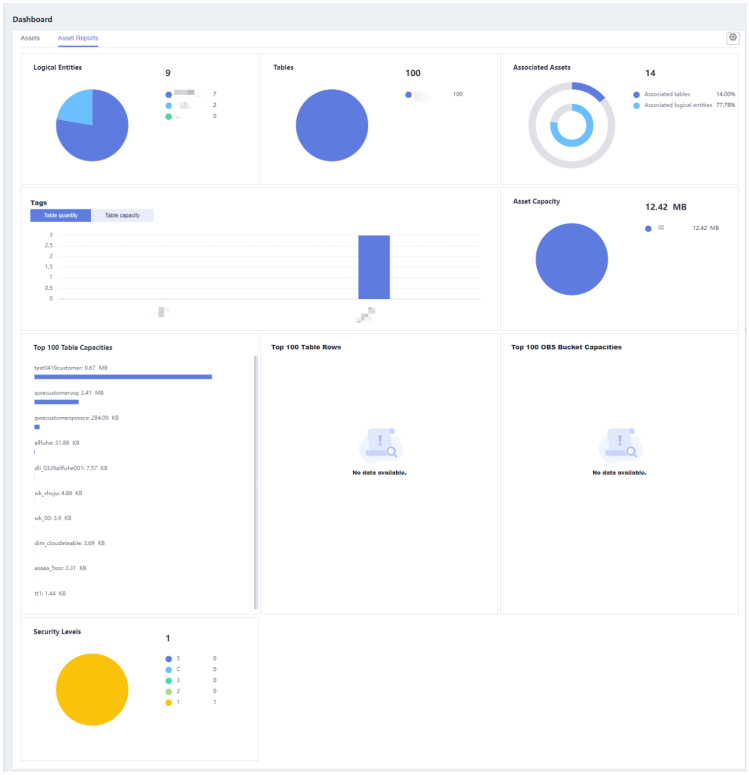
   Figure 11-2 Configuring asset report tasks



4. After the system schedules and runs asset report tasks, you can go to the **Asset Reports** page again to view the logical entities, data tables, asset associations, asset capacities, tags, security levels, top 100 tables by capacity and number of rows, and top 100 buckets by capacity.

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Figure 11-3 Asset Reports



11.1.3 Viewing Data Assets

You can search for and filter assets, and view asset details on the **Data Catalog** page.

- Logical assets include the logical entities and data tables defined and published in DataArts Architecture.
- Technical assets include the data connections from Management Center, and the databases, tables, and columns obtained by metadata collection tasks in DataArts Catalog.
- Metric assets come from the business metrics defined and published in DataArts Architecture.

Constraints

- Logical assets and metric assets come from DataArts Architecture and are updated if data is synchronized from DataArts Architecture. However, they cannot be deleted directly in DataArts Architecture. Instead, you must locate and delete them in DataArts Catalog.
- Data connections in technical assets come from Management Center and are updated if data is synchronized from Management Center. However, they cannot be deleted directly in Management Center. Instead, you must locate and delete them in DataArts Catalog.
- Information such as databases, tables, and columns in technical assets come from metadata collection tasks. Whether to update and automatically delete such information depends on the parameter settings of metadata collection tasks. For details, see **Configuring a Metadata Collection Task**.

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- Data lineages in technical assets are updated by job scheduling. Data lineages are generated based on the latest job instances. To delete data lineages, you need to delete jobs or job metadata. Stopping jobs alone does not delete data lineages.

Searching for a Data Asset

An asset can be searched by its name, description, or attributes. Fuzzy search is supported.

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. In the left navigation pane, choose **Data Map** > **Data Catalog**. Click the **Logical Assets**, **Technical Assets**, and **Metric Assets** tabs as needed.
3. In the search box, enter a keyword to search for your desired assets.
   - By their names and description
   - By their attributes, which are displayed on the asset details page

     NOTE

     - You can save the search criteria you set.
     - You can import the search criteria you need.

Filtering an Asset

Technical assets can be filtered by the following criteria:

- **Data Connections**: the data connection that your target asset uses.
- **Types**: the type of your target asset.
- **Tags**: the tags of data assets. The tags were configured in DataArts Catalog. For details, see **Managing Asset Tags**.
- **Classifications**: the data asset classifications in DataArts Catalog

  In regions where DataArts Security is available:The data map capability is provided by the Data Map module, and the data security and permission capabilities are provided by the DataArts Security module. These capabilities are no longer evolved in the DataArts Catalog module. If DataArts Security and Data Map are available, related capabilities will be unavailable in DataArts Catalog. You cannot create classifications or configure classifications for assets in DataArts Catalog. Instead, you can create classifications or configure classifications for assets through DataArts Security and Data Map. For details, see **Creating Data Classifications**.
- **Security Levels**: the data asset security levels in DataArts Security

  In regions where DataArts Security is available:The data map capability is provided by the Data Map module, and the data security and permission capabilities are provided by the DataArts Security module. These capabilities are no longer evolved in the DataArts Catalog module. If DataArts Security and Data Map are available, related capabilities will be unavailable in DataArts Catalog. You cannot create security levels or configure security levels for assets in DataArts Catalog. Instead, you can create security levels and configure security levels for assets through DataArts Security and Data Map. For details, see **Creating Data Security Levels**.

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The following uses **type** as an example to demonstrate how to filter an asset.

Step 1 Select **Table** under **Types**. Table assets are displayed.

Step 2 In the **Types** area, **Table**, **Column**, **Database**, **Bucket**, and **ColumnFamily** are supported by default. If you select **All**, the system displays assets of all types.

----End

Viewing the Details of an Asset

This section describes how to view data table details on the **Technical Assets** page.

Step 1 In the list of technical assets, select a table and click its name to access its details page.

Step 2 On the **Details** tab page, view the basic attributes of the technical metadata, add or delete classifications, tags, and security levels for the table, table columns, or OBS objects, and edit the description.

NOTE

The sources of tags, classifications, and security levels are as follows:

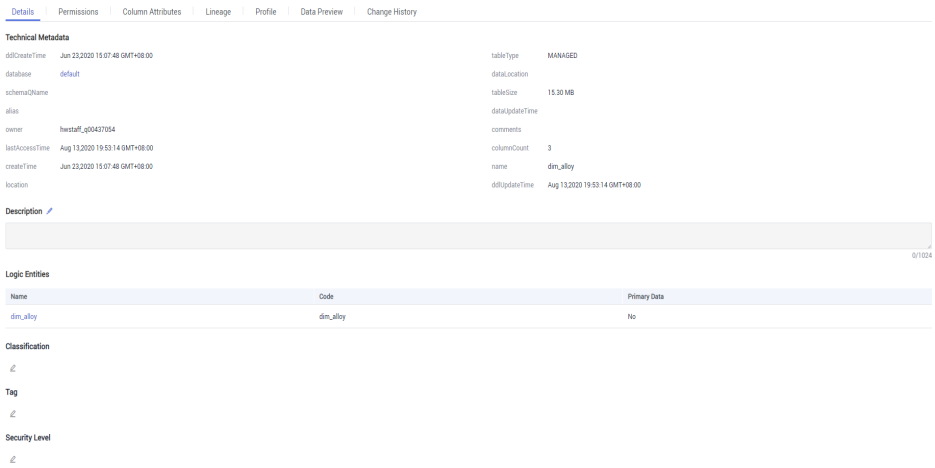
- **Tags**: the tags of data assets. The tags were configured in DataArts Catalog. For details, see **Managing Asset Tags**.
- **Classifications**: the data asset classifications in DataArts Catalog

  In regions where DataArts Security is available:The data map capability is provided by the Data Map module, and the data security and permission capabilities are provided by the DataArts Security module. These capabilities are no longer evolved in the DataArts Catalog module. If DataArts Security and Data Map are available, related capabilities will be unavailable in DataArts Catalog. You cannot create classifications or configure classifications for assets in DataArts Catalog. Instead, you can create classifications or configure classifications for assets through DataArts Security and Data Map. For details, see **Creating Data Classifications**.
- **Security Levels**: the data asset security levels in DataArts Security

  In regions where DataArts Security is available:The data map capability is provided by the Data Map module, and the data security and permission capabilities are provided by the DataArts Security module. These capabilities are no longer evolved in the DataArts Catalog module. If DataArts Security and Data Map are available, related capabilities will be unavailable in DataArts Catalog. You cannot create security levels or configure security levels for assets in DataArts Catalog. Instead, you can create security levels and configure security levels for assets through DataArts Security and Data Map. For details, see **Creating Data Security Levels**.

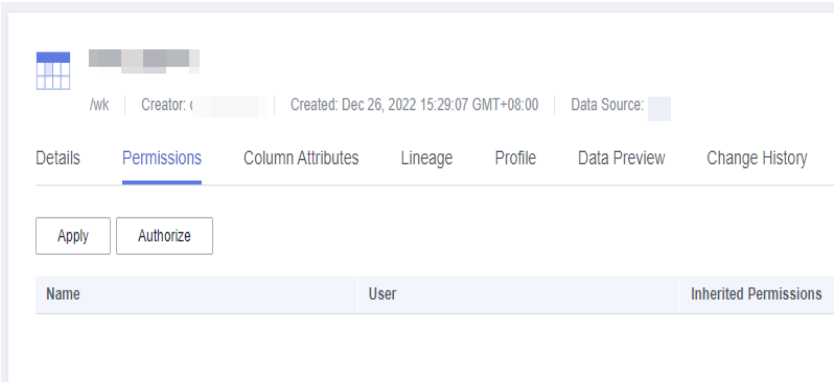
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Figure 11-4 Details tab page



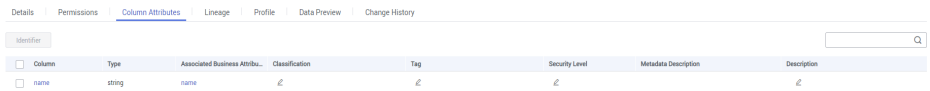
Step 3 On the **Permission** tab page, you can apply for data table permissions or grant permissions to other users.

Figure 11-5 Permissions tab page



Step 4 On the **Column Attributes** tab page, view the column attributes of the table; add or delete classifications, tags, and security levels for the data columns; edit the description.

Figure 11-6 Managing column attributes



Step 5 On the **Lineage** tab page, view table lineages and impacts. For details on how to set a data lineage, see **Viewing Data Lineages Through DataArts Catalog**. If a node that supports automatic lineage is configured for a data development job or the lineage of a node is manually configured, the data lineage can be automatically parsed during job execution and displayed in the data catalog.

Step 6 On the **Profile** tab page, view the profile of the data table. (Currently, this function is available only for GaussDB(DWS) and DLI data tables. The profile sampling mode is subject to the **metadata collection** task configuration.)

Click **Update** to update the table profile.

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Step 7 On the **Data Preview** tab page, preview the business data in the current table. The data can be masked in real time based on the column classification information and the configuration in **Creating a Data Masking Policy (To Be Removed)**.

- Data assets that use DWS, DLI, MRS Hive, and MySQL data connections can be previewed.
- Column classification information can be automatically set when a collection task is created or manually added in the data classification menu. Automatic classification setting is available only for DWS and DLI data collections.

Step 8 On the **Change History** tab page, view the change history of the table.

----End

11.1.4 Managing Asset Tags

Tags can be defined and associated with technical assets for better asset management. For example, you can tag a table as the SDI source data layer or DWI data integration layer.

Tags are keywords used to identify the business meanings of technical assets. They help you classify and describe technical assets for easy search.

Tags and Classifications

Tags are highly related keywords that help you classify and describe assets for easy retrieval.

Classification is the process of categorizing assets by category, level, or nature. Classification is top-down. Assets are classified according to certain standards.

The table below lists the differences between tags and classifications.

Table 11-1 Differences between tags and classifications

Item	Category	Tag
Exclusiveness	Yes	None
Relationship	Dependent	Relevant (associated)
Creation	Pre-event planning	Any time
Cost	High	Low
Source	For details, see **Creating a Data Classification (To Be Removed)**.	For details, see **Managing Asset Tags**.

Managing a Tag

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.

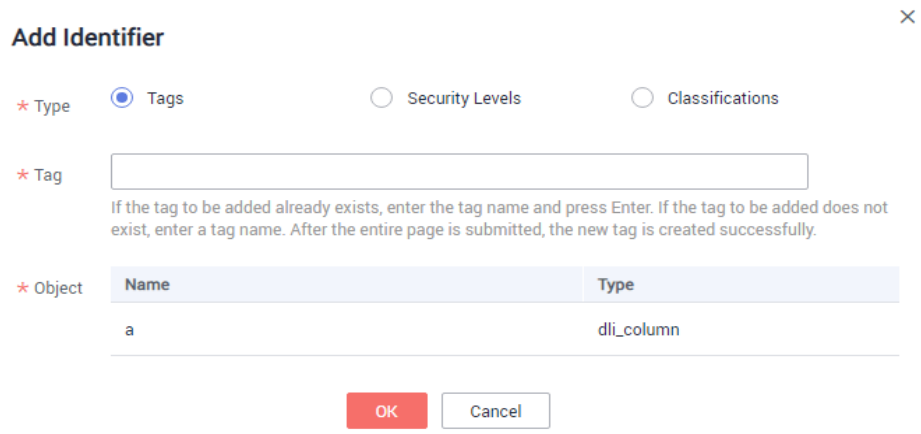
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2. Choose **Data Map** > **Tag Management** from the left navigation bar.
3. Click **Create** to create a tag.
   - **Tag Name**: Tag names can include only letters, numbers, and underscores (_). They cannot start with underscores (_) or exceed 100 characters.
   - **Description**: Up to 255 characters are allowed.
4. Select a tag and click **Delete** to delete the tag.
5. Click **Edit** to modify the description of a tag.

Identifying Technical Assets: Adding Tags

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. Choose **Data Map** > **Data Catalog** and click the **Technical Assets** tab.
3. Enter a keyword in the search box, and click the search icon. The search results are listed below the search box.
4. Select the technical asset that you want to add a tag to and click **Add Identifier** in the upper right corner. In the **Add Identifier** dialog box, select **Tags** for **Type**.

   Figure 11-7 Adding an identifier



5. Set the parameters and click **OK**.

   NOTE

   You can add a new tag or select an existing tag. Existing tags are created by following instructions in **Managing a Tag**.

11.2 Configuring Data Access Permissions (To Be Removed)

11.2.1 Introduction to Data Permissions (To Be Removed)

To ensure data security and controllability, you need to apply for permissions before using data tables.

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The **Permissions** module facilitates permission control, provides visualized application and approval processes, and supports for permission audit and management. Data is secure and data permission control is convenient.

NOTICE

Data permission capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. The data permission functions in DataArts Catalog are available only to existing users.

The **Permissions** module consists of **Data Catalog Permissions**, **Data Table Permissions**, and **Review Center**. The provided functions are:

- Self-service permission application: You can select a data table and quickly apply for the needed permissions online.
- Permission audit: Administrators can quickly and easily view the personnel with the corresponding database table permissions and perform audit management.
- Permission revoking and returning: Administrators can revoke user permissions in a timely manner. Users can also proactively return unnecessary permissions.
- Permission approval and management: Visualized and process-based management and authorization mechanism facilitates post-event tracing.

11.2.2 Configuring Data Catalog Permissions (To Be Removed)

You can manage data catalog permissions.

NOTICE

Data permission capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. The data permission functions in DataArts Catalog are available only to existing users.

Constraints

- Only workspace admins can create, delete, and modify data catalog permissions rules and set the permissions effective status.
- Workspace developers, operators, and viewers can only view data permissions.

Managing a Data Catalog Permissions Rule

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. Choose **Permissions** > **Data Catalog Permissions** from the left navigation bar, and click **Create** on the page displayed to configure a data catalog permissions rule.
   a. **Rule**: Name of a data catalog permissions rule.

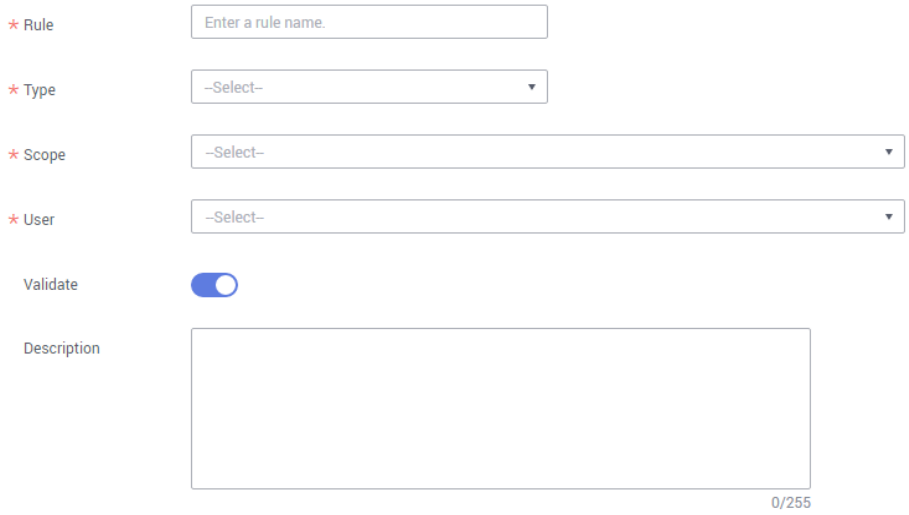
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b. **Type**: Currently, only **Tag**, **Security level**, and **Classification** can be used for filtering.
c. **Scope**: Select available tags, security levels, and classifications.
d. **User**: User to whom the configured data catalog permissions rule applies.
e. **Validate**: If this function is enabled, the data catalog permissions rule takes effect. Otherwise, the rule does not take effect.

NOTE

After a data catalog permissions rule takes effect, only users to whom the configured data directory permissions rule applies can manage data assets with specified tags or classifications. For example, if **Type** is set to **Tag**, **Scope** is set to **test**, and **User** is set to **A**, user A can manage assets with tag **test** after the permissions rule is enabled.

Figure 11-8 Creating a rule



3. In the data catalog permissions rule list, click **Edit** or **Delete** in the **Operation** column to modify or delete the rule.

11.2.3 Configuring Table Permissions (To Be Removed)

NOTICE

Data permission capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. The data permission functions in DataArts Catalog are available only to existing users.

On the **My Permissions** page, you can view your table and column permissions in the workspace, and apply for or return the permissions.

Workspace admins have the permissions to manage user permissions. An admin can view the resource permissions of all users in the workspace.

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Applying for Table or Column Permissions

NOTE

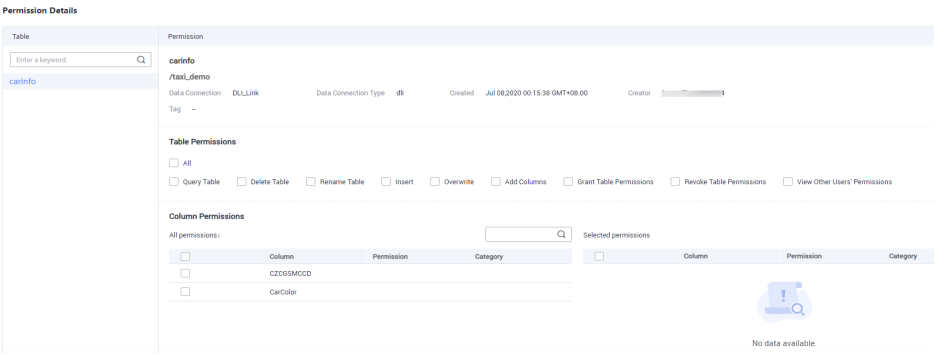
- The current version supports permissions control only on DLI data tables.
- The table or column permissions you applied for take effect only after being approved by reviewers. Therefore, before applying for the permissions, create a reviewer by referring to **Managing Reviewers**.

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. Choose **Permissions** > **Data Table Permissions** from the left navigation bar. On the **My Permissions** tab page, click **Apply**.
3. On the page displayed, describe the scenario where the permissions are required, and select the data connection, database, and data table.
4. Select the table or column permissions you want to apply for.
   - Applying for the permissions of a single table or column

     Select the table or column permissions that you do not have but need to use.
   - Applying for the permissions of multiple tables or columns

     After selecting multiple tables, select the table or column permissions to be used in the **Permission Details** area.

   Figure 11-9 Applying for permissions on tables and columns

5. Click **OK**. Configure a reviewer and click **OK**.
6. Wait for the reviewer to approve the application. After the application is approved, the permissions take effect.

Managing Existing Table Permissions

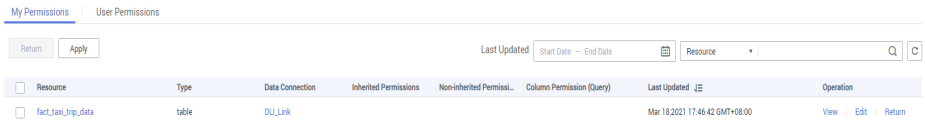
You can manage the table or field permissions you already have, including viewing, editing, and returning permissions.

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. Choose **Permissions** > **Table Permissions**. On the **My Permissions** tab page, you can perform the following operations:
   - Click **View** in the **Operation** column to view the permissions details.
   - Click **Edit** in the **Operation** column to modify table permissions as needed.

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- Click **Return** in the **Operation** column to return table permissions as needed.

Figure 11-10 Managing table permissions



Auditing User Permissions

On the **User Permissions** tab page, administrators can view the accounts that have permissions on tables and fields in the same workspace, reclaim the table and field permissions as needed, or grant permissions to users in batches.

NOTE

Only workspace admins can audit user permissions, including viewing the user list, reclaiming user permissions, or granting permissions to users.

- Viewing accounts with table permissions and the corresponding asset list

  Choose **Data Table Permissions** > **User Permissions** to view the accounts with applied permissions in the same workspace.

Figure 11-11 Viewing accounts with table permissions



- Reclaiming user permissions
  - Choose **Data Table Permissions** > **User Permissions** and click **Reclaim** under **Operation** to the right of the account to reclaim all its permissions.
  - On the **User Permissions** tab page, select the check boxes to the left of one or more usernames, and click **Reclaim** in the upper left corner to revoke their permissions in batches.

Figure 11-12 Reclaiming user permissions



- Granting permissions to users

Figure 11-13 Authorization



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- Managing user permissions

  Choose **Data Table Permissions** > **User Permissions**, and click the drop-down arrow to the utmost left of an account to display the assets of the user. Click **View**, **Edit**, and **Return** in the **Operation** column to the right of a specific resource as required.

  Figure 11-14 Managing user permissions



11.2.4 Managing Review Center (To Be Removed)

NOTICE

Data permission capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. The data permission functions in DataArts Catalog are available only to existing users.

Constraints

Only workspace admins can manage reviewers, including creating and deleting reviewers.

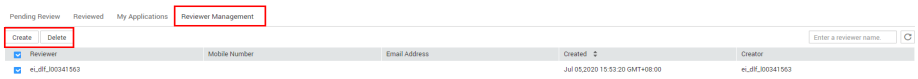
Approval Management

On the **Review Center** page, you can view the application status, applications to be approved, and approved applications, and manage reviewers.

- Reviewer management

  Choose **Permissions** > **Review Center** from the left navigation bar. On the **Reviewer Management** tab page, create and delete reviewers as required. See **Figure 11-15**. The reviewer data refers to the person added in the workspace.

  Figure 11-15 Managing reviewers



- Pending review

  a. Choose **Permissions** > **Review Center** from the left navigation bar, and click the **Pending Review** tab.

     On this page, you can view the applications that need to be approved.

  b. Click **Review** in the **Operation** column to view the application details and approve the application.

  c. After entering the approval comments, approve or reject the application based on the actual situation.

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- Reviewed applications
  a. Choose **Permissions** > **Review Center** from the left navigation bar, and click the **Reviewed** tab.
  b. Click **View Details** in the **Operation** column to view the approval records and application content.
- My Applications
  a. Choose **Permissions** > **Review Center** from the left navigation bar, and click the **My Applications** tab.
  b. Click **View Details** in the **Operation** column to view details about an application.
  c. Click **Retry** in the **Operation** column to re-authorize an application.

11.3 Configuring Data Security Policies (To Be Removed)

11.3.1 Introduction to Data Security (To Be Removed)

NOTICE

Data security capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. Currently, the data security function in DataArts Catalog is available only to existing users.

Background

Data security provides data lakes with unified data usage protection capabilities throughout the data lifecycle. Sensitive data identification, classification, privacy protection, resource permission control, encrypted data transmission, encrypted storage, data risk identification, and compliance audit help users establish a security warning mechanism and enhance the overall security protection capability, to ensure data security.

Functional Module

Data security includes:

- Data security levels

  You can classify your data into different levels to facilitate data management.
- Data classification rules

  You can classify data to effectively identify sensitive data in databases.
- Masking policies

  Based on the data classification, you can create masking policies to mask data assets and protect privacy.

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11.3.2 Creating a Data Security Level (To Be Removed)

You can manage data security levels, including creating and deleting security levels and adjusting their ranking sequences.

NOTICE

Data security capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. Currently, the data security function in DataArts Catalog is available only to existing users.

You can create a data classification rule and data masking policy only after you have created a data security level.

Prerequisites

None

Accessing the Data Security Levels Page

1. On the DataArts Studio console, locate an instance and click **Access**. On the displayed page, locate a workspace and click **DataArts Catalog**.
2. Choose **DataArts Security** > **Security Levels** from the left navigation bar. On the page displayed, you can create, delete, edit, move up, and move down data security levels as required.
   - Creating a security level: Click **Create** in the upper left corner of the **Data Security Levels** page and enter the name and description.
   - Deleting a security level: Select unnecessary security levels and click **Delete** in the upper left corner of the **Security Levels** page.
   - Adjusting the ranking sequence of a security level: Click **Up** or **Down** to the right of a security level to adjust its sequence.

11.3.3 Creating a Data Classification (To Be Removed)

You can create data classification rules.

NOTICE

Data security capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. Currently, the data security function in DataArts Catalog is available only to existing users.

You can create a data masking policy to mask data only after you have created a data classification rule.

Prerequisites

A data security level has been created. For details, see **Creating a Data Security Level (To Be Removed)**.

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Creating a Data Classification Rule

1. On the DataArts Studio console, locate an instance and click **Access**. On the displayed page, locate a workspace and click **DataArts Catalog**.
2. Choose **DataArts Security** > **Classifications** from the left navigation bar. On the **Classification Rule** tab page, click **Create**.

   On the page displayed, set the parameters to create a data classification rule. You can either create a rule by using a system template or custom template.

Figure 11-16 Creating a data classification rule

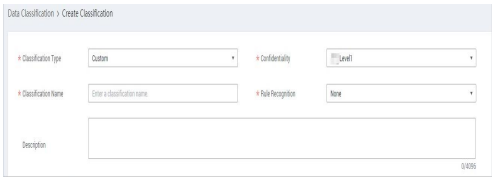


Table 11-2 Parameters for creating a data classification rule

Parameter	Description
Classification Type	The category to which a rule belongs. You can either create a rule by using a system template or custom template.
Confidentiality	Classify the configured data into different levels. If the existing confidentiality does not meet the requirements, go to the confidentiality management page to set security levels. For details, see **Creating a Data Security Level (To Be Removed)**.
Classification Template	This parameter is available when **Classification Type** is set to **Built-in**. You can select a system sensitive data identification template based on service requirements, for example, **Time**, **Mobile number**, and **License plate number**.
Classification Name	• If **Classification Type** is set to **Built-in**, a classification name is automatically generated based on the classification template selected. • If **Classification Type** is set to **Custom**, you can customize a classification name. **NOTE** The name of a data classification rule must be unique.
Rule Recognition	This parameter is available when **Classification Type** is set to **Custom**. Regular expressions are supported.
Regular Expression	• **Content recognition**: You can customize a regular expression. • **Column name recognition**: Both exact match and fuzzy match are supported. Multiple fields can be matched.
Description	A description of the data classification rule to create.

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Creating a Group

1. On the DataArts Studio console, locate an instance and click **Access**. On the displayed page, locate a workspace and click **DataArts Catalog**.
2. Choose **DataArts Security** > **Classifications** from the left navigation bar. On the **Groups** tab page, click **Create**.

   In the **Create Group** dialog box, set the parameters and click **OK**.

   Set the parameters by referring to **Table 11-3** and select classification rules in the list.

   The selected rules are displayed in the list on the right.

   Table 11-3 Parameters for creating a group

Parameter	Description
Name	The name of a group. Only letters, numbers, and underscores (_) are allowed.
Description	Information to better identify the group. It cannot exceed 4,096 characters.

11.3.4 Creating a Data Masking Policy (To Be Removed)

You can create a data masking policy and perform masking query in DataArts Catalog.

NOTICE

Data security capabilities are provided by DataArts Security, and no longer by DataArts Catalog in regions where DataArts Security is available. Currently, the data security function in DataArts Catalog is available only to existing users.

Prerequisites

- A data classification rule has been created. For details on how to create a classification rule, see **Creating a Data Classification (To Be Removed)**.
- A data connection and a data table have been created, and sensitive data has been collected by DataArts Catalog.

Creating a Masking Policy

1. On the DataArts Studio console, locate an instance and click **Access**. On the displayed page, locate a workspace and click **DataArts Catalog**.
2. Choose **DataArts Security** > **Masking Policies** from the left navigation bar, and click **Create** on the page displayed.
3. Set **Classification Rule**, **Masking Algorithm**, and **Algorithm Type**. The options for **Masking Algorithm** include **Mask**, **Truncate**, and **Hash**. Each

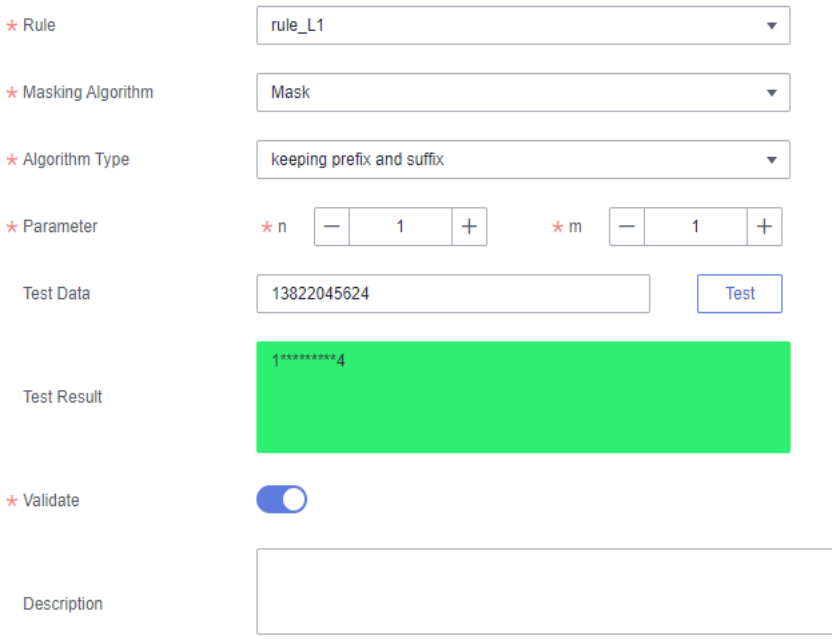
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masking algorithm has multiple algorithm types. Select an algorithm type as required. After the configuration, click **OK**.

NOTE

A data classification rule can be bound to only one masking algorithm.

Figure 11-17 Creating a masking policy



4. After you configured the making algorithm, you can perform an online test. Enter the test data, and click **Test**. You can verify the result in the **Test Result** text box.
5. Enable or disable **Status**. The masking policy takes effect only when **Status** is enabled.

Viewing the Data Masking Effect

1. On the DataArts Studio console, locate an instance and click **Access**. On the displayed page, locate a workspace and click **DataArts Catalog**.
2. Choose **Data Map** > **Catalog** from the left navigation bar.
3. In a list of asset results, click a table name to access its details page.
4. Click **Data Preview** to view the data masking effect.

11.4 Collecting Metadata of Data Sources

11.4.1 Overview

Metadata is data about data. Metadata streamlines source data, data warehouses, and data applications, and records the entire process from data generation to data

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consumption. Metadata mainly refers to model definitions in the data warehouse and mappings between layers. It also describes the monitoring data status of the data warehouse and running status of ETL tasks. In the data warehouse system, metadata helps data warehouse administrators and developers easily locate the data they are looking for, improving the efficiency of data management and development.

In DataArts Studio, metadata may be used to describe the attributes of data (such as the data connection, type, name, and size) or other related information of data (such as the data owner, tag, category, and security level).

Metadata is classified into technical metadata and business metadata by function.

- Technical metadata is data that stores technical details of a data warehouse system and is used to develop and manage data warehouses. In DataArts Studio, technical metadata is technical assets, including databases, data tables, and data volume and their details.
- Business metadata describes data in a data warehouse from the business perspective. It provides a semantic layer between users and actual systems, enabling business personnel who do not understand computer technologies to understand data in the data warehouse. In DataArts Studio, business metadata includes logical assets and metric assets. Business assets include business objects, logical entities, and business attributes and their details. Metric assets include business metrics and their details.

Technical metadata in DataArts Studio are obtained through metadata collection tasks. You can view metadata on the **Data Map** page only after you have created and run a metadata collection task.

11.4.2 Configuring a Metadata Collection Task

You can create collection tasks by configuring metadata collection policies. Different types of data sources require different collection policies. Metadata management allows you to collect technical metadata using the configured collection policies.

Constraints

- If the collection scope is not specified for a metadata collection task, all data tables and files of a data connection are collected by default. After the collection task is complete, if data tables or files are added to the data connection, you must run the metadata collection task again to collect the new data tables or files.
- Before collecting Oracle metadata, ensure that the database user of the data connection has the permission to read and write data tables and read metadata. For details, see how to assign permissions to users in **Oracle Connection Parameters**.
- Due to MRS cluster restrictions, metadata collection tasks cannot directly collect metadata of Hive partitioned tables by default.

  To collect metadata of Hive partitioned tables, add parameter **hive-ext.display.desc.statistic.stats** and value **true** to **hive.server.customized.configs** in **HiveServer(Role) > Customization** of the MRS cluster. For details, see **Enabling Metadata Collection from Hive Partitioned Tables of an MRS Cluster**.

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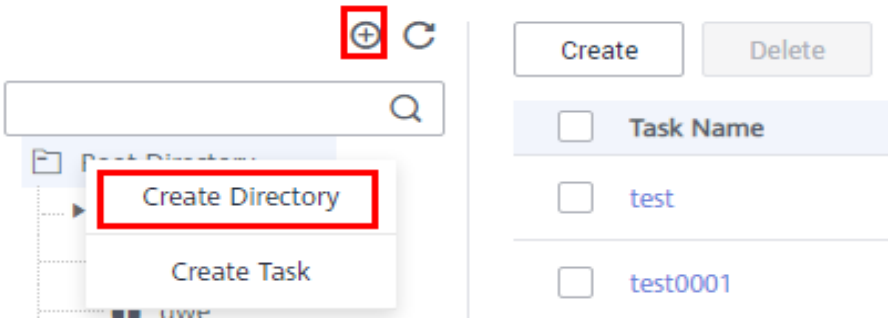
Prerequisites

- Metadata of the following types of data sources can be collected: DWS, DLI, MRS HBase, MRS Hive, RDS, and Oracle. To obtain metadata, you must first create data connections in Management Center. To collect metadata from other data sources (such as OBS, CSS, and GES), you do not need to create data connections in Management Center.
- Before you can collect the metadata of Hudi tables by collecting the MRS Hive metadata, you must enable synchronization of the Hive table configuration for Hudi tables.
- To collect metadata of Hive partitioned tables, add parameter **hive-ext.display.desc.statistic.stats** and value **true** to **hive.server.customized.configs** in **HiveServer(Role) > Customization** of the MRS cluster. For details, see **Enabling Metadata Collection from Hive Partitioned Tables of an MRS Cluster**.

Creating a Collection Task

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. Choose **Metadata Collection** > **Task Management** from the left navigation bar.
3. Select the directory for the collection task. If no directory is available, create one as **Figure 11-18** shows.

   Figure 11-18 Directory that stores the collection task to create

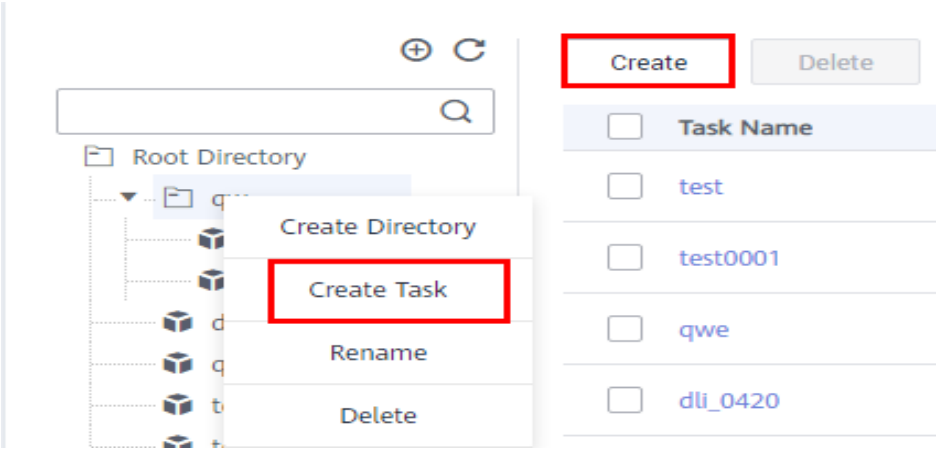
   

4. Click **Create** in the upper part of the displayed page or right-click **Task name** and choose **Add Task** from the shortcut menu. On the page displayed, set the parameters.

   Figure 11-19 shows the entries for creating a task.

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Figure 11-19 Entries for creating a collection task



a. Set the basic configuration based on **Table 11-4**.

Table 11-4 Basic configuration parameters

Parameter	Description
Task Name	Name of a collection task. The value can contain only letters, numbers, and underscores (_), and cannot exceed 62 characters.
Description	Information to better identify the collection task. Length of the description cannot exceed 255 characters.
Select Directory	The directory that stores the collection task. You can select an existing one. **Figure 11-18** shows the directory.

b. Configure data source information based on **Table 11-5**.

Table 11-5 Data source parameters

Parameter	Description
Data Connection Type	Select a data connection type from the drop-down list box. **NOTE** Metadata of the following types of data sources can be collected: DWS, DLI, MRS HBase, MRS Hive, RDS, and Oracle. To obtain metadata, you must first create data connections in Management Center. To collect metadata from other data sources (such as OBS, CSS, and GES), you do not need to create data connections in Management Center.

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Parameter		Description
• **DWS** • **DLI** • **MRS HBase** • **MRS Hive** • **ORACLE** • **RDS**	Data Connection Name	• To use an existing data connection, select a value from the drop-down list. • To use a data connection that does not exist, click **Create** to add one.
	Database (or **Database and Schema** and **Namespace**)	Database, schema, or namespace and data table from which data will be collected • Click **Set** next to **Database** (or **Database and Schema** or **Namespace**) to set the range of databases (or databases and schemas or namespaces) to be scanned by the collection task. If this parameter is not set, all databases (or databases and schemas or namespaces) under the data connection are scanned by default. • Click **Set** next to **Table** to set the range of tables to be scanned by the collection task. If this parameter is not set, all tables in the database (or database and schema or namespace) are scanned by default. • If neither the database (or database and schema or namespace) nor the data table is set, the task scans all data tables of the selected data connection. • Click **Clear** to delete the selected database (or database and schema or namespace) and data table.
	Table	
CSS	Cluster	Select the CSS cluster for storing the data to be collected. You can also click **Create** to create a CSS cluster. After the CSS cluster is created, click **Refresh** and select the new CSS cluster.
	CDM Cluster	Select the agent provided by the CDM cluster. You can also click **Create** to create an agent. After the agent is created, click **Refresh** and select the new agent.
	Index	Index, similar to "database" in the relational database (RDB), stores Elasticsearch data. It is a logical space that consists of one or more shards.
GES	Graph	Select graphs that store structured data based on "relationships".
	CDM Cluster	Select the agent provided by the CDM cluster. You can also click **Create** to create an agent. After the agent is created, click **Refresh** and select the new agent.

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Parameter		Description
OBS	OBS Bucket	Select the OBS bucket from which data will be collected.
	OBS Path	Select the path of the OBS bucket from which data will be collected.
	Collection Scope	Select the range of data to be collected. • If you select **This folder**, the collection task collects only the objects in the folder set in the OBS path. • If you select **This folder and subfolders**, the collection task collects all objects in the folder set in the OBS path, including the objects in the sub-folders.
	Collected Content	Select the content of data to be collected. • If you select **Folders and objects**, the collection task collects folders and objects. • If you select **Folders**, the collection task collects only folders.

c. Set parameters under **Metadata Collection**. See **Table 11-6**.

NOTE

Metadata collection parameters are available only for DWS, DLI, MRS HBase, MRS Hive, RDS, or Oracle connections.

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Table 11-6 Parameters for metadata collection

Parameter	Description
The data source metadata has been updated.	When metadata in a data connection changes, you can configure an update policy to set the metadata update mode in the data catalog. Note that the configured update and deletion policies apply only to the databases and data tables configured by yourself. • If you select **Update metadata in the data directory only**, the collection task updates only the metadata that has been collected in the data catalog. • If you select **Add new metadata to the data directory only**, the collection task collects only metadata that exists in the data source but does not exist in the data catalog. • If you select **Update metadata in the data directory and add metadata**, the collection task fully synchronizes metadata from the data source. • If you select **Ignore the update and addition operations**, the metadata in the data source is not collected.
The data source metadata has been deleted.	When metadata in a data connection changes, you can configure a deletion policy to set the metadata update mode in the data catalog. • If you select **Delete metadata from data directory**, when some metadata in the data source is deleted, the corresponding metadata is also deleted from the data catalog. • If you select **Ignore the deletion**, when some metadata in the data source is deleted, the corresponding metadata is not deleted from the data catalog.

d. Set parameters when **Data Summary** is selected. See **Table 11-7** for details.

NOTE

- **Data Summary** parameters are available only for DWS, DLI connections.
- You are advised not to select **Data Summary** unless necessary. Selecting this option will increase the SQL execution workload. As a result, the metadata collection task may take a longer time than expected.

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Table 11-7 Parameters

Parameter	Description
Full data	If this option is selected, a data profile is generated in the data catalog based on all data collected. This mode applies to scenarios where the data volume is less than 1 million.
Sampled data, first *x* rows	If this option is selected, a data profile is generated in the data catalog based on all data collected. This mode is applicable to scenarios with a large amount of data.
Randomly collect *x*% records of data from all data	If this option is selected, a data profile is generated in the data catalog based on all data collected. This mode is applicable to scenarios with a large amount of data.
Data Lake Insight Queue	The queue used to obtain profile data and execute DLI SQL statements. If you select **Collect unique value**, the number of unique values in the collected table is calculated and displayed on the **Profile** tab page in the data catalog.

e. Set parameters when **Data Classification** is selected. (This option is available only when DataArts Catalog provides data security functions. The data classification cannot be associated with a sensitive data identification rule created in the independent DataArts Security module.)

- If you select **Data Classification** and create a classification rule group or select an existing classification rule group by referring to **Creating a Data Classification (To Be Removed)**, data will be automatically identified and a classification will be added.
- If you select **Update the data table security level based on the data classification result**, the table security level must be the same as the highest security level of the matched classification rules.
- If you select **Manually** for **Synchronize Data**, classification rules and security levels are not automatically added to **Column Attributes** of **Data Catalog** under **Data Map**. Go to the **Task Monitoring** page. Locate the target instance and choose **More** > **View Scanning Result** to view the execution result of the collection task and check whether the classification result matches. Select the check box of the classification matching field and click **Synchronize** to manually synchronize the classification rule and security level.

NOTE

Only when you choose the DWS or DLI data source, you can add data classifications for automatic data identification. In addition, you can add classification rules only for columns in the data tables and OBS objects.

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5. Click **Next** and select a scheduling mode.

   Once: If the execution duration of a task exceeds the configured timeout duration, the task is considered failed.

   Repeating: See **Table 11-8** for details.

   NOTE

   1. If **Once** is selected, a manual task instance is generated. A manual task has no dependency on scheduling and must be manually triggered.
   2. If **Repeating** is selected, a periodic instance is generated. A periodic instance is an instance snapshot that is automatically scheduled when the scheduled execution time is arrived.
   3. When a periodic task is scheduled once, an instance workflow is generated. You can perform routine O&M on scheduled instance tasks, such as viewing the running status, stopping and rerunning the scheduled tasks.

   Table 11-8 Parameters

Parameter	Description
Scheduling Date	The period during which a scheduling task takes effect.
Scheduling Cycle	The frequency at which the scheduling task is executed, which can be: • Minutes • Hours • Days • Weeks
Start Time	Start time of periodic scheduling, which is used together with the start time in **Scheduling Date**.
Time Interval	Interval between two periodic scheduling operations A scheduling task instance starts even if the previous scheduling task instance has not ended. A collection task supports concurrent running of multiple instances.
End Time	End time of periodic scheduling, which is used together with the end time in **Scheduling Date**.
Timeout	Timeout duration for a task instance. If a task runs longer than the value of this parameter, the task fails to be executed.
Start	If this check box is selected, the task is scheduled immediately.

6. Click **Submit**. The collection task is created.

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Managing a Collection Task

1. On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.
2. Choose **Metadata Collection** > **Task Management** from the left navigation bar.

Then, you can view all created collection tasks.

Table 11-9 Parameters for managing collection tasks

Parameter	Description
Task Name	The name of a collection task. Click a collection task name to view the collection policies and scheduling properties.
Type	The name of a data connection.
Scheduling Status	The scheduling status of a collection task. You can click  to view only tasks of the specified statuses.
Scheduling Cycle	The scheduling frequency of a collection task. You can click  to view only tasks of the specified frequencies.
Description	The description of a collection task.
Creator	The creator of a collection task.
Last Executed On	The last time when the collection task ran.
Operation	You can perform the following operations on a created collection task: • **Edit**: Modify the parameters that are closely related to the policies of collection tasks whose status is **Started**, **Not started**, or **Failed**. The data source type cannot be modified. • **Run**: Click **Run** to run a collection task once and view its status and related logs on the **Task Monitoring** page. • **Start Scheduling**: If the status of a task is **Stopped**, you can start scheduling the task based on the configured scheduling mode. • **Stop Scheduling**: When the scheduling status is **Scheduling**, you can stop the scheduling.

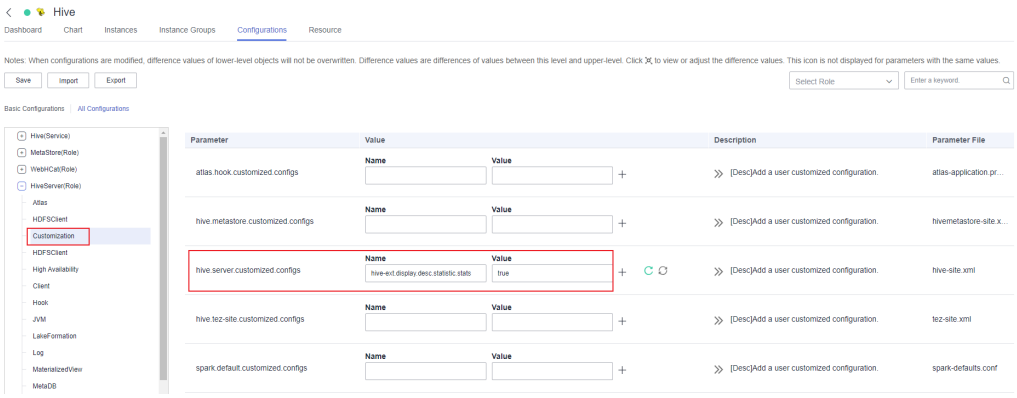
Enabling Metadata Collection from Hive Partitioned Tables of an MRS Cluster

Step 1 Log in to MRS Manager as user **admin**.

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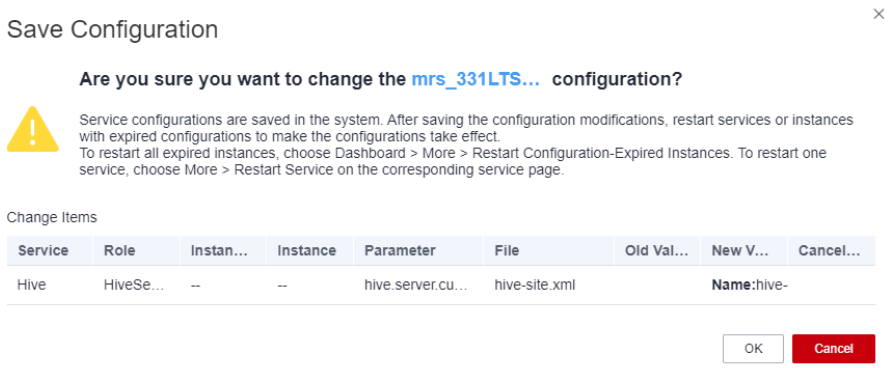
Step 2 On FusionInsight Manager, choose **Cluster** > **Services** > **Hive** and click the **Configurations** tab and then **All Configurations**. Choose **HiveServer(Role)** > **Customization**. Add **hive-ext.display.desc.statistic.stats** to the value of **hive.server.customized.configs** and set the value of **hive-ext.display.desc.statistic.stats** to **true**.

Figure 11-20 Adding a custom parameter



Step 3 After setting the parameter, click **Save** in the upper left corner and then **OK** in the dialog box to save the configuration.

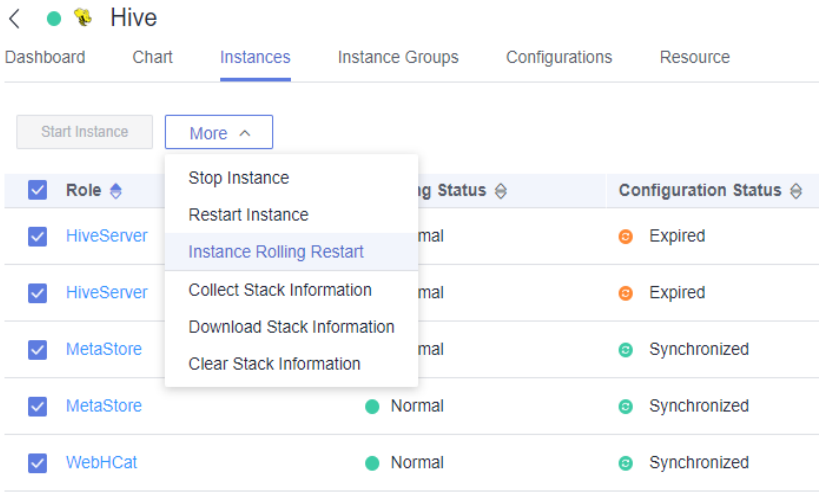
Figure 11-21 Saving the configuration



Step 4 After saving the configuration, switch to the **Instances** tab page, select the instance that has expired, click **More**, and select **Instance Rolling Restart** to make the configuration take effect.

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Figure 11-22 Performing a rolling instance restart



----End

11.4.3 Viewing Task Monitoring Information

You can monitor the running status of metadata collection tasks, view collection logs, and perform operations such as rerunning collection tasks.

On the **DataArts Catalog** page, choose **Metadata Collection** > **Task Monitoring** in the left navigation pane. On the page displayed, monitor the created collection tasks. See **Table 11-10** for details.

Table 11-10 Parameters for monitoring a collection task

Parameter	Description
Task Name	The name of a collection task.
Instance Status	The status of an instance (collection task), which can be: • Successful • Partially successful • Executing • Failed • Running exception • Paused: Task monitoring is paused due to management plane upgrade. After the upgrade is complete, the monitoring will recover.
Schedule	The scheduling mode of the collection task. The options are **Schedule once** and **Schedule periodically**.
Time Interval	The scheduling period of the collection task.

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Parameter	Description
Start Time	The time when the collection task restarts running.
End Time	The time when the collection task stops running.
Running Duration (min)	The duration that the collection task has run.
Operation	The operations that can be performed on the collection task under monitoring: • **Rerun**: Instances whose statuses are **Failed** or **Succeeded** can be rerun. • **View Log**: You can view instance logs. **NOTE** Click **View Log** to view the run logs of metadata collection, data summary, and data classification tasks in real time. • **More > Cancel**: You can perform this operation only when **Manually** is selected for **Synchronize Data** under **Data Classification** during the creation of the collection task. Instances whose statuses are **Executing** can be stopped. • **More > View Scanning Result**: You can perform this operation only when **Manually** is selected for **Synchronize Data** under **Data Classification** during the creation of the collection task. You can view the execution result of the collection task instance to check whether the classification result is matched. Select the check box of the classification matching field and click **Synchronize** to manually synchronize the classification rule and security level.

11.5 Tutorial for Typical Scenarios of DataArts Catalog

11.5.1 Configuring an Incremental Metadata Collection Task

Configuring and running a collection task is the prerequisite for building data assets. This section describes how to create different types of metadata collection tasks.

Scenario 1: Adding Metadata Only

Create a collection task to collect new tables only.

For example, if table4 is newly added:

- Data table metadata before collection: table1, table2, table3
- Data table metadata after collection: table1, table2, table3, **table4**

If you only want to collect table 4 in the preceding figure, perform the following steps (on condition that table 1, 2, and 3 are already in DataArts Catalog):

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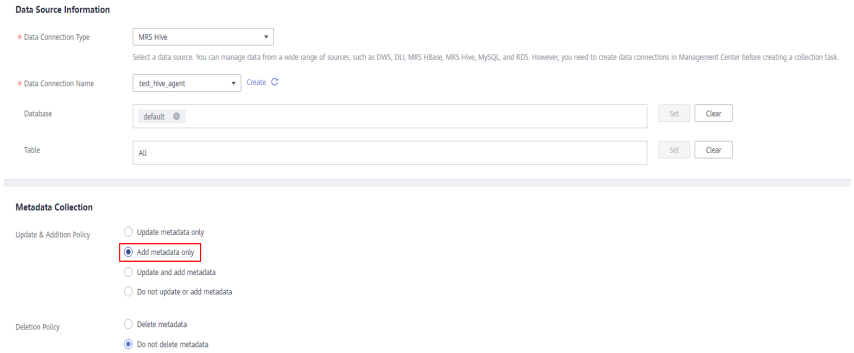
Step 1 Access the **DataArts Catalog** module on the DataArts Studio console.

Step 2 In the navigation pane on the left, choose **Collection Tasks**.

Step 3 Click **Create**.

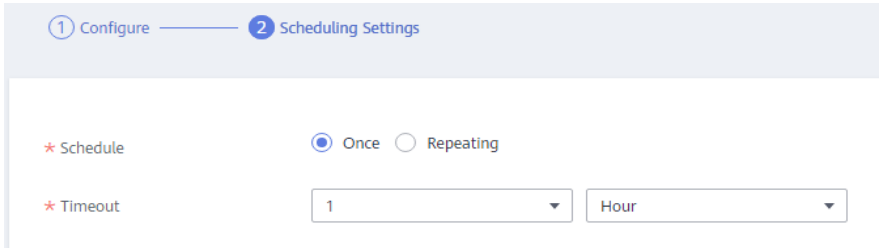
Step 4 Configure parameters for the task.

Figure 11-23 Configuring task information



Step 5 Click **Next** and set scheduling parameters.

Figure 11-24 Configuring scheduling parameters



Step 6 Click **Submit** to create a collection task.

Step 7 In the task list, locate the created task and click **Run** or **Start Schedule** in the **Operation** column to go to the **Task Monitoring** page and view the task status.

----End

Scenario 2: Updating Existing Metadata and Adding New Metadata

Create a collection task to collect all tables, including existing and new ones.

For example, if table4 is newly added:

- Data table metadata before collection: table1, table2, table3
- Data table metadata after collection: **table1**, **table2**, **table3**, **table4**

If you want to collect all tables in the preceding figure, perform the following steps:

Step 1 Access the **DataArts Catalog** module on the DataArts Studio console.

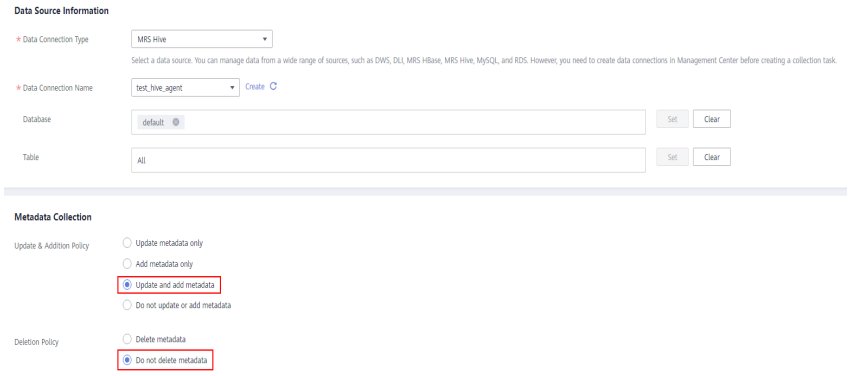
Step 2 In the navigation pane on the left, choose **Collection Tasks**.

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Step 3 Click **Create**.

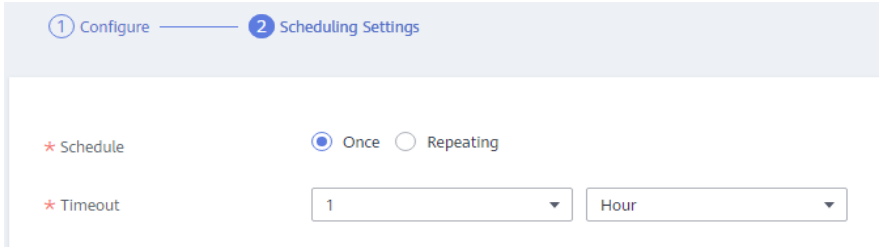
Step 4 Configure parameters for the task.

Figure 11-25 Configuring task information



Step 5 Click **Next** and set scheduling parameters.

Figure 11-26 Configuring scheduling parameters



Step 6 Click **Submit** to create a collection task.

Step 7 In the task list, locate the created task and click **Run** or **Start Schedule** in the **Operation** column to go to the **Task Monitoring** page and view the task status.

----End

Scenario 3: Updating Existing Metadata Only

Create a collection task to collect existing tables.

For example, if table4 is newly added:

- Data table metadata before collection: table1, table2, table3
- Data table metadata after collection: **table1**, **table2**, **table3**

If you want to collect table 1, 2, and 3 in the preceding figure, perform the following steps:

Step 1 Access the **DataArts Catalog** module on the DataArts Studio console.

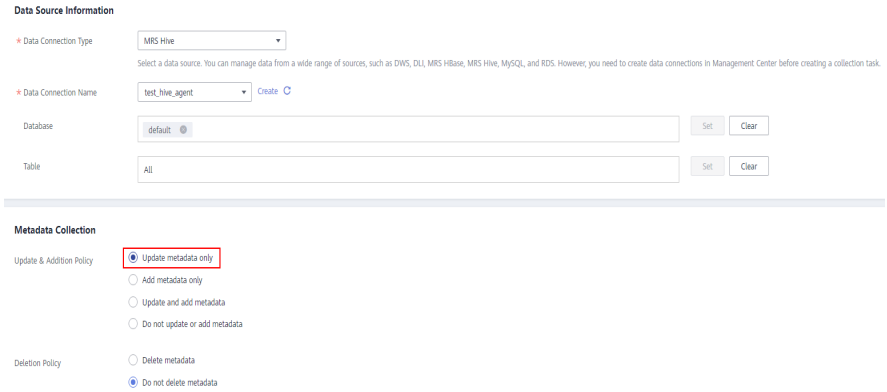
Step 2 In the navigation pane on the left, choose **Collection Tasks**.

Step 3 Click **Create**.

Step 4 Configure parameters for the task.

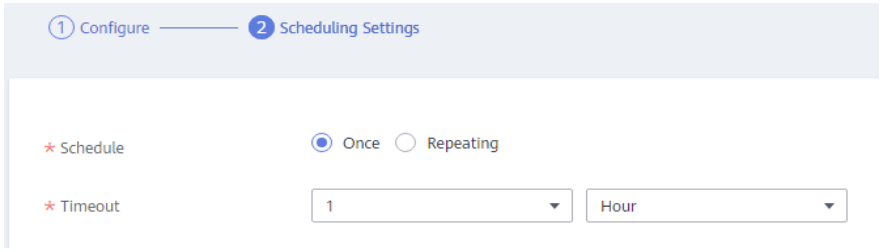
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Figure 11-27 Configuring task information



Step 5 Click **Next** and set scheduling parameters.

Figure 11-28 Configuring scheduling parameters



Step 6 Click **Submit** to create a collection task.

Step 7 In the task list, locate the created task and click **Run** or **Start Schedule** in the **Operation** column to go to the **Task Monitoring** page and view the task status.

----End

Scenario 4: Updating and Deleting Existing Metadata and Adding New Metadata

Create a collection task to delete existing tables.

For example, if table1 is deleted from the database:

- Data table metadata before collection: table1, table2, table3
- Data table metadata after collection: **table2**, **table3**

If you want to delete table1, perform the following steps:

Step 1 Access the **DataArts Catalog** module on the DataArts Studio console.

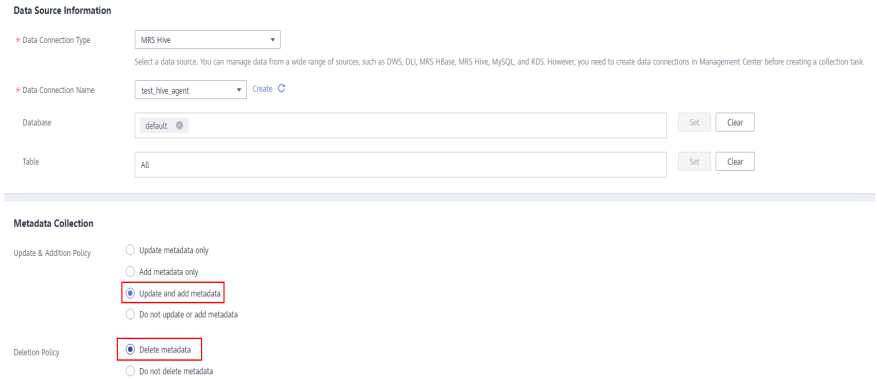
Step 2 In the navigation pane on the left, choose **Collection Tasks**.

Step 3 Click **Create**.

Step 4 Configure parameters for the task.

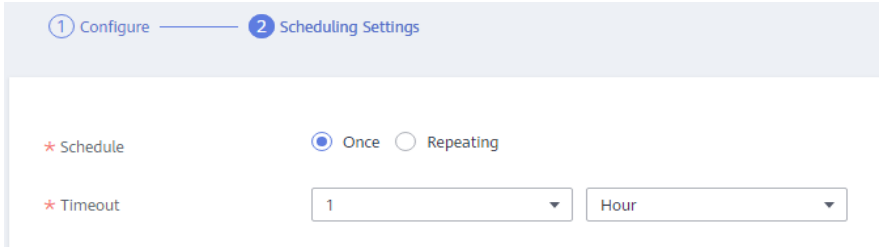
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Figure 11-29 Configuring task information



Step 5 Click **Next** and set scheduling parameters.

Figure 11-30 Configuring scheduling parameters



Step 6 Click **Submit** to create a collection task.

Step 7 In the task list, locate the created task and click **Run** or **Start Schedule** in the **Operation** column to go to the **Task Monitoring** page and view the task status.

----End

11.5.2 Viewing Data Lineages Through DataArts Catalog

11.5.2.1 Data Lineage Overview

What Is Data Lineage?

In the era of big data, various types of data are rapidly generated due to explosive data growth. The massive and complex data information is converged, transformed, and transferred to generate new data and aggregate into an ocean of data.

During this process, a relationship is formed between the data, and these relationships are their lineages. They are analogous to the genetic relationships between people. However, in contrast from our human lineages, data lineages have the following distinct features:

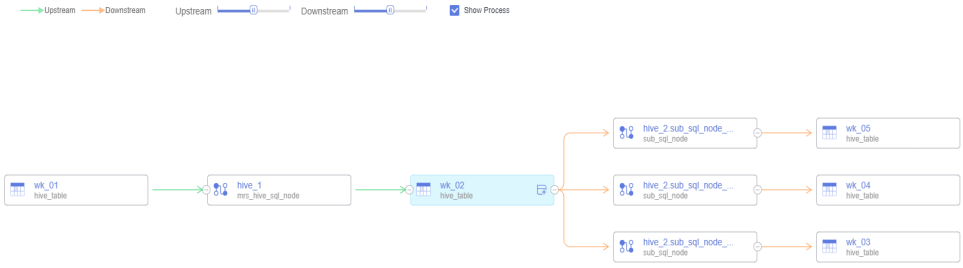
- **Belongingness**: Specific data belongs to a specific organization or individual.
- **Multi-source**: One piece of data can have multiple sources. One piece of data may be generated by processing multiple pieces of data, and there may be multiple such processes.

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- **Traceability**: The data lineage is traceable. It reflects the data lifecycle and the entire process from data generation to data disappearance.
- **Hierarchy**: The data lineage is hierarchical. Data classification and summary form new data, and different levels of description result in data layers.

Figure 11-31 shows the lineage relationship graph for DataArts Studio.  indicates a data table, and  indicates a job node. They are orchestrated using arrows. As shown in the graph, the data in table **wk_01** is processed on the **hive_1** job node and then written to table **wk_02**. The data in table **wk_02** is processed on the **hive_2** job node and written to tables **wk_03**, **wk_04**, and **wk_05**, respectively.

Figure 11-31 Data lineage example



How DataArts Studio Data Lineage Is Implemented

- Generation of data lineages:

  The DataArts Studio data lineage parsing solution supports automatic lineage analysis and manual lineage configuration. Automatic lineage parsing is recommended. In this mode, lineages can be generated without manual configuration. If automatic lineage parsing is not supported, manually configure lineages.

  - Automatic lineage parsing: Lineages are automatically generated after the system parses the data processing and data migration nodes in data development jobs. No manual configuration is required. For details about the node types and scenarios that support automatic lineage parsing, see **Automatic Lineage Parsing**.
  - Manual lineage configuration: Customize the input and output tables of lineages in data development job nodes. If you configure lineages manually for a node, the automatic lineage parsing does not take effect for this node. For details about the node types that support manual lineage configuration, see **Manually Configuring a Lineage**.

- Display of data lineages:

  You need to create a metadata collection task in DataArts Catalog first. When a data development job meets the **automatic lineage parsing requirements** or **lineages have been manually configured**, and when the job is successfully scheduled, you can view the data lineages in DataArts Catalog.

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11.5.2.2 Configuring Data Lineages

The DataArts Studio data lineage parsing solution supports automatic lineage analysis and manual lineage configuration. Automatic lineage parsing is recommended. In this mode, lineages can be generated without manual configuration. If automatic lineage parsing is not supported, manually configure lineages.

- Automatic lineage parsing: Lineages are automatically generated after the system parses the data processing and data migration nodes in data development jobs. No manual configuration is required. For details about the node types and scenarios that support automatic lineage parsing, see **Automatic Lineage Parsing**.
- Manual lineage configuration: Customize the input and output tables of lineages in data development job nodes. If you configure lineages manually for a node, the automatic lineage parsing does not take effect for this node. For details about the node types that support manual lineage configuration, see **Manually Configuring a Lineage**.

Constraints

Currently, field-level lineage parsing is not supported.

Automatic Lineage Parsing

Automatic lineage parsing does not require manual configuration. When a data development job contains the nodes and scenarios listed in **Table 11-11**, the system can automatically parse lineages.

NOTE

The lineage of an SQL node can be parsed using multiple SQL statements, and column-level lineage parsing is supported. A single SQL statement cannot contain semicolons (;).

Table 11-11 Job nodes and scenarios that support automatic lineage parsing

Job Node	Supported Scenario
DLI SQL	• Lineages generated by data insertion between DLI tables • Lineages between OBS files generated by table creation statements and DLI tables
DWS SQL	Lineages between DWS tables generated by DML operations such as "Insert into"
MRS Hive SQL	Lineages between MRS tables generated by DML operations such as "Insert into/overwrite"
MRS Spark SQL	Lineages between MRS tables generated by DML operations such as "Insert into/overwrite"
CDM Job	Lineages generated during table file migration between MRS Hive, DLI, RDS, OBS, CSS, and GaussDB(DWS)

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Job Node	Supported Scenario
ETL Job	Data lineages generated by ETL tasks between DLI, OBS, MySQL, and DWS.

Manually Configuring a Lineage

In a DataArts Studio data development job, you can customize the input and output tables of lineages on the nodes of the job. If you configure lineages manually for a node, the automatic lineage parsing does not take effect for this node.

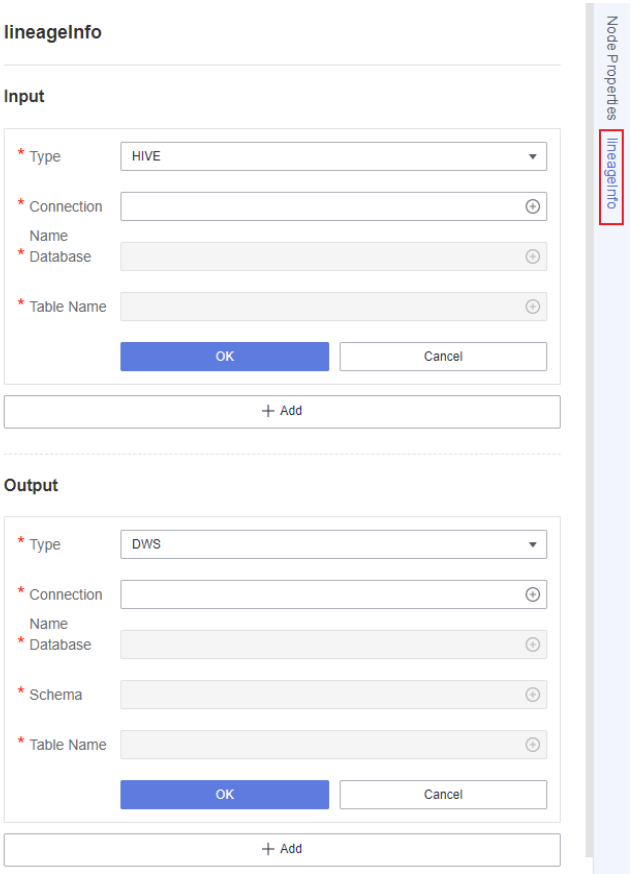
The following types of job nodes support manual lineage configuration.

- CDM Job
- Rest Client
- DLI SQL
- DLI Spark
- DWS SQL
- MRS Spark SQL
- MRS Hive SQL
- MRS Presto SQL
- MRS Spark
- MRS Spark Python
- ETL Job
- OBS Manager

When manually configuring the lineage, configure the input and output tables of the lineage on the Lineage tab page of the node. The data sources of the input and output tables can be DLI, DWS, Hive, CSS, OBS and CUSTOM. CUSTOM indicates a custom type. When manually configuring a lineage, you can add data sources that are not supported as custom types.

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Figure 11-32 Example of manual configuration of lineage relationships



For example, you need to manually configure a lineage for an MRS Spark node in a pipeline data development job because this node does not support automatic lineage parsing. The procedure is as follows:

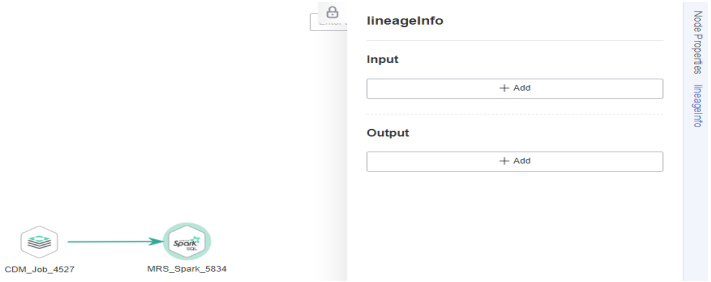
Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 On the DataArts Factory console, choose **Data Development** > **Develop Job**. Double-click the name of the job for which you want to configure a lineage to open the job canvas.

Step 4 Click the MRS Spark node in the job canvas and then the **lineageInfo** page.

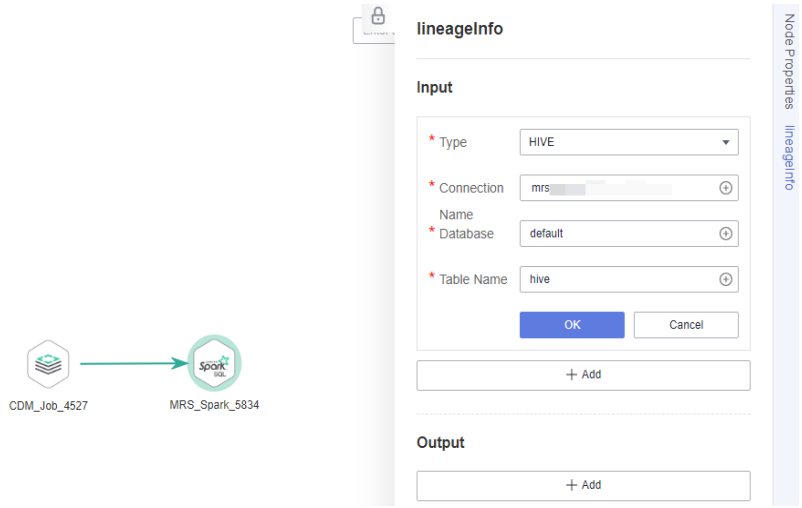
Figure 11-33 lineageInfo page



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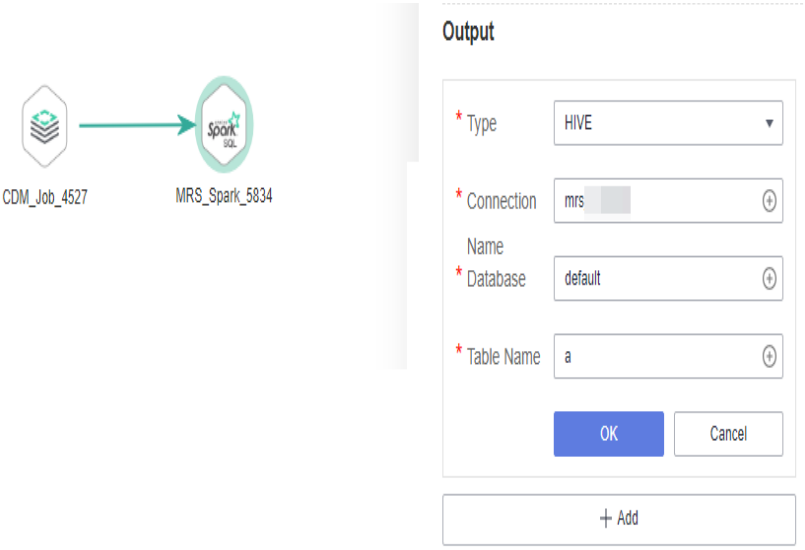
Step 5 Configure the lineage input table. For example, you can configure input table **hive**, as shown in **Figure 11-34**.

Figure 11-34 Configuring the lineage input



Step 6 Click **OK** and configure the lineage output table. For example, you can configure output table **a**, as shown in **Figure 11-35**.

Figure 11-35 Configuring the lineage output



Step 7 Click **OK**. The lineage for the MRS Spark node has been configured. If you want to view the lineage later, collect metadata by referring to **Viewing Data Lineages** and schedule the job. Then, you can view the manually configured lineage of the MRS Spark node in DataArts Catalog.

----End

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11.5.2.3 Viewing Data Lineages

You need to create a metadata collection task in DataArts Catalog first. When a data development job meets the **automatic lineage parsing requirements** or **lineages have been manually configured**, and when the job is successfully scheduled, you can view the data lineages in DataArts Catalog.

Constraints

- Data lineage updates depend on job scheduling. Data lineages are generated based on the latest job instances.

  NOTE

  After a data lineage is generated based on the latest instance of a data development job, the lineage will not be updated within the cooldown period (48 hours by default), as long as no new version is submitted for the job. If you want to update the lineage, wait until the cooldown period ends or submit another version of the job and schedule the job.

- To delete data lineages, you need to delete jobs or job metadata. Stopping jobs alone does not delete data lineages.

Creating and Running a Metadata Collection Task

Create and run a metadata collection task by referring to **Configuring a Metadata Collection Task**. When creating the task, select the tables whose lineages you want to view.

If a task for collecting the metadata of these tables has been created and run, skip this part.

Starting Job Scheduling

After metadata is collected, the system generates data lineages based on the latest job instances.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts Factory**.

Step 3 In the navigation pane, click  and double-click the job for which lineages have been configured to open it.

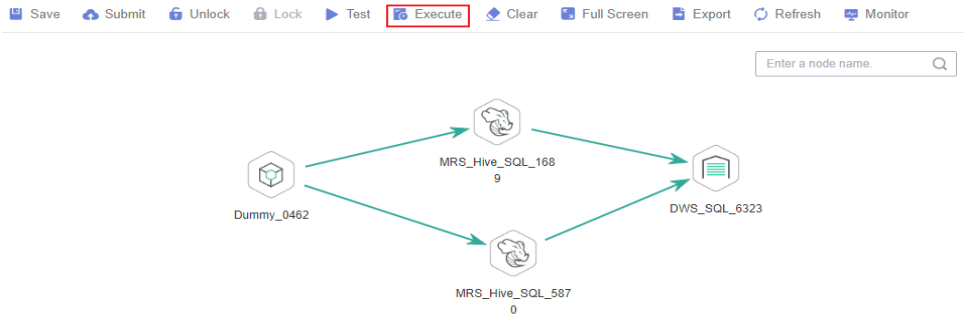
Step 4 Click **Execute**. The system starts parsing lineages of the job.

NOTE

If you click **Test**, the system will not parse lineages of the job.

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Figure 11-36 Starting job scheduling



Step 5 After the job is successfully executed, wait for about 1 minute. The data lineage is generated.

----End

Viewing Data Lineages

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Catalog**.

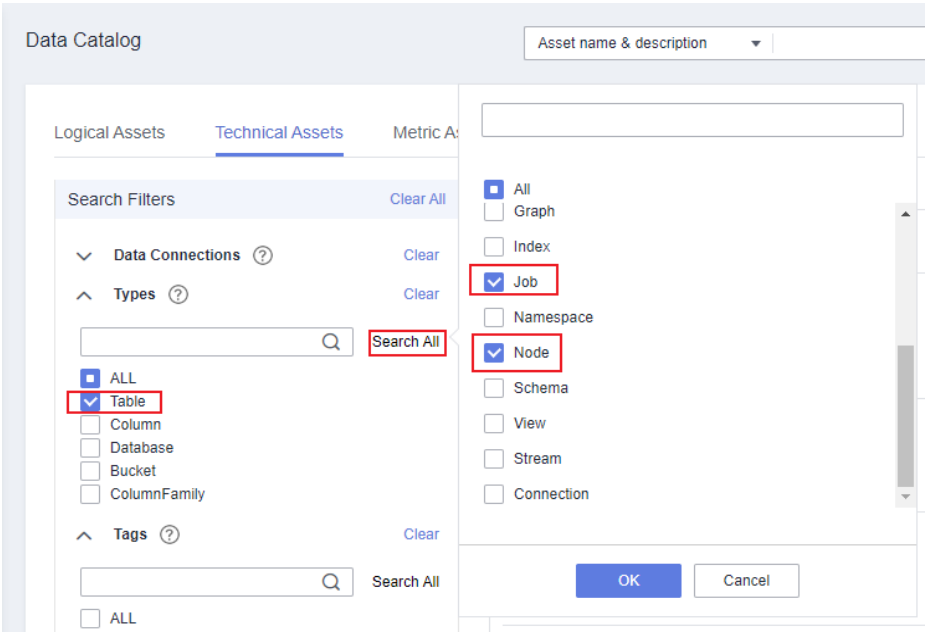
Step 2 In the navigation pane, choose **Data Catalog**. In the right pane, click the **Technical Assets** tab. On this page, you can query jobs, nodes, and tables.

In the **Types** area, click **Search All**, select **Job**, **Node**, and **Table**, and click **OK**.

NOTE

Jobs do not belong to any data connection. If you select a data connection in the search filters, no result will be returned.

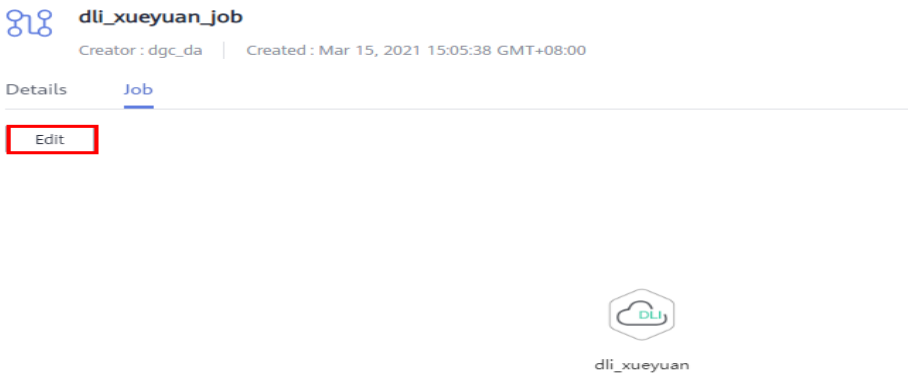
Figure 11-37 Selecting types



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Step 3 In the search result, click the name of an asset ending with **_job** to view its details. On the job details page, click the **Job** tab and then **Edit** to go to the job editing page.

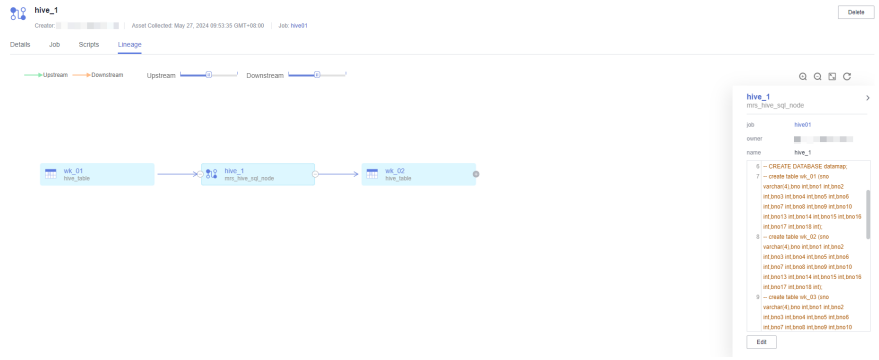
Figure 11-38 Viewing job details



Step 4 In the data asset search result, click the name of an asset ending with **_node** to view its details. On the node details page, you can view the node lineage information.

- Click the **+** or **-** icon beside the node to expand its upstream and downstream links.
- Click a node to view the its details.
- Click the **Job** tab and then **Edit** to go to the job editing page.

Figure 11-39 Viewing lineages of a node



Step 5 In the data asset search result, click the name of an asset whose icon is a table to view its details. On the table details page, you can view lineages of the table.

- Click the **+** or **-** icon beside the table to expand its upstream and downstream links.
- Click a table to view its details.

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Figure 11-40 Viewing lineages of a table



----End

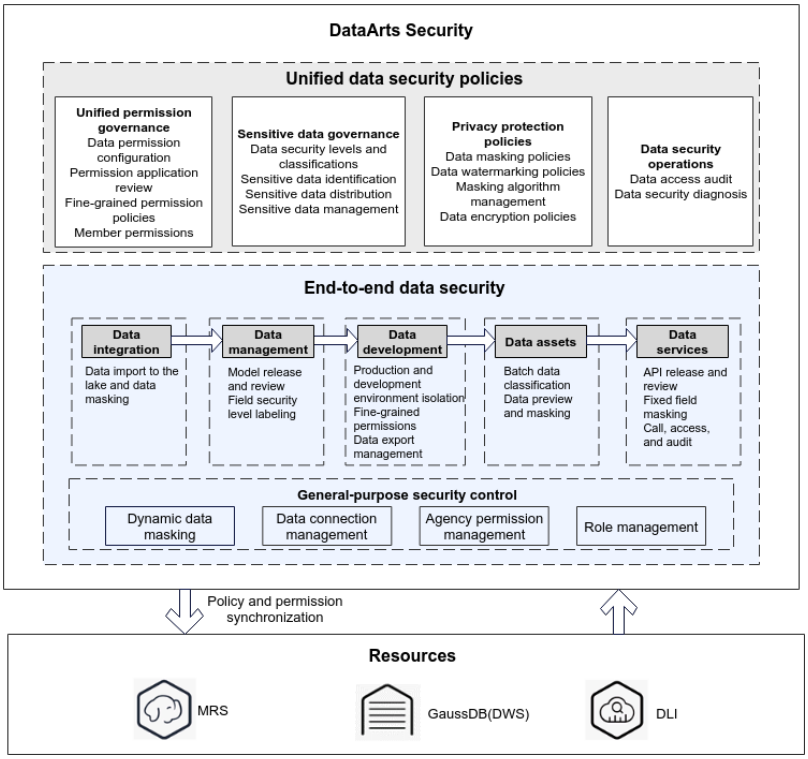
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12 DataArts Security

12.1 Overview

DataArts Security protects data lake security and meets the data security and governance requirements of different roles, such as data development engineers, data security administrators, data security auditors, and data security operators.

Figure 12-1 DataArts Studio DataArts Security framework



- **Resources**: databases, tables, fields, and computing engine queues in the Huawei Cloud data lake. They include the databases, tables, and fields of MRS Hive/Spark, DLI, and GaussDB(DWS), as well as computing queues of MRS Yarn and DLI.

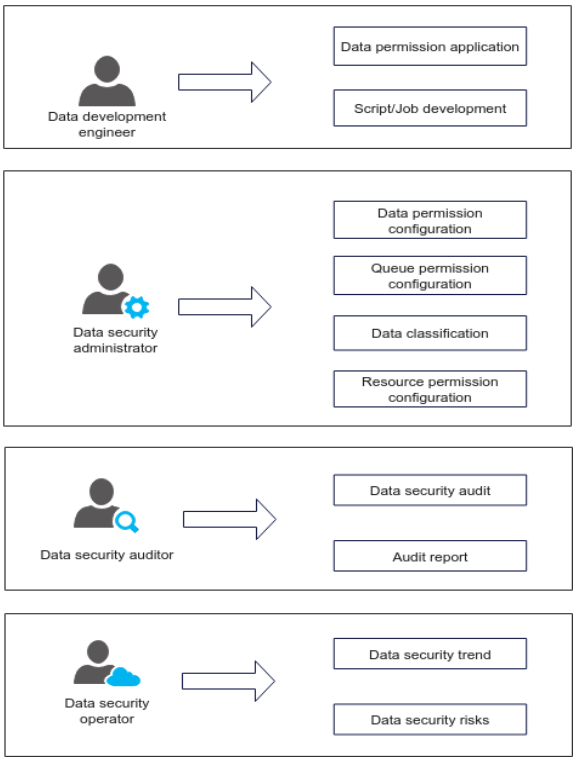
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

- **End-to-end data security**: DataArts Studio protects data security throughout data integration, data management (architecture design, metric design, and data quality management), data development, data asset management, and data services. It protects data throughout its lifecycle and ensures secure data flow through measures such as data access control and data masking. For example, it can mask sensitive fields in the data to be imported to the data lake and can control access to data sources. When analysts query data, sensitive data can be protected using dynamic masking policies or field access permissions.
- **Unified data security policies**: unified permission governance, sensitive data governance, privacy protection policies, and data security operations.

Scenario

DataArts Security meets the data security and governance requirements of different roles, such as data development engineers, data security administrators, data security auditors, and data security operators. **Figure 12-2** shows how different roles can use DataArts Security.

Figure 12-2 How different roles can use DataArts Security



Advantages

- DataArts Security integrates and centrally manages different big data services, such as MRS, DLI, and GaussDB(DWS), and provides unified permission configuration to improve usability and maintainability.
- DataArts Security provides end-to-end data security capabilities, such as unified permission governance, sensitive data governance, and privacy protection policy management.

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- Unified permission governance allows you to allocate workspace permission sets (databases and tables that can be managed by each project workspace). You can assign permissions to users and user groups of different roles in a workspace. Cross-workspace dependency supports on-demand permission application, review, and approval.
- Sensitive data management supports classification, automatic discovery, and security management policies based on security levels of sensitive data.
- Privacy protection and management provides static and dynamic data masking and data watermarking capabilities to meet service requirements while ensuring data security.

Function

DataArts Security provides the following functions:

- **Unified permission governance**

  DataArts Security provides unified management of data permissions based on MRS, DLI, and GaussDB(DWS). You can create workspace permission sets, permission sets, or roles, and use them to control access to MRS, DLI, and GaussDB(DWS) data, assign the minimum permissions to users and user groups on demand, and reduce data security risks.
- **Sensitive data governance**

  You can create sensitive data identification rules (or rule groups), or use the built-in identification rules (or rule groups), to detect, classify, and grade sensitive data.
- **Privacy protection and management**

  You can use static and dynamic data masking, and data, file, and dynamic watermarking to prevent your data from being misused, disclosed, or stolen intentionally or unintentionally. In this way, your sensitive data is secure, complete, and safe to use.
- **Data security operations**

  DataArts Security provides data security diagnosis and data lake access and audit log query capabilities, helping you manage security better.

12.2 Dashboard

On the **Dashboard** page on the DataArts Security console, you can configure the data security administrator and view the number of sensitive tables, a pie chart of the security levels of sensitive tables, a pie chart of the security levels of sensitive fields, and the trends of the number of masking tasks and watermark embedding tasks.

Configuring the Security Administrator

The security administrator is specified by an account with the permissions of the DAYU Administrator system role. The security administrator has the highest permissions in the DataArts Security module of all workspaces in the DataArts Studio instance. In the DataArts Security module, only the security administrator and the DAYU Administrator system role have the permission to perform the following operations:

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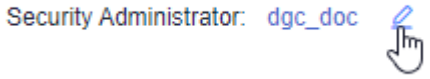
- Configuring workspace permission sets
- Configuring row-level access control using permissions
- Synchronizing users
- Configuring workspace resource permissions
- Configuring fine-grained authentication
- Configuring queue permissions

To configure the security administrator, log in to the DataArts Security console using an account with the permissions of the DAYU Administrator system role, and select an IAM user or user group on the **Dashboard** page. (If a user group is selected, all users in the user group are security administrators.)

NOTE

- Only the DAYU Administrator can configure a security administrator.
- The permissions of a security administrator take effect only for the DataArts Security component and are invalid for other components and services.

Figure 12-3 Configuring the security administrator



Viewing Sensitive Data

On the **Dashboard** page, you can filter data by data source and time. For example, you can view the sensitive data in the databases of GaussDB(DWS), DLI, and MRS Hive, including the number of sensitive tables, sensitive fields, masked tables, tables with watermarks, and watermarks traced.

Figure 12-4 Data overview



Data Analysis Reports

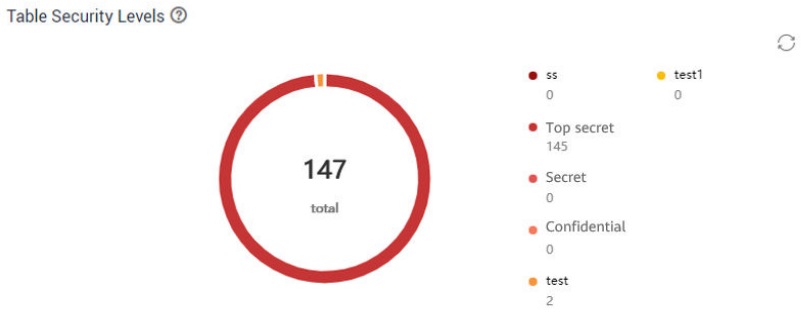
- Table security levels

  Create sensitive data discovery tasks to collect the number of table security levels. The security levels are customizable. The number of custom security levels and associated sensitive tables are displayed beside the pie chart.

  For details on how to create and run a sensitive data discovery task, see **Creating a Sensitive Data Discovery Task**.

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Figure 12-5 Security level pie chart

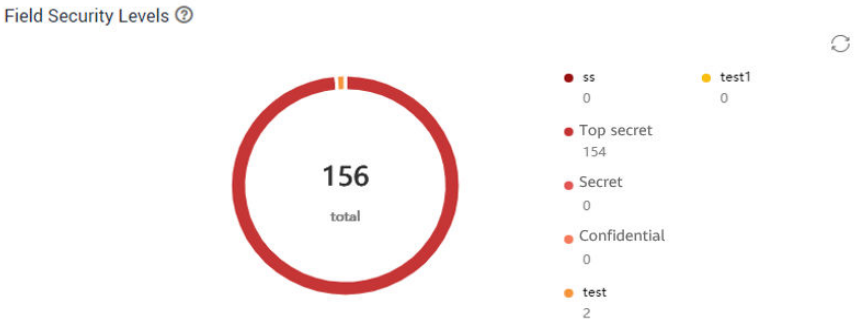


- Field security levels

  Create sensitive data discovery tasks to detect sensitive table fields. The field security levels are customizable. The number of custom security levels and associated sensitive fields are displayed beside the pie chart.

  For details on how to create and run a sensitive data discovery task, see **Creating a Sensitive Data Discovery Task**.

  Figure 12-6 Security level pie chart

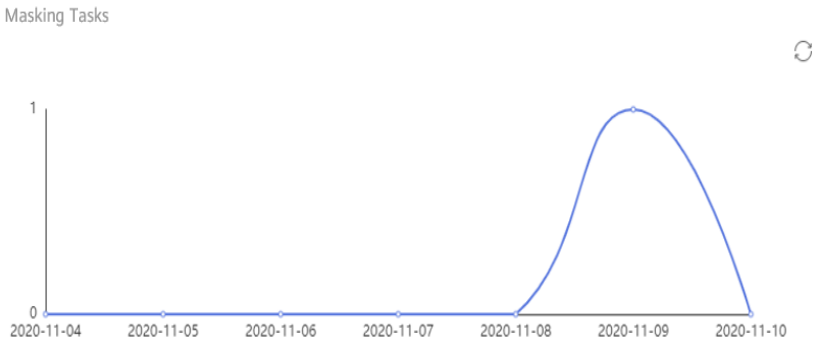


- Masking tasks

  The number of masking tasks on each day in the last seven days is displayed. For details on how to create and run a data masking task, see **Create a Static Masking Task**.

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Figure 12-7 Changes of masking task quantity

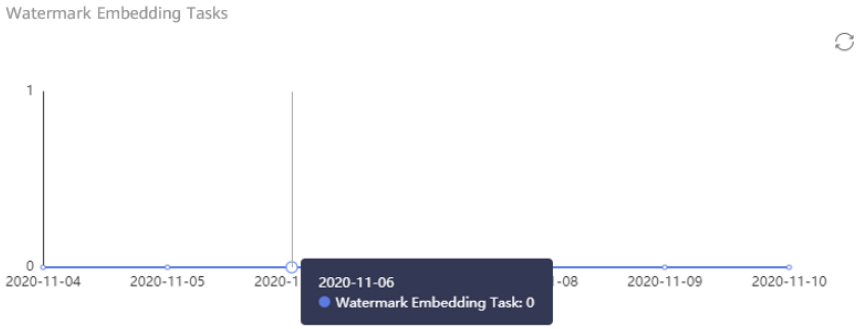


- Watermark embedding tasks

  The number of watermark embedding tasks on each day in the last seven days is displayed.

  For details on how to create and run a watermark embedding task, see **Creating a Data Watermark Embedding Task**.

  Figure 12-8 Changes of watermark embedding task quantity



12.3 Unified Permission Governance

12.3.1 Permission Governance Process

Unified permission governance allows you to configure access permissions for the databases, tables, and fields in MRS, DLI, and GaussDB(DWS). It has the following features:

- Centralized access control

  Permissions of different big data services, such as MRS, DLI, and GaussDB(DWS), are centrally managed. A unified portal is available for you to configure and maintain permissions easily.

- Multi-level permission configuration model

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Permission models are clearly defined and managed by level. A permission set or role further splits the permission scope defined by the workspace permission set and associates users with permissions for permission control.

- Refined permission management

  Role-based access control (RBAC) on the console supports refined data permission configuration and permission assignment by role, user, and user group. In addition, on-demand and efficient permission application approval is supported. Approved permissions take effect immediately.

- Multi-dimensional permission display
  - By workspace member: You can display the data table permissions requested by each user or user group and display, configure, and revoke the permission set relationship of each user or user group.
  - By data: You can display and configure the permission relationships of data in the current permission set by database, table, or field.
  - By permission: You can display, configure, and revoke the permission policy relationships of data in the current permission set by permission policy.

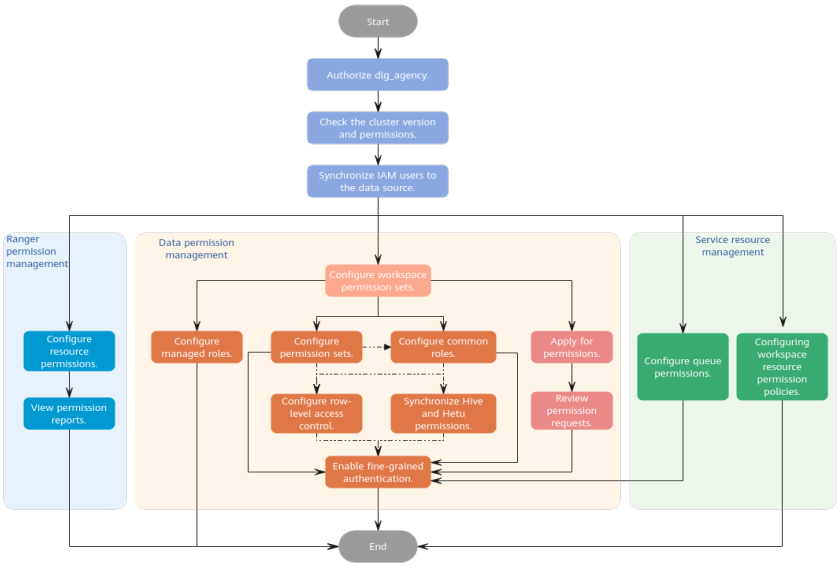
- Workspace resource management

  In addition to data permissions, workspace resources, such as data connections and agencies, can be managed.

Use Process

Figure 12-9 shows the process for using unified permission governance.

Figure 12-9 Process of using unified permission governance



Unified permission governance supports **data permission management**, **service resource management**, and **Ranger permission management**. Their processes are as follows:

Data permission management process

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1. **Authorize dlg_agency.**

   When using an agency, DataArts Security requires higher cloud service permissions. Before using DataArts Security, you need to grant required permissions to dlg_agency.

2. **Check the cluster version and permissions.**

   Unified permission governance has requirements on the data connection agent, data source version, and user permissions. Before using it, you need to check and prepare related configurations.

3. **Synchronize IAM users to the data source.**

   Synchronize user information from IAM to data sources so that users' access to the data sources can be managed based on user information.

4. **Configure workspace permission sets.**

   As the largest permission set in a DataArts Studio workspace, the workspace permission set defines the resources that can be accessed by users in the workspace.

5. **Configure permission sets.**

   A permission set associates users with permissions. You can create multiple permission sets to associate users in different scenarios with different permissions. Permissions can be managed through permission synchronization (association of permission sets with roles are more recommended in actual applications.)

6. **Configure common roles.**

   Create roles in the data source to associate users and permissions. In this way, you can manage permissions more intuitively.

7. **Configure managed roles.**

   Manage the existing roles in the MRS data source and inherit the MRS data source permissions of the existing roles.

8. **Configure row-level access control.**

   DataArts Security allows you to view the permissions of workspace members, and manage roles and permission sets.

9. **Synchronize MRS Hive and Hetu permissions.**

   DataArts Security allows you to view the permissions of workspace members, and manage roles and permission sets.

10. **Apply for permissions.**

    During access permission management, you can grant permissions to users through permission sets or roles, or apply for permissions and approve permission applications.

11. **Review permission requests.**

    The approver is the administrator of the permission set or role. The requested permission takes effect immediately after being approved.

12. **Enable fine-grained authentication.**

    After fine-grained authentication is enabled, data sources no longer use the accounts of the data connections during script execution, job tests, and job scheduling in DataArts Factory of DataArts Studio. Instead, the current user is used for authentication. In this way, different users have different data permissions, and the permissions of roles, permission sets, and queues can be managed.

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Service resource management process

1. **Configure queue permissions.**

   Queue permissions can be used to allocate MRS Yarn and DLI queues to the current workspace and configure queue permission policies for user groups or users.

   - After queues are allocated to the workspace, they can be selected during the job node configuration in DataArts Factory.
   - After queue permission policies are configured for user groups or users, they have the permissions specified in the policies.

2. **Configure workspace resource permission policies.**

   DataArts Security supports management of workspace resources, such as data connections and agencies. Unauthorized users cannot view or use the resources.

Ranger permission management process

1. **Configure resource permissions.**

   You can create permission policies for MRS components and use the Ranger component to manage permissions.

2. **View permission reports.**

   You can view resource permission policies and their details through a comprehensive permission report.

Data Permission Management

The current data permission control uses the allowlist mechanism, which adds operation conditions to the users to be authorized without affecting the permissions the users already have. If you only want to make the permissions granted by the data permission control take effect, you need to revoke the original permissions of the users to be authorized. By default, DataArts Studio users have the following permissions:

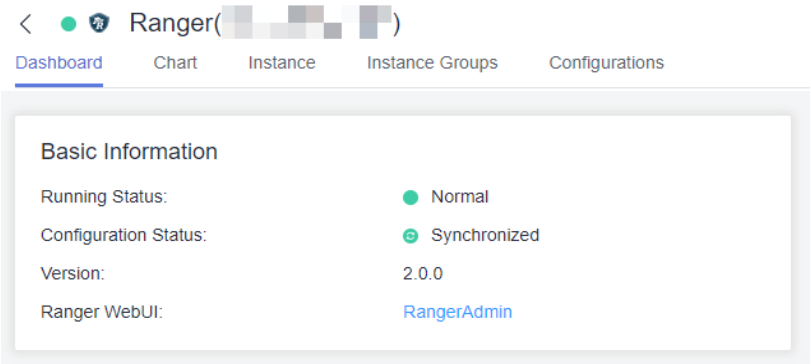
- For DLI data sources, the DAYU Administrator or DAYU User has the DLI Service Admin permission by default. Therefore, the users to be authorized have all the data permissions of DLI database tables by default. To remove the default permissions of an authorized user, you need to delete the DLI Service Admin permission of the user.
- For GaussDB(DWS) data sources, even if the DAYU Administrator or DAYU User has the GaussDB(DWS) Administrator permission by default, the GaussDB(DWS) database permissions are isolated from the IAM permissions on the console. Therefore, the users to be authorized do not have the data permissions of GaussDB(DWS) database tables by default. Only the data permission granted by the current data permission control takes effect.
- For MRS data sources, DAYU Administrator or DAYU User has the MRS Administrator permission by default and will be assigned the corresponding role after it is synchronized to MRS. For details, see **Synchronizing IAM Users to MRS**. The Ranger component provides the default policy bypass permissions. For details, see **Adding a Ranger Permission Policy**. If you want to revoke the default permissions of the users to be authorized, perform the following operations to remove the **public** user group from the default system policies on the Ranger component:

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a. Log in to MRS Manager as user **admin**.

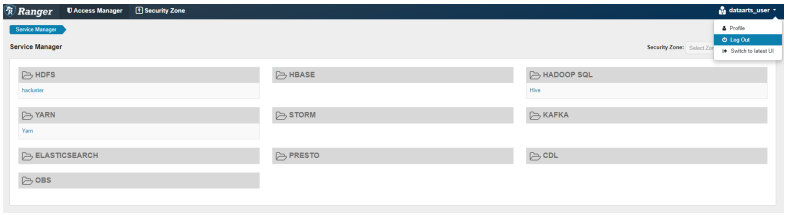
b. On the Manager page, choose **Cluster** > **Services** > **Ranger**. On the Ranger overview page, click **RangerAdmin** to go to the Ranger WebUI.

Figure 12-10 Accessing the Ranger WebUI



c. Log out of the current account and use the Ranger administrator account to log in again. For a common cluster, the admin account for the Manager page can be used as the Ranger administrator account. For a security cluster, **rangeradmin** is the Ranger administrator account. For details about the default password of **rangeradmin**, see **User Account List**.

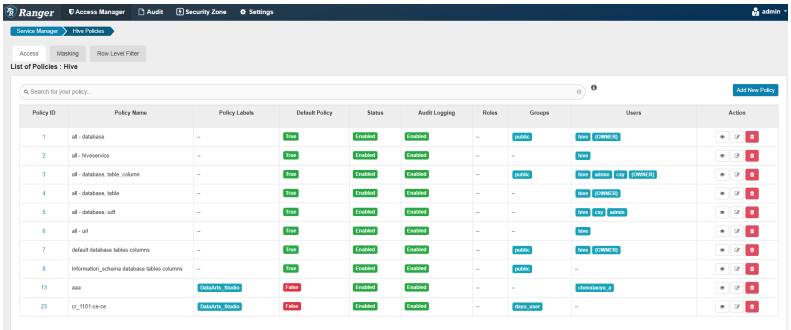
Figure 12-11 Logging out of the current account



d. On the home page, click the component plug-in name in the **HADOOP SQL** area, for example, **Hive**.

e. On the **Access** tab page, locate the default policies whose **Groups** column contains **public** (that is, the policy whose value in the **Default Policy** column is **True**) and remove the **public** user group from the policies.

Figure 12-12 Policy list



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12.3.2 Authorizing dlg_agency

Cloud service agencies allow DataArts Studio to perform operations such as task scheduling and resource O&M on cloud services on your behalf. When you log in to the DataArts Studio console homepage for the first time, a dialog box is displayed, prompting you to authorize other cloud services to access DataArts Studio. After the authorization is complete, DataArts Studio automatically creates an agency named **dlg_agency**. If you do not agree to the authorization, the dialog box will be displayed again when you access the console homepage next time.

When using an agency, DataArts Security requires higher cloud service permissions. Before using DataArts Security, you need to grant the permissions listed in **Table 12-1** to **dlg_agency**.

Table 12-1 Required permissions

Permission	Purpose	Mandatory	Authorization Item/System Permission (Configure Either of Them)	
IAM permission	This permission is required for the system to obtain users or user groups, or create roles. For example, user or permission synchronization fails if this permission is missing.	Mandatory for MRS, Gauss DB(DWS), and DLI permission management	• iam:users:listUsers • iam:groups:listGroups • iam:users:listUsersForGroup • iam:roles:createRole • iam:roles:deleteRole • iam:roles:updateRole • iam:permissions:grantRoleToGroup • iam:permissions:listRoleAssignments • iam:permissions:revokeRoleFromGroup **NOTE** Due to the restrictions of permission policies in IAM, no action is available for obtaining DLI user groups. To manage the permissions of DLI user groups, you must grant the Security Administrator system permissions.	Security Administrator

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Permission	Purpose	Mandatory	Authorization Item/System Permission (Configure Either of Them)	
MRS/ GaussDB(DWS) data connection agent permission	This permission is required for permission synchronization. For example, if this permission is missing, permission synchronization between permission sets, role permission synchronization, or permission application approval fails.	Mandatory for MRS and GaussDB(DWS) permission management	Any CDM permission, for example, cdm:cluster:get	Any CDM permission, for example, CDM Administrator
MRS user synchronization permission	This permission is required for MRS user synchronization. For example, MRS user synchronization fails if this permission is missing.	Mandatory for MRS permission management	• mrs:cluster:syncUser	MRS FullAccess
GaussDB(DWS) user synchronization permission	This permission is required for GaussDB(DWS) user synchronization. For example, GaussDB(DWS) user synchronization fails if this permission is missing.	Mandatory for GaussDB(DWS) permission management	• dws:dbAuthority:syncIamUser • dws:dbAuthority:updateUser	DWS FullAccess

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Permission	Purpose	Mandatory	Authorization Item/System Permission (Configure Either of Them)	
DLI permission synchronization permission	This permission is required for DLI permission synchronization and sensitive data discovery. For example, if this permission is missing, DLI permission synchronization fails and the system displays a message indicating insufficient permissions.	Mandatory for DLI permission management	Actions are not supported. System permissions DLI FullAccess and DLI Service Administrator are required.	DLI FullAccess DLI Service Administrator

Prerequisites

In the dialog box displayed on the DataArts Studio console homepage, you have selected **Agree** to allow the system to automatically create an agency named **dlg_agency**.

Constraints

After the agency authorization is successful, it takes 15 to 30 minutes for the permissions to take effect. Then, you can use DataArts Security to manage access permissions.

Granting Permissions to dlg_agency

When granting permissions to **dlg_agency**, you need to select either an authorization item or system permission from **Table 12-1** as needed.

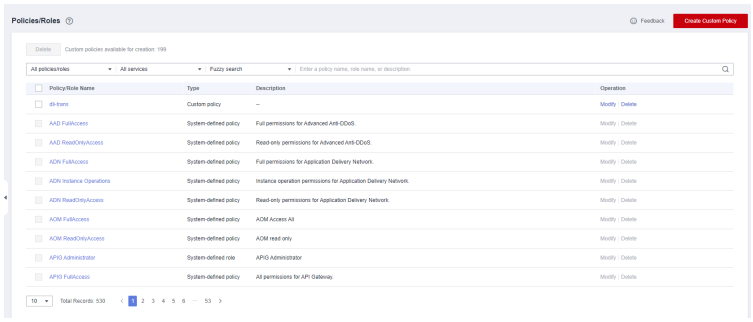
This section uses the MRS permission management scenario as an example. The permissions to be granted include the IAM permission, MRS/GaussDB(DWS) data connection agent permission, and MRS user synchronization permission. The principle of least privilege is used. The operations are as follows:

Step 1 Log in to the IAM console.

Step 2 In the left navigation pane, choose **Permissions** > **Policies/Roles** and click **Create Custom Policy**.

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Figure 12-13 Clicking Create Custom Policy



Step 3 On the displayed **Create Custom Policy** page, select **JSON** for **Policy View**, enter the IAM custom policy content required for MRS permission management, and click **OK**.

NOTE

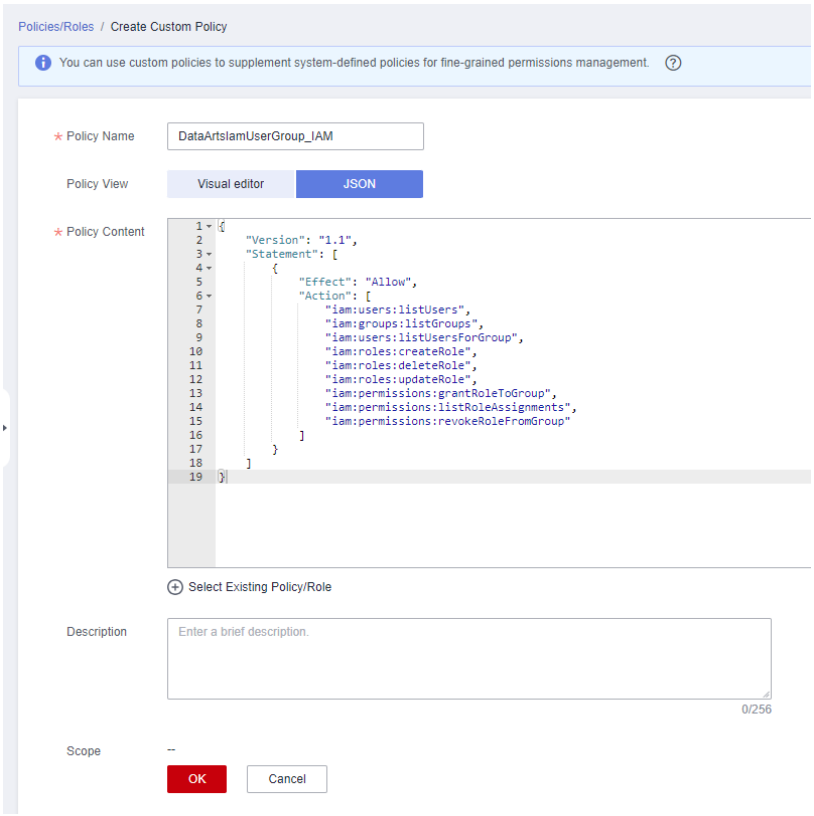
A custom policy can contain permissions for either global or project-level services. You need to configure IAM policies first, and then MRS and CDM policies.

- **Policy Name**: Enter **DataArtsIamUserGroup_IAM**.
- **Policy View**: Select **JSON** to switch to the JSON view.
- **Policy Content**: Enter the following JSON code and click **OK**.

```
{
    "Version": "1.1",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "iam:users:listUsers",
                "iam:groups:listGroups",
                "iam:users:listUsersForGroup",
                "iam:roles:createRole",
                "iam:roles:deleteRole",
                "iam:roles:updateRole",
                "iam:permissions:grantRoleToGroup",
                "iam:permissions:listRoleAssignments",
                "iam:permissions:revokeRoleFromGroup"
            ]
        }
    ]
}
```

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Figure 12-14 Creating a custom policy for IAM



Step 4 Click **Create Custom Policy** again. On the displayed **Create Custom Policy** page, select **JSON** for **Policy View**, enter the MRS and CDM custom policy content required for MRS permission management, and click **OK**.

NOTE

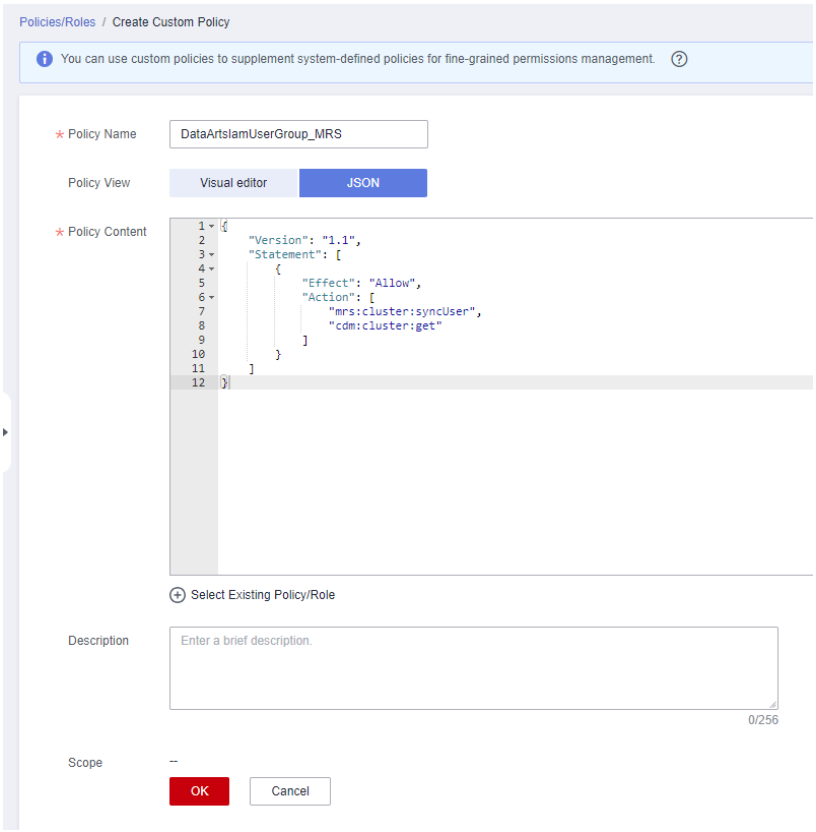
A custom policy can contain permissions for either global or project-level services. You need to configure IAM policies first, and then MRS and CDM policies.

- **Policy Name**: Enter **DataArtsIamUserGroup_MRS**.
- **Policy View**: Select **JSON** to switch to the JSON view.
- **Policy Content**: Enter the following JSON code.

```
{
   "Version": "1.1",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": [
            "mrs:cluster:syncUser",
            "cdm:cluster:get"
         ]
      }
   ]
}
```

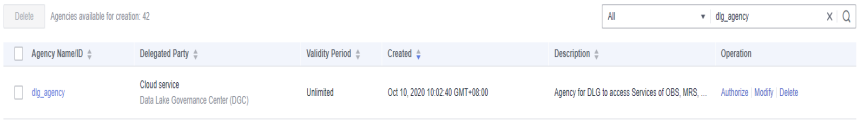
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Figure 12-15 Creating custom policies for MRS and CDM



Step 5 In the left navigation pane, choose **Agencies**, search for **dlg_agency**, and click **Authorize**.

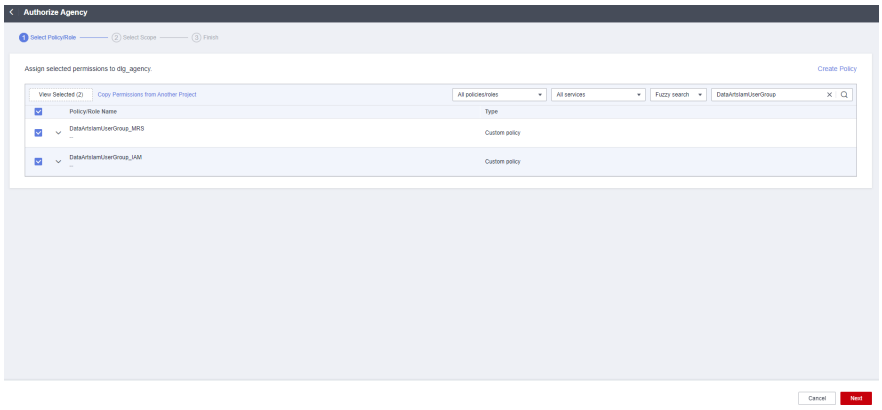
Figure 12-16 Authorizing dlg_agency



Step 6 In the displayed dialog box, locate and select the created custom policies **DataArtsIamUserGroup_IAM** and **DataArtsIamUserGroup_MRS**, and click **Next**.

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Figure 12-17 Selecting the created custom policies



Step 7 Click **OK**. After the authorization is complete, wait for 15 to 30 minutes. Then, you can use DataArts Security to manage MRS access permissions.

----End

12.3.3 Checking the Cluster Version and Permissions

Unified permission governance has requirements on the data connection agent, data source version, and user permissions. Before using it, you need to check and prepare related configurations based on **Table 12-2**.

NOTE

DLI permission management involves only **Authorizing dlg_agency** and does not involve cluster version and permissions check.

Checklist

Table 12-2 Checklist

Check Item	Mandatory	Check Content	Configuration Guide
Data connection agent version	Mandatory for MRS/ GaussDB(DWS) permission management	The CDM cluster version is 2.10.0.300 or later.	Log in to the CDM console and click **Cluster Management**. In the cluster list, locate the required cluster and click the cluster name. On the **Basic Information** page, view the cluster version. If the version is not the required one, create another CDM cluster of the latest version or contact customer service or technical support.

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Check Item	Mandatory	Check Content	Configuration Guide
Ranger component configuration	Mandatory for MRS permission management	LDAP user synchronization is enabled for the Ranger component of an MRS non-security cluster.	In a non-security MRS cluster, the Ranger component synchronizes Unix users by default, but does not synchronize users, user groups, or roles on Manager. Therefore, you need to switch the user synchronization policy. For details, see **Configuring the Ranger Component**.
Ranger connection user permission		The user for the connection has the admin permission of the Ranger component.	The user for the Ranger connection must have the admin permission of the Ranger component. For details, see **Preparing a Ranger Admin User**.
guest_agent version of the GaussDB(DWS) cluster	Mandatory for GaussDB(DWS) permission management	The guest_agent version of the GaussDB(DWS) cluster is 8.2.1, or later than 8.2.1 and earlier than 9.0.0.	You can view the guest_agent version of the GaussDB(DWS) cluster using a developer debugging tool. For details, see **Viewing the guest_agent Version of a GaussDB(DWS) Cluster**.
GaussDB(DWS) connection user permissions		• In the non-RSM mode, the user for the connection must have at least the dbadmin permission of the database. • In the RSM mode, the user must have the system administrator permissions.	• In the non-RSM mode, set the dbadmin administrator by referring to **Database Users**. • In the RSM mode, set the system administrator by referring to **Configuring Separation of Permissions**.

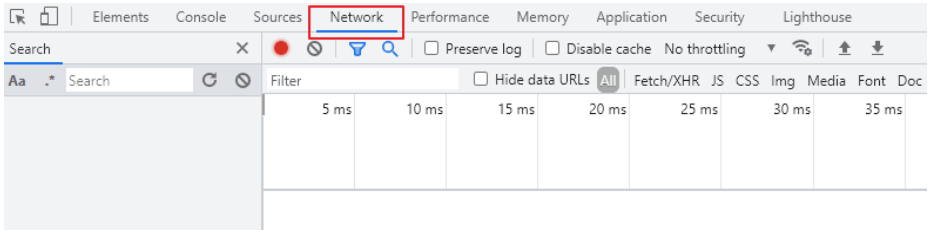
Viewing the guest_agent Version of a GaussDB(DWS) Cluster

Step 1 Log in to the GaussDB (DWS) console, choose **Clusters**, and locate a cluster.

Step 2 Press **F12** to open the developer debugging tool and click the **Network** tab.

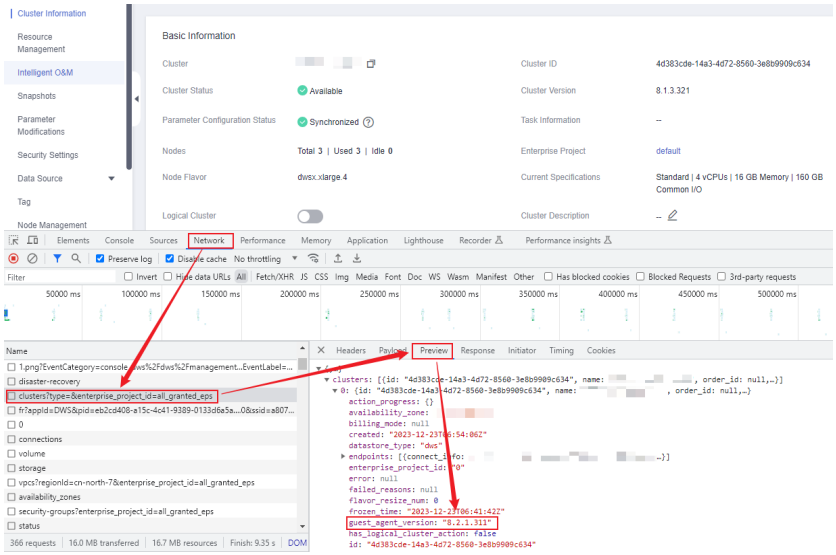
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Figure 12-18 Network



Step 3 Click the name of the cluster to go to the **Basic Information** page. On the **Network** tab page, locate and click the long string starting with **clusters?type=xxxxxx**. In the right pane, click **Preview** and search for the **guest_agent_version** field, whose value is the guest_agent version of the GaussDB(DWS) cluster.

Figure 12-19 Locating the guest_agent_version field



Step 4 If the version is not your required one, contact the customer service or technical support of GaussDB(DWS).

----End

Configuring the Ranger Component

In a non-security MRS cluster, the Ranger component synchronizes Unix users by default, but does not synchronize users, user groups, or roles on FusionInsight Manager. Therefore, you need to switch the user synchronization policy. The procedure is as follows:

NOTE

By default, the Ranger component of an MRS security cluster synchronizes LDAP users. No additional operation is required. If the default configuration is changed, you can change the user synchronization policy by referring to this section.

Step 1 Log in to MRS Manager as user **admin**.

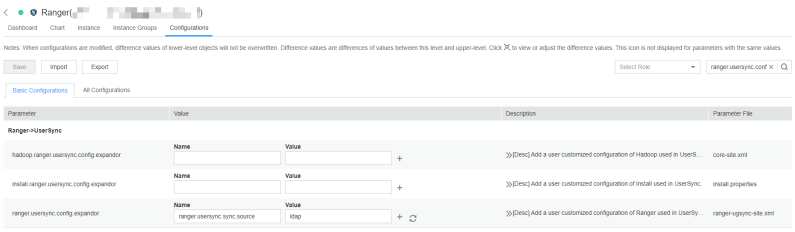
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Step 2 On the Manager page, choose **Cluster** > **Services** > **Ranger** > **Configurations** > **Basic Configurations**, search for **ranger.usersync.config.expandor** in the search box, and set its name to **ranger.usersync.sync.source** and value to **ldap**.

NOTE

By default, this parameter is unavailable for MRS clusters of old versions (for example, MRS 3.1.0). You can contact the customer service or technical support of MRS for support.

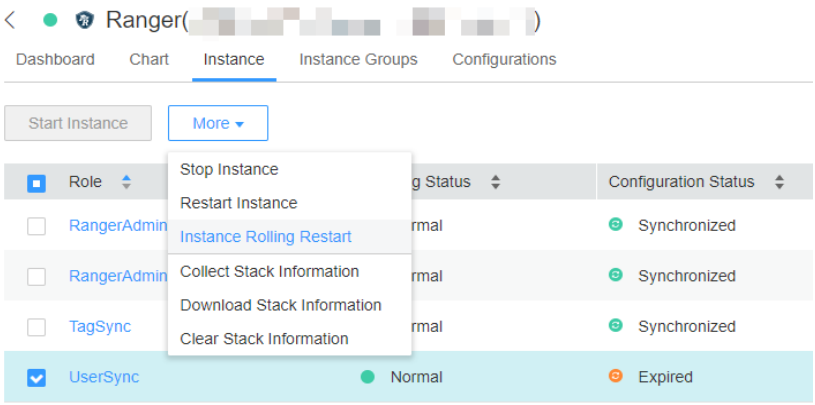
Figure 12-20 Configuring the ranger.usersync.config.expandor parameter



Step 3 After the parameter is set, click **Save** in the upper left corner and then **OK** in the dialog box to save the configuration.

Step 4 After the configuration is saved, switch to the **Instances** tab page, select the **UserSync** instance that has expired, click **More**, and select **Instance Rolling Restart** to make the configuration take effect.

Figure 12-21 Performing a rolling instance restart



----End

Preparing a Ranger Admin User

The user for the Ranger connection must have the admin permission of the Ranger component. The procedure is as follows:

Step 1 Log in to MRS Manager as user **admin**.

Step 2 Choose **System** > **Permission** > **User**. On the page displayed, click **Create** to add a dedicated human-machine user as the Kerberos authentication user. Select user

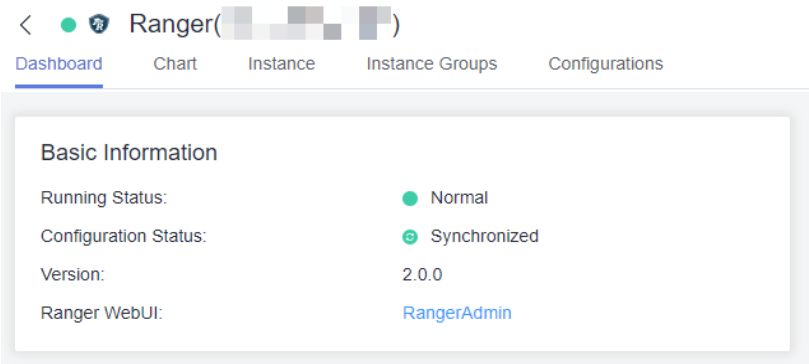
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groups **superGroup** and **hive** for the user, and assign the **Manager_administrator** role to the user.

Step 3 Log in to MRS Manager as the new user and change the initial password.

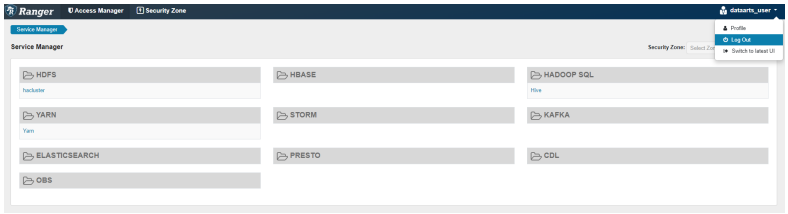
Step 4 On the Manager page, choose **Cluster** > **Services** > **Ranger**. On the Ranger overview page, click **RangerAdmin** to go to the Ranger WebUI.

Figure 12-22 Accessing the Ranger WebUI



Step 5 Log out of the current account and use the Ranger administrator account to log in again. For a common cluster, the admin account for the Manager page can be used as the Ranger administrator account. For a security cluster, **rangeradmin** is the Ranger administrator account. For details about the default password of **rangeradmin**, see **User Account List**.

Figure 12-23 Logging out of the current account

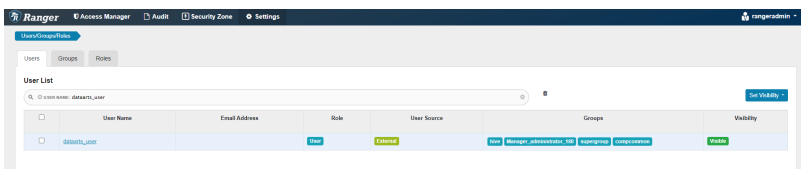


Step 6 Change the role of the new user from Ranger to Admin. Find the name of the new user in **Settings** > **Users/Groups/Roles** > **Users**.

NOTE

If the new user is not found on Ranger, wait for about five minutes until Ranger automatically synchronizes the MRS cluster role.

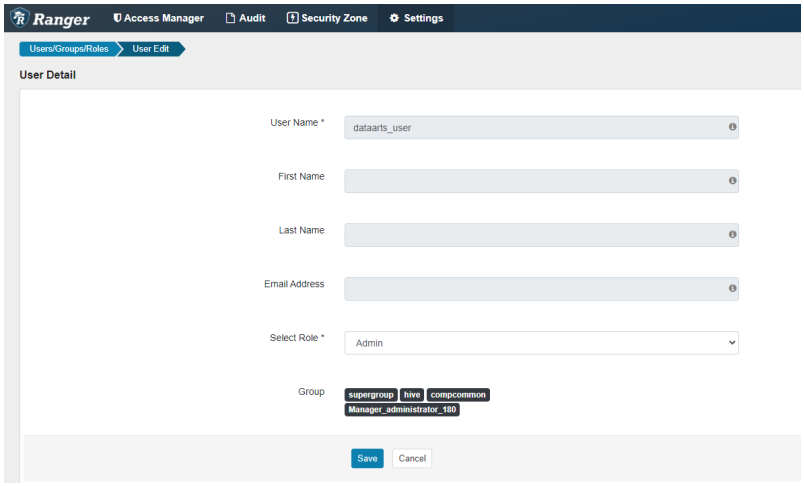
Figure 12-24 Searching for the username



Step 7 Click the username to go to the details page, change the user role to **Admin**, and click **Save**.

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Figure 12-25 Changing the user role



----End

12.3.4 Synchronizing IAM Users to the Data Source

By default, when a user accesses the MRS or GaussDB(DWS) data source through a data connection in DataArts Studio, the username and password in the data connection are used for authentication. To manage users' data access permissions based on user information, you need to synchronize user information from IAM to the data source so that different users have different identities in the data source and can use their own user information for authentication during data permission management.

Note that each MRS/GaussDB(DWS) cluster in a DataArts Studio instance can have only one user synchronization task. User synchronization tasks are configured at the DataArts Studio instance level, and data can be exchanged between workspaces.

Prerequisites

- You have created a GaussDB(DWS) or MRS Ranger data connection in Management Center. For details, see **Creating a DataArts Studio Data Connection**.
- You have configured permissions for the **dlg_agency** by referring to **Authorizing dlg_agency**.

Constraints

- In a DataArts Studio instance, each MRS/GaussDB(DWS) cluster can have only one user synchronization task.
- If a user synchronization task keeps running for more than half an hour, the task will be stopped due to timeout. If the synchronization fails for more than 10 consecutive times, the task will be stopped.
- Federated users have only user group information and cannot be synchronized.
- The data source synchronizes only the user information of its own tenant and cannot synchronize the clusters from data sources of other tenants who are not connected through IP connections.

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- User synchronization is available only for MRS Hive and GaussDB(DWS) data sources. For the GaussDB(DWS) data source, user synchronization is mandatory. For the MRS data source, you can create MRS users with the same name as IAM users so that user synchronization is not needed. DLI uses IAM users for authentication. Therefore, user synchronization is not required.
- The restrictions on MRS user synchronization tasks are as follows:
  - If a human-machine user with the same name as the user to be synchronized exists in MRS, the MRS user synchronization task fails. No error message is displayed for this error. You are advised to use either of the following methods to resolve this issue:
    - Use the IAM user synchronization function on the MRS cluster details page, rather than run the user synchronization task on the DataArts Security console again. The IAM user synchronization function is similar to the user synchronization task, except that if there are users with the same name, only these users will fail to be synchronized, and the other users can still be synchronized successfully.
    - Log in to MRS Manager, choose **System** > **Permission** > **User**, and delete the human-machine user with the same name as the user to be synchronized.
    - On the IAM console, delete the user to be synchronized with the same name as the MRS human-machine user.
  - Before MRS data source synchronization, ensure that the user or user group has at least one of the following permissions. Otherwise, the user or user group will not be synchronized.
    - Tenant Administrator
    - MRS FullAccess
    - MRS CommonOperations
    - MRS ReadOnlyAccess
    - MRS Administrator
    - MRS Admin
    - MRS User
    - MRS Viewer
    - Self Define (any custom policy)
- The restrictions on GaussDB(DWS) user synchronization tasks are as follows:
  - GaussDB(DWS) user synchronization is supported only when the guest_agent version of a GaussDB(DWS) cluster is 8.2.1, or later than 8.2.1 and earlier than 9.0.0. For details about how to check the guest_agent version of a GaussDB(DWS) cluster, see **Viewing the guest_agent Version of a GaussDB(DWS) Cluster**.
  - Before GaussDB(DWS) user synchronization, ensure that the users at least have the DWS Database Access permission. Otherwise, the synchronization will fail.

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- To synchronize IAM users to GaussDB(DWS), you must configure the following permissions for the **dlg_agency**. For details, see **Authorizing dlg_agency**.
  - dws:dbAuthority:syncIamUse
  - iam:users:listUsers
  - iam:groups:listGroups
  - iam:users:listUsersForGroup
- GaussDB(DWS) does not support user groups. When an IAM user group is synchronized to GaussDB(DWS), a user named in the *iam_group_**User group ID*** format will be created in GaussDB(DWS), and the *iam_group_**User group ID*** user corresponding to the user group deleted from IAM will be deleted from GaussDB(DWS). Do not create a user prefixed with **iam_group_** on GaussDB(DWS) because such a user may be deleted by mistake.

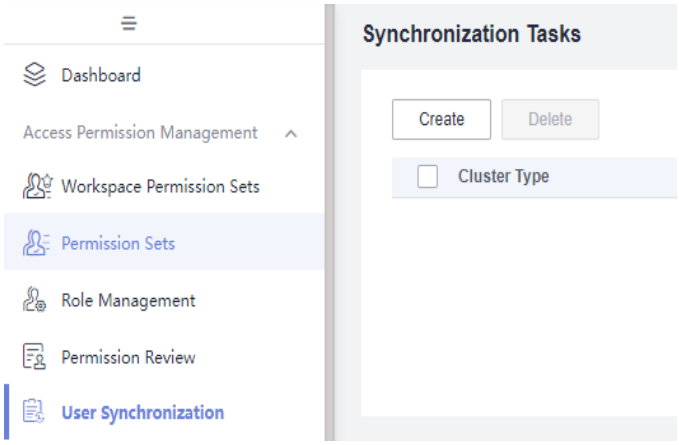
Creating a User Synchronization Task

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane on the DataArts Security console, choose **User Synchronization**.

Step 3 On the **Synchronization Tasks** page, click **Create** to create a user synchronization task.

Figure 12-26 Creating a user synchronization task



Step 4 For details about how to set parameters for creating a user synchronization task, see **Table 12-3**. After setting the parameters, click **OK** to create a user synchronization task.

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Figure 12-27 Creating a user synchronization task

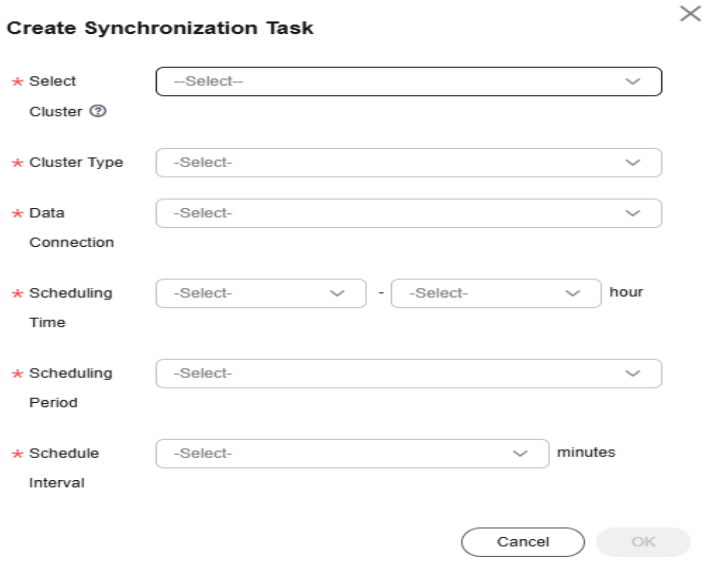


Table 12-3 Parameters for creating a user synchronization task

Parameter	Description
*Select Cluster	Select a GaussDB(DWS) or MRS cluster that is connected through a GaussDB(DWS) or MRS data connection.
*Cluster Type	You do not need to set this parameter. A matched cluster type is automatically selected.
*Data Connection	You do not need to set this parameter. The data source cluster is automatically selected.
*Scheduling Time	Select the time period for scheduling, with the start time included and end time excluded. For example, if the scheduling time is set to **00-05**, the task runs from 00:00 to 05:00 every day. Scheduling is triggered at 00:00 but not at 05:00.
*Scheduling Period	The task can be scheduled by hour or minute.
*Schedule Interval	Select a proper scheduling interval based on the selected scheduling period. The scheduling interval is the interval from the last running time. Manual synchronization is also counted in the running time. For example, if a task starts at 20:00 and manually executed at 20:03, and the interval is five minutes, the task is scheduled again at 20:08.
Full Synchronization	If an MRS cluster is selected, you can set whether to synchronize all users. By default, this function is enabled. You can disable it if you do not need to synchronize all users.

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Parameter	Description
*User/User Group	If **Full Synchronization** is disabled, you can specify the users or user groups to be synchronized. Select at least one user or user group.

Step 5 After the user synchronization task is created, it does not run directly. You need to manually synchronize or schedule the task. The task takes effect after it is successfully synchronized. For details, see **Synchronizing or Scheduling Tasks**.

----End

Related Operations

- Synchronizing or scheduling tasks: On the user synchronization task page, click **Synchronize** or choose **More** > **Start Schedule** in the **Operation** column of the corresponding task. If a task has not been executed before and is scheduled for the first time, the task is triggered immediately.

  NOTE

  If a task fails to be executed, perform the following operations:

  - If the error message indicates insufficient permissions, see **Authorizing dlg_agency**.
  - If the error message indicates that the GaussDB(DWS) IAM credential fails to be downloaded, check whether the current user has at least the GaussDB(DWS) database access permission.
  - If error message "Mrs sync failed, please check the failure cause on the MRS page" is displayed for the MRS task, log in to the MRS console and choose **Operation Logs** in the navigation pane to view the cause.
  - If the MRS operation logs do not contain error information, the synchronization failure cause is that the IAM username conflicts with the name of an existing MRS human-machine user. Log in to MRS Manager and delete the human-machine user with the same name as the IAM user. The default description of the IAM username for the synchronization is **IAM Custom Policy User**, and the IAM user cannot be deleted. A common MRS human-machine user can be deleted.
  - Handle other errors based on the error messages and logs.

- Viewing task logs: On the user synchronization task page, locate the task whose logs need to be viewed and click **Details** in the **Operation** column to view the run logs. A maximum of 20 logs are displayed.

  If a task fails to be executed, you can locate the failure cause based on logs, rectify the fault, and try to execute the task again. If the fault persists, contact technical support for assistance.

- Editing a task: On the user synchronization task page, click **More** in the **Operation** column and select **Edit** to edit the user synchronization task.
- Deleting a task: On the user synchronization task page, click **More** in the **Operation** column and select **Delete** to delete the user synchronization task. To delete multiple tasks at a time, select the tasks and click **Delete** above the task list.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

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12.3.5 Controlling Data Access Using Permissions

12.3.5.1 Configuring Workspace Permission Sets

In data access permission management, permissions are usually classified into multiple levels of permissions, such as those for level-1, level-2, and level-3 departments. DataArts Security provides a top-down hierarchical mode for data permission management. You can configure the maximum permissions in the workspace through a workspace permission set. Then, you can split the workspace permission set into permission sets for refined permission management.

A workspace permission set contains all the permissions for users in a DataArts Studio workspace. This permission set is created by the DAYU Administrator, Tenant Administrator, or data security administrator. A permission set contains only part of the permissions in a workspace.

Both a workspace permission set and a permission set directly associate users with permissions, but they differ in the following aspects:

- A workspace permission set is a top-level permission set that has no parent permission set. Generally, you only need to create one workspace permission set for each workspace. However, a permission set must be associated with a parent permission set, which can be a workspace permission set or another permission set. You can create multiple permission sets to associate users with different permissions in different scenarios.
- A workspace permission set mainly determines the permissions of a workspace, while a permission set is mainly used to manage permissions. A workspace permission set does not require permission synchronization and cannot be associated with roles. A permission set supports permission synchronization, which can be used for permission management, though associating a permission set with roles for permission management is more recommended.

This section describes how to **create** and **configure** a workspace permission set to define the permissions for a workspace.

Prerequisites

- A DWS connection, DLI connection, MRS Hive connection, and MRS Ranger connection have been created in Management Center based on **Creating a DataArts Studio Data Connection**.
- Permissions have been configured for the **dlg_agency** based on **Authorizing dlg_agency**.
- User information has been synchronized from IAM to the data source based on **Synchronizing IAM Users to the Data Source**.
- Metadata of tables has been collected in DataArts Catalog through a **metadata collection task** if you want to view the metadata of databases, tables, and fields in data connections during permission configuration.

Constraints

- Only the DAYU Administrator, Tenant Administrator, or security administrator can create, modify, or synchronize workspace permission sets. The permission

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set administrator can synchronize workspace permission sets. Other common users cannot perform these operations.

- Workspace permission sets can only be used to define permissions for MRS Hive, DLI, and GaussDB(DWS).
- After a workspace permission set is configured, permission management does not take effect immediately. Instead, you need to synchronize the workspace permission set to the data source for permission management to take effect.

  Because workspace permission sets are mainly used to determine the permissions of workspaces rather than manage permissions, generally workspace permission sets do not need to be synchronized. You are advised to configure roles based on **Configuring Roles** to manage permissions. If you need to synchronize workspace permission sets, pay attention to the following restrictions:

  - During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).
  - GaussDB(DWS) permission sets are used only to determine the permission scope. Only role permissions can be synchronized. Permissions of user groups and users cannot be synchronized. To make GaussDB(DWS) permissions take effect, you must configure roles. For details, see **Configuring Roles**.
  - GaussDB(DWS) permission sets can be used to grant permissions of a specified database or schema. The asterisk (*) cannot be used as a wildcard character. Wildcard characters are supported for tables or columns. For example, if you want to grant permissions to all tables in a schema, enter ***** for the data tables.
  - If a GaussDB(DWS) permission set is used to grant a user the permissions of all tables in a schema of the GaussDB(DWS) data source (that is, the data tables are set to *), the user has permissions on all tables in the schema. Due to the restrictions of GaussDB(DWS) permissions, these permissions are applicable only to the current table. This user has no permissions on the tables (future tables) created after permission synchronization. In this case, the administrator must manually synchronize permissions of the role or permission set so that the user has permissions on future tables.

    To avoid manually synchronizing the permissions on future tables, you can configure the users for creating future tables in a specified schema. When these users create future tables in the specified schema, all the users that have full table permissions on the schema in the current instance automatically obtain the permissions on the created future tables.
  - During DLI permission set synchronization, the custom policies created in IAM are associated with users or user groups. A maximum of 200 custom policies can be created in IAM. Before synchronization, ensure that the quotas are sufficient.
  - During permission synchronization, you need to configure required permissions for the **dlg_agency**. For details, see **Authorizing dlg_agency**.
- The current data permission control uses the allowlist mechanism, which adds operation conditions to the users to be authorized without affecting the permissions the users already have. If you only want to make the permissions

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granted by the data permission control take effect, you need to revoke the original permissions of the users to be authorized. For details, see **Data Permission Management**.

- Deleted workspace permission sets are moved to the recycle bin. You can restore them within 30 days. After 30 days, they will be deleted permanently. For details, see **Managing the Recycle Bin**.
- During script execution and job testing in DataArts Factory, the MRS or GaussDB(DWS) data source uses the account of the data connection for authentication by default. Therefore, permission management still does not take effect during data development. You need to enable fine-grained authentication so that the current user is used for authentication during script execution and job testing in DataArts Factory. In this way, different users have different data permissions, and permission management for roles and permission sets takes effect.

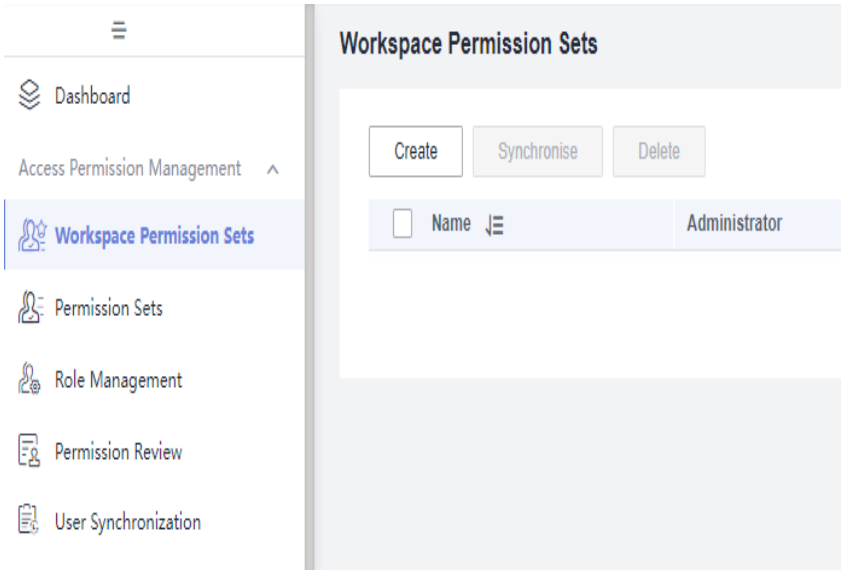
Creating a Workspace Permission Set

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Workspace Permission Sets**.

Step 3 On the displayed page, click **Create**.

Figure 12-28 Creating a workspace permission set



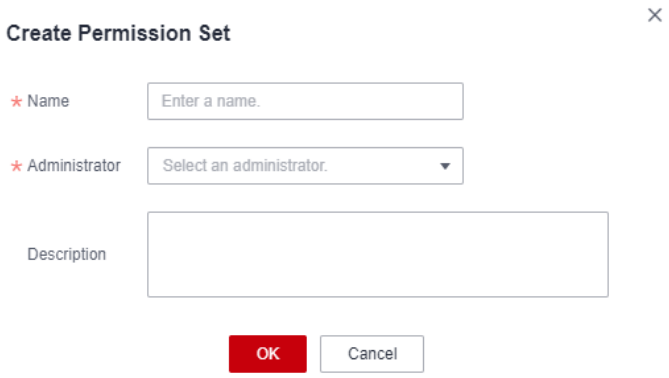
Step 4 Configure parameters based on **Table 12-4** and click **OK**.

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Table 12-4 Parameters for creating a workspace permission set

Parameter	Description
*Name	Permission set name, which is unique in the instance. You should include the meaning of the permission set and avoid meaningless descriptions in the name so that the permission set can be quickly identified.
*Administrator	Select up to five administrators of the user or user group type. The administrators are the owners of the permission set and can configure the permissions in the permission set. The administrators can perform the following operations: • Permission configuration: Assign data source permissions to the workspace permission set. • User configuration: Assign permissions in the workspace permission set to users, user groups, or workspace roles. • Permission set creation: Create permission sets and roles based on the workspace permission set. The created permission sets do not contain more permissions than the workspace permission set.
Description	Information to make the workspace permission set easier to be identified

Figure 12-29 Creating a workspace permission set



----End

Configuring the Workspace Permission Set

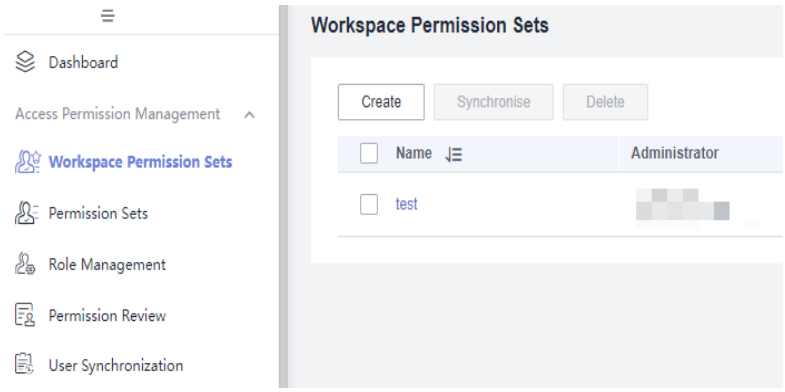
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Workspace Permission Sets**.

Step 3 Locate a workspace permission set and click its name to go to the details page.

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Figure 12-30 Going to the workspace permission set details page



Step 4 In the **Basic Information** area, you can view the name, ID, and administrator of the workspace permission set. For details, see **Figure 12-31**.

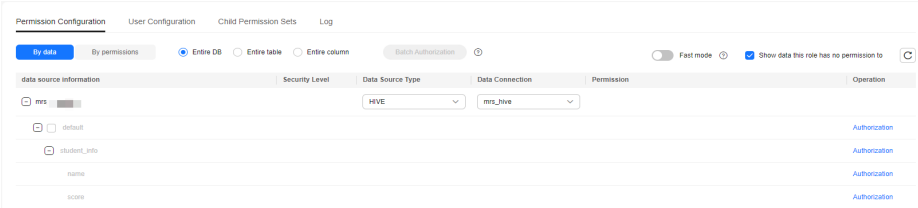
Figure 12-31 Basic information about the workspace permission set



Step 5 On the **Permission Configuration** tab page, **By data** is selected by default. You can select **By permissions**. The configured permissions are the same for **By data** and **By permissions**, and the only difference lies in how the permissions are displayed. You are advised to select **By permissions** for batch authorization.

- **By data**: The system allows you to configure permissions for data. Currently, only MRS data sources are supported. The configured permissions will be automatically synchronized.

  Figure 12-32 Configuring permissions on the By data page

  When configuring permissions, you can select **Entire DB**, **Entire table**, or **Entire column**, and select the corresponding levels in the data source information to perform a batch authorization. You can also click **Authorization** in the **Operation** column of a data record in the expanded navigation pane to authorize access to the data.

  Fast mode and **Show data this role has no permission to** are supported. If **Fast mode** is enabled, metadata of databases, tables, and columns is obtained from DataArts Catalog. Otherwise, metadata is obtained from the

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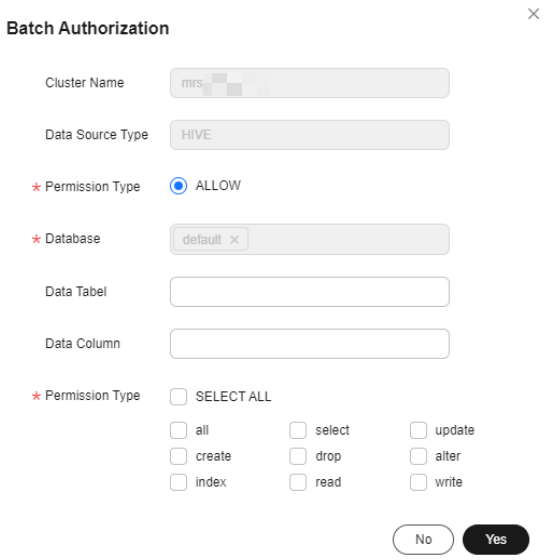
data source. If metadata has been collected, you are advised to enable **Fast mode**.

NOTE

- Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

  For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
- During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).

Figure 12-33 Authorization on the By data page



- **By permissions**: The system allows you to configure permissions.

  To configure permissions, click **Add** and select data levels in sequence. You cannot select multiple objects at the same level (such as database, table, and column) for batch authorization. **Permission Type** cannot be set to **DENY**. During permission configuration, you can select **Automatic Permissions Synchronization**. The configured permissions will be automatically synchronized. You do not need to synchronize them manually.

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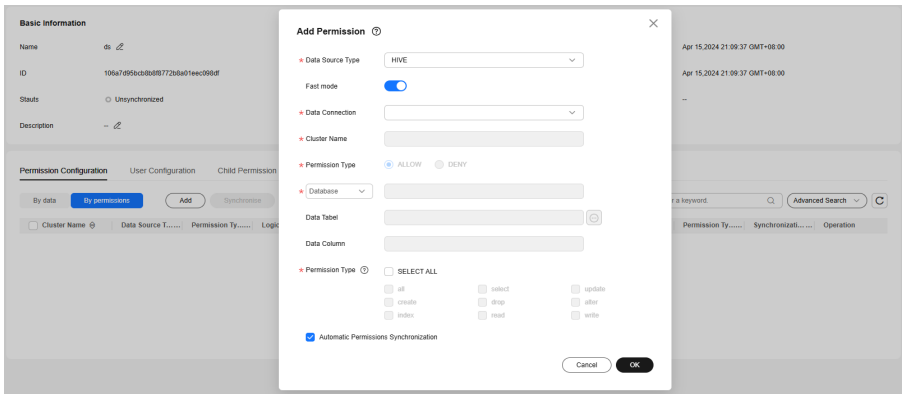
NOTE

- Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

  For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
- During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).
- When you select **HIVE** for **Data Source Type**, you can change **Database** to **URL** to authorize an OBS path in the storage-compute decoupling scenario. In this scenario, the following URL permissions are required for using Hive:
  - **write**: creating a database
  - **read**: creating a table, writing data, and deleting a table
- When you select **DWS** for **Data Source Type**, you can change **Database** to **Logical Clusters** to authorize logical DWS clusters. The following logical cluster permissions are required:
  - **create**: allows the creation of tables in sub-clusters.
  - **usage**: allows access to tables in sub-clusters.
  - **compute**: allows users with compute permissions to perform elastic computing in sub-clusters.

After configuring permissions, you can edit, synchronize, or delete them.

Figure 12-34 Configuring permissions on the By permissions page

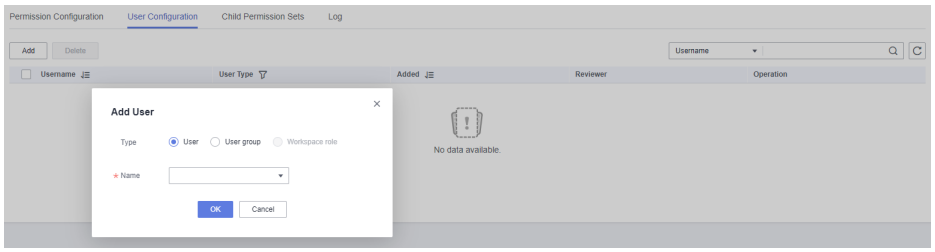


Step 6 **User Configuration**: On the permission set details page, click the **User Configuration** tab.

On this page, you can associate the permissions configured on the **Permission Configuration** page with users. Click **Add** and select **User** or **User group** (**Workspace role** is unavailable currently) to add users to the permission set. You can select users or user groups that have been added to the workspace.

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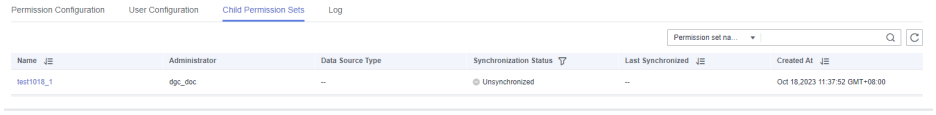
Figure 12-35 User Configuration



Step 7 **Child Permission Sets**: On the permission set details page, click the **Child Permission Sets** tab.

On this page, you can view the child permission sets of the current permission set.

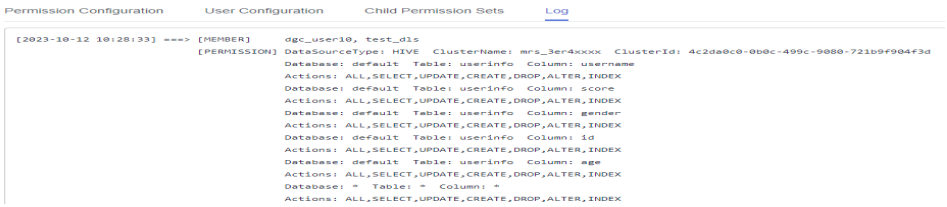
Figure 12-36 View child permission sets



Step 8 **Log**: On the permission set details page, click the **Log** tab.

On this page, you can view the log details if permission synchronization fails. The system deletes logs generated 30 days ago at 00:00 every day.

Figure 12-37 Viewing logs



Step 9 After the permission set is configured, permission management does not take effect immediately. You need to manually synchronize permissions to the data source for permission management to take effect. For details, see **Synchronizing Permission Sets**.

Because workspace permission sets are mainly used to determine the permissions of workspaces rather than manage permissions, generally workspace permission sets do not need to be synchronized. You are advised to configure roles based on **Configuring Roles** to manage permissions.

----End

Related Operations

- Synchronizing workspace permission sets: Workspace permission sets take effect only after they are manually synchronized to the data source. Because workspace permission sets are mainly used to determine the permissions of

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workspaces rather than manage permissions, generally workspace permission sets do not need to be synchronized. You are advised to configure roles based on **Configuring Roles** to manage permissions.

To synchronize a workspace permission set, click **Synchronize** in the **Operation** column of the permission set on the **Workspace Permission Sets** page. To synchronize multiple permission sets, select them and click **Synchronize** above the list.

- Editing a workspace permission set: On the **Workspace Permission Sets** page, click **Edit** in the **Operation** column of a permission set. You can change the name, administrator, and description of the permission set.
- Deleting workspace permission sets: On the **Workspace Permission Sets** page, click **Delete** in the **Operation** column of a permission set. In the displayed dialog box, confirm the permission set to delete and click **Yes**. To delete multiple permission sets, select them and click **Delete** above the list.

  Workspace permission sets for which permissions, users, or child permission sets have been configured cannot be deleted. To delete such workspace permission sets, delete the configurations first.

  NOTE

  Deleted workspace permission sets are moved to the recycle bin. You can restore them within 30 days. After 30 days, they will be deleted permanently. For details, see **Managing the Recycle Bin**.

12.3.5.2 Configuring Permission Sets

In data access permission management, permissions are usually classified into multiple levels of permissions, such as those for level-1, level-2, and level-3 departments. DataArts Security provides a top-down hierarchical mode for data permission management. You can configure the maximum permissions in the workspace through a workspace permission set. Then, you can split the workspace permission set into permission sets for refined permission management.

A permission set directly associates users and permissions. A workspace permission set is special as it has no parent permission set. It defines the permissions for the entire workspace. Each child permission set defined in the workspace permission set has a parent permission set, and the permissions of a child permission set are a subset of its parent permission set's permissions.

Both a workspace permission set and a permission set directly associate users with permissions, but they differ in the following aspects:

- A workspace permission set is a top-level permission set that has no parent permission set. Generally, you only need to create one workspace permission set for each workspace. However, a permission set must be associated with a parent permission set, which can be a workspace permission set or another permission set. You can create multiple permission sets to associate users with different permissions in different scenarios.
- A workspace permission set mainly determines the permissions of a workspace, while a permission set is mainly used to manage permissions. A workspace permission set does not require permission synchronization and cannot be associated with roles. A permission set supports permission synchronization, which can be used for permission management, though associating a permission set with roles for permission management is more recommended.

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This section describes how to manage permissions through **Creating a Permission Set** and **Configuring the Permission Set**. In practice, you are advised to manage permissions based on **Configuring Roles**.

Prerequisites

- You have configured a workspace permission set. For details, see **Configuring Workspace Permission Sets**.
- Metadata of tables has been collected in DataArts Catalog through a **metadata collection task** if you want to view the metadata of databases, tables, and fields in data connections during permission configuration.

Constraints

- Only the DAYU Administrator, Tenant Administrator, data security administrator, and the administrator of the parent permission set can create, modify, and synchronize permission sets. The permission set administrator can synchronize workspace permission sets. Other common users cannot perform these operations.
- Permission sets can only be used to manage permissions for MRS Hive, DLI, and GaussDB(DWS).
- In some cases, a child permission set may contain more permissions than its parent permission set. For example, this may occur if a permission record is configured for a child permission set and then deleted from the parent permission set, because cascading deletion of permissions is not supported.
- After a permission set is configured, permission management does not take effect immediately. Instead, you need to synchronize the permission set to the data source for permission management to take effect.

  Role management provides more intuitive and powerful permission management capabilities based on permission sets. Generally, you do not need to synchronize permission sets except for DLI data sources. You are advised to manage permissions based on **Configuring Roles**. If you need to synchronize workspace permission sets, pay attention to the following restrictions:

  - During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).
  - GaussDB(DWS) permission sets are used only to determine the permission scope. Only role permissions can be synchronized. Permissions of user groups and users cannot be synchronized. To make GaussDB(DWS) permissions take effect, you must configure roles. For details, see **Configuring Roles**.
  - GaussDB(DWS) permission sets can be used to grant permissions of a specified database or schema. The asterisk (*) cannot be used as a wildcard character. Wildcard characters are supported for tables or columns. For example, if you want to grant permissions to all tables in a schema, enter ***** for the data tables.
  - If a GaussDB(DWS) permission set is used to grant a user the permissions of all tables in a schema of the GaussDB(DWS) data source (that is, the data tables are set to *), the user has permissions on all tables in the schema. Due to the restrictions of GaussDB(DWS) permissions, these

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permissions are applicable only to the current table. This user has no permissions on the tables (future tables) created after permission synchronization. In this case, the administrator must manually synchronize permissions of the role or permission set so that the user has permissions on future tables.

To avoid manually synchronizing the permissions on future tables, you can configure the users for creating future tables in a specified schema. When these users create future tables in the specified schema, all the users that have full table permissions on the schema in the current instance automatically obtain the permissions on the created future tables.

- During DLI permission set synchronization, the custom policies created in IAM are associated with users or user groups. A maximum of 200 custom policies can be created in IAM. Before synchronization, ensure that the quotas are sufficient.
- During permission synchronization, you need to configure required permissions for the **dlg_agency**. For details, see **Authorizing dlg_agency**.

- The current data permission control uses the allowlist mechanism, which adds operation conditions to the users to be authorized without affecting the permissions the users already have. If you only want to make the permissions granted by the data permission control take effect, you need to revoke the original permissions of the users to be authorized. For details, see **Data Permission Management**.
- During script execution and job testing in DataArts Factory, the MRS or GaussDB(DWS) data source uses the account of the data connection for authentication by default. Therefore, permission management still does not take effect during data development. You need to enable fine-grained authentication so that the current user is used for authentication during script execution and job testing in DataArts Factory. In this way, different users have different data permissions, and permission management for roles and permission sets takes effect.

Creating a Permission Set

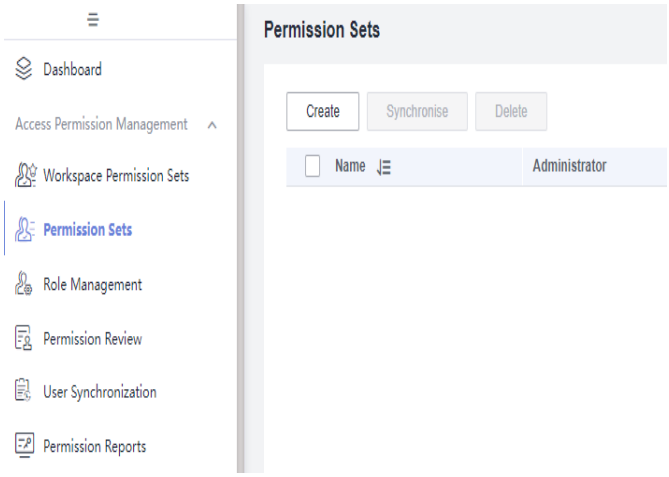
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Permission Sets**.

Step 3 On the displayed page, click **Create**.

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Figure 12-38 Creating a permission set



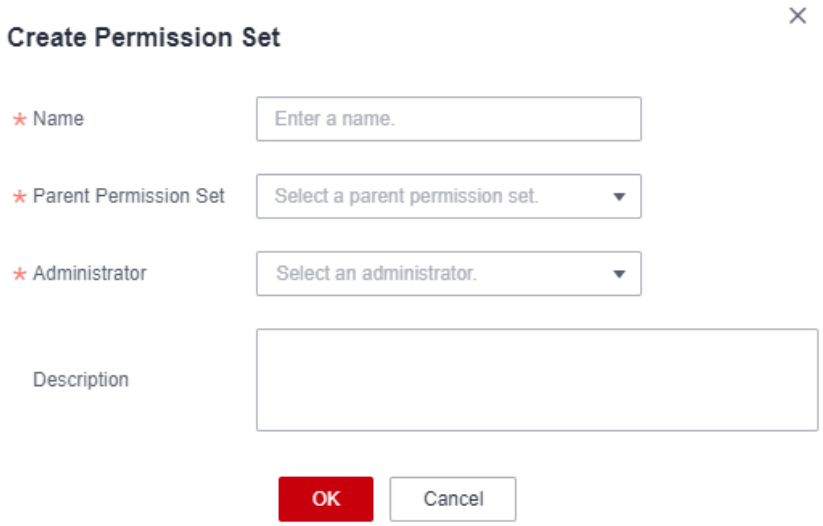
Step 4 Configure parameters based on **Table 12-5** and click **OK**.

Table 12-5 Parameters

Parameter	Description
*Name	Permission set name, which is unique in the instance. You should include the meaning of the permission set and avoid meaningless descriptions in the name so that the permission set can be quickly identified.
*Parent Permission Set	Select a parent permission set, which can be a workspace permission set or another permission set. After you select a parent permission set, the permissions of the current permission set are a subset of the parent permission set's permissions.
*Administrator	The administrators are the owners of the permission set and can configure the permissions in the permission set. The administrators can perform the following operations: • Permission configuration: Assign data source permissions to the workspace permission set. • User configuration: Assign permissions in the workspace permission set to users, user groups, or workspace roles. • Permission set creation: Create permission sets and roles based on the workspace permission set. The created permission sets do not contain more permissions than the workspace permission set.
Description	Information to make the permission set easier to be identified

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Figure 12-39 Parameters for creating a permission set



----End

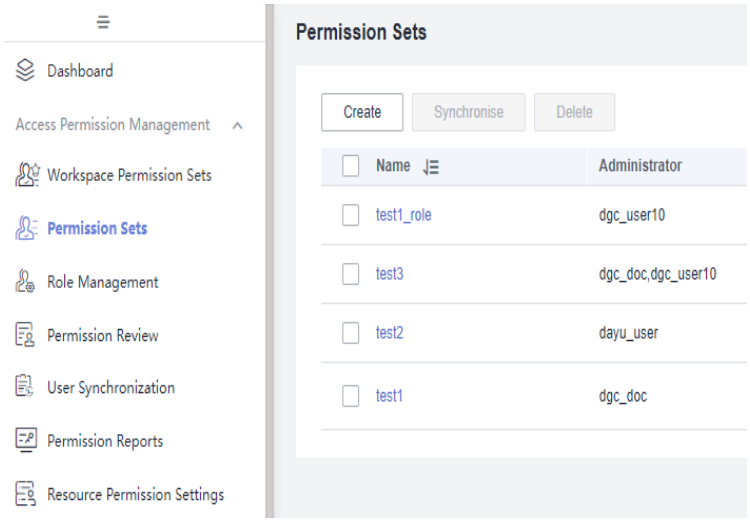
Configuring the Permission Set

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Permission Sets**.

Step 3 Locate a permission set and click its name to go to the details page.

Figure 12-40 Going to the permission set details page



Step 4 In the **Basic Information** area, you can view the name, ID, and administrator of the permission set. For details, see **Figure 12-41**.

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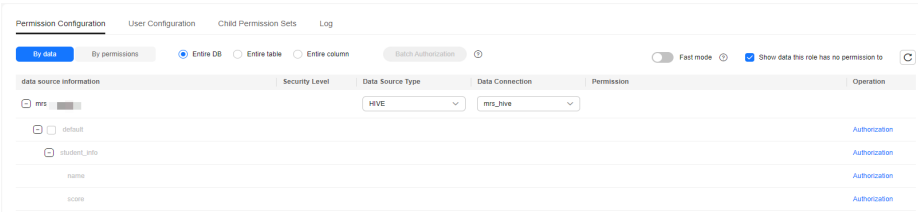
Figure 12-41 Basic information of the permission set



Step 5 On the **Permission Configuration** tab page, **By data** is selected by default. You can select **By permissions**. The configured permissions are the same for **By data** and **By permissions**, and the only difference lies in how the permissions are displayed. You are advised to select **By permissions** for batch authorization.

- **By data**: The system allows you to configure permissions for MRS data. You can select the authorized data in the parent permission set. The configured permissions will be automatically synchronized.

  Figure 12-42 Configuring permissions on the By data page

  When configuring permissions, you can select **Entire DB**, **Entire table**, or **Entire column**, and select the corresponding levels in the data source information to perform a batch authorization. You can also click **Authorization** in the **Operation** column of a data record in the expanded navigation pane to authorize access to the data.

  Fast mode and **Show data this role has no permission to** are supported. If **Fast mode** is enabled, metadata of databases, tables, and columns is obtained from DataArts Catalog. Otherwise, metadata is obtained from the data source. If metadata has been collected, you are advised to enable **Fast mode**.

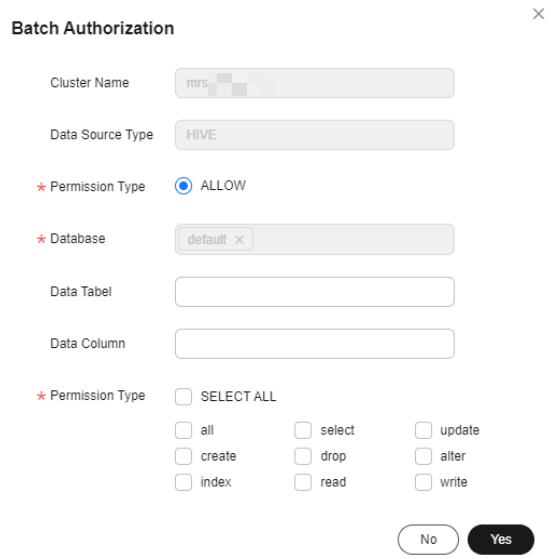
  NOTE

  - Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

    For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
  - During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).

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Figure 12-43 Authorization on the By data page



- **By permissions**: The system allows you to configure permissions. You can select the authorized data in the parent permission set.

  To configure permissions, click **Add** and select data levels in sequence. You cannot select multiple objects at the same level (such as database, table, and column) for batch authorization. **Permission Type** cannot be set to **DENY**. During permission configuration, you can select **Automatic Permissions Synchronization**. The configured permissions will be automatically synchronized. You do not need to synchronize them manually.

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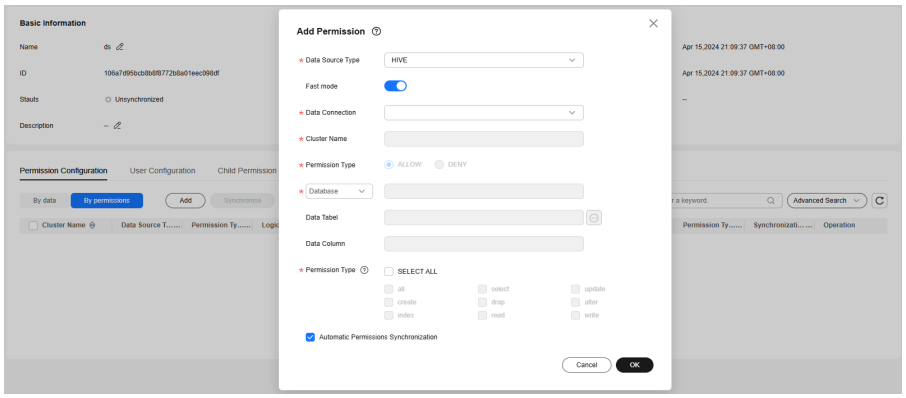
NOTE

- Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

  For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
- During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).
- When you select **HIVE** for **Data Source Type**, you can change **Database** to **URL** to authorize an OBS path in the storage-compute decoupling scenario. In this scenario, the following URL permissions are required for using Hive:
  - **write**: creating a database
  - **read**: creating a table, writing data, and deleting a table
- When you select **DWS** for **Data Source Type**, you can change **Database** to **Logical Clusters** to authorize logical DWS clusters. The following logical cluster permissions are required:
  - **create**: allows the creation of tables in sub-clusters.
  - **usage**: allows access to tables in sub-clusters.
  - **compute**: allows users with compute permissions to perform elastic computing in sub-clusters.

After configuring permissions, you can edit, synchronize, or delete them.

Figure 12-44 Configuring permissions on the By permissions page

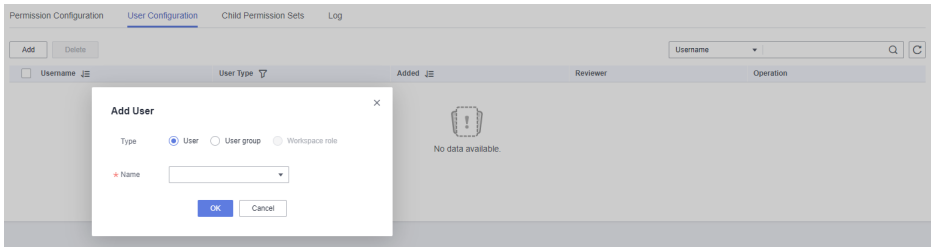


Step 6 **User Configuration**: On the permission set details page, click the **User Configuration** tab.

On this page, you can associate the permissions configured on the **Permission Configuration** page with users. Click **Add** and select **User** or **User group** (**Workspace role** is unavailable currently) to add users to the permission set. You can select users or user groups that have been added to the workspace.

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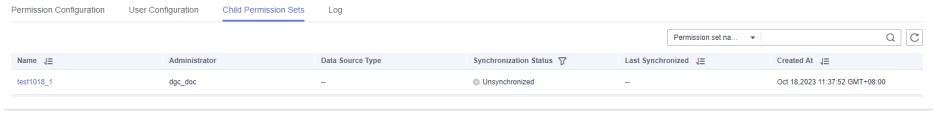
Figure 12-45 User Configuration



Step 7 **Child Permission Sets**: On the permission set details page, click the **Child Permission Sets** tab.

On this page, you can view the child permission sets of the current permission set.

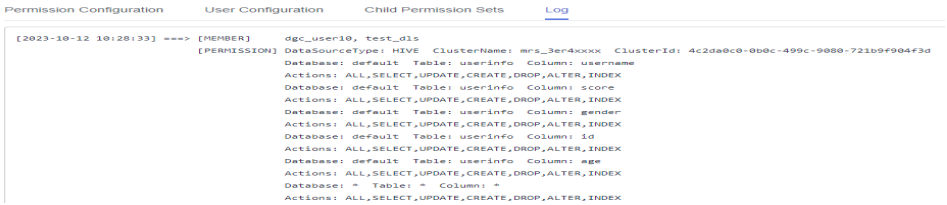
Figure 12-46 View child permission sets



Step 8 **Log**: On the permission set details page, click the **Log** tab.

On this page, you can view the log details if permission synchronization fails. The system deletes logs generated 30 days ago at 00:00 every day.

Figure 12-47 Viewing logs



Step 9 After the permission set is configured, it does not take effect immediately. You need to manually synchronize the permission set to the data source for permission management to take effect. For details, see **Synchronizing Permission Sets**.

Role management provides more intuitive and powerful permission management capabilities based on permission sets. Generally, you do not need to synchronize workspace permission sets. In practice, you are advised to manage permissions based on **Configuring Roles**.

----End

Related Operations

- Synchronizing permission sets: Permission sets take effect only after they are synchronized to the data source. Role management provides more intuitive and powerful permission management capabilities based on permission sets. Generally, you do not need to synchronize permission sets. In practice, you are advised to manage permissions based on **Configuring Roles**.

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To synchronize a permission set, click **Synchronize** in the **Operation** column of the permission set on the **Permission Sets** page. To synchronize multiple permission sets, select them and click **Synchronize** above the list.

- Editing a permission set: On the **Permission Sets** page, click **Edit** in the **Operation** column of a permission set. You can change the name, administrator, and description of the permission set.
- Deleting permission sets: On the **Permission Sets** page, click **Delete** in the **Operation** column of a permission set. In the displayed dialog box, confirm the permission set to delete and click **Yes**. To delete multiple permission sets, select them and click **Delete** above the list.

  Permission sets for which permissions, users, or child permission sets have been configured cannot be deleted. To delete such permission sets, delete the configurations first.

  NOTE

  Deleted permission sets are moved to the recycle bin. You can restore them within 30 days. After 30 days, they will be deleted permanently. For details, see **Managing the Recycle Bin**.

12.3.5.3 Configuring Roles

Role management in DataArts Security provides more intuitive and powerful permission management capabilities based on permission sets. The difference between a role and a permission set is that a permission set directly associates users with permissions, while a role is created or managed on the data source to carry the association between users and permissions.

If you associate roles with permission sets on the role management page, permissions are synchronized only to roles instead of users. You are advised to use role management to manage permissions and permission relationships more intuitively. Role management also allows you to use managed roles to manage existing data source permissions.

- Common roles: Create roles on the data source to associate users and permissions.
- Manage roles: Manage existing roles on the MRS data source and inherit their permissions of the MRS data source. (To view existing roles on the MRS data source, log in to MRS FusionInsight Manager and choose **System** > **Permission** > **Role**).

This section describes **Configuring a Common Role**, **Configuring Managed Roles**, and **Related Operations**.

Prerequisites

- You have configured a workspace permission set. For details, see **Configuring Workspace Permission Sets**.
- During the synchronization of MRS and GaussDB(DWS) roles, the system uses the users in the data connections in Management Center to perform addition, deletion, modification, and query operations. Users in the data connections must have the following permissions:
  - Users in MRS Ranger connections must have the admin permission of the Ranger component.

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  - In non-rights separation mode (RSM), database users in GaussDB(DWS) connections must have at least the dbadmin permission of the database. In RSM, users must have the system administrator permissions.

  For details about the configuration method, see **Checking the Cluster Version and Permissions**.
- Metadata of tables has been collected in DataArts Catalog through a **metadata collection task** if you want to view the metadata of databases, tables, and fields in data connections during permission configuration in fast mode.

Constraints

- Currently, roles can only be created for MRS and GaussDB(DWS) clusters.
- Role management is available only when the version of the CDM cluster selected for the agent in the data connection is 2.10.0.300 or later.
- During the synchronization of MRS and GaussDB(DWS) roles, the system uses the users in the data connections in Management Center to perform addition, deletion, modification, and query operations. Users in the data connections must have the following permissions:
  - Users in MRS Ranger connections must have the admin permission of the Ranger component.
  - In non-rights separation mode (RSM), database users in GaussDB(DWS) connections must have at least the dbadmin permission of the database. In RSM, users must have the system administrator permissions.

  For details about the configuration method, see **Checking the Cluster Version and Permissions**.
- Workspace permission sets are mainly used to define the permissions of workspaces rather than manage permissions. Roles cannot be created for workspace permission sets. If you create roles for permission sets, permissions are synchronized only to roles instead of users.
- Only the directory permissions of the cluster are displayed for roles in the workspace.
- During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).
- GaussDB(DWS) permission sets can be used to grant permissions of a specified database or schema. The asterisk (*) cannot be used as a wildcard character. Wildcard characters are supported for tables or columns. For example, if you want to grant permissions to all tables in a schema, enter ***** for the data tables.
- If a GaussDB(DWS) permission set is used to grant a user the permissions of all tables in a schema of the GaussDB(DWS) data source (that is, the data tables are set to *), the user has permissions on all tables in the schema. Due to the restrictions of GaussDB(DWS) permissions, these permissions are applicable only to the current table. This user has no permissions on the tables (future tables) created after permission synchronization. In this case, the administrator must manually synchronize permissions of the role or permission set so that the user has permissions on future tables.

  To avoid manually synchronizing the permissions on future tables, you can configure the users for creating future tables in a specified schema. When

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these users create future tables in the specified schema, all the users that have full table permissions on the schema in the current instance automatically obtain the permissions on the created future tables.

- During permission synchronization, you need to configure required permissions for the **dlg_agency**. For details, see **Authorizing dlg_agency**.
- The current data permission control uses the allowlist mechanism, which adds operation conditions to the users to be authorized without affecting the permissions the users already have. If you only want to make the permissions granted by the data permission control take effect, you need to revoke the original permissions of the users to be authorized. For details, see **Data Permission Management**.
- During script execution and job testing in DataArts Factory, the MRS or GaussDB(DWS) data source uses the account of the data connection for authentication by default. Therefore, permission management still does not take effect during data development. You need to enable fine-grained authentication so that the current user is used for authentication during script execution and job testing in DataArts Factory. In this way, different users have different data permissions, and permission management for roles and permission sets takes effect.

Configuring a Common Role

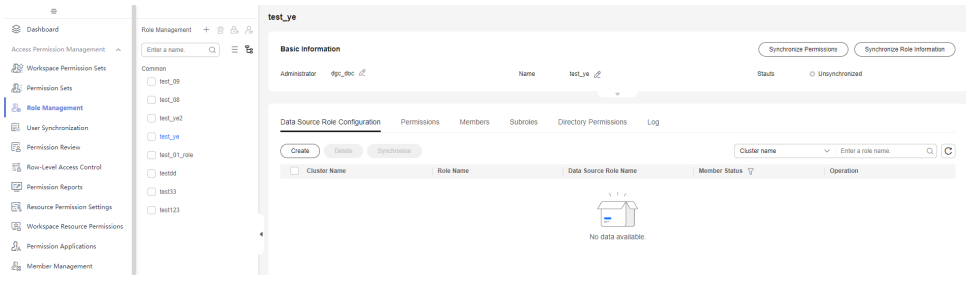
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Role Management**.

Step 3 Use either of the following methods to configure a common role:

- Configuring an existing role: On the **Role Management** page, permission sets that have been created in **Creating a Permission Set** are displayed in the navigation tree as common roles by default. You can click a role name to go to the role details page.

  Figure 12-48 Role details page

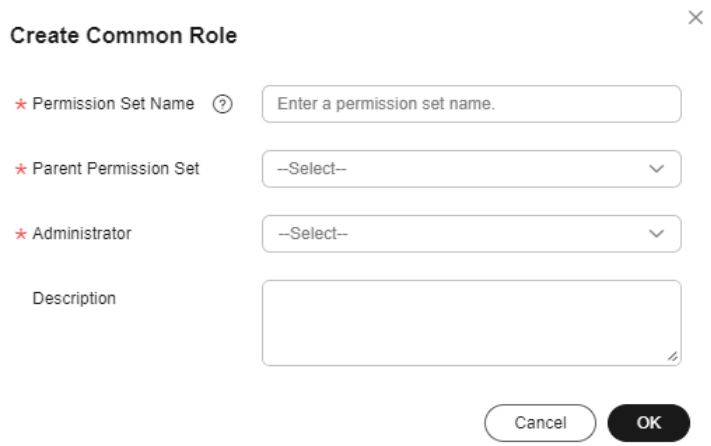
- Creating a role: On the **Role Management** page, click + in the navigation tree and select **Create Common Role**. Set the parameters listed in **Table 12-6** and click **OK**. The details page of the created role is displayed by default.

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Table 12-6 Parameters

Parameter	Description
*Name	Permission set name, which is unique in the instance. You should include the meaning of the permission set and avoid meaningless descriptions in the name so that the permission set can be quickly identified.
*Parent Permission Set	Select a parent permission set, which can be a workspace permission set or another permission set. After you select a parent permission set, the permissions of the current permission set are a subset of the parent permission set's permissions.
*Administrator	The administrators are the owners of the permission set and can configure the permissions in the permission set. The administrators can perform the following operations: – Permission configuration: Assign data source permissions to the workspace permission set. – User configuration: Assign permissions in the workspace permission set to users, user groups, or workspace roles. – Permission set creation: Create permission sets and roles based on the workspace permission set. The created permission sets do not contain more permissions than the workspace permission set.
Description	Information to make the permission set easier to be identified

Figure 12-49 Creating a common role

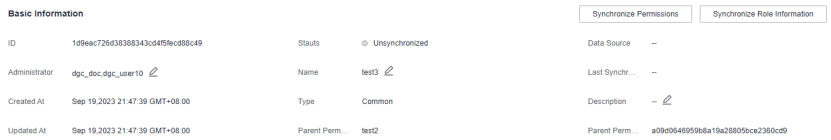


Step 4 On the role details page, you can expand the **Basic Information** area to view the name, ID, and administrator of the role. For details, see **Figure 12-50**.

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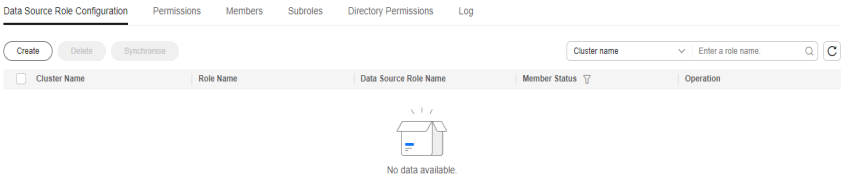
After configuring roles and permissions, you can synchronize them by clicking **Synchronize Permissions** and **Synchronize Role Information** in the upper right corner.

Figure 12-50 Basic role information



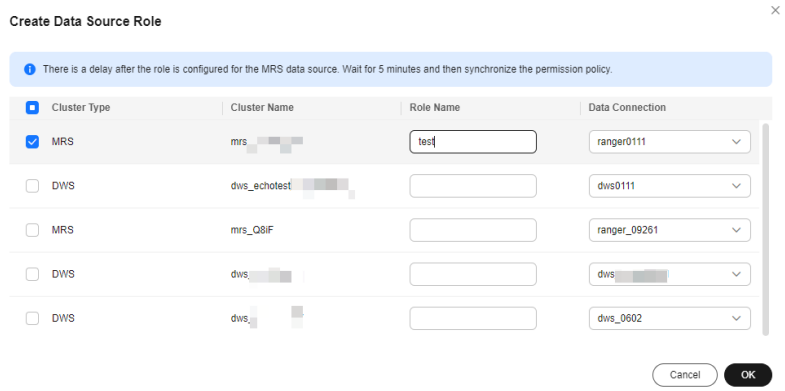
Step 5 **Data Source Role Configuration**: On this page, you can click **Create** to create roles for associating users and permissions.

Figure 12-51 Data Source Role Configuration page



Click **Create**. In the displayed dialog box, select data sources, set **Role Name**, and click **OK**.

Figure 12-52 Creating a data source role



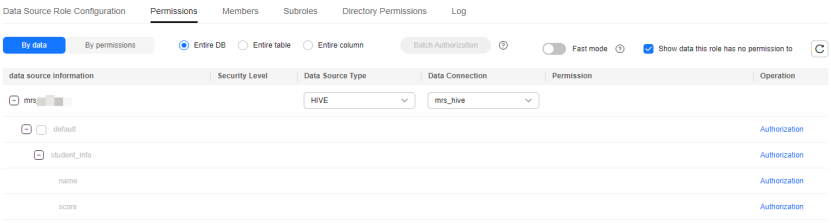
If you no longer need a data source role, click **Delete** in the **Operation** column to delete the role. After the role is deleted, permissions are no longer synchronized to the role and only synchronized to user information.

Step 6 **Permissions**: On the role details page, click the **Permissions** tab. By default, **By data** is selected. You can also select **By permissions**. The configured permissions are the same for **By data** and **By permissions**, and the only difference lies in how the permissions are displayed. You are advised to select **By permissions** for batch authorization.

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- **By data**: The system allows you to configure permissions for data. Currently, only MRS data sources are supported. The configured permissions will be automatically synchronized.

  Figure 12-53 Configuring permissions on the By data page

  When configuring permissions, you can select **Entire DB**, **Entire table**, or **Entire column**, and select the corresponding levels in the data source information to perform a batch authorization. You can also click **Authorization** in the **Operation** column of a data record in the expanded navigation pane to authorize access to the data.

  Fast mode and **Show data this role has no permission to** are supported. If **Fast mode** is enabled, metadata of databases, tables, and columns is obtained from DataArts Catalog. Otherwise, metadata is obtained from the data source. If metadata has been collected, you are advised to enable **Fast mode**.

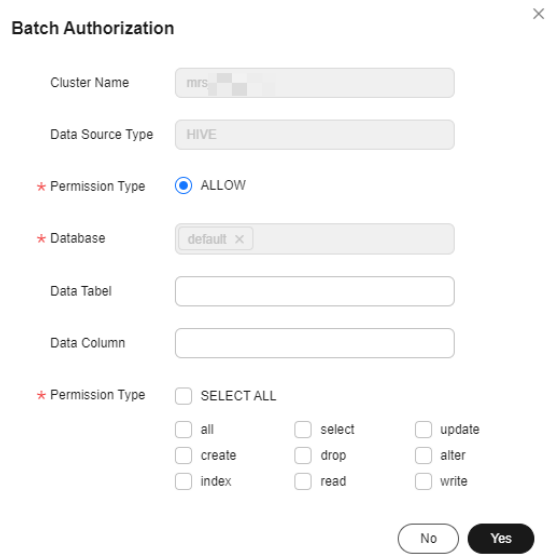
  NOTE

  - Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

    For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
  - During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).

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Figure 12-54 Authorization on the By data page



- **By permissions**: The system allows you to configure permissions.

  To configure permissions, click **Add** and select data levels in sequence. You cannot select multiple objects at the same level (such as database, table, and column) for batch authorization. **Permission Type** cannot be set to **DENY**. During permission configuration, you can select **Automatic Permissions Synchronization**. The configured permissions will be automatically synchronized. You do not need to synchronize them manually.

  NOTE

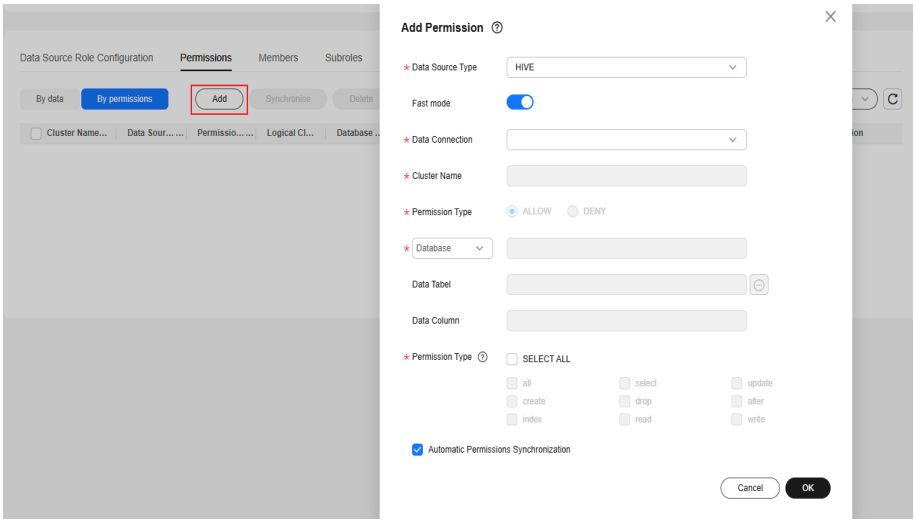
  - Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

    For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
  - During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).
  - When you select **HIVE** for **Data Source Type**, you can change **Database** to **URL** to authorize an OBS path in the storage-compute decoupling scenario. In this scenario, the following URL permissions are required for using Hive:
    - **write**: creating a database
    - **read**: creating a table, writing data, and deleting a table
  - When you select **DWS** for **Data Source Type**, you can change **Database** to **Logical Clusters** to authorize logical DWS clusters. The following logical cluster permissions are required:
    - **create**: allows the creation of tables in sub-clusters.
    - **usage**: allows access to tables in sub-clusters.
    - **compute**: allows users with compute permissions to perform elastic computing in sub-clusters.

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After configuring permissions, you can edit, synchronize, or delete them.

Figure 12-55 Configuring permissions on the By permissions page

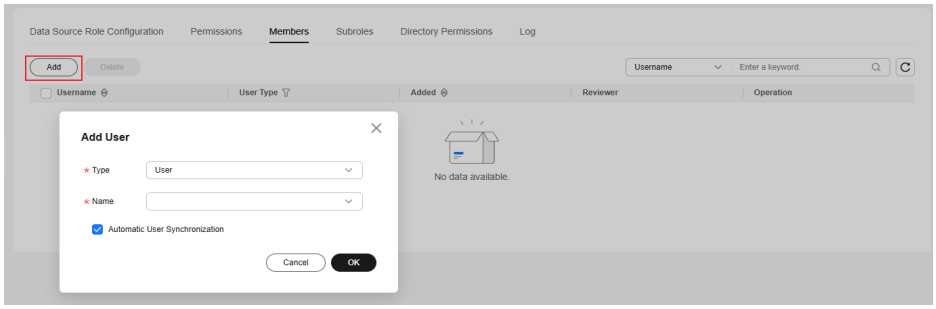


Step 7 **Members**: On the role details page, click the **Members** tab.

Members associate the roles on the **Data Source Role Configuration** page with users. Click **Add** to add users, user groups, or workspace roles to roles. You can select users or user groups that have been added to the workspace.

When you add a member, **Automatic User Synchronization** is selected. The added member will be automatically synchronized. You do not need to synchronize role information manually.

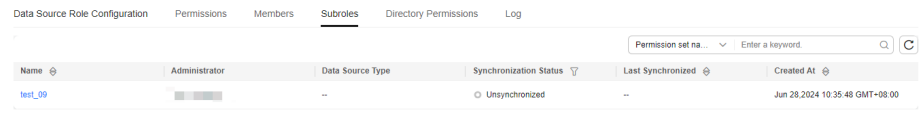
Figure 12-56 Members



Step 8 **Subroles**: On the role details page, click the **Subroles** tab.

On this page, you can view the subroles of the current role.

Figure 12-57 Viewing subroles

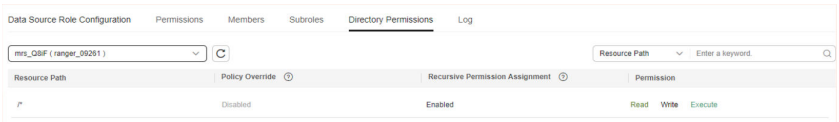


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Step 9 **Directory Permissions**: On the role details page, click the **Directory Permissions** tab.

Directory permissions obtain the HDFS policies of this role from the Ranger component to display the HDFS paths to which this role has permissions. In addition, you can view the operation permissions of the paths. You can search for the permissions of a path. Only exact match is supported.

Figure 12-58 Viewing directory permissions



Step 10 **Log**: On the role details page, click the **Log** tab.

On this page, you can view the log details if permission synchronization fails. The system deletes logs generated 30 days ago at 00:00 every day.

Figure 12-59 Viewing logs



Step 11 After the role is configured, it does not take effect immediately. You need to synchronize the permissions and role to the data source for permission management to take effect. For details, see **Related Operations**.

----End

Configuring Managed Roles

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

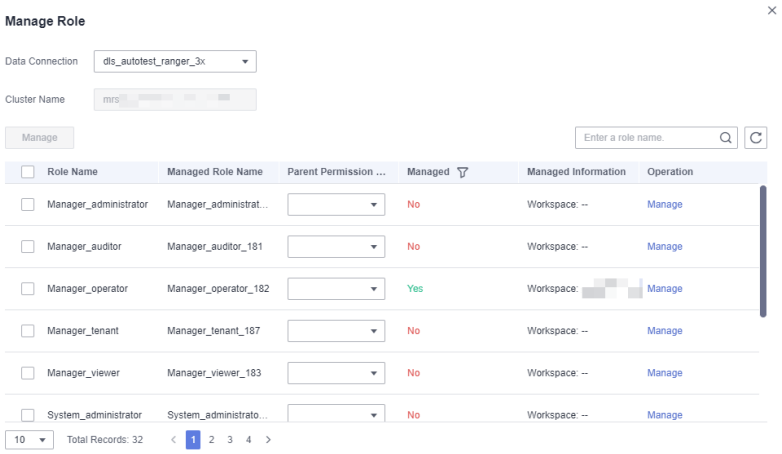
Step 2 In the navigation pane on the left, choose **Role Management**.

Step 3 On the **Role Management** page, click + in the navigation tree and select **Create Managed Role**. In the displayed dialog box, select a Ranger connection, set **Parent Permission Set/Role**, and click **Manage** in the **Operation** column of the MRS roles to be managed. You can also select multiple MRS roles to be managed and click **Manage** above the list.

If you no longer want to manage roles, you can delete the managed roles from the role management navigation tree. After the managed roles are deleted, permissions are no longer synchronized to the roles and only synchronized to user information.

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Figure 12-60 Creating a managed role

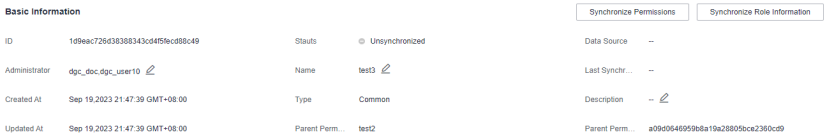


Step 4 Close the **Manage Role** dialog box and return to the **Role Management** page. In the role management navigation tree, locate the MRS role added in the previous step and click the role name to go to the role details page.

Step 5 On the role details page, you can expand the **Basic Information** area to view the name, ID, and administrator of the role. For details, see **Figure 12-61**.

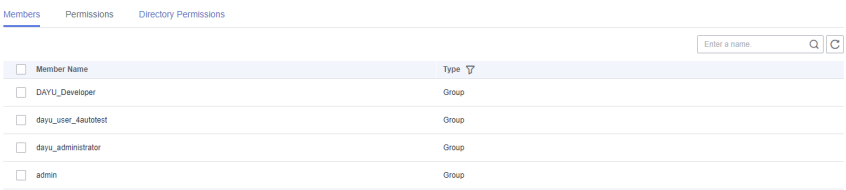
After configuring roles and permissions, you can synchronize them by clicking **Synchronize Permissions** and **Synchronize Role Information** in the upper right corner.

Figure 12-61 Basic role information



Step 6 **Members**: On this page, you can view the users or user groups associated with the MRS role. Currently, users cannot be added to managed roles in DataArts Security.

Figure 12-62 Members

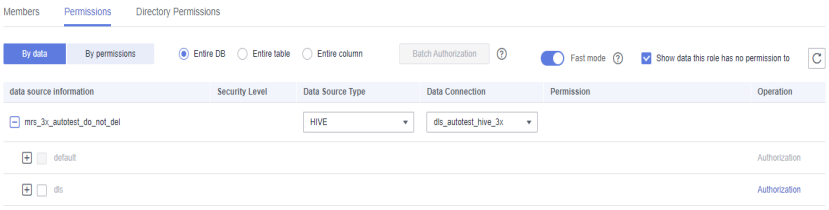


Step 7 **Permissions**: On the role details page, click the **Permissions** tab. By default, **By data** is selected. You can also select **By permissions**. The configured permissions are the same for **By data** and **By permissions**, and the only difference lies in how the permissions are displayed. You are advised to select **By permissions** for batch authorization.

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- **By data**: The system allows you to configure permissions. If a **metadata collection task** has been executed successfully, you can view the data source information and click to expand the navigation pane.

  Figure 12-63 Configuring permissions on the By data page

  When configuring permissions, you can select **Entire DB**, **Entire table**, or **Entire column**, and select the corresponding levels in the data source information to perform a batch authorization. You can also click **Authorization** in the **Operation** column of a data record in the expanded navigation pane to authorize access to the data.

  Fast mode and **Show data this role has no permission to** are supported. If **Fast mode** is enabled, metadata of databases, tables, and columns is obtained from DataArts Catalog. Otherwise, metadata is obtained from the data source. If metadata has been collected, you are advised to enable **Fast mode**.

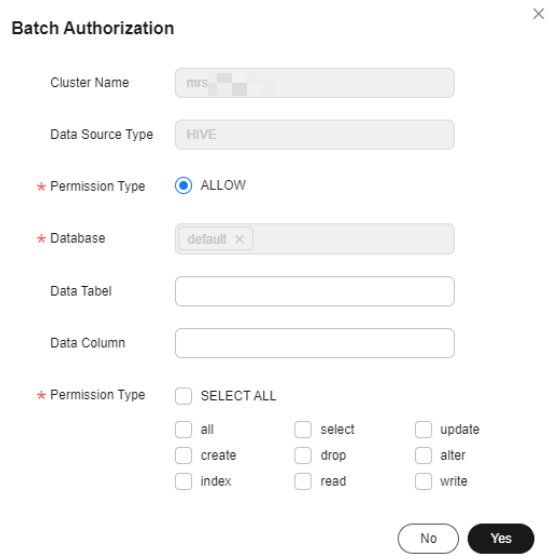
  NOTE

  - Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

    For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
  - During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).

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Figure 12-64 Authorization on the By data page



- **By permissions**: The system allows you to configure permissions.

  To configure permissions, click **Add** and select data levels in sequence. You cannot select multiple objects at the same level (such as database, table, and column) for batch authorization. **Permission Type** cannot be set to **DENY**. During permission configuration, you can select **Automatic Permissions Synchronization**. The configured permissions will be automatically synchronized. You do not need to synchronize them manually.

  NOTE

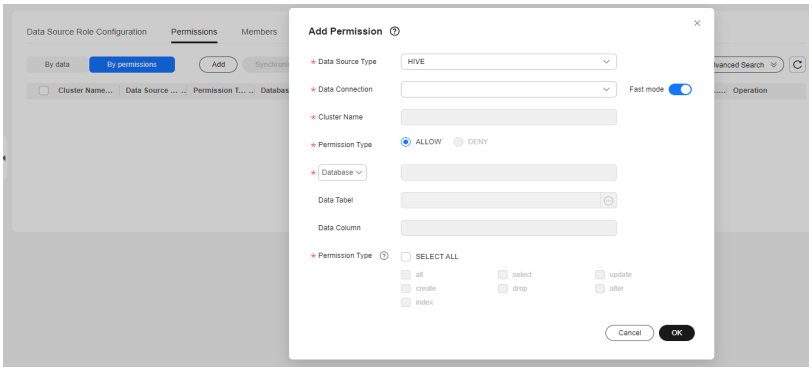
  - Note that the permissions of databases, tables, and columns are managed by layer. For example, a user who has been granted database permissions does not have the permissions of tables and columns. Table and column permissions must be granted separately.

    For example, if you enter a table name or an asterisk (*) as a wildcard during database authorization, you are authorizing the table. If you enter a column name or an asterisk (*) as a wildcard character, you are authorizing the column.
  - During authorization, the name of the object to be authorized (database, table, or column name) can contain only digits, letters, underscores (_), hyphens (-), and wildcards (*).
  - When you select **HIVE** for **Data Source Type**, you can change **Database** to **URL** to authorize an OBS path in the storage-compute decoupling scenario. In this scenario, the following URL permissions are required for using Hive:
    - **write**: creating a database
    - **read**: creating a table, writing data, and deleting a table
  - When you select **DWS** for **Data Source Type**, you can change **Database** to **Logical Clusters** to authorize logical DWS clusters. The following logical cluster permissions are required:
    - **create**: allows the creation of tables in sub-clusters.
    - **usage**: allows access to tables in sub-clusters.
    - **compute**: allows users with compute permissions to perform elastic computing in sub-clusters.

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After configuring permissions, you can edit, synchronize, or delete them.

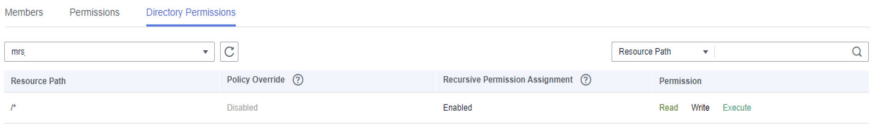
Figure 12-65 Configuring permissions on the By permissions page



Step 8 **Directory Permissions**: On the role details page, click the **Directory Permissions** tab.

Directory permissions obtain the HDFS policies of this role from the Ranger component to display the HDFS paths to which this role has permissions. In addition, you can view the operation permissions of the paths. You can search for the permissions of a path. Only exact match is supported.

Figure 12-66 Viewing directory permissions



Step 9 The permissions configured for the managed role do not take effect immediately. You need to manually synchronize the permissions to the Ranger component for permission management to take effect. For details, see **Synchronizing Permissions**.

----End

Related Operations

- Synchronizing permissions: After configuring data permissions on the **Role Management** page, you need to synchronize the permissions to the data source for permission management to take effect.

  To synchronize permissions, click **Synchronize Permissions** in the upper right corner of the **Basic Information** area on the role details page. To synchronize the permissions of multiple roles, select the roles in the role management navigation tree and click above the navigation tree.

- Synchronizing roles: In common role management (managed roles do not need to be synchronized), after a role is created for a permission set, the role takes effect only after being synchronized to the data source.

  To synchronize a role, click **Synchronize Role Information** in the upper right corner of the **Basic Information** area or click **Synchronize** in the **Operation**

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column on the **Data Source Role Configuration** tab page. To synchronize multiple roles, select the roles in the role management navigation tree and click  above the navigation tree.

NOTE

- After role synchronization is successful, MRS data source roles are named in *Role name_Timestamp* format, and the GaussDB(DWS) data source roles are named in **dataarts_studio_role**_*Role name* format.
- In scenarios where roles are synchronized to an MRS cluster, after the system prompts a successful role synchronization, permission management takes effect after about five minutes during which the Ranger component automatically synchronizes roles from the MRS cluster. You can check whether the synchronization is complete based on **Data Source Role Name** on the **Data Source Role Configuration** tab page.
  - Roles that are not synchronized are named in *Role name_10-digit timestamp* format.
  - Roles that have been synchronized are named in *Role name_13-digit timestamp* format.

- Deleting roles: In the **Role Management** navigation pane, select roles and click  above the navigation pane. In the displayed dialog box, confirm the roles to be deleted and click **Yes**.

  Common roles for which roles, permissions, users, or child permission sets have been configured cannot be deleted. To delete such roles, delete the related configurations first. If permissions have been configured for a managed role, the role cannot be deleted. To delete the role, clear related configurations first.

  NOTE

  Deleted common roles are moved to the recycle bin. You can restore them within 30 days. After 30 days, they will be deleted permanently. For details, see **Managing the Recycle Bin**.

12.3.5.4 Managing Members

DataArts Security allows you to view the permissions of workspace members, and manage roles and permission sets.

Prerequisites

- Permission sets or roles have been configured for members. For details, see **Configuring Permission Sets** or **Configuring Roles**.

Constraints

- Only the DAYU Administrator, Tenant Administrator, data security administrator, or role or permission set administrator can add or delete roles or permission sets for members.
- Only common roles can be added or deleted for members. Managed roles are not supported.
- The permissions configured for members take effect only after roles or permission sets are successfully synchronized.

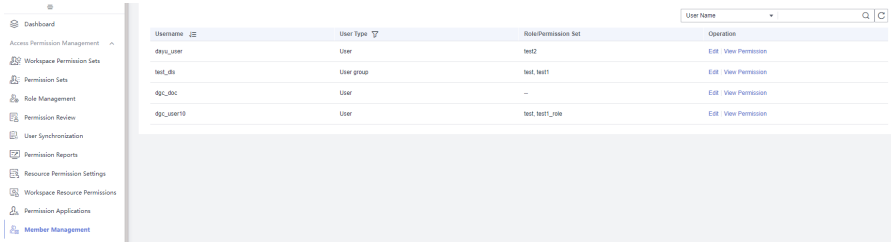
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Viewing the Policy and Details

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

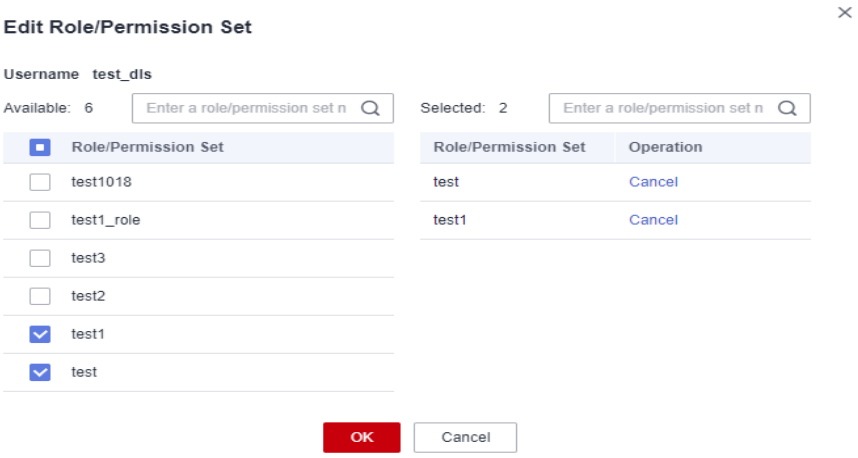
Step 2 In the navigation pane on the left, choose **Member Management**.

Figure 12-67 Member Management page



Step 3 Locate a member and click **Edit** in the **Operation** column. In the displayed dialog box, add or delete roles or permission sets for the member to manage its permissions.

Figure 12-68 Edit Role/Permission Set



Step 4 Click **View Permission** in the **Operation** column to view the basic information, permissions, and permission sources of a member.

----End

12.3.5.5 Configuring Row-level Access Control

Multiple developers may need to access and perform operations on the same GaussDB(DWS) table at the same time. In this case, you need to grant developers the permissions for specific rows in the table by configuring row-level access control policies.

After creating a row-level access control policy on the DataArts Security console, you can synchronize the policy to GaussDB(DWS). Row-level access control is automatically enabled for the GaussDB(DWS) table so that the policy takes effect.

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The row-level access control policies configured for a DataArts Studio instance are visible to and take effect for all the workspaces of the instance.

Prerequisites

- Before creating a row-level access control policy, you have created a GaussDB(DWS) connection. For details, see **Creating a DataArts Studio Data Connection**. The account in the GaussDB(DWS) connection must have the GRANT permission of the target table. (By default, only the owner of a database object or system administrator can run the **GRANT** command to grant the object permissions to other users.)
- Row-level access control policies need to be associated with data sources for specified users or user groups. Therefore, you need to synchronize user information from IAM to data sources first. For details, see **Synchronizing IAM Users to the Data Source**.
- If you want to use the current user identity authentication to make row-level access control policies take effect during script execution and job tests in DataArts Factory, you need to enable permission applications by following the instructions in **Enabling Fine-grained Authentication**.
- To ensure that a row-level access control policy takes effect, ensure that the user specified in the policy has the permission to the table to be controlled and has the USAGE permission of the schema to which the table belongs. You can run the following commands to grant permissions to user1, user2, and user3:

```
GRANT USAGE ON SCHEMA schema_name TO user1,user2,user3;
GRANT SELECT,UPDATE,DELETE ON TABLE table_name TO user1,user2,user3;
```

Constraints

- Only the DAYU Administrator, Tenant Administrator, or data security administrator can create, modify, or delete row-level access control policies. Other common users do not have permission to perform these operations.
- Row-level access control policies are available for GaussDB(DWS) data sources and unavailable for GaussDB(DWS) logical clusters. The account in the GaussDB(DWS) connection must have the GRANT permission of the target table. (By default, only the owner of a database object or system administrator can run the **GRANT** command to grant the object permissions to other users.)
- Row-level access control policies need to be associated with data sources for specified users or user groups. Therefore, you need to synchronize user information from IAM to data sources first. For details, see **Synchronizing IAM Users to the Data Source**.
- Row-level access control supports read operations on data tables (SELECT, UPDATE, DELETE, and ALL), and does not support write operations on data tables (INSERT and MERGE INTO).
- A row-level access control policy name is specific to a table. A data table cannot have row-level access control policies with the same name. Different data tables can have the same row-level access control policy.
- Row-level access control policies can be defined for row-store tables, row-store partitioned tables, column-store tables, column-store partitioned tables, replication tables, unlogged tables, and hash tables. Row-level access control

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policies cannot be defined for HDFS tables, foreign tables, or temporary tables.

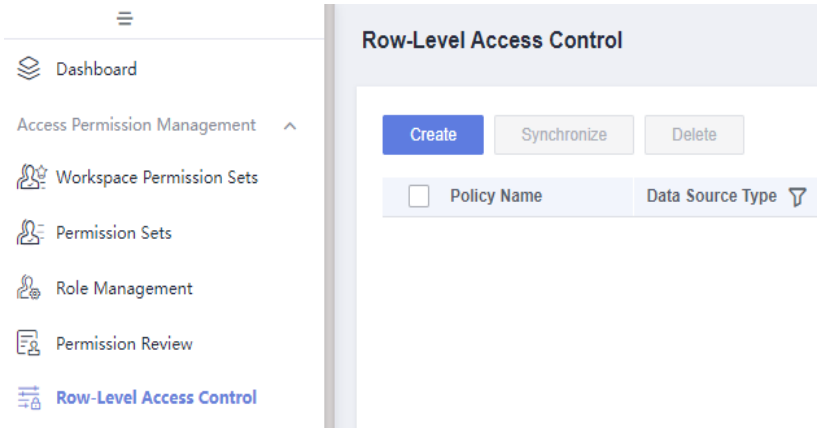
- Row-level access control policies cannot be defined for views.
- A maximum of 100 row-level access control policies can be defined for a table.
- Users with GaussDB(DWS) administrator permissions and the initial O&M user (Ruby) are not affected by row-level access control. They can view all the data of a table.
- Tables queried by using SQL statements, views, functions, and stored procedures are affected by row-level access control policies.
- After a row-level access control policy is synchronized, the types of the columns on which the row-level access control policy depends cannot be changed.

Create a Row-Level Access Control Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Row-Level Access Control**.

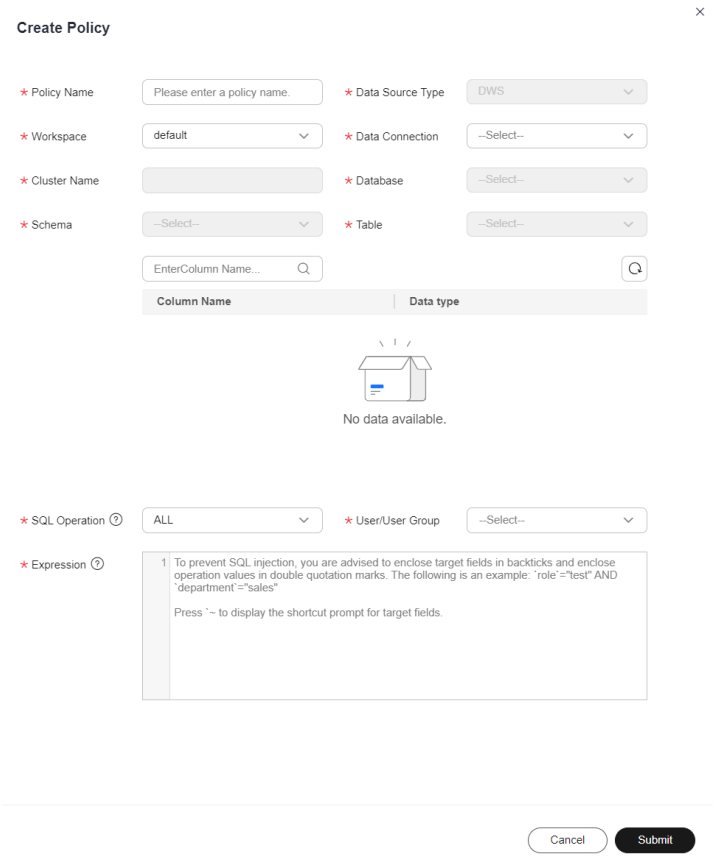
Figure 12-69 Row-Level Access Control page



Step 3 Click **Create** and set the parameters listed in **Table 12-7**.

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Figure 12-70 Setting the parameters for creating a row-level access control policy



The following table lists the parameters for creating a row-level access control policy.

Table 12-7 Policy parameters

Parameter	Description
*Policy Name	Name of the row-level access control policy. It must be unique for a data table. To facilitate policy management, you are advised to include the target object and content rule in the name.
*Data Source Type	Only **DWS** is supported.
*Workspace	Workspace where the data connection is located. You can select a data connection in another workspace. Row-level security policies are not associated with workspaces. Workspaces are only associated with data connections.
*Data Connection	DWS data connection created in the selected workspace. If no DWS data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.

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Parameter	Description
*Cluster Name	You do not need to set this parameter. The data source cluster in the data connection is automatically selected.
*Database	Database where the row is located
*Table	Table where the row is located. After you select a table, the table structure is automatically displayed.
*SQL Operation	Select the operation to be controlled (**SELECT**, **UPDATE**, **DELETE**, or **ALL**). Write operations including INSERT and MERGE INTO are not supported. ● If you select **SELECT**, SELECT operations will be controlled by the policy. The selected user group or user can only view the rows that meet the conditions defined by the expression. The affected operations include SELECT, UPDATE ... RETURNING, and UPDATE ... RETURNING. ● If you select **UPDATE**, UPDATE operations will be controlled by the policy. The selected user group or user can only update the rows that meet the conditions defined by the expression. The affected operations include UPDATE, UPDATE ... RETURNING, and SELECT ... FOR UPDATE/ SHARE. ● If you select **DELETE**, DELETE operations will be controlled by the policy. The selected user group or user can only delete the rows that meet the conditions defined by the expression. The affected operations include DELETE, DELETE ... , and RETURNING.
*User Group/ User	Select the user or user group from the current workspace members. The specified user or user group can perform the selected SQL operation only on the row-level data that meets the condition defined by the expression. ● If you select **SELECT**, SELECT operations will be controlled by the policy. The selected user group or user can only view the rows that meet the conditions defined by the expression. The affected operations include SELECT, UPDATE ... RETURNING, and UPDATE ... RETURNING. ● If you select **UPDATE**, UPDATE operations will be controlled by the policy. The selected user group or user can only update the rows that meet the conditions defined by the expression. The affected operations include UPDATE, UPDATE ... RETURNING, and SELECT ... FOR UPDATE/ SHARE. ● If you select **DELETE**, DELETE operations will be controlled by the policy. The selected user group or user can only delete the rows that meet the conditions defined by the expression. The affected operations include DELETE, DELETE ... , and RETURNING.

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Parameter	Description

*Expression	Enter the expression for determining the row data. The specified user or user group can perform the selected SQL operation only on the rows of data that meet the condition defined by the expression. The expression is in the following format:
	`` `*Target field*="*Operation value*" ``
	You are advised to enclose target fields in backquotes and enclose operation values in double quotation marks. Use **AND** to combine multiple rows of data to be matched. The following is an example.
	`` `role`="test" AND `department`="sales" ``

Step 4 Click **Submit**. After the row-level access control policy is created, click **Synchronize** to synchronize the policy to the data source.

----End

Related Operations

- Synchronizing a policy: On the **Row-Level Access Control** page, locate a policy and click **Synchronize** in the **Operation** column to synchronize the policy to the data source. To synchronize multiple policies, select them and click **Synchronize** above the list.

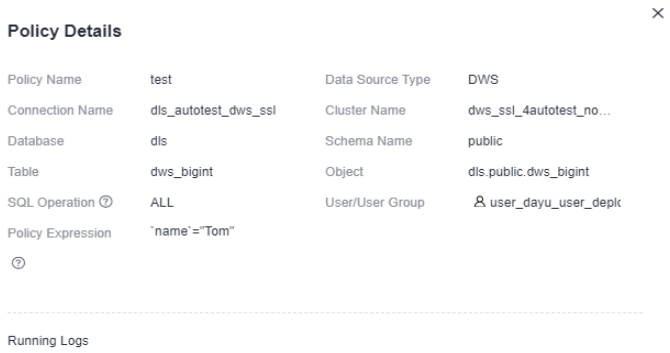
  Policies take effect only after they are synchronized successfully. If the policy synchronization fails, you can view the policy run log in the **policy details** to locate the failure cause. After rectifying the fault, synchronize the policy again. If the synchronization still fails, contact technical support.
- Editing a policy: On the **Row-Level Access Control** page, locate a policy and click **Edit** in the **Operation** column.
- Deleting policies: On the **Row-Level Access Control** page, locate a policy and click **Delete** in the **Operation** column. To delete multiple policies, select them and click **Delete** above the list.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.
- Viewing policy details: On the **Row-Level Access Control** page, locate a policy and click its name to view its details.

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Figure 12-71 Viewing policy details



12.3.5.6 Synchronizing MRS Hive and Hetu Permissions

If MRS Hetu is connected to MRS Hive and Ranger is used for permission control, the Ranger permissions of Hetu rather than of Hive are used to authenticate the access to Hive data from Hetu in the same cluster.

To avoid repeated configuration of Hive data permissions on Hetu, you can configure a Hetu permission synchronization policy so that Hive permissions can be automatically synchronized to Hetu. This improves permission management consistency and usability.

The Hetu permission synchronization policies configured for a DataArts Studio instance are visible to and take effect for all the workspaces of the instance.

Prerequisites

- Ranger permission control has been enabled for MRS Hetu. For details, see **HetuEngine Permission Management Overview**.
- Before configuring a Hetu permission synchronization policy, you have created an MRS Hive connection and an MRS Hetu connection in Management Center. For details, see **Creating a DataArts Studio Data Connection**.

Constraints

- Only the DAYU Administrator, Tenant Administrator, or data security administrator can create, modify, or delete Hetu permission synchronization policies. Other common users do not have permission to perform these operations.
- Hive permissions can be synchronized only to Hetu in the same MRS cluster.
- When configuring a Hetu permission synchronization policy, you need to configure mappings between Hive and Hetu catalogs. If a Hive source is connected to multiple Hetu catalogs, you need to configure multiple synchronization policies.
- After a Hetu permission synchronization policy is created, existing Hive permissions will not be automatically synchronized to Hetu. Instead, the permissions will be synchronized to Hetu only after a permission synchronization is triggered. This prolongs the permission synchronization duration.

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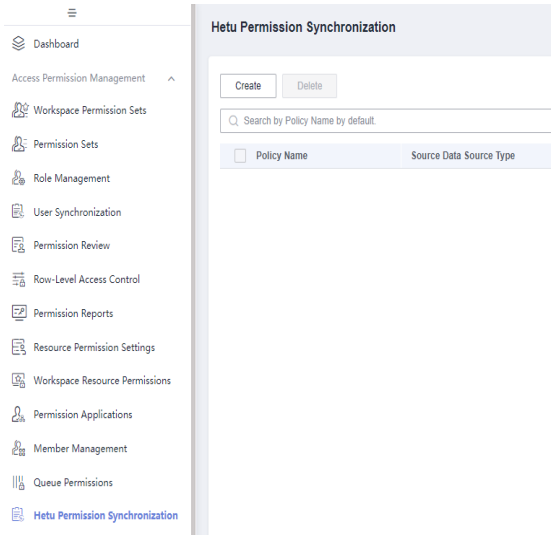
- Hive permission synchronization is not affected if permissions fail to be synchronized to Hetu.
- After a Hetu permission synchronization policy is deleted, the permissions that have been synchronized to Hetu will not be revoked.
- The names of Ranger policies for synchronizing permissions to Hetu are in the following format: ***Catalog name_Schema name*+*Table name*+*Column name***. If a policy with the same resource and name already exists on Hetu Ranger, permissions will fail to be synchronized to Hetu. In this case, you must manually clear that existing policy on Hetu Ranger.

Creating a Hetu Permission Synchronization Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Hetu Permission Synchronization**.

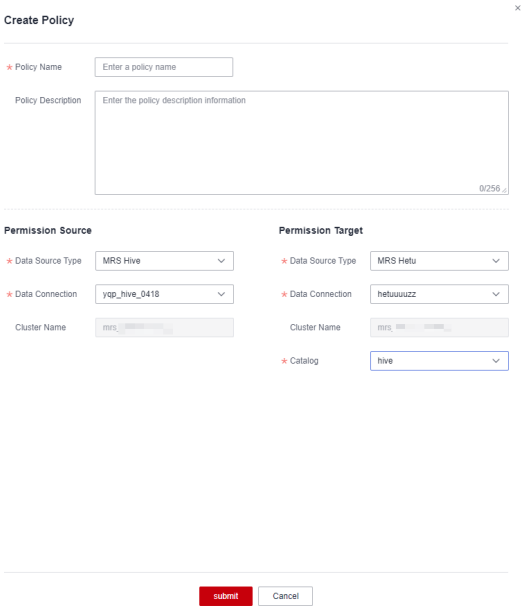
Figure 12-72 Hetu Permission Synchronization page



Step 3 Click **Create** and set the parameters listed in **Table 12-8**.

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Figure 12-73 Setting parameters for a Hetu permission synchronization policy



The following table lists the parameters for a Hetu permission synchronization policy.

Table 12-8 Policy parameters

Parameter	Description
*Policy Name	Name of the Hetu permission synchronization policy. It must be unique for each data table. You are advised to include the cluster name and catalog name in the policy name for easy management.
Policy Description	A description of the Hetu permission synchronization policy to be created. It can contain a maximum of 255 characters.
Permission Source	
*Data Source Type	Only **MRS Hive** is supported.
*Data Connection	If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
Cluster Name	The data source cluster in the data connection is automatically selected.
Permission Target	
*Data Source Type	Only **MRS Hetu** is supported.

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Parameter	Description
*Data Connection	If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**. The cluster to which the selected Hetu connection belongs must be the same as that to which the Hive connection belongs.
Cluster Name	The data source cluster in the data connection is automatically selected.
*Catalog	Name of the Hetu data source, which is **hive** by default. Multiple Hetu catalogs can connect to the same Hive. You can also select another catalog of the cluster.

Step 4 Click **Submit**.

Step 5 When Hive permission synchronization is triggered, permissions are synchronized to Ranger on Hetu. The policy is named in the following format: ***Catalog name_Schema name*+*Table name*+*Column name***. **Table 12-9** shows the policy mapping between Hive and Hetu.

Table 12-9 Policy mapping between Hive and Hetu

Hive	Hetu
Resource mapping	
Hive data source	Hetu Catalog
Hive database	Hetu Schema
Hive table	Hetu table
Hive column	Hetu column
Permission mapping	
select	select and use
update	insert, delete, and update
create	create
drop	drop
alter	alter
all	all

----End

Related Operations

- Editing a policy: On the **Hetu Permission Synchronization** page, locate a policy and click **Edit** in the **Operation** column to edit the policy.

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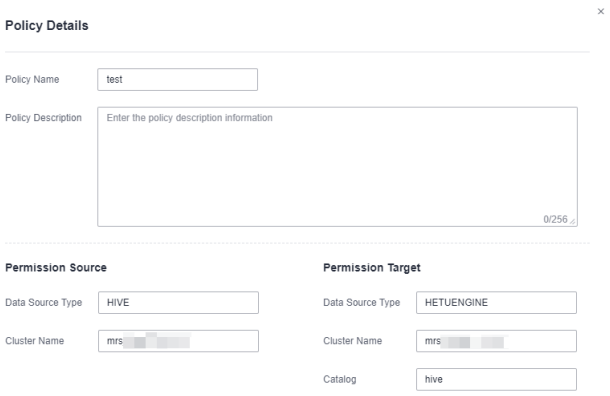
- Deleting policies: On the **Hetu Permission Synchronization** page, locate a policy and click **Delete** in the **Operation** column to delete the policy. To delete multiple policies, select them and click **Delete** above the policy list.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

- Viewing policy details: On the **Hetu Permission Synchronization** page, locate a policy, and click **Details** in the **Operation** column to view details of the policy.

  Figure 12-74 Viewing policy details



12.3.5.7 Applying for Permissions and Approving Permissions

During access permission management, you can grant permissions to users through permission sets or roles, or apply for permissions and approve permission applications.

This section describes how to **configure a review policy**, how to **configure and subscribe to permission review notifications**, how an applicant applies for permissions (**Applying for Permissions**), and how a reviewer reviews permission requests (**Reviewing Permission Requests**) and revokes permissions (**Revoking Permissions**).

Prerequisites

- Before applying for permissions, you have configured a workspace permission set. For details, see **Configuring Workspace Permission Sets**.
- Before applying for permissions, you have collected the metadata of the data connection in DataArts Catalog. For details, see **Metadata Collection Task**.

Notes and Constraints

- For configuring review policies:
  - Only one review policy is allowed for a security level. If no security level is selected, only one review policy is allowed.
  - To create a security level-based review policy, ensure that the following conditions are met:

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    - Data Map is enabled.
    - Metadata has been collected from the data of a specific security level.
    - A sensitive data discovery task has been executed, and the security level information has been synchronized to Data Map.
- For applying for permissions and reviewing permission requests:
  - You can only apply for the SELECT permission for querying data in tables. Before applying for the permission, ensure that the SELECT permission for all columns in the target table has been configured in the workspace permission set.
  - If you apply for the permission of multiple tables at a time, multiple requests are generated.
  - You can apply for DLI permissions for users but not for user groups.
  - Only the DAYU Administrator, Tenant Administrator, data security administrator, and workspace administrator can revoke permissions from other users.
  - You can only view your permission requests and review records, and cannot audit permissions.
- For configuring and subscribing to permission review notifications:
  - Only the DAYU Administrator, Tenant Administrator, and data security administrator can configure permission review notifications and operate all subscriptions. Non-administrator users can operate their subscriptions, but cannot view or operate other users' subscriptions.
  - To configure permission review notifications, you must grant the SMN FullAccess permission of the SMN service to the dlg_agency.
  - If a notification topic in DataArts Factory is used for review notifications, no notifications will be received because the subscriptions added in DataArts Factory have filtering policies. In this case, you must associate notifications with subscriptions apart from subscribing to notifications so that permission review notifications can be received.
  - Subscriptions are associated with users through remarks. Subscriptions whose remarks are usernames are regarded as subscriptions of the corresponding users.
  - The subscription list is associated a topic. If the topic is changed, you must reconfigure notifications.
  - The configured endpoint information cannot be edited. If the phone number or email address changes, delete the endpoint, add it again, and request a subscription again.
  - SMN can send a maximum of 100 messages to a specific phone number or email address within 10 minutes.
  - A permission review notification contains the number of service tickets to be reviewed at the time when the notification is sent. During the notification cooldown period, no notification is sent even if a new service ticket is received. When the cooldown period ends, notifications are sent again for new service tickets.
  - Due to concurrency and SMN performance limitations, SMN notifications may be delayed for a few minutes.

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- For making permissions take effect:
  - During permission synchronization, you need to configure required permissions for the **dlg_agency**. For details, see **Authorizing dlg_agency**.
  - The current data permission control uses the allowlist mechanism, which adds operation conditions to the users to be authorized without affecting the permissions the users already have. If you only want to make the permissions granted by the data permission control take effect, you need to revoke the original permissions of the users to be authorized. For details, see **Data Permission Management**.
  - During script execution and job testing in DataArts Factory, the MRS or GaussDB(DWS) data source uses the account of the data connection for authentication by default. Therefore, permission management still does not take effect during data development. You need to enable fine-grained authentication so that the current user is used for authentication during script execution and job testing in DataArts Factory. In this way, different users have different data permissions, and permission management for roles and permission sets takes effect.

Configuring a Review Policy

Through review policies, you can set multi-level review processes or set different review processes for data of different security levels.

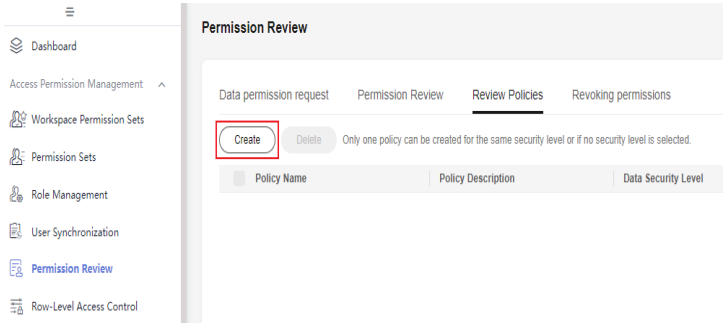
Note that review policies configured for a DataArts Studio instance are visible to and take effect for all the workspaces of the instance.

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Permission Review**.

Step 3 On the displayed page, click the **Review Policies** tab and then **Create**.

Figure 12-75 Creating a review policy



Step 4 In the slide-out panel, set parameters based on **Table 12-10**. You can click + to add review nodes.

Figure 12-76 Configuring the review policy

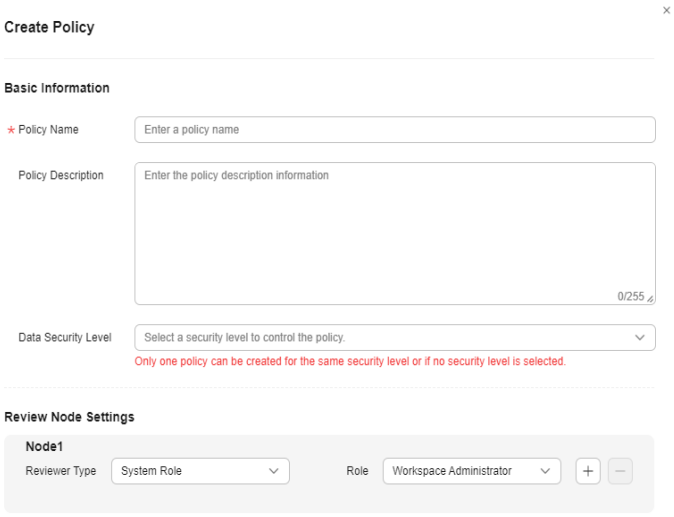


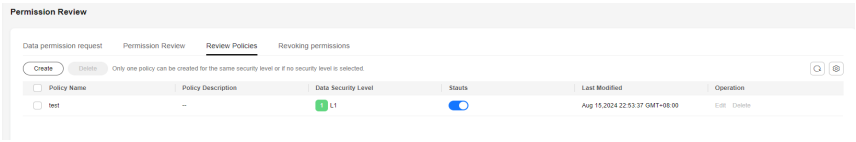
Table 12-10 Review policy parameters

Configuration Item	Description
Basic Information	
*Policy Name	Name of the review policy. It can contain a maximum of 32 characters, including letters, digits, and underscores (_).
Policy Description	Description of the policy. It can contain a maximum of 255 characters.
Data Security Level	If you want to set different review processes for the permission requests for data of different security levels, select a data security level. Only one review policy is allowed for a security level. If no security level is selected, only one review policy is allowed. The prerequisites for selecting a data security level are as follows: • Data Map is enabled. • Metadata has been collected from the data of a specific security level. • A sensitive data discovery task has been executed, and the security level information has been synchronized to Data Map.
Review Node Settings-System Role/IAM User/IAM User Group	
Reviewer Type	Type of the reviewer
Role	Reviewer role matching the reviewer type

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Step 5 After setting the review policy, click **Submit**. The created review policy is disabled by default. To make it take effect, click  in the **Status** column.

Figure 12-77 Review policy list



----End

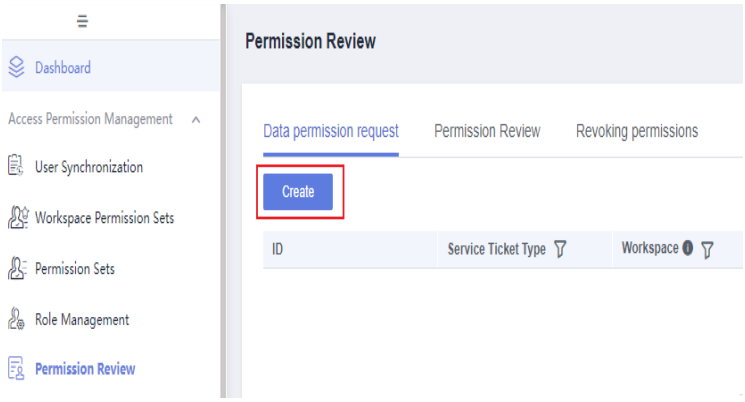
Applying for Permissions

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Permission Review**.

Step 3 On the **Data permission request** page, click **Create** to create a service ticket for applying for permissions.

Figure 12-78 Creating a permission request



Step 4 On the displayed **Data permission request** page, fill in the service ticket by referring to **Table 12-11**.

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Figure 12-79 Filling in the service ticket

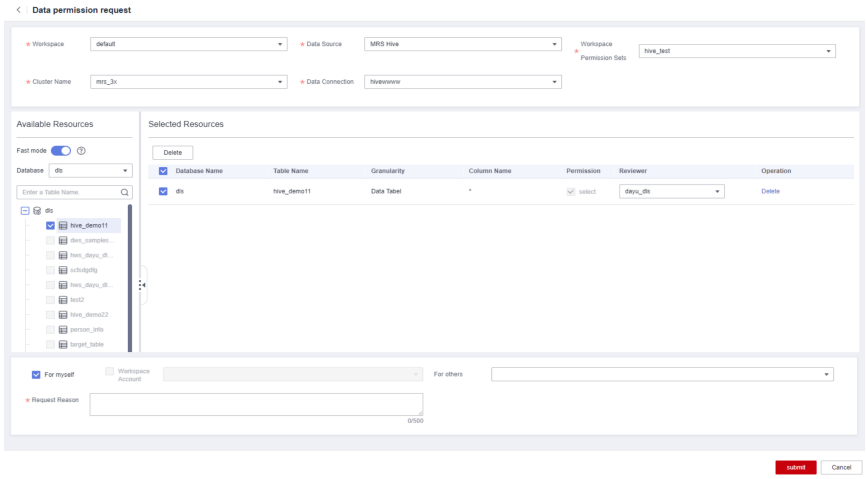


Table 12-11 Parameters for the permission request

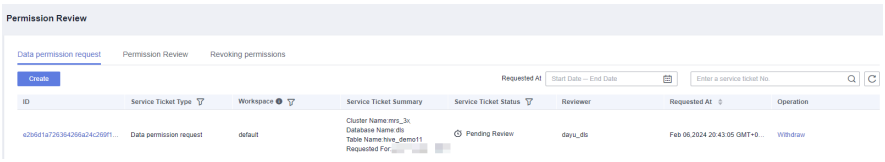
Item	Description
Basic information	
*Workspace	Select a workspace for which a workspace permission set has been configured.
*Workspace Permission Sets	Select a workspace permission set that contains the required resource permissions.
*Data Source	Select **MRS Hive**, **DLI**, or **DWS**.
*Cluster Name	Select the cluster of the requested resource permissions.
*Data Connection	Select the data connection of the requested resource permissions.
Resource selection	
*Available Resources	After selecting a database in the navigation tree, select the required data tables. You can select tables in different databases. **NOTE** • You can only apply for the SELECT permission for querying data in tables. Before applying for the permission, ensure that the SELECT permission for all columns in the selected table has been configured in the workspace permission set. If **Fast mode** is enabled, metadata of databases, tables, and columns is obtained from DataArts Catalog. Otherwise, metadata is obtained from the data source. You are advised to enable **Fast mode**.

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Item	Description
*Selected Resources	In the list of selected resources, you can view the selected tables, permissions, and reviewers. **NOTE** The reviewers are the administrators of permission sets or roles by default. For example, if the SELECT permission for all columns in the selected table is defined in the workspace permission set, permission set A, and role B, the reviewer can be the administrator of permission set A or role B. If the SELECT permission for all columns in the selected table is only defined in the workspace permission set, the reviewer is the administrator of the workspace permission set.
Request information	
For myself	If you select this option, you can apply for the selected resource permissions for yourself.
Workspace Account	If a public IAM account for scheduling has been configured in DataArts Factory, you can apply for the selected resource permissions for the workspace account.
For others	Select members in the workspace and apply for the selected resource permissions for them.
*Request Reason	Enter the reason for applying for the permissions so that the reviewer can determine whether to approve your request.

Step 5 After filling in the service ticket, click **Submit** to generate a service ticket to be reviewed. In the service ticket list, you can view the service ticket ID, summary, and status. You can click the service ticket ID to view the ticket details. You can also withdraw service tickets that have not been approved.

Figure 12-80 Service ticket list



----End

Reviewing Permission Requests

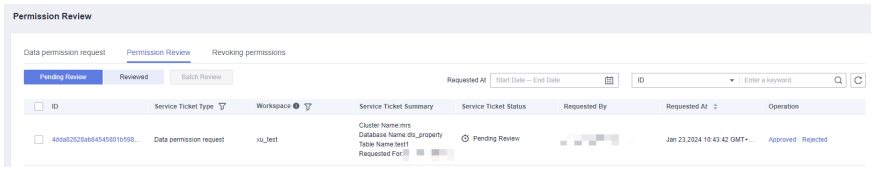
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Permission Review**.

Step 3 Click the **Permission Review** tab.

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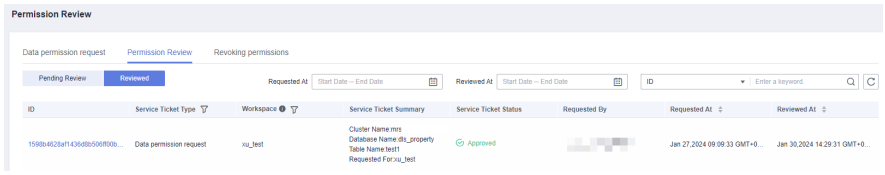
Figure 12-81 Permission Review



Step 4 The **Permission Review** page displays the service tickets to be reviewed. You can view the service ticket ID, summary, and status, and click the service ticket ID to view the ticket details. Review the service ticket based on service rationality and data security, and click **Approve** or **Reject**. You can also select service tickets and click **Batch Review** above the list to approve or reject service tickets in batches.

Step 5 Click the **Reviewed** tab to view the service tickets that have been approved.

Figure 12-82 List of approved service tickets



----End

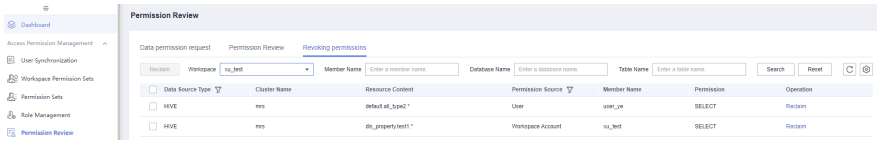
Revoking Permissions

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Permission Review**.

Step 3 Click the **Revoking permissions** tab.

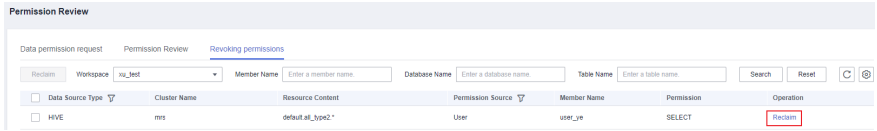
Figure 12-83 Revoking permissions tab



Step 4 The **Revoking permissions** page displays the data permissions you have obtained. You can filter permissions by **Workspace**, **Member Name**, **Database Name**, or **Table Name** (fuzzy match is supported). Locate a permission and click **Reclaim** in the **Operation** column to delete the permission.

Only the DAYU Administrator, Tenant Administrator, workspace administrator, and data security administrator can revoke data permissions of users in the corresponding workspace.

Figure 12-84 Revoking permissions



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----End

Configuring and Subscribing to Permission Review Notifications

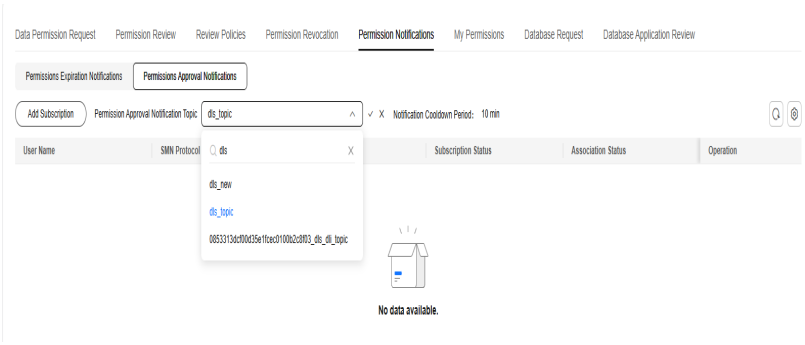
The administrator can configure topics for permission review notifications. Reviewers who subscribe to the topics will receive notifications after permission requests are received.

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Permission Review**. On the **Permission Review** page, click the **Permission Notifications** tab.

Step 3 On the **Permission Notifications** page, click the **Permission Approval Notifications** tab and , select an SMN topic for permission review notifications, and click .

Figure 12-85 Permission Notifications page



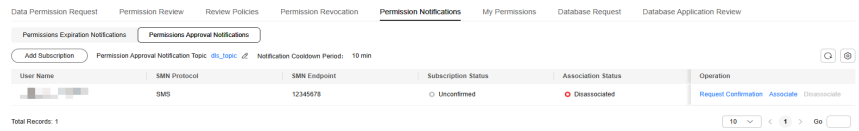
Step 4 The endpoints that have subscribed to the SMN topic are displayed in the subscription list. The usernames in the list correspond to subscription remarks. Subscribers can only perform operations on subscriptions whose remarks are the same as usernames. If there is no subscription corresponding to the current username, click **Add Subscription** to add a subscription.

A subscriber can select an endpoint and send a subscription request. When the subscription status is **Confirmed**, the subscription is successful.

NOTE

If a notification topic in DataArts Factory is used for review notifications, no notifications will be received because the subscriptions added in DataArts Factory have filtering policies. In this case, you must associate notifications with subscriptions apart from subscribing to notifications so that permission review notifications can be received.

Figure 12-86 Subscribing to permission review notifications



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----End

Related Operations

- Editing a review policy: On the **Review Policies** page, locate a policy and click **Edit** in the **Operation** column.
- Setting the review policy status: A new review policy is disabled by default and does not take effect.

  To change the status of a review policy, click  or  to enable or disable the policy.
- Deleting review policies: On the **Review Policies** page, locate a policy and click **Delete** in the **Operation** column. To delete multiple policies, select them and click **Delete** above the policy list.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

12.3.5.8 Enabling Fine-grained Authentication

If fine-grained authentication is disabled, the data source uses the account of the data connection for authentication during script execution and job tests in DataArts Factory. Therefore, user permission management enabled through roles or permission sets does not take effect for data development.

After fine-grained authentication is enabled, data sources no longer use the accounts of the data connections during script execution, job tests, and job scheduling in DataArts Factory of DataArts Studio. Instead, the current user is used for authentication. In this way, different users have different data permissions, and the permissions of roles and permission sets can be managed.

The impact of fine-grained authentication on the execution of scripts and jobs in DataArts Factory is as follows:

- If fine-grained authentication is disabled, the account of the data connection is used for authentication during script execution and job tests and scheduling in DataArts Factory.
- If fine-grained authentication is enabled for development mode, the current user is used for authentication during script execution and job tests in DataArts Factory, and the account of the data connection is used for authentication during job scheduling.
- If fine-grained authentication is enabled for scheduling mode, the current user is used for authentication during script execution, job tests, and job scheduling in DataArts Factory.

Prerequisites

- Required data permissions have been configured for the user who uses the data source to prevent service interruptions due to insufficient data permissions after fine-grained authentication is enabled. For details about how to configure permissions, see **Configuring Permission Sets** or **Configuring Roles**.

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- Before testing GaussDB(DWS) connectivity, you have synchronized users and switched the current login account to an IAM sub-user account with at least the DWS Database Access permission.
- Proxy permissions have been configured for the users of an MRS Hive connection and MRS Spark connection. For details, see **Reference: Configuring Proxy Permissions for MRS Data Connection Users**.
- The Spark2x component corresponding to the MRS Spark connection uses the multi-active instance mode. Otherwise, change the mode to the multi-active instance mode by referring to **Configuring the Switchover Between the Multi-active Instance Mode and the Multi-tenant Mode**.

Constraints

- Fine-grained authentication for development mode is available only for GaussDB(DWS) and MRS Hive and MRS Spark data connections in proxy mode. Fine-grained authentication for scheduling mode is available only for the MRS Hive data connection in proxy mode.
- Only the DAYU Administrator, Tenant Administrator, and data security administrator have the permission to configure fine-grained authentication.
- Fine-grained authentication is supported only when the version of the CDM cluster selected for the agent in the data connection is 2.10.0.300 or later.
- User permissions configured in a role/permission set take effect only after the role/permission set is successfully synchronized and fine-grained authentication is enabled.
- The restrictions on the GaussDB(DWS) connectivity test are as follows:
  - During the connectivity test, the system uses the current user to access the data source. The connectivity test will fail if the current user is a Huawei account, because GaussDB(DWS) data cannot be accessed directly using a Huawei account. Before testing GaussDB(DWS) connectivity, you must synchronize users and switch the current login account to an IAM sub-user account with at least the DWS Database Access permission.
  - Fine-grained authentication is supported only when the guest_agent version of a GaussDB(DWS) cluster is 8.2.1, or later than 8.2.1 and earlier than 9.0.0. For details about how to check the guest_agent version of a GaussDB(DWS) cluster, see **Viewing the guest_agent Version of a GaussDB(DWS) Cluster**.
- The restrictions on the MRS Hive connectivity test are as follows:

  Fine-grained authentication is supported only when proxy permissions are configured for the users of MRS Hive data connections.
- The restrictions on the MRS Spark connectivity test are as follows:
  - Fine-grained authentication is supported only when proxy permissions are configured for the users of MRS Spark data connections.
  - Fine-grained authentication is supported only when the Spark 2x component corresponding to the MRS Spark data connection uses the multi-active instance mode. For details about how to change the mode to the multi-active instance mode, see **Configuring the Switchover Between the Multi-active Instance Mode and the Multi-tenant Mode**.

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Enabling Fine-grained Authentication

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

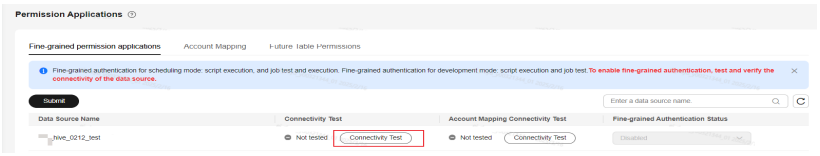
Step 2 In the left navigation pane, choose **Permissions Applications**.

Step 3 On the **Permission Applications** page, test the connectivity of the data connections for which you want to enable fine-grained authentication. During the connectivity test, the system uses the current user account to access the data source to ensure that the current user can access the data source.

NOTE

- DWS data sources cannot be accessed using a a Huawei account. Therefore, if you log in using a a Huawei account, the connectivity test will fail. Before testing GaussDB(DWS) connectivity, you must synchronize users and switch the current login account to an IAM sub-user account with at least the DWS Database Access permission.

Figure 12-87 Testing connectivity



If the connectivity is abnormal, perform the following checks:

1. Ensure that the data source of the data connection is available.
2. Check that the version of the CDM cluster selected as the agent for the data connection is 2.10.0.300 or later.
3. Ensure that users have been synchronized. For details, see **Synchronizing IAM Users to the Data Source**.
4. GaussDB(DWS) connection:
   a. Check whether the guest_agent version of the GaussDB(DWS) cluster connected by the data connection is 8.2.1 or later than 8.2.1 and earlier than 9.0.0. For details about how to check the guest_agent version of a GaussDB(DWS) cluster, see **Viewing the guest_agent Version of a GaussDB(DWS) Cluster**.
   b. You have switched the current login account to an IAM sub-user account with at least the DWS Database Access permission.
5. MRS Hive connection:

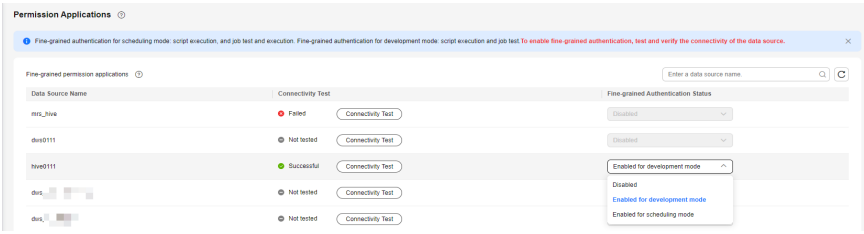
   Check whether a proxy has been configured for the user of the MRS Hive connection. If no proxy has been configured, see **Reference: Configuring Proxy Permissions for MRS Data Connection Users**.
6. MRS Spark connection:
   a. Check whether a proxy has been configured for the user of the MRS Spark connection. If no proxy has been configured, see **Reference: Configuring Proxy Permissions for MRS Data Connection Users**.
   b. Check whether the Spark 2x component corresponding to the MRS Spark data connection uses the multi-active instance mode. Fine-grained authentication is supported only in multi-active instance mode. For

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details about how to change the mode to the multi-active instance mode, see **Configuring the Switchover Between the Multi-active Instance Mode and the Multi-tenant Mode**.

Step 4 After the connectivity test is successful, select **Enabled for development mode** or **Enabled for scheduling mode** in the **Fine-grained Authentication Status** column, and click **Submit** to enable fine-grained authentication.

Figure 12-88 Enabling fine-grained authentication



----End

Reference: Configuring Proxy Permissions for MRS Data Connection Users

By default, when you access a data source through an MRS Hive or Spark data connection on DataArts Studio, the account configured in the data connection is used by default. If you configure Hive or Spark proxy permissions for the account in the MRS Hive or Spark data connection, you can use your own identity to perform this operation and enable fine-grained authentication. For details, see **Configuring Hive proxy permissions** and **Configuring Spark proxy permissions**.

Configuring Hive proxy permissions

Step 1 Log in to MRS FusionInsight Manager.

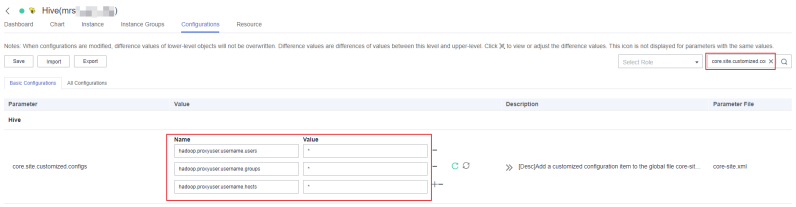
Step 2 Choose **Cluster** > **Services** > **Hive** and click **Configurations** and then **Basic Configurations**. In the search box, enter **core.site.customized.configs** and set the parameter listed in **Figure 12-89**.

Table 12-12 Parameter

Parameter	Name	Value
core.site.customized.configs	hadoop.proxyuser.***Username configured for the data connection***.users	*
	hadoop.proxyuser.***Username configured for the data connection***.groups	*
	hadoop.proxyuser.***Username configured for the data connection***.hosts	*

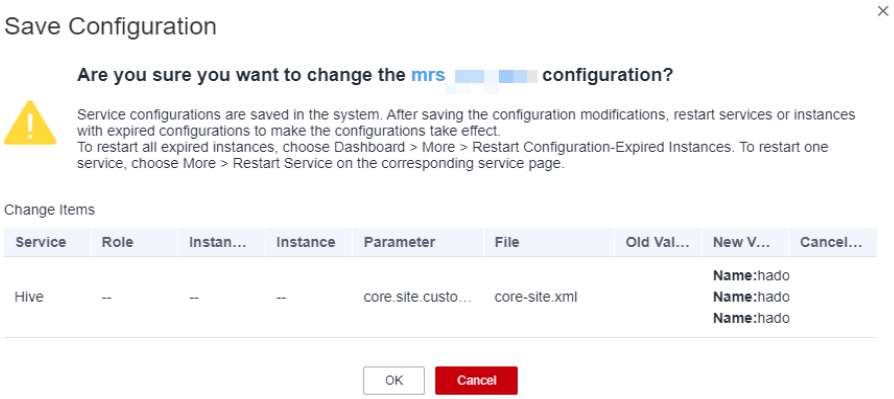
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Figure 12-89 Configuring the core.site.customized.configs parameter



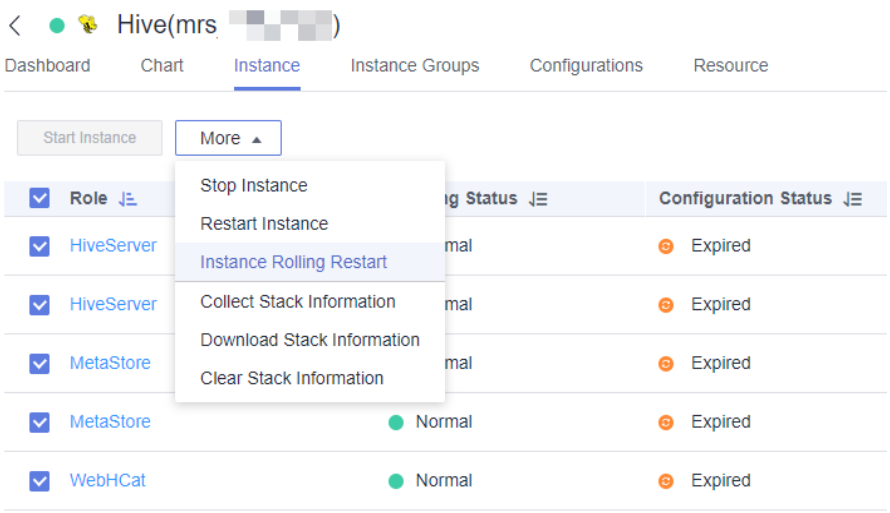
Step 3 After setting the parameter, click **Save** in the upper left corner and then **OK** in the dialog box to save the configuration.

Figure 12-90 Saving the configuration



Step 4 After saving the configuration, switch to the **Instances** tab page, select the instance that has expired, click **More**, and select **Instance Rolling Restart** to make the configuration take effect.

Figure 12-91 Performing a rolling instance restart



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----End

Configuring Spark proxy permissions

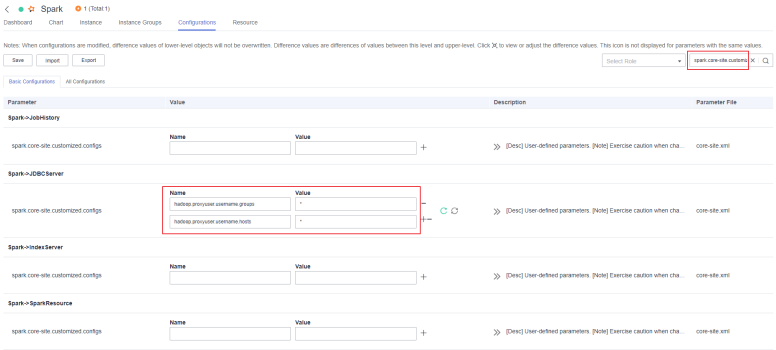
Step 1 Log in to MRS FusionInsight Manager.

Step 2 Choose **Cluster** > **Services** > **Spark** and click **Configurations** and then **Basic Configurations** or choose **Cluster** > **Services** > **Spark2x** and click **Configurations** and then **Basic Configurations**. In the search box, enter **spark.core-site.customized.configs** and set the parameter listed in **Figure 12-92**. The Spark component is used as an example.

Table 12-13 Parameter

Parameter		Name	Value
Spark->JDBCServer Or Spark2x->JDBCServer2x	core.site.customized.configs	hadoop.proxyuser.***Username configured for the data connection***.groups	*
		hadoop.proxyuser.***Username configured for the data connection***.hosts	*
		hadoop.proxyuser.***Username configured for the data connection***.groups	*
		hadoop.proxyuser.***Username configured for the data connection***.hosts	*

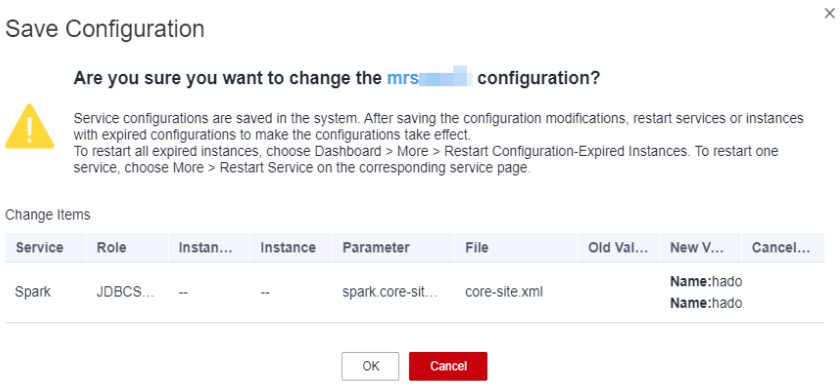
Figure 12-92 Configuring the spark.core-site.customized.configs parameter



Step 3 After setting the parameter, click **Save** in the upper left corner and then **OK** in the dialog box to save the configuration.

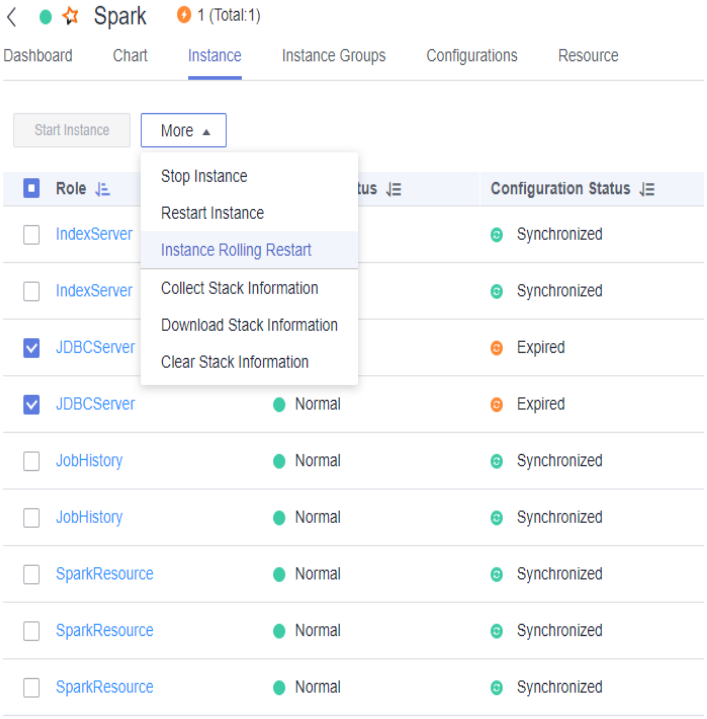
 Copyright © Huawei Cloud Computing Technologies Co., Ltd.

Figure 12-93 Saving the configuration



Step 4 After saving the configuration, switch to the **Instance** tab page, select the instance that has expired, click **More**, and select **Instance Rolling Restart** to make the configuration take effect.

Figure 12-94 Performing a rolling instance restart



----End

12.3.6 Controlling Service Resource Access

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12.3.6.1 Configuring Queue Permissions

This section describes how to allocate MRS Yarn and DLI queues to the current workspace and configure queue permission policies for user groups or users through queue permission management.

Currently, the whitelist mechanism is used for queue allocation and queue permission management. If no queue is allocated, no queue can be selected. If queue permissions are not granted to a user, the user cannot use the queue.

- After queues are allocated to the workspace, they can be selected during the job node configuration in DataArts Factory.

  NOTE

  Currently, the queue list can be obtained from allocated queues when the MRS Yarn queue is selected. If no queue is allocated, only the root.default queue can be selected.

- After queue permissions are configured for user groups or users, MRS Ranger manages the permissions of MRS queues and DLI manages the permissions of DLI queues. Only authorized users can access the queues.

  NOTE

  When you use queues in DataArts Factory, the data source uses the account of the data connection for authentication. Therefore, queue permission management still does not take effect during data development. You need to enable fine-grained authentication so that the current user is used for authentication during the use of queues in DataArts Factory. In this way, queue permission management takes effect.

Prerequisites

- Only the DAYU Administrator, Tenant Administrator, or data security administrator has the permission to allocate available queues to the current workspace, configure MRS queue attributes (offline/real-time), and configure user permission policies for specified queues. The workspace administrator can configure queue permission policies for user groups and users.
- Before configuring queue permissions, you have created an MRS Ranger and a DLI connection in Management Center. For details, see **Creating a DataArts Studio Data Connection**.
- Before configuring permissions for MRS Yarn queues, you have synchronized user information from IAM to the data source based on **Synchronizing IAM Users to the Data Source**.
- To make the permission policy for MRS Yarn queues take effect, you have enabled Yarn access control by setting the **yarn.acl.enable** parameter to **true**. For details, see **Reference: Configuring Strict Permission Control for Yarn**.

Constraints

- Currently, only MRS Yarn queues can be allocated. Permission management is supported only for MRS Yarn and DLI queues. Authorization for the DLI default queue is not supported due to DLI limitations.
- Permissions of MRS Yarn queues can be managed only when the version of the CDM cluster selected as the agent for the data connection is 2.10.0.300 or later.
- Only the DAYU Administrator, Tenant Administrator, or data security administrator has the permission to allocate available queues to the current

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workspace, configure MRS queue attributes (offline/real-time), and configure user permission policies for specified queues. The workspace administrator can configure queue permission policies for user groups and users.

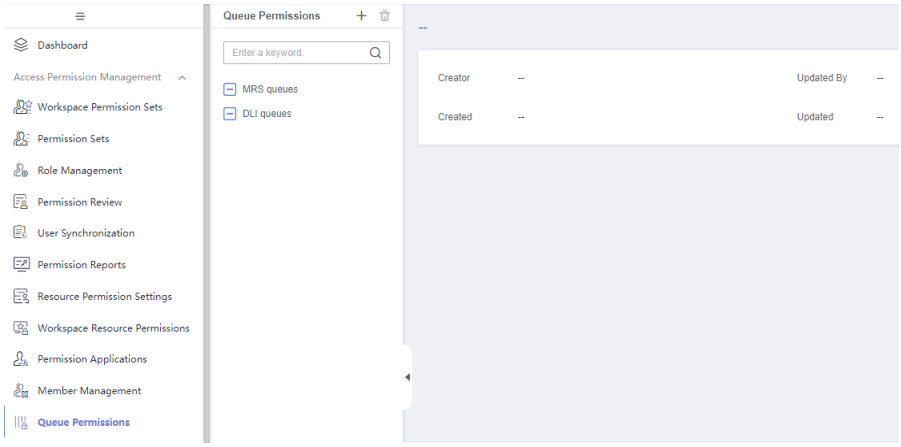
- The queues allocated to the current workspace are not associated with the configured queue permissions policies which are contained in the data source configuration. Therefore, if the queues are deleted from the current workspace, the configured queue permission policies still take effect. When the queues are added again, the permissions are still available.
- The configured queue permission policies are implemented based on the permission control capability of the data source. You can view the configured policies in the data source (such as MRS Ranger policies and DLI queue management). If you delete a queue policy from the data source, the policy will not be automatically deleted from the DataArts Security component. You need to manually delete the policy from the DataArts Security component.
- Queue attributes (offline or real-time) can be configured only for MRS Yarn queues, and different attributes can be configured for the same queue in different workspaces.
- Due to DLI limitations, permissions of DLI queues can be granted only to users, but not to user groups.

Allocating Queues and Granting Permissions

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Queue Permissions**.

Figure 12-95 Queue Permissions page

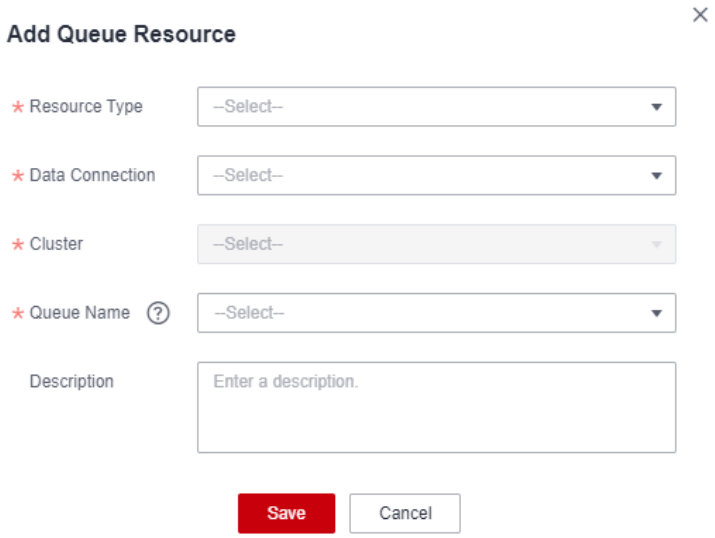


Step 3 Click + above the queue permission directory to allocate a queue to the current workspace. In the displayed **Add Queue Resource** dialog box, set the parameters listed in **Table 12-14** and click **Save**.

Table 12-14 Parameters for adding a queue

Parameter	Description
*Resource Type	Select **MRS queues** or **DLI queues**.
*Data Connection	Select the data connection where the queue is located. For details about how to create a data connection, see **Creating a DataArts Studio Data Connection**.
*Cluster Name	This parameter is displayed only when **Resource Type** is set to **MRS queues**. The system automatically matches the cluster name corresponding to the data connection.
*Queue Name	Select the queue to be authorized. • If you set **Resource Type** to **MRS queues**, the available queues are from an MRS cluster. To view the available queues, go to the MRS console, click a cluster name to go to the cluster details page, and click the **Tenants** and then **Queue Configuration** tab. • If you set **Resource Type** to **DLI queues**, the available queues are the queues purchased in DLI. To view the available queues, go to the DLI console and choose **Resources** > **Queue Management**. In addition, DLI queues are classified into SQL queues and general-purpose queues. SQL queues are used to run SQL jobs, and general-purpose queues are used to run Flink and Spark JAR jobs.
Description	Information to make the queue easier to be identified

Figure 12-96 Adding queues



Step 4 Click a queue in the queue permission directory to go to the queue details page.

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You can configure attributes for MRS Yarn queues, which are mainly used for task management in DataArts Factory. Real-time queues are used to run real-time jobs, and offline queues are used to run batch jobs. By default, job types of queues are not distinguished.

Figure 12-97 MRS Yarn queue details

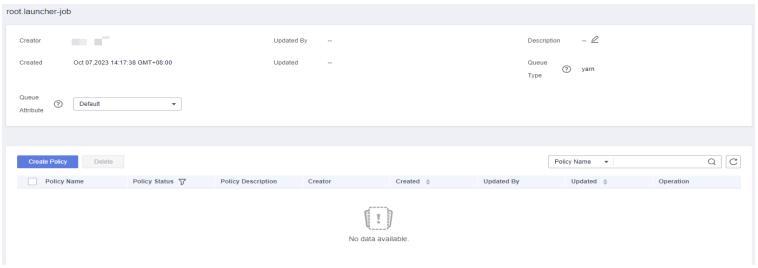
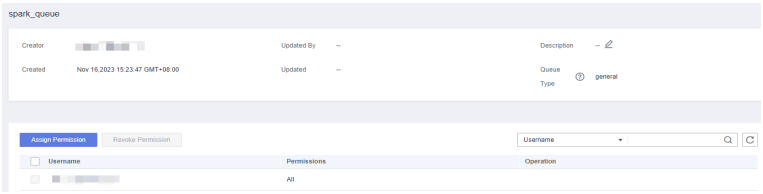


Figure 12-98 DLI queue details



Step 5 Grant permissions to the allocated queues.

- **MRS Yarn queue**

  On the MRS Yarn queue details page, click **Create Policy**. In the displayed dialog box, set the parameters in **Table 12-15** and click **Save**.

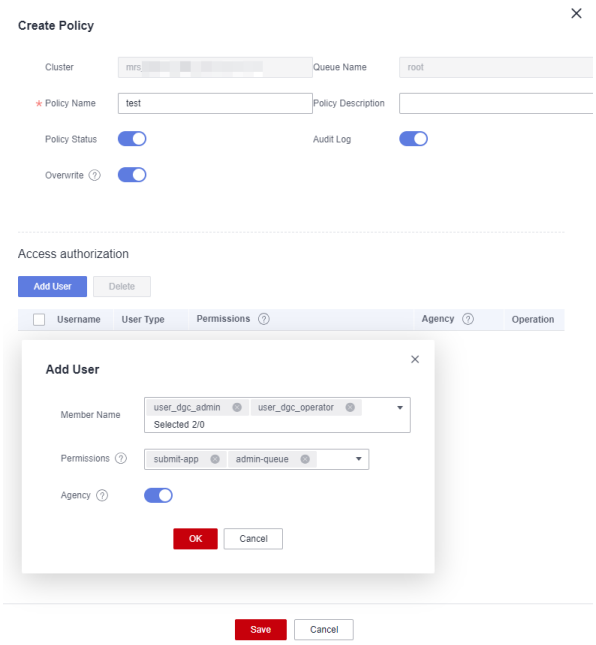
  Table 12-15 MRS Yarn queue policy parameters

Parameter	Description
Cluster Name	The system automatically sets this parameter to the name of the cluster where the queue is located.
Queue Name	The system automatically sets this parameter to the current queue name.
*Policy Name	Name of the permission policy for the MRS Yarn queue. To facilitate policy management, you are advised to include the authorization object in the name.
Policy Description	Information to make the policy easier to be identified
Policy Status	If this function is enabled, the current policy takes effect.
Audit Log	If this function is enabled, operation logs of the current queue can be recorded. You can view the audit logs in the data source.

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Parameter	Description
Overwrite	Due to the restrictions of the Ranger component, if a queue permission policy already exists for the user or user group in the Ranger component, the current policy may be considered duplicate and cannot be added. If this function is enabled, the system attempts to overwrite the existing queue permission policy for the user or user group in Ranger. If the overwriting fails, you need to delete the queue permission policy of the user or user group from the Ranger component and add the policy again.
***Access Authorization** (Click **Add User** to open the configuration window.)	
Username	Select the users or user groups to be authorized. The users and user groups that have been added to the workspace are available for selection.
Permission	– **submit-app**: the permission required for submitting queues – admin-queue: the permission required for managing queues
Agency	If you want the users or user groups to be authorized to manage this policy, you can enable this option so that the users or user groups become the administrators of this policy and can update or delete the policy.

Figure 12-99 MRS Yarn queue details



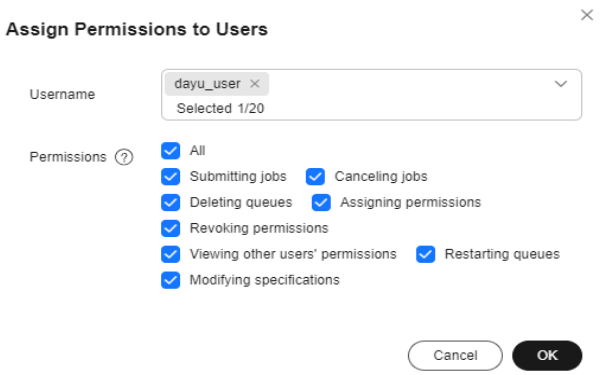
- **DLI queue**

On the DLI queue details page, click **Authorize**. In the displayed dialog box, set the parameters in **Table 12-15** and click **Save**.

Table 12-16 DLI queue authorization parameters

Parameter	Description
Username	Select the users to be authorized. The users that have been added to the workspace are available for selection. **NOTE** Permissions of DLI queues can be granted only to users, but not to user groups.
Permissions	– **Submitting jobs**: This permission allows you to submit jobs to this queue. – **Terminating jobs**: This permission allows you to terminate jobs submitted to this queue. – **Deleting queues**: This permission allows you to delete the queue. – **Granting permissions**: This permission allows you to grant queue permissions to other users. – **Revoking permissions**: This permission allows you to revoke the queue permissions from other users except the queue owner. – **Viewing other users' permissions**: This permission allows you to view the queue permissions of other users. – **Restarting queues**: This permission allows you to restart the queue. – **Modifying queue specifications**: This permission allows you to modify queue specifications.

Figure 12-100 DLI queue details



----End

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Related Operations

- Deleting queues: In the queue permission directory, select queues and click to delete them.

  NOTE

  - When a queue is deleted, it is not directly deleted from MRS or DLI. Instead, the queue will no longer be allocated to the workspace.
  - After a queue is deleted, the permissions configured for the queue are still valid. For how to delete queue permissions, see **Deleting policies** or **Revoking permissions**.
  - Yarn queues that are being used in DataArts Factory cannot be deleted in DataArts Security.

- Editing policies: On the MRS Yarn queue details page, locate a policy and click **Edit** in the **Operation** column to edit the policy.
- Deleting policies: On the MRS Yarn queue details page, locate a policy and click **Delete** in the **Operation** column to delete the policy. To delete multiple policies at a time, select the policies and click **Delete** above the policy list.

  NOTE

  - If you delete an MRS Ranger queue permission policy managed by DataArts Security, the policy will also be deleted from MRS Ranger.
  - The deletion operation cannot be undone. Exercise caution when performing this operation.

- Modifying permissions: On the DLI queue details page, locate a permission and click **Modify** in the **Operation** column.
- Revoking permissions: On the DLI queue details page, locate a permission and click **Revoke** in the **Operation** column.

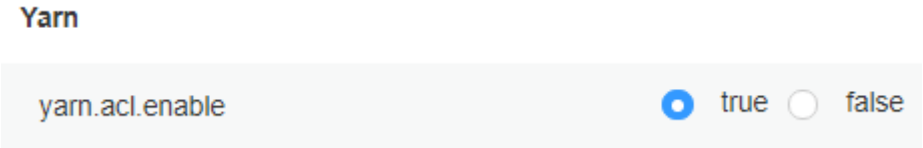
Reference: Configuring Strict Permission Control for Yarn

- The procedure is as follows:

  a. Log in to FusionInsight Manager and choose **Cluster** > **Services** > **Yarn**.

  b. On the displayed page, click the **Configuration** tab then the **All Configurations** sub-tab. On this sub-tab page, search for the **yarn.acl.enable** parameter and change its value to **true**. If the value is **true**, no further action is required.

  Figure 12-101 Configuring yarn.acl.enable

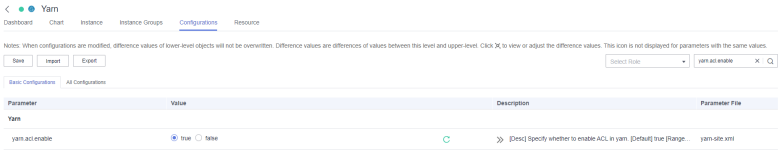
Before configuring permissions for Yarn queues, you need to enable permission control for Yarn queues.

Step 1 Log in to MRS FusionInsight Manager.

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Step 2 Choose **Cluster** > **Services** > **Yarn** and click **Configurations** and then **Basic Configurations**. Search for the **yarn.acl.enable** parameter and change its value to **true**. If the value is **true**, no further action is required.

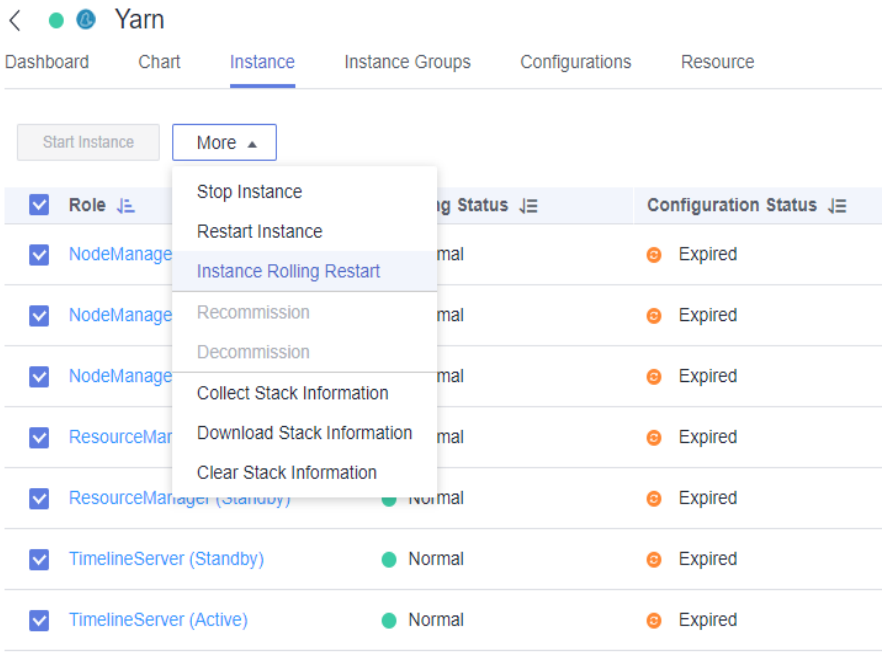
Figure 12-102 Configuring the yarn.acl.enable parameter



Step 3 After the parameter is set, click **Save** in the upper left corner and then **OK** in the dialog box to save the configuration.

Step 4 After saving the configuration, switch to the **Instances** tab page, select the instance that has expired, click **More**, and select **Instance Rolling Restart** to make the configuration take effect.

Figure 12-103 Performing a rolling instance restart



----End

12.3.6.2 Configuring Workspace Resource Permission Policies

This section describes how to use workspace resource permission policies to implement refined permission control on all the data connections and IAM agencies (only those whose agency object is DGC) in the Management Center based on users, user groups, or roles.

- If no workspace resource permission policy is configured for a resource, all users can view and use the resource by default.

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- If the permissions of a resource (such as a connection or an agency) are granted to any user, user group, or role, other common users cannot view and use the resource, except the DAYU Administrator, Tenant Administrator, data security administrator, and preset workspace administrator.

Prerequisites

Only the DAYU Administrator, Tenant Administrator, data security administrator, and preset workspace administrator have the permission to create, edit, or delete workspace resource permission policies.

Constraints

- Resources of workspaces in simple mode can be managed, but those of workspaces in enterprise mode cannot.
- If no permission is assigned to a resource, permission control is disabled for the resource.
- Currently, only the DataArts Factory component supports workspace resource permission policies. Other components are not restricted by workspace resource permission policies. In the following scenarios of DataArts Factory, authentication is performed based on workspace resource permission policies:
  - Selecting a connection, job agency, or public agency during script or job development
  - Submitting a script or job
- Resource permission management is not supported for the data connections created in DataArts Factory in earlier versions.
- When a workspace resource is deleted, the corresponding workspace resource permission policy will not be automatically deleted.

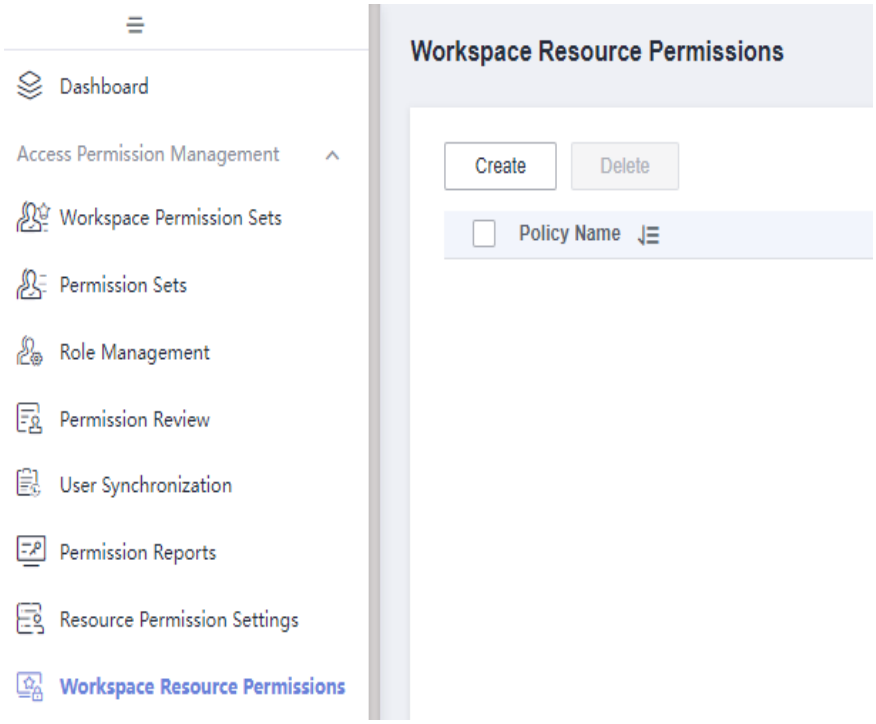
Creating a Workspace Resource Permission Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Workspace Resource Permissions**.

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Figure 12-104 Workspace Resource Permissions



Step 3 On the **Workspace Resource Permissions** page, click **Create**. In the slide-out panel, set the parameters listed in **Table 12-17** and click **Save**.

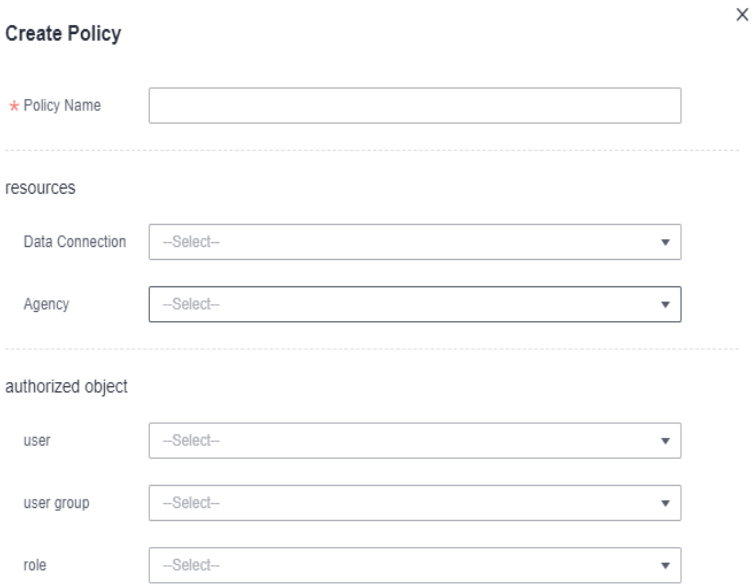
Table 12-17 Parameters for creating a workspace resource permission policy

Parameter	Description
*Policy Name	Enter the name of the workspace resource permission policy. To facilitate policy management, you are advised to include the resource object and authorization object in the name.
Resource Object	
Data Connection	Select the data connections in the Management Center to be authorized. For details about how to create a data connection, see **Creating a DataArts Studio Data Connection**. **NOTE** • Permission control is disabled for the data connections that are not selected. • Unauthorized common users (except the DAYU Administrator, Tenant Administrator, data security administrator, and preset workspace administrator) cannot view or use the selected connections. When you view or modify a job that uses the connection, the data connection and its configurations are invisible.

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Parameter	Description
Agency	Select the IAM agencies to be authorized. Only cloud service agencies whose agency object is DGC are supported. For details about how to create an agency, see **Reference: Creating an Agency**. **NOTE** • Permission control is disabled for the agencies that are not selected. • Unauthorized common users (except the DAYU Administrator, Tenant Administrator, data security administrator, and preset workspace administrator) cannot view or use the selected agencies.
Authorization Object	
user	Select the users to be authorized. The workspace users are available for selection.
user group	Select the user groups to be authorized. The workspace user groups are available for selection.
role	Select the roles to be authorized. The preset and custom roles are available for selection.

Figure 12-105 Creating a workspace resource permission policy



----End

Related Operations

- Editing policies: On the **Workspace Resource Permissions** page, locate a policy and click **Edit** in the **Operation** column to edit the policy.

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- Deleting policies: On the **Workspace Resource Permissions** page, locate a policy and click **Delete** in the **Operation** column to delete the policy. To delete multiple policies at a time, select the policies and click **Delete** above the policy list.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

12.3.7 Controlling Ranger Access Using Permissions

12.3.7.1 Configuring Resource Permissions

This section describes how to create resource permission policies for Ranger to control access to MRS resources and reduce data security risks for your enterprise.

Currently, the following permission policies can be created:

- **Creating an HDFS Permission Policy**
- **Creating a Hive Access Permission Policy**
- **Creating a Hive Masking Permission Policy**
- **Creating a Hive Row-Level Filter Permission Policy**
- **Creating an HBase Permission Policy**
- **Creating a Yarn Permission Policy**
- **Creating a Kafka Permission Policy**
- **Creating a Storm Permission Policy**

Prerequisites

- A Ranger connection has been created in Management Center, and a correct RangerAdmin service IP address and Ranger service port have been set for the connection (see **MRS Ranger Connection Parameters** for details).

  NOTE

  When you test the Ranger connection in Management Center, the Ranger service IP address and port will not be verified, and no error will be reported even if they are incorrect. You are advised to check them manually.

- Ranger authentication has been enabled for the corresponding MRS cluster. In security mode, Ranger authentication is enabled by default. In common mode, Ranger authentication is disabled by default. For details, see **Enabling Ranger Authentication**.

Constraints

- Resource permission policies depend on the Ranger authentication of MRS clusters. Currently, only permissions on MRS resources can be controlled.
- A permission policy takes effect about 1 minute after being configured.

MRS Components that Support Access Control and the Permission List

Ranger can be used to integrate components in MRS clusters of version 3.0.0 or a later version to enable fine-grained access permission control for components.

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Table 12-18 lists the supported components and describes related permissions. For details, see **Configuring Component Permission Policies**.

Table 12-18 Supported components and permissions

Component	Permission
HDFS	HDFS file permissions: • Read: the permission required for read • Write: the permission required for write • Execute: the permission required for executing a job
Hive	Hive database, data table, and column permissions: • Select: the permission required for query • Update: the permission required for update • Create: the permission required for creation • Drop: the permission required for dropping • Alter: the permission required for alteration • All: the permissions required for all operations • Temporary UDF Admin: the permission required for managing a temporary UDF
Yarn	Yarn queue permissions: • submit-app: the permission required for submitting a queue • admin-queue: the permission required for managing a queue
HBase	HBase column and column family permissions: • Read: the permission required for read • Write: the permission required for write • Create: the permission required for creation • Admin: the permission required by an administrator

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Component	Permission
Kafka	Kafka topic permissions: • Publish: the permission required for production • Consume: the permission required for consumption • Configure: the permission required for expanding the capacity of a topic • Describe: the permission required for query • Create: the permission required for creating a topic • Delete: the permission required for deleting a topic • Describe Configs: the permission required for querying configurations • Alter Configs: the permission required for modifying configurations
Storm	Storm topology permissions: • Submit Topology: the permission required for submitting a topology • File Upload: the permission required for uploading a file • File Download: the permission required for downloading a file • Kill Topology: the permission required for deleting a topology • Rebalance: the permission required for rebalance • Activate: the permission required for activation • Deactivate: the permission required for deactivation • Get Topology Conf: the permission required for getting the configurations of a topology • Get Topology: the permission required for getting a topology • Get User Topology: the permission required for getting a user topology • Get Topology Info: the permission required for getting the information of a topology • Upload New Credential: the permission required for uploading a new credential

Creating an HDFS Permission Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

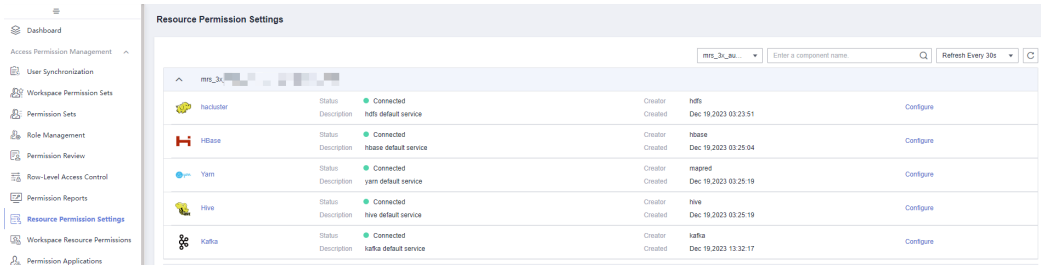
Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

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NOTE

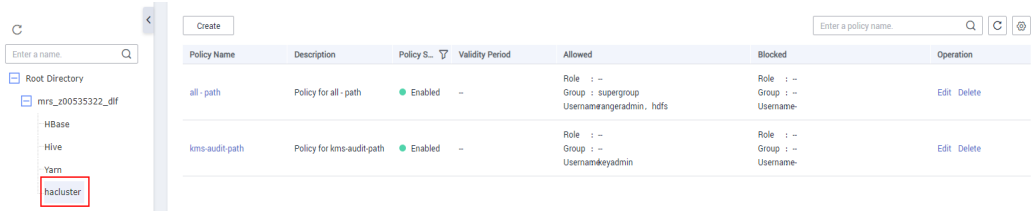
If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

Figure 12-106 Resource Permission Settings page



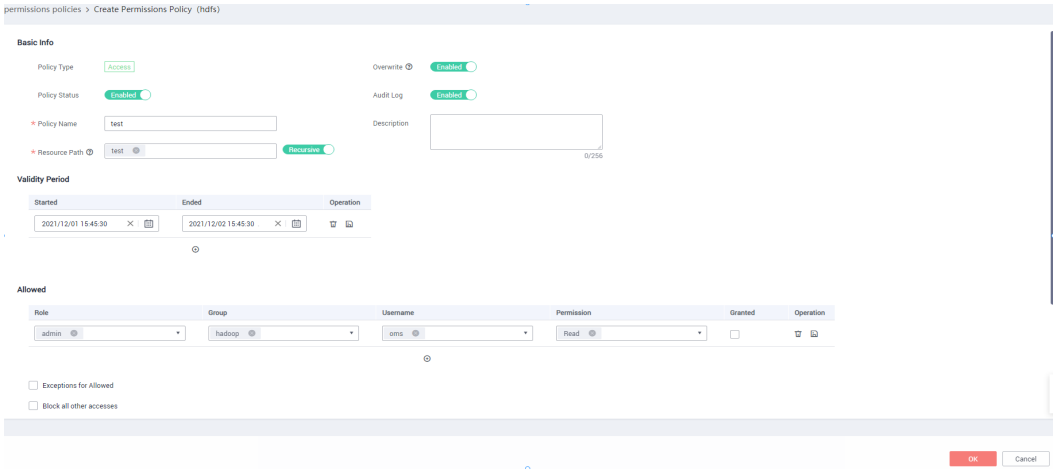
Step 3 Click **Configure** to the right of **hacluster** under the HDFS component, and click **Create** in the upper part of the page displayed.

Figure 12-107 Creating a permission policy



Step 4 Set the parameters and click **OK**.

Figure 12-108 Assigning a permission policy



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Table 12-19 Parameters for configuring an HDFS permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. When you need to create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.
Description	A description of the policy. Up to 256 characters are allowed.
Topology	HDFS path for access permission control.
Recursion	If the function is enabled, the resource path is in recursive mode. If the function is disabled, the resource path is in non-recursive mode. **Policy Status** is set to **Enabled** by default.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.
Allowed	Users and user groups that are allowed to access the resources. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

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Parameter	Description
Exceptions	If you select **Exceptions for Allowed**, users who are not allowed to access the system are added to the user group that is allowed to access the system. If you select **Exceptions for blocked**, users who are allowed to access the system are added to the user group that is blocked from the system.
Block all other accesses	If you select **Block all other accesses**, only specified users or user groups are allowed to access the system.
Blocked	**Blocked** is displayed when **Block all other accesses** is not selected. Users and user groups that are not allowed to access the system can be specified in the **Blocked** area. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are not allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

----End

Creating a Hive Access Permission Policy

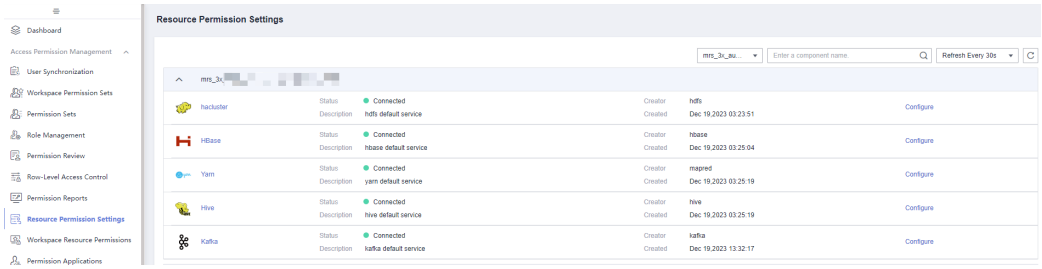
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

NOTE

If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

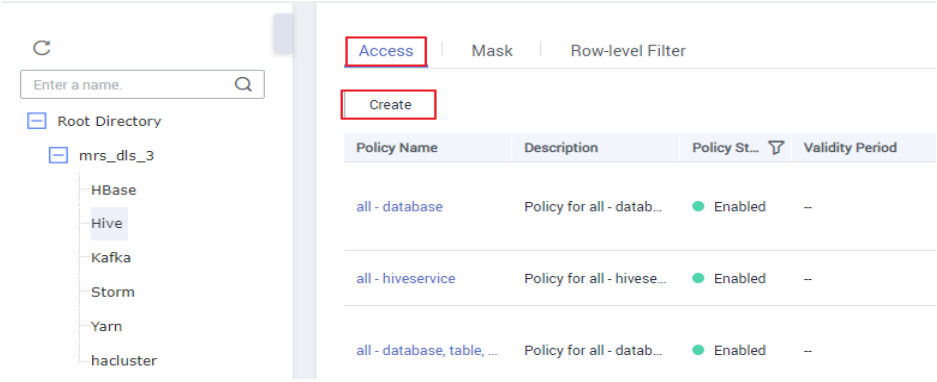
Figure 12-109 Resource Permission Settings page



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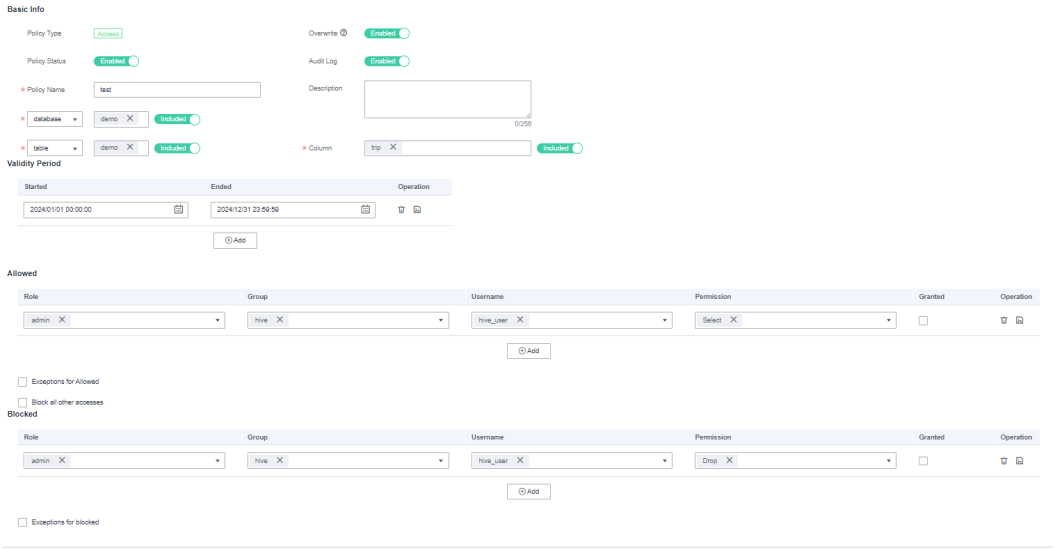
Step 3 Click **Configure** to the right of the Hive component, and click **Create** in the upper part of the page displayed.

Figure 12-110 Creating a permission policy



Step 4 Set the parameters and click **OK**.

Figure 12-111 Configuring a Hive policy



The following table lists the parameters of a Hive permission policy.

Table 12-20 Parameters of a Hive permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.

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Parameter	Description
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. To create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.
Description	A description of the policy. Up to 256 characters are allowed.
database	The **database** parameter is mandatory. You can set the database whose permissions need to be controlled. Fuzzy search is supported.
table	The **table** parameter is mandatory. You can set the table whose permissions need to be controlled. Fuzzy search is supported.
Column	The **Column** parameter is mandatory. You can set the column whose permissions need to be controlled. Fuzzy search is supported.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.
Allowed	Users and user groups that are allowed to access the resources. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

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Parameter	Description
Exceptions	If you select **Exceptions for Allowed**, users who are not allowed to access the system are added to the user group that is allowed to access the system. If you select **Exceptions for blocked**, users who are allowed to access the system are added to the user group that is blocked from the system.
Block all other accesses	If you select **Block all other accesses**, only specified users or user groups are allowed to access the system.
Blocked	**Blocked** is displayed when **Block all other accesses** is not selected. Users and user groups that are not allowed to access the system can be specified in the **Blocked** area. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are not allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

----End

Creating a Hive Masking Permission Policy

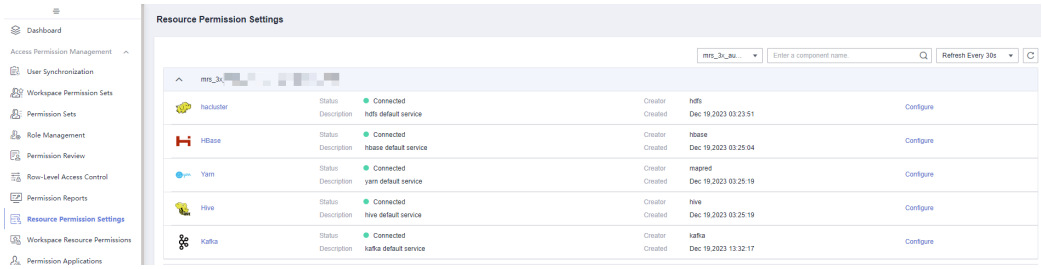
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

NOTE

If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

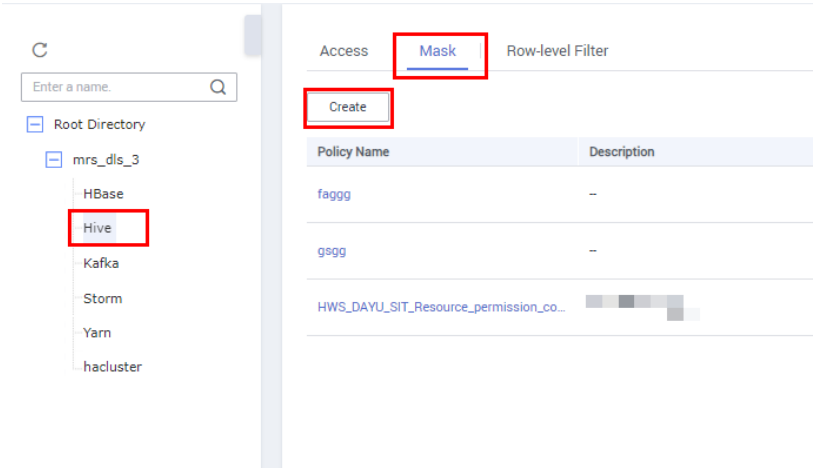
Figure 12-112 Resource Permission Settings page



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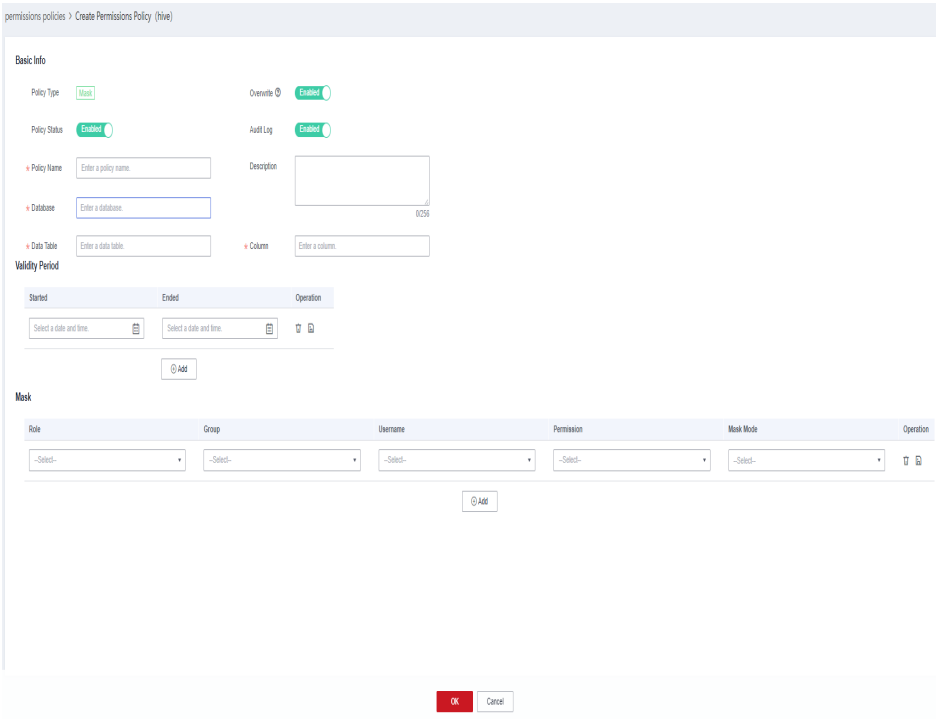
Step 3 Click **Configure** to the right of the Hive component, and click **Create** in the upper part of the **Mask** tab page.

Figure 12-113 Creating a permission policy



Step 4 Set the parameters and click **OK**.

Figure 12-114 Configuring a Hive policy



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Table 12-21 Parameters of a Hive permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. To create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.
Description	A description of the policy. Up to 256 characters are allowed.
Database	The **Database** parameter is mandatory. You can set the database whose permissions need to be controlled. Fuzzy search is supported.
Data Table	The **Data Table** parameter is mandatory. You can set the table whose permissions need to be controlled. Fuzzy search is supported.
Column	The **Column** parameter is mandatory. You can set the column whose permissions need to be controlled. Fuzzy search is supported.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.

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Parameter	Description
Mask	The masking mode for users or user groups to access data. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Mask Mode**: Columns that require permission control in a Hive table are masked based on the value of this parameter.

----End

Creating a Hive Row-Level Filter Permission Policy

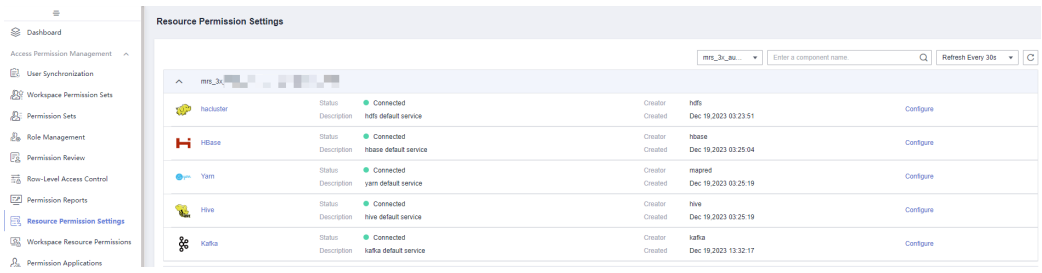
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

NOTE

If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

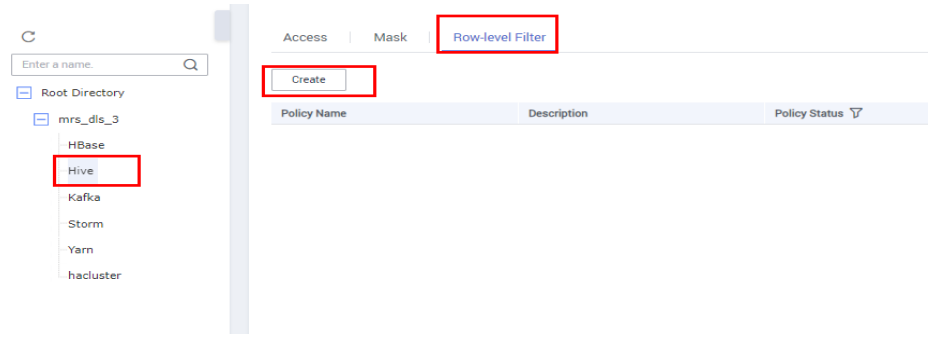
Figure 12-115 Resource Permission Settings page



Step 3 Click **Configure** to the right of the Hive component, and click **Create** in the upper part of the **Row-level Filter** tab page.

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Figure 12-116 Creating a Hive row-level filter policy



Step 4 Set the parameters and click **OK**.

Figure 12-117 Configuring a Hive policy

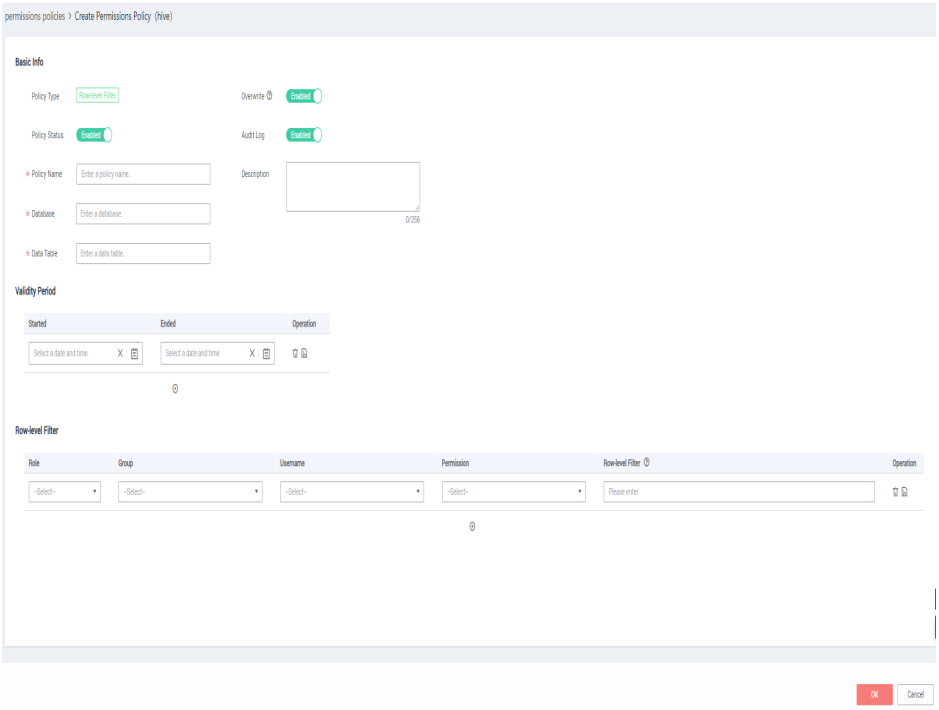


Table 12-22 Parameters of a Hive permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.

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Parameter	Description
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. To create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.
Description	A description of the policy. Up to 256 characters are allowed.
Database	The **Database** parameter is mandatory. You can set the database whose permissions need to be controlled. Fuzzy search is supported.
Data Table	The **Data Table** parameter is mandatory. You can set the table whose permissions need to be controlled. Fuzzy search is supported.
Column	The **Column** parameter is mandatory. You can set the column whose permissions need to be controlled. Fuzzy search is supported.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.
Row-level Filter	Users and user groups that are allowed to access the resources. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Row-level Filter**: Filter by field content. The parameter format is as follows: Field=Value. Example: state=1.

----End

Creating an HBase Permission Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

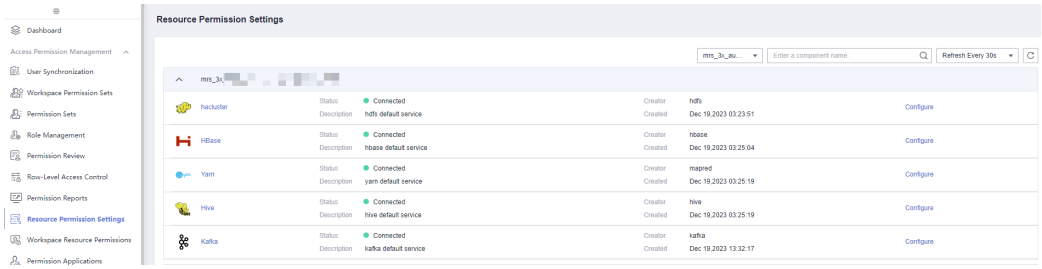
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Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

NOTE

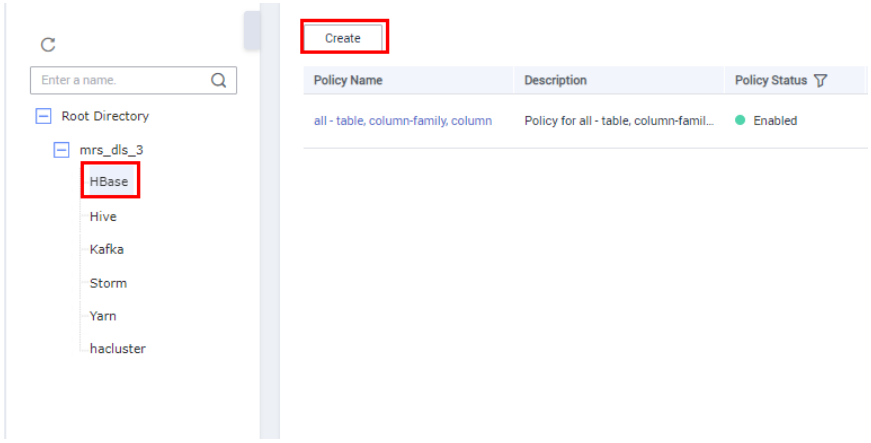
If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

Figure 12-118 Resource Permission Settings page



Step 3 Click **Configure** to the right of the HBase component, and click **Create** in the upper part of the page displayed.

Figure 12-119 Creating an HBase permission policy



Step 4 Set the parameters and click **OK**.

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Figure 12-120 Configuring an HBase policy

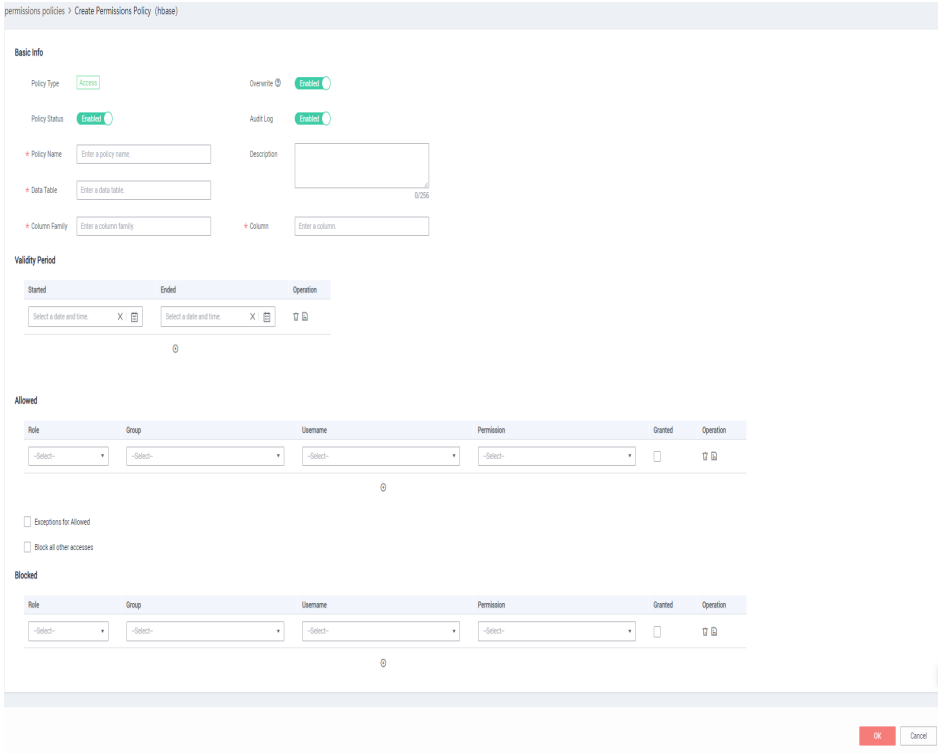


Table 12-23 Parameters of an HBase permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. To create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.

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Parameter	Description
Description	A description of the policy. Up to 256 characters are allowed.
Data Table	The **Data Table** parameter is mandatory. You can set the table whose permissions need to be controlled. Fuzzy search is supported.
Column	The **Column** parameter is mandatory. You can set the column whose permissions need to be controlled. Fuzzy search is supported.
Column Family	**Column Family** is mandatory. This parameter indicates a set of column families in an HBase cluster.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.
Allowed	Users and user groups that are allowed to access the resources. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.
Exceptions	If you select **Exceptions for Allowed**, users who are not allowed to access the system are added to the user group that is allowed to access the system. If you select **Exceptions for blocked**, users who are allowed to access the system are added to the user group that is blocked from the system.
Block all other accesses	If you select **Block all other accesses**, only specified users or user groups are allowed to access the system.

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Parameter	Description
Blocked	**Blocked** is displayed when **Block all other accesses** is not selected. Users and user groups that are not allowed to access the system can be specified in the **Blocked** area. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are not allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

----End

Creating a Yarn Permission Policy

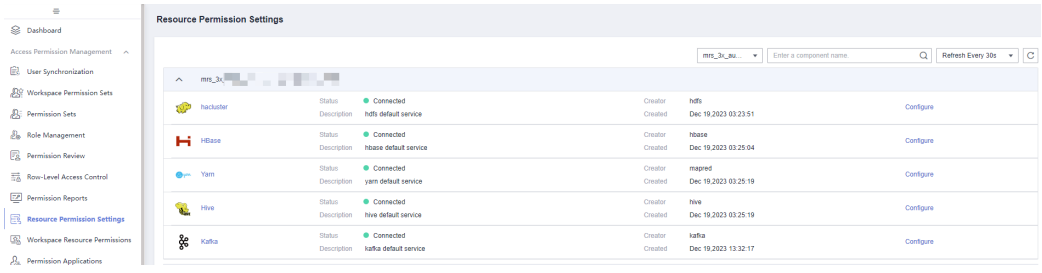
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

NOTE

If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

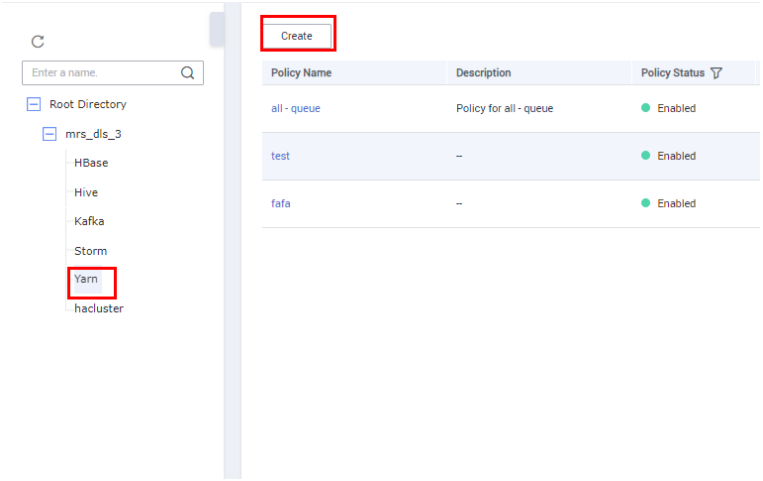
Figure 12-121 Resource Permission Settings page



Step 3 Click **Configure** to the right of the Yarn component, and click **Create** in the upper part of the page that is displayed.

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Figure 12-122 Creating a Yarn permission policy



Step 4 Set the parameters and click **OK**.

Figure 12-123 Configuring a Yarn policy

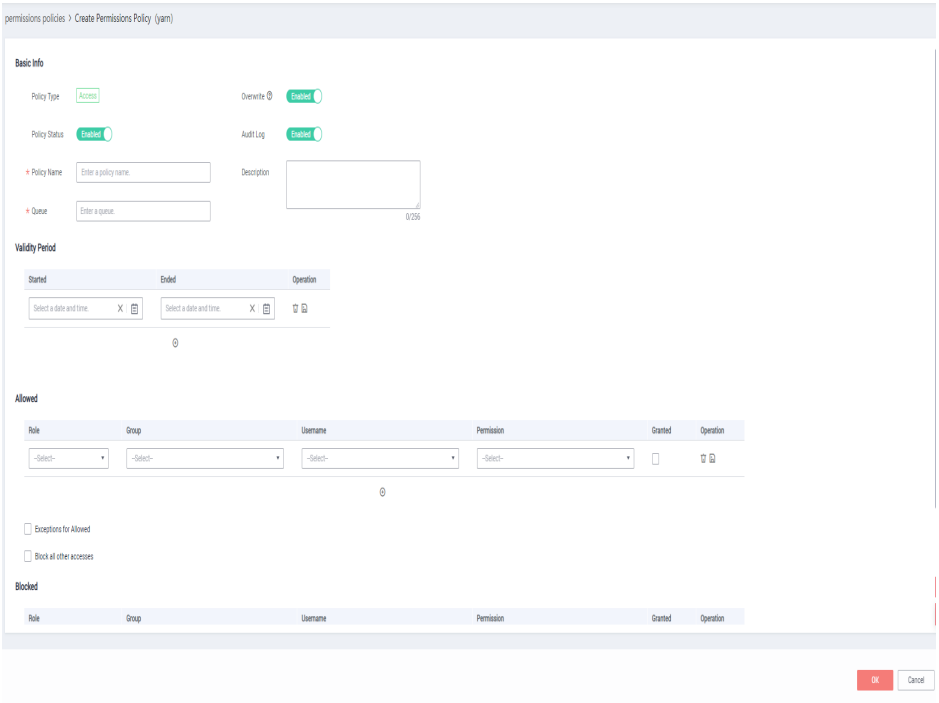


Table 12-24 Parameters of a Yarn permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.

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Parameter	Description
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. To create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.
Description	A description of the policy. Up to 256 characters are allowed.
Queue	Resource scheduling queue in the Yarn service.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.
Allowed	Users and user groups that are allowed to access the resources. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.
Exceptions	If you select **Exceptions for Allowed**, users who are not allowed to access the system are added to the user group that is allowed to access the system. If you select **Exceptions for blocked**, users who are allowed to access the system are added to the user group that is blocked from the system.
Block all other accesses	If you select **Block all other accesses**, only specified users or user groups are allowed to access the system.

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Parameter	Description
Blocked	**Blocked** is displayed when **Block all other accesses** is not selected. Users and user groups that are not allowed to access the system can be specified in the **Blocked** area. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are not allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

----End

Creating a Kafka Permission Policy

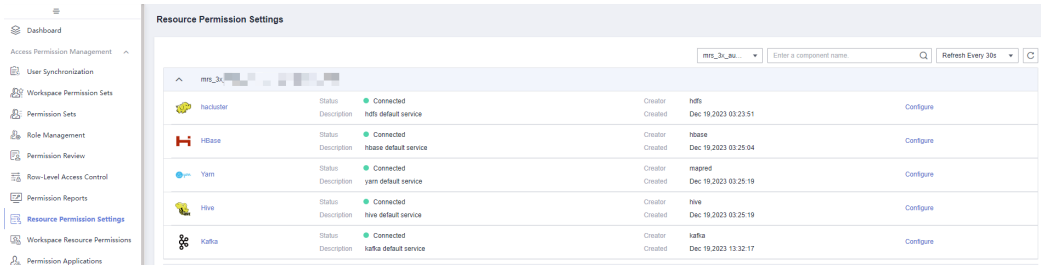
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

NOTE

If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

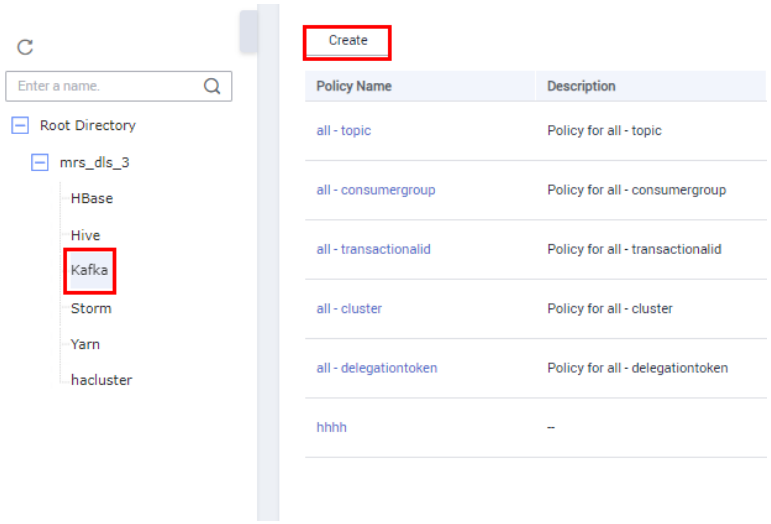
Figure 12-124 Resource Permission Settings page



Step 3 Click **Configure** to the right of the Kafka component, and click **Create** in the upper part of the page that is displayed.

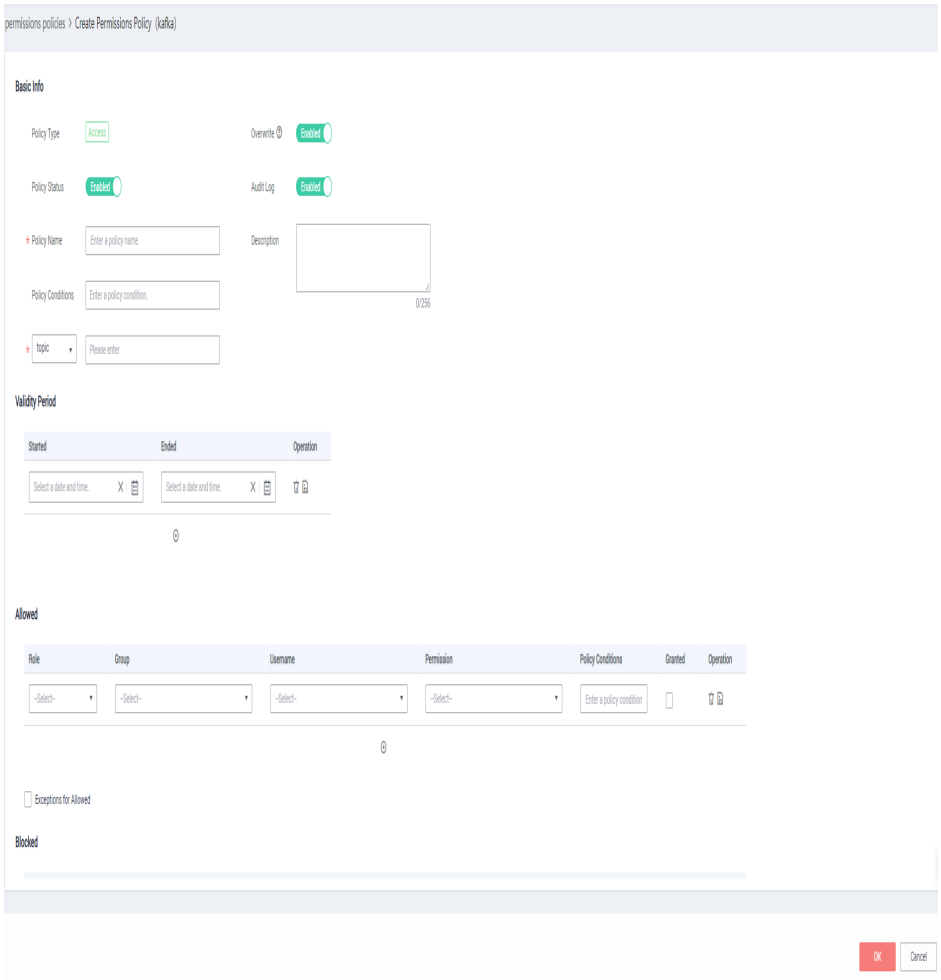
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Figure 12-125 Creating a Kafka permission policy



Step 4 Set the parameters and click **OK**.

Figure 12-126 Configuring a Kafka policy



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Table 12-25 Parameters of a Kafka permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. To create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.
Description	A description of the policy. Up to 256 characters are allowed.
Policy Conditions	Range of IP addresses that can access the Kafka topic.
Topic	The message topic of a Kafka cluster.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.
Allowed	Users and user groups that are allowed to access the resources. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Policy Conditions**: the range of IP addresses that can access the Kafka topic. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

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Parameter	Description
Exceptions	If you select **Exceptions for Allowed**, users who are not allowed to access the system are added to the user group that is allowed to access the system. If you select **Exceptions for blocked**, users who are allowed to access the system are added to the user group that is blocked from the system.
Blocked	**Blocked** is displayed when **Block all other accesses** is not selected. Users and user groups that are not allowed to access the system can be specified in the **Blocked** area. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are not allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Policy Conditions**: the range of IP addresses that can access the Kafka topic. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

----End

Creating a Storm Permission Policy

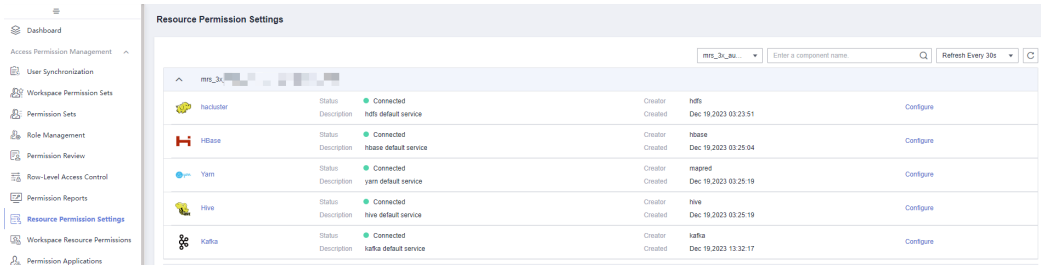
Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Access Permission Management** > **Resource Permission Settings** from the left navigation bar.

NOTE

If error message "cluster [mrs_3x_autotest_do_not_del] get service failed. due to [null response from cdm:[404 NOT FOUND]]." is displayed, check whether the RangerAdmin service IP address and Ranger service port of the Ranger connection are correct in Management Center by referring to **MRS Ranger Connection Parameters**.

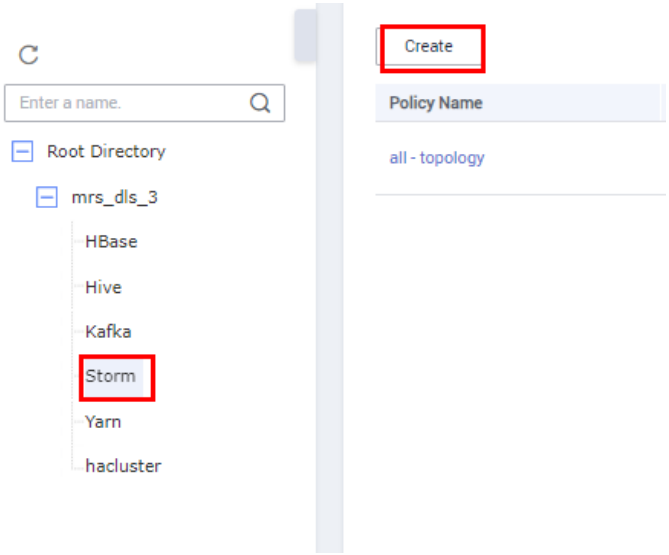
Figure 12-127 Resource Permission Settings page



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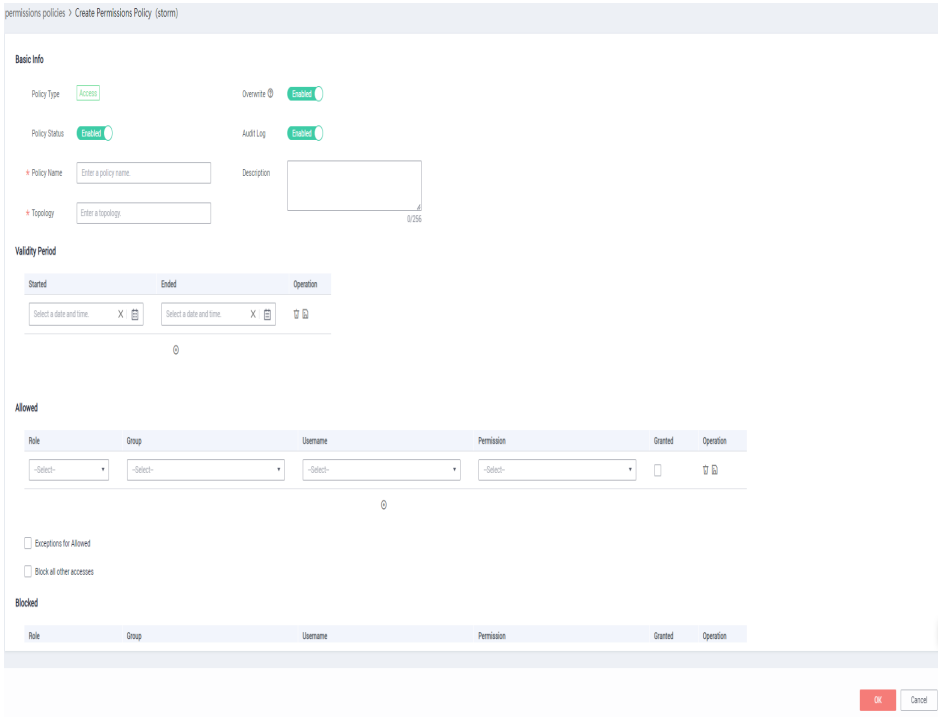
Step 3 Click **Configure** to the right of the Storm component, and click **Create** in the upper part of the page displayed.

Figure 12-128 Creating a Storm permission policy



Step 4 Set the parameters and click **OK**.

Figure 12-129 Configuring a Storm policy



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Table 12-26 Parameters of a Storm permission policy

Parameter	Description
Policy Type	The policy type is automatically generated based on the selected service component. **Policy Type** can be set to **Access**, **Mask**, and **Row-level Filter**. **Mask** and **Row-level Filter** are specific to Hive.
Policy Status	If **Policy Status** is **Enabled**, the permission policy takes effect immediately. If **Policy Status** is **Disabled**, the permission policy does not take effect after being created. **Policy Status** is set to **Enabled** by default.
Overwrite	If **Overwrite** is set to **Enabled**, the new policy takes effect and the old policy does not take effect. **Overwrite** is set to **Enabled** by default. To create a temporary access policy, enable **Overwrite** and set **Validity Period** as required. In this way, even if the temporary access policy expires, the original permission policy still takes effect.
Audit Log	If **Audit Log** is set to **Enabled**, logs are recorded. The log content includes the client access time, client IP address, client user, and resource operation result.
Policy Name	Policy name is mandatory. A policy name can include only letters, numbers, underscores (_), and hyphens (-). Up to 50 characters are allowed.
Description	A description of the policy. Up to 256 characters are allowed.
Topology	Tasks in a Storm cluster.
Validity Period	You can set the effective time and expiration time of a policy. You can configure multiple time ranges.
Allowed	Users and user groups that are allowed to access the resources. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

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Parameter	Description
Exceptions	If you select **Exceptions for Allowed**, users who are not allowed to access the system are added to the user group that is allowed to access the system. If you select **Exceptions for blocked**, users who are allowed to access the system are added to the user group that is blocked from the system.
Block all other accesses	If you select **Block all other accesses**, only specified users or user groups are allowed to access the system.
Blocked	**Blocked** is displayed when **Block all other accesses** is not selected. Users and user groups that are not allowed to access the system can be specified in the **Blocked** area. • **Username**: MRS user. • **Role**: MRS role. • **Group**: MRS user groups. • **Permission**: the permission required by users who are not allowed to access the system. **Permission** and **Username** can be left blank or not left blank at the same time. For details on service permissions, see **Table 12-18**. • **Granted**: If **Granted** is selected, management permissions are assigned to appropriate users and groups. Delegated administrators can update and delete policies and create sub-policies based on the original policies.

----End

12.3.7.2 Viewing Permission Reports

This section describes how to view the resource permission policies and policy details.

Prerequisites

The permission policy has been configured. For details on how to configure a permission policy, see **Configuring Resource Permissions**.

Viewing the Details of a Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Permission Reports** from the left navigation bar.

Step 3 Choose an MRS cluster (Ranger) and select a service to view its policies and policy details.

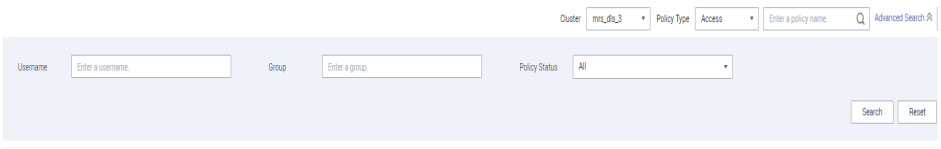
- Advanced search:

  When viewing a report, you can search for policies by cluster, policy name, username, user group, policy type, or policy status. You only need to click

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Advanced Search in the upper right corner of the **Permission Reports** page to display the search box.

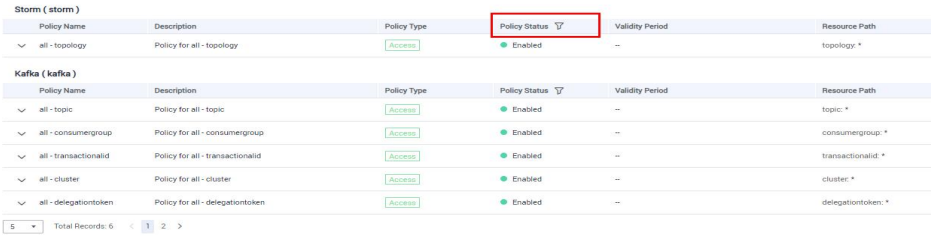
Figure 12-130 Advanced search



- Policy status filtering:

  In the policy list of a service, you can click in the **Policy Status** column to filter the policies to be viewed.

  Figure 12-131 Policy status filtering



----End

12.4 Sensitive Data Governance

12.4.1 Sensitive Data Governance Process

Sensitive Data Definition

Sensitive data is usually used by others without the consent of individuals or companies. The interests of individuals or companies might be seriously compromised.

According to *GB/T 35273-2020 Information Security Technology — Personal Information Security Specification*, sensitive personal data includes:

- Personal property information (deposit, credit, and banking transactions)
- Personal health state and physiological information (physical examination information and medical records)
- Personal biometric information (fingerprint and facial features)
- Personal identity information (ID card, social security card, and driving license)
- Other information (religious belief and precise location)

Sensitive Data Protection Methods

- **Sensitive data identification and label adding**

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Classify and grade data to facilitate security management of different granularities and levels.

- **Data leakage detection and prevention**

  If sensitive data is frequently accessed, a risk alarm is reported immediately.

- **Static data masking and data watermarking**

  Sensitive data with a specific security level can be masked or watermarked when being provided to external systems.

- **Personal information compliance**

  Accurately distinguish and protect personal data to avoid compliance issues.

- **General data protection regulation (GDPR) compliance**

  Comply with GDPR requirements on detecting and protecting sensitive data, and audit the use of sensitive data.

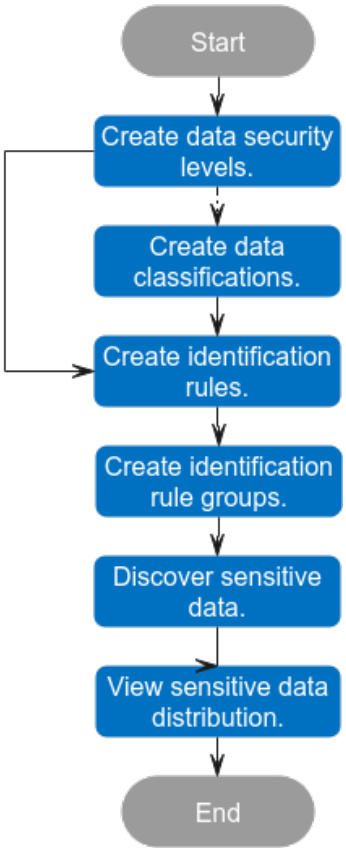
- **Data security compliance check**

  Based on the analysis of sensitive data, develop data security compliance management regulations to help enterprises build and improve their information security compliance management systems.

Sensitive Data Identification Process

Figure 12-132 shows the sensitive data identification process.

Figure 12-132 Sensitive data identification process



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1. **Create data security levels.**

   Before performing any operations on data, create security levels for the data to specify the scope of confidential information.

2. **Create data classifications.**

   If data security levels cannot meet the data classification requirements in the case of a large amount of data, you can create data classifications for data of different values to better manage and measure your data.

3. **Create identification rules.**

   Define sensitive data identification standards.

4. **Create identification rule groups.**

   Define sensitive data identification rules and rule groups for the purpose of effectively identifying sensitive data in a database.

5. **Discover sensitive data.**

   Create and run a sensitive data identification task.

6. **View sensitive data distribution.**

   View the sensitive data identified by the sensitive data identification task.

12.4.2 Creating Data Security Levels

To facilitate data management, you need to create data security levels and describe data confidentiality, for example, you can specify the application scope of your data. This section describes how to define data security levels and configure the default security level.

Data security levels, data classifications, and identification rules are DataArts Studio instance-level configurations and can be exchanged between workspaces. In this way, data can be managed based on unified standards in the Data Map component.

Prerequisites

At least one security level has been created based on **Creating a Security Level**.

Constraints

- According to the industry common practice, a larger number indicates a higher security level. A maximum of 10 security levels can be created.
- Only the DAYU Administrator, Tenant Administrator, or data security administrator can create, modify, or delete data security levels, classifications, and identification rules. Other common users do not have permission to perform these operations.
- After the default security level is configured, it applies to all the data tables and fields (including inventory and incremental data) that have no security levels in MRS Hive and GaussDB(DWS) data sources. The default security level can be displayed in Data Map and can be used to control permissions for data preview based on **Managing Sensitive Data**.

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NOTE

The security levels displayed during permission requests are from Data Map and include the default security level. The security levels displayed during static and dynamic masking are from sensitive data discovery tasks and do not include the default security level.

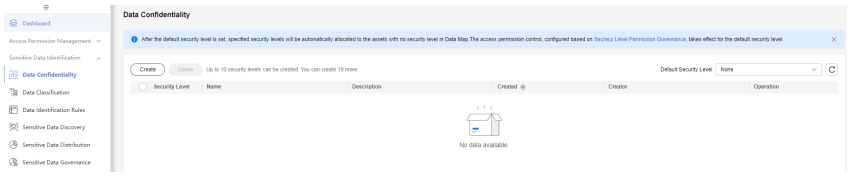
- Data security levels that are referenced can be deleted only if the reference is canceled.

Creating a Security Level

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Data Confidentiality**.

Figure 12-133 Data Confidentiality page



Step 3 On the displayed page, click **Create** and set the parameters listed in **Table 12-27**.

Figure 12-134 Creating a data security level

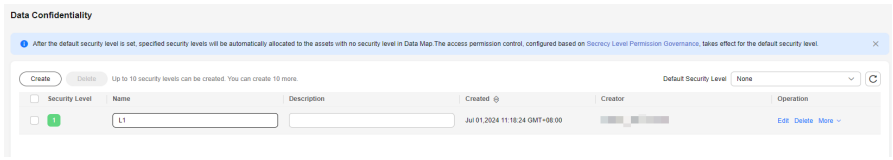


Table 12-27 Parameters

Parameter	Description
*Name	The security level name can include only letters, numbers, and underscores (_). After a security level is created, its name cannot be edited.
Description	All characters can be entered in a security level description. After a security level is created, you can edit its description.

NOTE

By default, security levels are displayed in ascending order. You can also move a security level up or down as required.

----End

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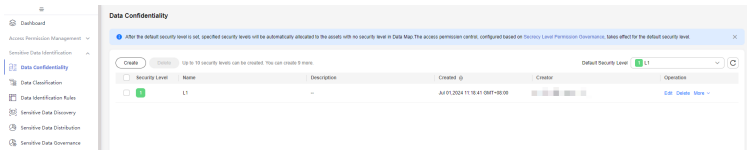
Configuring the Default Security Level

You can configure the default security level for the assets in MRS Hive and GaussDB(DWS) data sources.

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Data Confidentiality**.

Figure 12-135 Data Confidentiality page



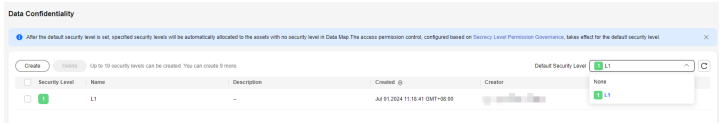
Step 3 Select a security level from the **Default Security Level** drop-down list box in the upper right corner as the default security level.

After the default security level is configured, it applies to all the data tables and fields (including inventory and incremental data) that have no security levels in MRS Hive and GaussDB(DWS) data sources. The default security level can be displayed in Data Map and can be used to control permissions for data preview based on **Managing Sensitive Data**.

NOTE

The security levels displayed during permission requests are from Data Map and include the default security level. The security levels displayed during static and dynamic masking are from sensitive data discovery tasks and do not include the default security level.

Figure 12-136 Creating a data security level



----End

Related Operations

- Adjusting a security level: On the **Data Confidentiality** page, locate a security level, click **More** in the **Operation** column, and select **Up** or **Down**.
- Editing a security level: On the **Data Confidentiality** page, locate a security level and click **Edit** in the **Operation** column to change the description of the security level.
- Deleting one or more security levels: On the **Data Confidentiality** page, locate a security level and click **Delete** in the **Operation** column to delete the security level. To delete multiple security levels, select them and click **Delete** above the list.

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NOTE

- Data security levels that are referenced can be deleted only if the reference is canceled.
- The deletion operation cannot be undone. Exercise caution when performing this operation.

12.4.3 Creating Data Classifications

If data security levels cannot meet the data classification requirements in the case of a large amount of data, you can create data classifications for data of different values to better manage and measure your data. Data of different classifications are parallel, equal, and mutually exclusive. This section describes how to create data classifications.

Data security levels, data classifications, and identification rules are DataArts Studio instance-level configurations and can be exchanged between workspaces. In this way, data can be managed based on unified standards in the Data Map component.

Prerequisites

Before importing preset data classifications, ensure that at least one security level has been created according to **Creating Data Security Levels**.

Constraints

- A maximum of 1,000 data classifications at five layers are allowed.
- Only the DAYU Administrator, Tenant Administrator, or data security administrator can create, modify, or delete data security levels, classifications, and identification rules. Other common users do not have permission to perform these operations.
- Classifications with the same name can be created in different parent nodes but not in the same parent node.
- Before importing preset data classifications, you must configure data security levels for all preset rules.
- During the import of preset data classifications, their identification rules are also imported. Classifications and rules with the same name as existing classifications and rules cannot be imported.
- If a parent classification contains sub-classifications, the parent classification can be deleted only after the sub-classifications have been deleted.
- Data classifications that are referenced can be deleted only if the reference is canceled.

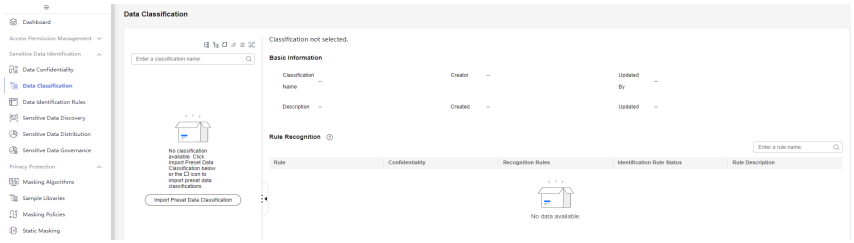
Creating a Classification

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Data Classification**.

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Figure 12-137 Data Classification page



Step 3 Before creating your first classification, click above the classification directory to add at least one root classification. Then you can click or to add a classification of the same level or a sub-classification.

After you click or , set parameters in the displayed dialog box by referring to **Table 12-28**.

Figure 12-138 Creating a data classification

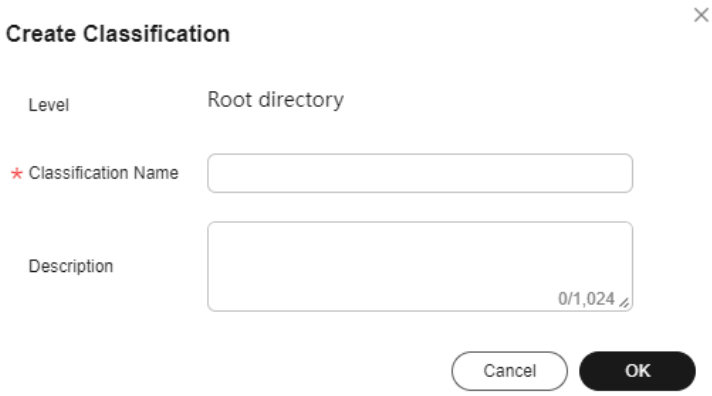


Table 12-28 Parameters

Parameter	Description
*Classification Name	Only letters, digits, and underscores (_) are allowed.
Description	All characters are allowed.

----End

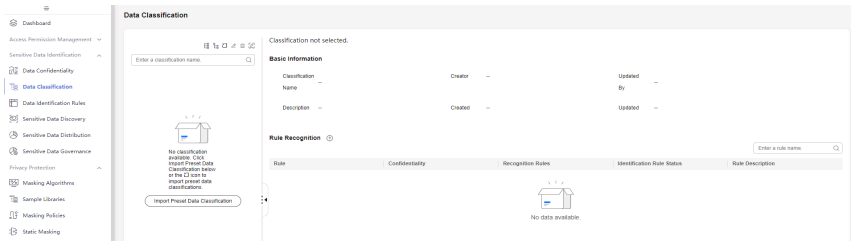
Importing Preset Classifications

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Data Classification**.

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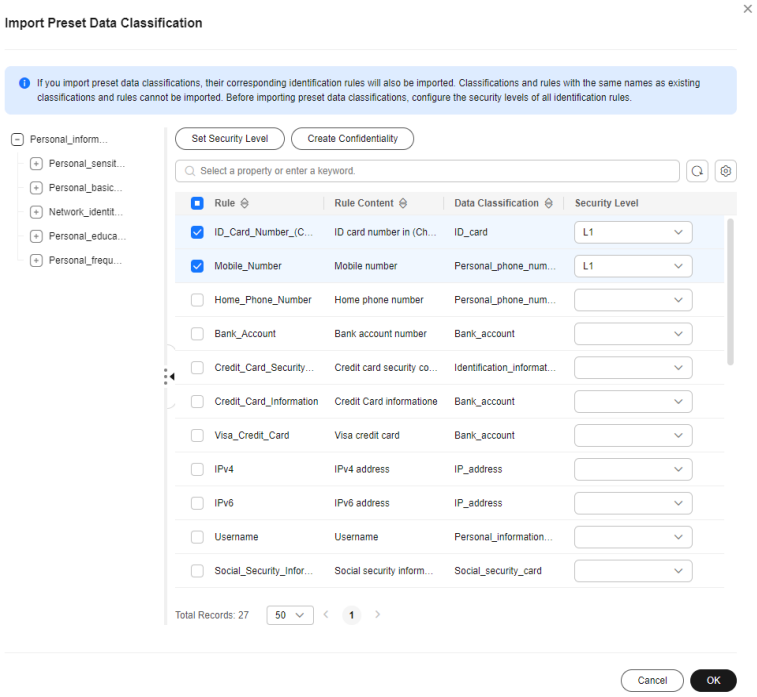
Figure 12-139 Data Classification page



Step 3 If no classification is available, click **Import Preset Data Classification**. If there are classifications, click to open the **Import Preset Data Classification** dialog box.

In the **Import Preset Data Classification** dialog box, select the data classifications to import, set security levels for the rules to import, and click **OK**.

Figure 12-140 Importing preset data classifications



----End

Related Operations

- Editing a classification: On the **Data Classification** page, select the classification to be modified and click above the classification directory to change the classification name or description.
- Deleting a classification: On the **Data Classification** page, select the classification to be deleted and click above the classification directory to delete the classification.

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You can also delete classifications by editing the data classification directory. To be specific, you can click above the classification directory and delete classifications on the displayed **Edit Data Classification Directory** page.

NOTE

- If a parent classification contains sub-classifications, the parent classification can be deleted only after the sub-classifications have been deleted.
- Data classifications that are referenced can be deleted only if the reference is canceled.
- The deletion operation cannot be undone. Exercise caution when performing this operation.

- Editing a classification directory: Click above the classification directory. On the **Edit Data Classification Directory** page, you can add sub-classifications or delete classifications.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

12.4.4 Creating Identification Rules

To effectively identify sensitive data fields in a database, you can create identification rules. Currently, only built-in rules and simple regular expressions are supported.

Data security levels, data classifications, and identification rules are DataArts Studio instance-level configurations and can be exchanged between workspaces. In this way, data can be managed based on unified standards in the Data Map component.

NOTE

After an identification rule is created, it remains to be confirmed by default and cannot take effect for a static masking task. To make the identification rule take effect, perform the following operations:

After running a sensitive data discovery task, you must choose **Sensitive Data Distribution** in the left navigation pane, click the **Manual Recovery** tab, and ensure that the identification rule of the task is valid, so that the rule can take effect for dynamic masking tasks.

Prerequisites

- (Mandatory) A data security level has been created. For details, see **Creating Data Security Levels**.
- (Optional) A data classification has been created. For details, see **Creating Data Classifications**.

Constraints

- Only the Administrator, Tenant Administrator, or data security administrator can create, modify, or delete data security levels, classifications, and identification rules. Other common users do not have permission to perform these operations.

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- If the sensitive data identification rule is of the content identification type (that is, a built-in rule or a custom rule of the content identification type), a field is considered as a sensitive field and matched with a security level and classification only when the proportion of the number of records that match the identification rule of a field to the total number of records in the data table exceeds a specified threshold (80% by default).
- Data identification rules that are referenced can be deleted only if the reference is canceled.

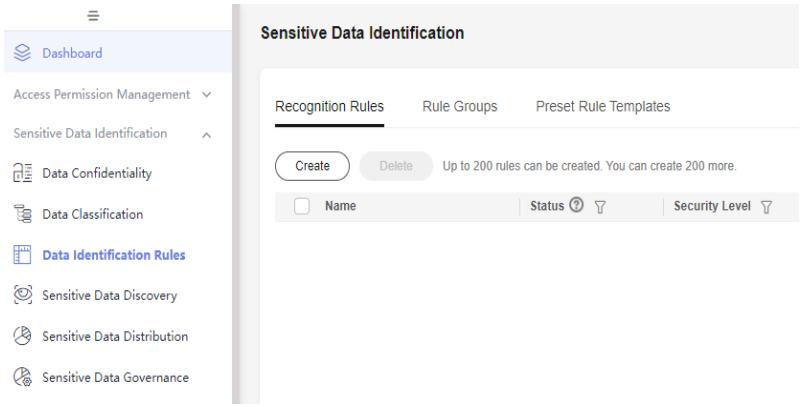
Creating a Data Identification Rule

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Data Identification Rules**.

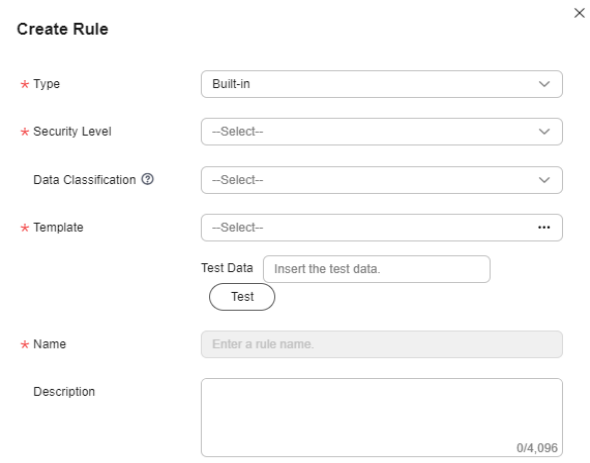
Step 3 On the displayed page, click **Create**.

Figure 12-141 Creating a data identification rule



Step 4 Set the parameters based on **Table 12-29** and click **OK**.

Figure 12-142 Setting parameters for the rule



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Table 12-29 Parameters

Parameter	Description
*Type	The category to which a rule belongs. You can either create a rule based on built-in templates or customize one.
*Security Level	Classify the configured data into different levels. If the existing security levels do not meet the requirements, go to the **Data Confidentiality** page to create security levels. For details, see **Creating Data Security Levels**.
Data Classification	Classify the configured data into different types. If the existing classifications do not meet the requirements, go to the **Data Classification** page to create classifications. For details, see **Creating Data Classifications**.
Description	A description of the rule to be created.
Built-in	
*Template	This parameter is displayed when **Type** is set to **Built-in**. The system provides more than 80 sensitive data identification rules, which can be used to identify and mask sensitive personal information (such as bank cards and credit cards), basic personal information (such as mobile numbers and email addresses), network identification information (such as IPv4 and IPv6 addresses), and other sensitive information. You can view the preset sensitive data identification rules on the **Preset Rule Templates** page. After selecting a preset rule, you can enter test data to check whether the preset rule can identify the test data.
*Name	If **Type** is set to **Built-in**, the rule name is automatically generated based on the template.
Custom	
*Name	If **Type** is set to **Custom**, you can enter a rule name, which is mandatory. You are advised to include the rule meaning into the rule name and avoid meaningless descriptions so that the rule can be quickly located and selected. **NOTE** The name must be unique.
*Rule Recognition	This parameter is displayed when **Type** is set to **Custom**. The options are **None** and **Regular**. If you select **None**, the sensitive data identification task associated with the rule does not take effect. Data assets cannot be automatically classified. You need to manually add categories.

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Parameter	Description
*Regular	This parameter is displayed when **Regular** is set for **Rule Recognition**. • If you select **Content recognition**, enter a custom regular expression. The expression will be used to identify data content. Example: **^ male$|^female&**. • If you select **Column name recognition**, enter a custom regular expression. The expression will be used to accurately or fuzzily identify column names. Multiple column names can be identified at the same time. Example: **age|years**. • If you select **Remarks recognition**, enter a custom regular expression. The expression will be used to fuzzily identify remarks. Example: **.*comment.***.

----End

Related Operations

- Editing an identification rule: On the **Data Identification Rules** page, locate an identification rule and click **Edit** in the **Operation** column to change the security level, classification, and description of the identification rule. For a custom rule, you can also change the rule recognition and regular expression.
- Editing the identification rule status: The identification rule is enabled by default. If the identification rule is disabled, it cannot be added to an identification rule group.

  To change the status of the identification rule, click  or  to enable or disable the rule.
- Deleting identification rules: On the **Data Identification Rules** page, locate an identification rule and click **Delete** in the **Operation** column. To delete identification rules in a batch, select them and click **Delete** above the list.

  NOTE

  - Data identification rules that are referenced can be deleted only if the reference is canceled.
  - The deletion operation cannot be undone. Exercise caution when performing this operation.
- Testing preset rule templates: On the **Preset Rule Templates** tab page, you can view all preset rule templates and test the recognition result of the templates by entering custom sample data.

12.4.5 Creating Identification Rule Groups

A sensitive data identification rule group has service logic and contains scattered rules. A rule group is the prerequisite for running a sensitive data discovery task.

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Prerequisites

Identification rules have been created. For details, see **Creating Identification Rules**.

Constraints

- During sensitive data identification, if a field matches multiple identification rules in an identification rule group, the highest security level of the identification rules is used as the security level of the field, and multiple field classifications are allowed.
- A maximum of 100 identification rule groups can be created.
- Data identification rule groups that are referenced can be deleted only if the reference is canceled.

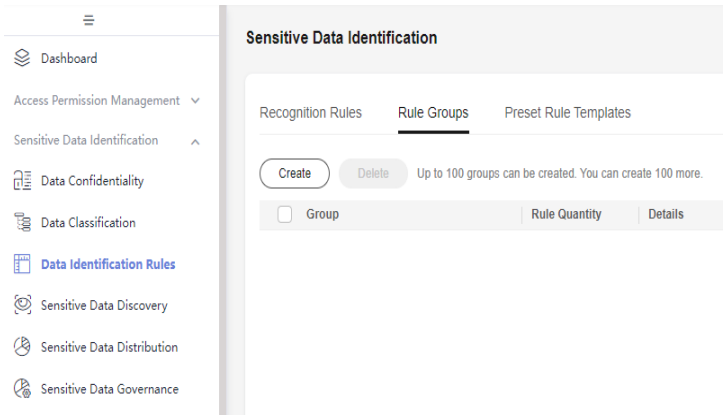
Creating a Sensitive Data Identification Rule Group

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Data Identification Rules** from the left navigation bar.

Step 3 Click the **Rule Groups** tab in the upper part of the displayed page.

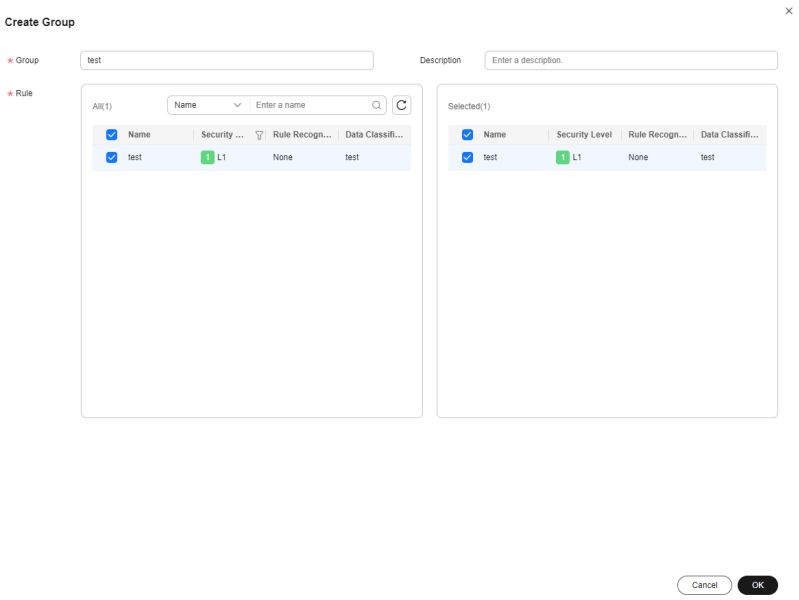
Figure 12-143 Creating a sensitive data identification rule group



Step 4 Click **Create**, set the group name and description based on **Table 12-30**, select identification rules, and click **OK**.

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Figure 12-144 Parameters for creating an identification rule group



The selected rules are displayed in the list on the right. You can click to deselect the selected rules.

Table 12-30 Parameters

Parameter	Description
*Group	Group names can include only letters, numbers, and underscores (_). You are advised to include the rule group meaning into the name and avoid meaningless descriptions so that the rule group can be quickly located and selected.
Description	Information to better identify the group

----End

Related Operations

- Editing a rule group: On the **Rule Groups** page, locate a group and click **Edit** in the **Operation** column to change the name, description, and rules of the group.
- Deleting a rule group: On the **Rule Groups** page, locate a group and click **Delete** in the **Operation** column. To delete rule groups in a batch, select them and click **Delete** above the list.

  NOTE

  - Data identification rule groups that are referenced can be deleted only if the reference is canceled.
  - The deletion operation cannot be undone. Exercise caution when performing this operation.

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12.4.6 Discovering Sensitive Data

After creating a sensitive data identification rule group, you can create a sensitive data discovery task to discover sensitive data and synchronize it to Data Map.

NOTE

After running a sensitive data discovery task, you must choose **Sensitive Data Distribution** in the left navigation pane, click the **Manual Recovery** tab, and ensure that the identification rule of the task is valid, so that the rule can take effect for dynamic masking tasks.

Prerequisites

- Sensitive data identification rule groups have been created. For details, see **Creating Identification Rule Groups**.
- A DWS connection, a DLI connection, and an MRS Hive connection have been created in Management Center based on **Creating a DataArts Studio Data Connection**.
- To discover sensitive DLI data, you need to prepare a DLI general-purpose queue in advance. Currently, general-purpose queues whose Spark version is 3.3.1 are not supported.
- To enable automatic synchronization of identified sensitive data to the Data Map component, the sensitive data discovery task must be created, run, or scheduled by DAYU Administrator, Tenant Administrator, or data security administrator.
- To enable the synchronization of sensitive data classifications to the Data Map component, ensure that the following prerequisites are met:
  - You have collected the metadata of the data table in DataArts Catalog. For details, see **Metadata Collection Task**.
  - Real-time metadata synchronization has been enabled for the data connections in Management Center. For details, see **Creating a DataArts Studio Data Connection**.

Constraints

- Sensitive data discovery is only available for standard warehouses of GaussDB(DWS), Data Lake Insight (DLI), and MRS Hive.
- Sensitive DLI data discovery tasks do not support general-purpose queues whose Spark version is 3.3.1.
- Only sensitive DLI and GaussDB(DWS) data discovery tasks can discover sensitive data in data tables matching specified wildcard characters or in all data tables. Resource specifications can be configured only for sensitive DLI data discovery tasks. (If more resources are configured than available ones, the tasks may fail.)
- Only sensitive GaussDB(DWS) data discovery tasks support resumable scans and task progress display in logs.
- If the sensitive data identification rule is of the content identification type (that is, a built-in rule or a custom rule of the content identification type), a field is considered as a sensitive field and matched with a security level and classification only when the proportion of the number of records that match

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the identification rule of a field to the total number of records in the data table exceeds a specified threshold (80% by default).

- During sensitive data identification, if a field matches multiple identification rules in an identification rule group, the highest security level of the identification rules is used as the security level of the field, and multiple field classifications are allowed.
- After a sensitive data discovery task is executed, the security levels and classifications are generated for the discovered sensitive fields. By default, security levels of data tables are not generated. Security levels of data tables are generated only if you select **Update the security level**. The security level of a data table is the highest security level of sensitive fields.
- Currently, sensitive data can be synchronized only to Data Map. Sensitive data cannot be synchronized to DataArts Catalog, and sensitive data security levels and classifications cannot be added or edited in DataArts Catalog.
- Only the DAYU Administrator, Tenant Administrator, or data security administrator has the permission to enable automatic synchronization of sensitive data to Data Map or manually synchronize sensitive data to Data Map.
  - Automatic synchronization: If **Manually synchronize the recognition result** is not selected during the creation of a sensitive data discovery task, sensitive data is automatically synchronized to Data Map.
  - Manual synchronization: If you select **Manually synchronize the recognition result** when creating a sensitive data discovery task, you need to choose **Sensitive Data Distribution** and click the **Manual Recovery** tab to synchronize sensitive data to Data Map.

  When creating a sensitive data discovery task as a common user other than the DAYU Administrator, Tenant Administrator, or data security administrator, you must select **Manually synchronize the recognition result** so that the task can be successfully created. In addition, if you run or schedule a task for which **Manually synchronize the recognition result** is not selected as a common user, the task cannot be executed.

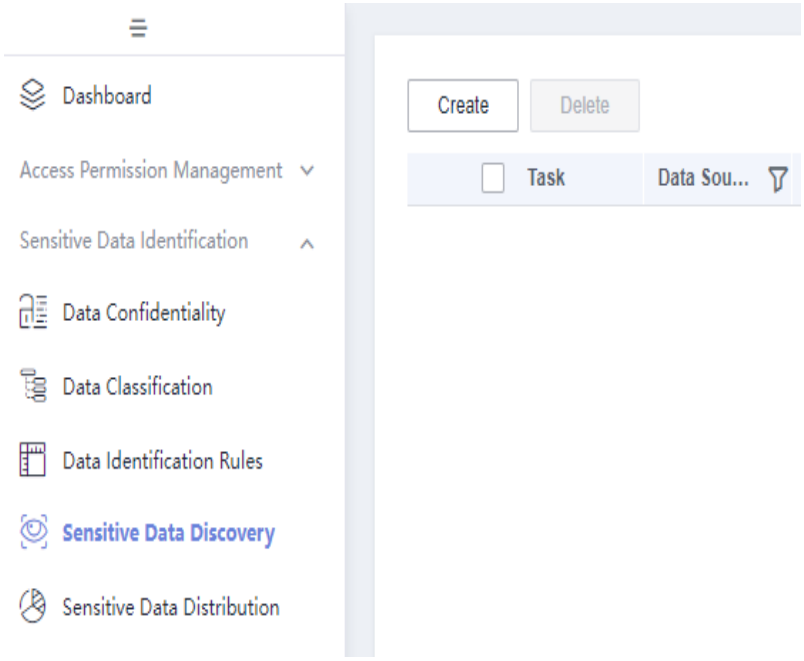
Creating a Sensitive Data Discovery Task

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Sensitive Data Discovery** from the left navigation bar.

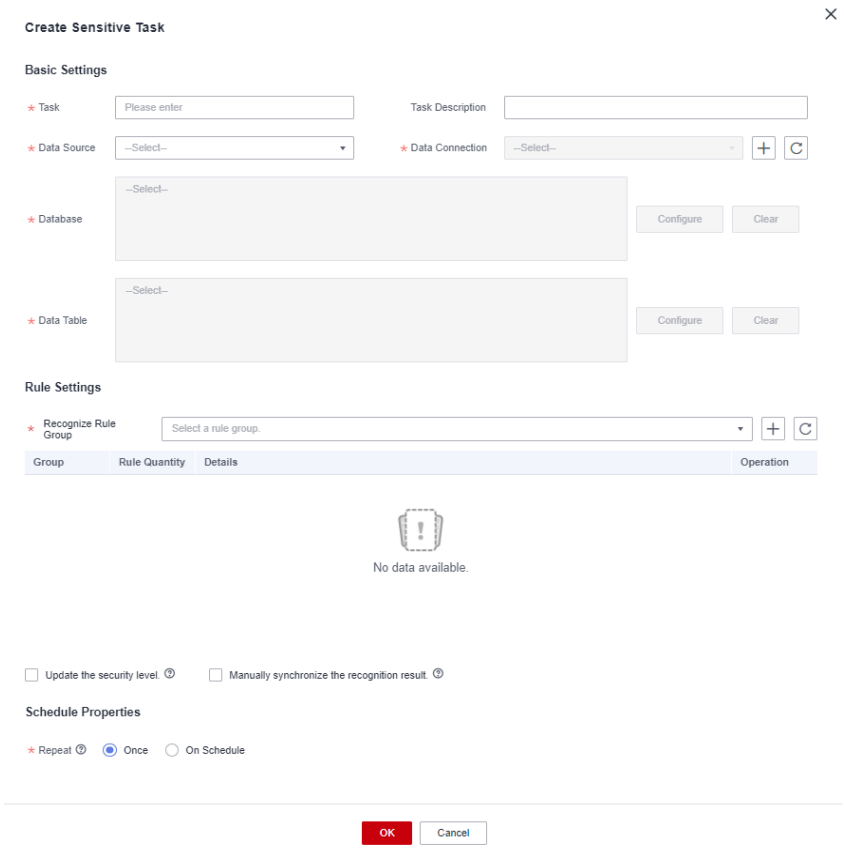
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Figure 12-145 Sensitive Data Discovery page



Step 3 Click **Create**. In the **Create Sensitive Task** slide-out panel, set parameters based on **Table 12-31**.

Figure 12-146 Setting parameters for the sensitive data discovery task



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The following table lists the parameters for a sensitive data discovery task.

Table 12-31 Parameters

Parameter	Description
Basic Settings	
*Task	Name of the task. To facilitate task management, you are advised to include the data table to be identified and the rule group to be used in the task name.
Task Description	A description of the task to be created.
*Data Source	Select a created data source from the drop-down list.
*Data Connection	Select a data connection from the drop-down list. If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*Database	Databases to be scanned. Click **Configure** following the **Database** box to select databases. Click **Clear** to delete the selected databases.

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Parameter	Description
*Data Table	• For sensitive DLI andGaussDB(DWS) data discovery tasks, you need to select one of the following table selection modes: – **Manual**: Select the tables in which you want to discover sensitive data. You can perform fuzzy match in the search box in the table filtering window. If you want to select all tables, you need to select them page by page. This mode is recommended if you want to discover sensitive data in a small number of tables. – **Wildcard**: Enter matching rules to match target tables based on wildcards. You can enter a maximum of 100 matching rules for a task and separate them by line breaks. Each line is regarded as a rule. A rule can contain only letters, digits, underscores (_), and wildcards (*). For example, the **test_*** rule means to match tables whose names start with **test_**. You can also check whether the matching rules meet expectations in the test window. This mode is recommended if there are a large number of rules and tables. – **All**: You do not need to enter rules or filter tables. All tables will be scanned. Select this mode if you want to scan all tables in the selected databases. • For sensitive MRS Hive data discovery tasks, only the **Manual** mode is available. You can perform fuzzy match in the search box in the table filtering window. If you want to select all tables, you need to select them page by page.
Sampling	This parameter is available when **Data Source** is **DWS**. The maximum value allowed is **10,000**.
*Computing Queue	This parameter is mandatory if **Data Source** is set to **DLI**. Select a general-purpose DLI queue for executing DLI jobs. **NOTE** General-purpose queues whose Spark version is 3.3.1 are not supported.
Rule Settings	

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Parameter	Description
*Recognize Rule Group	Select a rule group from the drop-down list. If no rule groups are created, create one by referring to **Creating Identification Rule Groups**. When you select a group, details about the identification rules in the group are displayed. You can configure thresholds for preset rules and custom rules that contain content matching. When the proportion of the number of records that match the identification rule of a field to the total number of records in the data table exceeds the threshold (80% by default), the field is considered sensitive. If different rule groups contain the same rule, the threshold for the rule must be the same.
Manually synchronize the recognition result	Only the DAYU Administrator, Tenant Administrator, or data security administrator has the permission to enable automatic synchronization of sensitive data to Data Map or manually synchronize sensitive data to Data Map. • Automatic synchronization: If **Manually synchronize the recognition result** is not selected during the creation of a sensitive data discovery task, sensitive data is automatically synchronized to Data Map. • Manual synchronization: If you select **Manually synchronize the recognition result** when creating a sensitive data discovery task, you need to choose **Sensitive Data Distribution** and click the **Manual Recovery** tab to synchronize sensitive data to Data Map. When creating a sensitive data discovery task as a common user other than the DAYU Administrator, Tenant Administrator, or data security administrator, you must select **Manually synchronize the recognition result** so that the task can be successfully created. In addition, if you run or schedule a task for which **Manually synchronize the recognition result** is not selected as a common user, the task cannot be executed.
Schedule Properties	
Once	The sensitive data discovery task runs only once.

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Parameter	Description
On Schedule	The sensitive data discovery task runs based on the configured scheduling period. • **Date** Period during which the task takes effect • **Cycle** The frequency at which a task is executed. The options are: – **minutes**: Select the scheduling start time and end time, and set the interval in minutes. – **hours**: Select the scheduling start time and end time, and set the interval in hours. – **Day**: Set the scheduling time everyday. – **Week**: Select a day in a week and set the specific time to start scheduling. – **Month**: Select a day in a month and set the specific time to start scheduling. For example, you can set **Cycle** to **Week**, **Time** to **15:52**, and **Time Range** to **Tuesday**. In this case, the task is executed at 15:52 every Tuesday within the configured date range. • **Start now**: If you select this option, the task is scheduled immediately.
Configure Resources	

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Parameter	Description
Specifications	If DLI Spark resources are sufficient, you can configure Spark task resources to accelerate the execution of the sensitive data discovery task. The system provides three types of resource flavors. The default flavor is A. You can choose a flavor that meets your requirements. **NOTE** If more resources than available ones are requested, the task may fail. ● A (8 vCPUs, 32 GB memory; executor memory: 4 GB; number of executors: 6; number of executor CPUs: 1; number of driver CPUs: 2; driver memory: 7 GB) ● B (16 vCPUs, 64 GB memory; executor memory: 8 GB; number of executors: 7; number of executor CPUs: 2; number of driver CPUs: 2; driver memory: 7 GB) ● C (32 vCPUs, 128 GB memory; executor memory: 8 GB; number of executors: 14; number of executor CPUs: 2; number of driver CPUs: 4; driver memory: 15 GB) **NOTE** The parallelism degree of Spark resources is jointly determined by the number of Executors and the number of Executor CPU cores. The maximum number of tasks that can be concurrently executed is equal to the number of executors multiplied by the number of executor CPUs. You can properly plan compute resource specifications based on the DLI queue resources. Note that Spark tasks need to be jointly executed by multiple roles, such as **driver** and **executor**. So, the number of executors multiplied by the number of executor CPU cores must be less than the number of compute CUs of the queue to prevent other roles from failing to start Spark tasks. Calculation formula for Spark job parameters: ● CUs = Driver Cores + Executors x Executor Cores ● Memory = Driver Memory + (Executors x Executor Memory)
Executor Memory	Memory of each Executor. It is recommended that the ratio of Executor CPU cores to Executor memory be 1:4. The value ranges from 0 to 16 GB or from 0 to 16,384 MB. If more resources than available ones are requested, the task may fail.
Executor Cores	Number of CPU cores of each Executor applied for by jobs, which determines the capability of each Executor to execute tasks concurrently. Enter a value from 0 to 4. If more resources than available ones are requested, the task may fail.
Executors	Number of Executors applied for by a job Enter a value from 0 to 100. If more resources than available ones are requested, the task may fail.

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Parameter	Description
Driver Cores	Number of CPU cores of the driver Enter a value from 0 to 4. If more resources than available ones are requested, the task may fail.
Driver Memory	Driver memory size. It is recommended that the ratio of the number of driver CPU cores to the driver memory be 1:4. The value ranges from 0 to 16 GB or from 0 to 16,384 MB. If more resources than available ones are requested, the task may fail.

Step 4 Click **OK**. The sensitive data discovery task is created.

NOTE

If no execution result is displayed after the sensitive data discovery task is successfully executed, and no matched information is found in the run log, it means no sensitive data is discovered.

----End

Related Operations

- Running or scheduling a task: On the **Sensitive Data Discovery** page, locate a task and click **Run** in the **Operation** column or click **More** in the **Operation** column and select **Start**.

  You can determine whether a task is scheduled once or repeatedly based on the scheduling period.

  NOTE

  If you run or schedule a task for which **Manually synchronize the recognition result** is not selected as a common user other than the DAYU Administrator, Tenant Administrator, or data security administrator, the task fails to be executed. Only the DAYU Administrator, Tenant Administrator, or data security administrator can run or schedule tasks for which **Manually synchronize the recognition result** is not selected.

- Editing a task: On the **Sensitive Data Discovery** page, locate a task and click **Edit** in the **Operation** column.

  A task in the **Running** state cannot be edited.

- Deleting tasks: On the **Sensitive Data Discovery** page, locate a task, click **More** in the **Operation** column, and select **Delete**. To delete multiple tasks at a time, select the tasks and click **Delete** above the task list.

  A task in the **Running** state cannot be deleted.

  NOTE

  - Deleting a sensitive data discovery task will delete the discovery result. Exercise caution when performing this operation.
  - The deletion operation cannot be undone. Exercise caution when performing this operation.

- Viewing running instance logs: On the **Sensitive Data Discovery** page, locate a task and click ⌄ to expand instances. Click **Operation** and select **View Log**.

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If a task fails to be executed, you can locate the failure cause based on logs, rectify the fault, and try the task again. If the fault persists, contact technical support.

12.4.7 Viewing Sensitive Data Distribution

This section describes how to view and modify the sensitive data discovery result.

- View the result of a sensitive data discovery task.
- Manual recovery: After sensitive data is discovered, you must perform manual recovery to confirm that the identification rule in the task is in valid state so that the identification rule takes effect for static masking tasks.

  If you selected **Manually synchronize the recognition result** for the sensitive data discovery task, you must click **Data Sync** to synchronize the discovered sensitive data to Data Map. (Before synchronizing data, ensure that a metadata collection task has been performed in DataArts Architecture. Otherwise, the synchronization will fail.)

Prerequisites

- You have created and executed a sensitive data discovery task. For details, see **Creating a Sensitive Data Discovery Task**.
- Only the DAYU Administrator, Tenant Administrator, or data security administrator has the permission to synchronize sensitive data to Data Map.
- Before synchronizing sensitive data, you have collected the metadata of the data connection in DataArts Catalog. For details, see **Metadata Collection Task**. Otherwise, the synchronization will fail and an error message will be displayed, indicating that no data connection is available.

Constraints

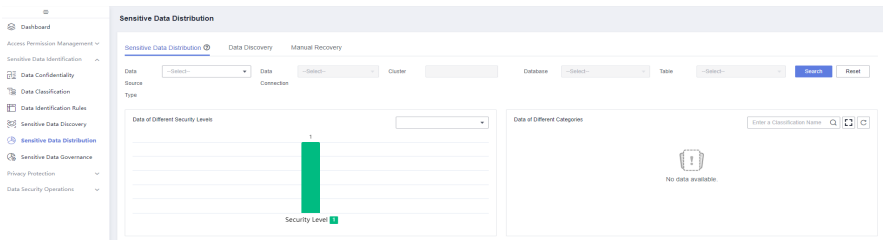
- Currently, sensitive data can be synchronized only to Data Map. Sensitive data cannot be synchronized to DataArts Catalog, and sensitive data security levels and classifications cannot be added or edited in DataArts Catalog.
- Sensitive data synchronization depends on metadata collection tasks. If the metadata of a data connection has not been collected, no data connection can be found.

Viewing and Modifying the Sensitive Data Discovery Result

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Sensitive Data Distribution**.

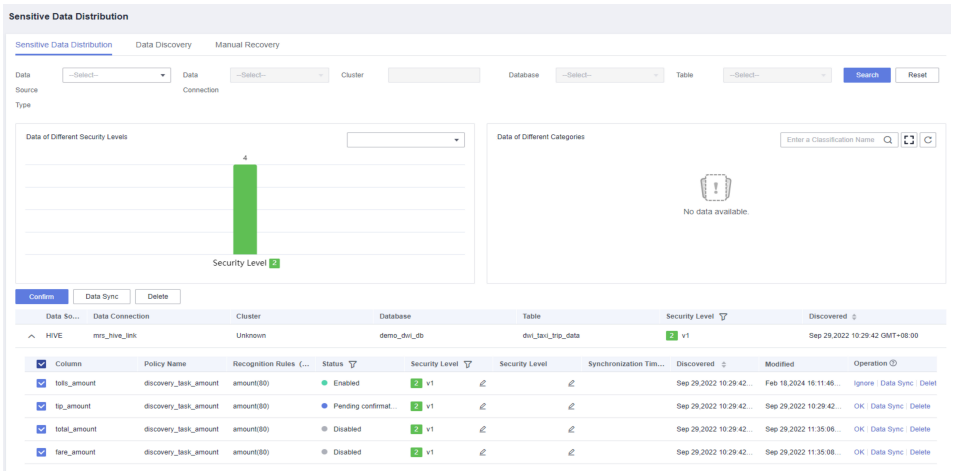
Figure 12-147 Sensitive Data Distribution page



Step 3 On the **Sensitive Data Distribution** page, you can use either of the following methods to view and modify the sensitive data discovery result. Method 1 is recommended. It allows you to view and modify the discovered sensitive data, change the data security level and classification, and perform batch operations without switching to other pages.

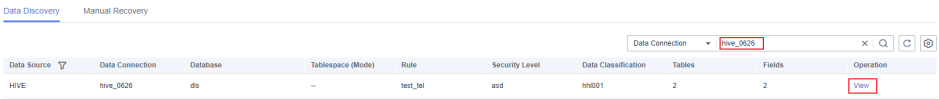
- (Recommended) Method 1: On the **Sensitive Data Distribution** tab page, click ⌄ to expand data source details, view sensitive data, and change the data security level, classification, and status.
  - **OK**: Confirm that the identification result is valid. You can confirm rules in unconfirmed or invalid state. Static masking tasks can be executed using valid identification rules.
  - **Ignore**: Confirm that the identification result is invalid. You can ignore rules in valid state. Unconfirmed or invalid identification rules cannot be selected for static masking tasks.
  - **Data Sync**: If you selected **Manually synchronize the recognition result** for the sensitive data discovery task, you must click **Data Sync** to synchronize the discovered sensitive data to Data Map. (Before synchronizing data, ensure that a metadata collection task has been performed in DataArts Architecture. Otherwise, the synchronization will fail.)
  - **Delete**: Delete the discovered result.

Figure 12-148 Viewing and modifying the discovered sensitive data



- Method 2: Click the **Data Discovery** tab. Search for a data connection name to find the sensitive data you want and click **View** in the **Operation** column to view details of the sensitive data.

Figure 12-149 Data discovery



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Figure 12-150 Viewing details



Click the **Manual Recovery** tab, search for and locate a rule, and click **OK**, **Ignore**, or **Data Sync** in the **Operation** column to change the data status.

- **OK**: Confirm that the identification result is valid. You can confirm rules in unconfirmed or invalid state. Static masking tasks can be executed using valid identification rules.
- **Ignore**: Confirm that the identification result is invalid. You can ignore rules in valid state. Unconfirmed or invalid identification rules cannot be selected for static masking tasks.
- **Data Sync**: If you selected **Manually synchronize the recognition result** for the sensitive data discovery task, you must click **Data Sync** to synchronize the discovered sensitive data to Data Map. (Before synchronizing data, ensure that a metadata collection task has been performed in DataArts Architecture. Otherwise, the synchronization will fail.)

Figure 12-151 Modifying sensitive data



----End

12.4.8 Managing Sensitive Data

With DataArts Security, you can manage Data Map assets by security level and control users' access to metadata. After you configure a security level for a specified user or user group, the user or user group can only preview the fields whose security levels are lower than or equal to the configured security level.

The security level-based permission control policies configured for a DataArts Studio instance are visible to and take effect for all the workspaces of the instance. If no security level-based permission control policy is configured, DataArts Security provides a default policy. This policy grants the permission to access data of the highest security level to all users by default. After the administrator configures a policy, the default policy can be deleted.

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Prerequisites

A sensitive data discovery task has been performed and discovered sensitive data has been automatically or manually synchronized to Data Map. For details, see **Discovering Sensitive Data** or **Viewing Sensitive Data Distribution**.

Constraints

- Only the DAYU Administrator, Tenant Administrator, or data security administrator can create, modify, or delete security level-based permission control policies. Other common users do not have permission to perform these operations.
- Security level-based permission control is available only for the fields with security levels in Data Map and unavailable for tables with security levels.
- A user/user group and a security level uniquely identify a security level-based permission control policy. A policy for the same user, user group, or security level cannot be created.
- If a user or user group corresponds to multiple security levels, the highest security level prevails.

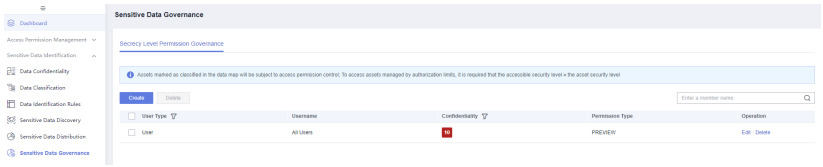
Creating a Sensitive Data Control Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Sensitive Data Governance**.

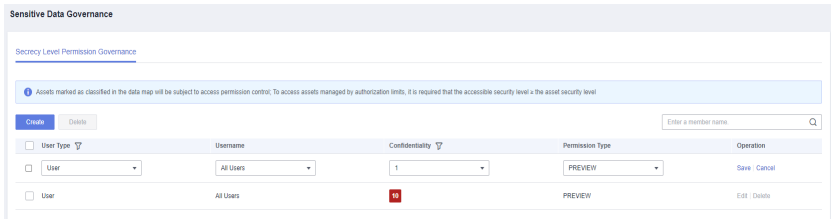
A default policy is displayed on the page. This policy grants all users the permission to access data with the highest security level.

Figure 12-152 Sensitive Data Governance page



Step 3 Click **Create** and set the parameters listed in **Table 12-32**.

Figure 12-153 Setting parameters for a security level-based permission control policy



The following table lists the parameters for the security level-based permission control policy.

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Table 12-32 Policy parameters

Parameter	Description
*User Type	Select **User** or **User Group**.
*Username	Select a user or user group from all workspace members of the current instance.
*Confidentiality	Select a security level for the specified user or user group. The user or user group can only access assets whose security levels are lower than or equal to the configured security level.
*Permission Type	Only **PREVIEW** in Data Map is available.

Step 4 Click **Save**.

NOTE

After creating the policy, delete the default policy to make the created policy take effect.

----End

Related Operations

- Editing a security level-based permission control policy: On the **Sensitive Data Governance** page, locate a policy and click **Edit** in the **Operation** column to change the user/user group, confidentiality, or permission type.
- Deleting security level-based permission control policies: On the **Sensitive Data Governance** page, locate a policy and click **Delete** in the **Operation** column to delete the policy. To delete multiple policies, select them and click **Delete** above the policy list.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

12.5 Sensitive Data Protection

12.5.1 Overview

DataArts Security provides privacy data protection to protect enterprises' sensitive data. You can use static and dynamic data masking, and data, file, and dynamic watermarking to prevent your data from being misused, disclosed, or stolen intentionally or unintentionally. In this way, your sensitive data is secure, complete, and safe to use.

Methods

Privacy data protection provides the following methods for protecting sensitive data:

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- Static masking

  Static data masking prevents private data leakage, and ensures regulatory compliance as well as data security for enterprises. Sensitive data is masked, truncated, and hashed based on the abundant and effective built-in masking algorithms, and the processed data can be written to the target data table. For security purpose, it is the target data table that can be used to provide services for external requirements.

- Dynamic data masking

  After a dynamic masking policy is created in DataArts Security, the system synchronizes the policy to the data source. The data source dynamically masks data columns based on specified rules. When the users and user groups specified in the policy access sensitive data, the system returns the data that is dynamically masked by the data source to protect sensitive data from being disclosed.

- Data watermarking

  Users can embed watermarks into data. The watermarked data is transparent, available, and covert. It is not easy for others to crack the watermarked data. Even if data is leaked, watermarks can be traced to find the person accountable for the leakage. Once the watermarked data is used without the content of data owners, users can import the leaked file to trace and extract the watermarks. In this case, the organization or person that is accountable for the leakage problem can be easily found.

- File watermarks

  File watermarks can be injected into data files in the following scenarios to accurately locate security events:

  – Insert invisible watermarks into structured data files (CSV, XML, and JSON files) and extract the watermarks.

  – Insert visible watermarks into unstructured data files (DOCX, PPTX, XLSX, and PDF files) and open the files on a local host to view the watermarks.

- Dynamic watermarking

  After data development dynamic watermarking is enabled for DataArts Security and a dynamic watermarking policy is created, when a user group or role specified in the policy dumps or downloads sensitive data in DataArts Factory, DataArts Factory injects an invisible watermark into the sensitive data to protect it from being disclosed.

12.5.2 Static Masking Tasks

12.5.2.1 Managing Masking Algorithms

Masking algorithms are mandatory for creating masking policies. The system provides more than 20 built-in masking algorithms. If you want to use these algorithms, you need to configure their parameters. If the built-in algorithms cannot meet your needs, you can create algorithms.

This section describes built-in masking algorithms and how to create masking algorithms.

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Notes and Constraints

- When creating a random or character replacement masking algorithm, if you select **Sample library** for **Random Mode** or **Replacement Mode**, the sample file for testing the algorithm cannot be larger than 10 KB. This restriction applies only to the algorithm test and does not apply to real static masking tasks.

Built-in Masking Algorithms

DataArts Security provides the following built-in masking algorithms. Before selecting an algorithm, you can use the algorithm configuration and testing functions to check whether the algorithm suits your needs.

Table 12-33 Built-in algorithms

Type	Name	Description	Configurable
Hash	HMAC-SHA256 hash	Use the HMAC-SHA256 algorithm for hash processing.	A salt value and a key can be configured. **NOTE** • Before using the algorithm, you must configure a key. • You need to set a salt value rather than use the secure random number provided by the system. Pay attention to the risks.
	SHA-256	Use the SHA-256 algorithm for hash processing.	A salt value can be configured. **NOTE** You need to set a salt value rather than use the secure random number provided by the system. Pay attention to the risks.
Cut	Value truncation	Retain x digits before the decimal point and replace the x-1 digits from the first digit before the decimal point and the digits after the decimal point with 0. For example, if x is 3, 1234 is truncated to 1200, 999.999 is truncated to 900, and 10.7 is truncated to 0.	The number of digits before the decimal point can be configured.
	Date truncation	Truncate a specified date.	The date format and masking range can be configured.

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Type	Name	Description	Configurable
Mask	Masking of specified GaussDB(DWS) columns	Masks specified columns in GaussDB(DWS). This algorithm can be used only when both the source and destination of a static masking task are GaussDB(DWS) and the execution engine is GaussDB(DWS).	Not supported
	Masking with specified characters for GaussDB(DWS)	Replaces the characters from the start to end position with specified characters. This algorithm can be used only when both the source and destination of a static masking task are GaussDB(DWS) and the execution engine is GaussDB(DWS).	The start position, end position, and mask flag can be configured.
	Masking with specified digits for GaussDB(DWS)	Replaces the characters from the start to end position with specified digits. This algorithm can be used only when both the source and destination of a static masking task are GaussDB(DWS) and the execution engine is GaussDB(DWS).	The start position, end position, and mask flag can be configured.
	ID masking	Masks an ID card No.	Not supported
	Bank card No. masking	Masks a bank card No.	Not supported
	Email masking	Masks email information.	Not supported
	Mobile equipment identity masking	Masks the device code, such as IMEI, MEDI, and ESN.	The type can be configured.
	IPv6 masking	Masks an IPv6 address.	Not supported
	IPv4 masking	Masks an IPv4 address.	Not supported

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Type	Name	Description	Configurable
	MAC address masking	Masks a MAC address.	Not supported
	Phone No. masking	Masks a phone number.	Not supported
	Date type masking	Masks a specified date format, such as ISO, EUR, and USA.	The date format and masking range can be configured.
	Masking *X* to *Y*	Masks the characters from *X* to *Y* of a string.	*X* and *Y* can be configured.
	Retaining *X* to *Y*	Retains the characters from *X* to *Y* of a string.	*X* and *Y* can be configured.
	Masking first *n* and last *m* characters	Masks the first *n* and last *m* characters of a string.	*n* and *m* can be configured.
	Retaining first *n* and last *m* characters	Retains the first *n* and last *m* characters of a string.	*n* and *m* can be configured.

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Type	Name	Description	Configurable
Encryption	GaussDB(DWS) column encryption	The symmetric cryptographic algorithm gs_encrypt_aes128(encryptstr,keystr) provided by GaussDB (DWS) is invoked to encrypt DWS data columns. This algorithm uses keystr as the key to encrypt the encryptstr character string and returns the encrypted character string. Note the following: • This algorithm takes effect only when the destination of the masking task is GaussDB (DWS). • When SQL decryption is executed after encryption, the decryption result can be correctly returned only when all data is successfully decrypted. Otherwise, the decryption fails.	The key can be configured. The key length ranges from 1 byte to 16 bytes. **NOTE** Before using the algorithm, you must configure a key.
	Hive column encryption	The Hive column encryption function provided by MRS is invoked to encrypt and decrypt Hive data columns using the AES cryptographic algorithm. Note the following: • This algorithm takes effect only when the target of the masking task is Hive. • Column encryption can be performed in HDFS tables of only the TextFile and SequenceFile file formats. • The Hive column encryption does not support views and the Hive over HBase scenario.	The encryption type can be configured.

Creating a Masking Algorithm

If the built-in algorithms do not meet your needs, you can create custom masking algorithms, such as mask, truncation, hash, encryption, nulling, random masking, character replacement, key-value masking, value range conversion, and fuzzy masking.

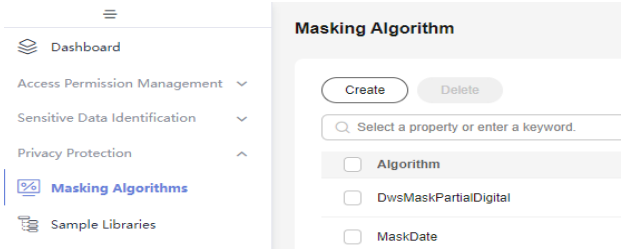
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Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Masking Algorithms**.

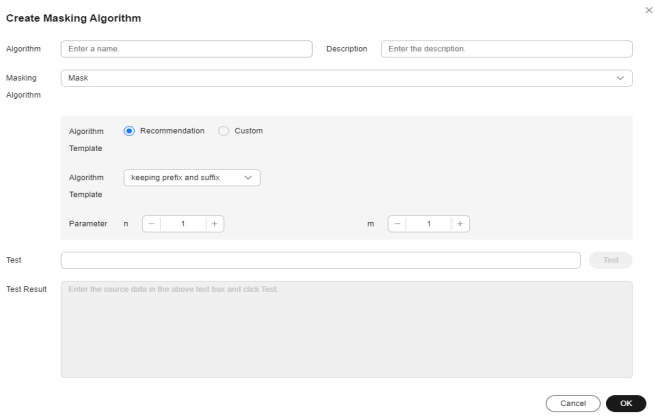
Step 3 Click **Create**.

Figure 12-154 Creating a masking algorithm



Step 4 Set the parameters listed in **Table 12-34** and click **OK**.

Figure 12-155 Configuring algorithm parameters



The following table lists the masking algorithm parameters.

Table 12-34 Parameters for the masking algorithm

Parameter	Description
*Algorithm	Algorithm name, which can contain a maximum of 64 characters
Description	Brief description of the algorithm. It can contain a maximum of 255 characters.

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Parameter	Description
*Masking Algorithm	The following options are available: • **Mask**: This algorithm supports characters, numeric values, and date values. It replaces data at specified positions with fixed values. • **Truncate**: This algorithm supports date and numeric values. It truncates a date to the month, day, hour, minute, or second and rounds the value. • **Hash**: This algorithm supports all types of data. The selected algorithm is used to calculate the hash value. • **ENCRYPT**: This algorithm supports all types of data. The selected encryption algorithm is used to encrypt data from a specified source. • **SET_NULL**: This algorithm supports all types of data. It sets the value to null. • **RANDOM**: Replaces date or numeric values with values within a specified range or in a sample library. For how to create a sample library, see **Managing Sample Libraries**. If you select **Sample library** for **Random Mode**, the OBS sample file can only be used for static DLI data masking tasks and the HDFS sample file can only be used for static MRS data masking tasks. For details about the mapping between static masking scenarios and engines, see **Reference: Static Data Masking Scenarios**. If you enable **Keep Association with Source Data**, the same result will be generated for the same data in different databases after the data is masked using the same rule. If this parameter is enabled, data may be cracked. If you need to enable this parameter, you are advised to configure a random salt value to defend against dictionary attacks. • **CHARACTER_REPLACEMENT**: This algorithm replaces numeric values and characters at specified positions with fixed values or values in sample files in the sample library. Random digits or lowercase letters can be used to replace the characters at custom positions. If you select **Replace the last digit of an ID card number**, **Bits** can only be **1**, and there must be 17 or more bits to be masked before the selected bit. For how to create a sample library, see **Managing Sample Libraries**. If you select **Sample library** for **Replacement Mode**, the OBS sample file can only be used for static DLI data masking tasks and the HDFS sample file can only be used for static MRS data masking tasks. For details about the mapping between static masking scenarios and engines, see **Reference: Static Data Masking Scenarios**. If you enable **Keep Association with Source Data**, the same result will be generated for the same data in different databases after the data is masked using the

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Parameter	Description
	same rule. If this parameter is enabled, data may be cracked. If you need to enable this parameter, you are advised to configure a random salt value to defend against dictionary attacks. • **KEY_VALUE**: This algorithm replaces numeric keys and values with values that are calculated using custom expressions. The source data supports the following operations: addition (+), subtraction (-), multiplication (*), division (/), parentheses (()), and modulo (%). For example, expression **((X*4+3)%100)/2-1** can replace 3 with 6.5. • **INTERVAL_TRANSFORMATION**: This algorithm converts digits in a specified range into specified values. • **FUZZY**: This algorithm replaces a numeric value with a random value within a fuzzy percentage or absolute value range. For example, in percentage blurring mode, if the percentage ranges from –10% to 20%, value 10 will be replaced with a random value from 9 to 12. If you enable **Keep Association with Source Data**, the same result will be generated for the same data in different databases after the data is masked using the same rule. If this parameter is enabled, data may be cracked. If you need to enable this parameter, you are advised to configure a random salt value to defend against dictionary attacks.
Test	Enter the data to be tested and click **Test**. You can view the masking result in the **Test Result** area. **NOTE** When creating a random or character replacement masking algorithm, if you select **Sample library** for **Random Mode** or **Replacement Mode**, the sample file for testing the algorithm cannot be larger than 10 KB.
Test Result	

----End

Related Operations

- Editing an algorithm: On the **Masking Algorithms** page, locate an algorithm and click **Edit** in the **Operation** column.

  The parameters that can be edited vary depending on the algorithm type.

- Testing an algorithm: On the **Masking Algorithms** page, locate an algorithm and click **Test** in the **Operation** column.

  NOTE

  Before using an algorithm, you are advised to test it to ensure that it meets your needs.

  Whether the test function is available varies depending on the algorithm type.

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- Deleting algorithms: On the **Masking Algorithms** page, locate an algorithm and click **Delete** in the **Operation** column. To delete multiple algorithms, select them and click **Delete** above the list.

  Built-in algorithms cannot be deleted. Custom algorithms that are used by masking policies or specified column masking cannot be deleted. To delete such algorithms, cancel the reference first.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

12.5.2.2 Managing Sample Libraries

DataArts Security can generate sample libraries based on your OBS or HDFS sample files. When creating a random masking algorithm or character replacement masking algorithm, you can replace sensitive data with values in the sample library file. For details, see **Creating a Masking Algorithm**.

This section describes how to create a sample library.

Prerequisites

A sample file has been uploaded to OBS or HDFS. The sample file must be in TXT format. It is recommended that the file be no larger than 10 MB. Data in the file can be separated by line breaks (\n), spaces, commas (,), or vertical bars (|).

Notes and Constraints

- When creating a random or character replacement masking algorithm, if you select **Sample library** for **Random Mode** or **Replacement Mode**, the sample file for testing the algorithm cannot be larger than 10 KB. This restriction applies only to the algorithm test and does not apply to real static masking tasks.
- It is recommended that a sample file be no larger than 10 MB. Otherwise, static masking tasks for which the sample file needs to be parsed may fail.
- OBS sample files can only be used for static DLI data masking tasks and HDFS sample files can only be used for static MRS data masking tasks. For details about the mapping between static masking scenarios and engines, see **Reference: Static Data Masking Scenarios**.

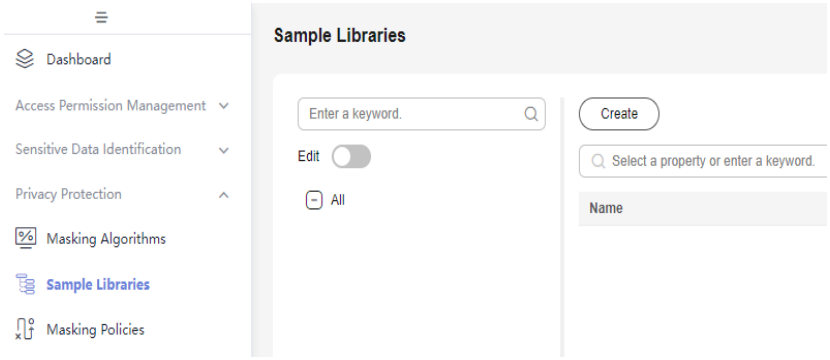
Creating a Sample

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Sample Libraries**.

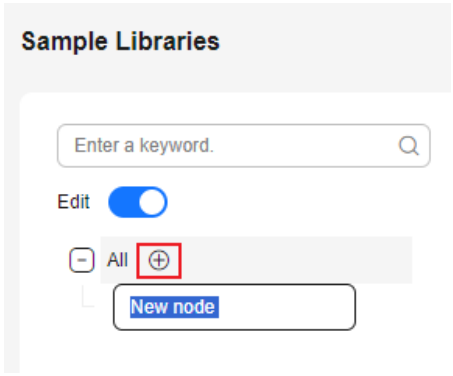
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Figure 12-156 Sample Libraries page



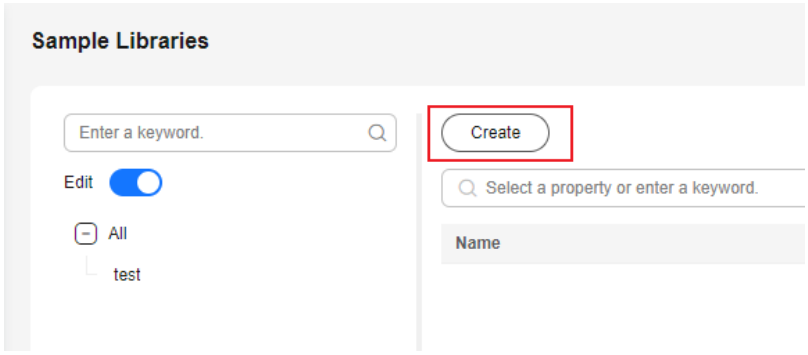
Step 3 On the **Sample Libraries** page, click  in the directory, move the cursor to the directory, click  , and enter a classification name to add a sample library classification. The classification name can contain a maximum of 64 characters, including only letters, digits, and underscores (_). The excess part, if any, will be truncated. A maximum of 10 layers of sample library classifications (except the **All** layer) are supported.

Figure 12-157 Adding a sample library classification



Step 4 In the right pane, click **Create**. The classification selected on the left is set for **Classification** in the **Create** dialog box.

Figure 12-158 Creating a sample



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Step 5 In the displayed dialog box, set the parameters listed in **Table 12-35** and click **Confirm**.

Figure 12-159 Creating a sample

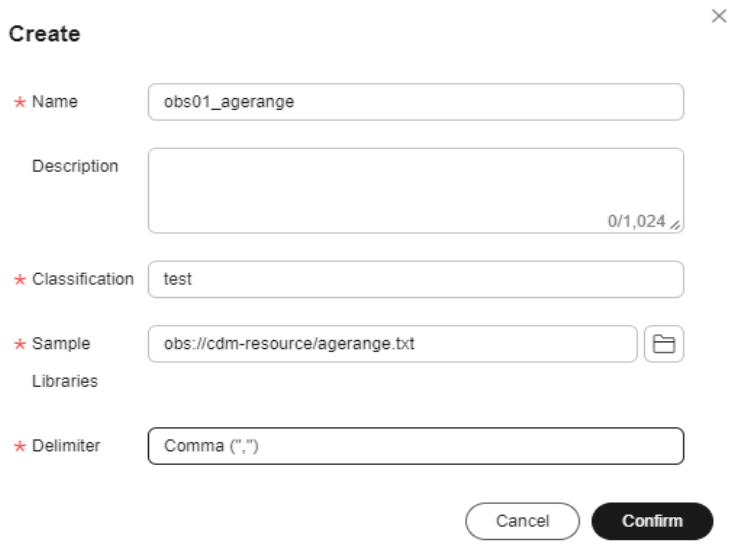


Table 12-35 Parameters for creating a sample

Parameter	Description
*Name	Sample name. It can contain a maximum of 64 characters, including only letters, digits, and underscores (_). The excess part, if any, will be truncated.
Description	A description of the sample to be created, which can contain a maximum of 1,024 characters.
*Classification	The classification selected on the left is entered by default. You can also click it to select another classification.
*Sample Libraries	Select a sample file that has been uploaded to OBS or HDFS. The sample file must be in TXT format. It is recommended that the file be no larger than 10 MB. Data in the file can be separated by line breaks (\n), spaces, commas (,), or vertical bars (|). OBS sample files can only be used for static DLI data masking tasks and HDFS sample files can only be used for static MRS data masking tasks. For details about the mapping between static masking scenarios and engines, see **Reference: Static Data Masking Scenarios**.
*Delimiter	Delimiter of data in the sample file, which can be a link break (\n), space, comma (,), or vertical bar (|)

----End

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Related Operations

- Editing a sample library classification: On the **Sample Libraries** page, click  , move the cursor to the classification to be edited, click  , and edit the classification name.
- Deleting a sample library classification: On the **Sample Libraries** page, click  , move the cursor to the classification to be edited, and click  .

  Sample library classifications that contain samples cannot be deleted. The **All** root classification cannot be deleted either.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.
- Editing a sample: On the **Sample Libraries** page, locate a sample and click **Edit** in the **Operation** column to modify parameters of the sample.
- Deleting a sample: On the **Sample Libraries** page, locate a sample and click **Delete** in the **Operation** column to delete the sample.

  Samples being used by masking algorithms cannot be deleted. To delete such samples, cancel the reference first.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

12.5.2.3 Managing Masking Policies

In business activities, some enterprise departments need to analyze data for operations. In this case, data must be accessible to these departments even if it is sensitive. To meet this requirement and prevent data leakage, you can create data masking policies to mask sensitive data.

This section describes how to manage the masking policies for static masking tasks.

Prerequisites

- A sensitive data identification rule has been created. For details, see **Creating Identification Rules**.
- A built-in or custom masking algorithm has been created. For details, see **Managing Masking Algorithms**.

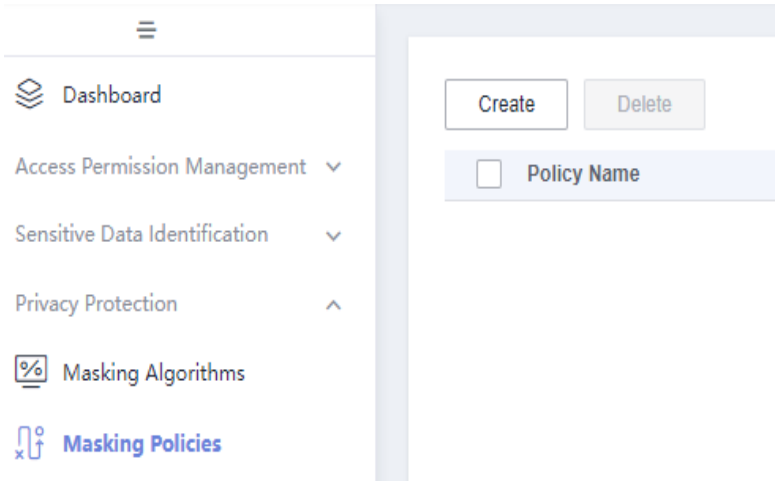
Creating a Data Masking Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Masking Policies** from the left navigation bar, and click **Create** in the upper part of the displayed page.

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Figure 12-160 Creating a data masking policy



Step 3 In the displayed dialog box, set the parameters listed in **Table 12-36** and click **OK**.

Figure 12-161 Creating a data masking policy

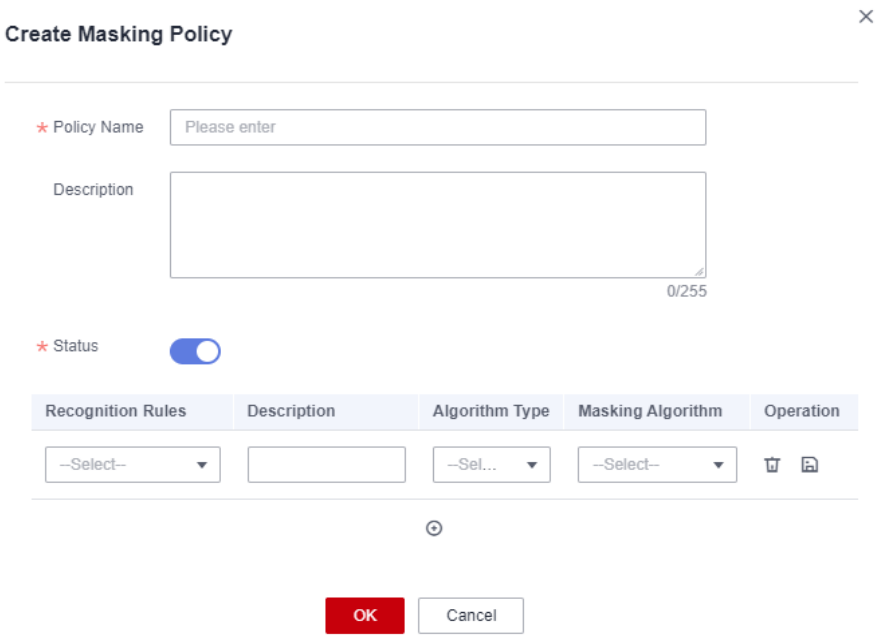


Table 12-36 Parameters

Parameter	Description
*Policy Name	The name of the policy to be created. Policy names can include only letters, numbers, and underscores (_) and cannot exceed 64 characters.
Description	A description of the policy to be created, which can contain a maximum of 255 characters.

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Parameter	Description
*Status	If the status switch is turned on, the policy is available. If the status switch is turned off, the policy cannot be used.
*Recognition Rules and Masking Algorithm	Sensitive data identification rule and the corresponding masking algorithm • ***Recognition Rules**: Select a data identification rule. For details, see **Creating Identification Rules**. • **Description**: Enter a description of the rule. • ***Algorithm Type**: Select an algorithm type. For details, see **Table 12-33**. • ***Masking Algorithm**: Select an algorithm of the selected type. For details, see **Table 12-33**. **NOTE** Before using the following masking algorithms, you must configure keys: • HMAC-SHA256 hash algorithm • DWS column encryption algorithm For more restrictions on different masking algorithms, see **Managing Masking Algorithms**.

----End

Related Operations

- Editing a masking policy: On the **Masking Policies** page, locate a policy and click **Edit** in the **Operation** column.
- Setting the masking policy status: A masking policy is enabled by default. If a data masking policy is disabled, it cannot be used by static data masking tasks.

  To change the status of a data masking policy, click  or  to enable or disable the policy.

  NOTE

  Masking policies used by static masking tasks cannot be disabled.
- Deleting masking policies: On the **Masking Policies** page, locate a policy and click **Delete** in the **Operation** column. To delete multiple policies, select them and click **Delete** above the list.

  Policies used by static masking tasks cannot be deleted. To delete such policies, modify the reference relationship first.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

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12.5.2.4 Managing Static Masking Tasks

This section describes how to create a static masking task. For the source and destination types that support static masking, see **Reference: Static Data Masking Scenarios**.

Static data masking prevents private data leakage, and ensures regulatory compliance as well as data security for enterprises. Sensitive data is masked, truncated, and hashed based on the abundant and effective built-in masking algorithms, and the processed data can be written to the target data table. For security purpose, it is the target data table that can be used to provide services for external requirements.

Prerequisites

- Static masking tasks rely on masking policies. The prerequisites are as follows:
  - A built-in or custom masking algorithm has been created. For details, see **Managing Masking Algorithms**.
  - A masking policy has been created. For details, see **Creating a Data Masking Policy**.
  - A sensitive data discovery task has been created for the data tables to be masked. For details, see **Creating a Sensitive Data Discovery Task**.
  - The sensitive data status has been changed to valid on the **Sensitive Data Distribution** page. For details, see **Viewing Sensitive Data Distribution**.
- For static masking tasks using the DLI engine, the following OBS permissions have been granted to the **dlg_agency**. For details, see **Authorizing dlg_agency**.

```
obs:bucket:HeadBucket
obs:bucket:CreateBucket
obs:object:PutObject
obs:object:DeleteObject
obs:bucket:ListBucket
obs:object:GetObject
obs:bucket:GetEncryptionConfiguration
obs:bucket:PutEncryptionConfiguration
```

Constraints

- You need to select a proper static masking algorithm based on the field type of the data to be masked. Otherwise, data in the database may be abnormal. For example, if the numeric random algorithm is used to mask date fields, the data type of the fields will be forcibly converted into numeric (Hive and DLI data masking), or a write failure occurs (DWS data masking). If the hash algorithm is used to mask numeric fields, the fields will be forcibly changed to hash value strings (Hive and DLI data masking), or a write failure occurs (DWS data masking).
- When you run a static masking task for which a sample file needs to be parsed, it is recommended that the sample file be no larger than 10 MB. Otherwise, the static masking task may fail. In addition, OBS sample files can only be used for static DLI data masking tasks and HDFS sample files can only be used for static MRS data masking tasks. For details about the mapping between static masking scenarios and engines, see **Reference: Static Data Masking Scenarios**.

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- For a static masking task using the DLI engine, the running parameters need to be stored in an OBS bucket. After the task is complete or fails, the task running parameter file is deleted.
  - For a same-source static masking task using the DLI engine, the running parameters are stored in the workspace log bucket named **dlf-log-*{Project id}*** by default.
  - For a cross-source static masking task using the DLI engine, the running parameters are stored in the encrypted user bucket named **dls-dli-*{projectId}*** that is automatically created.

  Therefore, before performing static masking using the DLI engine, you must grant the following OBS permissions to the **dlg_agency**. For details, see **Authorizing dlg_agency**.

  ```
  obs:bucket:HeadBucket
  obs:bucket:CreateBucket
  obs:object:PutObject
  obs:object:DeleteObject
  obs:bucket:ListBucket
  obs:object:GetObject
  obs:bucket:GetEncryptionConfiguration
  obs:bucket:PutEncryptionConfiguration
  ```

- For a static masking task using the DLI engine, if the source or destination is GaussDB(DWS), enable network communications between the DLI Spark common queue and GaussDB(DWS). Otherwise, the static masking task will fail. For details, see **Configuring the Connection Between a DLI Queue and a Data Source in a Private Network** or **Configuring the Connection Between a DLI Queue and a Data Source in the Internet**.
- If the source or destination of a static masking task is DLI, data tables in the DLI default database cannot be masked.
- Kerberos authentication must be enabled for the MRS cluster where MRS Hive is located, and the Spark component must be installed for the MRS cluster.
- For a static masking task using the MRS engine, if the source or destination is GaussDB(DWS), configure an agency for the MRS cluster by referring to **Reference: Authorizing and Binding an Agency** and ensure that the outbound rule of the MRS cluster's security group meets the following requirements. Otherwise, the static masking task will fail.
  - Protocol: TCP
  - Port: 80
  - Destination: 169.254.0.0/16
- For a static masking task using the MRS engine, if either the source or destination is GaussDB(DWS), the following data types are supported. If there is data of other unsupported types, the static masking task will fail.
  - tinyint
  - smallint
  - int
  - bigint
  - decimal
  - double
  - float

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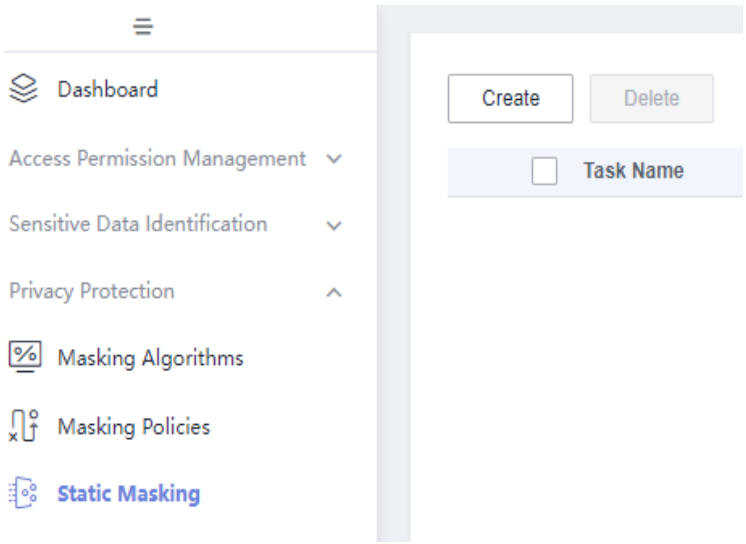
  - boolean
  - string
  - timestamp
- A same-source static masking task using the GaussDB(DWS) engine does not support cross-database masking. That is, the source and destination data tables must be in the same database.
- If **Dataset Scope** is set to **Incremental** for a static masking task, **Timestamp** or **Date** needs to be selected for **Time Field**.

Create a Static Masking Task

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

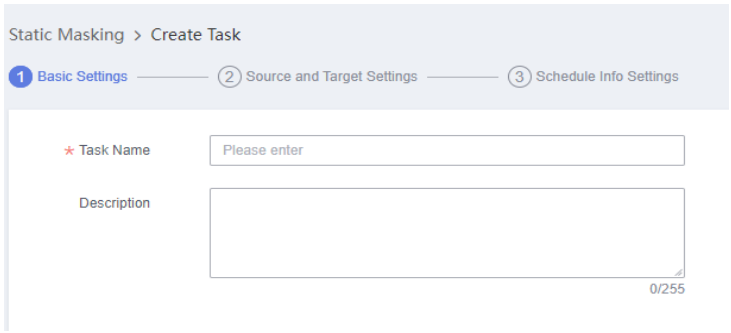
Step 2 In the left navigation pane, choose **Static Masking**. In the right pane, click **Create**.

Figure 12-162 Creating a static masking task



Step 3 In the displayed dialog box, set **Task Name** and **Description** and click **Next**.

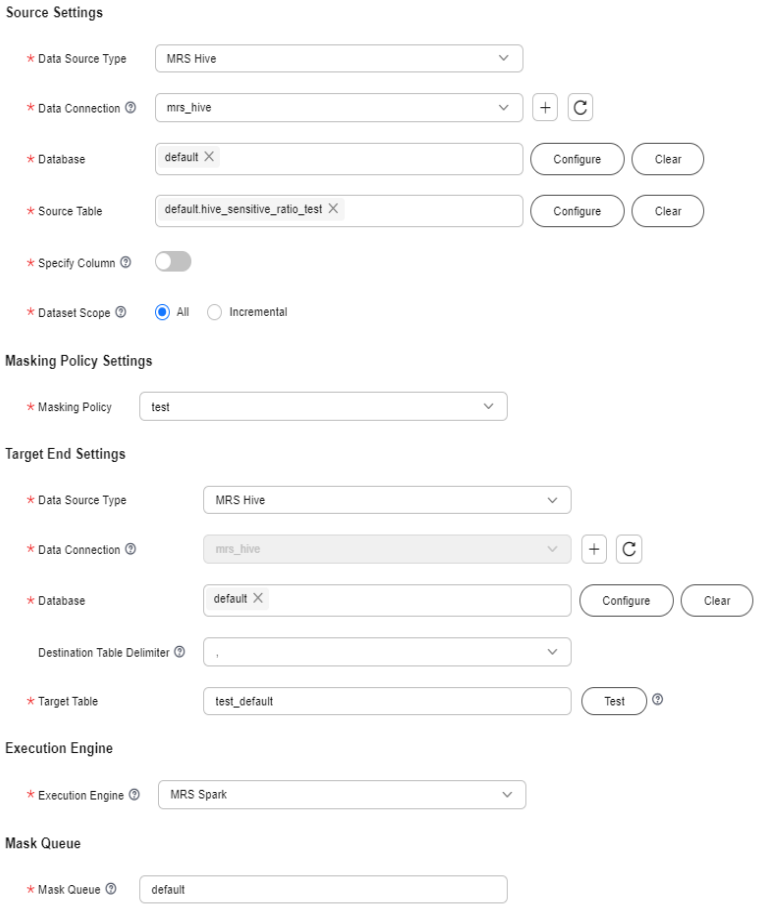
Figure 12-163 Configuring basic information



Step 4 Configure the source and destination parameters. For parameter details, see **Table 12-37**.

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Figure 12-164 Configuring the masking task



The following table lists the parameters of the masking task.

Table 12-37 Parameters of the masking task

Parameter	Description
Source Settings	
*Data Source Type	**DLI**, **DWS** and **MRS Hive** are supported.
*Data Connection	Select a data connection that has been created in Management Center. If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*SQL Queue	This parameter is mandatory if **Data Source Type** is set to **DLI**.
*Database	Click **Configure** to select the database whose data is to be masked. Data tables in the DLI default database cannot be masked.
*Source Table	Click **Configure** to select the table whose data is to be masked.

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Parameter	Description
*Specify Column	Whether to specify the columns to mask. If this function is enabled, you can configure masking algorithms for specified columns in the source table. You can configure different masking algorithms for multiple columns. **NOTE** Once saved, this option cannot be changed.
*Column	This parameter is mandatory when **Specify Column** is enabled. If you want to mask a column, you must select the column and select a masking algorithm. If you only select the masking algorithm, no column will be masked. **NOTE** • You need to select a proper static masking algorithm based on the field type of the data to be masked. Otherwise, data in the database may be abnormal. For example, if the numeric random algorithm is used to mask date fields, the data type of the fields will be forcibly converted into numeric (Hive and DLI data masking), or a write failure occurs (DWS data masking). If the hash algorithm is used to mask numeric fields, the fields will be forcibly changed to hash value strings (Hive and DLI data masking), or a write failure occurs (DWS data masking). • Before using the following masking algorithms, you must configure keys: – HMAC-SHA256 hash algorithm – DWS column encryption algorithm For more restrictions on different masking algorithms, see **Managing Masking Algorithms**.
*Dataset Scope	If **Dataset Scope** is set to **Incremental**, you can set **Time Field** to **Timestamp** or **Date**. Generally, the masking task is scheduled once if this parameter is set to **All** and is scheduled periodically if this parameter is set to **Incremental**.
*Time Field	If **Dataset Scope** is set to **Incremental**, you can set this parameter to **Timestamp** or **Date**.
Masking Policy Settings	

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Parameter	Description
*Masking Policy	This parameter is configurable only when no column is specified. Select a created masking policy from the drop-down list. **NOTE** • You need to select a proper static masking algorithm based on the field type of the data to be masked. Otherwise, data in the database may be abnormal. For example, if the numeric random algorithm is used to mask date fields, the data type of the fields will be forcibly converted into numeric (Hive and DLI data masking), or a write failure occurs (DWS data masking). If the hash algorithm is used to mask numeric fields, the fields will be forcibly changed to hash value strings (Hive and DLI data masking), or a write failure occurs (DWS data masking). • Before using the following masking algorithms, you must configure keys: – HMAC-SHA256 hash algorithm – DWS column encryption algorithm For more restrictions on different masking algorithms, see **Managing Masking Algorithms**.
Target End Settings	
*Data Source Type	Select the storage type for the masked data. **Table 12-39** lists the supported masking scenarios.
*Data Connection	Select a data connection that has been created in Management Center. If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*SQL Queue	This parameter is mandatory if **Data Source Type** is set to **DLI**.
*Database	Click **Configure** to select the database for storing the masked data. Data tables in the DLI default database cannot be masked.
*Target Table	Enter a unique table name. The table is automatically created when the table name entered does not exist. Click **Test** to check whether the target table can be used. Otherwise, you cannot proceed to the next step.
Execution Engine	
*Execution Engine	Select the engine that runs the masking task. **Table 12-39** lists the supported engines and precautions in different masking scenarios.
Masking Queue	

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Parameter	Description
* Mask Queue	Select a queue in the DLI or MRS engine. • If the execution engine is DLI, select a DLI Spark common queue. For a static masking task using the DLI engine, if the source or destination is GaussDB(DWS), enable network communications between the DLI Spark common queue and GaussDB(DWS). Otherwise, the static masking task will fail. For details, see **Configuring the Connection Between a DLI Queue and a Data Source in a Private Network** or **Configuring the Connection Between a DLI Queue and a Data Source in the Internet**. • If the execution engine is MRS, you need to enter the MRS tenant queue. To view available queues, you can click a cluster name in the cluster list on the MRS console to go to the cluster details page and click the **Tenants** tab and then the **Queue Configuration** tab.

Step 5 Click **Next** and configure scheduling.

- If **Dataset Scope** is set to **All**, **Repeat** can be only set to **Once**.
- If **Dataset Scope** is set to **Incremental**, **Repeat** can be set to **Once** or **On Schedule**.

If you set **Repeat** to **On Schedule**, set the parameters listed in **Table 12-38**.

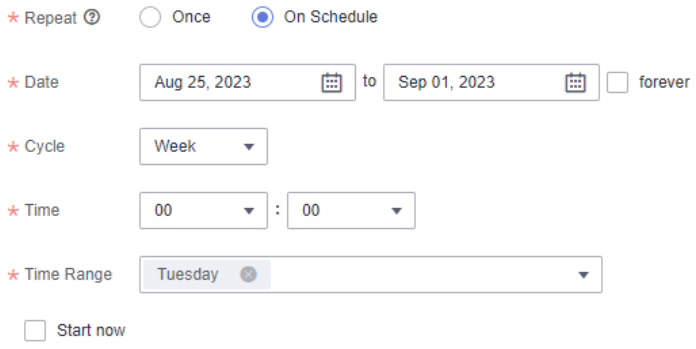
Table 12-38 Parameters for periodic scheduling

Parameter	Description
*Date	Period during which the task takes effect.
*Cycle	The frequency at which a task is executed. The options are: • **minutes**: Select the scheduling start time and end time, and set the interval in minutes. • **hours**: Select the scheduling start time and end time, and set the interval in hours. • **Day**: Set the scheduling time everyday. • **Week**: Select a day in a week and set the specific time to start scheduling. • **Month**: Select a day in a month and set the specific time to start scheduling. For example, you can set **Cycle** to **Week**, **Time** to **15:52**, and **Time Range** to **Tuesday**. In this case, the task is executed at 15:52 every Tuesday within the configured date range.

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Parameter	Description
Start now	If you select **Start now**, the task is scheduled immediately.

Figure 12-165 Setting parameters for periodic scheduling



Step 6 After all settings are complete, click **OK**.

----End

Related Operations

- Editing a task: On the **Static Masking** page, locate a task and click **Edit** in the **Operation** column.

  A task in the **Scheduling** state cannot be edited.

- Deleting tasks: On the **Static Masking** page, locate a task, click **More** in the **Operation** column, and select **Delete**. To delete multiple tasks at a time, select the tasks and click **Delete** above the task list.

  A task in the **Scheduling** state cannot be deleted.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

- Running or scheduling a task: On the **Static Masking** page, locate a task and click **Run** in the **Operation** column or click **More** in the **Operation** column and select **Start**.

  You can determine whether a task is scheduled once or repeatedly based on the scheduling period.

- Viewing running instance logs: On the **Static Masking** page, locate a task and click ⌄ to expand instances. Then click **View Log**.

  If a task fails to be executed, you can locate the failure cause based on logs, rectify the fault, and try the task again. If the fault persists, contact technical support.

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Reference: Authorizing and Binding an Agency

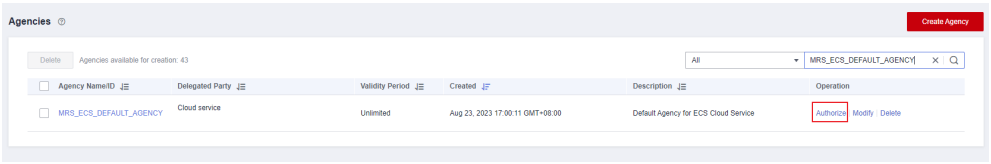
Step 1 Log in to the IAM console.

Step 2 Choose **Agencies**. In the agency list, locate the preset **MRS_ECS_DEFAULT_AGENCY** agency and click **Authorize**.

NOTE

If the preset **MRS_ECS_DEFAULT_AGENCY** agency is not found, you can buy an MRS cluster and select the **MRS_ECS_DEFAULT_AGENCY** agency in advanced settings. When the MRS cluster creation starts, the **MRS_ECS_DEFAULT_AGENCY** agency is automatically generated.

Figure 12-166 Authorizing an agency

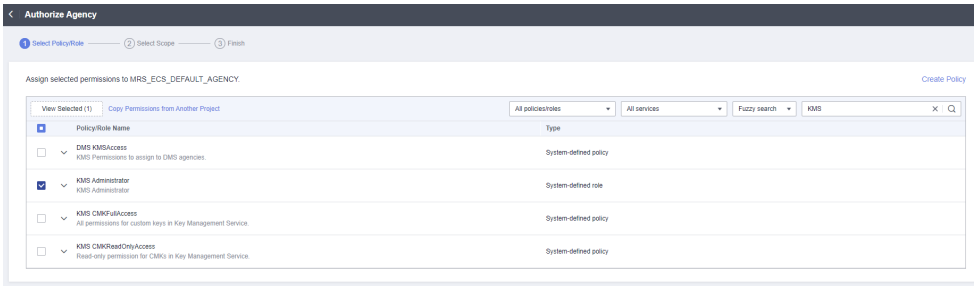


Step 3 In the search box, enter **KMS** and select the **KMS Administrator** policy.

NOTE

The minimum permission required by the **MRS_ECS_DEFAULT_AGENCY** is **kms:cmk:decrypt**. In addition to directly granting the **KMS Administrator** policy, you can create a custom policy with the **kms:cmk:decrypt** permission of the KMS on the IAM console and grant the policy to the **MRS_ECS_DEFAULT_AGENCY**.

Figure 12-167 Selecting permissions



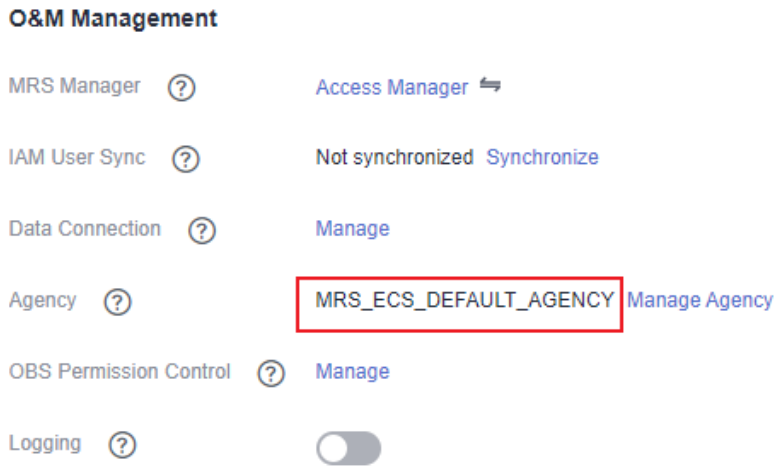
Step 4 After selecting the permission, click **Next** to set the authorization scope. In this example, retain the default settings and click **OK** to complete the authorization.

Step 5 On the MRS management console, choose **Clusters** > **Active Clusters**. Click the name of the target cluster to go to the cluster details page.

Step 6 On the **Dashboard** page, locate the **O&M Management** area and check that the cluster has been bound to the **MRS_ECS_DEFAULT_AGENCY** agency. If the cluster is not bound to the **MRS_ECS_DEFAULT_AGENCY** agency, you need to manually select the **MRS_ECS_DEFAULT_AGENCY** agency.

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Figure 12-168 Binding an agency



----End

Reference: Static Data Masking Scenarios

Table 12-39 lists the static masking scenarios supported by privacy protection.

Table 12-39 Static masking scenarios

Data Source (Source)	Data Source (Target)	Computing Engine	Description
Data Lake Insight (DLI)	Data Lake Insight (DLI)	DLI Spark common queue	None
	GaussDB(DWS)	DLI Spark common queue	• For a static masking task using the DLI engine, if the source or destination is GaussDB(DWS), enable network communications between the DLI Spark common queue and GaussDB(DWS). Otherwise, the static masking task will fail. For details, see **Configuring the Connection Between a DLI Queue and a Data Source in a Private Network** or **Configuring the Connection Between a DLI Queue and a Data Source in the Internet**.

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Data Source (Source)	Data Source (Target)	Computing Engine	Description
GaussDB(DWS)	DWS	• GaussDB(DWS) cluster • MRS cluster • DLI Spark common queue	**GaussDB(DWS) engine:** • A same-source static masking task using the GaussDB(DWS) engine does not support cross-database masking. That is, the source and destination data tables must be in the same database. **MRS engine:** • Kerberos authentication must be enabled for the MRS cluster where MRS Hive is located, and the Spark component must be installed for the MRS cluster. • For a static masking task using the MRS engine, if the source or destination is GaussDB(DWS), configure an agency for the MRS cluster by referring to **Reference: Authorizing and Binding an Agency** and ensure that the outbound rule of the MRS cluster's security group meets the following requirements. Otherwise, the static masking task will fail. – Protocol: TCP – Port: 80 – Destination: 169.254.0.0/16 **DLI engine:** • For a static masking task using the DLI engine, if the source or destination is GaussDB(DWS), enable network communications between the DLI Spark common queue and GaussDB(DWS). Otherwise, the static masking task will fail. For details, see **Configuring the Connection Between a DLI Queue and a Data Source in a Private Network** or **Configuring the Connection Between a DLI Queue and a Data Source in the Internet**.

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Data Source (Source)	Data Source (Target)	Computing Engine	Description
	MRS Hive	MRS cluster where MRS Hive is located	• Kerberos authentication must be enabled for the MRS cluster where MRS Hive is located, and the Spark component must be installed for the MRS cluster. • For a static masking task using the MRS engine, if the source or destination is GaussDB(DWS), configure an agency for the MRS cluster by referring to **Reference: Authorizing and Binding an Agency** and ensure that the outbound rule of the MRS cluster's security group meets the following requirements. Otherwise, the static masking task will fail. – Protocol: TCP – Port: 80 – Destination: 169.254.0.0/16 • For a static masking task using the MRS engine, if either the source or destination is GaussDB(DWS), the following data types are supported. If there is data of other unsupported types, the static masking task will fail. – tinyint – smallint – int – bigint – decimal – double – float – boolean – string – timestamp

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Data Source (Source)	Data Source (Target)	Computing Engine	Description
	Data Lake Insight (DLI)	DLI Spark common queue	• For a static masking task using the DLI engine, if the source or destination is GaussDB(DWS), enable network communications between the DLI Spark common queue and GaussDB(DWS). Otherwise, the static masking task will fail. For details, see **Configuring the Connection Between a DLI Queue and a Data Source in a Private Network** or **Configuring the Connection Between a DLI Queue and a Data Source in the Internet**.
MRS Hive	MRS Hive	MRS cluster where the source MRS Hive is located	• Kerberos authentication must be enabled for the MRS cluster where MRS Hive is located, and the Spark component must be installed for the MRS cluster.

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Data Source (Source)	Data Source (Target)	Computing Engine	Description
	GaussDB(DWS)	MRS cluster where MRS Hive is located	• Kerberos authentication must be enabled for the MRS cluster where MRS Hive is located, and the Spark component must be installed for the MRS cluster. • For a static masking task using the MRS engine, if the source or destination is GaussDB(DWS), configure an agency for the MRS cluster by referring to **Reference: Authorizing and Binding an Agency** and ensure that the outbound rule of the MRS cluster's security group meets the following requirements. Otherwise, the static masking task will fail. – Protocol: TCP – Port: 80 – Destination: 169.254.0.0/16 • For a static masking task using the MRS engine, if either the source or destination is GaussDB(DWS), the following data types are supported. If there is data of other unsupported types, the static masking task will fail. – tinyint – smallint – int – bigint – decimal – double – float – boolean – string – timestamp

12.5.3 Dynamic Masking Tasks

12.5.3.1 Managing Dynamic Masking Policies

After a dynamic masking policy is created in DataArts Security, the system synchronizes the policy to the data source. The data source dynamically masks

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data columns based on specified rules. When the users and user groups specified in the policy access sensitive data, the system returns the data that is dynamically masked by the data source to protect sensitive data from being disclosed.

Note that dynamic masking policies configured for a DataArts Studio instance are visible to and take effect for all the workspaces of the instance.

Prerequisites

- Before creating an MRS Hive data masking policy, ensure that:
  - An MRS Ranger data connection has been created in Management Center. For details, see **Creating a DataArts Studio Data Connection**.
  - User information has been synchronized from IAM to the data source. For details, see **Synchronizing IAM Users to the Data Source**.
- Before creating a GaussDB(DWS) data masking policy, ensure that:
  - A GaussDB(DWS) data connection has been created in Management Center. For details, see **Creating a DataArts Studio Data Connection**.
  - User information has been synchronized from IAM to the data source. For details, see **Synchronizing IAM Users to the Data Source**.
  - The CN and DN values of the **feature_support_options** parameter of the GaussDB(DWS) cluster have been changed to **enable_data_redaction**, which enables data masking for GaussDB(DWS). For details, see **Modifying Database Parameters**.
  - The account in the connection must have the GRANT permission of the target table. (By default, only the owner of a database object or system administrator can run the **GRANT** command to grant the object permissions to other users.)
- MRS Hive and GaussDB(DWS) dynamic masking policies are associated with specified users or user groups on data sources. Therefore, if you want to use the current user for identity authentication to make the dynamic masking policies take effect during script execution and job tests in DataArts Factory, you must enable fine-grained authentication by referring to **Enabling Fine-grained Authentication**.
- If you want to view sensitive fields during the creation of a data masking policy, you need to create a sensitive data discovery task in advance and change the statuses of sensitive data fields to valid on the **Sensitive Data Distribution** page. For details, see **Discovering Sensitive Data** and **Viewing Sensitive Data Distribution**.

Constraints

- Only the DAYU Administrator, Tenant Administrator, or data security administrator can create, modify, or delete dynamic masking policies. Other common users do not have permission to perform these operations.
- MRS Hive and GaussDB(DWS) dynamic masking policies are associated with specified users or user groups on data sources. Therefore, if you want to use the current user for identity authentication to make the dynamic masking policies take effect during script execution and job tests in DataArts Factory, you must enable fine-grained authentication by referring to **Enabling Fine-grained Authentication**.

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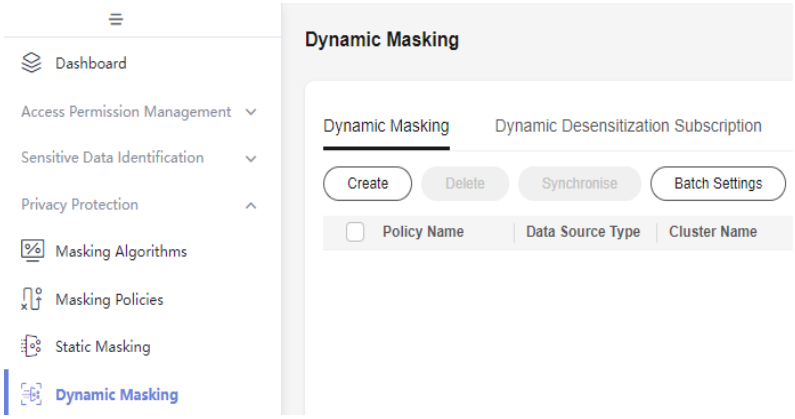
- Dynamic masking policies are only available for MRS Hive and GaussDB(DWS) data sources.
- A table can be associated with only one dynamic data masking policy. Policies take effect only after they are synchronized successfully.
- During dynamic masking of MRS Hive data, MRS Ranger allows you to configure different rules for the same column, and the rules are matched in the sequence of their configuration time. Therefore, you can configure multiple masking policies for different content in the same cluster, database, table, and column.
- **Table 12-41** lists the masking rules supported by the MRS service. For Chinese characters, only null and hash masking are supported. If other masking methods are selected, masking does not take effect.
- GaussDB(DWS) dynamic masking is unavailable for GaussDB(DWS) logical clusters. Before masking data, enable GaussDB(DWS) dynamic masking by changing the CN and DN values of parameter **feature_support_options** to **enable_data_redaction**. For details, see **Modifying Database Parameters**. In addition, ensure that the user in the GaussDB(DWS) data connection has the GRANT permission on the table to be masked. (By default, after a database object is created, only the object owner or system administrator can run the **GRANT** command to grant the object permissions to other users.)
- **Table 12-42** lists the masking rules supported by GaussDB(DWS). Chinese characters cannot be masked. If you mask data that contains Chinese characters, garbled characters may be displayed.

Creating a Dynamic Masking Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Dynamic Masking**.

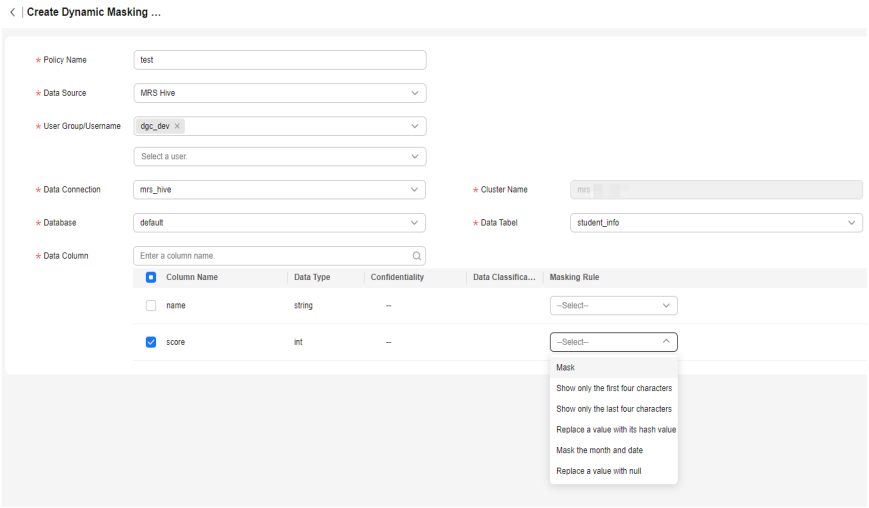
Figure 12-169 Dynamic Masking



Step 3 Click **Create** and set the parameters listed in **Table 12-40**.

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Figure 12-170 Setting parameters for the dynamic masking policy



The following table lists the parameters.

Table 12-40 Policy parameters

Parameter	Description
*Policy Name	Unique identifier of the dynamic masking policy. It must be unique in a DataArts Studio instance. To facilitate policy management, you are advised to include the object to be masked and masking rule in the name.
*Data Source Type	Currently, only **MRS Hive** and **DWS** are supported.
MRS Hive	
*User Group/ Username	User or user group in the current workspace members. When a specified object queries or exports sensitive data from DataArts Factory, the system dynamically masks the sensitive data to protect the sensitive data from being disclosed.
*Data Connection	If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*Cluster Name	You do not need to set this parameter. The data source cluster in the data connection is automatically selected.
*Database	Database where the sensitive data is stored
*Data Table	Data table where the sensitive data is stored

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Parameter	Description
*Data Column	Select one or more columns to be masked and select a proper masking rule for each column based on the data type. Supported data masking rules vary depending on the data type of each data source. For details, see **Reference: Dynamic Masking Rules**. If sensitive data discovery has been performed on the selected columns and the statuses of the sensitive data fields are valid, the data security levels and classifications are displayed in the **Data Column** area.
DWS	
*User Group/ Username	User or user group in the current workspace members. When a specified object queries or exports sensitive data from DataArts Factory, the system dynamically masks the sensitive data to protect the sensitive data from being disclosed.
*Data Connection	If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*Cluster Name	You do not need to set this parameter. The data source cluster in the data connection is automatically selected.
*Database	Database where the sensitive data is stored
*schema	Schema where the sensitive data is stored
*Data Table	Data table where the sensitive data is stored
*Data Column	Select one or more columns to be masked and select a proper masking rule for each column based on the data type. Supported data masking rules vary depending on the data type of each data source. For details, see **Reference: Dynamic Masking Rules**. If sensitive data discovery has been performed on the selected columns and the statuses of the sensitive data fields are valid, the data security levels and classifications are displayed in the **Data Column** area.

Step 4 After setting all required parameters, click **OK**. After the dynamic masking policy is created, you need to click **Synchronize** to synchronize the policy to the data source.

----End

Related Operations

- Synchronizing a policy: On the **Dynamic Masking** page, locate a policy and click **Synchronize** in the **Operation** column to synchronize the policy to the data source. To synchronize multiple policies, select them and click **Synchronize** above the list.

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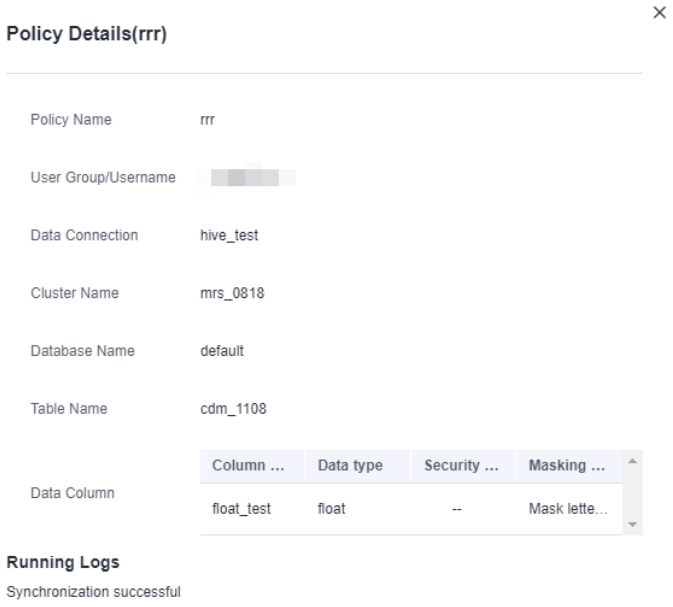
Policies take effect only after they are synchronized successfully. If the policy synchronization fails, you can view the policy run log in the **policy details** to locate the failure cause. After rectifying the fault, synchronize the policy again. If the synchronization still fails, contact technical support.

- Editing a policy: On the **Dynamic Masking** page, locate a policy and click **Edit** in the **Operation** column.
- Deleting policies: On the **Dynamic Masking** page, locate a policy and click **Delete** in the **Operation** column. In the displayed dialog box, confirm the policy to delete and click **Yes**. To delete multiple policies, select them and click **Delete** above the list.

  NOTE

  Deleted dynamic masking policies are moved to the recycle bin. You can restore them within 30 days. After 30 days, they will be deleted permanently. For details, see **Managing the Recycle Bin**.
- Viewing policy details: On the **Dynamic Masking** page, locate a policy and click its name to view its details. You can also filter policies by **Sync Status**.

Figure 12-171 Viewing policy details



Reference: Dynamic Masking Rules

- MRS Hive dynamic masking rules are provided by MRS Ranger. **Table 12-41** lists the supported rules.
- GaussDB(DWS) dynamic masking rules are provided by GaussDB(DWS). **Table 12-42** lists the supported rules.

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Table 12-41 MRS dynamic masking rules

Data Type	Mask Letters and Digits	Show Only the Last Four Characters	Show Only the First Four Characters	Replace a Value with Its Hash Value	Mask the Month and Date	Replace a Value with Null
TINYINT	The number of characters remains unchanged. All values are replaced with 1.	No change. The maximum value is 127.	No change. The minimum value is –128.	The value changes to null.	The number of characters remains unchanged. All values are replaced with 1.	The value changes to null.
SMALLINT	The number of characters remains unchanged. All values are replaced with 1.	No change. The maximum value is 12767.	No change. The maximum value is –32768.	The value changes to null.	The number of characters remains unchanged. All values are replaced with 1.	The value changes to null.
INT	The number of characters remains unchanged. All values are replaced with 1.	The last four characters are shown.	The first four characters are shown.	The value changes to null.	The number of characters remains unchanged. All values are replaced with 1.	The value changes to null.

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Data Type	Mask Letters and Digits	Show Only the Last Four Characters	Show Only the First Four Characters	Replace a Value with Its Hash Value	Mask the Month and Date	Replace a Value with Null
BIGINT	The number of characters remains unchanged. All values are replaced with 1.	The last four characters are shown.	The first four characters are shown.	The value changes to null.	The number of characters remains unchanged. All values are replaced with 1.	The value changes to null.
BOOLEAN	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.
FLOAT	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.
DOUBLE	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.
STRING	Letters change to x, and digits change to n.	Chinese characters remain unchanged, and letters change to X.	Letters change to X.	The value changes to its hash value of 64 bytes.	Chinese characters remain unchanged with each character occupying one digit, and letters change to X.	The value changes to null.
TIMESTAMP	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.	The value changes to null.

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Data Type	Mask Letters and Digits	Show Only the Last Four Characters	Show Only the First Four Characters	Replace a Value with Its Hash Value	Mask the Month and Date	Replace a Value with Null
CHAR	Letters change to x, and digits change to n.	Letters and digits change to X, and the last four characters are retained (a fixed length with spaces).	Letters and digits change to X, and the first four characters are retained (a fixed length with spaces).	The value changes to its hash value of 64 bytes.	Chinese characters remain unchanged with each character occupying one digit, and letters change to X.	The value changes to null.
VARCHAR	Letters change to x, and digits change to n.	The last four characters are retained (Chinese characters remain unchanged with each character occupying one digit), and letters change to X.	The first four characters are retained (Chinese characters remain unchanged with each character occupying one digit), and letters change to X.	The value changes to its hash value of 64 bytes.	Chinese characters remain unchanged with each character occupying one digit, and letters change to X.	The value changes to null.
DATE	The date changes to 0001-01-01.	The date changes to 0001-01-01.	The date changes to 0001-01-01.	The value changes to null.	The year is retained, and other values change to 01.	The value changes to null.

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Table 12-42 GaussDB(DWS) dynamic masking rules

Data Type	Replace All Characters with Asterisks (*)	Retain Last Four Characters and Replace Others with Asterisks (*)	Retain First Two Characters and Replace Others with Asterisks (*)	Custom
Character bpchar, varchar, text, inet, macaddr, uuid, char, txt	All characters are replaced by null.	The last four characters are retained, and the other characters are replaced with asterisks (*).	The first two characters are retained, and the other characters are replaced with asterisks (*).	The start and end positions, as well as masking characters are customized.
Value numeric, int2, int8, money, float8, float4, interval, decimal, double precision, real, integer, smallint, bigint	All characters are replaced by 0.	Not supported	Not supported	The start and end positions, as well as masking characters are customized.
Time timestamp, time, timetz, timestamptz, date, time without time zone, timestamp without time zone, time without time zone, timestamp without time zone	All characters are replaced by a fixed value.	Not supported	Not supported	The year, month, or day can be masked as needed.
Other	All characters are replaced by a fixed value.	Not supported	Not supported	Not supported

12.5.3.2 Subscribing to Dynamic Masking Policies

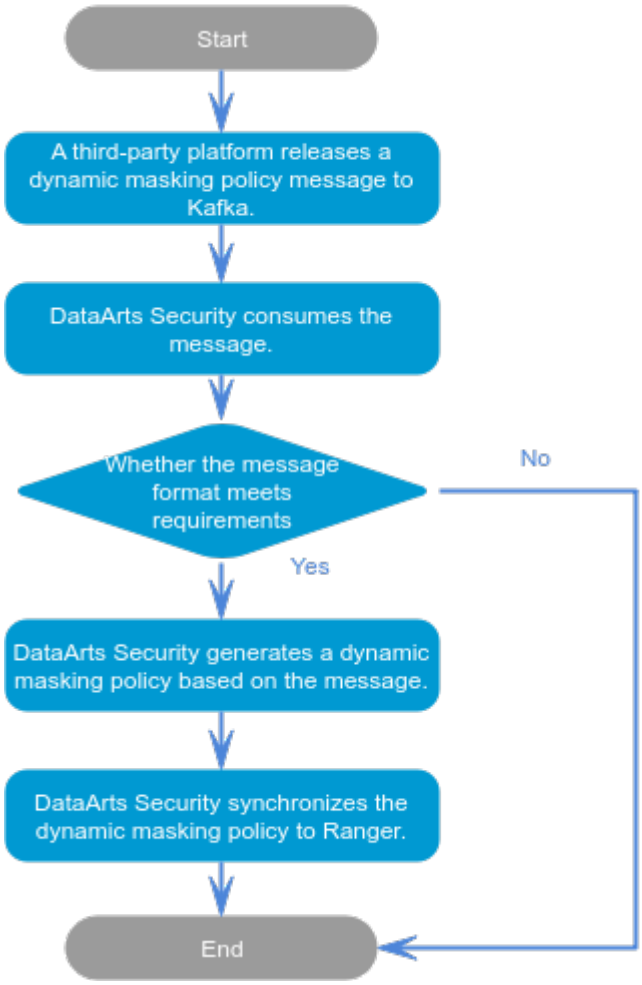
You can synchronize dynamic masking policies from third-party platforms by subscribing to the policies.

After dynamic masking policies of third-party platforms are released to Kafka message queues, you can subscribe to and consume them in DataArts Security. If the message format meets requirements, DataArts Security generates a dynamic

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masking policy (whose name is the policy name in the Kafka message) and synchronizes the policy to the MRS Ranger component to make the policy take effect.

Figure 12-172 Dynamic masking policy subscription process



Note that dynamic masking subscriptions configured for a DataArts Studio instance are visible to and take effect for all the workspaces of the instance.

Prerequisites

- A dynamic masking policy of a third-party platform has been released to the Kafka message queue, and the message format meets requirements. For details, see **Reference: Kafka Message Format Requirements**.
- An MRS Kafka data connection has been created in Management Center. For details, see **Creating a DataArts Studio Data Connection**. The Kafka must be the Kafka where the third-party platform releases a message. The account in the data connection must have the permissions of the **kafkaadmin** user group.

Constraints

- Only the DAYU Administrator, Tenant Administrator, or data security administrator can create, edit, start, stop, or synchronize dynamic masking

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subscription tasks. Other common users do not have permission to perform these operations.

- You can only subscribe to the dynamic masking policies for MRS Hive on third-party platforms. The dynamic masking policies support only the masking rules supported by DataArts Security. The following rules are not supported: Custom/Show First x and Last y Characters and Custom/Mask First x and Last y Characters. For details, see **Table 12-41**.
- The name of the dynamic masking policy generated by the subscription is the policy name in the Kafka message. DataArts Security does not allow duplicate policy names. Ensure that no dynamic masking policy name is the same as any policy name in the Kafka message.
- After the dynamic masking policy generated by the subscription is synchronized to Ranger, the policy name is **dlsMasking-***Database name*-*Table name*-*Column name*. Ranger does not allow duplicate policy names. Ensure that no existing policy name in Ranger is the same as the name of any generated policy.
- During dynamic masking subscription, DataArts Security uses the MRS cluster in the subscription task and the database, table, and column in the Kafka message dynamic masking policy to identify a dynamic masking policy. If a dynamic masking policy for the same table column in the same cluster's database already exists in the message queue or DataArts Security, the policy is skipped and will not be generated.
- DataArts Security can consume a Kafka message only if the message format meets the requirements described in **Reference: Kafka Message Format Requirements**.
  - If the Kafka message does not meet the message format requirements, the system records a synchronization failure message log and continues to consume the next message. The final status is partially failed or synchronization failed.
  - If the Kafka message is valid but fails to be consumed due to network resource issues, the consumption will be retried three times at intervals of 4, 6, and 9 seconds. If the message still fails to be consumed, a log will be recorded and the scheduling will be terminated.
  - If the Kafka message is valid and consumed properly, but a policy fails to be generated or synchronized to Ranger, the system records a synchronization failure message log and continues to consume the next message. The final status is partially failed or synchronization failed.
  - A maximum of 16 MB of failed Kafka messages can be stored.

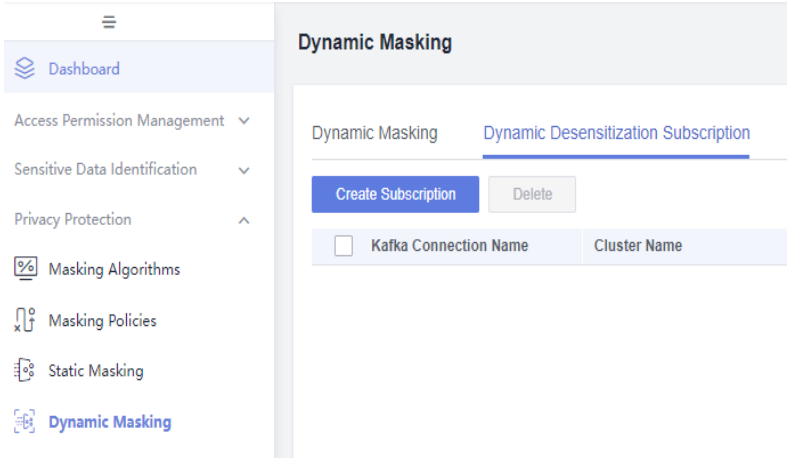
Subscribing to Dynamic Masking Policies

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Dynamic Masking**. On the displayed page, click the **Dynamic Desensitization Subscription** tab.

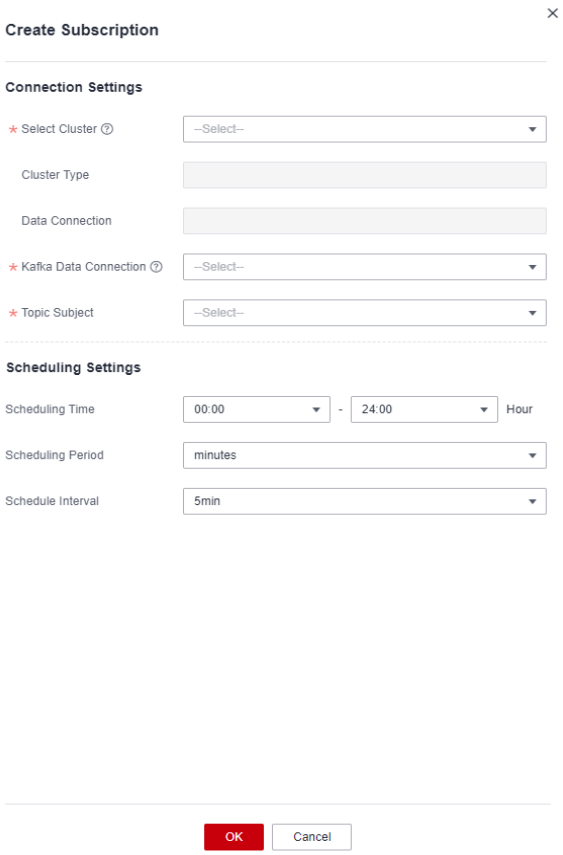
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Figure 12-173 Dynamic Desensitization Subscription tab



Step 3 Click **Create Subscription**. In the displayed slide-out panel, set the parameters listed in **Table 12-43**.

Figure 12-174 Parameters for creating a subscription



The following table lists the parameters for creating a dynamic masking subscription.

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Table 12-43 Parameters

Parameter	Description
Connection Settings	
*Select Cluster	Select the cluster to which a dynamic masking policy of a third-party platform will be synchronized. Currently, a policy cannot be synchronized to multiple clusters. If you want to do so by creating multiple subscription tasks, Kafka messages will fail to be consumed due to duplicate policy names.
Cluster Type	You do not need to set this parameter. The system automatically sets it based on the cluster you select. Currently, policies can only be synchronized to an MRS cluster.
Data Connection	You do not need to set this parameter. The system automatically sets it based on the cluster you select.
*Kafka Data Connection	Select the MRS Kafka connection created in **Prerequisites**. The Kafka must be the Kafka where the third-party platform releases a message. The account in the Kafka connection must have the permissions of the **kafkaadmin** user group.
*Topic Subject	Select the topic of the Kafka message released for the dynamic masking policy of the third-party platform. A topic in the same MRS cluster can correspond to only one subscription task.
Scheduling Settings	
Scheduling Time	Select the time period every day during which tasks will be scheduled. Set an appropriate time period based on the number of messages. Currently, it takes about two seconds to consume and synchronize a piece of data.
Scheduling Period	Set whether to schedule tasks by hour or minute.
Schedule Interval	Select the interval at which tasks are scheduled.

Step 4 After setting all required parameters, click **OK**. Then click **Start** to start task scheduling.

----End

Related Operations

- Starting or stopping a subscription task: On the **Dynamic Desensitization Subscription** tab page, locate a subscription task and click **Start** or **Stop** in the **Operation** column.

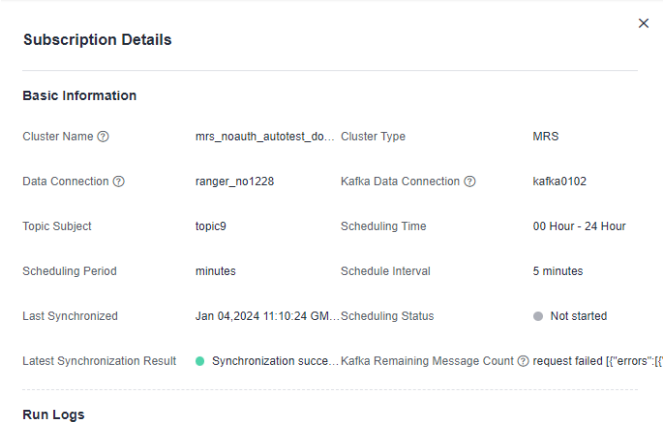
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- Editing a subscription task: On the **Dynamic Desensitization Subscription** tab page, locate a subscription task, click **More** in the **Operation** column, and select **Edit**.
- Deleting subscription tasks: On the **Dynamic Desensitization Subscription** tab page, locate a subscription task, click **More** in the **Operation** column, and select **Delete**. To delete multiple tasks, select them and click **Delete** above the task list.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.
- Synchronizing a subscription task: On the **Dynamic Desensitization Subscription** tab page, locate a subscription task, click **More** in the **Operation** column, and select **Synchronize**. After that, DataArts Security consumes the message, generates a policy, and synchronizes the policy to Ranger.
- Viewing subscription task details: On the **Dynamic Desensitization Subscription** tab page, locate a task, and click **Details** in the **Operation** column to view the task details.

Figure 12-175 Viewing task details



Reference: Kafka Message Format Requirements

Dynamic masking policies of third-party platforms need to be released to a Kafka message queue, and the message format must meet requirements. The following is a message template with parameters.

```
{
  "mask_policy_template":
  {
      "create_time":1692839884000  //Synchronization time
      "name":" task1", //Name of the dynamic masking policy, which cannot be the same as the name of any existing dynamic masking policy
      "database": "1", //Database name
      "table": "1", //Data table name
      "column": "1", //Field name
      "column_type":"int", //Field type
      "data_level": "1", //Field security level, which is optional
```

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```
    "algorithm_config": {
      "name": "MASK", //Dynamic masking rule name, which can be MASK, MASK_SHOW_LAST_4,
MASK_SHOW_FIRST_4, MASK_HASH, MASK_DATE_SHOW_YEAR, or MASK_NULL
      "type": "MASK", //Type of the dynamic masking rule, which is MASK
      "description": "Mask letters and digits.", //Description of the dynamic masking rule
    },
    "datasource_type":"HIVE", //Data source type, which can only be Hive
    "users":"aaa,bbb",  //Masking users
    "user_groups":"ggg"  //Masking user groups
    "description":{
        "jdbc_url": "hive2://xxx" //Custom description, which is contained in a failure message
    }
  }
}
```

12.5.4 Data Watermarks

12.5.4.1 Embedding Data Watermarks

This section describes how to embed data watermarks. Data watermarking applies to the following scenarios:

- Data forwarding process standardization

  Unauthorized users need to be approved when they forward data from enterprises for external usage. After the approval, the watermark technology is used to generate files that can be used outside enterprises.

- Digital right protection

  To associate databases with their owners, embed watermarks representing ownerships in relational databases. In this way, enterprises' digital rights can be protected.

- Quick source tracing of leaked data

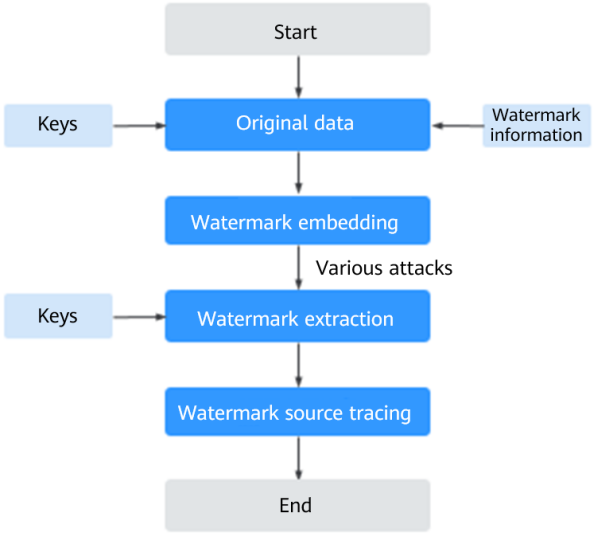
  To locate security vulnerabilities, unseal the leaked data files, check whether watermarks exist based on the file integrity and watermark traces, and identify watermark information such as data source addresses, distribution units, owners, and distribution time.

Watermark Use Process

Figure 12-176 shows the process of using watermarks.

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Figure 12-176 Watermark use process



Constraints

- Only the MRS Doris and MRS Hive data sources support data watermark tasks.
- Watermarks cannot be embedded into a primary key.
- If a watermark is embedded in a numeric integer field, the data may be modified. Embed watermarks into a field whose value can be changed.
- If **Dataset Scope** is set to **Incremental** for a data watermark embedding task, **Timestamp** or **Date** needs to be selected for **Time Field**.
- For the MRS Doris data source, watermarks can be embedded only into fields of the string type, including Varchar, Text, and String. Ensure that the table into which watermarks are to be embedded contains fields of the string type.
- To embed watermarks into the MRS Doris data source, you need to prepare an MRS cluster that contains the Hadoop, Spark, and Yarn components. The MRS cluster is used to run the watermark embedding task.

Prerequisites

An MRS Hive or MRS Doris connection has been created. For details, see **Creating a DataArts Studio Data Connection**.

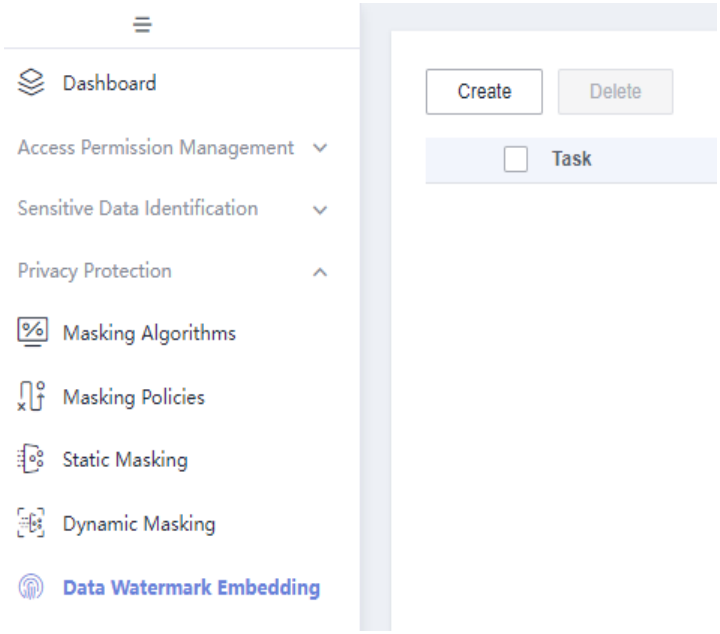
Creating a Data Watermark Embedding Task

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Data Watermark Embedding** from the left navigation bar, and click **Create** in the upper part of the displayed page.

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Figure 12-177 Creating a data watermark embedding task



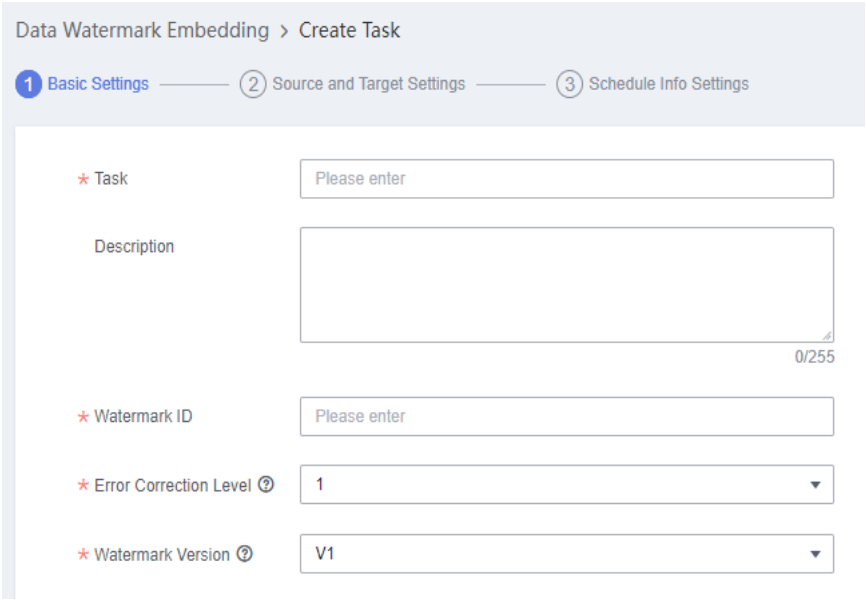
Step 3 In the displayed dialog box, set the parameters listed in **Table 12-44**.

Table 12-44 Basic settings

Parameter	Description
*Task	Name of the watermark embedding task. The name can only contain letters, digits, underscores (_), and hyphens (-), and can contain a maximum of 64 characters. To facilitate the management of the watermark embedding task, you are advised to include the object into which you want to embed the watermark and the watermark ID in the name.
Description	A description of the task
*Watermark ID	Watermark ID that will be embedded by the system into data tables. The watermark ID can contain a maximum of 16 characters.
*Error Correction Level	The higher the level, the more bits of watermark information, and the lower bit error rate during source tracing. Note that a higher error correction level requires a larger amount of data to ensure the integrity of embedded information. The default value is **1**.
*Watermark Version	**V1**: Watermarks depend on primary keys, and the embedding speed is fast. If primary keys are attacked, source tracing may fail. **V2**: Watermarks do not depend on primary keys. They are related only to embed columns. The embedding speed is slow and the robustness is enhanced.

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Figure 12-178 Configuring basic information



Step 4 Click **Next** to configure the source and target end parameters listed in **Table 12-45**.

Table 12-45 Source and target end parameters

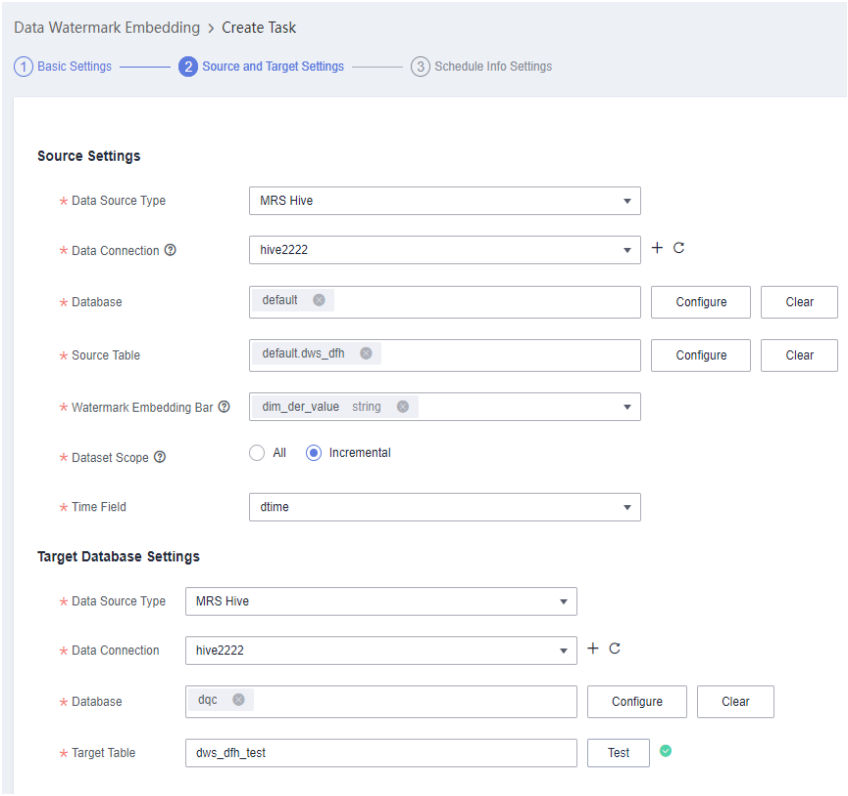
Parameter	Description
Source Settings	
*Data Source Type	Currently, the value can only be **MRS Hive**.
*Data Connection	Select a data connection. If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*HTTP/HTTPS Port	This parameter is required for the MRS Doris data source. To obtain the port, perform the following operations: Log in to MRS FusionInsight Manager of the Doris cluster, choose **Cluster** > **Services** > **Doris**, and click **Configurations**. If Kerberos authentication is enabled for the cluster, enter the value of **https_port** for this parameter. Otherwise, enter the value of **http_port** for this parameter.
*Database	Select the databases and tables into which you want to embed the watermark. • Click **Configure** to select databases and tables. • Click **Clear** to delete the selected databases and data tables.
*Source Table	

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Parameter	Description
*Watermark Embedding Bar	Select a field type from the drop-down list as the embedding bar. For example, the value can be a number or a character. Note that when **Watermark Version** is set to **V1**, the primary key column cannot be selected.
*Dataset Scope	If **Dataset Scope** is set to **Incremental**, you can set **Time Field** to **Timestamp** or **Date**. Generally, the watermark embedding task is scheduled once if this parameter is set to **All** and is scheduled periodically if this parameter is set to **Incremental**.
*Time Field	If **Dataset Scope** is set to **Incremental**, you can set this parameter to **Timestamp** or **Date**.
Target End Settings	
*Data Source Type	Currently, the value can only be **MRS Hive**.
*Data Connection	Select a data connection. If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*HTTP/HTTPS Port	This parameter is required for the MRS Doris data source. To obtain the port, perform the following operations: Log in to MRS FusionInsight Manager of the Doris cluster, choose **Cluster** > **Services** > **Doris**, and click **Configurations**. If Kerberos authentication is enabled for the cluster, enter the value of **https_port** for this parameter. Otherwise, enter the value of **http_port** for this parameter.
*Database	Select the database where the watermark table is stored from the drop-down list.
*Target Table	Enter a unique table name. The table is automatically created when the table name entered does not exist. Click **Test**. Otherwise, the next operation is not allowed.

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Figure 12-179 Configuring source and target information



Step 5 Click **Next** and configure scheduling.

- If **Dataset Scope** is set to **All**, **Repeat** can be only set to **Once**.
- If **Dataset Scope** is set to **Incremental**, **Repeat** can be set to **Once** or **On Schedule**.

If you set **Repeat** to **On Schedule**, set the parameters listed in **Table 12-46**.

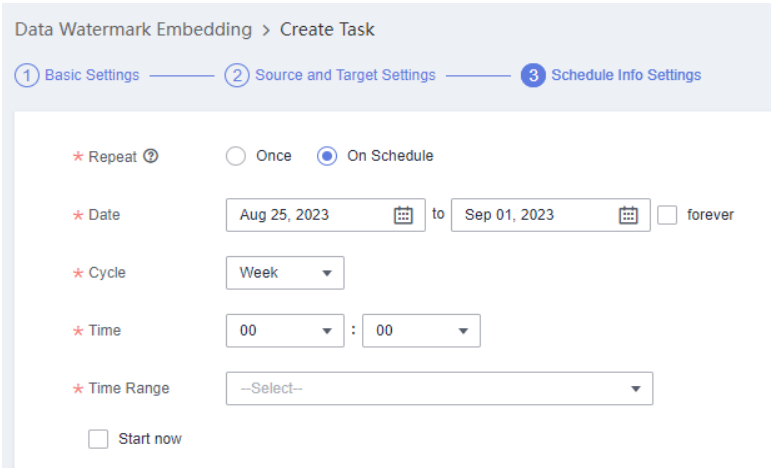
Table 12-46 Parameters for periodic scheduling

Parameter	Description
*Date	Period during which the task takes effect.

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Parameter	Description
*Cycle	The frequency at which a task is executed. The options are: • **minutes**: Select the scheduling start time and end time, and set the interval in minutes. • **hours**: Select the scheduling start time and end time, and set the interval in hours. • **Day**: Set the scheduling time everyday. • **Week**: Select a day in a week and set the specific time to start scheduling. • **Month**: Select a day in a month and set the specific time to start scheduling. For example, you can set **Cycle** to **Week**, **Time** to **15:52**, and **Time Range** to **Tuesday**. In this case, the task is executed at 15:52 every Tuesday within the configured date range.
Start now	If you select **Start now**, the task is scheduled immediately.

Figure 12-180 Configuring scheduling



Step 6 Click **OK**.

----End

Related Operations

- Editing a task: On the **Data Watermark Embedding** page, locate a task and click **Edit** in the **Operation** column.

  A task in the **Scheduling** state cannot be edited.
- Deleting tasks: On the **Data Watermark Embedding** page, locate a task, click **More** in the **Operation** column, and select **Delete**. To delete multiple tasks at a time, select the tasks and click **Delete** above the task list.

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A task in the **Scheduling** state cannot be deleted.

NOTE

The deletion operation cannot be undone. Exercise caution when performing this operation.

- Running or scheduling a task: On the **Data Watermark Embedding** page, locate a task and click **Run** in the **Operation** column or click **More** in the **Operation** column and select **Start**.

  You can determine whether a task is scheduled once or repeatedly based on the scheduling period.

- Viewing running instance logs: On the **Data Watermark Embedding** page, locate a task and click to expand instances. Then click **View Log**.

  If a task fails to be executed, you can locate the failure cause based on logs, rectify the fault, and try the task again. If the fault persists, contact technical support.

12.5.4.2 Tracing Data Using Watermarks

This section describes how to use watermarks to trace leaked data in files.

DataArts Security provides users with the source tracing function to accurately trace the leaked data. Users can check whether watermarks exist based on the leaked data file integrity and watermark traces, identify watermark traces, and accurately locate the security issues and find the personnel or departments accountable for the leakage problem.

Prerequisites

- After obtaining the leaked data file, a CSV (Comma-Separated Values) file whose size does not exceed 20 MB has been generated and saved to the local host.
- A data watermark embedding task has been created. For details, see **Embedding Data Watermarks**.

Notes and Constraints

- Watermarks can only be used to trace data in files no larger than 20 MB.
- To trace data accurately, ensure the integrity and correctness of the data. The first column of the target table data file cannot be empty, and the file should contain more than 5,000 data records.

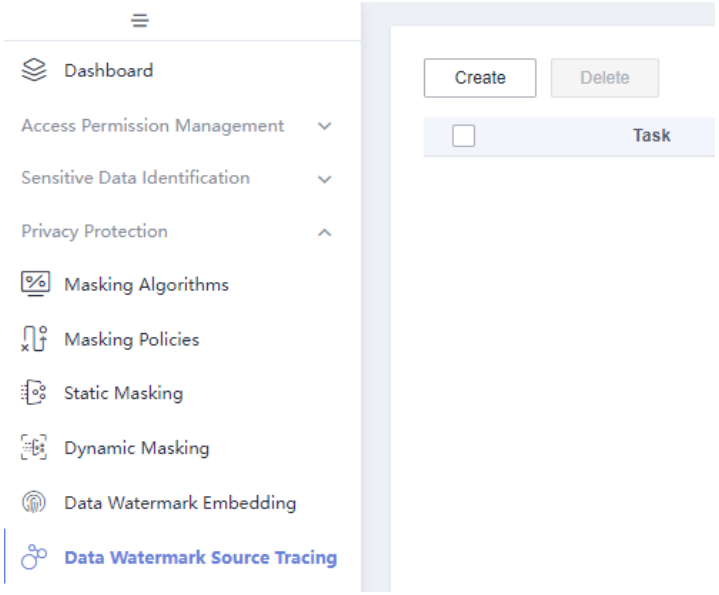
Creating a Data Watermark Source Tracing Task

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 Choose **Data Watermark Source Tracing** from the left navigation bar, and click **Create** in the upper part of the displayed page.

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Figure 12-181 Creating a source tracing task



Step 3 In the displayed dialog box, set the parameters listed in **Table 12-47**.

Figure 12-182 Creating a source tracing task

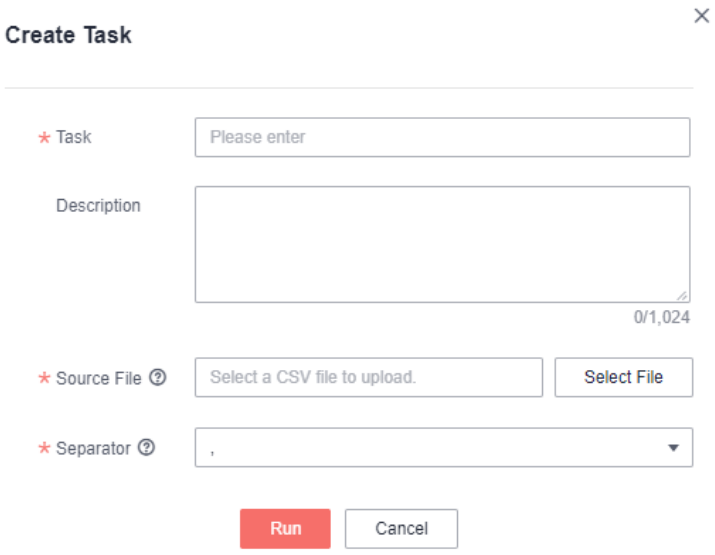


Table 12-47 Parameters

Parameter	Description
Task	The name of the watermark task to be created. Task names can include only letters, numbers, underscores (_), and hyphens (-), and cannot exceed 64 characters.

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Parameter	Description
Description	A description of the task. The description can contain a maximum of 1,024 characters.
Source File	CSV file generated from the leaked data file. The file cannot be larger than 20 MB.
Separator	Select a separator from the drop-down list based on the uploaded CSV file. The options are **Comma (,)**, **Tab**, **Vertical bar (|)**, and **Semicolon (;)**. By default, **Comma (,)** is selected.

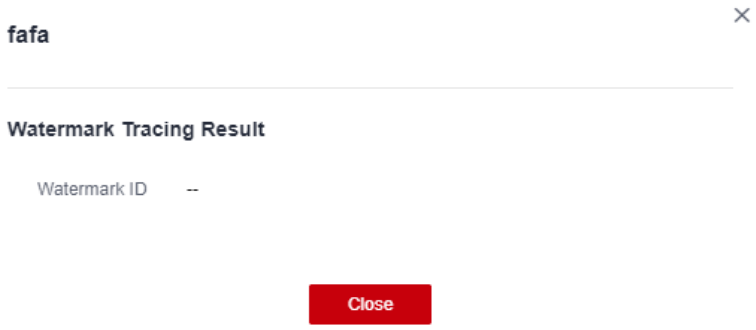
Step 4 After all settings are complete, click **Run**.

----End

Related Operations

- Viewing the source tracing result: On the **Data Watermark Source Tracing** page, locate a task and click **View Result** in the **Operation** column. Source tracing results are displayed only for the tasks that have been successfully executed.

  Figure 12-183 Source tracing result

- Deleting tasks: On the **Data Watermark Source Tracing** page, locate a task and click **Delete** in the **Operation** column. To delete multiple tasks at a time, select the tasks and click **Delete** above the task list.

  A task in the **Scheduling** state cannot be deleted.

  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

12.5.5 File Watermarks

This section describes the following operations on file watermarks:

- Insert invisible watermarks into structured data files (CSV, XML, and JSON files) and extract the watermarks.

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- Insert visible watermarks into unstructured data files (DOCX, PPTX, XLSX, and PDF files) and open the files on a local host to view the watermarks.

Constraints

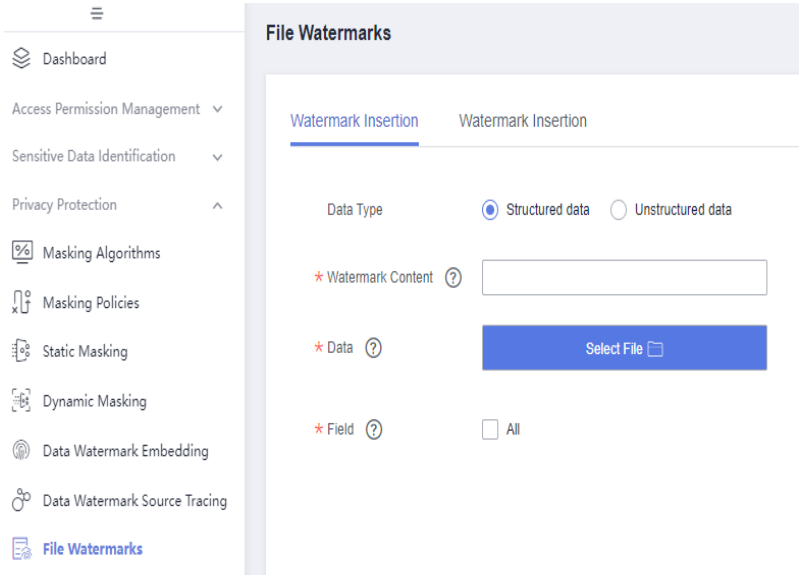
- Invisible watermarks can be inserted into and extracted from structured data files that are no longer than 4 MB.
- Visible watermarks can be inserted into unstructured data files that are no longer than 20 MB.
- Watermarks cannot be injected into files that already contain watermarks.
- The data in structured data files into which watermarks are to be inserted must meet the following requirements:
  - The source data must contain 5,000 or more lines. If the source data contains less than 5,000 lines, watermarks may fail to be extracted due to insufficient features.
  - You are advised to select a column with various data values. If all the values of the column can be enumerated, the extraction may fail due to insufficient features. Common columns that can be embedded with watermarks include the address, name, UUID, amount, and total amount.
  - If a watermark is inserted into a numeric integer field, the data may be modified. Insert watermarks into a field whose value can be changed.
- Watermark extraction from structured data files is irrelevant to the source tracing tasks using data watermarks. Only users under the same account can extract watermarks from structured data files into which watermarks have been inserted by following the instructions in **Inserting a Watermark** or **Dynamic Watermarks**.

Inserting a Watermark

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **File Watermarks**.

Figure 12-184 Accessing the File Watermarks page



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Step 3 Set the parameters listed in **Table 12-48**.

Table 12-48 Parameters for inserting a watermark

Parameter	Description
*Data Type	Select a file type. • **Structured data**: CSV, XML, and JSON. You can insert an invisible watermark into a file and extract the watermark. • **Unstructured data**: DOCX, PPTX, XLSX, and PDF You can insert a visible watermark into a file and open the file to view the watermark.
Structured data	
*Watermark Content	Watermark ID that will be embedded by the system into data tables. The watermark ID can contain a maximum of 16 characters.
*Data	CSV, XML, or JSON files are supported.
*Field	Fields into which the watermark is to be inserted.
Unstructured data	
*Watermark Content	Watermark ID that will be embedded by the system into data tables. The watermark ID can contain a maximum of 16 characters.
Transparency	Transparency of the plaintext watermark
Rotation Angle	Rotation angle of the plaintext watermark
Font Size	Font size of the plaintext watermark
*Data	DOCX, PPTX, XLSX, and PDF files are supported.

Step 4 Click **Insert Watermark**. The browser automatically downloads the inserted file.

You can click **Reset** to restore the parameters to default settings.

----End

Extracting a Watermark

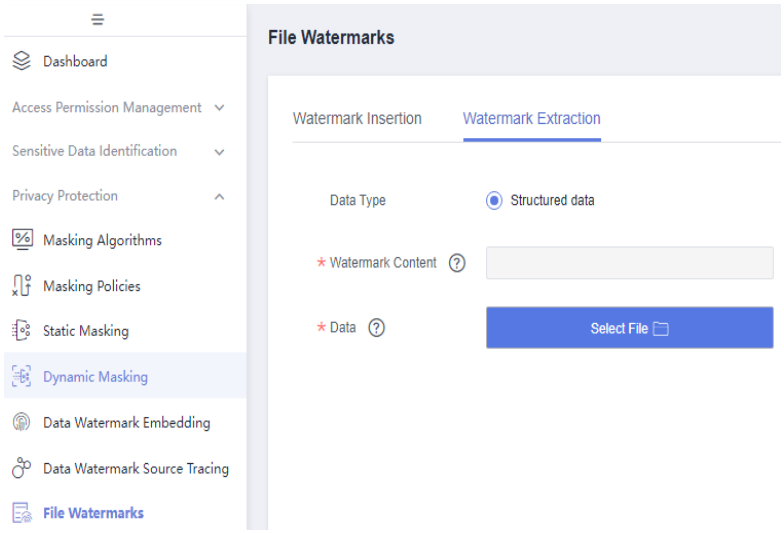
You can extract invisible watermarks that have been inserted into structured data files in CSV, XML, or JSON format. For details about watermark insertion, see **Inserting a Watermark**.

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **File Watermarks**. In the right pane, click the **Watermark Extraction** tab.

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Figure 12-185 Accessing the Watermark Extraction page



Step 3 Set the parameters listed in **Table 12-49**.

Table 12-49 Parameters for extracting a watermark

Parameter	Description
*Data Type	File type. Only CSV, XML, and JSON are supported. You can insert an invisible watermark into a file of any preceding type and extract the watermark.
*Watermark Content	You do not need to set this parameter. The extracted watermark will be automatically displayed.
*Data	Select the structured data file in CSV, XML, or JSON format into which an invisible watermark has been inserted based on **Inserting a Watermark**.

Step 4 Click **Extract Watermark**. The extracted watermark is displayed in the **Watermark Content** parameter.

You can click **Reset** to restore the parameters to default settings.

----End

12.5.6 Dynamic Watermarks

Dynamic watermarking means dynamically inserting watermarks into the result sets returned by data query and access requests. This section describes how to enable dynamic watermarking for DataArts Factory so that data watermarks can be dynamically inserted during the dump or download of sensitive data in DataArts Factory.

After data development dynamic watermarking is enabled for DataArts Security and a dynamic watermarking policy is created, when a user group or role specified in the policy dumps or downloads sensitive data in DataArts Factory, DataArts

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Factory injects an invisible watermark into the sensitive data to protect it from being disclosed.

> **NOTE**
>
> The invisible watermark is the first 16 digits of the IAM user ID of the user who obtains sensitive data. To obtain the user ID, perform the following steps:
>
> 1. Register with and log in to the management console.
> 2. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list.
> 3. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.

Note that dynamic watermarking policies configured for a DataArts Studio instance are visible to and take effect for all the workspaces of the instance.

Prerequisites

An MRS Hive or MRS Spark connection has been created.

Constraints

- Only the DAYU Administrator, Tenant Administrator, or data security administrator can enable or disable dynamic watermarking for DataArts Factory. The workspace administrator can create dynamic watermarking policies. Other common users do not have the permission to perform these operations.
- Dynamic watermarking policies are only available for MRS Hive and MRS Spark data sources.
- Adding, deleting, or modifying a dynamic watermarking policy takes about five minutes to take effect.
- A watermark will be inserted only when more than 500 rows of data are to be dumped or downloaded. If there are less than 500 rows of data, source tracing will be impossible even if a watermark is inserted.

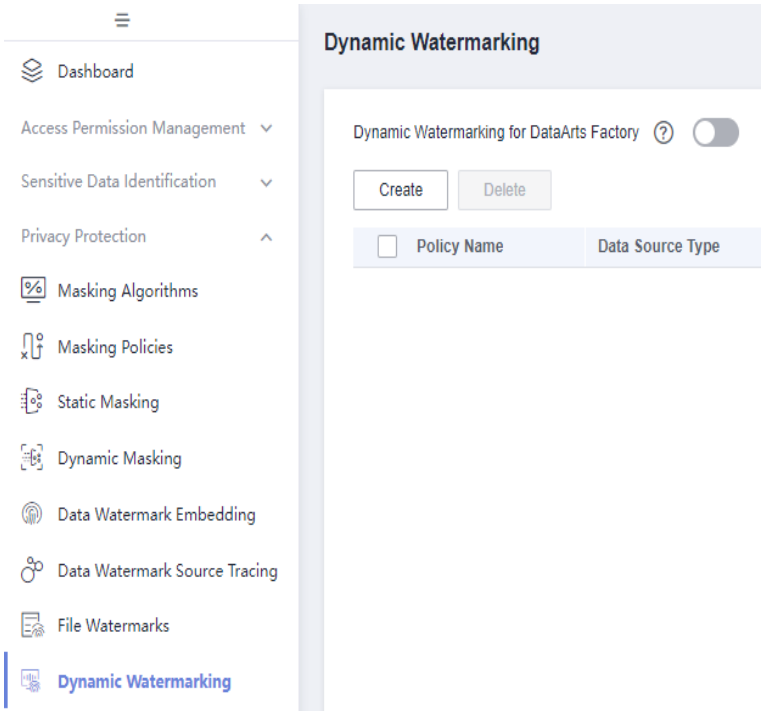
Creating a Dynamic Watermarking Policy

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Dynamic Watermarking**.

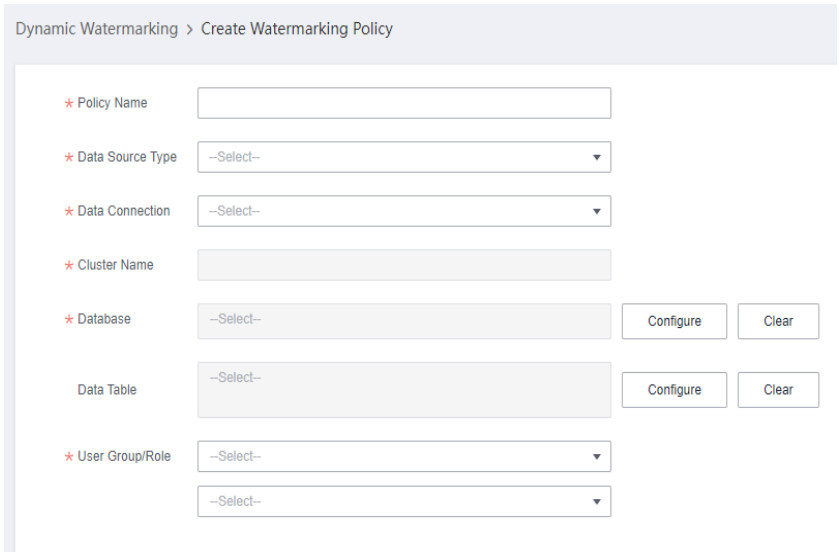
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Figure 12-186 Accessing the Dynamic Watermarking page



Step 3 Click  to enable dynamic watermarking for DataArts Factory. Click **Create** and set the parameters listed in **Table 12-50**.

Figure 12-187 Setting parameters for the dynamic watermarking policy



The following table lists the parameters.

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Table 12-50 Policy parameters

Parameter	Description
*Policy Name	Unique identifier of the dynamic watermarking policy. It must be unique in a DataArts Studio instance. To facilitate policy management, you are advised to include the object to be watermarked and the watermark to be added in the name.
User Group/ Role	User, user group, or role in the current workspace members. When a specified object queries or exports sensitive data from DataArts Factory, the system adds a dynamic watermark to the sensitive data to protect the sensitive data from being disclosed.
*Data Source Type	Select **MRS Hive** or **MRS Spark**.
*Data Connection	If no data connection is available, create one by referring to **Creating a DataArts Studio Data Connection**.
*Cluster Name	You do not need to set this parameter. The data source cluster in the data connection is automatically selected.
*Database	Databases where the sensitive data is stored.
*Data Table	Tables where the sensitive data is stored. You need to set one of the following table selection modes:

Step 4 After setting all required parameters, click **OK**.

----End

Related Operations

- Extracting a watermark: After obtaining the CSV data file containing a dynamic watermark from DataArts Factory, trace the watermark by referring to **Extracting a Watermark**.
- Editing a policy: On the **Dynamic Watermarking** page, locate a policy and click **Edit** in the **Operation** column.
- Setting the policy status: A watermarking policy is enabled by default. If the watermarking policy is disabled, it does not take effect.

  To change the status of a watermarking policy, click  or  to enable or disable the policy.
- Deleting policies: On the **Dynamic Watermarking** page, locate a policy and click **Delete** in the **Operation** column. To delete multiple policies, select them and click **Delete** above the list.

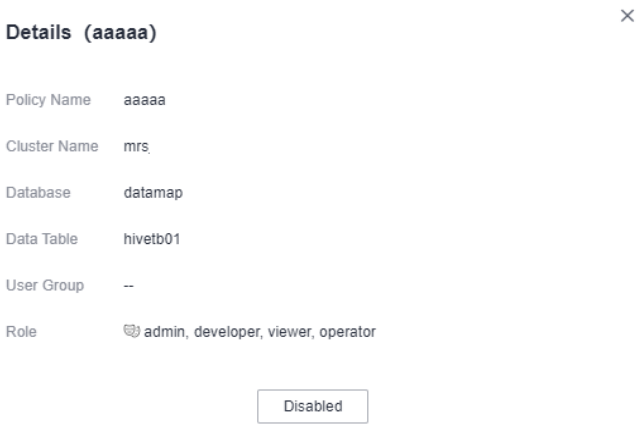
  NOTE

  The deletion operation cannot be undone. Exercise caution when performing this operation.

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- Viewing policy details: On the **Dynamic Watermarking** page, locate a policy and click its name to view its details.

  Figure 12-188 Viewing policy details



12.6 Data Security Operations

12.6.1 Viewing Audit Logs

DataArts Security provides detailed data operation logs for GaussDB(DWS), DLI, and Hive data sources. The logs contain the time, users, objects, and types of operations. Based on these logs, you can quickly audit data operations and better manage data security.

Prerequisites

- To audit access to MRS Hive data sources, ensure that the following conditions are met:
  - The CDM cluster used as the agent in the MRS Hive data connection is of version 2.10.0.300 or later.
  - The user in the MRS Hive data connection must meet the following conditions:
    - It is assigned a role that has at least the cluster resource management permission. (You can directly assign the default Manager_operator role to the user.)
    - A Hive user group has been configured for the user.
- To audit access to GaussDB(DWS) data sources, ensure that the following conditions are met:
  - The audit function has been enabled for GaussDB(DWS) clusters.

    The audit function is enabled by default. If it is disabled, set **audit_enabled** to **ON** by following the instructions in **Modifying Database Parameters**.

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  - The items to be audited have been enabled.

    For details about GaussDB(DWS) audit items and how to enable them, see **Configuring the Database Audit Logs**.
  - For the GaussDB(DWS) data source, if separation of duties is disabled, users with the SYSADMIN attribute can view audit records by default. If separation of duties is enabled, only users with the AUDITADMIN attribute can view audit records. Therefore, ensure that the account in the data connection or the current user has the preceding permissions. (Before enabling fine-grained authentication, use the account in the data connection to view audit records. If fine-grained authentication is enabled, use the current IAM user to view audit records.)

Constraints

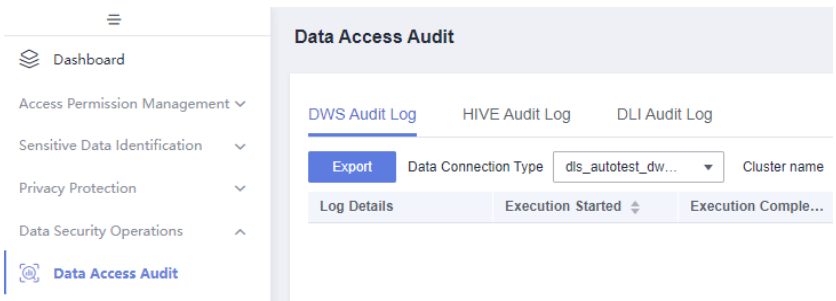
- For the GaussDB(DWS) data source, you need to manually enable the audit function and audit items for the GaussDB(DWS) cluster for data access audit. If separation of duties is disabled, users with the SYSADMIN attribute can view audit records by default. If separation of duties is enabled, only users with the AUDITADMIN attribute can view audit records. Therefore, you must ensure that the account of the data connection or the current account has the preceding permissions. (If fine-grained authentication is disabled, you can use the account of the data connection to view audit records. If fine-grained authentication is enabled, you can use the current IAM user to view audit records.)
- For MRS data, viewing the audit data depends on the agent (CDM cluster) version in the data connection. Ensure that the CDM cluster version is 2.10.0.300 or later. The user in the MRS Hive data connection must meet the following conditions:
  - It is assigned a role that has at least the cluster resource management permission. (You can directly assign the default Manager_operator role to the user.)
  - A Hive user group has been configured for the user.

Viewing Data Access Logs

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Data Access Audit**.

Figure 12-189 Data Access Audit

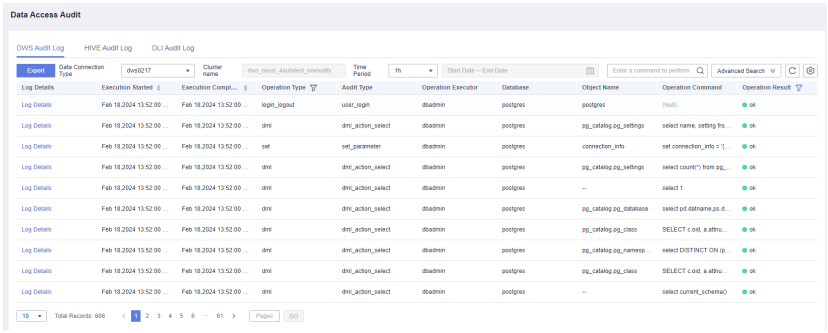


Step 3 You can switch between tabs to view the audit logs of different data sources. By default, logs generated in the last one hour are displayed. You can customize the time range, which can be up to one month.

- DWS audit log: The log list uses the latest DWS data connection by default. Click **Log Details** to view information about a log.

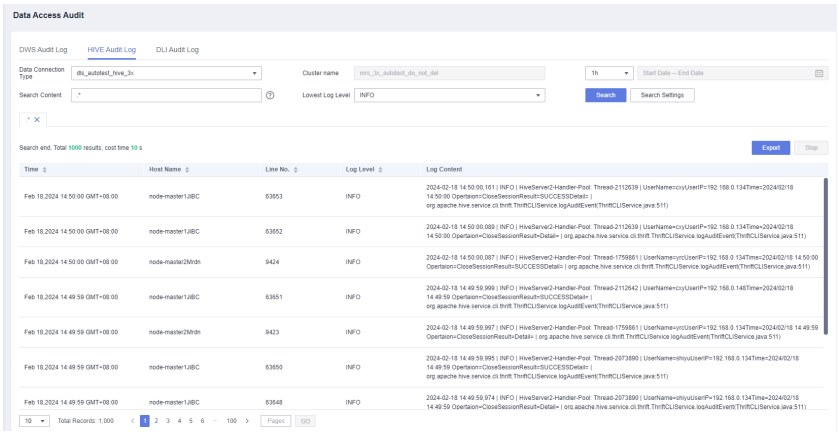
  Click **Export** to export DWS audit logs on the current page in JSON format.

  Figure 12-190 DWS audit logs

- MRS Hive audit logs: By default, the MRS Hive log list does not display log content. You can search for logs based on conditions. The search results are displayed by tab page. A maximum of five tab pages of search results can be displayed.

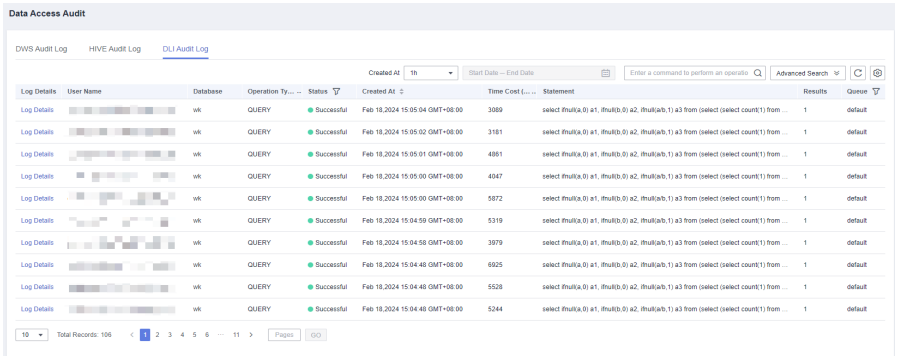
  Figure 12-191 MRS Hive audit logs

- DLI audit logs: By default, the DLI log list displays log information. Click **Log Details** to view information about a log.

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Figure 12-192 DLI audit logs



----End

12.6.2 Diagnosing Data Security Risks

Data security diagnosis can help you diagnose data security capabilities and provide rectification suggestions and solutions for you based on the diagnosis result. In this way, you can quickly establish a basic data security system to ensure data security and reliability.

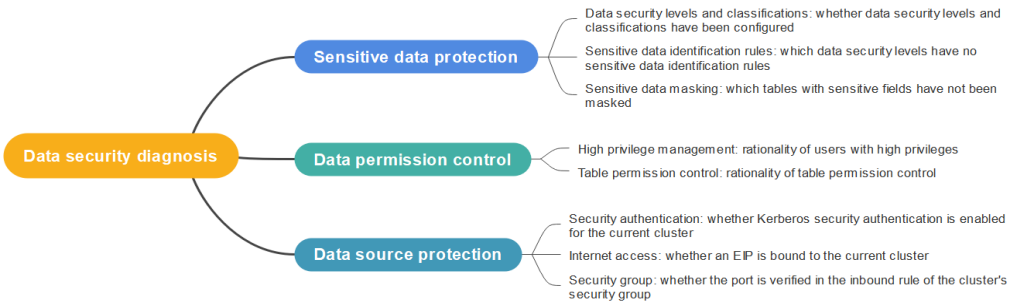
Constraints

- Currently, only the security of the MRS data source can be diagnosed.
- The timeout duration of a scanning task for security diagnosis is one hour.
- For the data permission control diagnosis item, the workspace administrator and security administrator only collect statistics of users, but not of user group members.

Diagnosing Data Security Risks

Data security diagnosis supports three diagnosis items: sensitive data protection, data permission control, and data source protection. For details, see **Figure 12-193**.

Figure 12-193 Data security diagnosis



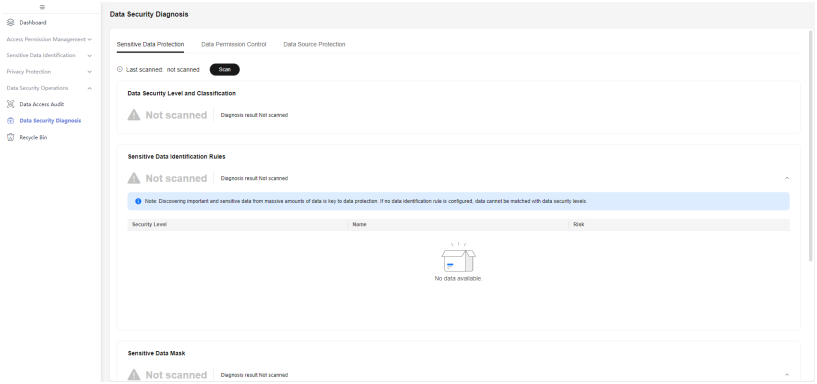
You are advised to scan data at least once a month to ensure data security and reliability. The procedure of diagnosing data security risks is as follows:

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Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the navigation pane on the left, choose **Data Security Diagnosis**.

Figure 12-194 Data Security Diagnosis

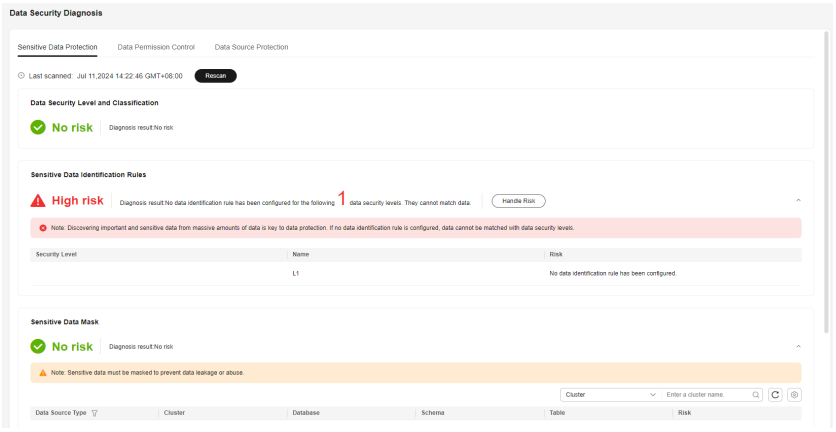


Step 3 Click the **Sensitive Data Protection**, **Data Permission Control**, or **Data Source Protection** tab, and click **Scan** or **Rescan**.

Step 4 After the scan is complete, identify risky items based on the scan result and handling suggestions and click **Handle Risk** to ensure data security and reliability.

You are advised to handle medium and high security risks as soon as possible. The following figure shows the risk level and diagnosis result of a check item on the **Sensitive Data Protection** page.

Figure 12-195 Security diagnosis result



----End

12.7 Managing the Recycle Bin

The recycle bin allows you to restore key data of DataArts Security that has been deleted by mistake. The key data includes permission set–related resources (workspace permission sets, permission sets, and common roles), dynamic masking policies, and keys. The key data is determined by the importance, use frequency, and restoration difficulty of data.

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Prerequisites

Permission set–related resources (workspace permission sets, permission sets, and common roles), dynamic masking policies, or keys have been deleted in the last 30 days.

Notes and Constraints

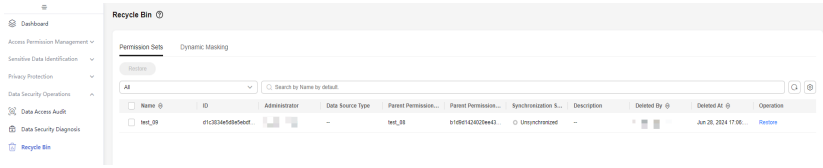
- Only the DAYU Administrator, Tenant Administrator, and data security administrator can restore data.
- Managed MRS roles are existing roles in MRS data and are not defined in DataArts Security, so they will not be moved to the recycle bin when deleted.
- After permission set–related resources and dynamic masking policies are deleted and moved to the recycle bin, their synchronization statuses will become unsynchronized. After they are restored from the recycle bin, they must be synchronized so that they can take effect.
- Data in the recycle bin can be retained for a maximum of 30 days. Deleted data will be permanently cleared after a 30-day retention period.
- A maximum of 1,000 permission sets, dynamic masking policies, or keys can be retained in the recycle bin of an instance. If that limit is exceeded, the oldest permission sets or dynamic masking policies will be automatically cleared first, on a first-in-first-out basis.
- If **Name Conflict Strategy** is set to **Add a timestamp to each name** during data restoration and the name of the data to be restored already exists, a timestamp will be added to the name of the data to be restored. That is, the name of the restored data is in ***Original name_13-digit timestamp*** format. If the name of the data to be restored with the timestamp contains more than 64 characters, the original name will be truncated to ensure that the name of the data to be restored contains no more than 64 characters.
- When you restore a permission set that was deleted by mistake from the recycle bin, the association between permission sets will be checked. If certain conditions are not met, the permission set cannot be restored. For example, if the parent permission set of a permission set has been deleted, the permission set can be restored only after its parent permission set is restored.
- A maximum of 20 data records can be restored at a time.

Restoring Data in the Recycle Bin

Step 1 On the DataArts Studio console, locate a workspace and click **DataArts Security**.

Step 2 In the left navigation pane, choose **Recycle Bin**.

Figure 12-196 Recycle Bin page

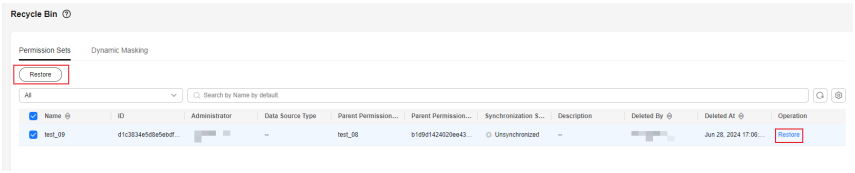


Step 3 On the **Recycle Bin** page, you can view and restore deleted permission set–related resources (workspace permission sets, permission sets, and common roles), dynamic masking policies, or keys.

The operations for restoring different types of data are similar. In the following operations, permission sets are used as an example to describe how to restore data.

Step 4 On the **Permission Sets** page, locate the permission set you want to restore and click **Restore** in the **Operation** column. Alternatively, select the permission sets you want to restore and click **Restore** above the list to restore the permission sets.

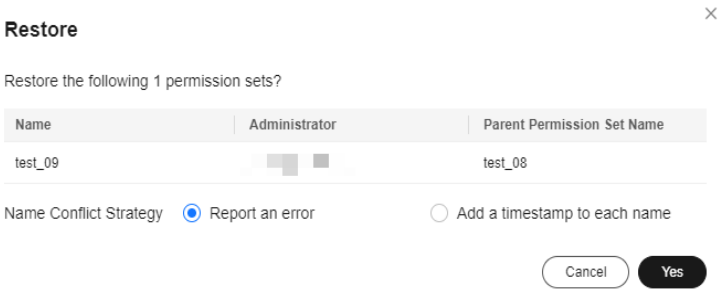
Figure 12-197 Restoring data



Step 5 In the displayed dialog box, set **Name Conflict Strategy** to avoid a conflict between the restored data and existing data. Then click **Yes**.

- **Report an error**: If the name of the data to be restored already exists, an error will be reported and the data will not be restored.
- **Add a timestamp to each name**: If the name of the data to be restored already exists, a timestamp will be added to the name. That is, the name of the data to be restored is in ***Original name_13-digit timestamp*** format. If the name of the data to be restored with the timestamp contains more than 64 characters, the original name will be truncated to ensure that the name of the data to be restored contains no more than 64 characters.

Figure 12-198 Setting Name Conflict Strategy



Step 6 After restoring workspace permission sets, permission sets, common roles, or dynamic masking policies, check them on corresponding pages and synchronize them to make them take effect.

----End

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13 DataArts DataService

13.1 Overview

DataArts Studio DataArts DataService aims to build a unified data service bus for enterprises to centrally manage internal and external API services. DataArts DataService helps you quickly generate data APIs based on data tables and allows you manage the full lifecycle of APIs, covering API publishing, management, and O&M. With DataArts DataService, you can implement microservice aggregation, frontend-backend separation, and system integration, and provide functions and data for partners and developers easily and quickly at a low cost and risk.

DataArts DataService has the following advantages over other data sharing and exchange methods:

- Unified interface standards reduce the workload for interconnection with upper-layer applications.
- Data logic is deployed on the data platform and is therefore decoupled from the application logic. This reduces repeated development of data models and avoids frequent changes caused by data logic adjustment.
- Data logic-related storage and compute resources are deployed on the data platform, reducing resource consumption on applications.
- A large amount of detailed and sensitive data is inaccessible to applications. In addition, DataArts DataService improves data security by means of API review and publishing, authentication and throttling, and dynamic anonymization.

DataArts DataService encapsulates data logic into RESTful APIs of a unified standard that can be used to access data. DataArts DataService applies to quick response to the requests for accessing a small amount of data. To open a large amount of data, you are advised to adopt data sharing and exchange or other solutions.

Publishing an API

To publish an API or a group of APIs, do as follows:

1. **Buying and Managing an Exclusive Cluster**

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If you want to use DataArts DataService, you must buy a DataArts DataService Exclusive cluster.

2. **Creating a Reviewer in DataArts DataService**

   Before creating an API, you need to create a reviewer.

3. **Creating an API**

   You can **generate** an API. An API can be generated using **configuration** or **a script/MyBatis**.

4. **Debugging an API**

   Debug the created API on the management console to check whether it runs properly.

5. **Publishing an API**

   The API can be called only after it is published.

6. **Managing APIs**

   You can manage the published API as needed.

7. **Orchestrating an API**

   API orchestration allows you to reorganize and reconstruct APIs in a visualized manner based on specific service logic and processes without compiling code. In this way, you can perform secondary development easily without affecting native APIs.

8. **(Optional) Configuring a Throttling Policy**

   To ensure the stability of backend services, you can perform throttling on the API.

9. **(Optional) Authorizing an API**

   An app defines the identity of an API caller. An API that uses app or IAM authentication must be authorized so that the authentication information for calling the API can be obtained.

Calling an API

To call an API, perform the following operations:

1. Obtain an API.

   Obtain the API from the service catalog. An API can be called only after it is published.

2. **Applying for API Authorization**

   If you are an API developer and want to call an API which uses app or IAM authentication, you must apply for API authorization.

3. **Calling the API**.

   After completing the preceding steps, you can call the API.

Overview Page

On the **Overview** page, you can view various monitoring data views. The **Overview** page displays information about APIs and apps.

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Figure 13-1 API-based data statistics



Table 13-1 API-based data statistics

Category	Metric	Description
Data overview	Published	Number of APIs that have been published
	Developing	Number of APIs that are being developed
	Applications	Number of apps authorized by published APIs
	Total calls	Number of calls to the APIs in all clusters over the last seven days (excluding the current day)
	Successful	Number of successful API calls
	Failed	Number of failed API calls
	Valid	Number of valid API calls. Valid API calls refer to the calls that pass the verification.
	Invalid	Number of invalid API calls. Invalid API calls refer to the calls that fail to pass the verification due to incorrect request parameters.
Trend chart	APIs Called	Trend of the number of API calls in one or all clusters during a specified time period. • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Cluster dimension: one cluster or all clusters • Number of calls: total number of calls, number of successful/failed calls, or number of valid/invalid calls

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Category	Metric	Description
	APIs Published	Trend of the number of API publishing times in a specified time period • Time period: today, this week, this month, or this year
Top 5 statistics	Top 5 APIs by Call Rate	Top 5 APIs by call rate in one or all clusters during a specified time period • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Cluster dimension: one cluster or all clusters • Rate: success rate, failure rate, validity rate, or invalidity rate
	Top 5 APIs by Call Duration	Top 5 APIs by call duration in one or all clusters during a specified time period • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Cluster dimension: one cluster or all clusters • Duration: average duration, average duration of successful calls, or average duration of failed calls
	Top 5 APIs by Call Quantity	Top 5 APIs by the number of calls in one or all clusters during a specified time period. (If an API is authorized to different apps, the number of calls made by those apps to the API is counted together.) • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Cluster dimension: one cluster or all clusters • Number of calls: total number of calls, number of successful/failed calls, or number of valid/invalid calls
	Top 5 by Call Quantity	Top 5 APIs by the number of calls in one or all clusters during a specified time period. (If an API is authorized to different apps, the number of calls made by those apps to the API is counted separately.) • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Cluster dimension: one cluster or all clusters • Number of calls: total number of calls, number of successful/failed calls, or number of valid/invalid calls

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Figure 13-2 App-based data statistics



Table 13-2 App-based data statistics

Category	Metric	Description
Data overview	Completed	Number of apps authorized by all APIs
	Total calls	Number of calls to the APIs (that use app or IAM authentication) in all clusters over the last seven days (excluding the current day)
	Successful	Number of successful calls to APIs that use app or IAM authentication.
	Failed	Number of failed calls to APIs that use app or IAM authentication.
	Valid	Number of valid calls to APIs that use app or IAM authentication. Valid API calls refer to the calls that pass the verification.
	Invalid	Number of invalid calls to APIs that use app or IAM authentication. Invalid API calls refer to the calls that fail to pass the verification due to incorrect request parameters.
Trend chart	APIs Called	Trend of the number of calls to APIs that use app or IAM authentication in all clusters during a specified time period. • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Number of calls: total number of calls, number of successful/failed calls, or number of valid/invalid calls

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Category	Metric	Description
Top 5 statistics	Top 5 Apps by Call Rate	Top 5 APIs (using app or IAM authentication) by call rate in all clusters during a specified time period • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Rate: success rate, failure rate, validity rate, or invalidity rate
	Top 5 Apps by Call Duration	Top 5 APIs (using app or IAM authentication) by call duration in all clusters during a specified time period • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Duration: average duration, average duration of successful calls, or average duration of failed calls
	Top 5 Apps by Call Quantity	Top 5 APIs (using app or IAM authentication) by the number of calls in all clusters during a specified time period. (If an API is authorized to different apps, the number of calls made by those apps to the API is counted together.) • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Number of calls: total number of calls, number of successful/failed calls, or number of valid/invalid calls
	Top 5 by Call Quantity	Top 5 APIs (using app or IAM authentication) by the number of calls in all clusters during a specified time period. (If an API is authorized to different apps, the number of calls made by those apps to the API is counted separately.) • Time period: last 12 hours, last 1 day, last 7 days, or last 30 days • Number of calls: total number of calls, number of successful/failed calls, or number of valid/invalid calls

13.2 Specifications

Specifications of Exclusive DataArts DataService

Table 13-3 lists the specifications of DataArts DataService Exclusive.

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Table 13-3 Specifications of Exclusive DataArts DataService

Instance	Max. APIs That Can Be Published	Delay (Unit: ms)
Small	500	<20
Medium	1,000	<15
Large	2,000	<10

Specifications of API Return Data

DataArts DataService is applicable to interactions involving a small amount of data, and is not applicable to returning a large amount of data through APIs. The following table lists the specifications of the data returned by DataArts DataService APIs.

Table 13-4 Restrictions on the number of data records returned by an API

API Category	Scenario	Data Source	Default Number of Data Records
Configuration	Debugging	DLI/ MySQL/RDS/DWS	10
	Call	DLI/ MySQL/RDS/DWS	100
Script	Test SQL	N/A	10
	Debugging	DLI	• Default pages: 100 • Custom pages: 1,000
		MySQL/RDS/DWS	• Default pages: 10 • Custom pages: 2,000
	Call	DLI	• Default pages: 100 • Custom pages: 1,000
		MySQL/RDS/DWS	• Default pages: 10 • Custom pages: 2,000

13.3 Developing APIs in DataArts DataService

13.3.1 Buying and Managing an Exclusive Cluster

This topic describes how to buy an exclusive DataArts DataService instance. You can create an API in Exclusive DataArts DataService and use it to provide services only after the instance is available.

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NOTICE

To create or delete an exclusive cluster or change API quotas, you must have either of the following accounts:

- DAYU Administrator with the VPCEndpoint Administrator permission
- Tenant Administrator with the VPCEndpoint Administrator permission

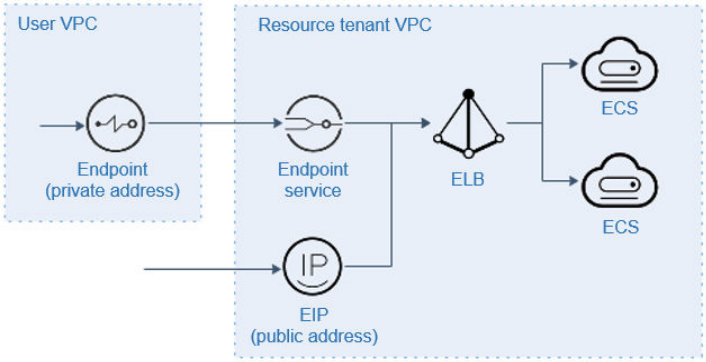
Network Environment Preparation

After a DataArts DataService exclusive cluster is created, resources are located in the resource tenant zone. ELB performs load balancing for the nodes in the cluster.

After creating an exclusive cluster, you can access APIs in the cluster in the following ways:

- Private address: IP address of the VPC endpoint. This method is available by default.
- Public address (optional): EIP bound to ELB The EIP is available only when you enable the Internet access when creating the DataArts DataService cluster.
- Private domain name (optional): A private domain name takes effect in a VPC. After creating a cluster, you can bind a private domain name to the cluster. DataArts DataService invokes the DNS service to associate the private domain name with the private IP address.
- Public domain name (optional): A public domain name is resolved on the Internet. After creating a cluster, you can bind a public domain name to the cluster by entering a registered domain name. DataArts DataService invokes the DNS service to associate the public domain name with the external IP address.

Figure 13-3 Networking of the DataArts DataService exclusive cluster



To ensure that the APIs in the exclusive cluster are accessible, pay attention to the following network configurations during cluster creation:

- Virtual Private Cloud (VPC)

  A VPC must be configured for an exclusive DataArts DataService instance. Resources (such as ECSs) in the same VPC can use the private address of the exclusive instance to call APIs.

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When you buy an exclusive instance, you are advised to configure the same VPC as other associated services to ensure network security and facilitate network configuration.

- Elastic IP (EIP)

  If you want to call an API of an exclusive instance, buy an EIP and bind it to the instance. The EIP will be used as the Internet entry of the instance.

- Security Group

  A security group is similar to a firewall. It controls who can access the specified port of an instance and enables the communication data flow of the instance to move to the specified destination address. You are advised to enable the IP address and port in the inbound direction of the security group to protect the network security of the instance to the maximum extent.

  The security group bound to an exclusive instance must meet the following requirements:

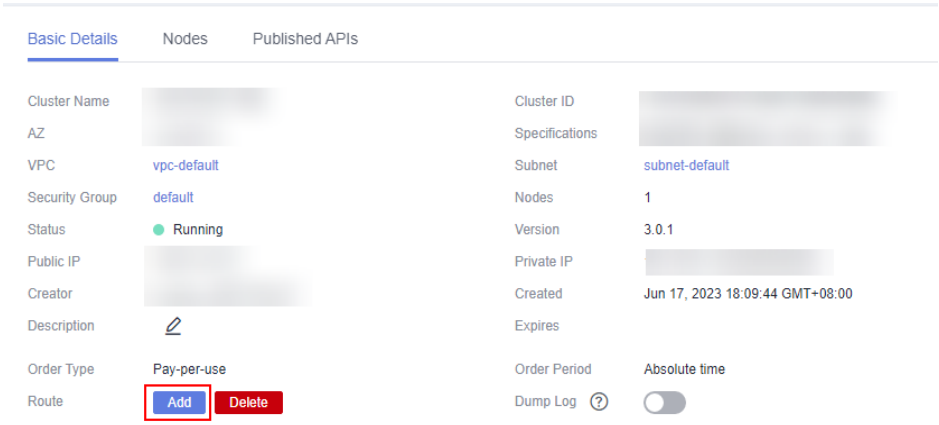
  – Inbound rule: To call APIs from the Internet or from resources in other security groups, enable ports 80 (HTTP) and 443 (HTTPS) in the inbound direction of the security group bound to the exclusive instance.
  – Outbound direction: If the backend service is deployed on the Internet or in another security group, enable the backend service address and API calling listening port in the outbound direction of the security group bound to the exclusive instance.
  – If the frontend and backend services of the API are bound to the same security group and VPC as the exclusive instance, you do not need to enable the preceding ports for the exclusive instance.

- Route

  In the physical machine management scenario, if the physical machine and the cluster have different network segments, you need to configure a route.

  On the **Basic Details** page, click **Add** following **Route** and add the IP address of the physical server.

Figure 13-4 Basic Details page



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Procedure

After you buy a DataArts DataService incremental package, the system automatically creates a cluster based on your selected specifications.

Step 1 Locate an enabled instance and click .

Step 2 On the displayed page, set parameters based on **Table 13-5**.

Table 13-5 Parameters for an exclusive DataArts DataService instance

Parameter	Description
Package	Select **DataArts DataService**.
Billing Mode	Currently, **Yearly/Monthly** is supported.
Workspace	The workspace for which you want to use the incremental package. For example, if you want to use DataArts DataService Exclusive in workspace A of the DataArts Studio instance, select workspace A. After you buy an exclusive DataArts DataService cluster, you can view it in workspace A. If you want to use the cluster in other workspaces, you can share it with those workspaces by referring to **Managing Cluster Sharing**.
AZ	Select the AZ where the DataArts DataService Exclusive cluster is located. Select **One AZ** or **Multiple AZs**. **Multiple AZs** is recommended. • **One AZ**: Nodes of the DataArts DataService Exclusive cluster are deployed in the same AZ. • **Multiple AZs**: Nodes of the DataArts DataService Exclusive cluster are deployed in 2 to 10 AZs. For details, see **Regions and AZs**.
Name	The cluster name must start with a letter and can contain only letters, digits, hyphens (-), and underscores (_). It must contain at least five characters.
Description	A description of the exclusive DataArts DataService cluster.
Version	Cluster version of the exclusive DataArts DataService cluster.
Cluster Details	The number of APIs supported varies depending on the instance specifications.
Public Address	Enable this function. When the cluster is created, a new EIP is automatically bound to the cluster. You can use this EIP to call the APIs of the exclusive cluster. The EIP assigned through this function is free. If you want to call APIs locally or across networks, you are advised to enable this function. If you do not enable this function during cluster creation, you cannot bind an EIP to the cluster later.

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Parameter	Description
Bandwidth	Bandwidth range on the Internet.
VPC Subnet Security Group	VPC, subnet, and security group to which the DataArts DataService Exclusive cluster in the DataArts Studio instance belongs. Cloud resources (such as ECSs) within the same VPC, subnet, and security group can call APIs using the private IP address of the DataArts DataService Exclusive instance. Deploy the DataArts DataService Exclusive cluster in the same VPC, subnet, and security group as your other services to facilitate network configuration and secure network access. For details about the operations on VPCs, subnets, and security groups, see ***Virtual Private Cloud User Guide***. **NOTE** • After a DataArts DataService Exclusive cluster is created, the VPC, subnet, and security group of the cluster cannot be changed. Exercise caution when setting them during the cluster creation. • If **Enabling the public IP address** is selected, the security group must allow access from ports 80 (HTTP) and 443 (HTTPS) in the inbound direction. • You can select a VPC subnet shared by the VPC owner when you buy a DataArts DataService Exclusive cluster. Through VPC subnet sharing, you can easily configure and manage multiple accounts' resources at low costs. For details about how to share a VPC subnet, see **VPC Sharing**.
Managing Cluster Resources Using an Enterprise Project	Enterprise project associated with the exclusive DataArts DataService cluster. An enterprise project facilitates management of cloud resources. For details, see **Enterprise Management User Guide**.
Nodes	N/A
Required Duration	N/A

Step 3 Click **buy Now**, confirm the settings, and click **Next**.

----End

Managing Cluster Sharing

By default, an exclusive cluster can be used only in its associated workspace by default. If you want to use the cluster in other workspaces, you can share it with them. Then you can view and use the cluster and publish APIs to the cluster in those workspaces. However, you cannot manage the cluster.

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

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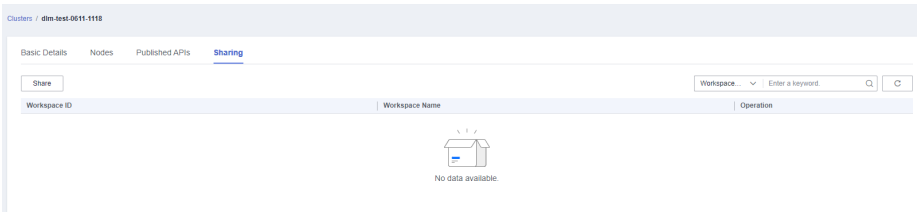
Step 2 On the DataArts Studio console, locate a workspace in which you have obtained an exclusive cluster and click **DataArts DataService**.

Step 3 In the navigation pane on the left, choose **Clusters**.

Step 4 Click the name of a cluster to go to its details page.

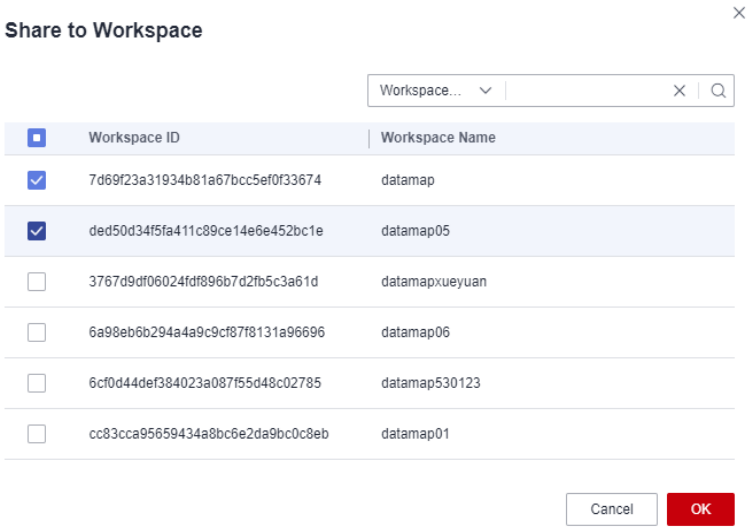
Step 5 On the cluster details page, click the **Sharing** tab.

Figure 13-5 Sharing page



Step 6 Click **Share**. In the displayed dialog box, select the workspaces you want to share the cluster to and click **OK**.

Figure 13-6 Selecting workspaces



Step 7 You can view and use the cluster in the workspaces.

If you want to stop sharing the cluster with a workspace, suspend the APIs you have published in the cluster in the workspace, and go to the cluster details page to stop sharing the cluster.

----End

Setting the Allocated API Quota

After an exclusive cluster is created, you need to set the API quota for the current workspace.

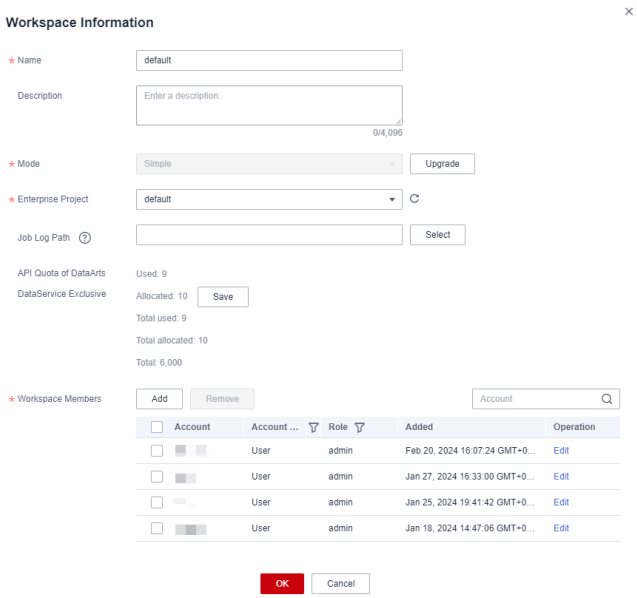
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By default, the total quota for a DataArts DataService Exclusive cluster in a DataArts Studio instance is 5,000 by default. You can create APIs in a workspace only after allocating an API quota to the workspace. The procedure of allocating the quota is as follows:

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the **Workspaces** page, locate the target workspace and click **Edit** in the **Operation** column.

Figure 13-7 Workspace Information dialog box



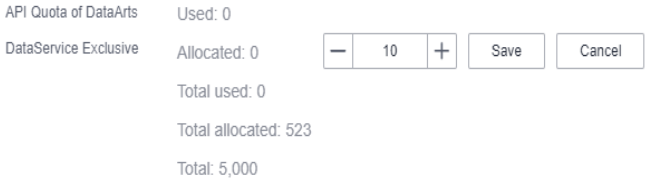
Step 3 Locate **API Quota of DataArts DataService Exclusive** and click **Edit** in the **Operation** column to set it. Click **OK** to save the change.

The allocated quota indicates the quota that can be used in the current workspace. It cannot be less than the used quota or greater than the unallocated quota (total quota minus total allocated quota).

NOTE

You can create 10 DataArts DataService Exclusive APIs for free in each DataArts Studio instance, and you will be billed for each extra API.

Figure 13-8 Setting the allocated quota



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Step 4 In the **Workspace Information** dialog box, click **OK**.

----End

Related Operations

- Enabling cluster log dump: When this function is enabled, all the API access logs in the current workspace of the cluster will be dumped to a specified OBS bucket or LTS log.

  On the page displaying clusters, click a cluster name to go to the **Basic Details** tab page. Enable the log dump function and select a dump mode:

  - If you select **OBS**, all the API access logs in the current workspace will be dumped to the specified OBS bucket.
  - If you want to select **LTS**, you need to create a log group and a log stream on the LTS console in advance. For details about how to create a log group and a log stream, see **Viewing API Access Logs**. When you select **LTS**, all the API access logs in the current workspace will be dumped to the created log stream.

- Restarting a cluster: If a cluster is restarted, the APIs published in the cluster cannot be called. Exercise caution when performing this operation.

  On the **Clusters** page, locate a cluster and click **Restart** to restart it.

- Deleting a cluster: If the current cluster does not meet your requirements, you can delete it. Note that a deleted cluster cannot be restored. Ensure that related service data has been exported for backup and exercise caution when performing this operation.

  On the **Clusters** page, locate a cluster, click **More** in the **Operation** column, and select **Delete**.

- Binding a private domain name: A private domain name takes effect in a VPC. When a private domain name is bound, it is associated with a private IP address. Then you can call APIs using the private domain name in the same VPC in the private network.

  On the **Clusters** page, locate a cluster, click **More** in the **Operation** column, select **Bind Private Zone**, and enter a custom private domain name. DataArts DataService invokes the DNS service to associate the private domain name with the private IP address. Each tenant can add up to 50 private domain names in all projects.

  The private domain name supports various domain name levels and must comply with domain name naming rules.

  - Domain name labels are separated by dot (.), and each label does not exceed 63 characters.
  - A domain name label can contain letters, digits, and hyphens (-) and cannot start or end with a hyphen.
  - The total length of the domain name cannot exceed 254 characters.

- Binding a public domain name: A public domain name is resolved on the Internet. When a public domain name is bound, it is associated with a public IP address. Then you can call APIs using the public domain name on the Internet. On the **Clusters** page, locate a cluster, click **More** in the **Operation** column, select **Bind Public Zone**, and enter a registered domain name. DataArts DataService invokes the DNS service to associate the public domain

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name with the public IP address. To bind a public domain name, ensure that **Public Address** has been enabled during cluster creation and an EIP has been bound to the cluster. Otherwise, the public domain name cannot be bound to the cluster. In addition, each tenant can have up to 50 public domain names.

The public domain name can include a primary domain name and its subdomain name, for example, abc.example.com.

13.3.2 Creating a Reviewer in DataArts DataService

APIs must be reviewed and approved before they can be published. APIs are reviewed in the following way:

- An API publisher who does not have the reviewer permission must submit the API to the reviewer for review.
- An API publisher who has the reviewer permission can publish an API without review or approval.

Therefore, if you do not have the reviewer permission and want to publish an API, you must add a reviewer first. Only the workspace admin has the permissions required to add reviewers.

NOTE

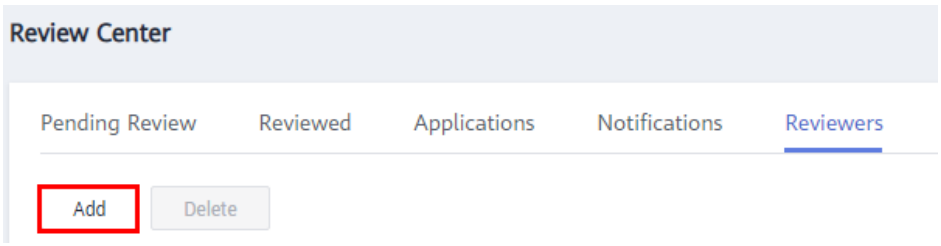
An admin, developer, or operator can be a reviewer. A viewer cannot be a reviewer.

Regardless of whether they are added as reviewers, users with the admin role of the workspace have the reviewer permissions by default.

Procedure

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
3. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
4. Choose **Operation Management** > **Review Center** from the left navigation pane. On the page displayed, choose **Reviewer Management** and click **Add**.

Figure 13-9 Adding reviewers



5. Select a reviewer (workspace member), enter a correct phone number and email address, and click **OK**.
6. Add more reviewers, if required.

13.3.3 Creating an API

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13.3.3.1 Generating an API Using Configuration

This section describes how to generate an API using configuration.

Generating data APIs using configuration is simple. You do not need to write any code. Wizard mode is designed for users who do not have high requirements on API functions or have no experience in code development.

Prerequisites

You have configured data sources on the **Data Connection Management** page of **Management Center**.

Notes and Constraints

APIs cannot be generated for the Chinese tables and columns in Hive data sources.

Creating an API Directory

An API catalog is an API index that is orchestrated and recorded in a certain sequence. It is a tool for reflecting categories, guiding API usage, and searching for APIs, helping API developers effectively classify and manage API services.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
3. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
4. Choose **API Development** > **API Catalogs** and click  .

   In the dialog box displayed, enter an API catalog name, and click **OK**.
5. Right-click the API catalog and select **Edit** or **Delete** to edit or delete the API catalog.

Configuring Basic API Information

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs** from the left navigation bar, and click **Create**. On the displayed page, enter the basic information.

Table 13-6 API basic configuration

Parameter	Description
API	An API name consists of 3 to 64 characters and starts with a letter. Only letters, numbers, and underscores (_) are allowed.

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Parameter	Description
API Catalog	A collection of APIs for a specific function or scenario. It is similar to a folder and specifies the location of APIs. You can search for APIs in a specified API catalog. The API catalog is the minimum organization unit of APIs in DataArts DataService. You can select an API catalog you have created by referring to **Creating an API Directory**.
Request Path	API access path, for example, **/getUserInfo** It is the part between the domain name and query parameters in the URL of a request path, for example, **/blogs/*xxxx*** shown in the following figure. **Figure 13-10** API access path in the URL  Braces ({}) can be used to identify parameters in a request path as wildcard characters. For example, **/blogs/{blog_id}** indicates that any parameter can follow **/blogs**. **/blogs/188138** and **/blogs/0** can both match **/blogs/{blog_id}**, and are processed by this API. In addition, duplicate request paths are not allowed for the same domain name. When a path parameter is used as a wildcard, the name is not unique. For example, **/blogs/{blog_id}** and **/blogs/{xxxx}** are considered as the same path.
Parameter Protocol	Protocol used to transmit requests. The exclusive edition supports HTTPS. HTTPS is recommended. HTTP is insecure and may have security risks. • HTTP is a basic network transmission protocol. It is stateless, connectionless, simple, fast, and flexible, and uses plaintext for transmission. It is easy to use but has poor security. • HTTPS is an HTTP-based protocol with SSL or TLS encryption verification. It can effectively verify identities and protect data integrity. To access HTTPS APIs, you need to configure related SSL certificates or skip SSL verification.

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Parameter	Description
Request Method	HTTP request method, indicating the type of the requested operation, such as GET and POST. The method complies with the resultful style. ● **GET** requests the server to return specified resources. This method is recommended. ● **POST** requests the server to add resources or perform special operations. The POST request does not have a body. Instead, it involves transparent transmission.
Description	A brief description of the API to create.
Tag	API tag. The tag is used to mark the API attributes. After the API is created, you can quickly search for the API by tag. A maximum of 20 tags can be set for an API.
Reviewer	A reviewer who has permissions to review APIs. Click **Add** to enter the **Review Center** page and click **Add** on the **Reviewers** tab page to add a reviewer.
Security Authentication	When creating an API, you can select one of the following security authentication modes. The three modes differ in how the API is called. You are advised to select **App authentication**, which is more secure that the other two modes. ● **App authentication**: After the API is authorized to an application, the key pair (AppKey and AppSecret) of the application is used for security authentication. The API can be called using an SDK or API calling tool. This authentication mode is highly secure and recommended. ● **IAM authentication**: After the API is authorized to the current account or another account, the user token obtained from IAM is used for security authentication. The API can be called using an API invoking tool. The security level of this mode is medium. ● **Non-authentication**: This mode allows all users to access APIs, which may pose security risks. It is recommended only for testing APIs. In this mode, no authentication information is required. The security level is low. You can use an API invoking tool or browser to directly call the API.
Display Scope	After the API is published, all users in the selected scope can view the API in the service catalog. ● Current workspace APIs ● Current project APIs ● Current tenant's APIs
Access Log	If you select this option, the API query result will be recorded and retained for seven days. You can choose **Operations Management** > **Access Logs** and select the request date to view the logs.

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Parameter	Description
Min. Retention Period	Minimum retention period of the API publishing status, in hours. Value **0** indicates that the retention period is not limited. You can suspend, unpublish, or cancel authorization for an API only after the minimum retention period ends. The system notifies the authorized users. If all authorized users have processed the notifications or unbound the API from their apps, the API will be suspended or unpublished, or the API authorization will be canceled. Otherwise, the system will forcibly suspend, unpublish, or cancel authorization for the API when the minimum retention periods ends. For example, if the minimum retention period is set to 24 hours, the API can be suspended 24 hours after it is published. If the authorized user handles the notifications in the review center or unbind the API from the app, the API will be directly suspended. Otherwise, the API will be forcibly suspended when the minimum retention period ends.

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Parameter	Description
Input Parameters	Parameters required for calling the API. The parameters are used as the request parameters on the **Set Data Extract Logic** page. An input parameter consists of the parameter location, parameter type, whether the parameter is mandatory, whether a null value is allowed, and the default value. ● The parameter location can be **Query**, **Header**, **Path**, or **Body**. In addition, static parameters are supported. – **Query** is the query parameter following the URL. It starts with a question mark (?) and connects multiple parameters with **&**. – **Header** is located in the request header and is used to transfer current information, for example, host and token. – **Path** is a request parameter in the request path. If you configure a path parameter, you must also add this parameter to the request path. – **Body** is a parameter in the request body and is generally in JSON format. – **Static** is a static parameter that does not change with the value transferred by the API caller. It is supported only when **Security Authentication** is **App authentication**. The value of a static parameter is determined during API authorization. (If the parameter value is not set during authorization, the default value of the API input parameter is used when the API is called using an SDK, and an error is reported indicating that the static parameter value is missing when the API is called using an API tool.) ● The parameter type can be **Number** or **String**. **Number** corresponds to numeric data types such as int, double, and long. **String** corresponds to text data types such as char, vachar, and text. ● Whether the parameter is mandatory, whether a null value is allowed, and default value – If the parameter is mandatory, it must be transferred for accessing the API. – If this parameter is not mandatory and if it is not transferred during API access, the default value will be used. If the parameter is not transferred and no default value is available, null will be used if it is allowed and this parameter will be ignored if null is not allowed.

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Parameter	Description
	NOTE When defining an input parameter, ensure that the following size requirements are met: • **Query** and **Path**: 32 KB. • **HEADER**: The maximum size is 128 KB. • **BODY**: The maximum size is 128 KB. You need to set input parameters based on the designed request parameters for the API. For example, the request path of the API used to query user information in a table by user ID is **/getUserInfo**. You can configure input parameters as follows: • If the request parameter for calling the API is **id**, and the information about the user with **id** needs to be returned, configure an input parameter as follows: 1. Click **Add** and enter **id** for **Name**. 2. Set **Parameter Location** to **Query**. 3. Set **Type** to **Number**. 4. Select **Yes** for **Mandatory**. 5. Retain the default value. • If the request parameters for calling the API are **id1** and **id2**, and the user information between **id1** and **id2** needs to be returned, configure input parameters as follows: 1. Click **Add** and enter **id1** for **Name**. 2. Set **Parameter Location** to **Query**. 3. Set **Type** to **Number**. 4. Select **Yes** for **Mandatory**. 5. Retain the default value. 6. Click **Add** again and configure parameter **id2**.

4. After the basic API information is complete, click **Next** to go to the **Data Extract Logic** page.

Configuring the Data Extraction Logic

Set **Data Acquisition Method** to **GUI based**.

1. Select a data source, data connection, database, and data table to obtain the tables to be configured.

   NOTE

   For details on the data sources supported by DataArts DataService, see **Data Sources Supported by DataArts Studio**. Configure data sources in Management Center in advance. You can search for a data table by name.

2. Configure parameter fields.

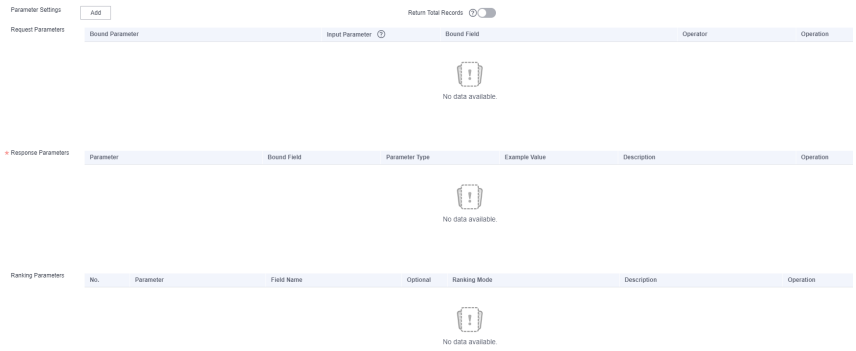
   Click **Add** next to **Parameter Settings**. All fields in the table are displayed on the page for adding parameters. Select the request parameters, response

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parameters, and ranking parameters that you want to add to the corresponding lists.

In addition, you can enable **Return Total Records**. Then the total number of script execution results will be returned.

Figure 13-11 Add Parameter dialog box



3. Edit request parameters.

   A request parameter consists of a bound parameter, bound field, and operator. In the request parameter list, select a bound parameter and an operator.

   - Bound parameters are available to external systems. They are the input parameters defined on the **Configure Basic Details** page and are directly used to access the API.
   - Bound fields are invisible to external systems. They are fields of the selected tables and are accessed during an API call.
   - Operators determine how bound fields and parameters in access requests are processed. A bound field is on the left of an operator and a bound parameter is on the right. The following table lists the available operators.

     Table 13-7 Available operators

Operator	Description
=	Checks whether the values of two operands are equal. The condition is true if the bound field is equal to the bound parameter. **NOTE** The values of FLOAT4 and FLOAT8 parameters of the DWS database cannot be compared.
<>	Checks whether the values of two operands are equal. The condition is true if the bound field is not equal to the bound parameter. **NOTE** The values of FLOAT4 and FLOAT8 parameters of the DWS database cannot be compared.

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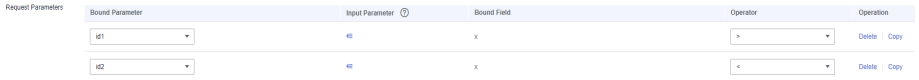
Operator	Description
>	Checks whether the value of the left operand is greater than that of the right operand. The condition is true if the bound field is greater than the bound parameter.
>=	Checks whether the value of the left operand is greater than or equal to that of the right operand. The condition is true if the bound field is greater than or equal to the bound parameter.
<	Checks whether the value of the left operand is less than that of the right operand. The condition is true if the bound field is less than the bound parameter.
<=	Checks whether the value of the left operand is less than or equal to that of the right operand. The condition is true if the bound field is less than or equal to the bound parameter.
%like%	Ignores the prefix and suffix in character matching. The condition is true if the bound field (excluding the prefix and suffix) can match the bound parameter.
%like	Ignores the prefix in character matching. The condition is true if the bound field (excluding the prefix) can match the bound parameter.
like%	Ignores the suffix in character matching. The condition is true if the bound field (excluding the suffix) can match the bound parameter.
in	Compares a value with a specified list of values. The condition is true if the bound field can match the values in multiple bound parameters.
not in	Compares a value with values not in a specified list. It is the opposite of the in operator. The condition is true if the bound field cannot match the values in multiple bound parameters.

You can copy and set operators in request parameters to match input bound parameters with bound fields.

As shown in **Figure 13-12**, you can enter parameters **id1** and **id2** when accessing an API to match the values of **x** columns between **id1** and **id2**.

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Figure 13-12 Request parameters

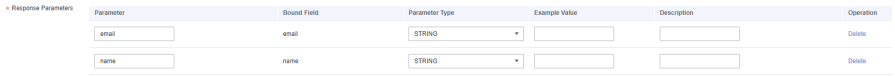


4. Edit response parameters.

   A response parameter consists of the parameter name, bound field, and parameter type.

   - Parameters are available to external systems and can be customized. They are returned to API callers.
   - Bound fields are invisible to external systems. They are fields of the selected tables and are returned during an API call.
   - The parameter type is the data display format when the API is called, and can be a numeric or character.

   Figure 13-13 Response parameters

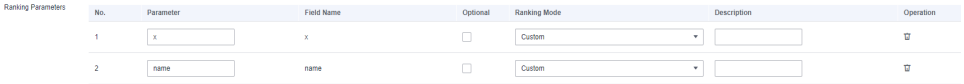


5. Edit ranking parameters.

   A ranking parameter consists of the parameter name, field name, whether the parameter is optional, and ranking mode. Multiple ranking parameters are allowed.

   - Parameter names can be customized and associated with field names.
   - Field names are invisible to external systems. They are fields of the selected tables and are accessed during an API call.
   - Whether the parameter is optional for calling the API. If you select it, this parameter is optional. You can use the value of **pre_order_by** to configure whether this parameter is used for ranking. If you do not select it, this parameter is mandatory. Even if this parameter is not set for **pre_order_by**, this parameter is still used for ranking.
   - The ranking mode can be ascending, descending, or custom. The default ranking mode of a custom ranking parameter is ascending. You can change the ranking mode by setting **pre_order_by**. If the ranking mode of a parameter is ascending or descending, the ranking mode cannot be changed using **pre_order_by**. If the value of **pre_order_by** is different from the ranking mode set, an error is reported during configuration debugging or API calling.
   - If there are multiple ranking parameters, when the first ranking parameter is the same, the subsequent parameters are used for ranking. The order of ranking parameters cannot be adjusted using **pre_order_by**. To adjust the order, click **Add**next to **Parameter Settings** to open the **Add Parameter** dialog box and adjust the order of ranking parameters.

Figure 13-14 Ranking parameters



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6. Click **Next** to go to the API test page.

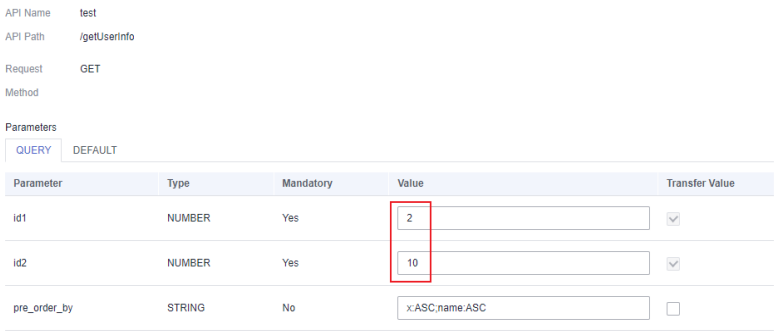
Testing the API

1. Set values for input parameters.

   If you want to set multiple values for a parameter, observe the following format:

   - String: 'a','b','c'
   - Value: 1,2
   - Field: a,b,c

   Figure 13-15 Setting values for input parameters



2. (Optional) Change the value of **pre_order_by**, which indicates the ranking parameter description.

   The system provides the default value of **pre_order_by** based on all the ranking parameters configured in **5**. The default ranking mode is ascending. The value of **pre_order_by** is in either of the following formats: ***Ranking parameter name***:ASC (ascending order) or ***Ranking parameter name***:DESC (descending order). Separate multiple ranking parameter descriptions by semicolons (;). If you select **Transfer Value**, test results are sorted by the value of **pre_order_by**.

   You can change the value of **pre_order_by** as follows:

   - Delete an optional ranking parameter. The parameter is no longer used for ranking.
   - Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

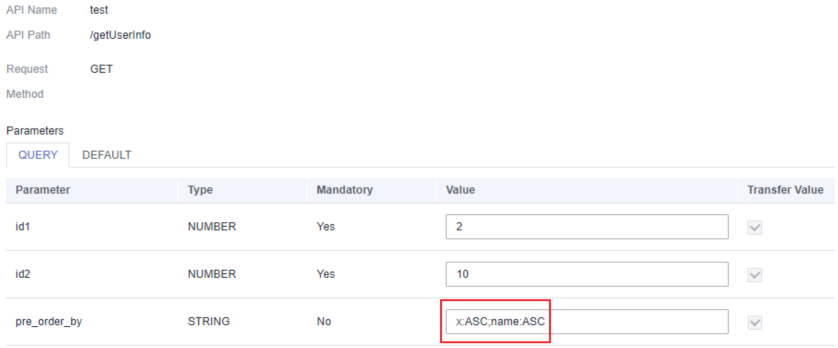
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NOTE

The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

- If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.
- If the sequence of ranking parameters is adjusted, the sequence of the parameters is still the same as that configured during the configuration of these parameters. The adjustment does not take effect.
- If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

Figure 13-16 Changing the value of pre_order_by



3. (Optional) Change the values of pagination parameters.

   The system displays the returned data on multiple pages. Parameter **pageSize** indicates the size of a page, and **pageNum** indicates the page number. During API debugging, the default page size is 100, and data on the first page is returned.

   NOTE

   During API debugging, the maximum value of **page_size** is **100**. If the value of **page_size** is greater than **100**, 100 records are returned by default.

   Figure 13-17 Changing the values of pagination parameters



4. After setting and saving all parameters, click **Next**.

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Specify **Value** and click **Debug**. You can view the **Request** and **Response** details on the right part of the displayed page.

- If the total duration of API query and response exceeds the default value 60 seconds, a timeout error is reported.
- If the test fails, modify parameters based on the error message and try again.

After the test is complete, click **OK**.

Modifying the API

To modify an API, choose **API Development** > **API Catalogs** or **API Development** > **APIs**, locate the API, and click **Edit** to modify the API.

NOTE

An API cannot be edited if it is in the pending review or execution state after published, unpublished, suspended, or resumed.

13.3.3.2 Generating an API Using a Script or MyBatis

This section describes how to generate an API using a script or MyBatis.

This mode can meet personalized query requirements of users. It allows you to compile API query SQL statements and provides multi-table join, complex query conditions, aggregation functions, and more capabilities.

- Script: Only common SQL syntax is supported.
- MyBatis: Only DataArts DataService Exclusive supports this mode. In this mode, the script supports the MyBatis tag syntax. The parameter parsing format is #{parameter}. Tag syntax such as if, choose, when, foreach, and where is supported. You can use the tag syntax to implement complex query logic such as null value verification, multi-value traversal, dynamic table query, dynamic sorting, and aggregation.

Prerequisites

You have configured data sources on the **Data Connection Management** page of **Management Center**.

Notes and Constraints

- APIs cannot be generated for the Chinese tables and columns in Hive data sources.
- When configuring the data extraction logic of an API using MyBatis, you cannot test SQL statements. Instead, you can verify SQL statements only in the test phase or during API debugging.

Creating an API Directory

An API catalog is an API index that is orchestrated and recorded in a certain sequence. It is a tool for reflecting categories, guiding API usage, and searching for APIs, helping API developers effectively classify and manage API services.

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1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
3. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
4. Choose **API Development** > **API Catalogs** and click ⊕.

   In the dialog box displayed, enter an API catalog name, and click **OK**.
5. Right-click the API catalog and select **Edit** or **Delete** to edit or delete the API catalog.

Configuring Basic API Information

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs** from the left navigation bar, and click **Create**. On the displayed page, enter the basic information.

Table 13-8 API basic configuration

Parameter	Description
API	An API name consists of 3 to 64 characters and starts with a letter. Only letters, numbers, and underscores (_) are allowed.
API Catalog	A collection of APIs for a specific function or scenario. It is similar to a folder and specifies the location of APIs. You can search for APIs in a specified API catalog. The API catalog is the minimum organization unit of APIs in DataArts DataService. You can select an API catalog you have created by referring to **Creating an API Directory**.

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Parameter	Description
Request Path	API access path, for example, **/getUserInfo** It is the part between the domain name and query parameters in the URL of a request path, for example, **/blogs/*xxxx*** shown in the following figure. **Figure 13-18** API access path in the URL  Braces ({}) can be used to identify parameters in a request path as wildcard characters. For example, **/blogs/{blog_id}** indicates that any parameter can follow **/blogs**. **/blogs/188138** and **/blogs/0** can both match **/blogs/{blog_id}**, and are processed by this API. In addition, duplicate request paths are not allowed for the same domain name. When a path parameter is used as a wildcard, the name is not unique. For example, **/blogs/{blog_id}** and **/blogs/{xxxx}** are considered as the same path.
Parameter Protocol	Protocol used to transmit requests. The exclusive edition supports HTTPS. HTTPS is recommended. HTTP is insecure and may have security risks. • HTTP is a basic network transmission protocol. It is stateless, connectionless, simple, fast, and flexible, and uses plaintext for transmission. It is easy to use but has poor security. • HTTPS is an HTTP-based protocol with SSL or TLS encryption verification. It can effectively verify identities and protect data integrity. To access HTTPS APIs, you need to configure related SSL certificates or skip SSL verification.
Request Method	HTTP request method, indicating the type of the requested operation, such as GET and POST. The method complies with the resultful style. • **GET** requests the server to return specified resources. This method is recommended. • **POST** requests the server to add resources or perform special operations. The POST request does not have a body. Instead, it involves transparent transmission.
Description	A brief description of the API to create.
Tag	API tag. The tag is used to mark the API attributes. After the API is created, you can quickly search for the API by tag. A maximum of 20 tags can be set for an API.

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Parameter	Description
Reviewer	A reviewer who has permissions to review APIs. Click **Add** to enter the **Review Center** page and click **Add** on the **Reviewers** tab page to add a reviewer.
Security Authentication	When creating an API, you can select one of the following security authentication modes. The three modes differ in how the API is called. You are advised to select **App authentication**, which is more secure that the other two modes. ● **App authentication**: After the API is authorized to an application, the key pair (AppKey and AppSecret) of the application is used for security authentication. The API can be called using an SDK or API calling tool. This authentication mode is highly secure and recommended. ● **IAM authentication**: After the API is authorized to the current account or another account, the user token obtained from IAM is used for security authentication. The API can be called using an API invoking tool. The security level of this mode is medium. ● **Non-authentication**: This mode allows all users to access APIs, which may pose security risks. It is recommended only for testing APIs. In this mode, no authentication information is required. The security level is low. You can use an API invoking tool or browser to directly call the API.
Display Scope	After the API is published, all users in the selected scope can view the API in the service catalog. ● Current workspace APIs ● Current project APIs ● Current tenant's APIs
Access Log	If you select this option, the API query result will be recorded and retained for seven days. You can choose **Operations Management** > **Access Logs** and select the request date to view the logs.

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Parameter	Description
Min. Retention Period	Minimum retention period of the API publishing status, in hours. Value **0** indicates that the retention period is not limited. You can suspend, unpublish, or cancel authorization for an API only after the minimum retention period ends. The system notifies the authorized users. If all authorized users have processed the notifications or unbound the API from their apps, the API will be suspended or unpublished, or the API authorization will be canceled. Otherwise, the system will forcibly suspend, unpublish, or cancel authorization for the API when the minimum retention periods ends. For example, if the minimum retention period is set to 24 hours, the API can be suspended 24 hours after it is published. If the authorized user handles the notifications in the review center or unbind the API from the app, the API will be directly suspended. Otherwise, the API will be forcibly suspended when the minimum retention period ends.

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Parameter	Description
Input Parameters	Parameters required for calling the API. The parameters are used as the request parameters on the **Set Data Extract Logic** page. An input parameter consists of the parameter location, parameter type, whether the parameter is mandatory, whether a null value is allowed, and the default value. ● The parameter location can be **Query**, **Header**, **Path**, or **Body**. In addition, static parameters are supported. – **Query** is the query parameter following the URL. It starts with a question mark (?) and connects multiple parameters with **&**. – **Header** is located in the request header and is used to transfer current information, for example, host and token. – **Path** is a request parameter in the request path. If you configure a path parameter, you must also add this parameter to the request path. – **Body** is a parameter in the request body and is generally in JSON format. – **Static** is a static parameter that does not change with the value transferred by the API caller. It is supported only when **Security Authentication** is **App authentication**. The value of a static parameter is determined during API authorization. (If the parameter value is not set during authorization, the default value of the API input parameter is used when the API is called using an SDK, and an error is reported indicating that the static parameter value is missing when the API is called using an API tool.) ● The parameter type can be **Number** or **String**. **Number** corresponds to numeric data types such as int, double, and long. **String** corresponds to text data types such as char, vachar, and text. ● Whether the parameter is mandatory, whether a null value is allowed, and default value – If the parameter is mandatory, it must be transferred for accessing the API. – If this parameter is not mandatory and if it is not transferred during API access, the default value will be used. If the parameter is not transferred and no default value is available, null will be used if it is allowed and this parameter will be ignored if null is not allowed.

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Parameter	Description
	NOTE When defining an input parameter, ensure that the following size requirements are met: • **Query** and **Path**: 32 KB. • **HEADER**: The maximum size is 128 KB. • **BODY**: The maximum size is 128 KB. You need to set input parameters based on the designed request parameters for the API. For example, the request path of the API used to query user information in a table by user ID is **/getUserInfo**. You can configure input parameters as follows: • If the request parameter for calling the API is **id**, and the information about the user with **id** needs to be returned, configure an input parameter as follows: 1. Click **Add** and enter **id** for **Name**. 2. Set **Parameter Location** to **Query**. 3. Set **Type** to **Number**. 4. Select **Yes** for **Mandatory**. 5. Retain the default value. • If the request parameters for calling the API are **id1** and **id2**, and the user information between **id1** and **id2** needs to be returned, configure input parameters as follows: 1. Click **Add** and enter **id1** for **Name**. 2. Set **Parameter Location** to **Query**. 3. Set **Type** to **Number**. 4. Select **Yes** for **Mandatory**. 5. Retain the default value. 6. Click **Add** again and configure parameter **id2**.

4. After the basic API information is complete, click **Next** to go to the **Data Extract Logic** page.

Configuring the Data Extraction Logic

NOTE

This section uses a script to describe how to configure the API data extraction logic. The configuration procedure for the MyBatis mode is the same as that for the script mode, except for the parameter parsing mode and supported syntax, and except that the SQL statements cannot be tested during the configuration of API data extraction logic using MyBatis.

If you use MyBatis to generate an API, you need to change the parameter parsing format in the scripts in this section from ***${parameter}*** to ***#{parameter}***. In addition, you can click in the script editing area to view the tag syntax supported by MyBatis.

Set **Data Acquisition Method** to **Script** or **MyBatis**.

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1. Set **Data Source**, **Data Connection**, and **Database**.

   NOTE

   For details on the data sources supported by DataArts DataService, see **Data Sources Supported by DataArts Studio**. Configure data sources in Management Center in advance and enter SQL statements as prompted.

2. Set **Paging Mode**. You are advised to select **Custom**.
   - Default pagination: If you enter a SQL script when creating an API, DataArts DataService automatically adds the pagination logic to the SQL script.

     For example, if you enter the following SQL script:

     ```
     SELECT * FROM userinfo WHERE id=${userid}
     ```

     When processing API debugging or calling, DataArts DataService automatically adds the pagination logic to the preceding SQL script and generates the following script:

     ```
     SELECT * FROM (SELECT * FROM userinfo WHERE id=${userid}) LIMIT {limitValue} OFFSET {offsetValue}
     ```

     limitValue indicates the number of data records read, and **offsetValue** indicates the number of skipped data records (offset). They have default values.
   - Custom pagination: DataArts DataService does not process the SQL script for creating an API. You need to define the pagination logic when writing the SQL statement. If you select the custom pagination mode, you must add the pagination logic when writing SQL statements to prevent cluster exceptions that may occur when the API is used to query a large amount of data.

     If **limitValue** (number of data records to be read) and **offsetValue** (number of data records to be skipped) have been obtained, you can define the pagination logic using the following script:

     ```
     SELECT * FROM userinfo WHERE id=${userid} LIMIT {limitValue} OFFSET {offsetValue}
     ```

     More commonly, you can use **pageSize** and **pageNum** to define the pagination logic. The script format is as follows:

     ```
     SELECT * FROM userinfo WHERE id=${userid} LIMIT {pageSize} OFFSET {pageSize*(pageNum-1)}
     ```

     NOTE

     The syntax style varies depending on the data source, and so does the pagination script. The following are some example data sources:

     - DLI does not support the **LIMIT {limitValue} OFFSET {offsetValue}** format. It only supports the **LIMIT {limitValue}** format.
     - HetuEngine does support the **LIMIT {limitValue} OFFSET {offsetValue}** format. It only supports the **OFFSET {offsetValue} LIMIT {limitValue}** format.

3. Compile the SQL statement for a query API.

   On the script editing page, click next to **Edit Script** and develop a SQL query statement as prompted. You can click to add input parameters to the SQL statement as API request parameters. In addition, you can enable **Return Total Records**. Then the total number of script execution results will be returned.

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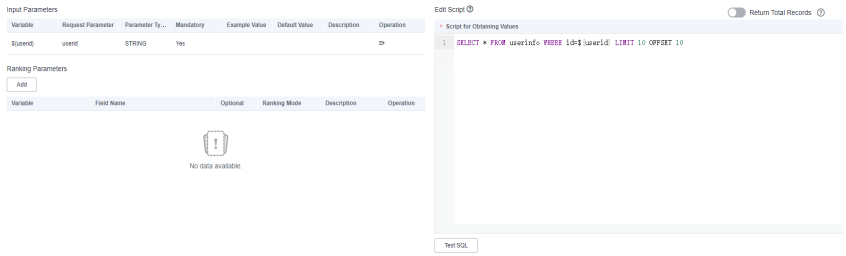
For example, you can write the following script to query user information in a user table based on the user ID. **id** is a field in the **userinfo** table, and **userid** is an input parameter defined for the API.

```
SELECT * FROM userinfo WHERE id=${userid}
```

If custom pagination is used, the value of **pageSize** is **10**, and the value of **pageNum** is **2**, write the following script based on the **LIMIT {pageSize} OFFSET {pageSize*(pageNum-1)}** conversion method:

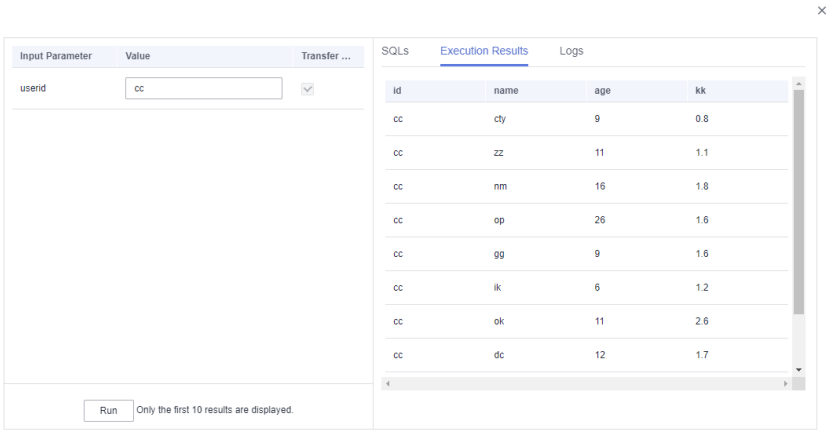
```
SELECT * FROM userinfo WHERE id=${userid} LIMIT 10 OFFSET 10
```

Figure 13-19 Compiling the SQL statement for a query API



Click **Test SQL** under the script editing window, set the value for the input parameter, and click **Run** to check whether the expected result can be returned. If the test fails, you can check whether the SQL statement meets the expectation on the **SQLs** tab page or view the error message on the **Logs** tab page.

Figure 13-20 Testing the SQL statement



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NOTE

- When configuring the data extraction logic of an API using MyBatis, you cannot test SQL statements. Instead, you can verify SQL statements only in the test phase or during API debugging.
- The fields obtained by SELECT are the response parameters of the API. (The aliases can be obtained through AS.)
- Parameters in the where condition are API request parameters. In the script mode, the parameter format is **${Parameter name}**. In the MyBatis mode, the parameter format is **#{Parameter name}**.
- The values of FLOAT4 and FLOAT8 parameters of the DWS database cannot be compared.
- You can enable **Return Total Records**. Then the total number of script execution results will be returned.
- If you want to set multiple values for a parameter, observe the following format:
  - String: 'a','b','c'
  - Value: 1,2
  - Field: a,b,c

4. Add ranking parameters.

   In the ranking parameter list, click **Add** to add ranking fields.

   - Field names are invisible to external systems. They are fields of the selected tables and are accessed during an API call. If the query SQL statement of the API has been compiled and verified through a test, you can select a ranking field from the **Field Name** text box.
   - Variables can be customized and associated with field names. Enter a parameter name in the **Variable** text box. The system automatically changes the parameter name to a variable.
   - Whether the parameter is optional for calling the API. If you select it, this parameter is optional. You can use the value of **pre_order_by** to configure whether this parameter is used for ranking. If you do not select it, this parameter is mandatory. Even if this parameter is not set for **pre_order_by**, this parameter is still used for ranking.
   - The ranking mode can be ascending, descending, or custom. The default ranking mode of a custom ranking parameter is ascending. You can change the ranking mode by setting **pre_order_by**. If the ranking mode of a parameter is ascending or descending, the ranking mode cannot be changed using **pre_order_by**. If the value of **pre_order_by** is different from the ranking mode set, an error is reported during configuration debugging or API calling.
   - If there are multiple ranking parameters, when the first ranking parameter is the same, the subsequent parameters are used for ranking. Different from the configuration mode, the sequence of the ranking parameters is irrelevant to the sequence in which they are added. Instead, the sequence needs to be customized using a SQL script and cannot be adjusted using **pre_order_by**.

   Note that the ranking fields of an API created using a script/MyBatis must be added to the SQL statement using **ORDER BY** so that they can take effect. You can click ⇛ to add a ranking parameter to the SQL statement. When adding the **ORDER BY** parameter, you only need to associate the field name. The sequence of multiple ranking fields is defined by the script. You cannot

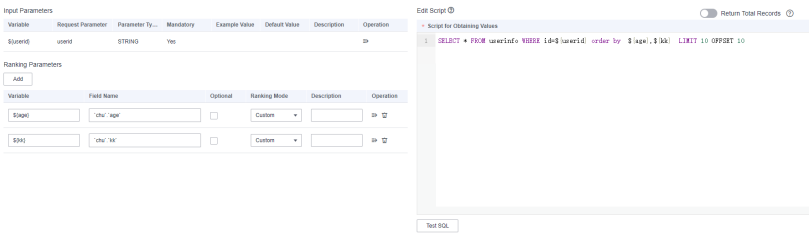
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use **ASC** or **DESC** to set the sequence in the script. Ranking parameters that are not added to the SQL statement do not take effect even if they are defined in **pre_order_by**.

For example, you can write the following script to query user information in a user table based on the user ID, with **age** and **kk** in sequence used to sort the query results and **pageSize** and **pageNum** set to **10** and **2**, respectively.

```
SELECT * FROM userinfo WHERE id=${userid} order by ${age},${kk} LIMIT 10 OFFSET 10
```

Figure 13-21 Adding ranking parameters



Click **Test SQL** under the script editing window, enter the values for input parameters and **pre_order_by**, and click **Run** to check whether the expected result can be returned.

NOTE

When configuring the data extraction logic of an API using MyBatis, you cannot test SQL statements. Instead, you can verify SQL statements only in the test phase or during API debugging.

The default value of **pre_order_by** is provided by the system based on all configured ranking parameters. The custom ranking mode is ascending by default. The value of **pre_order_by** is in either of the following formats: ***Ranking parameter name***:ASC (ascending order) or ***Ranking parameter name***:DESC (descending order). Separate multiple ranking parameter descriptions by semicolons (;). If you select **Transfer Value**, test results are sorted by the value of **pre_order_by**.

You can change the value of **pre_order_by** as follows:

- Delete an optional ranking parameter. The parameter is no longer used for ranking.
- Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

NOTE

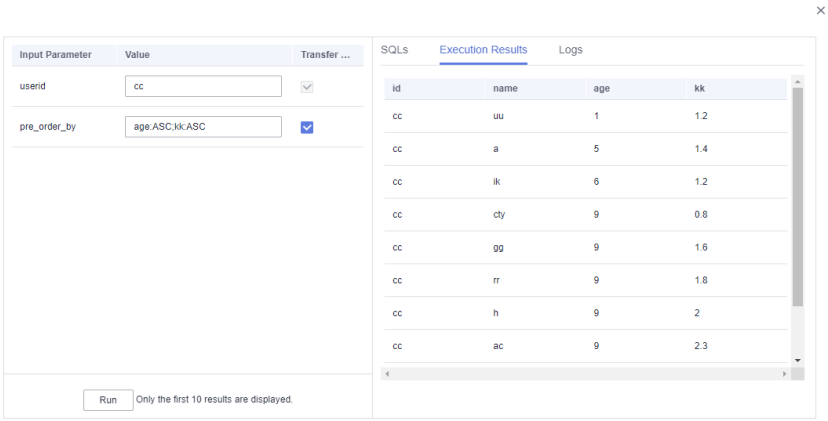
The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

- If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.
- If the sequence of ranking parameters is adjusted, the sequence of the parameters is still the same as that in the SQL statement. The adjustment does not take effect.
- If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

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If the test fails, you can check whether the SQL statement meets the expectation on the **SQLs** tab page or view the error message on the **Logs** tab page.

Figure 13-22 Testing the SQL statement



5. Click **Next** to go to the API test page.

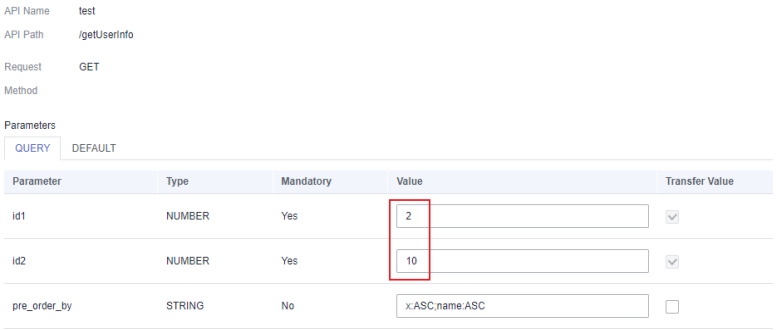
Testing the API

1. Set values for input parameters.

   If you want to set multiple values for a parameter, observe the following format:

   - String: 'a','b','c'
   - Value: 1,2
   - Field: a,b,c

   Figure 13-23 Setting values for input parameters



2. (Optional) Change the value of **pre_order_by**, which indicates the ranking parameter description.

   The default value of **pre_order_by** is provided by the system based on all configured ranking parameters. The custom ranking mode is ascending by default. The value of **pre_order_by** is in either of the following formats:

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***Ranking parameter name*:ASC** (ascending order) or ***Ranking parameter name*:DESC** (descending order). Separate multiple ranking parameter descriptions by semicolons (;). If you select **Transfer Value**, test results are sorted by the value of **pre_order_by**.

You can change the value of **pre_order_by** as follows:

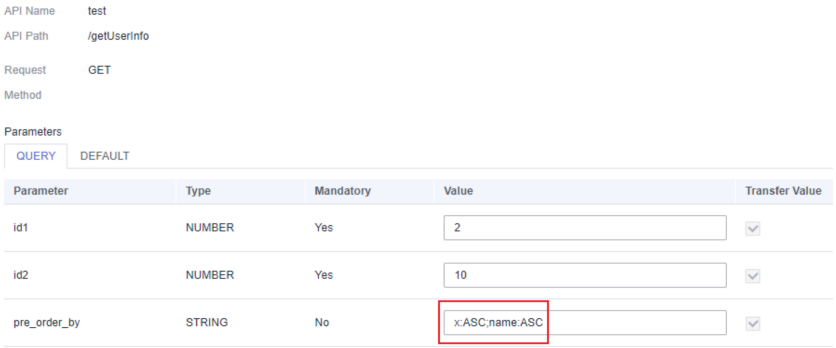
- Delete an optional ranking parameter. The parameter is no longer used for ranking.
- Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

NOTE

The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

- If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.
- If the sequence of ranking parameters is adjusted, the sequence of the parameters is still the same as that in the SQL statement. The adjustment does not take effect.
- If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

Figure 13-24 Changing the value of pre_order_by



3. (Optional) View the values of pagination parameters.

   If the default pagination mode is used, you can view the pagination parameters. **pageSize** indicates the size of a page, and **pageNum** indicates the page number. By default, the page size is 100, and data on the first page is returned.

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Figure 13-25 View the values of pagination parameters



4. After setting and saving all parameters, click **Next**.

   Specify **Value** and click **Debug**. You can view the **Request** and **Response** details on the right part of the displayed page.

   - If the total duration of API query and response exceeds the default value 60 seconds, a timeout error is reported.
   - If the test fails, modify parameters based on the error message and try again.

After the test is complete, click **OK**.

Modifying the API

To modify an API, choose **API Development** > **API Catalogs** or **API Development** > **APIs**, locate the API, and click **Edit** to modify the API.

NOTE

An API cannot be edited if it is in the pending review or execution state after published, unpublished, suspended, or resumed.

13.3.4 Debugging an API

Scenarios

You can debug an API on the management console by adding HTTP header parameters and body parameters.

NOTE

- APIs whose backend paths contain environment variables cannot be debugged.
- APIs bound to a signature key cannot be debugged.
- If a request throttling policy has been bound to an API, the policy does not take effect when you debug the API.

Prerequisites

An API has been created.

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Procedure

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Use either of the following methods to debug an API:
   - Locate the row that contains the target API, and choose **More** > **Debug**.
   - Click the name of the target API, and click **Test** on the displayed API details page.

     You can configure API request parameters in the left pane. See **Table 13-9** for parameter details. The request information sent by the API and the returned result after the API request is invoked are displayed on the right.

     Table 13-9 Debugging APIs

Parameter	Description
API Version	Only specified API versions in DataArts DataService Exclusive can be debugged. If the API version is not specified, unpublished APIs will be debugged by default.
Parameters	Query parameters and their values.
Cluster Settings	Supported only by Exclusive Edition. Select the instance where the API to be debugged resides.

     NOTE

     The information displayed on the debugging page varies according to the request type.
5. After request parameters are added, click **Debug**.

   The API calling response information is displayed in the command output area in the right pane.
   - If the API is successfully called, HTTP status code 200 and response information are returned.
   - If no result is returned within 60 seconds (default value), a timeout error is reported.
   - If the debugging fails, the HTTP status code 4*xx* or 5*xx* is returned.
6. You can send different requests using varied parameters and values to verify the API.

   NOTE

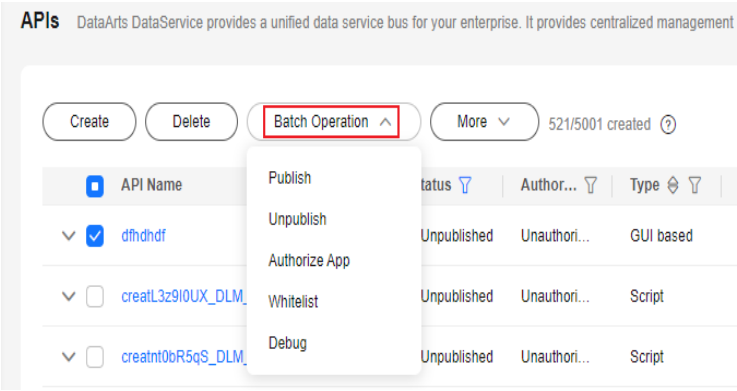
   To modify the API parameters, click **Edit** in the upper right corner. The API editing page is displayed.

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Related Operations

- Debugging APIs: On the DataArts DataService Exclusive console, choose **API Management** > **APIs** in the navigation pane on the left. In the right pane, select APIs, click **Batch Operation** above the list, and select **Debug**. On the displayed page, import the Excel file with the modified API debugging parameters.

  Figure 13-26 Batch operation

- Publishing an API: After debugging an API, you can publish it so that it can be called by API callers. For details, see **Publishing an API**.

13.3.5 Publishing an API

This section describes how to publish APIs in DataArts DataService.

Scenario

For the sake of security, APIs generated in DataArts DataService must be published before they can provide services.

Prerequisites

An API has been debugged.

Notes and Constraints

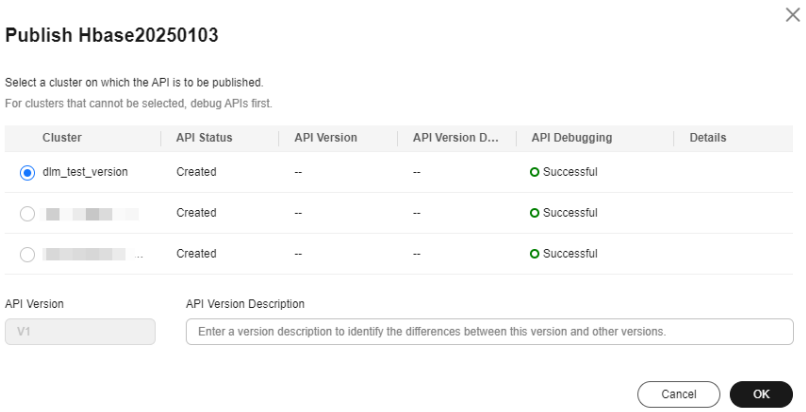
If one or more users publish APIs to the same exclusive cluster at the same time, the system displays message "Operation in progress. Try again later."

Procedure

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. In the navigation pane, choose **API Development** > **APIs**. Locate an API, click **More** in the **Operation** column, and select **Publish**.
4. In the displayed dialog box, select the target cluster.

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Figure 13-27 Selecting a cluster



- In DataArts DataService Exclusive, the API is published to a DataArts DataService Exclusive cluster by default and can be published by version. After the API is published, it can be called through the intranet or Internet.

5. APIs must be reviewed and approved before they can be published. APIs are reviewed in the following way:
   - An API publisher who does not have the reviewer permission must submit the API to the reviewer for review.
   - An API publisher who has the reviewer permission can publish an API without review or approval.

   An API submitted by a non-reviewer is published after it is approved by the reviewer.

   NOTE

   The data connection of an API in the pending review state cannot be changed. It can be changed only when the application is rejected by a user with the workspace administrator role.

   An admin, developer, or operator can be a reviewer. A viewer cannot be a reviewer.

   Regardless of whether they are added as reviewers, users with the admin role of the workspace have the reviewer permissions by default.

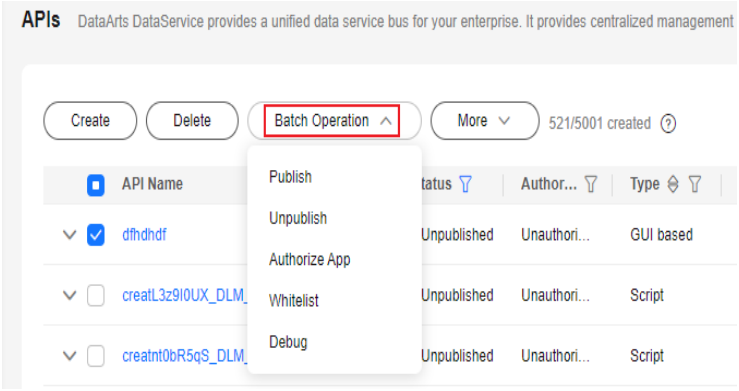
6. After the API is published, you can go to the **Service Catalogs** page to view the API information.

Related Operations

Publishing APIs in batches: On the **APIs** page, select APIs, click **Batch Operation** above the list, and select **Publish**.

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Figure 13-28 Batch operation



13.3.6 Managing APIs

13.3.6.1 Managing API Versions

Scenario

DataArts DataService allows you to manage APIs by version, and debug and publish APIs of different versions.

You can also track API changes by API version and compare versions. The system retains 10 latest version records.

Prerequisites

- API version management is supported only in the exclusive edition.
- To update an API version, you need to edit a published API and publish it again. An API cannot be edited and the API version cannot be updated if it is in the pending review or execution state after published, unpublished, suspended, or resumed.

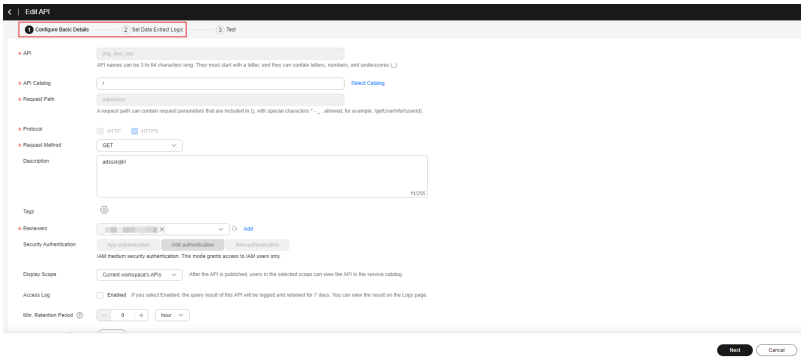
Updating an API Version

To update an API version, you need to edit a published API and publish it again.

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose **Exclusive**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**. Ensure that the API you want to update is in **Published** state and click **Edit** in the **Operation** column.
4. On the **Edit API** page, you can modify the basic configuration or data extraction logic of the API, such as the API catalog, description, request method, input parameters, and data extraction method. The API name, request path, protocol, and security authentication cannot be changed.

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Figure 13-29 Modifying the basic configuration or data extraction logic of the API



5. After modifying the API, click **Next**. On the displayed page, set related parameters and test the API.

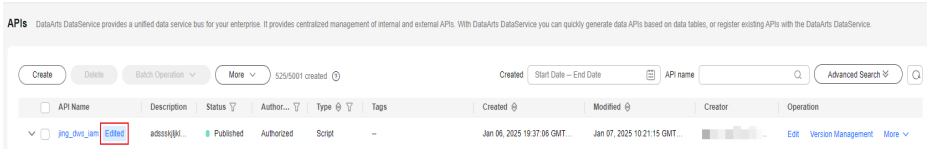
   You can configure API request parameters in the left pane. See **Table 13-10** for parameter details. The request information sent by the API and the returned result after the API request is invoked are displayed on the right.

Table 13-10 Debugging APIs

Parameter	Description
API Version	Only specified API versions in DataArts DataService Exclusive can be debugged. If the API version is not specified, unpublished APIs will be debugged by default.
Parameters	Query parameters and their values.
Cluster Settings	Supported only by Exclusive Edition. Select the instance where the API to be debugged resides.

6. After the test is complete, click **OK** to return to the API list. **Edited** is displayed next to the name of the API that you have modified.

Figure 13-30 Editing an API



7. Publish the edited API again. In the API list, locate the API you have edited, click **More** in the **Operation** column, and select **Publish**. In the displayed dialog box, select a cluster you have debugged.

   You can publish the API to the cluster where the API was published last time. Then the API information in the cluster will be updated. You can also publish the API to another cluster. Then this API has different versions in different clusters.

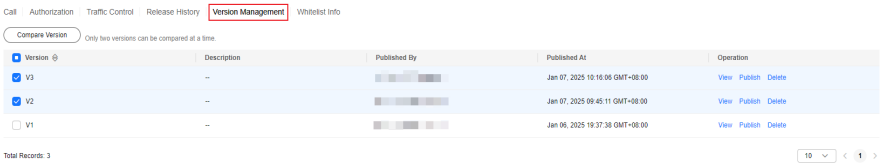
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Viewing and Comparing Versions

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the navigation pane on the left, choose **Exclusive**. The **Overview** page is displayed.
3. Choose **API Development** > **API Catalogs** or **API Development** > **APIs**.
4. On the API details page, click the **Version Management** tab to view the versions of the API. A maximum of 10 latest versions are retained.

   You can view the details of an API version, or delete or publish a version. You can also select two versions and click **Compare Version** to compare them.

   Figure 13-31 Managing API versions



13.3.6.2 Displaying an API

Scenario

If you want to change the visibility scope of an API in the service catalog, you can use the **Display** function or set the **Display Scope** parameter for the API.

Prerequisites

An API has been created.

Changing the API Visibility Scope Using the Display Function

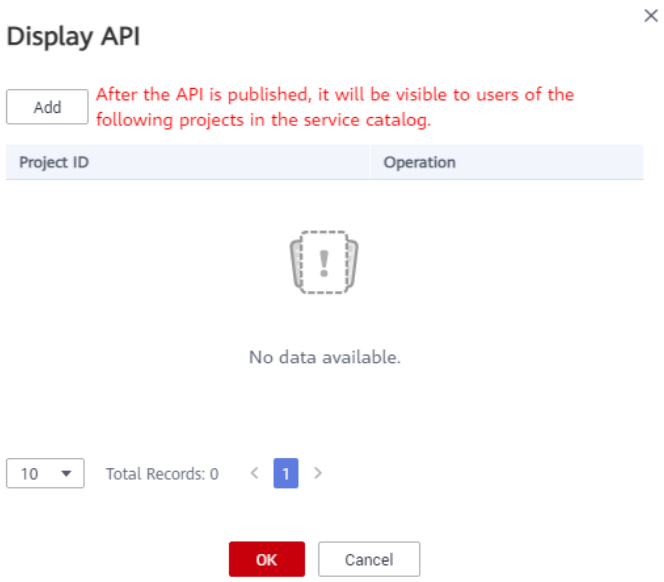
1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **API Catalogs** or **API Development** > **APIs**. Locate an API, click **More** in the **Operation** column, and select **Display**.
4. In the displayed dialog box, click **Add**, enter a project ID, and click **OK** to make the API visible to users in the project.

   To obtain the project ID, perform the following steps:

   a. Register with and log in to the management console.
   b. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list.
   c. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.

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Figure 13-32 Display API



Changing the API Visibility Scope by Setting the Display Scope Parameter

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **API Catalogs** or **API Development** > **APIs**. Locate an API and click **Edit** in the **Operation** column. An API cannot be edited if it is in the pending review or execution state after published, unpublished, suspended, or resumed.
4. On the **Configure Basic Details** page, select a value for the **Display Scope** parameter. The value can be **Current workspace's APIs**, **Current project's APIs**, or **Current tenant's APIs**. Then save the modification.
5. Restore or publish the API again to change the visibility scope of the API in the service catalog.

13.3.6.3 Suspending/Restoring an API

Scenarios

To edit or debug a published API, you must suspend the API first. After the API is suspended, its original authorization information is retained. You can edit and debug the API.

You can restore the API so that it can continue to provide services.

NOTE

The suspended API cannot be accessed in the specified time, which may affect the applications or users who are using the API. Ensure that users have been notified of this consequence.

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Prerequisites

- An API has been created.
- An API has been published in the environment.

Suspending an API

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Locate the row that contains the API to be suspended, click **More** in the **Operation** column, and select **Suspend**.
5. In the displayed dialog box, select the time period when the API needs to be suspended and click **OK**.

   NOTE

   The API suspension time must be later than its minimum retention period. Authorized users will be notified of the suspension. If all authorized users process the notifications in the review center or unbind the API from their apps, the API will be directly suspended. Otherwise, the API will be forcibly suspended when the minimum retention period ends.

Restoring an API

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Locate the row that contains the API to be restored, click **More** in the **Operation** column, and select **Restore**.

13.3.6.4 Unpublishing/Deleting APIs

Scenario

If you want to stop an API that has been published from providing services, you can unpublish the API. For details, see **Unpublishing an API**.

- If you want to continue to use an API that has been unpublished, you need to publish it again. Note that the original authorization information of the API will not be retained once the API is unpublished.
- If you no longer need the API, you can delete it. For details, see **Deleting APIs**.

NOTE

The unpublished API cannot be accessed in the specified time, which may affect the applications or users who are using the API. Ensure that users have been notified of this consequence.

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Prerequisites

- An API has been created.
- The API has been published.

Unpublishing an API

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Locate the row that contains the target API, choose **More** > **Unpublish**.
5. In the displayed dialog box, select the time period where the API needs to be unpublished and click **OK**.

   NOTE

   The API unpublishing time must be later than its minimum retention period. Authorized users will be notified of the unpublishing. If all authorized users process the notifications in the review center or unbind the API from their apps, the API will be directly unpublished. Otherwise, the API will be forcibly unpublished when the minimum retention period ends.

Deleting APIs

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **API Catalogs**. On the page displayed, select the API you want to delete and click **Delete**.

   NOTE

   - Only APIs in an unpublished state can be deleted. APIs in suspended or published state cannot be deleted.
   - A maximum of 1,000 APIs can be deleted at a time.

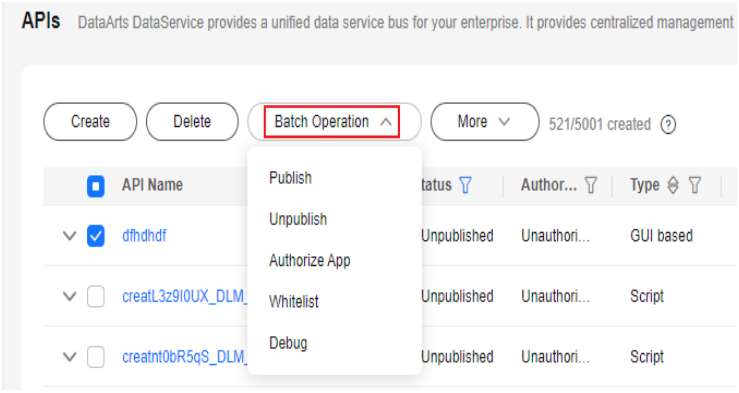
4. Click **OK** to delete the API.

Related Operations

Suspending APIs in batches: On the **APIs** page, select APIs, click **Batch Operation** above the list, and select **Suspend**.

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Figure 13-33 Batch operation



13.3.6.5 Copying an API

Scenario

You can copy an API to obtain another API with the same configuration.

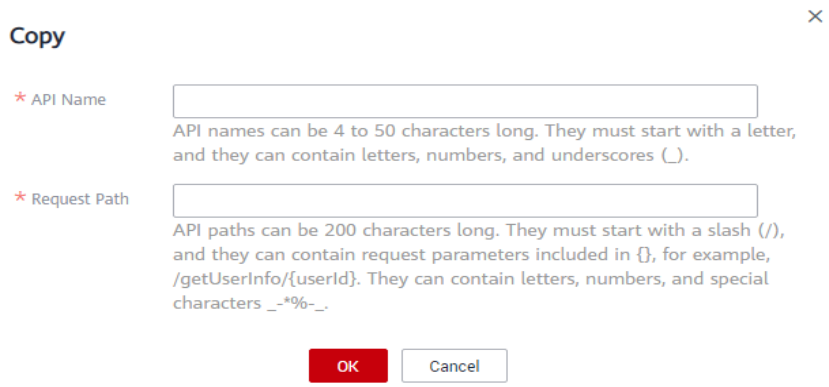
Prerequisites

An API has been created.

Procedure

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Select the target API, click **More** above the API list, and select **Copy**.
5. In the displayed dialog box, enter the new API name and request path, and click **OK**.

Figure 13-34 Copying an API



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13.3.6.6 Synchronizing APIs

Operation Scenario

You can synchronize APIs from DataArts DataService Exclusive to Data Map.

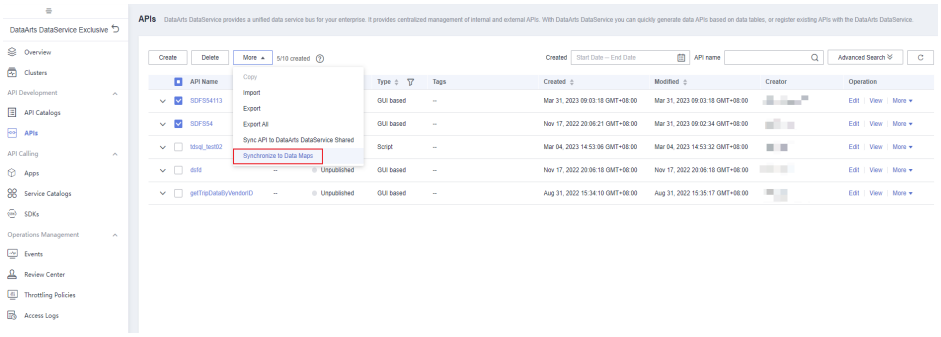
Prerequisites

An API has been created.

Synchronizing APIs to Data Map

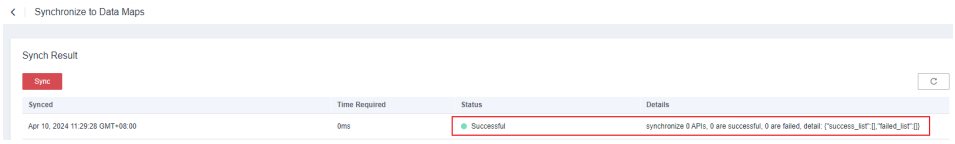
1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example **DataArts DataService Exclusive**, to access the **Overview** page.
3. Choose **API Development** > **APIs**.
4. Select the target APIs, click **More** above the API list, and select **Synchronize to Data Maps**.

Figure 13-35 Synchronize to Data Maps



5. On the **Synch Result** page, check the API synchronization status and details.

Figure 13-36 Synchronization result



NOTE

- Only published APIs can be synchronized to Data Map.
- Only APIs of the following data sources can be synchronized: DLI, DWS, HBase, and ClickHouse.

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13.3.6.7 Exporting All/Exporting/Importing APIs

Operation Scenario

DataArts DataService allows you to import and export (including exporting all) APIs to quickly copy or migrate existing APIs.

Constraints

- To export all APIs, you must have the permissions of the DAYU Administrator or Tenant Administrator.
- All the APIs of a workspace can be exported only once, and only one such export task can be executed within a minute.

Exporting All APIs

You can export all APIs based on the current filter criteria. You must have the permissions of the DAYU Administrator or Tenant Administrator.

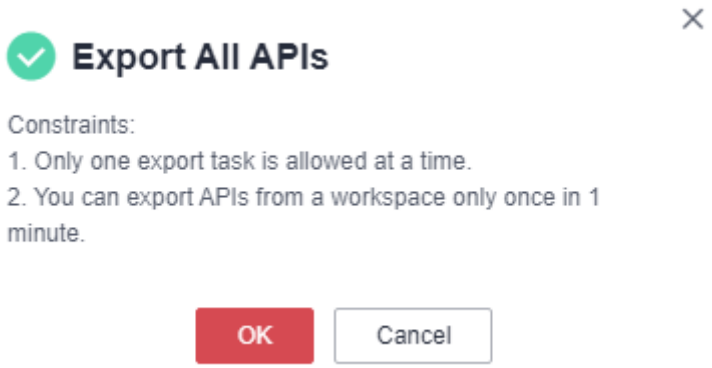
1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Above the API list, choose **More** > **Export All**.

   NOTE

   - To export all APIs, you must have the permissions of the DAYU Administrator or Tenant Administrator.
   - All the APIs of a workspace can be exported only once, and only one such export task can be executed within a minute.

   In the displayed dialog box, click **Yes** to export all the APIs to an Excel file.

   Figure 13-37 Exporting all APIs

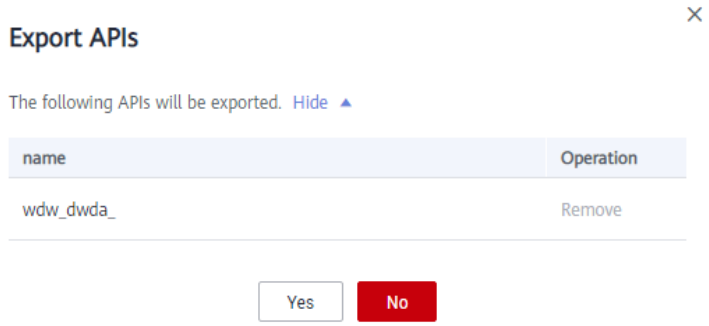
5. Open the downloaded Excel file to view the exported APIs. APIs of different types are exported to different sheets.

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Exporting APIs

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Select the target APIs, click **More** above the API list, and select **Export**.
5. In the displayed dialog box, confirm the APIs to export and click **Yes** to export the APIs to an Excel file.

Figure 13-38 Exporting APIs



6. Open the downloaded Excel file to view the exported APIs. APIs of different types are exported to different sheets.

Importing APIs

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Click **More** above the API list and select **Import**.
5. On the **Import API** page, set parameters and click **Select**. Select the API file to be imported and click **Import**. The import status is displayed in the **Import Result** area.

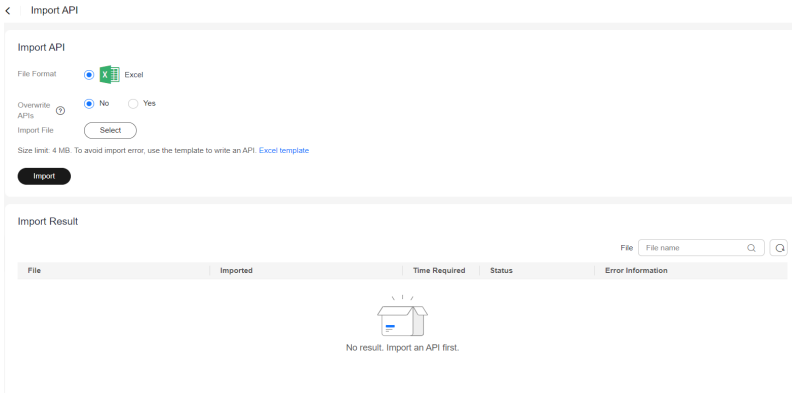
Table 13-11 Parameters for importing APIs

Parameter	Description
Overwrite	Whether to overwrite APIs with the same names as the APIs to be imported. By default, APIs are not overwritten. • **No**: If there is an API with the same name as an API to be imported, the API will not be imported. • **Yes**: If there is already an API with the same name, the API definition is updated based on the imported API.

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Parameter	Description
Import File	The API file can be one exported from another project or an Excel file edited based on the template specifications.

Figure 13-39 Importing APIs



6. After the APIs are imported successfully, you can view them in the API list.

13.3.7 Orchestrating APIs

13.3.7.1 Overview

API orchestration allows you to reorganize and reconstruct APIs in a visualized manner based on specific service logic and processes without compiling code. In this way, you can perform secondary development easily without affecting native APIs. API orchestration provides you with drag-and-drop and visualized API workflow orchestration capabilities. You can combine multiple APIs into a workflow in serial or parallel mode based on the service logic, invoke the API workflow through the entry API, and obtain the required data.

API orchestration provides more intuitive and efficient design and optimization of business processes, and more convenient secondary development. You can use API orchestration in the following scenarios to simplify development:

- **Map or convert the format of a returned message** through API orchestration.
- **A data request depends on multiple data APIs**: API orchestration reduces the number of API calls, cuts down integration costs, and improves efficiency.

Constraints

- API orchestration is available only for DataArts DataService Exclusive clusters of version 3.0.6 or later.
- Before publishing an API workflow, ensure that all common APIs in the workflow have been published.

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Introduction to Operators and Workflows

On the API workflow orchestration page, you can drag various types of operators to the canvas, connect them to orchestrate a workflow based on specific service logic and processes, configure the operators, and save, debug, and publish the workflow.

API orchestration supports five types of drag-and-drop operators: Entry API, Common API, Conditional Branch, Parallel Processing, and Output Processing. A workflow starts with an Entry API operator and ends with an Output Processing operator, with any combination of Common API, Conditional Branch, and Parallel Processing operators in the middle. A workflow must meet the following requirements:

- It starts with and contains only one Entry API operator which can have only one downstream branch.
- It contains at least one Common API operator at the middle layer. The Common API operator has upstream and downstream operators, but can have only one downstream branch.
- Conditional Branch operators are optional and located at the middle layer. They must have at least two branches and can have a maximum of 20 branches. If multiple branches meet a condition, only the first branch is executed.

  The Output Processing operator cannot be the direct downstream operator of a Conditional Branch operator. Instead, Conditional Branch operators obtain the request parameters or result sets of their upstream operators for condition judgment.
- Parallel Processing operators are optional and located at the middle layer. They must have at least two branches and can have a maximum of 20 branches. Failure policies must be configured for Parallel Processing operators.

  The Output Processing operator cannot be the direct downstream operator of a Parallel Processing operator. The logic of multiple branches can be executed at the same time without any impact on each other.
- An API workflow ends with and can have only one Output Processing operator. The direct upstream operator of the Output Processing operator must be a Common API operator, and at least one result mapping must be configured.
- An API workflow cannot have a ring structure or isolated operators. A maximum of 20 layers are supported.

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Figure 13-40 API workflow orchestration page

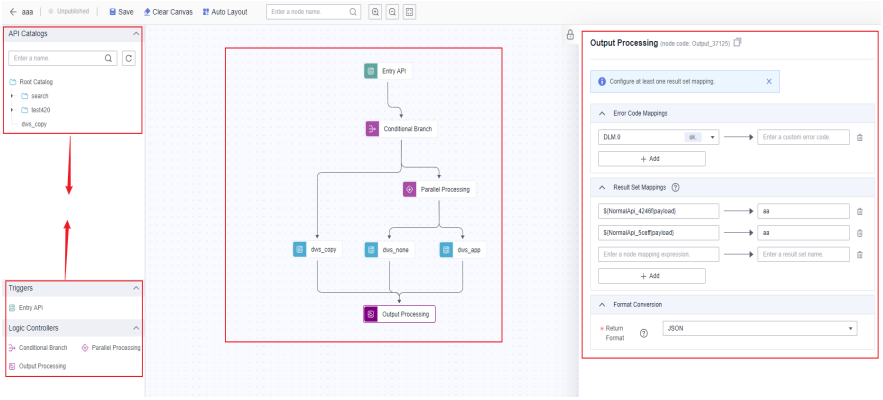


Table 13-12 API workflow operators

Navigation Path	Operator	Mandatory	Description
Triggers	**Entry API**	Yes	An API workflow starts with the Entry API operator. After the API workflow is published, it can be invoked through the Entry API operator. In the Entry API operator, you need to define the API workflow name, URL, parameter protocol, request method, reviewer, security authentication, and request parameters. For details about how to configure an Entry API operator, see **Configuring an Entry API Operator**.
API Catalogs	**Common API**	Yes	Common API operators are used to perform data query operations. Common APIs are APIs you have created. During API orchestration, you can drag a Common API operator from the API catalog, use the operator to obtain data, and transfer request parameters or result sets as variables. For details about Common API operators, see **Generating an API Using Configuration** or **Generating an API Using a Script or MyBatis**.
Logic Controllers	**Conditional Branch**	No	The Conditional Branch operator obtains the request parameters or result sets of its upstream operator for condition judgment and determines the next branch to be executed based on the defined expression. If the conditions of multiple branches are met, only the first branch is executed. For details about how to configure Conditional Branch operators and expressions, see **Configuring a Conditional Branch Operator**.

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Navigation Path	Operator	Mandatory	Description
	Parallel Processing	No	The Parallel Processing operator can execute multiple branches at the same time. The branches do not affect each other. For details about how to configure Parallel Processing operators, see **Configuring a Parallel Processing Operator**.
	Output Processing	Yes	The Output Processing operator maps the error codes and result sets, and converts the format of an API workflow to determine the format of the returned data. For details about how to configure Output Processing operators, see **Configuring an Output Processing Operator**.

13.3.7.2 Configuring an Entry API Operator

An API workflow starts with the Entry API operator. After the API workflow is published, it can be invoked through the Entry API operator. In the Entry API operator, you need to define the API workflow name, URL, parameter protocol, request method, reviewer, security authentication, and request parameters.

Table 13-13 Entry API operator parameters

Parameter	Descriptions
API	Entry API name, that is, API workflow name An API name consists of 3 to 64 characters and starts with a letter. Only letters, numbers, and underscores (_) are allowed.

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Parameter	Descriptions
Request Path	Entry API access path, that is, API workflow access path, for example, **/getUserInfo** It is the part between the domain name and query parameters in the URL of a request path, for example, **/blogs/*xxxx*** shown in the following figure. **Figure 13-41** API access path in the URL  Braces ({}) can be used to identify parameters in a request path as wildcard characters. For example, **/blogs/{blog_id}** indicates that any parameter can follow **/blogs**. **/blogs/188138** and **/blogs/0** can both match **/blogs/{blog_id}**, and are processed by this API. In addition, duplicate request paths are not allowed for the same domain name. When a path parameter is used as a wildcard, the name is not unique. For example, **/blogs/{blog_id}** and **/blogs/{xxxx}** are considered as the same path.
Protocol	Protocol used to transmit requests. The exclusive edition supports HTTPS. HTTPS is recommended. It is an HTTP-based protocol with SSL or TLS encryption verification. It can effectively verify identities and protect data integrity. To access HTTPS APIs, you need to configure related SSL certificates or skip SSL verification.
Request Method	HTTP request method, indicating the type of the requested operation, such as GET and POST. The method complies with the resultful style. • **GET** requests the server to return specified resources. This method is recommended. • **POST** requests the server to add resources or perform special operations. The POST request does not have a body. Instead, it involves transparent transmission.
Description	A brief description of the API to create.
Tags	API tag. The tag is used to mark the API attributes. After the API is created, you can quickly search for the API by tag. A maximum of 20 tags can be set for an API.
Reviewers	A reviewer who has permissions to review APIs. Click **Add** to enter the **Review Center** page and click **Add** on the **Reviewers** tab page to add a reviewer.

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Parameter	Descriptions
Security Authentication	When creating an API, you can select one of the following security authentication modes. The three modes differ in how the API is called. You are advised to select **App authentication**, which is more secure that the other two modes. ● **App authentication**: After the API is authorized to an application, the key pair (AppKey and AppSecret) of the application is used for security authentication. The API can be called using an SDK or API calling tool. This authentication mode is highly secure and recommended. ● **IAM authentication**: After the API is authorized to the current account or another account, the user token obtained from IAM is used for security authentication. The API can be called using an API invoking tool. The security level of this mode is medium. ● **Non-authentication**: This mode allows all users to access APIs, which may pose security risks. It is recommended only for testing APIs. In this mode, no authentication information is required. The security level is low. You can use an API invoking tool or browser to directly call the API.
Display Scope	After the API is published, all users in the selected scope can view the API in the service catalog. ● Current workspace APIs ● Current project APIs ● Current tenant's APIs
Access Log	If you select this option, the API query result will be recorded and retained for seven days. You can choose **Operations Management** > **Access Logs** and select the request date to view the logs.

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Parameter	Descriptions
Min. Retention Period	Minimum retention period of the API publishing status, in hours. Value **0** indicates that the retention period is not limited. You can suspend, unpublish, or cancel authorization for an API only after the minimum retention period ends. The system notifies the authorized users. If all authorized users have processed the notifications or unbound the API from their apps, the API will be suspended or unpublished, or the API authorization will be canceled. Otherwise, the system will forcibly suspend, unpublish, or cancel authorization for the API when the minimum retention periods ends. For example, if the minimum retention period is set to 24 hours, the API can be suspended 24 hours after it is published. If the authorized user handles the notifications in the review center or unbind the API from the app, the API will be directly suspended. Otherwise, the API will be forcibly suspended when the minimum retention period ends.

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Parameter	Descriptions
Input Parameters	Parameters required for invoking the API workflow. An input parameter consists of the parameter location, parameter type, whether the parameter is mandatory, whether a null value is allowed, and the default value. • The parameter location can be **Query**, **Header**, **Path**, or **Body**. In addition, static parameters are supported. – **Query** is the query parameter following the URL. It starts with a question mark (?) and connects multiple parameters with **&**. – **Header** is located in the request header and is used to transfer current information, for example, host and token. – **Path** is a request parameter in the request path. If you configure a path parameter, you must also add this parameter to the request path. – **Body** is a parameter in the request body and is generally in JSON format. – **Static** is a static parameter that does not change with the value transferred by the API caller. It is supported only when **Security Authentication** is **App authentication**. The value of a static parameter is determined during API authorization. (If the parameter value is not set during authorization, the default value of the API input parameter is used when the API is called using an SDK, and an error is reported indicating that the static parameter value is missing when the API is called using an API tool.) • The parameter type can be **Number** or **String**. **Number** corresponds to numeric data types such as int, double, and long. **String** corresponds to text data types such as char, vachar, and text. • Whether the parameter is mandatory, whether a null value is allowed, and default value – If the parameter is mandatory, it must be transferred for accessing the API. – If this parameter is not mandatory and if it is not transferred during API access, the default value will be used. If the parameter is not transferred and no default value is available, null will be used if it is allowed and this parameter will be ignored if null is not allowed.

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Parameter	Descriptions
	NOTE When defining an input parameter, ensure that the following size requirements are met: • **Query** and **Path**: 32 KB. • **HEADER**: The maximum size is 128 KB. • **BODY**: The maximum size is 128 KB. You need to set input parameters based on the designed request parameters for the API workflow. For example, the request path of the API workflow used to query user information in multiple tables by user ID is **/getUserInfo**. You can configure input parameters as follows: • If the request parameter for calling the API is **id**, and the information about the user with **id** needs to be returned through the API workflow , configure an input parameter as follows: 1. Click **Add** and enter **id** for **Name**. 2. Set **Parameter Location** to **Query**. 3. Set **Type** to **Number**. 4. Select **Yes** for **Mandatory**. 5. Retain the default value. • If the request parameters for calling the API are **id1** and **id2**, and the user information between **id1** and **id2** needs to be returned through the API workflow, configure input parameters as follows: 1. Click **Add** and enter **id1** for **Name**. 2. Set **Parameter Location** to **Query**. 3. Set **Type** to **Number**. 4. Select **Yes** for **Mandatory**. 5. Retain the default value. 6. Click **Add** again and configure parameter **id2**.

13.3.7.3 Configuring a Conditional Branch Operator

The Conditional Branch operator obtains the request parameters or result sets of its upstream operator for condition judgment and determines the next branch to be executed based on the defined expression. If the conditions of multiple branches are met, only the first branch is executed.

Table 13-14 Conditional Branch operator parameters

Parameter	Description
Branch 1	

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Parameter	Description
Condition Type	Condition type. • **Meets the current condition**: When data transferred to the conditional branch meets the specified expression, the branch is executed. • **Does not meet other conditions**: When data transferred to the conditional branch does not meet the conditions of any other branch, the branch is executed.
Expression	This parameter is mandatory when **Condition Type** is **Meets the current condition**. The expression consists of the code and variable name of the upstream operator. For details about how to use the expression, see **Defining an Expression**.
Branch 2	
Condition Type	Condition type. • **Meets the current condition**: When data transferred to the conditional branch meets the specified expression, the branch is executed. • **Does not meet other conditions**: When data transferred to the conditional branch does not meet the conditions of any other branch, the branch is executed.
Expression	This parameter is mandatory when **Condition Type** is **Meets the current condition**. The expression consists of the code and variable name of the upstream operator. For details about how to use the expression, see **Defining an Expression**.
...	
Branch *n*	
Condition Type	Condition type. • **Meets the current condition**: When data transferred to the conditional branch meets the specified expression, the branch is executed. • **Does not meet other conditions**: When data transferred to the conditional branch does not meet the conditions of any other branch, the branch is executed.
Expression	This parameter is mandatory when **Condition Type** is **Meets the current condition**. The expression consists of the code and variable name of the upstream operator. For details about how to use the expression, see **Defining an Expression**.

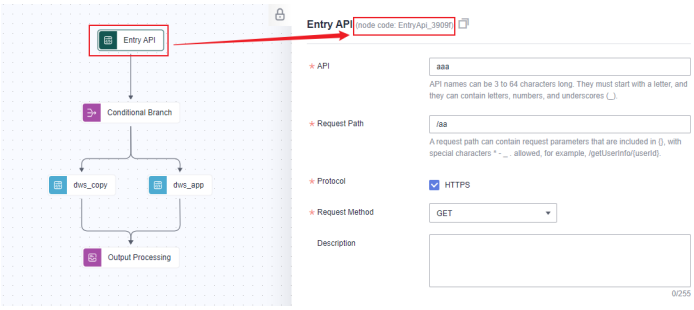
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Defining an Expression

When defining the expression of a conditional branch, you need to configure a variable expression. Variable expressions are available for Entry API and Common API operators, but unavailable for Conditional Branch, Parallel Processing, and Output Processing operators. The standard expression format is ${***Node code*|*Variable name***}. For details about how to define an expression, see **Table 13-15**.

- **Node code**: It is dynamically allocated by the system and cannot be changed. You can click a node in the API orchestration canvas to view the node code and click to copy the node code.

  Figure 13-42 Viewing the node code

- **Variable name**: Supported variables include request parameter values and result set parameters. For details, see **Table 13-15**.

Table 13-15 Methods for defining a condition expression

Operator	Variable Expression	Example Value
Entry API	Obtain the value of the request parameter of the entry API: ${***Node code*|*Input parameter name***}. **NOTE** This expression is supported for POST requests whose input parameters are located in Query, Header, Path, or Body.	If the node code of the entry API is **EntryApi_3909f**, and the input parameter **userId** is located in Path, set the expression for obtaining the value of the request parameter to **${EntryApi_3909f|userId}**.

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Operator	Variable Expression	Example Value
Common API	1. Obtain the value of the request parameter of the common API: ${***Node code*|*Input parameter name***}. **NOTE** This expression is supported for POST requests whose input parameters are located in Query, Header, Path, or Body. 2. Obtain the result sets and related variables of common APIs: ● ${***Node code***|payload.success}: checks whether the query status of a common API is successful. The result is true or false. ● ${***Node code***|payload.rowSize}: obtains the number of rows in the query result set of a common API. ● ${***Node code***|payload.columnSize}: obtains the number of columns in the query result set of a common API. ● ${***Node code***|payload.columnNames}: obtains the column names in the query result set of a common API. ● ${***Node code***|payload.data[***n-1***].***id***}: obtains the value of row n in the *id* column in the query result set of a common API.	● If the node code of a common API is **NormalApi_4246f**, and the input parameter **userId** is located in Path, set the expression for obtaining the value of the request parameter to **${NormalApi_4246f\|userId}**. ● If the node code of a common API is **NormalApi_4246f**, and the value is a one-dimensional array of multiple rows and a single column, set the expression for obtaining the values of the first row in the result set to **${NormalApi_4246f|payload.data[0]}**. ● If the node code of a common API is **NormalApi_4246f**, and the value is a two-dimensional array of multiple rows and columns, set the expression for obtaining the value in the first row and **price** column in the result set to **${NormalApi_4246f|payload.data[0].price}**.

For example, if there are three sequential nodes, A (entry API), B (common API), and C (conditional branch), and node C needs to obtain the request parameter values of node A and the output values of node B:

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- If the code of node A is **EntryApi_3909f**, and the location of input parameter **userId** is **Path**, set the expression for obtaining the request parameter value of node A as follows:

  ${EntryApi_3909f|userId}

- If the code of node B is **NormalApi_4246f**, and the value is a two-dimensional array of multiple rows and columns, set the expression for obtaining the value in the first row and **name** column in the result set of node B as follows:

  ${NormalApi_4246f|payload.data[0].name}

13.3.7.4 Configuring a Parallel Processing Operator

The Parallel Processing operator can execute multiple branches at the same time. The branches do not affect each other.

Table 13-16 Parallel Processing operator parameters

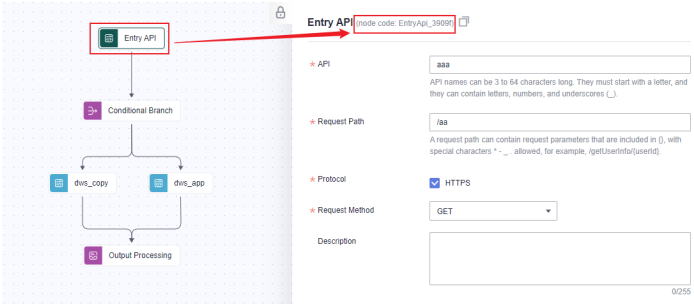
Parameter	Description
Policy Upon Branch Failure	Policy for processing the API workflow when one of the parallel branches fails • **Terminate processing**: terminates the API workflow if any branch fails. • **Continue execution of next branch**: continues to execute other branches and subsequent operators even if a branch fails. If all branches fail and no operators can be executed, the API workflow status becomes failed.
Branch 1	
Timeout Duration (ms)	If the execution of the current branch times out, the branch status becomes failed. The default value is 0, indicating that there is no time limit.
Branch 2	
Timeout Duration (ms)	If the execution of the current branch times out, the branch status becomes failed. The default value is 0, indicating that there is no time limit.
...	
Branch *n*	
Timeout Duration (ms)	If the execution of the current branch times out, the branch status becomes failed. The default value is 0, indicating that there is no time limit.

13.3.7.5 Configuring an Output Processing Operator

The Output Processing operator maps the error codes and result sets, and converts the format of an API workflow to determine the format of the returned data.

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Table 13-17 Output Processing operator parameters

Parameter	Mandatory	Description
Error Code Mappings	No	Error codes returned by DataArts DataService can be mapped to custom information, for example, error code **DLM.0** can be mapped to **OK**.
Result Set Mappings	Yes	The result set names of one or more Common API operators can be mapped to custom names which will be used in the JSON string or file name. Result sets that are not mapped will not be output to the final returned result. The node mapping expression is in **${*Node code*\|payload}** format. You can obtain the node code by clicking a node in the API orchestration canvas, and copy the code by clicking  . **Figure 13-43** Viewing the node code  For example, if the node code is **NormalApi_5a256**, set the node mapping expression to **${NormalApi_5a256|payload}** and the result set name to **sales record**.
Format Conversion	No	By default, a workflow result is a JSON string. You can export each mapped result set to a CSV, TXT, Excel, or XML file, or export all mapped result sets to a .zip file. Resumable data transfer is not supported during export.

13.3.7.6 Typical API Orchestration Configuration

The typical application scenarios of API orchestration are as follows:

- **Map or convert the format of a returned message** through API orchestration.
- **A data request depends on multiple data APIs**: API orchestration reduces the number of API calls, cuts down integration costs, and improves efficiency.

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Constraints

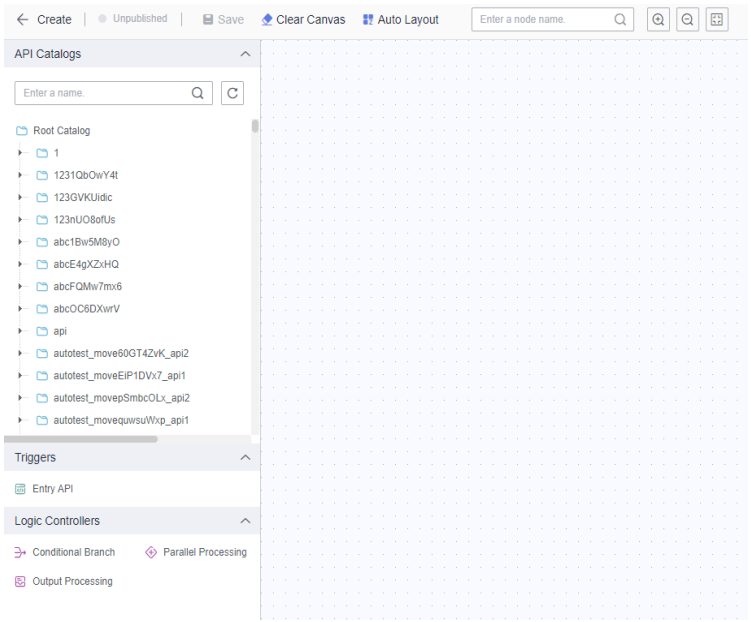
- API orchestration is available only for DataArts DataService Exclusive clusters of version 3.0.6 or later.
- Before publishing an API workflow, ensure that all common APIs in the workflow have been published.

Developing an API Workflow 1: Mapping or Converting the Format of a Returned Message

To convert the result returned by an API from JSON data into an Excel file, perform the following operations:

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
3. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
4. Choose **API Development** > **API Orchestration** and click **Create**.

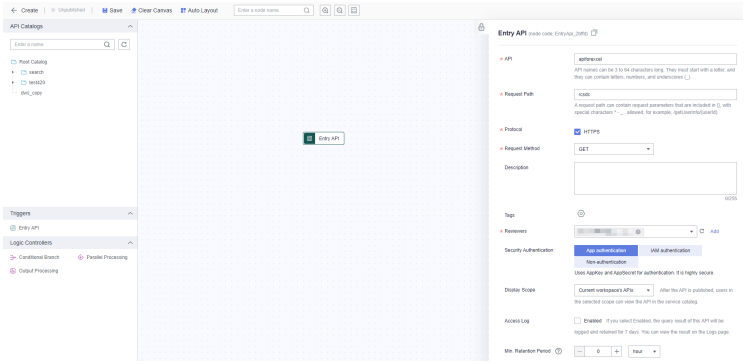
   Figure 13-44 API orchestration page



5. Drag the Entry API operator to the canvas, click the operator, and configure its parameters.

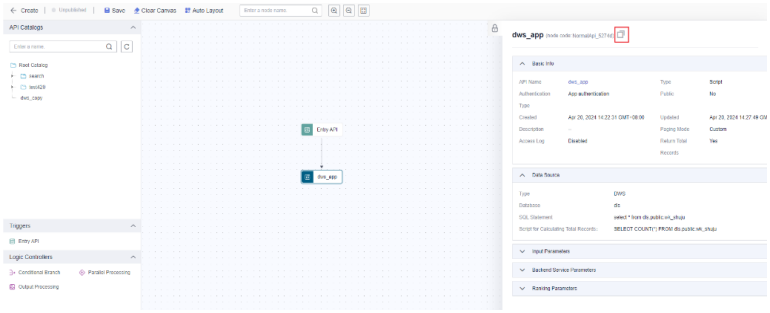
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Figure 13-45 Configuring the Entry API operator



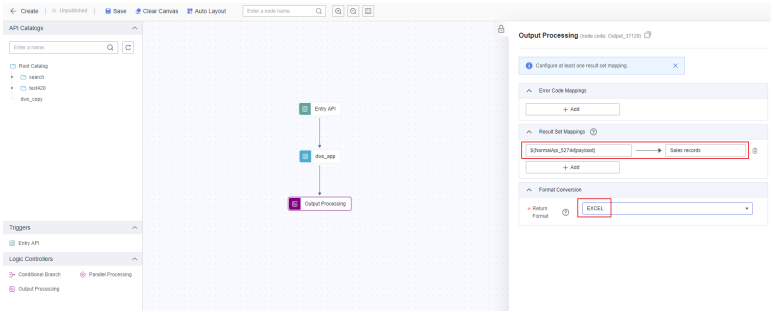
6. Drag the target Common API operator to the canvas and mount it to the Entry API operator. Click the Common API operator and copy its code, for example, **NormalApi_5274d**.

Figure 13-46 Copying code



7. Drag the Output Processing operator to the canvas and mount it to the Common API operator. Click the Output Processing operator configure its parameters.
   - Add a result set mapping. Enter the result of the Common API operator for the mapping expression, for example, **${NormalApi_5274d|payload}** and enter the result set name, for example, **Sales records**.
   - Select **EXCEL** for **Return Format**.

Figure 13-47 Configuring the Output Processing operator



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8. Save the API workflow, debug it, and publish it to the cluster. After that, the Entry API operator of the API workflow can be invoked to save the data obtained by the common API to an Excel file.

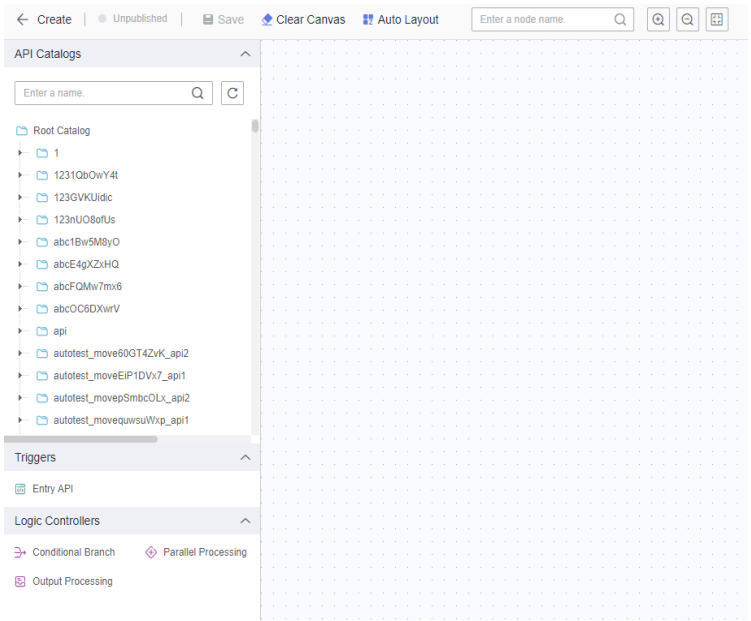
Developing an API Workflow 2: A Data Request Depends on Multiple Data APIs

A department of an e-commerce company wants to provide supplier information and sales rating data for users in area1 and provide retailer information for users in other areas.

The following APIs are available: AreaInformation, SupplierInformation, SalesRating, and RetailerInformation. You can create an API workflow that meets the department's demands by performing the following steps:

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
3. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
4. Choose **API Development** > **API Orchestration** and click **Create**.

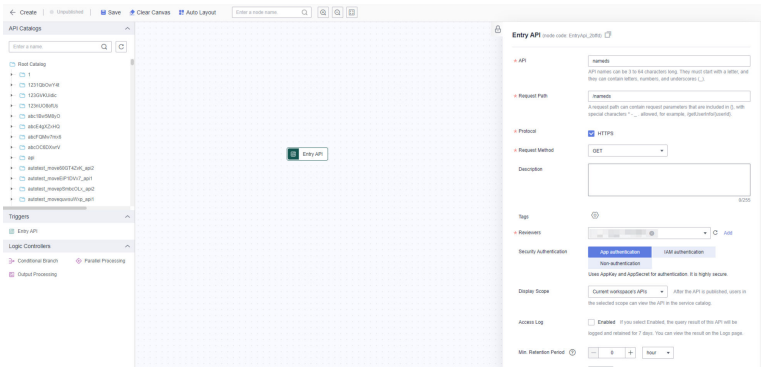
Figure 13-48 API orchestration page



5. Drag the Entry API operator to the canvas, click the operator, and configure its parameters.

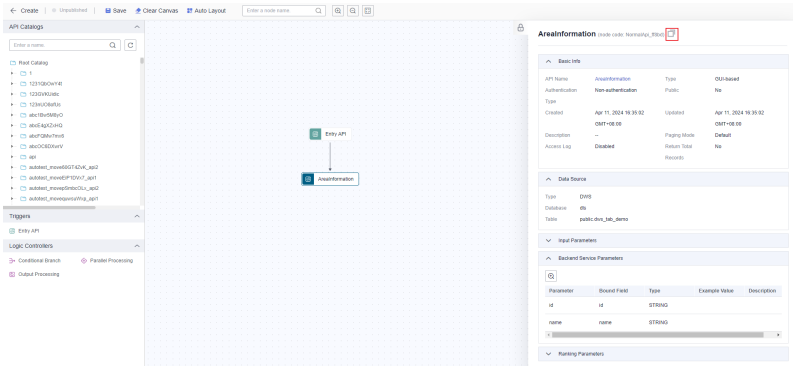
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Figure 13-49 Configuring the Entry API operator



6. Drag the AreaInformation API operator in the API catalogs to the canvas and mount it to the Entry API operator. Click the AreaInformation API operator and copy its code, for example, **NormalApi_ff8bd**.

Figure 13-50 Copying the code of the AreaInformation operator



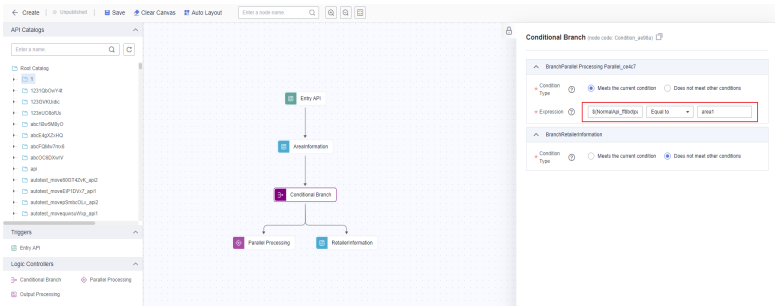
7. Drag the Conditional Branch operator to the canvas, mount it to the AreaInformation operator, and mount the Parallel Processing operator and RetailerInformation operator to the Conditional Branch. The code of the RetailerInformation operator is **NormalApi_de62d**.

   Click the Conditional Branch operator on the canvas and configure its parameters.

   - For the Parallel Processing operator, set **Condition Type** to **Meets the current condition** and **Expression** to **${NormalApi_ff8bd|payload.data[0].area}**. The expression is used to obtain the field value in the first row and the **area** column in the result set of the AreaInformation API. If the obtained field value is **area1**, the Parallel Processing operator is executed.
   - For the RetailerInformation operator, set **Condition Type** to **Does not meet other conditions**. If the conditions of the Parallel Processing operator are not met, the RetailerInformation operator is executed.

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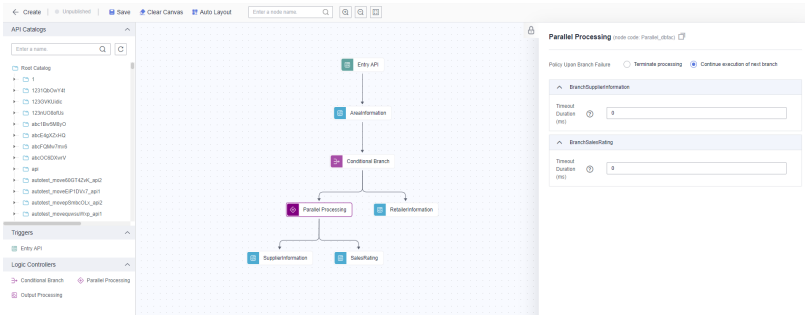
Figure 13-51 Configuring the Conditional Branch operator



8. Drag the SupplierInformation API and SalesRating API operators in the API catalogs to the canvas, and mount them to the Parallel Processing operator. The code of the SupplierInformation operator is **NormalApi_3ad5c** and that of the SalesRating operator is **NormalApi_01e7e**.

   Click the Parallel Processing operator and set **Policy Upon Branch Failure** and **Timeout Duration** for the SupplierInformation and SalesRating operators. (retain their default values.) When the Parallel Processing operator is executed, the SupplierInformation and SalesRating operators are both scheduled.

Figure 13-52 Configuring the Parallel Processing operator

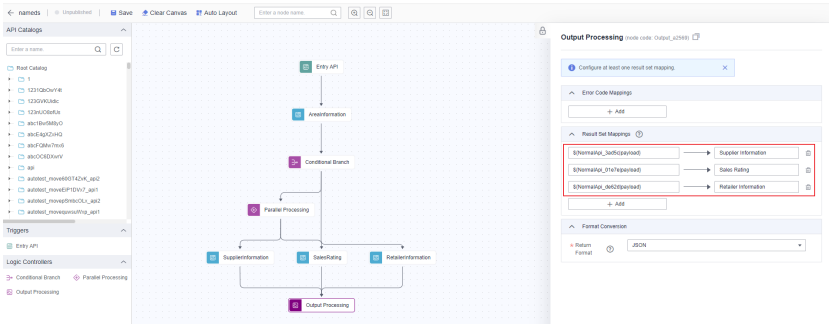


9. Drag the Output Processing operator to the canvas and mount it to the three Common API operators. Click the Output Processing operator and add result set mappings.

   Add three mappings to output the results of the three Common API operators. Set the expressions of the mappings to the results of the corresponding Common API operators, for example, **${NormalApi_3ad5c|payload}**, **${NormalApi_01e7e|payload}**, and **${NormalApi_de62d|payload}**, and set the result set names.

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Figure 13-53 Configuring the Output Processing operator



10. Save the API workflow, debug it, and publish it to the cluster. After that, the Entry API operator of the API workflow can be invoked to return different information for users in different areas.

Related Operations

- Editing an API workflow: On the API workflow list page, locate a workflow, and click **Edit** in the **Operation** column. On the displayed page, orchestrate the workflow again or modify it.
- Viewing API workflow authorization: On the API workflow list page, locate a workflow and click **View** in the **Operation** column to access the API information page, where you can authorize the workflow.

  If the app or IAM authentication mode is used for the Entry API, you must create an app and authorize the app to use the API before invoking the API workflow. The workflow authorization method is basically the same as the API authorization method. For details, see **Authorizing API Calling** or **Applying for API Authorization**.
- Debugging an API workflow: On the API workflow list page, locate a workflow, click **More** in the **Operation** column, and select **Debug**.

  Add request parameters and click **Test**. The response of the API call is displayed in the result output area on the right. The workflow debugging process is basically the same as the API debugging process. For details, see **Debugging an API**.
- Publishing an API workflow: On the API workflow list page, locate a workflow, click **More** in the **Operation** column, and select **Publish**.

  An API workflow is available only after it is published. The workflow publishing process is basically the same as the API publishing process. For details, see **Publishing an API**.
- Unpublishing/Deleting an API workflow: On the API workflow list page, locate a workflow, click **More** in the **Operation** column, and select **Unpublish** to unpublish the workflow. Select a workflow and click **Delete** above the workflow list to delete the workflow.

  If you want to stop a published API workflow from providing services, you can unpublish it. The authorization information will not be retained after the API workflow is unpublished. If you no longer need the suspended API, you can delete it. The deletion cannot be undone. The process of unpublishing/deleting an API workflow is basically the same as that of unpublishing/deleting an API. For details, see **Unpublishing/Deleting APIs**.

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- Suspending/Restoring an API workflow: On the API workflow list page, locate a workflow, click **More** in the **Operation** column, and select **Suspend** or **Restore**.

  To edit or debug a published API workflow, you must suspend the API workflow first. After the API workflow is suspended, its authorization information is retained. You can still edit and debug the API workflow. You can resume the API workflow so that it can continue to provide services. The process of suspending/resuming an API workflow is basically the same as that of suspending/resuming an API. For details, see **Suspending/Restoring an API**.

- Displaying an API workflow: On the API workflow list page, locate a workflow, click **More** in the **Operation** column, and select **Display**.

  Then you can set the visibility scope of the API workflow in the service catalog. The process of setting the visibility scope of an API workflow is basically the same as that of setting the visibility scope of an API. For details, see **Displaying an API**.

- Copying an API workflow: On the API workflow list page, locate a workflow, click **More** above the list, and select **Copy**.

  By copying an API workflow, you can obtain an API workflow with the same configuration as the source API workflow. The processing of copying an API workflow is basically the same as that of copying an API. For details, see **Copying an API**.

- Synchronizing an API workflow to Data Map: On the API workflow list page, locate a workflow, click **More** above the list, and select **Synchronize to Data Map**.

  This allows you to view API workflows in Data Map. The processing of synchronizing an API workflow to Data Map is basically the same as that of synchronizing an API to Data Map. For details, see **Synchronizing APIs to Data Map**.

13.3.8 Configuring a Throttling Policy for API Calling

Scenario

A throttling policy limits the maximum number of times that an API can be called within a specific period. Throttling policies can protect the backend service from getting overloaded. Currently, API throttling can limit the number of API calls by user, application, and time period.

To ensure the stability of services, you can create throttling policies to control the calls made to specified APIs. Throttling policies take effect for an API only if they are bound to the API.

NOTE

An API can be bound to only one throttling policy in an environment, but each throttling policy can be bound to multiple APIs.

Prerequisites

The API to be bound has been published.

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Creating a Throttling Policy

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. On the displayed page, choose **Throttling Policies** from the left navigation bar.
4. On the displayed page, click **Create**. Set the parameters listed in **Table 13-18**.

Figure 13-54 Creating a throttling policy

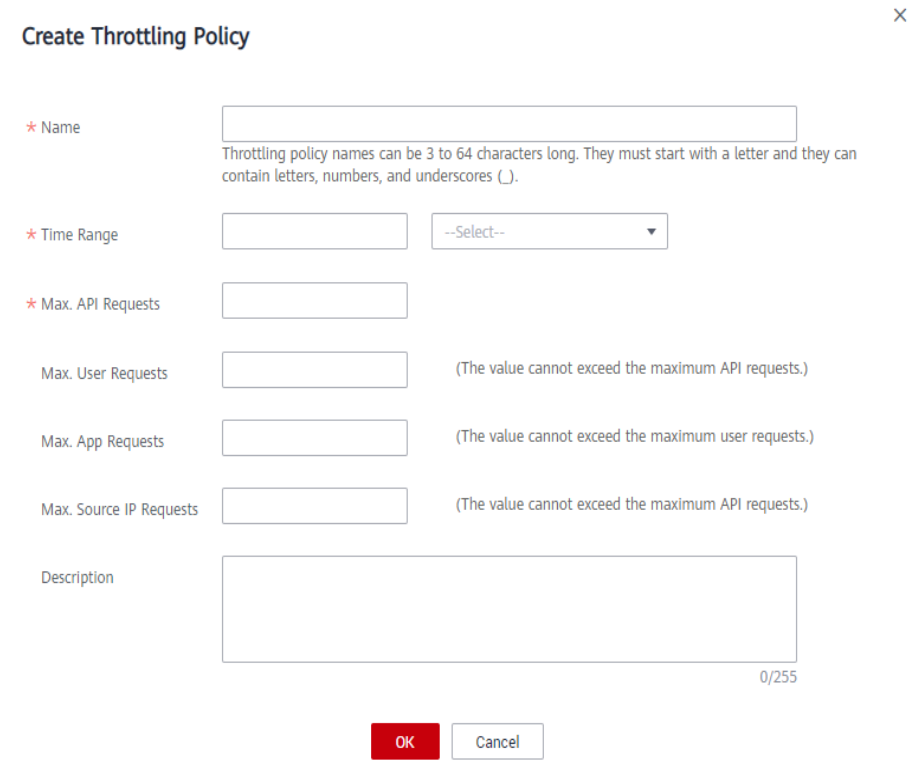


Table 13-18 Parameters

Parameter	Description
Name	The throttling policy name.

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Parameter	Description
Time Range	The time duration for limiting the number of API calls • Used together with **Max. API Requests** to specify the total number of times an API can be called within a time period. • Used together with **Max. User Requests** to specify the number of times an API can be called by a user within a time period. • Used together with **Max. App Requests** to specify the total number of times an API can be called by an app within a time period.
Max. API Requests	The maximum number of times an API can be called within the specified time period. Used together with **Time Range** to specify the maximum number of times an API can be called within the period.
Max. User Requests	The maximum number of times an API can be called by a user within the specified period. • The value of this parameter must be less than that of **Max. API Requests**. • Used together with **Time Range** to specify the maximum number of times an API can be called by a user within the specified period.
Max. App Requests	The maximum number of times an application can be called by a user within the specified period. • The value of this parameter must be less than that of **Max. User Requests**. • Used together with **Time Range** to specify the maximum number of requests an app can make within the specified period.
Description	A description of the throttling policy to be created

5. Click **OK**.

   After the throttling policy is created, it is listed in the throttling policy list. Bind the throttling policy to an API to limit the access traffic.

Binding a Throttling Policy to an API

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **Throttling Policies** from the left navigation bar.
4. Bind a throttling policy to an API in either of the following ways:
   - Locate the throttling policy to be bound and click **Associate with APIs**.

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- Click the target policy name to go to its details page and click **Associate with APIs** on the **List of Associated APIs** tab page.

5. Enter an API group and API name to search for the target API.
6. Select the API and click **OK**.

   NOTE

   If a throttling policy is no longer needed, click **Unbind** on the **List of Associated APIs** tab page. To unbind multiple APIs at a time, select the APIs to be unbound and click **Unbind**. Up to 1000 APIs can be unbound at a time.

Deleting a Throttling Policy

You can delete a throttling policy if it is no longer needed.

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. On the displayed page, choose **Throttling Policies** from the left navigation bar.
4. On the displayed page, locate the policy you want to unbind and click **Delete** in the **Operation** column.

   NOTE

   - Throttling policies bound to APIs cannot be deleted. Therefore, you need to unbind them from APIs before deleting them.
   - To delete multiple throttling policies at a time, select the policies, and click **Delete**. Up to 1000 throttling policies can be deleted at a time.

5. Click **Yes**.

13.3.9 Authorizing API Calling

13.3.9.1 Authorizing an API Which Uses App Authentication to Apps

An app defines the identity of an API caller. For an API that uses app authentication, you must create an app of the APP type and authorize the app to use the API to obtain authentication information for calling the API.

An API using app authentication can be authorized to multiple apps of the APP type, and multiple APIs using app authentication can be authorized to the same app of the APP type. After an API is authorized, the key pair (AppKey and AppSecret) of any authorized app can be used for security authentication when the API is called. There are no limitations on the identity of the API caller.

Notes and Constraints

- APIs that use app authentication can be called only after being authorized to apps.
- APIs using the app authentication can be authorized only to apps of the APP type.

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- If you authorize apps to call an API without authentication, the system ignores this operation.
- Only the DAYU Administrator, Tenant Administrator, or workspace administrator can reset the AppSecret of an app of the APP type.
- The APPSecret can be reset only once within one minute. You can view the reset records on the event management page.
- If the AppSecret is reset, authorized APIs cannot be called. Exercise caution when performing this operation.

Creating an App of the APP Type

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Calling** > **Apps**. On the page displayed, click **Create**. The **Create App** dialog box is displayed. Set the parameters listed in **Table 13-19**.

   Table 13-19 App information

Parameter	Description
App Name	Name of the app to create
Type	Select **APP**. APIs using the APP authentication mode can be authorized only to applications of the APP type. • **IAM**: APIs using IAM authentication can be authorized to apps of this type. The name of an app of the IAM type is fixed at the a Huawei account. Only one such app can be created for each DataArts Studio instance and is visible to all workspaces in the instance. • **APP**: APIs using app authentication can be authorized to apps of this type. You can authorize APIs using different app authentication modes to different apps to improve data security.
Description	A description of the app to create

4. Click **OK**.

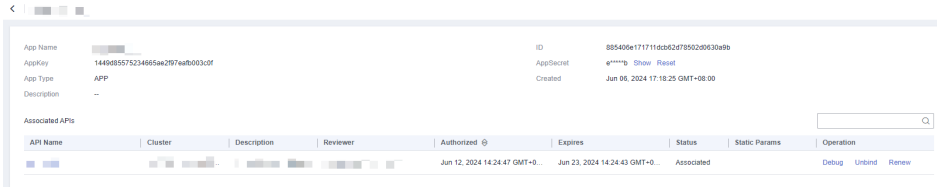
   After the app is created, its name and ID are displayed in the application list.
5. Click the app name to view the **AppKey** and **AppSecret** on the displayed app details page. You can reset **AppSecret**.

   NOTE

   If the **AppSecret** is reset, authorized APIs cannot be called. Exercise caution when performing this operation.

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Figure 13-55 App details page



Authorizing an API Which Uses App Authentication to Apps of the APP Type

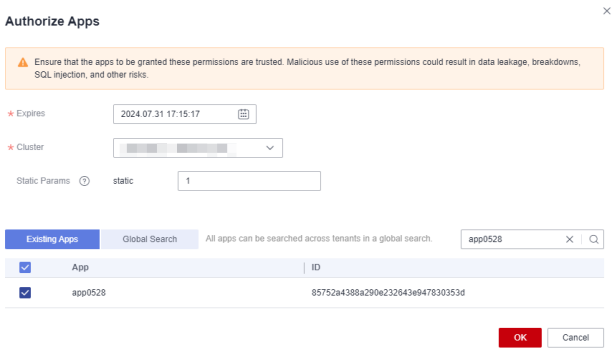
An API that uses app authentication can be called only after it is authorized to apps. Authorization can be performed by an API developer or an API caller. This section uses the former as an example.

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Locate the row that contains an API which uses app authentication, click **More** in the **Operation** column, and select **View Authorization**. On the **Complete Information** tab page, click **Assign Authorization**.
5. In the **Authorize Apps** dialog box, set **Expires** and **Cluster**, select apps, and click **OK**.

   NOTE

   If **Parameter Location** was set to **Static** for an input parameter during API creation, you must also set a static parameter value. If no value is set for the static parameter, the default value of the API input parameter will be used when the API is called using an SDK, and an error will be reported indicating that the static parameter value is missing when the API is called using a tool.

Figure 13-56 Authorize Apps



6. After the authorization is complete, view the bound APIs on the app details page.

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NOTE

- In the API list, if you no longer access an API through the app, click **Unbind** in the **Operation** column.
- To test an API to which the app is bound, choose **More** > **Debug** in the **Operation** column.
- To extend the authorization period for the bound API, click **Renew**.

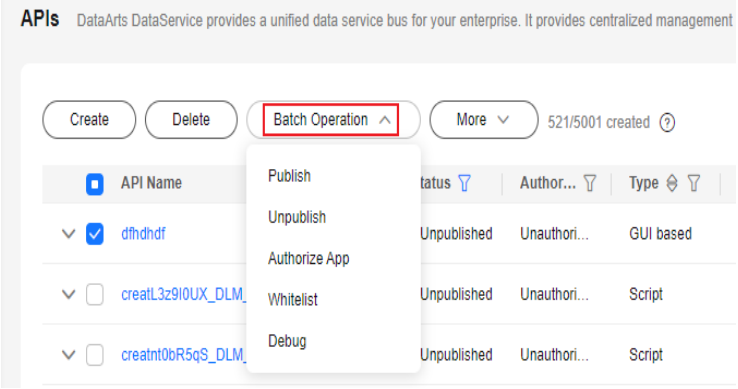
Related Operations

Authorizing an API to multiple apps: On the **APIs** page, select APIs, click **Batch Operation** above the list, and select **Authorize**.

NOTE

You cannot authorize APIs of different authentication modes to apps simultaneously.

Figure 13-57 Batch operation



13.3.9.2 Authorizing an API Which Uses IAM Authentication to Apps

APIs which use IAM authentication support two authorization modes: app of the IAM type and whitelist. The former can only authorize APIs to the current account, while the latter can authorize APIs to any account. You can choose either mode based on the application scenario.

- API authorization through apps of the IAM type: An app of the IAM type is the current Huawei account. Only one such app can be created for each DataArts Studio instance. Therefore, authorizing an API which uses IAM authentication to an app of the IAM type is authorizing the API to the current account. After authorization, you can obtain the tokens of the current account and its users from IAM. The tokens can be used for security authentication during API calls.
- API authorization through a whitelist: A Huawei account whitelist can be added for an API which uses IAM authentication. Accounts in the whitelist can use the API. After authorization, you can obtain the tokens of the authorized account and its users from IAM. The tokens can be used for security authentication during API calls.

This section describes how to authorize an API to the current account through an app of the IAM type.

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Notes and Constraints

- APIs which use IAM authentication authorized to apps of the IAM type can be called only using the token of the current account or those of its users, rather than any other account or user If needed, you can use a whitelist to authorize the APIs to other accounts. For details, see **Authorizing an API Which Uses IAM Authentication Through a Whitelist**.
- APIs using the IAM authentication can be authorized only to apps of the IAM type.
- If you authorize apps to call an API without authentication, the system ignores this operation.
- Only one app of the IAM type can be created for each DataArts Studio instance. The app name is fixed at the a Huawei account and cannot be changed.
- In DataArts DataService Exclusive, APIs which use IAM authentication must be authorized through apps or whitelists so that they can be called.

Creating an App of the IAM Type

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Calling** > **Apps**. On the page displayed, click **Create**. The **Create App** dialog box is displayed. Set the parameters listed in **Table 13-20**.

   Table 13-20 App information

Parameter	Description
App Name	App name, which is fixed at the a Huawei account and cannot be changed.
Type	Select **IAM**. APIs using the IAM authentication mode can be authorized only to apps of the IAM type. • **IAM**: APIs using IAM authentication can be authorized to apps of this type. The name of an app of the IAM type is fixed at the a Huawei account. Only one such app can be created for each DataArts Studio instance and is visible to all workspaces in the instance. • **APP**: APIs using app authentication can be authorized to apps of this type. You can authorize APIs using different app authentication modes to different apps to improve data security.
Description	A description of the app to create

4. Click **OK**.

   After the app is created, its name and ID are displayed in the application list.

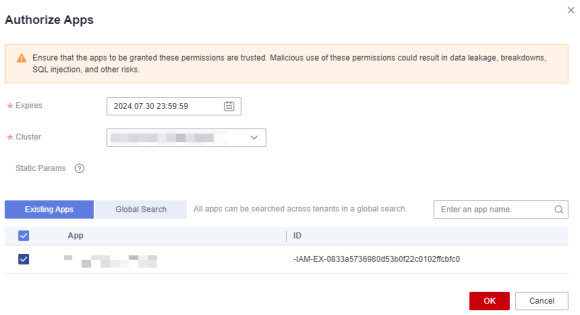
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Authorizing an API Which Uses IAM Authentication to the Current Account

An API that uses IAM authentication can be called only after it is authorized. Authorization can be performed by an API developer or an API caller. This section uses the former as an example.

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.
4. Locate the row that contains an API which uses IAM authentication, click **More** in the **Operation** column, and select **View Authorization**. On the **Complete Information** tab page, click **Assign Authorization**.
5. In the **Authorize Apps** dialog box, set **Expires** and **Cluster**, select IAM apps, and click **OK**.

Figure 13-58 Authorize Apps



6. After the authorization is complete, view the bound APIs on the app details page.

   NOTE

   - In the API list, if you no longer access an API through the app, click **Unbind** in the **Operation** column.
   - To test an API to which the app is bound, choose **More** > **Debug** in the **Operation** column.
   - To extend the authorization period for the bound API, click **Renew**.

Related Operations

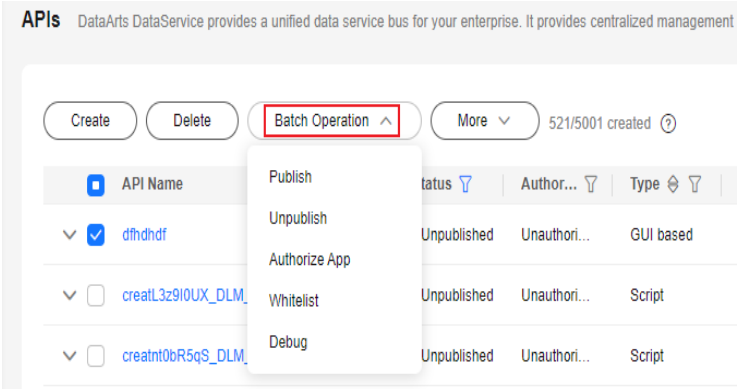
Authorizing an API to multiple apps: On the **APIs** page, select APIs, click **Batch Operation** above the list, and select **Authorize**.

NOTE

You cannot authorize APIs of different authentication modes to apps simultaneously.

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Figure 13-59 Batch operation



13.3.9.3 Authorizing an API Which Uses IAM Authentication Through a Whitelist

APIs which use IAM authentication support two authorization modes: app of the IAM type and whitelist. The former can only authorize APIs to the current account, while the latter can authorize APIs to any account. You can choose either mode based on the application scenario.

- API authorization through apps of the IAM type: An app of the IAM type is the current Huawei account. Only one such app can be created for each DataArts Studio instance. Therefore, authorizing an API which uses IAM authentication to an app of the IAM type is authorizing the API to the current account. After authorization, you can obtain the tokens of the current account and its users from IAM. The tokens can be used for security authentication during API calls.
- API authorization through a whitelist: A Huawei account whitelist can be added for an API which uses IAM authentication. Accounts in the whitelist can use the API. After authorization, you can obtain the tokens of the authorized account and its users from IAM. The tokens can be used for security authentication during API calls.

This section describes how to authorize an API to an account through a whitelist.

Notes and Constraints

- In DataArts DataService Exclusive, APIs which use IAM authentication must be authorized through apps or whitelists so that they can be called.
- Only APIs using IAM authentication can be authorized through a whitelist.

Authorizing an API to an Account Through a Whitelist

An API that uses IAM authentication can be called only after it is authorized.

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Development** > **APIs**.

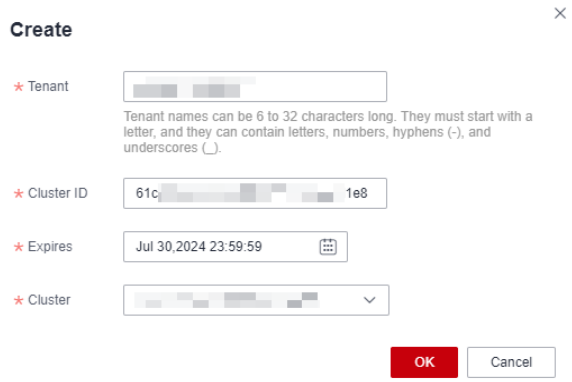
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4. Locate the row that contains the API to be authorized to another Huawei account, click **More** in the **Operation** column, and select **View Authorization**.
5. Click the **Whitelist Info** tab and click **Create**.
6. In the displayed dialog box, set the tenant name, tenant ID, and authorization expiration time, select a cluster, and click **OK**.

   To obtain the tenant name and tenant ID, log in using the account to be authorized or a user of the account and perform the following steps (the tenant name and ID are the account name and ID, respectively):

   a. Register with and log in to the management console.
   b. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list.
   c. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.

Figure 13-60 Creating a whitelist



7. After the authorization is successful, you can view the authorized accounts on the **Whitelists** page.

   NOTE

   If you do not want to authorize the API to an account, click **Delete** in the **Operation** column of the row that contains the tenant name.

Related Operations

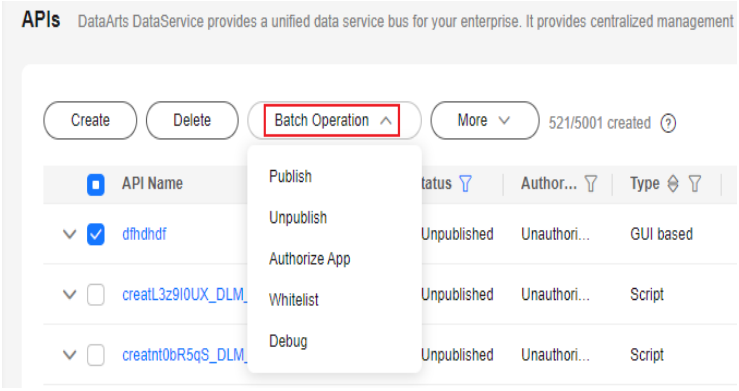
Adding a whitelist for multiple APIs: On the **APIs** page, select APIs, click **Batch Operation** above the API list, and click **Add Whitelist**.

NOTE

You can add a whitelist only for multiple APIs that use IAM authentication.

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Figure 13-61 Batch operation



13.4 Calling APIs in DataArts DataService

13.4.1 Applying for API Authorization

If you are an API developer and want to call an API which uses app or IAM authentication, you must apply for API authorization.

If you have authorized apps to use the API by following the instructions in **Authorizing an API Which Uses App Authentication to Apps**, **Authorizing an API Which Uses IAM Authentication to Apps**, or **Authorizing an API Which Uses IAM Authentication Through a Whitelist**, skip this section.

Notes and Constraints

- In DataArts DataService Exclusive, APIs which use IAM authentication must be authorized through apps or whitelists so that they can be called.
- You can only authorize an API through an app rather than a whitelist.
- APIs using the app authentication can be authorized only to apps of the APP type.
- APIs using the IAM authentication can be authorized only to apps of the IAM type.

Authorizing an API to Apps

An API that uses app or IAM authentication can be called only after it is authorized. Authorization can be performed by an API developer or an API caller. This section uses the latter as an example.

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **API Calling** > **Service Catalogs** to view all the published APIs.
4. Click the name of the API you want to bind to an app.
5. On the page displayed, click **Permission Application**.

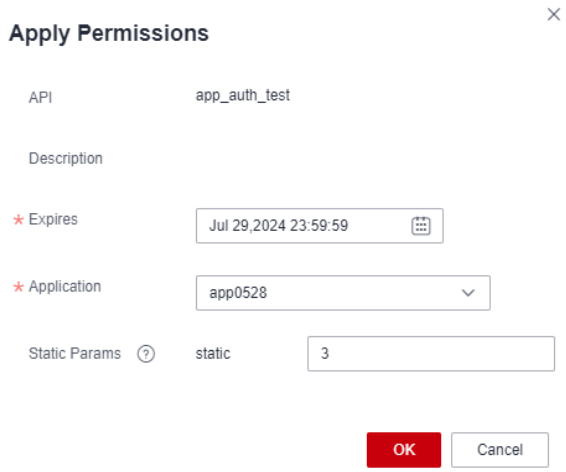
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6. On the displayed page, set the expiration time, select an app, and click **OK**.

   NOTE

   If **Parameter Location** was set to **Static** for an input parameter during API creation, you must also set a static parameter value. If no value is set for the static parameter, the default value of the API input parameter will be used when the API is called using an SDK, and an error will be reported indicating that the static parameter value is missing when the API is called using a tool.

   Figure 13-62 Applying for permissions



7. The authorization takes effect after the submitted request is approved in the review center.
8. After the authorization is complete, view the bound APIs on the app details page.

   NOTE

   - In the API list, if you no longer access an API through the app, click **Unbind** in the **Operation** column.
   - To test an API to which the app is bound, choose **More** > **Debug** in the **Operation** column.
   - To extend the authorization period for the bound API, click **Renew**.

13.4.2 Calling APIs Using Different Methods

13.4.2.1 API Calling Methods

Three authentication modes are available during API creation. The method for calling APIs varies depending on the API authentication mode. For details, see **Table 13-21**.

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Table 13-21 API authentication modes and calling methods

Authentication Mode	Security Level	Authorization and Authentication Mechanism	Calling Method	Example Calling Method	Description
(Recommended) App authentication	High	After an API is authorized to an app, the key pair (AppKey and AppSecret) of the app is used for security authentication.	• (Recommended) SDKs for multiple languages such as Java, Go, Python, JavaScript, C#, PHP, C++, C and Android • API tool: You must manually generate a signature using **demo.html** in the JavaScript SDK package so that the API tool can be used to call APIs.	• **(Recommended) Using an SDK to Call an API Which Uses App Authentication** • **Using an API Tool to Call an API Which Uses App Authentication**	App authentication and SDKs are recommended, which can help you easily and quickly obtain open data through data APIs.
IAM authentication	Medium	After an API is authorized to an account using an IAM app or whitelist, the user token obtained from IAM is used for security authentication.	API tool: You need to call the API for **obtaining a user token through password authentication** to obtain a token, and then use an API tool to call the API.	**Using an API Tool to Call an API Which Uses IAM Authentication**	IAM authentication can be used when an API tool is used to call APIs.

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Authentication Mode	Security Level	Authorization and Authentication Mechanism	Calling Method	Example Calling Method	Description
None	Low	No authorization is required. All users can access APIs.	• API tool: An API tool can be used to call APIs directly, without authentication information. • Browser: If the API input parameters are located in Query and Path, a browser can be used to call APIs. If the input parameters are located in Header or Body, the browser cannot be used to call APIs because the parameters cannot be transferred.	• **Using an API Tool to Call an API Which Requires No Authentication** • **Using a Browser to Call an API Which Requires No Authentication**	It is recommended that the non-authentication mode be used only for testing APIs. If the caller is not a trusted user, there is a risk of data leakage, breakdowns caused by high concurrent access, SQL injection, and others.

13.4.2.2 (Recommended) Using an SDK to Call an API Which Uses App Authentication

APIs using app authentication can be bound to different apps, which provides the highest security level. APIs using app authentication can be called via SDKs of multiple languages, such as Java, Go, Python, JavaScript, C#, PHP, C++, C and Android, helping you easily and quickly obtain open data.

This section uses the Java SDK as an example to describe how to use an SDK to call an API which uses app authentication. The procedure is as follows:

1. **Obtaining App and API Information**: Prepare key information of the app and API.
2. **Obtaining the SDK Package**: Download the SDK package and verify its integrity.
3. **Calling an API Using an SDK**: Modify the SDK code and run it.

Prerequisites

- An API or API workflow using app authentication has been published. The published API is available in DataArts Catalog.

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- An App has been created and the API has been authorized to the app. That is, the API developer has completed the operations in **Authorizing an API Which Uses App Authentication to Apps**, or the API caller has completed the operations in **Applying for API Authorization**.
- Eclipse 3.6.0 or later has been installed. If not, download it from the **Eclipse official website** and install it.

Notes and Constraints

- Before calling an API which uses app authentication, you must perform the operations in **Authorizing an API Which Uses App Authentication to Apps** or **Applying for API Authorization**.
- To call an API in DataArts DataService locally, you need to bind an EIP to the DataArts DataService Exclusive cluster when creating the cluster.
- When an API in DataArts DataService is called, if the total duration of query and response exceeds 60 seconds (default value), a timeout error is reported. In this case, you can optimize the API configuration based on the API calling duration recorded in the access log.

```
__________Duration information_________
duration: 60491ms //Total duration
url_duration: 0ms //URL matching duration
auth_duration: 70ms //Authentication duration
befor_sql_duration: 402ms //Preprocessing duration before SQL execution
sql_duration: 60001ms //SQL execution duration
after_sql_duration:18ms //Postprocessing duration after SQL execution
```

Obtaining App and API Information

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

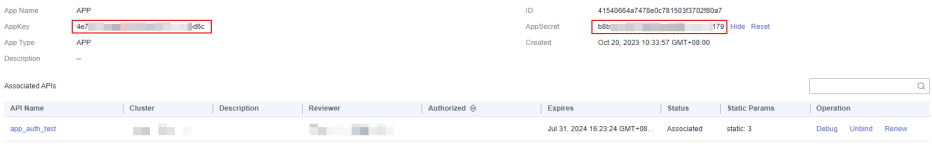
Step 2 On the DataArts Studio console, locate a workspace and click **DataArts DataService**.

Step 3 In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.

Step 4 Obtain the AppKey and AppSecret of the app authorized by the API. (If multiple apps have been authorized, you only need to obtain information about one of them.)

In the navigation pane on the left, choose **Apps**. Locate the app to which the API has been authorized, click the app name to access its details page, and record the AppKey and AppSecret.

Figure 13-63 Recording the AppKey and AppSecret



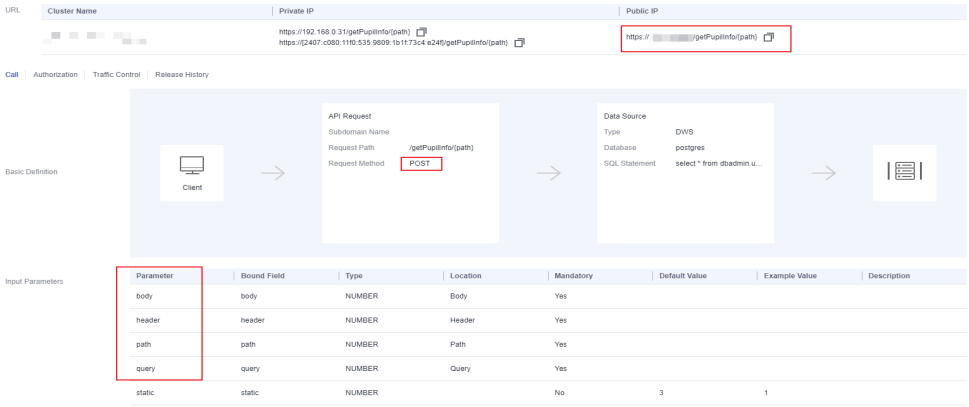
Step 5 Obtain the URL, request method, and input parameters of the API to be called.

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In the navigation pane on the left, choose **APIs**. Locate the API to be called, click the API name to access its details page, and record the URL, request method, and input parameters of the API.

- URL for calling the API: The exclusive edition supports both private and public IP addresses. To use the public IP address, you need to bind an EIP to the cluster during cluster creation. If you want to call an API in DataArts DataService Exclusive locally, you need to use a public IP address to ensure network connectivity.
- Input parameters: In this example, an API with various input parameter locations is created to describe how to enter various input parameters during an API call. Static is a static parameter that does not change with the value transferred by the API caller. Therefore, you do not need to set Static when calling an API.

Figure 13-64 Recording the URL, request method, and input parameters

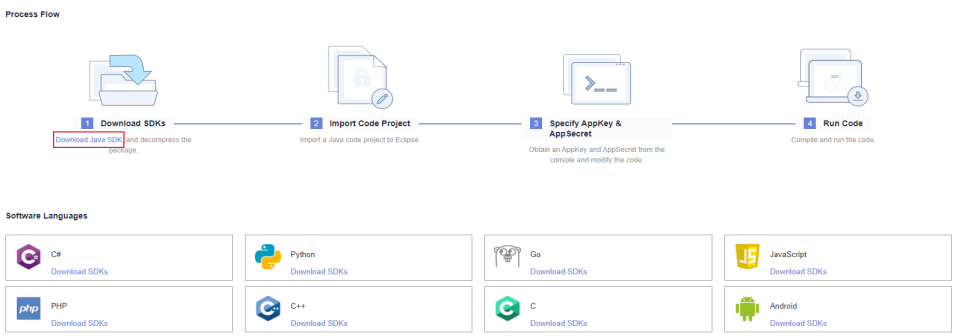


----End

Obtaining the SDK Package

Step 1 On the DataArts DataService console, choose **SDKs** in the navigation pane. On the displayed page, download the Java SDK.

Figure 13-65 Downloading the SDK



Step 2 Verify integrity of the SDK package. In Windows, open the CLI and run the following command to generate the SHA-256 value of the downloaded SDK

package. In the command, **D:\java-sdk.zip** is an example local path and name of the SDK package. Replace it with the actual value.

```
certutil -hashfile D:\java-sdk.zip SHA256
```

The following is an example command output:

```
SHA-256 hash value of D:\java-sdk.zip
96fced412700cf9b863cb2d867e6f4edf76480bc679416efab88a9e1912503b9
CertUtil: -hashfile command executed.
```

Compare the SHA-256 value of the downloaded SDK package with that provided in the following table. If they are the same, no tampering or packet loss occurred during the package download.

Table 13-22 SDK packages and the corresponding SHA-256 values

Language	SHA-256 Value of the SDK Package
Java	96fced412700cf9b863cb2d867e6f4edf76480bc679416efab88a9e1912503b9
Go	f448645da65b4f765d9569fc97ca45dc3e8f1ce4f79d70c5c43934318521d767
Python	54b4984d91db641d2b1b0e77064c162850cb2511a587f95e2f8b8340e7afa128
C#	b66caf856ffccb61fe758872aac08876aa33fb0cf5f4790e3bec163593b2cbae
JavaScript	43da0b54d6b04d1f5ed7f278c2918c2a63a1ddb8048e2d1c5db60baafb17663c
PHP	394c068420a3817f32d5d88b6c1632978f573f2a685e4a1d10c2f698e0f6786e
C++	abae5473d47594f88dcd5eaa0902dc12cd6f1e3bd63c0b82d9d1fab8b4351f54
C	a376573fe8aa3a636a6d123926ddc3dca11748b289b8c2c16a5056830a095acb
Android	c19175d736f05b1945dab4675df19311834ede0d9b1978b11b50c86687baf85c

----End

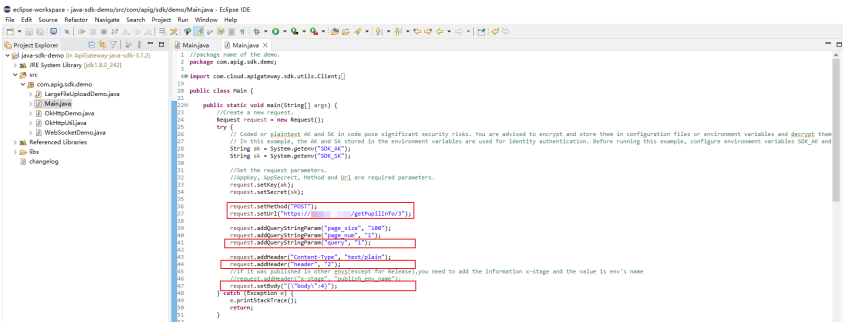
Calling an API Using an SDK

Step 1 Decompress the Java SDK package obtained in **Step 1** and import the SDK to Eclipse.

Step 2 After the SDK is successfully imported, open the **main.java** file, and modify the content shown in the red box in the following figure.

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Figure 13-66 Modifying the main.java file



- Set the request method and URL for calling the API. You can obtain them from **Step 5**.

  If input parameters include the path parameter, replace the **{path}** variable in the API calling URL with a specific value, for example, 3 in the following code:

  ```
  request.setMethod("POST");
  request.setUrl("https://xx.xx.xx.xx/getPupilInfo/3");
  ```

- Set the values of Query, Header, and Body parameters.

  Use double quotation marks and braces (**"{}"**) to enclose the string in "***Body parameter name***":***Body parameter value*** format and escape the double quotation marks (**""**) using a backslash (\).

  ```
  request.addQueryStringParam("query", "1");
  request.addHeader("header", "2");
  request.setBody("{\"body\":4}");
  ```

- (Optional) By default, the system assigns pagination data to the APIs created using configuration or a script/MyBatis. If you want to obtain specified pagination data, modify the following parameters. **pageSize** indicates the page size, and **pageNum** indicates the page number.

  ```
  request.addQueryStringParam("page_size", "100");
  request.addQueryStringParam("page_num", "1");
  ```

  NOTE

  For APIs created using a script/MyBatis with custom pagination configuration, the pagination logic is written to the data acquisition SQL statement during API creation. Therefore, the pagination settings cannot be modified during an API call.

- (Optional) By default, the system provides the default sorting based on the ranking parameters. By default, the custom ranking mode is ascending. To change the sorting, modify the following parameters. The value of **pre_order_by** is in either of the following formats: ***Ranking parameter name***:ASC (ascending order) or ***Ranking parameter name***:DESC (descending order). Separate multiple ranking parameter descriptions by semicolons (;).

  ```
  request.addQueryStringParam("pre_order_by", "id:ASC;age:ASC;score:DESC");
  ```

  You can change the value of **pre_order_by** as follows:

  - Delete an optional ranking parameter. The parameter is no longer used for ranking.
  - Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

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NOTE

The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

- If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.
- Adjustment of the sequence of ranking parameters will not take effect. The sequence of ranking parameters configured during the creation of an API through configuration, a script, or MyBatis will still be used.
- If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

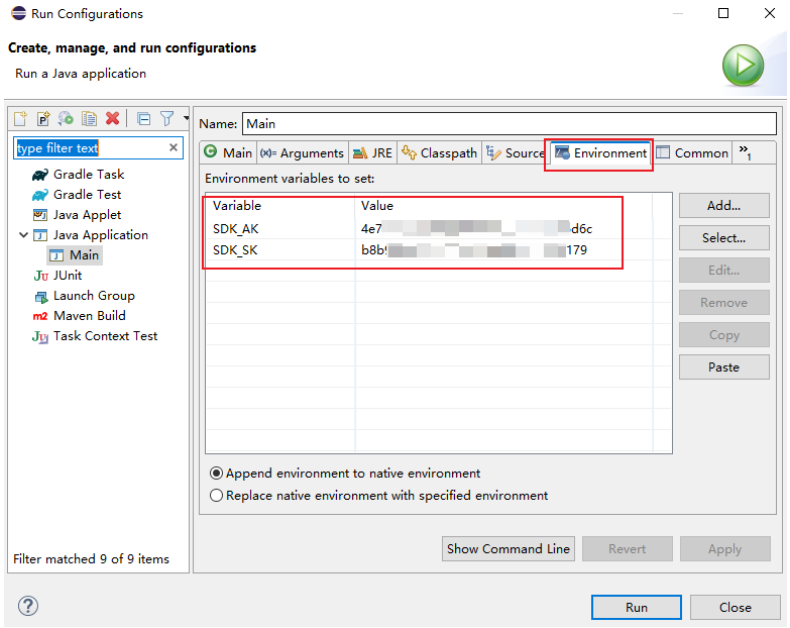
- (Optional) If **Return Total Records** is enabled during API creation, it takes a long time to obtain the total number of data records if the data table corresponding to the API contains a large amount of data. In this case, if you do not want the system to calculate and return the total number of data records during an API call, you can modify the following parameter settings. The **use_total_num** parameter specifies whether to calculate and return the total number of data records. If its value is **1**, the total number of data records is returned. If its value is not **1**, the total number of data records is not returned.

```
request.addQueryStringParam("use_total_num", "0");
```

Step 3 Set AppKey and AppSecret. Coded or plaintext AppKey and AppSecret in code pose significant security risks. You are advised to store them in configuration files or environment variables. This example takes environment variables as an example.

On Eclipse, choose **Run** > **Run Configurations**. In the displayed dialog box, select **Environment** and add variables **SDK_AK** and **SDK_SK**, whose values correspond to the AppKey and AppSecret obtained in **Step 4**, respectively. Then click **Apply** and **Run** to run the program.

Figure 13-67 Configuring the AppKey and AppSecret



Step 4 After running the program, view the API calling result. **"errCode":"DLM.0"** in the 200 message indicates that the API call is successful. If the API call fails, rectify the fault based on the error message.

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Figure 13-68 Running the program



----End

13.4.2.3 Using an API Tool to Call an API Which Uses App Authentication

APIs using app authentication can be bound to different apps, which provides the highest security level. To use an API tool to call an API which uses app authentication, you need to manually generate authentication information using **demo.html** in the JavaScript SDK package.

This section uses Postman as an example to describe how to use an API tool to call an API which uses app authentication. The procedure is as follows:

1. **Obtaining App and API Information**: Prepare key information of the app and API.
2. **Obtaining the JavaScript SDK Package**: Download the JavaScript package and verify its integrity.
3. **Generating Authentication Information**: Generate authentication information manually using **demo.html** in the JavaScript SDK package.
4. **Calling an API**: Use Postman to call the API.

Prerequisites

- An API or API workflow using app authentication has been published. The published API is available in DataArts Catalog.
- An App has been created and the API has been authorized to the app. That is, the API developer has completed the operations in **Authorizing an API Which Uses App Authentication to Apps**, or the API caller has completed the operations in **Applying for API Authorization**.
- The static parameter defined in input parameters of the API has been configured during API authorization.
- Postman has been installed. If it has not been installed, download it from the **Postman official website** and install it.

Notes and Constraints

- Before calling an API which uses app authentication, you must perform the operations in **Authorizing an API Which Uses App Authentication to Apps** or **Applying for API Authorization**.
- If a static parameter is defined in input parameters of the API, the static parameter value must be set during API authorization. Otherwise, an error indicating that the static parameter value is missing will be reported when the API is called using a tool.
- To call an API in DataArts DataService locally, you need to bind an EIP to the DataArts DataService Exclusive cluster when creating the cluster.

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- The validity period of the authentication information generated using **demo.html** is 15 minutes. When the validity period expires, the authentication information becomes invalid.
- When an API in DataArts DataService is called, if the total duration of query and response exceeds 60 seconds (default value), a timeout error is reported. In this case, you can optimize the API configuration based on the API calling duration recorded in the access log.

```
__________Duration information_________
duration: 60491ms //Total duration
url_duration: 0ms //URL matching duration
auth_duration: 70ms //Authentication duration
befor_sql_duration: 402ms //Preprocessing duration before SQL execution
sql_duration: 60001ms //SQL execution duration
after_sql_duration:18ms //Postprocessing duration after SQL execution
```

Obtaining App and API Information

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

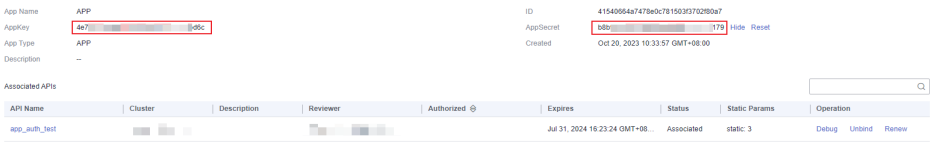
Step 2 On the DataArts Studio console, locate a workspace and click **DataArts DataService**.

Step 3 In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.

Step 4 Obtain the AppKey and AppSecret of the app authorized by the API. (If multiple apps have been authorized, you only need to obtain information about one of them.)

In the navigation pane on the left, choose **Apps**. Locate the app to which the API has been authorized, click the app name to access its details page, and record the AppKey and AppSecret.

Figure 13-69 Recording the AppKey and AppSecret



Step 5 Obtain the URL, request method, and input parameters of the API to be called.

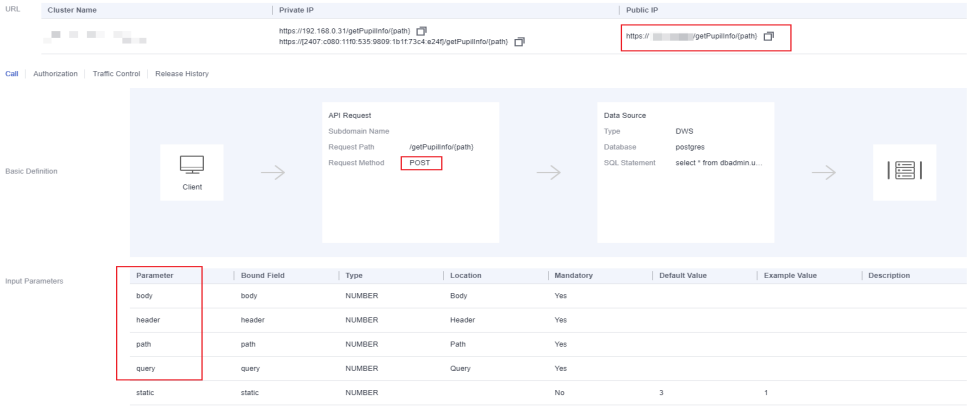
In the navigation pane on the left, choose **APIs**. Locate the API to be called, click the API name to access its details page, and record the URL, request method, and input parameters of the API.

- URL for calling the API: The exclusive edition supports both private and public IP addresses. To use the public IP address, you need to bind an EIP to the cluster during cluster creation. If you want to call an API in DataArts DataService Exclusive locally, you need to use a public IP address to ensure network connectivity.
- Input parameters: In this example, an API with various input parameter locations is created to describe how to enter various input parameters during an API call. Static is a static parameter that does not change with the value

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transferred by the API caller. Therefore, you do not need to set Static when calling an API.

Figure 13-70 Recording the URL, request method, and input parameters

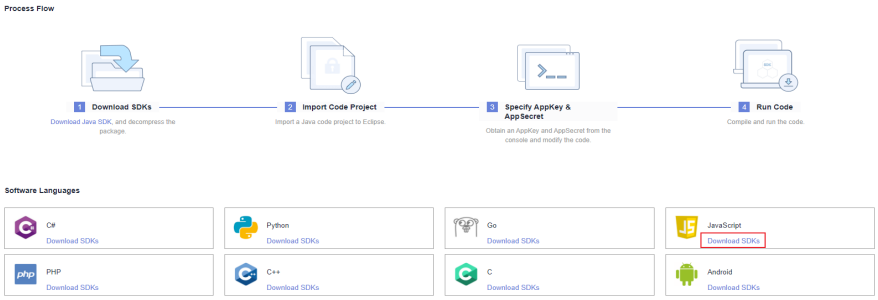


----End

Obtaining the JavaScript SDK Package

Step 1 On the DataArts DataService console, choose **SDKs** in the navigation pane. On the displayed page, download the JavaScript SDK.

Figure 13-71 Downloading the JavaScript SDK



Step 2 Verify integrity of the SDK package. In Windows, open the CLI and run the following command to generate the SHA-256 value of the downloaded SDK package. In the command, **D:\javascript-sdk.zip** is an example local path and name of the SDK package. Replace it with the actual value.

```
certutil -hashfile D:\javascript-sdk.zip SHA256
```

The following is an example command output:

```
SHA-256 hash value of D:\javascript-sdk.zip
43da0b54d6b04d1f5ed7f278c2918c2a63a1ddb8048e2d1c5db60baafb17663c
CertUtil: -hashfile command executed.
```

Compare the SHA-256 value of the downloaded SDK with that in the command example. If they are the same, no tampering or packet loss occurred during the package download.

----End

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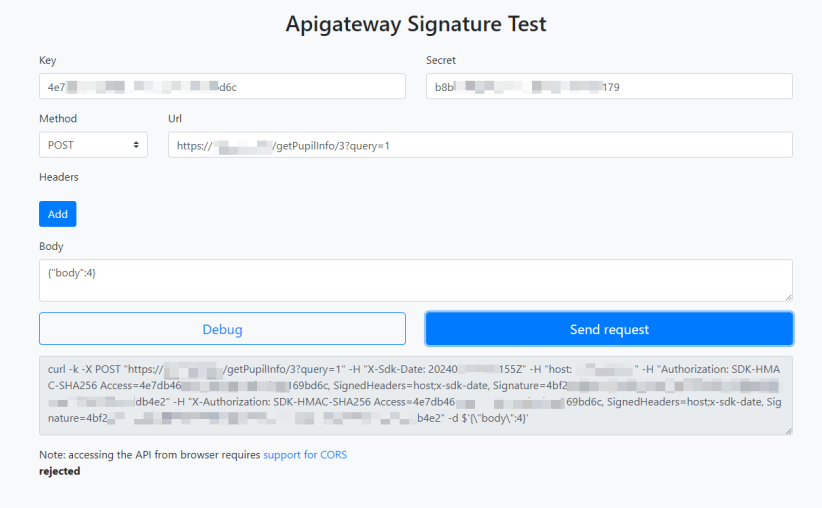
Generating Authentication Information

Step 1 Decompress the SDK package, double-click the **demo.html** file, set the following parameters, and click **Send request** to view the returned value:

- **Key** and **Secret**: AppKey and AppSecret of the app authorized by the API, which can be obtained by referring to **Obtaining App and API Information**.
- **Method** and **Url**: API request method and calling URL, which can be obtained by referring to **Obtaining App and API Information**.

  If input parameters include Path and Query parameters, you need to change the **{path}** variable in the API calling URL to the value of the Path parameter, and add the value of the Query parameter to the end of the API calling URL in the following format: ?***Query parameter name***=***Query parameter value***, for example, **?query=1** in this example.
- **Headers**: Leave it empty even if it has been defined.
- **Body**: Use braces (**{}**) to enclose a string in "***Body parameter name***":***Body parameter value*** format, for example, **{"body":4}** in this example.

Figure 13-72 Generating authentication information



Step 2 Record the content of **X-Sdk-Date**, **Authorization**, and **X-Authorization** in the return. In this example, you need to copy the following content:

```
...
X-Sdk-Date: 202********55Z
...
Authorization: SDK-HMAC-SHA256 Access=4e7********d6c, SignedHeaders=host;x-sdk-date,
Signature=4bf2********4e2
X-Authorization: SDK-HMAC-SHA256 Access=4e72********d6c, SignedHeaders=host;x-sdk-date,
Signature=4bf2********4e2
...
```

----End

Calling an API

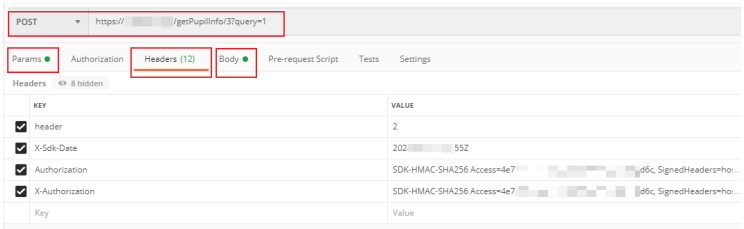
Step 1 Start Postman and add an API request.

Step 2 Configure the API request as follows:

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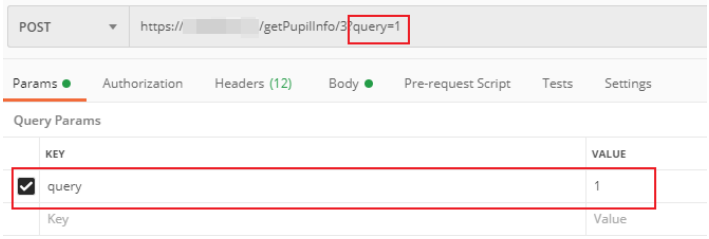
- Request method and calling URL: Obtain them by referring to **Obtaining App and API Information**. The values must be the same as those in **Generating Authentication Information**.

  Figure 13-73 Request method and calling URL

- **Params**: If the Query parameter has been added to the end of the calling URL in the ?***Query parameter name*=***Query parameter value*** format, the value of **Query Params** is automatically generated. Otherwise, you need to enter a value.

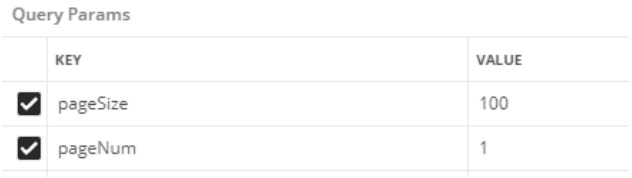
  Figure 13-74 Params

  If you want to customize the calling result, set the following Query parameters:

  – (Optional) Pagination configuration: By default, the system assigns pagination data to the APIs created using configuration or a script/MyBatis. If you want to obtain specified pagination data, modify the following parameters. **pageSize** indicates the page size, and **pageNum** indicates the page number.

    Figure 13-75 Pagination parameters

    NOTE

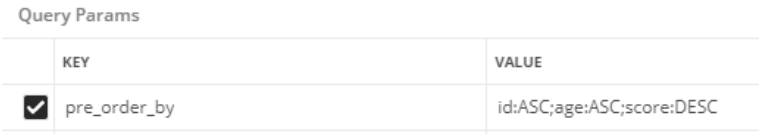
    For APIs created using a script/MyBatis with custom pagination configuration, the pagination logic is written to the data acquisition SQL statement during API creation. Therefore, the pagination settings cannot be modified during an API call.

  – (Optional) Sorting configuration: By default, the system provides the default sorting based on the ranking parameters. By default, the custom ranking mode is ascending. To change the sorting, modify the

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pre_order_by parameter. The value of **pre_order_by** is in either of the following formats: ***Ranking parameter name***:ASC (ascending order) or ***Ranking parameter name***:DESC (descending order). Separate multiple ranking parameter descriptions by semicolons (;).

Figure 13-76 Ranking parameters



You can change the value of **pre_order_by** as follows:

- Delete an optional ranking parameter. The parameter is no longer used for ranking.
- Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

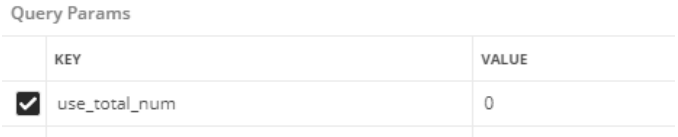
NOTE

The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

- If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.
- Adjustment of the sequence of ranking parameters will not take effect. The sequence of ranking parameters configured during the creation of an API through configuration, a script, or MyBatis will still be used.
- If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

– (Optional) Number of returned records: If **Return Total Records** is enabled during API creation, it takes a long time to obtain the total number of data records if the data table corresponding to the API contains a large amount of data. In this case, if you do not want the system to calculate and return the total number of data records during an API call, you can modify the **use_total_num** parameter. The **use_total_num** parameter specifies whether to calculate and return the total number of data records. If its value is **1**, the total number of data records is returned. If its value is not **1**, the total number of data records is not returned.

Figure 13-77 Number of returned records



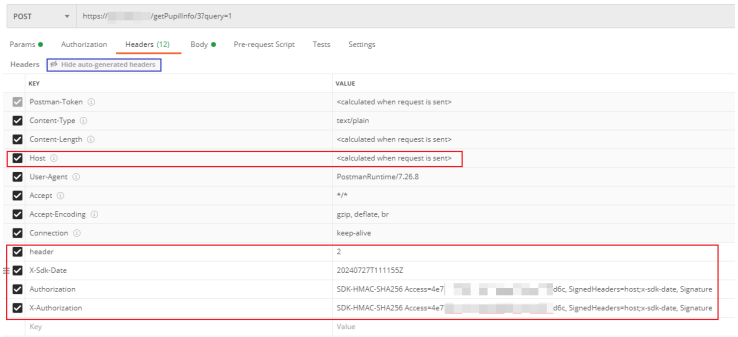
- **Headers**: Enter **X-Sdk-Date**, **Authorization**, **X-Authorization**, and their values recorded in **Step 2** in sequence, and enter **header** and its value.

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NOTE

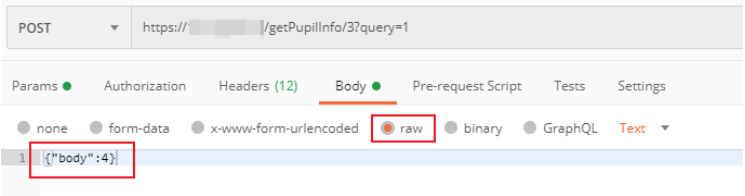
By default, Postman automatically selects **Host** and generates a host value from the URI.

Figure 13-78 Headers



- **Body**: Select the **raw** format and use braces (**{}**) to enclose a string in "***Body parameter name***":***Body parameter value*** format, for example, **{"body":4}** in this example.

Figure 13-79 Body



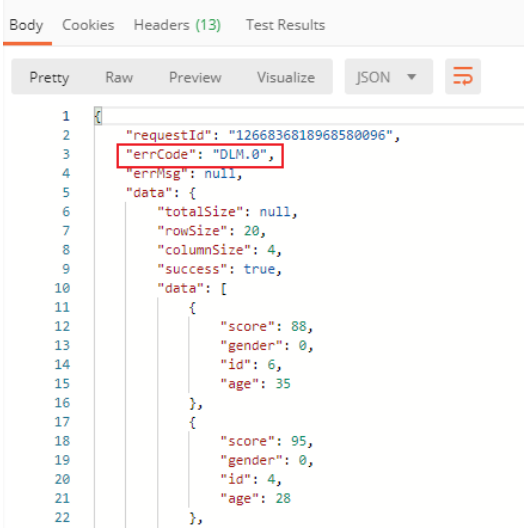
Step 3 After configuring the API request, click **Send** to send a request to the server and check the returned result. If **"errCode":"DLM.0"** is returned, the API is successfully called. If the API call fails, rectify the fault based on the error message.

NOTE

If the API call fails and message "Could not get any response" is displayed, disable **SSL certificate verification** or proxy as prompted, and try again.

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Figure 13-80 Calling an API



----End

13.4.2.4 Using an API Tool to Call an API Which Uses IAM Authentication

Before calling an API which uses IAM authentication, call the IAM API for **obtaining a user token** to obtain the token, which can be used for security authentication.

This section uses Postman as an example to describe how to use an API tool to call an API which uses IAM authentication. The procedure is as follows:

1. **Obtaining API Information**: Prepare key information of the API.
2. **Obtaining a Token**: Call the API for **obtaining a user token** to obtain the token.
3. **Calling an API**: Use Postman to call the API.

Prerequisites

- An API or API workflow using IAM authentication has been published. The published API is available in DataArts Catalog.
- API authorization has been completed. That is, the API developer has completed the operations in **Authorizing an API Which Uses IAM Authentication to Apps** or **Authorizing an API Which Uses IAM Authentication Through a Whitelist**, or the API caller has completed the operations in **Applying for API Authorization**.
- Postman has been installed. If it has not been installed, download it from the **Postman official website** and install it.

Notes and Constraints

- APIs which use IAM authentication authorized to apps of the IAM type can be called only using the token of the current account or those of its users, rather than any other account or user If needed, you can use a whitelist to authorize the APIs to other accounts. For details, see **Authorizing an API Which Uses IAM Authentication Through a Whitelist**.

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- To call an API in DataArts DataService locally, you need to bind an EIP to the DataArts DataService Exclusive cluster when creating the cluster.
- The validity period of a token is 24 hours. If you use the same token for authentication, cache the token to prevent frequent API calls.
- When an API in DataArts DataService is called, if the total duration of query and response exceeds 60 seconds (default value), a timeout error is reported. In this case, you can optimize the API configuration based on the API calling duration recorded in the access log.

```
_____Duration information_____
duration: 60491ms //Total duration
url_duration: 0ms //URL matching duration
auth_duration: 70ms //Authentication duration
befor_sql_duration: 402ms //Preprocessing duration before SQL execution
sql_duration: 60001ms //SQL execution duration
after_sql_duration:18ms //Postprocessing duration after SQL execution
```

Obtaining API Information

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts DataService**.

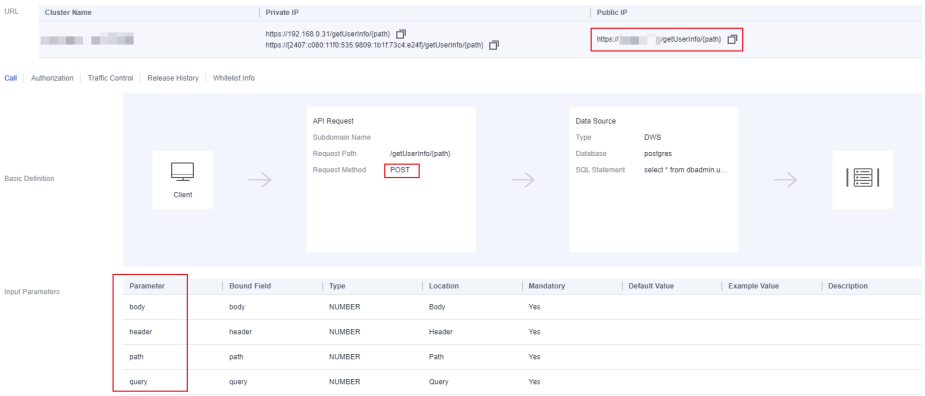
Step 3 In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.

Step 4 Obtain the URL, request method, and input parameters of the API to be called.

In the navigation pane on the left, choose **APIs**. Locate the API to be called, click the API name to access its details page, and record the URL, request method, and input parameters of the API.

- URL for calling the API: The exclusive edition supports both private and public IP addresses. To use the public IP address, you need to bind an EIP to the cluster during cluster creation. If you want to call an API in DataArts DataService Exclusive locally, you need to use a public IP address to ensure network connectivity.
- Input parameters: In this example, an API with various input parameter locations is created to describe how to enter various input parameters during an API call.

Figure 13-81 Recording the URL, request method, and input parameters



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----End

Obtaining a Token

Step 1 Start Postman and add an API request.

Step 2 Use an API tool to call the API to obtain the token.

When calling the API to **obtain a user token**, you must set **auth.scope** in the request body to **project**.

NOTE

In the request, POST https://***IAM endpoint***/v3/auth/tokens is the URL, and Content-Type: application/json is the message header. The content in {} is the request body.

Configure the bold and italic parameters based on site requirements.

- ***IAM endpoint*** indicates the endpoint of IAM.

  An endpoint is the **request address** for calling an API. Endpoints vary depending on services and regions. You can obtain endpoints from **Endpoints**.

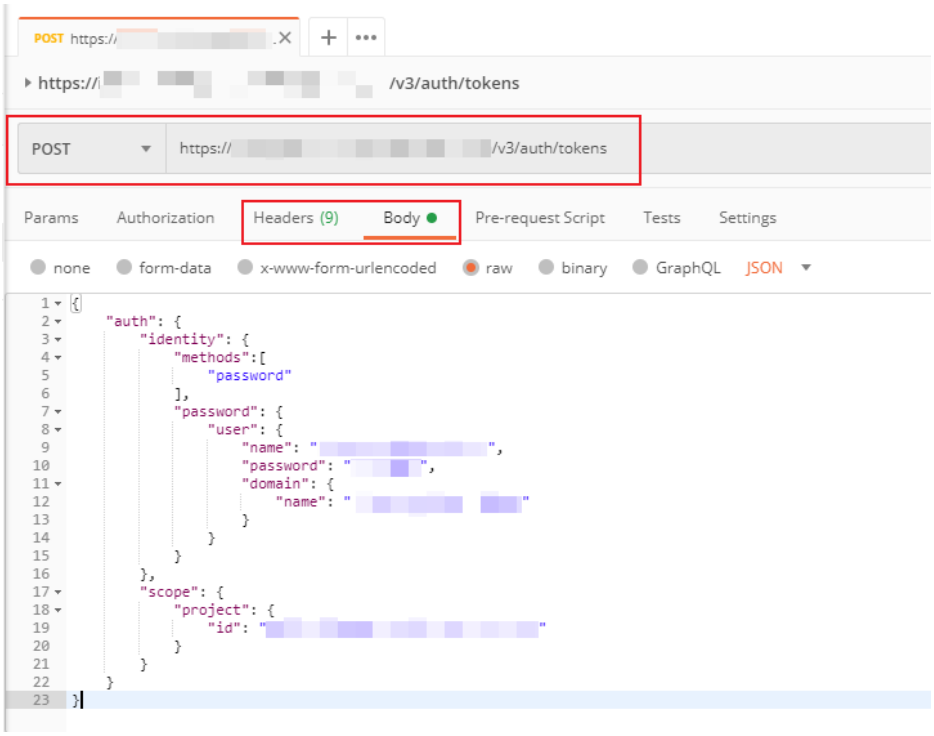
- ***username*** indicates the username, ***domainname*** indicates the account to which the user belongs, ************* indicates the login password, and ***xxxxxxxxxxxxxxxxx*** indicates the project ID. To obtain the username, account name, and project ID, perform the following steps:

  1. Register with and log in to the management console.
  2. Hover the cursor on the username in the upper right corner and select **My Credentials** from the drop-down list.
  3. On the **API Credentials** page, obtain the account name, account ID, IAM username, and IAM user ID, and obtain the project and its ID from the project list.

```
POST https://IAM endpoint/v3/auth/tokens
Content-Type: application/json
{
    "auth": {
        "identity": {
            "methods": [
                "password"
            ],
            "password": {
                "user": {
                    "name": "username",
                    "password": "********",
                    "domain": {
                        "name": "domainname"
                    }
                }
            }
        },
        "scope": {
            "project": {
                "id": "xxxxxxxxxxxxxxxxx"
            }
        }
    }
}
```

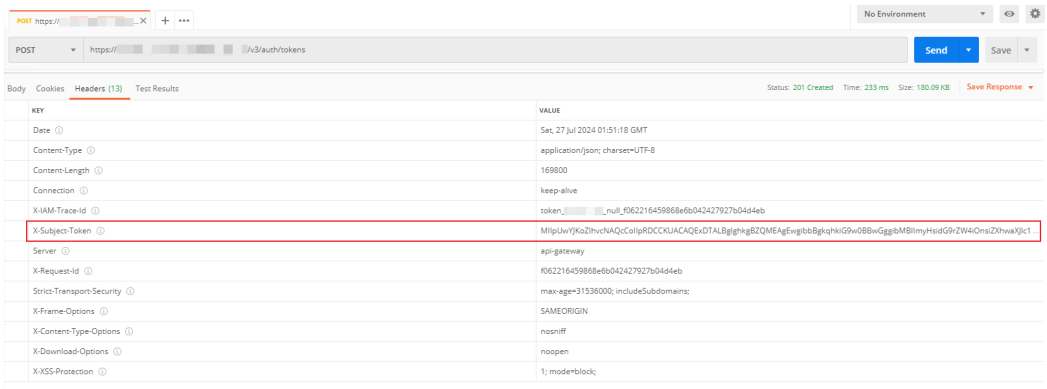
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Figure 13-82 Obtaining a token by calling



Step 3 Obtain the value of **x-subject-token** in the response header, which is the user token. When calling an API, you can add the token to the request header to obtain the permission to call the API through identity authentication.

Figure 13-83 Obtaining a token



----End

Calling an API

Step 1 Start Postman and add an API request.

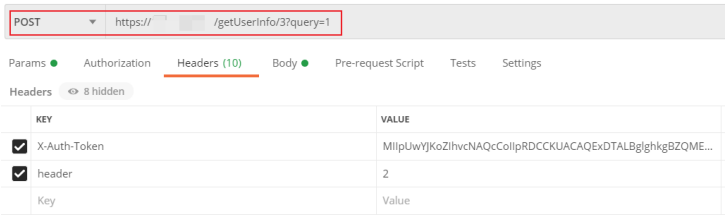
Step 2 Configure the API request as follows:

- Request method and calling URL: Obtain them by referring to **Obtaining API Information**. If input parameters include Path and Query parameters, you need to change the **{path}** variable in the API calling URL to the value of the Path parameter, and add the value of the Query parameter to the end of the

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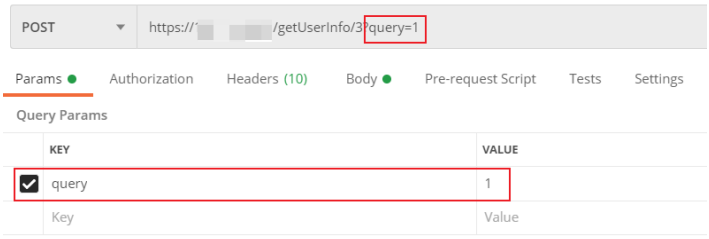
API calling URL in the following format: ?***Query parameter name*=*Query parameter value***, for example, **?query=1** in this example.

Figure 13-84 Request method and calling URL



- **Params**: If the Query parameter has been added to the end of the calling URL in the ?***Query parameter name*=*Query parameter value*** format, the value of **Query Params** is automatically generated. Otherwise, you need to enter a value.

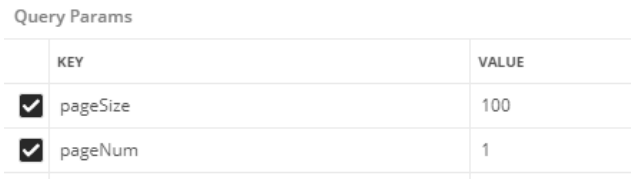
  Figure 13-85 Params

  If you want to customize the calling result, set the following Query parameters:

  – (Optional) Pagination configuration: By default, the system assigns pagination data to the APIs created using configuration or a script/MyBatis. If you want to obtain specified pagination data, modify the following parameters. **pageSize** indicates the page size, and **pageNum** indicates the page number.

    Figure 13-86 Pagination parameters

    NOTE

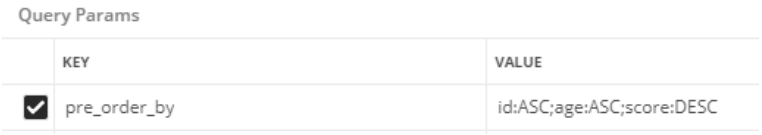
    For APIs created using a script/MyBatis with custom pagination configuration, the pagination logic is written to the data acquisition SQL statement during API creation. Therefore, the pagination settings cannot be modified during an API call.

  – (Optional) Sorting configuration: By default, the system provides the default sorting based on the ranking parameters. By default, the custom ranking mode is ascending. To change the sorting, modify the

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pre_order_by parameter. The value of **pre_order_by** is in either of the following formats: ***Ranking parameter name***:ASC (ascending order) or ***Ranking parameter name***:DESC (descending order). Separate multiple ranking parameter descriptions by semicolons (;).

Figure 13-87 Ranking parameters



You can change the value of **pre_order_by** as follows:

- Delete an optional ranking parameter. The parameter is no longer used for ranking.
- Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

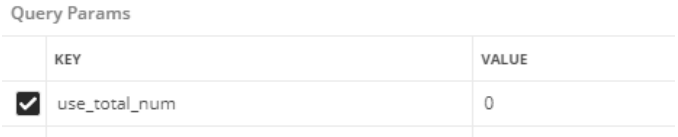
NOTE

The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

- If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.
- Adjustment of the sequence of ranking parameters will not take effect. The sequence of ranking parameters configured during the creation of an API through configuration, a script, or MyBatis will still be used.
- If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

– (Optional) Number of returned records: If **Return Total Records** is enabled during API creation, it takes a long time to obtain the total number of data records if the data table corresponding to the API contains a large amount of data. In this case, if you do not want the system to calculate and return the total number of data records during an API call, you can modify the **use_total_num** parameter. The **use_total_num** parameter specifies whether to calculate and return the total number of data records. If its value is **1**, the total number of data records is returned. If its value is not **1**, the total number of data records is not returned.

Figure 13-88 Number of returned records

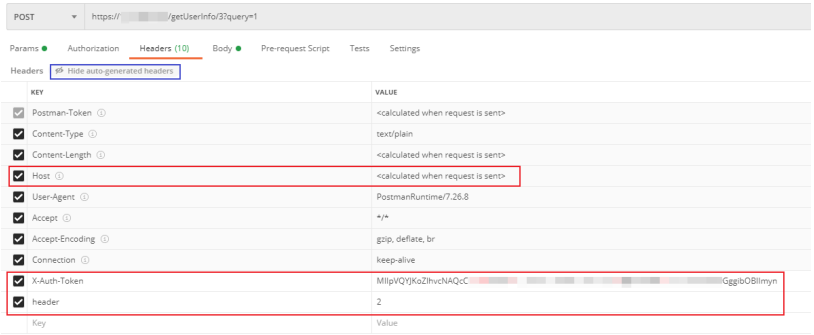


- **Headers**: Enter the value of **x-subject-token** recorded in **Obtaining a Token** for **X-Auth-Token**, and enter parameter header and its value.

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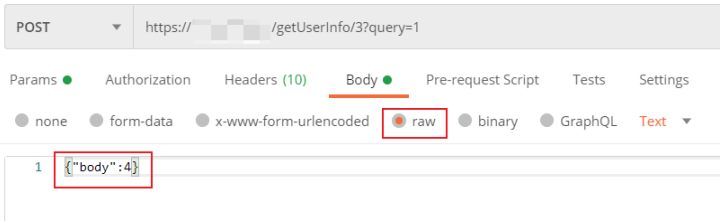
> **NOTE**
>
> By default, Postman automatically selects **Host** and generates a host value from the URI.

Figure 13-89 Headers



- **Body**: Select the **raw** format and use braces (**{}**) to enclose a string in "***Body parameter name***":***Body parameter value*** format, for example, **{"body":4}** in this example.

Figure 13-90 Body

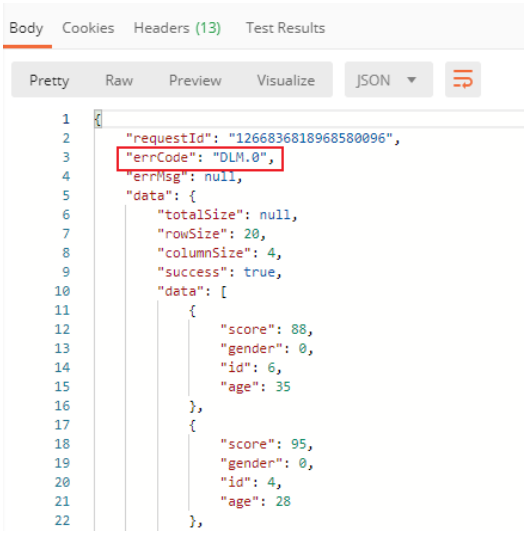


Step 3 After configuring the API request, click **Send** to send a request to the server and check the returned result. If **"errCode":"DLM.0"** is returned, the API is successfully called. If the API call fails, rectify the fault based on the error message.

> **NOTE**
>
> If the API call fails and message "Could not get any response" is displayed, disable **SSL certificate verification** or proxy as prompted, and try again.

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Figure 13-91 Calling an API



----End

13.4.2.5 Using an API Tool to Call an API Which Requires No Authentication

APIs requiring no authentication can be directly called using an API tool. Authentication information is not required.

NOTE

It is recommended that the non-authentication mode be used only for testing APIs. If the caller is not a trusted user, there is a risk of data leakage, breakdowns caused by high concurrent access, SQL injection, and others.

This section uses Postman as an example to describe how to use an API tool to call an API which requires no authentication. The procedure is as follows:

1. **Obtaining API Information**: Prepare key information of the API.
2. **Calling an API**: Use Postman to call the API.

Prerequisites

- An API or API workflow requiring no authentication has been published. The published API is available in DataArts Catalog.
- Postman has been installed. If it has not been installed, download it from the **Postman official website** and install it.

Notes and Constraints

- To call an API in DataArts DataService locally, you need to bind an EIP to the DataArts DataService Exclusive cluster when creating the cluster.
- When an API in DataArts DataService is called, if the total duration of query and response exceeds 60 seconds (default value), a timeout error is reported. In this case, you can optimize the API configuration based on the API calling duration recorded in the access log.

```
__________Duration information_________
duration: 60491ms //Total duration
url_duration: 0ms //URL matching duration
```

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```
auth_duration: 70ms //Authentication duration
befor_sql_duration: 402ms //Preprocessing duration before SQL execution
sql_duration: 60001ms //SQL execution duration
after_sql_duration:18ms //Postprocessing duration after SQL execution
```

Obtaining API Information

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts DataService**.

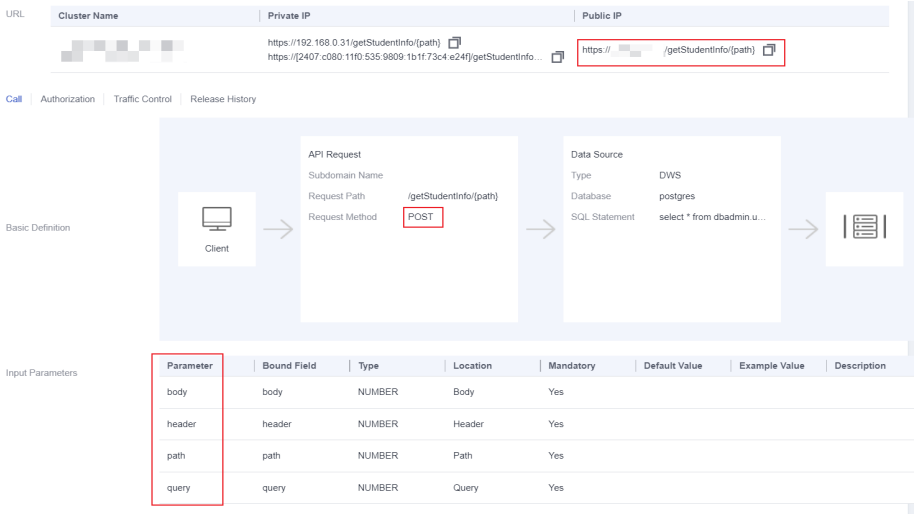
Step 3 In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.

Step 4 Obtain the URL, request method, and input parameters of the API to be called.

In the navigation pane on the left, choose **APIs**. Locate the API to be called, click the API name to access its details page, and record the URL, request method, and input parameters of the API.

- URL for calling the API: The exclusive edition supports both private and public IP addresses. To use the public IP address, you need to bind an EIP to the cluster during cluster creation. If you want to call an API in DataArts DataService Exclusive locally, you need to use a public IP address to ensure network connectivity.
- Input parameters: In this example, an API with various input parameter locations is created to describe how to enter various input parameters during an API call.

Figure 13-92 Recording the URL, request method, and input parameters



----End

Calling an API

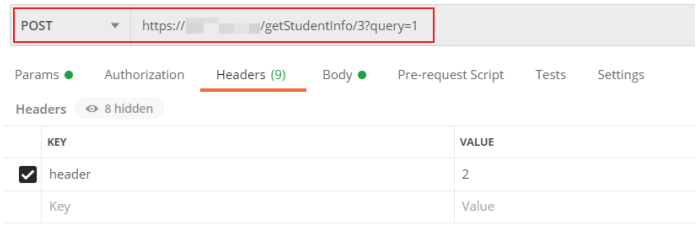
Step 1 Start Postman and add an API request.

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Step 2 Configure the API request as follows:

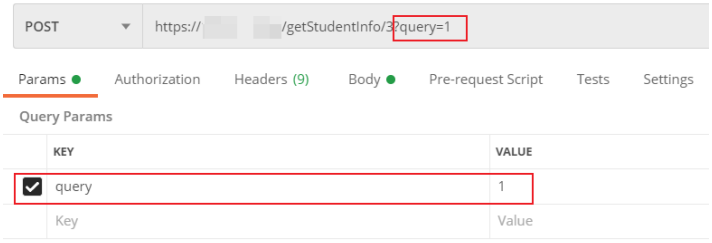
- Request method and calling URL: Obtain them by referring to **Obtaining API Information**. If input parameters include Path and Query parameters, you need to change the **{path}** variable in the API calling URL to the value of the Path parameter, and add the value of the Query parameter to the end of the API calling URL in the following format: ?***Query parameter name***=***Query parameter value***, for example, **?query=1** in this example.

  Figure 13-93 Request method and calling URL

- **Params**: If the Query parameter has been added to the end of the calling URL in the ?***Query parameter name***=***Query parameter value*** format, the value of **Query Params** is automatically generated. Otherwise, you need to enter a value.

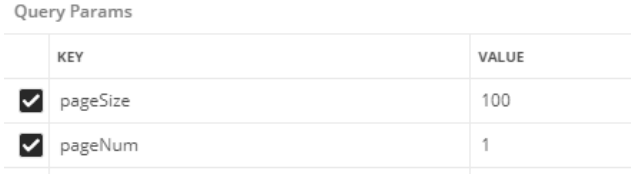
  Figure 13-94 Params

  If you want to customize the calling result, set the following Query parameters:

  – (Optional) Pagination configuration: By default, the system assigns pagination data to the APIs created using configuration or a script/MyBatis. If you want to obtain specified pagination data, modify the following parameters. **pageSize** indicates the page size, and **pageNum** indicates the page number.

    Figure 13-95 Pagination parameters

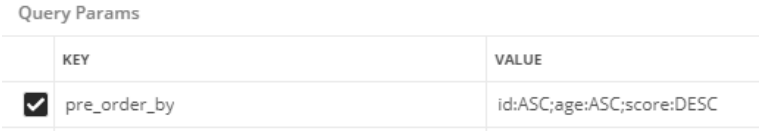
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NOTE

For APIs created using a script/MyBatis with custom pagination configuration, the pagination logic is written to the data acquisition SQL statement during API creation. Therefore, the pagination settings cannot be modified during an API call.

- (Optional) Sorting configuration: By default, the system provides the default sorting based on the ranking parameters. By default, the custom ranking mode is ascending. To change the sorting, modify the **pre_order_by** parameter. The value of **pre_order_by** is in either of the following formats: ***Ranking parameter name***:ASC (ascending order) or ***Ranking parameter name***:DESC (descending order). Separate multiple ranking parameter descriptions by semicolons (;).

  Figure 13-96 Ranking parameters

  You can change the value of **pre_order_by** as follows:

  - Delete an optional ranking parameter. The parameter is no longer used for ranking.
  - Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

  NOTE

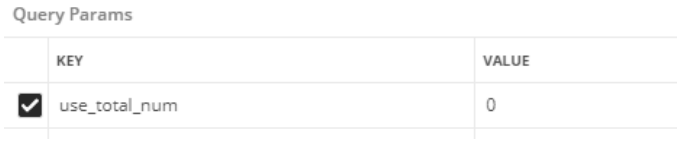
  The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

  - If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.
  - Adjustment of the sequence of ranking parameters will not take effect. The sequence of ranking parameters configured during the creation of an API through configuration, a script, or MyBatis will still be used.
  - If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

- (Optional) Number of returned records: If **Return Total Records** is enabled during API creation, it takes a long time to obtain the total number of data records if the data table corresponding to the API contains a large amount of data. In this case, if you do not want the system to calculate and return the total number of data records during an API call, you can modify the **use_total_num** parameter. The **use_total_num** parameter specifies whether to calculate and return the total number of data records. If its value is **1**, the total number of data records is returned. If its value is not **1**, the total number of data records is not returned.

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Figure 13-97 Number of returned records

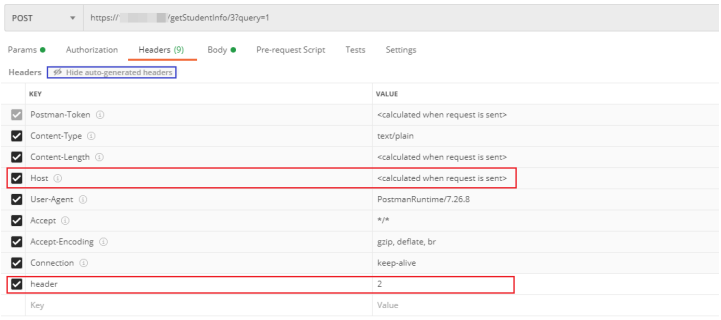


- **Headers**: Enter parameter **header** and its value.

  NOTE

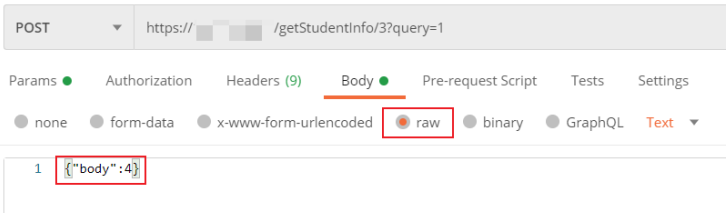
  By default, Postman automatically selects **Host** and generates a host value from the URI.

Figure 13-98 Headers



- **Body**: Select the **raw** format and use braces (**{}**) to enclose a string in "***Body parameter name***":***Body parameter value*** format, for example, **{"body":4}** in this example.

Figure 13-99 Body



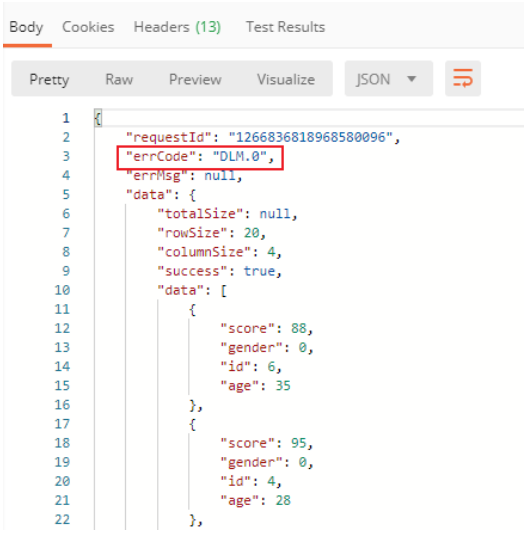
Step 3 After configuring the API request, click **Send** to send a request to the server and check the returned result. If **"errCode":"DLM.0"** is returned, the API is successfully called. If the API call fails, rectify the fault based on the error message.

NOTE

If the API call fails and message "Could not get any response" is displayed, disable **SSL certificate verification** or proxy as prompted, and try again.

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Figure 13-100 Calling an API



----End

13.4.2.6 Using a Browser to Call an API Which Requires No Authentication

If the input parameters of an API requiring no authentication are located in Query or Path, the API can be directly called using a browser.

NOTE

It is recommended that the non-authentication mode be used only for testing APIs. If the caller is not a trusted user, there is a risk of data leakage, breakdowns caused by high concurrent access, SQL injection, and others.

This section uses Chrome as an example to describe how to use a browser to call an API which requires no authentication. The procedure is as follows:

1. **Obtaining API Information**: Prepare key information of the API.
2. **Calling an API**: Use Chrome to call the API.

Prerequisites

- An API or API workflow requiring no authentication has been published. The published API is available in DataArts Catalog.
- Chrome has been installed.

Notes and Constraints

- To call an API in DataArts DataService locally, you need to bind an EIP to the DataArts DataService Exclusive cluster when creating the cluster.
- When an API in DataArts DataService is called, if the total duration of query and response exceeds 60 seconds (default value), a timeout error is reported. In this case, you can optimize the API configuration based on the API calling duration recorded in the access log.

```
__________Duration information_________
duration: 60491ms //Total duration
url_duration: 0ms //URL matching duration
auth_duration: 70ms //Authentication duration
befor_sql_duration: 402ms //Preprocessing duration before SQL execution
```

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```
sql_duration: 60001ms //SQL execution duration
after_sql_duration:18ms //Postprocessing duration after SQL execution
```

Obtaining API Information

Step 1 Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.

Step 2 On the DataArts Studio console, locate a workspace and click **DataArts DataService**.

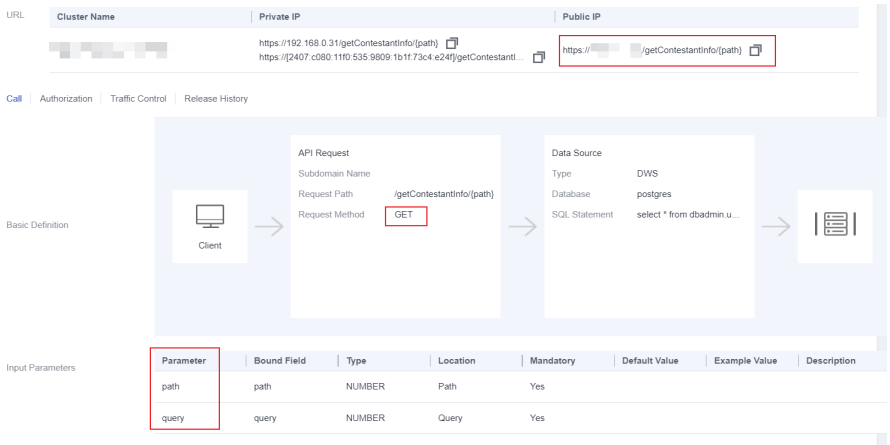
Step 3 In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.

Step 4 Obtain the URL, request method, and input parameters of the API to be called.

In the navigation pane on the left, choose **APIs**. Locate the API to be called, click the API name to access its details page, and record the URL, request method, and input parameters of the API.

- URL for calling the API: The exclusive edition supports both private and public IP addresses. To use the public IP address, you need to bind an EIP to the cluster during cluster creation. If you want to call an API in DataArts DataService Exclusive locally, you need to use a public IP address to ensure network connectivity.
- Input parameters: In this example, an API with Query and Path input parameters is created to describe how to enter various input parameters during an API call.

Figure 13-101 Recording the URL, request method, and input parameters



----End

Calling an API

Step 1 Start Chrome and create a blank tab.

Step 2 Enter the API calling URL obtained in **Obtaining API Information** in the address box of the browser and access the URL. If input parameters include Path and Query parameters, you need to change the **{path}** variable in the API calling URL

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to the value of the Path parameter, and add the value of the Query parameter to the end of the API calling URL in the following format: ?***Query parameter name***=***Query parameter value***, for example, **?query=1** in this example.

```
https://xx.xx.xx.xx/getContestantInfo/2?query=1
```

If you want to customize the calling result, set the following Query parameters and use & to connect parameters:

- (Optional) Pagination configuration: By default, the system assigns pagination data to the APIs created using configuration or a script/MyBatis. If you want to obtain specified pagination data, add the following parameters. **pageSize** indicates the page size, and **pageNum** indicates the page number.

  ```
  https://xx.xx.xx.xx/getContestantInfo/2?query=1&pageSize=100&pageNum=1
  ```

  NOTE

  For APIs created using a script/MyBatis with custom pagination configuration, the pagination logic is written to the data acquisition SQL statement during API creation. Therefore, the pagination settings cannot be modified during an API call.

- (Optional) Sorting configuration: By default, the system provides the default sorting based on the ranking parameters. By default, the custom ranking mode is ascending. To change the sorting, modify the **pre_order_by** parameter. The value of **pre_order_by** is in either of the following formats: ***Ranking parameter name***:ASC (ascending order) or ***Ranking parameter name***:DESC (descending order). Separate multiple ranking parameter descriptions by semicolons (;).

  ```
  https://xx.xx.xx.xx/getContestantInfo/2?query=1&pre_order_by=id:ASC;age:ASC;score:DESC
  ```

  You can change the value of **pre_order_by** as follows:

  – Delete an optional ranking parameter. The parameter is no longer used for ranking.

  – Change the ranking mode of a ranking parameter whose ranking mode is custom to ascending or descending. The ranking parameter is sorted based on the new ranking mode.

  NOTE

  The value of **pre_order_by** cannot be changed in any of the following ways. Otherwise, the change does not take effect or an error is reported during API calling.

  – If a mandatory ranking parameter is deleted, the parameter is still used for ranking and the deletion does not take effect.

  – Adjustment of the sequence of ranking parameters will not take effect. The sequence of ranking parameters configured during the creation of an API through configuration, a script, or MyBatis will still be used.

  – If you change the ranking mode of a ranking parameter whose ranking mode is ascending or descending, the API cannot be called. Such a change is not allowed.

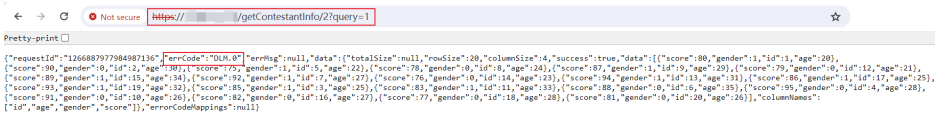
- (Optional) Number of returned records: If **Return Total Records** is enabled during API creation, it takes a long time to obtain the total number of data records if the data table corresponding to the API contains a large amount of data. In this case, if you do not want the system to calculate and return the total number of data records during an API call, you can modify the **use_total_num** parameter. The **use_total_num** parameter specifies whether to calculate and return the total number of data records. If its value is **1**, the total number of data records is returned. If its value is not **1**, the total number of data records is not returned.

  ```
  https://xx.xx.xx.xx/getContestantInfo/2?query=1&use_total_num=0
  ```

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Step 3 View the returned result. If **"errCode":"DLM.0"** is returned, the API is successfully called. If the API call fails, rectify the fault based on the error message.

Figure 13-102 Using a browser to call an API



----End

13.5 Viewing API Access Logs

Scenario

You can query logs of DataArts DataService APIs, including the request path, request parameters, and response.

NOTE

Currently, logs are only supported for APIs in DataArts DataService Exclusive.

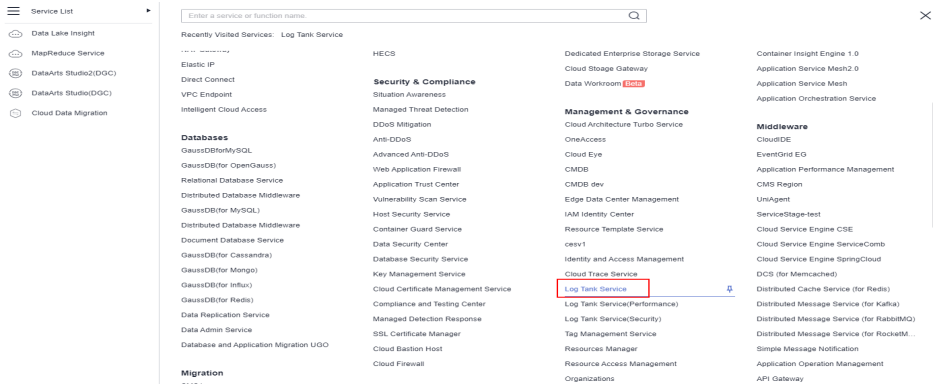
Configuring LTS

To view logs of DataArts DataService APIs, you need to first configure LTS. For details about how to configure LTS, see .

Step 1 Create a log group on the LTS console.

1. Log in to the management console.
2. Click  in the upper left corner and select a region and project.
3. Click **Service List** and click **Log Tank Service** under **Management & Governance**.

Figure 13-103 Accessing the LTS console



4. In the navigation pane on the left, choose **Log Management**.
5. Click **Create Log Group**. In the displayed dialog box, enter a log group name.

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6. Click **OK**.

Step 2 Create a log stream.

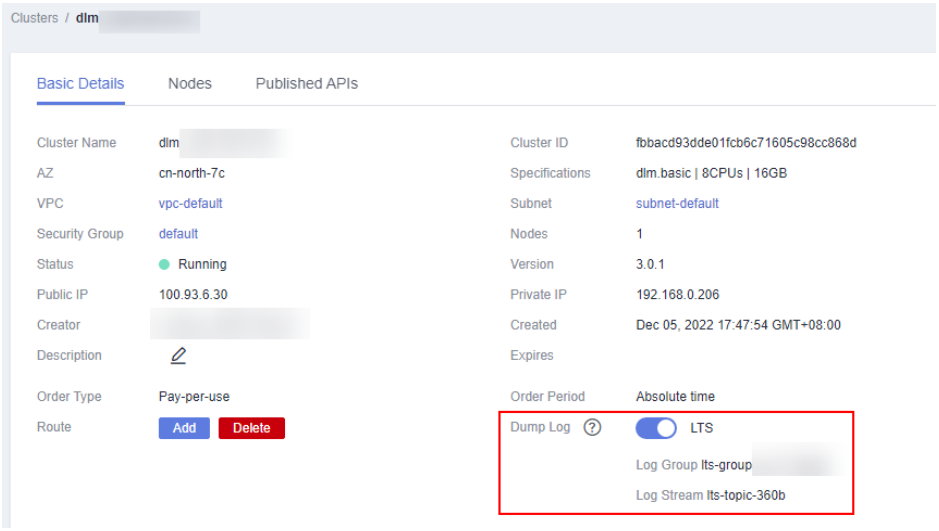
1. Click the name of the created log group.
2. Click **Create Log Stream**. In the displayed dialog box, enter a log stream name.
3. Click **OK**.

----End

Enabling Dump of DataArts DataService Logs

Log in to the DataArts DataService Exclusive console, enter the **Basic Details** page of a cluster, enable **Dump Log**, and select **LTS**.

Figure 13-104 Enabling dump of logs to LTS



Viewing Access Logs

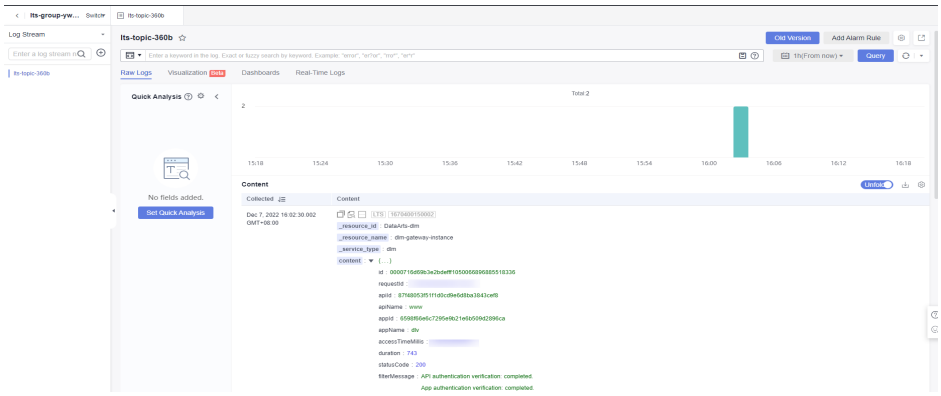
After configuring log dump, you can view details about access logs.

On the LTS console, click the name of the corresponding log stream. On the **Raw Logs** page, you can view access logs.

The following figure shows the log format, which cannot be changed.

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Figure 13-105 Log format



13.6 Configuring Review Center

On the **Review Center** page, API developers and callers can review the requests for operations such as publishing APIs.

APIs must be reviewed and approved before they can be published. APIs are reviewed in the following way:

- An API publisher who does not have the reviewer permission must submit the API to the reviewer for review.
- An API publisher who has the reviewer permission can publish an API without review or approval.

Requests can also be withdrawn on the **Review Center** page.

NOTE

An admin, developer, or operator can be a reviewer. A viewer cannot be a reviewer.

Regardless of whether they are added as reviewers, users with the admin role of the workspace have the reviewer permissions by default.

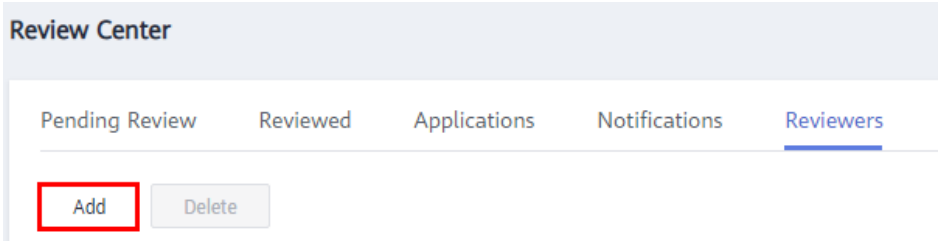
Managing a Reviewer

You can create and delete reviewers. The following procedure describes how to create a reviewer.

1. Log in to the DataArts Studio console by following the instructions in **Accessing the DataArts Studio Instance Console**.
2. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
3. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
4. Choose **Operation Management** > **Review Center** from the left navigation pane. On the page displayed, choose **Reviewer Management** and click **Add**.

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Figure 13-106 Adding reviewers

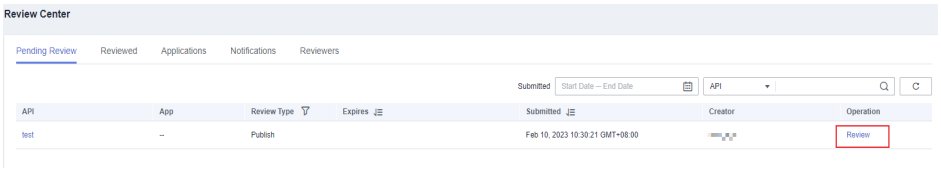


5. Select a reviewer (workspace member), enter a correct phone number and email address, and click **OK**.
6. Add more reviewers, if required.

Reviewing API Applications

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **Operation Management** > **Review Center** in the left navigation bar and click the **Pending Review** tab.
4. Locate a task and click **Review** in the **Operation** column, or click an API name to access the API details page to review the API application. You can also select multiple tasks and click **Batch Review** above the task list to review them. APIs take effect immediately upon approval.

Figure 13-107 Review



Canceling an API Application

DataArts DataService provides the function of canceling applications to be reviewed. You can cancel applications to be reviewed on the **Applications** tab page on the **Review Center** page.

1. On the DataArts Studio console, locate a workspace and click **DataArts DataService**.
2. In the left navigation pane, choose an edition, for example, **Exclusive Edition**. The **Overview** page is displayed.
3. Choose **Operations Management** > **Review Center** in the left navigation pane and click the **Applications** tab.
4. Locate the row that contains the API to be canceled, and click **Cancel** in the **Operation** column.

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14 Audit Log

14.1 Viewing Traces

Overview

You can use Cloud Trace Service (CTS) to record key operation events related to DataArts Studio. The events can be used in various scenarios such as security analysis, compliance audit, resource tracing, and problem locating.

After you enable CTS, the system starts to record DataArts Studio operations. The management console of CTS stores the traces of the latest seven days.

Prerequisites

CTS has been enabled. For details about how to enable it, see **Enabling CTS**.

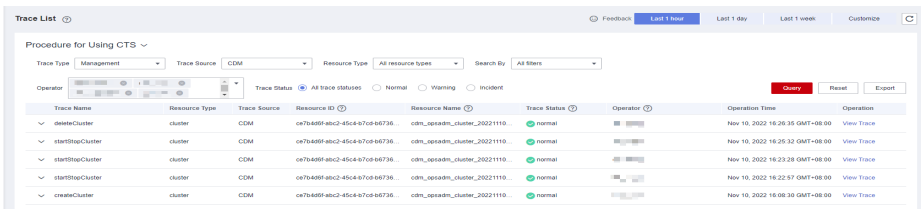
Procedure

1. Log in to the management console and choose **Cloud Trace Service** from the service list.
2. The trace list is displayed by default. You can filter traces.

   The sources of DataArts Studio traces include:

   - **CDM**: traces of DataArts Migration
   - **DLF**: traces of DataArts Factory
   - **DLG**: traces of Management Center, DataArts Architecture, DataArts Quality, DataArts Catalog, and DataArts DataService

Figure 14-1 CDM traces



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3. Click ⌄ on the left of a trace to expand its details.
4. Click **View Trace** in the **Operation** column to view the trace structure details.
   For more information about CTS, see ***Cloud Trace Service User Guide***.

14.2 Key Operations Recorded by CTS

14.2.1 Management Center Operations

CTS provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack those operations.

Table 14-1 Key operations recorded by CTS

Operation	Resource Type	Trace Name
Creating data connections	dataWarehouse	createDataWarehouse
Editing data connections	dataWarehouse	updateDataWarehouse
Deleting data connections	dataWarehouse	deleteDataWarehouse
Creating workspaces	workspace	createWorkspaces
Updating workspaces	workspace	updateWorkspaces
Deleting workspaces	workspace	deleteWorkspaces
Freezing workspaces	workspace	frozenWorkspaces
Unfreezing workspaces	workspace	unfrozenWorkspaces
Adding workspace users	User	saveWorkspaceUser
Editing workspace users	User	updateWorkspaceUser
Deleting workspace users	User	deleteWorkspaceUser
Downloading files	Config	downloadFile
Creating import/export tasks	Config	createObsImportOrExport-Task

14.2.2 Key CDM Operations Recorded by CTS

CTS provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack those operations.

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Table 14-2 Key operations recorded by CTS

Operation	Resource Type	Trace Name
Creating a cluster	cluster	createCluster
Deleting a cluster	cluster	deleteCluster
Modifying cluster configurations	cluster	modifyCluster
Starting a cluster	cluster	startCluster
Restarting a cluster	cluster	restartCluster
Importing a job	cluster	clusterImportJob
Binding an EIP	cluster	bindEip
Unbinding an EIP	cluster	unbindEip
Creating a link	link	createLink
Modifying a link	link	modifyLink
Testing a link	link	verifyLink
Deleting a link	link	deleteLink
Creating a job	job	createJob
Modifying a job	job	modifyJob
Deleting a job	job	deleteJob
Starting a job	job	startJob
Stopping a job	job	stopJob

14.2.3 DataArts Architecture Operations

CTS provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack those operations.

Table 14-3 Key operations recorded by CTS

Operation	Resource Type	Resource Names	Trace Name
Querying subjects	DAYU_DS	dsSubject	getListSubject
Creating subjects	DAYU_DS	dsSubject	createSubject
Updating subjects	DAYU_DS	dsSubject	updateSubject

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Operation	Resource Type	Resource Names	Trace Name
Publishing subjects	DAYU_DS	dsSubject	publishedSubject
Suspending subjects	DAYU_DS	dsSubject	offlineSubject
Deleting subjects	DAYU_DS	dsSubject	deleteSubject
Querying processes	DAYU_DS	dsBizCatalog	getListBizCatalog
Creating processes	DAYU_DS	dsBizCatalog	createBizCatalog
Updating processes	DAYU_DS	dsBizCatalog	updateBizCatalog
Deleting processes	DAYU_DS	dsBizCatalog	deleteBizCatalog
Querying lookup tables	DAYU_DS	dsCodeTable	getListCodeTable
Creating lookup tables	DAYU_DS	dsCodeTable	createCodeTable
Updating lookup tables	DAYU_DS	dsCodeTable	updateCodeTable
Publishing lookup tables	DAYU_DS	dsCodeTable	publishedCodeTable
Suspending lookup tables	DAYU_DS	dsCodeTable	offlineCodeTable
Deleting lookup tables	DAYU_DS	dsCodeTable	deleteCodeTable
Querying data standards	DAYU_DS	dsStandardElement	getListStandardElement
Creating data standards	DAYU_DS	dsStandardElement	createStandardElement
Updating data standards	DAYU_DS	dsStandardElement	updateStandardElement
Publishing data standards	DAYU_DS	dsStandardElement	publishedStandardElement

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Operation	Resource Type	Resource Names	Trace Name
Suspending data standards	DAYU_DS	dsStandardElement	offlineStandardElement
Deleting data standards	DAYU_DS	dsStandardElement	deleteStandardElement
Querying logical entities or physical tables	DAYU_DS	dsTableModel	getListTableModel
Creating logical entities or physical tables	DAYU_DS	dsTableModel	createTableModel
Updating logical entities or physical tables	DAYU_DS	dsTableModel	updateTableModel
Publishing logical entities or physical tables	DAYU_DS	dsTableModel	publishedTableModel
Suspending logical entities or physical tables	DAYU_DS	dsTableModel	offlineTableModel
Deleting logical entities or physical tables	DAYU_DS	dsTableModel	deleteTableModel
Querying dimensions	DAYU_DS	dsDimension	getListDimension
Creating dimensions	DAYU_DS	dsDimension	createDimension
Updating dimensions	DAYU_DS	dsDimension	updateDimension

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Operation	Resource Type	Resource Names	Trace Name
Publishing dimensions	DAYU_DS	dsDimension	publishedDimension
Suspending dimensions	DAYU_DS	dsDimension	offlineDimension
Deleting dimensions	DAYU_DS	dsDimension	deleteDimension
Querying dimension tables	DAYU_DS	dsDimensionLogicTable	getListDimensionLogicTable
Deleting dimension tables	DAYU_DS	dsDimensionLogicTable	deleteDimensionLogicTable
Querying fact tables	DAYU_DS	dsFactLogicTable	getListFactLogicTable
Creating fact tables	DAYU_DS	dsFactLogicTable	createFactLogicTable
Updating fact tables	DAYU_DS	dsFactLogicTable	updateFactLogicTable
Publishing fact tables	DAYU_DS	dsFactLogicTable	publishedFactLogicTable
Suspending fact tables	DAYU_DS	dsFactLogicTable	offlineFactLogicTable
Deleting fact tables	DAYU_DS	dsFactLogicTable	deleteFactLogicTable
Querying summary tables	DAYU_DS	dsAggregationLogicTable	getListAggregationLogicTable
Creating summary tables	DAYU_DS	dsAggregationLogicTable	createAggregationLogicTable
Updating summary tables	DAYU_DS	dsAggregationLogicTable	updateAggregationLogicTable
Publishing summary tables	DAYU_DS	dsAggregationLogicTable	publishedAggregationLogicTable
Suspending summary tables	DAYU_DS	dsAggregationLogicTable	offlineAggregationLogicTable

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Operation	Resource Type	Resource Names	Trace Name
Deleting summary tables	DAYU_DS	dsAggregationLogicTable	deleteAggregationLogicTable
Querying business metrics	DAYU_DS	dsBizMetric	getListBizMetric
Creating business metrics	DAYU_DS	dsBizMetric	createBizMetric
Updating business metrics	DAYU_DS	dsBizMetric	updateBizMetric
Publishing business metrics	DAYU_DS	dsBizMetric	publishedBizMetric
Suspending business metrics	DAYU_DS	dsBizMetric	offlineBizMetric
Deleting business metrics	DAYU_DS	dsBizMetric	deleteBizMetric
Querying atomic metrics	DAYU_DS	dsAtomicIndex	getListAtomicIndex
Creating atomic metrics	DAYU_DS	dsAtomicIndex	createAtomicIndex
Updating atomic metrics	DAYU_DS	dsAtomicIndex	updateAtomicIndex
Publishing atomic metrics	DAYU_DS	dsAtomicIndex	publishedAtomicIndex
Suspending atomic metrics	DAYU_DS	dsAtomicIndex	offlineAtomicIndex
Deleting atomic metrics	DAYU_DS	dsAtomicIndex	deleteAtomicIndex

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Operation	Resource Type	Resource Names	Trace Name
Querying derivative metrics	DAYU_DS	dsDerivativeIndex	getListDerivativeIndex
Creating derivative metrics	DAYU_DS	dsDerivativeIndex	createDerivativeIndex
Updating derivative metrics	DAYU_DS	dsDerivativeIndex	updateDerivativeIndex
Deleting derivative metrics	DAYU_DS	dsDerivativeIndex	deleteDerivativeIndex
Publishing derivative metrics	DAYU_DS	dsDerivativeIndex	publishedDerivativeIndex
Suspending derivative metrics	DAYU_DS	dsDerivativeIndex	offlineDerivativeIndex
Querying compound metrics	DAYU_DS	dsCompoundMetric	getListCompoundMetric
Creating compound metrics	DAYU_DS	dsCompoundMetric	createCompoundMetric
Updating compound metrics	DAYU_DS	dsCompoundMetric	updateCompoundMetric
Deleting compound metrics	DAYU_DS	dsCompoundMetric	deleteCompoundMetric
Publishing compound metrics	DAYU_DS	dsCompoundMetric	publishedCompoundMetric
Suspending compound metrics	DAYU_DS	dsCompoundMetric	offlineCompoundMetric
Querying time filters	DAYU_DS	dsTimeCondition	getListTimeCondition
Creating time filters	DAYU_DS	dsTimeCondition	createTimeCondition

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Operation	Resource Type	Resource Names	Trace Name
Updating time filters	DAYU_DS	dsTimeCondition	updateTimeCondition
Publishing time filters	DAYU_DS	dsTimeCondition	publishedTimeCondition
Suspending time filters	DAYU_DS	dsTimeCondition	offlineTimeCondition
Deleting time filters	DAYU_DS	dsTimeCondition	deleteTimeCondition
Querying directories	DAYU_DS	dsDirectory	getListDirectory
Creating directories	DAYU_DS	dsDirectory	createDirectory
Updating directories	DAYU_DS	dsDirectory	updateDirectory
Deleting directories	DAYU_DS	dsDirectory	deleteDirectory
Querying models	DAYU_DS	dsModel	getListModel
Creating models	DAYU_DS	dsModel	createModel
Updating models	DAYU_DS	dsModel	updateModel
Deleting models	DAYU_DS	dsModel	deleteModel

14.2.4 DataArts Factory Operations

CTS provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack those operations.

Table 14-4 Key operations recorded by CTS

Operation	Resource Type	Trace Name
Creating a job	job	createJob(api)
Modifying a job	job	editJob(api)
Saving a job	job	saveJob
Deleting a job	job	deleteJob

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Operation	Resource Type	Trace Name
Renaming a job	job	renameJob
Importing a job	job	importPipeline/ importJob(api)
Exporting a job	job	exportPipeline/ exportJob(api)
Exporting jobs	job	exportJobs(api)
Submitting a job version	job	addNewVersion
Locking a job	job	acquireEditLock
Unlocking a job	job	releaseLock
Unlocking jobs	job	batchReleaseEditLock
Testing a job	job	testRun
Starting a job	job	startJob
Starting a job with a specified name	job	startJobByName
Stopping a job	job	stopJob
Stopping jobs	job	stopJobs
Pausing a job	job	pauseJob
Copying and saving a job	job	copyAndSaveJob
Deleting jobs	job	deleteDirectoryList
Moving a job	job	move
Stopping an instance	task	stopTask/stop(api)
Forcibly making the execution of an instance succeed	task	forceTaskSuccess
Continuing to execute an instance	task	continueExecute
Rerunning an instance	task	retryTask/restart(api)
Pausing a node	task	pauseJob
Resuming a node	task	resumeJob
Retrying a node	task	redoJobs
Skipping a node	task	skipJob

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Operation	Resource Type	Trace Name
Forcibly making the execution of a node succeed	task	forceJobSuccess
Creating a script	script	addScript/createScript(api)
Executing a script	script	executeScript
Modifying a script	script	saveScript/editScript(api)
Exporting a script	script	exportScripts
Importing a script	script	importScript
Checking the syntax of a script	script	checkSyntax
Submitting a script version	script	addNewVersion
Locking a script	script	acquireScriptLock
Unlocking a script	script	releaseScriptLock
Unlocking scripts	script	batchReleaseScriptLock
Deleting scripts	script	deleteDirectoryList
Moving a script	script	move
Creating a directory	directory	createDirectory
Modifying a directory	directory	modifyDirectory
Deleting a directory	directory	deleteDirectoryByPath
Moving a directory	directory	move
Deleting directories	directory	deleteDirectoryList
Creating a data connection	dataWarehouse	createDataWarehouse
Testing a data connection	dataWarehouse	testDataWarehouseConnec-tivity
Updating a data connection	dataWarehouse	updateDataWarehouse
Deleting a data connection	dataWarehouse	deleteDataWarehouse
Exporting a data connection	dataWarehouse	exportConnection
Importing a data connection	dataWarehouse	importConnection

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Operation	Resource Type	Trace Name
Creating a database	dataWarehouse	createDatabase
Updating a database	dataWarehouse	updateDatabase
Deleting a database	dataWarehouse	deleteDatabase
Creating a data table	dataWarehouse	createDataTable
Updating a data table	dataWarehouse	updateDataTable
Deleting a data table	dataWarehouse	deleteDataTable
Creating a schema	dataWarehouse	createSchema
Deleting a schema	dataWarehouse	deleteSchema
Updating a schema	dataWarehouse	updateSchema
Create a notification	alarmRule	createAlarmRules
Creating and updating a notification	alarmRule	createAndUpdateAlarm-Rules
Deleting a notification	alarmRule	deleteAlarmRules
Updating a notification	alarmRule	updateAlarmRules
Creating a resource	dataResource	createResource
Updating a resource	dataResource	updateResource
Deleting a resource	dataResource	deleteResources
Exporting a resource	dataResource	exportResource
Importing a resource	dataResource	importResource
Deleting resources	dataResource	deleteDirectoryList
Creating a tag	tag	create
Deleting a tag	tag	delete
Exporting a tag	tag	exportJobTags
Importing a tag from OBS	tag	importJobTag
Importing a tag from a local server	tag	importJobTag2
Saving an environment variable	environmentVariable	saveEnvParams

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Operation	Resource Type	Trace Name
Deleting an environment variable	environmentVariable	deleteEnvParams
Exporting an environment variable	environmentVariable	exportEnvParams
Importing an environment variable	environmentVariable	importEnvParams
Updating a workspace configuration item	workspaceConfig	updateWorkSpaceConfigs
Uploading a file	file	uploadFile
Configuring an agency	agency	saveAgency
Saving a sensitive variable	sensitiveParam	saveSensitiveParam
Updating a sensitive variable	sensitiveParam	updateSensitiveParam
Deleting a sensitive variable	sensitiveParam	deleteSensitiveParam
Creating a CDM connection	createConnection	cdmConnection
Updating a CDM connection	updateConnection	cdmConnection
Deleting a CDM connection	deleteConnection	cdmConnection
Sending an HTTP trigger message	sendMessage	httpTriggerMessage

14.2.5 DataArts Quality Operations

CTS provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack those operations.

Table 14-5 Key operations recorded by CTS

Operation	Resource Type	Trace Name
Creating directories	Category	createCategory
Deleting directories	Category	deleteCategory
Updating directories	Category	updateCategory

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Operation	Resource Type	Trace Name
Batch stopping instances	Instance	batchStop
Batch deleting instances	Instance	batchDeleteInstances
Creating comparison jobs	ConsistencyTask	createConsistencyTask
Deleting comparison jobs	ConsistencyTask	batchDeleteConsistencyTask
Editing comparison jobs	ConsistencyTask	editConsistencyTask
Starting scheduling comparison jobs	ConsistencyTask	startScheduleConsistency-Task
Stopping scheduling comparison jobs	ConsistencyTask	stopScheduleConsistency-Task
Running comparison jobs	ConsistencyTask	runConsistencyTask
Creating quality jobs	Rule	createRuleTask
Deleting quality jobs	Rule	deleteRule
Updating quality jobs	Rule	updateRule
Running a quality job	Rule	instanceScheduleOperation
Running quality jobs	Rule	batchInstanceScheduleOp-eration
Operating quality jobs	Rule	batchOperateRules
Creating rule templates	RuleTemplate	createTemplate
Deleting rule templates	RuleTemplate	deleteTemplate
Querying rule templates	RuleTemplate	getRuleTemplateList
Updating rule templates	RuleTemplate	updateTemplate
Querying a rule template	RuleTemplate	getTemplate
Obtaining the quality jobs and comparison jobs that depend on rule templates	RuleTemplate	getDependentTasks

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Operation	Resource Type	Trace Name
Updating rule templates for jobs	RuleTemplate	batchUpdateDependent-Tasks

14.2.6 DataArts Catalog Operations

CTS provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack those operations.

Table 14-6 Key operations recorded by CTS

Operation	Resource Type	Trace Name
Creating data masks	datamask	createDataMask
Querying data masks	datamask	listDataMask
Querying a data mask	datamask	getDataMask
Deleting a data mask	datamask	deleteDataMask
Deleting data masks	datamask	batchDeleteDataMask
Updating data masks	datamask	updateDataMask
Creating and running a collection task	bridgetask	createBridgeTask
Querying collection tasks	bridgetask	getBridgeTask
Editing collection tasks	bridgetask	updateBridgeTask
Deleting collection tasks	bridgetask	batchDeleteBridgeTask
Adding a tag to a data asset	asset	addTagToAsset
Adding a tag	tag	createTag
Adding tags	tag	batchCreateTag
Deleting tags	tag	batchDeleteTag
Updating a tag	tag	updateTag
Querying tags	tag	getTags
Deleting a tag	tag	deleteTag
Creating a task directory	bridgetaskcategory	createBridgeTaskCategory

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Operation	Resource Type	Trace Name
Obtaining task directories	bridgetaskcategory	getBridgeTaskCategoryTree
Editing a task directory	bridgetaskcategory	updateBridgeTaskCategory
Deleting a task directory	bridgetaskcategory	deleteBridgeTaskCategory
Creating a classification group	classificationgroup	createClassificationGroup
Querying classification groups	classificationgroup	listClassificationGroup
Querying a classification group	classificationgroup	getClassificationGroup
Deleting classification groups	classificationgroup	batchDeleteClassifica-tionGroup
Modifying a classification group	classificationgroup	updateClassificationGroup
Creating a classification rule	classificationrule	createClassificationRule
Querying classification rules	classificationrule	listClassificationRule
Querying a classification rule	classificationrule	getClassificationRule
Deleting classification rules	classificationrule	batchDeleteClassification-Rule
Modifying a classification rule	classificationrule	updateClassificationRule
Creating a data security level	secrecylevel	createSecrecyLevel
Querying data security levels	secrecylevel	listSecrecyLevel
Querying a data security level	secrecylevel	getSecrecyLevel
Deleting data security levels	secrecylevel	batchDeleteSecrecyLevel
Modifying a data security level	secrecylevel	updateSecrecyLevel
Creating collection tasks	bridgetask	createBridgeTask

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Operation	Resource Type	Trace Name
Editing collection tasks	bridgetask	updateBridgeTask
Deleting collection tasks	bridgetask	deleteBridgeTask
Querying collection tasks	bridgetask	getTasks

14.2.7 DataArts DataService Operations

CTS provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack those operations.

Table 14-7 Key operations recorded by CTS

Operation	Resource Type	Trace Name
Creating an API	DLMApi	createApi
Updating an API	DLMApi	updateApi
Querying an API	DLMApi	getApi
Querying APIs	DLMApi	getApiList(Api)
Deleting an API	DLMApi	deleteApi
Publishing an API	DLMApi	publishApi
Unpublishing an API	DLMApi	unpublishApi
Renewing an API	DLMApi	renewApi
Suspending an API	DLMApi	stopApi
Restoring an API	DLMApi	recoverApi
Copying an API	DLMApi	copyApi
Operating an API	DLMApi	actionApi
Creating an app	DLMApp	createApp
Updating an app	DLMApp	updateApp
Deleting an app	DLMApp	deleteApp
Querying an app	DLMApp	getApp
Querying app details	DLMApp	getAppInfo
Authorizing an app to access an API	DLMRelation	authorizeApi

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Operation	Resource Type	Trace Name
Querying authorized apps	DLMRelation	getAuthorizeApp
Canceling authorization	DLMRelation	cancelApprovalApi
Querying unauthorized apps	DLMRelation	getLeftApp
Applying for an API	DLMApply	applyApi
Canceling an application	DLMApply	revokeApply
Obtaining applications	DLMApply	getApplyList
Obtaining application details	DLMApply	getApplyDetail
Obtaining notification details	DLMApply	getMessageDetail
Creating an application	DLMApply	createApply
Reviewing applications	DLMApply	batchApproveNewApply
Sending a notification	DLMApply	sendMesg
Obtaining notifications	DLMApply	getMessageList
Obtaining the publication trend	DLMApply	getPublishTrend
Creating a throttling policy	DLMFlowControl	createFlowControlStrategy
Updating a throttling policy	DLMFlowControl	updateFlowControlStrategy
Deleting a throttling policy	DLMFlowControl	deleteFlowControlStrategy
Querying a throttling policy	DLMFlowControl	getFlowControlStrategy
Querying APIs (related to throttling)	DLMFlowControlBindApi	getAllApiList
Querying the APIs that have been associated with a throttling policy	DLMFlowControlBindApi	getBindingApiList
Associating a throttling policy with an API	DLMFlowControlBindApi	bindingApi

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Operation	Resource Type	Trace Name
Disassociating a throttling policy from an API	DLMFlowControlBindApi	unBindingApi
Querying the API overview	DLMRequestRecord	getApisOverview
Querying the app overview	DLMRequestRecord	getAppsOverView
Querying top N services called by an API	DLMRequestRecord	getApisTop
Querying the top N services used by an app	DLMRequestRecord	getAppsTop
Querying API statistics details	DLMRequestRecord	getApisDetail
Querying app statistics details	DLMRequestRecord	getAppsDetail
Querying API dashboard data details	DLMRequestRecord	getApisDashboard
Querying app dashboard data details	DLMRequestRecord	getAppsDashboard
Querying top N abnormal API calls	DLMRequestRecord	getApisError
Querying supported data source types	DLMDataSourceType	getDatasources
Querying data connections	DLMDataSourceConnection	getDatasourceConnections
Querying databases	DLMDataSourceDatabase	getDatasourcedatabases
Querying data tables	DLMDataSourceTable	getDatasourcedatables
Querying table fields	DLMDataSourceTableField	getDatasourceTableFields
Querying queues	DLMDataSourceQueue	getQueue
Querying users who can be reviewers	DLMAuthorizedUser	getAuthorizedUser
Creating reviewers	DLMApprover	createApprover
Deleting reviewers	DLMApprover	deleteApprover
Querying reviewers	DLMApprover	getApproverList

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Operation	Resource Type	Trace Name
Querying the content in a service catalog	DLMServiceCatalog	getCatalogAllDetail
Querying APIs in a service catalog	DLMServiceCatalog	getCatalogApis
Querying sub-catalogs in a service catalog	DLMServiceCatalog	getCatalogCatalogs
Creating service catalogs	DLMServiceCatalog	createCatalog
Deleting service catalogs	DLMServiceCatalog	deleteCatalog
Updating service catalogs	DLMServiceCatalog	updateCatalog
Querying service catalog details	DLMServiceCatalog	getCatalogDetail
Moving service catalogs	DLMServiceCatalog	moveCatalog
Moving APIs	DLMServiceCatalog	moveApi
Obtaining tags	DLMTag	getTags
Obtaining local tags	DLMTag	getLocalTags
Updating tags	DLMTag	updateTags

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