Cloud Data Migration

Best Practice

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Contents

1 Tutorials

1.1 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.

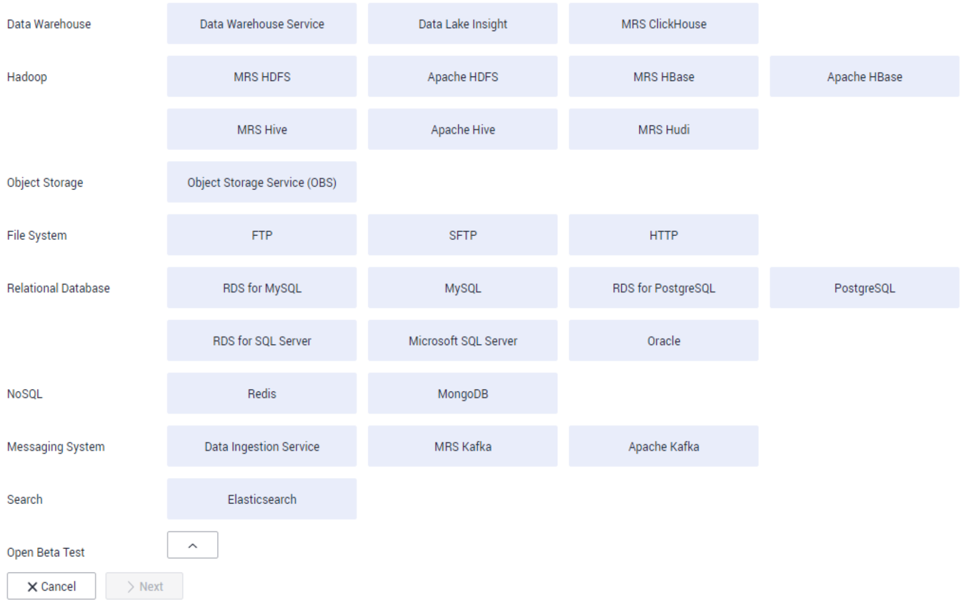
Prerequisites

- 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 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

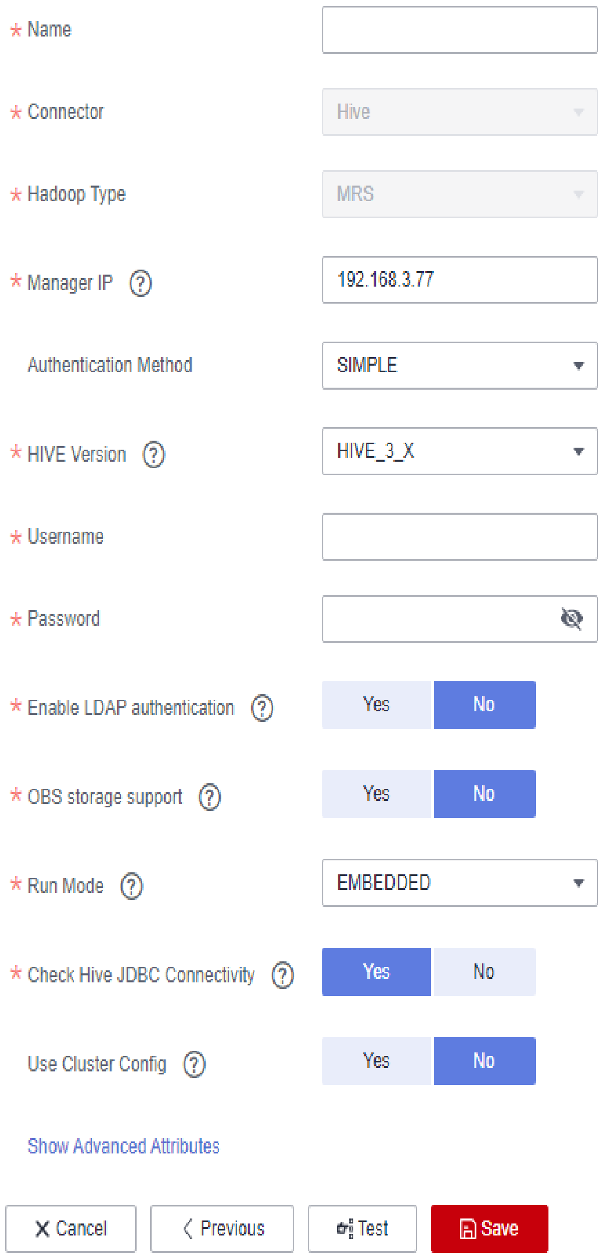
Step 1 On the **Cluster Management** page, locate a cluster and click **Job Management** in the **Operation** column. On the displayed page, click the **Links** tab and then **Create Link**.

Figure 1-1 Selecting a connector type



Step 2 Select **MRS Hive** and click **Next** to configure parameters for the MRS Hive link.

Figure 1-2 Creating an MRS Hive link



* Name

* Connector: Hive

* Hadoop Type: MRS

* Manager IP: 192.168.3.77

Authentication Method: SIMPLE

* HIVE Version: HIVE_3_X

* Username

* Password

* Enable LDAP authentication: Yes [✓ No]

* OBS storage support: Yes [✓ No]

* Run Mode: EMBEDDED

* Check Hive JDBC Connectivity: [✓ Yes] No

Use Cluster Config: Yes [✓ No]

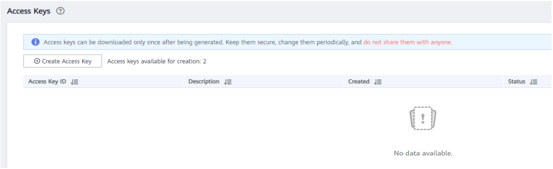
Step 3 Click **Show Advanced Attributes** to view more optional parameters. Retain their default values. The following table lists the mandatory parameters.

Table 1-1 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

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.	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	-

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

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 1-3**. **Figure 1-3** Clicking Create Access Key  Access Keys Access keys can be downloaded only once after being generated. Keep them secure, change them periodically, and do not share them with anyone. Access keys available for creation: 2 No data available. 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		-

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

1.2 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.

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.

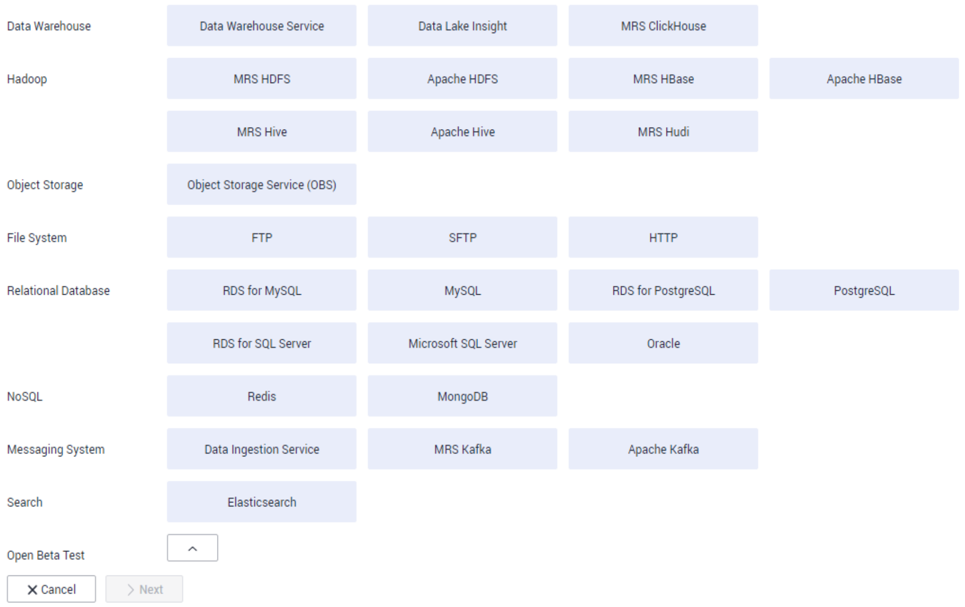
Step 3 On the **Driver Management** page, upload the MySQL driver using either of the following methods:

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 1-4 Selecting a connector type



Step 5 Select **MySQL** and click **Next** to configure parameters for the MySQL link.

Table 1-2 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

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

1.3 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.

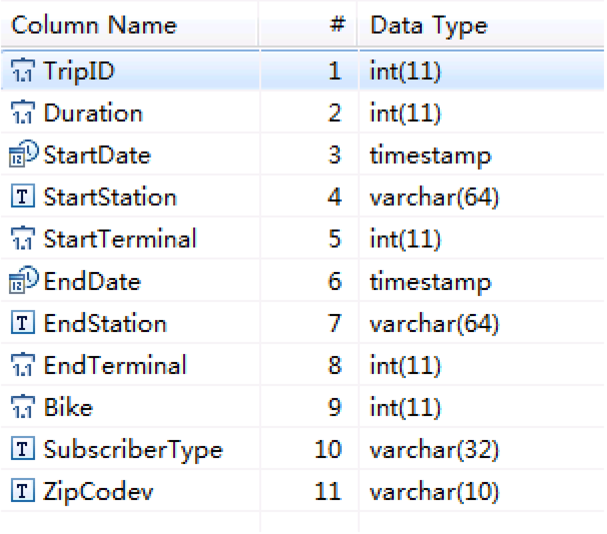
Hive partitions are implemented by using the HDFS subdirectory function. Each subdirectory contains the column names and values of each partition. If there are multiple partitions, many HDFS subdirectories exist. It is not easy to load external data to each partition of the Hive table without relying 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 1-5**.

Figure 1-5 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, improving the performance.

Creating a CDM Cluster and Binding an EIP to the Cluster

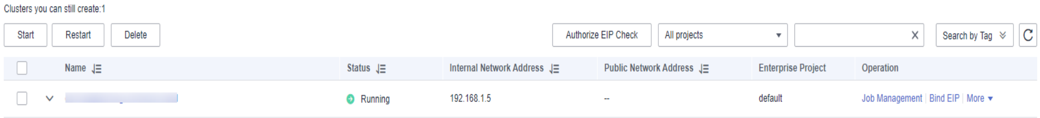
Step 1 If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

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 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 1-6 Cluster list



Clusters you can still create:1

Name	Status	Internal Network Address	Public Network Address	Enterprise Project	Operation
[redacted]	Running	192.168.1.5	--	default	Job Management | Bind EIP | More

NOTE

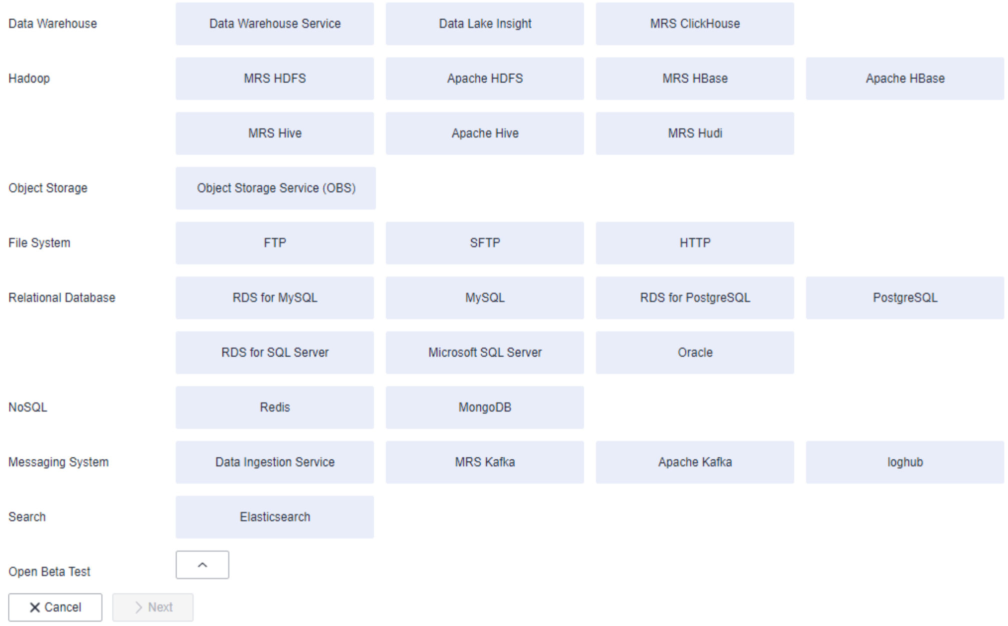
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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 1-7 Selecting a connector



Step 2 Select **RDS for MySQL** and click **Next** to set the 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 1-3**.

Table 1-3 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

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

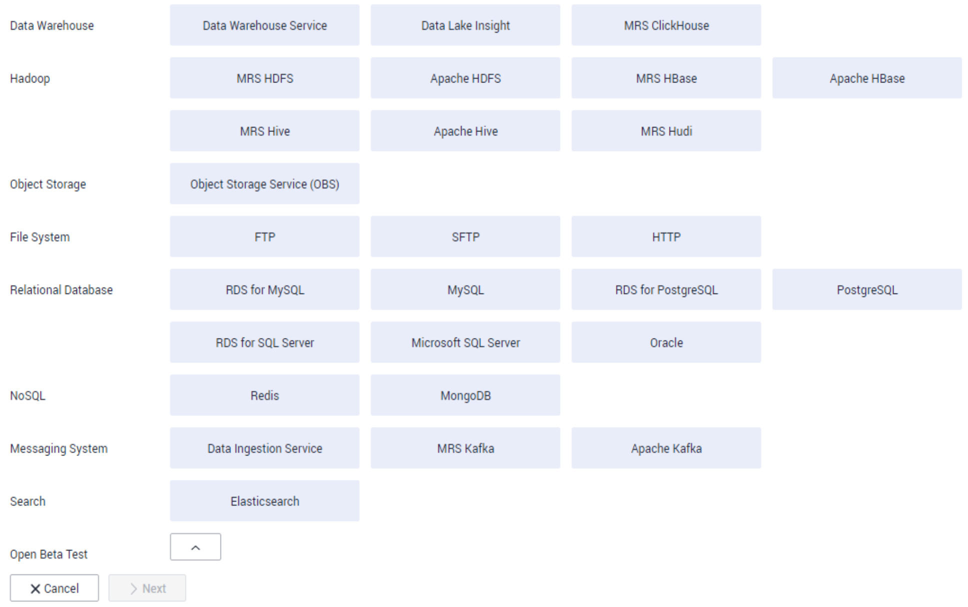
If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

Creating a 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.

Figure 1-8 Selecting a connector type



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	
Search	Elasticsearch			
Open Beta Test	^			

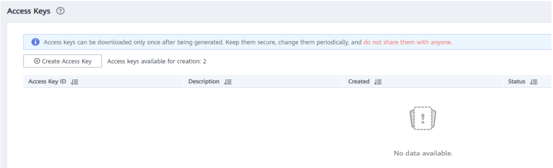
Step 2 Select **MRS Hive** and click **Next** to configure parameters for the MRS Hive link.

Table 1-4 describes the parameters. You can configure the parameters according to the actual situation.

Table 1-4 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
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.	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

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	-
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.	-

Parameter	Description	Example Value
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
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 1-9**. **Figure 1-9** Clicking Create Access Key  Access Keys Access keys can be downloaded only once after being generated. Keep them secure, change them periodically, and do not share them with anyone. Create Access Key Access keys available for creation: 2 Access Key ID Description Created Status No data available. 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		-

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

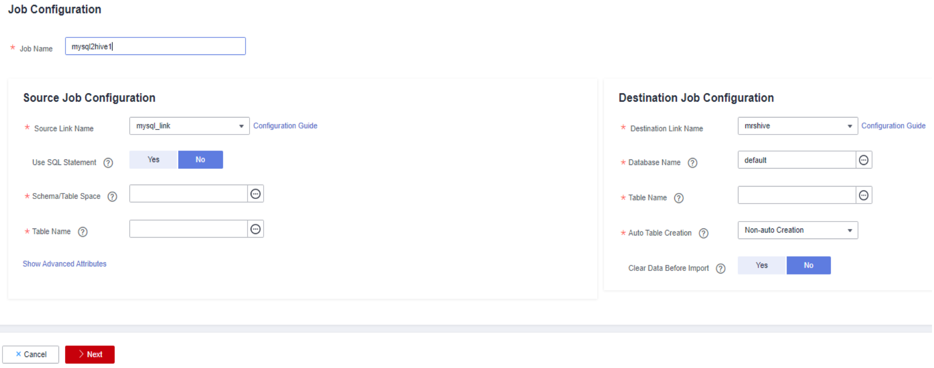
Step 3 Click **Save**. The **Link Management** page is displayed.

----End

Creating a Migration Job

Step 1 Click the **Table/File Migration** tab and then **Create Job**.

Figure 1-10 Creating a job for migrating data from MySQL to Hive



Job Configuration

* Job Name: mysql2hive1

Source Job Configuration

* Source Link Name: mysql_link

Use SQL Statement: Yes [✓ No]

* Schema/Table Space:

* Table Name:

Destination Job Configuration

* Destination Link Name: mrshive

* Database Name: default

* Table Name:

* Auto Table Creation: Non-auto Creation

Clear Data Before Import: Yes [✓ No]

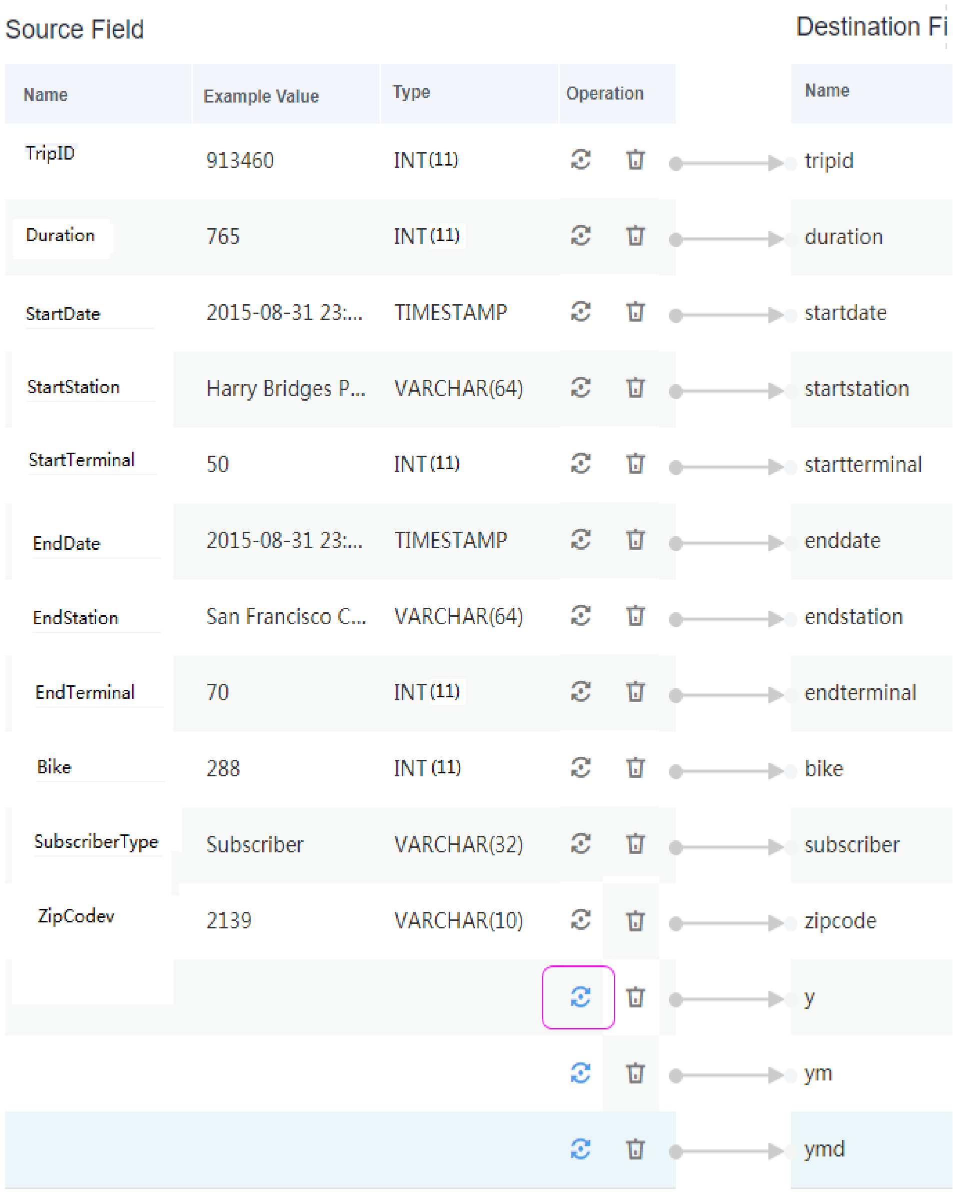
NOTE

Set **Clear Data Before Import** to **Yes**, so that the data in the Hive table will be cleared before data import.

Step 2 After the parameters are configured, click **Next**. The **Map Field** tab page is displayed. See **Figure 1-11**.

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.

Figure 1-11 Hive field mapping



Source Field

Destination Fi

Name	Example Value	Type	Operation	Name
TripID	913460	INT(11)	⟳ 🗑	tripid
Duration	765	INT(11)	⟳ 🗑	duration
StartDate	2015-08-31 23:...	TIMESTAMP	⟳ 🗑	startdate
StartStation	Harry Bridges P...	VARCHAR(64)	⟳ 🗑	startstation
StartTerminal	50	INT(11)	⟳ 🗑	startterminal
EndDate	2015-08-31 23:...	TIMESTAMP	⟳ 🗑	enddate
EndStation	San Francisco C...	VARCHAR(64)	⟳ 🗑	endstation
EndTerminal	70	INT(11)	⟳ 🗑	endterminal
Bike	288	INT(11)	⟳ 🗑	bike
SubscriberType	Subscriber	VARCHAR(32)	⟳ 🗑	subscriber
ZipCodev	2139	VARCHAR(10)	⟳ 🗑	zipcode
			⟳ 🗑	y
			⟳ 🗑	ym
			⟳ 🗑	ymd

Step 3 Click ⟳ to display the **Converter List** dialog box, and then choose **Create Converter** > **Expression conversion**. See **Figure 1-12**.

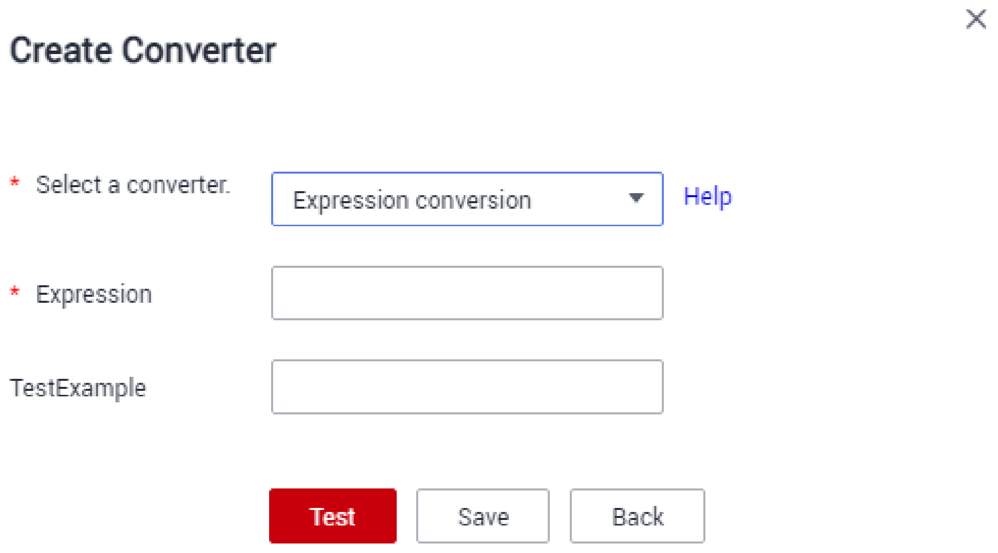
The expressions for the **y**, **ym**, and **ymd** fields are as follows:

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")

Figure 1-12 Configuring the expression



Create Converter

* Select a converter. Expression conversion Help

* Expression

TestExample

NOTE

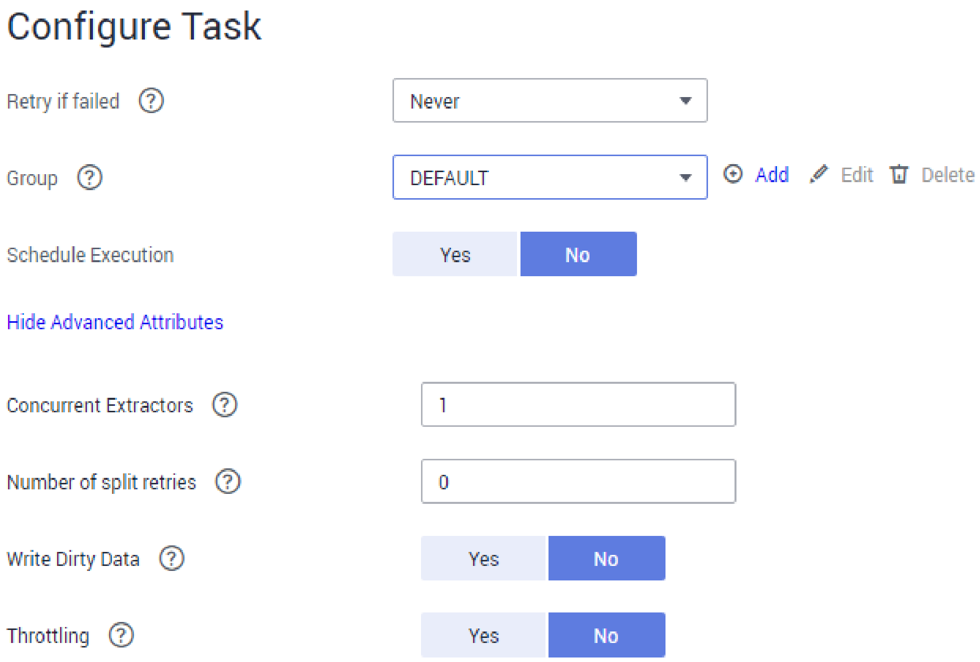
The expressions in CDM support field conversion of common character strings, dates, and values. For details, see **Converting Fields**.

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.

Figure 1-13 Configuring the task



Configure Task

Retry if failed: Never

Group: DEFAULT

Schedule Execution: Yes [✓ No]

Hide Advanced Attributes

Concurrent Extractors: 1

Number of split retries: 0

Write Dirty Data: Yes [✓ No]

Throttling: Yes [✓ No]

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

1.4 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.

- 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

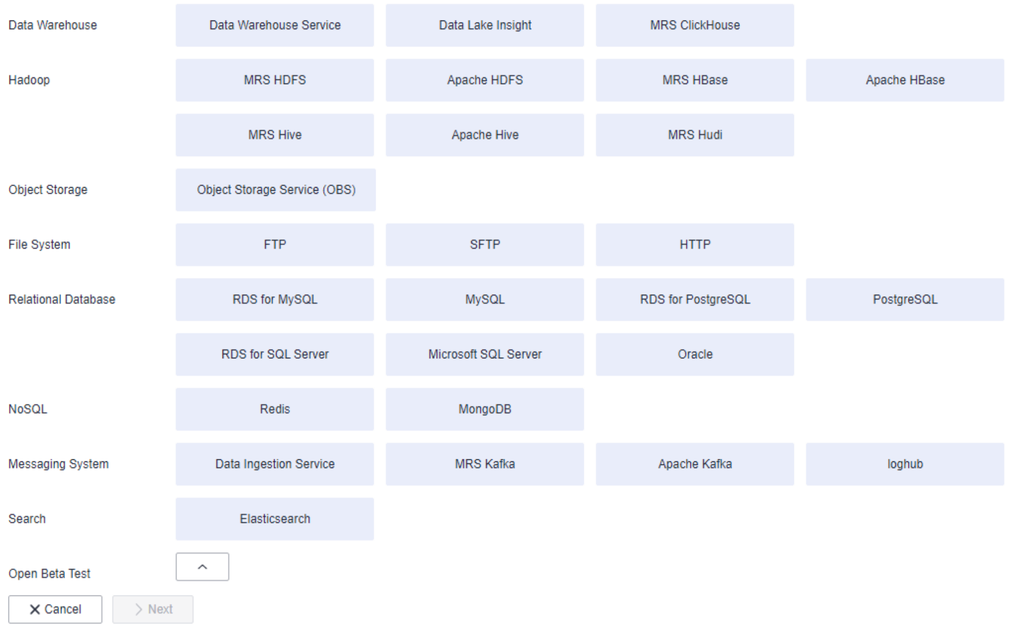
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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 1-14 Selecting a connector



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	loghub
Search	Elasticsearch			
Open Beta Test	^			

Step 2 Select **RDS for MySQL** and click **Next** to set the 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 1-5**.

Table 1-5 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

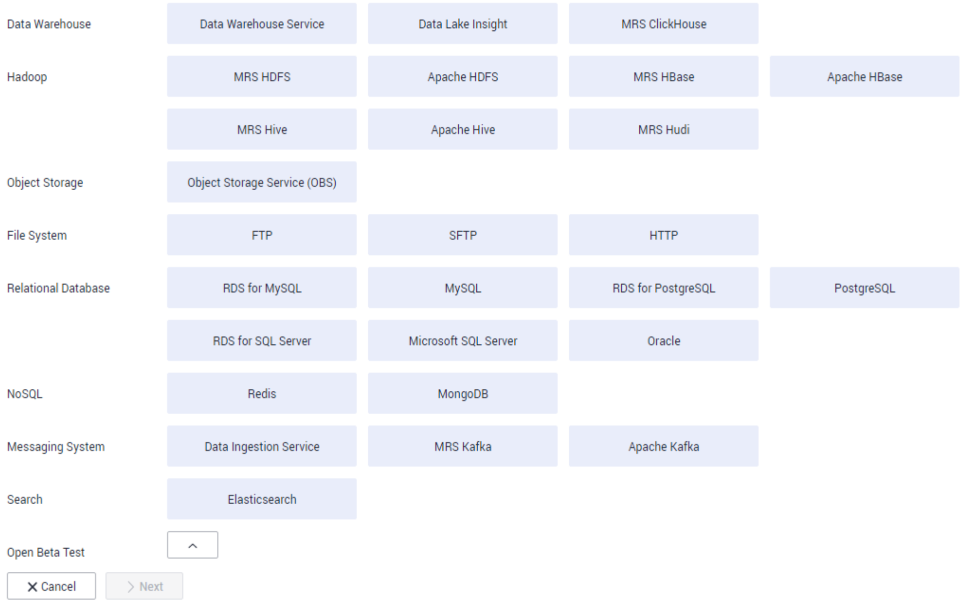
If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

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 1-15 Selecting a connector type



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	
Search	Elasticsearch			
Open Beta Test				

Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

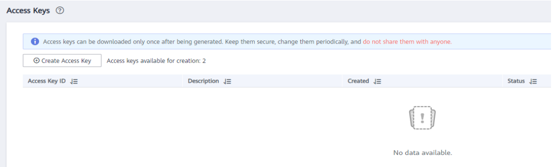
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  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 1-16**.

Figure 1-16 Clicking Create Access Key



Access Keys

Access keys can be downloaded only once after being generated. Keep them secure, change them periodically, and do not share them with anyone.

Access keys available for creation: 2

Access Key ID	Description	Created	Status

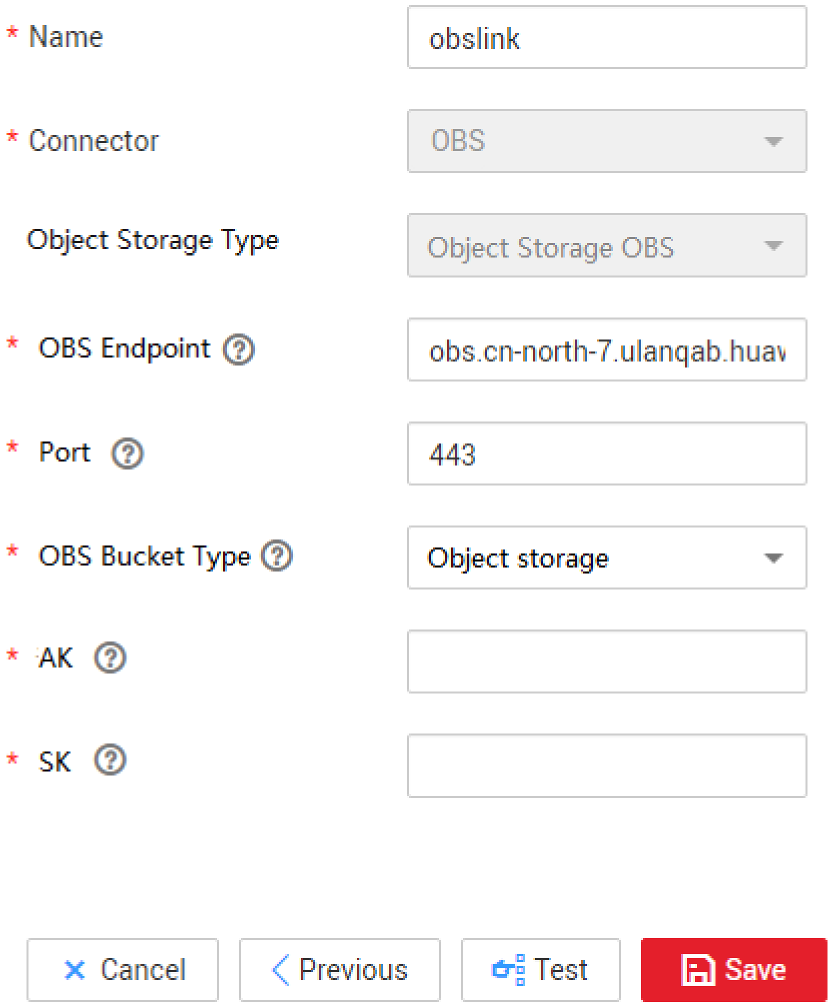
No data available.

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 1-17 Creating an OBS link



* Name	obslink
* Connector	OBS
Object Storage Type	Object Storage OBS
* OBS Endpoint	obs.cn-north-7.ulanqab.huav
* Port	443
* OBS Bucket Type	Object storage
* AK	
* SK	

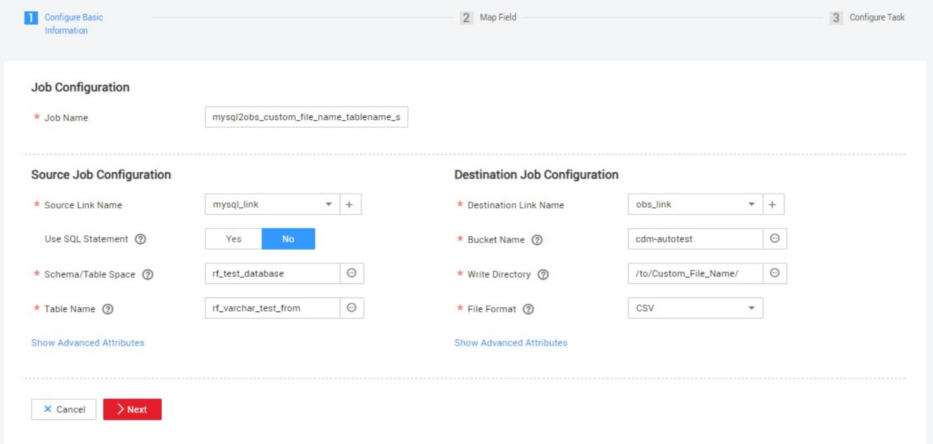
Step 3 Click **Save**. The **Link Management** page is displayed.

----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.

Figure 1-18 Creating a job for migrating data from MySQL to OBS



Job Configuration

* Job Name: mysql2obs_custom_file_name_tablename_s

Source Job Configuration

* Source Link Name: mysql_link
Use SQL Statement: Yes [✓ No]
* Schema/Table Space: rf_test_database
* Table Name: rf_varchar_test_from

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: obs_link
* Bucket Name: cdm-autotest
* Write Directory: /to/Custom_File_Name/
* File Format: CSV

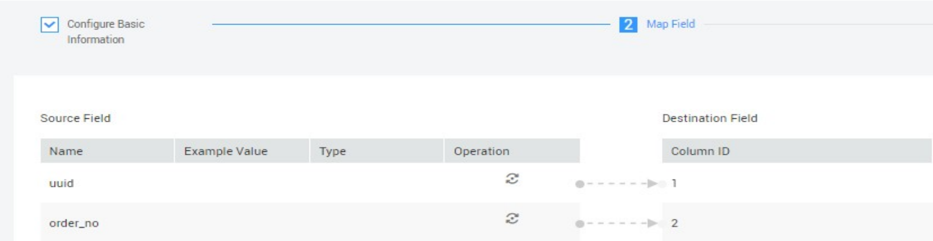
Show Advanced Attributes

- **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 1-19**.

- 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 1-19 Table-to-file field mapping



Source Field

Name	Example Value	Type	Operation
uuid			
order_no			

Destination Field

Column ID
1
2

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

1.5 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.

- 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

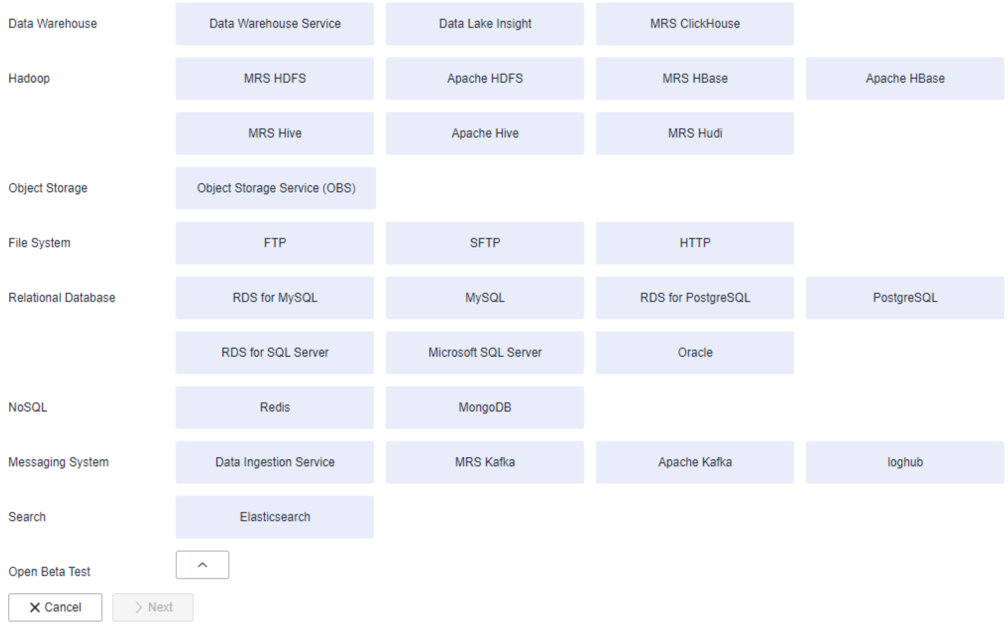
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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**.

Figure 1-20 Selecting a connector



Step 2 Select **RDS for MySQL** and click **Next** to set the 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 1-6**.

Table 1-6 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

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

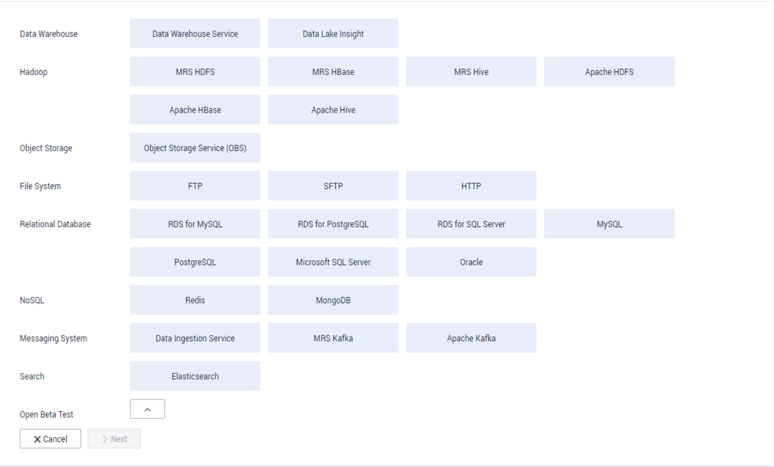
If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----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 1-21 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 1-7** and retain the default values for the optional parameters.

Table 1-7 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

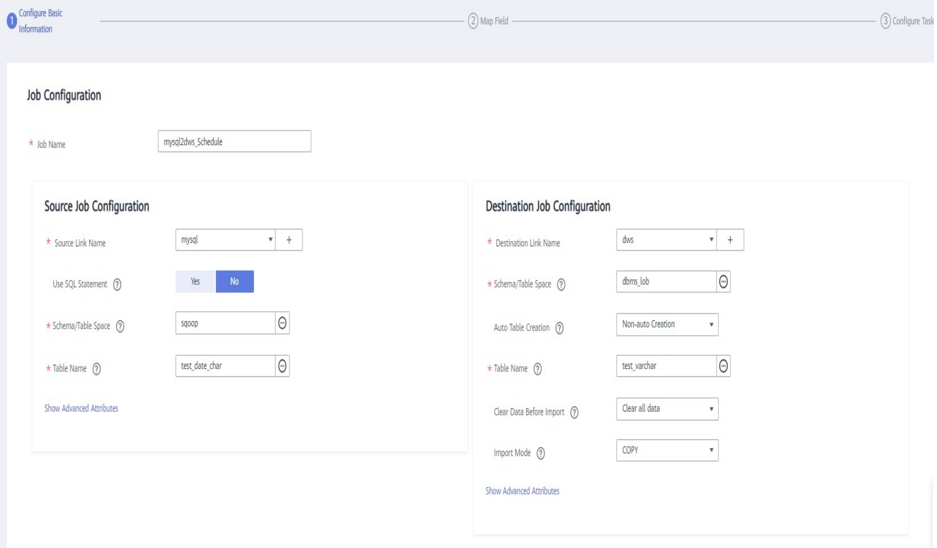
Step 3 Click **Save**.

----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.

Figure 1-22 Creating a job for migrating data from MySQL to DWS



Job Configuration

* Job Name: mysql2dws_Schedule

Source Job Configuration

* Source Link Name: mysql

Use SQL Statement: Yes [✓ No]

* Schema/Table Space: sqoop

* Table Name: test_date_char

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: dws

* Schema/Table Space: dbms_lob

Auto Table Creation: Non-auto Creation

* Table Name: test_varchar

Clear Data Before Import: Clear all data

Import Mode: COPY

Show Advanced Attributes

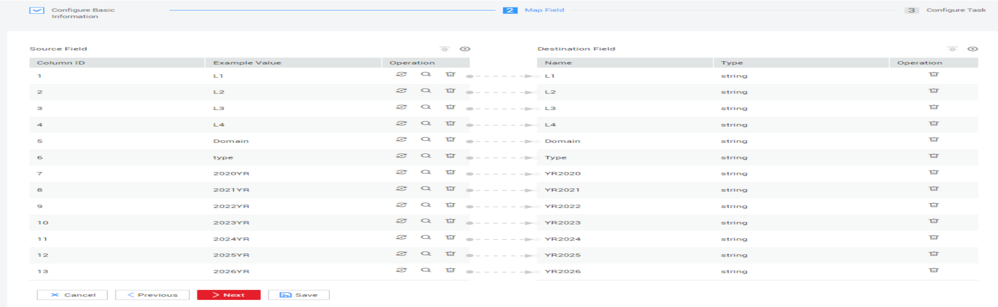
- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **mysqllink** created in **Creating a MySQL Link**.
  - **Use SQL Statement**: Select **No**.
  - **Schema/Tablespace**: name of the schema or tablespace from which data is to be extracted
  - **Table 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.

- **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 1-23**.

- 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 1-23 Table-to-table field mapping



Source Field

Column ID	Example Value	Operation
1	L1	
2	L2	
3	L3	
4	L4	
5	Domain	
6	type	
7	2020YR	
8	2021YR	
9	2022YR	
10	2023YR	
11	2024YR	
12	2025YR	
13	2026YR	

Destination Field

Name	Type	Operation
L1	string	
L2	string	
L3	string	
L4	string	
Domain	string	
Type	string	
YR2020	string	
YR2021	string	
YR2022	string	
YR2023	string	
YR2024	string	
YR2025	string	
YR2026	string	

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.

On the **Historical Record** page, click **Log** to view the job logs.

----End

1.6 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**.

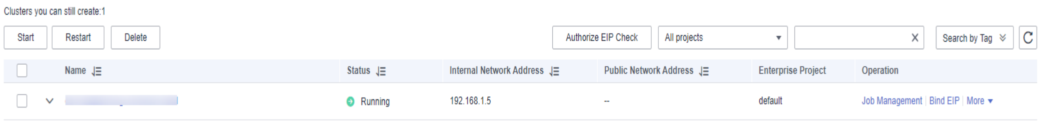
The key configurations are as follows:

- 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.

- 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 1-24 Cluster list



Clusters you can still create:1

	Name	Status	Internal Network Address	Public Network Address	Enterprise Project	Operation
□	[redacted]	Running	192.168.1.5	--	default	Job Management | Bind EIP | More ▾

NOTE

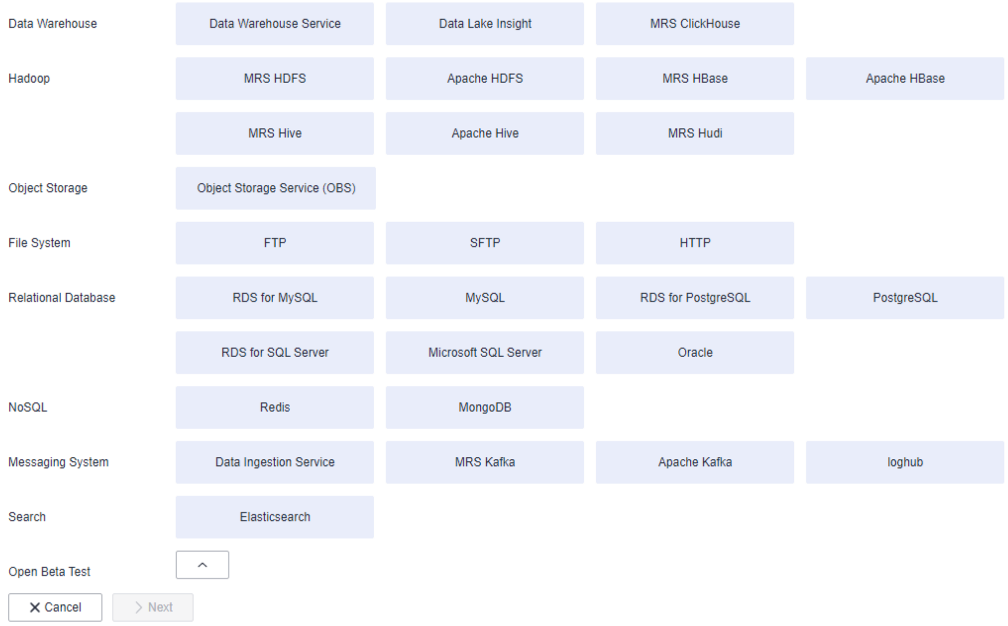
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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 1-25 Selecting a connector



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	loghub
Search	Elasticsearch			
Open Beta Test				

Step 2 Select **RDS for MySQL** and click **Next** to set the 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 1-8**.

Table 1-8 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

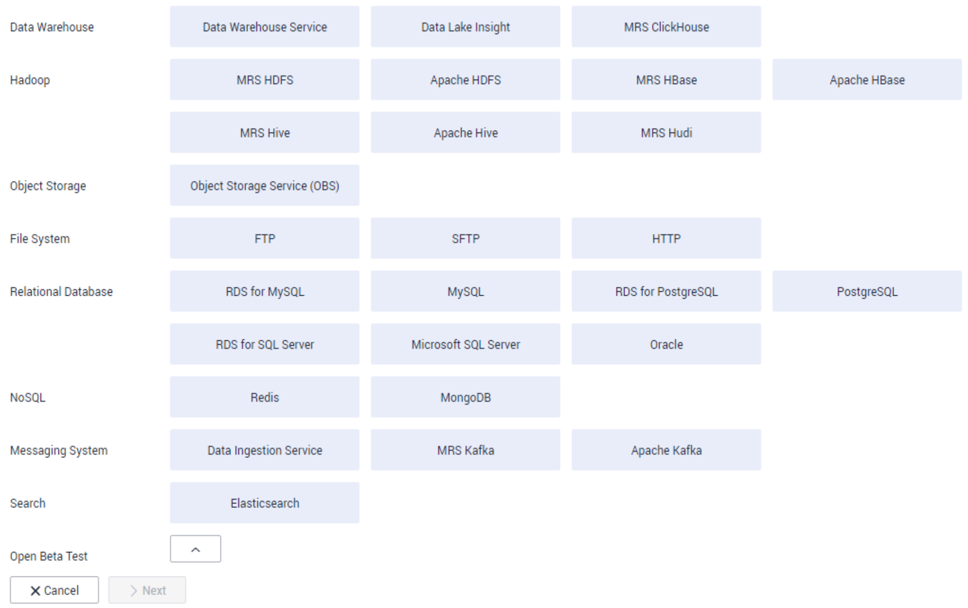
If an error occurs during the saving, the security settings of the MySQL database are incorrect. In this case, you need to enable the EIP of the CDM cluster to access the MySQL database.

----End

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 1-26 Selecting a connector type



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	
Search	Elasticsearch			
Open Beta Test	^			

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.

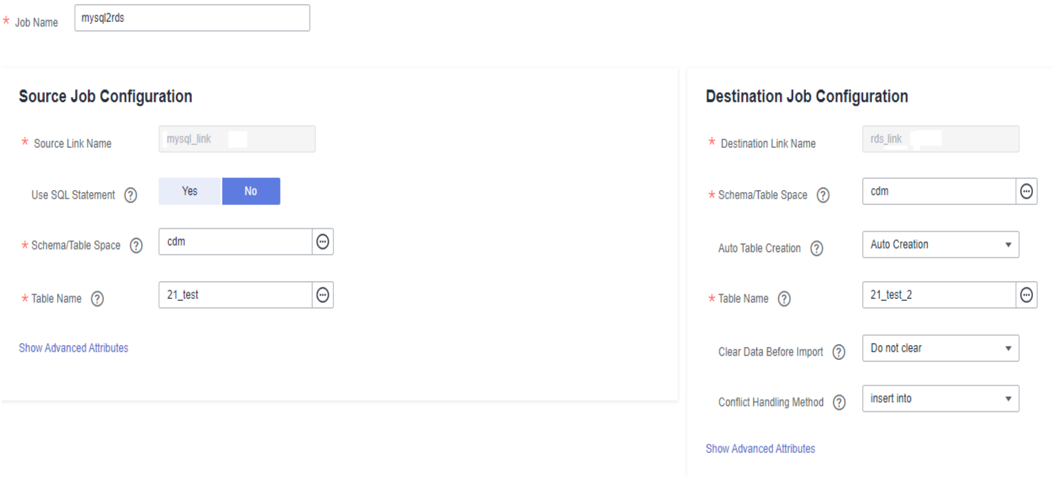
Step 3 Click **Save**. The **Link Management** page is displayed.

----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 1-27**.

Figure 1-27 Creating an entire DB migration job



* Job Name: mysql2rds

Source Job Configuration

* Source Link Name: mysql_link

Use SQL Statement: Yes [✓ No]

* Schema/Table Space: cdm

* Table Name: 21_test

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: rds_link

* Schema/Table Space: cdm

Auto Table Creation: Auto Creation

* Table Name: 21_test_2

Clear Data Before Import: Do not clear

Conflict Handling Method: insert into

Show Advanced Attributes

- **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

1.7 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 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.
- 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.

NOTE

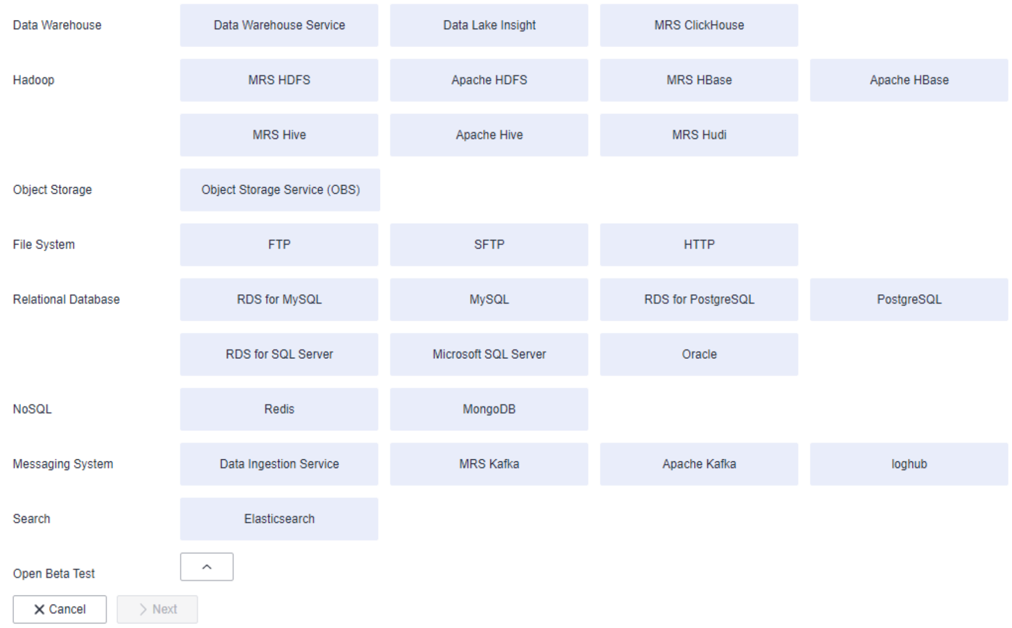
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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.

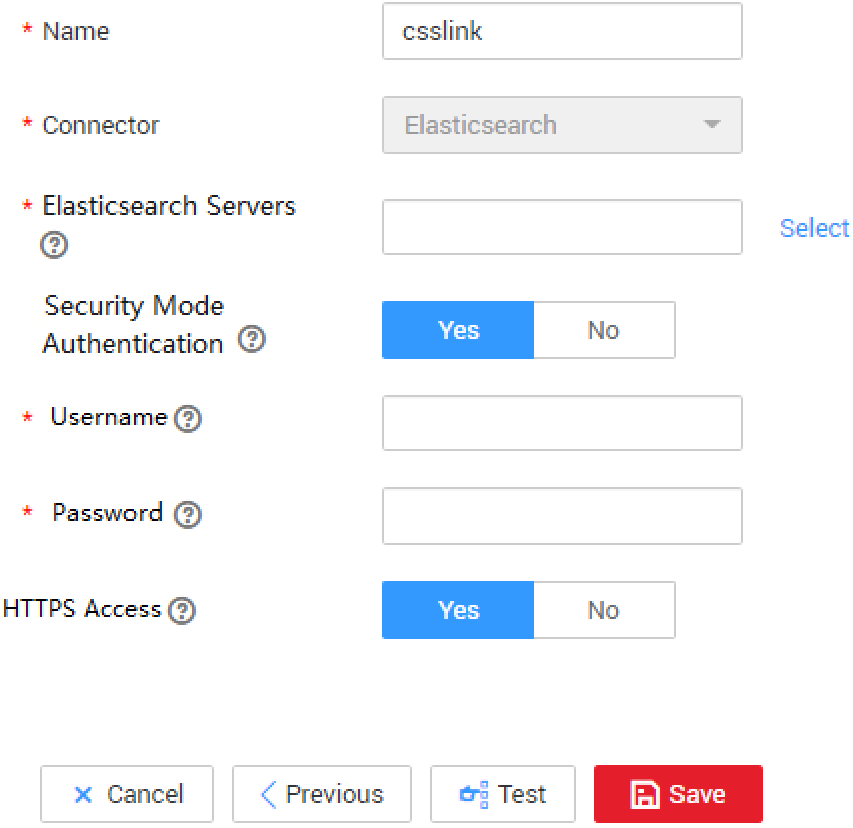
Figure 1-28 Selecting a connector



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.

Figure 1-29 Creating a CSS link



* Name	csslink
* Connector	Elasticsearch
* Elasticsearch Servers	
Security Mode Authentication	Yes
* Username	
* Password	
HTTPS Access	Yes

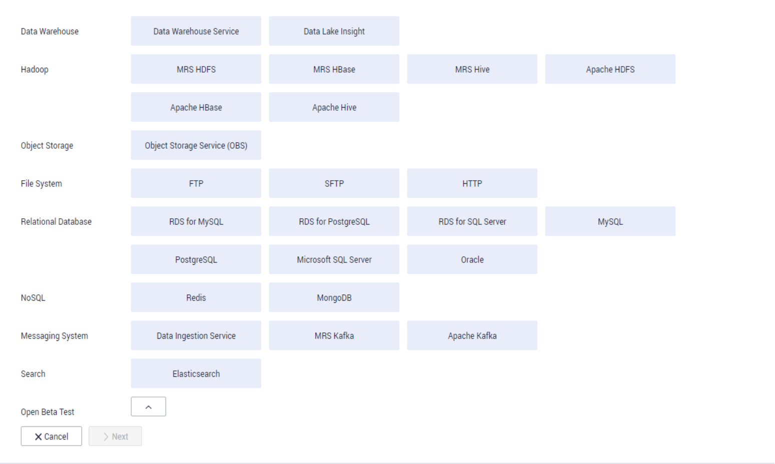
Step 3 Click **Save**. The **Link Management** page is displayed.

----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.

Figure 1-30 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.

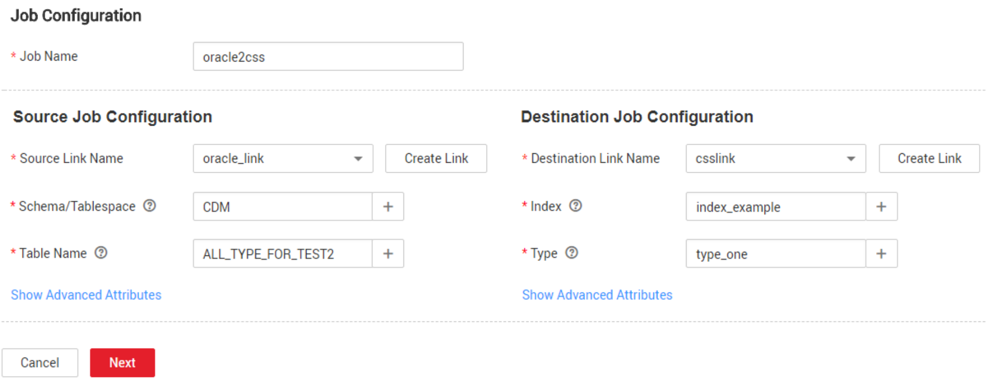
Step 3 Click **Save**. The **Link Management** page is displayed.

----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.

Figure 1-31 Creating a job for migrating data from Oracle to Cloud Search Service



Job Configuration

* Job Name: oracle2css

Source Job Configuration

* Source Link Name: oracle_link

* Schema/Tablespace: CDM

* Table Name: ALL_TYPE_FOR_TEST2

Destination Job Configuration

* Destination Link Name: csslink

* Index: index_example

* Type: type_one

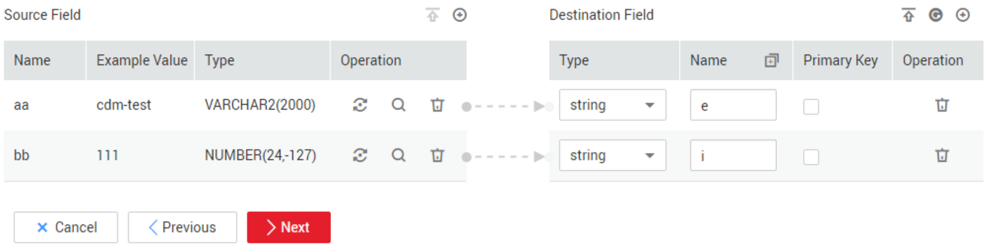
- **Job Name**: Enter a unique name.
- **Source Job Configuration**

   - **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. See **Figure 1-32**.

- 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**.

Figure 1-32 Field mapping of Cloud Search Service



Source Field

Name	Example Value	Type	Operation
aa	cdm-test	VARCHAR2(2000)	
bb	111	NUMBER(24,-127)	

Destination Field

Type	Name	Primary Key	Operation
string	e	□	
string	i	□	

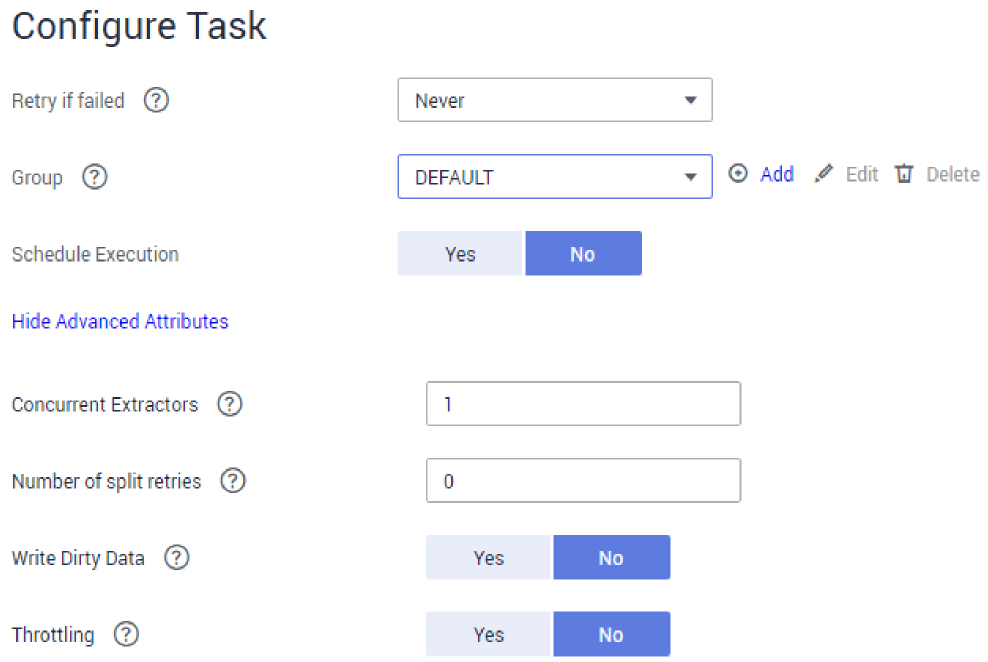
Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

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 1-33 Configuring the task



Configure Task

Retry if failed: Never

Group: DEFAULT

Schedule Execution: Yes [✓ No]

Hide Advanced Attributes

Concurrent Extractors: 1

Number of split retries: 0

Write Dirty Data: Yes [✓ No]

Throttling: Yes [✓ No]

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

1.8 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.
- 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

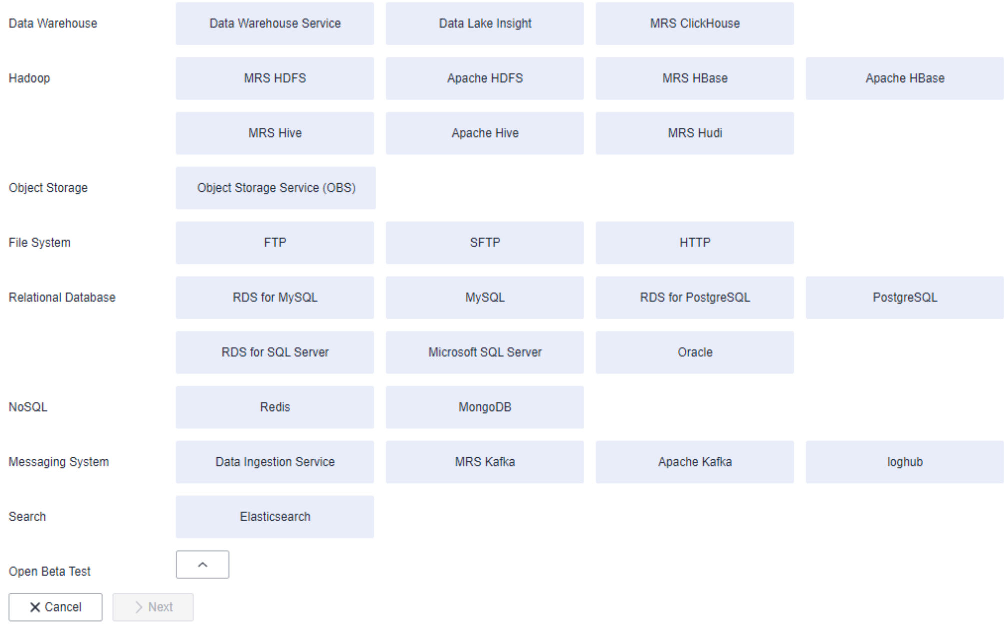
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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.

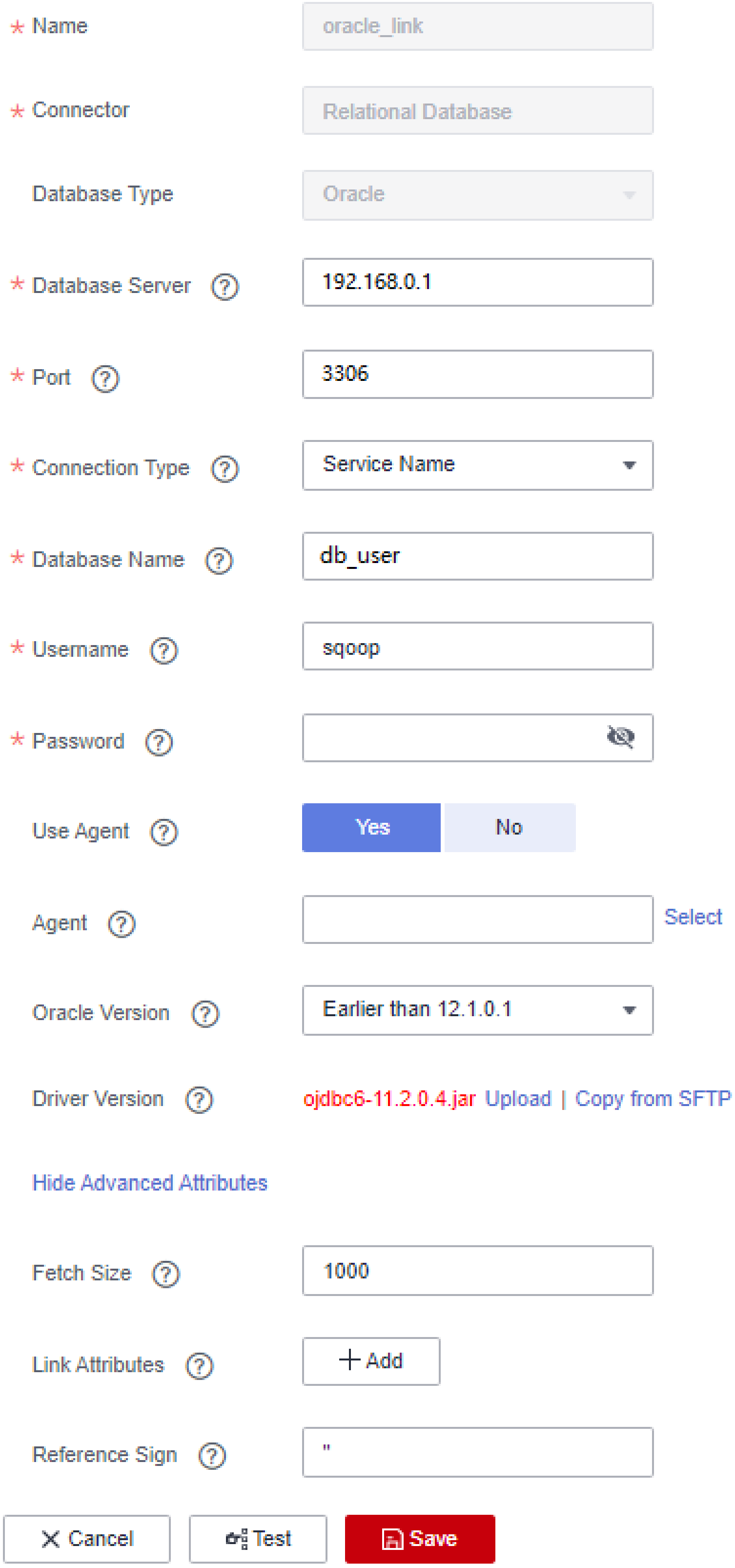
Figure 1-34 Selecting a connector



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	loghub
Search	Elasticsearch			
Open Beta Test	^			

Step 2 Select **Oracle** and click **Next** to configure parameters for the link.

Figure 1-35 Creating an Oracle link



* Name	oracle_link
* Connector	Relational Database
Database Type	Oracle
* Database Server	192.168.0.1
* Port	3306
* Connection Type	Service Name
* Database Name	db_user
* Username	sqoop
* Password	
Use Agent	Yes / No
Agent	Select
Oracle Version	Earlier than 12.1.0.1
Driver Version	ojdbc6-11.2.0.4.jar Upload | Copy from SFTP
Hide Advanced Attributes	
Fetch Size	1000
Link Attributes	+ Add
Reference Sign	"

Table 1-9 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.	'

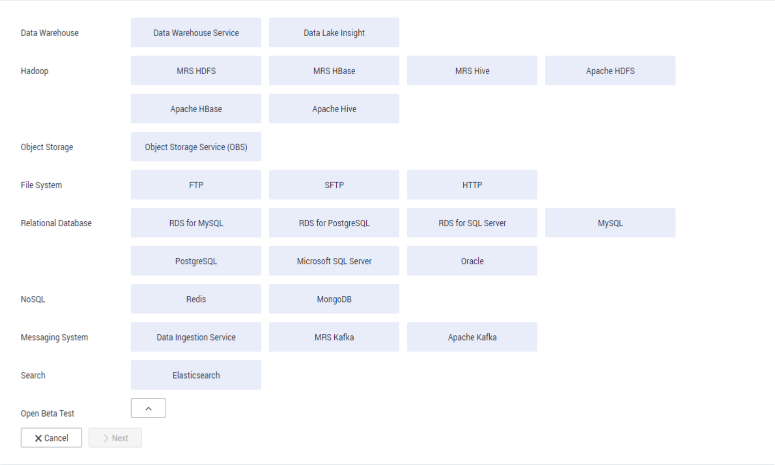
Step 3 Click **Save**. The **Links** page is displayed.

----End

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 1-36 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 1-10** and retain the default values for the optional parameters.

Table 1-10 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.	-

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

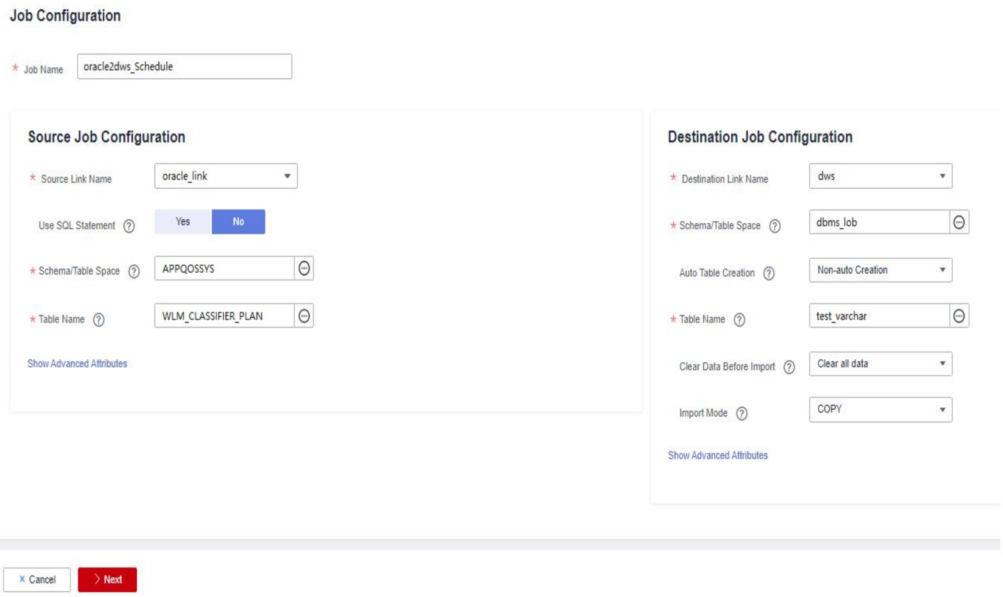
Step 3 Click **Save**.

----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 1-37 Creating a job for migrating data from Oracle to DWS



Job Configuration

* Job Name: oracle2dws_Schedule

Source Job Configuration

- * Source Link Name: oracle_link
- Use SQL Statement: Yes / No (No selected)
- * Schema/Table Space: APPQOSSYS
- * Table Name: WLM_CLASSIFIER_PLAN
- Show Advanced Attributes

Destination Job Configuration

- * Destination Link Name: dws
- * Schema/Table Space: dbms_lob
- Auto Table Creation: Non-auto Creation
- * Table Name: test_varchar
- Clear Data Before Import: Clear all data
- Import Mode: COPY
- Show Advanced Attributes

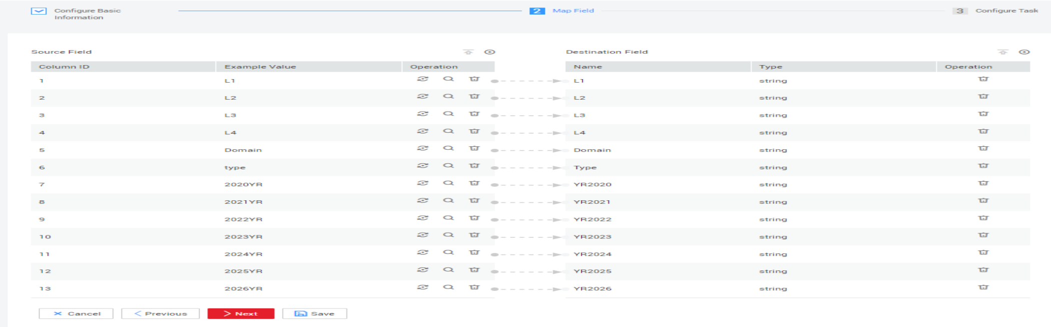
- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **oracle_link** created in **Creating an Oracle Link**.
  - **Schema/Tablespace**: Enter the name of the database whose data is to be migrated.
  - **Table Name**: Enter the name of the table whose 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**.

- **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 1-38**.

- 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 1-38 Table-to-table field mapping



Source Field

Column ID	Example Value	Operation
1	L1	
2	L2	
3	L3	
4	L4	
5	Domain	
6	type	
7	2020YR	
8	2021YR	
9	2022YR	
10	2023YR	
11	2024YR	
12	2025YR	
13	2026YR	

Destination Field

Name	Type	Operation
L1	string	
L2	string	
L3	string	
L4	string	
Domain	string	
Type	string	
YR2020	string	
YR2021	string	
YR2022	string	
YR2023	string	
YR2024	string	
YR2025	string	
YR2026	string	

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.

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.

1.9 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:

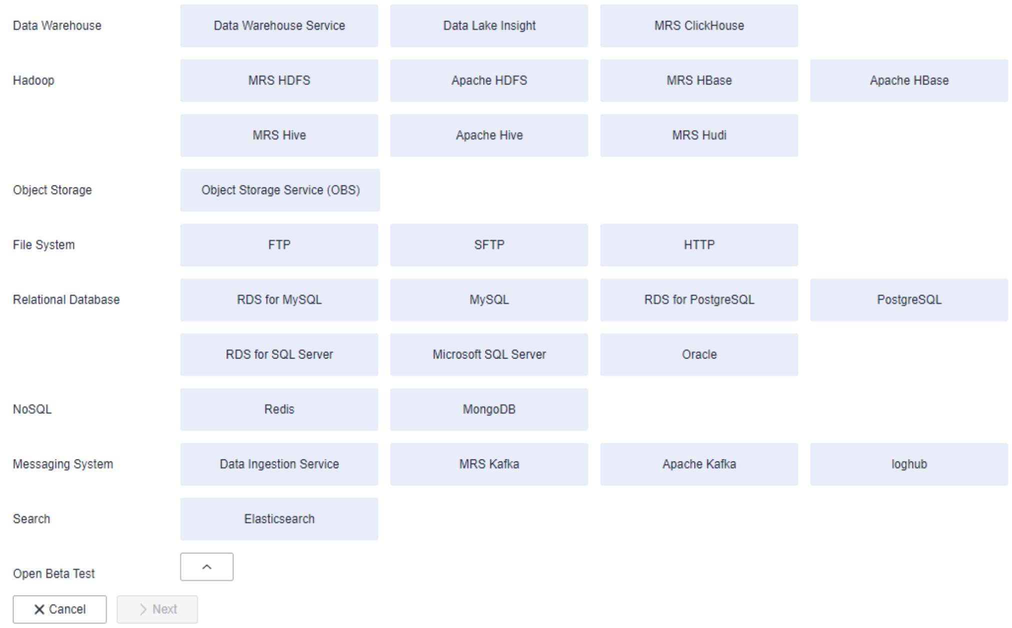
- The flavor of the CDM cluster is selected based on the amount of data to be migrated. Generally, cdm.medium meets the requirements for most migration scenarios.

- 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.

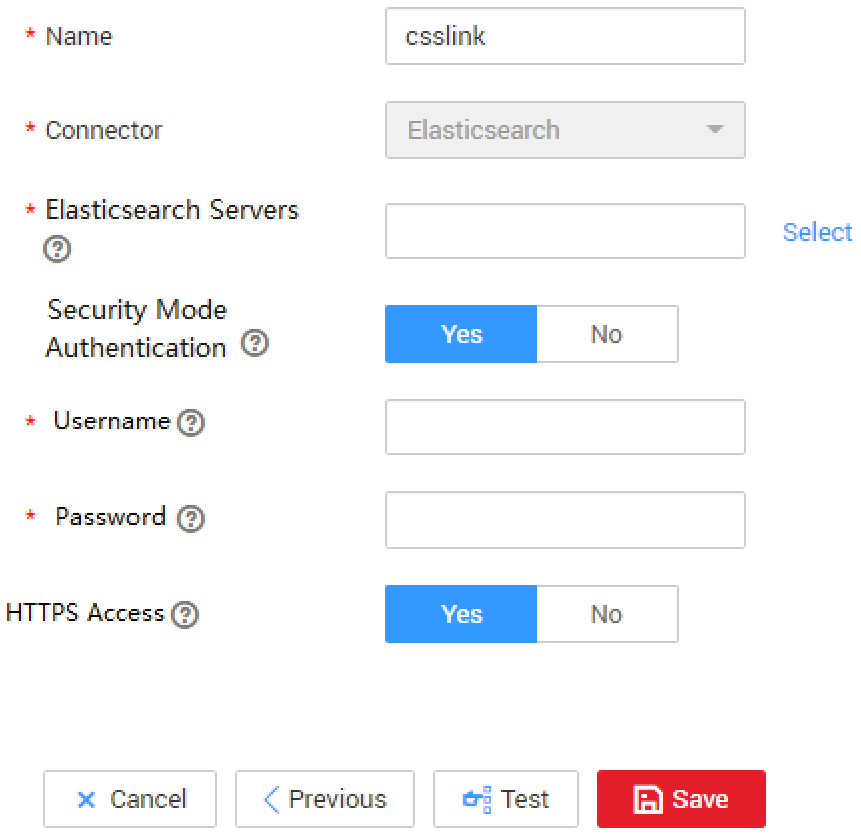
Figure 1-39 Selecting a connector



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.

Figure 1-40 Creating a CSS link



* Name: csslink

* Connector: Elasticsearch

* Elasticsearch Servers ⓘ

Security Mode Authentication ⓘ: Yes

* Username ⓘ

* Password ⓘ

HTTPS Access ⓘ: Yes

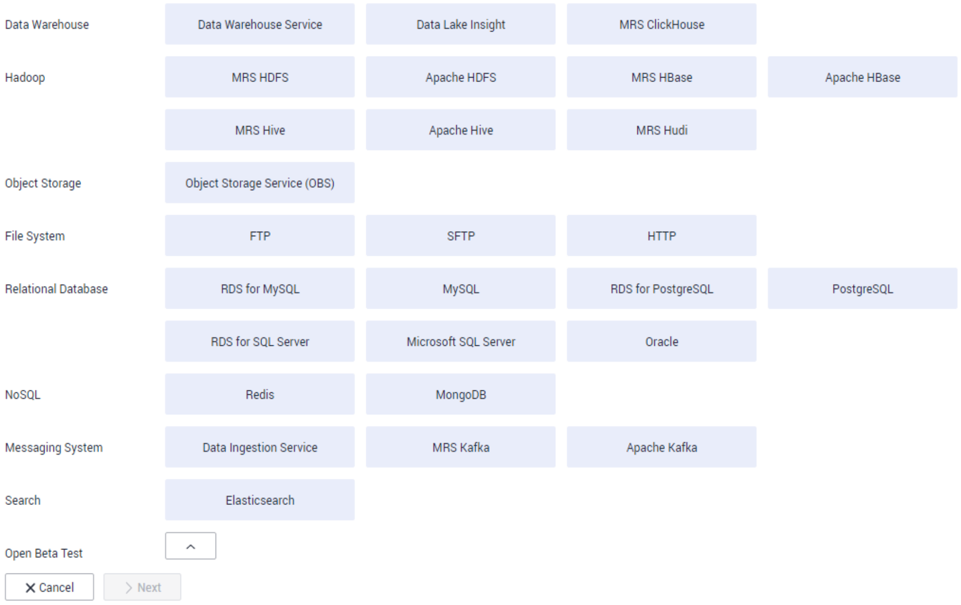
Step 3 Click **Save**. The **Link Management** page is displayed.

----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 1-41 Selecting a connector type



Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

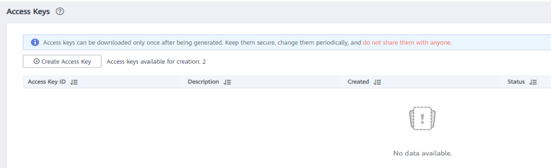
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  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 1-42**.

  Figure 1-42 Clicking Create Access Key

  Access keys can be downloaded only once after being generated. Keep them secure, change them periodically, and do not share them with anyone.

  Access keys available for creation: 2

Access Key ID	Description	Created	Status

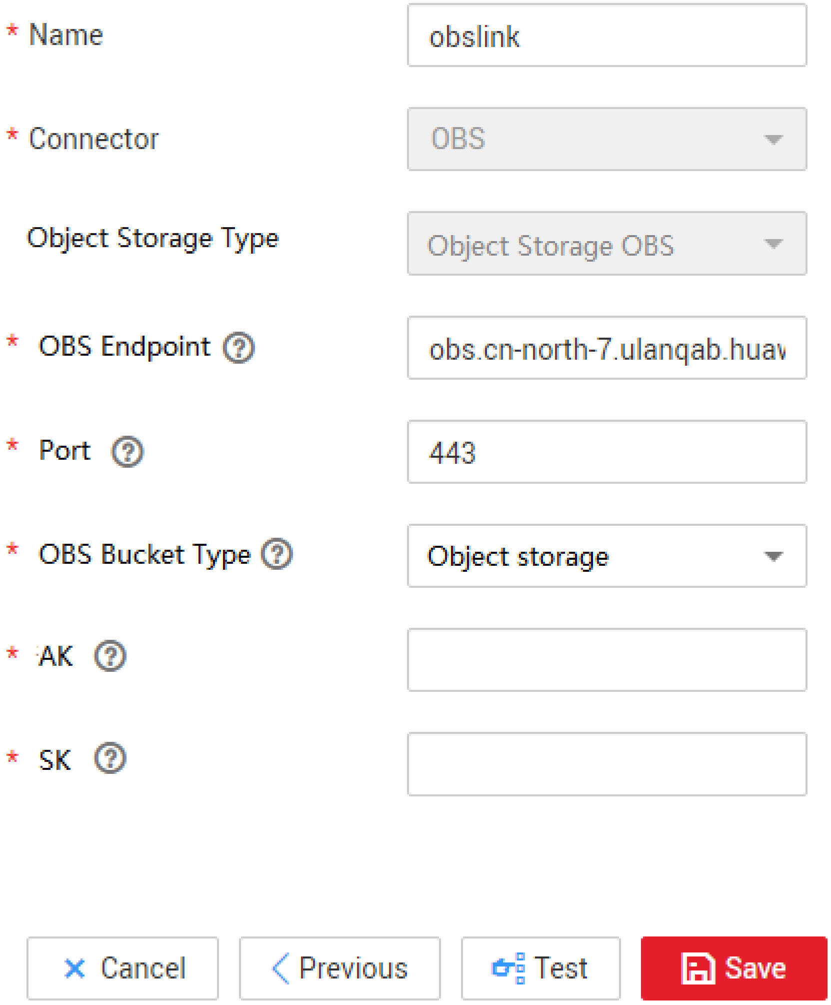
  No data available.

  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 1-43 Creating an OBS link



* Name	obslink
* Connector	OBS
Object Storage Type	Object Storage OBS
* OBS Endpoint	obs.cn-north-7.ulanqab.huav
* Port	443
* OBS Bucket Type	Object storage
* AK	
* SK	

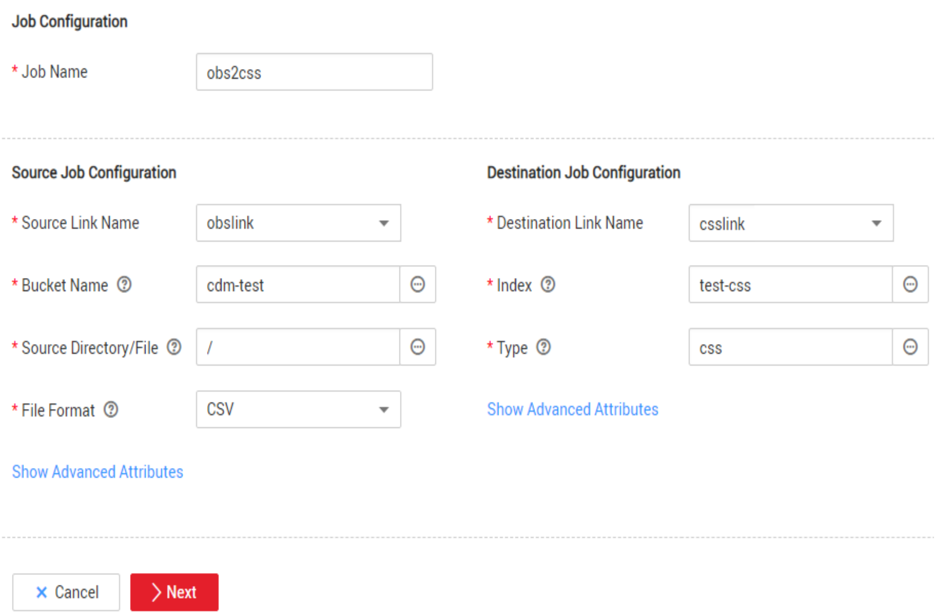
Step 3 Click **Save**. The **Link Management** page is displayed.

----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.

Figure 1-44 Creating a job for migrating data from OBS to Cloud Search Service



Job Configuration

* Job Name: obs2css

Source Job Configuration

* Source Link Name: obslink
* Bucket Name: cdm-test
* Source Directory/File: /
* File Format: CSV

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: csslink
* Index: test-css
* Type: css

Show Advanced Attributes

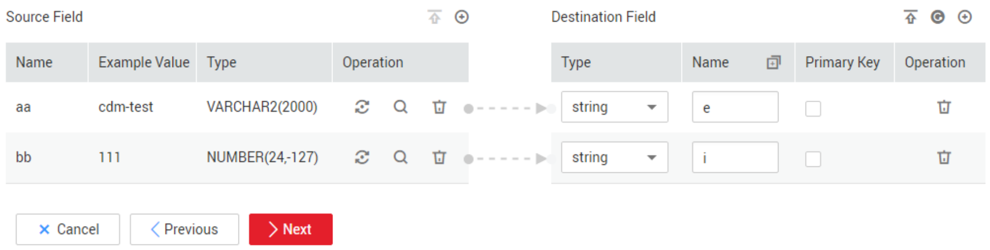
- **Job Name**: Enter a unique name.
- **Source Job Configuration**
  - **Source Link Name**: Select the **obslink** link created in **Creating an OBS Link**.
  - **Bucket Name**: Select the bucket from which the data will be migrated.
  - **Source Directory/File**: Set this parameter to the path of 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 1-45**.

- 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**.

Figure 1-45 Field mapping of Cloud Search Service



Source Field

Name	Example Value	Type	Operation
aa	cdm-test	VARCHAR2(2000)	
bb	111	NUMBER(24,-127)	

Destination Field

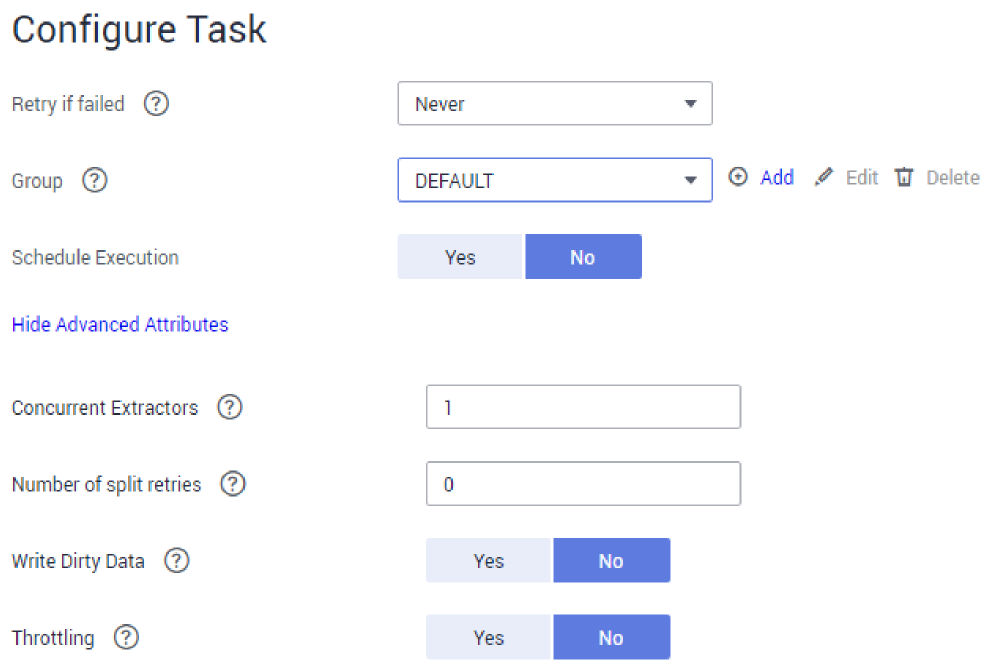
Type	Name	Primary Key	Operation
string	e	□	
string	i	□	

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 1-46 Configuring the task



Configure Task

Retry if failed: Never

Group: DEFAULT

Schedule Execution: Yes [✓ No]

Hide Advanced Attributes

Concurrent Extractors: 1

Number of split retries: 0

Write Dirty Data: Yes [✓ No]

Throttling: Yes [✓ No]

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

1.10 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.

Creating a CDM Cluster

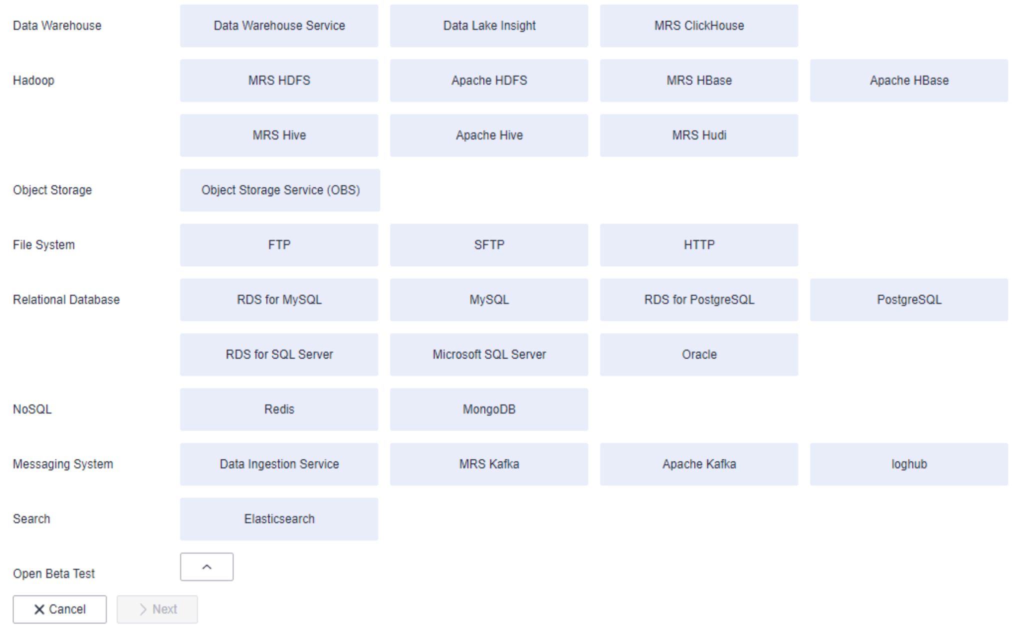
If CDM is used an independent service, create a CDM cluster by following the instructions in **Creating a CDM Cluster**. If CDM is used as a module of DataArts Studio, create a CDM cluster by following the instructions in **Creating a CDM Cluster**.

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.

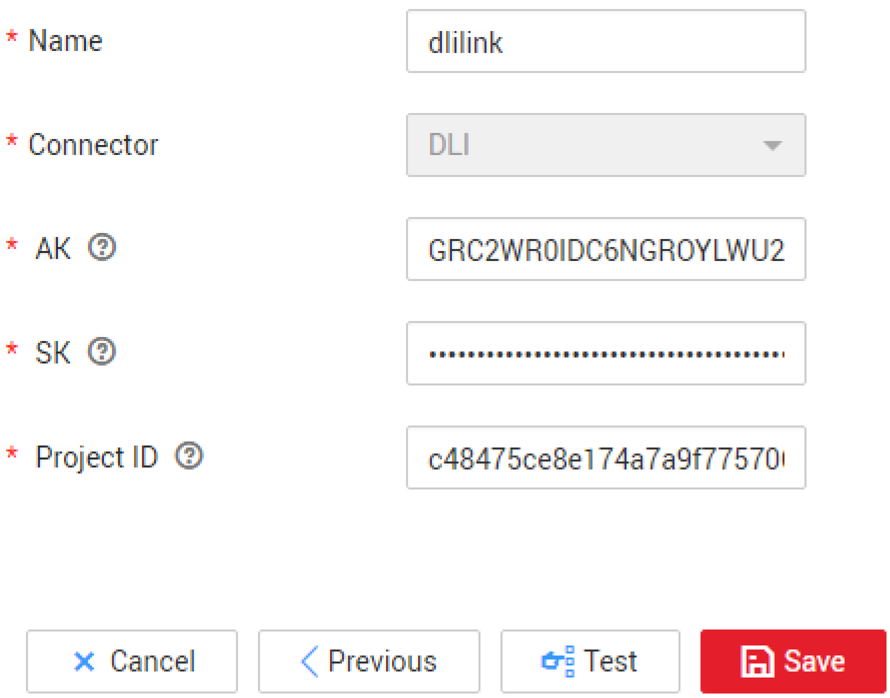
Figure 1-47 Selecting a connector



Step 2 Select **Data Lake Insight**, click **Next**, and configure the DLI link parameters. See **Figure 1-48**.

- **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.

Figure 1-48 Creating a DLI link



* Name	dlilink
* Connector	DLI
* AK	GRC2WR0IDC6NGROYLWU2
* SK	••
* Project ID	c48475ce8e174a7a9f77570

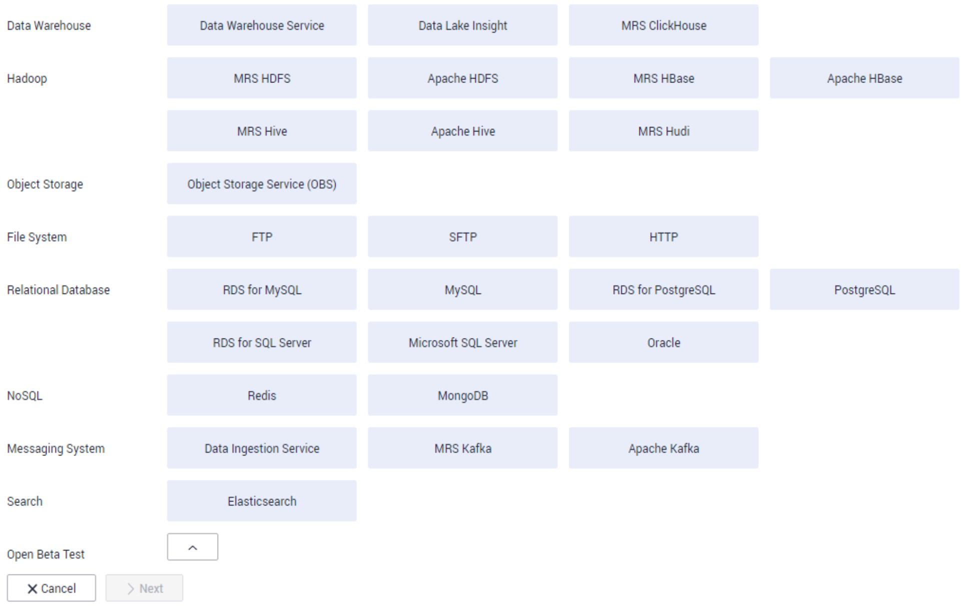
Step 3 Click **Save**. The **Link Management** page is displayed.

----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 1-49 Selecting a connector type



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	
Search	Elasticsearch			
Open Beta Test				

Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

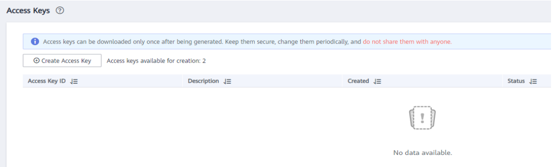
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  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 1-50**.

  Figure 1-50 Clicking Create Access Key

  Access keys can be downloaded only once after being generated. Keep them secure, change them periodically, and do not share them with anyone.

  Access keys available for creation: 2

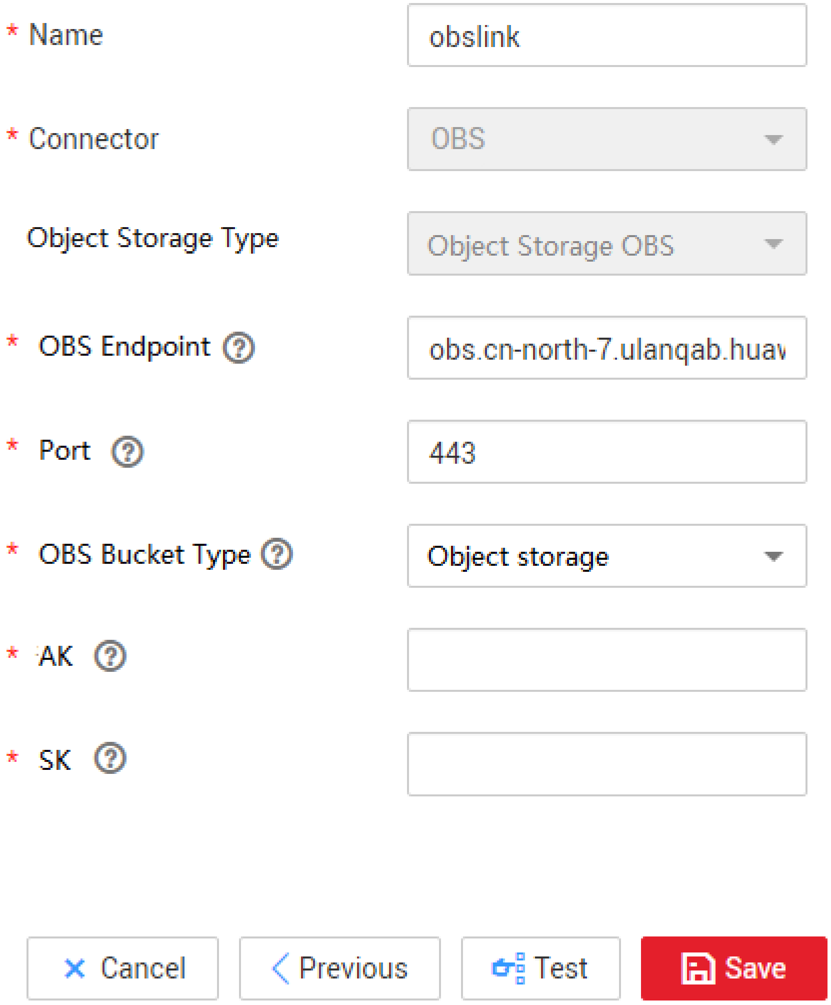
  No data available.

  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 1-51 Creating an OBS link



* Name	obslink
* Connector	OBS
Object Storage Type	Object Storage OBS
* OBS Endpoint	obs.cn-north-7.ulanqab.huav
* Port	443
* OBS Bucket Type	Object storage
* AK	
* SK	

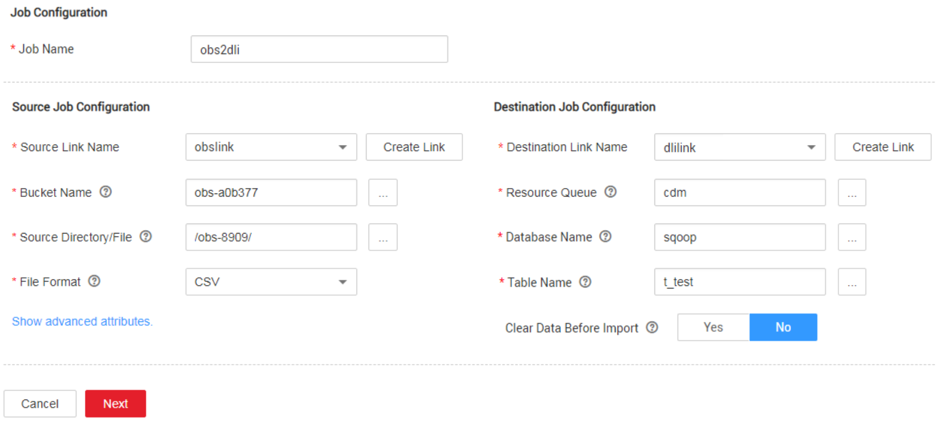
Step 3 Click **Save**. The **Link Management** page is displayed.

----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 1-52**.

Figure 1-52 Creating a job for migrating data from OBS to DLI



Job Configuration

* Job Name: obs2dli

Source Job Configuration

- * Source Link Name: obslink
- * Bucket Name: obs-a0b377
- * Source Directory/File: /obs-8909/
- * File Format: CSV

Destination Job Configuration

- * Destination Link Name: dlilink
- * Resource Queue: cdm
- * Database Name: sqoop
- * Table Name: t_test
- Clear Data Before Import: Yes [✓ No]

- **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**.

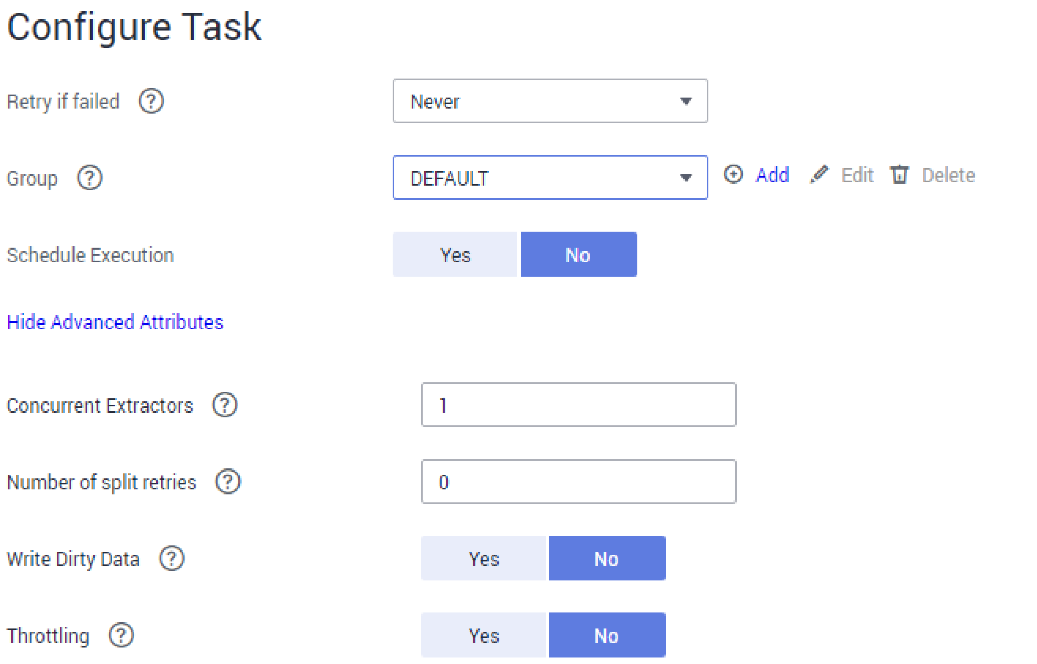
Step 3 Click **Next** and set task parameters. Generally, retain the default values of all parameters.

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**.

- **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 1-53 Configuring the task



Configure Task

Retry if failed: Never

Group: DEFAULT

Schedule Execution: Yes [✓ No]

Hide Advanced Attributes

Concurrent Extractors: 1

Number of split retries: 0

Write Dirty Data: Yes [✓ No]

Throttling: Yes [✓ No]

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

1.11 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:

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

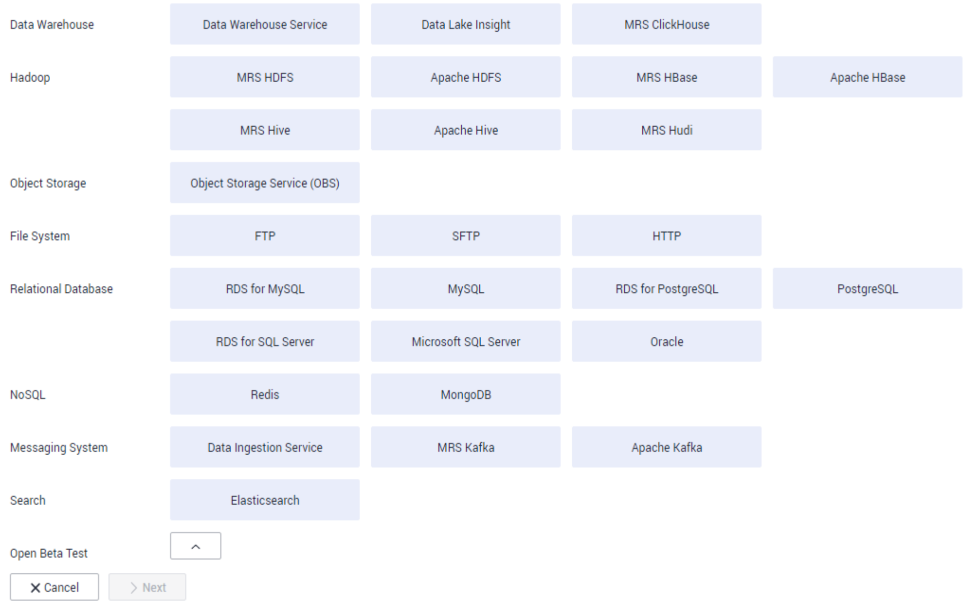
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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**.

Figure 1-54 Selecting a connector type



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	
Search	Elasticsearch			
Open Beta Test	⌃			

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.

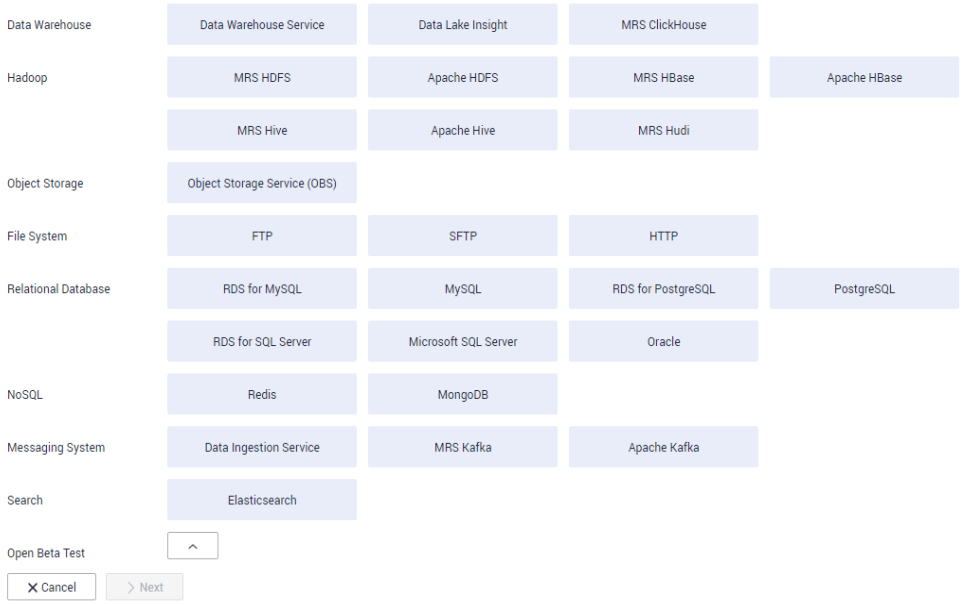
  If you need to create a snapshot when exporting a directory from HDFS, the user configured here must have the administrator permission on HDFS.
- **Password**: password for logging in to MRS Manager
- **Authentication Method**: authentication method for accessing MRS
- **Run Mode**: Select the running 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.

Figure 1-55 Selecting a connector type



Data Warehouse	Data Warehouse Service	Data Lake Insight	MRS ClickHouse	
Hadoop	MRS HDFS	Apache HDFS	MRS HBase	Apache HBase
	MRS Hive	Apache Hive	MRS Hudi	
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	MySQL	RDS for PostgreSQL	PostgreSQL
	RDS for SQL Server	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	
Search	Elasticsearch			
Open Beta Test				

Step 2 Select **Object Storage Service (OBS)** and click **Next** to configure parameters for the OBS link.

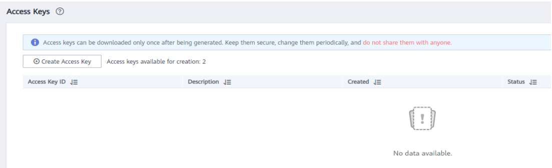
- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Server** and **Port**: Enter the actual OBS address information.
- **AK** and **SK**: Enter the AK and SK used for logging in to OBS.

  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 1-56**.

  Figure 1-56 Clicking Create Access Key

  Access Keys

  Access keys can be downloaded only once after being generated. Keep them secure, change them periodically, and do not share them with anyone.

  Access keys available for creation: 2

Access Key ID	Description	Created	Status

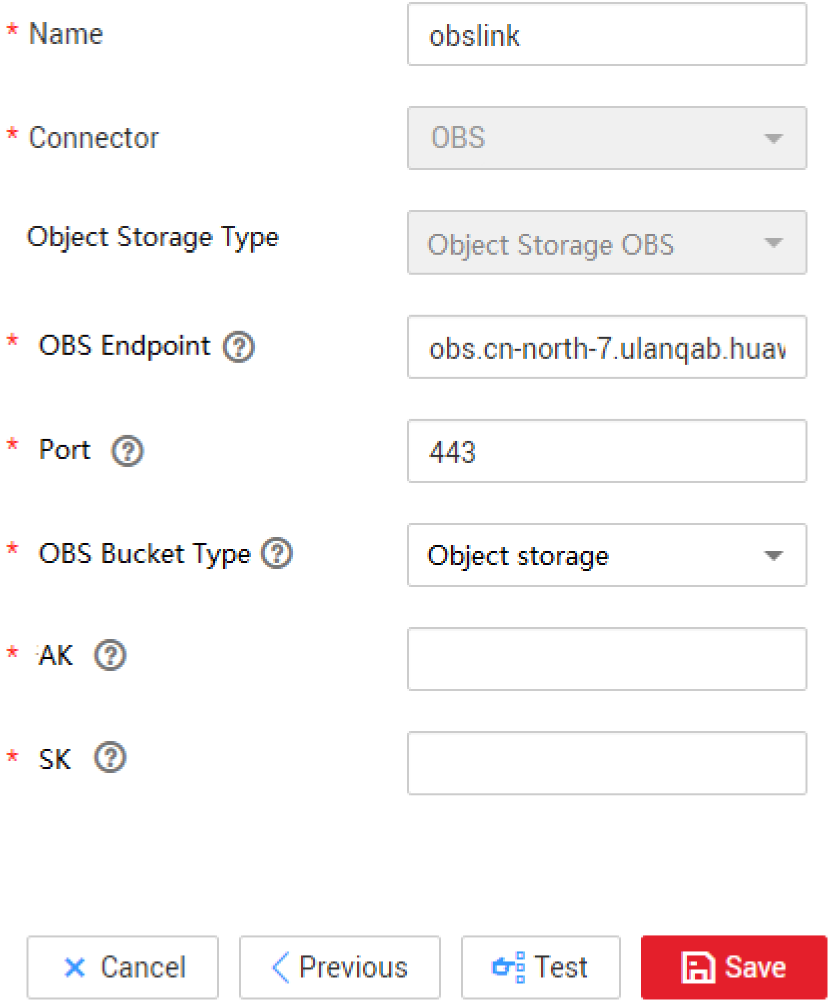
  No data available.

  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 1-57 Creating an OBS link



* Name	obslink
* Connector	OBS
Object Storage Type	Object Storage OBS
* OBS Endpoint	obs.cn-north-7.ulanqab.huav
* Port	443
* OBS Bucket Type	Object storage
* AK	
* SK	

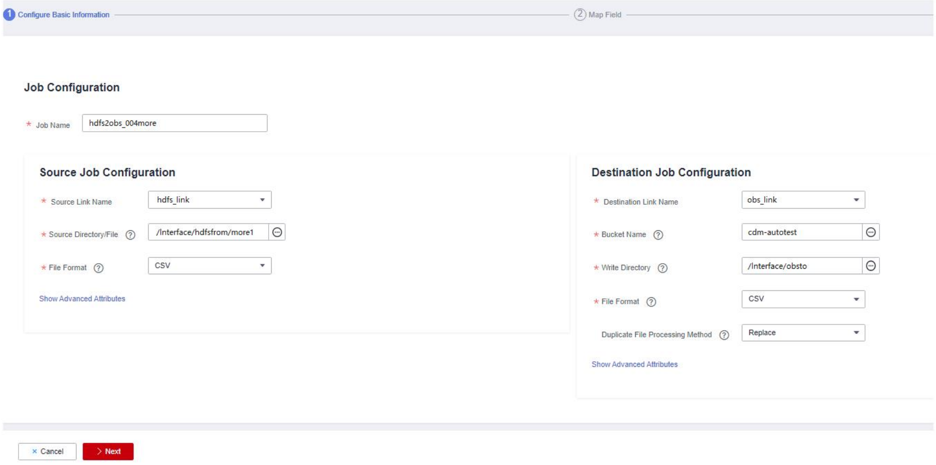
Step 3 Click **Save**. The **Link Management** page is displayed.

----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.

Figure 1-58 Creating a job for migrating data from MRS HDFS to OBS



Job Configuration

* Job Name: hdfs2obs_004more

Source Job Configuration

* Source Link Name: hdfs_link
* Source Directory/File: /Interface/hdfsfrom/more1
* File Format: CSV

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: obs_link
* Bucket Name: cdm-autotest
* Write Directory: /Interface/obsto
* File Format: CSV

Duplicate File Processing Method: Replace

Show Advanced Attributes

- **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**.

- **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

1.12 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.

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

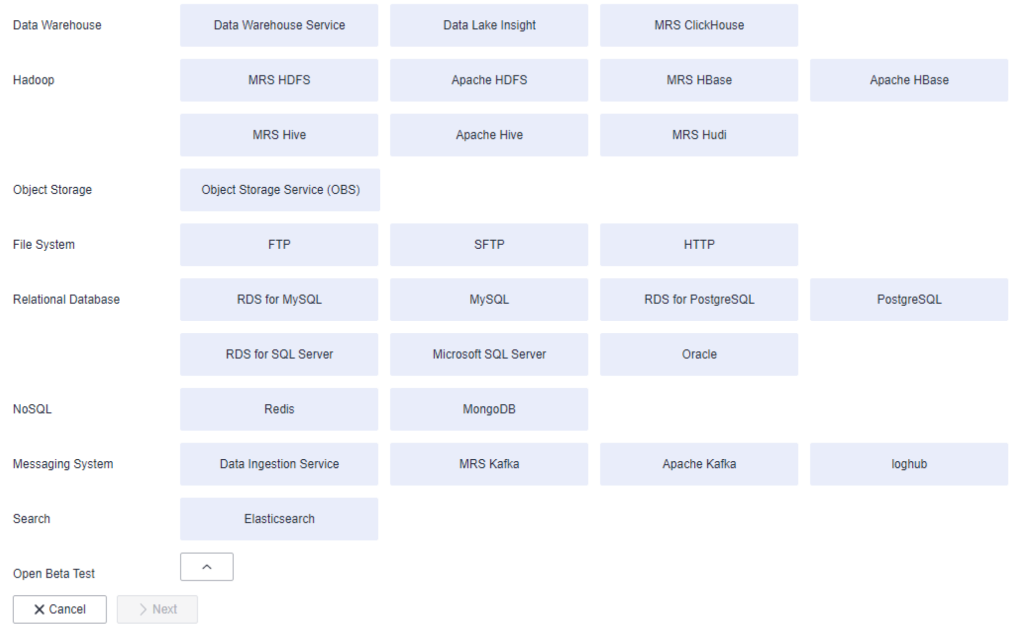
If SSL encryption is configured for the access channel of a local data source, CDM cannot connect to the data source using the EIP.

----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.

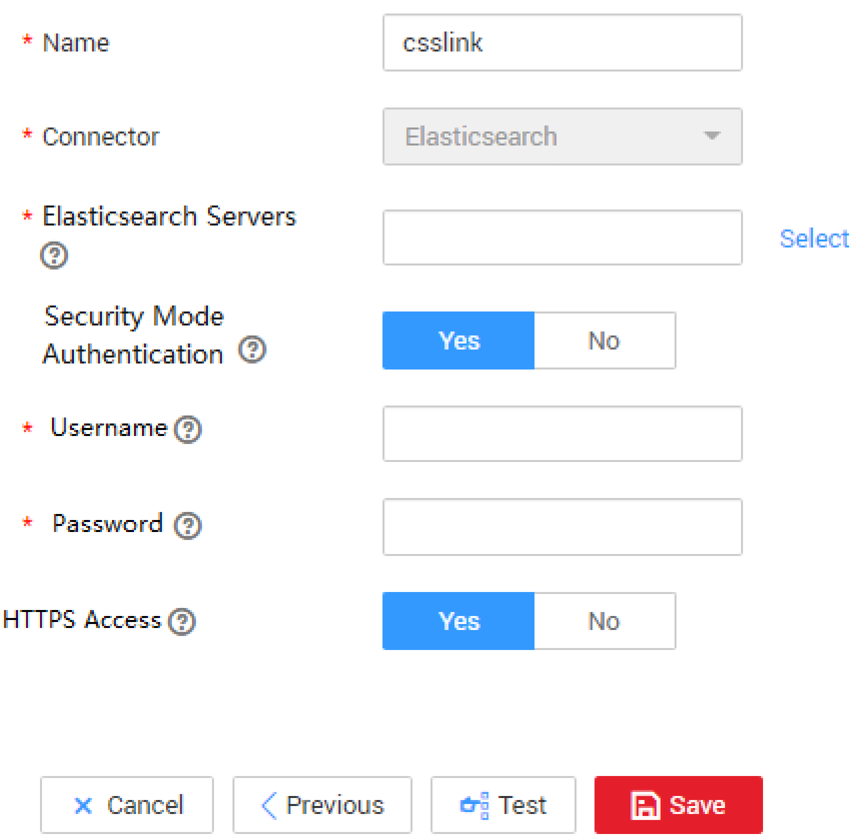
Figure 1-59 Selecting a connector



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.

Figure 1-60 Creating a CSS link



* Name	csslink
* Connector	Elasticsearch
* Elasticsearch Servers ?	
Security Mode Authentication ?	[✓ Yes] No
* Username ?	
* Password ?	
HTTPS Access ?	[✓ Yes] No

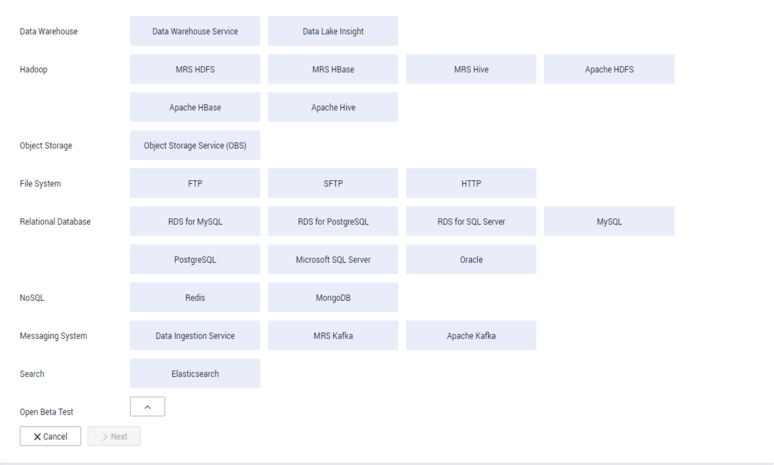
Step 3 Click **Save**. The **Link Management** page is displayed.

----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**.

Figure 1-61 Selecting a connector type



Data Warehouse: Data Warehouse Service, Data Lake Insight

Hadoop: MRS HDFS, MRS HBase, MRS Hive, Apache HDFS, Apache HBase, Apache Hive

Object Storage: Object Storage Service (OBS)

File System: FTP, SFTP, HTTP

Relational Database: RDS for MySQL, RDS for PostgreSQL, RDS for SQL Server, MySQL, PostgreSQL, Microsoft SQL Server, Oracle

NoSQL: Redis, MongoDB

Messaging System: Data Ingestion Service, MRS Kafka, Apache Kafka

Search: Elasticsearch

Open Beta Test

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.

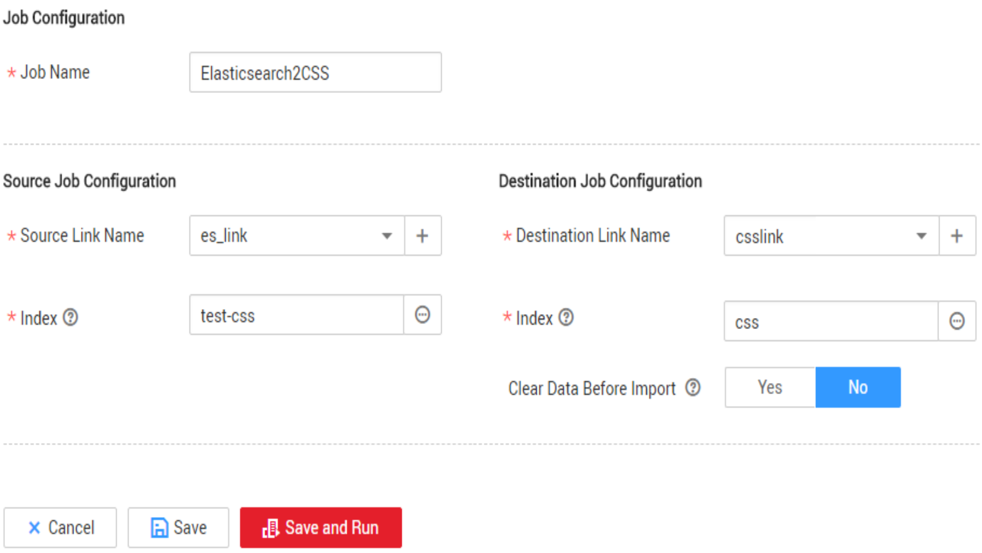
Step 3 Click **Save**. The **Link Management** page is displayed.

----End

Creating an Entire DB Migration Job

Step 1 Choose **Entire DB Migration** > **Create Job** to create an entire DB migration job.

Figure 1-62 Creating an entire DB migration job



Job Configuration

* Job Name: Elasticsearch2CSS

Source Job Configuration

* Source Link Name: es_link

* Index: test-css

Destination Job Configuration

* Destination Link Name: csslink

* Index: css

Clear Data Before Import: Yes [✓ No]

- **Job Name**: Enter a unique name.

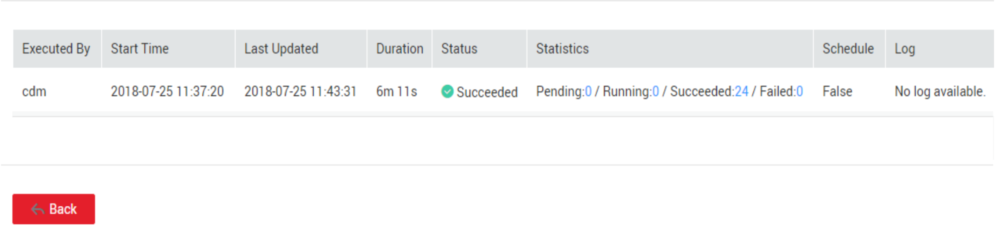
- **Source Job Configuration**
  - **Source Link Name**: Select the **es_link** link created in **Creating an Elasticsearch Link**.
  - **Index**: Click the icon next to the text box to select an index in the on-premises Elasticsearch database or manually enter an index name. The name can contain only 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 1-63 Historical Record



Executed By	Start Time	Last Updated	Duration	Status	Statistics	Schedule	Log
cdm	2018-07-25 11:37:20	2018-07-25 11:43:31	6m 11s	✓ Succeeded	Pending:0 / Running:0 / Succeeded:24 / Failed:0	False	No log available.

----End

2 Advanced Data Migration Guidance

2.1 Incremental Migration

2.1.1 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*).

File/Path Filter

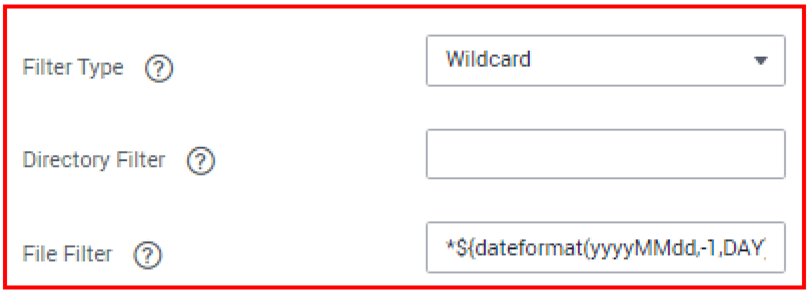
- Parameter position: When creating a table/file migration job, if the migration source is a file system, set **Filter Type** in advanced attributes of **Source Job Configuration** to **Wildcard** or **Regular expression**.
- Parameter principle: If you select **Wildcard** for **Filter Type**, CDM filters 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 2-1 Filtering files



Filter Type: Wildcard

Directory Filter:

File Filter: *${dateformat(yyyyMMdd,-1,DAY

  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:

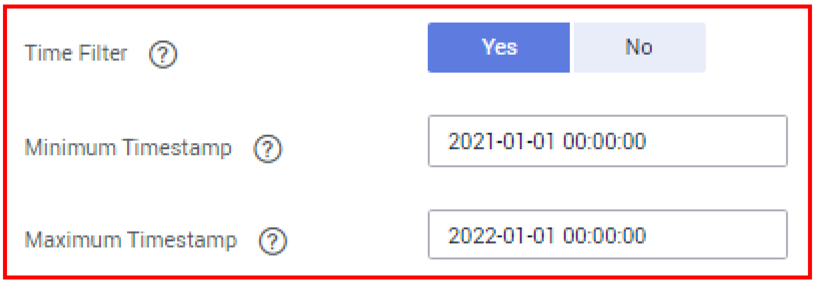
  For example, if you want CDM to synchronize only the files generated from January 1, 2021 to January 1, 2022 to the destination, configure the following parameters:

  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**.

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 2-2 Time Filter



Time Filter: Yes | No

Minimum Timestamp: 2021-01-01 00:00:00

Maximum Timestamp: 2022-01-01 00:00:00

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.

2.1.2 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

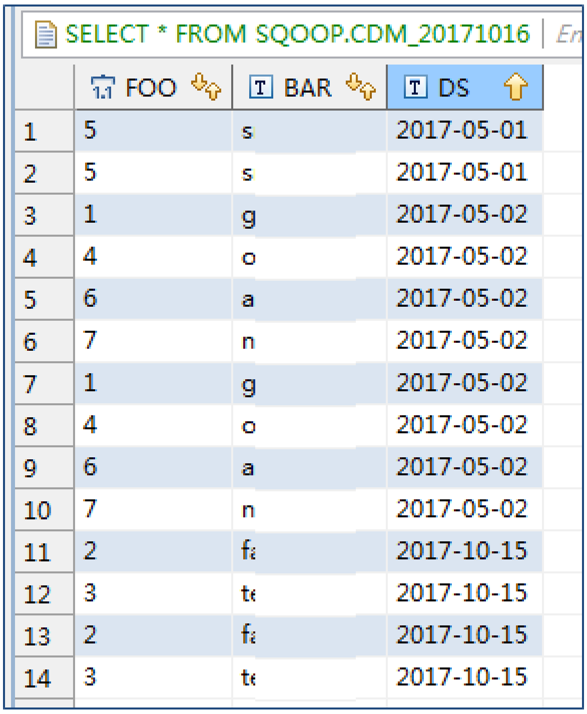
- Parameter position: When creating a table/file migration job, if the source end is a relational database, the **Where Clause** parameter is available in the advanced attributes of **Source Job Configuration**.
- Parameter principle: Set **WHERE Clause** to an SQL statement, for example, **age > 18 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.

- 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 2-3**. Set the parameters as follows:

Figure 2-3 Table data

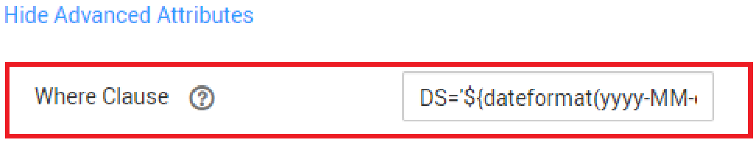


SELECT * FROM SQOOP.CDM_20171016 | En

	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 2-4 WHERE Clause



Where Clause: DS='${dateformat(yyyy-MM-

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.

2.1.3 HBase/CloudTable Incremental Migration

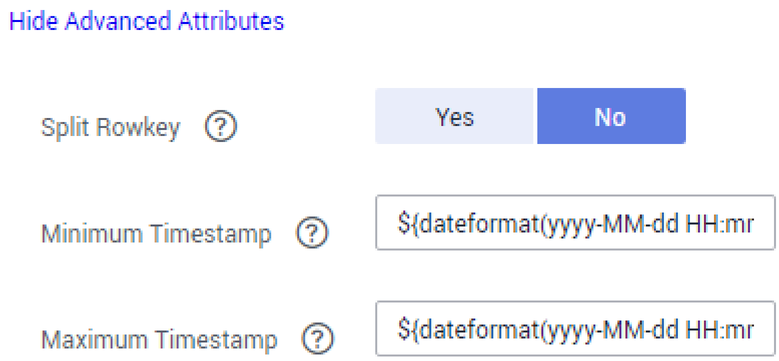
You can use CDM to export data in a specified period of time from HBase (including MRS HBase, FusionInsight HBase, and Apache HBase) and CloudTable. The CDM scheduled jobs can be used together to implement incremental migration of HBase and CloudTable.

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 2-5 Time range



Hide Advanced Attributes

Split Rowkey: Yes [✓ No]

Minimum Timestamp: ${dateformat(yyyy-MM-dd HH:mr

Maximum Timestamp: ${dateformat(yyyy-MM-dd HH:mr

- 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.

2.1.4 MongoDB/DDS Incremental Migration

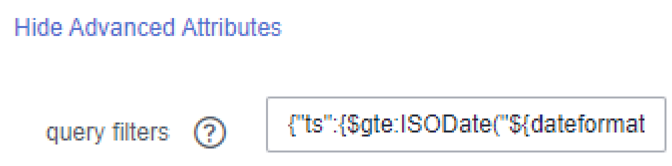
By using CDM, you can export MongoDB or DDS data within a specified period. With the scheduled jobs of CDM, you can implement incremental migration of MongoDB and DDS.

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*).

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 2-6 Setting query filters



Hide Advanced Attributes

query filters ? {"ts":{$gte:ISODate("${dateformat

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.

2.2 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:

- 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**.
  - **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 2-1** describes the macro variable definitions of time and date.

Table 2-1 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
${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

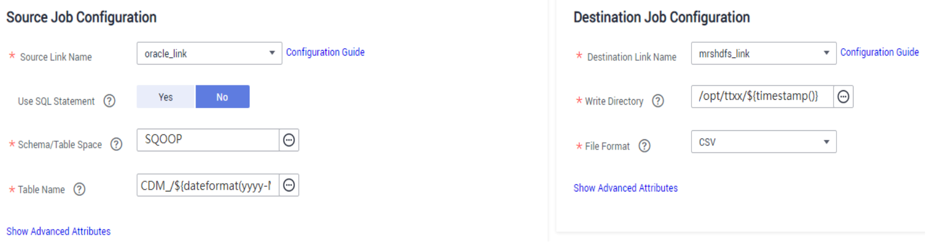
Time and Date Macro Variables of Paths and Table Names

Figure 2-7 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()}**.

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 2-7 Setting **Table Name** and **Write Directory** to a time and date macro variable



Source Job Configuration

- * Source Link Name: oracle_link
- Use SQL Statement: Yes [✓ No]
- * Schema/Table Space: SQOOP
- * Table Name: CDM_/${dateformat(yyyy-I

Destination Job Configuration

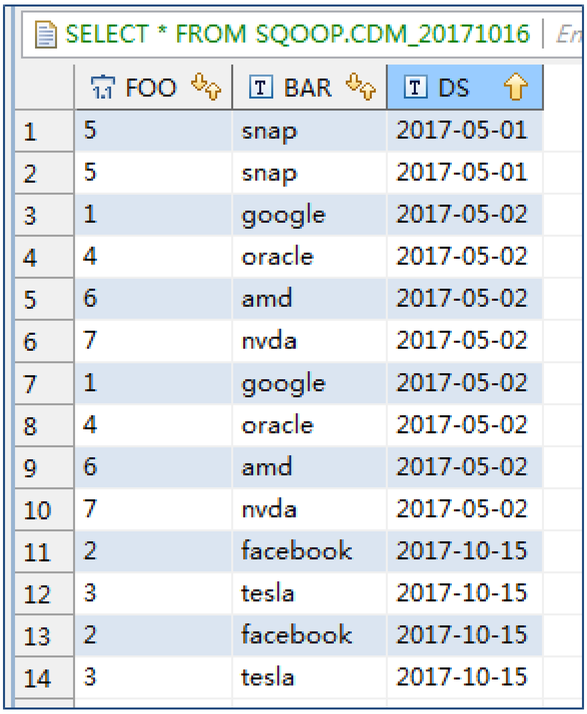
- * Destination Link Name: mrshdfs_link
- * Write Directory: /opt/ttxx/${timestamp()}
- * File Format: CSV

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 2-8 uses table **SQOOP.CDM_20171016** as an example. The table contains column **DS**, which indicates the time.

Figure 2-8 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.

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.

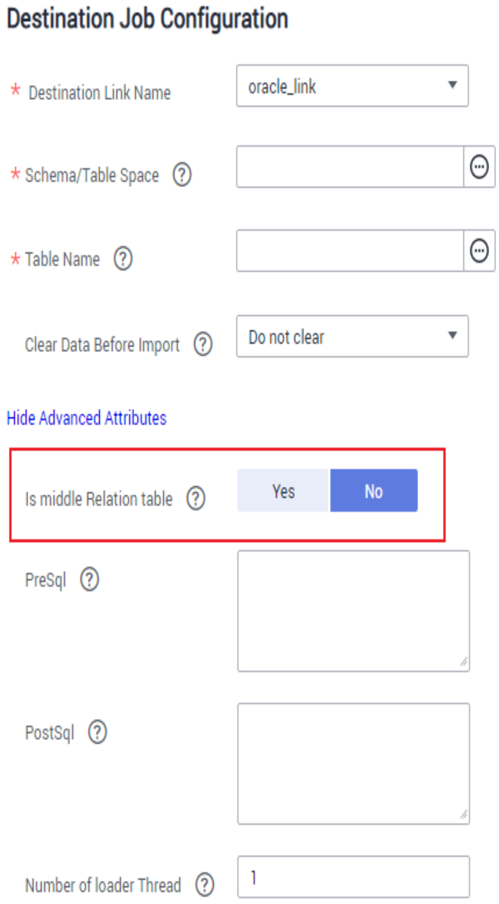
Configuration principles of other application scenarios are the same.

2.3 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.

Figure 2-9 Migration in transaction mode



Destination Job Configuration

* Destination Link Name: oracle_link

* Schema/Table Space:

* Table Name:

Clear Data Before Import: Do not clear

Hide Advanced Attributes

Is middle Relation table: Yes [✓ No]

PreSql:

PostSql:

Number of loader Thread: 1

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.

2.4 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)

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.

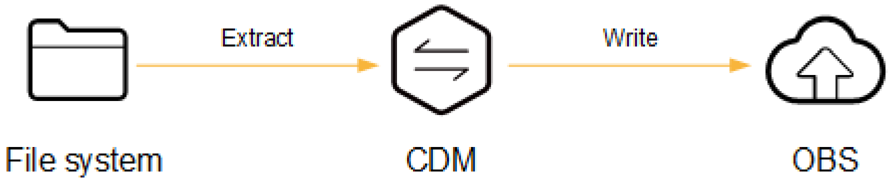
NOTE

- 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.

2.5 MD5 Verification

CDM extracts data from the migration source and writes the data to the migration destination. **Figure 2-10** shows the migration mode when files are migrated to OBS.

Figure 2-10 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.

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.

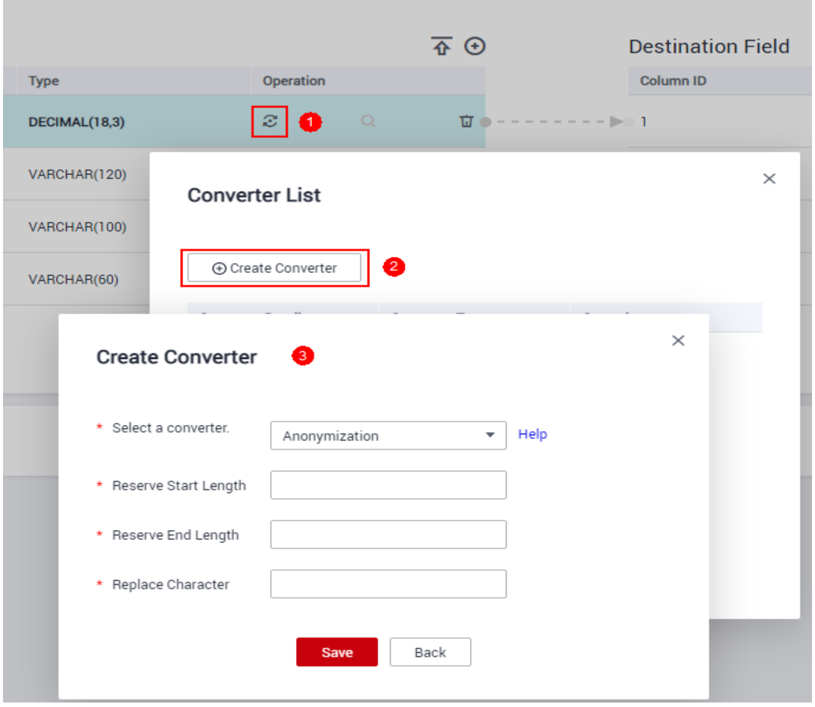
2.6 Configuring Field Converters

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 2-11 Creating a field converter



Create Converter

* Select a converter. Anonymization Help

* Reserve Start Length

* Reserve End Length

* Replace Character

Save Back

CDM can convert fields during migration. Currently, the following field converters are supported:

- **Anonymization**
- **Trim**
- **Reverse String**

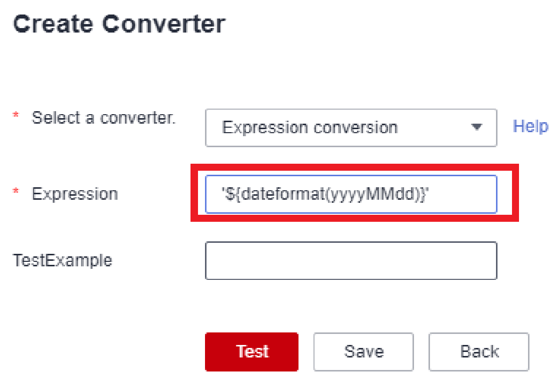
- **Replace String**
- **Remove line break**
- **Expression Conversion**

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 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.

Figure 2-12 Using two single quotation marks ('') to enclose an expression



Create Converter

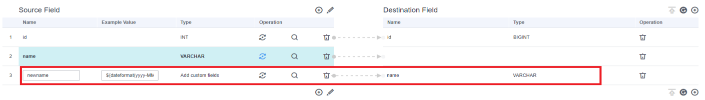
* Select a converter. Expression conversion

* Expression '${dateformat(yyyyMMdd)}'

TestExample

– 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 2-13 Adding a custom source field



Source Field

	Name	Example Value	Type	Operation
1	id		INT	
2	name		VARCHAR	
3	newname	${dateformat(yyyy-MM	Add custom fields	

Destination Field

Name	Type	Operation
id	BIGINT	
name	VARCHAR	

- 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.

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,"-")

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.

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.

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:

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**.

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.

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"*)

2.7 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.

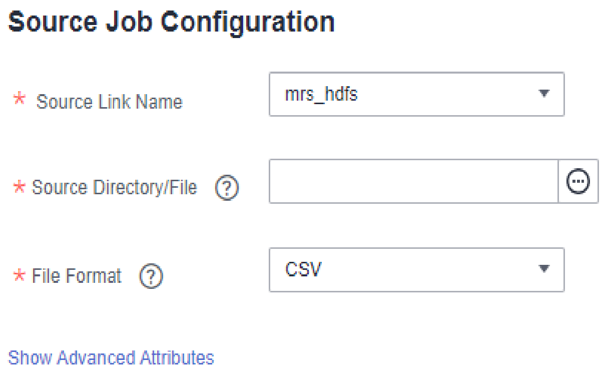
   For example, if three files are to be migrated and the second file fails to be migrated due to the network fault. When the migration task is started again, the first file is skipped. The second file, however, cannot be migrated from the point where the fault occurs, but can only be migrated again.
2. 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.

2.8 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**.

Figure 2-14 Setting regular expression parameters



Source Job Configuration

* Source Link Name: mrs_hdfs

* Source Directory/File:

* File Format: CSV

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 2-2 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

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 2-3 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

Column Number	Example Value
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 2-4 Tomcat log parsing result

Column Number	Example Value
1	11-Jan-2018 09:00:06.907
2	INFO
3	main
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 2-5 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 2-6 Apache server log parsing result

Column Number	Example Value
1	Mon Jan 08 20:43:51.854334 2018
2	mpm_event:notice
3	pid 36465:tid 140557517657856
4	AH00489: Apache/2.4.12 (Unix) OpenSSL/1.0.1t configured -- resuming normal operations

2.9 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

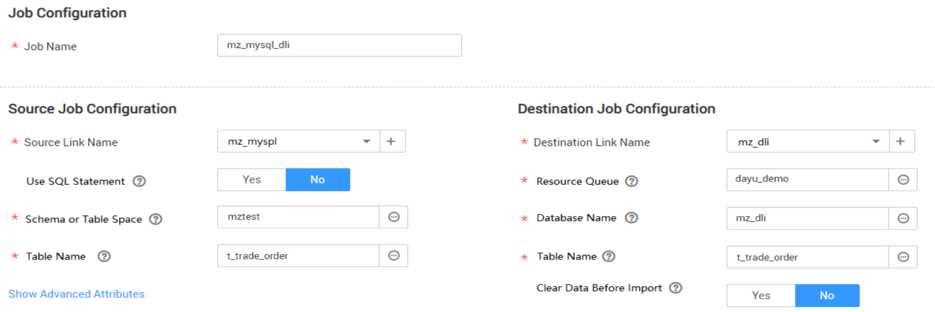
- A link has been created, and the source end of the connector is a relational database.

- 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 2-15 Configuring the job



Job Configuration

* Job Name: mz_mysql_dli

Source Job Configuration

* Source Link Name: mz_myspl

Use SQL Statement: Yes [✓ No]

* Schema or Table Space: mztest

* Table Name: t_trade_order

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: mz_dli

* Resource Queue: dayu_demo

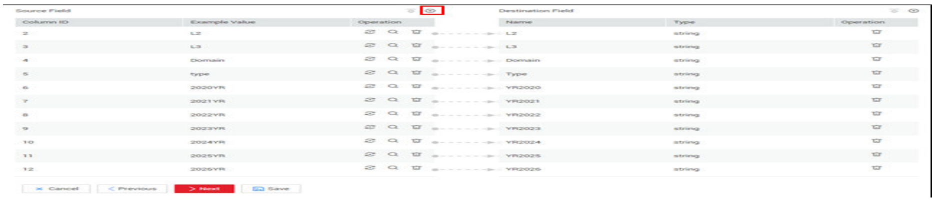
* Database Name: mz_dli

* Table Name: t_trade_order

Clear Data Before Import: Yes [✓ No]

Step 2 Click **Next** to go to the **Map Field** page and click ⊕.

Figure 2-16 Configuring field mapping



Source Field

Column ID	Example Value
2	L2
3	L3
4	Domain
5	type
6	2020YR
7	2021YR
8	2022YR
9	2023YR
10	2024YR
11	2025YR
12	2026YR

Destination Field

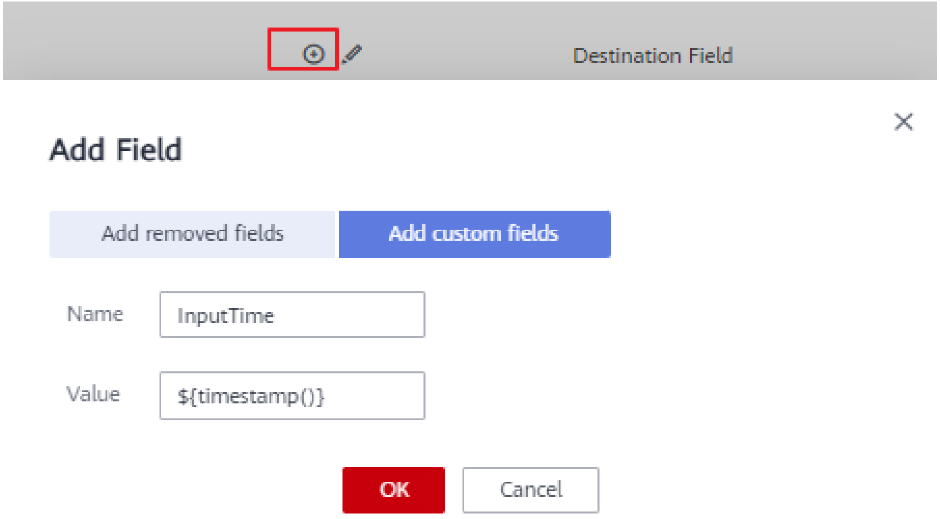
Name	Type
L2	string
L3	string
Domain	string
Type	string
YR2020	string
YR2021	string
YR2022	string
YR2023	string
YR2024	string
YR2025	string
YR2026	string

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 2-7**.

Figure 2-17 Add Field



Destination Field

Add Field

Add removed fields | Add custom fields

Name: InputTime

Value: ${timestamp()}

Table 2-7 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
${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.

Step 7 Go to the destination data source to check the time when the data is imported to the database.

----End

2.10 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 2-8 URL encoded characters of special characters

Special Character	URL Encoded Character
Space	%20
Tab	%09
%	%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 2-8**.

3. **Encoding Type**

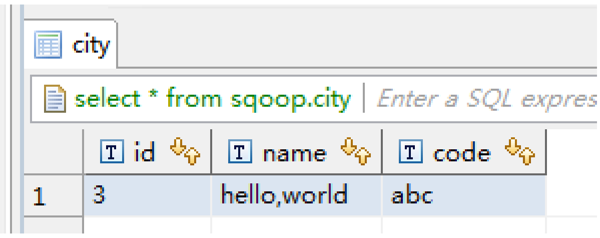
   Encoding type of a CSV file. The default value is **UTF-8**. Some Chinese characters are encoded by GBK.

   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 2-18** shows that the value of the **name** field in the database contains a comma (,).

     Figure 2-18 Field value containing the field delimiter

     select * from sqoop.city

	id	name	code
1	3	hello,world	abc

     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"""
```

- 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,
   "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 2-9 Example

took	timedOut	total	maxScore
190	false	1000001	1.0
191	false	1000002	1.0
192	false	1000003	1.0

b. Example 2

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 2-10 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
  }]
```

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 2-11 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:

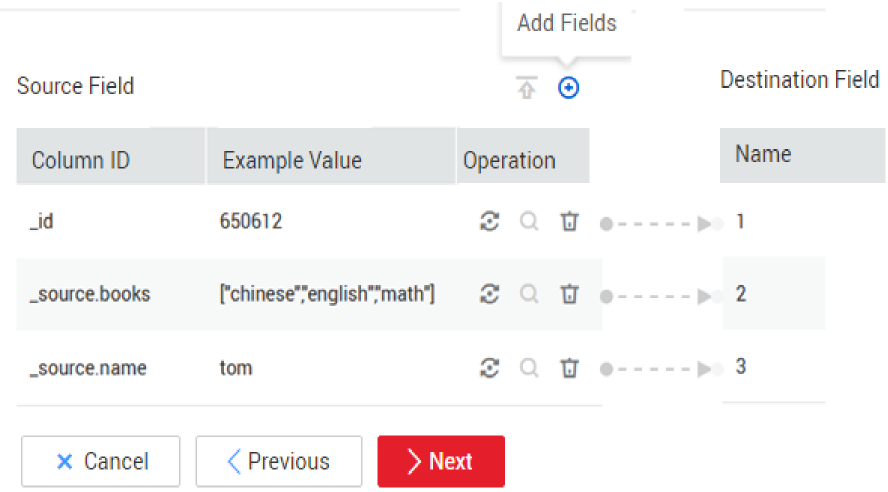
Table 2-12 Example

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.

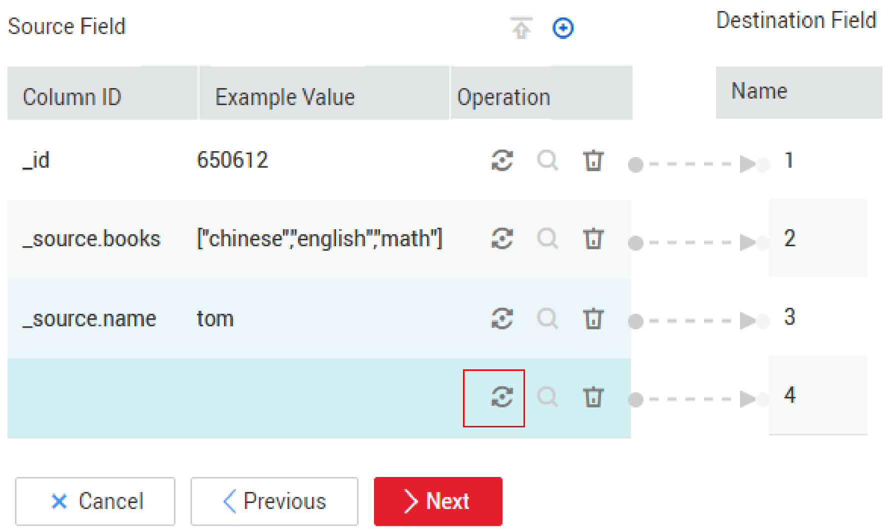
Figure 2-19 Adding a field



Column ID	Example Value	Operation	Name
_id	650612		1
_source.books	["chinese","english","math"]		2
_source.name	tom		3

ii. Click ⟳ to create a converter for the new field.

Figure 2-20 Creating a field converter



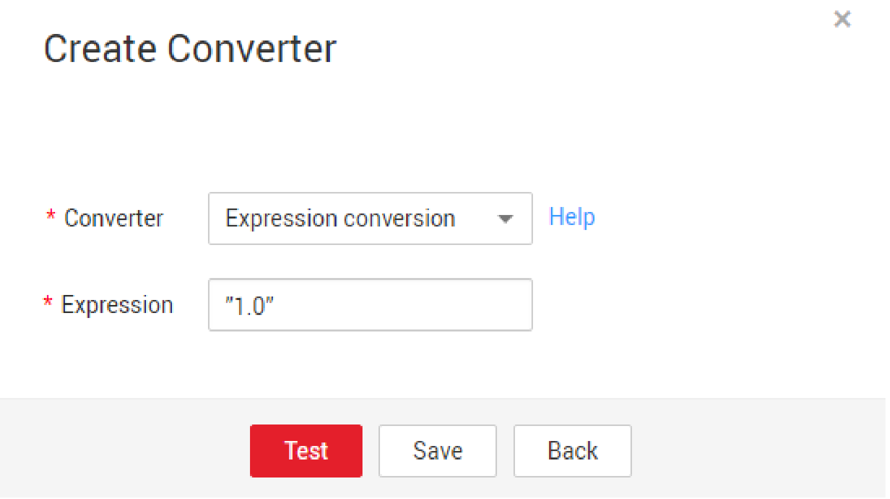
Source Field

Destination Field

Column ID	Example Value	Operation	Name
_id	650612		1
_source.books	["chinese","english","math"]		2
_source.name	tom		3
			4

iii. Set **Converter** to **Expression conversion**, enter **"1.0"** in the **Expression** text box, and click **Save**.

Figure 2-21 Configuring a field converter



Create Converter

* Converter: Expression conversion

* Expression: "1.0"

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.

- **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

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 2-8**.

   - 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.

3 Scheduling a CDM Job by Transferring Parameters Using DataArts Factory

You can use EL expressions in DataArts Factory to transfer parameters to a CDM job to schedule it.

NOTE

- The parameter transfer function is supported by CDM 2.8.6 or later versions.
- This section uses a CDM job for migrating data from Oracle to MRS Hive as an example.

Prerequisites

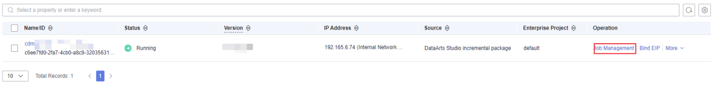
A CDM incremental package is available.

Creating a CDM Migration Job

Step 1 Log in to the console, locate an instance, click **Access**, and click **DataArts Migration**.

Step 2 On the **Cluster Management** page, click **Job Management** in the **Operation** column.

Figure 3-1 Cluster Management



Select a property or enter a keyword.

☐	Name/ID	Status	Version	IP Address	Source	Enterprise Project	Operation
☐	cdm[redacted] c6ee7fd0-2fa7-4cb0-a8c9-32035631...	Running	[redacted]	192.165.6.74 (Internal Network ...	DataArts Studio incremental package	default	Job Management Bind EIP | More

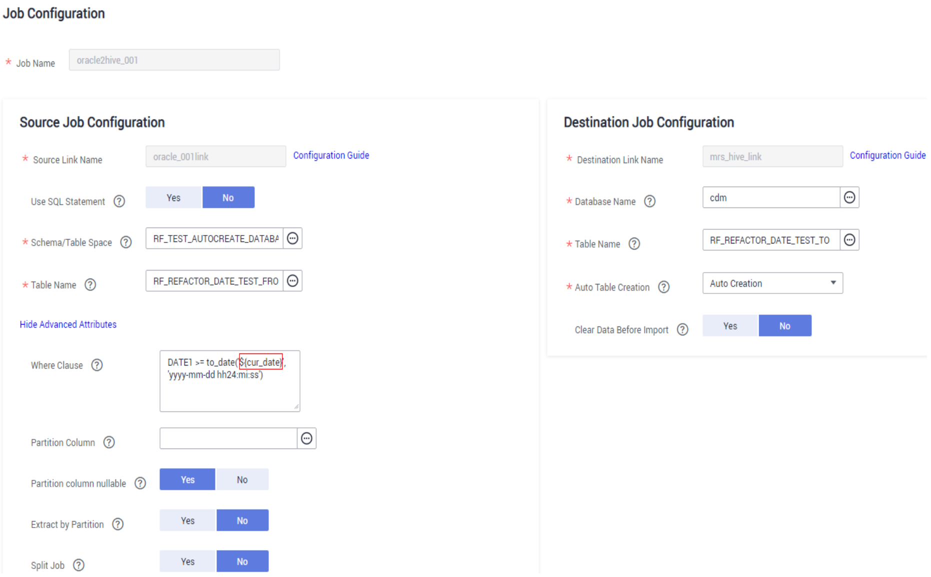
10 Total Records: 1 < 1 >

Step 3 Click the **Links** tab and then **Create Link** to create an Oracle link and an MRS Hive link. For details, see **Link to an Oracle Database** and **Link to Hive**.

Step 4 Click the **Table/File Migration** tab and then **Create Job** to create a data migration job.

Step 5 Configure parameters for the source Oracle link and destination MRS Hive link, and configure the parameter to transfer in **${*varName*}** format (**${cur_date}** in this example).

Figure 3-2 Creating a job



Job Configuration

* Job Name: oracle2hive_001

Source Job Configuration

- * Source Link Name: oracle_001link (Configuration Guide)
- Use SQL Statement: Yes [✓ No]
- * Schema/Table Space: RF_TEST_AUTOCREATE_DATABA
- * Table Name: RF_REFACTOR_DATE_TEST_FRO
- Hide Advanced Attributes
- Where Clause: DATE1 >= to_date('${cur_date}', 'yyyy-mm-dd hh24:mi:ss')
- Partition Column:
- Partition column nullable: [✓ Yes] No
- Extract by Partition: Yes [✓ No]
- Split Job: Yes [✓ No]

Destination Job Configuration

- * Destination Link Name: mrs_hive_link (Configuration Guide)
- * Database Name: cdm
- * Table Name: RF_REFACTOR_DATE_TEST_TO
- * Auto Table Creation: Auto Creation
- Clear Data Before Import: Yes [✓ No]

NOTE

The **Retry upon Failure** parameter is unavailable in the CDM migration job. You can configure this parameter on the CDM node in DataArts Factory.

----End

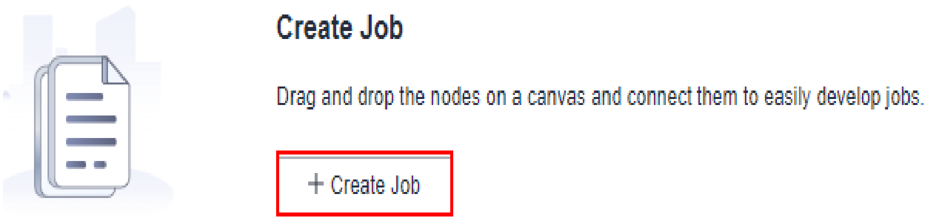
Creating and Executing a Data Development Job

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

Step 2 In the navigation pane of the DataArts Factory homepage, choose **Data Development** > **Develop Job**.

Step 3 On the **Develop Job** page, click **Create Job**.

Figure 3-3 Create Job



Create Job

Drag and drop the nodes on a canvas and connect them to easily develop jobs.

+ Create Job

Step 4 In the displayed dialog box, configure job parameters and click **OK**.

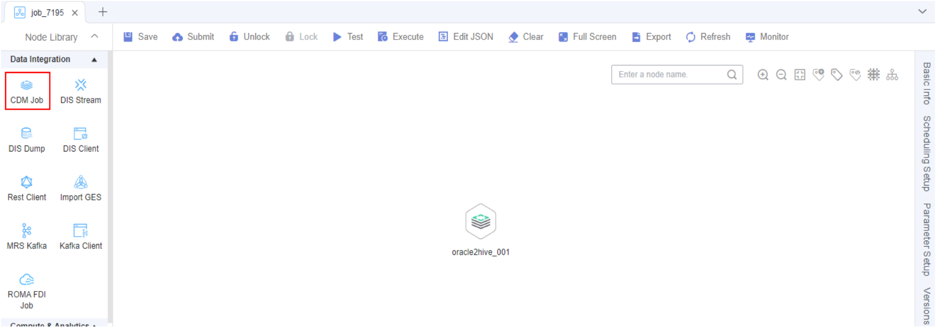
Table 3-1 Job parameters

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	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 batch processing jobs. 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 a scheduling policy 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 real-time processing jobs. For details, see **Setting Up Scheduling for Nodes of a Job Using the Real-Time Processing Mode**.
Creation Method	Job creation method - **Create Empty Job**: Create an empty job. - **Create Based on Template**: Use a template provided by DataArts Factory to create a job.
Select Directory	Directory to which the job belongs. The default value is the root directory.
Owner	Owner of the job
Priority	Priority of the job. The options are **High**, **Medium**, and **Low**.
Agency	After an agency is configured, the job interacts with other services as an agency during job execution. **NOTE** A job-level agency takes precedence over a workspace-level agency.

Parameter	Description
Log Path	Path of the OBS bucket for storing job logs. By default, logs are stored in an OBS bucket named **dlf-log-**{*Projectid*}. **NOTE** ● If you want to customize a storage path, select the bucket that you have created on OBS by following the instructions provided in **(Optional) Changing a Job Log Storage Path**. ● Ensure that you have the read and write permissions on the OBS bucket specified by this parameter, or the system cannot write or display logs.

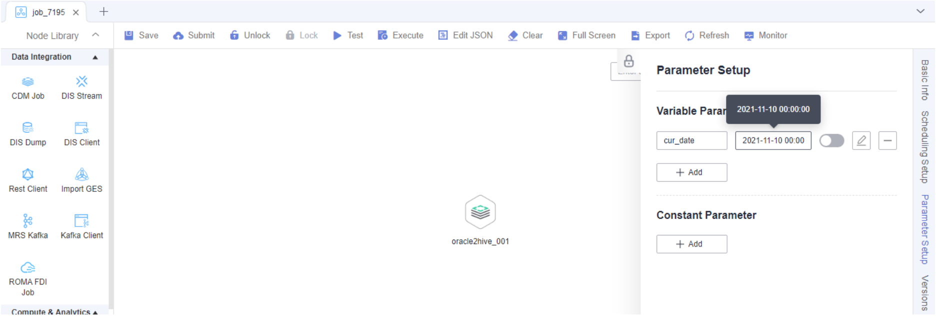
Step 5 Add a CDM Job node in the data development job and associate the node with the created CDM job.

Figure 3-4 Associating the CDM Job node with the created CDM job



Step 6 Configure the parameter to be transferred to the CDM job.

Figure 3-5 Configuring the parameter to be transferred



cur_date 2021-11-10 00:00

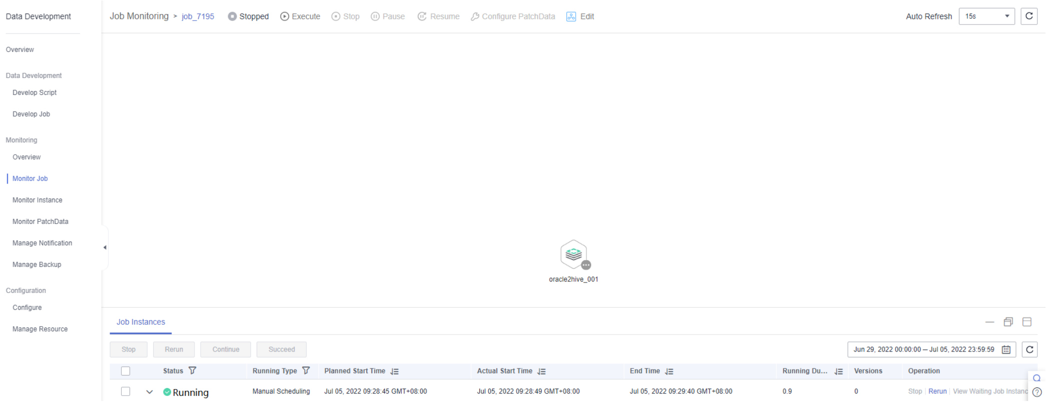
NOTE

When the job is scheduled and executed, the value of the configured parameter will be transferred to the CDM job. The value of the parameter **cur_date** can be set to a fixed value (for example, **2021-11-10 00:00:00**) or an EL expression (for example, **#{DateUtil.format(DateUtil.addDays(Job.planTime,-1),"yyyy-MM-dd")}** which means the day before the scheduled job execution date. For more EL expressions, see **EL expressions**.

Step 7 Save and submit a job version and click **Test** to execute the data development job.

Step 8 After the data development job is executed, click **Monitor** in the upper right corner to go to the **Monitor Job** page and check whether the generated task or instance meets requirements.

Figure 3-6 Viewing the execution result



Auto Refresh: 15s

Jun 29, 2022 00:00:00 – Jul 05, 2022 23:59:59

	Status	Running Type	Planned Start Time	Actual Start Time	End Time	Running Du...	Versions	Operation
□	Running	Manual Scheduling	Jul 05, 2022 09:28:45 GMT+08:00	Jul 05, 2022 09:28:49 GMT+08:00	Jul 05, 2022 09:29:40 GMT+08:00	0.9	0	Stop | Rerun | View Waiting Job Instanc

----End

4 Enabling Incremental Data Migration Through DataArts Factory

The DataArts Factory module of DataArts Studio is a one-stop, collaborative big data development platform. You can enable incremental data migration through online script editing in DataArts Factory and periodic scheduling of CDM jobs.

This section describes how to use DataArts Factory together with CDM to migrate incremental data from GaussDB(DWS) to OBS.

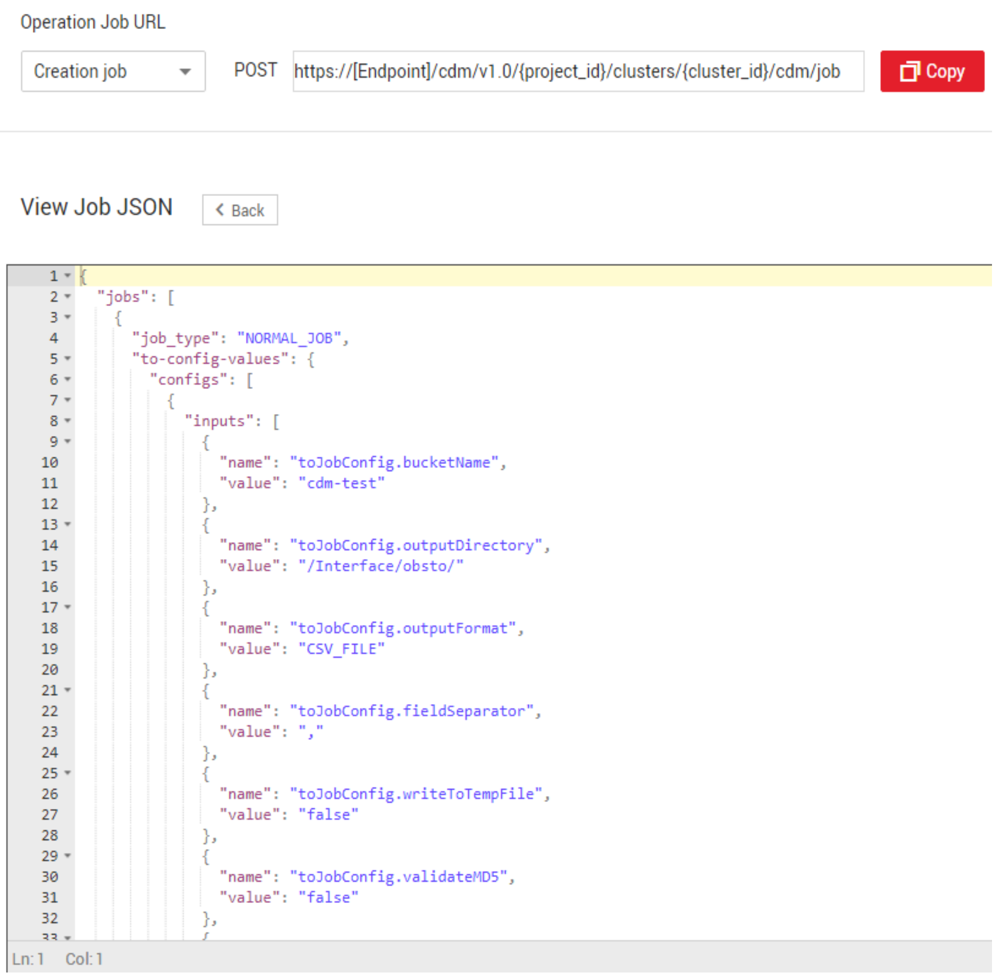
1. **Obtaining the CDM Job JSON**
2. **Modifying JSON**
3. **Creating a Job in DataArts Factory**

Obtaining the CDM Job JSON

1. On the CDM console, create a table/file migration job from GaussDB(DWS) to OBS.
2. On the **Table/File Migration** tab page of the **Job Management** page, locate the created job, click **More** in the **Operation** column, and select **View Job JSON** from the drop-down list.

   You can also view JSON of any other CDM job.

Figure 4-1 Viewing job JSON



```
https://[Endpoint]/cdm/v1.0/{project_id}/clusters/{cluster_id}/cdm/job
```

```
{
  "jobs": [
    {
      "job_type": "NORMAL_JOB",
      "to-config-values": {
        "configs": [
          {
            "inputs": [
              {
                "name": "toJobConfig.bucketName",
                "value": "cdm-test"
              },
              {
                "name": "toJobConfig.outputDirectory",
                "value": "/Interface/obsto/"
              },
              {
                "name": "toJobConfig.outputFormat",
                "value": "CSV_FILE"
              },
              {
                "name": "toJobConfig.fieldSeparator",
                "value": ","
              },
              {
                "name": "toJobConfig.writeToTempFile",
                "value": "false"
              },
              {
                "name": "toJobConfig.validateMD5",
                "value": "false"
              },
              {
```

3. The job JSON is the request body template for creating a CDM job. Replace **[Endpoint]**, **{project_id}**, and **{cluster_id}** in the URL with the actual values.
   - [Endpoint]: indicates the endpoint.

     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 **Regions and Endpoints**.
   - **{project_id}**: indicates the project ID.
   - **{cluster_id}**: Indicates the cluster ID. You can click the cluster name on the **Cluster Management** page to view the cluster ID.

Modifying JSON

You can modify the JSON body as required. In this example, the period is one day, and the WHERE clause is used for filtering the incremental data to be migrated (generally, the time range is used for filtering data). The data generated on the previous day is migrated every day.

1. Modify the WHERE clause to add incremental data in a certain period.

```
{
   "name": "fromJobConfig.whereClause",
   "value": "_timestamp >= '${startTime}' and _timestamp < '${currentTime}'"
}
```

NOTE

- If the source database is DWS or MySQL, the value can be set to:
  ```
  _timestamp >= '2018-10-10 00:00:00' and _timestamp < '2018-10-11 00:00:00'
  Or
  _timestamp between '2018-10-10 00:00:00' and '2018-10-11 00:00:00'
  ```
- If the source database is Oracle, the value should be set to:
  ```
  _timestamp >= to_date (2018-10-10 00:00:00' , 'yyyy-mm-dd hh24:mi:ss' ) and _timestamp <
  to_date (2018-10-10 00:00:00' , 'yyyy-mm-dd hh24:mi:ss' )
  ```

2. Import incremental data in each period to different directories.
   ```
     {
       "name": "toJobConfig.outputDirectory",
       "value": "dws2obs/${currentTime}"
     }
   ```
3. Change the job name to a dynamic one. Otherwise, the job cannot be created because the job name is duplicate.
   ```
       "to-connector-name": "obs-connector",
       "from-link-name": "dws_link",
       "name": "dws2obs-${currentTime}"
   ```

For details about how to modify more parameters, see ***Cloud Data Migration API Reference***. The following is an example of the modified JSON file:

```
{
  "jobs": [
    {
      "job_type": "NORMAL_JOB",
      "to-config-values": {
        "configs": [
          {
            "inputs": [
              {
                "name": "toJobConfig.bucketName",
                "value": "cdm-test"
              },
              {
                "name": "toJobConfig.outputDirectory",
                "value": "dws2obs/${currentTime}"
              },
              {
                "name": "toJobConfig.outputFormat",
                "value": "CSV_FILE"
              },
              {
                "name": "toJobConfig.fieldSeparator",
                "value": ","
              },
              {
                "name": "toJobConfig.writeToTempFile",
                "value": "false"
              },
              {
                "name": "toJobConfig.validateMD5",
                "value": "false"
              },
              {
                "name": "toJobConfig.encodeType",
                "value": "UTF-8"
              },
              {
                "name": "toJobConfig.duplicateFileOpType",
                "value": "REPLACE"
              },
              {
                "name": "toJobConfig.kmsEncryption",
                "value": "false"
              }
```

```
            ],
            "name": "toJobConfig"
          }
        ]
      },
      "from-config-values": {
        "configs": [
          {
            "inputs": [
              {
                "name": "fromJobConfig.schemaName",
                "value": "dws_database"
              },
              {
                "name": "fromJobConfig.tableName",
                "value": "dws_from"
              },
              {
                "name": "fromJobConfig.whereClause",
                "value": "_timestamp >= '${startTime}' and _timestamp < '${currentTime}'"
              },
              {
                "name": "fromJobConfig.columnList",
                "value": 
"_tiny&_small&_int&_integer&_bigint&_float&_double&_date&_timestamp&_char&_varchar&_text"
              }
            ],
            "name": "fromJobConfig"
          }
        ]
      },
      "from-connector-name": "generic-jdbc-connector",
      "to-link-name": "obs_link",
      "driver-config-values": {
        "configs": [
          {
            "inputs": [
              {
                "name": "throttlingConfig.numExtractors",
                "value": "1"
              },
              {
                "name": "throttlingConfig.submitToCluster",
                "value": "false"
              },
              {
                "name": "throttlingConfig.numLoaders",
                "value": "1"
              },
              {
                "name": "throttlingConfig.recordDirtyData",
                "value": "false"
              },
              {
                "name": "throttlingConfig.writeToLink",
                "value": "obs_link"
              }
            ],
            "name": "throttlingConfig"
          },
          {
            "inputs": [],
            "name": "jarConfig"
          },
          {
            "inputs": [],
            "name": "schedulerConfig"
          },
          {
```

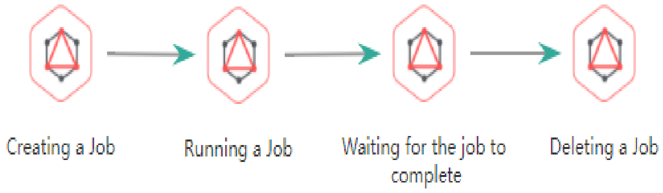
```
          "inputs": [],
          "name": "transformConfig"
        },
        {
          "inputs": [],
          "name": "smnConfig"
        },
        {
          "inputs": [],
          "name": "retryJobConfig"
        }
      ]
    },
    "to-connector-name": "obs-connector",
    "from-link-name": "dws_link",
    "name": "dws2obs-${currentTime}"
  }
 ]
}
```

Creating a Job in DataArts Factory

1. On the DataArts Factory console, create a data development job with Rest Client nodes shown in **Figure 4-2**. For details, see **Creating a Job** in *DataArts Studio User Guide*.

   For details about how to configure the nodes and the job, see the following steps.

   Figure 4-2 DataArts Factory job

2. Configure the **CreatingJob** node.

   DataArts Factory uses a Rest Client node to call a RESTful API to create a CDM migration job. Configure the properties of the Rest Client node.

   a. **Node Name**: Enter a custom name, for example, **CreatingJob**. Note that the CDM job is only used as a node in the DataArts Factory job.

   b. **URL Address**: Set it to the URL obtained in **Obtaining the CDM Job JSON**. The format is https://{*Endpoint*}/cdm/v1.0/{*project_id*}/clusters/{*cluster_id*}/cdm/job.

   c. **HTTP Method**: Enter **POST**.

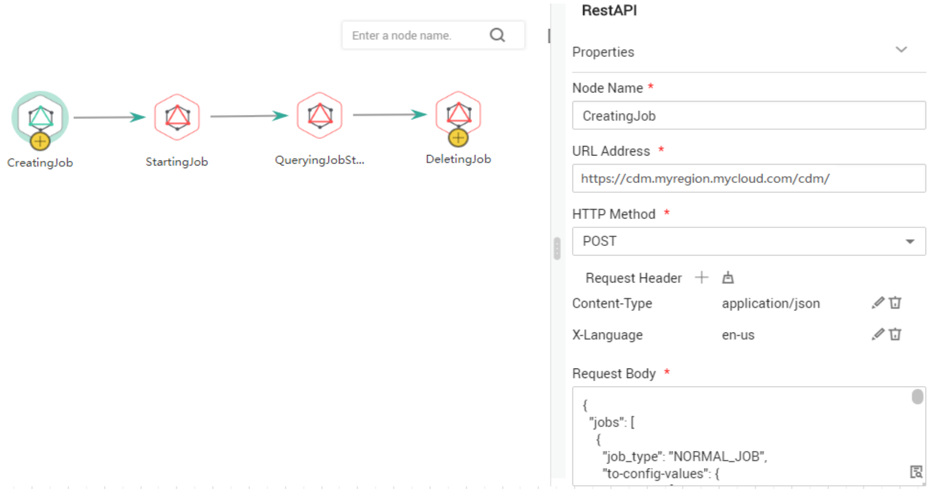
   d. Add the following request headers:

      - Content-Type = application/json

      - X-Language = en-us

   e. **Request Body**: Enter the modified JSON of the CDM job in **Modifying JSON**.

Figure 4-3 Properties of the node for creating the CDM job



Node Name * CreatingJob

URL Address * https://cdm.myregion.mycloud.com/cdm/

HTTP Method * POST

Request Header

Content-Type	application/json
X-Language	en-us

Request Body *

```
{
 "jobs": [
  {
   "job_type": "NORMAL_JOB",
   "to-config-values": {
```

3. Configure the **StartingJob** node.

   After configuring the RESTful API node for creating a CDM job, you must add the RESTful API node for running the CDM job. For details, see section "Starting a Job" in ***Cloud Data Migration API Reference***. Configure the properties of the RestAPI node.

   a. **Node Name**: Enter the name of the node where the job is to be run.

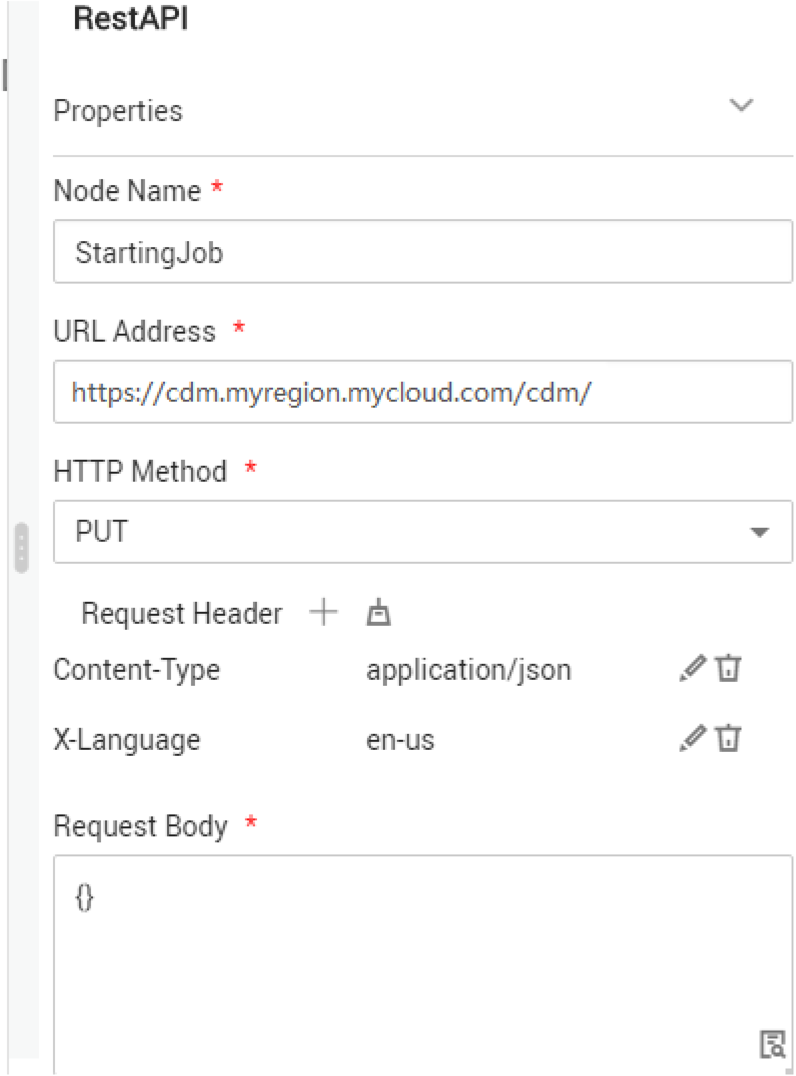
   b. **URL Address**: Keep the values of **project_id** and **cluster_id** consistent with those in 2. Set the job name to **dws2obs-${currentTime}**. The format is https://{*Endpoint*}/cdm/v1.0/{*project_id*}/clusters/{*cluster_id*}/cdm/job/{*job_name*}/start.

   c. **HTTP Method**: Enter **PUT**.

   d. **Request Header**:

      - Content-Type = application/json
      - X-Language = en-us

Figure 4-4 Properties of the node for running the CDM job



RestAPI

Properties

Node Name *

StartingJob

URL Address *

https://cdm.myregion.mycloud.com/cdm/

HTTP Method *

PUT

Request Header

Content-Type	application/json
X-Language	en-us

Request Body *

{}

4. Configure the **WaitingJobCompletion** node.

   CDM jobs are run asynchronously. Therefore, even if the REST request for running the job returns 200, it does not mean that the data has been migrated successfully. If a computing job depends on the CDM job, a RestAPI node is required to periodically check whether the migration is successful. Computing is performed only when the migration is successful. For details about the API used to check whether the CDM migration is successful, see section "Querying Job Status" in ***Cloud Data Migration API Reference***.

   After configuring the RestAPI node for running the CDM job, add the node for waiting for the CDM job completion. The node properties are as follows:

   a. Node Name: Wait until the job is complete.

   b. **URL Address**: The format is https://{*Endpoint*}/cdm/v1.0/{*project_id*}/clusters/{*cluster_id*}/cdm/job/{*job_name*}/status. Keep the values of **project_id** and **cluster_id** consistent with those in 2. Set the job name to **dws2obs-${currentTime}**.

   c. **HTTP Method**: Enter **GET**.

   d. **Request Header**:
      - Content-Type = application/json
      - X-Language = en-us
   e. **Check Return Value**: Select **YES**.
   f. **Property Path**: Enter **submissions[0].status**.
   g. **Request Success Flag**: Set this parameter to **SUCCEEDED**.
   h. Retain default values for other parameters.

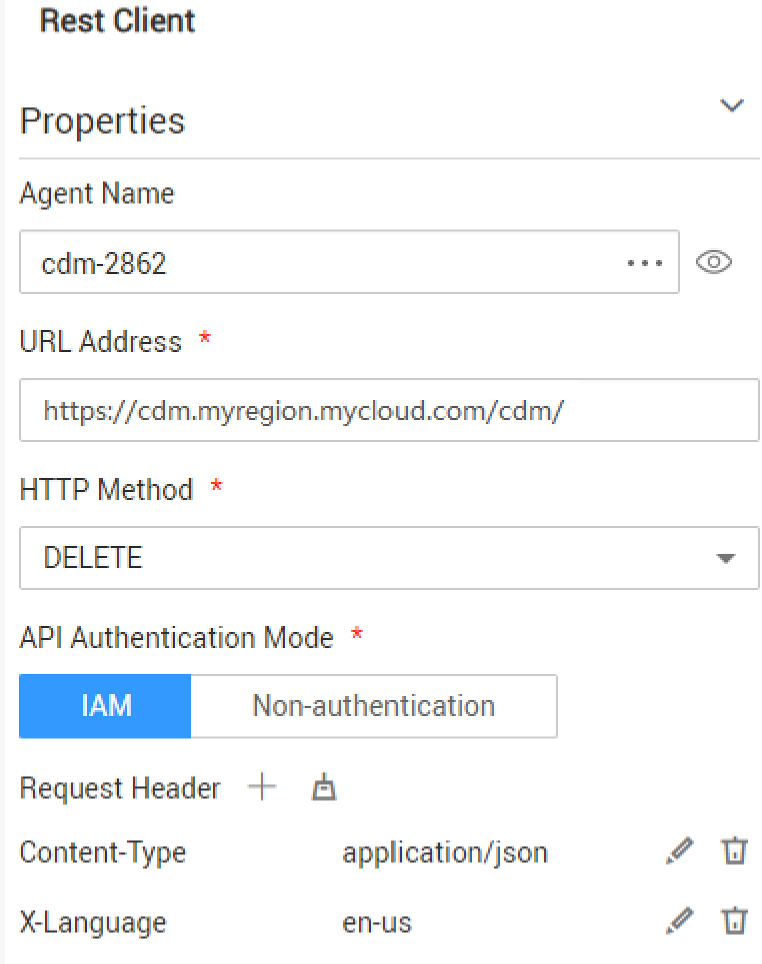
5. (Optional) Configure the **DeletingJob** node.

   You can delete jobs as required. DataArts Factory periodically creates CDM jobs to implement incremental migration. Therefore, a large number of jobs exist in the CDM cluster. After the migration is successful, you can delete the jobs that have been successfully executed. To delete a CDM job, add a RestAPI node for deleting CDM jobs after the node for querying the CDM job status. DataArts Factory calls the API for deleting a job described in ***Cloud Data Migration API Reference***.

   Properties of the node for deleting the CDM job are as follows:

   a. **Node Name**: Enter **DeletingJob**.
   b. **URL Address**: The format is https://{*Endpoint*}/cdm/v1.0/{*project_id*}/clusters/{*cluster_id*}/cdm/job/{*job_name*}. Keep the values of **project_id** and **cluster_id** consistent with those in 2. Set the job name to **dws2obs-${currentTime}**.
   c. **HTTP Method**: Enter **DELETE**.
   d. **Request Header**:
      - Content-Type = application/json
      - X-Language = en-us
   e. Retain default values for other parameters.

Figure 4-5 Properties of the node for deleting the CDM job



Rest Client

Properties

Agent Name

cdm-2862

URL Address *

https://cdm.myregion.mycloud.com/cdm/

HTTP Method *

DELETE

API Authentication Mode *

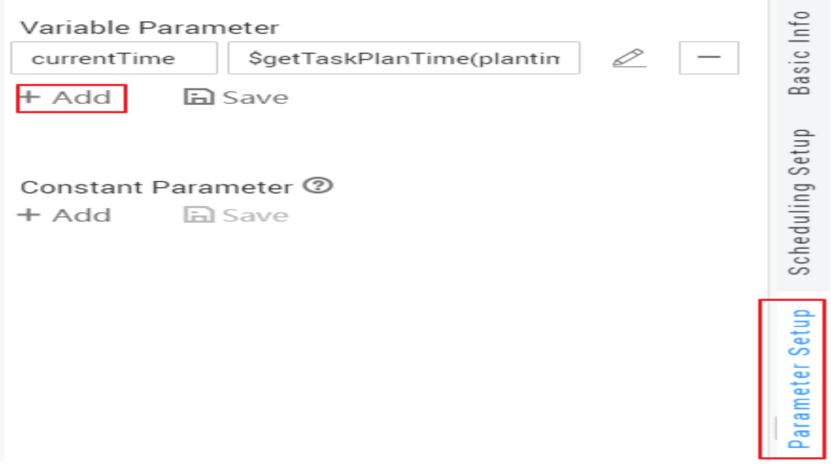
IAM | Non-authentication

Request Header

Content-Type	application/json
X-Language	en-us

6. To perform computing operations after the migration is complete, you can add various computing nodes.
7. Configure job parameters in DataArts Factory.
   a. Configure the job parameters shown in **Figure 4-6**.
      - startTime = $getTaskPlanTime(plantime,@@yyyyMMddHHmmss@@,-24*60*60)
      - currentTime = $getTaskPlanTime(plantime,@@yyyyMMdd-HHmm@@,0)

Figure 4-6 Configuring job parameters in DataArts Factory



b. After saving the job, choose **Scheduling Configuration** > **Periodic Scheduling** and set the scheduling period to one day.

In this way, DataArts Factory works with CDM to migrate data generated on the previous day every day.

5 Creating Table Migration Jobs in Batches Using CDM Nodes

Scenario

In a service system, data sources are usually stored in different tables to reduce the size of a single table in complex application scenarios.

In this case, you need to create a data migration job for each table when using CDM to integrate data. This tutorial describes how to use the For Each and CDM nodes provided by the DataArts Factory module to create table migration jobs in batches.

In this tutorial, the source MySQL database has three tables, mail01, mail02, and mail03. The tables have the same structure but different data content. The destination is MRS Hive.

Prerequisites

- You have created a CDM cluster.
- MRS Hive has been enabled.
- Databases and tables have been created in MRS Hive.

Creating a Link

Step 1 Log in to the DataArts Studio console, locate the target DataArts Studio instance, and click **Access** on the instance card.

Step 2 Locate a workspace and click **DataArts Migration**.

Step 3 In the **Operation** column, click **Job Management**.

Step 4 Click the **Links** tab and then **Driver Management**. Upload the MySQL database driver by following the instructions in **Managing Drivers**.

Step 5 Click the **Links** tab and then **Create Link**. Select **MySQL** and click **Next** to configure parameters for the link. After the configuration is complete, click **Save** to return to the **Links** page.

Table 5-1 Parameters for a link to a MySQL 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	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 Number	Port of the database to connect	3306
Database	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	This parameter does not need to be configured. The agent function will be unavailable soon.	-

Parameter	Description	Example Value
Agent	This parameter does not need to be configured. The agent function will be unavailable soon.	-
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.	-

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. ● **tinyInt1isBit=false** or **mysql.bool.type.transform=false**: By default, **tinyInt1isBit** is **true**, indicating that **TINYINT(1)** is processed as a bit, that is, **Types.BOOLEAN**, and **1** or **0** is read as **true** or **false**. As a result, the migration fails. In this case, you can set **tinyInt1isBit** to **false** to avoid migration failures. ● **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 a MySQL database may fail. In this case, you can enable public key retrieval to avoid connection failures.	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.	'

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

Step 6 Click the **Links** tab and then **Create Link**. Select **MRS Hive** and click **Next** to configure parameters for the link. After the configuration is complete, click **Save** to return to the **Links** page.

Table 5-2 MRS Hive link parameters

Parameter	Remarks	Example
Metric Name	Link name, which should be defined based on the data source type, so it is easier to remember what the link is for	hive
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.	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
Hive Version	Hive version. Set it to the Hive version on the server.	HIVE_3_X

Parameter	Remarks	Example
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 data of a component, you also need to add the user group permissions of the component to the user. ● 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**, **Manager_tenant**, or **System_administrator** to create links on CDM.	cdm
Password	Password for logging in to MRS Manager	-
OBS storage support	The server must support OBS storage. When creating a Hive table, you can store the table in OBS.	Disabled

Parameter	Remarks	Example
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 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.	EMBEDDED
Use Cluster Config	You can use the cluster configuration to simplify parameter settings for the Hadoop connection.	Disabled

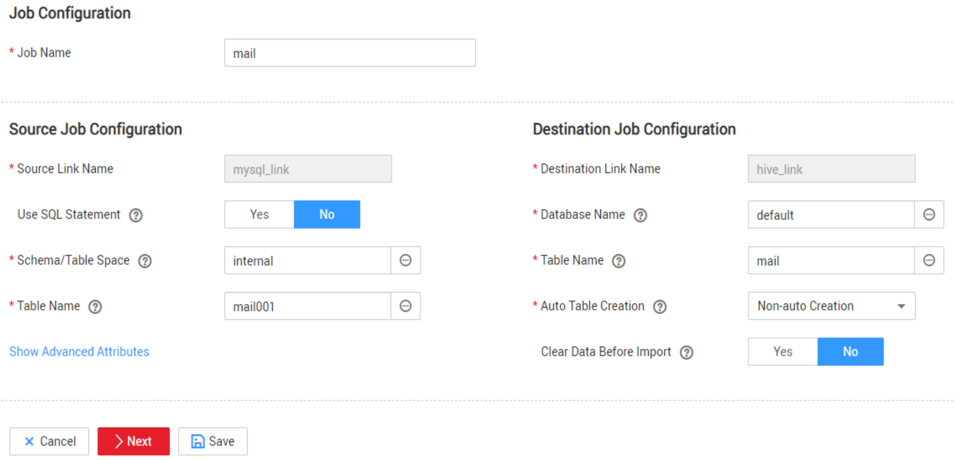
----End

Creating a Sample Job

Step 1 In the **Operation** column, click **Job Management**.

Step 2 Click the **Table/File Migration** tab and then **Create Job** to create a job for migrating data from the first MySQL subtable **mail001** to the MRS Hive table **mail**.

Figure 5-1 Creating a job



Job Configuration

* Job Name: mail

Source Job Configuration

* Source Link Name: mysql_link

Use SQL Statement: Yes [✓ No]

* Schema/Table Space: internal

* Table Name: mail001

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: hive_link

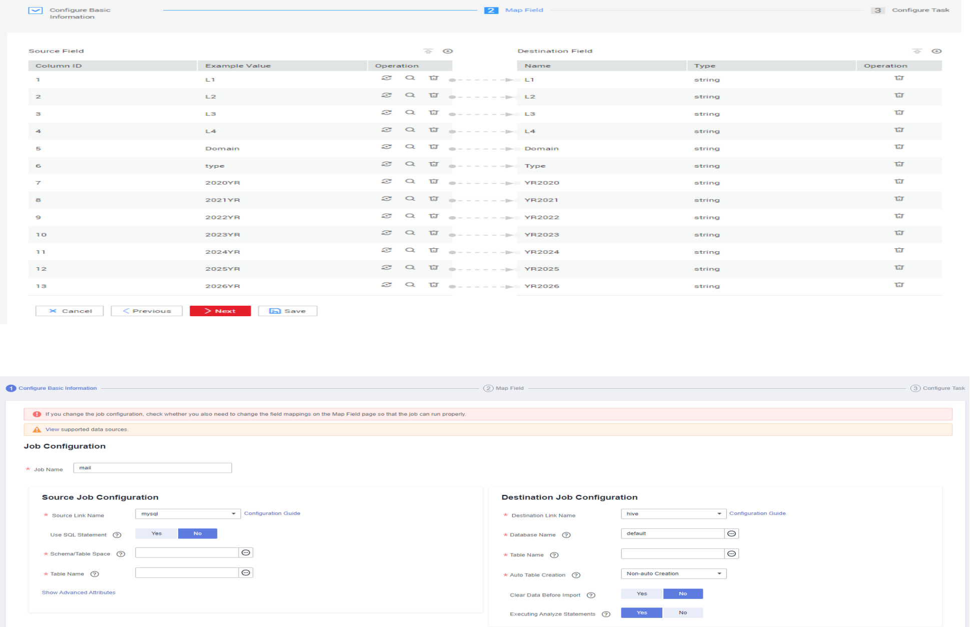
* Database Name: default

* Table Name: mail

* Auto Table Creation: Non-auto Creation

Clear Data Before Import: Yes [✓ No]

Figure 5-2 Configuring basic information



Source Field

Column ID	Example Value	Operation
1	L1	
2	L2	
3	L3	
4	L4	
5	Domain	
6	type	
7	2020YR	
8	2021YR	
9	2022YR	
10	2023YR	
11	2024YR	
12	2025YR	
13	2026YR	

Destination Field

Name	Type	Operation
L1	string	
L2	string	
L3	string	
L4	string	
Domain	string	
Type	string	
YR2020	string	
YR2021	string	
YR2022	string	
YR2023	string	
YR2024	string	
YR2025	string	
YR2026	string	

If you change the job configuration, check whether you also need to change the field mappings on the Map Field page so that the job can run properly.

View supported data sources.

Job Configuration

* Job Name: mail

Source Job Configuration

* Source Link Name: mysql — Configuration Guide

Use SQL Statement: Yes [✓ No]

* Schema/Table Space:

* Table Name:

Show Advanced Attributes

Destination Job Configuration

* Destination Link Name: hive — Configuration Guide

* Database Name: default

* Table Name:

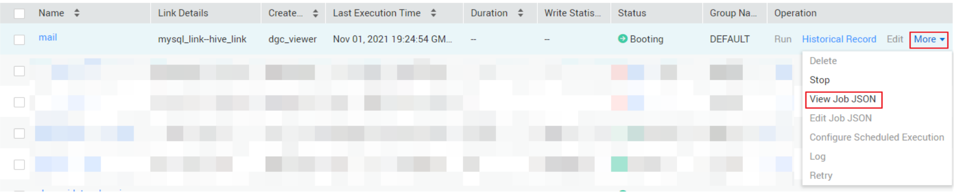
* Auto Table Creation: Non-auto Creation

Clear Data Before Import: Yes [✓ No]

Executing Analyze Statements: [✓ Yes] No

Step 3 After the sample job is created, view and copy the job JSON for subsequent configuration of data development jobs.

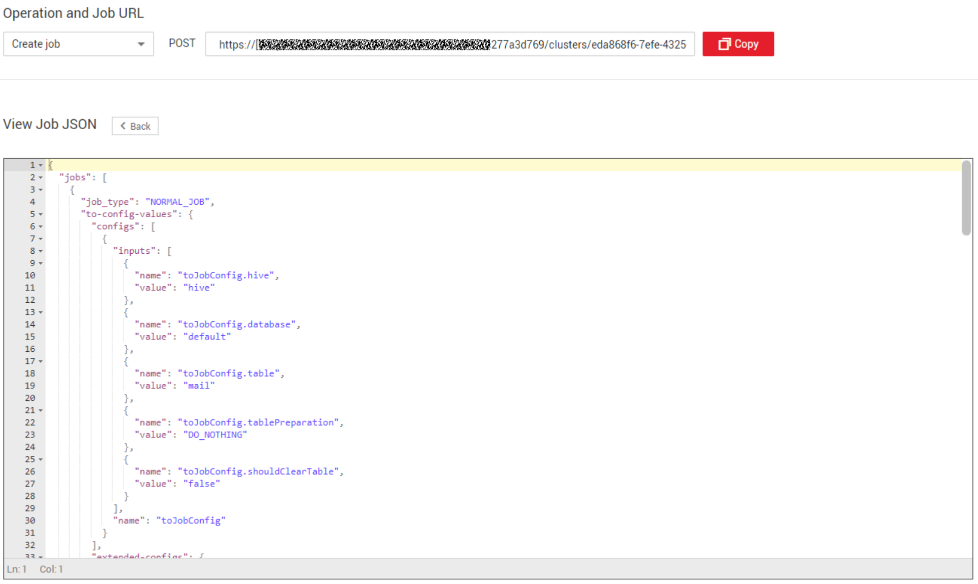
Figure 5-3 Viewing job JSON



Name	Link Details	Create...	Last Execution Time	Duration	Write Statis...	Status	Group Na...	Operation
mail	mysql_link--hive_link	dgc_viewer	Nov 01, 2021 19:24:54 GM...	--	--	Booting	DEFAULT	Run Historical Record Edit More

[redacted]

Figure 5-4 Copying job parameters



Operation and Job URL

Create job　POST　https://[redacted]277a3d769/clusters/eda868f6-7efe-4325

View Job JSON

```
{
  "jobs": [
    {
      "job_type": "NORMAL_JOB",
      "to-config-values": {
        "configs": [
          {
            "inputs": [
              {
                "name": "toJobConfig.hive",
                "value": "hive"
              },
              {
                "name": "toJobConfig.database",
                "value": "default"
              },
              {
                "name": "toJobConfig.table",
                "value": "mail"
              },
              {
                "name": "toJobConfig.tablePreparation",
                "value": "DO_NOTHING"
              },
              {
                "name": "toJobConfig.shouldClearTable",
                "value": "false"
              }
            ],
            "name": "toJobConfig"
          }
        ],
        "extended-configs": {
```

Ln: 1　Col: 1

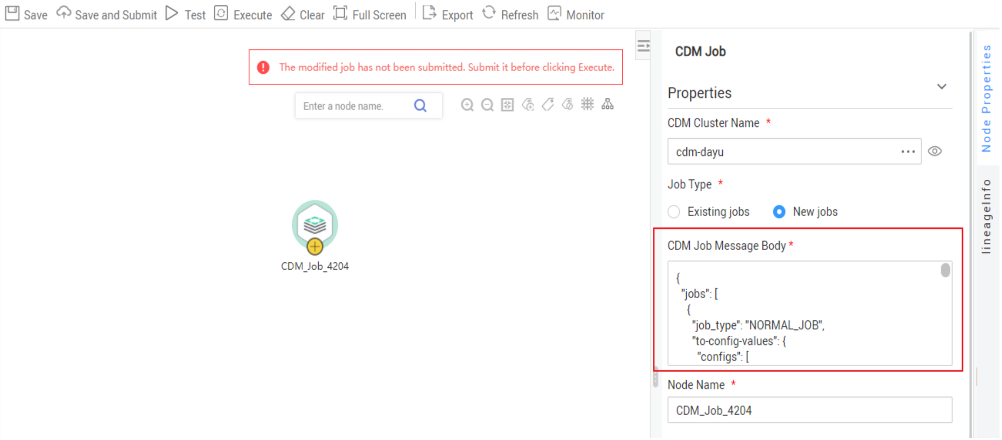
----End

Creating a Data Development Job

Step 1 Locate a workspace and click **DataArts Factory**.

Step 2 Create a subjob named **table**, select the CDM node, select **New jobs** for **Job Type** in **Properties**, and copy and paste the JSON file in **Step 2** to the **CDM Job Message Body**.

Figure 5-5 Configuring the CDM job message body



The modified job has not been submitted. Submit it before clicking Execute.

CDM Job

Properties

CDM Cluster Name * cdm-dayu

Job Type * ○ Existing jobs ● New jobs

CDM Job Message Body *

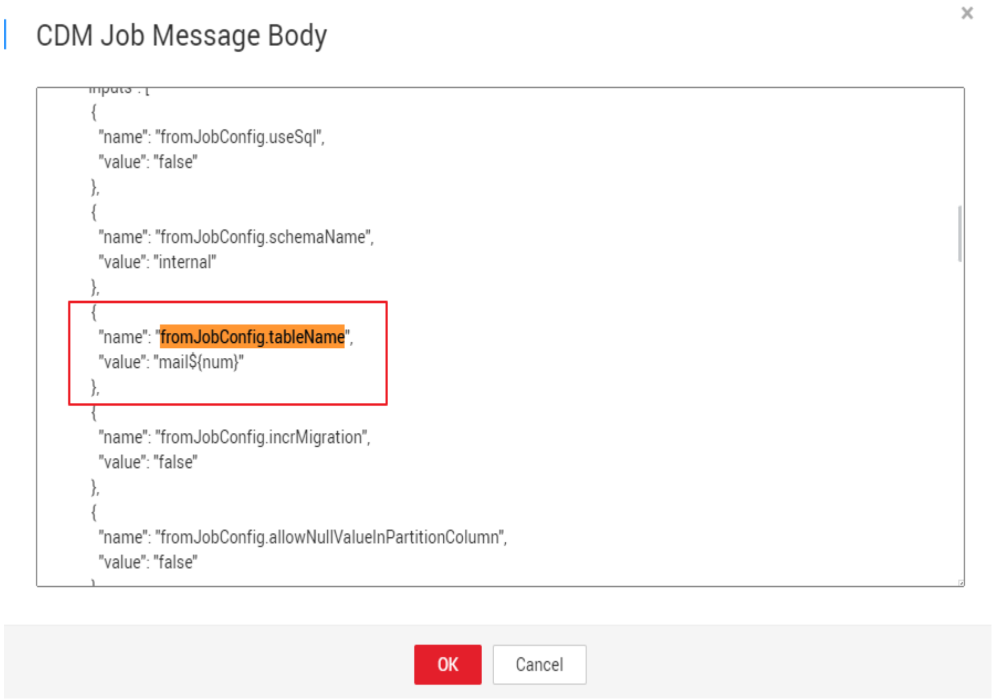
```
{
 "jobs": [
  {
   "job_type": "NORMAL_JOB",
   "to-config-values": {
    "configs": [
```

Node Name * CDM_Job_4204

Step 3 Edit the CDM job message body.

1. Since there are three source tables **mail001**, **mail002**, and **mail003**, you need to set **fromJobConfig.tableName** to **mail${num}** in the JSON file of the job. The following figure shows the parameters for creating a main job.

Figure 5-6 Editing JSON



CDM Job Message Body

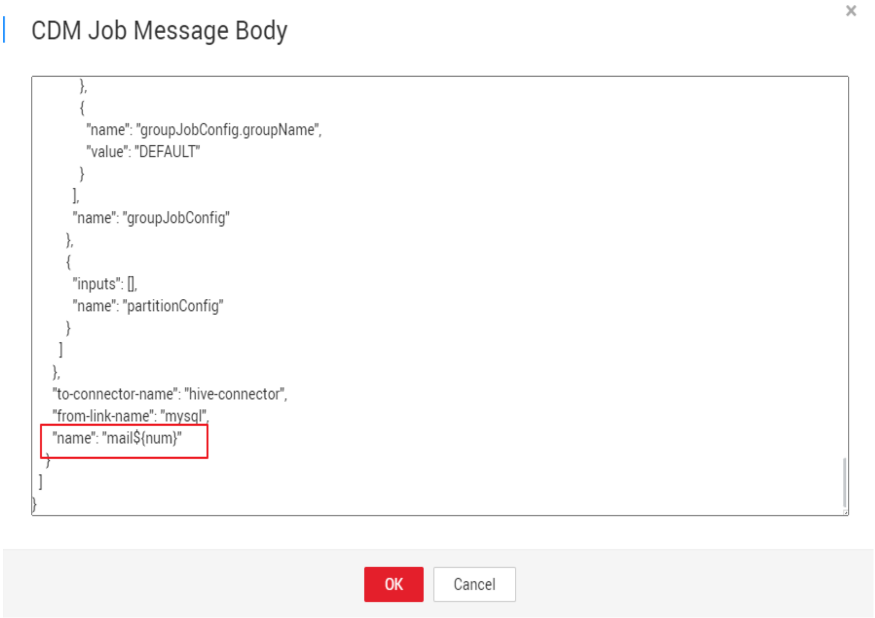
```
   "inputs": [
    {
     "name": "fromJobConfig.useSql",
     "value": "false"
    },
    {
     "name": "fromJobConfig.schemaName",
     "value": "internal"
    },
    {
     "name": "fromJobConfig.tableName",
     "value": "mail${num}"
    },
    {
     "name": "fromJobConfig.incrMigration",
     "value": "false"
    },
    {
     "name": "fromJobConfig.allowNullValueInPartitionColumn",
     "value": "false"
    }
```

2. The name of each data migration job must be unique. Therefore, you need to change the value of **name** in the JSON file to **mail${num}** to create multiple CDM jobs. The following figure shows the parameters for creating a main job.

   NOTE

   To create a sharding job, you can change the source link in the job JSON file to a variable that can be easily replaced.

   Figure 5-7 Editing JSON

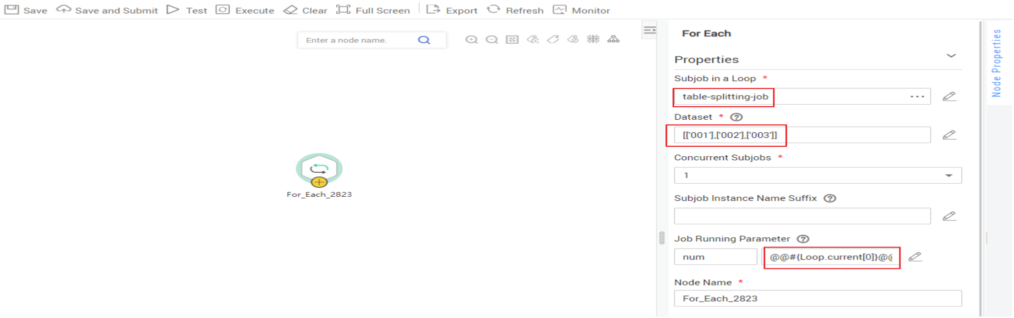


CDM Job Message Body

```
          },
          {
            "name": "groupJobConfig.groupName",
            "value": "DEFAULT"
          }
        ],
        "name": "groupJobConfig"
      },
      {
        "inputs": [],
        "name": "partitionConfig"
      }
    ]
  },
  "to-connector-name": "hive-connector",
  "from-link-name": "mysql",
  "name": "mail${num}"
  }
 ]
}
```

Step 4 Add the **num** parameter, which is invoked in the job JSON file. The following figure shows the parameters for creating a main job.

Figure 5-8 Adding job parameter num



For Each

Properties

Subjob in a Loop *: table-splitting-job

Dataset * : [['001'],['002'],['003']]

Concurrent Subjobs * : 1

Subjob Instance Name Suffix:

Job Running Parameter: num @@#{Loop.current[0]}@@

Node Name * : For_Each_2823

Click **Save and Submit** to save the subjobs.

Step 5 Create the main job **integration_management**. Select the For Each node that executes the subjobs in a loop and transfers parameters **001**, **002**, and **003** to the subjobs to generate different table extraction tasks.

The key configurations are as follows:

- **Subjob in a Loop**: Select **table**.

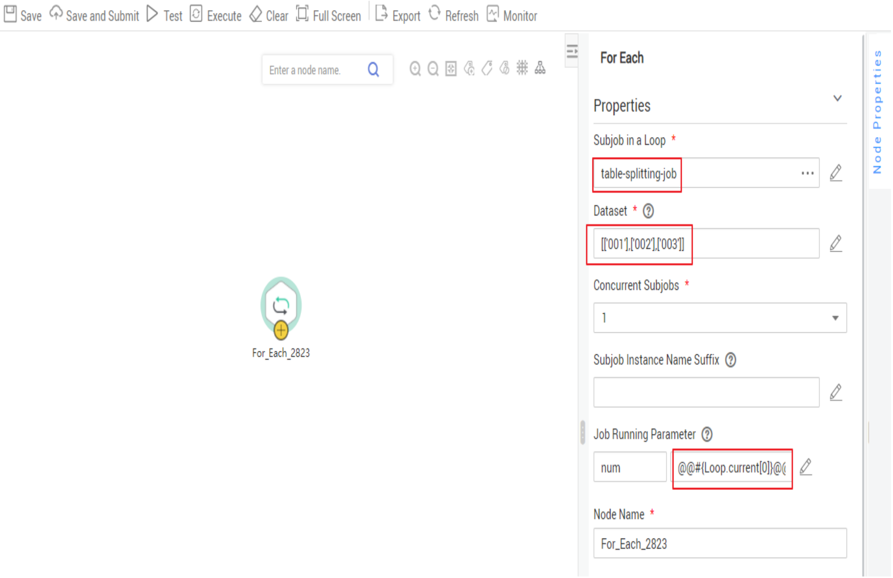
- **Dataset**: Enter **[['001'],['002'],['003']]**.
- **Subjob Parameter Name**: Enter **@@#{Loop.current[0]}@@**.

  NOTE

  Add **@@** to the EL expression of the subjob parameter. If **@@** is not added, dataset 001 will be identified as 1. As a result, the source table name does not exist.

The following figure shows the parameters for creating a main job.

Figure 5-9 Configure key parameters



For Each

Properties

Subjob in a Loop *: table-splitting-job

Dataset *: [['001'],['002'],['003']]

Concurrent Subjobs *: 1

Subjob Instance Name Suffix:

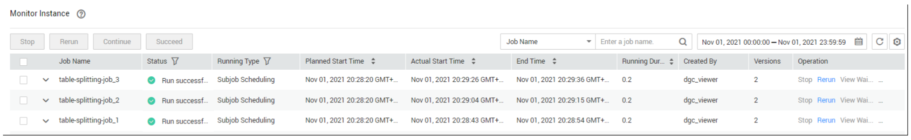
Job Running Parameter: num @@#{Loop.current[0]}@(

Node Name *: For_Each_2823

Click **Save and Submit** to save the main job.

Step 6 After the main job and subjobs are created, test and run the main job to check whether it is successfully created. If the job is successfully executed, the CDM subjobs are successfully created and executed.

Figure 5-10 Viewing the job creation status



Nov 01, 2021 00:00:00 — Nov 01, 2021 23:59:59

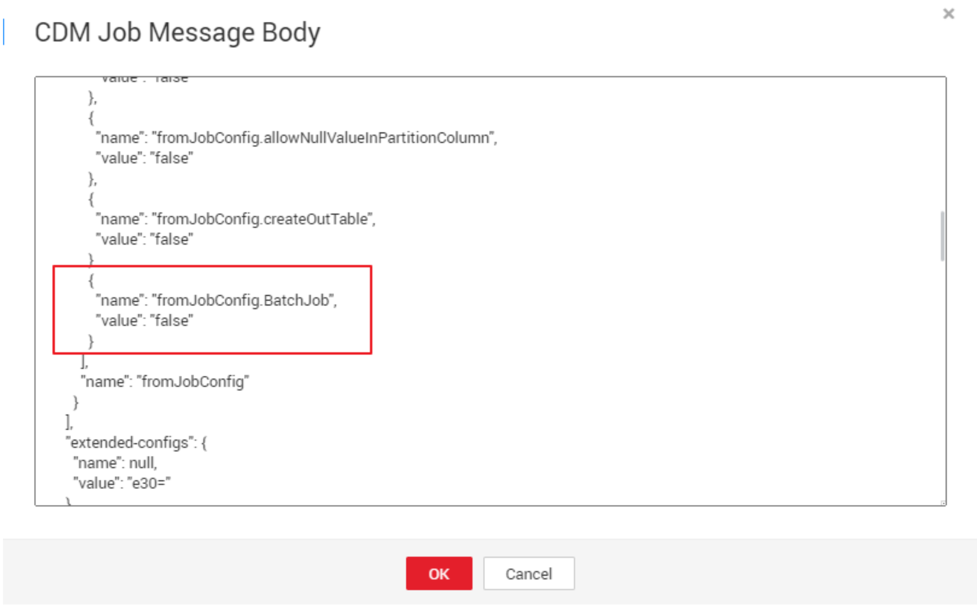
Job Name	Status	Running Type	Planned Start Time	Actual Start Time	End Time	Running Dur...	Created By	Versions	Operation
table-splitting-job_3	Run successf...	Subjob Scheduling	Nov 01, 2021 20:28:20 GMT+...	Nov 01, 2021 20:29:26 GMT+...	Nov 01, 2021 20:29:36 GMT+...	0.2	dgc_viewer	2	Stop Rerun View Wai... ...
table-splitting-job_2	Run successf...	Subjob Scheduling	Nov 01, 2021 20:28:20 GMT+...	Nov 01, 2021 20:29:04 GMT+...	Nov 01, 2021 20:29:15 GMT+...	0.2	dgc_viewer	2	Stop Rerun View Wai... ...
table-splitting-job_1	Run successf...	Subjob Scheduling	Nov 01, 2021 20:28:20 GMT+...	Nov 01, 2021 20:28:43 GMT+...	Nov 01, 2021 20:28:54 GMT+...	0.2	dgc_viewer	2	Stop Rerun View Wai... ...

----End

Important Notes

- Some attributes, such as **fromJobConfig.BatchJob**, may not be supported in some CDM versions. If an error is reported during task creation, you need to delete the attribute from the request body. The following figure shows the parameters for creating a main job.

Figure 5-11 Modifying an attribute



```
        "value": "false"
      },
      {
        "name": "fromJobConfig.allowNullValueInPartitionColumn",
        "value": "false"
      },
      {
        "name": "fromJobConfig.createOutTable",
        "value": "false"
      }
      {
        "name": "fromJobConfig.BatchJob",
        "value": "false"
      }
    ],
    "name": "fromJobConfig"
  }
],
"extended-configs": {
  "name": null,
  "value": "e30="
}
```

- If a CDM node is configured to create a job, the node 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, wait until the job is run. During this period, the CDM 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 start or create multiple jobs with the same name.

6 Simplified Migration of Trade Data to the Cloud and Analysis

6.1 Scenario

Consulting company H uses CDM to import local trade statistics to OBS, and Data Lake Insight (DLI) to analyze trade statistics. In this way, company H builds its big data analytics platform at an extremely low cost, allowing the company more time to focus on their businesses and make innovations continuously.

Background

Company H is a commercial organization in China that engages in collecting trade statistics of major trading nations and buyer data. It has a large-scale trade statistics database. The collected data is widely used in industry research, international trade promotion, and other fields.

In the past, company H used its own big data cluster with maintenance by dedicated personnel. Each year, company H purchased the dedicated bandwidth from China Telecom and China Unicom and invested heavily in equipment room, electric power, private networks, servers, and O&M. However, the company could not satisfy customers' ever-changing service requirements due to insufficient workforce and limited capabilities of its big data cluster. As a result, only 4% of 100 TB inventory data was useful.

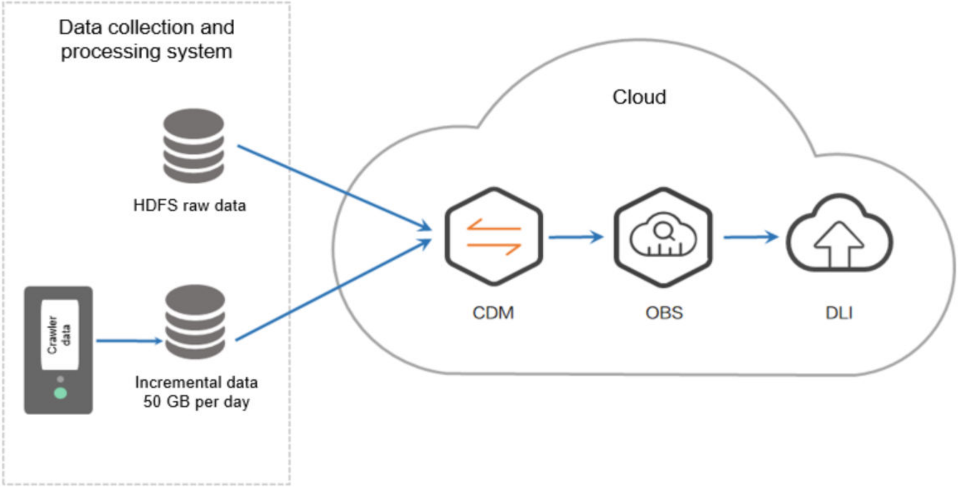
After migrating local trade statistics to Huawei Cloud, company H can make full use of the 100 TB inventory data in maximizing asset monetization, without the need of constructing and maintaining infrastructures but relying on Huawei Cloud's big data analysis capabilities.

CDM and DLI use the pay-per-use billing mode, so maintenance personnel are not required and the dedicated bandwidth cost is reduced. Compared with the offline data center, CDM and DLI save the maintenance cost by 70%. In addition, CDM and DLI have low skill demands for personnel and enable smooth migration of existing services, shortening the service rollout period by 50%.

Task

Use CDM, OBS, and DLI to complete trade statistics analysis using the existing data (for example, trade detail records and basic information) of company H's customer data collection and processing system.

Figure 6-1 Scenario scheme



NOTE

When creating an OBS foreign table on DLI, the data storage format of the OBS table must meet the following requirements:

- When you use the DataSource syntax to create an OBS table, the ORC, Parquet, JSON, CSV, Carbon, and Avro formats are supported.
- When you use the Hive syntax to create an OBS table, the Text file, Avro, ORC, SequenceFile, RCFile, Parquet, Carbon formats are supported.

If the storage format of the raw data table does not meet the requirements, you can use CDM to import the raw data to DLI for analysis without uploading the data to OBS.

Data Types

- Trade detail records

  Trade detail records include trade statistics of major trading nations.

Table 6-1 Trade detail records

Field Name	Field Type	Field Description
hs_code	string	List of import and export offering code
country	smallint	Basic information about countries
dollar_value	double	Transaction amount
quantity	double	Transaction volume

Field Name	Field Type	Field Description
unit	smallint	Measurement unit
b_country	smallint	Basic information about the target country
imex	smallint	Import or export
y_year	smallint	Year
m_month	smallint	Month

- Basic information

  The basic information indicates the dictionary data corresponding to the fields in the trade detail records.

Table 6-2 Basic information about countries (description of **country**)

Field Name	Field Type	Field Description
countryid	smallint	Country code
country_en	string	English name of a country
country_cn	string	Chinese name of a country

Table 6-3 Information about the update time (description of **updatetime**)

Field Name	Field Type	Field Description
countryid	smallint	Country code
imex	smallint	Import or export
hs_len	smallint	Length of the offering code
minstartdate	string	Minimum start time
startdate	string	Start time
newdate	string	Update time
minnewdate	string	Last update time

Table 6-4 Information about import and export offering code (description of **hs246**)

Field Name	Field Type	Field Description
id	bigint	ID
hs	string	Offering code
hs_cn	string	Chinese name of an offering
hs_en	string	English name of an offering

Table 6-5 Information about units (description of **unit_general**)

Field Name	Field Type	Field Description
id	smallint	Measurement unit code
unit_en	string	English name of a measurement unit
unit_cn	string	Chinese name of a measurement unit

6.2 Analysis Process

Introduction

To use CDM, OBS, and DLI to analyze trade statistics, you need to perform the following steps:

1. **Using CDM to Upload Data to OBS**
   a. Use CDM to upload the inventory data of company H to OBS.
   b. Configure a scheduled task of CDM to automatically upload incremental data to OBS every day.
2. **Using DLI to Analyze Data**
   Use DLI to directly analyze the service data in OBS to support the customers of company H for trade statistics analysis.

6.3 Using CDM to Upload Data to OBS

6.3.1 Uploading Inventory Data

1. Use **Direct Connect** to establish a Direct Connect connection between the local data center and Huawei Cloud Virtual Private Cloud (VPC).

2. Create an OBS bucket and record the access domain name, port number, access key ID (AK), and secret access key (SK) of the OBS bucket.
3. Create a CDM cluster.

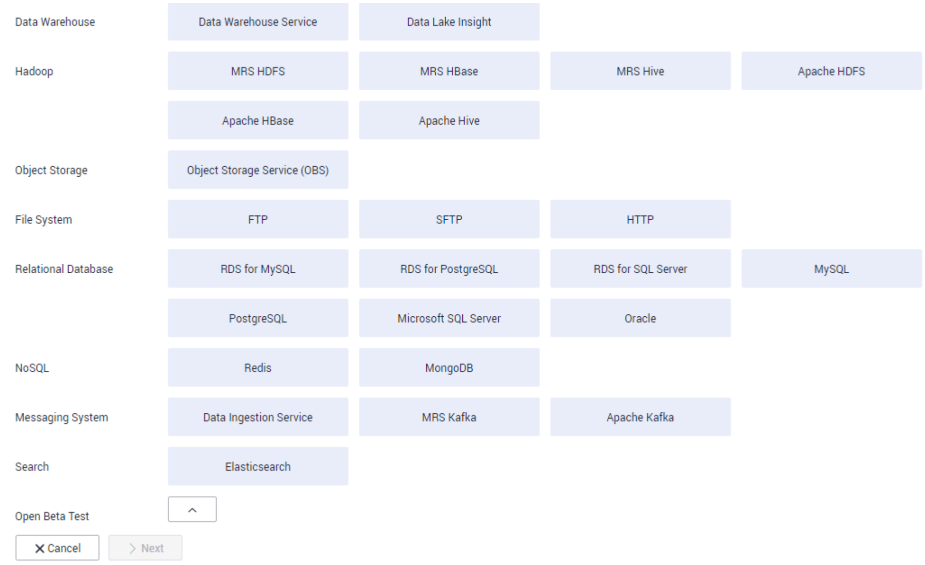
   NOTE

   If a DataArts Studio instance includes a CDM cluster (except the trial version) and the cluster 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**.

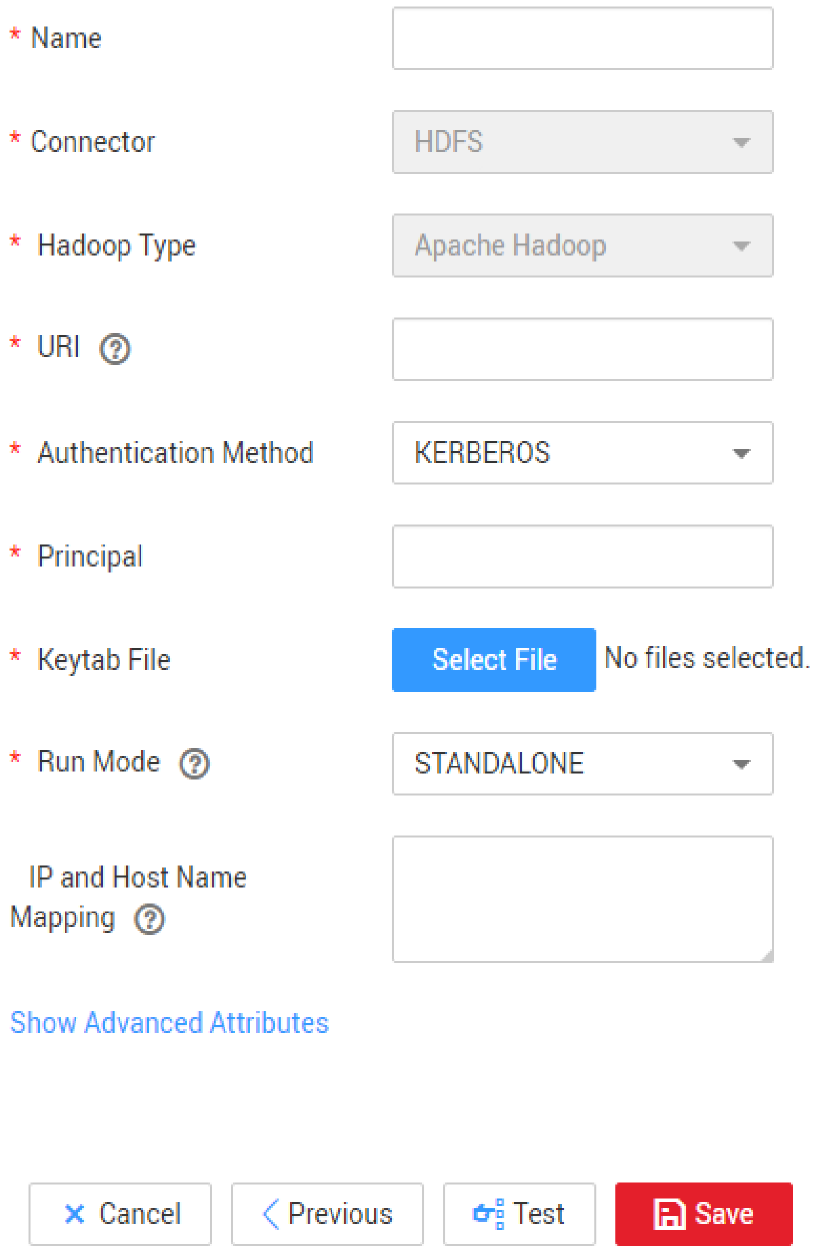
   - **Instance Type**: Select **cdm.xlarge**, which applies to most migration scenarios.
   - **VPC**: VPC of the CDM cluster. Select the VPC that connects to the local data center through Direct Connect.
   - (Optional) **Subnet** and **Security Group**: You can configure either of them.
4. After the cluster is created, choose **Job Management** > **Link Management** > **Create Link**. The page for selecting a link type is displayed. See **Figure 6-2**.

Figure 6-2 Selecting a connector



5. To connect to the local Apache HDFS of company *H*, select **Apache HDFS**, and click **Next**.

Figure 6-3 Creating an HDFS link



* Name

* Connector: HDFS

* Hadoop Type: Apache Hadoop

* URI

* Authentication Method: KERBEROS

* Principal

* Keytab File: Select File No files selected.

* Run Mode: STANDALONE

IP and Host Name Mapping

NOTE

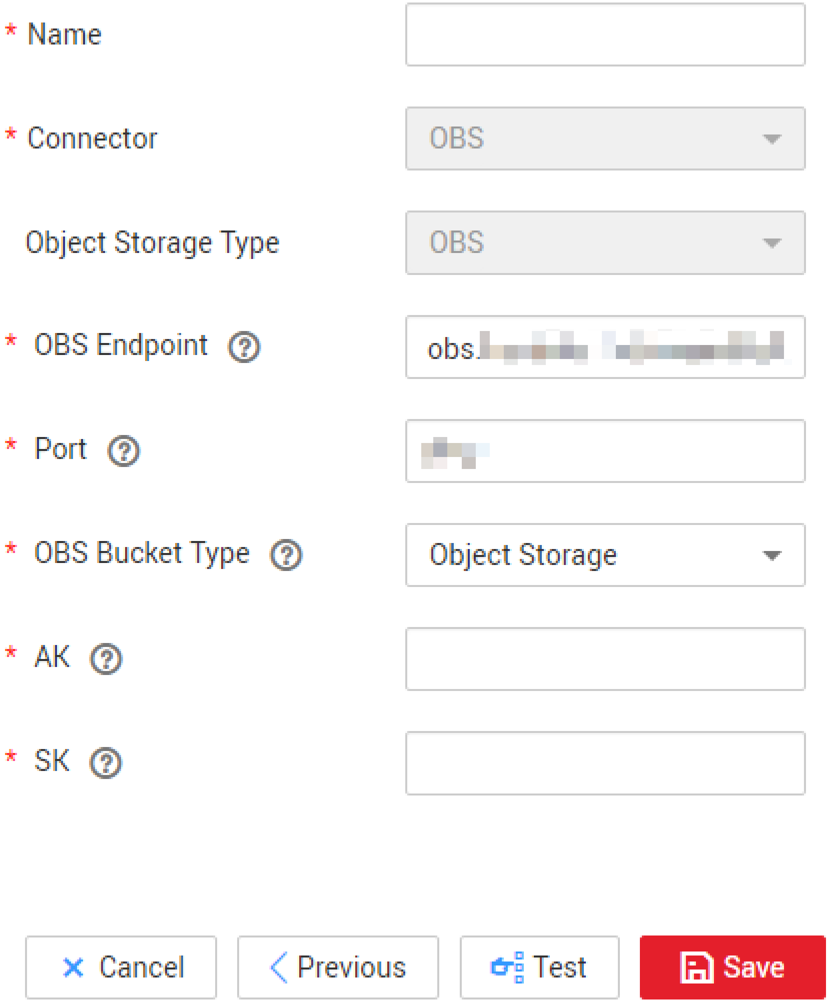
- **Name**: Enter a custom link name, for example, **hdfs_link**.
- **URI**: Enter the NameNode URI of HDFS of company *H*.
- **Authentication Method**: Select **KERBEROS** if Hadoop is in security mode to obtain the **principal** and **keytab** files from the client for authentication.
- **Principal** and **Keytab File**: Obtain the **principal** account and **keytab** file from the Hadoop administrator.

6. Click **Save**. CDM automatically checks whether the link is available.
   – If the link is available, a message is displayed, indicating that the link is successfully saved, and the link management page is displayed.

– If the link is unavailable, check whether the link parameters are correctly configured or whether the firewall of company *H* allows the elastic IP address (EIP) of the CDM cluster to access the data source.

7. Click **Create Link** to create an OBS link. On the page that is displayed, select **Object Storage Service (OBS)** and click **Next**. Set the OBS link parameters as required. See **Figure 6-4**.

Figure 6-4 Creating an OBS link



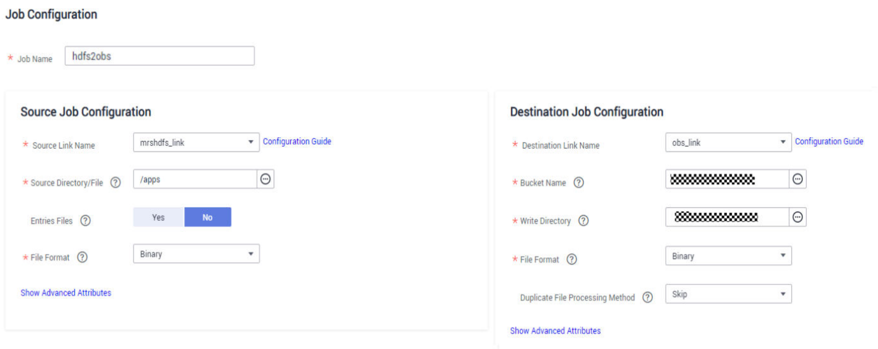
* Name	
* Connector	OBS
Object Storage Type	OBS
* OBS Endpoint	obs.[redacted]
* Port	[redacted]
* OBS Bucket Type	Object Storage
* AK	
* SK	

NOTE

- **Name**: Enter a custom link name, for example, **obslink**.
- **OBS Endpoint**: Enter the domain name or IP address of OBS, for example, **obs.myhuaweicloud.com**.
- **Port**: Enter the port number of OBS, for example, **443**.
- **OBS Bucket Type**: Select a value from the drop-down list box as required.
- **AK** and **SK**: Enter the AK and SK used for accessing the OBS database. To obtain the AK and SK, log in to the management console, click the username in the upper right corner, and select **My Credentials** from the drop-down list. On the displayed page, choose **Access Keys** in the left navigation pane.

8. Click **Save**. The **Link Management** page is displayed.
9. Choose **Table/File Migration** > **Create Job** to create a job for migrating trade statistics of company *H* to OBS. See **Figure 6-5**.

Figure 6-5 Creating a job



Job Configuration

* Job Name: hdfs2obs

Source Job Configuration

* Source Link Name: mrshdfs_link
* Source Directory/File: /apps
Entries Files: Yes [✓ No]
* File Format: Binary

Destination Job Configuration

* Destination Link Name: obs_link
* Bucket Name: [redacted]
* Write Directory: [redacted]
* File Format: Binary
Duplicate File Processing Method: Skip

NOTE

- **Job Name**: Enter a user-defined job name.
- **Source Link Configuration**:
  - **Source Link Name**: Select the HDFS link **hdfs_link** created in **5**.
  - **Source Directory/File**: Set this parameter to the local storage path of company *H*'s trade statistics. The value can be either a directory or a file. Set this parameter to a directory. CDM migrates all files in the directory to OBS.
  - **File Format**: Select **Binary**. The file format refers to the format used by CDM to transmit data. The formats of the original files are not changed. **Binary** is recommended for migration between files because the transmission efficiency and performance are optimal.
- **Destination Link Configuration**:
  - **Destination Link Name**: Select the OBS link **obslink** created in **7**.
  - **Bucket Name** and **Write Directory**: Enter the path for storing trade statistics in OBS. CDM writes the files to this path.
  - **File Format**: Select **Binary**. Similar to the source link, the formats of the original files are not changed.
  - **Duplicate File Processing Method**: Select **Skip**. CDM determines that a file is a duplicate file only when the file name and file size are the same on the source and destination ends. In this case, CDM skips the file and does not migrate the file to OBS.

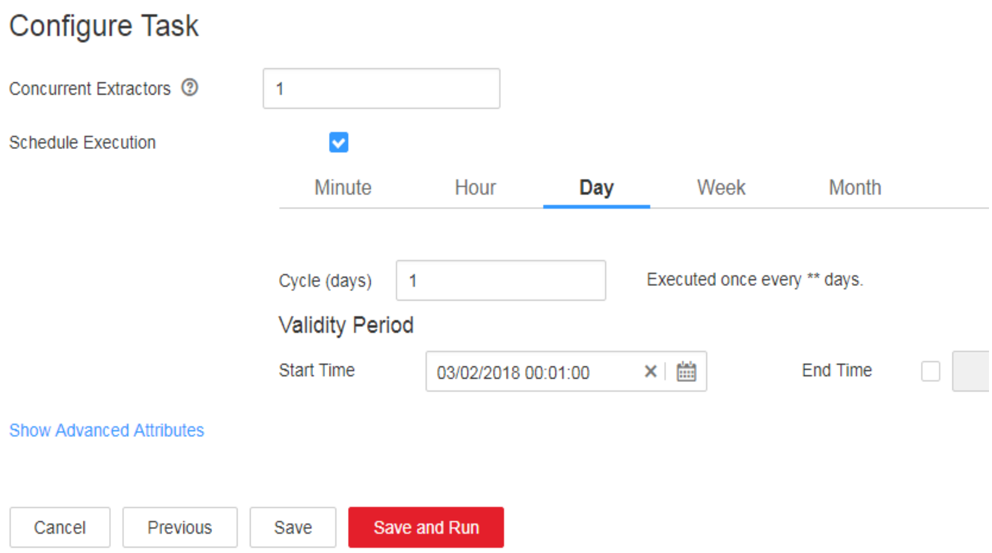
10. Click **Next** to go to the tab page for configuring the task parameters. For the migration of inventory data, retain the default values of the parameters.
11. Click **Save and Run**. On the displayed job management page, you can view the job execution progress and result.
12. After the job is successfully executed, click **Historical Record** to view the number of written rows, number of read rows, number of written bytes, number of written files, and execution logs.

6.3.2 Uploading Incremental Data

1. After uploading inventory data using CDM, click **Edit** in the **Operation** column to modify a job.

2. Retain the values of the basic parameters, and click **Next** to modify the task parameters. See **Figure 6-6**.

Figure 6-6 Configuring a scheduled task



Configure Task

Concurrent Extractors: 1

Schedule Execution: ☑

Minute | Hour | **Day** | Week | Month

Cycle (days): 1 — Executed once every ** days.

Validity Period

Start Time: 03/02/2018 00:01:00

End Time: □

3. Select **Schedule Execution** and configure the scheduled task.
   - Set **Cycle (days)** to 1 day.
   - Set **Start Time** to 00:01:00 every day.

   In this way, CDM automatically performs full migration in the early morning every day. However, because **Duplicate File Processing Method** is set to **Skip**, files with the same name and size are not migrated. Therefore, only new files are uploaded every day.

4. Click **Save**.

6.4 Analyzing Data

Use DLI to analyze the trade statistics stored in OBS buckets.

Prerequisites

When creating an OBS foreign table on DLI, the data storage format of the OBS table must meet the following requirements:

- When you use the DataSource syntax to create an OBS table, the ORC, Parquet, JSON, CSV, Carbon, and Avro formats are supported.
- When you use the Hive syntax to create an OBS table, the Text file, Avro, ORC, SequenceFile, RCFile, Parquet, Carbon formats are supported.

If the storage format of the raw data table does not meet the requirements, you can use CDM to import the raw data to DLI for analysis without uploading the data to OBS.

Procedure

1. Log in to the DLI console and create a database by referring to **Creating a Database**.
2. Create an OBS foreign table by referring to **Creating an OBS Table**, including the trade statistics database, trade detail record table, and basic information table.
3. Develop SQL scripts on the DLI console for trade statistics analysis to meet service requirements.

7 Migration of IoV Big Data to the Lake Without Loss

7.1 Scenario

Background

Company *H* intends to build an enterprise-class cloud management platform for its IoV service to centrally manage and deploy hardware resources and common software resources, and implement cloud-based and service-oriented transformation of IT applications. Cloud Data Migration (CDM) helps company *H* build the platform without code modification and data loss.

Constraints

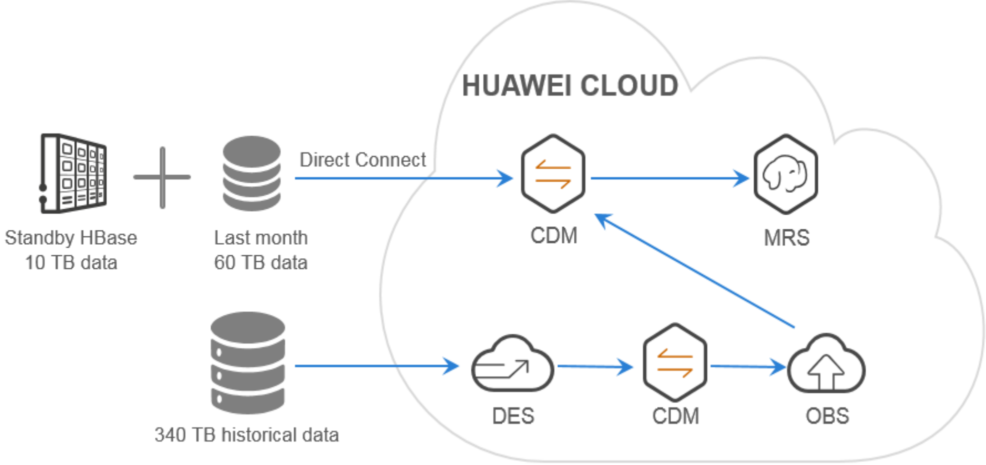
This solution supports only data migration to MRS 1.x clusters. In MRS 2.x and later versions, HBase tables cannot be rebuilt by running HBase repair commands.

NOTICE

If the target cluster version is 2.x or later, the HBase repair command is no longer supported, and the HBase data directory migration cannot be implemented.

Migration Scheme

Figure 7-1 Migration scheme



Company *H* stores 854 tables (400 TB) in the Cloudera Hadoop (CDH) HBase cluster and 149 tables (about 10 TB) in the standby HBase cluster. An amount of 60 TB data is increased in the last month.

Use CDM to extract HBase HFiles from the CDH cluster and save the extracted data to MapReduce Service (MRS) HDFS, and run the HBase repair command to rebuild the HBase table. Based on this migration scheme, the following two migration modes are optional:

1. CDM migrates data of the last month and data of the standby HBase cluster through the private line.

   CDH → CDM (HUAWEI CLOUD) → MRS

   NOTE

   The advantage and disadvantage of direct migration using the private line are as follows:

   - Advantage: Data does not need to be migrated multiple times, which shortens the overall migration duration.
   - Disadvantage: When a large amount of data is transmitted, the private line bandwidth is heavily occupied, which affects the concurrent services of the customer and crosses multiple switches.

2. Use CDM to migrate historical data generated one month ago from **Data Express Service (DES)**. The migration path is as follows:

   CDH → DES → CDM (HUAWEI CLOUD) → OBS → CDM (HUAWEI CLOUD) → MRS

   NOTE

   DES is well suited to the scenario where a large amount of data is to be transmitted, no private line is set up between the private cloud and HUAWEI CLOUD, and the bandwidth from the private cloud network to the public network is limited.

   - Advantage: The transmission is highly reliable without depending on the private line and network quality.
   - Disadvantage: The migration takes a long time.

7.2 Migration Preparation

Prerequisites

- The CDH HBase version is earlier than or equal to the MRS HBase version.
- No write, split, or merge operations can be performed on the tables that are being migrated.
- A **Direct Connect** connection has been established between the CDH cluster and Huawei Cloud Virtual Private Cloud (VPC).

Migration Process

1. Estimate the amount of data to be migrated and the migration duration.
2. Output the detailed data tables, the number and sizes of files to be migrated for subsequent verification.
3. Configure migration tasks in batches to ensure the migration progress and speed.
4. Check the number and sizes of files.
5. Restore the HBase table on MRS and verify the restoration.

Required Information

Item	Information	Description	Example Value
DES Teleport	Mount address	Address to which the DES Teleport box is mounted on the customer's VM	//*IP address of the VM*/huawei
	DeviceManager	Storage management system of the DES Teleport box, which is related to the management IP address	https://*Management IP address*:8088/deviceManager/devicemanager/login/login.html
	Username	Username for logging in to DeviceManager	admin
	Password	Password for logging in to DeviceManager	-
CDH cluster	NameNode IP	IP address of the active NameNode in the CDH cluster	192.168.2.3
	HDFS port	The default port number is 9000.	9000

Item	Information	Description	Example Value
	HDFS URI	NameNode URI of HDFS in the CDH cluster	hdfs://192.168.2.3:9000
OBS	OBS endpoint	Endpoint of OBS	obs.ap-southeast-1.myhuaweicloud.com
	OBS bucket	OBS bucket that stores historical data one month ago of the CDH cluster	cdm
	AK/SK	AK and SK for accessing OBS	-
MRS	Manager IP	IP address of MRS Manager	192.168.3.11

7.3 Using CDM to Migrate Data of the Last Month

The standby HBase cluster stores about 10 TB data, and the amount of data increased in the last month is about 60 TB. Therefore, the total amount of data is about 70 TB. Company *H*'s 20GE private line supports the cdm.xlarge cluster of CDM. Considering the migration duration, costs, and performance, two cdm.xlarge clusters are used to perform concurrent migrations. **Table 7-1** describes the cluster specifications.

Table 7-1 CDM cluster specifications

Instance Flavor	vCPUs/ Memory	Maximum/ Assured Bandwidth	Concurrent Extractors	Scenario
cdm.large	8 vCPUs and 16 GB memory	3/0.8 Gbit/s	16	A single table with 10 million or more than 10 million pieces of data
cdm.xlarge	16 vCPUs and 32 GB memory	10/4 Gbit/s	32	TB-level data migration requiring 10GE bandwidth
cdm.4xlarge	64 vCPUs and 128 GB memory	40/36 Gbit/s	64	-

NOTE

You can use multiple CDM clusters to perform migrations concurrently to improve migration efficiency. The MRS HDFS multi-replica policy occupies network bandwidth and affects the migration efficiency.

Creating Links on HUAWEI CLOUD CDM

1. Create two CDM clusters.

   NOTE

   If a DataArts Studio instance includes a CDM cluster (except the trial version) and the cluster 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**.

   – Select the **cdm.xlarge** flavor.

   – The clusters must reside in the same VPC as MRS and DirectConnect.

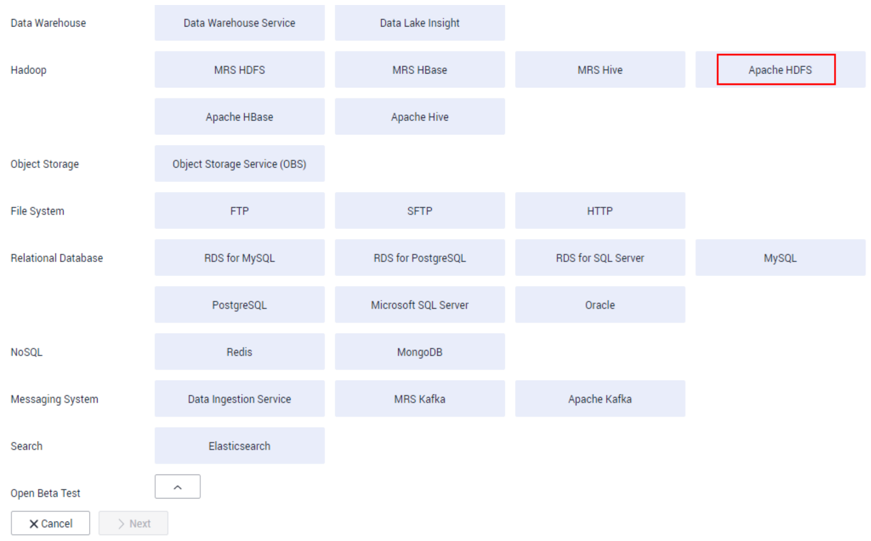
   – Configure other parameters as required or retain the default values.

2. Perform the following operations to create a CDH HDFS link:

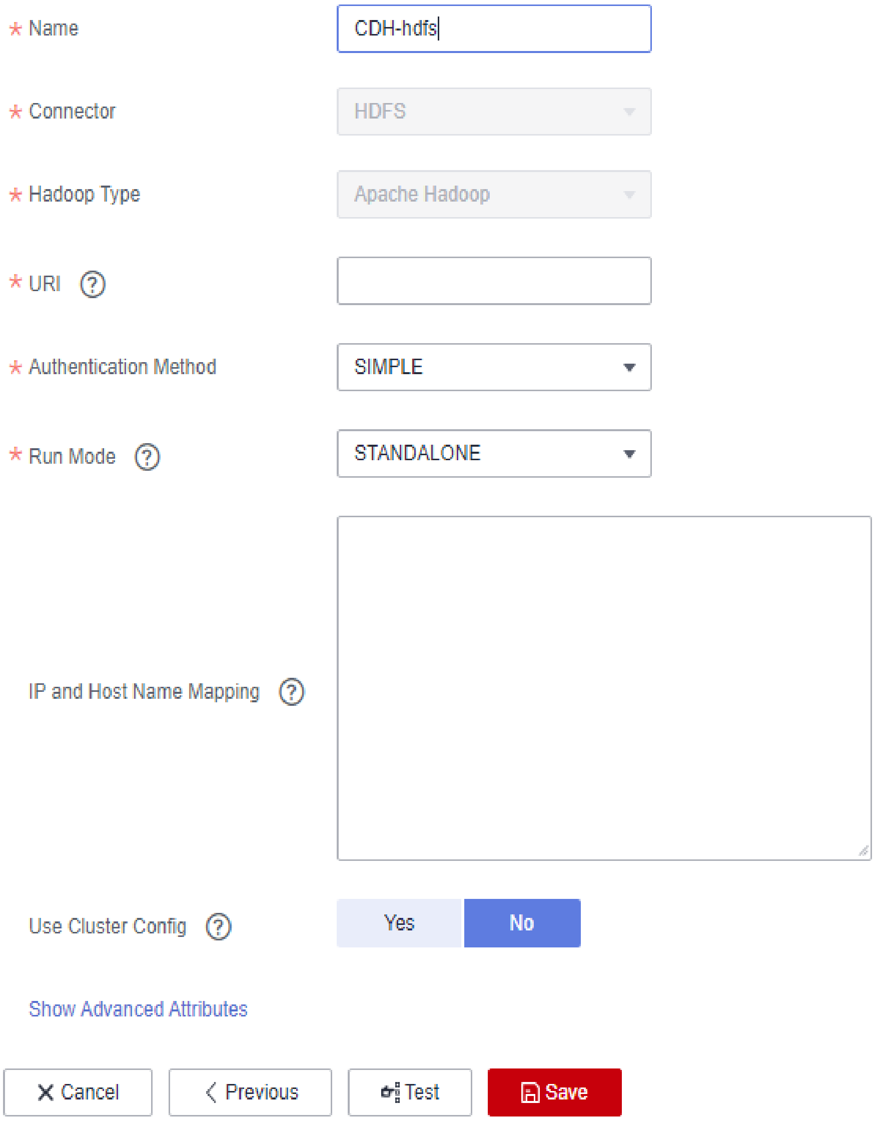
   a. In the **Operation** column, click **Job Management**.

   b. Click the **Links** tab and then **Create Link**. On the page that is displayed, select **Apache HDFS**.

   Figure 7-2 Selecting a connector



   c. Click **Next** and configure the link parameters. The URI format is *hdfs://NameNode IP address:Port number*. If Kerberos authentication is not enabled in the CDH cluster, set **Authentication Method** to **SIMPLE**.



* Name: CDH-hdfs

* Connector: HDFS

* Hadoop Type: Apache Hadoop

* URI:

* Authentication Method: SIMPLE

* Run Mode: STANDALONE

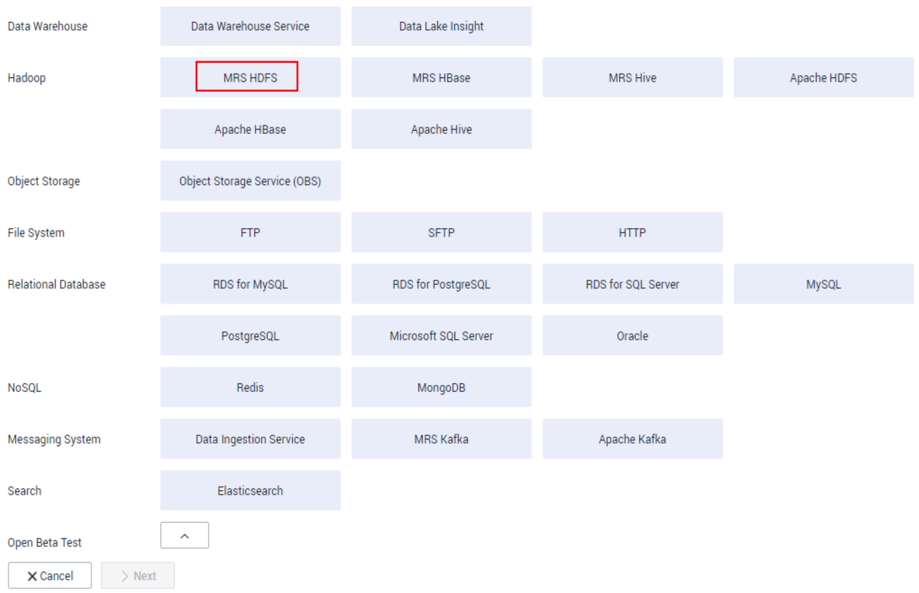
IP and Host Name Mapping:

Use Cluster Config: Yes [✓ No]

d. Click **Test**. If a test success message is displayed in the upper right corner, the link works properly. Click **Save**.

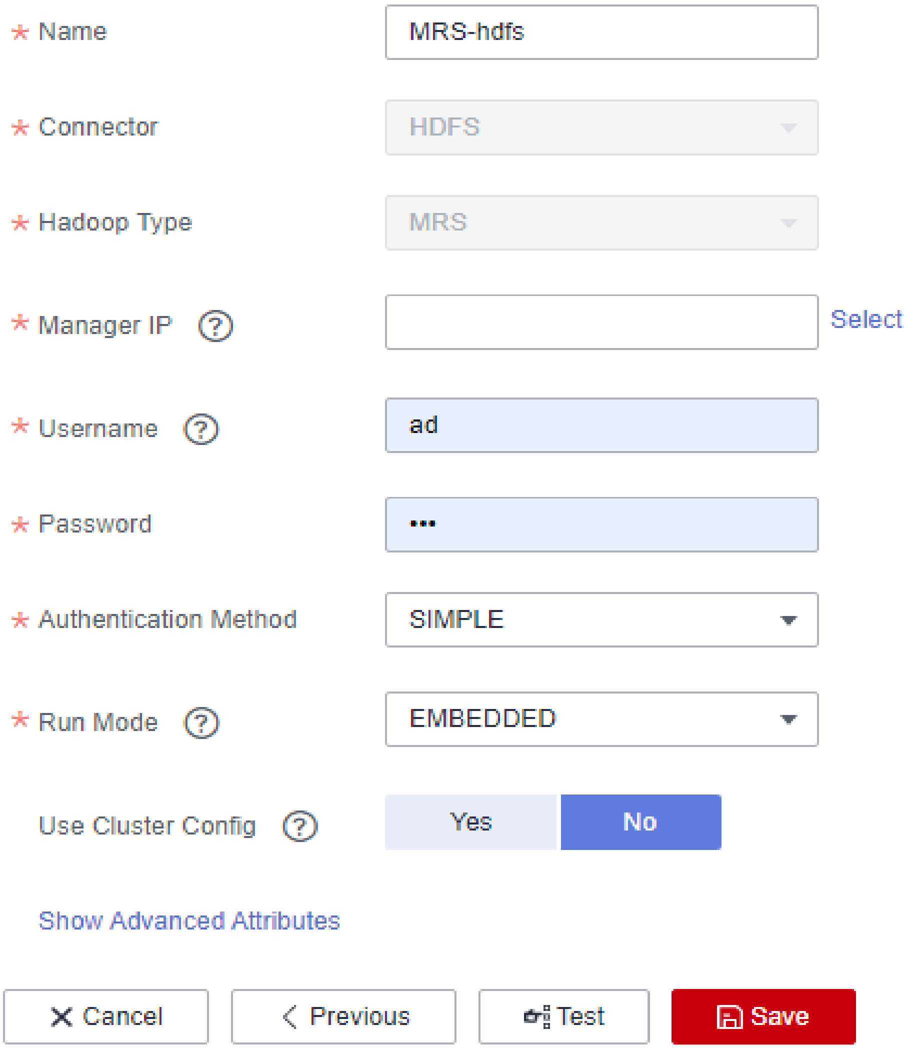
3. Perform the following operations to create an MRS HDFS link:

   a. Choose **Link Management** > **Create Link**. On the page that is displayed, select **MRS HDFS**.



Data Warehouse	Data Warehouse Service	Data Lake Insight		
Hadoop	MRS HDFS	MRS HBase	MRS Hive	Apache HDFS
	Apache HBase	Apache Hive		
Object Storage	Object Storage Service (OBS)			
File System	FTP	SFTP	HTTP	
Relational Database	RDS for MySQL	RDS for PostgreSQL	RDS for SQL Server	MySQL
	PostgreSQL	Microsoft SQL Server	Oracle	
NoSQL	Redis	MongoDB		
Messaging System	Data Ingestion Service	MRS Kafka	Apache Kafka	
Search	Elasticsearch			
Open Beta Test				

b. Click **Next** and configure the link parameters. Set **Authentication Method** to **SIMPLE** and retain the default run mode.



* Name: MRS-hdfs

* Connector: HDFS

* Hadoop Type: MRS

* Manager IP:

* Username: ad

* Password: •••

* Authentication Method: SIMPLE

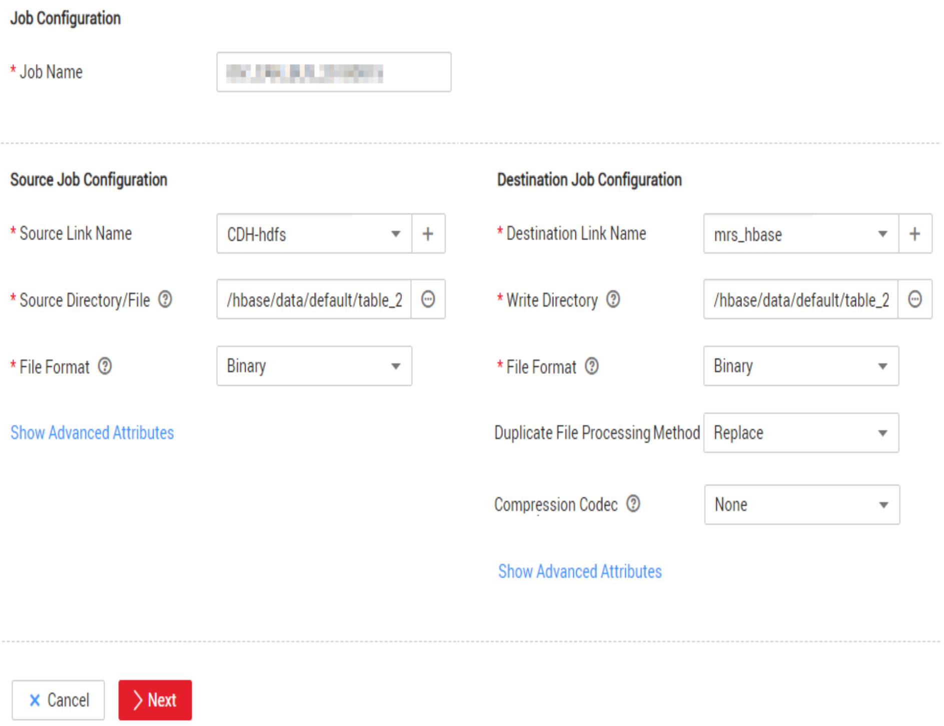
* Run Mode: EMBEDDED

Use Cluster Config: Yes [✓ No]

c. Click **Test**. If a test success message is displayed in the upper right corner, the link works properly. Click **Save**.

Creating a Migration Job on HUAWEI CLOUD CDM

1. On the job management page of the CDM cluster, choose **Table/File Migration** > **Create Job** to create jobs. Create a migration job for each table file directory.



Job Configuration

* Job Name: [redacted]

Source Job Configuration

* Source Link Name: CDH-hdfs

* Source Directory/File: /hbase/data/default/table_2

* File Format: Binary

Destination Job Configuration

* Destination Link Name: mrs_hbase

* Write Directory: /hbase/data/default/table_2

* File Format: Binary

Duplicate File Processing Method: Replace

Compression Codec: None

   – **Source Job Configuration**

      - **Source Link Name**: Select the created **CDH HDFS link**.

      - **Source Directory/File**: Select the directory where the HBase table of the CDH cluster resides. For example, **/hbase/data/default/table_20180815** indicates that all files in the **table_20180815** directory will be migrated.

      - **File Format**: Select **Binary** for copying files.

   – **Destination Job Configuration**

      - **Destination Link Name**: Select the created **MRS HDFS link**.

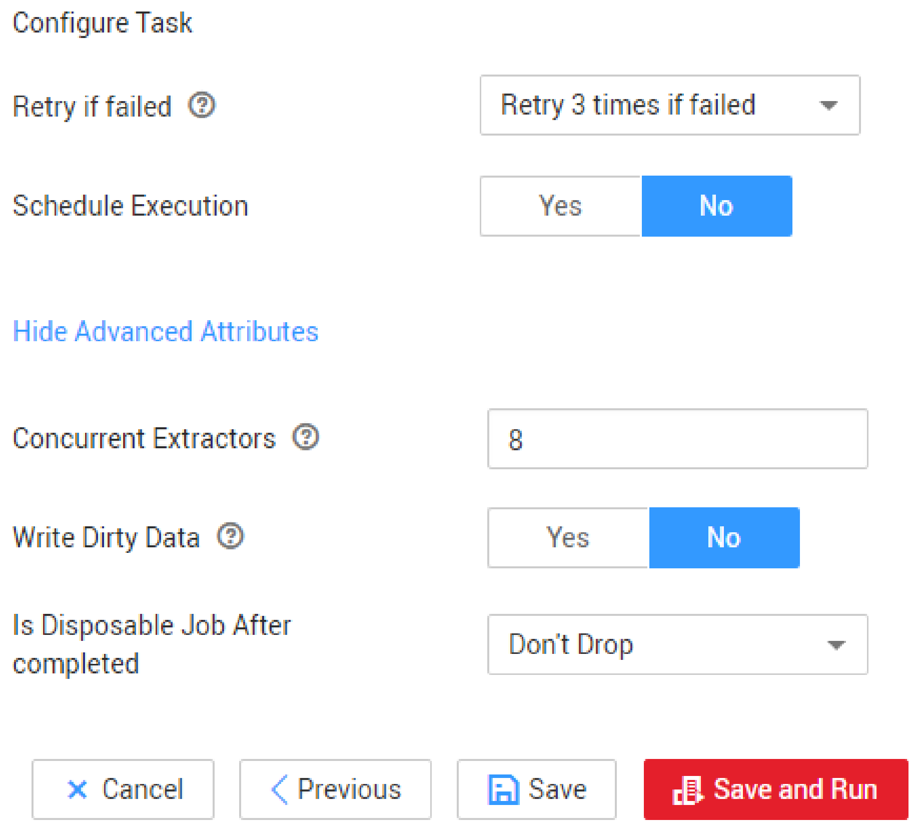
      - **Write Directory**: Select the MRS HBase directory, for example, **/hbase/data/default/table_20180815/**. The directory must carry a table name (for example, **table_20180815**). If the directory does not exist, CDM automatically creates it.

      - **File Format**: Select **Binary**.

   – Retain the default values of other parameters.

2. Click **Next** to configure the task. By default, the value of **Concurrent Extractors** is **3**. You can increase the number of concurrent extractors (set it

to **8** in this example) to improve the migration efficiency. Retain the default values of other parameters.



Configure Task

Retry if failed ⓘ: Retry 3 times if failed

Schedule Execution: Yes [✓ No]

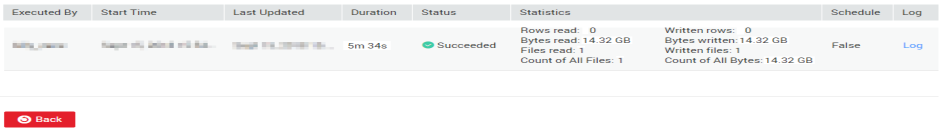
Hide Advanced Attributes

Concurrent Extractors ⓘ: 8

Write Dirty Data ⓘ: Yes [✓ No]

Is Disposable Job After completed: Don't Drop

3. Repeat the preceding operations to create migration jobs for other directories. The parameter settings are the same. The number of jobs in the two CDM clusters is evenly allocated and executed concurrently.
4. After a job is executed, you can view the detailed statistics by clicking **Historical Record** in the **Operation** column.



Executed By	Start Time	Last Updated	Duration	Status	Statistics		Schedule	Log
[redacted]	[redacted]	[redacted]	5m 34s	Succeeded	Rows read: 0 Bytes read: 14.32 GB Files read: 1 Count of All Files: 1	Written rows: 0 Bytes written: 14.32 GB Written files: 1 Count of All Bytes: 14.32 GB	False	Log

7.4 Using DES to Migrate Historical Data Generated One Month Ago

Migration Process

1. Use a script to import the historical data generated one month ago to the DES Teleport box. For details about the operations related to DES Teleport boxes, see **Data Express Service (DES)**.
2. Use DES to deliver data to HUAWEI CLOUD data center.
3. Use CDM to migrate data from DES to Object Storage Service (OBS).
4. Use CDM to migrate data from OBS to MRS.

The operations on CDM are the same as those described in **Using CDM to Migrate Data of the Last Month**. File directories are transmitted in binary format and two clusters concurrently execute jobs.

Precautions

- If the migration affects the source HDFS cluster, manually stop the job.
- If a large number of jobs fail, perform the following operations:
  a. Check whether the DES Teleport box is fully written. If the Teleport box is fully written, clear the failed directories to ensure that the data written later is complete.
  b. Check the network connectivity.
  c. Check the source HDFS cluster. Check whether indicators are abnormal. If any indicator is abnormal, suspend the migration task.

7.5 Restoring the HBase Table on MRS

After the CDH HBase table directories are migrated to MRS HBase, you can run commands to restore the directories. For data that may change, create snapshots to ensure that the data remains unchanged, and then migrate and restore the data.

Constraints

This solution supports only data migration to MRS 1.x clusters. In MRS 2.x and later versions, HBase tables cannot be rebuilt by running HBase repair commands.

NOTICE

If the target cluster version is 2.x or later, the HBase repair command is no longer supported, and the HBase data directory migration cannot be implemented.

Running Commands to Restore the Data Remaining Unchanged

For example, to restore the **/hbase/data/default/table_20180811** table, perform the following operations:

1. Access the node where MRS Client is located, for example, **master1**.
2. Run the following command to switch to user **omm**:

   su – omm
3. Run the following command to load environment variables:

   source /opt/client/bigdata_env
4. Run the following command to change the directory permission:

   hdfs dfs –chown *omm:hadoop* **–R** */hbase/data/default/table_20180811*
   - **omm:hadoop**: Indicates the username. Replace it with the actual username.
   - **/hbase/data/default/table_20180811**: Indicates the path of the table.

5. Run the following command to restore metadata:

   hbase hbck –fixMeta *table_20180811*

6. Run the command to restore regions:

   hbase hbck –fixAssignments *table_20180811*

7. If the message "Status: OK" is displayed, the table is restored successfully.

Using Snapshots to Migrate and Restore the Data that May Change

1. Run the following command in the HBase shell of the source CDH cluster:

   flush <*table name***>**

2. Run the following command in the HBase shell of the source CDH cluster:

   compact *<table name>*

3. If the Snap function is not enabled in the table, run the following command to enable the function:

   hadoop dfsadmin -allowSnapshot $path

4. Run the following commands to create an HDFS snapshot named **s0**:

   hdfs dfs -createSnapshot *<snapshotDir>* [*s0*]

   hdfs dfs -createSnapshot test

5. CDM copies files to MRS using the HDFS snapshot. Configure the migration job on CDM as follows:

   – **Source Directory/File**: **/hbase/data/default/src_test/.snapshot/s0**

   – **Write Directory**: **/hbase/data/default/***Table name*

6. Run the **fixMeta** and **fixAssignments** commands to restore the table. For details, see **Running Commands to Restore the Data Remaining Unchanged**.

7. Run the following command to delete the snapshot from the CDH cluster:

   hdfs dfs -deleteSnapshot *<snapshotDir> s0*

Rectifying the Fault That Occurs When Restoring a Table

1. After the **fixMeta** command is executed, the error message "xx inconsistent" is displayed.

   The **fixMeta** command is used to check the consistency of metadata between HDFS and HBase. This is a normal situation. Proceed to run the **fixAssignments** command.

2. After the **fixAssignments** command is executed, the error message "xx inconsistent" is displayed.

   The **fixAssignments** command is used to restore all regions. Sometimes, some regions go online slowly. You can run the following command to check whether the HBase table is successfully restored:

   hbase hbck *Table name*

   If the message "Status: OK" is displayed, the HBase table is restored successfully.

3. After the **fixAssignments** command is executed, an error message is displayed, indicating that multiple regions have the same startkey and some regions overlap.

Run the following command:

hbase hbck –fixHdfsOverlaps *Table name*

Then run the **fixMeta** and **fixAssignments** commands.