

**GaussDB**

# Best Practices

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# 1 Overview

This document provides best practices for GaussDB and guides you through buying DB instances that meet your service requirements.

Section	Introduction
<a href="#">Best Practices of Migrating Data from Oracle to GaussDB</a>	This section describes how to use DRS to migrate data from an on-premises Oracle database to Huawei Cloud GaussDB in real time.
<a href="#">GaussDB Security Best Practices</a>	This section describes the security capabilities provided by GaussDB to improve the overall security defense and protect stored data from leakage and tampering both at rest and in transit.

# 2 Best Practices of Migrating Data from Oracle to GaussDB

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## 2.1 Purpose

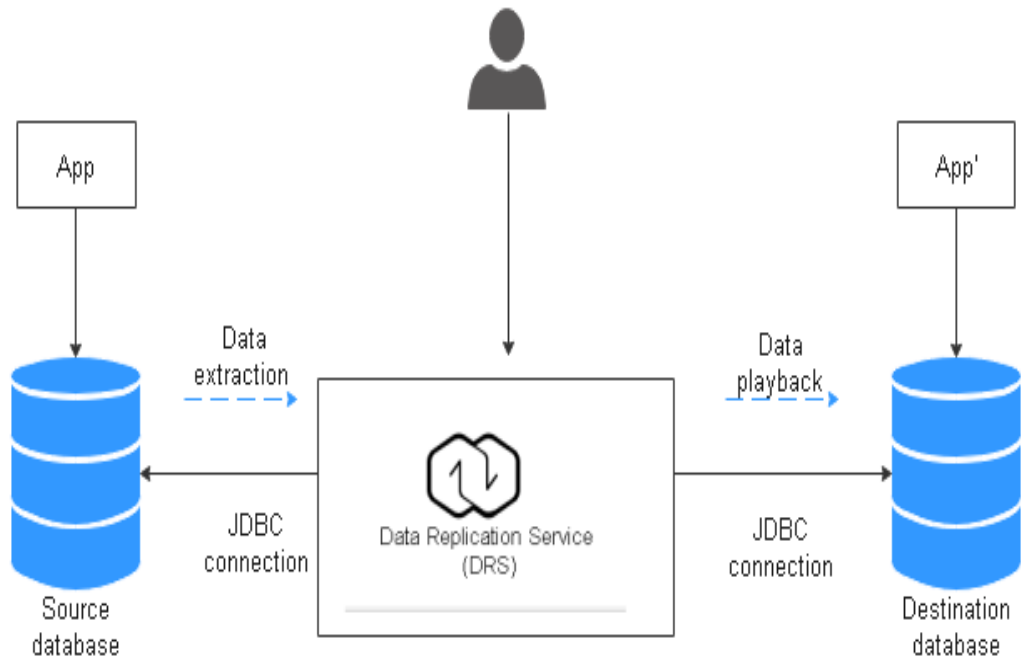
### Description

You can use real-time synchronization of Data Replication Service (DRS) to migrate data from on-premises Oracle databases to Huawei Cloud GaussDB. Full and incremental synchronization can ensure the long-term data synchronization between the source Oracle database and the destination GaussDB database.

### Problems

- With the rapid increase of enterprise workloads, traditional databases have poor scalability and distributed databases are required.
- Building traditional databases require purchasing and install servers, systems, databases, and other software. Its O&M is expensive and difficult.
- The performance of complex queries for traditional databases is poor.
- It is hard for traditional databases to smoothly migrate data without interrupting services.

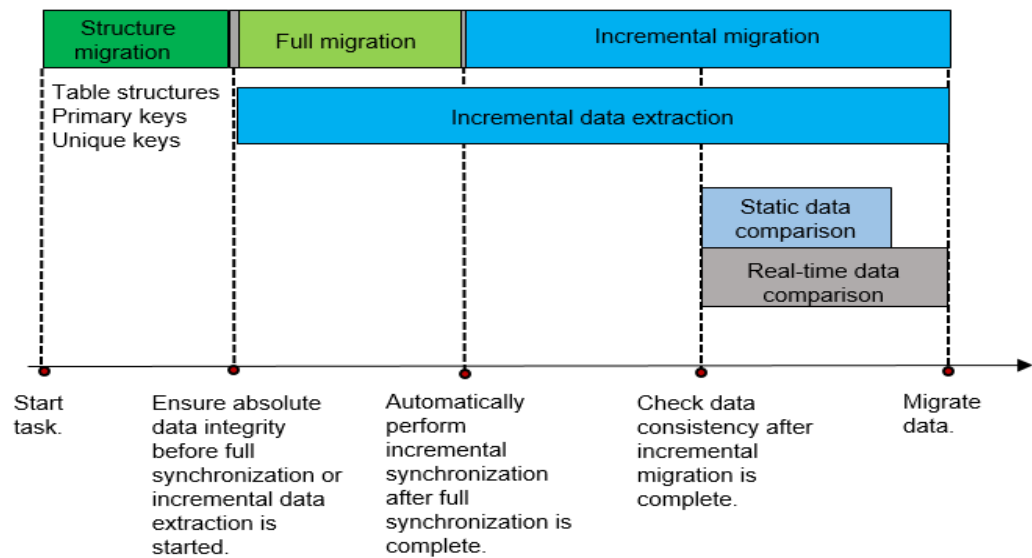
## Migration Architecture



## Migration Principles

Perform the following operations to complete full and incremental synchronization:

1. In the full synchronization phase, migrate tables, primary keys, and unique keys.
2. Start incremental data extraction to ensure that the incremental data generated during full data synchronization is completely extracted to the DRS instance.
3. Start the full migration task.
4. Automatically perform incremental synchronization after the full migration is complete. The playback starts from the location where the full migration starts.
5. Start the comparison task after the incremental replay is complete to check the data consistency. Real-time comparison is supported.
6. Start migration if the data is consistent.



## Service List

- Virtual Private Cloud (VPC)
- GaussDB
- Data Replication Service (DRS)
- Data Admin Service (DAS)

## Notes on Usage

- The resource planning in this document is for demonstration only. Adjust it as needed.
- The end-to-end test data in this document is for reference only.
- Full synchronization is used to migrate data. Incremental synchronization is used to synchronize data between the source and destination databases in real time.

## Prerequisites

- You have registered with Huawei Cloud and completed account authentication.
- Your account balance is greater than or equal to \$0 USD.
- You have set up an on-premises Oracle database for testing.
- You have obtained the IP address, port number, username, and password of the Oracle database to be migrated.

## 2.2 Resource Planning

**Table 2-1** Resource planning

Category	Subcategory	Planned Value	Remarks
VPC	VPC name	vpc-src-172	Specify a name that is easy to identify.
	Region	Test region	For low network latency and quick resource access, select the region nearest to you.
	AZ	AZ3	-
	Subnet	172.16.0.0/16	Select a subnet with sufficient network resources.
	Subnet name	subnet-src-172	Specify a name that is easy to identify.
Oracle	Name	orcl	Specify a name that is easy to identify.
	Specifications	16 vCPUs   32 GB	-
	Database version	11.2.0.1	-
	Database user	test_info	Specify a username. The user must have the following permissions during migration: CREATE SESSION, SELECT ANY TRANSACTION, SELECT ANY TABLE, SELECT ANY DICTIONARY, and EXECUTE_CATALOG_ROLE.
GaussDB	Instance name	Auto-drs-gaussdbv5-tar-1	Specify a name that is easy to identify.
	Database version	GaussDB 1.3 Enterprise Edition	-
	Instance type	Distributed (1 CN, 3 DN shards, and 3 replicas)	In this example, a distributed instance will be created.



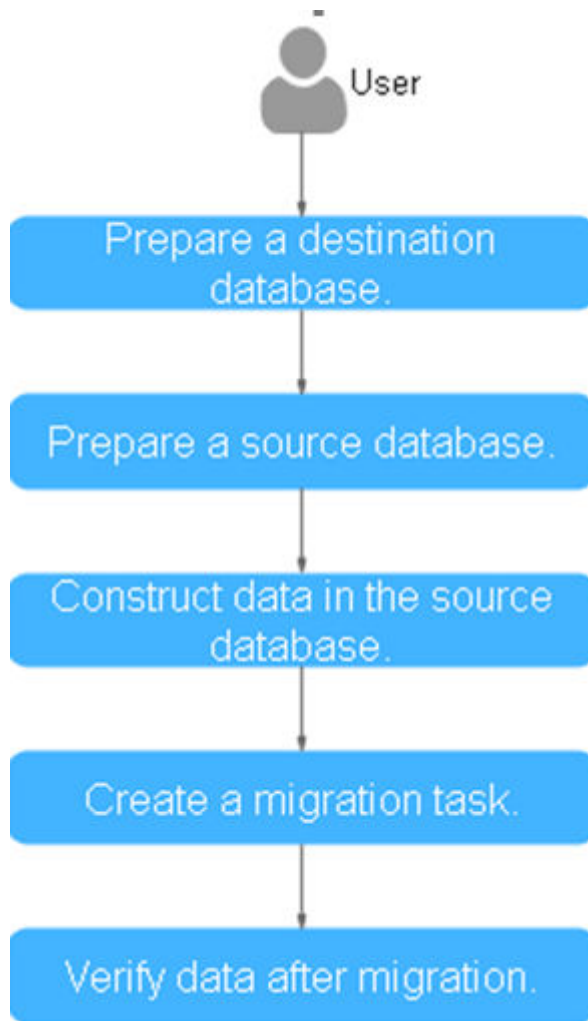
Category	Subcategory	Planned Value	Remarks
	Deployment model	Independent	-
	Transaction consistency	Strong consistency	-
	Shards	3	-
	Coordinator nodes	3	-
	Storage type	Ultra-high I/O	-
	AZ	AZ 2	In this example, a single AZ is select. You are advised to select multiple AZs to improve instance availability in actual use.
	Instance specifications	General-enhanced II: 8 vCPUs   64 GB	Small specifications are selected for this test instance. You are advised to configure specifications based on service requirements in actual use.
	Storage space	480 GB	A small storage space is selected for this test instance. You are advised to configure the storage space based on service requirements in actual use.
	Disk encryption	Disable	In this example, disk encryption is disabled. Enabling disk encryption improves the security of data, but may slightly affect the database read/write performance.
Logging in to the database through DAS	DB engine	GaussDB	-
	Database source	GaussDB	Select the GaussDB instance created in this example.
	Database name	postgres	-

Category	Subcategory	Planned Value	Remarks
	Username	root	-
	Password	-	Password for user <b>root</b> of the GaussDB instance created in this example
DRS migration task	Migration task name	DRS-test-info	Specify a name that is easy to identify.
	Destination database name	test_database_info	Specify a name that is easy to identify. The name must be compatible with the Oracle database name.
	Source DB engine	Oracle	-
	Destination DB engine	GaussDB	-
	Network type	Public	In this example, a public network is used.

## 2.3 Operation Flowchart

[Figure 2-1](#) shows the main operation flowchart.

Figure 2-1 Operation flowchart





## 2.4 Creating a VPC and Security Group

This section describes how to create a VPC and security group for the GaussDB instance you will create.

### Creating a VPC

**Step 1** Log in to the [Huawei Cloud console](#).

**Step 2** Click  in the upper left corner and select a region.

**Step 3** Click  in the upper left corner of the page and choose **Networking > Virtual Private Cloud**.

The VPC console is displayed.

**Step 4** Click **Create VPC**.

**Basic Information**

Region:

Regions are geographic areas isolated from each other. Resources are region-specific and cannot be used across regions through internal network connections. For low network latency and quick resource access, select the nearest region.

Name:

CIDR Block:  ·  ·  ·  /

Recommended: [10.0.0.0/8-24 \(Select\)](#) [172.16.0.0/12-24 \(Select\)](#) [192.168.0.0/16-24 \(Select\)](#)

⚠ The CIDR block 192.168.0.0/16 overlaps with a CIDR block of another VPC in the current region. If you intend to enable communication between VPCs or between a VPC and an on-premises data center, change the CIDR block. [View VPC CIDR blocks in current region](#)

Enterprise Project:  [Create Enterprise Project](#)

---

Advanced Settings | Tag | Description

**Default Subnet**

AZ:

Name:

CIDR Block:  ·  ·  ·  /  Available IP Addresses: 251

The CIDR block cannot be modified after the subnet has been created.

Associated Route Table:

---

Advanced Settings | Gateway | DNS Server Address | DHCP Lease Time | Tag | Description

---

[+ Add Subnet](#)

**Step 5** Configure parameters as needed and click **Create Now**.


**Step 6** Return to the VPC list and check whether the VPC is created.


If the VPC status becomes available, the VPC has been created.

----End

## Creating a Security Group

**Step 1** Log in to the [Huawei Cloud console](#).

**Step 2** Click  in the upper left corner and select a region.

**Step 3** Click  in the upper left corner of the page and choose **Networking > Virtual Private Cloud**.

The VPC console is displayed.

**Step 4** Choose **Access Control > Security Groups**.

**Step 5** Click **Create Security Group**.

**Step 6** Configure parameters as needed.

✕

### Create Security Group

★ Name

★ Enterprise Project  ↕ Create Enterprise Project ?

★ Template

Description 

The security group is for general-purpose web servers and includes default rules that allow all inbound ICMP traffic and inbound traffic on ports 22, 80, 443, and 3389. The security group is used for remote login, ping, and hosting a website on ECSs.

0/255

[Show Default Rule](#) ▼

OK
Cancel

**Step 7** Click **OK**.

**Step 8** Return to the security group list and click the security group name.

**Step 9** Click the **Inbound Rules** tab, and then click **Add Rule**.

Summary
Inbound Rules
Outbound Rules
Associated Instances

Add Rule
Fast-Add Rule
Delete
Allow Common Ports
Inbound Rules: 3 [Learn more about security group configuration.](#)

**Step 10** Configure an inbound rule, add the IP address of the source database, and click **OK**.

✕

#### Add Inbound Rule Learn more about security group configuration.

i Some security group rules will not take effect for ECSs with certain specifications. [Learn more](#)  
 If you select IP address for Source, you can enter multiple IP addresses in the same IP address box. Each IP address represents a different security group rule.

Security Group default

You can import multiple rules in a batch.

Priority ?	Action ?	Type	Protocol & Port ?	Source ?	Description	Operation
1-100	Allow ▼	IPv4 ▼	Protocols/TCP (Custo... ▼ Example: 22 or 22,24 or 22-3	IP address ▼ 0.0.0.0/0		<a href="#">Replicate</a>   <a href="#">Delete</a>

⊕ Add Rule


OK
Cancel


----End

## 2.5 Creating a GaussDB Instance

This section describes how to create a GaussDB instance as the destination database for the migration task.

**Step 1** Log in to the [Huawei Cloud console](#).

**Step 2** Click  in the upper left corner and select a region.

**Step 3** Click  in the upper left corner of the page and choose **Databases > GaussDB**.

**Step 4** In the navigation pane on the left, choose **GaussDB > Instances**.

**Step 5** Click **Buy DB Instance**.

**Step 6** Configure the instance name and basic information.

Billing Mode: Yearly/Monthly | Pay-per-use ⓘ

Region: [dropdown]

Regions are geographic areas isolated from each other. Resources are region-specific and cannot be used across regions through internal network connections. For low network latency and quick resource access, select the nearest region.

---

DB Instance Name: gauss-#963 ⓘ

DB Engine: GaussDB

DB Engine Version: 1.4 Enterprise Edition | 2.7 Enterprise Edition

DB Instance Type: Distributed | Primary/Standby

Deployment Model ⓘ: Independent

Transaction Consistency ⓘ: Strong consistency | Eventual consistency

Replicas ⓘ: [ - 3 + ]

Shards: [ - 3 + ]

Coordinator Nodes ⓘ: [ - 3 + ]

If Coordinator Nodes is set to 1, the instance can only be used for testing.

AZ: AZ3 | AZ1 | AZ2

Only one or three AZs can be selected.

Time Zone: (UTC+08:00) Beijing, Chongqing, Hong Kon... [dropdown]

**Step 7** Configure instance specifications.

Select small specifications for this test instance. You are advised to configure specifications based on service requirements in actual use.

**Step 8** Select the VPC created in [Creating a VPC](#) and security group created in [Creating a Security Group](#) for the DB instance and configure the database port.

**Step 9** Configure password and other information.

**Step 10** Click **Next**, confirm the information, and click **Submit**.

**Step 11** Go to the instance list.

If the instance status becomes available, the instance has been created.

----End

## 2.6 Constructing Data Before Migration

Before the migration, you need to construct some data types in the source database for data verification after the migration.

The following table lists data types supported by DRS.

**Table 2-2** Data type mapping

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
CHAR	character	Supported	Supported	Supported. The spaces before and after the character are ignored.	Supported. The spaces before and after the character are ignored.	-
VARCHAR	character varying	Supported	Supported	Supported	Supported	The precision ranges of the source and destination databases are different, causing precision loss.
VARCHAR2	character varying	Supported	Supported	Supported	Supported	-
NCHAR	character	Supported	Supported	Supported. The spaces before and after the character are ignored.	Supported. The spaces before and after the character are ignored.	-
NVARCHAR2	nvarchar2	Supported	Supported	Supported	Supported	-
NUMBER	numeric	Supported	Supported	Supported	Supported	-
NUMBER (6,3)	numeric(6,3)	Supported	Supported	Supported	Supported	-



Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
NUMBER (6,0)	Integer	Supported	Supported	Supported	Supported	-
NUMBER (3)	smallint	Supported	Supported	Supported	Supported	-
NUMBER (6,-2)	integer	Supported	Supported	Supported	Supported	-
BINARY_FLOAT	real	Unsupported (The destination database does not support creating tables using the primary key.)	Supported	Unsupported	Supported	The precision ranges of the source and destination databases are different, causing precision loss.
BINARY_DOUBLE	double precision	Unsupported (The destination database does not support creating tables using the primary key.)	Supported	Unsupported	Supported	-

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
FLOAT	real	Unsupported (The destination database does not support creating tables using the primary key.)	Supported	Unsupported	Supported	The precision ranges of the source and destination databases are different, causing precision loss.
INT	numeric	Supported	Supported	Supported	Supported	-
INTEGER	numeric	Supported	Supported	Supported	Supported	-

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
DATE	date	Supported	Supported	Unsupported	Supported	If a table with date type is created in the destination database, the data type precision range in the source database is different from that in the destination database, causing precision loss. Therefore, comparison is not supported.
TIMESTAMP	timestamp(6) without time zone	Supported	Supported	Unsupported	The value is accurate to six decimal places.	The maximum precision supported by the source database is 6.

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
TIMESTAMP_TZ	timestamp(6) with time zone	Unsupported (The source database does not support creating tables using the primary key.)	Supported	Unsupported	Filter this column.	-
TIMESTAMP_LTZ	timestamp(6) with time zone	Unsupported (The destination database does not support creating tables using the primary key.)	Supported	Unsupported	Filter this column.	-
INTERVAL_YM	interval year to month	Supported	Supported	Unsupported	Unsupported	Incremental synchronization does not support this type.

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
INTERVAL_DS	interval day to second	Supported	Supported	Unsupported	Unsupported	Incremental synchronization does not support this type. The maximum precision supported by the source database is 6.
BLOB	bytea	Unsupported (The source database does not support creating tables using the primary key.)	Supported	Unsupported	Filter this column.	-

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
CLOB	text	Unsupported (The source database does not support creating tables using the primary key.)	Supported	Unsupported	Filter this column.	-
NCLOB	text	Unsupported (The source database does not support creating tables using the primary key.)	Supported	Unsupported	Filter this column.	-

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
LONG	text	Unsupported (The source database does not support creating tables using the primary key.)	Supported	Unsupported	Filter this column.	-
LONG_RAW	bytea	Unsupported (The source database does not support creating tables using the primary key.)	Supported	Unsupported	Filter this column.	-

Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
RAW	bytea	Unsupported (The destination database does not support creating tables using the primary key.)	Supported	Unsupported	Supported	-
RowID	character varying(18)	Supported	Supported	Supported	Supported	-
BFILE	-	Unsupported	Unsupported	Unsupported	Unsupported	Restrictions on the source database: The bfile type is not supported.
XMLTYPE	-	Unsupported	Unsupported	Unsupported	Unsupported	Restrictions on the source database: The xmltype type is not supported.



Source Data Type	Destination Data Type	Sync (Source Data Type as Primary Key)	Sync (Source Data Type as Non-Primary Key)	Comparison (Source Data Type as Primary Key)	Comparison (Source Data Type as Non-Primary Key)	Remarks
UROWID	-	Unsupported	Unsupported	Unsupported	Unsupported	Full and incremental synchronizations are not supported.
sdo_geometry	-	Unsupported	Unsupported	Unsupported	Unsupported	Restrictions on the source database: The sdo_geometry type is not supported.
NUMBER(*, 0)	numeric	Supported	Supported	Supported	Supported	-

Perform the following steps to construct data in the source database:

**Step 1** Use a database connection tool to connect to the source Oracle database based on its IP address.

**Step 2** Construct data in the source database based on data types supported by DRS.

1. Create a test user.

**create user test\_info identified by xxx;**

*test\_info* indicates the user created for the test, and *xxx* indicates the password of the user.

2. Assign permissions to the user.

**grant dba to test\_info;**

3. Create a data table under the user.

```
CREATE TABLE test_info.DATATYPELIST(
  ID INT,
  COL_01_CHAR_____E CHAR(100),
  COL_02_NCHAR____E NCHAR(100),
  COL_03_VARCHAR___E VARCHAR(1000),
  COL_04_VARCHAR2__E VARCHAR2(1000),
```

```
COL_05_NVARCHAR2_E NVARCHAR2(1000),
COL_06_NUMBER___E NUMBER(38,0),
COL_07_FLOAT___E FLOAT(126),
COL_08_BFLOAT___E BINARY_FLOAT,
COL_09_BDOUBLE___E BINARY_DOUBLE,
COL_10_DATE___E DATE DEFAULT SYSTIMESTAMP,
COL_11_TS_____E TIMESTAMP(6),
COL_12_TSTZ___E TIMESTAMP(6) WITH TIME ZONE,
COL_13_TSLTZ___E TIMESTAMP(6) WITH LOCAL TIME ZONE,
COL_14_CLOB___E CLOB DEFAULT EMPTY_CLOB(),
COL_15_BLOB___E BLOB DEFAULT EMPTY_BLOB(),
COL_16_NCLOB___E NCLOB DEFAULT EMPTY_CLOB(),
COL_17_RAW_____E RAW(1000),
COL_19_LONGRAW___E LONG RAW,
COL_24_ROWID___E ROWID,
PRIMARY KEY(ID)
);
```

4. Insert two rows of data.



```
insert into test_info.DATATYPELIST
values(4,'huawei','xian','shanxi','zhongguo','shijie',
666,12.321,1.123,2.123,sysdate,sysdate,sysdate,sysdate,'hw','cb','df','FF','FF',
'AAAYEVAAJAAAACrAAA');
```

```
insert into test_info.DATATYPELIST values(2,'Migrate-
test','test1','test2','test3','test4',
666,12.321,1.123,2.123,sysdate,sysdate,sysdate,sysdate,'hw','cb','df','FF','FF',
'AAAYEVAAJAAAACrAAA');
```

5. Make the above statements take effect.

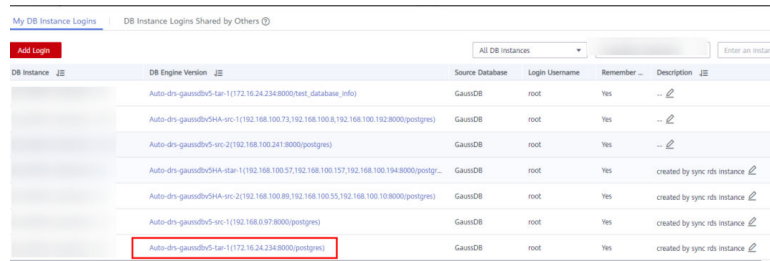
```
commit;
```

### Step 3 Create a database in the GaussDB instance.

1. Log in to the [Huawei Cloud console](#).
2. Click  in the upper left corner and select a region.
3. Click  in the upper left corner of the page and choose **Databases > Data Admin Service**.
4. In the navigation pane on the left, click **Development Tool** to go to the login list page.
5. Click **Add Login**.
6. On the displayed page, select the DB engine, source database, and target DB instance, enter the login username, password, and description (optional), and enable **Collect Metadata Periodically** and **Show Executed SQL Statements**. If **Collect Metadata Periodically** is enabled, select **Remember Password**.
7. Click **Test Connection** to check whether the connection is successful.

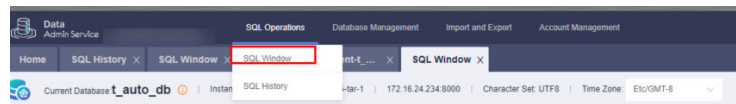
If a message is displayed indicating connection successful, continue with the operation. If a message is displayed indicating connection failed and the failure cause is provided, make modifications according to the error message.

- Click **OK**.
- Locate the added instance, click **Log In** in the **Operation** column.



DB Instance	DB Engine Version	Source Database	Login Username	Remember ...	Description
Auto-drs-gaussdbv5-lar-1172.16.24.234-8000(test_database_info)		GaussDB	root	Yes	
Auto-drs-gaussdbv5-sha-ec-1192.168.100.72.192.168.100.8.192.168.100.192.8000(postgres)		GaussDB	root	Yes	
Auto-drs-gaussdbv5-ec-2192.168.100.241.8000(postgres)		GaussDB	root	Yes	
Auto-drs-gaussdbv5-sha-star-1192.168.100.57.192.168.100.157.192.168.100.194.8000(postgres)		GaussDB	root	Yes	created by sync rds instance
Auto-drs-gaussdbv5-sha-ec-2192.168.100.89.192.168.100.55.192.168.100.10.8000(postgres)		GaussDB	root	Yes	created by sync rds instance
Auto-drs-gaussdbv5-ec-1192.168.0.97.8000(postgres)		GaussDB	root	Yes	created by sync rds instance
Auto-drs-gaussdbv5-lar-1172.16.24.234-8000(postgres)		GaussDB	root	Yes	created by sync rds instance

- Choose **SQL Operations > SQL Window** on the top menu bar.



- Run the following statement to create a database compatible with Oracle:  
**test\_database\_info** indicates the database name. Replace it based on the site requirements.  

```
CREATE DATABASE test_database_info DBCOMPATIBILITY 'ORA';
```

----End

## 2.7 Migrating the Database

This section describes how to create a DRS instance and migrate **test\_info** in the Oracle database to **test\_database\_info** in the GaussDB instance.


### Pre-migration Check

Before creating a migration task, you need to manually check the migration conditions for smooth migration.


Before the migration, you need to obtain [notes on migration to the cloud](#).

### Creating a Migration Task

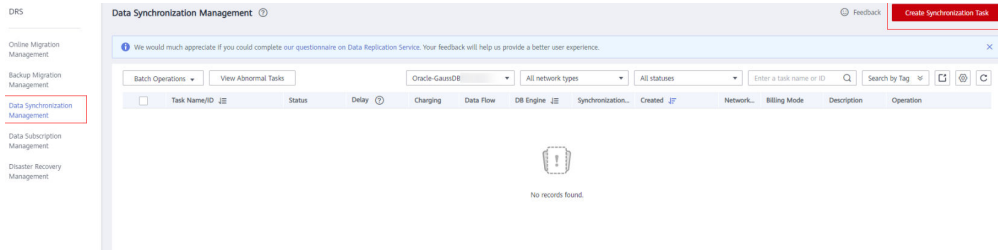
**Step 1** Log in to the [Huawei Cloud console](#).

**Step 2** Click  in the upper left corner and select a region.

Select the region in which the destination instance is located.

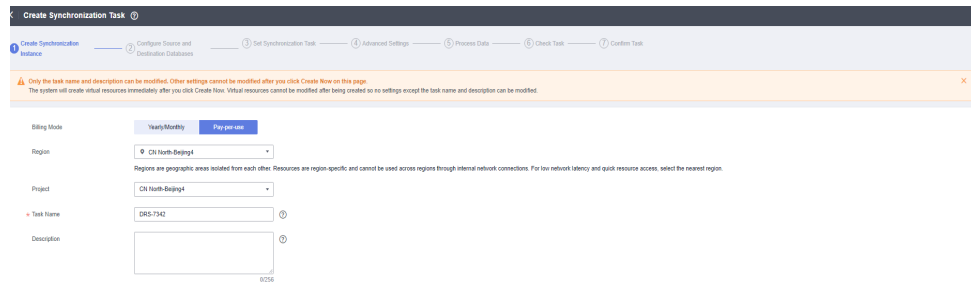
**Step 3** Click  in the upper left corner of the page and choose **Databases > Data Replication Service**.

**Step 4** In the navigation pane on the left, choose **Data Synchronization Management**. On the displayed page, click **Create Synchronization Task**.

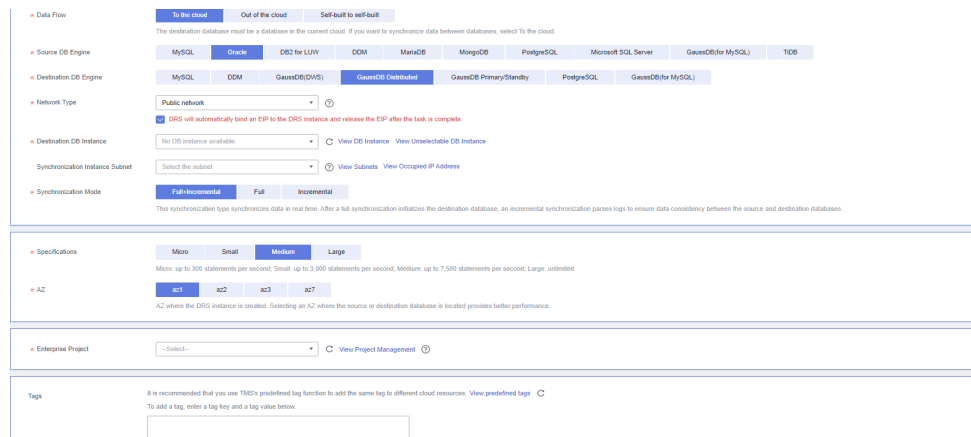


**Step 5** Configure synchronization instance information.

1. Select a region, billing mode, and project, and enter a task name.



2. Specify **Data Flow**, **Source DB Engine**, **Destination DB Engine**, **Network Type**, **Destination DB Instance**, **Synchronization Instance Subnet** (optional), **Synchronization Mode**, **Specifications**, **AZ**, **Enterprise Project**, and **Tags** (optional).



3. Click **Create Now**.

**Step 6** Configure the source and destination database information.

1. Enter the IP address, port number, username, and password of the source database.

Click **Test Connection**.

The synchronization instance is being created. This operation takes about 5 to 10 minutes to complete.

**Source Database**

System databases, users, parameters, and jobs will not be migrated. You need to manually import users and jobs to the destination database and configure parameters in parameter templates of the destination database.

IP Address or Domain Name   
For a RAC cluster, use a Scan IP address and specify Service Name to improve access performance.

Port

Database Service Name  Service Name   
?

PDB Name  ?

Database Username

Database Password

SSL Connection

This button is available only after the replication instance is created successfully.

2. Enter the username and password of the destination database. Click **Test Connection**.

**Destination Database**

DB Instance Name Auto-drs-gaussdbv5-tar-1 (172.16.24.234:8000)

Database Username

Database Password

This button is available only after the replication instance is created successfully.

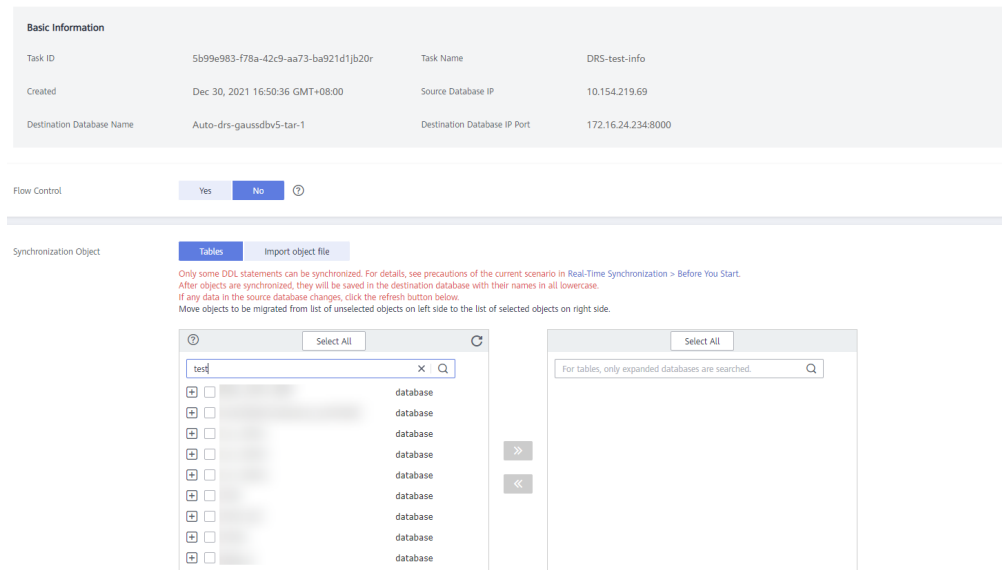
3. Click **Next**. In the displayed box, read the message carefully and click **Agree**.

**Notice**

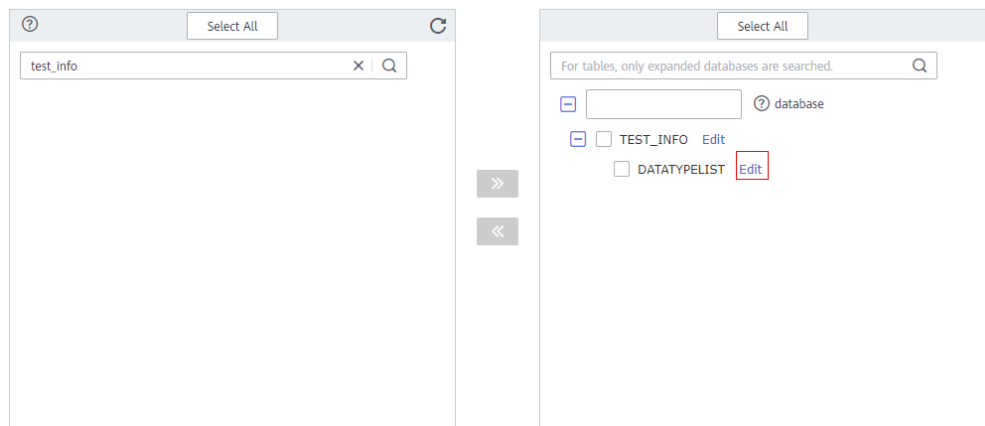
I acknowledge that the IP addresses, domain names, ports, usernames, and passwords of involved databases will be temporarily collected and used in this task. These items will be deleted after the task is deleted.

**Step 7** Set the synchronization task.

1. Select the databases and tables of the source database to be migrated. For example, select the **DATATYPELIST** table from the **test\_info** database.

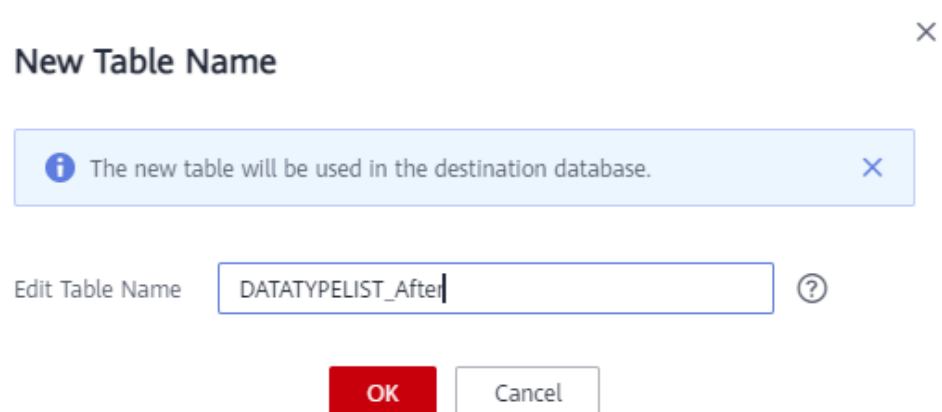


2. Locate the database and table, respectively, and click **Edit** to change the database name and table name.

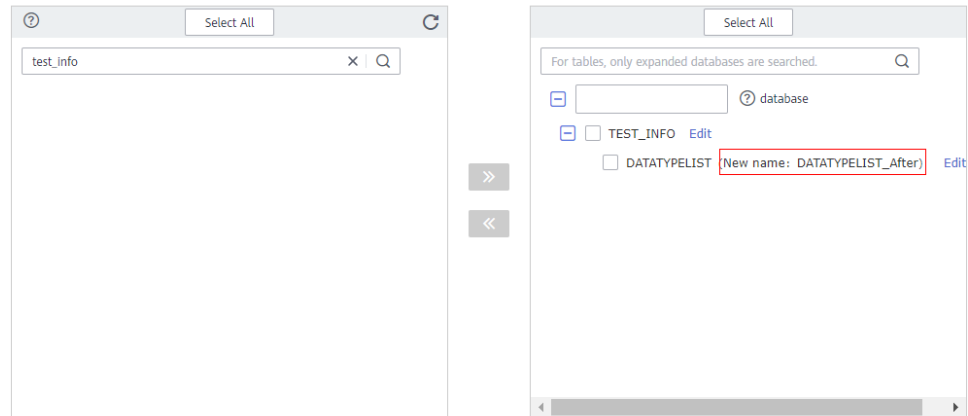


3. On the displayed box, enter the new name, for example, enter **DATATYPELIST\_After** as the new table name.

The name cannot include special characters. Otherwise, an error will be reported during SQL statement execution after the migration.

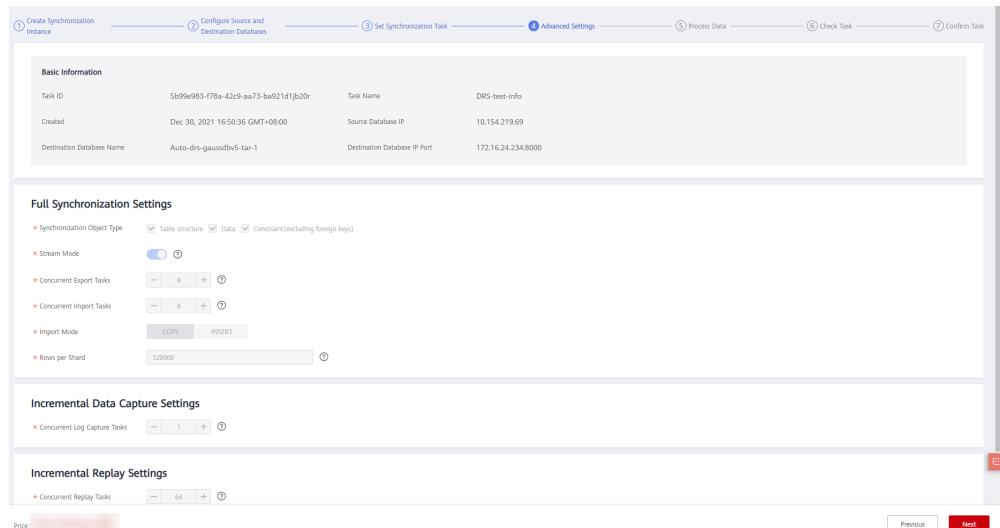


4. Confirm the settings and click **Next**.



**Step 8** Confirm advanced settings.

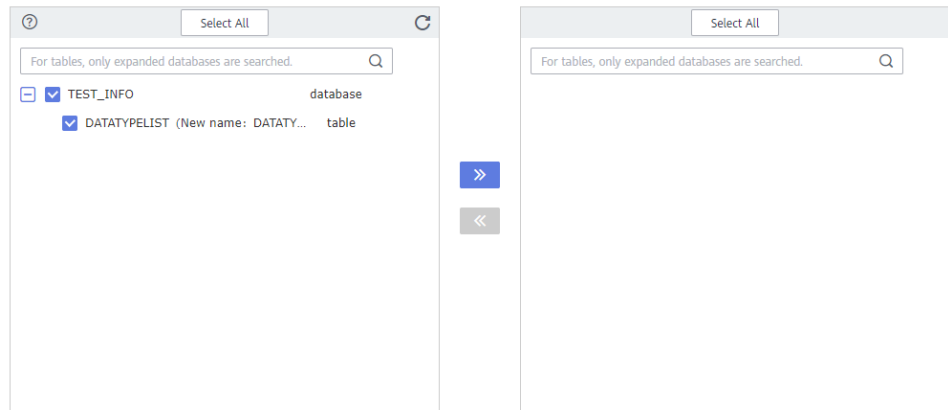
The information on the **Advanced Settings** page is for confirmation only and cannot be modified. After confirming the information, click **Next**.



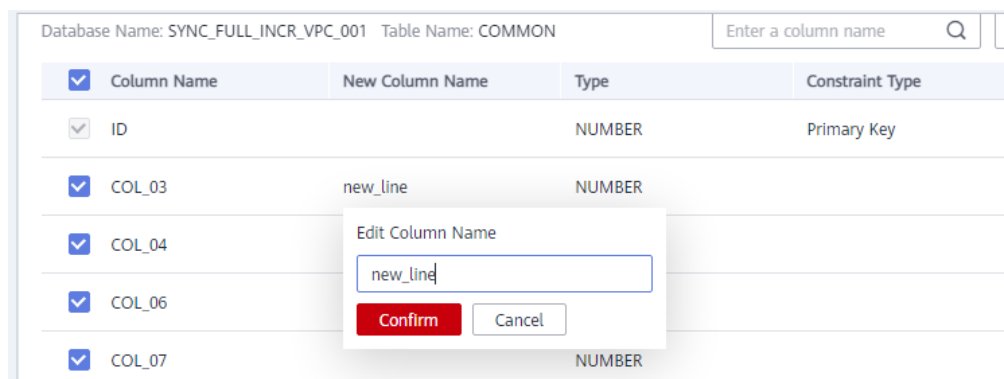
**Step 9** Process data.

On this page, you can process the table to be migrated. Select the column to be migrated and change its name, for example, change **COL\_01\_CHAR\_\_\_\_\_E** to **new-line**.

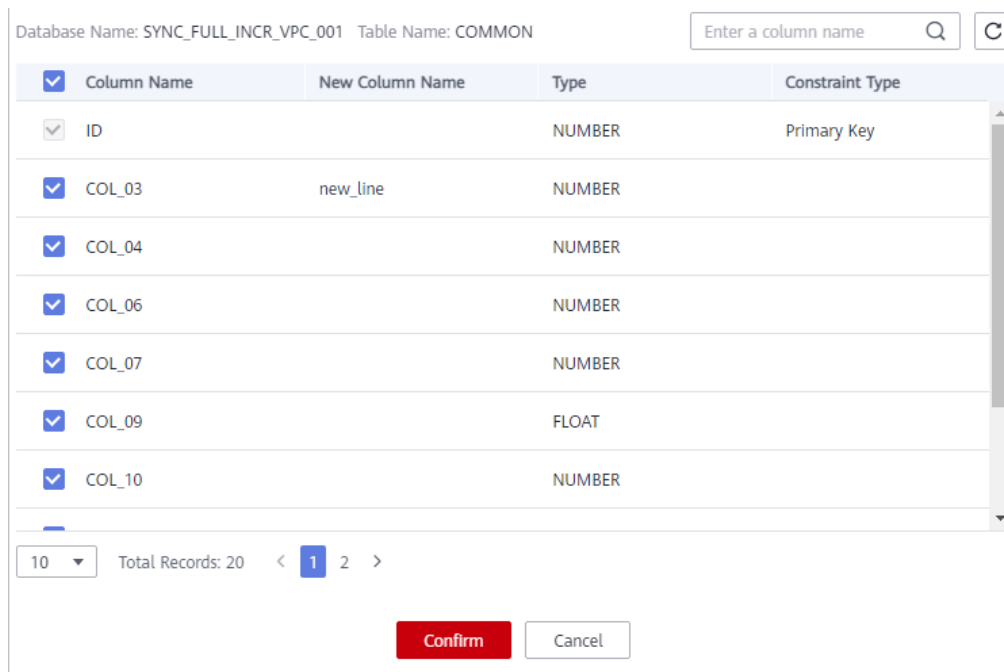
1. Select the table to be processed.



2. Select the **COL\_01\_CHAR\_\_\_\_\_E** column.



3. Enter the new name **new-line** and click **OK**.



4. Click **Next**.

**Step 10** Perform a pre-check.



1. After all settings are complete, perform a pre-check to ensure that the migration is successful.

**Basic Information**

Task ID	5b99e983-f78a-42c9-aa73-ba921d1jb20r	Task Name	DRS-test-info
Created	Dec 30, 2021 16:50:36 GMT+08:00	Source Database IP	10.154.219.69
Destination Database Name	Auto-drs-gaussdbv5-tar-1	Destination Database IP Port	172.16.24.234:8000

[Check Again](#)

Check success rate  4% All checks must pass before you can continue. If any check requires confirmation, check and confirm the results before proceeding to the next step.

Check Item	Check Result
<b>Database parameters</b>	
Whether the source database contains unsupported table field types	🔄 Checking
Whether the destination database is compatible with the source database	🔄 Checking
Whether the character set of the source database matches that of the destination database	🔄 Checking
Whether the destination database has sufficient available connections	🔄 Checking
Whether the selected objects exist in the destination database	🔄 Checking
Whether the destination database contains the configured databases	🔄 Checking
Whether there are source database foreign keys	🔄 Checking
Whether tables to be migrated contain primary keys	🔄 Checking

2. If any check fails, review the cause and rectify the fault. Then, click **Check Again**.

[Check Again](#)

Check success rate  100% All checks must pass before you can continue. If any check requires confirmation, check and confirm the results before proceeding to the next step.

Check Item	Check Result
<b>Database parameters</b>	
Whether the source database contains unsupported table field types	✅ Passed
Whether the destination database is compatible with the source database	✅ Passed
Whether the character set of the source database matches that of the destination database	✅ Passed
Whether the destination database has sufficient available connections	✅ Passed
Whether the selected objects exist in the destination database	✅ Passed
Whether the destination database contains the configured databases	✅ Passed
Whether there are source database foreign keys	✅ Passed
Whether tables to be migrated contain primary keys	✅ Passed
Whether existing data meets the constraints	✅ Passed
Whether the source database character set is supported	✅ Passed
Whether the source database has sufficient available connections	✅ Passed
Whether the source database container type is correct	✅ Passed
Whether archive logs are enabled on the source database	✅ Passed
Whether the source database name is valid	✅ Passed
Whether the supplementary log is enabled for the source database.	✅ Passed
Whether OGG log reading is enabled on the source database	✅ Passed
Whether the source database table name is valid	✅ Passed

3. If all check items are successful, click **Next**.

## Step 11 Confirm the task.

1. Check whether all configured information is correct.

Start Time 
[Start upon task creation](#)
[Start at a specified time](#)

Send Notifications  If disabled, DRS alarms, such as task failure, high latency, and frozen, cannot be received.

Stop Abnormal Tasks After  Abnormal tasks run longer than the period you set (unit: day) will automatically stop.


**Details**


Product Name	Configuration
	<b>Task Information</b>
	Name: DRS-test-info
	Description: Source Database IP Address or Domain Name: 10.154.219.69 Destination DB Instance Name: Auto-drs-gaussdbv5-tar-1
	Synchronization Mode: Full-Incremental synchronization
	Data Flow: To the cloud

2. Specify **Start Time** and select the check box before the agreement.
3. Click **Submit**.

×

### Notice

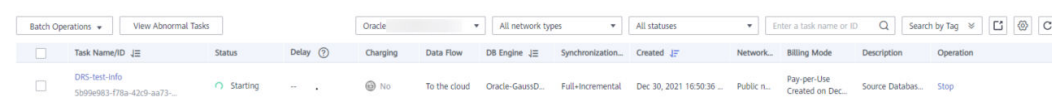
 During the synchronization, do not perform any operations on the destination DB instance through the management console. To ensure migration success, we strongly recommend that you read the [migration precautions](#) carefully before starting migration tasks and follow the instructions to ensure migration stability.

 If the task status is abnormal for more than 14 days, the task automatically stops. Pay attention to the alarms you received and handle the task in time to resume the download and avoid task retry failure.

I have read the precautions. **Submit**

**Step 12** After the task is submitted, view and manage it.

After the task is created, return to the task list to view the status of the created task.



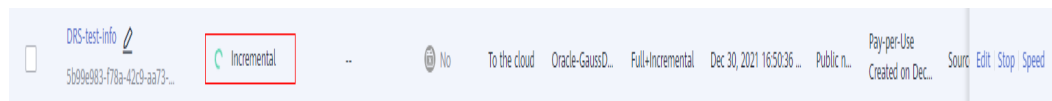
Batch Operations	View Abnormal Tasks	Oracle	All network types	All statuses	Enter a task name or ID	Search by Tag	⊞	⊞	⊞		
Task Name/ID	Status	Delay	Charging	Data Flow	DB Engine	Synchronization...	Created	Network...	Billing Mode	Description	Operation
DRS-test-info 5b99e983-776a-42c9-aa73-...	Starting	--	No	To the cloud	Oracle-GaussD...	Full+Incremental	Dec 30, 2021 16:50:36 ...	Public n...	Pay-per-Use Created on Dec...	Source Databas...	Stop

----End

## 2.8 Verifying Data After Migration

When the task status changes to **Incremental**, the full synchronization is complete. You can log in to the GaussDB console and view the data migration result.

**Step 1** Wait until the migration task status becomes **Incremental**.

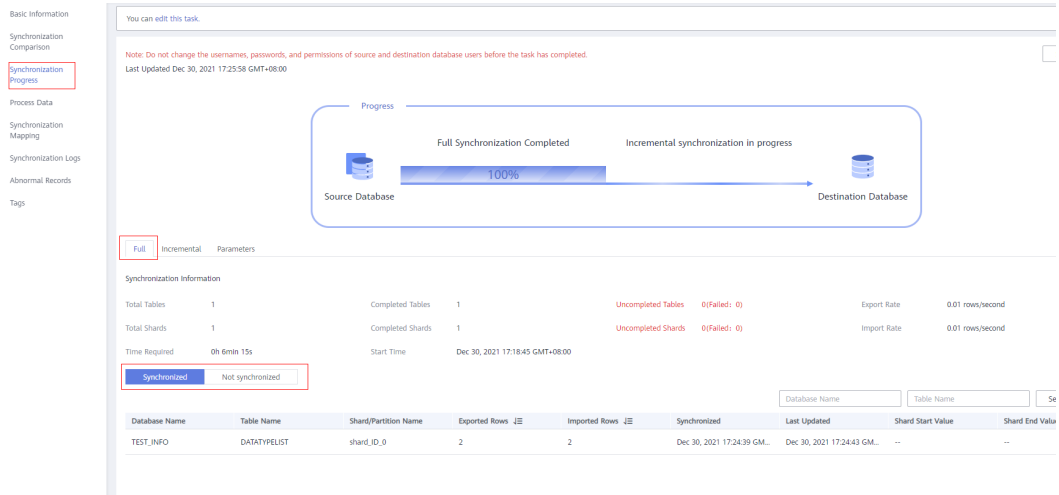


DRS-test-info 5b99e983-776a-42c9-aa73-...	Incremental	--	No	To the cloud	Oracle-GaussD...	Full+Incremental	Dec 30, 2021 16:50:36 ...	Public n...	Pay-per-Use Created on Dec...	Source	Edit	Stop	Speed
--	-------------	----	----	--------------	------------------	------------------	---------------------------	-------------	----------------------------------	--------	------	------	-------

**Step 2** Click the task name to go to the **Basic Information** page.

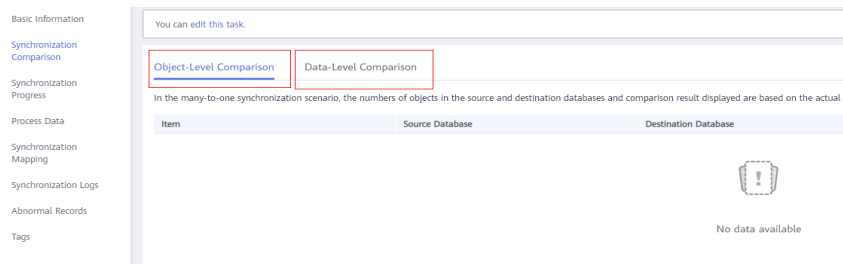
**Step 3** On the **Synchronization Progress** page, view the full synchronization result.

As shown in the following figure, the **DATATYPELIST** table in the **TEST\_INFO** database has been migrated to **shard\_0**. Two rows were migrated successfully.

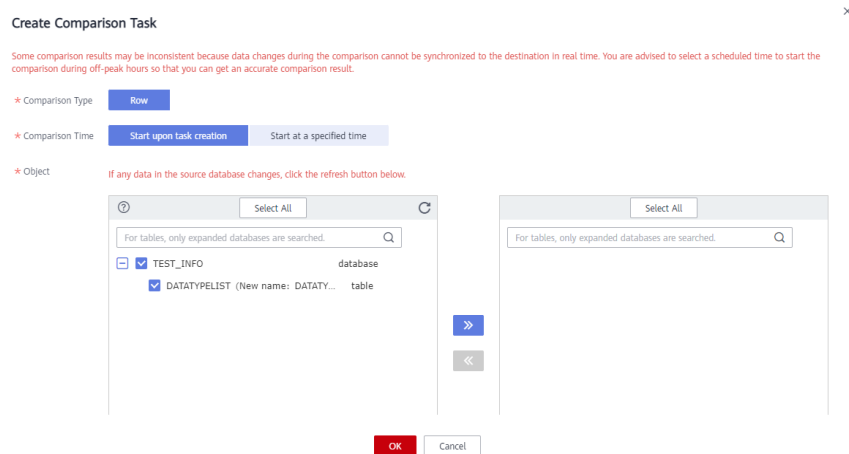


**Step 4** Verify data consistency.

1. Choose **Synchronization Comparison > Object-Level Comparison** to view the database and table migration results.



2. Choose **Synchronization Comparison > Data-Level Comparison**, click **Create Comparison Task**, and view the migration results of the rows in the table.



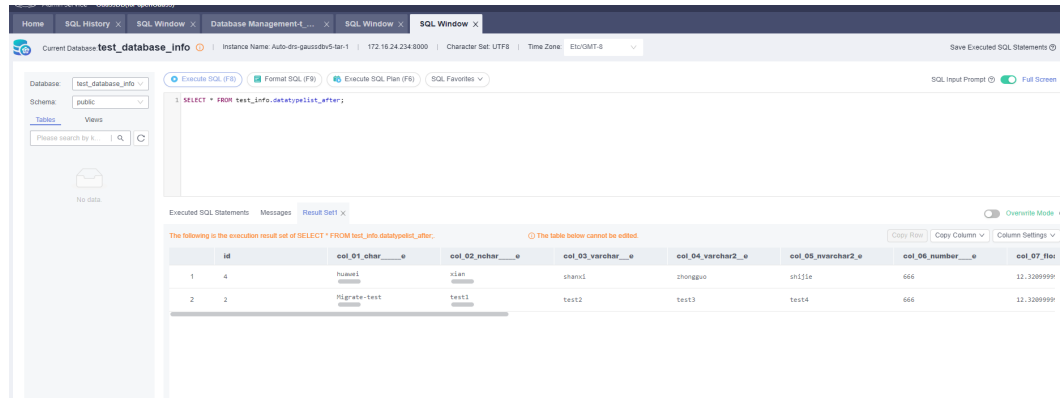
**Step 5** Connect to **test\_database\_info** in GaussDB using DAS.

**Step 6** Run the following statement to query the full synchronization result:

```
SELECT * FROM test_info.datatypelist_after;
```

After the schema in Oracle is migrated, it will be used as the schema in GaussDB. Therefore, it is required to add the schema in the query statement for exact query.

As shown in the following figure, all data types in the table were successfully migrated and the data is correct.



**Step 7** Verify incremental synchronization.

In the migration type of full and incremental synchronization, after the full synchronization is complete, the data that is written to the source database after the task is created can still be synchronized to the destination database until the task is complete. The following describes how to synchronize incremental data from the source database to the destination database.

1. Use a database connection tool to connect to the source Oracle database based on its IP address.
2. Run the following statement to insert a data record into the source database:

Insert a data record whose ID is 1.

```
insert into test_info.DATATYPEELIST values(1,'Migrate-test','test1','test2','test3','test4',666,12.321,1.123,2.123,sysdate,sysdate,sysdate,sysdate,'hw','cb','df','FF','FF','AAAYEVAJAAAACrAAA');
commit;
```

3. Run the following statement in the destination database to query the result:
 

```
SELECT * FROM test_info.datatypeelist_after;
```

As shown in the following figure, the new data inserted in the source database has been synchronized to the destination database in real time.



**Step 8** Stop the migration task.

After data is completely migrated to the destination database, stop the migration task.


1. Locate the task and click **Stop** in the **Operation** column.





2. In the display box, click **Yes**.

✕

## Stop Task

 Are you sure you want to stop this task?

Name	Status
DRS-test-info	 Incremental

 If you forcibly stop a task, the migration task will be stopped first.

✕

Force stop task

Description:  
· Once this task is stopped, it cannot be recovered.

YesNo

**Step 9** After the migration is complete, test the performance.

For details, see [Performance White Paper](#).

----End

# 3 GaussDB Security Best Practices

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## 3.1 Overview

Security is a shared responsibility between Huawei Cloud and you. Huawei Cloud is responsible for the security of cloud services to provide a secure cloud. As a tenant, you should properly use the security capabilities provided by cloud services to protect data, and securely use the cloud. For details, see [Shared Responsibilities](#).

This section provides actionable guidance for enhancing the overall security of using GaussDB. You can continuously evaluate the security status of your GaussDB and enhance their overall security defense by combining different security capabilities provided by GaussDB. By doing this, data stored in GaussDB can be protected from leakage and tampering both at rest and in transit.

## 3.2 Security

### 3.2.1 Maximum Number of Connections

If the number of GaussDB connections is too large, excessive server resources are consumed and the operation response becomes slow. You can optimize the following parameters. For details, see [Connection Settings](#).

- **max\_connections**: maximum number of concurrent connections to the database. This parameter affects the concurrency capability of the cluster.
- **max\_inner\_tool\_connections**: maximum number of concurrent connections of a tool which is allowed to connect to the database. This parameter influences the maximum concurrency of the GaussDB tool.
- **sysadmin\_reserved\_connections**: minimum number of connections reserved for the administrator. You are advised not to set this parameter to a large value. This parameter is used together with the **max\_connections** parameter. The maximum number of connections of the administrator is equal to the value of **max\_connections** + the value of **sysadmin\_reserved\_connections**.

This parameter is a POSTMASTER parameter. Set it based on instructions provided in [Setting Parameters](#).

## 3.2.2 Security Authentication

To ensure user experience and prevent accounts from being cracked, you can configure the following parameters to set the maximum number of login retries and the automatic unlocking time.

- **failed\_login\_attempts**: maximum number of failed login attempts.
- **password\_lock\_time**: number of days after which a locked account is automatically unlocked.

Once detecting that an account is stolen or the account is used to access the database without being authorized, administrators can manually lock the account. If the account becomes normal, administrators can manually unlock the account. For details, see [Setting Account Security Policies](#).

## 3.2.3 User Password Security

GaussDB enhances user account security in the following aspects:

- User passwords are stored in the **pg\_authid** system catalog. To prevent password leakage, GaussDB encrypts user passwords for storage. The encryption algorithm is determined by the **password\_encryption\_type** parameter. For details, see [Setting Password Security Policies](#).
- All passwords must have a validity period. You can configure the **password\_effect\_time** parameter to set a validity period for each database user password, and configure **password\_notify\_time** to remind you to change a password.

## 3.2.4 Permissions Management

- A VPC provides an isolated virtual network for GaussDB instances. You can configure and manage the network as required. A subnet provides dedicated network resources that are logically isolated from other networks for security. If you need to assign different permissions to different employees in your enterprise to access your DB instance resources, IAM is a good choice. For details, see [Permissions Management](#).
- To ensure database security and reliability, configure security groups before using a DB instance. For details, see [Configuring Security Group Rules](#).
- Run the following SQL statement to check whether the **PUBLIC** role has the **CREATE** permission in public schema. If so, any user can create and modify tables or database objects in public schema.

```
SELECT CAST(has_schema_privilege('public','public','CREATE') AS TEXT);
```

- If **TRUE** is returned, run the following SQL statement to revoke the permission:

```
REVOKE CREATE ON SCHEMA public FROM PUBLIC;
```

- All users are attached to the **PUBLIC** role. If all permissions of an object are granted to the **PUBLIC** role, any user can inherit all the permissions of the object, which violates the principle of least privilege. For this reason, this role should have the fewest permissions for database security purposes. Run the following SQL statement to check whether all permissions are granted to the **PUBLIC** role:

```
SELECT relname,relacl FROM pg_class WHERE (CAST(relacl AS TEXT) LIKE '%,=arwdDxt/%}' OR CAST(relacl AS TEXT) LIKE '{=arwdDxt/%}') AND (CAST(relacl AS TEXT) LIKE '%,=APmiv/%}' OR CAST(relacl AS TEXT) LIKE '{=APmiv/%}');
```

- If the returned value is empty, all permissions have been granted. In this case, run the following SQL statement to revoke the permissions:

```
REVOKE ALL ON <OBJECT_NAME> FROM PUBLIC;
```

- The **pg\_authid** system catalog in the **pg\_catalog** schema contains information about all roles in a database. To prevent sensitive information from being disclosed or modified, the **PUBLIC** role is not allowed to have any permission on this system catalog. Run the following SQL statement to check whether permissions on the **pg\_authid** system catalog have been granted:

```
SELECT relname,relacl FROM pg_class WHERE relname = 'pg_authid' AND CAST(relacl AS TEXT) LIKE '%,=%}';
```

- If the returned value is not empty, the permissions have been granted. In this case, run the following SQL statement to revoke the permissions:

```
REVOKE ALL ON pg_authid FROM PUBLIC;
```

- Common users are non-administrator users who perform common service operations. Common users should not have management permissions beyond their normal permission scope, such as permissions for creating roles, permissions for creating databases, audit permissions, monitoring permissions, O&M permissions, and security policy permissions. To minimize common user permissions while meeting normal service requirements, unnecessary management permissions of common users should be revoked.
- The SECURITY DEFINER function is executed with the permissions of the creator. Improper use of SECURITY DEFINER may cause the function executor to perform unauthorized operations with the permissions of the creator. For this reason, ensure that this function is not misused. For security purposes, the **PUBLIC** role is not allowed to execute functions of the SECURITY DEFINER type. Run the following SQL statement to check whether the **PUBLIC** role has functions of the SECURITY DEFINER type:

```
SELECT a.proname, b.nspname FROM pg_proc a, pg_namespace b where a.pronamespace=b.oid and b.nspname <> 'pg_catalog' and a.prosecdef='t';
```

- If the returned value is not empty, run the following SQL statement to check whether a user has the **EXECUTE** permission:

```
SELECT CAST(has_function_privilege('public',  
'function_name([arg_type][, ...])', 'EXECUTE') AS TEXT);
```

- If **TRUE** is returned, the user has the permission. In this case, run the following SQL statement to revoke the permission:

```
REVOKE EXECUTE ON FUNCTION function_name([arg_type][, ...])  
FROM PUBLIC;
```

- The SECURITY INVOKER function is executed with the permissions of the invoker. Improper use of SECURITY INVOKER may cause the function creator to perform unauthorized operations with the permissions of the executor. Before invoking a function not created by yourself, check the function content to prevent the function creator from performing unauthorized operations with your permissions.



### 3.2.5 Database Audit

- GaussDB can record operations you perform on your DB instances. However, only operations supported by Cloud Trace Service (CTS) can be recorded. View the supported operations before performing operations. For details, see [Key Operations Supported by CTS](#).
- Ensure that the audit function for adding, deleting, and modifying database objects is enabled. For details, see [Database Audit](#).
- To view audit logs in a visualized manner, enable **Upload Audit Logs to LTS**. For details, see [Uploading Audit Logs to LTS](#).

### 3.2.6 WAL Archiving

Write Ahead Log (WAL) is also called Xlog. The parameter **wal\_level** specifies the level of information to be written into a WAL. To enable read-only queries on a standby node, you need to set the **wal\_level** parameter to **hot\_standby** on the primary node and **hot\_standby** to **on** on the standby node. In a distributed environment, **hot\_standby** cannot be set to **off** and **wal\_level** cannot be set to **archive** or **minimal**. Otherwise, a database cannot be started. You are advised to use the default value (**hot\_standby**) of **wal\_level**.

### 3.2.7 Backup Management

GaussDB lets you back up and restore instances in unencrypted form to ensure data reliability. To prevent data loss caused by misoperations or service exceptions, you can:

- Configure automated backups and create manual backups. For details, see [Working with Backups](#). When you create a GaussDB instance, the instance-level automated backup policy is enabled by default. After your instance is created, you can modify the automated backup policy as needed.
- [Configure an automated backup policy](#) to periodically back up data.
- [Export backup information](#).