Database and Application Migration UGO 24.9.0

Quick Start

Issue	01
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Contents

1 Database Evaluation

UGO collects basic information and performance data of a source database, as well as SQL statements of specific object types, and provides an overview of the source database. Based on the analysis of factors such as compatibility and object complexity, UGO provides an analysis report on the compatibility and reconstruction cost of the source and target databases, helping you select a suitable target database and evaluate migration workloads.

The database needs to be evaluated before its objects are migrated using UGO.

1.1 Preparations

User Permissions

You need to obtain permissions to create an evaluation project. For details, see **Permission Management**.

Network Configurations

1. Check whether a source database and UGO are connected. Currently, they can be connected only over a public network.
2. Enable the source database firewall to allow UGO to access a local database.
3. Check whether the access whitelist of the source database allows UGO. The method of adding a whitelist entry varies depending on the database type. For details, see official documents.
4. Set the maximum number of connections for the source database. The parameters and modification methods vary depending on the database type. For details, see official documents.
5. Check whether the database connection information is correct, including IP address, database service name, username, and password.

Source Database Permissions

Before using UGO to evaluate a database, you need to create a database account for data collection and obtain access permissions.

- Grant DBA permissions when Oracle is used as the source database.

a. Create a user. *USER* indicates a database username.
```
CREATE USER user IDENTIFIED BY password;
```

b. Grant the login permission to the user.
```
GRANT CONNECT TO user;
```

c. Grant DBA permissions to the user.
```
GRANT DBA TO user;
```

- Grant non-DBA permissions when Oracle is used as the source database.

a. Create a user. *USER* indicates a database username.
```
CREATE USER user IDENTIFIED BY password;
```

b. Grant the login permission to the user.
```
GRANT CONNECT TO user;
```

c. Grant the SELECT_CATALOG_ROLE permission to the user, so that the user can obtain DDL statements of objects from a data dictionary. If the user does not have this permission, the permission check fails and the user is unable to proceed to next steps.
```
GRANT SELECT_CATALOG_ROLE TO user;
GRANT SELECT ANY DICTIONARY TO user;
```

NOTICE

When the source database type is Oracle, the user must obtain the DBMS_METADATA, dynamic view, and schema object counting permissions. To ensure that DDLs returned by DBMS_METADATA.GET_DDL are consistent, UGO needs to format the captured SQL statements. So a non-read-only account is required. When UGO is being connected, you need to set export parameters. The settings are valid only for the collected DDLs. Only sessions will be affected, and the source database will not. The following parameters need to be set:

- Make table constraints and indexes a part of the CREATE TABLE statements.
```
DBMS_METADATA.SET_TRANSFORM_PARAM(dbms_metadata.SESSION_TRANSFORM,
'CONSTRAINTS_AS_ALTER', false)
```

- Ensure that there are no collation clauses in the exported DDLs.
```
DBMS_METADATA.SET_TRANSFORM_PARAM(dbms_metadata.SESSION_TRANSFORM,
'COLLATION_CLAUSE', 'NEVER')
```

- Add a semicolon (;) to each collected SQL statement.
```
DBMS_METADATA.SET_TRANSFORM_PARAM(dbms_metadata.SESSION_TRANSFORM,
'SQLTERMINATOR', true)
```

- Grant query and PROCESS permissions on the MySQL system database and all permissions on a database to be migrated when MySQL is used as the source database. In MySQL 8.0 and later versions, if there are stored procedures and functions, grant the SHOW_ROUTINE permission as well.

a. Create a user. *db-user* indicates a database username.
```
CREATE USER db-user IDENTIFIED BY passwd;
```

b. Grants user permissions. By default, when UGO connects to the MySQL database, the user needs to obtain permissions to access the MySQL database.
```
GRANT SELECT ON mysql.* TO db-user;
```

c. Grant the PROCESS permission to view all tables in information_schema.
```
GRANT PROCESS ON *.* TO db-user;
```

    d. Grant the following permissions to objects to be collected:
```
GRANT SELECT ON schema-name.* TO db-user;
GRANT SHOW VIEW ON schema-name.* TO db-user;
GRANT TRIGGER ON schema-name.* TO db-user;
```

          📖 **NOTE**

          To collect all schemas, replace *<schema-name>.** with **.** to grant the permission of collecting all objects.

    e. In MySQL 8.0.20 and later versions, if there are stored procedures and functions, grant the following permission as well:
```
GRANT SHOW_ROUTINE ON *.* TO db-user;
```

- Grant query and PROCESS permissions on the GoldenDB system database and all permissions on a database to be migrated when GoldenDB is used as the source database. If there are stored procedures and functions, grant the SHOW_ROUTINE permission as well.

    a. Create a user. *db-user* indicates a database username.
```
CREATE USER db-user IDENTIFIED BY passwd;
```

    b. Grant permissions to collect user and role information in GoldenDB system table **mysql.user**.
```
GRANT SELECT ON mysql.user TO db-user;
```

    c. Grant the PROCESS permission to view all tables in information_schema.
```
GRANT PROCESS ON *.* TO db-user;
```

    d. Grant the following permissions to objects to be collected:
```
GRANT SELECT ON schema-name.* TO db-user;
GRANT SHOW VIEW ON schema-name.* TO db-user;
GRANT TRIGGER ON schema-name.* TO db-user;
```

          📖 **NOTE**

          To collect all schemas, replace *<schema-name>.** with **.** to grant the permission of collecting all objects.

    e. In MySQL 8.0.20 and later versions, if there are stored procedures and functions, grant the following permission as well:
```
GRANT SHOW_ROUTINE ON *.* TO db-user
```

    📖 **NOTE**

    MySQL or GoldenDB as the source database: If a user is granted to the global SELECT permission and the SHOW_ROUTINE permission. No other permissions are required.

- Grant the VIEW DEFINITION permission when Microsoft SQL Server is used as the source database.

    a. Create login user **login-user**.
```
CREATE LOGIN login-user WITH PASSWORD=password,DEFAULT_DATABASE =database;
```

    b. Create database user **db-user**.
```
CREATE USER db-user FOR LOGIN login-user;
```

    c. Grant the user permissions to query metadata and table structures.
```
GRANT VIEW DEFINITION ON DATABASE :: database TO db-user;
```

    d. Grant the permission to query dependencies to the user.
```
GRANT SELECT ON OBJECT :: sys.sql_expression_dependencies TO db-user;
```

1.2 Creating an Evaluation Project

Scenarios

Based on basic information (including the number of schemas) about the source database and SQL statements of specific objects, UGO generates a report to evaluate workloads and risks before database migration and recommends a suitable target database, helping you make decisions and work plans during migration.

Suggestions

- To collect objects, UGO needs to connect to the source database, which may affect the database performance. You are advised to use a database in a non-production environment or perform database evaluation during off-peak hours.

- GoldenDB as the source database: Create an evaluation task as a CN user.

Constraints

- If the source database type is MySQL or GoldenDB, the username cannot contain special characters, such as single quotation marks ('), double quotation marks ("), and backslashes (\).

- UGO cannot evaluate overloaded functions with the same name in the same source database.

- Each user can create up to 10 evaluation projects.

Procedure

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **Schema Migration** > **DB Evaluation**.

Step 3 Click **Create Project** in the upper right corner.

Step 4 Read **Source Database Preparation and Authorization Tips** and click **Create**.

Step 5 Enter basic information on the **Basic Information** page. **Table 1-1** describes details about the parameters.

Figure 1-1 Evaluation project creation

Step 6 After entering the basic information, click **Test**.

- If the connection test succeeds, the **Next** button will be available.

- If the connection test fails, an error message is displayed, indicating that **the database cannot be connected**. For details, see **Database Connection Error**.

Step 7 (Optional) Test network stability. A successful network stability test only means that there is a little network latency or packet loss, or no packet loss at the current time. The test lasts for 10 to 15 seconds.

Step 8 Click **Next** to go to the **Precheck** page.

Figure 1-2 Prechecking permissions of Oracle database

Step 9 After all check items are passed, click **Next** to go to the **Evaluation Scope Selection** page. **Table 1-2** and **Table 1-3** describe details about the parameters.

Figure 1-3 Selecting evaluation scope

📖 **NOTE**

- Only selected database objects are collected.
- All collected data is stored in the source database of the tenant. The database password encrypted before being saved. Related data is visible only to you on the UGO console.
- When a user deletes an evaluation task, the user data is deleted.
- Dynamic SQL evaluation and object-level permission collection are available only for Oracle databases.

Step 10 Click **Next** to go to the **Confirmation** page.

- The basic information, pre-check results, selected target databases, selected and unselected schemas and object types are displayed.
- If the source database type is GoldenDB, the database configuration and instance quantity are not displayed.
- If the source database type is Microsoft SQL Server, database OS, connection string, database time zone, database configuration, and database memory are not displayed.

Figure 1-4 Confirming information (Oracle as the source database)
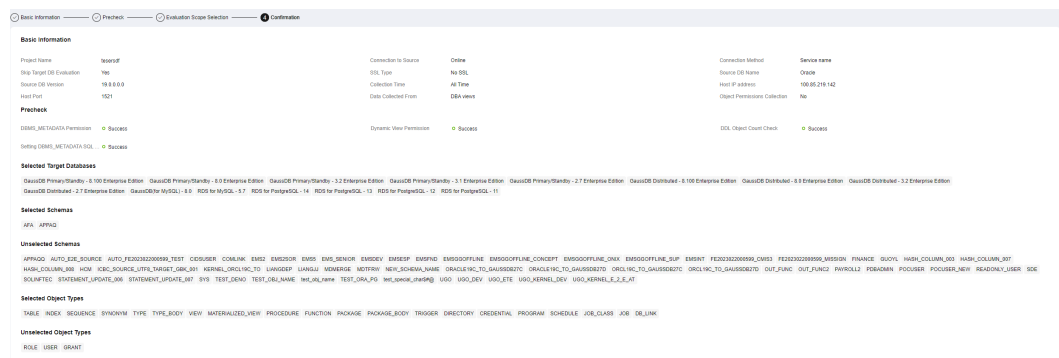
📖 **NOTE**

The parameters displayed on the task confirmation page vary depending on the source database.

Step 11 Verify the settings and click **Create**. A message is displayed, indicating that the project is created.

Step 12 Click **OK** to go to the **DB Evaluation** page. You can view the evaluation project you created in the list.

Data collection, project evaluation, pre-migration evaluation are required. You can view the status in the **Project Status** column. You can stop a project that is being evaluated or resume a stopped project.

Figure 1-5 Viewing the created project

 NOTE

- You can create up to 10 evaluation projects.
- Before **Project Status** of an evaluation project becomes **In progress. Confirm Target DB Pending**, you can stop and continue the creation of the project. When the **Project Status** is **In progress. Confirm Target DB Pending**, you can confirm a target database by following **Confirming the Target Database** or re-evaluate objects. However, if the source database type is GoldenDB, re-evaluation is not supported.
- The evaluation time varies depending on the number of objects selected.
- After the evaluation is complete, click a project name to view the result by following **Viewing the Database Evaluation Result**.
- During data collection, the system periodically automatically retries the connection to the source database. Next connection retry time: Current time + Time required for checking the connection and network stability + Sleep retry interval. After a connection test, there is several second delay before a network stability check can be performed. You may see a few seconds difference between the two retry times.

----End

Parameters

Table 1-1 Basic information

Parameter	Description
Project Name	Enter a project name. The name is unique. It can contain 5 to 50 characters and must start with a letter and end with a digit or letter. Only letters (case-insensitive), digits, underscores (_), and hyphens (-) are allowed.
(Optional) Exception Notification Mode	**SMN Topic** Specifies whether to report exceptions through Simple Message Notification (SMN). To create an SMN topic, see **Creating a Topic**. **NOTE** 　**Follow-up Operation** 　After the topic is created, you can **add a subscription**. After the subscription has been confirmed, alarm notifications will be sent to the subscription endpoint via SMN.
Enterprise Project	If you have been associated with an enterprise project, select the target project from the **Enterprise Project** drop-down list. You can also go to the project management console to create a project. For details about how to create a project, see *Enterprise Management User Guide*.

Parameter	Description
Source DB Type	Select a source database type. For details about supported source database types, see **Supported Databases**. If you want to select GoldenDB, Microsoft SQL Server 2012/14/16/17/19/22, or PostgreSQL 10/11/12/13/14/15 as the source database, submit an application by choosing **Service Tickets > Create Service Ticket** in the upper right corner of the console. **NOTE** If the source database type is MySQL, run the following command on the source database to enable the CPU count function. **SET GLOBAL innodb_monitor_enable = cpu_n;**
(Optional) Network Type	**Public Network**: An elastic IP address (EIP) is used to connect to the source database. If the source database network is restricted by the IP address whitelist, add the EIP to the source database network whitelist to ensure that the UGO can connect to the source database. ● EIP in AP-Singapore: 110.238.109.54 ● EIP in LA-Santiago: 159.138.116.198

Parameter	Description
Connection Method	Select **Service name** or **Connection string**. **Service name** is used by default. The following uses **Service name** as an example. Subsequent parameters vary depending on your selection of this parameter. ● Oracle: 　Compatible with JDBC formats of IPv4: 　– ip:port:databaseName 　– ip:port/databaseName 　– jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCP)(HOST=ip)(PORT=port)))(CONNECT_DATA=(SERVICE_NAME=databaseName))) 　– jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)(HOST=ip)(PORT=port)))(CONNECT_DATA=(SERVICE_NAME=databaseName))) ● MySQL: 　Compatible with JDBC formats of IPv4: 　– jdbc:mysql://ip:port/databaseName?useUnicode=true&characterEncoding=UTF-8 　– jdbc:mysql://ip:port/databaseName?useUnicode=true&characterEncoding=UTF-8&useSSL=true&requireSSL=true 　– jdbc:mysql://ip:port/databaseName?useUnicode=true&characterEncoding=UTF-8&allowPublicKeyRetrieval=true 　– jdbc:mysql://address=(protocol=tcp)(host=ip)(port=port)/databaseName?useUnicode=true&characterEncoding=UTF-8 　– jdbc:mysql://address=(protocol=tcp)(host=ip)(port=port)/databaseName?useUnicode=true&characterEncoding=UTF-8&useSSL=true&requireSSL=true 　– jdbc:mysql://address=(protocol=tcp)(host=ip)(port=port)/databaseName?useUnicode=true&characterEncoding=UTF-8&allowPublicKeyRetrieval=true ● PostgreSQL: 　Compatible with JDBC formats of IPv4: 　– jdbc:postgresql://ip:port/databaseName ● GoldenDB: 　Compatible with JDBC formats of IPv4: 　– jdbc:mysql://ip:port/databaseName?useUnicode=true&characterEncoding=UTF-8 　– jdbc:mysql://ip:port/databaseName?useUnicode=true&characterEncoding=UTF-8&useSSL=true&requireSSL=true

Parameter	Description
	– jdbc:mysql://ip:port/databaseName?useUnicode=true&characterEncoding=UTF-8&allowPublicKeyRetrieval=true – jdbc:mysql://address=(protocol=tcp)(host=ip)(port=port)/databaseName?useUnicode=true&characterEncoding=UTF-8 – jdbc:mysql://address=(protocol=tcp)(host=ip)(port=port)/databaseName?useUnicode=true&characterEncoding=UTF-8&useSSL=true&requireSSL=true – jdbc:mysql://address=(protocol=tcp)(host=ip)(port=port)/databaseName?useUnicode=true&characterEncoding=UTF-8&allowPublicKeyRetrieval=true **NOTE** ● For connection string, standard JDBC is used to connect to the source database. ● If the source database type is Microsoft SQL Server, only **Service name** can be selected.
Host Type	Select **Hostname** or **Host IP address**.
Hostname or Host IP Address	**Host IP Address**: IPv6 addresses are not supported. **Hostname**: ● The host name cannot be empty. ● You can enter multiple host names and use commas (,) to separate them. All host names can contain up to 1,024 characters. ● A host name can contain a maximum of 253 characters and cannot contain the following special characters: '!', '@', '#', '$', '%', '^', '&', '*', '(', ')', '+', '=', '[', ']', '{', '}', '|', '\\', ':', ';', '<', '>', ',', '?', '/'
DB Name	Name of a source database to be evaluated. The source database name: ● Consists of letters, digits, periods (.), underscores (_), hyphens (-), dollar signs ($), and number signs (#). ● Contains 2 to 128 characters. ● Starts with a letter, digit, dot (.), underscore (_), or hyphen (-) and can be enclosed in quotation marks ("). **NOTE** This parameter is not displayed when the source database type is MySQL.
Host Port	Enter a database port. The port number ranges from 1 to 65535.

Parameter	Description
Username	Enter the username of the source database. It can contain up to 128 characters. You are advised to use the administrator username. The username can contain 2 to 128 characters and must start with a letter, digit, period (.), underscore (_), or hyphen (-). Only letters, digits, periods (.), underscores (_), hyphens (-), dollar signs ($), and number signs (#) are allowed. The username can be enclosed in double quotation marks ("").
Password	Enter the password of the source database. The value contains up to 50 characters.

SSL Type	Select **No SSL**. Currently, **One-way SSL** is unavailable.
	● **No SSL**: The SSL security protocol is disabled. There may be potential security risks.
	● **One-way SSL**: The target database will be authenticated and transmission will be encrypted.
	  – **Upload**: Upload the root certificate file in JKS format.
	  – **Trust Store Password**: Enter the password of the trust store used to access the certificate.
	NOTE
	● Secure Socket Layer (SSL) provides a secure connection between the network and application layers. In mutual SSL authentication, an SSL connection between a client and a server is established only if they validate each other's identity using digital signatures. If SSL is disabled, your data may be at risk.
	● If the source database type is Oracle 10g or 11g, one way SSL is not supported.
	● If the source database type is a PostgreSQL, only PEM SSL certificates can be uploaded, and the trust password is not required.

Data Collected From	You can select **DBA views** or **All views** to collect data from the source Oracle database. By default, **DBA views** is selected. ● **DBA views**: UGO collects data from objects in the entire source DB instance. ● **All views**: UGO collects data from all objects owned and accessed by the source DB user.
(Optional) Tags	Use predefined tags in Tag Management Service (TMS). Predefined tags are visible to all service resources that support the tagging function. For details, see *Tag Management Service User Guide*. Enter a key and a value, and click **Add**. You can add up to 20 tags. For details, see **Managing Tags**.

Table 1-2 Parameters for selecting the evaluation scope

Parameter	Description
Object Types to be Collected	By default, all object types are selected. You can also manually select the object types to be collected as required. **NOTE** If the source database type is MySQL and its version is earlier than 8.0, there are no ROLE objects in the source database. UGO does not collect ROLE objects. If the source database type is GoldenDB, there are no ROLE objects in the source database. UGO does not collect ROLE objects.
Target Database Selection	Select target databases and click ![arrow]. You can also select all of them. The target databases that you did not select will not be evaluated.
Schemas to be Collected	Manually select the schemas to be collected and click ![arrow]. You can search for or select all schemas. If there are many schemas, you can search for them by name. The names and number of selected schemas are displayed on the right list. **NOTICE** ● If there are multiple schemas with the same name (case-insensitive), select one of them. ● Oracle Lightweight Jobs are collected as part of PROGRAM object type.

Table 1-3 Advanced settings

Parameter	Description
Target DB Analysis	Whether the target database needs to be evaluated. **Skip Target DB Evaluation** is selected by default. ● If **Skip Target DB Evaluation** is selected, UGO only collects data. The target databases will not be evaluated, so no evaluation report is generated. There are only recommended target databases on the **Target DB Analysis** tab page when you view the evaluation result by following **Viewing the Database Evaluation Result**. Select **Skip Target DB Evaluation** if you have determined a target database. If you need to re-evaluate the task after the evaluation project is created, go to the evaluation project list page, locate the project, click **More** and choose **Re-Evaluate** in the **Operation** column. You can view the evaluation result of the target database only after the re-evaluation. ● If you deselect **Skip Target DB Evaluation**, an evaluation report of the target database will be generated.

Parameter	Description
Dynamic SQL Evaluation	Whether dynamic SQL statements need to be evaluated. **Enable** is selected by default. ● If **Enable** is selected, dynamic SQL statements in objects are analyzed, and a report is generated. ● If **Enable** is deselected, dynamic SQL statements are not analyzed.

1.3 Viewing the Database Evaluation Result

This section describes how to view details of an evaluated project, including the source and target database analysis results. This helps you select a target database.

Constraints

If **Skip Target DB Evaluation** is selected setting when **you create an evaluation project**, there are only the basic information of recommended target databases on the **Target DB Analysis** tab.

Viewing the Collection Result of a Source Database

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **Schema Migration** > **DB Evaluation**.

- All the evaluation projects are displayed in the list. You can view the project basic information, including the project name/ID, connection type, and project status. The project ID can be directly copied.

- If there are many projects, you can search for them by project status, tag, project name, or project ID.

Figure 1-6 Viewing the created project

Step 3 Click a project name. The **Source DB Analysis** tab page is displayed by default. **Table 1-4** describes functions on this page.

Figure 1-7 Source DB Analysis
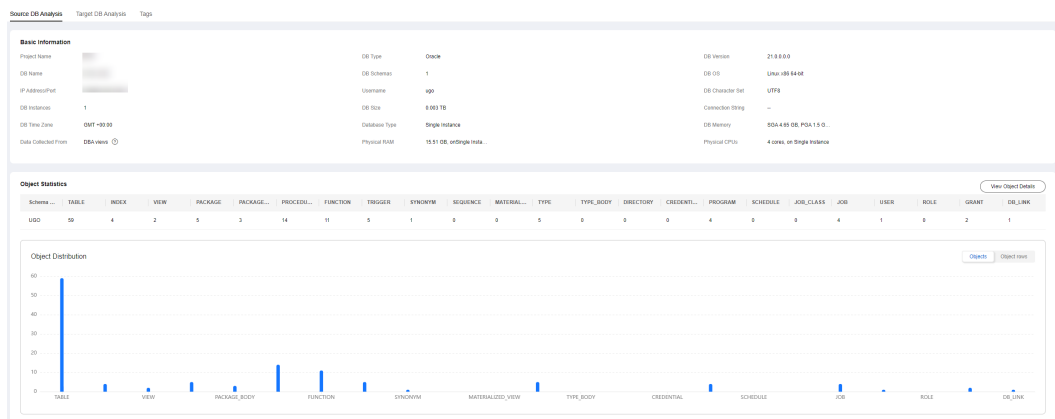
Step 4 Click **View Object Details**. In the displayed schema list, view the object name, object type, and DDL collection status.

Figure 1-8 Database schemas
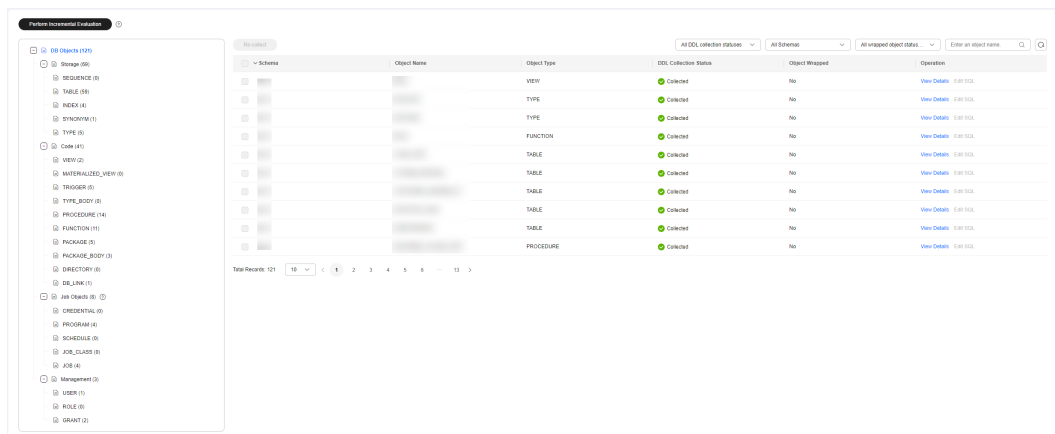
- You can search for data by DDL collection status, schema, wrap encryption status, or specific object name.

- For details about incremental evaluation, see **Performing an Incremental Evaluation**.

- For details about how to re-collect objects, see **Re-Collecting Objects**.

- The collected object types vary depending on the source data structure. For details, see **Table 1-5**.

Step 5 Click **View Details** to view DDL statements of the object.

Figure 1-9 DDL statement details
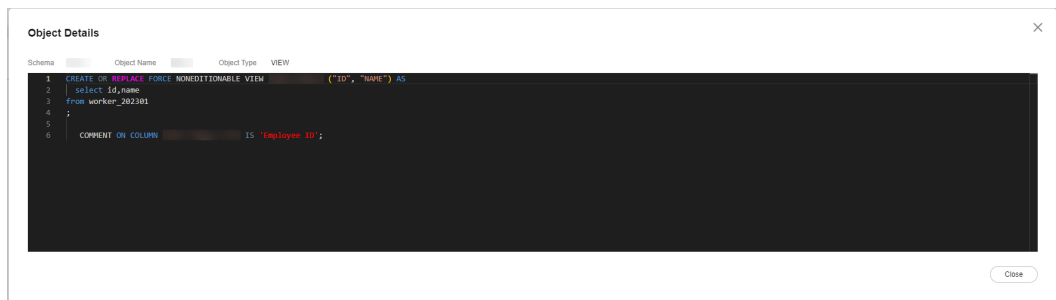
----End

> **NOTICE**
>
> The source database syntax is complex and flexible, so the workload evaluation and object evaluation statistics are for reference only.

Viewing the Analysis Result of a Target Database

Step 1 Log in to the UGO console.

Step 2 In the navigation pane, choose **Schema Migration** > **DB Evaluation**.

Step 3 Click a project name to go to the **Source DB Analysis** tab page.

Step 4 Click the **Target DB Analysis** tab. Table 1-6 describes functions on this page. If you deselect **Skip Target DB Evaluation** in Step 9, the following page is displayed.

Figure 1-10 Target DB Analysis
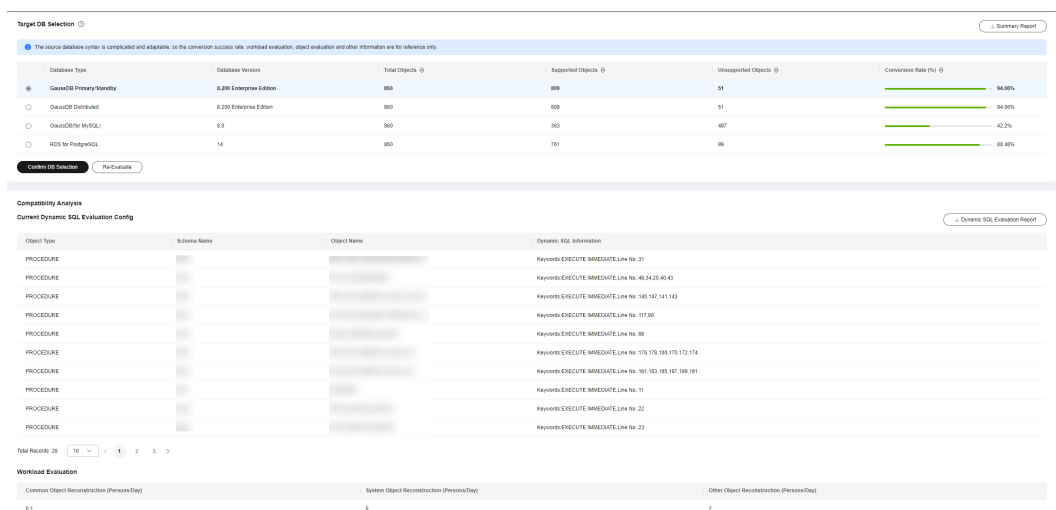
Step 5 Based on the analysis result, select the target database and click **Confirm Database Selection**.

> **NOTICE**
>
> The target database cannot be modified after it is confirmed.

----End

Page Functions

Table 1-4 Functions on the **Source DB Analysis** tab page

Function	Description
Basic Information	Displays basic information, including the project name, source database type, database version, database name, number of instances, and database memory. **NOTE** If the source database type is GoldenDB, the database configuration and instance quantity are not displayed. If the source database type is MySQL and GoldenDB, database names are not displayed.
Object Statistics	Displays the number of database objects, which may vary depending on the source database type. Click **View Object Details** to view schema details. For details, see **Table 1-5**. **NOTE** Objects of some types (such as cluster) are not displayed.
Object Distribution	Displays the database object statistics in a bar chart. Hovering over on a bar shows the exact values.

> **NOTE**
>
> The source database analysis result provides a reference for you to select a target database.

Table 1-5 Functions in the schema list

Function	Description

Schema list	Displays the schema, object name, object type, and operation.
	
	● If there is a large amount of data, you can search for your desire data by DDL collection status, schema, wrapped object status (only available for Oracle database), or object name.
	
	● Incremental evaluation: The SQL data has to be incrementally evaluated if:
	
	  – The DDL collection status is **Not collected**.
	
	  – The wrapped objects are edited.
	
	● Click **View Details** in the **Operation** column to view the detailed information and SQL script of the object.
	
	● Locate an object and click **Edit SQL** in the **Operation** column to edit the SQL script of the object.
	
	NOTE
	
	  ● When the source database type is Microsoft SQL Server, incremental evaluation is not supported and SQL scripts cannot be edited.
	
	  ● If the source database type is PostgreSQL, SQL scripts cannot be edited.
	
	  ● **Edit SQL** is available only when the target database is not confirmed and any of the following conditions is met:
	
	    ● The wrapped objects are edited.
	
	    ● **DDL Collection Status** of the object is displayed as **Not collected**.

DB Objects (Oracle as the source database)	Include storage objects, code objects, job objects, and management. You can click an object to view details. ● **Storage**: include SEQUENCE, TABLE, INDEX, SYNONYM, and TYPE. **NOTICE** When the number of level-1 partitions in a table exceeds the upper limit (3,000 by default), UGO only collects key information, such as schema name, table name, column name, column data type, constraints of unique keys, primary keys, checks, and foreign keys, level-1 partition type, partition column, partition name, and partition range (partition information collection is ignored for automated partitioned tables). ● **Code**: VIEW, MATERIALIZED_VIEW, TRIGGER, TYPE_BODY, PROCEDURE, FUNCTION, PACKAGE, PACKAGE_BODY, DIRECTORY, and DB_LINK ● **Job**: CREDENTIAL, PROGRAM, SCHEDULE, JOB_CLASS, and JOB ● **Management**: include USER, ROLE, and GRANT.
DB Objects (for MySQL database)	Include storage objects, code objects, and management objects. You can click an object to view details. ● **Storage**: include TABLE, VIEW, and SCHEMA. ● **Code**: include FUNCTION, PROCEDURE, and TRIGGER. ● **Management**: includes GRANT, ROLE, and USER.

Function	Description
DB Objects (for PostgreSQL database)	Include storage objects and code objects. You can click an object to view details. ● **Storage**: includes SCHEMA, TABLE, and INDEX. ● **Code**: includes VIEW, TRIGGER, PROCEDURE, and FUNCTION. ● **Management**: includes GRANT and ROLE.
DB Objects (for GoldenDB database)	Include storage objects, code objects, and management objects. You can click an object to view details. ● **Storage**: include TABLE, VIEW, and SCHEMA. ● **Code**: include FUNCTION, PROCEDURE, and TRIGGER. ● **Management**: includes GRANT, ROLE, and USER.
DB Objects (for Microsoft SQL Server database)	Include storage objects and code objects. You can click an object to view details. ● **Storage**: include SCHEMA, TABLE, VIEW, and INDEX. ● **Code**: include TRIGGER, FUNCTION, and PROCEDURE.

Table 1-6 Function description of the Target DB Analysis tab

Function	Sub-function	Description
Target DB Selection	Summary Report	Click **Summary Report** to download the compatibility evaluation summary report in PDF format to the local PC. You can view basic information about the source database and analysis result of the target database.
	Database list	The names, versions, and conversion success rates of recommended target databases are displayed. NOTE ● By default, a database with the highest success rate is selected. You can also select other databases. ● The database compatibility evaluation changes as you change the target database. Comprehensive evaluation facilitates you to make a choice.
	Confirm DB Selection	You can determine the target database type to complete the evaluation. If the target database has been confirmed, the button is unavailable.

Function	Sub-function	Description
	Re-Evaluate	This function is displayed only when **Project Status** is **In progress. Confirm Target DB Pending**. You can re-evaluate objects as needed. The time required depends on the number of objects. **NOTE** After the re-evaluation, the target database, workload evaluation, object conversion statistics, and partially compatible/incompatible syntax are displayed.
Compatibility Analysis	Current Dynamic SQL Evaluation Config	Only when the source database is Oracle, information such as object type, schema name, object name, and dynamic SQL information are displayed. Click **Dynamic SQL Evaluation Report** to download the evaluation report, which contains the object type, object name, keyword, location, and statements.
	Workload Evaluation	The estimated workloads required for reconstructing common objects, system objects and other objects during database migration are displayed.
	Evaluation Statistics	The information of supported and unsupported objects is displayed. Natively compatible objects, compatible objects after conversion, and partially compatible objects are supported. Move the cursor to a bar chart to view the conversion details. You can click a bar chart to view the conversion analysis details, which are displayed by partially compatible and incompatible objects. Click **View Object Details** to view partially compatible and incompatible objects. Click **Report on Partially Compatible and Incompatible Objects**. This report includes all source SQL statements and details on any syntax conversion failures. Click **Anonymous Report on Partially Compatible and Incompatible Objects**. This report includes all source SQL statements and details about any failure points in the SQL statements, but the statements will be anonymized. The actual syntax will not be exposed.

Function	Sub-function	Description
	Partially Compatible/ Incompatible Syntax Points	All partially compatible or uncompatible syntax during database object conversion, object scopes, types, risk levels, quantities, and explanations are displayed. There are partially compatible syntax and uncompatible syntax. You can view their definitions and the quantity of partially compatible syntax. The risk levels are classified for partially compatible syntax.
		Locate the syntax and click **View Definition** in the **Operation** column. If a syntax point is partially compatible, UGO provides different conversion configuration items for the syntax point. During the migration, you can select a configuration item as needed.
		If no modification suggestion is provided, you can click the syntax name to view details.
	System Objects	The page displays the types of system objects, occurrences, and compatibility if the source database type is Oracle, PostgreSQL, or MySQL and the target database type is GaussDB. You can click a system object name to view its database objects.
		Click **System Objects Report**, a compressed package is downloaded to the local PC. You can extract an excel file from the package. There are two sheet **System Data Report** and **System Table And View Details** in the file.
		• **System Data Report** describes the compatibility of all system objects. The following information includes: target database type and version, system object type, name and quantity, supported type, and SQL statements. If a SQL character string is greater than the maximum value of a cell in the excel file, an independent SQL file is generated and stored in the compressed package.
		• **System Table And View Details** describes the column compatibility of all system views. The system object names, column names, quantities, and supported types are displayed.

2 Database Schema Migration

After the database evaluation is complete and the target database is confirmed, you can start to migrate database objects with a few clicks. In this module, UGO guides you to make a conversion plan and design a solution to automatically convert syntax. For objects that fail to be converted or migrated, you can edit and batch modify them to simplify manual reconstruction. Each modification is recorded, so that you can view and roll back historical modifications.

2.1 Creating a Migration Project

Scenarios

After the source database evaluation is complete, select the target database based on the evaluation result, enter related information, and create a migration project. Each migration project corresponds to an evaluation project. You can create multiple migration projects based on an evaluation project.

To create a migration project, perform the following steps:

- Step 1: **Confirming the Target Database**
- Step 2: **Creating a Database Migration Project**

Precautions

The target database performance is affected during migration. You are advised to use the target database in a non-production environment or perform the migration during off-peak hours.

Prerequisites

- You have permissions to create a migration project in the UGO console. To obtain permissions, see **Permission Management**.
- There is at least one evaluation project whose **Evaluation Status** is **Completed. Create Migration Project**.
- The type and version of the target database to be used must be the same as those confirmed in the evaluation project.

● The target database to be connected is normal and has no arrears or suspension.

● Ensure that the destination database can be accessed and the target database user must have the permission to create, delete, or modify databases objects, such as schemas, tables, programs, indexes, users, functions, and views. For details, see **Viewing the Permission Check Report**.

Confirming the Target Database

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **Schema Migration** > **DB Evaluation**.

Step 3 Locate the project whose **Project Status** is **In progress. Confirm Target DB Pending**. Click the project name or click **Confirm Target DB Pending**.

Step 4 On the displayed page, select your desired target database and click **Confirm DB Selection**.

Step 5 Click **Confirm**.

Step 6 After the target database is confirmed, a dialog box is displayed.

● Click **Create Now** to go to the **Create Migration Project** page.

● Click **Create Later** to stay on the current page.

----End

◻ **NOTE**

● After you confirm the target database, **Confirm DB Selection** and **Re-Evaluate** buttons are unavailable. The confirmed target database cannot be modified. Exercise caution when you select a target database.

● After you confirm the target database, **Project Status** changes to **Completed. Create Migration Project**.

Creating a Database Migration Project
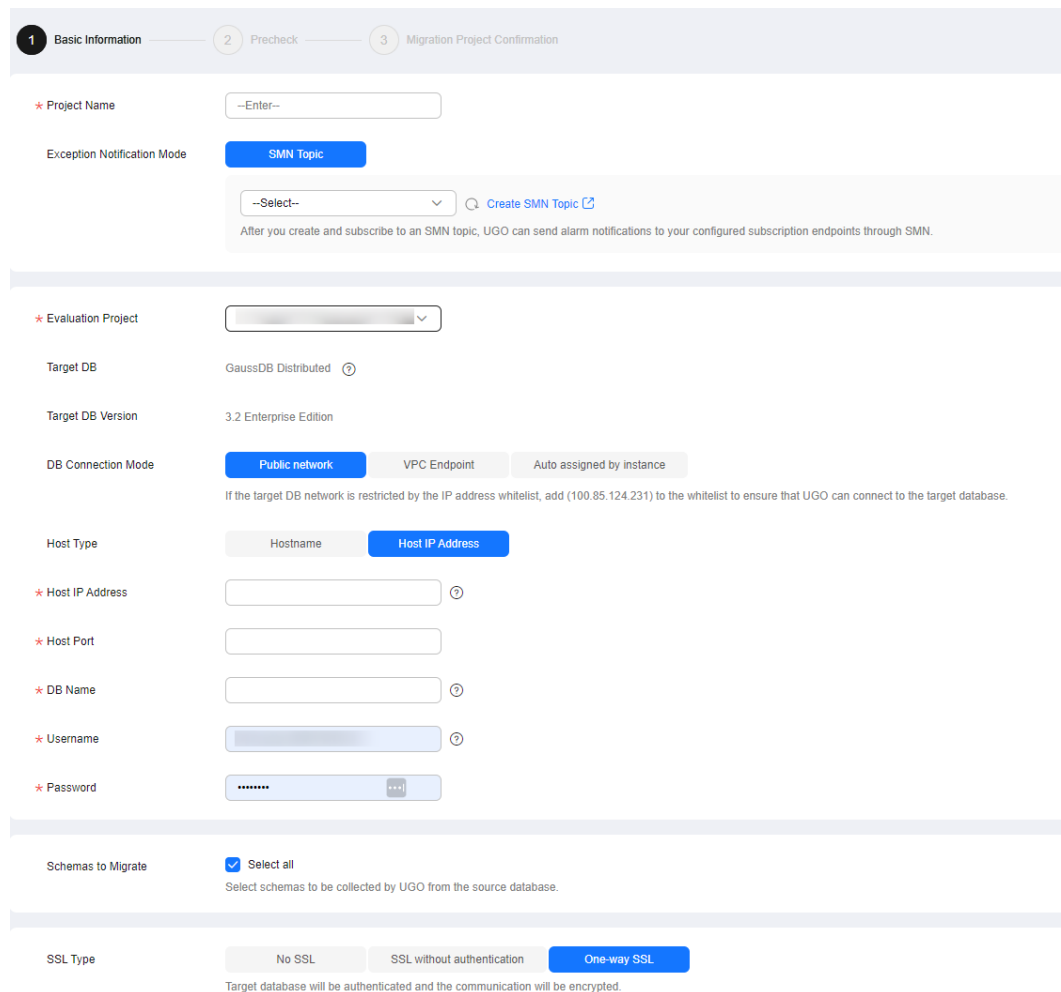
Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **Schema Migration** > **Object Migration**.

Step 3 Click **Create Project** in the upper right corner.

Step 4 On the **Create Project** page, configure parameters. For details, see **Table 2-1**.

Figure 2-1 Creating a migration project

Step 5 Click **Test Connection**.

- If the connection test is successful, the **Next** button is available.
- If the connection test fails, an error message is displayed.

Step 6 Click **Next** to go to the **Precheck** page.

Figure 2-2 Performing a pre-check

- For check items in the **Failed** status, click **View Details** in the **Operation** column, perform operations as prompted, and click **Recheck**. The **Next** button is activated only when all check items are in the **Success** or **Alarm** status.

- If you have known the possible impact of unhandled check items and still want to create a project, click **Skip Failed Check Items**. When the results of failed check items change to **Alarm**, and the **Next** button is activated.
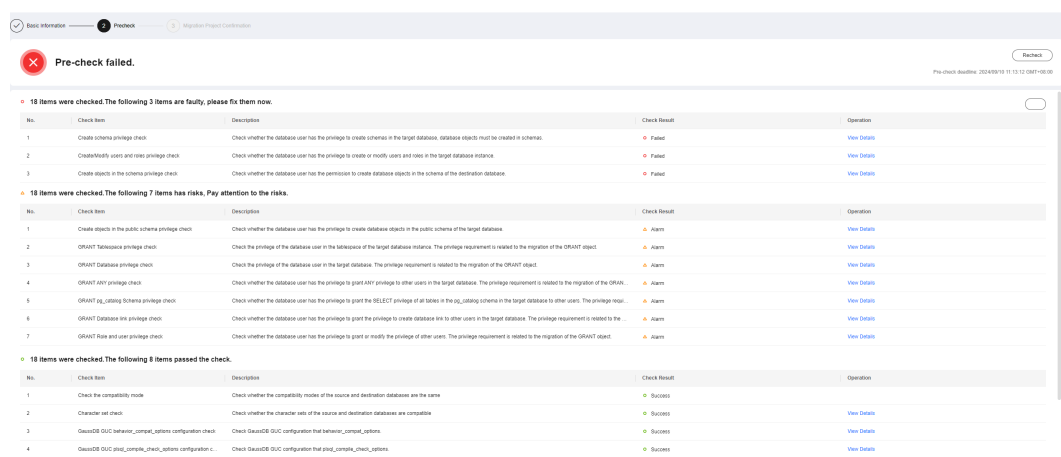
📖 **NOTE**

- If the target database type is GaussDB, the following checks are performed:
  - Check the compatibility mode. For details, see **Checking the Compatibility Mode**.
  - Check the character set. For details, see **Checking the Character Set**.
  - Check GUC parameters. For details about the check items, see **Checking GUC Parameters**.
  - Check user permissions. For details, see **Checking User Permissions**.
  - Database write permissions: The system checks whether the data node is normal. If the target database is read-only, this check item is displayed and the check is not passed.
- If the target database type is not GaussDB, the following checks are performed:
  - Check the character set. For details, see **Checking the Character Set**.
  - Check user permissions. For details, see **Checking Permissions**.

Step 7 Click **Next** in the lower right corner.

Figure 2-3 Confirming information
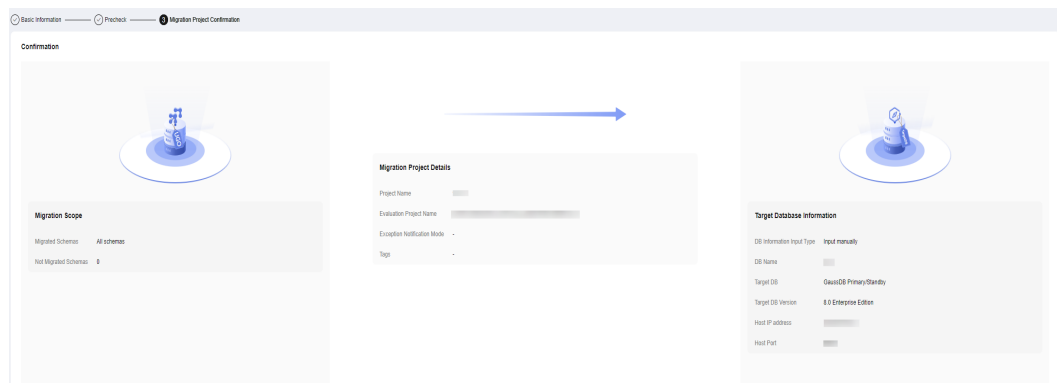
The database migration scope, migration project details, and target database information are displayed.

Step 8 Confirm the information and click **Create**. After the creation is successful, click **OK**. to the **Object Migration** page.

📖 **NOTE**

After a migration project is created, the permission check is automatically triggered when the target database is not GaussDB. If the check is successful, the project status is **Ready**.

If the permission check fails, the project status is **Not ready**. You can manually **check permissions**.

----End

Parameters

Table 2-1 Parameter description

Parameter	Description
Project Name	The project name must be unique. The name is unique. It can contain 5 to 50 characters and must start with a letter and end with a digit or letter. Only letters (case-insensitive), digits, underscores (_), and hyphens (-) are allowed.
(Optional) Exception Notification Mode	**SMN Topic** Specifies whether to report exceptions through Simple Message Notification (SMN). To create an SMN topic, see **Creating a Topic**. **NOTE** **Follow-up Operation** After the topic is created, you can **add a subscription**. After the subscription has been confirmed, alarm notifications will be sent to the subscription endpoint via SMN. **Notification scenario:** When the account is frozen or unfrozen, SMN can be used to send notifications.
Enterprise Project	If you have been associated with an enterprise project, select the target project from the **Enterprise Project** drop-down list. You can also go to the project management console to create a project. For details about how to create a project, see *Enterprise Management User Guide*.
Permission Check	If the target database type is not GaussDB, **Skip Permission Check** is displayed and is not selected by default. If **Skip Permission Check** is selected, the **View Permission Check Report** button is grayed out. **NOTE** To create objects in the target database, you must have some database permissions, such as creating tables and functions. If you skip the permission check, the system does not check whether you have these permissions. The migration may fail due to lack of permissions when SQL statements are converted on the target database.
Evaluation Project	Select the evaluation project where a target database has confirmed. ● **Target DB**: The confirmed target database type is displayed. Each tenant can connect to a maximum of five target databases at the same time. ● **Target DB Version**: The confirmed target database version is displayed.

Parameter	Description

DB Connection Mode	If you select **Public network**, the source database will be connected using an EIP. Select **Hostname** or **Host IP Address** for **Host Type** and Set **Host Port**.
	
	● If the target database network is restricted by the IP address whitelist, add the EIP to the target database network whitelist to ensure that UGO can connect to the target database.
	   – EIP in AP-Singapore: 110.238.109.54
	   – EIP in LA-Santiago: **159.138.116.198**
	
	● **Host IP Address**: Enter the IP address of the target database host.
	   – If the target database type is GaussDB Primary/Standby, you can enter only the IP address of the primary node or the IP addresses of the primary node and multiple standby nodes. Use commas (,) to separate the IP addresses. When you connect to the database, the system automatically selects the IP address of the primary node.
	   – If the target database type is GaussDB Distributed, you can enter one or more CN IP addresses separated by commas (,). The first IP address is preferentially used to connect to the database. If the previous IP address is abnormal, the next IP address will be used to connect to the database. If the first IP address of the CN can be connected but the CN node is abnormal and cannot be written, the connection test is normal, but an error message is displayed during permission check and object migration.
	
	● **Host Name**: Enter a host name.
	   – The host name cannot be empty.
	   – You can enter multiple hostnames and use commas (,) to separate them. All hostnames can contain up to 1,024 characters.
	   – A host name can contain a maximum of 253 characters and cannot contain the following special characters: !@#$%^&*()+=[]{}|\:;<>,?/
	
	If you select **VPC Endpoint** for **DB Connection Mode**, you also need to set **VPC Endpoint** and **Port Mapping**.
	
	● Click **View VPC Endpoint** to go to the VPC Endpoint management page and view the VPC endpoints.
	● For details about how to configure VPC Endpoint, see **Connecting to the Target Database Using VPC Endpoint**.
	
	If you select **Auto assigned by instance**, select a value from the **Database Instance** drop-down list.
	
	● Click **View DB Instance** to go to the instance management page of the target database and view instance information.

Parameter	Description
	● Click **View instances that cannot be selected**. A dialog box is displayed, showing the unavailable instance names and reasons. NOTE **Auto assigned by instance** is available only to whitelisted users. To use this function, you need to submit a service ticket. To configure the whitelist permission, in the upper right corner of the management console, submit an application by choosing **Service Tickets > Create Service Ticket**.
DB Name	Name of the database. The name can contain 2 to 128 characters and must start with a letter, digit, period (.), underscore (_), or hyphen (-). Only letters, digits, periods (.), underscores (_), hyphens (-), dollar signs ($), and number signs (#) are allowed. The name can be enclosed in double quotation marks ("").
Username	Username of the target database. It is recommended that the user has the administrator permissions.
Password	Password for accessing the target database.
Schemas to Migrate	● Select **Select all**: Select schemas to be collected by UGO from the source database. ● Deselect **Select all**: whether to reselect the schemas selected in the evaluation project. By default, **Select all** is selected.

SSL Type	● **No SSL**: SSL is disabled and there may be potential security risks.
	● **SSL No Auth**: Transmission will be encrypted without authentication.
	● **One-way SSL**: The target database will be authenticated and transmission will be encrypted.
	  – **Truststore password**: Enter the password of the truststore used to access the certificate.
	  – Click **Add File** to upload the root certificate file of the target database.
	NOTE
	● If you select **One-way SSL**, enter the correct uploaded file and entered password, which are private information of users. If the target database type is GaussDB or PostgreSQL, upload a PEM root certificate file. No password is required.
	● Secure Socket Layer (SSL) provides a secure connection between the network and application layers. In mutual SSL authentication, an SSL connection between a client and a server is established only if they validate each other's identity using digital signatures. If SSL is disabled, your data may be at risk.

Parameter	Description
(Optional) Tags	Use predefined tags in Tag Management Service (TMS). Predefined tags are visible to all service resources that support the tagging function. For details, see *Tag Management Service User Guide*.
	Enter a key and a value, and click **Add**.
	A maximum of 10 tags can be added. For details, see **Managing Tags**.

2.2 Database Migration and Verification

Scenarios

After the migration project is created, you need to start the migration project, select objects to be migrated, and configure the conversion solution based on the migration risk items. After the syntax conversion is started, UGO converts the SQL syntax of the source database to the syntax compatible with the target database. The syntax that fails to be converted can be manually corrected. After the modification is complete, migrate objects to the target database. You can view the migration progress and details to verify the migration result.

You can perform the following steps to migrate a database and verify the migration result:

- Step 1: **Selecting Objects To Be Migrated**
- Step 2: **Setting Conversion Configuration Items**
- Step 3: **Starting Syntax Conversion**
- Step 4: **Correcting Objects That Failed to Be Converted**
- Step 5: **Verifying the Object Migration Result**

Selecting Objects To Be Migrated

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **Schema Migration** > **Object Migration**.

Step 3 On the **Object Migration** page, locate the project that you want to migrate and click **Migrate** in the **Operation** column.

On the conversion plan page, the objects to be converted and their categories are displayed. You can search for objects by date or object name, or filter objects by schema, object status, or conversion status. For details, see **Viewing the Collection Result of a Source Database**.

Figure 2-4 Configuring a conversion plan
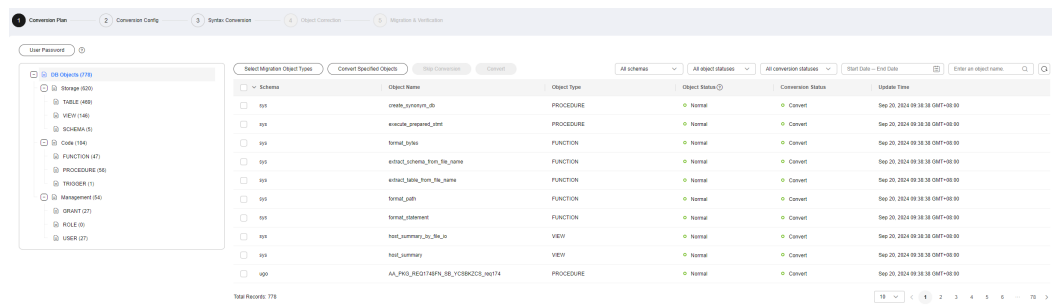
- Select objects to be converted on the GUI.
  - All objects to be converted by default are displayed in the navigation pane. You can click **Select Migration Object Types** and quickly set **Conversion Status** of objects that are not migrated to **Skip**.
  - Click the check boxes next to the **Schema** column to select objects. Click **Skip Conversion** or **Convert** to determine whether to migrate the objects in batches. You can filter objects by name or status.
- Upload a specified object locally.

  Click **Convert Specified Objects**, download the template, enter the objects to be converted in an Excel file, and upload the Excel file. For details, see **Uploading Objects**.

Step 4 (Optional) Set the GaussDB database data distribution mode.

- This function is supported when the source database type is an Oracle or MySQL and the target database type is GaussDB Distributed.
- You can set the data distribution mode for table objects. For details, see **Distribution Mapping of Table Objects**.

Step 5 If the object to be converted contains a user, you need to set a unified user password. Click **User Password** in the upper left corner. In the displayed dialog box, set the password.

Figure 2-5 Configuring USER password
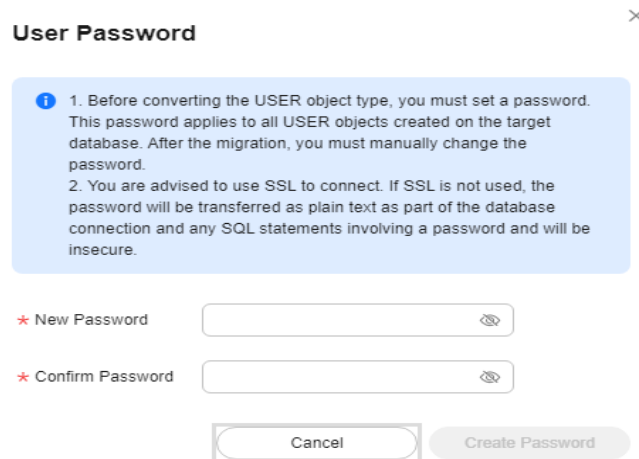
- If you want to convert the user object, you must set a password. The same password will be used for all USER object creation on the target database. After the migration, the individual user passwords must be changed manually. If you do not want to convert the object type USER, select the desired USER objects and click **Skip Conversion**. Then, the **Conversion Status** of the objects becomes **Skip**. To continue the conversion, select the desired objects and click **Convert**.

  📖 **NOTE**

  > If you ignore user migration, a message is displayed. You need to set **Current Configuration** to **Allow the object owner to execute scripts on the GaussDB database.** for item **User connection** in **Setting Conversion Configuration Items**. Otherwise, the migration may fail.

- You are advised to use SSL connection. If non-SSL connection is used, the password will be transmitted as plain text as part of the database connection and any SQL statements involving a password will be insecure.

- After the password is configured, it cannot be changed again until after the migration is complete.

- The password can consist of 8 to 32 characters and contain at least three types of the following characters: uppercase letters, lowercase letters, digits, and special characters (~!@#$%^&*()-_=+\|[{}];:,<.>/?). Spaces are not allowed. The password can contain up to three consecutive characters.

  ----End

Setting Conversion Configuration Items

Step 1 Click **Next**. The **Conversion Config** tab page is displayed.

Step 2 Set conversion configuration items using either of the following methods:

- By default, the default template is used. Click **Edit** in the **Operation** column of each conversion configuration item and set them based on the site requirements.

- If the maximum migration success rate is preferred, you can select **Max compatibility** from the **Baseline Template** drop-down list and fine-tune the template.

Figure 2-6 Setting conversion configuration items
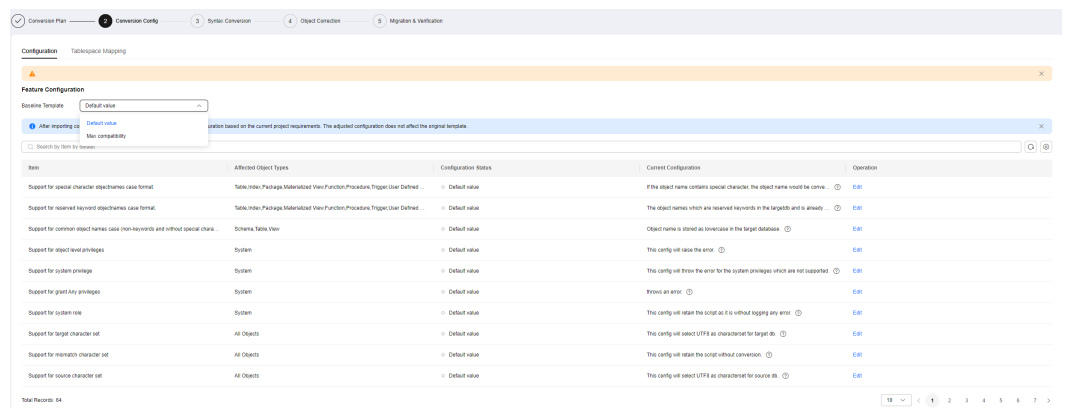
Step 3 (Optional) Click the **Tablespace Mapping** tab.

To map tablespaces, select required tablespaces of the source and target databases and click **Tablespace Mapping**.

📖 **NOTE**

The following migration flows support the tablespace mapping function.

- From Oracle to GaussDB
- From Oracle to PostgreSQL

----End

Starting Syntax Conversion

Step 1 Click **Next**.

Step 2 Click **Start** to start the conversion.

Figure 2-7 Syntax conversion
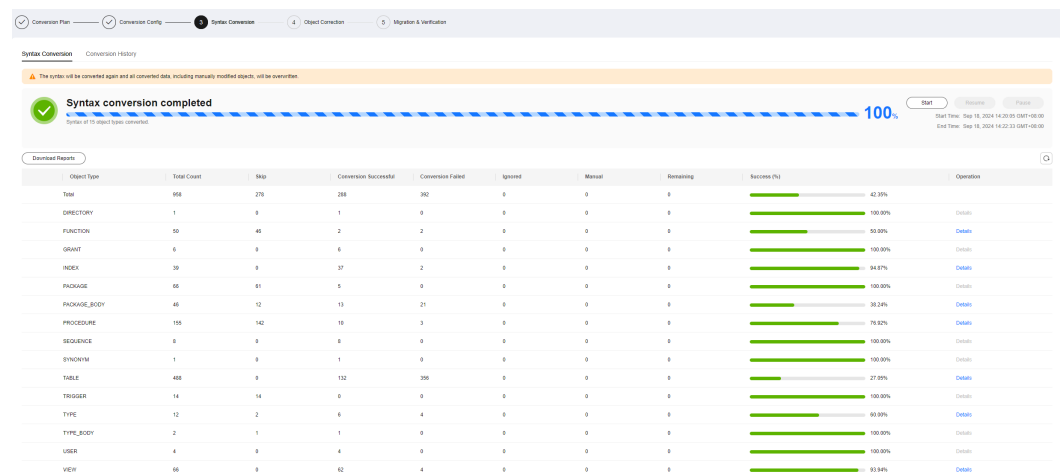
- After the conversion is complete, the following information is displayed: object type, the number of total objects, the number of objects converted successfully, the number of objects that failed to be converted, conversion start time, and conversion end time.
- The migration progress is displayed in a progress bar and as a percentage.

⚠️ **WARNING**

If you click **Start**, the syntax will be converted again and all converted data, including manually modified objects, will be overwritten. Exercise caution when performing this operation. To start the conversion, click **Start** and in the displayed dialog box, click **OK**.

Step 3 After the syntax conversion is complete, you can view the syntax conversion history and details. For details, see **Viewing the Syntax Conversion History**.

- If the syntax conversion is complete, you need to modify the conversion plan. For details, see **Setting Conversion Configuration Items**.

● If syntax conversion fails, you need to manually modify the objects. For
details, see **Correcting Objects That Failed to Be Converted**.

----End

Correcting Objects That Failed to Be Converted

Step 1 Click **Next** to go to the **Object Correction** page.

Figure 2-8 Object correction
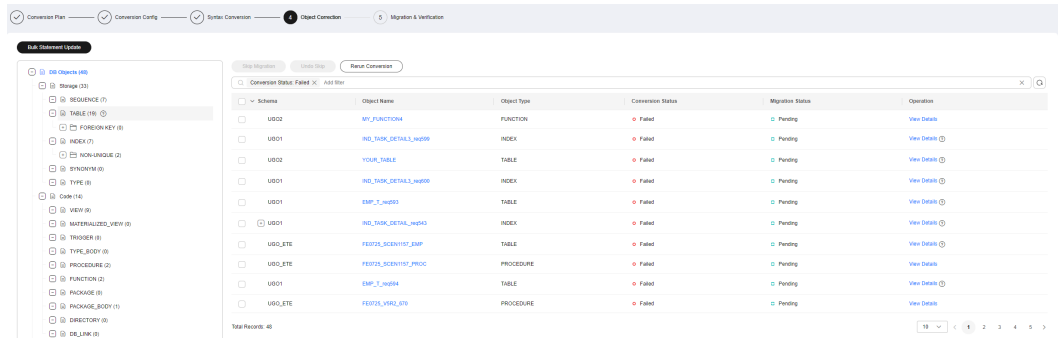
● Locate objects and click **Skip Migration** to ignore the objects that you do not
want to verify.

● Batch update: You can click **Bulk Statement Update** to search for and modify
objects with the similar issues in batches. For details, see **Updating
Statements in Batches**.

Step 2 Locate an object and click **View Details** in the **Operation** column. You can view
conversion error and modification suggestions.

Figure 2-9 Conversion errors on the object details page
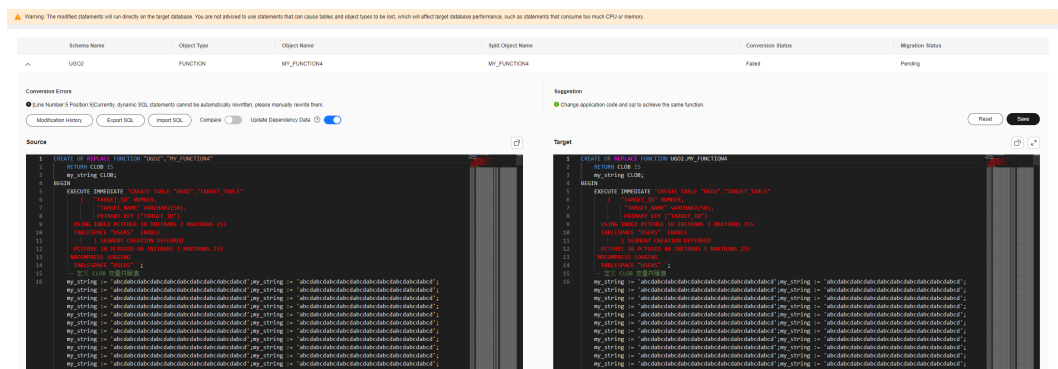
📖 **NOTE**

● You are advised to correct objects in the sequence of management, storage, code, and
job objects.

● When you return to the object correction page and view details about the objects that
failed to be migrated, migration errors are displayed.

Step 3 Modify the SQL statements of the objects that failed to be converted or migrated.
Click **Save**. The modification record is generated,

Step 4 Click **Modification History** to view the modification history. Click the drop-down icon next to a historical ID to display the comparison result of SQL statements before and after the modification.

Step 5 Click **Rollback** to roll back the SQL statements to the status before the modification.

Figure 2-10 Modification history
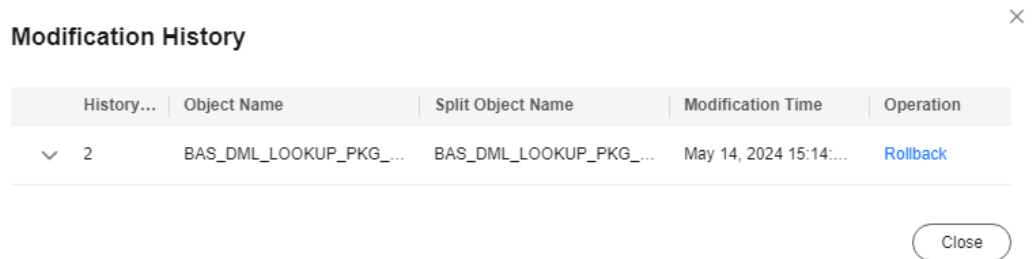
----End

Verifying the Object Migration Result

Step 1 Click **Next**. The **Migration** tab page is displayed by default.

Figure 2-11 Migration
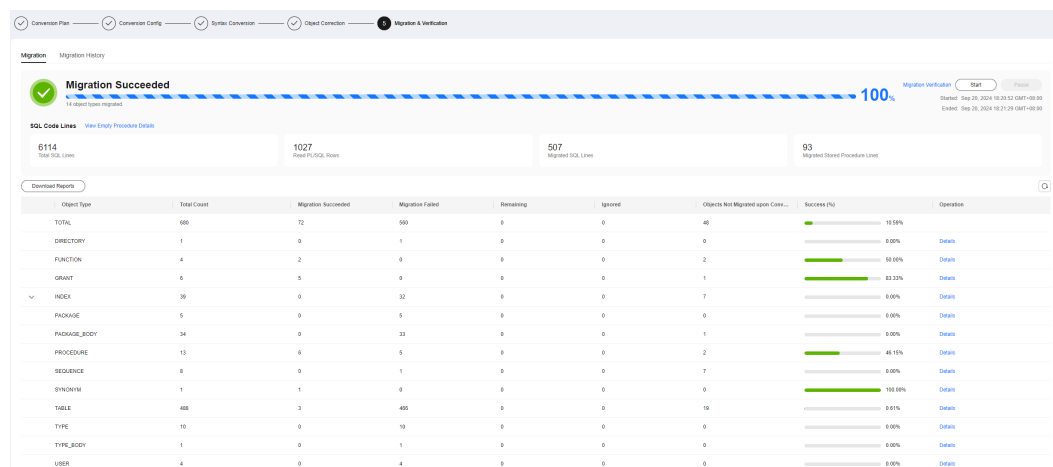
- Click **Migration Verification** to set the migration process.
- The detailed information about the migration project is displayed, including object types, total objects, objects that have been migrated, objects that failed to be migrated, and objects that have not been migrated. If objects that failed to be converted will not be migrated, **Objects Not Migrated upon Conversion Failure** is also displayed.
- Click **Details** in the **Operation** column to go to the **Object Correction** page and view the migration and syntax conversion details.

Step 2 Click **Start**. Objects start to be migrated to the target database.

If the migration is successful, you can log in to the target database to view the migrated objects. You can also perform **Step 3** to view the migrated objects.

If the migration fails, click **Details** next to a failed object and manually correct the object by following **Correcting Objects That Failed to Be Converted**.

Step 3 After the migration is complete, click **Migration History** to view the migration details.

Detailed information of the migrated projects is displayed in the descending order. The information includes the serial number, total count, migration succeed, migration failed. Click **Details** to view details.

Step 4 Click **Details** to view information such as object types, total number of objects, and migration result (successful or failed).

Step 5 Locate an object type and click **Details** to view its details. The detailed information includes the schema, object name, object types, and migration status. You can search for an object by name or view details about each schema.

----End

3 SQL Audit

SQL audit helps users detect SQL standardization, design rationality, and performance issues hidden in code at the development phase. More than 200 audit rules are preset for various SQL statements such as DML, DDL, and PL/SQL. You can adjust the risk level, threshold, and suggestion in a rule and create a custom audit template by combining multiple rules. GaussDB and MySQL databases can be audited. You can use a single statement, upload code files in batches (SQL statements are automatically extracted), or directly connect to the database to audit SQL statements. UGO also prevents inappropriate SQL statements from flowing into the production environment.

3.1 Creating a Data Source

Scenarios

You can perform unified data source management. Currently, this function is used only for SQL audit.

Prerequisites

The data source to be created must be connected successfully.

Procedure

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **Data Source Management**.

Step 3 Click **Create Data Source** in the upper right corner.

Step 4 Configure parameters as needed.

After the basic information is configured, the **Test** button next to **Test Connection** is available.

Figure 3-1 Creating a data source

Table 3-1 Parameter description

Parameter	Description
Name	Name displayed in the data source management list. The name must contain 5 to 50 characters, start with a letter, and end with a digit or letter. Only letters (case-insensitive), digits, underscores (_), and hyphens (-) are allowed.
DB Type	Type of the source database to be configured. Only GaussDB and MySQL are supported.
Network Type	**Public Network**: An EIP is used to connect to a database. If the database has an IP address whitelist, add the EIP to the whitelist to ensure that UGO can connect to the database.
Connection Method	Only the server name can be used for connection.
DB Name	Name of a database to be managed. Enter a string of 2 to 128 characters, including letters, digits, periods (.), underscores (_), hyphens (-), dollar signs ($), and number signs (#). The value must start with a letter, digit, period (.), underscore (_), or hyphen (-) and can contain quotation marks (").
Host Type	Only the host IP address can be used.
Host IP Address	Host IP address, which can be an IPv4 or IPv6 address **NOTE** When **DB Type** is set to **MySQL**, IPv6 address can be used.

Parameter	Description
Host Port	Port of the database to be managed
Username	Username of the database to be managed.
	The value is a string of 2 to 128 characters, including letters, digits, underscores (_), hyphens (-), dollar signs ($), and number signs (#). It must start with a letter, digit, period (.), underscore (_), or hyphen (-) and can be enclosed in double quotation marks.
Password	Password of the database to be managed.
	The password can contain up to 50 characters.

Step 5 Click **Test**. If the test is successful, **Connected** is displayed, and the **Create** button in the lower right corner is available.

If the test failed dut to network faults or insufficient permissions, an error is displayed. You cannot create a data source.

Step 6 Click **Create**. A message is displayed, indicating that the project is created.

Step 7 Click **OK** to go to the **Data Source Management** page. View the data source you created in the list.

You can search for a data source by data source ID, data source name, database name, database type, IP address, or port.

Figure 3-2 Viewing a data source

----End

3.2 Creating a Rule Template

Scenarios

You can create rule templates based on different service scenarios.

Constraints

- Up to 1,000 rule templates can be created.

Procedure

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **SQL Audit** > **Rules**. The **Templates** page is displayed by default.

Step 3 Click **Create Template**. In the displayed dialog box, configure parameters as needed.

Figure 3-3 Creating a rule template
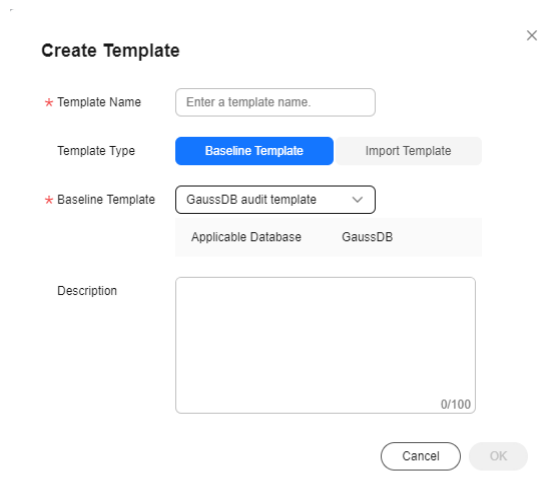
Table 3-2 Parameter description

Parameter	Description
Template Name	Name displayed in the rule template list. The name must contain 5 to 50 characters, start with a letter, digit, and end with a digit or letter. Only letters (case-insensitive), digits, underscores (_), and hyphens (-) are allowed.
Template Type	Baseline template and import template.
Import Template	Local file template to be imported, which must meet the following requirements: 1. The file size cannot exceed 1 MB. 2. The file name can contain only digits, letters, underscores (_), and hyphens (-). 3. Maximum file name length: 240 characters 4. The columns must be sorted according to the sequence in the template. TEXT data is recommended for each column to prevent deviation during data conversion. 5. No blank line is allowed between two rows of data, or the data after the blank line will be invalid. The number of rows cannot exceed 200, or the data after 200th row will be invalid. **NOTICE** You are advised to modify rules in the exported Excel file template. For details, see **Table 3-3**. You are advised to modify the values in the **Threshold**, **Risk Level**, and **Suggestion** columns.

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Parameter	Description
Baseline Template	You can select any existing template as the baseline template.
Description	Template description, which can contain up to 100 characters This parameter is optional.

Table 3-3 Example of file template

Rule Name	Rule ID	Description	Applicable Database	Audited Object Type	Severity	Threshold	Suggestion
Do not use too many combined index fields.	10055	The number of composite index fields cannot exceed the threshold. Audit object: CREATE INDEX	GaussDB	sqltext	Major	5	-

Step 4 Click **OK**.

The created template is displayed in the rule template list. Up to 1,000 custom templates can be created.

Figure 3-4 Rule template

----**End**

3.3 Creating an Audit Task

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3.3.1 Creating a Text Audit Task

Scenarios

You want to check whether a SQL statement complies with specifications and affects performance.

Constraints

- Only four types of syntax for nested statements can be audited. For details, see **Table 3-4**.
- When WITH AS is used, only SELECT subqueries are supported.
- The table name and table alias must be different. The aliases of different tables must be different.
- Tables in the audit view cannot be audited.
- Database system tables and system views cannot be audited.
- MySQL statements containing number signs (#) cannot be audited.

Table 3-4 Supported nested statements

No.	SQL Statement
1	select id, (select *subquery*) as name from table;
2	select id from table where id in (select *subquery*);
3	select * from table1, (select …);
4	with e as (select …) select * from e;

Rule Constraints

- In all UPDATE and DELETE rules, multiple tables cannot be updated and deleted at a time.
- Multi-table UPDATE and DELETE operations are audited based on the rule **Do not use a single UPDATE or DELETE statement to update or delete multiple tables**.
- For rules **In the PL/pgSQL, use uppercase for keywords and lowercase for non-keywords** and **In SQL statements, use uppercase for keywords and lowercase for non-keywords**, you are not advised using object names as non-reserved keywords, or the audit may be inaccurate. For example, in **SELECT ID FROM name**, **name** is a non-reserved keyword.
- After the database system parameter **enable_gpi_auto_update** is modified, the rule **Global indexes must be updated when partitions are swapped, merged, separated, cleared, or deleted in a partitioned table** may not take effect. To clear sessions in the database, you can log in to the database.
  CLEAN CONNECTION TO ALL FORCE FOR DATABASE db_name;
- When object names are used as filters for querying system views, use lowercase object names. For details about supported system views, see **Table 3-5**.

- Exercise caution when deleting database objects and data. For supported SQL Syntax, see **Table 3-6**.

Table 3-5 View audit

View Name	Schema	Object Name Column
adm_arguments	pg_catalog, sys	owner, object_name, package_name, argument_name
adm_audit_object	pg_catalog, sys	username, owner, obj_name, action_name
adm_audit_session	pg_catalog, sys	username, action_name
adm_audit_statement	pg_catalog, sys	username, obj_name, action_name
adm_col_comments	pg_catalog, sys	owner, table_name, column_name, schema
adm_col_privs	pg_catalog, sys	grantor, owner, grantee, table_schema, table_name, column_name, privilege
adm_coll_types	pg_catalog, sys	owner, type_name, elem_type_mod, elem_type_owner, elem_type_name
adm_constraints	pg_catalog, sys	owner, constraint_name, table_name, index_owner, index_name
adm_indexes	pg_catalog, sys	owner, index_name, table_name, table_owner, tablespace_name
adm_ind_columns	pg_catalog, sys	index_owner, index_name, table_name, table_owner, column_name
adm_objects	pg_catalog, sys	owner, object_name, subobject_name
adm_procedures	pg_catalog, sys	owner, object_name, procedure_name, impltypeowner, impltypename
adm_role_privs	pg_catalog, sys	grantee, granted_role
adm_tab_col_statistics	pg_catalog, sys	owner, table_name, column_name, schema
adm_roles	pg_catalog, sys	role

View Name	Schema	Object Name Column
adm_source	pg_catalog, sys	owner, name
adm_sys_privs	pg_catalog, sys	grantee, privilege
adm_tab_cols	pg_catalog, sys	owner, table_name, column_name, data_type_owner, schema, qualified_col_name
adm_tab_privs	pg_catalog, sys	grantee, owner, table_name, grantor, privilege
adm_tables	pg_catalog, sys	owner, table_name, tablespace_name
adm_tab_columns	pg_catalog, sys	owner, table_name, column_name, data_type_owner, schema
adm_tab_comments	pg_catalog, sys	owner, table_name, column_name, schema
adm_tab_statistics	pg_catalog, sys	owner, table_name
adm_triggers	pg_catalog, sys	owner, trigger_name, table_owner, table_name
adm_type_attrs	pg_catalog, sys	type_name, attr_name, attr_type_name, character_set_name
adm_types	pg_catalog, sys	owner, type_name
adm_users	pg_catalog, sys	username, default_tablespace, temporary_tablespace, default_collation
adm_views	pg_catalog, sys	owner, view_name
db_all_tables	pg_catalog, sys	owner, table_name, tablespace_name
db_arguments	pg_catalog, sys	owner, object_name, package_name, argument_name
db_col_comments	pg_catalog, sys	owner, table_name, column_name, schema
db_col_privs	pg_catalog, sys	grantor, owner, grantee, table_schema, table_name, column_name, privilege

View Name	Schema	Object Name Column
db_coll_types	pg_catalog, sys	owner, type_name, elem_type_mod, elem_type_owner, elem_type_name
db_constraints	pg_catalog, sys	owner, constraint_name, table_name, index_owner, index_name
db_indexes	pg_catalog, sys	owner, index_name, table_name, table_owner, tablespace_name
db_ind_columns	pg_catalog, sys	index_owner, index_name, table_name, table_owner, column_name
db_objects	pg_catalog, sys	owner, object_name, subobject_name
db_procedures	pg_catalog, sys	owner, object_name
db_tab_col_statistics	pg_catalog, sys	owner, table_name, column_name, schema
db_source	pg_catalog, sys	owner, name
db_tab_columns	pg_catalog, sys	owner, table_name, column_name, data_type_owner, schema
db_tab_comments	pg_catalog, sys	owner, table_name, schema
db_tables	pg_catalog, sys	owner, table_name, tablespace_name
db_triggers	pg_catalog, sys	trigger_name, table_owner, table_name
db_types	pg_catalog, sys	owner, type_name
db_users	pg_catalog, sys	username
db_views	pg_catalog, sys	owner, view_name
dict	pg_catalog, sys	table_name
dictionary	pg_catalog, sys	table_name
my_col_comments	pg_catalog, sys	owner, table_name, column_name, schema
my_col_privs	pg_catalog, sys	grantor, owner, grantee, table_schema, table_name, column_name, privilege

View Name	Schema	Object Name Column
my_coll_types	pg_catalog, sys	owner, type_name, elem_type_mod, elem_type_owner, elem_type_name
my_constraints	pg_catalog, sys	owner, constraint_name, table_name, index_owner, index_name
my_indexes	pg_catalog, sys	owner, index_name, table_name, table_owner, tablespace_name
my_ind_columns	pg_catalog, sys	index_owner, index_name, table_name, table_owner, column_name
my_objects	pg_catalog, sys	object_name, subobject_name
my_procedures	pg_catalog, sys	owner, object_name, procedure_name, impltypeowner, impltypename
my_role_privs	pg_catalog, sys	grantee, granted_role
my_tab_col_statistics	pg_catalog, sys	table_name, column_name, schema
my_source	pg_catalog, sys	owner, name
my_tab_columns	pg_catalog, sys	owner, table_name, column_name, data_type_owner, schema
my_tab_comments	pg_catalog, sys	owner, table_name, column_name, schema
my_tab_statistics	pg_catalog, sys	table_name
my_tables	pg_catalog, sys	owner, table_name, tablespace_name
my_triggers	pg_catalog, sys	owner, trigger_name, table_owner, table_name
my_type_attrs	pg_catalog, sys	type_name, attr_name, attr_type_name, character_set_name
my_types	pg_catalog, sys	type_name
my_views	pg_catalog, sys	owner, view_name

View Name	Schema	Object Name Column
pg_indexes	pg_catalog, sys	schemaname, tablename, indexname, tablespace
pg_roles	pg_catalog, sys	rolename
pg_tables	pg_catalog, sys	schemaname, tablename, tableowner, tablespace, tablecreator
pg_user	pg_catalog, sys	username, nodegroup
pg_views	pg_catalog, sys	schemaname, viewname, viewowner
column_privileges	information_schema, sys	grantor, grantee, table_catalog, table_schema, table_name, column_name
columns	information_schema, sys	table_catalog, table_schema, table_name, column_name
constraint_column_usage	information_schema, sys	table_catalog, table_schema, table_name, column_name, constraint_catalog, constraint_schema, constraint_name
constraint_table_usage	information_schema, sys	table_catalog, table_schema, table_name, constraint_catalog, constraint_schema, constraint_name
enabled_roles	information_schema, sys	role_name
schemata	information_schema, sys	catalog_name, schema_name, schema_owner, default_character_set_catalog, default_character_set_schema, default_character_set_name
table_constraints	information_schema, sys	constraint_catalog, constraint_schema, constraint_name, table_catalog, table_schema, table_name

View Name	Schema	Object Name Column
table_privileges	information_schema, sys	grantor, grantee, table_catalog, table_schema, table_name
tables	information_schema, sys	table_catalog, table_schema, table_name, self_referencing_column_name, user_defined_type_catalog, user_defined_type_schema, user_defined_type_name
triggers	information_schema, sys	trigger_catalog, trigger_schema, trigger_name, event_object_catalog, event_object_schema, event_object_table, action_reference_old_table, action_reference_new_table
usage_privileges	information_schema, sys	grantor, grantee, object_catalog, object_schema, object_name
views	information_schema, sys	table_catalog, table_schema, table_name

Table 3-6 SQL syntax that can be audited

DDL Type	SQL syntax
DROP	DROP TABLE, DROP TABLESPACE, DROP AGGREGATE, DROP AUDIT POLICY, DROP CAST, DROP DATABASE, DROP DATA SOURCE, DROP DIRECTORY, DROP EVENT, DROP FOREIGN TABLE, DROP GLOBAL CONFIGURATION, DROP GROUP, DROP MASKING POLICY, DROP MATERIALIZED VIEW, DROP MODEL, DROP OPERATOR, DROP OWNED, DROP PACKAGE, DROP PACKAGE BODY, DROP PROCEDURE, DROP RESOURCE LABEL, DROP RESOURCE POOL, DROP ROLE, DROP ROW LEVEL SECURITY POLICY, DROP RULE, DROP PUBLICATION, DROP SCHEMA, DROP SEQUENCE, DROP FUNCTION, DROP SERVER, DROP SUBSCRIPTION, DROP SYNONYM, DROP TEXT SEARCH CONFIGURATION, DROP TEXT SEARCH DICTIONARY, DROP TRIGGER, DROP TYPE, DROP USER, DROP USER MAPPING, DROP VIEW, DROP WEAK PASSWORD DICTIONARY
ALTER	ALTER DROP PARTITION, ALTER TRUNCATE PARTITION, ALTER DROP COLUMN, ALTER DROP CONSTRAINT, ALTER DROP FOREIGN TABLE, ALTER DROP AUDIT POLICY, ALTER DROP MASKING POLICY, ALTER DROP SERVER, ALTER DROP TEXT SEARCH CONFIGURATION, ALTER DROP USER MAPPING, ALTER DROP DATA SOURCE
TRUNCATE	TRUNCATE

Procedure

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **SQL Audit** > **Statement Audit**. The **SQL Text** page is displayed by default.

Step 3 Configure parameters as needed and view that the **Submit** button is highlighted.

Figure 3-5 Audited Text

Table 3-7 Parameter description

Parameter	Description
Database Type	Select a database type. Currently, only GaussDB and MySQL are supported.
Data Source	Select a data source. Currently, only GaussDB and MySQL are supported. This parameter is optional. If no data source is provided, the audit rules that depend on the data source are skipped by default.
Schema	Select a schema. This parameter is optional and only available for GaussDB databases. ● If the SQL statement contains a schema name, use the schema in the SQL statement. ● If the SQL statement does not contain a schema name, the selected schema is used. ● If the SQL statement does not contain a schema name and no schema is selected, use the public schema.
Rule Template	Select a template based on the selected database type. You can set the template information by referring to **Adding a Rule Template**.
SQL Statement	Enter the SQL statement to be audited. ● Text audit is supported only for a single statement. If there are multiple statements, only the first statement is audited. ● If a SQL object name is in uppercase and is not enclosed in double quotation marks, the system automatically converts the name to lowercase and then queries the corresponding table structure in the database.

Step 4 Click **Submit**. The **View Details** dialog box is displayed, and a corresponding record is generated.

Figure 3-6 Viewing details
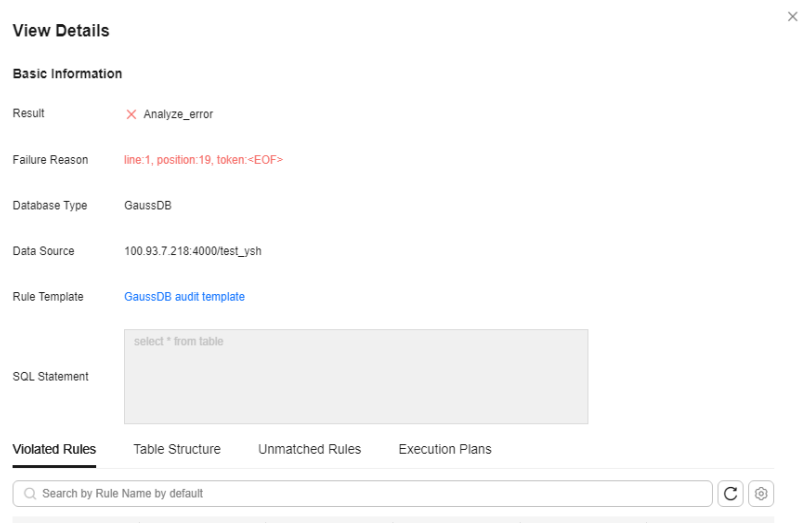
Click the template name next to **Rule Template** to view template information.

If the statement fails to be audited, the cause is displayed.

Failure causes (examples):

- **line:1, position:14, token:table** indicates the SQL statement contains **table**.
- **line:1, position:3, token:<EOF>** indicates the entered SQL statement is incomplete.

----End

3.3.2 Creating a File Audit Task

Scenarios

You want to check whether SQL statements in a file comply with specifications and affect performance.

Constraints

- Only four types of syntax for nested statements can be audited. For details, see **Table 3-4**.
- The table name and table alias must be different. The aliases of different tables must be different.
- Tables in a view cannot be audited.
- Database system tables and system views cannot be audited.
- MySQL statements containing number signs (#) cannot be audited.
- You cannot click **Retry** when the file is being or has been audited.
- If a system template is used, the audit results before and after a version upgrade will be inconsistent. You are advised to use a custom template.
- Up to 110 SQL audit tasks can be created, and up to 10 can be executed concurrently.

Procedure

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **SQL Audit** > **Statement Audit**. Click the **SQL from Files** tab.

Step 3 Click **Upload File**.

Figure 3-7 Upload a file

Table 3-8 Parameter description

Parameter	Description
Database Type	Select a database type. Currently, only GaussDB and MySQL are supported.
Data Source	Select a data source. Currently, only GaussDB and MySQL are supported. This parameter is optional. If no data source is provided, the audit rules that depend on the data source are skipped by default.

Parameter	Description
Schema	Select a schema. This parameter is optional and only available for GaussDB databases. ● If the SQL statement contains a schema name, use the schema in the SQL statement. ● If the SQL statement does not contain a schema name, the selected schema is used. ● If the SQL statement does not contain a schema name and no schema is selected, use the public schema.
Rule Template	Select a template based on the selected database type. You can set the template information by referring to **Adding a Rule Template**.

Upload Data File	Upload a SQL file that meets the following requirements:
	● The SQL object name can contain only lowercase letters. If you enter an uppercase SQL object name, the system automatically converts it to lowercase letters.
	● The file can contain only simple SQL statements, such as INSERT, ALTER, DELETE, SELECT operations, and cannot contain stored procedures, functions, triggers, packages, or anonymous blocks, which is regarded as one SQL statement for audit.
	● Only .zip, .xml, .sql, .java, and .json files can be uploaded.
	  – The file name can contain only digits, letters, underscores (_), and hyphens (-).
	  – Maximum file name length: 240 characters
	● Max. file size: 5 MB.
	● Only XML, SQL, Java, and JSON files in the .zip package can be audited. Any other file types will be skipped automatically.
	  – Max.size per file: 10 MB
	  – Max. files: 10,000
	  – The file name can contain only digits, letters, underscores (_), and hyphens (-).
	  – Maximum file name length: 240 characters
	  – Files to be uploaded cannot contain sensitive data such as binary files, passwords, and keys.

Description	(Optional) Enter a description, which contains up to 100 characters.

Step 4 Click **OK**. view the file task you created on the task list page.

Figure 3-8 Audit task list

The status can be one of the following:

- **Pending**: The SQL audit task is to be scheduled.

- **Collecting objects**: SQL statements scanned in the file.

- **Auditing SQL statements**: The file is being audited.

- **Audit completed**: The audit is complete only after all SQL statements in the file are audited.

- **Audit failed**: An exception occurred during the audit.

----End

3.3.3 Creating a Database Audit Task

Scenarios

You want to check whether database objects for audit meet specifications and affect performance

Prerequisites

A data source has been created and connected successfully.

Constraints

- The audited database objects can only be tables, views, sequences, indexes, functions, procedures, triggers, or packages.

- A maximum of 10,000 schemas can be audited at a time.

- During the database audit, do not delete database objects that are being audited, or audit results may be affected.

- If a system template is used, the audit results before and after a version upgrade will be inconsistent. You are advised to use a custom template.

Procedure

Step 1 **Log in to the UGO console.**

Step 2 In the navigation pane, choose **SQL Audit** > **Database Audit**.

Step 3 Click **Create Audit Task**.

Figure 3-9 Creating a Database Audit Task

Table 3-9 Parameter description

Parameter	Description
Task Name	Enter a task name, which is mandatory.
	The value is a string of 5 to 50 characters, including letters, digits, underscores (_), and hyphens (-). It must start with a letter (case-insensitive) and end with a digit or letter.
Database Type	Select a database type. Only the GaussDB database is supported. This parameter is mandatory.
Data Source	Select a data source. Currently, only GaussDB is supported. This parameter is mandatory.
	If there is no available data source, click **Create Data Source**.
Schema	Select a schema. This parameter is optional and only available for GaussDB databases.
	● If this parameter is not specified, all schemas are audited by default. However, up to 10,000 schemas can be audited.
	● If the parameter is specified, you can select up to 10,000 schemas.

Parameter	Description
Rule Template	Select a template based on the selected database type. You can set the template information by referring to **Adding a Rule Template**.
Description	Enter a task description, which contains up to 100 characters. This parameter is optional.

Step 4 Click **OK**. The task is displayed in the list.

Figure 3-10 Audit task list

The task status can be:

- **Pending**: The database audit task is to be scheduled.
- **Collecting objects**: DDL statements in the schema of a specified database.
- **Auditing SQL statements**: The database is being audited.
- **Audit completed**: The database audit is complete only after all database objects are audited.
- **Audit failed**: An exception occurred during the audit.

----End