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Apsara Stack Enterprise

Developer Guide - Analytics and Artificial Intelligence

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Document conventions

Style	Description	Example
	A danger notice indicates a situation that will cause major system changes, faults, physical injuries, and other adverse results.	 **Danger:** Resetting will result in the loss of user configuration data.
	A warning notice indicates a situation that may cause major system changes, faults, physical injuries, and other adverse results.	 **Warning:** Restarting will cause business interruption. About 10 minutes are required to restart an instance.
	A caution notice indicates warning information, supplementary instructions, and other content that the user must understand.	 **Notice:** If the weight is set to 0, the server no longer receives new requests.
	A note indicates supplemental instructions, best practices, tips, and other content.	 **Note:** You can use Ctrl + A to select all files.
>	Closing angle brackets are used to indicate a multi-level menu cascade.	Click Settings > Network > Set network type.
Bold	Bold formatting is used for buttons, menus, page names, and other UI elements.	Click **OK**.
`Courier font`	Courier font is used for commands.	Run the `cd /d C:/window` command to enter the Windows system folder.
Italic	Italic formatting is used for parameters and variables.	`bae log list --instanceid` *`Instance_ID`*
[] or [a|b]	This format is used for an optional value, where only one item can be selected.	`ipconfig [-all|-t]`

Style	Description	Example
{} or {a|b}	**This format is used for a required value, where only one item can be selected.**	`switch {active|stand}`

Contents

1 MaxCompute

1.1 Java SDK

1.1.1 Java SDK introduction

This topic describes most commonly used APIs of the MaxCompute Java SDK. For more information, see *ODPS SDK Core 0.32.5-public API*.

You can use Maven to manage and configure the new SDK version. The following example shows how to use Maven to configure the MaxCompute Java SDK:

```
<dependency>
  <groupId>com.aliyun.odps</groupId>
  <artifactId>odps-sdk-core</artifactId>
  <version>xxxx-public</version>
</dependency>
```

The following table lists the overall information about the SDK packages provided by MaxCompute.

Package name	Description
odps-sdk-core	Basic functions of MaxCompute. This package encapsulates MaxCompute APIs such as odps , and basic functions such as projects and tables. It also includes the Tunnel-related functions.
odps-sdk-core-internal	Extended functions of MaxCompute. This package encapsulates less commonly-used MaxCompute functions and operations, such as Event and XFlow.
odps-sdk-commons	MaxCompute infrastructure. This package includes TableSchema, Column, Record, OdpsType, and some util packages.
odps-sdk-udf	The UDF API for MaxCompute.
odps-sdk-mapred	The MapReduce API for MaxCompute.
odps-sdk-graph	The Graph API for MaxCompute.

The SDK packages are available at *SDK package download*.

Note:

If you use a MaxCompute version earlier than V3.8.0, download the 0.27.2-public/ version of SDK packages. If you use MaxCompute V3.8.0 or later, download the 0.30 .8-public/ or 0.30.9-public/ version of SDK packages.

1.1.2 Prerequisites

1.1.2.1 Overview

Before using SDKs for MaxCompute, you must perform the following operations:

- **Create an account that is authorized to access MaxCompute and obtain an AccessKey pair (AccessKey ID and AccessKey secret).**
- **Obtain the service endpoint.**

1.1.2.2 Obtain an AccessKey pair

You can obtain an AccessKey pair in the Apsara Stack Cloud Management (ASCM) console.

1.1.2.2.1 Log on to the ASCM console

This topic describes how to log on to the Apsara Stack Cloud Management (ASCM) console.

Prerequisites

- **Before you log on to the ASCM console, make sure that you have obtained the IP address or domain name of the ASCM console from the deployment personnel. The URL to access the ASCM console is in the format of http://the IP address or domain name of the ASCM console/manage.**
- **We recommend that you use the Google Chrome browser.**

Procedure

1. **In the address bar, enter the URL of the ASCM console. Press Enter.**
2. **Enter your username and password.**

   The system has a default super administrator, whose username is super. The super administrator can create system administrators. The system administra

tors can create other users and notify them of their default passwords by SMS or email.

> **Note:**
> When you log on to the ASCM console for the first time, you must change the password of your username as instructed. For security concerns, your password must meet the minimum complexity requirements: The password must be 8 to 20 characters in length and must contain at least two types of the following characters: letters, digits, and special characters such as exclamation points (!), at signs (@), number signs (#), dollar signs ($), and percent signs (%).

3. Click Login.

1.1.2.2.2 Obtain the AccessKey pair of an organization

An administrator can obtain the AccessKey pair of an organization.

Procedure

1. Log on to the Apsara Stack Cloud Management (ASCM) console as an administrator.
2. In the top navigation bar, click Enterprise. In the left-side navigation pane of the Enterprise page, click Organizations.
3. In the organization navigation tree, move the pointer over the name of the target organization and click on the right.
4. Choose AccessKey from the shortcut menu.
5. In the AccessKey message that appears, view the AccessKey pair of the organization.

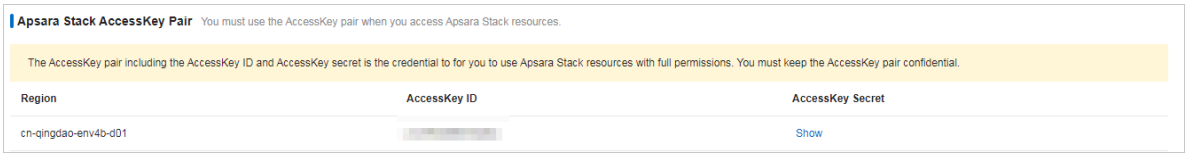
1.1.2.2.3 View the AccessKey pair of your Apsara Stack tenant account

To secure cloud resources, the system must verify the identity of visitors and ensure that they have the relevant permissions. You must obtain the AccessKey ID and AccessKey secret of your personal account to access cloud resources.

Procedure

1. Log on to the Apsara Stack Cloud Management (ASCM) console as an administrator.

2. In the upper-right corner of the homepage, move the pointer over the profile picture and click User Information.
3. In the Apsara Stack AccessKey Pair section of the User Information page, view your AccessKey pair.



Note:
The AccessKey pair is made up of the AccessKey ID and AccessKey secret. These credentials provide you full permissions on Apsara Stack resources. You must keep the AccessKey pair confidential.

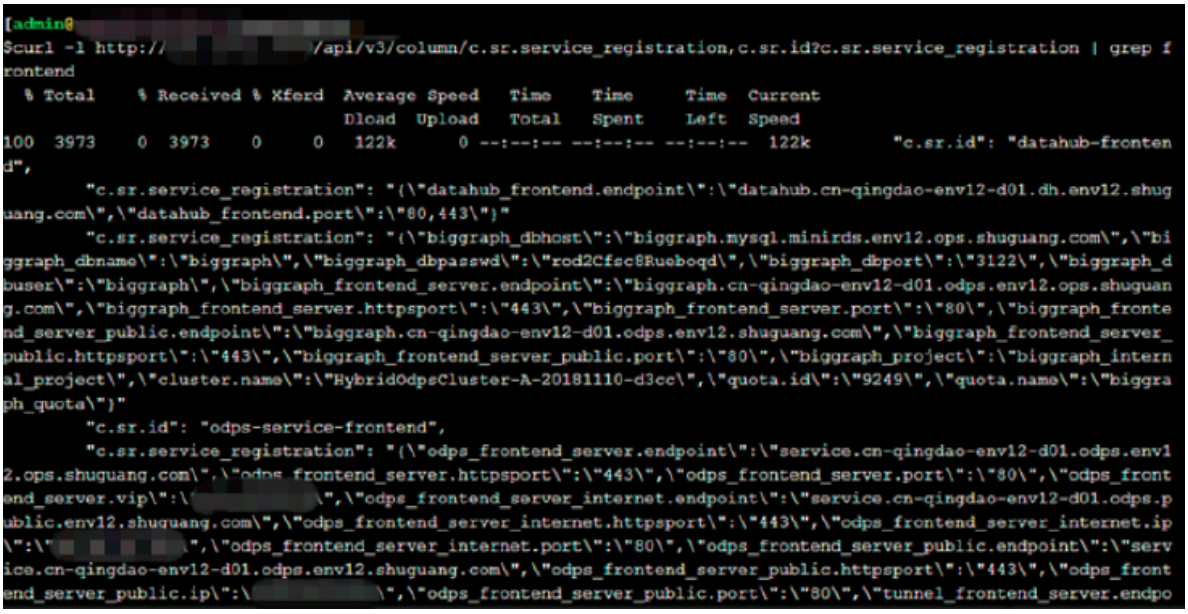
1.1.2.3 Obtain an endpoint

You can obtain the endpoint of MaxCompute in the Apsara Stack Operations console.

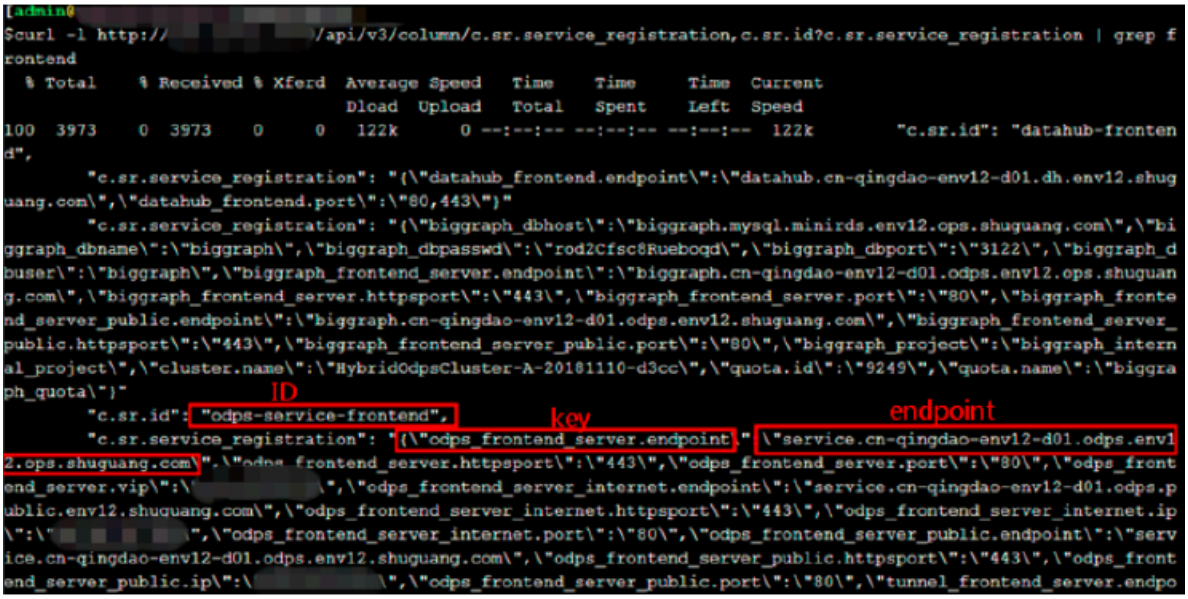
Procedure

1. Log on to the Apsara Stack Operations console.
2. In the left-side navigation pane, click Products.
3. On the Product List page, click Apsara Infrastructure Management Framework.
4. In the left-side navigation pane, choose Operations > Machine Operations to go to the Machine Operations page.
5. In the Machines search box, search for a machine. Click Terminal in the Actions column corresponding to the machine to log on to the machine.

6. **Run the following command on the machine to obtain JSON data:** `curl -l "http://127.0.0.1:7070/api/v3/column/c.sr.service_registration,c.sr.id?c.sr.service_registration".`



7. **Find the endpoint of** *MaxCompute* **through the service ID (***odps-service-frontend***) and key value (***odps_frontend_server.endpoint***) of** *MaxCompute***.**



1.1.3 Major APIs

1.1.3.1 AliyunAccount

The primary account created with Alibaba Cloud. The input parameters are AccessKey ID and AccessKey Secret. AccessKey ID uniquely identifies an Alibaba

Cloud user, and AccessKey Secret is used to authenticate the identity of the user. This class is used to initialize MaxCompute.

1.1.3.2 Odps

It is the entrance to MaxCompute SDK. You can use this class to obtain all object collections in a project, including Projects, Tables, Resources, Functions, and Instances.

You can pass this class into the AliyunAccount instance to construct a MaxCompute object. Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
odps.setDefaultProject("my_project");
for (Table t : odps.tables()) {
....
}
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview* **.**

1.1.3.3 Projects

A collection of all projects in MaxCompute.

A project is an element in a collection. Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps  odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
Project p = odps.projects().get("my_exists");
p.reload();
Map<String, String> properties = prj.getProperties();
...
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview***.**

1.1.3.4 Project

A description of project information. You can obtain a list of projects through Projects.

1.1.3.5 SQLTask

An API for running and processing SQL tasks. You can use SQLTask.run to run SQL tasks. The SQLTask.run API returns an instance, and obtains the running status and results of SQL from the instance.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String  odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
Instance instance = SQLTask.run(odps, "my_project", "select ...") ;
String id = instance.getId();
instance.waitforsuccess();
Set<String> taskNames = instance.getTaskNames();
for (String name
taskNames) {
TaskSummary summary = instance.getTaskSummary(name);
String s = summary.getSummaryText();
}
Map<String, String> results = instance.getTaskResults();
Map<String, TaskStatus> taskStatus = instance.getTaskStatus();
for (Entry<String, TaskStatus> status : taskStatus.entrySet()) {
String result = results.get(status.getKey());
}
```

Note:

To create a table, you must use the SQLTask API instead of the Table API. You must pass the CREATE TABLE statement into SQLTask. MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

1.1.3.6 Instances

A collection of all instances in MaxCompute.

An instance is an element in a collection. Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
odps.setDefaultProject("my_project");
for (Instance i : odps.instances ()) {
....
```

```
}
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

1.1.3.7 Instance

A description of instance information. You can obtain a list of instances through Instances.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps (account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
Instance ins = odps.instances().get("instance id");
Date startTime = instance.getStartTime();
Date endTime = instance.getEndTime();
...
Status instanceStatus = instance.getStatus();
String instanceStatusStr = null;
if (instanceStatus == Status.TERMINATED) {
instanceStatusStr = TaskStatus.Status.SUCCESS.toString();
Map<String, TaskStatus> taskStatus = instance.getTaskStatus();
for (Entry<String, TaskStatus> status : taskStatus.entrySet()) {
if (status.getValue().getStatus() ! = TaskStatus.Status.SUCCESS) {
instanceStatusStr = status.getValue().getStatus().toString();
break;
}
}
} else {
instanceStatusStr = instanceStatus.toString();
}
...
TaskSummary summary = instance.getTaskSummary("instance name");
String s = summary.getSummaryText();
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

1.1.3.8 Tables

A collection of all tables in MaxCompute. A table is an element in a collection.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
odps.setDefaultProject("my_project");
for (Table t : odps.tables()) {
....
```

```
}
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

1.1.3.9 Table

A description of table information. You can obtain a list of tables through Tables.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
Table t = odps.tables().get("table name");
t.reload();
Partition part = t.getPartition(new PartitionSpec(tableSpec[1]));
part.reload();
...
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

1.1.3.10 Resources

A collection of all resources in MaxCompute. A resource is an element in a collection.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
odps.setDefaultProject("my_project");
for (Resource r : odps.resources()) {
....
}
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

1.1.3.11 Resource

A description of resource information. You can obtain a list of resources through Resources.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
```

```
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
Resource r = odps.resources().get("resource name");
r.reload();
if (r.getType() == Resource.Type.TABLE) { TableResource tr = new
TableResource(r);
String tableSource = tr.getSourceTable().getProject() + "." + tr.
getSourceTable().getName();
if (tr.getSourceTablePartition() ! = null) {
tableSource += " partition(" + tr.getSourceTablePartition().toString()
 + ")";
}
....
}
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

The following sample code shows how to create a file resource:

```
String projectName = "my_porject";
String source = "my_local_file.txt";
File file = new File(source);
InputStream is = new FileInputStream(file);
FileResource resource = new FileResource();
String name = file.getName();
resource.setName(name);
odps.resources().create(projectName, resource, is);
```

The following sample code shows how to create a table resource:

```
TableResource resource = new TableResource(tableName, tablePrj,
partitionSpec);
//resource.setName(INVALID_USER_TABLE);
resource.setName("table_resource_name");
odps.resources().update(projectName, resource);
```

1.1.3.12 Functions

A collection of all functions in MaxCompute. A function is an element in a collection.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
odps.setDefaultProject("my_project");
for (Function f : odps.functions()) {
....
}
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

1.1.3.13 Function

A description of function information. You can obtain a list of functions through Functions.

Sample code:

```
Account account = new AliyunAccount("my_access_id", "my_access_key");
Odps odps = new Odps(account);
String odpsUrl = "<your odps endpoint>";
odps.setEndpoint(odpsUrl);
Function f = odps.functions().get("function name");
List<Resource> resources = f.getResources();
```

Note:

MaxCompute provides two endpoints. For more information, see *Tunnel SDK overview*.

The following sample code shows how to create a function:

```
String resources = "xxx:xxx";
String classType = "com.aliyun.odps.mapred.open.example.WordCount";
ArrayList<String> resourceList = new ArrayList<String>();
for (String r : resources.split(":")) {
resourceList.add(r);
}
Function func = new Function();
func.setName(name);
func.setClassType(classType);
func.setResources(resourceList);
odps.functions().create(projectName, func);
```

1.1.3.14 Spark Shell

An API commonly used by Spark to submit tasks to a cluster.

Run the following commands to enable the API:

```
$cd $SPARK_HOME
-- Access the spark directory.
$bin/spark-shell --master yarn
-- Select the running mode and enable the API.
```

Sample code:

```
sc.parallelize(0 to 100, 2).collect
sql("show tables").show
```

```
sql("select * from spark_user_data").show(200,100)
```

1.1.3.15 Spark R

An API commonly used by Spark to submit tasks to a cluster.

Run the following commands to enable the API:

```
$mkdir -p /home/admin/R && unzip . /R/R.zip -d /home/admin/R/
-- Create a directory named R and decompress R.zip in the directory.
$export PATH=/home/admin/R/bin/:$PATH
-- Configure environment variables.
$bin/sparkR --master yarn --archives . /R/R.zip
-- Select a running mode and enable the API.
```

Sample code:

```
df <- as.DataFrame(faithful)
df
head(select(df, df$eruptions))
head(select(df, "eruptions"))
head(filter(df, df$waiting < 50))
results <- sql("FROM spark_user_data SELECT *")
head(results)
```

1.1.3.16 Spark SQL

An API commonly used by Spark to submit tasks to a cluster.

Run the following commands to enable the API:

```
$cd $SPARK_HOME
-- Access the spark directory.
$bin/spark-sql --master yarn
-- Select the running mode and enable the API.
```

Sample code:

```
show tables;
select * from spark_user_data limit 3;
quit;
```

1.1.3.17 Spark JDBC

An API commonly used by Spark to submit tasks to a cluster.

Run the following commands to enable the API:

```
$sbin/stop-thriftserver.sh
-- Stop a thread.
$sbin/start-thriftserver.sh
-- Restart a thread.
$bin/beeline
```

```
-- Enable the API.
```

Sample code:

```
! connect jdbc:hive2://localhost:10000/odps_smoke_test
show tables;
select * from mr_input limit 3;
! quit
```

1.1.3.18 Document APIs

An open-source API repository compatible with Elasticsearch on MaxCompute. For more information about the APIs, see the following link:

Document APIs

1.1.3.19 Search APIs

An open-source API repository compatible with Elasticsearch on MaxCompute. For more information about the APIs, see the following link:

Search APIs

1.2 Python SDK

This topic describes how to use the Python SDK to create, view, and delete tables.

PyODPS is the Python SDK of MaxCompute. PyODPS provides the DataFrame framework and basic operations on MaxCompute objects to allow you to easily analyze data in MaxCompute. For more information, see the *Github project* and *Docs* including details about all interfaces and classes.

For more information about PyODPS, see *MaxCompute User Guide*.

The following sections describe how to use the Python SDK to create, view, and delete tables.

Note:
The following examples are for reference only.

Install PyODPS

PyODPS supports Python 2.6 and later (including Python 3). After installing pip in the system, you only need to run the `pip install pyodps` command. The related dependencies of PyODPS are automatically installed. For more information, see the Installation Guide section in *MaxCompute User Guide*.

Initialization

You must use your Apsara Stack tenant account to initialize a MaxCompute entry object. Example:

```
from odps import ODPS
odps = ODPS('**your-access-id**', '**your-secret-access-key**', '**
your-default-project**',
            endpoint='**your-end-point**')
```

After initialization, you can perform operations on tables, resources, and functions.

Note:

Unless otherwise specified, objects in the following sections all refer to MaxCompute entry objects.

Obtain a PyODPS project

A project is the basic unit of operation in MaxCompute, similar to a database.

You can use the `get_project` method to obtain information about a project.

Example:

```
project = odps.get_project('my_project')  # Obtain information about a
 project.
project = odps.get_project()              # Obtain information about
the default project.
```

Note:

- **If no parameters are provided, information about the default project is obtained .**
- **You can use the exist_project method to check whether a project exists.**
- **A table is the data storage unit in MaxCompute.**

PyODPS table operations

Call `list_tables` to list all tables in a project. Example:

```
for table in odps.list_tables():  # Process each table.
```

Call `exist_table` to check whether a table exists. Call `get_table` to obtain information about a table.

```
 t = odps.get_table('dual')
 t.schema
odps.Schema {
  c_int_a                 bigint
```

```
  c_int_b                 bigint
  c_double_a              double
  c_double_b              double
  c_string_a              string
  c_string_b              string
  c_bool_a                boolean
  c_bool_b                boolean
  c_datetime_a            datetime
  c_datetime_b            datetime
}
 t.lifecycle
-1
 print(t.creation_time)
2014-05-15 14:58:43
 t.is_virtual_view
False
 t.size
1408
 t.schema.columns
[<column c_int_a, type bigint>,
 <column c_int_b, type bigint>,
 <column c_double_a, type double>,
 <column c_double_b, type double>,
 <column c_string_a, type string>,
 <column c_string_b, type string>,
 <column c_bool_a, type boolean>,
 <column c_bool_b, type boolean>,
 <column c_datetime_a, type datetime>,
 <column c_datetime_b, type datetime>]
```

Create the schema of a PyODPS table

You can use one of the following methods to initialize the schema of a PyODPS table:

- **Initialize the schema through table columns and optional partitions.**

```
 from odps.models import Schema, Column, Partition
 columns = [Column(name='num', type='bigint', comment='the column')]
 partitions = [Partition(name='pt', type='string', comment='the
partition')]
 schema = Schema(columns=columns, partitions=partitions)
 schema.columns
[<column num, type bigint>, <partition pt, type string>]
```

- **Call `Schema.from_lists`. Although this method is more convenient, you cannot directly set comments for columns and partitions.**

```
 schema = Schema.from_lists(['num'], ['bigint'], ['pt'], ['string'])
 schema.columns
[<column num, type bigint>, <partition pt, type string>]
```

Create a PyODPS table

You can create a table based on table schema. Example:

```
table = odps.create_table('my_new_table', schema)
```

```
table = odps.create_table('my_new_table', schema, if_not_exists=True)
 # Create a table only when no table with the same name exists.
table = o.create_table('my_new_table', schema, lifecycle=7)  # Set the
 lifecycle.
```

You can also use a comma-connected string in the "field name, field type" format to create a table. Example:

```
 # Create a non-partitioned table.
 table = o.create_table('my_new_table', 'num bigint, num2 double',
if_not_exists=True)
 # To create a partitioned table, you can pass in (table field list,
partition field list).
 table = o.create_table('my_new_table', ('num bigint, num2 double', '
pt string'), if_not_exists=True)
```

By default, when you create a table, you can only use the BIGINT, DOUBLE, DECIMAL, STRING, DATETIME, BOOLEAN, MAP, and ARRAY data types.

If you need to use other data types, such as TINYINT and STRUCT, you can set `options.sql.use_odps2_extension` to True. Example:

```
 from odps import options
 options.sql.use_odps2_extension = True
 table = o.create_table('my_new_table', 'cat smallint, content struct<
title:varchar(100), body string>')
```

Obtain PyODPS table data

You can use one of the following methods to obtain table data:

- **Call `head` to retrieve up to the first 10,000 data records in a table. Example:**

```
 t = odps.get_table('dual')
 for record in t.head(3):
     print(record[0])  # Obtain the value at position 0.
     print(record['c_double_a'])  # Obtain a value based on a field.
     print(record[0: 3])  # Perform slicing operations.
     print(record[0, 2, 3])  # Obtain values at multiple positions.
     print(record['c_int_a', 'c_double_a'])  # Obtain values based
on multiple fields.
```

- **Use `open_reader` for a table object to open a reader and read the table data. You can open the reader with or without a WITH clause.**

```
# Open the reader with a WITH clause:
 with t.open_reader(partition='pt=test') as reader:
     count = reader.count
     for record in reader[5:10]  # You can execute this line
multiple times until all records are read. The number of records is
specified by count. You can change it to parallel-operation code.
         # Process a record.

# Open the reader without a WITH clause:
 reader = t.open_reader(partition='pt=test')
 count = reader.count
```

```
  for record in reader[5:10]
      # Process a record.
```

- **Call the Tunnel API to read table data. The `open_reader` method is an encapsulation of the Tunnel API.**

Use PyODPS to write data

Similar to `open_reader`, you can use `open_writer` for a table object to open a writer and write data to a table. Example:

```
 # Open the writer with a WITH clause:
 with t.open_writer(partition='pt=test') as writer:
     writer.write(records)  # Here, records can be any iteratable
records and are written to block 0 by default.

 with t.open_writer(partition='pt=test', blocks=[0, 1]) as writer:  #
Two blocks are enabled here.
     writer.write(0, gen_records(block=0))
     writer.write(1, gen_records(block=1))  # The two write operations
 can be performed in parallel based on the multithreading technique.
Each block is independent.

 # Open the writer without a WITH clause:
 writer = t.open_writer(partition='pt=test', blocks=[0, 1])
 writer.write(0, gen_records(block=0))
 writer.write(1, gen_records(block=1))
 writer.close()  # You must close the writer. Otherwise, the written
data may be incomplete.
```

Similarly, writing data to a table is an encapsulation of the Tunnel API.

Delete a PyODPS table

Delete a table as follows:

```
 odps.delete_table('my_table_name', if_exists=True)  # Delete a table
only when the table exists.
  t.drop()  # Directly drop a table if the table exists.
```

PyODPS table partition operations

- **Perform basic operations.**

  Traverse all partitions of a table. Example:

```
  for partition in table.partitions:
      print(partition.name)
  for partition in table.iterate_partitions(spec='pt=test'):
```

```
    # Traverse list partitions.
```

Check whether a partition exists. Example:

```
table.exist_partition('pt=test,sub=2019')
```

Obtain information about a partition. Example:

```
 partition = table.get_partition('pt=test')
 print(partition.creation_time)
2019-09-18 22:22:27
 partition.size
0
```

- **Create a partition.**

```
t.create_partition('pt=test', if_not_exists=True) # Create a
partition only when no partition with the same name exists.
```

- **Delete a partition.**

```
t.delete_partition('pt=test', if_exists=True)  # Delete a partition
only when the partition exists.
 partition.drop()  # Directly drop a partition if the partition
exists.
```

PyODPS SQL

PyODPS supports MaxCompute SQL queries and provides methods to read execution results.

- **Run SQL statements.**

```
odps.execute_sql('select * from dual')  #  Execute the SQL statement
 in synchronous mode. Blocking continues until execution of the SQL
statement is completed.
instance = odps.run_sql('select * from dual')  # Execute the SQL
statement in asynchronous mode.
instance.wait_for_success()  # Blocking continues until execution of
 the SQL statement is completed.
```

- **Obtain SQL query results.**

  You can directly call the `open_reader` method to obtain SQL query results. In the following example, structured data is returned.

```
 with odps.execute_sql('select * from dual').open_reader() as reader
:
    for record in reader:
```

```
        # Process each record.
```

When the `desc` command is executed, you can use `reader.raw` to obtain the raw SQL query results.

```
with o.execute_sql('desc dual').open_reader() as reader:
    print(reader.raw)
```

PyODPS resources

Resources commonly apply to UDFs and MapReduce on MaxCompute.

You can call `list_resources` to list all resources, `exist_resource` to check whether a resource exists, and `delete_resource` to delete a resource. You can also call the `drop` method to delete a resource.

PyODPS mainly supports two resource types: file resources and table resources.

- **File resources**

  Files of basic file types and the .py, .jar, and .archive types are supported.

  - **Create a file resource.**

    You can create a file resource by specifying a resource name, a file type, and a file-like or string object. Example:

    ```
    resource = odps.create_resource('test_file_resource', 'file',
    file_obj=open('/to/path/file'))  # Use a file-like object.
    resource = odps.create_resource('test_py_resource', 'py', file_obj
    ='import this')  # Use a string.
    ```

  - **Read and modify a file resource.**

    You can call the `open` method for a file resource or call `open_resource` at the MaxCompute entry to open a file resource. The opened object is a file-like object. Similar to the `open` method built in Python, file resources also support various opening modes. Example:

    ```
    with resource.open('r') as fp:  # Open the file in read mode.
       content = fp.read()  # Read all content.
        fp.seek(0)  # Return to the beginning of the resource.
        lines = fp.readlines()  # Read multiple lines.
        fp.write('Hello World')  # Error. Data cannot be written into
    a file in read mode.

    with odps.open_resource('test_file_resource', mode='r+') as fp:
    # Open the file in read/write mode.
        fp.read()
        fp.tell()  # Current position
        fp.seek(10)
        fp.truncate()  # Truncate the file to the specified length.
    ```

```
    fp.writelines(['Hello\n', 'World\n'])  # Write multiple lines
 into the file.
    fp.write('Hello World')
    fp.flush()  # Manually calling the method will submit the
update to MaxCompute.
```

PyODPS supports the following opening modes:

- **r: read mode. The file can be opened but data cannot be written into it.**
- **w: write mode. Data can be written into the file, but data in it cannot be read. Note that the file content is cleared first if the file is opened in write mode.**
- **a: append mode. Data can be added to the end of the file.**
- **r+: read/write mode. You can read and write data from and to the file.**
- **w+: This mode is similar to r+, but the file content is cleared first.**
- **a+: This mode is similar to r+, but data can only be written to the end of the file .**

In PyODPS, file resources can be opened in binary mode. For example, some compressed files must be opened in binary mode. rb indicates that a file is opened in binary read mode, and r+b indicates that a file is opened in binary read/write mode.

- **Table resources**

  Create a table resource.

```
 odps.create_resource('test_table_resource', 'table', table_name='
my_table', partition='pt=test')
```

  Update a table resource.

```
 table_resource = odps.get_resource('test_table_resource')
 table_resource.update(partition='pt=test2', project_name='
my_project2')
```

DataFrame

PyODPS provides a pandas-like interface called PyODPS DataFrame. This interface can make full use of the computing power of MaxCompute. For more information, see *DataFrame*.

The following DataFrame examples are provided for reference only.

Note:

You must create a MaxCompute object before performing the following steps.

```
 odps = ODPS('**your-access-id**', '**your-secret-access-key**',
            project='**your-project**', endpoint='**your-end-point
**'))
```

Assume that the following tables exist: `pyodps_ml_100k_movies` **(movie-related data),** `pyodps_ml_100k_users` **(user-related data), and** `pyodps_ml_100k_ratings` **(rating-related data).**

You only need to pass in a Table object to create a DataFrame object. Example:

```
from odps.df import DataFrame
```

```
users = DataFrame(o.get_table('pyodps_ml_100k_users'))
```

You can use the `dtypes` **attribute to view the fields of DataFrame and the types of these fields. Example:**

```
users.dtypes
```

You can use the `head` **method to obtain the first N data records for quick data preview. Example:**

```
users.head(10)
```

	user_id	age	sex	occupation	zip_code
0	1	24	M	technician	85711
1	2	53	F	other	94043
2	3	23	M	writer	32067
3	4	24	M	technician	43537
4	5	33	F	other	15213
5	6	42	M	executive	98101
6	7	57	M	administrator	91344
7	8	36	M	administrator	05201
8	9	29	M	student	01002
9	10	53	M	lawyer	90703

You can add a filter on the fields to selectively view fields. Example:

```
users[['user_id', 'age']].head(5)
```

	user_id	age
0	1	24
1	2	53
2	3	23
3	4	24
4	5	33

You can also exclude several fields from results. Example:

```
users.exclude('zip_code', 'age').head(5)
```

	user_id	sex	occupation
0	1	M	technician
1	2	F	other
2	3	M	writer
3	4	M	technician
4	5	F	other

When you exclude some fields, you may want to obtain new columns through computation. For example, add the sex_bool attribute and set it to True if sex is M. Otherwise, set it to False.

```
users.select(users.exclude('zip_code', 'sex'), sex_bool=users.sex == '
M').head(5)
```

	user_id	age	occupation	sex_bool
0	1	24	technician	True
1	2	53	other	False
2	3	23	writer	True
3	4	24	technician	True
4	5	33	other	False

Obtain the number of users aged between 20 and 25. Example:

```
users.age.between(20, 25).count().rename('count')
```

```
943
```

Obtain the numbers of male and female users. Example:

```
users.groupby(users.sex).count()
```

	sex	count
0	F	273
1	M	670

To divide users by occupation, obtain the first 10 occupations that have the largest population, and sort the occupations in descending order of population. Example:

```
df = users.groupby('occupation').agg(count=users['occupation'].count
())
df.sort(df['count'], ascending=False)[:10]
```

	occupation	count
0	student	196
1	other	105
2	educator	95
3	administrator	79
4	engineer	67
5	programmer	66
6	librarian	51
7	writer	45
8	executive	32
9	scientist	31

The DataFrame API provides the value_counts method for the same purpose. Example:

```
users.occupation.value_counts()[:10]
```

	occupation	count
0	student	196
1	other	105
2	educator	95

	occupation	count
3	administrator	79
4	engineer	67
5	programmer	66
6	librarian	51
7	writer	45
8	executive	32
9	scientist	31

Show data in an intuitive graph. Example:

```
 %matplotlib inline
```

Use a horizontal column chart to visualize data. Example:

```
 users['occupation'].value_counts().plot(kind='barh', x='occupation',
ylabel='prefession')
```

Divide users into 30 groups by age and view the histogram of age distribution. Example:

```
users.age.hist(bins=30, title="Distribution of users' ages", xlabel='
age', ylabel='count of users')
```

Use the join method to join the three tables and save the joined tables as a new table. Example:

```
movies = DataFrame(o.get_table('pyodps_ml_100k_movies'))
ratings = DataFrame(o.get_table('pyodps_ml_100k_ratings'))
o.delete_table('pyodps_ml_100k_lens', if_exists=True)
lens = movies.join(ratings).join(users).persist('pyodps_ml_100k_lens')
lens.dtypes
```

```
odps.Schema {
  movie_id                                 int64
  title                                    string
  release_date                             string
  video_release_date                       string
  imdb_url                                 string
  user_id                                  int64
  rating                                   int64
  unix_timestamp                           int64
  age                                      int64
  sex                                      string
  occupation                               string
  zip_code                                 string
```

```
}
```

Divide users aged 0 to 80 into eight age groups. Example:

```
 labels = ['0-9', '10-19', '20-29', '30-39', '40-49', '50-59', '60-69
', '70-79']
 cut_lens = lens[lens, lens.age.cut(range(0, 81, 10), right=False,
labels=labels).rename('age_group')]
```

View the first 10 data records of a single age in a group. Example:

```
cut_lens['age_group', 'age'].distinct()[:10]
```

	age_group	age
0	0-9	7
1	10-19	10
2	10-19	11
3	10-19	13
4	10-19	14
5	10-19	15
6	10-19	16
7	10-19	17
8	10-19	18
9	10-19	19

View the total rating and average rating of users in each age group. Example:

```
 cut_lens.groupby('age_group').agg(cut_lens.rating.count().rename('
total_rating'), cut_lens.rating.mean().rename('average_rating'))
```

	age_group	average_rating	total_rating
0	0-9	3.767442	43
1	10-19	3.486126	8181
2	20-29	3.467333	39535
3	30-39	3.554444	25696
4	40-49	3.591772	15021
5	50-59	3.635800	8704
6	60-69	3.648875	2623
7	70-79	3.649746	197

Configuration

PyODPS provides a series of configuration options, which can be obtained through `odps.options`. The following table lists configurable MaxCompute options.

- **General configuration**

Option	Description	Default value
end_point	The MaxCompute endpoint.	None
default_project	The default project.	None
log_view_host	The hostname of LogView.	None
log_view_hours	The retention time of LogView (unit: hours).	24
local_timezone	The time zone to be used. True indicates local time, and False indicates UTC. The pytz time zone can also be used.	None
lifecycle	The lifecycle of all tables.	None
temp_lifecycle	The lifecycle of temporary tables.	1
biz_id	The ID of the user.	None
verbose	Specifies whether to display logs.	False
verbose_log	The log receiver.	None
chunk_size	The size of the write buffer.	1496
retry_times	The maximum number of times to retry the request.	4
pool_connections	The number of cached connections in the connection pool.	10
pool_maxsize	The maximum capacity of the connection pool.	10

Option	Description	Default value
connect_timeout	The time to wait before the connection times out.	5
read_timeout	The time to wait before the read times out.	120
completion_size	The limit on the number of object completion listing items.	10
notebook_repr_widget	Specifies whether to use interactive graphs.	True
sql.settings	MaxCompute SQL runs global hints.	None
sql.use_odps2_extension	Specifies whether to enable MaxCompute 2.0 language extension.	False

- Data upload/download configuration

Option	Description	Default value
tunnel.endpoint	The Tunnel endpoint.	None
tunnel.use_instance_tunnel	Specifies whether to use Instance Tunnel to obtain execution results.	True
tunnel.limited_instance_tunnel	Specifies whether to limit the number of data records obtained by using Instance Tunnel.	True
tunnel.string_as_binary	Specifies whether to use bytes instead of unicode for data of the STRING type.	False

- DataFrame configuration

Option	Description	Default value
interactive	Specifies whether DataFrame is used in an interactive environment.	Depends on the measured value

Option	Description	Default value
df.analyze	Specifies whether to enable non-MaxCompute built-in functions.	True
df.optimize	Specifies whether to enable full DataFrame optimization.	True
df.optimizes.pp	Specifies whether to enable DataFrame predicate push optimization.	True
df.optimizes.cp	Specifies whether to enable DataFrame column pruning optimization.	True
df.optimizes.tunnel	Specifies whether to enable DataFrame tunnel optimization.	True
df.quote	Specifies whether to use `` to mark fields and table names in the backend of MaxCompute SQL.	True
df.libraries	The resource name of the third-party library that is used for DataFrame operation.	None

- PyODPS ML configuration

Option	Description	Default value
ml.xflow_project	The default XFlow project name.	algo_public
ml.use_model_transfer	Specifies whether to use ModelTransfer to obtain the model PMML.	True
ml.model_volume	The volume name used when ModelTransfer is used.	pyodps_volume

2 DataWorks

2.1 Product introduction

DataWorks is an end-to-end big data platform released by Alibaba Cloud in 2009. It integrates all processes from data collection to data display and from data analysis to application running. It offers a wide range of features and services to help enterprises quickly and effectively build Data Mid-End.

2.2 Terms

Workspace

A workspace is the basic organizational object in DataWorks. It serves as the basic unit for you to manage tables, resources, user-defined functions (UDFs), nodes, and permissions.

Node

A node is a scheduling definition that is submitted and released on DataStudio or created by calling APIs.

Business flow

A business flow consists of a set of nodes with dependency between each other.

Instance or task instance

Before nodes can be run, they must be converted into task instances in the DataWorks scheduling system.

2.3 List of operations by function

Operations of the scheduling system

- **Create a node**
- **Update a node**
- **Update multiple nodes at a time**
- **Delete a node**
- **Query parent nodes**

- Query child nodes
- Query the node code
- Query nodes
- Query a node by ID
- Query the total number of nodes
- Query node instances
- Query the operational logs of a node instance
- Query a node instance by ID
- Query the parent node at a specified level
- Query the child node instances at a specified level
- Query the number of node instances in each status of an application
- Query the number of task instances in each status on a specified date
- Query the number of node instances in each status for applications
- Rerun an instance
- Restore an instance
- Set the instance status to Success and trigger descendant instances
- Terminate a node
- Rerun a descendant instance
- Update the scheduling configurations of an instance
- Pause an instance
- Terminate multiple instances at a time
- Rerun multiple instances at a time
- Restore multiple nodes at a time
- Pause multiple instances at a time
- Set the status of multiple instances to Success
- Query the total number of instances on the current day
- Query workflow instances
- Create a retroactive data generation task
- Run a smoke test
- Run an ad-hoc workflow
- Terminate a workflow
- Submit a resource package
- View the submission status of the resource package

2.4 Make API requests

DataWorks allows you to make API requests by using the POP Java SDK or the HTTP method. The POP Java SDK is newly released. You can only use the Java SDK to call new API operations in the later versions of DataWorks. The HTTP method can only be used to call existing API operations.

2.4.1 POP Java SDK

If you want to use a client to make an API request by using the POP Java SDK, you must specify the following parameters to initialize the client: popEndpoint, accessId, accessKey, popProduct, regionId, and popEndpointName.

popEndpoint

An endpoint consists of the prefix dataworks. followed by the domain name of Apsara Stack DataWorks. For example, if the DataStudio URL for Apsara Stack is http://ide.envxxx.yyyyy.com, the endpoint is dataworks. envxxx.yyyyy.com. If this is not true, contact Alibaba Cloud technical support.

accessId and accessKey

Specify the AccessKey ID and AccessKey secret of the Apsara Stack tenant account.

popProduct

The popProduct parameter is set to dataworks-private-cloud, a fixed string.

regionId and popEndpointName

- **The regionId parameter is set to default.**
- **The popEndpointName parameter is set to default.**

Authorization

You can only use an authorized Apsara Stack tenant account to make API requests by using the POP Java SDK.

The whitelist mechanism is used at POP for the access control of APIs. To authorize an Apsara Stack tenant account, add the account to the whitelist. If the account that

you use to make API requests is not on the whitelist, the following error message appears.

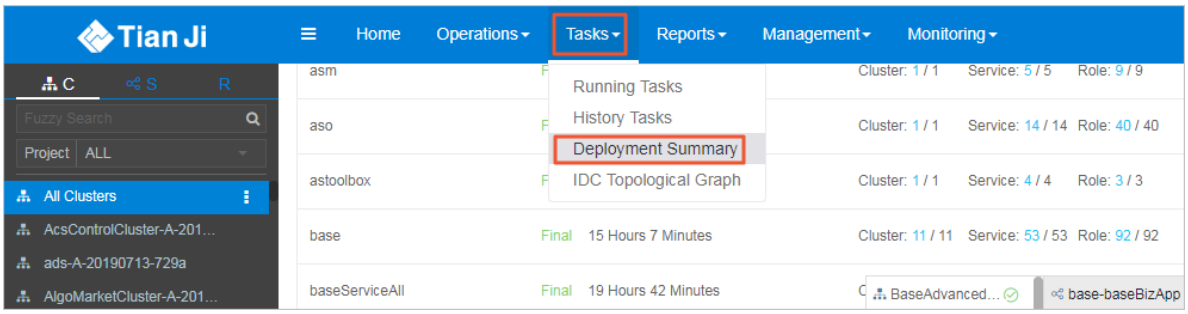
```
com.aliyuncs.exceptions.ClientException: InvalidApi.NotFound :
Specified api is not found, pleasecheck your url and method.
```

This error message specifies that the account is not authorized to call the specified API operation. To resolve this issue, perform the following operations.

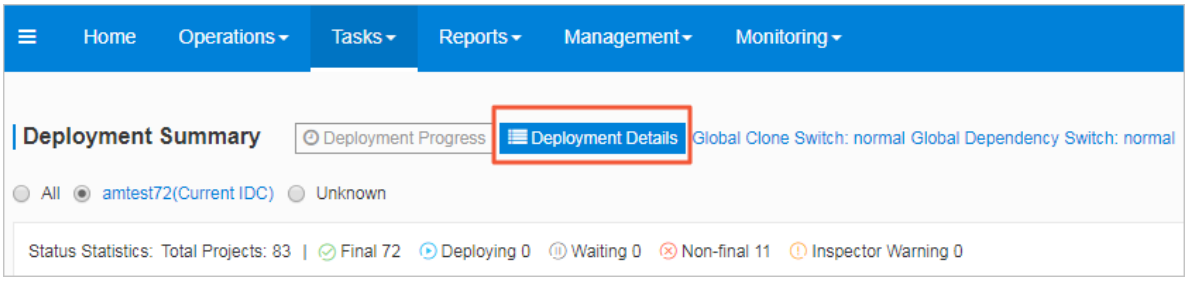
Contact the DataWorks technical support staff and provide them with the Apsara Stack tenant account to be authorized and the API operations to be called. After receiving an encrypted license generated by the DataWorks technical support staff based on the configuration in the runtime environment, use the license to authorize the account to make API requests. For more information, see the following procedure.

1. Log on to Apsara Infrastructure Management Framework.

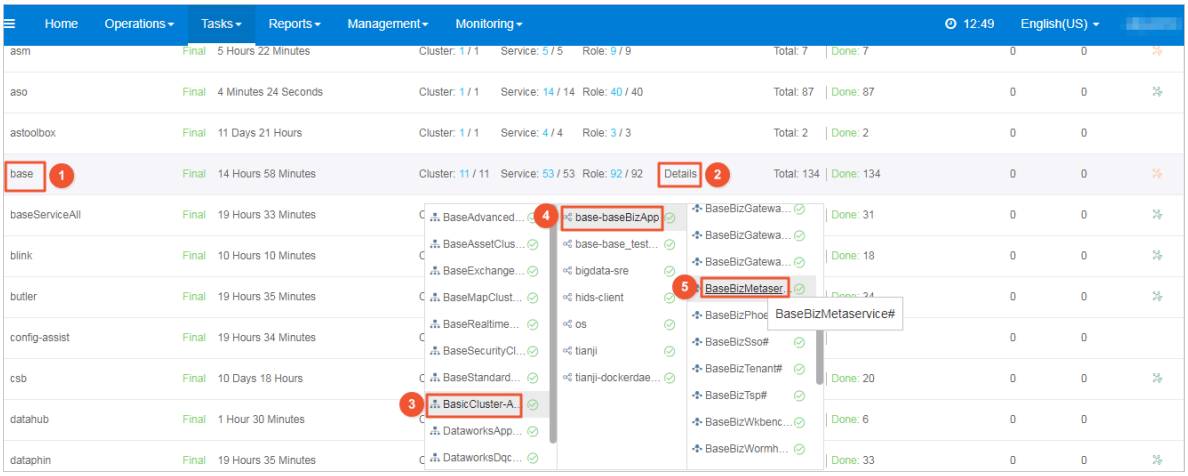
   For more information, see *the* Log on to Apsara Infrastructure Management Framework topic in the Apsara Infrastructure Management Framework section of the Basic platform operations chapter *in* Alibaba Cloud Apsara Stack Enterprise Operation Guide.
2. In the top navigation bar, move the pointer over Tasks and select Deployment Summary from the drop-down menu.



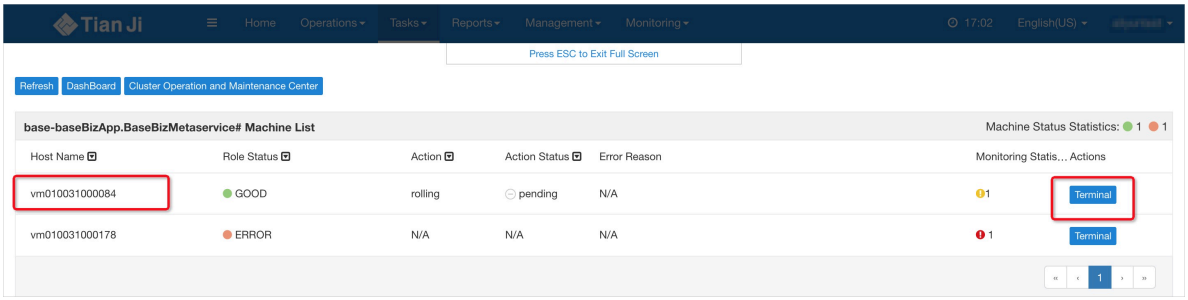
3. On the Deployment Summary page that appears, click Deployment Details. The Deployment Details page appears.



4. Move the pointer over the base project, click Details, and then choose BasicCluster-A-20190708-376d Machine List > base-baseBizApp > BaseBizMetaservice.



5. On the page that appears, click Terminal in the Actions column for the target host to go to the TerminalService page.



6. On the TerminalService page, click the add icon, and run the `docker ps | grep meta` command on the tab that appears to obtain the ID of the base-biz-metaservice container. For example, the following figure shows that the container ID is d6eb89507a17.
7. Log on to the container and run the docker exec -it d6eb89507a17 bash command. Then, you can use the license for authorization.

   Run the following command to authorize the account to make API requests:

```
curl -X POST -d "license=4AA481CE03EAFA6529ECA131ED6E29AAD511B66A
760C33786AD241BE1D90D7007C4056FA26FD13318B92BCFB4B254E42" "http://
127.0.0.1/dataos/v1/conf_dataos_api";
```

   In this command, the license is provided by the DataWorks technical support. If the command is run successfully, it returns `{"data":"ok","errCode":0,"errMsg":"success","requestId":"0a0414261555747936747847e031b"}`. You can then use the authorized account to make API requests.

Sample code

```
public void setup () throws IOException, ClientException {
   popEndpoint = "dataworks. envxxx.yyyyy.com";
   popEndpointName = "default";
   accessId = "accessId";
   accessKey = "accessKey";
   regionId = "default";
   popProduct = "dataworks-private-cloud";
   X509TrustAll.ignoreSSLCertificate();
   DefaultProfile.addEndpoint(popEndpointName, regionId, popProduct,
popEndpoint);
   IClientProfile profile = DefaultProfile.getProfile(regionId,
accessId, accessKey);
   IAcsClient client = new DefaultAcsClient(profile);
   }
```

```
/** * Example: DemoApiRequest *
@throws ServerException *
@throws ClientException */
@Test
public void test_DemoApi() throws ServerException, ClientException {
   DemoApiRequest request = new DemoApiRequest();
   request.setKeyword("abc");
   DemoApiResponse response = client.getAcsResponse(request);
   System.out.println(gson.toJson(response));
   }
```

Specify the account for calling API operations that involve the scheduling system

If you call an API operation that involves the scheduling system, you must specify the following three common request parameters: accountId, accountPwd, and clientName. The following procedure describes how to specify these three parameters.

1. **You can ask a field engineer to log on to the database that hosts the base-biz-tsp service. The name of the database is dwtsp.**
2. **The field engineer inserts a record into the cloudapi_account table to specify the accountId, accountPwd, and clientName parameters. These three parameters uniquely identify the account that is used for calling the API operation.**

2.4.2 HTTP API

2.4.2.1 Endpoints

The DataWorks API operations are categorized based on functions. Each type of API operations is accessed by using a specific domain name. For more information about the domain names, see the description about each type of API operations.

2.4.2.2 Protocol

All APIs use the HTTP protocol in Apsara Stack.

2.4.2.3 Request method

You can use the HTTP GET or POST request method to fulfill your intentions based on the description in the related API reference.

- **If you use the GET method, an API operation returns the result based on the parameters in the query string.**
- **If you use the POST method, an API operation returns the result based on the parameters in the query string. The parameters in the request body are ignored.**

2.4.2.4 Encoding

UTF-8 encoding is used in all the DataWorks APIs.

2.4.2.5 Signature method

Header

(Required) base_id

(Required) tenant_id

Signature

You must sign all API requests so that your identity can be verified. To sign an API request, follow these steps:

1. **Add the following two parameters to the request URL: baseKey and timestamp.**
2. **Calculate a signature and add it to the HTTP header.**
   - **Sample GET request**

     In this example, User B provides an HTTP GET API: /getapi. The name and age parameters are query parameters in the request URL. User A needs to use a URL that includes the following part to make the API request: `/getapi?name=fengyeng&age=20` . After User A obtains a token from the token center with the authentication passed such as AppCode, the baseKey and timestamp parameters are added to the request URL as query parameters. You can specify the authentication method to allow others to access the API operation. Therefore, the new URL includes the following part: `/getapi?name=fengyeng&age=20?baseKey=dsa134&timestamp=123456789` . A signature is

then generated based on the token and query parameters in the new URL, and added to the request header by the requester as a field, for example, signature:dsafadfsa141fdsaf1.

- **Sample POST request**

  In this example, User B provides an HTTP POST API: /postapi. User A needs to use a URL that includes the following part to make the API request: /postapi. After User A obtains a token from the token center, the baseKey and timestamp parameters are added to the request URL as query parameters. Therefore, the new URL includes the following part: /postapi?baseKey=dsa134&timestamp=123456789. A signature is then generated based on the token and query parameters in the new URL, and added to the request header by the requester as a field, for example, signature:dsafadfsa141fdsaf1.

2.4.2.6 Response parameters

```
{
    "requestId": <STRING>, # The request ID, which is used to locate
the log entries for troubleshooting.
    "returnCode": "0", # A value of 0 indicates that the API operation
 is successful.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": <The returned result>
}
```

2.4.2.7 API example

Sample code

```
import org.apache.commons.lang3.StringUtils; import org.apache.http.
HttpResponse;
import org.apache.http.client.HttpClient; import org.apache.http.
client.methods.HttpGet;
import org.apache.http.client.methods.HttpUriRequest; import org.
apache.http.impl.client.HttpClientBuilder;

import java.io.BufferedReader; import java.io.IOException; import java
.io.InputStreamReader; import java.net.URLDecoder;
import java.security.MessageDigest; import java.util.Arrays;

public class SearchNodes {

public static void main(String[] args) throws Exception {
HttpClient httpClient = HttpClientBuilder.create().buil
d();
String uri = "http://baseapi. ***.com/v1.0/node/prod?exe cuteMethod=
SEARCH&searchText=nodeTest";
HttpUriRequest request = createHttpRequest(
"base key",
```

```
"base token", uri
);
request.setHeader("tenant_id", "tenant ID"); request.setHeader("
base_id", "Apsara Stack tenant account ID");
HttpResponse response = httpClient.execute(request); BufferedReader
bufferedReader = new BufferedReader(new
InputStreamReader(response.getEntity().getContent())); StringBuilder
stringBuilder = new StringBuilder(); while(bufferedReader.ready()) {
String line = bufferedReader.readLine(); if (line == null) {
break;
}
stringBuilder.append(line);
}
System.out.println(stringBuilder.toString());
}

private static String byteArrayToHexString(byte[] byteArray) {

final char[] HEX_DIGITS = {'0', '1', '2', '3', '4', '5', '6', '7', '8
', '9', 'a', 'b','c', 'd', 'e', 'f'};
String result = null;
int l = byteArray.length; char[] str = new char[l << 1]; int k = 0;
for (int i = 0; i < l; i++) {
byte byte0 = byteArray[i];
str[k++] = HEX_DIGITS[byte0 >>> 4 & 0xf];
str[k++] = HEX_DIGITS[byte0 & 0xf];
}
result = new String(str); return result;
}

public static String tokenSign(String param, String salt) t hrows
Exception {
if (StringUtils.isEmpty(param) || StringUtils.isEmpty(salt)) {
  return null;
}

String query = URLDecoder.decode(param, "UTF-8");

String[] pStr = query.trim().split("&");
Arrays.sort(pStr);

StringBuilder buf = new StringBuilder(); for (int i = 0; i < pStr.
length; ++i) {
buf.append(pStr[i]);
buf.append("&");
}
String paramStr = buf.substring(0, buf.length() - 1);
String sourceStr = salt + ":" + paramStr + ":" + salt;
MessageDigest md = MessageDigest.getInstance("SHA-256");
byte[] byteArray = md.digest(sourceStr.getBytes("UTF-8"));
return byteArrayToHexString(byteArray);
}

protected static HttpUriRequest createHttpRequest(String baseKey,
String baseToken, String uri) {
StringBuilder buf;
int index = uri.indexOf('?') ;
if (index == -1) {
   index = uri.length();
   buf = new StringBuilder(uri.length() + baseKey.length() + 13);
   buf.append(uri).append('?') ;
} else {
   buf = new StringBuilder(uri.length() + baseKey.length() + 13);
   buf.append(uri).append('&');
```

```
}
   buf.append("baseKey=").append(baseKey);
   buf.append("&timestamp=").append(System.currentTimeMillis());
   HttpUriRequest request = new HttpGet(buf.toString()); String
signature;
   try {
       signature = tokenSign(buf.substring(index + 1), baseToken);
   } catch (Exception ex) {
     throw new RuntimeException("error on sign for uri: " + uri, ex);
   }
   request.addHeader("signature", signature);
   return request;
  }
}
```

2.5 APIs for HTTP requests

2.5.1 Create a node

URL: /v1.0/node/{projectEnv}/sync

Method: POST

Path parameters

Parameter	Type	Description
projectEnv	**String**	**The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environmen t. The value PROD specifies the production environment.**

Body

```
{
    "executeMethod": CREATE_NODE_SYNC, # The type of the operation.
    # For more information about the parameters, see NodeModifyDto in
Data structure.
    "nodeType": <INTEGER>, # The node type. Valid values: 0, 1, 2, and
 3. The value 0 specifies a node that runs as scheduled. The value 1
 specifies a one-off node. The value 2 specifies a paused node. The
value 3 specifies a dry-run node.
    "dependentType": <INTEGER>, # The dependency type of the node.
Valid values: 0, 1, 2, and 3. The value 0 specifies that the node can
 be run without waiting for the previous cycle of a specified node is
 completed. The value 1 specifies that the node is run only after the
 previous cycle of its child nodes is completed. The value 2 specifies
 that the node is run only after its previous cycle is completed. The
value 3 specifies that the node is run only after the previous cycle
of a custom node is completed.
    "nodeName": <STRING>, # The name of the node.
```

```
    "prgType": <INTEGER>, # The type of the node code.
    "priority": <INTEGER>, # The priority of the node.
    "owner": <STRING>, # The owner of the node.
    "appId": <LONG>, # The ID of the workspace to which the node
belongs.
    "cycType": <INTEGER>, # The scheduling type.
    "codeSrc": <STRING>, # The node code.
    "nodeFrom": <STRING>, # The source of the node.
    "inputs": [{ # The input data of the node.
     "data": <STRING>, # The output data of the ancestor node.
    }],
    "outputs": [{ # The output data of the node.
      "data": <STRING>, # The output data of the current node.
    }],
"uniqueId": <STRING>, # The unique ID that you define for the request.
}
```

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "returnValue": <LONG>, # Node ID
}
```

2.5.2 Update a node

URL: /v1.0/node/{projectEnv}/sync

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
    "executeMethod": CREATE_NODE_SYNC, # The operation type.
    # For more information about the parameters, see NodeModifyDto in
Data structure.
    "nodeType": <INTEGER>, # The node type. Valid values: 0, 1, 2, and
 3. 0: a normal task. 1: an ad-hoc task. 2: a task of a paused node. 3
: a task of a dry-run node.
    "dependentType": <INTEGER>, # The dependency type. Valid values:
0, 1, 2, and 3. 0:  The node is executed only after the current cycle
 of another node is completed. 1: The node is executed only after
the previous cycle of the user-created node is completed. 2: The node
 is executed only after the previous cycle of the level-1 node is
completed. 3: The node is executed only after its previous cycle is
completed.
```

```
    "nodeName": <STRING>, # The name of the node.
    "prgType": <INTEGER>, # The type of the node script.
    "priority": <INTEGER>, # The priority.
    "owner": <STRING>, # The workspace owner.
    "appId": <LONG>, # The workspace ID.
    "cycType": <INTEGER>, # The scheduling type.
    "codeSrc": <STRING>, # The node code.
    "nodeFrom": <STRING>, # The source of the node.
    "inputs": [{ # The node inputs.
     "data": <STRING>,  # The output of the ancestor nodes.
    }],
    "outputs": [{ # The node outputs.
      "data": <STRING>, # The output of the node.
    }],
"uniqueId": <STRING>, # The unique ID that you define for the request.
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operatiaon details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.3 Update multiple nodes at a time

URL: /v1.0/node/{projectEnv}

Method: POST

Path parameters

Parameter	Type	Description
projectEnv	**String**	**The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environmen t. The value PROD specifies the production environment.**

Body

```
[
    {
        "executeMethod": "CREATE_NODE", # The operation that you want
to perform. Valid values: CREATE_NODE, UPDATE_NODE, and DELETE_NODE.
        "nodeId": <LONG>, # The ID of the node in the scheduling
system. This parameter must be specified when you call this operation
to update a node.
```

```
        "uniqueId": <LONG>, # Required. The unique ID of the request
. It is transferred from the client and used only by the client to
compare execution results.
        "nodeName": <STRING>, # Required. The name of the node.
        "nodeType": <INTEGER>, # Required. The node type. Valid values
: 0, 1, 2, and 3. The value 0 specifies a node that runs as scheduled
. The value 1 specifies a one-off node. The value 2 specifies a paused
 node. The value 3 specifies a dry-run node.
        "prgType": <INTEGER>, # Required. The type of the node code,
for example, odps_shell and odps_sql.
        "description": <STRING>, # Optional. The description of the
node.
        "paraValue": <STRING>, # Optional. The key-value pairs of a
node.
        "priority": <INTEGER>, # Optional. The priority of the node.
Default value: 0.
        "cronExpress": <STRING>, # Required. The CRON expression.
        "cloudUUID": <LONG>, # The node ID that is stored in the code
 library. This parameter is required when you call this operation to
update a node and is optional when you call this operation to create a
 node.
        "fileId": <LONG>, # Optional. The ID of the node code file.

        "fileVersion": <LONG>, # Optional. The version number of the
node code file.
        "owner": <STRING>, # Required. The owner of the node. The
value must be a standard employee ID.
        "resGroupId": <LONG>, # Required. The ID of the resource group
 to which the node belongs.
        "appId": <LONG>, # Required. The ID of the workspace to which
the node belongs.
        "baseLineId": <LONG>, # The ID of the baseline to which the
node belongs.
        "createUser": <STRING>, # Required. The user who created the
node.
        "modifyUser": <STRING>, # Required. The user who modified the
node last time.
        "multiInstCheckType": <INTEGER>, # Optional. The identifier of
 the operation that checks whether multiple instances exist.
        "cycType": <INTEGER>, # Required. The cycle type. Valid values
: 0, 1, and 2. The value 0 specifies that the cycle is equal to or
longer than one day. The value 1 specifies that the cycle is shorter
than one day. The value 2 specifies that the cycle is shorter than one
 day and node instances are executed in order of the node instance IDs
, such as 1, 2, 3...
        "dependentType": <INTEGER>, # Required. The dependency type
 of the node. Valid values: 0, 1, 2, and 3. The value 0 specifies
that the node can be run without waiting for the previous cycle of a
 specified node is completed. The value 1 specifies that the node is
run only after the previous cycle of its child nodes is completed. The
 value 2 specifies that the node is run only after its previous cycle
 is completed. The value 3 specifies that the node is run only after
the previous cycle of a custom node is completed.
        "dependentNodeIds": [<LONG>, ...], # The ID of nodes on which
the current node depends. By default, this parameter is set to the IDs
 of child nodes of the current node.
        "multiInstKillType": <INTEGER>, # Optional. The type of
instances to be terminated. Valid values: 0, 1, and 2. The value
0 specifies to terminate no node instances. The value 1 specifies
to terminate non-routine node instances. The value 2 specifies to
terminate routine node instances.
        "refreshToTask": <BOOLEAN>, # Optional. Specifies whether the
configuration takes effect on the current node instance.
```

```
        "updateNodeOnly": <BOOLEAN>, # Specifies whether to refresh
the metadata of ancestor and descendant nodes. Default value: false.

        "codeSrc": <STRING>, # The node code. This parameter must be
specified when the value of updateNodeOnly is set to false.
        "envType": <INTEGER> , # Optional. The type of the runtime
environment.
        "nodeFrom": <STRING>, # Optional. The source of the node, that
 is, the system from which the node is deployed.
        "inputs": [
            {
                "data": <STRING>, # Required. The input data of the
node.
            },
            ...
        ], # Required. The input data of the node.
        "outputs": [
            {
                "data": <STRING>, # Required. The output data of the
node.
            }
            , ...
        ], # Required. The output data of the node.
        "relatedFlowId": <LONG>, # Optional. The ID of the sub-flow to
 which the node belongs.
        "startEffectDate": <STRING>, # Optional. The start date of the
 time period during which scheduling is permitted.
        "endEffectDate": <STRING>, # Optional. The end date of the
time period during which scheduling is permitted.
        "rerunAble": <BOOLEAN>, # Required. Specifies whether the node
 can be rerun.
        "userExtension": <STRING>, # Optional. The extended properties
 of the node.
        "childNodeId": <LONG>, # Optional. The ID of the child node.
It is used when you add or delete a node dependency.
        "parentNodeId": <LONG>, # Optional. The ID of the parent node.

        "createInstanceUrl": <STRING>, # Optional. The URL used to
create a node instance.
        "dqcType": <INTEGER>, # Optional. The type of the Data Quality
 check.
        "dqcDescription": <STRING>, # Optional. The description of the
 Data Quality check.
        "taskRerunTime": <INTEGER>, # Optional. The time when the node
 reruns.
        "taskRerunInterval": <LONG>, # Optional. The interval at which
 the node reruns.
        "manualTrigger": <INTEGER>, # Optional. Specifies whether the
node needs to be manually triggered.
        "sycRefreshTask": <BOOLEAN>, # Optional. Specifies whether the
 node instances are updated when the node is updated.
        "flowId": <LONG> # Required. The ID of the flow to which the
node belongs.
    },
    ...
]
```

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
```

```
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "returnValue": <STRING> # requestId
}
```

2.5.4 Delete a node

URL: /v1.0/node/{projectEnv}/sync

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
    "executeMethod": DELETE_NODE_SYNC, # The operation type.
    "nodeId": <LONG>, # The node ID.
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": {
        "Node ID": "success",
        …
     }
}
```

2.5.5 Query parent nodes

Description: You can call this operation to query the parent nodes of the specified node.

URL: /v1.0/node/{projectEnv}

Method: GET

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

URL query string parameters

Name	Type	Description
executeMethod	String	(Required) The operation that you want to perform. Set the value to SEARCH_NODE_PARENTS_BY_DEPTH.
nodeId	Long	(Required) The ID of the node.
depth	Integer	(Required) The number of levels to be traversed.
nodeIds	String	(Optional) The node IDs, separated by commas (,).
cloudUUID	Long	(Optional) The node ID that is stored in the code library.

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": [<NodeEntity>, ...]
}
```

2.5.6 Query child nodes

Description: You can call this operation to retrieve child nodes of a specified node by level.

URL: /v1.0/node/{projectEnv}

Method: GET

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

URL query string parameters

Name	Type	Description
executeMethod	String	(Required) The operation that you want to perform. Set the value to SEARCH_NODE_PARENTS_BY_DEPTH.
nodeId	Long	(Required) The node ID.
depth	Integer	(Required) The number of levels to be traversed.
nodeIds	String	(Optional) The node IDs, separated by commas (,).
cloudUUID	Long	(Optional) The node ID that is stored in the code library.

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": [<NodeEntity>, ...]
}
```

2.5.7 Query the node code

URL: /v1.0/node/{projectEnv}

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	String	The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.

Query parameters in the request URL

Parameter	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH_NODE_CODE.
cloudUUID	Long	The node ID that is stored in the code library.
version	Long	The version of the node code.

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": <STRING> # The node code.
}
```

2.5.8 Query nodes

URL: /v1.0/node/{projectEnv}

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	String	The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environmen t. The value PROD specifies the production environment.

Query parameters in the request URL

Parameter	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH.
nodeName	String	Optional. The name of the node.
cloudUUID	Long	Optional. The node ID that is stored in the code library .
nodeId	Long	Optional. The ID of the node to query.
version	Long	Optional. The version of the node code.
inputs	String	Optional. The input data of the node. Separate multiple records with commas (,).
outputs	String	Optional. The output data of the node. Separate multiple records with commas (,).
fileId	Long	Optional. The ID of the code file.
nodeIds	String	Optional. The IDs of nodes to query. Separate multiple IDs with commas (,).
searchText	String	Optional. The characters to be entered on the front end used for searches, including the node ID and node name. The suffix fuzzy search is supported.
prgType	String	Optional. The type of the node code.
prgTypes	Integer	Optional. The types of the node code. Separate multiple types with commas (,).
appId	Long	Optional. The ID of the workspace to which the nodes belong. If you do not specify this parameter, all the applications under the current account are searched.

Parameter	Type	Description
owner	String	Optional. The owner of the node.
createUser	String	Optional. The user who created the node.
modifyUser	String	Optional. The user who modified the node.
createTime	String	Optional. The time when the node was created, in the format of yyyy-MM-dd HH:mm:ss.
modifyTime	String	Optional. The time when the node was modified, in the format of yyyy-MM-dd HH:mm:ss.
baseLineId	Long	Optional. The ID of the baseline.
deployDate	String	Optional. The time when the node was deployed.
orderBy	String	Optional. Specifies the way in which the nodes are ordered.
isDetail	Boolean	Optional. Specifies whether to query the node details.
depth	Integer	Optional. The number of levels to be traversed.
flowId	Long	The ID of the flow to which the node belongs.
nodeType	Integer	The type of the node. Valid values: 0, 1, 2, and 3. 0: the nodes that run as scheduled. 1: a node that must be manually triggered and cannot be scheduled. 2: a paused node. Paused nodes are initiated as scheduled but the system immediately returns a failure indication without executing the nodes. 3: a dry-run node. Dry-run nodes are initiated as scheduled but the system immediately returns a success indication without executing the nodes. This parameter is optional.
tenantId	Long	Optional. The ID of the tenant.
bizDate	String	Optional. The date-based timestamp of the node, in the format of yyyy-MM-dd.
prgName	String	Optional. The name of the node code file.
isOnline	Integer	Optional. The online status of the node. Valid values: 0 and 1. 0: online. 1: offline.

Parameter	Type	Description
modifyStartTime	String	Optional. The start of the time period during which the node was modified.
modifyEndTime	String	Optional. The end of the time period during which the node was modified.
deployStartingDate	String	Optional. The start of the time period during which the node was deployed.
deployDeadlineDate	String	Optional. The end of the time period during which the node was deployed.
nodeForm	String	The source of the node.
rerunAble	Boolean	Optional. Specifies whether to query nodes that can be or cannot be rerun.
bizId	Long	Optional. The workflow ID.
solId	Long	Optional. The solution ID.
filePaths	String	Optional. The paths to the node code files.
isSmoke	Boolean	Optional. Specifies whether to query nodes for which the smoke test is or is not run.
resGroupId	Long	Optional. The ID of the resource group.
isDeploy	Boolean	Optional. Specifies whether to query nodes that are deployed or are not deployed.
deployType	Integer	Optional. The type of the node after deployment. Valid values: 0, 1, 2, and 3. The value 0 specifies no type limit. The value 1 specifies a new node. The value 2 specifies a modified node. The value 3 specifies a deleted node.
pageStart	Integer	
pageSize	Integer	

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": [
        <NodeEntity>,
        ...
```

```
    ]
}
```

2.5.9 Query a node by ID

URL: /v1.0/node/{projectEnv}

Method: GET

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

URL query string parameters

Name	Type	Description
executeMethod	String	SEARCH_NODE_BY_ID
nodeId	Long	
isDetail	Boolean	Indicates whether to query the details about the node.

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", #  0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": <NodeEntity>
}
```

2.5.10 Obtain the total number of nodes

URL: /v1.0/node/{projectEnv}

Method: GET

Headers: application/json; charset=UTF-8

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

URL query string parameters

Name	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH_NODE_COUNT.

Response

```
{
    "returnCode": "0",
    "returnErrorSolution": "",
    "returnMessage": "",
    "requestId": null,
    "returnValue": 283232, # The total number of nodes.
    "success": true
}
```

2.5.11 Query node instances

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	String	The type of the environment. Valid values: DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.

Query parameters in the request URL

Parameter	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH.
appId	Long	The ID of the workspace to which the node instance belongs.
appIds	String	The IDs of workspaces to which the node instances belong. Separate multiple application IDs with commas (,).
taskId	Long	The ID of the node instance to query.
nodeId	Long	The ID of the node to which the node instance belongs .
inGroupId	Long	The ID of the cycle to which the node instance belongs .
nodeIds	String	The IDs of nodes to which the node instances belong. Separate multiple node IDs with commas (,).
dagId	Long	The ID of the workflow instance to which the node instance belongs.
taskType	Integer	The type of the node instance. Valid values: 0, 1, 2, and 3. · 0: routine. · 1: manually triggered. · 2: paused. · 3: dry-run.
taskTypes	String	The types of the node instances. Separate multiple types with commas (,).
taskStatuses	String	The statuses of the node instances. Separate multiple statuses with commas (,).
dagType	Integer	The type of the workflow instance to which the node instance belongs. Valid values: 1, 2, 3, and 4. · 1: the routine workflow instance that is run as scheduled. · 2: the workflow instance for smoke test. · 3: the workflow instance for generating retroactive data. · 4: the manually triggered workflow instance.

Parameter	Type	Description
prgType	Integer	The type of the node code.
status	Integer	The status of the node.
owner	String	The owner of the node or the node instance.
bizdate	String	The date-based timestamp.
odpsInstanceId	String	The ID of the ODPS node instance.
bizBeginHour	String	The start of the time period when the workflow runs.
bizEndHour	String	The end of the time period when the workflow runs.
beginBizDate	String	The start date of the period when the workflow runs.
endBizDate	String	The end date of the period when the workflow runs.
searchText	String	The characters entered on the front end used for searches, including the node ID and node name.
baseLineId	Long	The ID of the baseline to which the node instance belongs.
createTime	String	The time when the node instance was created.
isDetail	Boolean	Optional. Specifies whether to query the details of the node instance.
opSeq	Long	The sequence number of the operation.
depth	Integer	Optional. The number of levels to be traversed.
historyId	Long	The ID of the node instance log.
costTime	Integer	The time elapsed for running the node instance. Unit: seconds.
startRunTimeFrom	String	The start of a time period during which the node instance starts running.
startRunTimeTo	String	The end of a time period during which the node instance starts running.
finishRunTimeFrom	String	The start of a time period during which the node instance stops running.
finishRunTimeTo	String	The end of a time period during which node instance stops running.
createTimeFrom	String	The start of a time period during which the node instance was created.

Parameter	Type	Description
createTimeTo	String	The end of a time period during which the node instance was created.
prgTypes	String	The types of the node code. Separate multiple types with commas (,).
taskIds	String	The IDs of the node instances to query.
rerunAble	Boolean	Optional. Specifies whether to query node instances that can be or cannot be rerun.
dagName	String	The name of the workflow instance.
orderBy	String	Optional. Specifies the way in which the node instances are ordered.
bizId	Long	The ID of the workflow.
solId	Long	The ID of the solution.
gmtdate	String	The date when the node instance was generated.
createUser	String	The user who created the node instance.
modifyUser	String	The user who modified the node instance last time.
modifyTime	String	The time when the node instance was last modified.
deployDate	String	The date when the node instance was deployed.
pageStart	Integer	The start number of the returned page.
pageSize	Integer	The number of entries returned per page.

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": [
        <TaskEntity>,
        ...
    ]
}
```

2.5.12 Query the operational logs of a node instance

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	**String**	**The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.**

Query parameters in the request URL

Parameter	Type	Description
executeMethod	**String**	**The operation that you want to perform. Set the value to SEARCH_TASK_RUNLOG.**
taskId	**Long**	**The ID of the node instance. Specify either taskId or historyId.**
historyId	**Long**	**The ID of the node instance log. Specify either taskId or historyId.**

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "returnValue": <STRING>
}
```

2.5.13 Query a node instance by ID

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	String	The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.

Query parameters in the request URL

Parameter	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH_TASK_BY_ID.
taskId	Long	The ID of the node instance to query.
isDetail	Boolean	Specifies whether to obtain the application details.

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "returnValue": <TaskEntity>
}
```

2.5.14 Query the parent node instance by level

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

URL query string parameters

Name	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH_TASK_PARENTS_BY_DEPTH.
taskId	Long	The ID of the business flow instance that contains the task instance.
depth	Integer	The level of the node.

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": [
        <TaskEntity>,
        ...
    ]
}
```

2.5.15 Query the child node instances at a specified level

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	String	The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.

Query parameters in the request URL

Parameter	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH_TASK_CHILDREN_BY_DEPTH.
taskId	Long	The ID of the node instance.
depth	Integer	The level where the node instance resides.

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": [
        <TaskEntity>,
        ...
    ]
}
```

2.5.16 Query the number of node instances in each status of an application

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	String	The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.

Query parameters in the request URL

Parameter	Type	Description
executeMethod	**String**	**The operation that you want to perform. Set the value to SEARCH_TASK_STATISTICS.**
appId	**Long**	-
bizdate	**String**	-

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": {
         "dagType": <INTEGER>,
         "appId": <LONG>,
         "bizdate": <STRING>, # The date-based timestamp.
         "noRun": <INTEGER>,
         "running": <INTEGER>,
         "waittingResource": <INTEGER>,
         "failure": <INTEGER>,
         "success": <INTEGER>,
        "waittingTime": <INTEGER>
    }
}
```

2.5.17 Query the number of task instances in each status on a specified business date

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

URL query string parameters

Name	Type	Description
executeMethod	**String**	**The operation that you want to perform. Set the value to SEARCH_TASK_STATISTICS_BY_OWNER.**
bizdate	**String**	

Response

```
{
   "requestId": <STRING>, # The request ID, used to search for logs to
 diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": {
         "dagType": <INTEGER>,
      "appId": <LONG>,
      "bizdate": <STRING>, # The business date.
      "noRun": <INTEGER>,
      "running": <INTEGER>,
      "waittingResource": <INTEGER>,
      "failure": <INTEGER>,
      "success": <INTEGER>,
        "waittingTime": <INTEGER>
    }
}
```

2.5.18 Query the number of node instances in each status for applications

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Parameter	Type	Description
projectEnv	String	The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.

Query parameters in the request URL

Parameter	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH_TASK_SUCCESSINFO.
bizdate	String	The date-based timestamp.
costTime	Integer	The time elapsed for running the node instance. Unit: seconds.
startRunTimeFrom	String	The start of a time period during which the node instance starts running.
startRunTimeTo	String	The end of a time period during which the node instance starts running.
finishRunTimeFrom	String	The start of a time period during which the node instance stops running.
finishRunTimeTo	String	The end of a time period during which the node instance stops running.
createTimeFrom	String	The start of a time period during which the node instance was created.

Parameter	Type	Description
createTimeTo	String	The end of a time period during which the node instance was created.
appId	Long	The ID of workspace to which the node instance belongs.
searchText	String	The characters entered on the front end used for searches, including the node ID and node name. The suffix fuzzy search is supported.
nodeId	Long	The ID of the node to which the node instance belongs.
nodeIds	String	The IDs of nodes to which the node instances belong .
taskIds	String	The IDs of the node instances to query.
taskStatuses	String	The statuses of the node instances to query.
taskTypes	String	The types of the node instances to query.
prgTypes	String	The time when the node instance was created.
createTime	String	
modifyTime	String	The time when the node instance was last modified .
deployDate	String	The date when the node instance was deployed.
gmtdate	String	The date when the node instance was generated.
bizBeginHour	String	The start of the time period when the workflow runs.

Parameter	Type	Description
bizEndHour	String	The end of the time period when the workflow runs.
bizBeginDate	String	The start date of the period when the workflow runs.
bizEndDate	String	The end date of the period when the workflow runs.

Response

```
{
   "requestId": <STRING>, # The request ID. It is used to find the log
 entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "returnValue": {
        "totalCount": <INTEGER>,
        "notRunCount": <INTEGER>,
        "waitTimeCount": <INTEGER>,
        "waitResCount": <INTEGER>,
        "runningCount": <INTEGER>,
        "failureCount": <INTEGER>,
        "successCount": <INTEGER>
    }
}
```

2.5.19 Rerun an instance

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

Request body

```
{
    "executeMethod": "RERUN_TASK",
    "taskId": <LONG>
```

```
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.20 Restore an instance

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
    "executeMethod": "RESUM_TASK",
    "taskId": <LONG>
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # The value 0 indicates that the operation is
called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.21 Set the instance status to Success and trigger descendant instances

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
    "executeMethod": "SETSUCCESS_TASK",
    "taskId": <LONG>
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.22 Terminate a task

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
    "executeMethod": "KILL_TASK",
    "taskId": <LONG>
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
```

```
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.23 Rerun a descendant instance

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
    "executeMethod": "FIXDATA",
    "taskId": <LONG>,
    "includeTaskIds": [<LONG>, ...]
}
```

Response

```
{
     "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.24 Update the scheduling configurations of an instance

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
    "Executemethod": "maid ",
    "taskId": <LONG>
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.25 Pause an instance

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

Request body

```
{
    "executeMethod": "STOP_TASK",
    "taskId": <LONG>
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.26 Terminate multiple instances

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
     "executeMethod": "BATCH_KILL_TASK",
     "includeTaskIds": [<LONG>, ...]
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.27 Rerun multiple instances

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
     "executeMethod": "BATCH_RESUM_TASK",
     "includeTaskIds": [<LONG>, ...]
```

```
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.28 Resume multiple tasks

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
      "executeMethod": "BATCH_RESUM_TASK",
      "includeTaskIds": [<LONG>, ...]
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.29 Pause multiple instances

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
      "executeMethod": "BATCH_STOP_TASK",
      "includeTaskIds": [<LONG>, ...]
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.30 Set the status of multiple instances to Success

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
     "executeMethod": "BATCH_SETSUCCESS_TASK",
     "includeTaskIds": [<LONG>, ...]
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
```

```
    "successCode": "0",
    "returnValue": true
}
```

2.5.31 Retrieve the total number of instances on the day

URL: /v1.0/task/{projectEnv}

Headers: application/json; charset=UTF-8

Method: GET

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

URL query string parameters

Name	Type	Description
executeMethod	String	SEARCH_TASK_STATISTICS_BY_DATE
dagType	Integer	(Optional) Default value: 1.
bizdate	String	(Optional) The day before the current day, in the format of yyyy-MM-dd.

Response

```
{
    "returnCode": "0",
    "returnErrorSolution": "",
    "returnMessage": "",
    "requestId": null,
    "Redding value": 283232, # The number of instances.
    "success": true
}
```

2.5.32 Query business flow instances

URL: /v1.0/dag/{projectEnv}

Method: GET

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

URL query string parameters

Name	Type	Description
executeMethod	String	The operation that you want to perform. Set the value to SEARCH_DAG_BY_ID.
dagId	Long	The ID of the business flow instance that contains the task instance.

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": [<DagEntity>, ...]
}
```

2.5.33 Retroactive execution

URL: /v1.0/dag/{projectEnv}

Method: POST

Path parameters

Name	Type	Description
projectEnv	String	Valid values: DEV and PROD.

Request body

```
{
        "executeMethod": "CREATE_DAG",
        "name": <STRING>, # The name of the retroactive workflow.
 "type": 3, # The business flow type. 3: retroactive execution.
 "rootNodeId": <LONG>, # The root node ID from which the retroactiv
e execution starts. If data of only one node is retroacted, set the
value to the ID of the node.
 "includeNodeIds": [<LONG>, ...], # The IDs of the nodes to be
retroacted. If data of only one node is retroacted, set the value to
the ID of the node.
```

```
 "excludeNodeIds": [<LONG>, ...], # The IDs of nodes that are excluded
 from the retroactive execution.
 "startBizDate": <STRING>, # The start date-based timestamp of data
involved in the retroactive task, in the format of yyyy-MM-dd hh:mm:ss
.
 "endBizDate": <STRING>, # The end date-based timestamp of data
involved in the retroactive task, in the format of yyyy-MM-dd hh:mm:ss
.
 "bizBeginTime": <STRING>, # The start time of the hourly task. For
example, 13:04:04.
 "bizEndTime": <STRING>, # The end time of the hourly task. For
example, 14:04:04.
 "isParallel": <BOOLEAN>, # Indicates whether the DAGs of retroactive
execution can run concurrently.
 "nodeParas": {<LONG>: <STRING>, ...}, # (Optional) The user-defined
parameter for updating a node. The key is node ID. The value is the ID
 of the node.
        "dagPara": <STRING>, # (Optional) The parameter for configurin
g a DAG, which applies to all instances in the DAG.
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": <LONG>, # The DAG ID.
}
```

2.5.34 Run a smoke test

URL: /v1.0/dag/{projectEnv}

Method: POST

Path parameters

Parameter	Type	Description
projectEnv	**String**	**The type of the environment. Valid values : DEV and PROD. The value DEV specifies the development environmen t. The value PROD specifies the production environment.**

Body

```
{
        "executeMethod": "CREATE_DAG",
        "name": <STRING>, # The custom name of the workflow.
```

```
 "type": 2, # The type of the workflow instance. The value 2 specifies
 a smoke test.
 "bizdate": <STRING>, # The date-based timestamp, in the format of
yyyy-MM-dd hh:mm:ss.
 "rootNodeId": <LONG>, # The ID of the root node.
 "rootNodeAppId": <LONG>, # The ID of the workspace to which the root
node belongs.
 "includeNodeIds": [], # The IDs of the whitelisted nodes. Leave this
parameter blank.
 "excludeNodeIds": [], # The IDs of the blacklisted nodes. Leave this
parameter blank.
 "bizBeginTime": <STRING>, # The start time of the hourly node, for
example, 13:04:04.
 "bizEndTime": <STRING>, # The end time of the hourly node, for
example, 14:04:04.
 "isParallel": false, # Specifies whether the node instance for
running the smoke test can be run concurrently.
 "nodeParas": {<LONG>: <STRING>, ...}, # Optional. The custom key
-value pairs for updating a node. Set the keys to node ID and the
values to the scheduling parameters of the node.
    "dagPara": <STRING>, # Optional. The key-value pair used to
generate retroactive data for a workflow instance. It applies to all
node instances that belong to the workflow instance.
}
```

Response

```
{
    "requestId": <STRING>, # The request ID. It is used to find the
log entries for troubleshooting.
    "returnCode": "0", # The execution status of the operation. The
value 0 indicates that the operation is successful.
    "returnMessage": <STRING>, # The returned execution details.
    "successCode": "0",
    "returnValue": <LONG>, # dag id
}
```

2.5.35 Execute an ad-hoc business flow

URL: /v1.0/dag/{projectEnv}

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
        "executeMethod": "CREATE_BUS_PROC_DAG",
        "name": <STRING>, # The name of the ad-hoc business flow
instance.
 "type": 5, # Set the type of the ad-hoc business flow instance to 5.
        "flowId": <LONG>, # The ID of the ad-hoc business flow.
```

```
 bizdate": <STRING>,  # The date-based timestamp of data, in the
format of yyyy-MM-dd hh:mm:ss.
 "rootNodeAppId": <LONG>,  # The ID of the application.
 "includeNodeIds": [],
 "excludeNodeIds": [],
 "isParallel": false,
 "nodeParas": {<LONG>: <STRING>, ...}, # (Optional) The user-defined
parameter for updating a node. The key is node ID. The value is the ID
 of the node.
        "dagPara": <STRING>, # (Optional) The parameter for configurin
g a DAG, which applies to all instances in the DAG.
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "count": <INTEGER>,
    "returnValue": <LONG>, # The DAG ID.
}
```

2.5.36 Terminate a business flow

URL: /v1.0/dag/{projectEnv}

Method: POST

Path parameters

Name	Type	Description
projectEnv	**String**	**Valid values: DEV and PROD.**

Request body

```
{
        "executeMethod": "CREATE_DAG",
       "Dagids": [<long>,...], # The ID of the DAGs to be terminated.
}
```

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "Charlevalue": <Boolean>
```

```
}
```

2.5.37 Submit a resource package

Description: You can call this operation to submit a resource package that contains flow and node definitions and resources. After the operation is called, RequestID is returned.

URL: /submission/project/{projectIdentifier}

Method: POST

Headers: Content-type: multipart/form-data

Data type: zipped files

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": true
}
```

2.5.38 Query the submission status of a resource package

URL: /submission/project/{projectIdentifier}/{requestId}

Path parameters

Name	Type	Description
requestId	**String**	

Response

```
{
    "requestId": <STRING>, # The request ID, used to search for logs
to diagnose the issues.
    "returnCode": "0", # 0 indicates that the operation is called.
    "returnMessage": <STRING>, # The operation details.
    "successCode": "0",
    "returnValue": {
        "createTime": <STRING>, # The time at which the submitted
request is accepted by the system.
        "name": <STRING>, # The generated name in the [the caller
system name-backToCheckId-createTime] format.
        "status": <STRING>, # The status. Values: success, fail, and
running.
        "message": <STRING>
    }
```

```
}
```

2.5.39 Data structure

2.5.39.1 NodeModifyDto

```
 {
        "nodeId": <LONG>, # The ID of the node in the scheduling
system. This parameter must be specified when you call this operation
to update a node.
        "uniqueId": <LONG>, # Required. The unique ID of the request
. It is transferred from the client and used only by the client to
compare execution results.
        "nodeName": <STRING>, # Required. The name of the node.
        "nodeType": <INTEGER>, # Required. The node type. Valid values
: 0, 1, 2, and 3. The value 0 specifies a node that runs as scheduled
. The value 1 specifies a one-off node. The value 2 specifies a paused
 node. The value 3 specifies a dry-run node.
        "prgType": <INTEGER>, # Required. The type of the node code,
for example, odps_shell and odps_sql.
        "description": <STRING>, # Optional. The description of the
node.
        "paraValue": <STRING>, # Optional. The key-value pairs of a
node.
        "priority": <INTEGER>, # Optional. The priority of the node.
Default value: 0.
        "cronExpress": <STRING>, # Required. The CRON expression.
        "cloudUUID": <LONG>, # The node ID that is stored in the code
 library. This parameter is required when you call this operation to
update a node and is optional when you call this operation to create a
 node.
        "fileId": <LONG>, # Optional. The ID of the code file.
        "fileVersion": <LONG>, # Optional. The version number of the
code file.
        "owner": <STRING>, # Required. The owner of the node.
        "resGroupId": <LONG>, # Required. The ID of the resource group
 to which the node belongs.
        "appId": <LONG>, # Required. The ID of the workspace to which
the node belongs.
        "baseLineId": <LONG>, # The ID of the baseline to which the
node belongs.
        "createUser": <STRING>, # Required. The user who created the
node.
        "modifyUser": <STRING>, # Required. The user who modified the
node last time.
        "cycType": <INTEGER>, # Required. The cycle type. Valid values
: 0, 1, and 2. The value 0 specifies that the cycle is equal to or
longer than one day. The value 1 specifies that the cycle is shorter
than one day. The value 2 specifies that the cycle is shorter than one
 day and node instances are executed in order of the node instance IDs
, such as 1, 2, 3...
        "dependentType": <INTEGER>, # Required. The dependency type
 of the node. Valid values: 0, 1, 2, and 3. The value 0 specifies
that the node can be run without waiting for the previous cycle of a
 specified node is completed. The value 1 specifies that the node is
run only after the previous cycle of a custom node is completed. The
value 2 specifies that the node is run only after the previous cycle
of its child nodes is completed. The value 3 specifies that the node
is run only after its previous cycle is completed.
        "dependentNodeIds": [<LONG>, ...], # The IDs of the custom
cross-version dependent nodes. This parameter must be specified when
```

```
 the value of dependentType is set to 3. Separate multiple IDs with
commas (,).
        "multiInstKillType": <INTEGER>, # Optional. The type of
instances to be terminated. Valid values: 0, 1, and 2. The value
0 specifies to terminate no node instances. The value 1 specifies
to terminate non-routine node instances. The value 2 specifies to
terminate routine node instances.
        "refreshToTask": <BOOLEAN>, # Optional. Specifies whether the
configuration takes effect on the current node instance.
        "updateNodeOnly": <BOOLEAN>, # Specifies whether to refresh
the metadata of ancestor and descendant nodes. Default value: false.

        "codeSrc": <STRING>, # The node code. This parameter must be
specified when the value of updateNodeOnly is set to false.
        "envType": <INTEGER> , # Optional. The type of the runtime
environment.
        "nodeFrom": <STRING>, # Optional. The source of the node, that
 is, the system from which the node is deployed.
        "inputs": [
            {
                "data": <STRING>, # Required. The input data of the
node.
            },
            ...
        ], # Required. The input data of the node.
        "outputs": [
            {
                "data": <STRING>, # Required. The output data of the
node.
            }
            , ...
        ], # Required. The output data of the node.
        "relatedFlowId": <LONG>, # Optional. The ID of the sub-flow to
 which the node belongs.
        "startEffectDate": <STRING>, # Optional. The start date of the
 time period during which scheduling is permitted.
        "endEffectDate": <STRING>, # Optional. The end date of the
time period during which scheduling is permitted.
        "rerunAble": <BOOLEAN>, # Required. Specifies whether the node
 can be rerun.
        "userExtension": <STRING>, # Optional. The extended properties
 of the node.
        "childNodeId": <LONG>, # Optional. The ID of the child node.
It is used when you add or delete a node dependency.
        "parentNodeId": <LONG>, # Optional. The ID of the parent node.

        "createInstanceUrl": <STRING>, # Optional. The URL used to
create a node instance.
        "dqcType": <INTEGER>, # Optional. The type of the Data Quality
 check.
        "dqcDescription": <STRING>, # Optional. The description of the
 Data Quality check.
        "taskRerunTime": <INTEGER>, # Optional. The time when the node
 reruns.
        "taskRerunInterval": <LONG>, # Optional. The interval at which
 the node reruns.
        "manualTrigger": <INTEGER>, # Optional. Specifies whether the
node needs to be manually triggered.
        "sycRefreshTask": <BOOLEAN>, # Optional. Specifies whether the
 node is a synchronous reloading node.
        "flowId": <LONG> # Required. The ID of the flow to which the
node belongs.
```

```
    }
```

2.5.39.2 TaskEntity

```
private Long id; // The node ID recorded in the database. It
increments automatically.
private Long taskId; // The ID of the node instance.
private Long nodeId; // The ID of the node to which the node instance
belongs.
private Long dagId; // The ID of the workflow instance to which the
node instance belongs.
private Integer inGroupId; // The sequence number of the cycle on the
current day of the hourly node.
private Integer taskType; // The type of the node. Valid values: 0, 1
, 2, and 3. The value 0 specifies a node that runs as scheduled. The
value 1 specifies a one-off node. The value 2 specifies a paused node
. The value 3 specifies a dry-run node.
private Integer dagType; // The type of the workflow instance to which
 the node instances belong. Valid values: 1, 2, 3, and 4. The value 1
specifies the routine workflow instance that is run as scheduled. The
 value 2 specifies the workflow instance for smoke test. The value 3
specifies the workflow instance for generating retroactive data. The
value 4 specifies the manually triggered workflow instance.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date dueTime; // The time when the node is scheduled to run.
private Integer status; // The status of the node.
private Long opSeq; // The sequence number of the operation.
private Integer opCode; // The operation command.
private String owner; // The owner of the node instance.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date bizdate; // The date-based timestamp.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date gmtdate; // The date when the node instance was generated
.
private String gateway; // The gateway server on which the node runs.
private String gwProcessId; // The ID of the gateway process in which
the node runs.
private String gwLogFile; // The log file of the gateway on which the
node runs.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date alisaReturnTime; // The date when the alisa service is
rerun.
private String prgName; // The name of the node code file.
private Integer prgType; // The type of the node code, for example,
odps_sql.
private Integer priority; // The priority of the node.
private Integer weight; // The weight of the node.
private String execName; // The name of the node code file.
private Long fileId; // The ID of the node code file.
private Integer fileVersion; // The version number of the node code
file.
```

```
private String odpsProjectName; // The name of the MaxCompute project.
private String paraValue; // The key-value pairs of a node.
private String gwLogLocalFile; // The local log file of the gateway on
 which the node runs.
private String resGroupIdentifier; // The identifier of the resource
group.
private Long resGroupId; // The ID of the resource group to which the
node instance belongs.
private Long baseLineId; // The ID of the baseline to which the node
instance belongs.
private Long appId; // The ID of the workspace to which the node
instance belongs.
private String appName; // The name of the application to which the
node instance belongs.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date beginWaitTimeTime; // The time elapsed until the node
status is changed to Pending (Schedule).

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date beginWaitResTime; // The time elapsed until the node
status is changed to Pending (Resources).

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date beginRunningTime; // The time elapsed until the node
status is changed to Running.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date finishTime; // The end of the time period when the node
instance runs.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date createTime; // The time when the node instance was
created.
private String createUser; // The user who created the node instance.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date modifyTime; // The time when the node instance was
modified last time.
private String modifyUser; // The user who modified the node instance
last time.
private Integer multiInstCheckType; // The identifier of the operation
 that checks whether multiple instances exist.
private Integer multiKillType; // The identifier of the operation that
 terminates multiple instances.
private Integer cycType; // The cycle type.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date cycTime; // The period that the cycle lasts.
```

```
private Integer roleType; // The role of the node, for example, a leaf
 node or a non-leaf node.
private Integer dependentType; // The dependency type of the node.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date deployDate; // The date when the node instance was
deployed.
private String nodeName; // The name of the node.
private Integer rerunTimes; // The number of times the node is rerun.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date nodeModifyTime; // The time when the node was modified
last time.

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date refreshTime;

@JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
@JsonDeserialize(using = DateDeserializer.class)
private Date delayExecTime;
private Boolean rerunAble;
private List<TaskRelationDto> parentTaskRelations; // The parent
relations of the node instance.
private List<TaskRelationDto> childTaskRelations; // The child
relations of the node instance.
private Integer isRunOver;// Indicates whether the node instance has
been run.
private Long bizId;
private List<MetaTable> parentOutputTabMetas; // The metadata of the
table on which the node instance depends.
private List<MetaTable> outputTabMetas; // The metadata of the output
table of the node instance.
```

2.5.39.3 DagEntity

```
private String name; // The name of the workflow instance.
 private Integer type; // The type of the workflow instance.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date bizdate; // The date-based timestamp. This parameter
must be specified for a one-off node.
 private Long rootNodeId; // The ID of the root node.
 private List<Long> includeNodeIds = new ArrayList<Long>(); // The IDs
 of the whitelisted nodes.
 private List<Long> excludeNodeIds = new ArrayList<Long>(); // The IDs
 of the blacklisted nodes.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date startBizDate; // The start of the time period when the
retroactive data generation task runs.
```

```
 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date endBizDate; // The end of the time period when the
retroactive data generation task runs.
 private String bizBeginTime; // The start time of the hourly node,
for example, 13:04:04.
 private String bizEndTime; // The end time of the hourly node, for
example, 14:04:04.
 private Boolean isParallel; // Specifies whether the workflow
instance to which the retroactive data generation task belongs can be
run concurrently.
 // ////////////////////////////////The preceding
parameters are required for creating an ad-hoc workflow
.//////////////////////////////////////////
 private Long dagId; // The ID of the workflow instance.
 private Integer status; // The status of the workflow instance.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date gmtdate; // The date when the workflow instance was
generated.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date startDate; // The date when the workflow instance starts
.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date startTime; // The start of the time period when the
workflow instance runs.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date finishTime; // The end of the time period when the
workflow instance runs.
 private String rootTaskIds; // The IDs of instances that belong to
the root node.
 private Long appId; // The ID of the workspace to which the workflow
instance belongs.
 private Long parentDagId; // The ID of the parent workflow instance.
 private Long childDagId; // The ID of the child workflow instance.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date createTime; // The time when the workflow instance was
created.
 private String createUser; // The user who created the workflow
instance.

 @JsonSerialize(using = DateSerializer.class, include = Inclusion.
NON_NULL)
        @JsonDeserialize(using = DateDeserializer.class)
 private Date modifyTime; // The time when the workflow instance was
modified last time.
 private String modifyUser; // The user who modified the workflow
instance last time.
```

```
 private Integer createStatus; // The status of the creation. Valid
 values: 1, 2, 3, and 4. 1: The instance is being initiated. 2: The
instance is being created. 3: The instance is created. 4: The instance
 failed to be created.
 private Long opSeq;
 private Integer dagNum;
 private Boolean isDependDaily = false; // Specifies whether the
workflow instance depends on an instance in the development environmen
t.
```

2.5.39.4 TaskStatus

- **Not_run (1, "The task is not running "),**
- **Wait_time (2, "The task is pending execution."),**
- **Wait_resource (3, "The task is waiting for resources."),**
- **RUNNING(4, "The task is running."),**
- **FAILURE(5, "An error occurred while the task is executed."),**
- **SUCCESS(6, "The task execution is completed.");**

2.5.39.5 Dagstatus

- **Created (1, "The DAG has been created."),**
- **RUNNING(4, "The DAG is running."),**
- **FAILURE(5, "An error occurred while the DAG is executed."),**
- **SUCCESS(6, "The DAG is executed.");**

2.5.39.6 ProgramType

- **IDE_SHELL(6),**
- **ODPS_SQL(10),**
- **ODPS_MR(11),**
- **POL_SYNC(23) Synchronization task**

2.5.39.7 CycleType

- **DAY(0), // Indicates cycles that are no shorter than one day.**
- **NOT_DAY(1), // Indicates cycles that are shorter than one day.**
- **NOT_DAY_SEQ(2); // The sequence number of each cycle that is shorter than one day. The cycles are arranged in an ordered array.**

2.5.39.8 DependencyType

- **NONE(0), // The node can be run without waiting for the previous cycle of a specified node is completed.**

- **USER_DEFINE(1), // The node is run only after the previous cycle of a custom node is completed.**
- **CHILD(2), // The node is run only after the previous cycle of its child nodes is completed.**
- **SELF(3); // The node is run only after its previous cycle is completed.**

2.6 APIs for POP Java SDK

2.6.1 GetInstanceSummary

You can call this operation to query the information about instances of readers or writers based on the specified Apsara Stack tenant account ID.

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set this parameter to GetInstanceSummary.**
Aliuid	**String**	**Yes**	**The ID of the Apsara Stack tenant account ID.**
EndTime	**String**	**Yes**	**The end time of time range where this operation is performed. Specify the time in the yyyy-mm-dd format.**
StartTime	**String**	**Yes**	**The start time of time range where this operation is performed. Specify the time in the yyyy-mm-dd format.**

Parameter	Type	Required	Description
Type	String	Yes	Specifies whether to return the instance information about readers or writers. A value of 1 indicates that the result is the information about instances of readers. A value of 2 indicates that the result is the information about instances of writers.

Response parameters

Parameter	Type	Description
Data	Long	The information about instances.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample request

```
http(s)://[Endpoint]/? Action=GetInstanceSummary
&Aliuid=178*****2537
&EndTime=2019-02-21
&StartTime=2019-02-21
&Type=1
&<Common request parameters>
```

Sample response

```
{
"Data": [
{
"InstanceCnt": 17,
"AliyunKp": "1782****62537",
"PluginName": "mysql", "TotalRecords": 4255624,
"TotalBytes": 266409932
}
],
```

```
"ErrMsg": "success",
"RequestId": "e19f8502-76d2-4cb1-ab54-b93013cfad17", "ErrCode": 0
}
```

2.6.2 AddResGroupGateWay

You can call this operation to add a gateway to a resource group.

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to AddResGroupGateWay.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account.**
Identifier	**String**	**Yes**	**The identifier of the resource group.**
Memory	**Integer**	**Yes**	**The memory size of the resource group.**
NodeAddress	**String**	**Yes**	**The IP address of the node that runs the gateway.**
NodeName	**String**	**Yes**	**The name of the node that runs the gateway.**
ProjectId	**Long**	**Yes**	**The ID of the DataWorks workspace.**
TenantId	**Long**	**Yes**	**The ID of the tenant.**
VCpu	**Integer**	**Yes**	**The number of cores in the vCPU of the gateway.**

Response parameters

Parameter	Type	Description
Data	Boolean	The returned data. Indicates whether the operation is successful.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=AddResGroupGateWay
&BaseId=1486***73474
&Identifier=3907f9a58******6b2506
&Memory=3
&NodeAddress=12.12.12.12
&NodeName=hostname
&ProjectId=75059
&TenantId=2678***8690
&VCpu=8
&<Common request parameters>
```

Sample success responses

```
{
    "requestId": "0bc1748b*****493e5f15",
    "data": true,
    "errMsg": "success",
    "errCode": 0
}
```

2.6.3 CreateConnection

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to CreateConnection.
Connection	String	Yes	The connection string of the data source.
Name	String	Yes	The name of the data source.

Parameter	Type	Required	Description
ProjectId	Long	Yes	The ID of the DataWorks workspace.
Type	String	Yes	The type of the data source.
EnvType	Integer	No	The type of the environment. Valid values: 0 and 1. The value 0 specifies the development environment. The value 1 specifies the production environment.
TenantId	Long	No	The ID of the tenant.
Shared	Boolean	No	Specifies whether the data source is shared or not.
Description	String	No	The description of the data source.
SubType	String	No	The subtype of the data source . Currently, only MySQL is supported.

Response parameters

Parameter	Type	Description
Data	Long	The returned data. If the operation is successful , it returns the ID of the connected data source. If the operation fails, it returns null.
ErrCode	Long	The error code.
ErrMsg	String	The error message.

Parameter	Type	Description
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=CreateConnection
&<Common request parameters>
```

2.6.4 CreateDag

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to CreateDag.
AccountId	String	Yes	The ID of the account that is assigned by the scheduling system to call this operation.
AccountPwd	String	Yes	The password of the account that is assigned by the scheduling system to call this operation.
ClientName	String	Yes	The name of the client that is assigned by the scheduling system to call this operation.

Parameter	Type	Required	Description
BaseId	String	Yes	The ID of the Apsara Stack account that you use to call this operation.

DagModifyDto	String	Yes	{
			"executeMethod": "CREATE_DAG",
			"name": "test_create_dag",
			"type": 3,
			"includeNodeIds": [3231],
			"excludeNodeIds": [],
			"rootNodeId": 3231,
			"startBizDate": "2018-07-08 00:00:00",
			"endBizDate": "2018-07-09 00:00:00",
			"isParallel": false
			}

ProjectEnv	String	Yes	The type of the environment. Valid values: DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.
TenantId	Long	Yes	The ID of the tenant.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.
ReturnValue	Long	The value of the DagID parameter.

Sample success responses

```
{
    "returnCode":"0",
    "returnErrorSolution":"",
    "returnMessage":"",
    "requestId":"740ded9e-f6f5-4fde-a419-9b54***e8",
    "returnValue":300000119,
    "success":true
}
```

2.6.5 CreateDQCEntity

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to CreateDQCEntity.
EnvType	String	Yes	The type of the computing engine.
MatchExpression	String	Yes	The name of the partition filter expression.

Parameter	Type	Required	Description
ProjectName	String	Yes	The name of the MaxCompute project.
TableName	String	Yes	The name of the table.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code. The value 0 indicates that the operation is successful. Other values indicate that the operation failed.
ReturnValue	Integer	The ID of the partition filter expression that has been created.

Sample requests

```
/? Action=CreateDQCEntity
&EntityLevel=0
&EnvType=odps
&MatchExpression=ds=${yyyymmdd-1}
&ProjectName=autotest
&TableName=test_dqc_decimal_1119_2
&<Common request parameters>
```

Sample success responses

```
{
"ReturnCode": "0",
"ReturnValue": 4003923
}
```

2.6.6 CreateDQCFollower

You can call this operation to subscribe to messages from Data Quality. The messages are generated for the partitions that are specified by the partition filter expression. The methods of receiving messages include the emails, Short Message Service (SMS), and DingTalk.

Note:

To receive messages by using DingTalk, specify a DingTalk group that receives the messages on the Robot Management page and add a chatbot. After you add the chatbot, a webhook URL for the chatbot is automatically generated. You can then enable Data Quality to send HTTP POST requests to this URL to send messages to the specified DingTalk group.

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to CreateDQCFollower.
ProjectName	String	No	The name of the MaxCompute project.
Follower	String	No	The object of receiving the subscribed messages. If you want to receive the messages by using emails or the SMS, specify your employee ID. If you want to receive the messages by using DingTalk, specify the webhook URL.

Parameter	Type	Required	Description
AlarmMode	Integer	No	The method of receiving alerts and notifications. The value 1 specifies that you receive alerts and notifications by using emails. The value 2 specifies that you receive alerts and notifications by using emails and the SMS. The value 3 specifies that you receive alerts and notifications from the specified DingTalk group by using the webhook URL. The value 4 specifies that you receive alerts and notifications from the specified DingTalk group and mention all members in the group.
EntityId	Long	No	The ID of the partition filter expression.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	Integer	The ID of the subscription.

Sample requests

```
/? Action=CreateDQCFollower
&AlarmMode=2
&EntityId=4003922
&Follower=50624
&ProjectName=autotest
&<Common request parameters>
```

Sample success responses

```
{
"ReturnValue": 1726,
"ReturnCode": "0"
}
```

2.6.7 CreateDQCRule

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set this parameter to CreateDQCRule.**
EntityId	**Integer**	**Yes**	**The ID of the partition expression.**
ProjectName	**String**	**Yes**	**The name of the MaxCompute project.**
Rules	**String**	**Yes**	**The rules to be created.**

Response parameters

Parameter	Type	Description
ReturnCode	**String**	**The return code.**
ReturnValue	**Boolean**	**Indicates whether the specified rules have been created.**

Sample request

```
/? EntityId=4003922
```

```
&ProjectName=autotest
&Rules={
"addTemplateRules":[{
"property":"table_count",
"propertyType":"table",
"blockType":"0",
"templateId":"7",
"trend":"abs",
"warningThreshold":10,
"critical Threshold":50,
"ruleType":"0"
}],
"addSelfserviceRules":[{
"property":"table_count",
"propertyType":"table",
"blockType":"0",
"methodName":"count/table_count",
"w hereCondition":"id>100",
"checker":"9",
"trend":"abs",
"operator":">",
"expectValue":0,
"comment":"This is a rule.",
"ruleType":"1",
"warningThreshold":null,
"criticalThreshold":null}],
"envType":"o dps",
"projectName":"autotest",
"entityId":4003922}
&<Common request parameters>
```

Sample response

```
{
"ReturnValue": true,
"ReturnCode": "0"
}
```

2.6.8 CreateManualDag

You can call this API operation in OpenAPI Explorer for debugging. OpenAPI Explorer allows you to call API operations through its web interface. It automatica lly generates SDK code examples based on the specified request parameters.

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set this parameter to CreateManualDag.**

Parameter	Type	Required	Description
Bizdate	String	Yes	The data timestamp. Specify the date-based timestamp of data to be processed, such as 2019-04-03 00:00:00.
FlowName	String	Yes	The name of the manually triggered workflow.
ProjectName	String	Yes	The name of the DataWorks workspace.
DagPara	String	No	The workflow parameters in the format of `{ "key1": "val1", "key2": "val2" }`.
NodePara	String	No	The node parameters in the format of Map<Long, String>. Long indicates the node ID, and String indicates a string of key-value pairs, such as `{ "1232234255": "key1=val1 key2=val2", "321231412": "key1=val1 key2=val2" }`.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request.
ReturnCode	String	The return code.

Parameter	Type	Description
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.
ReturnValue	Long	The value of the dagId parameter.

Sample response

```
{
"RequestId": "****",
"ReturnCode": 0,
"ReturnMessage": "",
"ReturnErrorSolution": "",
"ReturnValue": 123142124124
}
```

2.6.9 CreateMetaSpiderJob

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to CreateMetaSpiderJob.
BaseId	String	Yes	The ID of the Apsara Stack account.
DatasourceId	Long	Yes	The ID of the data source.
ProjectId	Long	Yes	The ID of the DataWorks workspace.
SpiderConfig	String	Yes	The configuration information about the job to create.
TenantId	Long	Yes	The ID of the tenant.

Parameter	Type	Required	Description
SpiderCron	String	No	The CRON expression of the job to create.

Response parameters

Parameter	Type
Data	Boolean
ErrCode	Long
ErrMsg	String
RequestId	String

Sample requests

```
http(s)://[Endpoint]/? Action=CreateMetaSpiderJob
&<Common request parameters>
```

2.6.10 CreateResGroup

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to CreateResGroup.
BaseId	String	Yes	The ID of the Apsara Stack account.
Name	String	Yes	The name of the resource group to create.
ProjectId	Long	Yes	The ID of the DataWorks workspace.
ProjectIds	JSON	Yes	The IDs of the DataWorks workspaces.

Parameter	Type	Required	Description
TenantId	Long	Yes	The ID of the tenant.

Response parameters

Parameter	Type	Description
Data	Object	The returned data.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=CreateResGroup
&BaseId=1486821399873474
&Name=test20190509
&ProjectId=75059
&ProjectIds=["75059"]
&TenantId=267883377178690
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0a98***e0b1b",
"data": {
"id": 334603176233473,
"identifier": "e86f****64dde44",
"name": "test1234",
"nick": null,
"type": "DI",
"mode": "ISOLATE",
"tenantId": 267883377178690,
"enableKp": false,
"cluster": "e86f1****64dde44",
"quota": null,
"isDefault": false,
"sequence": null,
"action": "create",
"specs": {
"resourceGroupTag": "1"
}
},
"errMsg": "success",
"errCode": 0
```

```
}
```

2.6.11 DeleteConnections

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to DeleteConnections.
ConnectionIds	String	Yes	The IDs of the data sources to delete.

Response parameters

Parameter	Type	Description
Data	Boolean	Indicates whether the specified data resources have been deleted.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=DeleteConnections
&<Common request parameters>
```

2.6.12 DeleteDQCEntity

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to DeleteDQCEntity.
EntityId	Long	Yes	The ID of the partition filter expression.

Parameter	Type	Required	Description
EnvType	String	Yes	The type of the computing engine. Supported computing engines are MaxCompute, Hive, and Realtime Compute.
ProjectName	String	Yes	The name of the MaxCompute project.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	Boolean	Indicates whether the operation is successful.

Sample requests

```
/? Action=DeleteDQCEntity
&EntityId=4003922
&EnvType=odps
&ProjectName=autotest
&<Common request parameters>
```

Sample success responses

```
{
"ReturnValue": true,
"ReturnCode": "0"
}
```

2.6.13 DeleteDQCFollower

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set this parameter to DeleteDQCFollower.

Parameter	Type	Required	Description
ProjectName	Long	No	The name of the MaxCompute project.
Id	Long	No	The ID of the subscription.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	Boolean	Indicates whether the operation is successful.

Sample request

```
/? Action=DeleteDQCFollower
&Id=1724
&ProjectName=autotest
&<Common request parameters>
```

Sample response

```
{
"ReturnValue": true,
"ReturnCode": "0"
}
```

2.6.14 DeleteDQCRule

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to DeleteDQCRule.
ProjectName	String	No	The name of the MaxCompute project.
Id	Long	No	The ID of the Data Quality check (DQC) rule to delete.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	Boolean	Indicates whether the specified rule has been deleted.

Sample requests

```
/? Action=DeleteDQCRule
&Id=279580661
&ProjectName=autotest
&<Common request parameters>
```

Sample success responses

```
{
"ReturnCode": "0",
"ReturnValue": true
}
```

2.6.15 DeleteProjectResGroup

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to DeleteProjectResGroup.
BaseId	String	Yes	The ID of the Apsara Stack account.
Identifier	String	Yes	The identifier of the resource group.
ProjectId	Long	Yes	The ID of the DataWorks workspace.
ResGroupId	Long	Yes	The ID of the resource group.

Parameter	Type	Required	Description
TenantId	Long	Yes	The ID of the tenant.

Response parameters

Parameter	Type	Description
Data	Boolean	Indicates whether the specified resource group has been deleted. Valid values: true and false. The value true indicates that the resource group has been deleted. The value false indicates that the resource group failed to be deleted.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=DeleteProjectResGroup
&BaseId=1486821399873474
&Identifier=e86f1a3ba2ca451eab8851ed564dde44
&ProjectId=75059 &ResGroupId=334603176233473
&TenantId=267883377178690
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0bc1746d15574010397142703e6afb",
"data": true,
"errMsg": "success",
"errCode": 0
```

```
}
```

2.6.16 DeleteResGroupGateWay

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to DeleteResGroupGateWay.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account.**
Identifier	**String**	**Yes**	**The identifier of the resource group.**
NodeName	**String**	**Yes**	**The name of the gateway.**
ProjectId	**Long**	**Yes**	**The ID of the DataWorks workspace.**
TenantId	**Long**	**Yes**	**The ID of the tenant.**

Response parameters

Parameter	Type	Description
Data	**Boolean**	**Indicates whether the specified gateway has been deleted.**
ErrCode	**Long**	**The error code.**
ErrMsg	**String**	**The error message.**
RequestId	**String**	**The ID of the request.**

Sample requests

```
http(s)://[Endpoint]/? Action=DeleteResGroupGateWay
&BaseId=1486821399873474
&Identifier=3907f9a5832942f9b63b0908476b2506
```

```
&NodeName=hostname
&ProjectId=75059
&TenantId=267883377178690
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0bc1748b15574028120678613e5f16",
"data": true,
"errMsg": "success",
"errCode": 0
}
```

2.6.17 GetDagDetail

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetDagDetail.**
AccountId	**String**	**Yes**	**The ID of the account that is assigned by the scheduling system to call this operation.**
AccountPwd	**String**	**Yes**	**The password of the account that is assigned by the scheduling system to call this operation.**
ClientName	**String**	**Yes**	**The name of the client that is assigned by the scheduling system to call this operation.**

Parameter	Type	Required	Description
BaseId	String	Yes	The ID of the Apsara Stack account that you use to call this operation.
ProjectEnv	String	Yes	The type of the environment. Valid values: DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.
TenantId	Long	Yes	The ID of the tenant.
DagId	Long	No	The ID of the workflow instance.

Response parameters

Parameter	Type	Description
Count	Integer	The number of the returned workflow instances.
RequestId	String	The ID of the request.
ReturnCode	String	The return code.
ReturnMessage	String	The error message.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnValue	Long	The returned data.

Sample success responses

```
{
"returnCode": "0",
"returnErrorSolution": "",
"returnMessage": "",
"requestId": "14***4-e059-4bf4-a2c1-***323f",
```

```
"returnValue": [
{
"name": "Retroactive Instance Test 15",
"type": 3,
"rootNodeId": 1,
"status": 6,
"flowId": 1
}
],
"success": true
}
```

2.6.18 GetDataServiceApiDetail

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to GetDataServiceApiDetail.
ApiId	Long	Yes	The ID of the API to query.
Verbose	Long	No	Specifies whether to return the details of the API.

Response parameters

Parameter	Type	Description
Data	Boolean	The details of the DataService API.
ErrCode	Integer	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=GetDataServiceApiDetail
```

```
&<Common request parameters>
```

2.6.19 GetDataServiceAppDetail

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetDataServiceAppDetail.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account.**
ProjectId	**Long**	**Yes**	**The ID of the DataWorks workspace.**

Response parameters

Parameter	Type	Description
Data	**Boolean**	**The details of the DataService application.**
ErrCode	**Integer**	**The error code.**
ErrMsg	**String**	**The error message.**
RequestId	**String**	**The ID of the request.**

Sample requests

```
http(s)://[Endpoint]/? Action=GetDataServiceAppDetail
&<Common request parameters>
```

2.6.20 GetDefaultTenant

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetDefaultTenant.**

Response parameters

Parameter	Type	Description
ErrCode	Integer	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.
Tenant	String	The information about the tenant.
TenantCode	String	The code of the tenant.
TenantOwnerBaseId	String	The ID of the Apsara Stack account of the tenant owner.

Sample requests

```
http(s)://[Endpoint]/? Action=GetDefaultTenant
&<Common request parameters>
```

2.6.21 GetDQCEntity

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to GetDQCEntity.
ProjectName	String	No	The name of the DataWorks workspace.
TableName	String	No	The name of the table.
EnvType	String	No	The type of the computing engine. Supported computing engines are MaxCompute, Hive, and Realtime Compute.

Parameter	Type	Required	Description
MatchExpression	String	No	The partition filter expression. If you do not specify this parameter, the operation returns all the partition filter expressions of the specified table.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	String	The partition filter expressions that were queried.

Sample requests

```
http(s)://[Endpoint]/? Action=GetDQCEntity
&EnvType=odps
&MatchExpression=dt=${yyyymmdd-1}
&ProjectName=autotest
&TableName=test_dqc_decimal_1119_2
&<Common request parameters>
```

Sample success responses

```
{
"ReturnValue": {
"Entity": [
{
"EntityLevel": 0,
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-3}",
"Followers": "050624",
"OnDuty": "050624",
"Sql": 0,
"GmtCreate": "2018-11-26 15:06:32",
"EnvType": "odps", "Task": 0,
"HasRelativeNode": false, "Id": 4003918,
"TableName": "test_dqc_decimal_1119_2",
"GmtModify": "2018-11-26 15:06:32"
},
{
"EntityLevel": 0,
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Followers": "050624",
"OnDuty": "050624",
```

```
"Sql": 0,
"GmtCreate": "2018-11-26 22:31:13",
"EnvType": "odps",
"Task": 0,
"HasRelativeNode": false,
"Id": 4003922,
"TableName": "test_dqc_decimal_1119_2",
"GmtModify": "2018-11-26 22:31:13"
},
{
"EntityLevel": 0,
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-2}",
"Followers": "050624",
"OnDuty": "050624",
"Sql": 0,
"GmtCreate": "2018-11-26 23:18:34",
"EnvType": "odps",
"Task": 0,
"HasRelativeNode": false,
"Id": 4003923,
"TableName": "test_dqc_decimal_1119_2",
"GmtModify": "2018-11-26 23:18:34"
}
]
},
"ReturnCode": "0"
}
```


2.6.22 GetDQCFollower

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetDQCFollower.**
ProjectName	**String**	**No**	**The name of the DataWorks workspace.**
EntityId	**Long**	**No**	**The ID of the partition filter expression.**

Response parameters

Parameter	Type	Description
ReturnCode	**String**	**The return code.**

Parameter	Type	Description
ReturnValue	String	The objects and applications that subscribe to the messages from Data Quality.

Sample requests

```
http(s)://[Endpoint]/? Action=GetDQCFollower
&EntityId=4003922
&ProjectName=odps
&<Common request parameters>
```

Sample success responses

```
{
"ReturnCode": "0",
"ReturnValue": {
"Follower": [
{
"ProjectName": "autotest",
"AlarmMode": 1,
"Follower": "050624",
"Id": 1726,
"TableName": "test_dqc_decimal_1119_2",
"EntityId": "4003922"
}
]
}
}
```

2.6.23 GetDQCRule

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to GetDQCRule.
ProjectName	String	No	The name of the DataWorks workspace.
EntityId	Long	No	The ID of the partition filter expression.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	List	The details of the rules.

Sample requests

```
http(s)://[Endpoint]/? Action=GetDQCRule
&EntityId=4003922
&ProjectName=autotest
&<Common request parameters>
```

Sample success responses

```
{
"ReturnValue": {
"TemplateRules": {
"TemplateRule": [
{
"TemplateName": "SQL task table rows, 1,7, 30 days fluctuation test",
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"WarningThreshold": "40",
"RuleCheckerRelationId": 1008005,
"RuleType": 0,
"MethodId": 8,
"CriticalThreshold": "80",
"FixCheck": false,
"OnDuty": "050624",
"Property": "table_count",
"TemplateId": 7,
"PropertyKey": "table_count",
"MethodName": "table_count",
"HistoryWarningThreshold": "history max:40%,history min:10%",
"BlockType": 1,
"CheckerId": 7,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580663,
"EntityId": 4003922,
"HistoryCriticalThreshold": "history max:80%,history min:50%",
"Trend": "abs"
},
{
"TemplateName": "SQL task table rows, 1,7, 30 days fluctuation test",
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"WarningThreshold": "10",
"RuleCheckerRelationId": 1008007,
"RuleType": 0,
"MethodId": 8,
"CriticalThreshold": "50",
"FixCheck": false,
"OnDuty": "050624",
"Property": "table_count",
"TemplateId": 7,
"PropertyKey": "table_count",
"MethodName": "table_count",
```

```
"HistoryWarningThreshold": "history max:10%,history min:10%",
"BlockType": 0,
"CheckerId": 7,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580665,
"EntityId": 4003922,
"HistoryCriticalThreshold": "history max:50%,history min:50%",
"Trend": "abs"
},
{
"TemplateName": "SQL task table rows, 1,7, 30 days fluctuation test",
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"WarningThreshold": "10",
"RuleCheckerRelationId": 1008009,
"RuleType": 0,
"MethodId": 8,
"CriticalThreshold": "50",
"FixCheck": false,
"OnDuty": "050624",
"Property": "table_count",
"TemplateId": 7,
"PropertyKey": "table_count",
"MethodName": "table_count",
"HistoryWarningThreshold": "history max:10%,history min:10%",
"BlockType": 0,
"CheckerId": 7,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580667,
"EntityId": 4003922,
"HistoryCriticalThreshold": "history max:50%,history min:50%",
"Trend": "abs"
}
]
},
"SelfserviceRules": {
"SelfserviceRule": [
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008004,
"WhereCondition": "id>100",
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580662,
"CheckerId": 6,
"EntityId": 4003922,
"Trend": "abs"
},
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008006,
"WhereCondition": "id>100",
```

```
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580664,
"CheckerId": 6,
"EntityId": 4003922,
"Trend": "abs"
},
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008008,
"WhereCondition": "id>100",
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580666,
"CheckerId": 6,
"EntityId": 4003922,
"Trend": "abs"
},
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008010,
"WhereCondition": "id>100",
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580668,
"CheckerId": 6,
"EntityId": 4003922, "Trend": "abs"
}
]
}
},
"ReturnCode": "0"
```

```
}
```

2.6.24 GetNodeDetail

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetNodeDetail.**
AccountId	**String**	**Yes**	**The ID of the account that is assigned by the scheduling system to call this operation.**
AccountPwd	**String**	**Yes**	**The password of the account that is assigned by the scheduling system to call this operation.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account that you use to call this operation.**
ClientName	**String**	**Yes**	**The name of the client that is assigned by the scheduling system to call this operation.**
NodeId	**Long**	**Yes**	**The ID of the node to query.**

Parameter	Type	Required	Description
ProjectEnv	String	Yes	The type of the environment. Valid values: DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production environment.
TenantId	Long	Yes	The ID of the tenant.
IsDetail	Boolean	No	Specifies whether to return the detailed information about this node. Valid values: true and false.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.
ReturnValue	String	None

Sample requests

```
http(s)://[Endpoint]/? Action=GetDQCRule
&EntityId=4003922
```

```
&ProjectName=autotest
&<Common request parameters>
```

Sample success responses


```
{
"ReturnValue": {
"TemplateRules": {
"TemplateRule": [
{
"TemplateName": "SQL task table rows, 1,7, 30 days fluctuation test",
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"WarningThreshold": "40",
"RuleCheckerRelationId": 1008005,
"RuleType": 0,
"MethodId": 8,
"CriticalThreshold": "80",
"FixCheck": false,
"OnDuty": "050624",
"Property": "table_count",
"TemplateId": 7,
"PropertyKey": "table_count",
"MethodName": "table_count",
"HistoryWarningThreshold": "history max:40%,history min:10%",
"BlockType": 1,
"CheckerId": 7,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580663,
"EntityId": 4003922,
"HistoryCriticalThreshold": "history max:80%,history min:50%",
"Trend": "abs"
},
{
"TemplateName": "SQL task table rows, 1,7, 30 days fluctuation test",
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"WarningThreshold": "10",
"RuleCheckerRelationId": 1008007,
"RuleType": 0,
"MethodId": 8,
"CriticalThreshold": "50",
"FixCheck": false,
"OnDuty": "050624",
"Property": "table_count",
"TemplateId": 7,
"PropertyKey": "table_count",
"MethodName": "table_count",
"HistoryWarningThreshold": "history max:10%,history min:10%",
"BlockType": 0,
"CheckerId": 7,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580665,
"EntityId": 4003922,
"HistoryCriticalThreshold": "history max:50%,history min:50%",
"Trend": "abs"
},
{
"TemplateName": "SQL task table rows, 1,7, 30 days fluctuation test",
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"WarningThreshold": "10",
"RuleCheckerRelationId": 1008009,
```

```
"RuleType": 0,
"MethodId": 8,
"CriticalThreshold": "50",
"FixCheck": false,
"OnDuty": "050624",
"Property": "table_count",
"TemplateId": 7,
"PropertyKey": "table_count",
"MethodName": "table_count",
"HistoryWarningThreshold": "history max:10%,history min:10%",
"BlockType": 0,
"CheckerId": 7,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580667,
"EntityId": 4003922,
"HistoryCriticalThreshold": "history max:50%,history min:50%",
"Trend": "abs"
}
]
},
"SelfserviceRules": {
"SelfserviceRule": [
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008004,
"WhereCondition": "id>100",
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580662,
"CheckerId": 6,
"EntityId": 4003922,
"Trend": "abs"
},
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008006,
"WhereCondition": "id>100",
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580664,
"CheckerId": 6,
"EntityId": 4003922,
"Trend": "abs"
},
```

```
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008008,
"WhereCondition": "id>100",
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580666,
"CheckerId": 6,
"EntityId": 4003922,
"Trend": "abs"
},
{
"ProjectName": "autotest",
"MatchExpression": "dt=${yyyymmdd-1}",
"Checker": 9,
"RuleCheckerRelationId": 1008010,
"WhereCondition": "id>100",
"RuleType": 1,
"MethodId": 21,
"FixCheck": true,
"CheckerName": "compared with a fixed value",
"OnDuty": "050624",
"Property": "table_count",
"PropertyKey": "table_count",
"MethodName": "count/table_count",
"BlockType": 0,
"TableName": "test_dqc_decimal_1119_2",
"Id": 279580668,
"CheckerId": 6,
"EntityId": 4003922, "Trend": "abs"
}
]
}
},
"ReturnCode": "0"
}
```


2.6.25 GetNodeUpdateStatus

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetNodeUpdateStatus.**

Parameter	Type	Required	Description
AccountId	String	No	The ID of the account that is assigned by the scheduling system to call this operation.
AccountPwd	String	No	The password of the account that is assigned by the scheduling system to call this operation.
ClientName	String	No	The name of the client that is assigned by the scheduling system to call this operation.
BaseId	String	No	The ID of the Apsara Stack account that you use to call this operation.
RequestId	String	No	The ID of the request. You can use this ID to call the ModifyNode operation to modify a node. The ModifyNode operation then returns this ID as the value of the ReturnValue response parameter.
TenantId	LONG	No	The ID of the tenant.

Parameter	Type	Required	Description
IsDetail	Boolean	No	Specifies whether to return the detailed information about the node update. Valid values: true and false.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.
ReturnValue	String	The value of the RequestId parameter.

Sample success responses


```
{
"returnCode": "0",
"returnErrorSolution": "",
"returnMessage": "",
"requestId": "0bbaa2451557469839878693 4e12b8",
"returnValue": {
"requestId": "0a64886b-1d63-4e5c-ad3e-d4eda4c2381c",
"createTime": 1555065345000,
"name": "ide-base",
"status": "SUCCESS",
"isDetail": true,
"flowId": 28620441,
"executeDetails": [
{
"uniqueId": "9745681_2",
"cloudUUID": 111164284,
"executeStatus": "SUCCESS",
"executeMsg": "success",
"dagId": null
```

```
},
{
"uniqueId": "9745682_5",
"cloudUUID": 111001035,
"executeStatus": "SUCCESS",
"executeMsg": "success",
"dagId": null
},
{
"uniqueId": "9745683_9",
"cloudUUID": 111087244,
"executeStatus": "SUCCESS",
"executeMsg": "success",
"dagId": null
},
{
"uniqueId": "9745680_12",
"cloudUUID": 111087242,
"executeStatus": "SUCCESS",
"executeMsg": "success",
"dagId": null
},
{
"uniqueId": "9745680_12",
"cloudUUID": 111087242,
"executeStatus": "INIT",
"executeMsg": null,
"dagId": null
}
]
},
"success": true
}
```


2.6.26 GetResGroupAk

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set this parameter to GetResGroupAk.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack tenant account.**
Identifier	**String**	**Yes**	**The identifier of the resource group .**
ProjectId	**Long**	**Yes**	**The ID of the DataWorks workspace.**

Parameter	Type	Required	Description
TenantId	Long	Yes	The ID of the tenant.

Response parameters

Parameter	Type	Description
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample request

```
http(s)://[Endpoint]/? Action=GetResGroupAk
&BaseId=148****873474
&Identifier=3907f9****6b2506
&ProjectId=75059
&TenantId=2678***78690
&<Common request parameters>
```

Sample response

```
{
"requestId": "0a98a368***97e56fd",
"data": {
"username": "zz_3907f9***08476b2506",
"password": "vcn9******",
"rank": 4,
"ossBackUp": false,
"callback": false,
"callbackUrl": ""
},
"errMsg": "success",
"errCode": 0
}
```

2.6.27 GetResGroupGatewayList

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set this parameter to GetResGroupGatewayList.

Parameter	Type	Required	Description
BaseId	String	Yes	The ID of the Apsara Stack account.
Identifier	String	Yes	The identifier of the resource group.
ProjectId	Long	Yes	The ID of the DataWorks workspace.
TenantId	Long	Yes	The ID of the tenant.

Response parameters

Parameter	Type	Description
Data	List	The returned data.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=GetResGroupAk
&BaseId=1486****73474
&Identifier=3907f9a5******76b2506
&ProjectId=75059
&TenantId=2678****78690
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0a98a3541557401599643271 9e2c97",
"data": [{
    "clusterName": "3907f9a5832942f9b63b0908476b2506",
    "nodeName": "1.2.3.50",
    "nodeAddress": "1.2.3.50",
    "maxSlot": 32,
    "useSlot": 0,
    "state": 1,
    "live": false,
    "startMon": false,
    "regionId": 1,
    "nodeProperties": "{\"memory\":8,\"vCpu\":4}",
    "vCpu": 4,
    "memory": 8,
    "useDmu": 0
```

```
    }],
    "errMsg": "success",
    "errCode": 0
}
```

2.6.28 GetResGroupList

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetResGroupList.**
AlisaDetail	**Boolean**	**Yes**	**Indicates whether to return the node details.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account.**
Level	**String**	**Yes**	**The level of the resource group. Valid values: project and tenant. The value project indicates that the resource group belongs to a project. The value tenant indicates that the resource group belongs to a tenant.**
ProjectId	**Long**	**Yes**	**The ID of the DataWorks workspace.**
ResourceGroupType	**String**	**Yes**	**The type of the resource group.**
TenantId	**Long**	**Yes**	**The ID of the tenant.**

Response parameters

Parameter	Type	Description
Data	List	The returned data.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=GetResGroupList
&AlisaDetail=true
&BaseId=14*****3474
&Level=project
&ProjectId=75059
&ResourceGroupType=di
&TenantId=2678*****690
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0a98a3****52214e2c97",
"data": [{
"id": 29810****9522,
"identifier": "group_267****178690",
"name": "default resource group",
"nick": null,
"isDefault": true,
"networkType": null,
"nodes": null,
"maxSlot": null,
"useSlot": null,
"useDmu": null,
"maxDmu": null,
"projects": null,
"resourceGroupType": null,
"diResourceGroupType": 0,
"buyType": "pay-as-you-go"
},
{
"id": 200000003001,
"identifier": "3907f9a58***08476b2506",
"name": "y1y1y1",
"nick": null,
"isDefault": false,
"networkType": 1,
"nodes": [{
"clusterName": "3907f9a583****8476b2506",
"nodeName": "1.2.3.50",
"nodeAddress": "1.2.3.50",
"maxSlot": 32,
"useSlot": 0,
"state": 1,
"live": false,
"startMon": false,
```

```
"regionId": 1,
"nodeProperties": "{\"memory\":8,\"vCpu\":4}",
"vCpu": 4,
"memory": 8,
"useDmu": 0
}],
"maxSlot": 32,
"useSlot": 0,
"useDmu": 0,
"maxDmu": 16,
"projects": null,
"resourceGroupType": null,
"diResourceGroupType": 1,
"buyType": "pay-as-you-go"
},
{
"id": 33224***49920,
"identifier": "c43d****cb7fef18c137",
"name": "cfr",
"nick": null,
"isDefault": false,
"networkType": 1,
"nodes": [{
"clusterName": "c43da72697****c137",
"nodeName": "deide",
"nodeAddress": "10.0.0.22",
"maxSlot": 8,
"useSlot": 0,
"state": 1,
"live": false,
"startMon": false,
"regionId": 1,
"nodeProperties": "{\"memory\":4,\"vCpu\":2}",
"vCpu": 2,
"memory": 4,
"useDmu": 0
}],
"maxSlot": 8,
"useSlot": 0,
"useDmu": 0,
"maxDmu": 4,
"projects": null,
"resourceGroupType": null,
"diResourceGroupType": 1,
"buyType": "pay-as-you-go"
},
{
"id": 329080157014786,
"identifier": "bd49c8014fb64f53835793e94932a9ac",
"name": "hello",
"nick": null,
"isDefault": false,
"networkType": 1,
"nodes": [{
"clusterName": "bd49c801******e94932a9ac",
"nodeName": "djed***qduew",
"nodeAddress": "0.1.0.0",
"maxSlot": 24,
"useSlot": 0,
"state": 1,
"live": false, "startMon": false, "regionId": 1,
"nodeProperties": "{\"memory\":8,\"vCpu\":8}", "vCpu": 8,
"memory": 8,
"useDmu": 0
```

```
}],
"maxSlot": 24,
"useSlot": 0,
"useDmu": 0,
"maxDmu": 12,
"projects": null,
"resourceGroupType": null,
"diResourceGroupType": 1,
"buyType": "pay-as-you-go"
}],
"errMsg": "success",
"errCode": 0
}
```

2.6.29 GetTableColumn

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to GetTableColumn.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account.**
DatasourceName	**String**	**Yes**	**The name of the data source.**
DatasourceType	**String**	**Yes**	**The type of the data source.**
ProjectId	**Long**	**Yes**	**The ID of the DataWorks workspace.**
SubType	**String**	**Yes**	**The subtype of the data source . Currently, only MySQL is supported.**
Table	**String**	**Yes**	**The name of the table in the data source.**
TenantId	**Long**	**Yes**	**The ID of the tenant.**

Parameter	Type	Required	Description
Id	String	No	The ID of the data source.

Response parameters

Parameter	Type	Description
Data	-	The fields of the specified table in the data source.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=GetTableColumn
&BaseId=148682***73474
&DatasourceName=odps_first
&DatasourceType=odps
&ProjectId=75059
&SubType=public
&Table=t
&TenantId=2678***78690
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0bc1748b15574030794246845e5f16",
"data": {
"splitPk": [],
"columns": [{
"name": "id",
"type": "STRING"
}],
"partitionColumns": [],
"extraInfo": {}
},
"errMsg": "success",
"errCode": 0
```

```
}
```

2.6.30 GetTableList

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set this parameter to GetTableList.
BaseId	String	Yes	The ID of the Apsara Stack tenant account.
DatasourceName	String	Yes	The name of the data store.
DatasourceType	String	Yes	The type of the data store.
ProjectId	Long	Yes	The ID of the DataWorks workspace.
SubType	String	Yes	The subtype of the data store.
Table	String	Yes	The name of the table in the data store.
TenantId	Long	Yes	The ID of the tenant.
Id	Long	No	The ID of the data store.
PageSize	Long	No	The number of entries to return on each page.

Response parameters

Parameter	Type	Description
Data	-	The returned data.
ErrCode	Long	The error code.

Parameter	Type	Description
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample request

```
http(s)://[Endpoint]/? Action=GetTableList
&BaseId=1486821399873474
&DatasourceName=odps_first
&DatasourceType=odps
&ProjectId=75059
&SubType=public
&Table=t
&TenantId=267883377178690
&<Common request parameters>
```

Sample response

```
{
"requestId": "0bc17****2e5f16",
"data": {
"tables": ["c", "t", "t1", "t2", "wowo", "zzyx", "oss_test", "
oss_tes00t", "test_input"]
},
"errMsg": "success",
"errCode": 0
}
```

2.6.31 GetTaskLog

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set this parameter to GetTaskLog.
AccountId	String	Yes	The ID of the account that is assigned by the scheduling system to call this operation.

Parameter	Type	Required	Description
AccountPwd	String	Yes	The password of the account that is assigned by the scheduling system to call this operation.
BaseId	String	Yes	The ID of the Apsara Stack account that you use to call this operation.
ClientName	String	Yes	The name of the client that is assigned by the scheduling system to call this operation.
ProjectEnv	String	Yes	The type of the environment. Valid values: PROD and DEV. The value PROD specifies to return the information about the node instances in the production environment that meet the search conditions. The value DEV specifies to return the information about the node instances in the developmen t environment that meet the search conditions.
TenantId	Long	Yes	The ID of the tenant. Set the value to 1.

Parameter	Type	Required	Description
TaskId	Long	No	The ID of the node instance.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request . If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	None
ReturnMessage	String	The error message.
ReturnValue	String	The logs that were returned.

Sample requests

```
http(s)://[Endpoint]/? Action=GetTaskLog
&AccountId=C00000
&AccountPwd=account_pwd
&BaseId=0I0001
&ClientName=aone_app_name
&ProjectEnv=DEV
&TenantId=1
&TaskId=20000000
&<Common request parameters>
```

Sample success responses

```
{
"ReturnValue": "I'm alog",
"ReturnCode": "0",
"RequestId": "023dbca2-3****f23fa26",
"ReturnErrorSolution": "",
"ReturnMessage": ""
```

```
}
```

2.6.32 GetUserInfo

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to**`GetUserInfo`**.**

Response parameters

Parameter	Type	Description
ErrCode	**Integer**	**The error code.**
ErrMsg	**String**	**The error message.**
RequestId	**String**	**The ID of the request.**
User	**N/A**	**The information about the user that was queried.**

2.6.33 ListConnection

You can call this operation to query data sources.

Request parameters

Parameter	Type	Required	Example	Description
ProjectId	**Long**	**Yes**	**12345**	**The ID of the data source.**

Parameter	Type	Required	Example	Description
Name	String	No	"myds"	The name of the data source. This parameter must be specified when you want to query the AccessKey of a computing engine. By default, do not set this parameter.
Keyword	Boolean	No	"mydatasource"	Specifies whether to hide the specified sensitive fields. Default value: `false`.
Status	Integer	No	0	The status of the data source. Valid values: 0, 1, and 2. · 0: The data source is deleted. · 1: The data source is normal. · 2: The data source is disabled.
BindEngineId	Long	No	12345	The ID of the compute engine that is bound with the data source.

Parameter	Type	Required	Example	Description
EnvType	Integer	No	1	The type of the environment. Valid values: 0 and 1. · 0: the development environment. · 1: the production environment.
BaseId	String	No	"034302"	The ID of the Apsara Stack account. This parameter must be specified when you want to query the AccessKey of a computing engine. By default, do not set this parameter.
Verbose	Boolean	No	true	Specifies whether to return the details about the connection string of the data source. Default value: false.
PageNum	Integer	No	1	The number of the page to return. Default value: 1.

Parameter	Type	Required	Example	Description
PageSize	Integer	No	10	The number of entries to return on each page. Default value: 10.

Response parameters

Parameter	Type	Example	Description
requestId	String	c9afd89b-7aef-47c9-9902-e0500d843268	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting. The request ID must be globally unique.
errCode	Long	0	The error code. · The value 0 indicates that the operation is successful. · A value greater than 0 indicates the error code of the error that occurred.
errMsg	String	success	The error message. If the value of the errCode parameter is 0, the value of the errMsg parameter is a null string or success.
data	PagingResult<Connection>	N/A	The returned data.

Parameter	Type	Example	Description
TotalNum	Integer	N/A	The total number of entries that were returned.
PageNum	Integer	N/A	The page number of the returned page.
PageSize	Integer	N/A	The number of entries returned per page.
Connections	List<Connection>	N/A	The list of data sources that were returned.
Id	Long	12345	The ID of the data source.
TenantId	Long	12345	The ID of the tenant.
ProjectId	Long	12345	The ID of the DataWorks workspace.
Name	String	"testDataSource"	The name of the data source.
Type	String	"mysql"	The type of the connection string.
SubType	String	""	The subtype of the connection string.
EnvType	Integer	0	The type of the environment. Valid values: 0 and 1. The value 0 indicates the development environment. The value 1 indicates the production environment.
Connection	String	{"username":"u1","password":"p1"}	The connection string of the data source.

Parameter	Type	Example	Description
Sequence	Integer	300	The sequence number of the data source.
Status	Integer	0	The status of the data source. Valid values: 0, 1, and 2. · 0: The data source is deleted. · 1: The data source is normal. · 2: The data source is disabled.
Description	String	"this is a testdatasource"	The description of the data source.
Shared	Boolean	true	Indicates whether the data source is shared among users of the tenant.
GmtCreate	Date	2018-11-11 00:00:00	The time when the data source was created.
GmtModified	Date	2018-11-11 00:00:00	The time when the data source was last modified.
Operator	String	"032214"	The user who modified the data source last time.
ConnectTime	Date	2018-11-11 00:00:00	The time when the data source was last connected.

Parameter	Type	Example	Description
ConnectStatus	Integer	0	The connection status of the data source. Valid values: 0, 1, and 2. · 0: The connectivity test has not been run. · 1: The data source is successfully connected. · 2: The data source failed the connectivity test.

Sample requests

```
/? ProjectId=12345
&Keyword="mydatasource"
&<Common request parameters>
```

Sample success responses

JSON format

```
{
  "data":{
    "TotalNum":35,
    "PageNum":1,
    "PageSize":10,
    "Connections":[
      {
        "Id":12345,
        "TenantId":12345,
        "ProjectId":12345,
        "Name":"testDataSource",
        "Type":"mysql",
        "SubType":"",
        "EnvType":0,
        "Connection":"{\"username\":\"u1\",\"password\":\"p1\"}",
        "Sequence":300,
        "Status":0,
        "Description":"this is a test datasource",
        "Shared":0,
        "GmtCreate":"2018-11-11 00:00:00",
        "GmtModified":"2018-11-11 00:00:00",
        "Operator":"032214",
        "ConnectTime":"2018-11-11 00:00:00",
        "ConnectStatus":0
```

```
      },...
    ]
  },
  "errCode":0,
  "errMsg":"success",
  "requestId":"c9afd89b-7aef-47c9-9902-e0500d843268"
}
```

Sample error responses

JSON format

```
{
  "data":null,
  "errCode":1101002001,
  "errMsg":"invalid parameter",
  "requestId":"c9afd89b-7aef-47c9-9902-e0500d843268"
}
```

2.6.34 ListDataServiceApps

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to ListDataServiceApps.**
BaseId	**String**	**No**	**The ID of the Apsara Stack account.**
AppName	**String**	**No**	**The name of the application to query.**
PageSize	**Integer**	**No**	**The number of entries to return on each page.**
PageNum	**Integer**	**No**	**The number of the page to return.**

Response parameters

Parameter	Type	Description
Data	**N/A**	**The returned data.**
ErrCode	**Integer**	**The error code.**

Parameter	Type	Description
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

2.6.35 ListDataServiceAuthedApi

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ListDataServiceAuthedApi.
BaseId	String	Yes	The ID of the Apsara Stack account.
ProjectId	Long	Yes	The ID of the DataWorks workspace.
ApiStatus	String	No	The status of the operation to query.
PageNum	Integer	No	The number of the page to return.
PageSize	Integer	No	The number of entries to return on each page.
Verbose	Boolean	No	Indicates whether to return the details of the operation.

Response parameters

Parameter	Type	Description
Data	N/A	The returned data.
ErrCode	Integer	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

2.6.36 ListPermission

You can call this operation to query permissions.

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ListPermission.
baseId	String	No	The ID of the Apsara Stack account.
tenantId	Long	No	The ID of the tenant.
projectId	Long	No	The ID of the DataWorks workspace.
modules	String	No	The modules of the DataWorks workspace.

Response parameters

Parameter	Type	Description
Data	N/A	The returned data.
errCode	Integer	The error code. · The value 0 indicates that the operation is successful. · A value greater than 0 indicates the error code of the error that occurred.

Parameter	Type	Description
requestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting. The request ID must be globally unique.

Sample requests

```
/? Action=ListPermission
&baseId=
&modules=
&projectId=
&tenantId=
&<Common request parameters>
```

2.6.37 ListProjectModule

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ListProjectModule.
ProjectId	Long	No	The ID of the DataWorks workspace.

Response parameters

Parameter	Type	Description
ErrCode	Integer	The error code.
ErrMsg	String	The error message.
Modules	N/A	The modules of the DataWorks workspace.
RequestId	String	The ID of the request.

2.6.38 ListProjectModules

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ListProjectModules.
ProjectId	Long	No	The ID of the DataWorks workspace.

Response parameters

Parameter	Type	Description
ErrCode	Integer	The error code.
ErrMsg	String	The error message.
Modules	N/A	The modules of the DataWorks workspace.
RequestId	String	The ID of the request.

2.6.39 ListProject

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ListProject.

Response parameters

Parameter	Type	Description
ErrCode	Long	The error code.
ErrMsg	String	The error message.

Parameter	Type	Description
ProjectList	N/A	The DataWorks workspaces that were queried.
RequestId	String	The ID of the request.

2.6.40 ListTenantModule

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ListTenantModule.
TenantId	Long	No	The ID of the tenant.

Response parameters

Parameter	Type	Description
ErrCode	Integer	The error code.
ErrMsg	String	The error message.
Modules	N/A	The modules of the tenant.
RequestId	String	The ID of the request.

2.6.41 ListUserPermission

You can call this operation to query permissions of a user.

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ListUserPermission.

Parameter	Type	Required	Description
BaseId	String	No	The ID of the Apsara Stack account.
TenantId	Long	No	The ID of the tenant.
ProjectId	Long	No	The ID of the DataWorks workspace.
Modules	String	No	The modules of the DataWorks workspace.

Response parameters

Parameter	Type	Description
Data	N/A	The returned data.
ErrCode	Integer	The error code. · The value 0 indicates that the operation is successful. · A value greater than 0 indicates the error code of the error that occurred.
ErrMsg	String	The error message. If the value of the errCode parameter is 0, the value of the errMsg parameter is a null string or success.
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting. The request ID must be globally unique.

2.6.42 ModifyBusiness

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to ModifyBusiness.**
AccountId	**String**	**No**	**The ID of the account that is assigned by the scheduling system to call this operation.**
AccountPwd	**String**	**No**	**The password of the account that is assigned by the scheduling system to call this operation.**

Parameter	Type	Required	Description
BaseId	String	No	The ID of the Apsara Stack account that you use to call this operation.
BusinessModifyDto	String	No	{ "executeMethod": "UPDATE_BUSINESS", "bizId": 100000003, "bizKey": "biz_key_01", "bizName": "biz_name_01_xxxx", "solId": 100000002, "appId": 78918, "tenantId": 2797***8706 }
ClientName	String	No	The name of the client that is assigned by the scheduling system to call this operation.
TenantId	Long	No	The ID of the tenant.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	None

Parameter	Type	Description
ReturnMessage	String	The error message.
ReturnValue	String	The information about the workflow that was modified.

2.6.43 ModifyNode

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ModifyNode.
AccountId	String	No	The ID of the account that is assigned by the scheduling system to call this operation.
AccountPwd	String	No	The password of the account that is assigned by the scheduling system to call this operation.

Parameter	Type	Required	Description
ClientName	String	No	The name of the client that is assigned by the scheduling system to call this operation.
ModifyDtoList	String	No	[{ "executeMethod": "CREATE_NODE", "nodeType": 0, "cronExpress": "0 0 0 * * ?", "owner": "{{user_id}}", "createUser": "{{user_id}}", "modifyUser": "{{user_id}}", "dependentType": 0, "nodeName": "locale_test_node118", "prgType": 99, "priority": 0, "appId": 14255, "cycType": 1, "codeSrc": "", "nodeFrom": "postman", "inputs": [{ "data": "test_dev_prod_depend_single_root" }], "outputs": ["data": "locale_test_node118out" }], "uniqueId": "locale_test_node6" }]
ProjectEnv	String	No	The type of the environment. Valid values: DEV and PROD. The value DEV specifies the development environment. The value PROD specifies the production

Parameter	Type	Required	Description
BaseId	String	No	The ID of the Apsara Stack account that you use to call this operation.
TenantId	Long	No	The ID of the tenant.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.
ReturnValue	String	The value of the RequestId parameter. The request ID is returned after you send an asynchronous request. You can use this ID to call the GetNodeUpdateStatus operation to query the node status.

Sample success responses

```
{
"returnCode": "0",
"returnErrorSolution": "",
"returnMessage": "",
"requestId": "82e4c****a39fbda",
"returnValue": "82e4c04****f5a39fbda",
"success": true
```

```
}
```

2.6.44 ModifySolution

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to ModifySolution.**
AccountId	**String**	**No**	**The ID of the account that is assigned by the scheduling system to call this operation.**
AccountPwd	**String**	**No**	**The password of the account that is assigned by the scheduling system to call this operation.**
BaseId	**String**	**No**	**The ID of the Apsara Stack account that you use to call this operation.**
ClientName	**String**	**No**	**The name of the client that is assigned by the scheduling system to call this operation.**
TenantId	**Long**	**No**	**The ID of the tenant.**
SolutionModifyDto	**String**	**No**	**The information about the solution in the JSON format.**

Response parameters

Parameter	Type	Description
RequestId	**String**	**The ID of the request . If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.**
ReturnCode	**String**	**The return code. The value 0 indicates that the operation is successful.**
ReturnErrorSolution	**String**	**The solution to resolve the issue.**
ReturnMessage	**String**	**The error message.**
ReturnValue	**String**	**None**

Example of the SolutionModifyDto parameter

```
{
"executeMethod": "UPDATE_SOLUTION",
"solId": 100000001,
"solName": "sol_name_01_xxxx",
"appId": 78918,
"tenantId": 279717776488706
}
```

Sample success responses

```
{
"returnCode": "0",
"returnErrorSolution": "",
"returnMessage": "",
"requestId": "53ca5f***11bab4d0975",
"returnValue": {
"solId": 100000001,
"solName": "sol_name_01_xxxx",
"appId": 78918,
"tenantId": 279717776488706
},
"success": true
```

```
}
```

2.6.45 RerunTask

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to RerunTask .**
AccountId	**String**	**Yes**	**The ID of the account that is assigned by the scheduling system to call this operation.**
AccountPwd	**String**	**Yes**	**The password of the account that is assigned by the scheduling system to call this operation.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account that you use to call this operation.**
ClientName	**String**	**Yes**	**The name of the client that is assigned by the scheduling system to call this operation.**
ProjectEnv	**String**	**Yes**	**The type of the environment.**
TaskId	**Long**	**Yes**	**None**
TenantId	**Long**	**Yes**	**The ID of the tenant.**

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request.
ReturnCode	String	The error code.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.
ReturnValue	Boolean	Indicates whether the node is successfully rerun.

Sample success responses

```
{
"RequestID": "",
"RetrunCode": 12344,
"ReturnErrorSolution": "****",
"ReturnMessage": "****",
"ReturnValue": true
}
```

2.6.46 ResumeTask

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to ResumeTask.
AccountId	String	No	The ID of the account that is assigned by the scheduling system to call this operation.

Parameter	Type	Required	Description
AccountPwd	String	No	The password of the account that is assigned by the scheduling system to call this operation.
BaseId	String	No	The ID of the Apsara Stack account that you use to call this operation.
ClientName	String	No	The name of the client that is assigned by the scheduling system to call this operation.
ProjectEnv	String	No	The type of the environment. Valid values: DEV and PROD.
TaskId	Long	No	The ID of the node to resume.
TenantId	Long	No	The ID of the tenant.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request . If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The error code.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.

Sample success responses

```
{
"RequestId": "1212adf***s-adfsdsf",
"ReturnCode": 0,
"ReturnMessage": "",
"ReturnErrorSolution": "",
"ReturnValue": true
}
```

2.6.47 SearchBusiness

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to SearchBusiness.**
AccountId	**String**	**No**	**The ID of the account that is assigned by the scheduling system to call this operation.**
AccountPwd	**String**	**No**	**The password of the account that is assigned by the scheduling system to call this operation.**
BaseId	**String**	**No**	**The ID of the Apsara Stack account that you use to call this operation.**
BizId	**Long**	**No**	**Optional. The ID of the workflow.**

Parameter	Type	Required	Description
ClientName	String	No	The name of the client that is assigned by the scheduling system to call this operation.
BizName	String	No	The name of the workflow.
BizKey	String	No	Optional. The key of the workflow.
TenantId	Long	No	The ID of the tenant.
AppId	Long	No	The ID of the DataWorks workspace.
AppIds	String	No	Optional. The IDs of the DataWorks workspaces. Separate multiple IDs with commas (,).

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.
ReturnValue	-	None

Sample success responses

```
{
"returnCode": "0",
"returnErrorSolution": "",
"returnMessage": "",
"requestId": "d4605f***145312",
"returnValue": [
{
"bizId": 10010759,
"bizName": "Control Node 0",
"bizKey": "10010759",
"appId": 12344,
"tenantId": 121**212
}
],
"success": true
}
```

2.6.48 SearchManualDagNodeInstance

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to SearchManualDagNodeInstance.**
ProjectName	**String**	**No**	**The name of the DataWorks workspace.**
DagId	**Long**	**No**	**The ID of the instance for a manually triggered workflow. You can obtain this ID by calling the CreateManualDag operation.**

Response parameters

Parameter	Type	Description
Data	String	The instances of the manually triggered workflow.
ErrCode	String	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.
Success	Boolean	Indicates whether the operation is successful.

2.6.49 SearchSolution

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set this parameter to SearchSolution.
AccountId	String	No	The ID of the account that is assigned by the scheduling system to make the API request.
AccountPwd	String	No	The password of the account that is assigned by the scheduling system to make the API request.
BaseId	String	No	The ID of the Apsara Stack tenant account that you use to call this operation.

Parameter	Type	Required	Description
ClientName	String	No	The name of the client that is assigned by the scheduling system to make the API request.
SolId	Long	No	(Optional) The ID of the solution.
SolName	String	No	The name of the solution.
TenantId	Long	No	The ID of the tenant.
AppId	Long	No	The ID of the DataWorks workspace.

Response parameters

Parameter	Type	Description
RequestId	String	The ID of the request. If an error occurs, you can send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The error code.
ReturnErrorSolution	String	The solution to resolve the issue.
ReturnMessage	String	The error message.

Sample response

```
{
"returnCode": "0",
"returnErrorSolution": "",
"returnMessage": "",
"requestId": "1381****b98d87c",
"returnValue": [
{
"solId": 100000007,
"solName": "Solution Test 222",
"appId": 33646,
"tenantId": 27***9020672
```

```
}
],
"success": true
}
```

2.6.50 SearchTasks

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to SearchTasks.**
AccountId	**String**	**Yes**	**The ID of the account that is assigned by the scheduling system to call this operation.**
AccountPwd	**String**	**Yes**	**The password of the account that is assigned by the scheduling system to call this operation.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account that you use to call this operation.**
ClientName	**String**	**Yes**	**The name of the client that is assigned by the scheduling system to call this operation.**

Parameter	Type	Required	Description
ProjectEnv	String	Yes	The type of the environment. Valid values: PROD and DEV. The value PROD specifies to return the information about the node instances in the production environment that meet the search conditions. The value DEV specifies to return the information about the node instances in the developmen t environment that meet the search conditions.
NodeId	Long	No	The ID of the node . You can view the ID on the node configuration page in the DataWorks console.
TenantId	Long	Yes	The ID of the tenant. Set the value to 1.

Parameter	Type	Required	Description
DagId	Long	No	The ID of the workflow instance to which the node instances belong. When you call the CreateDag operation to create a workflow instance, the ID of the workflow instance is returned. You can use this ID to query the workflow instance.
Bizdate	String	No	The date-based timestamp. The value is in the format of yyyy-mm-dd 00:00:00. You can use this data timestamp to filter the node instances.

Response parameters

Parameter	Type	Description
Count	Integer	The number of the node instances that meet the search conditions.
RequestId	String	The ID of the request. If an error occurs, send the request ID to the developers of the scheduling system for troubleshooting.
ReturnCode	String	The return code. The value 0 indicates that the operation is successful.
ReturnErrorSolution	String	The solution to resolve the issue.

Parameter	Type	Description
ReturnMessage	String	The error message.
ReturnValue		None

Sample requests

```
http(s)://[Endpoint]/? Action=SearchTasks
&AccountId=C00000
&AccountPwd=account-pwd
&BaseId=0I0001
&ClientName=aone_app_name
&ProjectEnv=PROD &TenantId=1
&Bizdate=2018-11-17 00:00:00
&DagId=10000000
&NodeId=1000001
&<Common request parameters>
```

Sample success responses

```
{
"Count": 3236869,
"ReturnValue": [
{
"DqcInstance": "",
"BeginWaitResTime": "",
"ResGroupId": 30004716,
"AppId": 14255,
"TaskId": 9993181585,
"PrgName": "",
"Gmtdate": "2018-11-17 00:00:00",
"NodeId": 20636213,
"DqcDescription": "",
"BeginRunningTime": "",
"AlisaReturnTime": "",
"FinishTime": "",
"GwLogLocalFile": "",
"DagId": 300041822,
"ParaValue": "",
"DueTime": "2018-11-17 00:06:00",
"BaseLineId": 332,
"NodeName": "trewtes",
"CycType": 0,
"DagType": 2,
"InGroupId": 1,
"Priority": 1,
"RerunAble": true,
"Status": 1,
"ResGroupIdentifier": "group_30004716",
"GwProcessId": "",
"PrgType": 10,
"Bizdate": "2018-11-16 00:00:00",
"ExecName": "/opt/taobao/tbdpapp/odpswrapper/odpswrapper.py",
"BeginWaitTimeTime": "",
"Gateway": "",
"GwLogFile": "",
"TaskType": 0
}
]
```

```
}
```

2.6.51 TestConnectivity

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to TestConnectivity.**
BaseId	**String**	**Yes**	**The ID of the Apsara Stack account.**
Connection	**String**	**Yes**	**The connection string of the data source.**
Name	**String**	**Yes**	**The name of the data source.**
ProjectId	**Long**	**Yes**	**The ID of the DataWorks workspace.**
SubType	**String**	**Yes**	**The subtype of the data source . Currently, only MySQL is supported.**
TenantId	**Long**	**Yes**	**The ID of the tenant. Set the value to 1.**
Type	**String**	**Yes**	**The type of the data source.**
Id	**Long**	**No**	**The ID of the data source.**
UseUserDefinedSecret	**Boolean**	**No**	**Specifies whether to use the saved password for logging on to the data source.**

Response parameters

Parameter	Type	Description
Data	Boolean	Indicates whether the data source is successfully connected.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=TestConnectivity
&BaseId=1486*****474
&Connection={"jdbcUrl":"jdbc:mysql://12.11.12.1:3306/data",
"username":"root ",
"password":"***",
"tag":"public"}
&Name="test"
&ProjectId=75059
&SubType=public
&TenantId=26788***178690
&Type=mysql
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0a98***7e2c95",
"data": null,
"errMsg": "Test for the data source connectivity failed:error message
: Communications link failure\n\nThe last packet sent successfully
 to the server was 0 milliseconds ago. The driver has not received
 any packets from the server. error with code: PROJECT_DATASOURCE_C
ONN_ERROR",
"errCode": 610008
}
```

2.6.52 UpdateDQCFollower

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set this parameter to UpdateDQCFollower.

Parameter	Type	Required	Description
ProjectName	String	No	The name of the DataWorks workspace.
Id	Long	No	The ID of the subscription.
Follower	String	No	The object of receiving the subscribed messages. If you want to receive the messages by using emails or the SMS, specify your employee ID. If you want to receive the messages by using DingTalk, specify the webhook URL.

Parameter	Type	Required	Description
AlarmMode	Integer	No	The method of receiving alerts and notifications. A value of 1 indicates that you receive alerts and notifications by using emails. A value of 2 indicates that you receive alerts and notifications by using emails and the SMS. A value of 3 indicates that you receive alerts and notifications from the specified DingTalk group by using the webhook URL. A value of 4 indicates that you receive alerts and notifications from the specified DingTalk group and mention all members in the group.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	Boolean	Indicates whether the subscription information has been changed.

Sample request

```
http(s)://[Endpoint]/? Id=279580663
&ProjectName=autotest
&BlockType=1
&Checker=9
&Comment=Test
```

```
&CriticalThreshold=40
&EntityId=4003922
&ExpectValue=0
&MethodName=count/table_count
&Operator=50624
&Property=table_count
&PropertyType=table
&RuleType=0
&TemplateId=7
&Trend=abs
&WarningThreshold=20
&WhereCondition=60
&<Common request parameters>
```

Sample response

```
{
"ReturnValue": true,
"ReturnCode": "0"
}
```

2.6.53 UpdateDQCRule

Request parameters

Parameter	Type	Required	Description
Action	**String**	**Yes**	**The operation that you want to perform. Set the value to UpdateDQCRule.**
ProjectName	**String**	**Yes**	**The name of the DataWorks workspace.**
Id	**Long**	**Yes**	**The ID of the Data Quality check (DQC) rule to change.**
BlockType	**Integer**	**No**	**The type of the DQC rule. Valid values: 0 and 1. The value 0 specifies a soft rule. The value 1 specifies a hard rule.**
EntityId	**Long**	**No**	**The ID of the partition filter expression.**

Parameter	Type	Required	Description
Comment	String	No	The description of the DQC rule.
Checker	Integer	No	The ID of the checker.
ExpectValue	String	No	The expected value of the checker.
Trend	String	No	The trend of the expected value.
MethodName	String	No	The sampling method, such as max, table_count-count_distinct, and user_defined.
Operator	String	No	The user who is to change the DQC rule.
Property	String	No	The field of the DQC rule to change .
PropertyType	String	No	The type of the field.
RuleType	Integer	No	The type of the DQC rule. Valid values: 0 and 1. The value 0 specifies that the rule is defined by the system. The value 1 specifies that the rule is defined by users.
WhereCondition	String	No	The filtering condition. Write a SQL statement to specify the filtering condition.

Parameter	Type	Required	Description
CriticalThreshold	String	No	The error threshold.
WarningThreshold	String	No	The warning threshold.
TemplateId	Integer	No	The ID of the template to use for changing the DQC rule.

Response parameters

Parameter	Type	Description
ReturnCode	String	The return code.
ReturnValue	Boolean	Indicates whether the DQC rule has been changed.

Sample requests

```
http(s)://[Endpoint]/? Action=UpdateDQCFollower
&AlarmMode=1
&Follower=50624
&Id=1724
&ProjectName=autotest
&<Common request parameters>
```

Sample success responses

```
{
"ReturnValue": true,
"ReturnCode": "0"
}
```

2.6.54 UpdateResGroupGateWay

Request parameters

Parameter	Type	Required	Description
Action	String	Yes	The operation that you want to perform. Set the value to UpdateResGroupGateWay.

Parameter	Type	Required	Description
BaseId	String	Yes	The ID of the Apsara Stack account.
Identifier	String	Yes	The identifier of the resource group .
Memory	Integer	Yes	The memory size of the gateway.
NodeName	String	Yes	The name of the node that runs the gateway.
ProjectId	Long	Yes	The ID of the DataWorks workspace.
TenantId	Long	Yes	The ID of the tenant.
VCpu	Integer	Yes	The number of cores in the vCPU of the gateway.

Response parameters

Parameter	Type	Description
Data	Boolean	Indicates whether the gateway configuration has been changed.
ErrCode	Long	The error code.
ErrMsg	String	The error message.
RequestId	String	The ID of the request.

Sample requests

```
http(s)://[Endpoint]/? Action=UpdateResGroupGateWay
&BaseId=1486821399873474
&Identifier=3907f9a58***8476b2506
&Memory=4
&NodeName=hostname
&ProjectId=75059
&TenantId=26788a***90
&VCpu=9
```

```
&<Common request parameters>
```

Sample success responses

```
{
"requestId": "0bc174***5f15",
"data": true,
"errMsg": "success",
"errCode": 0
}
```

2.7 Obtain an AccessKey pair

You can obtain an AccessKey pair in the Apsara Stack Cloud Management (ASCM) console.

Obtain the AccessKey pair of an organization

To obtain the AccessKey pair of an organization, perform the following operations:

1. **Log on to the ASCM console as an administrator.**
2. **In the top navigation bar, click Enterprise.**
3. **In the left-side navigation pane of the Enterprise page, click Organizations.**
4. **In the Organizations structure, click the icon on the right of the organization to be added.**
5. **Choose AccessKey from the shortcut menu.**
6. **In the AccessKey dialog box that appears, view the AccessKey pair of the organization.**

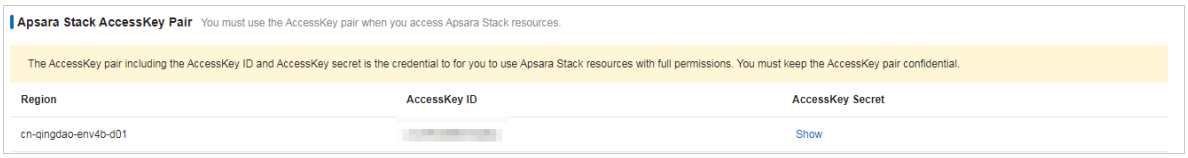
> **Note:**
> **An AccessKey pair is automatically allocated to a level-1 organization. Subordinate organizations use the same AccessKey pair as their level-1 organization.**

Obtain the AccessKey of a personal account

To obtain the AccessKey pair of a personal account, perform the following operations:

1. **Log on to the ASCM console as an administrator.**
2. **In the upper-right corner of the homepage, move the pointer over the user profile picture and click User Information.**

3. **In the Apsara Stack AccessKey Pair section of the User Information page, view your AccessKey pair.**



Note:

The AccessKey pair is made up of the AccessKey ID and AccessKey secret. These credentials provide you full permissions on Apsara Stack resources. You must keep the AccessKey pair confidential.

3 Realtime Compute

3.1 Flink SQL

3.1.1 Overview

As a programming language that conforms to standard SQL semantics, Flink SQL is designed to simplify the computational model, making it easy for users to use Realtime Compute. Flink SQL has the following advantages:

- **Low development cost. Flink SQL enables you to implement complex and varied business logic by using simple SQL statements instead of thousands of lines of Apache Storm code.**
- **Low maintenance cost. Flink SQL eliminates the need for you to maintain thousands of lines of Storm code.**

When you use Apache Storm code, system exceptions, errors, or even breakdown may occur and cause data inaccuracies.

Flink SQL features specified semantics to resolve the preceding issues. Realtime Compute has the following advantages:

- **Data accuracy. Realtime Compute provides unique exactly-once semantics to ensure data accuracy in various failover scenarios.**
- **Performance optimization. Realtime Compute integrates SQL optimization logic to translate SQL code into underlying Apache Storm code that can be used by universal developers. This helps to improve SQL code compilation efficiency.**
- **Programming extensibility. Realtime Compute supports user-defined functions (UDFs). You can customize functions to implement a custom business logic or a logic that cannot be achieved by SQL statements.**
- **System scalability. Realtime Compute supports auto scaling upon data surges (for example, during the Double 11) while ensuring job and system stability.**

3.1.2 Keywords

This topic describes the keywords in Realtime Compute.

Realtime Compute keywords

Table 3-1: Common keywords

Keyword type	Keywords
Data type	VARCHAR, INT, BIGINT, DOUBLE, DATE, BOOLEAN, TINYINT, SMALLINT, FLOAT, DECIMAL, and VARBINARY
DDL statement	CREATE TABLE, CREATE FUNCTION, and CREATE VIEW
DML statement	INSERT INTO
SELECT clause	SELECT FROM, WHERE, GROUP BY, and JOIN

Naming conventions

Names of source tables, result tables, views, and aliases must follow the standard database naming conventions. The names must start with a letter, and can only contain letters, numbers, and underscores (_).

Reserved keywords

The following strings are reserved as keywords for later use. If you want to use any of the following keywords as a field name, enclose the keyword in backticks (`), for example, `value`.

```
A, ABS, ABSOLUTE, ACTION, ADA, ADD, ADMIN, AFTER, ALL, ALLOCATE, ALLOW
, ALTER, ALWAYS, AND, ANY, ARE, ARRAY, AS, ASC, ASENSITIVE, ASSERTION
, ASSIGNMENT, ASYMMETRIC, AT, ATOMIC, ATTRIBUTE, ATTRIBUTES, AUTHORIZAT
ION, AVG, BEFORE, BEGIN, BERNOULLI, BETWEEN, BIGINT, BINARY, BIT, BLOB
, BOOLEAN, BOTH, BREADTH, BY, C, CALL, CALLED, CARDINALITY, CASCADE,
CASCADED, CASE, CAST, CATALOG, CATALOG_NAME, CEIL, CEILING, CENTURY,
CHAIN, CHAR, CHARACTER, CHARACTERISTICTS, CHARACTERS, CHARACTER_LENGTH
, CHARACTER_SET_CATALOG, CHARACTER_SET_NAME, CHARACTER_SET_SCHEMA,
CHAR_LENGTH, CHECK, CLASS_ORIGIN, CLOB, CLOSE, COALESCE, COBOL, COLLATE
, COLLATION, COLLATION_CATALOG, COLLATION_NAME, COLLATION_SCHEMA,
COLLECT, COLUMN, COLUMN_NAME, COMMAND_FUNCTION, COMMAND_FUNCTION_CODE
, COMMIT, COMMITTED, CONDITION, CONDITION_NUMBER, CONNECT, CONNECTION,
```

```
CONNECTION_NAME, CONSTRAINT, CONSTRAINTS, CONSTRAINT_CATALOG, CONSTRAINT
_NAME, CONSTRAINT_SCHEMA, CONSTRUCTOR, CONTAINS, CONTINUE, CONVERT
, CORR, CORRESPONDING, COUNT, COVAR_POP, COVAR_SAMP, CREATE, CROSS,
CUBE, CUME_DIST, CURRENT, CURRENT_CATALOG, CURRENT_DATE, CURRENT_DE
FAULT_TRANSFORM_GROUP, CURRENT_PATH, CURRENT_ROLE, CURRENT_SCHEMA
, CURRENT_TIME, CURRENT_TIMESTAMP, CURRENT_TRANSFORM_GROUP_FOR_TYPE
, CURRENT_USER, CURSOR, CURSOR_NAME, CYCLE, DATA, DATABASE, DATE,
DATETIME_INTERVAL_CODE, DATETIME_INTERVAL_PRECISION, DAY, DEALLOCATE,
DEC, DECADE, DECIMAL, DECLARE, DEFAULT, DEFAULTS, DEFERRABLE, DEFERRED
, DEFINED, DEFINER, DEGREE, DELETE, DENSE_RANK, DEPTH, DEREF, DERIVED
, DESC, DESCRIBE, DESCRIPTION, DESCRIPTOR, DETERMINISTIC, DIAGNOSTICS
, DISALLOW, DISCONNECT, DISPATCH, DISTINCT, DOMAIN, DOUBLE, DOW, DOY,
DROP, DYNAMIC, DYNAMIC_FUNCTION, DYNAMIC_FUNCTION_CODE, EACH, ELEMENT
, ELSE, END, END-EXEC, EPOCH, EQUALS, ESCAPE, EVERY, EXCEPT, EXCEPTION
, EXCLUDE, EXCLUDING, EXEC, EXECUTE, EXISTS, EXP, EXPLAIN, EXTEND,
EXTERNAL, EXTRACT, FALSE, FETCH, FILTER, FINAL, FIRST, FIRST_VALUE,
FLOAT, FLOOR, FOLLOWING, FOR, FOREIGN, FORTRAN, FOUND, FRAC_SECOND,
FREE, FROM, FULL, FUNCTION, FUSION, G, GENERAL, GENERATED, GET, GLOBAL
, GO, GOTO, GRANT, GRANTED, GROUP, GROUPING, HAVING, HIERARCHY, HOLD
, HOUR, IDENTITY, IMMEDIATE, IMPLEMENTATION, IMPORT, IN, INCLUDING,
INCREMENT, INDICATOR, INITIALLY, INNER, INOUT, INPUT, INSENSITIVE,
INSERT, INSTANCE, INSTANTIABLE, INT, INTEGER, INTERSECT, INTERSECTION,
INTERVAL, INTO, INVOKER, IS, ISOLATION, JAVA, JOIN, K, KEY, KEY_MEMBER
, KEY_TYPE, LABEL, LANGUAGE, LARGE, LAST, LAST_VALUE, LATERAL, LEADING
, LEFT, LENGTH, LEVEL, LIBRARY, LIKE, LIMIT, LN, LOCAL, LOCALTIME,
LOCALTIMESTAMP, LOCATOR, LOWER, M, MAP, MATCH, MATCHED, MAX, MAXVALUE
, MEMBER, MERGE, MESSAGE_LENGTH, MESSAGE_OCTET_LENGTH, MESSAGE_TEXT,
METHOD, MICROSECOND, MILLENNIUM, MIN, MINUTE, MINVALUE, MOD, MODIFIES
, MODULE, MONTH, MORE, MULTISET, MUMPS, NAME, NAMES, NATIONAL, NATURAL
, NCHAR, NCLOB, NESTING, NEW, NEXT, NO, NONE, NORMALIZE, NORMALIZED,
NOT, NULL, NULLABLE, NULLIF, NULLS, NUMBER, NUMERIC, OBJECT, OCTETS,
OCTET_LENGTH, OF, OFFSET, OLD, ON, ONLY, OPEN, OPTION, OPTIONS, OR,
ORDER, ORDERING, ORDINALITY, OTHERS, OUT, OUTER, OUTPUT, OVER, OVERLAPS
```

```
, OVERLAY, OVERRIDING, PAD, PARAMETER, PARAMETER_MODE, PARAMETER_NAME
, PARAMETER_ORDINAL_POSITION, PARAMETER_SPECIFIC_CATALOG, PARAMETER_
SPECIFIC_NAME, PARAMETER_SPECIFIC_SCHEMA, PARTIAL, PARTITION, PASCAL
, PASSTHROUGH, PATH, PERCENTILE_CONT, PERCENTILE_DISC, PERCENT_RANK,
PLACING, PLAN, PLI, POSITION, POWER, PRECEDING, PRECISION, PREPARE,
PRESERVE, PRIMARY, PRIOR, PRIVILEGES, PROCEDURE, PUBLIC, QUARTER, RANGE
, RANK, READ, READS, REAL, RECURSIVE, REF, REFERENCES, REFERENCING,
REGR_AVGX, REGR_AVGY, REGR_COUNT, REGR_INTERCEPT, REGR_R2, REGR_SLOPE
, REGR_SXX, REGR_SXY, REGR_SYY, RELATIVE, RELEASE, REPEATABLE, RESET
, RESTART, RESTRICT, RESULT, RETURN, RETURNED_CARDINALITY, RETURNED_L
ENGTH, RETURNED_OCTET_LENGTH, RETURNED_SQLSTATE, RETURNS, REVOKE,
RIGHT, ROLE, ROLLBACK, ROLLUP, ROUTINE, ROUTINE_CATALOG, ROUTINE_NAME
, ROUTINE_SCHEMA, ROW, ROWS, ROW_COUNT, ROW_NUMBER, SAVEPOINT, SCALE
, SCHEMA, SCHEMA_NAME, SCOPE, SCOPE_CATALOGS, SCOPE_NAME, SCOPE_SCHE
MA, SCROLL, SEARCH, SECOND, SECTION, SECURITY, SELECT, SELF, SENSITIVE
, SEQUENCE, SERIALIZABLE, SERVER, SERVER_NAME, SESSION, SESSION_USER
, SET, SETS, SIMILAR, SIMPLE, SIZE, SMALLINT, SOME, SOURCE, SPACE,
SPECIFIC, SPECIFICTYPE, SPECIFIC_NAME, SQL, SQLEXCEPTION, SQLSTATE,
SQLWARNING, SQL_TSI_DAY, SQL_TSI_FRAC_SECOND, SQL_TSI_HOUR, SQL_TSI_MI
CROSECOND, SQL_TSI_MINUTE, SQL_TSI_MONTH, SQL_TSI_QUARTER, SQL_TSI_SE
COND, SQL_TSI_WEEK, SQL_TSI_YEAR, SQRT, START, STATE, STATEMENT, STATIC
, STDDEV_POP, STDDEV_SAMP, STREAM, STRUCTURE, STYLE, SUBCLASS_ORIGIN,
SUBMULTISET, SUBSTITUTE, SUBSTRING, SUM, SYMMETRIC, SYSTEM, SYSTEM_USER
, TABLE, TABLESAMPLE, TABLE_NAME, TEMPORARY, THEN, TIES, TIME, TIMESTAMP
, TIMESTAMPADD, TIMESTAMPDIFF, TIMEZONE_HOUR, TIMEZONE_MINUTE, TINYINT
, TO, TOP_LEVEL_COUNT, TRAILING, TRANSACTION, TRANSACTIONS_ACTIVE,
TRANSACTIONS_COMMITTED, TRANSACTIONS_ROLLED_BACK, TRANSFORM, TRANSFORMS
, TRANSLATE, TRANSLATION, TREAT, TRIGGER, TRIGGER_CATALOG, TRIGGER_NA
ME, TRIGGER_SCHEMA, TRIM, TRUE, TYPE, UESCAPE, UNBOUNDED, UNCOMMITTED
, UNDER, UNION, UNIQUE, UNKNOWN, UNNAMED, UNNEST, UPDATE, UPPER, UPSERT
, USAGE, USER, USER_DEFINED_TYPE_CATALOG, USER_DEFINED_TYPE_CODE,
USER_DEFINED_TYPE_NAME, USER_DEFINED_TYPE_SCHEMA, USING, VALUE, VALUES
, VARBINARY, VARCHAR, VARYING, VAR_POP, VAR_SAMP, VERSION, VIEW, WEEK,
```

```
WHEN, WHENEVER, WHERE, WIDTH_BUCKET, WINDOW, WITH, WITHIN, WITHOUT, WORK
, WRAPPER, WRITE, XML, YEAR, ZONE
```

3.1.3 Terms

3.1.3.1 Watermark

Realtime Compute aggregates data by using window functions based on a time attribute. To use window functions based on event time, you must define a watermark in the DDL statement of a source table.

Watermarking is a mechanism in Flink to measure progress in event time. A watermark provides a time attribute by carrying a timestamp. Flink provides the following statement to define a watermark:

Note:

For more information about time attributes supported by Realtime Compute, see *Time attributes*.

```
WATERMARK [watermarkName] FOR <rowtime_field> AS withOffset(<
rowtime_field>, offset)
```

Parameter	Description
watermarkName	Specifies the name of a watermark. This parameter is optional.
<rowtime_field>	Specifies a column that is used to generate a watermark. The data type of the column must be TIMESTAMP. The column is labeled as the event time column. You can use this event time column to define windows in queries.
withOffset	Specifies the strategy of generating a watermark. The value for a watermark is obtained based on `<rowtime_field > - offset`. In `withOffset`, you must define `<rowtime_field>` as the first parameter.
offset	Specifies the offset between a watermark value and an event time, which is measured in milliseconds.

The time when a data record is generated is indicated by a field. For example, a table has a `rowtime` column of the TIMESTAMP data type, and one value is `1501750584000 (2017-08-03 08:56:24.000)`. Based on the `rowtime` column, you can define a watermark with a four-second offset as follows:

```
WATERMARK FOR rowtime AS withOffset(rowtime, 4000)
```

The watermark value of the specified data record is obtained: `1501750584000 - 4000 = 1501750580000 (2017-08-03 08:56:20.000)`. The watermark value indicates that all data with the timestamps earlier than `1501750580000 (2017-08-03 08:56:20.000)` has arrived.

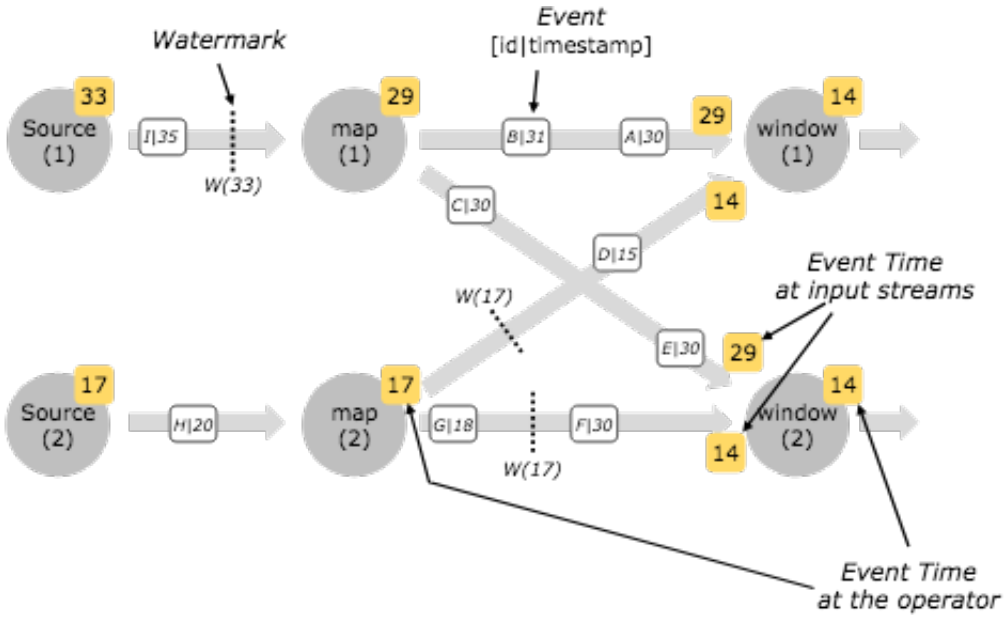
Note:

- When you define a watermark based on event time, the data type of the `rowtime` column must be TIMESTAMP. Currently, Realtime Compute only supports 13-bit Unix timestamps measured in milliseconds. If the data type of a rowtime column is not TIMESTAMP or a Unix timestamp is not 13 digits in length, we recommend that you use a *Computed column* to convert data types.
- Event time and processing time can only be declared in the DDL statement of a source table.

`Summary`

- A watermark indicates that all the events with the timestamps t' earlier than the watermark `t` have occurred. After a watermark `t` arrives at an operator, all subsequent records with timestamps earlier than the watermark `t` are discarded. This is the current watermarking mechanism in Realtime Compute. However, in the future, improvements to Realtime Compute will allow you to update subsequent data.
- The watermarking mechanism is crucial for handling out-of-order data streams. With watermarks, real-time computing results are accurate even if data streams arrive out of order.

- **When an operator has multiple input data streams, the event time of the operator equals the minimum event time of the data streams.**



3.1.3.2 Computed column

You can calculate a value for a computed column by using data from other columns. If a source table does not have a column of the TIMESTAMP data type, you can use a computed column expression to convert data types.

Definition

A computed column is a virtual column that is not physically stored in a table. You can create computed columns by using expressions, built-in functions, or user-defined functions. In Flink SQL, a computed column can be used as other columns that are physically stored in a table.

Usage

Currently, the data type of the event time (also known as rowtime) column in a *Watermark* must be TIMESTAMP. We are working on support for the LONG data type. You can only define a watermark in the DDL statement of a source table. If a source table does not have a column of the TIMESTAMP data type, you can use a computed column expression to convert data types.

Syntax

```
column_name AS computed_column_expression
```

Example

The data type of the rowtime column in a watermark must be TIMESTAMP. Currently, Realtime Compute only supports 13-bit Unix timestamps measured in milliseconds. If the TIME column in a DataHub source table is defined as 16-bit Unix timestamps measured in microseconds, you can use a computed column expression to convert data types. An example is described as follows:

```
CREATE TABLE test_stream(
  a INT,
  b BIGINT,
  `TIME` BIGINT,
  Ts AS TO_TIMESTAMP (TIME/1000), -- Converts 16-bit timestamps to 13-
bit timestamps by using a computed column expression.
  WATERMARK FOR ts AS withOffset(ts, 10000)
) WITH (
  type = 'datahub',
  ...
);
```

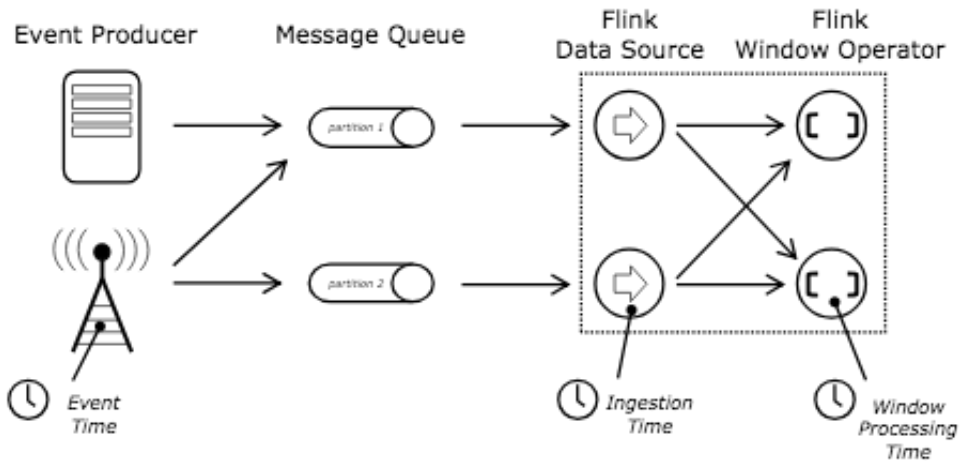
In this example, the data type of the `TIME` column in the source table is BIGINT. A computed column expression is created to convert the `TIME` column of the BIGINT data type to the `ts` column of the TIMESTAMP data type. The `ts` column is used as the rowtime of a watermark.

3.1.3.3 Time attributes

This topic describes two time attributes that are supported by Flink SQL: event time and processing time.

Event time and processing time are described as follows:

- **Event time: specifies the time at which an event is produced. The event time column must be included in the schema.**
- **Processing time: specifies the time at which the system processes an event.**



Ingestion time and processing time are the time attributes automatically generated by the system for a streaming data record and are not changeable. Event time is the time attribute carried by a streaming data record itself. Assume that data whose event time is t1 is written to Partition 1 and data whose event time is t2 is written to Partition 2. The event time t1 is earlier than t2. However, due to data disorder or network jitter, Realtime Compute may first read and process the data with an event time of t2.

Event time

Event time is also known as rowtime. The event time attribute must be declared in the DDL statement for creating a source table. You can declare a field in the source table as event time. Currently, only the TIMESTAMP data type is supported for a rowtime field. We are working on providing support for the LONG data type. If the data type of the specified field is not TIMESTAMP, you must create a computed column of the TIMESTAMP data type from existing fields. For more information about computed columns, see *Computed column*.

Due to data disorder or network jitter, the sequence in which Realtime Compute reads and processes data may differ from the sequence in which data arrives. Therefore, after you define the rowtime field, you must define a *Watermark*.

You can perform event time-based window function operations as follows:

```
CREATE TABLE tt_stream(
  a VARCHAR,
  b VARCHAR,
  c TIMESTAMP,
  WATERMARK wk1 FOR c as withOffset(c, 1000)  -- Defines a watermark.
) WITH (
  type = 'sls',
  topic = 'yourTopicName',
  accessId = 'yourAccessId',
  accessKey = 'yourAccessSecret'
```

```
);

CREATE TABLE rds_output(
  id VARCHAR,
  c TIMESTAMP,
  f TIMESTAMP,
  cnt BIGINT
) WITH (
  type = 'rds',
  url = 'jdbc:mysql://****3306/test',
  tableName='yourTableName',
  userName = 'yourUserName',
  password = 'yourPassword'
);

INSERT INTO rds_output
SELECT a AS id,
     SESSION_START(c, INTERVAL '1' SECOND) AS c,
     CAST(SESSION_END(c, INTERVAL '1' SECOND) AS TIMESTAMP) AS f,
     COUNT(a) AS cnt
FROM tt_stream
GROUP BY SESSION(c, INTERVAL '1' SECOND), a
```

Processing time

Processing time is generated by the system and is not included in your original data. Therefore, you need to define a processing time field in a DDL statement.

```
filedName as PROCTIME()
```

You can aggregate data by using a window function based on processing time. An example is described as follows:

```
CREATE TABLE mq_stream (
  a VARCHAR,
  b VARCHAR,
  c BIGINT,
  d AS PROCTIME()   --- Defines a processing time field.
) WITH (
  type = 'rds',
  topic = 'yourTopic',
  accessId = 'yourAccessId',
  accessKey = 'yourAccessSecret'
);

CREATE TABLE rds_output (
  id VARCHAR,
  c TIMESTAMP,
  f TIMESTAMP,
  cnt BIGINT
) with (
  type = 'rds',
  url = 'yourDatebaseURL',
  tableName='yourDatabaseTableName',
  userName = 'yourUserName',
  password = 'yourPassword'
);


INSERT INTO rds_output
```

```
SELECT a AS id,
     SESSION_START(d, INTERVAL '1' SECOND) AS c,
     SESSION_END(d, INTERVAL '1' SECOND) AS f,
     COUNT(a) AS cnt
FROM mq_stream
GROUP BY SESSION(d, INTERVAL '1' SECOND), a
```

Expiration of time attributes

A time attribute field no longer indicates a time attribute if you perform the following two operations:

- **GROUP BY operations (not for window functions)**
- **JOIN operations of two data streams**

Errors will occur if you perform time-based window function operations after the preceding operations. For example, the error message `org. apache. flink. table. api. ValidationException: Window can only be defined over a time attribute column.` **may appear.**

3.1.4 Data types

3.1.4.1 Data types

This topic describes data types supported by Realtime Compute.

Supported data types

Data type	Description	Value range
VARCHAR	Character string with a changeable length	Maximum storage capacity: 4 MB
BOOLEAN	Logical value	Valid values: TRUE, FALSE, and UNKNOWN
TINYINT	Tiny integer (one byte)	-128 to 127
SMALLINT	Small integer (two bytes)	-32768 to 32767
INT	Integer (four bytes)	-2147483648 to 2147483647
BIGINT	Big integer (eight bytes)	-9223372036854775808 to 9223372036 854775807
FLOAT	Four-byte floating point number	Six digits of precision

Data type	Description	Value range
DECIMAL	Decimal	An example value for `DECIMAL(5,2)` is `123.45`.
DOUBLE	Eight-byte floating point number	15 decimal digits of precision
DATE	Date	Example: `DATE'1969-07-20'`
TIME	Time	Example: `TIME '20:17:40'`
TIMESTAMP	Timestamp containing both date and time parts	Example: `TIMESTAMP '1969-07-20 20:17:40'`
VARBINARY	Binary data	Byte array

Type conversion

Convertible	Data Type										
	VARCHAR	BOOLEAN	TINYINT	SMALLINT	INT	BIGINT	FLOAT	DOUBLE	DATE	TIMESTAMP	TIME
VARCHAR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
BOOLEAN	Y	Y	N	N	N	N	N	N	N	N	N
TINYINT	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
SMALLINT	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
INT	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
BIGINT	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
FLOAT	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
DOUBLE	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
DATE	Y	N	N	N	N	N	N	N	Y	Y	N
TIMESTAMP	Y	N	N	N	N	N	N	N	Y	Y	Y
TIME	Y	N	N	N	N	N	N	N	N	Y	Y

Type conversion example

Input example

var1 (VARCHAR)	big1 (BIGINT)
1000	323

Sample code

```
CAST(var1 AS BIGINT) AS AA;
CAST(big1 AS VARCHAR) AS BB;
```

Output example

AA (BIGINT)	BB (VARCHAR)
1000	323

3.1.4.2 Data types and operators

This topic describes data types and operators in Realtime Compute.

You can perform mathematical and logical operations for different data types.

Examples are provided in the following table.

Operator	Description	Data types supported by numeric1 and numeric2	Example
numeric1 + numeric2	*Addition*	**INT, DOUBLE, DECIMAL, BIGINT**	`2 + 4.2`
numeric1 - numeric2	*Subtraction*		`3 - 5.3`
numeric1 * numeric2	*Multiplication*		`2 * 4`
numeric1/numeric2	*Division*		**2.4/5**
numeric1 > numeric2	>		`2.4 > 5`
numeric1 < numeric2	<		`2.4 < 5`
numeric1 >= numeric2	>=		`2.4 >= 5`
numeric1 <= numeric2	<=		`2.4 <= 5`
numeric1 = numeric2	=	**INT, DOUBLE, DECIMAL, BIGINT, VARCHAR**	`‘iphone’ = 5`
numeric1 <> numeric2	<>		`'iphone' <> 5`

3.1.5 DDL statements

3.1.5.1 Overview

Syntax

```
CREATE TABLE tableName
     (columnName dataType [, columnName dataType ]*)
```

```
    [ WITH (propertyName=propertyValue [, propertyName=propertyValue
 ]*) ];
```

Description

Realtime Compute does not store data from source and result tables. You can only perform operations on source and result tables by using DDL statements to declare references to data stores. Example:

```
create table tt_stream(
    a varchar,
    b varchar,
    c varchar
    ) with (
    type='DataHub',
    topic='blink_tt_test',
    accessId='yourAccessId',
    accessKey='yourAccessSecret'
    );
```

This Flink SQL statement is not used to create a DataHub topic, but to create a table named tt_stream in Realtime Compute and use the table to declare a reference to a DataHub topic. You can use tt_stream as an alias in subsequent DML statements to perform operations on the table.

- **A declaration of a table (tt_stream in this example) is only valid for the jobs generated from the current SQL file. A job is generated after a SQL file is published. The table can also be declared for reference in other SQL files under the same project.**
- **Since Realtime Compute adopts standard SQL, keywords, table names, and field names in DDL statements are case-insensitive.**
- **Table and field names must start with a letter or number and can only contain letters, numbers, and underscores (_).**
- **The method of mapping fields between a source table and an upstream data store depends on the feature of the data store. If the data store such as DataHub supports mapping based on key values, the field names in the source table must be the same as those in the data store. However, the number of fields can be different. If a data store does not support mapping based on key values, both the number and sequence of fields defined in the source table must the same as those in the data store. We recommend that you use the same field names and the same number of fields in DDL statements as those in external data stores. This can prevent data errors caused by inaccurate definitions.**

Field mapping

Data stores are classified into two types based on whether the data store has a schema.

- **Sequence mapping**

  Systems such as Message Queue (MQ) are non-structured storage systems that do not have a schema. You can customize field names in DDL statements. However, the data types and the number of fields must be the same as those in the data store.

  The following example shows an MQ record:

  ```
  asavfa,sddd32,sdfdsv
  ```

  You need to set field names of the tt_stream table based on naming conventions.

  ```
  create table tt_stream(
        a varchar,
        b varchar,
        c varchar
        ) with (
        type = 'mq',
        topic='blink_mq_test',
        accessId='yourAccessId',
        accessKey='yourAccessSecret'
        );
  ```

- **Name mapping**

  For structured storage systems such as DataHub, field names and data types are defined based on a table schema. We recommend that you define fields by using Flink SQL based on the table schema. The names, number, and sequence of fields must be the same as those in the data store.

  Note:
  If field names in the data store (such as Table Store) are case-sensitive, you need to enclose field names in backticks (`) in Flink SQL statements. Take DataHub as

an example. In DDL statements, field names of the declared source table must apply the same casing that DataHub uses.

The following table describes a sample schema of DataHub.

Table 3-2: A sample schema of DataHub

Field	Data type
name	varchar
age	bigint
value	varchar

We recommend that you declare references for all fields. Note that you can only reference the fields that are included in the data store. A sample of the DDL statement is provided as follows:

```
create table stream_result (
     name varchar,
     age bigint,
     value varchar
     ) with (
     type='DataHub',
     endpoint='http://dh-cn-hangzhou.aliyuncs.com',
     accessId='yourAccessId',
     accessKey='yourAccessSecret',
     project='project',
     topic = 'topic'
     );
```

Case insensitivity

Realtime Compute adopts standard SQL. Therefore, fields are case-insensitive. For example, the following two statements produce the same effect. Statement 1:

```
create  table stream_result (
    name            varchar,
    value           varchar
    );
```

Statement 2:

```
create  table STREAM_RESULT (
     NAME            varchar,
     VALUE           varchar
```

```
     );
```

Realtime Compute references data from multiple data stores. Some data stores, such as Table Store, are case-sensitive in field names. If a NAME parameter is defined in Table Store, the DDL statement must be as follows:

```
create  table STREAM_RESULT (
    `NAME`            varchar,
    `VALUE`           varchar
    );
```

In all subsequent DML statements, the parameter must be enclosed in backticks (`) if it is referenced. A sample code is provided as follows:

```
INSERT INTO Table_A
    SELECT
    `NAME`,
    `VALUE`
    FROM
    Table_B;
```

3.1.5.2 Create a data source table

3.1.5.2.1 Overview

A source table for Realtime Compute stores streaming data inputs. Streaming data triggers real-time computing. To perform real-time computing, you must create a source table to store streaming data inputs.

Syntax

```
  CREATE TABLE tableName
      (columnName dataType [, columnName dataType ]*)
      [ WITH (propertyName=propertyValue [, propertyName=propertyValue
 ]*) ];
```

Example

```
Create table metaq_stream (
 x VARCHAR,
 y VARCHAR,
 z VARCHAR
) WITH (
 type='mq',
 topic='<yourTopicName>',
 endpoint='<yourEndpointName>',
 pullIntervalMs='1000',
 accessId='<yourAccessId>',
 accessKey='<yourAccessKey>',
 startMessageOffset='1000',
 consumerGroup='<yourConsumerGroup>',
 fieldDelimiter='|'
```

```
);
```

Retrieve attribute fields from a source table

- Syntax

  You must add the `HEADER` keyword to the end of a field declaration in the DDL statement to retrieve the attribute field from a source table.

```
CREATE TABLE sourcetable
(
  `timestamp`   VARCHAR HEADER,
   name         VARCHAR,
   MsgID        VARCHAR
)WITH(
     type='RDS'
);
```

  In the preceding example, the `` `timestamp` `` field is defined as `HEADER`. Realtime Compute reads the values of the attribute field in the source table. Then, the field is used as a common field.

  Note:
  Different types of source tables (DataHub and Log Service) have different default attribute fields. For Log Service source tables, custom attribute fields are supported. For more information, see the topic of the corresponding source table.

- Example

  A Log Service source table is used as an example. Currently, Log Service supports the following three attribute fields by default.

Field name	Description
`__source__`	**Specifies a log source.**
`__topic__`	**Specifies a log topic.**
`__timestamp__`	**Specifies the time when a logged event occurs.**

  Note:

You must add the `HEADER` keyword to the end of a field declaration to retrieve this attribute field from a source table.

Example

- **Input example**

```
__topic__:  ens_altar_flow
        result:  {"MsgID":"ems0a","Version":"0.0.1"}
```

- **Sample code**

```
CREATE TABLE sls_log (
  __topic__  VARCHAR HEADER,
  result     VARCHAR
)WITH(
  type ='sls',
);
CREATE TABLE sls_out (
  name     varchar,
  MsgID    varchar,
  Version  varchar
)WITH(
  type='RDS'
);
INSERT INTO sls_out
SELECT
__topic__
JSON_VALUE (result, '$. MsgID '),
JSON_VALUE (result, '$. version ')
FROM
sls_log
```

- **Output example**

name (VARCHAT)	MsgID (VARCHAT)	Version (VARCHAT)
ens_altar_flow	ems0a	`0.0.1`

A source table for window function-based computing

Realtime Compute can aggregate data by using window functions based on event time or processing time. If window functions are used for a stream processing job, you must define a *Watermark* and *Computed column* in a source table DDL statement. For more information about data aggregation based on time attributes, see *Time attributes*.

3.1.5.2.2 Create a DataHub source table

This topic describes how to create a DataHub source table for Realtime Compute. It introduces attribute fields, parameters in the WITH clause, and type mapping.

Introduction to DataHub

DataHub is a real-time data distribution platform that is designed to process streaming data. It transmits big data to other Alibaba Cloud Services. DataHub can work with multiple Alibaba Cloud services to build an end-to-end data processing platform. Realtime Compute uses DataHub to store source tables and result tables for stream processing jobs. Data Transmission Services (DTS) and the Internet of Things (IoT) also use DataHub to access big data platforms. DataHub stores streaming data that can be used as input data for Realtime Compute.

Example

You can use the following sample code to create a DataHub source table:

```
create table datahub_stream(
  name VARCHAR,
  age BIGINT,
  birthday BIGINT
) with (
  type='datahub',
  endPoint='yourEndpoint',
  project='yourProjectName',
  topic = 'yourTopicName',
  accessId='yourAccessId',
  accessKey='yourAccessSecret',
  startTime='2017-07-21 00:00:00'
);
```

Attribute field (timestamp)

You can use Flink SQL to retrieve the timestamp field of a DataHub source table. You can obtain the system time of each data record by reading the timestamp field of a DataHub source table.

Field name	Description
timestamp	Specifies the system time at which data is written into a DataHub source table.

Attribute field instructions

To extract data from the attribute field of DataHub, you need to add the `HEADER` keyword to the end of a field declaration.

Attribute fields are not defined in the DataHub topic. To extract the `system time` of each data record, you can define a `timestamp` field, and add `HEADER` to the end of the field declaration. Example:

- **Input example**

name (VARCHAR)	MsgID (VARCHAR)
ens_altar_flow	ems0a

- **Sample code**

```
CREATE TABLE datahub_log (
  `timestamp`  varchar HEADER,
  name       varchar,
  MsgID        varchar
)
WITH
(
  type ='datahub'

);
CREATE TABLE RDS_out (
  `timestamp`     varchar,
  MsgID    varchar,
  name  varchar
)
WITH
(
  type ='RDS'

);
INSERT INTO RDS_out
SELECT
`timestamp`,
MsgID,
name
FROM datahub_log;
```

- **Output example**

TIME (VARCHAR)	MsgID (VARCHAR)	name (VARCHAR)
1522652455625	ems0a	ens_altar_flow

Parameters in the WITH clause

Currently, topics only support the data records of the tuple pattern.

Parameter	Description	Remarks
endPoint	Specifies the consumer endpoint.	For more information, see *Obtain an endpoint* in *DataHub Developer Guide*.
accessId	Specifies an AccessKey ID.	N/A

Parameter	Description	Remarks
accessKey	Specifies an AccessKey secret.	N/A
project	Specifies a project in DataHub.	N/A
topic	Specifies a topic of the project.	N/A
startTime	Specifies a start offset.	The format is `yyyy-MM-dd hh:mm:ss`.
maxRetryTimes	Specifies a maximum number of read attempts.	Optional. The default value is 20.
retryIntervalMs	Specifies an interval of retries.	Optional. The default value is 1000.
batchReadSize	Specifies the number of data records that are read at a time.	Optional. The default value is 10, and the maximum value is 1000.

Parameter	Description	Remarks
lengthCheck	Specifies a rule for checking the number of fields parsed from a row of data.	Optional. The default value is NONE, indicating: · When the number of fields parsed from a row of data is greater than the number of defined fields, data is extracted from left to right based on the order of defined fields. · When the number of fields parsed from a row of data is smaller than the number of defined fields, this row of data is skipped. Other valid values are SKIP, EXCEPTION, and PAD. · SKIP: When the number of fields parsed from data does not match the number of defined fields, this row of data is skipped. · EXCEPTION: When the number of fields parsed from data does not match the number of defined fields, an exception is reported. · PAD: Data is extracted from left to right based on the order of defined fields. - When the number of fields parsed from a row of data is greater than the number of defined fields, data is extracted from left to right based on the order of defined fields. - When the number of fields parsed from a row of data is smaller than the number of defined fields, the values of the missing fields are null.

Parameter	Description	Remarks
columnErrorDebug	Specifies whether debugging is enabled. If you enable debugging, parsing exceptions are logged when they occur.	Optional. The default value is false.

Type mapping

The following table lists the mapping between DataHub and Realtime Compute data types. We recommend that you declare the type mapping in the DDL statement.

DataHub data type	Realtime Compute data type
BIGINT	BIGINT
STRING	VARCHAR
DOUBLE	DOUBLE
TIMESTAMP	BIGINT
BOOLEAN	BOOLEAN
DECIMAL	DECIMAL

Note:

The TIMESTAMP type field defined in DataHub is a 16-digit Unix timestamp measured in microseconds. In contrast, the TIMESTAMP type field defined in Realtime Compute is a 13-digit Unix timestamp measured in milliseconds. Therefore, we recommend that you convert the TIMESTAMP data type to BIGINT. If you want to use the TIMESTAMP data type in Realtime Compute, we recommend that you use *Computed column* to convert the time format.

3.1.5.2.3 Create a Log Service source table

This topic describes how to create a Log Service source table for Realtime Compute. It introduces supported attribute fields, parameters in the WITH clause, and type mapping.

Introduction to Log Service

Log Service is a one-stop logging service developed by Alibaba Cloud. It has shown superior performance in big data scenarios. Log Service is used to store streaming

data. The streaming data can be used as input data for Realtime Compute. The data format of logs is JSON. An example is described as follows:

```
{
    "a": 1000,
    "b": 1234,
    "c": "li"
}
```

You can define a DDL statement as follows (sls in the code represents Log Service):

```
create table sls_stream(
  a int,
  b int,
  c VARCHAR
) with (
  type ='sls',
  endPoint='yourEndpoint',
  accessId ='yourAccessId',
  accessKey ='yourAccessKey',
  startTime = 'yourStartTime',
  project='yourProjectName',
  logStore='yourLogStoreName',
  consumerGroup ='yourConsumerGroupName'
);
```

Supported attribute fields

Currently, Flink SQL supports three types of Log Service attribute fields by default. Custom fields are also supported.

Field name	Description
`__source__`	**Specifies a log source.**
`__topic__`	**Specifies a log topic.**
`__timestamp__`	**Specifies the time when a logged event occurs.**

`Attribute field instructions`

To extract data from the supported fields, you need to add the `HEADER` keyword after the data type in the declaration. An example is described as follows:

- **Input example**

```
     __topic__:  ens_altar_flow
        result:  {"MsgID":"ems0a","Version":"0.0.1"}
```

- **Sample code**

```
CREATE TABLE sls_log (
  __topic__  VARCHAR HEADER,
```

```
  result     VARCHAR
)
WITH
(
  type ='sls',
);
CREATE TABLE sls_out (
  name     VARCHAR,
  MsgID    VARCHAR,
  Version  VARCHAR
)
WITH
(
  type ='RDS'
);
INSERT INTO sls_out
SELECT
__topic__
JSON_VALUE (result, '$. MsgID '),
JSON_VALUE (result, '$. version ')
FROM
sls_log
```

- **Output example**

name (VARCHAR)	MsgID (VARCHAR)	Version (VARCHAR)
ens_altar_flow	ems0a	0.0.1

Parameters in the WITH clause

Parameter	Description	Remarks
endPoint	Specifies the consumer endpoint.	Log Service Endpoint, for example `http://regionid.example.com`.
accessId	Specifies an AccessKey ID.	N/A
accessKey	Specifies an AccessKey Secret.	N/A
project	Specifies a project in Log Service.	N/A
logStore	Specifies the name of a Logstore in the project.	N/A
consumerGroup	Specifies the name of a consumer group.	You can specify a consumer group name. The format of the consumer group name is not fixed.
startTime	Specifies the time at which a log starts to be consumed.	N/A

Parameter	Description	Remarks
heartBeatIntervalMills	Optional. Specifies a heartbeat interval of a consumption client.	The default value is 10 seconds.
maxRetryTimes	Specifies a maximum number of read attempts.	Optional. The default value is 5.
batchGetSize	Specifies the number of log groups that are read at a time.	Optional. The default value is 10.

Parameter	Description	Remarks
lengthCheck	Specifies a rule for checking the number of fields parsed from a row of data.	Optional. The default value is NONE, indicating: · When the number of fields parsed from a row of data is greater than the number of defined fields, data is extracted from left to right based on the order of defined fields. · When the number of fields parsed from a row of data is smaller than the number of defined fields, this row of data is skipped. Other optional values are SKIP, EXCEPTION, and PAD. · SKIP: When the number of fields parsed from data does not match the number of defined fields, this row of data is skipped. · EXCEPTION: When the number of fields parsed from data does not match the number of defined fields, an exception is reported. · PAD: Data is extracted from left to right based on the order of defined fields. - When the number of fields parsed from a row of data is greater than the number of defined fields, data is extracted from left to right based on the order of defined fields. - When the number of fields parsed from a row of data is smaller than the number of defined fields , null is used to fill in the missing fields.

Parameter	Description	Remarks
columnErrorDebug	Specifies whether debugging is enabled.	Optional. The default value is false. If you enable debugging, a log entry that indicates a parsing exception is printed.
directMode	Specifies whether the direct connection mode to access Log Service is enabled.	Optional. The default value is false, indicating that the direct connection mode is not enabled. After the direct mode is enabled, you can access Log Service through an Nginx server. An Nginx server demonstrates high performance in handling connection requests.

Note:

- Currently, Log Service does not support the MAP data type.
- We recommend that you define the fields in the same order as the fields in the preceding table. Unordered fields are also supported.
- If input data is in the JSON format, define a delimiter and use the built-in function *JSON_VALUE* to analyze the data. Otherwise, a parsing error will occur and the following error message will appear:

```
2017-12-25 15:24:43,467 WARN [Topology-0 (1/1)] com.alibaba.blink
.streaming.connectors.common.source.parse.DefaultSourceCollector
 - Field missing error, table column number: 3, data column number
: 3, data filed number: 1, data: [{"lg_order_code":"LP00000005","
activity_code":"TEST_CODE1","occur_time":"2017-12-10 00:00:01"}]
```

- The batchGetSize value must not exceed 1000. Otherwise, an error will occur.
- The batchGetSize parameter specifies the number of log groups that are read at a time. If the size of a single log entry and the batchGetSize value are too large, frequent garbage collection is generated. To avoid this issue, you need to set this parameter to a small value.

Type mapping

The following table describes the mapping between Log Service data types and Realtime Compute data types. We recommend that you declare the mapping in a DDL statement.

Log Service data type	Realtime Compute data type
STRING	VARCHAR

3.1.5.3 Create a data result table

3.1.5.3.1 Overview

Realtime Compute uses the `CREATE TABLE` statement to define the schema of a result table for output data and how data is written into a target data store.

Data can be written by using either of the following methods: append and update.

- **Append: If the result table is stored in a relational database with no primary key defined, Log Service, or Message Queue, output data is appended to the result table.**
- **Update: If the result table is stored in a relational database or a Hadoop database with a primary key defined, output data is written into the result table as follows:**
  - **If the value for the primary key is not found in the result table, the data record is inserted into the database.**
  - **If the value for the primary key is found, the existing data record in the database is overwritten.**

Result table syntax

```
CREATE TABLE tableName
    (columnName dataType [, columnName dataType ]*)
    [ WITH (propertyName=propertyValue [, propertyName=propertyValue
 ]*) ];
```

Example

```
CREATE TABLE rds_output(
id INT,
len INT,
content VARCHAR,
PRIMARY KEY(id)
) WITH (
type='rds',
url='yourDatabaseURL',
tableName='yourTableName',
userName='yourDatabaseUserName',
password='yourDatabasePassword'
```

```
);
```

3.1.5.3.2 Create a DataHub result table

This topic describes how to create a DataHub result table for Realtime Compute.

Introduction to DataHub

DataHub is a data distribution platform that is designed to process streaming data. It provides a channel for other Apsara Stack services to process big data. DataHub works with multiple Alibaba Cloud services to provide an end-to-end data processing solution. In Realtime Compute, you can use DataHub to store input and output data.

DDL syntax

In Realtime Compute, you can create a DataHub result table to store output data. The sample code is provided as follows:

```
create table datahub_output(
  name varchar,
  age BIGINT,
  birthday BIGINT
)with(
  type='datahub',
  endPoint='yourEndpoint',
  project='yourProjectName',
  topic='yourTopicName',
  accessId='yourAccessId',
  accessKey='yourAccessSecret',
  batchSize='20',
  batchWriteTimeoutMs='1000'
);
```

Parameters in the WITH clause

Parameter	Description	Remarks
endPoint	**Specifies the endpoint.**	**For more information, see** *Obtain an endpoint* **in** *DataHub Developer Guide***.**
project	**Specifies the name of a DataHub project.**	**N/A**
topic	**Specifies the name of a DataHub topic.**	**N/A**
accessId	**Specifies the AccessKey ID .**	**N/A**

Parameter	Description	Remarks
accessKey	Specifies the AccessKey Secret.	N/A
maxRetryTimes	Specifies the maximum number of retries for writing data to the result table.	Optional. The default value is 3.
batchSize	Specifies the number of data records that are written at a time.	Optional. The default value is 300.
batchWriteTimeoutMs	Specifies the timeout period for writing data.	Optional. The default value is 5000.
maxBlockMessages	Specifies the maximum number of data blocks that are written at a time.	Optional. The default value is 100.

3.1.5.3.3 Create a Log Service result table

This topic describes how to create a Log Service result table for Realtime Compute.

Introduction to Log Service

Log Service (LOG) provides an end-to-end management solution for real-time log data. Log Service allows you to quickly collect, consume, ship, query, and analyze log data without the need for further development. Log Service has high performance in data O&M. You can use Log Service to process massive logs to meet business demands in the data technology (DT) era.

DDL syntax

In Realtime Compute, you can use Log Service to store output data. The sample code is provided as follows:

```
create table sls_stream(
 name varchar,
 age BIGINT,
 birthday BIGINT
)with(
 type='sls',
 endPoint='yourEndpoint',
 accessId='yourAccessId',
 accessKey='yourAccessKey',
 project='yourProjectName',
 logStore='yourLogStoreName'
```

```
);
```

Parameters in the WITH clause

Parameter	Description	Remarks
endPoint	**Specifies the endpoint.**	**Log Service Endpoint, for example `http://regionid.example.com`.**
project	**Specifies the name of a Log Service project.**	**N/A**
topic	**Specifies the name of a Log Service topic.**	**N/A**
accessId	**Specifies the AccessKey ID .**	**N/A**
accessKey	**Specifies the AccessKey Secret.**	**N/A**
mode	**Specifies the mode for writing data to the result table.**	**Optional. The default value is `random`. If you set this parameter to `partition`, the result table is partitioned and data is written to the specified partition.**
partitionColumn	**Specifies the partition column.**	**This parameter is required if the `mode` parameter is set to `partition`.**
source	**Specifies the source of logs. For example, you can set this parameter to the IP address of the server where logs are generated.**	**Optional. The default value is NONE.**

3.1.5.3.4 Create a Table Store result table

This topic describes how to create a Table Store result table for Realtime Compute. This topic also introduces the mapping between Table Store data types and Realtime Compute data types.

Introduction to Table Store

Table Store is a distributed NoSQL data storage service developed based on the Apsara distributed system. Based on data sharding and load balancing technologies, Table Store has high performance in scaling out and handling concurrent transactions. You can use Table Store to store and query large amounts of structured data.

DDL syntax

In Realtime Compute, you can use Table Store to store output data. The sample code is provided as follows:

```
CREATE TABLE stream_test_hotline_agent (
 name varchar,
 age BIGINT,
 birthday BIGINT,
 primary key(name,age)
) WITH (
 type='ots',
 instanceName='yourInstanceName',
 tableName='yourTableName',
 accessId='yourAccessId',
 accessKey='yourAccessSecret',
 endPoint='yourEndpoint',
 valueColumns='birthday'
);
```

Note:

The value of the valueColumns parameter can be the name of any field other than a declared primary key.

Parameters in the WITH clause

Parameter	Description	Remarks
instanceName	Specifies the name of a Table Store instance.	N/A
tableName	Specifies the name of a result table.	N/A

Parameter	Description	Remarks
endPoint	Specifies the endpoint to access the instance.	Table Store Endpoint, for example `http://regionid.example.com`.
accessId	Specifies the AccessKey ID.	N/A
accessKey	Specifies the AccessKey Secret.	N/A
valueColumns	Specifies the names of fields to be inserted into the result table. Multiple fields are separated with commas (,).	For example, you can insert two fields in the following format: `'ID,NAME'`.
bufferSize	Specifies the buffer size after data deduplication.	Optional. The default value is 5000, indicating that data output is triggered after 5,000 input data records are processed.
batchWriteTimeoutMs	Specifies the timeout period for writing data.	Optional. The default value is 5000, measured in milliseconds. This value indicates that if no data is written to Table Store within 5,000 milliseconds (5 seconds), all cached data is written to the result table.
batchSize	Specifies the number of data records that are written at a time.	Optional. The default value is 100.
retryIntervalMs	Specifies the retry interval.	Optional. The default value is 1000, measured in milliseconds.
maxRetryTimes	Specifies the maximum number of retries for writing data to the result table.	Optional. The default value is 100.
ignoreDelete	Specifies whether to skip delete operations.	The default value is false.

Type mapping

Table Store data type	Realtime Compute data type
INTEGER	BIGINT
STRING	VARCHAR
BOOLEAN	BOOLEAN
DOUBLE	DOUBLE

Note:

You must define a `primary key` in a Table Store result table. Output data is appended to the Table Store result table to update the result.

3.1.5.3.5 Create an RDS result table

This topic describes how to create a Relational Database Service (RDS) result table for Realtime Compute. This topic also introduces the mapping between Realtime Compute data types and RDS data types.

Introduction to RDS

ApsaraDB for Relational Database Service (RDS) offers stable, reliable, and scalable online database services. Based on the distributed file system and high-performanc e storage system developed by Alibaba Cloud, RDS supports a variety of database engines such as MySQL, SQL Server, and PostgreSQL. RDS also supports Postgre Plus Advanced Server (PPAS) that is highly compatible with Oracle databases. RDS provides comprehensive solutions for database operations and management (O&M), including disaster recovery, backup, monitoring, and migration.

Note:

An RDS result table is consistent with the parameters in the `WITH` clause. When you create an RDS result table, the RDS data store must have the corresponding table stored in the database.

DDL syntax

In Realtime Compute, you can use RDS to store output data. Currently, only RDS for MySQL is supported. The sample code is provided as follows:

```
create table rds_output(
 id int,
 len int,
```

```
 content varchar,
 primary key(id,len)
) with (
 type='rds',
 url='yourDatabaseURL',
 tableName='yourDatabaseTableName',
 userName='yourDatabaseUserName',
 password='yourDatabasePassword'
);
```

Note:

- **In Realtime Compute, each row of output data is converted into a row of strings. The strings are then written into an RDS result table. If you want to write multiple rows of output data at a time, you need to add `? rewriteBatchedStatements=true` to the end of the URL. This ensures optimal efficiency when writing multiple rows.**
- **For a result table stored in an RDS for MySQL instance, you can define an auto-increment primary key. If you want to use the auto-increment primary key in the result table, do not declare the auto-increment field in the DDL statement. For example, if ID is an auto-increment field in RDS for MySQL, do not declare the ID field in the DDL statement. When writing a row of output data to the database, a value is automatically generated for the auto-increment field.**

Parameters in the WITH clause

Parameter	Description	Remarks
url	**Specifies the URL for RDS.**	**For more information, see** *Connect to a MySQL instance from a client* **in** *RDS for MySQL User Guide*.
tableName	**Specifies the name of a result table.**	**N/A**
userName	**Specifies the username that is used to access RDS.**	**N/A**
password	**Specifies the password that is used to access RDS.**	**N/A**
maxRetryTimes	**Specifies the maximum number of retries for writing data to the result table.**	**Optional. The default value is 3.**

Parameter	Description	Remarks
batchSize	Specifies the number of data records that are written at a time.	Optional. The default value is 50.
bufferSize	Specifies the buffer size after data deduplication. You can only use this parameter when a primary key is defined.	Optional. The default value is 1, indicating that when one data record is processed, an output is generated. The default value is increased to 1000 in Realtime Compute version 1.4.1.
flushIntervalMs	Specifies the timeout period of writing data.	Optional. The unit of measurement is milliseconds. The default value is 5000, indicating that if no data is written within 5,000 milliseconds (5 seconds), all cached data is written to the result table.
excludeUpdateColumns	Specifies one or more columns to be excluded when you update the result table based on key values.	Optional. The default value is NONE, indicating that only primary key fields are excluded.
ignoreDelete	Specifies whether to skip delete operations.	The default value is false.
partitionBy	Specifies the partitioning rule for the result table. Before data is written into the result table, Hash partitioning is performed based on a partition key. Data flows to the corresponding node defined by the hash function.	Optional. The default value is NONE.

Type mapping

RDS data type	Realtime Compute data type
TEXT	VARCHAR
BYTE	VARCHAR
INTGER	INT
LONG	BIGINT
DOUBLE	DOUBLE
DATE	VARCHAR
DATETIME	VARCHAR
TIMESTAMP	VARCHAR
TIME	VARCHAR
YEAR	VARCHAR
FLOAT	FLOAT
DECIMAL	DECIMAL
CHAR	VARCHAR

JDBC connection parameters

Parameter	Description	Default value	Since version (JDBC driver)
useUnicode	Specifies whether to use the Unicode character set. If you want to set the characterEncoding parameter to gb2312 or gbk, this parameter must be set to true.	false	1.1g
characterEncoding	Specifies the character encoding when the useUnicode parameter is set to true. You can set this parameter to gb2312 or gbk.	false	1.1g

Parameter	Description	Default value	Since version (JDBC driver)
autoReconnect	Specifies whether to automatically re-establish a connection when the connection to the database is unexpectedly interrupted.	false	1.1
autoReconnectForPools	Specifies whether to use the reconnection policy for a database connection pool.	false	3.1.3
failOverReadOnly	Specifies whether to set the connection to read-only after the database is automatically reconnected.	true	3.0.12
maxReconnects	Specifies the maximum number of connection retries when the autoReconnect parameter is set to true.	3	1.1
initialTimeout	Specifies the interval between two connection retries when the autoReconnect parameter is set to true. The unit of measurement is seconds.	2	1.1

Parameter	Description	Default value	Since version (JDBC driver)
connectTimeout	Specifies the timeout period when you use a socket connection to access the database server . The unit of measurement is seconds. The default value of 0 indicates no timeout (only works on JDK version 1.4 and later).	0	3.0.1
socketTimeout	Specifies the timeout period for a socket-based read/write operation. The unit of measurement is seconds. The value of 0 indicates no timeout.	0	3.0.1

FAQ

- **Q: When output data is written to an RDS table, is a new data record generated in the table? If not, is the result table updated based on the primary key value?**

  A: If a primary key is defined in the DDL statement, the result table is updated in the `insert into on duplicate key update` method. For a data record, if the value of primary key field does not exist, the record is inserted into the table as a new row. If the value of primary key field exists, the original row of data in the table is updated. If a primary key is not declared in the DDL statement, output data is added to the result table by using the `insert into` method.

- **Q: How can I perform GROUP BY operations based on the unique index of an RDS table?**

  A: An RDS table has only one auto-increment field, which cannot be declared as the primary key in the Realtime Compute DDL statement. If you want to perform GROUP BY operations based on the unique index of an RDS table, declare the unique index in primary key() in the DDL statement.

3.1.5.4 Create a data dimension table

3.1.5.4.1 Overview

You must add `PERIOD FOR SYSTEM_TIME` in the CREATE TABLE statement that is used to create a dimension table. `PERIOD FOR SYSTEM_TIME` defines the period of time when a data record is valid. This means that the table is frequently updated.

```
CREATE TABLE white_list (
   id varchar,
   name varchar,
   age int,
   PRIMARY KEY (id),  -- You must define a primary key for the
dimension table.
   PERIOD FOR SYSTEM_TIME -- Defines the period of time when a data
record is valid.
   ) with (
   type = 'rds',
   ...
   )
```

Note:

- **When you declare a dimension table, you must specify the primary key.**
- **When you join a dimension table with another table, the ON condition must contain an equivalence condition that includes the primary key of either table.**

3.1.5.4.2 Create a Table Store dimension table

This topic describes how to create a Table Store dimension table for Realtime Compute.

Table Store is a distributed NoSQL data storage service developed based on the Apsara distributed system. Based on data sharding and load balancing technologies, Table Store has high performance in scaling out and handling concurrent transactions. You can use Table Store to store and query large amounts of structured data.

DDL syntax

```
CREATE TABLE ots_dim_table (
 id int,
 len int,
 content VARCHAR,
 PRIMARY KEY (id),
 PERIOD FOR SYSTEM_TIME -- Defines the period of time when a data
record is valid. This means that the table is frequently updated.
) WITH (
 type='ots',
 endPoint='yourEndpoint'
 instanceName='yourInstanceName',
 tableName='yourTableName',
 accessId='yourAccessId',
 accessKey='yourAccessSecret',
);
```

Note:

When you declare a dimension table, you must specify the primary key. When you join a dimension table with another table, the ON condition must contain an equivalent condition that includes the primary key of either table. The primary key of a Table Store table is the rowkey.

Parameters in the WITH clause

Parameter	Description
instanceName	Specifies the name of a Table Store instance.
tableName	Specifies the name of a table in the Table Store instance.
endPoint	Specifies the endpoint that is used to access the instance.
accessId	Specifies the AccessKey ID.
accessKey	Specifies the AccessKey Secret.

Cache parameters

Parameter	Description	Remarks
cache	Specifies the cache strategy.	The default value is None. You can set the parameter to LRU.

Parameter	Description	Remarks
cacheSize	Specifies the cache size.	Specifies the maximum number of data records that can be cached. You can specify this parameter if you set the cache parameter to LRU. The default value is 10000.
cacheTTLMs	Specifies the time-to-live (TTL) of each data record that is cached. The TTL is measured in milliseconds.	You can specify this parameter if you set the cache parameter to LRU. No TTL is set by default.

Sample code

```
CREATE TABLE datahub_input1 (
id            BIGINT,
name        VARCHAR,
age           BIGINT
) WITH (
type='datahub'
);
CREATE TABLE phoneNumber(
name VARCHAR,
phoneNumber BIGINT,
PRIMARY KEY(name),
PERIOD FOR SYSTEM_TIME -- Defines the period of time when a data
record is valid.
)WITH(
type='ots'
);
CREATE table result_infor(
id BIGINT,
phoneNumber BIGINT,
name VARCHAR
)WITH(
type='rds'
);
INSERT INTO result_infor
SELECT
t.id,
w.phoneNumber,
t.name
FROM datahub_input1 as t
JOIN phoneNumber FOR SYSTEM_TIME AS OF PROCTIME() as w -- You must
include this clause in the INSERT INTO statement if you are performing
 a JOIN query for a dimension table.
```

```
ON t.name = w.name;
```

3.1.5.4.3 Create an RDS dimension table

This topic describes how to create an RDS dimension table for Realtime Compute.

ApsaraDB for Relational Database Service (RDS) offers stable, reliable, and scalable online database services. Based on the distributed file system and high-performance storage system developed by Alibaba Cloud, RDS supports a variety of database engines such as MySQL, SQL Server, and PostgreSQL. RDS also supports PostgreSQL Plus Advanced Server (PPAS) that is fully compatible with Oracle databases. RDS provides comprehensive solutions for database operations and management (O&M), including disaster recovery, backup, monitoring, and migration.

DDL syntax

RDS can be used to store dimension tables. Only RDS for MySQL is supported.

```
CREATE TABLE rds_dim_table(
 id int,
 len int,
 content VARCHAR,
 PRIMARY KEY (id),
 PERIOD FOR SYSTEM_TIME -- Defines the period of time when a data
record is valid. This means that the table is frequently updated.
) with (
 type='rds',
 url='rdsDatabaseURL',
 tableName='<yourDatabaseTableName>',
 userName='<yourDatabaseUserName>',
 password='<yourDatabasePassword>'
);
```

Note:
When you define a dimension table, you must specify the primary key. You can join a dimension table with another table. In the ON clause, you must specify an equivalent condition that includes the primary key of either table. The primary key in RDS is the primary key or unique index column of an RDS dimension table.

Parameters in the WITH clause

Parameter	Description	Remarks
url	**Specifies the URL to access the database.**	**N/A**
tableName	**Specifies the name of the table in the database.**	**N/A**

Parameter	Description	Remarks
userName	Specifies the username that is used to log on to the database.	N/A
password	Specifies the password that is used to log on to the database.	N/A
maxRetryTimes	Specifies the maximum number of retries for writing data to the table.	Optional. The default value is 3.

Cache parameters

Parameter	Description	Remarks
cache	Specifies the cache strategy.	The default value is None. Other valid values include LRU and ALL.
cacheSize	Specifies the cache size.	When the cache parameter is set to LRU, you can specify the cache size. The default value is 10000, measured in lines.
cacheTTLMs	Specifies the cache timeout. The time is measured in milliseconds.	When the cache parameter is set to LRU, this parameter specifies the time before the cache expires. The cache does not expire by default. When the cache parameter is set to ALL, this parameter specifies the cache refresh interval. The cache is not refreshed by default.

Parameter	Description	Remarks
cacheReloadTimeBlackList	Specifies the time period in which the cache is not refreshed (for example, during Double 11). You can only specify this parameter when the cache parameter is set to ALL.	Optional. The default value is NONE. Example: 2017-10-24 14:00 -> 2017-10-24 15:00, 2017-11-10 23:30 -> 2017-11-11 08:00. Separate multiple time periods with commas (,). Separate the start and end time for a period of time with the string "->".

 **Note:**

RDS provides the following three cache strategies:

- **None: indicates that no data is cached.**
- **LRU: indicates that the recently used data is cached. When this cache strategy is used, you need to set the cacheSize and cacheTTLMs parameters.**
- **ALL: indicates that all data is cached. Before you run a job, all data in the remote table is loaded into memory. Queries for dimension tables are performed based on the cached data. If a cache miss occurs, no result is returned. The cache is refreshed after a specified interval. You can use the ALL cache strategy for a small remote table when cache misses frequently occur. When this cache strategy is used, you need to set the cacheTTLMs and cacheReloadTimeBlackList parameters.**

   **Note:**

  - **The memory space of the node must be two times the size of the remote table if you need to perform asynchronous cache refresh.**
  - **When the cache parameter is set to ALL, you must monitor the memory space of the node to avoid the out of memory (OOM) error.**

Sample code

```
CREATE TABLE datahub_input1 (
id            BIGINT,
name        VARCHAR,
age           BIGINT
) WITH (
type='datahub'
);
```

```
create table phoneNumber(
name VARCHAR,
phoneNumber bigint,
primary key(name),
PERIOD FOR SYSTEM_TIME -- Defines the period of time when a data
record is valid.
)with(
type='rds'
);
CREATE table result_infor(
id bigint,
phoneNumber bigint,
name VARCHAR
)with(
type='rds'
);
INSERT INTO result_infor
SELECT
t.id
,w.phoneNumber
,t.name
FROM datahub_input1 as t
JOIN phoneNumber FOR SYSTEM_TIME AS OF PROCTIME() as w -- You must
include this clause in the INSERT INTO statement if you are performing
 a JOIN query for a dimension table.
ON t.name = w.name;
```

3.1.6 DML statements

3.1.6.1 INSERT INTO statement

This topic describes how to use the INSERT INTO statement in Realtime Compute.

Syntax

```
INSERT INTO tableName
        [ (columnName[ , columnName]*) ]
            queryStatement;
```

Example

```
INSERT INTO LargeOrders
SELECT * FROM Orders WHERE units > 1000;
INSERT INTO Orders(z, v)
SELECT c,d FROM OO;
```

- **A Realtime Compute job created from an SQL file can include multiple DML operations. It also supports multiple data stores for input and output data, and supports multiple dimension tables. For example, a job can contain two paragraphs of SQL statements written for different businesses. You can use SQL statements to write output data into different data stores.**
- **In Realtime Compute, you cannot use separate SELECT statements. SELECT statements must be used after CREATE VIEW or INSERT INTO statements.**

- **You can update a table by using the INSERT INTO statement. For example, you can use an INSERT INTO statement to write a data record with a key value into an RDS table. If the key value is found in the table, the existing data record in the table is overwritten. If the key value is not found, the data record is added to the table.**

Table types and statements

Table type	Statement
Source table	**You can use the FROM clause. The INSERT INTO statement is not supported.**
Dimension table	**You can use the JOIN statement. The INSERT INTO statement is not supported.**
Result table	**You can only use the INSERT INTO statement.**
View	**You can only use the FROM clause.**

3.1.7 QUERY statements

3.1.7.1 SELECT statement

You can use the SELECT statement to select data from the table.

Syntax

```
SELECT [ DISTINCT ]
{ * | projectItem [, projectItem ]* }
FROM tableExpression;
```

Input example

a (VARCHAR)	b (INT)	c (DATE)
a1	**211**	**1990-02-20**
b1	**120**	**2018-05-12**
c1	**89**	**2010-06-14**
a1	**46**	**2016-04-05**

Example 1

```
SELECT * FROM tableName;
```

Output example

a (VARCHAR)	b (INT)	c (DATE)
a1	211	1990-02-20
b1	120	2018-05-12
c1	89	2010-06-14
a1	46	2016-04-05

Example 2

```
SELECT a, c AS d FROM tableName;
```

Input example

a (VARCHAR)	d (DATE)
a1	1990-02-20
b1	2018-05-12
c1	2010-06-14
a1	2016-04-05

Example 3

```
SELECT DISTINCT a FROM tableName;
```

Output example

a (VARCHAR)
a1
b1
c1

Subquery

The subquery can be nested in the SELECT statement. In the subquery, the table alias must be used to specify which table reference is to be used. A sample code is provided as follows:

```
INSERT INTO result_table
```

```
SELECT * from
       (SELECT   t.a,
                 sum(t.b) AS sum_b
                FROM t1 t
                GROUP BY t.a) t1
WHERE  t1.sum_b > 100;
```

Output example

a (VARCHAR)	b (INT)
a1	211
b1	120
a1	257

3.1.7.2 WHERE clause

To specify the condition based on which data is selected from the table, you can add the WHERE clause to the SELECT statement.

Syntax

```
SELECT [ ALL | DISTINCT ]
  { * | projectItem [, projectItem ]* }
  FROM tableExpression
  [ WHERE booleanExpression ];
```

The following table describes the operators that can be used in the WHERE clause.

Table 3-3: Operators

Operator	Description
=	**Equal to**
<>	**Not equal to**
>	**More than**
>=	**More than or equal to**
<	**Less than**
<=	**Less than or equal to**

Example

Table 3-4: Input example

Address	City
Oxford Street	Beijing

Address	City
Fifth Avenue	Beijing
Changan Street	Shanghai

```
SELECT * FROM XXXX WHERE City='Beijing'
```

Table 3-5: Output example

Address	City
Oxford Street	Beijing
Fifth Avenue	Beijing

3.1.7.3 HAVING clause

The WHERE clause cannot be used with aggregate functions. To solve this, you can use a HAVING clause instead.

Syntax

```
SELECT [ ALL | DISTINCT ]
  { * | projectItem [, projectItem ]* }
  FROM tableExpression
  [ WHERE booleanExpression ]
  [ GROUP BY { groupItem [, groupItem ]* } ]
  [ HAVING booleanExpression ];
```

Example

Table 3-6: Input example

Customer	OrderPrice
Bush	1000
Carter	1600
Bush	700
Bush	300
Adams	2000
Carter	100

```
SELECT Customer,SUM(OrderPrice) FROM XXX
GROUP BY Customer
```

```
HAVING SUM(OrderPrice)<2000;
```

Table 3-7: Output example

Customer	SUM (OrderPrice)
Carter	1700

3.1.7.4 GROUP BY clause

The GROUP BY clause is used with aggregate functions to split a result set into groups based on one or more columns.

Syntax

```
SELECT [ DISTINCT ]
  { * | projectItem [, projectItem ]* }
  FROM tableExpression
  [ GROUP BY { groupItem [, groupItem ]* } ];
```

Example

Table 3-8: Input example

Customer	OrderPrice
Bush	1000
Carter	1600
Bush	700
Bush	300
Adams	2000
Carter	100

```
SELECT Customer,SUM(OrderPrice) FROM XXXX
GROUP BY Customer;
```

Output example

Customer	SUM (OrderPrice)
Bush	2000
Carter	1700
Adams	2000

3.1.7.5 JOIN statement

For JOIN statements, Realtime Compute has the same semantics as BatchCompute. You can use a JOIN statement to join two tables. In Realtime Compute, the two tables are dynamic ones. The result of a JOIN query is dynamically updated. After a specific period, Realtime Compute returns the same result as BatchCompute.

Syntax

```
tableReference [, tableReference ]* | tableexpression
[ LEFT ] JOIN tableexpression [ joinCondition ];
```

Note:

- **Realtime Compute supports EQUI JOINS. NON EQUI JOINS are not supported.**
- **Only INNER JOINS and LEFT OUTER JOINS are supported.**
- **The fields and primary key defined in the DDL statement of tables to be joined must exist in the data store.**

Example 1

```
SELECT o.rowtime, o.productId, o.orderId, o.units,
  p.name, p.unitPrice
  FROM Orders AS o
  JOIN Products AS p
  ON o.productId = p.productId;
```

Table 3-9: Output example

rowtime	productId	orderId	units	name	unitPrice
10:17:00	30	5	4	Cheese	17
10:17:05	10	6	1	Beer	0.25
10:18:05	20	7	2	Wine	6
10:18:07	30	8	20	Cheese	17
11:02:00	10	9	6	Beer	0.25
11:04:00	10	10	1	Beer	0.25
11:09:30	40	11	12	Bread	100
11:24:11	10	12	4	Beer	0.25

Example 2

Table 3-10: Input example (table name: datahub_stream1)

a (BIGINT)	b (BIGINT)	c (VARCHAR)
0	10	test11
1	10	test21

Table 3-11: Input example (table name: datahub_stream2)

a (BIGINT)	b (BIGINT)	c (VARCHAR)
0	10	test11
1	10	test21
0	10	test31
1	10	test41

Sample code

```
-- Creates a DataHub source table.
create table datahub_stream1 (
 a int,
 b int,
 c varchar
) WITH (
    type='datahub',
    endpoint='yourEndpoint',
    accessId='yourAccessId',
    accessKey='yourAccessSecret',
    projectName='yourProjectName',
    topic='yourTopic',
    project='yourProjectName'
);
-- Creates another DataHub source table.
create table datahub_stream2 (
    a int,
    b int,
    c varchar
) WITH (
    type='datahub',
    endpoint='yourEndpoint',
    accessId='yourAccessId',
    accessKey='yourAccessSecret',
    projectName='yourProjectName',
    topic='yourTopicName',
    project='yourProjectName'
);
-- Creates an RDS result table.
create table rds_output(
     s1_c varchar,
     s2_c varchar
)with(
    type='rds',
```

```
    url='yourDatabaseURL',
    tableName='udf',
    userName='yourDatabaseUserName',
    password='yourDatabasePassword'
);
insert into rds_output
select
    s1.c,s2.c
from datahub_stream1 AS s1
join datahub_stream2 AS s2 on s1.a =s2.a
where s1.a = 0;
```

Table 3-12: Output example

s1_c (VARCHAR)	s2_c (VARCHAR)
test1	test11
test1	test31

3.1.7.6 JOIN statement for dimension tables

Introduction

Dimension tables are frequently updated. If you want to join a data record with a dimension table, you must specify the creation time of the table snapshot to be used in the JOIN operation. Currently, you can only use the snapshot that is created at the current system time. In the future, Realtime Compute will allow you to use a snapshot created at the time indicated by a value of the rowtime field.

Syntax

```
SELECT column-names
FROM table1  [AS <alias1>]
[LEFT] JOIN table2 FOR SYSTEM_TIME AS OF PROCTIME() [AS <alias2>]
ON table1.column-name1 = table2.key-name1
```

Description

Dimension tables support INNER JOIN and LEFT JOIN. Dimension tables do not support RIGHT JOIN and FULL JOIN. As shown in the preceding statement, when you join a data record with a dimension table, you must include the `FOR SYSTEM_TIME AS OF PROCTIME()` subclause in the JOIN statement. The subclause indicates that the JOIN operation is performed on the table snapshot created at the current system time. After a data record arrives at the left table, the system searches for matching values in the dimension table and returns the search result. If no search result is found but later a new data record with a matching value is inserted to the dimension table, the previous search result is not updated. JOIN queries work on

processing time. Any later operations in the dimension table such as deletion do not change the returned result.

An example of joining data records with dimension tables is provided as follows:

```
SELECT e.*, w. *
FROM event AS e
JOIN white_list FOR SYSTEM_TIME AS OF PROCTIME() AS w
ON e.id = w.id
```

Note:

- **In the ON clause, you must specify an equivalent condition that includes the primary key of either table. You can also add other conditions in the ON clause. For example,** `ON event.id = white_list.id AND event.name =white_list.name`**.**
- **You cannot perform JOIN queries between dimension tables.**
- **The fields and primary key defined in the DDL statement of a left table must exist in the data store.**

Example

Table 3-13: Input example (table name: nameinfor)

id (BIGINT)	name (VARCHAR)	age (BIGINT)
1	lilei	22
2	hanmeimei	20
3	libai	28

Table 3-14: Input example (table name: phoneNumber)

name (VARCHAR)	phoneNumber (BIGINT)
dufu	18867889855
baijuyi	18867889856
libai	18867889857
lilei	18867889858

Sample code

```
CREATE TABLE datahub_input1 (
id            BIGINT,
name        VARCHAR,
```

```
age           BIGINT
) WITH (
type='datahub',
);
create table phoneNumber(
name VARCHAR,
phoneNumber BIGINT,
primary key(name),
PERIOD FOR SYSTEM_TIME
)with(
type='rds'
);
CREATE table result_infor(
id BIGINT,
phoneNumber BIGINT,
name VARCHAR
)with(
type='rds'
);
INSERT INTO result_infor
SELECT
t.id
,w.phoneNumber
,t.name
FROM datahub_input1 as t
JOIN phoneNumber FOR SYSTEM_TIME AS OF PROCTIME() as w
ON t.name = w.name;
```

Table 3-15: Output example

id (BIGINT)	phoneNumber (BIGINT)	name (VARCHAR)
1	18867889858	lilei
3	18867889857	libai

3.1.7.7 UNION ALL clause

You can use the UNION ALL clause to merge multiple data streams.

Syntax

```
select_statement
  UNION ALL
  select_statement;
```

Note:

- **If you need to merge multiple data streams, the fields of the data streams must have the same data types and sequences.**
- **Realtime Compute does not support the UNION clause. The UNION ALL clause returns all merged streaming data records, including duplicates. The UNION statement removes duplicates.**

Example 1

```
SELECT *
     FROM (
     (SELECT user FROM tableName WHERE a % 2 = 0)
     UNION ALL
     (SELECT user FROM tableName WHERE b = 0)
     );
```

Example 1

Table 3-16: Input example (table name: test_source_union1)

a (VARCHAR)	b (BIGINT)	c (BIGINT)
test1	1	10

Table 3-17: Input example (table name: test_source_union2)

a (VARCHAR)	b (BIGINT)	c (BIGINT)
test1	1	10
test2	2	20

Table 3-18: Input example (table name: test_source_union3)

a (VARCHAR)	b (BIGINT)	c (BIGINT)
test1	1	10
test2	2	20
test1	1	10

Sample code

```
create table test_source_union1 (
 a VARCHAR,
 b BIGINT,
 c BIGINT
) WITH (
    type='datahub',
    endpoint='yourEndpoint',
    accessId='yourAccessId',
    accessKey='yourAccessSecret',
    projectName='yourProjectName',
    topic='yourTopicName',
    project='yourProjectName'
);
create table test_source_union2 (
 a VARCHAR,
 b BIGINT,
 c BIGINT
) WITH (
```

```
    type='datahub',
    endpoint='yourEndpoint',
    accessId='yourAccessId',
    accessKey='yourAccessSecret',
    projectName='yourProjectName',
    topic='yourTopicName',
    project='yourProjectName'
);
create table test_source_union3 (
 a VARCHAR,
 b BIGINT,
 c BIGINT
) WITH (
    type='datahub',
    endpoint='yourEndpoint',
    accessId='yourAccessId',
    accessKey='yourAccessSecret',
    projectName='yourProjectName',
    topic='yourTopicName',
    project='yourProjectName'
);
create table test_result_union (
    d VARCHAR,
    e BIGINT,
    f BIGINT,
    primary key(d)
) WITH (
      type='rds',
      url='yourDatabaseURL',
      username='yourUserName',
      password='yourPassword',
      tableName='yourTableName'
);
INSERT into test_result_union
SELECT
    a,
    sum(b),
    sum(c)
FROM
    (SELECT * from test_source_union1
    UNION ALL
    SELECT * from test_source_union2
    UNION ALL
    SELECT * from test_source_union3
    )t
 GROUP BY a;
```

Table 3-19: Output example

d (VARCHAR)	e (BIGINT)	f (BIGINT)
test1	1	10
test2	2	20
test1	2	20
test1	3	30
test2	4	40

d (VARCHAR)	e (BIGINT)	f (BIGINT)
test1	4	40

3.1.7.8 Top_N statement

You can use the Top_N statement to retrieve the largest or smallest N data records from data streams based on the specified metric. In Flink SQL, you can define an over window to perform Top_N queries.

Syntax

```
SELECT *
FROM (
  SELECT *,
    ROW_NUMBER() OVER ([PARTITION BY col1[, col2..]]
    ORDER BY col1 [asc|desc][, col2 [asc|desc]...]) AS rownum
  FROM table_name)
WHERE rownum <= N [AND conditions]
```

The parameters are described as follows:

- `ROW_NUMBER()`: **specifies an over window to compute the row number. The value of the row number starts from 1.**
- `PARTITION BY col1[, col2..]`: **optional. Specifies one or more columns based on the data records that are partitioned.**
- `ORDER BY col1 [asc|desc][, col2 [asc|desc]...]`: **specifies one or more columns based on which the rows in a partition are ordered. You can define different ordering directions for different columns.**

As indicated by the syntax, the query includes two steps. In the first step, the `ROW_NUMBER()` function is used to specify an over window to compute the row number for the rows that are ordered in a partition. The second step is to return the top N data records. For example, if N is 10, only the top 10 data records are returned.

When you use Flink SQL to perform Top_N queries, input data records are ordered and ranked based on the specified columns. If the top N data records in a partition change, the changed data records are sent to the downstream data store to update the result. You can only export the top N data records to a result table that is defined with a primary key.

The Top_N statement has specific constraints. To allow Flink SQL to identify a Top_N query, you must specify the `rownum <= N` condition in the WHERE clause.

You cannot use an expression such as `rownum - 5 <= N` to specify a condition.

If you specify multiple conditions in the WHERE clause, you must use AND to separate the conditions.

Example 1

You can use the following example to return the top 100 keywords that are most queried in a city within an hour. For the result table, you must define the rownum, start_time, and city columns as the composite primary key. The composite primary key can uniquely identify a data record.

```
CREATE TABLE rds_output (
  rownum int,
  start_time bigint,
  city varchar,
  keyword varchar,
  pv bigint,
  PRIMARY KEY (rownum, start_time, city)
) with (
  type = 'rds',
  ...
)
INSERT INTO rds_output
SELECT rownum, start_time, city, keyword, pv
FROM (
  SELECT *,
     ROW_NUMBER() OVER (PARTITION BY start_time, city ORDER BY pv desc
) AS rownum
  FROM (
        select substr(time_str,1,12) as start_time,
            keyword,
            count(1) AS pv,
            city
        from tmp_search
        group by substr(time_str,1,12), keyword, city
    ) a
)
WHERE rownum <= 100
```

Example 2

Table 3-20: Input example

ip (varchar)	time (varchar)
192.168.1.1	100000000
192.168.1.2	100000000
192.168.1.2	100000000
192.168.1.3	100030000
192.168.1.3	100000000

ip (varchar)	time (varchar)
192.168.1.3	100000000

Sample code

```
create table source_table (
  IP VARCHAR,
  `TIME` VARCHAR
)with(
  type='datahub',
  endPoint='http://dh-cn-hangzhou.aliyuncs.com',
  project='Flink_test',
  topic='yourTopicName',
  accessId='yourAccessId',
  accessKey='yourAccessSecret'
);
create table result_table (
  rownum int,
  start_time VARCHAR,
  IP VARCHAR,
  cc BIGINT,
  PRIMARY KEY (start_time, IP)
) with (
  type = 'rds',
  url='jdbc:mysql://rm-bp1gz4k202t8****s.com:3306/Flink_test',
  tableName='yourTableName',
  userName='yourAccessId',
  password='yourAccessPassword'
);
INSERT INTO result_table
SELECT rownum,start_time,IP,cc
FROM (
  SELECT *,
     ROW_NUMBER() OVER (PARTITION BY start_time ORDER BY cc desc) AS
rownum
  FROM (
        SELECT SUBSTRING(`TIME`,1,2) AS start_time, -- The input
example of the TIME parameter is provided in the preceding table. You
can change the value of the TIME parameter based on your situation.
        COUNT(IP) AS cc,
        IP
        FROM  source_table
        GROUP BY SUBSTRING(`TIME`,1,2), IP
    )a
)
WHERE rownum <= 3 -- You can change the number 3 based on your
situation.
```

Table 3-21: Output example

rownum (INT)	start_time (VARCHAR)	ip (VARCHAR)	cc (BIGINT)
1	10	192.168.1.3	6
2	10	192.168.1.2	4

rownum (INT)	start_time (VARCHAR)	ip (VARCHAR)	cc (BIGINT)
3	10	192.168.1.1	2

No ranking number optimization

As indicated by the syntax, the rownum field is written to the result table as one field of the primary key. Many repeated data records may be written to the result table. For example, if a data record with the ninth rank is updated and its rank is changed to the first, all top 9 data records are updated to the result table. During the process, workloads increase significantly for the result table. To resolve this issue, you can discard the rownum field when data records are written to the result table. In most cases, consumers can compute row numbers themselves because the number of top N data records is small. In the preceding example, only the changed records are updated for the result table, rather than nine records. This method helps to significantly reduce the workload for the result table.

Syntax

```
SELECT col1, col2, col3
FROM (
 SELECT col1, col2, col3
   ROW_NUMBER() OVER ([PARTITION BY col1[, col2..]]
   ORDER BY col1 [asc|desc][, col2 [asc|desc]...]) AS rownum
 FROM table_name)
WHERE rownum <= N [AND conditions]
```

Different from the original Top_N syntax, you need to exclude the rownum field from the second step of the query.

Note:
If the rownum field is excluded, use caution while defining the primary key for the result table. If the definition is inaccurate, a Top_N query may return inconsistent results. Without the rownum field, the primary key of the result table must be the same as the GROUP BY key that is defined before the Top_N operator.

Example

The following example describes a simplified business scenario for Youku. On Youku, each video generates large amounts of traffic after it is published. The most popular videos can be identified by analyzing the traffic generated by videos. You

can return the top 5 videos that generate the most traffic per minute by using the following code.

```
-- Reads data from a Log Service source table.
CREATE TABLE sls_cdnlog_stream (
vid VARCHAR, -- video id
rowtime timestamp, -- Defines the time when the video is played.
response_size BIGINT, -- Defines the traffic generated by the video.
WATERMARK FOR rowtime as withOffset(rowtime, 0)
) WITH (
type='sls',
...
);
-- Defines a one-minute window to aggregate the bandwidth consumed by
the video.
CREATE VIEW cdnvid_group_view AS
SELECT vid,
TUMBLE_START(rowtime, INTERVAL '1' MINUTE) AS start_time,
SUM(response_size) AS rss
FROM sls_cdnlog_stream
GROUP BY vid, TUMBLE(rowtime, INTERVAL '1' MINUTE);
-- Creates the result table.
CREATE TABLE hbase_out_cdnvidtoplog (
vid VARCHAR,
rss BIGINT,
start_time VARCHAR,
   -- Do not define the rownum field in the result table.
   -- Note that the primary key of the result table must be the same
as the GROUP BY key that is defined before the Top_N operator.
PRIMARY KEY(start_time, vid)
) WITH (
type='RDS',
...
);
-- Computes and exports the top 5 videos that generate the most
traffic per minute.
INSERT INTO hbase_out_cdnvidtoplog
-- Excludes the rownum field from the second step of the query.
SELECT vid, rss, start_time FROM
(
SELECT
vid, start_time, rss,
ROW_NUMBER() OVER (PARTITION BY start_time ORDER BY rss DESC) as
rownum,
FROM
cdnvid_group_view
)
WHERE rownum <= 5;
```

Input example

vid (VARCHAR)	rowtime (TIMESTAMP)	response_size (BIGINT)
10000	2017-12-18 15:00:10	2000
10000	2017-12-18 15:00:15	4000
10000	2017-12-18 15:00:20	3000
10001	2017-12-18 15:00:20	3000

vid (VARCHAR)	rowtime (TIMESTAMP)	response_size (BIGINT)
10002	2017-12-18 15:00:20	4000
10003	2017-12-18 15:00:20	1000
10004	2017-12-18 15:00:30	1000
10005	2017-12-18 15:00:30	5000
10006	2017-12-18 15:00:40	6000
10007	2017-12-18 15:00:50	8000

Output example

start_time (VARCHAR)	vid (VARCHAR)	rss (BIGINT)
2017-12-18 15:00:00	10000	9000
2017-12-18 15:00:00	10007	8000
2017-12-18 15:00:00	10006	6000
2017-12-18 15:00:00	10005	5000
2017-12-18 15:00:00	10002	4000

3.1.7.9 Complex event processing (CEP)

You can use the MATCH_RECOGNIZE clause to identify the events that match the specified pattern from data streams and export matched events by using a specified method.

Syntax

```
SELECT [ ALL | DISTINCT ]
{ * | projectItem [, projectItem ]* }
FROM tableExpression
[MATCH_RECOGNIZE (
[PARTITION BY {partitionItem [, partitionItem]*}]
[ORDER BY {orderItem [, orderItem]*}]
[MEASURES {measureItem AS col [, measureItem AS col]*}]
[ONE ROW PER MATCH|ALL ROWS PER MATCH|ONE ROW PER MATCH WITH TIMEOUT
ROWS|ALL ROWS PER MATCH WITH TIMEOUT ROWS]
[AFTER MATCH SKIP]
PATTERN (patternVariable[quantifier] [ patternVariable[quantifier]]*)
WITHIN intervalExpression
DEFINE {patternVariable AS patternDefinationExpression [, patternVar
iable AS patternDefinationExpression]*}
```

```
)];
```

Clause	Description
PARTITION BY	Optional. You can use the PARTITION BY clause to divide the rows of an input table into partitions based on one or more columns.
ORDER BY	Optional. You can use the ORDER BY clause to order the rows within a partition based on one or more columns. If you use multiple columns to order the rows, define `EVENT TIME` or `PROCESSING TIME` as the first column.
MEASURES	You can use the MEASURES clause to define a list of columns for an output table. You can create an expression to compute a value for each column that you have defined.
ONE ROW PER MATCH	Specifies that only one summary row is generated for a pattern match.
ONE ROW PER MATCH WITH TIMEOUT ROWS	Specifies that both a pattern match and timeout can trigger output. In the `PATTERN` clause, you can use the `WITHIN` subclause to define a timeout period.
ALL ROWS PER MATCH	Specifies that for a pattern match that spans multiple rows, each input row triggers one output row.
ALL ROWS PER MATCH WITH TIMEOUT ROWS	Specifies that both a pattern match and timeout can trigger output. In the `PATTERN` clause, you can use the `WITHIN` subclause to define a timeout period.
[ONE ROW PER MATCH|ALL ROWS PER MATCH|ONE ROW PER MATCH WITH TIMEOUT ROWS|ALL ROWS PER MATCH WITH TIMEOUT ROWS]	Optional. The default value is `ONE ROW PER MATCH`.
AFTER MATCH SKIP TO NEXT ROW	Specifies that pattern matching resumes from the next row that follows the first row of the current match.

Clause	Description
AFTER MATCH SKIP PAST LAST ROW	Specifies that pattern matching resumes from the next row that follows the last row of the current match.
AFTER MATCH SKIP TO FIRST patternItem	Specifies that pattern matching resumes from the first row that is mapped to the pattern item.
AFTER MATCH SKIP TO LAST patternItem	Specifies that pattern matching resumes from the last row that is mapped to the pattern item.
PATTERN	You can use the PATTERN clause to specify a regular expression that defines the pattern to be matched. The regular expression is enclosed in parentheses `()`. You can specify multiple pattern variables in the clause. **Note:** · If you use a space to separate two pattern variables, no rows are allowed between the two rows that are mapped to the pattern variables. · If you use a `->` string to separate two pattern variables, rows are allowed between the two rows that are mapped to the pattern variables.

· `Quantifiers`

`Quantifiers` are used to define the number of iterations for the rows that are mapped to a `pattern variable`.

Quantifier	Description
*	Zero or more iterations
+	One or more iterations
?	Zero or one iteration
{n}	n iterations (n > 0)
{n,}	n or more iterations (n ⩾ 0)

Quantifier	Description
{n, m}	From n to m iterations (0 ⩽ n ⩽ m, 0 < m)
{,m}	Between 0 and m iterations (m > 0)

The quantifiers are greedy by default. For example, if you define `A -> B+` in the PATTERN clause and the input is `a b1, b2, b3`, the output is `a b1, a b1 b2, a b1 b2 b3`. To make a quantifier reluctant, you can add a question mark (`?`) after the quantifier. Supported reluctant quantifiers are listed as follows:

- `*?`
- `+?`
- `{n}?`
- `{n,}?`
- `{n, m}?`
- `{,m}?`

In the preceding example, if you use a reluctant quantifier instead, the output is `a b1, a b2, a b1 b2, a b3, a b2 b3, a b1 b2 b3`.

Note:

- You can use the WITHIN clause to define the maximum time span of the rows that match the pattern.
- Syntax of a static window: `INTERVAL 'string' timeUnit [ TO timeUnit ]`. Example: `INTERVAL '10' SECOND, INTERVAL '45' DAY, INTERVAL '10:20' MINUTE TO SECOND, INTERVAL '10:20.10' MINUTE TO SECOND, INTERVAL '10:20' HOUR TO MINUTE, INTERVAL '1-5' YEAR TO MONTH`.
- Syntax of a dynamic window: `INTERVAL intervalExpression`. Example: `INTERVAL A.windowTime + 10`, in which A represents the first pattern variable defined in the PATTERN clause. In an interval expression, you can use the pattern variables defined in the PATTERN clause. Only the first pattern variable can be used. You can use a UDF for an interval expression. The result of the expression indicates the window size (time span), measured in milliseconds. The data type of the result must be LONG.

- **You can use the DEFINE clause to specify the definition of a pattern variable . If a pattern variable is not defined in the DEFINE clause, any row can be mapped to the pattern variable.**

- Functions in the MEASURES and DEFINE clauses

Function	Description
Row pattern column references	**Syntax:** `patternVariable.col`**. You can use a row pattern column reference to reference the column in all rows that match a** `pattern variable`**.**
PREV	**You can only use the PREV function in the DEFINE clause. In most cases, the function is used with** `row pattern column references`**. You can use the PREV function to reference the value of a column in a previous row based on an offset from the current row. Example:** `DOWN AS DOWN.price < PREV (DOWN.price)`**. In this example,** `PREV (DOWN.price)` **indicates the value of the** `price` **column in the previous row. Note that** `DOWN.price` **is equivalent to** `PREV(DOWN.price, 0)`**.** `PREV(DOWN .price)` **is equivalent to** `PREV(DOWN. price, 1)`**.**
FIRST and LAST	**In most cases, the FIRST and LAST functions are used with** `row pattern column references`**. You can use these functions to reference the value of a column in a row based on an offset from the first or last row that matches a** `pattern variable`**. For example,** `FIRST(A.price, 3)` **indicates the value of the price column in the fourth row that matches** `Pattern Variable A`**.** `LAST(A.price, 3)` **indicates the value of the price column in the fourth row from the last row that matches** `Pattern Variable A`**.**

- Output methods

Output method	Description
ONE ROW PER MATCH	Output columns include the columns specified in the `PARTITION BY` and `MEASURES` clauses. If a column is specified in the `PARTITION BY` clause, you do not need to define the column again in the `MEASURES` clause.
ONE ROW PER MATCH WITH TIMEOUT ROWS	A pattern match and timeout can both trigger output. In the `PATTERN` clause, you can use the `WITHIN` subclause to define a timeout period.

Note:

- **When you define a pattern, you need to define a timeout period for rows that match the pattern. Otherwise, the state may be overwhelming.**
- **In the ORDER BY clause, you must define EVENT TIME or PROCESSING TIME as the first column.**

Example

- **Syntax**

```
SELECT *
FROM Ticker MATCH_RECOGNIZE (
PARTITION BY symbol
ORDER BY tstamp
MEASURES STRT.tstamp AS start_tstamp,
LAST(DOWN.tstamp) AS bottom_tstamp,
LAST(UP.tstamp) AS end_tstamp
ONE ROW PER MATCH
AFTER MATCH SKIP TO NEXT ROW
PATTERN (STRT DOWN+ UP+) WITHIN INTERVAL '10' SECOND
DEFINE
DOWN AS DOWN.price < PREV(DOWN.price),
UP AS UP.price > PREV(UP.price)
) MR
ORDER BY MR.symbol, MR.start_tstamp;
```

- **Input example**

timestamp (TIMESTAMP)	card_id (VARCHAR)	location (VARCHAR)	action (VARCHAR)
2018-04-13 12:00 :00	1	WW	Tom
2018-04-13 12:05 :00	1	WW1	Tom
2018-04-13 12:10 :00	1	WW2	Tom
2018-04-13 12:20 :00	1	WW	Tom

- **Sample code**

```
CREATE TABLE datahub_stream (
 `timestamp`                TIMESTAMP,
 card_id                    VARCHAR,
 location                   VARCHAR,
 `action`                   VARCHAR,
    WATERMARK wf FOR `timestamp` AS withOffset(`timestamp`, 1000)
) WITH (
 type = 'datahub'
 ...
);
CREATE TABLE rds_out (
 start_timestamp               TIMESTAMP,
 end_timestamp                 TIMESTAMP,
 card_id                       VARCHAR,
 event                         VARCHAR
) WITH (
 type= 'rds'
 ...
);

-- Example
-- When a credit card specified with a unique card_id is found to
have two payment records in different locations within 10 minutes,
an alert is triggered. This helps to monitor the unauthorized use of
 credit cards.

-- Defines the computational logic as follows:
insert into rds_out
select
`start_timestamp`,
`end_timestamp`,
card_id, `event`
from datahub_stream
MATCH_RECOGNIZE (
    PARTITION BY card_id   -- Partitions rows by the card_id column
. The rows with the same card ID are allocated to the same compute
node.
```

```
    ORDER BY `timestamp`   -- Orders the rows in a partition based
on time.
    MEASURES               -- Defines a list of columns for an
output table. You can create an expression to compute values for
each column that you have defined.
        e2.`action` as `event`,
        e1.`timestamp` as `start_timestamp`,   -- Defines the time
of e1 as start_timestamp.
        LAST(e2.`timestamp`) as `end_timestamp`-- Defines the time
of e2 as end_timestamp.
    ONE ROW PER MATCH           -- Each match generates an output
row.
    AFTER MATCH SKIP TO NEXT ROW-- Resumes the pattern matching from
 the row that follows the first row of the current match.
    PATTERN (e1 e2+) WITHIN INTERVAL '10' MINUTE  -- Defines two
pattern variables: e1 and e2.
    DEFINE                      -- Specifies the conditions for the
pattern variables defined in the PATTERN clause.
        e1 as e1.action = 'Tom',    -- Defines the action of e1 as
Tom.
        e2 as e2.action = 'Tom' and e2.location <> e1.location --
Defines the action of e2 as Tom. The locations of e1 and e2 are
different.

);
```

- **Output example**

start_timestamp (TIMESTAMP)	end_timestamp (TIMESTAMP)	card_id (VARCHAR)	event (VARCHAR)
2018-04-13 20:00 :00.0	2018-04-13 20:05 :00.0	1	Tom
2018-04-13 20:05 :00.0	2018-04-13 20:10 :00.0	1	Tom

3.1.8 Create a view

In Realtime Compute, you can define a view to query data in one or more tables in a database. You can simplify the development process by using views.

A view displays a logical table that helps to describe the computational logic. It does not physically store any data. To simplify queries, you can use the SQL statement to define a manageable view. A view can be created based on fields of one or more tables in a database. Views do not require any disk space.

Syntax

```
CREATE VIEW viewName
        [ (columnName[ , columnName]*) ]
```

```
            AS queryStatement;
```

Example 1

```
CREATE VIEW  LargeOrders(r, t, c, u) AS
 SELECT rowtime,
   productId,
 c,
   units
 FROM Orders;
 INSERT INTO rds_output
 SELECT
 r,t,c,u
 FROM LargeOrders;
```

Example 2

Table 3-22: Input example

a (VARCHAR)	b (BIGINT)	c (TIMESTAMP)
test1	1	1506823820000
test2	1	1506823850000
test1	1	1506823810000
test2	1	1506823840000
test2	1	1506823870000
test1	1	1506823830000
test2	1	1506823860000

Sample code

```
CREATE TABLE datahub_stream (
a VARCHAR,
b BIGINT,
c TIMESTAMP,
d AS PROCTIME()
) WITH (
  type='datahub',
  endPoint='http://dh-cn-hangzhou.aliyuncs.com',
  project='blink_test',
  topic='window_count',
  accessId='yourAccessId',
  accessKey='yourAccessSecret'
);
CREATE TABLE rds_output (
a varchar,
b TIMESTAMP,
cnt BIGINT,
PRIMARY KEY(a)
)with(
  type = 'rds',
  url='jdbc:mysql://rm-bp1gz4k20****.mysql.rds.aliyuncs.com:3306/
****',
```

```
  tableName='yourTableName',
  userName='yourAccessUserName',
  password='yourAccessPassword'
);
CREATE VIEW rds_view AS
SELECT a,
   CAST(HOP_START(d, interval '5' second, interval '30' second) AS
TIMESTAMP) AS cc,
   sum(b) AS cnt
FROM datahub_stream
GROUP BY HOP(d, interval '5' second, interval '30' second),a;
INSERT INTO rds_output
SELECT
a,
cc,
cnt
FROM rds_view
WHERE cnt=4
```

Table 3-23: Output example

a (VARCHAR)	b (TIMESTAMP)	cnt (BIGINT)
test2	2017-11-06 16:54:10	4

3.1.9 Window functions

3.1.9.1 Overview

You can use Flink SQL to aggregate infinite streaming data without defining any window in SQL statements. You can also define a window to aggregate a set of streaming data records as required. For example, you need to calculate the page view for a webpage in the past one minute. You can define a window in the SQL statement to collect data in the past minute and compute the aggregate result.

In Flink SQL, you can aggregate data by using group windows and over windows. The core difference is that when you use over windows, each input data record triggers an aggregate and has an aggregate result. Therefore, over windows are applied to ranking, calculating a moving average, and other scenarios.

You can aggregate data by using group windows based on two time attributes: event time and processing time. Three types of group windows are available: tumbling window, sliding window, and session window.

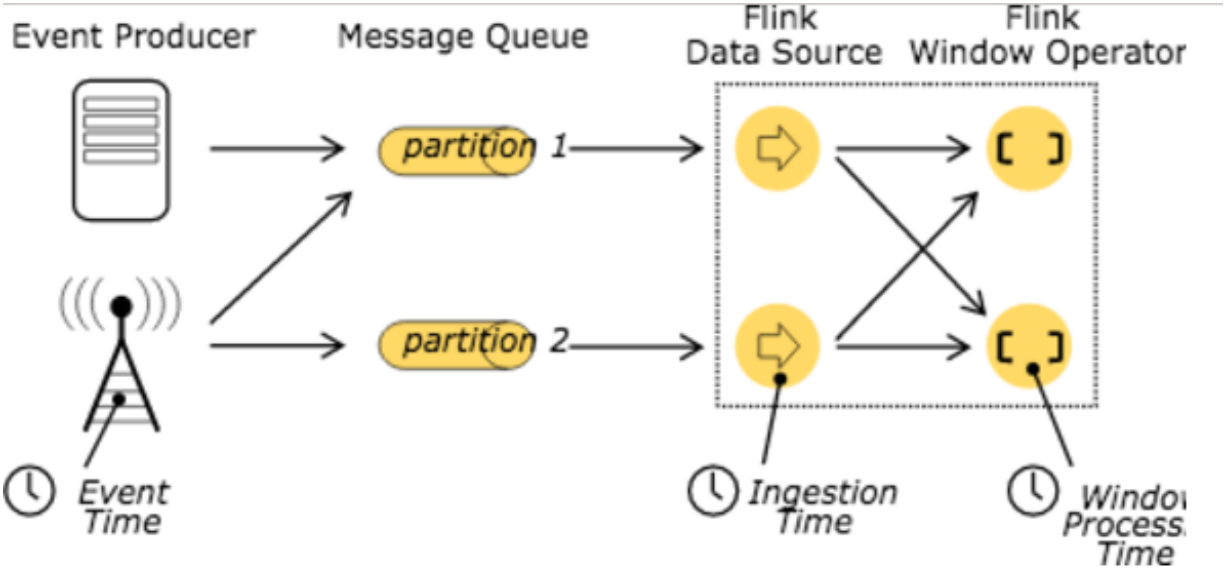
Time attributes

Flink SQL supports the following time attributes: event time and processing time.

- **Event time is the time when a data record is created. You must define the event time in the table schema.**

- **Processing time is the local time of the system when the system processes an event.**

Figure 3-1: Positions of different time attributes in the workflow of Realtime Compute



Ingestion time and processing time are the time attributes automatically generated by the system for a streaming data record. Event time is a time attribute that is carried by a steaming data record. Assume that the event time for a streaming data record is t1, and the event time for another streaming data record is t2 (t2 > t1). The first data record may arrive and be processed by Flink later than the second data record because of data disorder, network jitter, or other reasons.

Processing time-based aggregate

Processing time is generated by the system and is not included in source data received from data stores. Therefore, you need to define a processing time in a DDL statement as follows:

```
filedName as PROCTIME()
```

An example of processing time-based aggregate is provided as follows:

```
CREATE TABLE tt_stream (
    a VARCHAR,
    b VARCHAR,
    c BIGINT,
    d AS PROCTIME()
    ) with (
    type = 'sls',
    topic = 'yourTopicName',
    accessId = 'yourAccessId',
    accessKey = 'yourAccessSecret'
```

```
    );

    CREATE TABLE rds_output (
    id VARCHAR,
    c TIMESTAMP,
    f TIMESTAMP,
    cnt BIGINT
    ) with (
    type = 'rds',
    url = 'yourDatebaseURL',
    tableName='yourTableName',
    userName='yourDatabaseUserName',
    password='yourDatabasePassword'
    );

    INSERT INTO rds_output
    SELECT a AS id,
    SESSION_START(d, INTERVAL '1' SECOND) AS c,
    SESSION_END(d, INTERVAL '1' SECOND) AS f,
    COUNT(a) AS cnt
    FROM tt_stream
    GROUP BY SESSION(d, INTERVAL '1' SECOND), a
```

Event time-based aggregate

Event time is included in source data received from data stores. You do not need to define an event time in a DDL statement. However, you must use the watermarking mechanism to handle out-of-order data. If you do not define a watermark, data that arrives late may not be processed and the aggregate result is inaccurate.

Watermark

Watermarking is a mechanism in Flink to measure progress in event time. A watermark flows as part of the data stream and carries a timestamp. A watermark is defined in a DDL statement. You can use the following syntax to define a watermark in Flink:

```
WATERMARK [watermarkName] FOR <rowtime_field> AS withOffset(<
rowtime_field>, offset)
```

- `watermarkName`: **specifies the watermark name. This parameter is optional.**
- `<rowtime_field>`: **specifies a column (of the `TIMESTAMP` data type) that is used to generate a watermark. This column is labeled as the event time column. When you perform queries by using window functions, you must include a time attribute column in your table.**
- `withOffset`: **specifies the strategy of generating a waterwark. The value for a watermark is obtained based on `<rowtime_field> - offset`. The first parameter in withOffset must be `<rowtime_field>`.**

- `offset`: specifies the offset between a watermark value and an event time. The unit is measured in milliseconds.

For example, a table has a rowtime column of the TIMESTAMP data type, and one value is 1501750584000 (2017-08-03 08:56:24.000). Based on the preceding rowtime column, you can define a watermark with a four-second offset as follows:

```
WATERMARK FOR rowtime AS withOffset(rowtime, 4000)
```

The watermark value of the specified data record is obtained based on the following expression: 1501750584000 - 4000 = 1501750580000 (2017-08-03 08:56:20.000). The watermark indicates that all data with the timestamps earlier than 1501750580000 (2017-08-03 08:56:20.000) has arrived.

 **Note:**

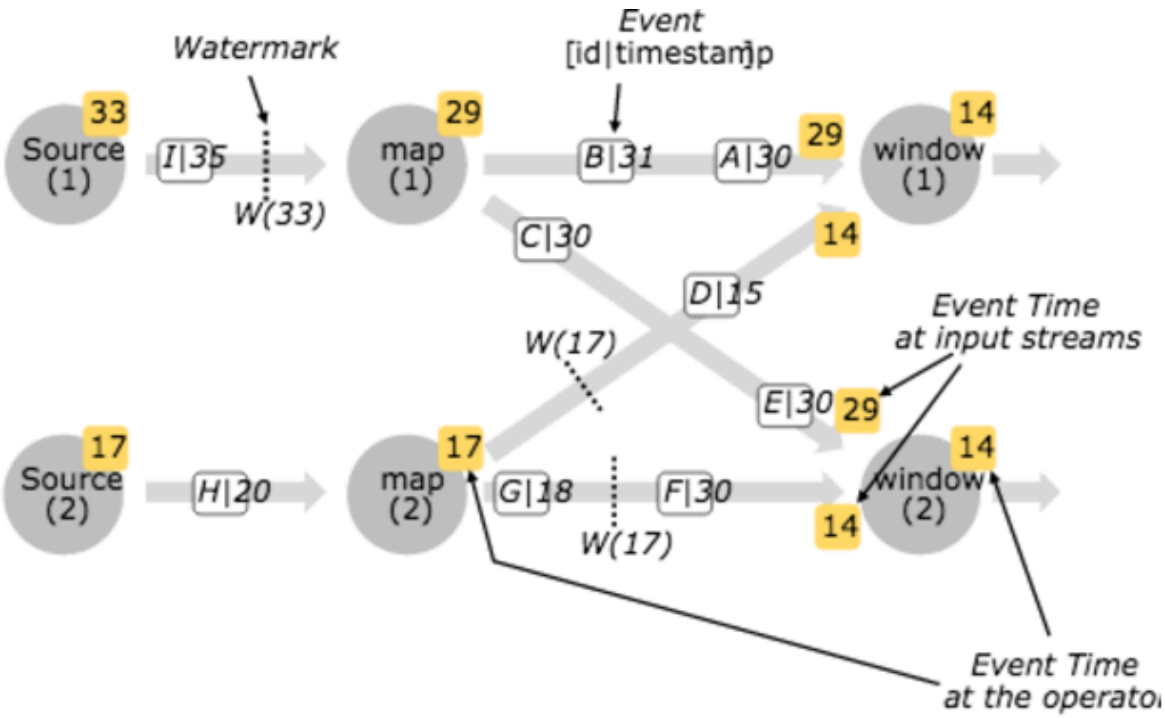
- When you define a watermark based on event time, the data type of the rowtime column must be TIMESTAMP. Currently, Realtime Compute only supports 13 -bit Unix timestamps measured in milliseconds. If the data type of a rowtime column is not TIMESTAMP or a Unix timestamp is not 13 digits in length, we recommend that you use a computed column expression to convert data types.
- You can only define event time and processing time in a DDL statement that is used to create a source table.

Summary:

- A watermark indicates that all the events with the timestamps (t') earlier than the watermark (t) have occurred. After a watermark takes effect, all subsequent records with timestamps earlier than the watermark are discarded. This is the current watermarking mechanism in Realtime Compute. However, in the future, improvements to Realtime Compute will allow you to update subsequent data.
- The watermarking mechanism is crucial for handling out-of-order data streams. With watermarks, real-time computing results are accurate even if data streams arrive out of order.

- **When an operator has multiple input data streams, the event time of the operator equals the minimum event time of the data streams.**

  Figure 3-2: Diagram of watermarks in parallel data streams



Example of event time-based Aggregation

```
CREATE TABLE tt_stream(
     a VARCHAR,
     b VARCHAR,
     c TIMESTAMP,
     WATERMARK wk1 FOR c as withOffset(c, 1000)
     ) with (
     type = 'sls',
     topic = 'blink_tt2tt_test',
     accessId = 'yourAccessId',
     accessKey = 'yourAccessSecret'
     );
     CREATE TABLE rds_output (
     id VARCHAR,
     c TIMESTAMP,
     f TIMESTAMP,
     cnt BIGINT
     ) with (
     type = 'rds',
     url = 'yourDatebaseURL',
     tableName='yourDatabaseTableName',
     userName='yourDatabaseUserName',
     password='yourDatabasePassword'
     );
     INSERT INTO rds_output
     SELECT a AS id,
     SESSION_START(c, INTERVAL '1' SECOND) AS c,
     CAST(SESSION_END(c, INTERVAL '1' SECOND) AS TIMESTAMP) AS f,
     COUNT(a) AS cnt
```

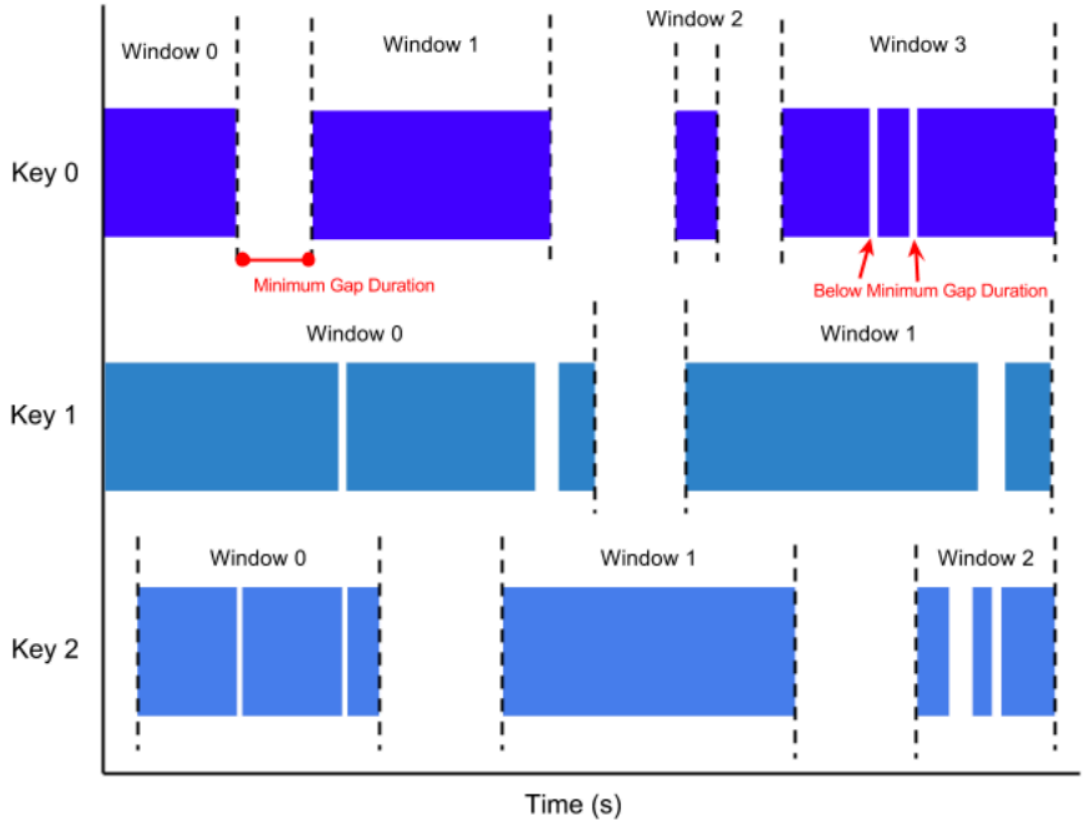
```
    FROM tt_stream
    GROUP BY SESSION(c, INTERVAL '1' SECOND), a
```

3.1.9.2 Session window

A session window groups elements by sessions of activities. Unlike tumbling windows and sliding windows, session windows do not overlap and are not fixed in size. If a session window does not receive any elements within a certain period, the session is disconnected and the window is closed.

A session window is configured by using a gap duration, which defines the required length of an inactive period. For example, a data stream that describes click activities may include highly clustered click events, separated by inactive periods. The data that arrives after a specified gap duration is assigned to a new window. *Figure 3-3: Session window* **shows a session window. Note that each key has different types of windows due to the irregular distribution of elements.**

Figure 3-3: Session window



Syntax

The SESSION function is used to define a session window in a GROUP BY clause.

```
SESSION(<time-attr>, <gap-interval>)
<gap-interval>: INTERVAL 'string' timeUnit
```

Note:

```
The <time-attr> parameter specifies a time attribute based on which a
 computation is performed. The time attribute is processing time or
event time.
```

Window identifier functions

A window identifier function specifies the start or end time of a window, or the window time attribute. The returned time attribute is used for window joins.

Table 3-24: Window identifier functions

Window identifier function	Return type	Description
SESSION_START(time-attr, size-interval)	TIMESTAMP	Returns the start time (the boundary value is included) of the window . For example, if the window is [00:10, 00:15), 00:10 is returned.
SESSION_END(time-attr, size-interval)	TIMESTAMP	Returns the end time (the boundary value is included) of the window . For example, if the window is [00:00, 00:15], 00:15 is returned.

Window identifier function	Return type	Description
SESSION_ROWTIME(time-attr, size-interval)	TIMESTAMP	Returns the end time (the boundary value is excluded) of the window . For example, if the window is [00:00, 00:15], 00:14:59.999 is returned . The return value is a rowtime attribute, based on which time-based operations such as window joins can be performed.

Example

The following example describes how to compute the number of clicks per user during each active session. The session timeout interval is 30 seconds.

```
CREATE TABLE user_clicks(
  username varchar,
  click_url varchar,
  ts timeStamp,
  WATERMARK wk FOR ts as withOffset(ts, 2000)  -- Defines a watermark
for rowtime.
) with (
  type='datahub',
  ...
);
CREATE TABLE tumble_output(
  window_start TIMESTAMP,
  window_end TIMESTAMP,
  username VARCHAR,
  clicks BIGINT
) with (
  type='rds'
);
INSERT INTO tumble_output
SELECT
  SESSION_START(ts, INTERVAL '30' SECOND),
  SESSION_END(ts, INTERVAL '30' SECOND),
  username,
  COUNT(click_url)
FROM window_input
```

```
GROUP BY SESSION(ts, INTERVAL '30' SECOND), username
```

Table 3-25: Input example

username (VARCHAR)	click_url (VARCHAR)	ts (TIMESTAMP)
Jark	http://taobao.com/xxx	2017-10-10 10:00:00.0
Jark	http://taobao.com/xxx	2017-10-10 10:00:10.0
Jark	http://taobao.com/xxx	2017-10-10 10:00:49.0
Jark	http://taobao.com/xxx	2017-10-10 10:01:05.0
Jark	http://taobao.com/xxx	2017-10-10 10:01:58.0
Timo	http://taobao.com/xxx	2017-10-10 10:02:10.0

Table 3-26: Output example

window_start (TIMESTAMP)	window_end (TIMESTAMP)	username (VARCHAR)	clicks (BIGINT)
2017-10-10 10:00:00 .0	2017-10-10 10:00:40 .0	Jark	2
2017-10-10 10:00:49 .0	2017-10-10 10:01:19 .0	Jark	2
2017-10-10 10:01:58 .0	2017-10-10 10:02:28 .0	Jark	1
2017-10-10 10:02:10 .0	2017-10-10 10:02:40 .0	Timo	1

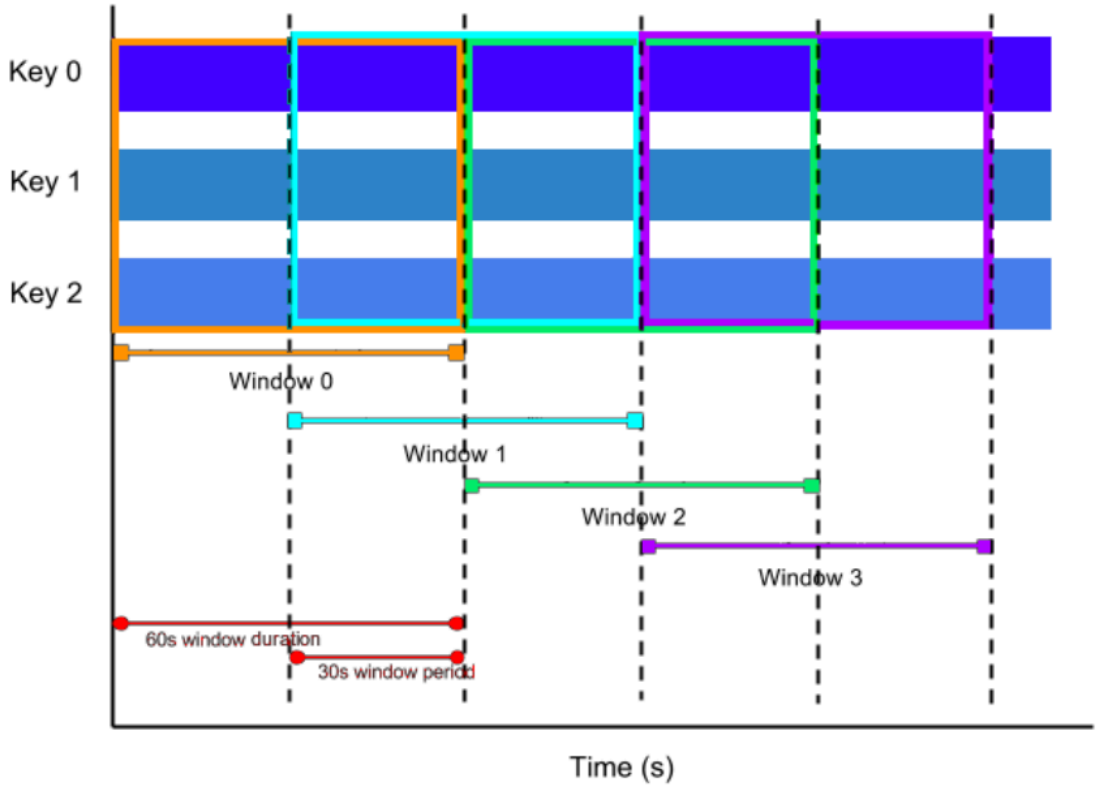
3.1.9.3 Sliding window

Unlike tumbling windows, sliding windows can overlap each other. Sliding windows have two parameters: size and slide. The size parameter specifies the size of a window. The slide parameter defines how frequently a sliding window is started.

- **If the slide is smaller than the window size, sliding windows can overlap each other. In this case, elements are assigned to multiple windows.**
- **If the slide is equal to the size, windows do not overlap and can be considered as tumbling windows.**
- **If the slide is greater than the size, windows can be considered as tumbling windows that are separated by gaps.**

In most cases, multiple windows overlap and most elements are assigned to multiple windows. This type of window is useful in computing moving averages. For example, if the average value of data over the past five minutes needs to be computed every 10 seconds, you can set the size to five minutes and the slide to 10 seconds. The *Sliding window* figure shows a one-minute window that slides every 30 seconds.

Figure 3-4: Sliding window



Syntax

The HOP function is used to define a sliding window in a GROUP BY clause.

```
HOP(<time-attr>, <slide-interval>, <size-interval>)
<slide-interval>: INTERVAL 'string' timeUnit
```

```
<size-interval>: INTERVAL 'string' timeUnit
```

Note:

```
The <time-attr> parameter specifies a time attribute based on which a
 computation is performed. The time attribute is processing time or
event time.
```

Window identifier function

A window identifier function specifies the start or end time of a window, or the window time attribute. The returned time attribute is used for window joins.

Table 3-27: Window identifier functions

Window identifier function	Return type	Description
HOP_START(time-attr, size-interval)	TIMESTAMP	Returns the start time (the boundary value is included) of the window . For example, if the window is [00:10, 00:15), 00:10 is returned.
HOP_END(time-attr, size-interval)	TIMESTAMP	Returns the end time (the boundary value is included) of the window . For example, if the window is [00:00, 00:15], 00:15 is returned.
HOP_ROWTIME(time-attr , size-interval)	TIMESTAMP	Returns the end time (the boundary value is excluded) of the window . For example, if the window is [00:00, 00:15], 00:14:59.999 is returned . The return value is a rowtime attribute, based on which time-based operations such as window joins can be performed.

Example

The following example describes how to compute the number of clicks per user over the past minute every 30 seconds. That is, a 1-minute window slides every 30 seconds.

```
CREATE TABLE user_clicks(
  username VARCHAR,
  click_url VARCHAR,
  ts TIMESTAMP,
  WATERMARK wk FOR ts as withOffset(ts, 2000) -- Defines a watermark
for rowtime.
) with (
  type='datahub',
  ...
);
CREATE TABLE tumble_output(
  window_start TIMESTAMP,
  window_end TIMESTAMP,
  username VARCHAR,
  clicks BIGINT
) with (
  type='rds'
);
INSERT INTO tumble_output
SELECT
  HOP_START(ts, INTERVAL '30' SECOND, INTERVAL '1' MINUTE),
  HOP_END(ts, INTERVAL '30' SECOND, INTERVAL '1' MINUTE),
  username,
  COUNT(click_url)
FROM window_input
GROUP BY HOP(ts, INTERVAL '30' SECOND, INTERVAL '1' MINUTE), username
```

Table 3-28: Input example

username (VARCHAR)	click_url (VARCHAR)	ts (TIMESTAMP)
Jark	http://taobao.com/xxx	2017-10-10 10:00:00.0
Jark	http://taobao.com/xxx	2017-10-10 10:00:10.0
Jark	http://taobao.com/xxx	2017-10-10 10:00:49.0
Jark	http://taobao.com/xxx	2017-10-10 10:01:05.0
Jark	http://taobao.com/xxx	2017-10-10 10:01:58.0
Timo	http://taobao.com/xxx	2017-10-10 10:02:10.0

Table 3-29: Output example

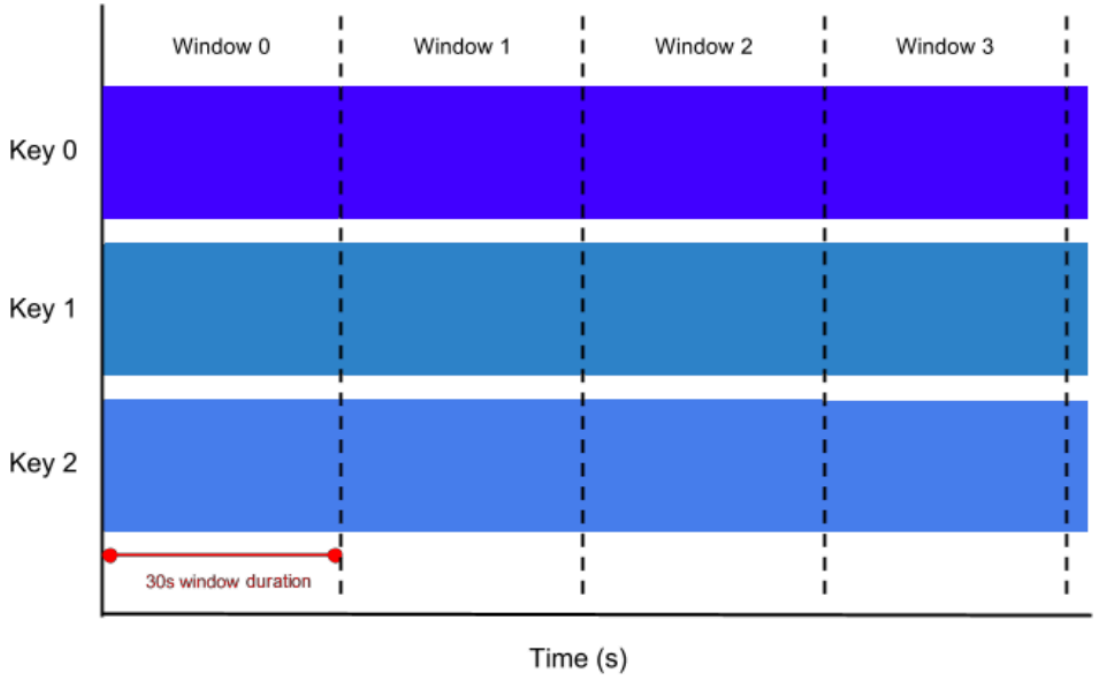
window_start (TIMESTAMP)	window_end (TIMESTAMP)	username (VARCHAR)	clicks (BIGINT)
2017-10-10 10:00:00.0	2017-10-10 10:01:00.0	Jark	3
2017-10-10 10:00:30.0	2017-10-10 10:01:30.0	Jark	2
2017-10-10 10:01:00.0	2017-10-10 10:02:00.0	Jark	2
2017-10-10 10:01:30.0	2017-10-10 10:02:30.0	Jark	1
2017-10-10 10:01:30.0	2017-10-10 10:02:30.0	Timo	1
2017-10-10 10:02:00.0	2017-10-10 10:03:00.0	Timo	1

3.1.9.4 Tumbling window

In tumbling windows, each element is assigned to a window with a specified size. Tumbling windows are fixed in size and do not overlap.

For example, if a 5-minute tumbling window is defined, elements are assigned into windows based on time periods: [0:00, 0:05), [0:05, 0:10), [0:10, 0:15), and so on. *Figure 3-5: Tumbling window* **shows a 30-second tumbling window.**

Figure 3-5: Tumbling window



Syntax

The TUMBLE function is used to define a tumbling window in a GROUP BY clause.

```
TUMBLE(<time-attr>, <size-interval>)
<size-interval>: INTERVAL 'string' timeUnit
```

Note:

```
The <time-attr> parameter specifies a time attribute based on which
a computation is performed. Time attributes include processing time
and event time.
```

Window identifier function

A window identifier function specifies the start or end time of a window, or the window time attribute, which is used for window joins.

Table 3-30: Window identifier functions

Window identifier function	Return type	Description
TUMBLE_START(time-attr, size-interval)	TIMESTAMP	Returns the start time (the boundary value is included) of a window. For example, if the time period of a window is [00:10, 00:15), 00:10 is returned.
TUMBLE_END(time-attr, size-interval)	TIMESTAMP	Returns the end time (the boundary value is included) of a window. For example, if the time period of a window is [00:00, 00:15], 00:15 is returned.
TUMBLE_ROWTIME(time-attr, size-interval)	TIMESTAMP	Returns the end time (the boundary value is excluded) of a window. For example, if the time period of a window is [00:00, 00:15], 00:14:59 .999 is returned. The return value is a rowtime attribute, based on which time-based operations such as window joins can be performed.

Example

You can use the following statements to compute the number of clicks per user every one minute.

```
CREATE TABLE user_clicks(
username varchar,
click_url varchar,
ts timeStamp,
WATERMARK wk FOR ts as withOffset(ts, 2000)  -- Defines the rowtime
field in the watermark statement.
) with (
type='datahub',
...
);
```

```
CREATE TABLE tumble_output(
window_start TIMESTAMP,
window_end TIMESTAMP,
username VARCHAR,
clicks BIGINT
) with (
type='RDS'
);
INSERT INTO tumble_output
SELECT
TUMBLE_START(ts, INTERVAL '1' MINUTE),
TUMBLE_END(ts, INTERVAL '1' MINUTE),
username,
COUNT(click_url)
FROM window_input
GROUP BY TUMBLE(ts, INTERVAL '1' MINUTE), username
```

Table 3-31: Input example

username (VARCHAR)	click_url (VARCHAR)	ts (TIMESTAMP)
Jark	*http://taobao.com/xxx*	2017-10-10 10:00:00.0
Jark	*http://taobao.com/xxx*	2017-10-10 10:00:10.0
Jark	*http://taobao.com/xxx*	2017-10-10 10:00:49.0
Jark	*http://taobao.com/xxx*	2017-10-10 10:01:05.0
Jark	*http://taobao.com/xxx*	2017-10-10 10:01:58.0
Timo	*http://taobao.com/xxx*	2017-10-10 10:02:10.0

Table 3-32: Output example

window_start (TIMESTAMP)	window_end (TIMESTAMP)	username (VARCHAR)	clicks (BIGINT)
2017-10-10 10:00:00 .0	2017-10-10 10:01:00 .0	Jark	3
2017-10-10 10:01:00 .0	2017-10-10 10:02:00 .0	Jark	2
2017-10-10 10:02:00 .0	2017-10-10 10:03:00 .0	Timo	1

3.1.9.5 Over window

Over window aggregates are known from the standard SQL OVER clause. Different from a group window, an over window is generated for each element, and includes a set of adjacent elements. One element in a stream is assigned to multiple

windows. The element that triggers computing of a window determines the last row of the window.

In a data stream that applies over windows, an over window is generated for each element and an aggregate is computed for each over window. Specifically, Realtime Compute stores only one copy of streaming data, and creates an over window for each element. It computes an aggregate for each over window by using the same data copy. Each time the computing is complete, data that is no longer used is deleted from the data copy.

Syntax

```
SELECT
    agg1(col1) OVER (definition1) AS colName,
    ...
    aggN(colN) OVER (definition1) AS colNameN
FROM Tab1
```

Note:

- **OVER (definition1) in the statement must be the same.**
- **The alias specified by AS can be queried through an outer SQL statement.**

Type

In Flink SQL, the over window definition follows standard SQL syntax. Over windows are classified into the following two types based on the type of interval each over window uses:

- **Over windows that use a row-count interval: Each row of elements is treated as a new computed row. That is, a new window is generated for each row.**
- **Over windows that use a time internal: All rows of elements with the same timestamp value are treated as one computed row and are assigned to the same window.**

Supported time attributes

Over window type	Processing time	Event time
Over window that uses a row-count interval	Yes	Yes
Over window that uses a time interval	Yes	Yes

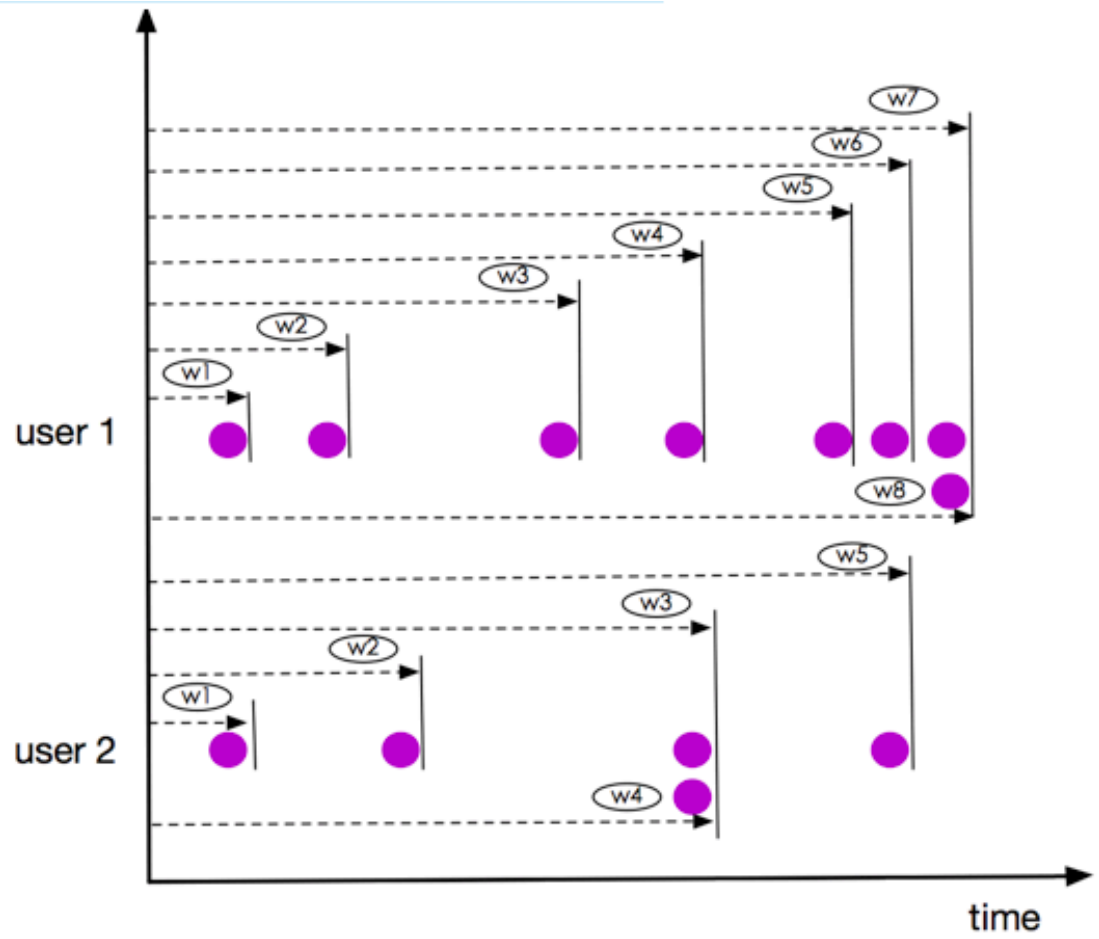
- **Over windows that use a row-count interval: The window size is determined by the number of rows of elements.**
- **Over windows that use a time interval: The window size is determined by a time range.**

Over windows that use a row-count interval

- **Description**

  In over windows that use a row-count interval, each element is assigned to a window and triggers computing. Over windows that use a row-count interval have two types: unbounded and bounded.

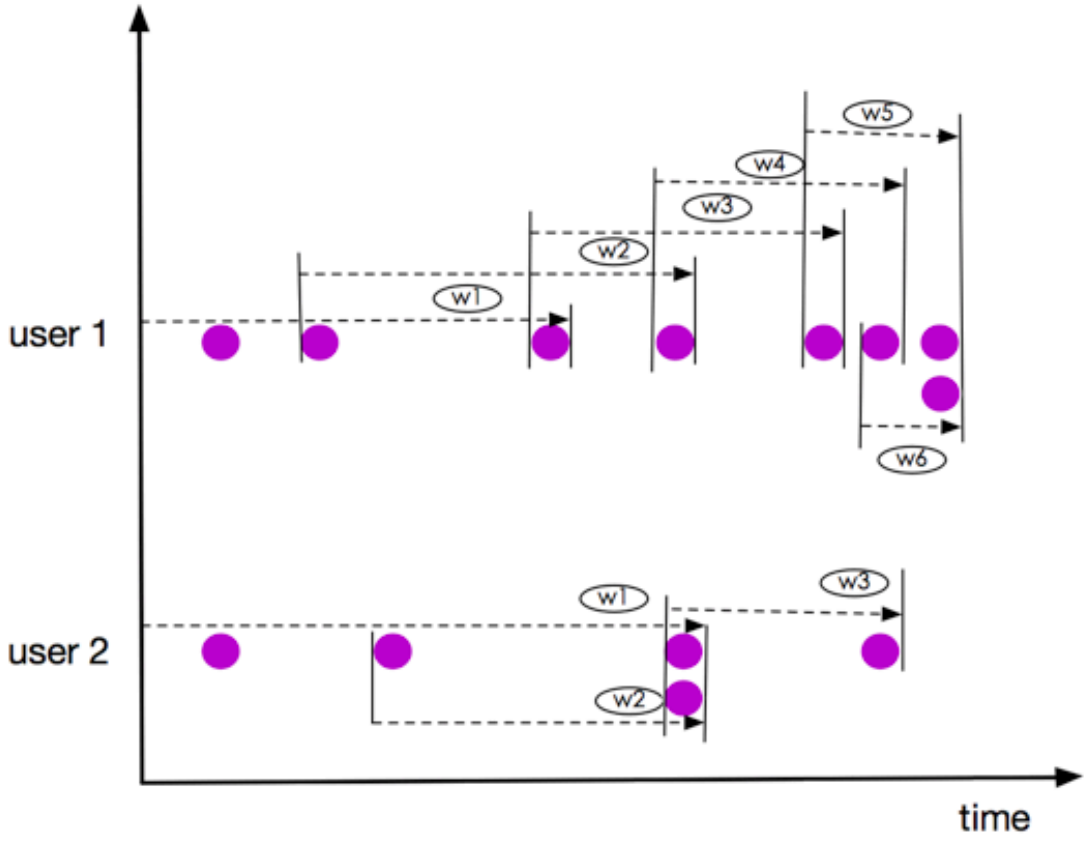
  The following figure shows unbounded over windows that use a row-count interval.



Note:
As shown in the preceding figure, elements in windows w7 and w8 of user 1 arrive at the same time, and so do elements in windows w3 and w4 of user 2.

However, the elements are assigned to different windows. In this regard, over windows that use a row-count interval are different from over windows that use a time interval.

The following figure shows bounded over windows that use a row-count interval , in which each window has three elements (first two elements have been assigned to the preceding window).



Note:
As shown in the preceding figure, elements in windows w5 and w6 of user 1 arrive at the same time, and so do elements in windows w2 and w3 of user 2. However, the elements are assigned to different windows. In this regard, over windows that use a row-count interval are different from over windows that use a time interval.

- **Syntax**

```
SELECT
    agg1(col1) OVER(
     [PARTITION BY (value_expression1,..., value_expressionN)]
     ORDER BY timeCol
```

```
     ROWS
     BETWEEN (UNBOUNDED | rowCount) PRECEDING AND CURRENT ROW) AS
colName, ...
FROM Tab1
```

- **value_expression: specifies the value expression used for partitioning.**
- **timeCol: specifies the time field used for sorting elements.**
- **rowCount: specifies the number of rows that precede the current row and are included in the window.**

- **Example**

  An example of over windows that use a row-count interval is described as follows . Assume a product shelving table, which lists the IDs, types, shelving time, and prices of products. You need to compute the highest price among three similar products before the current product reaches shelves.

  Input example

Item ID	Item type	Launch time	Price
Item 001	Electronic	2017-11-11 10:01:00	20
Item 002	Electronic	2017-11-11 10:02:00	50
Item 003	Electronic	2017-11-11 10:03:00	30
Item 004	Electronic	2017-11-11 10:03:00	60
Item 005	Electronic	2017-11-11 10:05:00	40
Item 006	Electronic	2017-11-11 10:06:00	20
Item 007	Electronic	2017-11-11 10:07:00	70
Item 008	Clothes	2017-11-11 10:08:00	20

  Sample code

```
CREATE TABLE tmall_item(
   itemID VARCHAR,
```

```
   itemType VARCHAR,
   onSellTime TIMESTAMP,
   price DOUBLE,
   WATERMARK onSellTime FOR onSellTime as withOffset(onSellTime, 0)
)
WITH (
  type = 'sls',
   ...
) ;

SELECT
    itemID,
    itemType,
    onSellTime,
    price,
    MAX(price) OVER (
        PARTITION BY itemType
        ORDER BY onSellTime
        ROWS BETWEEN 2 preceding AND CURRENT ROW) AS maxPrice
  FROM tmall_item
```

Output example

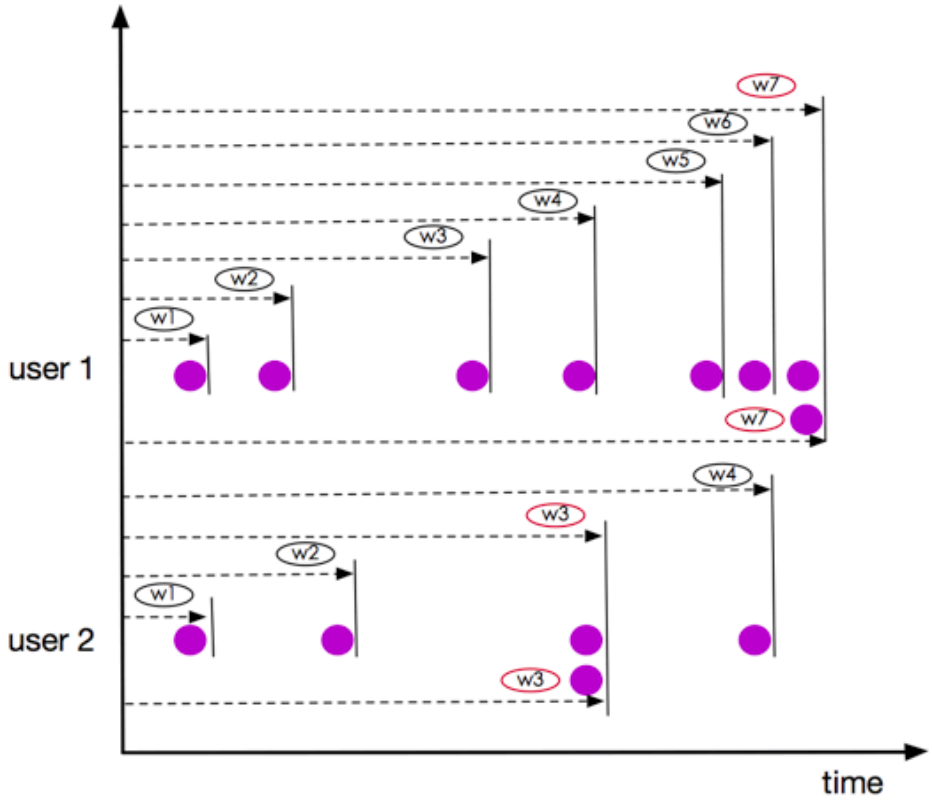
Item ID	Item type	Launch time	Price	Max. Price
Item 001	Electronic	2017-11-11 10:01:00	20	20
Item 002	Electronic	2017-11-11 10:02:00	50	50
Item 003	Electronic	2017-11-11 10:03:00	30	50
Item 004	Electronic	2017-11-11 10:03:00	60	60
Item 005	Electronic	2017-11-11 10:05:00	40	60
Item 006	Electronic	2017-11-11 10:06:00	20	60
Item 007	Electronic	2017-11-11 10:07:00	70	70
Item 008	Clothes	2017-11-11 10:08:00	20	20

Over windows that use a time interval

- **Description**

  In over windows that use a time interval, all elements with the same timestamp are assigned to a window and trigger computing. Over windows that use a time interval have two types: unbounded and bounded.

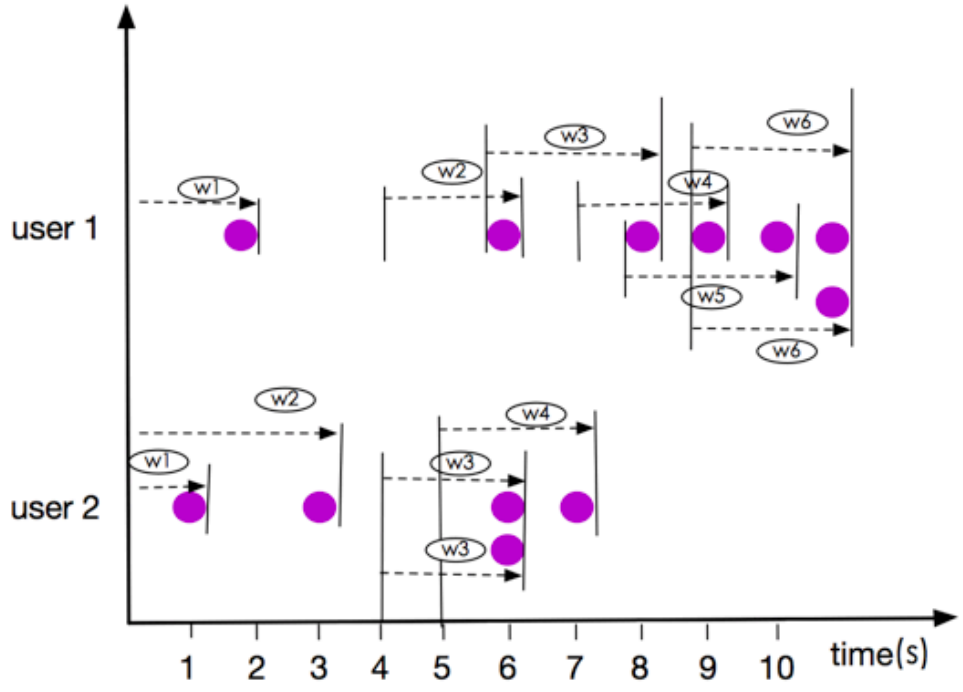
  The following figure shows unbounded over windows that use a time interval.



Note:
As shown in the preceding figure, elements in the w7 windows of user 1 arrive at the same time, and so do elements in the w3 windows of user 2. Elements with the same timestamp are assigned to the same window. In this regard, over

windows that use a time interval are different from over windows that use a row-count interval.

The following figure shows bounded over windows that use a time interval, in which a 3-second window has an interval of 2 seconds.



Note:
As shown in the preceding figure, elements in the w6 windows of user 1 arrive at the same time, and so do elements in the w3 windows of user 2. Elements with the same timestamps are assigned to the same window. In this regard, over windows that use a time interval are different from over windows that use a row-count interval.

- **Syntax**

```
SELECT
    agg1(col1) OVER(
     [PARTITION BY (value_expression1,..., value_expressionN)]
     ORDER BY timeCol
     RANGE
     BETWEEN (UNBOUNDED | timeInterval) PRECEDING AND CURRENT ROW)
AS colName,
...
FROM Tab1
```

- value_expression: specifies the value expression used for partitioning.
- timeCol: specifies the time field used for sorting elements.
- timeInterval: specifies the time interval between the time of the current row and that of the element row that you trace backwards to.

- Example

  An example of over windows that use a time interval is described as follows . Assume a product shelving table, which lists the IDs, types, shelving time, and prices of products. You need to compute the highest price among similar products that reach shelves 2 minutes earlier than the current product.

  Input example

Item ID	Item type	Launch time	Price
Item 001	Electronic	2017-11-11 10:01:00	20
Item 002	Electronic	2017-11-11 10:02:00	50
Item 003	Electronic	2017-11-11 10:03:00	30
Item 004	Electronic	2017-11-11 10:03:00	60
Item 005	Electronic	2017-11-11 10:05:00	40
Item 006	Electronic	2017-11-11 10:06:00	20
Item 007	Electronic	2017-11-11 10:07:00	70
Item 008	Clothes	2017-11-11 10:08:00	20

  Sample code

```
CREATE TABLE tmall_item(
   itemID VARCHAR,
   itemType VARCHAR,
   onSellTime TIMESTAMP,
   price DOUBLE,
   WATERMARK onSellTime FOR onSellTime as withOffset(onSellTime, 0)
```

```
)
WITH (
  type = 'sls',
   ...
) ;

SELECT
    itemID,
    itemType,
    onSellTime,
    price,
    MAX(price) OVER (
        PARTITION BY itemType
        ORDER BY onSellTime
        RANGE BETWEEN INTERVAL '2' MINUTE preceding AND CURRENT ROW
) AS maxPrice
  FROM tmall_item
```

Output example

Item ID	Item type	Launch time	Price	Max. Price
Item 001	Electronic	2017-11-11 10:01:00	20	20
Item 002	Electronic	2017-11-11 10:02:00	50	50
Item 003	Electronic	2017-11-11 10:03:00	30	50
Item 004	Electronic	2017-11-11 10:03:00	60	60
Item 005	Electronic	2017-11-11 10:05:00	40	60
Item 006	Electronic	2017-11-11 10:06:00	20	40
Item 007	Electronic	2017-11-11 10:07:00	70	70
Item 008	Clothes	2017-11-11 10:08:00	20	20

3.1.10 Logical operations

3.1.10.1 =

Syntax

```
A = B
```

Input parameters

Parameter	Data type
A	INT
B	INT

Description

Returns TRUE if A is equal to B, and returns FALSE in other cases.

Example

- **Input example**

int1 (INT)	int2 (INT)	int3 (INT)
97	65	65

- **Sample code**

```
SELECT int1 as aa
FROM T1
WHERE int3 = int2;
```

- **Output example**

aa (INT)
97

3.1.10.2 >

Syntax

```
A > B
```

Input parameters

Parameter	Data type
A	INT

Parameter	Data type
B	INT

Description

Returns TRUE if A is greater than B, and returns FALSE in other cases.

Example

- **Input example**

int1 (INT)	int2 (INT)	int3 (INT)
97	65	100

- **Sample code**

```
SELECT int1 as aa
FROM T1
WHERE int3 > int2;
```

- **Output example**

aa (INT)
97

3.1.10.3 >=

Syntax

```
A >= B
```

Input parameters

Parameter	Data type
A	INT
B	INT

Description

Returns TRUE if A is greater than or equal to B, and returns FALSE in other cases.

Example

- **Input example**

int1 (INT)	int2 (INT)	int3 (INT)
97	65	65

int1 (INT)	int2 (INT)	int3 (INT)
9	6	61

- **Sample code**

```
SELECT int1 as aa
FROM T1
WHERE int3 >= int2;
```

- **Output example**

aa (INT)
97
9

3.1.10.4 <

Syntax

```
A < B
```

Input parameters

Parameter	Data type
A	INT
B	INT

Description

Returns TRUE if A is smaller than B, and returns FALSE in other cases.

Example

- **Input example**

int1 (INT)	int2 (INT)	int3 (INT)
97	66	65
9	6	5

- **Sample code**

```
SELECT int1 as aa
FROM T1
```

```
WHERE int3 < int2;
```

- **Output example**

aa (INT)
97
9

3.1.10.5 <=

Syntax

```
A <= B
```

Input parameters

Parameter	Data type
A	INT
B	INT

Description

Returns TRUE if A is smaller than or equal to B, and returns FALSE in other cases.

Example

- **Input example**

int1 (INT)	int2 (INT)	int3 (INT)
97	66	65
9	6	5

- **Sample code**

```
SELECT int1 as aa
FROM T1
WHERE int3 <= int2;
```

- **Output example**

aa (INT)
97
9

3.1.10.6 <>

Syntax

```
A <> B
```

Input parameters

Parameter	Data type
A	INT
B	INT

Description

Returns TRUE if A is not equal to B, and returns FALSE in other cases.

Example

- **Input example**

int1 (INT)	int2 (INT)	int3 (INT)
97	66	6

- **Sample code**

```
SELECT int1 as aa
FROM T1
WHERE int3 <> int2;
```

- **Output example**

aa (INT)
97

3.1.10.7 AND

Syntax

```
A AND B
```

Argument: Both A and B are of the BOOLEAN type.

Description

TRUE is returned if both A and B are TRUE. Otherwise, FALSE is returned.

Sample code

Table 3-33: Input example

int1 (INT)	int2 (INT)	int3 (INT)
255	97	65

Sample code

```
SELECT int2 as aa
FROM T1
WHERE int1 = 255 AND int3 = 65;
```

Table 3-34: Output example

aa (int)
97

3.1.10.8 BETWEEN AND

Syntax

```
A BETWEEN B AND C
```

Arguments: A, B, and C are values of the DOUBLE, BIGINT, INT, VARCHAR, DATE, TIMESTAMP, or TIME type.

Description

Use the BETWEEN operator to select a value that is between the two given argument values.

Example 1

Table 3-35: Input example

int1 (INT)	int2 (INT)	int3 (INT)
90	80	100
11	10	7

Sample code

```
SELECT int1 as aa
FROM T1
```

```
WHERE int1 BETWEEN int2 AND int3;
```

Table 3-36: Output example

aa(int)
90

Example 2

Table 3-37: Input example

var1 (varchar)	var1 (varchar)	var1 (varchar)
b	a	c

Sample code

```
SELECT var1 as aa
FROM T1
WHERE var1  BETWEEN var2 AND var3;
```

Table 3-38: Output example

aa (varchar)
b

Example 3

Table 3-39: Input example

TIMESTAMP1 (TIMESTAMP)	TIMESTAMP2 (TIMESTAMP)	TIMESTAMP3 (TIMESTAMP)
1969-07-20 20:17:30	1969-07-20 20:17:20	1969-07-20 20:17:45

Sample code

```
SELECT TIMESTAMP1 as aa
FROM T1
WHERE TIMESTAMP1  BETWEEN TIMESTAMP2 AND TIMESTAMP3;
```

Table 3-40: Output example

aa (TIMESTAMP)
1969-07-20 20:17:30

3.1.10.9 IS NOT FALSE

Syntax

```
A IS NOT FALSE
```

Argument: A of the BOOLEAN type

Description

TRUE is returned if A is true. FALSE is returned if A is false.

Examples

Table 3-41: Input example

int1(INT)	int2(INT)
255	97

Sample code

```
SELECT int2 as aa
FROM T1
WHERE int1=255 IS NOT FALSE;
```

Table 3-42: Output example

aa(int)
97

3.1.10.10 IS NOT NULL

Syntax

```
A IS NOT NULL
```

Arguments: A of the INT type

Description

TRUE is returned if A is null. Otherwise, FALSE is returned.

Examples

Table 3-43: Input example

int1(INT)	int2(VARCHAR)
97	null
9	ww123

Note:
Here, null indicates empty, rather than a null string.

Sample code

```
SELECT int1 as aa
FROM T1
WHERE int2 IS NOT NULL;
```

Table 3-44: Output example

aa(int)
9

3.1.10.11 IS NOT TRUE

Syntax

```
A IS NOT TRUE
```

Argument: A specifies a condition of the BOOLEAN type.

Description

FALSE is returned if the condition is TRUE. TRUE is returned if the condition is FALSE.

Examples

Table 3-45: Input example

int1 (INT)	int2 (INT)
255	97

Sample code

```
SELECT int2 as aa
```

```
FROM T1
WHERE int1 = 25 IS NOT TRUE;
```

Table 3-46: Output example

aa (int)
97

3.1.10.12 IS NOT UNKNOWN

Syntax

```
A IS NOT UNKNOWN
```

Argument: A is of the BOOLEAN type.

Description

A is a logical comparison expression, such as 6 < 8.

The value of A is TRUE or FALSE if a logical comparison between two numeric values is performed successfully. If a numeric value is compared with a non-numeric value, the logical comparison fails, and the value of A is neither TRUE nor FALSE. IS NOT UNKNOWN is used to check for such failures. It returns FALSE if the value of A is neither TRUE nor FALSE and returns TRUE if the value of A is TRUE or FALSE.

Examples

Table 3-47: Input example

int1 (INT)	int2 (INT)
255	97

Sample code 1

```
SELECT int2 as aa
FROM T1
WHERE int1 = 25 IS NOT UNKNOWN;
```

Table 3-48: Output example 1

aa (int)
97

Sample code 2

```
SELECT int2 as aa
FROM T1
WHERE int1 < null IS NOT UNKNOWN;
```

Table 3-49: Output example 2

aa (int)
Null

3.1.10.13 IS NULL

Syntax

```
value IS NULL
```

Argument: value specifies a value of any type.

Description

TRUE is returned if A is null. Otherwise, FALSE is returned.

Examples

Table 3-50: Input example

int1 (INT)	int2 (VARCHAR)
97	null
9	www

Note:
In this case, null indicates empty, rather than a null string.

Sample code

```
SELECT int1 as aa
FROM T1
WHERE int2 IS NULL;
```

Table 3-51: Output example

aa (int)
97

3.1.10.14 IS TRUE

Syntax

```
A IS TRUE
```

Argument: A of the BOOLEAN type

Description

TRUE is returned if A is TRUE. FALSE is returned if A is FALSE.

Examples

Table 3-52: Input example

int1(INT)	int2(INT)
255	97

Sample code

```
SELECT int2 as aa
FROM T1
WHERE int1=255 IS TRUE;
```

Table 3-53: Output example

aa(int)
97

3.1.10.15 IS UNKNOWN

Syntax

```
A IS UNKNOWN
```

Argument: A of the BOOLEAN type

Description

A is a logical comparison expression, such as 6 <> 8.

The value of A is TRUE or FALSE if a logical comparison between two numeric values is performed successfully. If a numeric value is compared with a non-numeric value, the logical comparison fails, and the value of A is neither TRUE nor FALSE. IS UNKNOWN is used to check for such failures. It returns TRUE if the

value of A is neither TRUE nor FALSE and returns FALSE if the value of A is TRUE or FALSE.

Examples

Table 3-54: Input example

int1(INT)	int2(INT)
255	97

Sample code 1

```
SELECT int2 as aa
FROM T1
WHERE int1=25 IS UNKNOWN;
```

Table 3-55: Output example 1

aa(int)
Null

Sample code 2

```
SELECT int2 as aa
FROM T1
WHERE int1 > null IS UNKNOWN;
```

Table 3-56: Output example 2

aa(int)
97

3.1.10.16 LIKE

Syntax

```
A LIKE B
```

Arguments: A and B of the VARCHAR type

Description

TRUE is returned if A matches B. Otherwise, FALSE is returned.

Note:

The percent sign (%) can be used as a wildcard.

Examples

Table 3-57: Sample code

int1(INT)	VARCHAR2(VARCHAR)	VARCHAR3(VARCHAR)
90	ss97	97ss
99	ss10	7ho7

Sample code 1

```
SELECT int1 as aa
FROM T1
WHERE VARCHAR2 LIKE 'ss%';
```

Table 3-58: Output example 1

aa(int)
90
9

Sample code 2

```
SELECT int1 as aa
FROM T1
WHERE VARCHAR3 LIKE '%ss';
```

Table 3-59: Output example 2

aa(int)
90

Sample code 3

```
SELECT int1 as aa
FROM T1
WHERE VARCHAR3 LIKE '%ho%';
```

Table 3-60: Output example 3

aa(int)
99

3.1.10.17 NOT

Syntax

```
NOT A
```

Argument: A of the BOOLEAN type

Description

FALSE is returned if A is TRUE. TRUE is returned if A is FALSE.

Examples

Table 3-61: Input example

int2(INT)	int3(INT)
97	65

Sample code

```
SELECT int2 as aa
FROM T1
WHERE  NOT int3=62;
```

Table 3-62: Output example

aa(int)
97

3.1.10.18 NOT BETWEEN AND

Syntax

```
A NOT BETWEEN B AND C
```

Arguments: A, B, and C can be of the DOUBLE, BIGINT, INT, VARCHAR, DATE, TIMESTAMP, or TIME types.

Description

The NOT BETWEEN operator is used to select a value that is not between the two given argument values.

Example 1

Table 3-63: Input example

int1 (INT)	int2 (INT)	int3 (INT)
90	97	80
11	10	7

Sample code

```
SELECT int1 as aa
FROM T1
WHERE int1 NOT BETWEEN int2 AND int3;
```

Table 3-64: Output example

aa (int)
11

Example 2

Table 3-65: Input example

var1 (varchar)	var1 (varchar)	var1 (varchar)
d	a	c

Sample code

```
SELECT var1 as aa
FROM T1
WHERE var1 NOT BETWEEN var2 AND var3;
```

Table 3-66: Output example

aa (varchar)
d

Example 3

Table 3-67: Input example

TIMESTAMP1 (TIMESTAMP)	TIMESTAMP2 (TIMESTAMP)	TIMESTAMP3 (TIMESTAMP)
1969-07-20 20:17:30	1969-07-20 20:17:40	1969-07-20 20:17:45

Sample code

```
SELECT TIMESTAMP1 as aa
FROM T1
WHERE TIMESTAMP1 NOT BETWEEN TIMESTAMP2 AND TIMESTAMP3;
```

Table 3-68: Output example

aa (TIMESTAMP)
1969-07-20 20:17:30

3.1.10.19 OR

Syntax

```
 A OR B
```

Arguments: Both A and B are of the BOOLEAN type

Description

TRUE is returned if both A and B are TRUE. Otherwise, FALSE is returned.

Examples

Table 3-69: Input example

int1 (INT)	int2 (INT)	int3 (INT)
255	97	65

Sample code

```
SELECT int2 as aa
FROM T1
```

```
WHERE int1 = 255 OR int3 = 65;
```

Table 3-70: Output example

aa (int)
97

3.1.10.20 IN

Syntax

```
SELECT column_name(s)
  FROM table_name
 WHERE column_name IN (value1,value2,...)
```

Arguments: Both value1 and value2 must be constants.

Description

Query records that match the arguments.

Examples

Table 3-71: Input example

id (INT)	LastName (Varchar)
1	Adams
2	Bush
3	Carter

Sample code

```
SELECT * FROM T1
 WHERE LastName IN ('Adams','Carter')
```

Table 3-72: Output example

id (INT)	LastName (Varchar)
1	Adams
3	Carter

3.1.10.21 NOT IN

Syntax

```
SELECT column_name(s)
  FROM table_name
 WHERE column_name NOT IN (value1,value2,...)
```

Input parameters: value1 and value2, which must be constants

Description

Searches for records that do not match the values in the arguments.

Example

Table 3-73: Input example

id (INT)	LastName (VARCHAR)
1	Adams
2	Bush
3	Carter

Sample code

```
SELECT * FROM T1
 WHERE LastName NOT IN ('Adams','Carter')
```

Table 3-74: Output example

id (INT)	LastName (VARCHAR)
2	Bush

3.1.10.22 IS DISTINCT FROM

Syntax

```
A IS DISTINCT FROM B
```

Arguments: A and B of generic types

Description

Check whether two arguments are equal. TRUE is returned if their data types or values are different. FALSE is returned if their data types and values are the same. If either or both arguments are null, they are considered to be the same.

Examples

Table 3-75: Input example

A(Int)	B(Varchar)
97	97
null	sss
null	null

Sample code

```
SELECT
 A IS DISTINCT FROM B as `result`
FROM T1
```

Table 3-76: Output example

result(BOOLEAN)
true
true
false

3.1.10.23 IS NOT DISTINCT FROM

Syntax

```
A IS NOT DISTINCT FROM B
```

Arguments: A and B of generic types

Description

Check whether two arguments are equal. FALSE is returned if their data types or values are different. TRUE is returned if their data types and values are the same. If either or both arguments are null, they are considered to be the same.

Examples

Table 3-77: Input example

A(Int)	B(Varchar)
97	97
null	sss

A(Int)	B(Varchar)
null	null

Sample code

```
SELECT
 A IS NOT DISTINCT FROM B as `result`
FROM T1
```

Table 3-78: Output example

result(BOOLEAN)
false
false
true

3.1.11 Built-in functions

3.1.11.1 String functions

3.1.11.1.1 Overview

CHAR_LENGTH

- **Syntax:** `CHAR_LENGTH(A)`
- **Input parameter: The A parameter is of the VARCHAR data type.**
- **Description: Returns the number of characters in a string.**

Example

Table 3-79: Input example

var1 (VARCHAR)
ss
231ee

Sample code

```
SELECT  CHAR_LENGTH(var1) as aa
```

```
FROM T1;
```

Table 3-80: Output example

aa (INT)
2
5

ASCII2STR

- **Syntax:** `string ascii2str(int ascii)`
- **Description: Converts a number into an ASCII character. If any argument is NULL , the return value is NULL.**
- **Input parameter: The value of the ascii parameter ranges from 1 to 127. If the value fall out of the range, an exception occurs.**
- **Example:**

```
ascii2str(9) = '\t'
ascii2str(65) = 'A'
```

CONCAT

- **Syntax:** `string concat(string a, string b, ...)`
- **Description: Concatenates all input strings and returns a new string. If any argument is NULL, the return value is NULL.**
- **Example:**

```
concat('abc', 'def', 'gh') = 'abcdefgh'
concat('abc', NULL) = NULL
```

CONCAT_WS

- **Syntax:** `string concat_ws(string separator, string a, string b, ...)`
- **Description: Concatenates all input strings. Different from the CONCAT function , this function adds a separator between two concatenated strings. If any argument is NULL, the return value is NULL.**
- **Example:**

```
concat_ws(':', 'abc', 'def', 'gh') = 'abc:def:gh'
concat(':', 'abc', NULL) = NULL
```

SUBSTR

- **Syntax**

```
string substr(string a, int start)
string substr(string a, int start, int len)
```

- **Description: Extracts a substring of the specified length from a string, starting from the specified position. If the length is not specified, a substring is extracted from the specified position to the end of the string. The value of the start parameter begins from 1. If the value is negative, a substring is extracted from the end of the string. If any argument is NULL, the return value is NULL.**
- **Example:**

```
substr('galaxy_sql', 5) = 'xy_sql'
substr('galaxy_sql', -5) = 'y_sql'
substr('galaxy_sql', 5, 2) = 'xy'
```

LOWER

- **Syntax**

```
string lower(string a)
string lcase(string a)
```

- **Description: Converts uppercase letters in a string into lowercase letters. If any argument is NULL, the return value is NULL.**
- **Example:** `lower('fOoBaR') = 'foobar'`

UPPER

- **Syntax**

```
string upper(string a)
string ucase(string a)
```

- **Description: Converts lowercase letters in a string into uppercase letters. If any argument is NULL, the return value is NULL.**
- **Example:** `upper('fOoBaR') = 'FOOBAR'`

TRIM

- **Syntax:** `string trim(string a)`
- **Description: Removes the leading and trailing spaces of a string. If any argument is NULL, the return value is NULL.**

- **Example:** `trim(' foobar\t ') = 'foobar\t'`

LTRIM

- **Syntax:** `string ltrim(string a)`
- **Description: Removes the leading spaces of a string. If any argument is NULL, the return value is NULL.**
- **Example:** `ltrim(' foobar ') = 'foobar '`

RTRIM

- **Syntax:** `string rtrim(string a)`
- **Description: Removes the trailing spaces of a string. If any argument is NULL, the return value is NULL.**
- **Example:** `rtrim(' foobar ') = ' foobar'`

LPAD

- **Syntax:** `string lpad(string str, int len, string pad)`
- **Description: Left-pads a string (str) with another string (pad), to the specified length. If any argument is NULL, the return value is NULL.**
- **Example:**

```
lpad('hi', 5, '??') = '??? hi'
lpad('hi', 1, '??') = 'h'
lpad('---', 10, 'abc') = 'abcabca---'
```

RPAD

- **Syntax:** `string rpad(string str, int len, string pad)`
- **Description: Right-pads a string (str) with another string (pad), to the specified length. If any argument is NULL, the return value is NULL.**
- **Example:**

```
rpad('hi', 5, '??') = 'hi???'
rpad('hi', 1, '??') = 'h'
rpad('---', 10, 'abc') = '---abcabca'
```

LENGTH

- **Syntax:** `int length(string str)`
- **Description: Returns the length of a string. If any argument is NULL, the return value is NULL.**

- **Example:**

```
length('hi') = 2
length('I') = 1
length(NULL) = NULL
```

REPEAT

- **Syntax:** `string repeat(string str, int n)`
- **Description: Returns a new string that repeats the specified string for the specified number of times. If any argument is NULL, the return value is NULL.**
- **Example:** `repeat('hi', 2) = 'hihi'`

REVERSE

- **Syntax:** `string reverse(string str)`
- **Description: Reverses a string. If any argument is NULL, the return value is NULL .**
- **Example:** `reverse('abc') = 'cba'`

SPLIT_EX

- **Syntax:** `string split_ex(string str, string sep, int index)`
- **Description: Uses a separator to split a string into several segments and returns the segment identified by the index parameter. If the segment identified by the index parameter does not exist, NULL is returned. The value of the index parameter starts from 0. If any argument is NULL, the return value is NULL.**
- **Example:**

```
split_ex('1.2.3.4', '.', 1) = '2'
split_ex('1.2.3.4', '.', -1) = NULL
split_ex('1.2.3.4', '.', 4) = NULL
```

REGEXP_REPLACE

- **Syntax:** `string regexp_replace(string str, string pattern, string replacement)`
- **Description: Returns a string from the str string with its substrings that match the pattern regular expression replaced with the replacement string.**
- **Note: Backslashes (\) are used in a regular expression to escape special characters. If any argument is NULL, the return value is NULL.**

- **Example:**

```
regexp_replace('100-200', '(\\d+)', 'num') = 'num-num'
regexp_replace('2014-03-13', '-', '') = '20140313'
regexp_replace('foobar', 'oo|ar', '') = 'fb'
```

REGEXP_EXTRACT

- **Syntax:** `string regexp_extract(string str, string pattern, int index)`
- **Description: Returns a substring of the str string that matches the pattern regular expression. Multiple substrings may all match the pattern. The index parameter identifies the substring to be returned. The value of the index parameter starts from 1.**
- **Note: A backslash (\) is used in a regular expression to escape special characters. If any argument is NULL, the return value is NULL.**
- **Example:**

```
regexp_extract('foothebar', 'foo(. *?)( bar)', 2) = 'bar'
regexp_extract('100-200', '(\\d+)-(\\d+)', 1) = '100'
```

INSTR

- **Syntax:** `int instr(string str, string substr)`
- **Description: Returns the position where a substring first appears in a string. The return value starts from 1. If the specified substring does not exist in the string, 0 is returned. If any argument is NULL, the return value is NULL.**
- **Example:**

```
instr('foobar', 'foo') = 1
instr('foobar', 'abc') = 0
```

KEYVALUE

- **Syntax:** `string keyvalue(string str, string split1, string split2, string key_name)`
- **Description: Parses key-value pairs from the specified string and returns the value that is mapped to the specified key. If the key does not exist, the return value is NULL. If any argument is NULL, the return value is NULL.**
- **Example:**

```
keyvalue('k1=v1;k2=v2', ';', '=', 'k2') = 'v2'
keyvalue('k1:v1,k2:v2', ',', ':', 'k3') = NULL
```

HASH

- **Syntax:** `int hash(string str)`
- **Description: Returns the absolute value of the integer returned by the hashCode () function that takes the specified string as an input. If any argument is NULL, the return value is NULL.**

MD5

- **Syntax:** `string md5(string str)`
- **Description: Returns the MD5 value of a string. If any argument is NULL or an empty string, the return value is an empty string.**

3.1.11.1.2 CHAR_LENGTH

Syntax

```
CHAR_LENGTH(A)
```

Input parameter

A: VARCHAR data type

Description

Returns the number of characters in a string.

Example

Table 3-81: Input example

var1 (VARCHAR)
ss
231ee

Sample code

```
SELECT  CHAR_LENGTH(var1) as aa
FROM T1;
```

Table 3-82: Output example

aa (INT)
2

aa (INT)
5

3.1.11.1.3 CHR

Syntax

```
VARCHAR CHR(INT ascii)
```

Arguments

ascii: specifies an integer of the INT type, ranging from 0 to 255. If the argument falls out of this range, null is returned.

Description

Convert ASCII codes into characters.

Examples

Table 3-83: Input example

int1(INT)	int2(INT)	int3 (INT)
255	97	65

Sample code

```
SELECT CHR(int1) as var1, CHR(int2) as var2, CHR(int3) as var3
FROM T1
```

Table 3-84: Output example

var1(VARCHAR)	var2(VARCHAR)	var3(VARCHAR)
ÿ	a	A

3.1.11.1.4 CONCAT

Syntax

```
VARCHAR concat(VARCHAR var1, VARCHAR var2, ...)
```

Arguments

- **var1: specifies a common string of the VARCHAR type.**
- **var2: specifies a common string of the VARCHAR type.**

Description

Concatenate two or more strings into a single string. If any argument is NULL, the argument is skipped.

Examples

Table 3-85: Input example

var1 (VARCHAR)	var2 (VARCHAR)	var3 (VARCHAR)
Hello	My	World
Hello	null	World
null	null	World
null	null	null

Sample code

```
SELECT CONCAT(var1, var2, var3) as var
FROM T1
```

Table 3-86: Output example

var (VARCHAR)
HelloMyWorld
HelloWorld
World
""

3.1.11.1.5 CONCAT_WS

Syntax

```
VARCHAR CONCAT_WS(VARCHAR separator, VARCHAR var1, VARCHAR var2, ...)
```

Arguments

- **separator: specifies a separator of the VARCHAR type.**
- **var1: specifies a value of the VARCHAR type.**
- **var2: specifies a value of the VARCHAR type.**

Description

Concatenate each argument's value with a separator to a new string and return the new string, whose length and type depend on the input values.

Note:

- **If the separator value is null, it is treated as an empty string for concatenating the argument's values.**
- **If any argument is null, the argument is skipped during concatenation.**

Examples

Table 3-87: Input example

sep (VARCHAR)	str1 (VARCHAR)	str2 (VARCHAR)	str3 (VARCHAR)
|	Jack	Harry	John
null	Jack	Harry	John
|	null	Harry	John
|	Jack	null	null

Sample code

```
SELECT CONCAT_WS(sep, str1, str2, str3) as var
FROM T1
```

Table 3-88: Output example

var (VARCHAR)
Jack|Harry|John
JackHarryJohn
Harry|John
Jack

3.1.11.1.6 FROM_BASE64

Syntax

```
BINARY FROM_BASE64(str)
```

Arguments

str: specifies a Base64 string of the VARCHAR type.

Description

Parse a Base64 string into binary data.

Examples

Table 3-89: Input example

a (INT)	b (BIGINT)	c (VARCHAR)
1	1L	null

Sample code

```
SELECT
from_base64(c) as var1,from_base64('SGVsbG8gd29ybGQ=') as var2
FROM T1
```

Table 3-90: Output example

var1 (BINARY)	var2 (BINARY)
null	Byte Array: [72('H'), 101('e'), 108('l'), 108('l'), 111('o'), 32(' '), 119('w'), 111('o'), 114('r'), 108('l'), 100('d')]

3.1.11.1.7 HASH_CODE

Syntax

```
INT HASH_CODE(VARCHAR str)
```

Arguments

str: VARCHAR type

Description

Return the absolute value of a string on which hashCode() has been executed.

Examples

Table 3-91: Input example

str1(VARCHAR)	str2(VARCHAR)	nullstr(VARCHAR)
k1=v1;k2=v2	k1:v1,k2:v2	null

Sample code

```
SELECT  HASH_CODE(str1) as var1, HASH_CODE(str2) as var2, HASH_CODE(
nullstr) as var3
FROM T1
```

Table 3-92: Output example

var1(VARCHAR)	var2(VARCHAR)	var3(VARCHAR)
1099348823	401392878	null

3.1.11.1.8 INITCAP

Syntax

```
 INITCAP(A)
```

Input parameter

A: VARCHAR data type

Description

Returns a string with the first letter of each word in uppercase and all other letters in lowercase.

Example

Table 3-93: Input example

var1 (VARCHAR)
aADvbn

Sample code

```
SELECT INITCAP(var1) as aa
```

```
FROM T1;
```

Table 3-94: Output example

aa (VARCHAR)
Aadvbn

3.1.11.1.9 JSON_VALUE

Syntax

```
VARCHAR JSON_VALUE(VARCHAR content, VARCHAR path)
```

Arguments

- **content: specifies a JSON object to be parsed, which is represented as a JSON string of the VARCHAR type.**
- **path: specifies a path expression of the VARCHAR type to parse the JSON objects. The following table lists the path expressions that are currently supported.**

  Table 3-95: Path expressions supported

Symbol	Feature
$	Root object
[]	Array subscript
*	Array wildcard
.	Specified objects in a parent object

Description

Extract the value of the specified path from a JSON string. If the JSON string is invalid or any argument is NULL, the return value is NULL.

Examples

Table 3-96: Input example

id (INT)	json(VARCHAR)	path(VARCHAR)
1	[10, 20, [30, 40]]	$[2][*]

id (INT)	json(VARCHAR)	path(VARCHAR)
2	{"aaa": "bbb", "ccc": {"ddd": "eee", "fff": "ggg", " +"" hhh": ["h0", "h1", "h2"]}, " iii": "jjj"}	$.ccc.hhh [*]
3	{"aaa": "bbb", "ccc": {"ddd": "eee", "fff": "ggg"," +"" hhh": ["h0", "h1", "h2"]}, " iii": "jjj"}	$.ccc.hhh [1]
4	[10, 20, [30, 40]]	NULL
5	NULL	$[2] [*]
6	“{xx]”	“$[2][*]”

Sample code

```
SELECT
    id,
    JSON_VALUE(json, path) AS value
FROM
    T1
```

Table 3-97: Output example

id (INT)	value (VARCHAR)
1	[30, 40]
2	["h0", "h1", "h2"]
3	H1
4	NULL
5	NULL
6	NULL

3.1.11.1.10 KEYVALUE

Syntax

```
VARCHAR KEYVALUE(VARCHAR str, VARCHAR split1, VARCHAR split2, VARCHAR
key_name)
```

Arguments

- **str: specifies a string of key-value pairs. This argument is of the VARCHAR type.**
- **split1: specifies a delimiter of the VARCHAR type to separate the key-value pairs.**

- **split2: specifies a delimiter of the VARCHAR type to separate the key and value in a key-value pair.**
- **key_name: specifies a key value of the VARCHAR type.**

Description

Parse the key-value pairs in a string to locate a key-value pair that matches the key-value pair delimiter and key-value delimiter. Then return the key value corresponding to the key name in the key-value pair. If the key name does not exist or an exception occurs, the return value is NULL.

Examples

Table 3-98: Input example

str (VARCHAR)	split1 (VARCHAR)	split2 (VARCHAR)	key1 (VARCHAR)
k1=v1; k2=v2	;	=	k2
null	;	|	:
k1:v1|k2:v2	null	=	:
k1:v1|k2:v2	|	=	null
k1:v1|k2:v2	|	=	:
k1:v1|k2:v2	|	=	:

Sample code

```
SELECT  KEYVALUE(str, split1, split2, key1) as result
FROM T1
```

Table 3-99: Output example

result (VARCHAR)
v2
null
null
null
null
null

3.1.11.1.11 LOWER

Syntax

```
VARCHAR LOWER(A)
```

Argument

A: specifies a value of the VARCHAR type.

Description

Convert the specified string to a string of lowercase letters.

Examples

Table 3-100: Input example

var1 (VARCHAR)
Ss
yyT

Sample code

```
SELECT LOWER(var1) as aa
FROM T1;
```

Table 3-101: Output example

aa (VARCHAR)
ss
yyt

3.1.11.1.12 LPAD

Syntax

```
VARCHAR LPAD(VARCHAR str, INT len, VARCHAR pad)
```

Arguments

- **str: specifies a source string of the VARCHAR type.**
- **len: specifies the length of a new string. This argument is of the INT type.**
- **pad: specifies a string to be repeatedly padded to the source string. This argument is of the VARCHAR type.**

Description

Left pad a source string with another string several times until the new string reaches the specified length. If any argument is NULL, the return value is NULL. If the source string is an empty string or the target length is a negative number, the return value is NULL. If the string to be padded to the source string is an empty string, there are two scenarios. A trimmed source string is returned when the specified length is equal to or less than the length of the source string. NULL is returned when the specified length is greater than the length of the source string.

Examples

Table 3-102: Input example

str (VARCHAR)	len (INT)	pad (VARCHAR)
""	-2	""
HelloWorld	15	John
John	2	C
C	4	HelloWorld
null	2	C
c	2	null
asd	2	""
""	2	s
asd	4	""
""	0	""

Sample code

```
SELECT LPAD(str, len, pad) AS result
FROM T1
```

Table 3-103: Output example

result (VARCHAR)
null
JohnJHelloWorld
Jo
HelC

result (VARCHAR)
null
null
as
ss
null
""

3.1.11.1.13 MD5

Syntax

```
VARCHAR MD5(VARCHAR str)
```

Argument

str: specifies a string of the VARCHAR type.

Description

Return the MD5 value of a string. If the argument is NULL, the return value is NULL . If the argument is an empty string, the return value is an empty string.

Examples

Table 3-104: Input example

str1 (VARCHAR)	str2 (VARCHAR)
k1 = v1; k2 = v2	null

Sample code

```
SELECT
   MD5(str1) as var1,
   MD5(str2) as var2
FROM T1
```

Table 3-105: Output example

var1 (VARCHAR)	var2 (VARCHAR)
19c17f42b4d6a90f7f9ffc2ea9bdd775	NA

3.1.11.1.14 OVERLAY

Syntax

```
VARCHAR OVERLAY ( (VARCHAR x PLACING VARCHAR y FROM INT start_position
 [ FOR INT length ]) )
```

Arguments

- **x: VARCHAR type**
- **y: VARCHAR type**
- **start_position: INT type**
- **length (optional): INT type**

Description

Replace a substring of x with y. The replacement starts from start_position and a total of length+1 characters are to be replaced.

Examples

Sample code

```
OVERLAY('abcdefg' PLACING 'hij' FROM 2 FOR 2) as result
FROM   T1
```

Table 3-106: Output example

result(VARCHAR)
ahijdefg

3.1.11.1.15 PARSE_URL

Syntax

```
VARCHAR PARSE_URL(VARCHAR urlStr, VARCHAR partToExtract [, VARCHAR key
])
```

Arguments

- **urlStr: specifies a URL string of the VARCHAR type.**
- **partToExtract: specifies a value of the VARCHAR type obtained after parsing.**
- **key: specifies an argument name of the VARCHAR type.**

Description

Parse a URL to obtain the value of partToExtract, such as QUERY. The options for partToExtract include HOST, PATH, QUERY, REF, PROTOCOL, FILE, AUTHORITY, and USERINFO.

Note:
If the partToExtract value is NULL, NULL is returned.

Examples

Table 3-107: Input example

url1(VARCHAR)	nullstr(VARCHAR)
http://facebook.com/path/p1.php?query=1	null

Sample code

```
SELECT PARSE_URL(url1, 'QUERY', 'query') as var1,
       PARSE_URL(url1, 'QUERY') as var2,
       PARSE_URL(url1, 'HOST') as var3,
       PARSE_URL(url1, 'PATH') as var4,
       PARSE_URL(url1, 'REF') as var5,
       PARSE_URL(url1, 'PROTOCOL') as var6,
       PARSE_URL(url1, 'FILE') as var7,
       PARSE_URL(url1, 'AUTHORITY') as var8,
       PARSE_URL(nullstr, 'QUERY') as var9,
       PARSE_URL(url1, 'USERINFO') as var10,
       PARSE_URL(nullstr, 'QUERY', 'query') as var11
FROM T1
```

Table 3-108: Output example

var1(VARCHAR)	var2(VARCHAR)	var3(VARCHAR)	var4(VARCHAR)	var5(VARCHAR)	var6(VARCHAR)	var7(VARCHAR)	var8(VARCHAR)	var9(VARCHAR)	var10(VARCHAR)	var11(VARCHAR)
1	query=1	facebook.com	/path/p1.php	null	http	/path/p1.php?query=1	facebook.com	null	null	null

3.1.11.1.16 POSITION

Syntax

```
INTEGER POSITION( x IN y)
```

Arguments

- **x: specifies a value of the VARCHAR type.**
- **y: specifies a value of the VARCHAR type.**

Description

Return the position of the first occurrence of string x within string y. The function is similar to LOCATE(substr,str).

Examples

Sample code

```
POSITION('in' IN 'china') as result
FROM   T1
```

Table 3-109: Output example

result (INT)
3

3.1.11.1.17 REGEXP

Syntax

```
BOOLEAN REGEXP(VARCHAR str, VARCHAR pattern)
```

Arguments

- **str: specifies a string of the VARCHAR type.**
- **pattern: specifies a pattern of the VARCHAR type.**

Description

Perform regular expression matching on a string to check whether it matches the specified pattern. If the string or pattern is empty or null, FALSE is returned.

Examples

Table 3-110: Input example

str1(VARCHAR)	pattern1 (VARCHAR)
k1=v1;k2=v2	k2*
k1:v1|k2:v2	k3
null	k3
k1:v1|k2:v2	null
k1:v1|k2:v2	(

Sample code

```
SELECT  REGEXP(str1, pattern1) as result
FROM T1
```

Table 3-111: Output example

result(BOOLEAN)
true
false
null
null
false

3.1.11.1.18 REGEXP_EXTRACT

Syntax

```
VARCHAR REGEXP_EXTRACT(VARCHAR str, VARCHAR pattern, INT index)
```

Arguments

- **str: specifies a source string of the VARCHAR type.**
- **pattern: specifies the regular expression pattern used to match the string to be extracted. This argument is of the VARCHAR type.**
- **index: specifies the index number of the substring to be extracted from the source string. This argument is of the INT type.**

 **Note:**

Specify constants in the regular expression with Java format because SQL string constants are completely compiled to Java code. For example, you can specify a digit (0-9) in the regular expression as \d, which is the same as the digit in a regular expression in Java code.

Description

Use the regular expression pattern to match and extract the indexed substring from a source string. The index starts from 1. If any argument is NULL or the regular expression is invalid, the return value is NULL.

Examples

Table 3-112: Input example

str1 (VARCHAR)	pattern1 (VARCHAR)	index1 (INT)
foothebar	foo(. *?)(bar)	2
100-200	(\d+)-(\d+)	1
null	foo(. *?)(bar)	2
foothebar	null	2
foothebar	""	2
foothebar	(	2

Sample code

```
SELECT REGEXP_EXTRACT(str1, pattern1, index1) as result
FROM T1
```

Table 3-113: Output example

result (VARCHAR)
bar
100
null
null
null
null

3.1.11.1.19 REGEXP_REPLACE

Syntax

```
VARCHAR REGEXP_REPLACE(VARCHAR str, VARCHAR pattern, VARCHAR
replacement)
```

Arguments

- **str: specifies a string of the VARCHAR type.**
- **pattern: specifies the regular expression pattern used to match the string to be replaced. This argument is of the VARCHAR type.**
- **replacement: specifies the string used to replace others. This argument is of the VARCHAR type.**

Note:
Specify constants in the regular expression with Java format because SQL string constants are completely compiled to Java code. For example, you can specify a digit (0-9) in the regular expression as \d, which is the same as the digit in a regular expression in Java code.

Description

Replace a substring that matches the regular expression pattern in a source string with a specified string, and return a new string. If any argument is NULL or the regular expression is invalid, the return value is NULL.

Examples

Table 3-114: Input example

str1 (VARCHAR)	pattern1 (VARCHAR)	replace1 (VARCHAR)
2014-03-13	-	""
null	-	""
2014-03-13	-	null
2014-03-13	""	s
2014-03-13	(	s
100-200	(\d+)	num

Sample code

```
SELECT REGEXP_REPLACE(str1, pattern1, replace1) as result
FROM T1
```

Table 3-115: Output example

result (VARCHAR)
20140313
null
null
2014-03-13
null
num-num

3.1.11.1.20 REPEAT

Syntax

```
VARCHAR REPEAT(VARCHAR str, INT n)
```

Arguments

- **str: specifies the string to be repeated. This argument is of the VARCHAR type.**
- **n: specifies the number of repetitions. This argument is of the INT type.**

Description

Return a new string consisting of N repetitions of the specified string. If any argument is NULL, the return value is NULL. If the value of n is 0 or a negative number, the return value is an empty string.

Examples

Table 3-116: Input example

str(VARCHAR)	n(INT)
J	9
Hello	2
Hello	-9
null	9

Sample code

```
SELECT  REPEAT(str,n) as var1
FROM T1
```

Table 3-117: Output example

result(VARCHAR)
JJJJJJJJ
HelloHello
“”
null

3.1.11.1.21 REVERSE

Syntax

```
VARCHAR REVERSE(VARCHAR str)
```

Arguments

str: specifies a string of the VARCHAR type.

Description

Return a string in the reverse order of the specified string. If the argument is NULL, the return value is NULL.

Examples

Table 3-118: Input example

str1(VARCHAR)	str2(VARCHAR)	str3 (VARCHAR)	str4 (VARCHAR)
iPhoneX	Alibaba	World	null

Sample code

```
SELECT  REVERSE(str1) as var1 ,REVERSE(str2) as var2,
        REVERSE(str3) as var3,REVERSE(str4) as var4
```

```
FROM T1
```

Table 3-119: Output example

var1(VARCHAR)	var2(VARCHAR)	var3(VARCHAR)	var4(VARCHAR)
XenohPi	ababilA	dlroW	null

3.1.11.1.22 RPAD

Syntax

```
VARCHAR RPAD(VARCHAR str, INT len, VARCHAR pad)
```

Arguments

- **str: specifies a source string of the VARCHAR type.**
- **len: specifies the length of a new string. This argument is of the INT type.**
- **pad: specifies a string to be repeatedly padded to the source string. This argument is of the VARCHAR type.**

Description

Right pad a string with another string several times until the new string reaches the specified length. If any argument is NULL, the return value is NULL. If the source string is an empty string or the specified length is a negative number, the return value is NULL. If the string to be padded to the source string is an empty string, there are two scenarios. A trimmed source string is returned when the specified length is equal to or less than the length of the source string. NULL is returned when the specified length is greater than the length of the source string.

Examples

Table 3-120: Input example

str (VARCHAR)	len (INT)	pad (VARCHAR)
""	-2	""
HelloWorld	15	John
John	2	C
C	4	HelloWorld
null	2	C
c	2	null

str (VARCHAR)	len (INT)	pad (VARCHAR)
asd	2	""
""	2	s
asd	4	""
""	0	""

Sample code

```
SELECT RPAD(str, len, pad) as result
FROM T1
```

Table 3-121: Output example

result (VARCHAR)
null
HelloWorldJohnJ
Jo
CHel
null
null
as
ss
null
""

3.1.11.1.23 SPLIT_INDEX

Syntax

```
VARCHAR SPLIT_INDEX(VARCHAR str, VARCHAR sep, INT index)
```

Arguments

- **str: specifies the string to be split. This argument is of the VARCHAR type.**
- **sep: specifies the separator of the VARCHAR type.**
- **index: specifies the index number of the substring to be obtained from the split string. This argument is of the INT type.**

Description

Use a separator to split a string into several substrings and return the indexed substring. If no substring is indexed, NULL is returned. The index starts from 0. If any argument is NULL, the return value is NULL.

Examples

Table 3-122: Input example

str (VARCHAR)	sep (VARCHAR)	index (INT)
Jack,John,Mary	,	2
Jack,John,Mary	,	3
Jack,John,Mary	null	0
null	,	0

Sample code

```
SELECT SPLIT_INDEX(str, sep, index) as var1
FROM T1
```

Table 3-123: Output example

var1 (VARCHAR)
Mary
null
null
null

3.1.11.1.24 STR_TO_MAP

Syntax

```
MAP STR_TO_MAP(VARCHAR text)
MAP STR_TO_MAP(VARCHAR text, VARCHAR listDelimiter, VARCHAR keyValueDe
limiter)
```

Arguments

- **text: specifies given text of the VARCHAR type.**

- **listDelimiter: specifies the delimiter used to splits the given text into key-value pairs. This argument is of the VARCHAR type. The default delimiter is a comma (,).**
- **keyValueDelimiter: specifies the delimiter used to separate the key and value in a key-value pair. This argument is of the VARCHAR type. The default delimiter is an equal sign (=).**

> **Note:**
> **The delimiters are defined by Java regular expressions. If a special character is used, it needs to be converted to an escape character.**

Description

Use listDelimiter to split the given text into key-value pairs, use keyValueDelimiter to separate the key and value in each key-value pair, and then generate and return a map.

Examples

Sample code

```
SELECT
  STR_TO_MAP('k1 = v1, k2 = v2' ) ['k1'] as a
FROM T1
```

Table 3-124: Output example

a (VARCHAR)
v1

3.1.11.1.25 SUBSTRING

Syntax

```
VARCHAR SUBSTRING(VARCHAR a, INT start)
VARCHAR SUBSTRING(VARCHAR a, INT start, INT len)
```

Arguments

- **a: specifies the string from which a substring is to be obtained. This argument is of the VARCHAR type.**
- **len: specifies the length of the substring to be obtained. This argument is of the INT type.**

- **start: specifies the start position where the substring is to be obtained from the specified string. This argument is of the INT type.**

Description

Obtain a substring of the specified length from a string, starting from the specified position. If the length is not specified, the entire string is obtained. start begins with 1. If the value is 0, it is regarded as 1. If the value is negative, obtain a substring of the specified length backwards starting from the last character in the string.

Examples

Table 3-125: Input example

str (VARCHAR)	nullstr (VARCHAR)
k1 = v1; k2 = v2	null

Sample code

```
SELECT SUBSTRING('', 222222222) as var1,
       SUBSTRING(str, 2) as var2,
       SUBSTRING(str, -2) as var3,
       SUBSTRING(str, -2, 1) as var4,
       SUBSTRING(str, 2, 1) as var5,
       SUBSTRING(str, 22) as var6,
       SUBSTRING(str, -22) as var7,
       SUBSTRING(str, 1) as var8,
       SUBSTRING(str, 0) as var9,
       SUBSTRING(nullstr, 0) as var10
FROM T1
```

Table 3-126: Output example

var1 (VARCHAR)	var2 (VARCHAR)	var3 (VARCHAR)	var4 (VARCHAR)	var5 (VARCHAR)	var6 (VARCHAR)	var7 (VARCHAR)	var8 (VARCHAR)	var9 (VARCHAR)	var10 (VARCHAR)
""	1 = v1; k2 = v2	v2	v	1	""	""	k1 = v1; k2 = v2	k1 = v1; k2 = v2	null

3.1.11.1.26 TO_BASE64

Syntax

```
VARCHAR TO_BASE64(bin)
```

Argument

bin: specifies a value of the BINARY type.

Description

Convert the input value of the BINARY type to a Base64 string.

Examples

Table 3-127: Input example

c (VARCHAR)
SGVsbG8gd29ybGQ =
SGk =
SGVsbG8 =

Sample code

```
SELECT TO_BASE64(FROM_BASE64(c)) as var1
FROM T1
```

Table 3-128: Output example

var1 (VARCHAR)
SGVsbG8gd29ybGQ =
SGk =
SGVsbG8 =

3.1.11.1.27 TRIM

Syntax

```
VARCHAR TRIM( VARCHAR x )
```

Arguments

x: VARCHAR type

Description

Trim leading or trailing characters from a string. The most common use is to trim leading or trailing blank spaces.

Examples

Test example

```
SELECT TRIM('   Sample   '); as result
FROM   T1
```

Table 3-129: Output example

result(VARCHAR)
Sample

3.1.11.1.28 UPPER

Syntax

```
VARCHAR UPPER(A)
```

Arguments

A: VARCHAR type

Description

Convert the specified string to a string of uppercase letters.

Examples

Table 3-130: Input example

var1(VARCHAR)
ss
ttee

Sample code

```
SELECT UPPER(var1) as aa
```

```
FROM T1;
```

Table 3-131: Output example

aa(VARCHAR)
SS
TTEE

3.1.11.2 Mathematical unctions

3.1.11.2.1 Addition

Syntax

```
A + B
```

Arguments

A and B: INT type

Description

Return the result of adding B to A.

Examples

Table 3-132: Input example

int1(INT)	int2(INT)	int3(INT)
10	20	30

Sample code

```
SELECT int1+int2+int3 as aa
FROM T1;
```

Table 3-133: Output example

aa(INT)
60

3.1.11.2.2 Subtraction

Syntax

```
A - B
```

Arguments

A and B: specify values of the INT type.

Description

Return the result of subtracting B from A.

Examples

Table 3-134: Input example

int1 (INT)	int2 (INT)	int3 (INT)
10	10	30

Sample code

```
SELECT int3 - int2 - int1 as aa
FROM T1;
```

Table 3-135: Output example

aa (INT)
10

3.1.11.2.3 Multiplication

Syntax

```
A * B
```

Arguments

A and B: specify values of the INT type.

Description

Return the result of multiplying A by B.

Examples

Table 3-136: Input example

int1 (INT)	int2 (INT)	int3 (INT)
10	20	3

Sample code

```
SELECT int1*int2*int3 as aa
FROM T1;
```

Table 3-137: Output example

aa (INT)
600

3.1.11.2.4 Division

Syntax

```
A/B
```

Arguments

A and B: INT type

Description

Return the result of dividing A by B.

Examples

Table 3-138: Input example

int1(INT)	int2 (INT)
8	4

Sample code

```
SELECT int1 / int2 as aa
```

```
FROM T1;
```

Table 3-139: Output example

aa(INT)
2

3.1.11.2.5 ABS

Syntax

```
DOUBLE ABS(A)
```

Arguments

A: DOUBLE type

Description

Return the absolute value of the specified number.

Examples

Table 3-140: Input example

int1(DOUBLE)
4.3

Sample code

```
SELECT ABS(in1) as aa
FROM T1;
```

Table 3-141: Output example

aa(DOUBLE)
4.3

3.1.11.2.6 ACOS

Syntax

```
DOUBLE ACOS(A)
```

Argument

A: specifies a number of DOUBLE type.

Description

Return the arccos value of the specified number.

Examples

Table 3-142: Input example

int1 (DOUBLE)
0.7173560908995228
0.4

Sample code

```
SELECT ACOS(in1) as aa
FROM T1;
```

Table 3-143: Output example

aa (DOUBLE)
0.7707963267948966
1.1592794807274085

3.1.11.2.7 BIN

Syntax

```
VARCHAR BIN(BIGINT number)
```

Arguments

number: BIGINT type. INT type arguments support implicit conversion, whereas other types of arguments do not.

Description

Convert a value of the BIGINT type to a binary string.

Examples

Table 3-144: Input example

id(INT)	x (BIGINT)
1	12L

id(INT)	x (BIGINT)
2	10L
3	0L
4	10000000000L

Sample code

```
SELECT  id, bin(x) as var1
FROM T1
```

Table 3-145: Output example

id(INT)	var1(VARCHAR)
1	1100
2	1010
3	0
4	10010101000000101111100100000000000

3.1.11.2.8 ASIN

Syntax

```
DOUBLE ASIN(A)
```

Arguments

A: DOUBLE type

Description

Return the arcsine value of the specified number.

Examples

Table 3-146: Input example

int1 (DOUBLE)
0.7173560908995228
0.4

Sample code

```
SELECT ASIN(in1) as aa
```

```
FROM T1;
```

Table 3-147: Output example

aa (DOUBLE)
0.8
0.41151684606748806

3.1.11.2.9 ATAN

Syntax

```
DOUBLE ATAN(A)
```

Arguments

A: DOUBLE type

Description

Return the arctangent value of the specified number.

Examples

Table 3-148: Input example

int1 (DOUBLE)
0.7173560908995228
0.4

Sample code

```
SSELECT ATAN(in1) as aa
FROM T1;
```

Table 3-149: Output example

aa (DOUBLE)
0.6222796222326533
0.3805063771123649

3.1.11.2.10 BITAND

Syntax

```
INT BITAND(INT number1,INT number2)
```

Arguments

- **number1: specifies a common argument of the INT type.**
- **number2: specifies a common argument of the INT type.**

Description

Perform a bitwise AND operation on the specified values. The input and output values are both of the INT type.

Examples

Table 3-150: Input example

a(INT)	b(INT)
2	3

Sample code

```
SELECT  BITAND(a, b) as intt
FROM T1
```

Table 3-151: Output example

intt(INT)
2

3.1.11.2.11 BITNOT

Syntax

```
INT BITNOT((INT number)
```

Arguments

number: specifies a common argument of the INT type.

Description

Perform a bitwise NOT operation on the specified value. The input and output values are both integers.

Examples

Table 3-152: Input example

a(INT)
7

Sample code

```
SELECT   BITNOT(a) as var1,
FROM  T1
```

Table 3-153: Output example

var1(INT)
0xfff8

3.1.11.2.12 BITOR

Syntax

```
INT BITOR(INT number1, INT number2)
```

Arguments

- **number1: specifies a common argument of the INT type.**
- **number2: specifies a common argument of the INT type.**

Description

Perform a bitwise OR operation on the specified values. The input and output values are both of the INT type.

Examples

Table 3-154: Input example

a(INT)	b(INT)
2	3

Sample code

```
SELECT BITOR(a, b) as var1,
```

```
FROM  T1
```

Table 3-155: Output example

var1(INT)
3

3.1.11.2.13 BITXOR

Syntax

```
INT BITXOR(INT number1, INT number2)
```

Arguments

- **number1: specifies a common value of the INT type.**
- **number2: specifies a common value of the INT type.**

Description

Return the bitwise XOR (exclusive OR) of two given numbers. The argument and result are both of the INT type.

Examples

Table 3-156: Input example

a (INT)	b (INT)
2	3

Sample code

```
SELECT BITXOR(a, b) as var1,
FROM  T1
```

Table 3-157: Output example

var1 (INT)
1

3.1.11.2.14 CARDINALITY

Syntax

```
CARDINALITY(str)
```

Arguments

str: specifies an array.

Description

Return the number of elements in an array.

Examples

Table 3-158: Input example

str(INT)	b (Array[INT])
1	Array(1, 2, 3)

Sample code

```
SELECT cardinality(b) AS result
FROM T1
```

Table 3-159: Output example

result(INT)
3

3.1.11.2.15 COS

Syntax

```
DOUBLE COS(A)
```

Arguments

A: DOUBLE type

Description

Return the cosine value of the specified number.

Examples

Table 3-160: Input example

in1(DOUBLE)
0.8
0.4

Sample code

```
SELECT COS(in1) as aa
FROM T1;
```

Table 3-161: Output example

aa(DOUBLE)
0.6967067093471654
0.9210609940028851

3.1.11.2.16 COT

Syntax

```
DOUBLE COT(A)
```

Arguments

A: specifies a value of the DOUBLE type.

Description

Return the cotangent value of the specified number.

Examples

Table 3-162: Input example

in1 (DOUBLE)
0.8
0.4

Sample code

```
SELECT COT(in1) as aa
```

```
FROM T1;
```

Table 3-163: Output example

aa (DOUBLE)
1.0296385570503641
0.4227932187381618

3.1.11.2.17 E

Syntax

```
DOUBLE E()
```

Arguments

DOUBLE type

Description

Return the DOUBLE type value of natural constant E.

Examples

Table 3-164: Input example

id(INT)	X(DOUBLE)
1	8.0

Sample code

```
SELECT id, e() as dou1, E() as dou2
FROM T1
```

Table 3-165: Output example

id(INT)	dou1(DOUBLE)	dou2 (DOUBLE)
1	2.718281828459045	2.718281828459045

3.1.11.2.18 EXP

Syntax

```
DOUBLE EXP(A)
```

Argument

A: specifies a value of the DOUBLE type.

Description

Return the power of e, where e is the base of the natural logarithm.

Examples

Table 3-166: Input example

in1 (DOUBLE)
8.0
10.0

Sample code

```
SELECT EXP(in1) as aa
FROM T1;
```

Table 3-167: Output example

aa (DOUBLE)
2980.9579870417283
22026.465794806718

3.1.11.2.19 FLOOR

Syntax

```
DOUBLE FLOOR(A)
```

Arguments

A: DOUBLE type

Description

Return the maximum integer that is less than or equal to the provided number.

Examples

Table 3-168: Input example

in1(DOUBLE)
8.123
10.321

Sample code

```
SELECT FLOOR(in1) as aa
FROM T1;
```

Table 3-169: Output example

aa(INT)
8
10

3.1.11.2.20 LN

Syntax

```
DOUBLE ln(DOUBLE number)
```

Arguments

number: specifies a number of the DOUBLE type. If the input value is of the VARCHAR or BIGINT type, it is implicitly converted to the DOUBLE type before an operation.

Description

Return the natural logarithm of the specified number. The return value is a logarithm of the DOUBLE type.

Examples

Table 3-170: Input example

ID (INT)	X (DOUBLE)
1	100.0
2	8.0

Sample code

```
SELECT id, ln(x) as dou1, ln(e()) as dou2
FROM  T1
```

Table 3-171: Output example

ID (INT)	dou1 (DOUBLE)	dou2 (DOUBLE)
1	4.605170185988092	1.0
2	2.0794415416798357	1.0

3.1.11.2.21 LOG

Syntax

```
DOUBLE LOG(DOUBLE base, DOUBLE x)
DOUBLE LOG(DOUBLE x)
```

Arguments

- **base: specifies a value of the DOUBLE type.**
- **x: specifies a value of the DOUBLE type.**

Description

Return the natural logarithm of x to the base specified by the base argument. The return value is a logarithm of the DOUBLE type. If there is only one argument value , the return value is a natural logarithm to the base specified by the argument.

Examples

Table 3-172: Input example

ID (INT)	BASE (DOUBLE)	X (DOUBLE)
1	10.0	100.0
2	2.0	8.0

Sample code

```
SELECT id, LOG(base, x) as dou1, LOG(2) as dou2
```

```
FROM  T1
```

Table 3-173: Output example

ID (INT)	dou1 (DOUBLE)	dou2 (DOUBLE)
1	2.0	0.6931471805599453
2	3.0	0.6931471805599453

3.1.11.2.22 LOG10

Syntax

```
DOUBLE LOG10(DOUBLE x)
```

Argument

x: specifies a value of the DOUBLE type.

Description

Return the base-10 logarithm of x. If x is NULL, the return value is NULL. If x is a negative number, an exception occurs.

Examples

Table 3-174: Input example

id (INT)	X (INT)
1	100
2	10

Sample code

```
SELECT id, log10(x) as dou1
FROM T1
```

Table 3-175: Output example

ID (INT)	dou1 (DOUBLE)
1	2.0
2	1.0

3.1.11.2.23 LOG2

Syntax

```
DOUBLE LOG2(DOUBLE x)
```

Arguments

x: specifies a multiple of 2. This argument is of the DOUBLE type.

Description

Return the base-2 logarithm of x. If x is NULL, the return value is NULL. If x is a negative number, an exception occurs.

Examples

Table 3-176: Input example

id (INT)	X (INT)
1	8
2	2

Sample code

```
SELECT id, log2(x) as dou1
FROM T1
```

Table 3-177: Output example

ID (INT)	dou1 (DOUBLE)
1	3.0
2	1.0

3.1.11.2.24 PI

Syntax

```
DOUBLE PI( )
```

Description

Obtain the ratio of circumference to diameter, namely, Pi.

Examples

Table 3-178: Input example

id (INT)	X (INT)
1	8

Sample code

```
SELECT id, PI() as dou1
FROM T1
```

Table 3-179: Output example

ID (INT)	dou1 (DOUBLE)
1	3.141592653589793

3.1.11.2.25 POWER

Syntax

```
DOUBLE POWER(A, B)
```

Input parameters

A and B: DOUBLE data type

Description

Returns the result of raising A to the power of B.

Example

Table 3-180: Input example

int1 (DOUBLE)	in2 (DOUBLE)
2.0	4.0

Sample code

```
SELECT POWER(in1, in2) as aa
```

```
FROM T1;
```

Table 3-181: Output example

aa (DOUBLE)
16.0

3.1.11.2.26 RAND

Syntax

```
DOUBLE RAND([BIGINT seed])
```

Arguments

seed: specifies a random number of the BIGINT type. This argument specifies the start number of a random number sequence.

Description

Return a random number of the DOUBLE type. The return value range is `[0, 1)`.

Examples

Table 3-182: Input example

id(INT)	X(INT)
1	8

Sample code

```
SELECT id, rand(1) as dou1, rand(3) as dou2
FROM T1
```

Table 3-183: Output example

id(INT)	dou1(DOUBLE)	dou2(DOUBLE)
1	0.7308781907032909	0.731057369148862

3.1.11.2.27 SIN

Syntax

```
DOUBLE SIN(A)
```

Arguments

A: specifies a number of the DOUBLE type.

Description

Return the sine value of the specified number.

Examples

Table 3-184: Input example

in1 (DOUBLE)
8.0
0.4

Sample code

```
SELECT SIN(in1) as aa
FROM T1;
```

Table 3-185: Output example

aa (DOUBLE)
0.9893582466233818
0.3894183423086505

3.1.11.2.28 SQRT

Syntax

```
DOUBLE SQRT(A)
```

Arguments

A: specifies a number of the DOUBLE type.

Description

Return the square root of the specified number.

Examples

Table 3-186: Input example

in1 (DOUBLE)
8.0

Sample code

```
SELECT SQRT(in1) as aa
FROM T1;
```

Table 3-187: Output example

aa (DOUBLE)
2.8284271247461903

3.1.11.2.29 TAN

Syntax

```
DOUBLE TAN(A)
```

Arguments

A: DOUBLE type

Description

Return the tangent value of the specified number.

Examples

Table 3-188: Input example

in1(DOUBLE)
8.0
0.4

Sample code

```
SELECT TAN(in1) as aa
```

```
FROM T1;
```

Table 3-189: Output example

aa(DOUBLE)
1.0296385570503641
0.4227932187381618

3.1.11.2.30 CEIL

Syntax

```
value_class CEIL(value)
```

Arguments

value: specifies a value of the INT, DOUBLE, or BIGINT type.

Description

Return the smallest integer greater than or equal to a specified value. The value_class data type returned by CEIL is the same as that of the argument.

Examples

Table 3-190: Input example

ID (INT)	value1 (INT)	value2 (DOUBLE)
1	3	3.6

Sample code

```
SELECT CEIL (value2) as result1
SELECT CEIL (value2) as result2
FROM   T1
```

Table 3-191: Output example

ID (INT)	result1 (INT)	result2 (DOUBLE)
1	3	4.0

3.1.11.2.31 CHARACTER_LENGTH

Syntax

```
INTEGER CHARACTER_LENGTH( VARCHAR x )
```

Arguments

x: specifies a value of the VARCHAR type.

Description

Return the number of characters contained in a string.

Examples

Table 3-192: Input example

ID (INT)	X (VARCHAR)
1	StreamCompute

Sample code

```
SELECT CHARACTER_LENGTH( x ) as result
FROM   T1
```

Table 3-193: Output example

ID (INT)	result (INT)
1	13

3.1.11.2.32 DEGREES

Syntax

```
DOUBLE DEGREES(double x)
```

Arguments

x: specifies a radian value of the DOUBLE type.

Description

Return the result of converting radians to degrees.

Examples

Sample code

```
SELECT DEGREES( PI() ) as result
FROM   T1
```

Table 3-194: Output example

result(DOUBLE)
180.0

3.1.11.2.33 MOD

Syntax

```
Integer MOD(Integer x,Integer y)
```

Arguments

- **x: specifies a value of the Integer type.**
- **y: specifies a value of the Integer type.**

Description

Return the remainder when integer x is divided by integer y, without considering the quotient. When x is a negative integer or both x and y are negative integers, the result is negative.

Examples

Table 3-195: Input example

X (INT)	Y (INT)
29	3
-29	3
-29	-3

Sample code

```
SELECT MOD(x,y) as result
```

```
FROM   T1
```

Table 3-196: Output example

ID (INT)	result (INT)
1	2
2	-2
3	-2

3.1.11.2.34 ROUND

Syntax

```
DECIMAL ROUND(DECIMAL x, INT n)
```

Argument

x: DECIMAL type

Description

Round the x argument's value to n decimal places.

Examples

Table 3-197: Input example

in1 (DECIMAL)
0.7173560908995228
0.4

Sample code

```
SELECT ROUND(in1,2) as `result`
FROM T1;
```

Table 3-198: Output example

result (DECIMAL)
0.72
0.40

3.1.11.3 Date functions

3.1.11.3.1 CURRENT_TIMESTAMP

Syntax

```
CURRENT_TIMESTAMP
```

Arguments

None

Description

Return the current UTC (GMT+0) timestamp, which is eight hours earlier than Beijing time.

Examples

Sample code

```
SELECT CURRENT_TIMESTAMP as var1
FROM T1
```

Table 3-199: Output example

var1 (TIMESTAMP)
2007-04-30 13:10:02.047

3.1.11.3.2 DATEDIFF

Syntax

```
INT DATEDIFF(VARCHAR enddate, VARCHAR startdate)
INT DATEDIFF(TIMESTAMP enddate, VARCHAR startdate)
INT DATEDIFF(VARCHAR enddate, TIMESTAMP startdate)
INT DATEDIFF(TIMESTAMP enddate, TIMESTAMP startdate)
```

Arguments

- **startdate: specifies a start date of the TIMESTAMP or VARCHAR type. The format of a VARCHAR type date is yyyy-MM-dd or yyyy-MM-dd HH:mm:ss.**
- **enddate: specifies an end date of the TIMESTAMP or VARCHAR type. The format of a VARCHAR type date is yyyy-MM-dd or yyyy-MM-dd HH:mm:ss.**

Description

Compute the number of days between the specified start date and end date. The return value is an integer of the TIMESTAMP type or in the format of `yy-MM-dd HH:mm:ss` or `yy-MM-dd`. If any argument is NULL or a parsing error occurs, the return value is NULL.

Examples

Table 3-200: Input example

datetime1(VARCHAR)	datetime2 (VARCHAR)	nullstr(VARCHAR)
2017-10-15 00:00:00	2017-09-15 00:00:00	null

Sample code

```
SELECT  DATEDIFF(datetime1, datetime2) as int1,
        DATEDIFF(TIMESTAMP '2017-10-15 23:00:00',datetime2) as int2,
        DATEDIFF(datetime2,TIMESTAMP '2017-10-15 23:00:00') as int3,
        DATEDIFF(datetime2,nullstr) as int4,
        DATEDIFF(nullstr,TIMESTAMP '2017-10-15 23:00:00') as int5,
        DATEDIFF(nullstr,datetime2) as int6,
        DATEDIFF(TIMESTAMP '2017-10-15 23:00:00',TIMESTAMP '2017-9-15
00:00:00')as int7
FROM T1
```

Table 3-201: Output example

int1(INT)	int2(INT)	int3(INT)	int4(INT)	int5(INT)	int6(INT)	int7 (INT)
30	31	-31	null	null	null	31

3.1.11.3.3 DATE_ADD

Syntax

```
VARCHAR DATE_ADD(VARCHAR startdate, INT days)
VARCHAR DATE_ADD(TIMESTAMP time, INT days)
```

Arguments

- **startdate: specifies a date of the VARCHAR type. The format is yyyy-MM-dd or yyyy-MM-dd HH:mm:ss.**
- **time: specifies a date of the TIMESTAMP type.**
- **days: specifies the number of days of the INT type.**

Description

Return a date that is X (specified by days) days after the specified date of the VARCHAR type. The date format can be yyyy-MM-dd hh:mm:ss, yyyy-MM-dd, and timestamp string. The return value is a string type date in the format of yyyy-MM-dd. If any argument is NULL or a parsing error occurs, the return value is NULL.

Examples

Table 3-202: Input example

datetime1 (VARCHAR)	nullstr (VARCHAR)
2017-09-15 00:00:00	null

Sample code

```
SELECT DATE_ADD(datetime1, 30) as var1,
        DATE_ADD(TIMESTAMP '2017-09-15 23:00:00',30) as var2,
        DATE_ADD(nullstr,30) as var3
FROM T1
```

Table 3-203: Output example

var1 (VARCHAR)	var2 (VARCHAR)	var3 (VARCHAR)
2017-10-15	2017-10-15	null

3.1.11.3.4 DATE_FORMAT

Syntax

```
VARCHAR DATE_FORMAT(TIMESTAMP time, VARCHAR to_format)
VARCHAR DATE_FORMAT(VARCHAR date, VARCHAR to_format)
VARCHAR DATE_FORMAT(VARCHAR date, VARCHAR from_format, VARCHAR
to_format)
```

Input parameters

- **date: specifies a date of the VARCHAR data type. The default format is yyyy-MM-dd HH:mm:ss.**
- **time: specifies a date of the TIMESTAMP data type.**
- **from_format: specifies a source date format.**
- **to_format: specifies a target date format.**

Description

Converts a specified date from a source format to a target format. The date or time parameter specifies a date. The from_format parameter is optional and specifies the source date format. The default format is yyyy-MM-dd hh:mm:ss. The to_format parameter specifies the target date format. The return value is a date in the specified target format. If any argument is NULL or a parsing error occurs, the return value is NULL.

Example

Table 3-204: Input example

date1 (VARCHAR)	datetime1 (VARCHAR)	nullstr (VARCHAR)
0915-2017	2017-09-15 00:00:00	null

Sample code

```
SELECT  DATE_FORMAT(datetime1, 'yyMMdd') as var1,
        DATE_FORMAT(nullstr, 'yyMMdd') as var2,
        DATE_FORMAT(datetime1, nullstr) as var3,
        DATE_FORMAT(date1, 'MMdd-yyyy', nullstr) as var4,
        DATE_FORMAT(date1, 'MMdd-yyyy', 'yyyyMMdd') as var5,
        DATE_FORMAT(TIMESTAMP '2017-09-15 23:00:00', 'yyMMdd') as var6
FROM T1
```

Table 3-205: Output example

var1 (VARCHAR)	var2 (VARCHAR)	var3 (VARCHAR)	var4 (VARCHAR)	var5 (VARCHAR)	var6 (VARCHAR)
170915	null	null	null	20170915	170915

3.1.11.3.5 DATE_SUB

Syntax

```
VARCHAR DATE_SUB(VARCHAR startdate, INT days)
VARCHAR DATE_SUB(TIMESTAMP time, INT days)
```

Arguments

- **startdate: specifies a date of the VARCHAR type. The format is yyyy-MM-dd or yyyy-MM-dd HH:mm:ss.**
- **time: specifies a date of the TIMESTAMP type.**
- **days: specifies the number of days. This argument is of the INT type.**

Description

Return the date that is X (specified by days) days before the specified date. The return value is a VARCHAR type date in the format of yyyy-MM-dd. If any argument is NULL or a parsing error occurs, the return value is NULL.

Examples

Table 3-206: Input example

date1 (VARCHAR)	nullstr (VARCHAR)
2017-10-15	null

Sample code

```
SELECT  DATE_SUB(date1, 30) as var1,
        DATE_SUB(TIMESTAMP '2017-10-15 23:00:00',30) as var2,
        DATE_SUB(nullstr,30) as var3
FROM T1
```

Table 3-207: Output example

var1 (VARCHAR)	var2 (VARCHAR)	var3 (VARCHAR)
2017-09-15	2017-09-15	null

3.1.11.3.6 DAYOFMONTH

Syntax

```
 INT DAYOFMONTH(TIMESTAMP time)
 INT DAYOFMONTH(DATE date)
```

Arguments

- **date: specifies a date of the DATE type.**
- **time: specifies a date of the TIMESTAMP type.**

Description

Return the day number of the specified timestamp or date. Valid range: [1,31].

Examples

Table 3-208: Input example

tsStr (VARCHAR)	dateStr (VARCHAR)	tdate (DATE)	ts (TIMESTAMP)
2017-10-15 00:00:00	2017-09-15	2017-11-10	2017-10-15 00:00:00

Sample code

```
SELECT DAYOFMONTH(TIMESTAMP '2016-09-15 00:00:00') as int1,
       DAYOFMONTH(DATE '2017-09-22') as int2,
       DAYOFMONTH(tdate) as int3,
       DAYOFMONTH(ts) as int4,
       DAYOFMONTH(CAST(dateStr AS DATE)) as int5,
       DAYOFMONTH(CAST(tsStr AS TIMESTAMP))  as int6
FROM T1
```

Table 3-209: Output example

int1 (INT)	int2 (INT)	int3 (INT)	int4 (INT)	int5 (INT)	int6 (INT)
15	22	10	15	15	15

3.1.11.3.7 FROM_UNIXTIME

Syntax

```
VARCHAR FROM_UNIXTIME(BIGINT unixtime[, VARCHAR format])
```

Arguments

- **unixtime: specifies a Unix timestamp (in seconds) of the BIGINT type. An exception occurs if this argument is of another type.**
- **format: specifies the target date format of the VARCHAR type. The default format is yyyy-MM-dd hh:mm:ss. This argument is optional.**

Description

Return a VARCHAR type date in the specified date format. The default format is yyyy-MM-dd HH:mm:ss. If any argument is NULL or a parsing error occurs, the return value is NULL.

Examples

Table 3-210: Input example

unixtime1(INT)	nullstr(VARCHAR)
1505404800	null

Sample code

```
SELECT FROM_UNIXTIME(unixtime1) as var1,
        FROM_UNIXTIME(unixtime1,'MMdd-yyyy') as var2,
        FROM_UNIXTIME(unixtime1,nullstr) as var3
FROM T1
```

Table 3-211: Output example

var1 (VARCHAR)	var2 (VARCHAR)	var3 (VARCHAR)
2017-09-15 00:00:00	0915-2017	null

3.1.11.3.8 HOUR

Syntax

```
  INT HOUR(TIMESTAMP timestamp)
 INT HOUR(TIME time)
```

Arguments

- **time: specifies a time value of the TIME type.**
- **time: specifies a time value of the TIMESTAMP type.**

Description

Return the hours (in 24-hour format) from the specified time or timestamp string. The return value ranges from 0 to 23.

Examples

Table 3-212: Input example

datetime1 (VARCHAR)	time1 (VARCHAR)	time2 (TIME)	timestamp1 (TIMESTAMP)
2017-10-15 11:12:13	22:23:24	22:23:24	2017-10-15 11:12:13

Sample code

```
SELECT HOUR(TIMESTAMP '2016-09-20 23:33:33') as int1,
       HOUR(TIME '23:30:33') as int2,
       HOUR(time2) as int3,
       HOUR(timestamp1) as int4,
       HOUR(CAST(time1 AS TIME)) as int5,
       HOUR(CAST(datetime1 AS TIMESTAMP)) as int6
FROM T1
```

Table 3-213: Output example

int1 (INT)	int2 (INT)	int3 (INT)	int4 (INT)	int5 (INT)	int6 (INT)
23	23	22	11	22	11

3.1.11.3.9 LOCALTIME

Syntax

```
TIME LOCALTIME
```

Arguments

The function is a non-parameterized constructor and can be used directly as a variable.

Description

Return the current time of the TIME type in the session time zone.

Examples

Sample code

```
SELECT  LOCALTIME as `result`
FROM T1
```

Table 3-214: Output example

result(TIME)
19:00:47

3.1.11.3.10 MINUTE

Syntax

```
INT MINUTE(TIMESTAMP timestamp)
```

```
 INT MINUTE(TIME time)
```

Arguments

- **time: specifies a time value of the TIME type.**
- **time: specifies a time value of the TIMESTAMP type.**

Description

Return the minutes from the specified time value. Valid range: [0, 59].

Examples

Table 3-215: Input example

datetime1 (VARCHAR)	time1 (VARCHAR)	time2 (TIME)	timestamp1 (TIMESTAMP)
2017-10-15 11:12:13	22:23:24	22:23:24	2017-10-15 11:12:13

Sample code

```
SELECT MINUTE(TIMESTAMP '2016-09-20 23:33:33') as int1,
       MINUTE(TIME '23:30:33') as int2,
       MINUTE(time2) as int3,
       MINUTE(timestamp1) as int4,
       MINUTE(CAST(time1 AS TIME)) as int5,
       MINUTE(CAST(datetime1 AS TIMESTAMP)) as int6
FROM T1
```

Table 3-216: Output example

int1 (INT)	int2 (INT)	int3 (INT)	int4 (INT)	int5 (INT)	int6 (INT)
33	30	23	12	23	12

3.1.11.3.11 MONTH

Syntax

```
INT MONTH(TIMESTAMP time)
 INT MONTH(DATE date)
```

Arguments

- **time: specifies a time value of the TIMESTAMP type.**
- **date: specifies a time value of the TIME type.**

Description

Return the month number of the specified time or date. Valid range: [1, 12].

Examples

Table 3-217: Input example

tsStr (VARCHAR)	dateStr (VARCHAR)	tdate (DATE)	ts (TIMESTAMP)
2017-10-15 00:00:00	2017-09-15	2017-11-10	2017-10-15 00:00:00

Sample code

```
SELECT MONTH(TIMESTAMP '2016-09-15 00:00:00') as int1,
       MONTH(DATE '2017-09-22') as int2,
       MONTH(tdate) as int3,
       MONTH(ts) as int4,
       MONTH(CAST(dateStr AS DATE)) as int5,
       MONTH(CAST(tsStr AS TIMESTAMP))  as int6
FROM T1
```

Table 3-218: Output example

int1 (INT)	int2 (INT)	int3 (INT)	int4 (INT)	int5 (INT)	int6 (INT)
9	9	11	10	9	10

3.1.11.3.12 NOW

Syntax

```
BIGINT NOW()
```

Arguments

If no argument is specified, the Unix timestamp (in seconds) of the current system time is returned.

Description

Return the Unix timestamp (in seconds) of the current time zone. You can also specify an INT type argument as an offset (in seconds) and use UNIX_TIMESTAMP(CAST(NOW AS VARCHAR)) to convert the INT type argument to a timestamp value. Then add the offset to the current timestamp to return a value.

Examples

Table 3-219: Input example

b(VARCHAR)
null

Sample code

```
SELECT  NOW() as big1, NOW(b) as big2
FROM T1
```

Table 3-220: Output example

big1(BIGINT)	big2 (BIGINT)
1403006911	null

3.1.11.3.13 SECOND

Syntax

```
INT SECOND(TIMESTAMP timestamp)
 INT SECOND(TIME time)
```

Arguments

- **time: specifies a time value of the TIME type.**
- **time: specifies a time value of the TIMESTAMP type.**

Description

Extract the seconds from the specified time value. The return value ranges from 0 to 59.

Examples

Table 3-221: Input example

datetime1(VARCHAR)	time1 (VARCHAR)	time2(TIME)	timestamp1(TIMESTAMP)
2017-10-15 11:12:13	22:23:24	22:23:24	2017-10-15 11:12:13

Sample code

```
SELECT SECOND(TIMESTAMP '2016-09-20 23:33:33') as int1,
       SECOND(TIME '23:30:33') as int2,
```

```
       SECOND(time2) as int3,
       SECOND(timestamp1) as int4,
       SECOND(CAST(time1 AS TIME)) as int5,
       SECOND(CAST(datetime1 AS TIMESTAMP)) as int6
FROM T1
```

Table 3-222: Output example

int1(INT)	int2(INT)	int3(INT)	int4 (INT)	int5 (INT)	int6 (INT)
33	33	24	13	24	13

3.1.11.3.14 TIMESTAMPADD

Syntax

```
TIMESTAMP TIMESTAMPADD(interval,INT int_expr,TIMESTAMP datetime_expr)
DATE TIMESTAMPADD(interval,INT int_expr,DATE datetime_expr)
```

Input parameters

- **interval**

FRAC_SECOND	**Specifies an interval in milliseconds.**
SECOND	**Specifies an interval in seconds.**
MINUTE	**Specifies an interval in minutes.**
HOUR	**Specifies an interval in hours.**
DAY	**Specifies an interval in days.**
WEEK	**Specifies an interval in weeks.**
MONTH	**Specifies an interval in months.**
QUARTER	**Specifies an interval in quarters.**
YEAR	**Specifies an interval in years.**

- **int_expr: specifies an increment that is an integer.**
- **datetime_expr: specifies a timestamp or date to which the increment is to be added.**

Description

The data type of a result returned by the TIMESTAMPADD function is the same as that of datetime_expr. The TIMESTAMPADD function adds an increment (int_expr) to a timestamp or date (datetime_expr) and returns the updated time.

Example

Table 3-223: Input example

a (TIMESTAMP)	b (DATE)
2018-07-09 10:23:56	1990-02-20

Sample code

```
SELECT
TIMESTAMPADD(HOUR,3,a) AS `result1`,
TIMESTAMPADD(DAY,3,b) AS `result2`
FROM T1
```

Table 3-224: Output example

result1 (TIMESTAMP)	result2 (DATE)
2018-07-09 13:23:56	1990-02-23

3.1.11.3.15 TO_DATE

Syntax

```
Date TO_DATE(INT time)
Date TO_DATE(VARCHAR date)
Date TO_DATE(VARCHAR date, VARCHAR format)
```

Input parameters

- **time: specifies the number of days from January 1, 1970 to a specified date. This parameter is of the INT data type.**
- **date: specifies a date of the VARCHAR data type. The default format is yyyy-MM-dd.**
- **format: specifies a date format of the VARCHAR data type.**

Description

Converts a date of the INT or VARCHAR data type into a date of the DATE data type.

Example

Table 3-225: Input example

date1 (bigint)	date2 (VARCHAR)	date3 (VARCHAR)
100	2017-09-15	20170915

Sample code

```
SELECT  TO_DATE(date1) as var1,
        TO_DATE(date2) as var2,
        TO_DATE(date3, "yyyyMMdd") as var3
FROM T1
```

Table 3-226: Output example

var1 (VARCHAR)	var2 (VARCHAR)	var3 (VARCHAR)
1970-04-11	2017-09-15	2017-09-15

3.1.11.3.16 TO_TIMESTAMP

Syntax

```
TIMESTAMP TO_TIMESTAMP(BIGINT time)
TIMESTAMP TO_TIMESTAMP(VARCHAR date)
TIMESTAMP TO_TIMESTAMP(VARCHAR date, VARCHAR format)
```

Arguments

- **time: specifies a time value of the BIGINT type. The unit is milliseconds.**
- **date: specifies a date of the VARCHAR type. The default format is yyyy-MM-dd HH:mm:ss[. SSS].**
- **format: specifies the source date format of the VARCHAR type.**

Description

Convert a date of the BIGINT or VARCHAR type to a date of the TIMESTAMP type.

Examples

Table 3-227: Input example

timestamp1 (bigint)	timestamp2 (VARCHAR)	timestamp3 (VARCHAR)
1513135677000	2017-09-15 00:00:00	20170915000000

Sample code

```
SELECT TO_TIMESTAMP(timestamp1) as var1,
        TO_TIMESTAMP(timestamp2) as var2,
        TO_TIMESTAMP(timestamp3, "yyyyMMddHHmmss") as var3
```

```
FROM T1
```

Table 3-228: Output example

var1 (TIMESTAMP)	var2 (TIMESTAMP)	var3 (TIMESTAMP)
2017-12-13 03:27:57.0	2017-09-15 00:00:00.0	2017-09-15 00:00:00.0

3.1.11.3.17 UNIX_TIMESTAMP

Syntax

```
BIGINT UNIX_TIMESTAMP()
BIGINT UNIX_TIMESTAMP(VARCHAR date)
BIGINT UNIX_TIMESTAMP(VARCHAR date, VARCHAR format)
```

Arguments

- **date: specifies a date of the VARCHAR type. The default format is yyyy-MM-dd HH:mm:ss.**
- **format: specifies the source date format of the VARCHAR type. The default format is yyyy-MM-dd HH:mm:ss.**

Description

Convert the specified date to a Unix timestamp (in seconds) of the BIGINT type. Both the date and format parameters are optional. If neither is specified, the Unix timestamp (in seconds) of the current time is returned. If any argument is NULL or a parsing error occurs, the return value is NULL.

Examples

Table 3-229: Input example

nullstr (VARCHAR)
null

Sample code

```
SELECT  UNIX_TIMESTAMP() as big1,
        UNIX_TIMESTAMP(nullstr) as big2
```

```
FROM T1
```

Table 3-230: Output example

big1 (BIGINT)	big2 (BIGINT)
1403006911	null

3.1.11.3.18 WEEK

Syntax

```
INT WEEK(DATE date)
INT WEEK(TIMESTAMP time)
```

Arguments

- **date: specifies a date of the DATE type.**
- **time: specifies a date of the TIMESTAMP type.**

Description

Calculate the week number of the specified date in the year. The valid week number range is from 1 to 53.

Examples

Table 3-231: Input example

dateStr(VARCHAR)	date1 (DATE)	ts1 (TIMESTAMP)
2017-09-15	2017-11-10	2017-10-15 00:00:00

Sample code

```
SELECT WEEK(TIMESTAMP '2017-09-15 00:00:00') as int1,
        WEEK(date1) as int2, WEEK(ts1) as int3, WEEK(CAST(dateStr AS
DATE)) as int4
FROM T1
```

Table 3-232: Output example

int1 (INT)	int2 (INT)	int3 (INT)	int4 (INT)
37	45	41	37

3.1.11.3.19 YEAR

Syntax

```
INT YEAR(TIMESTAMP time)
INT YEAR(DATE date)
```

Arguments

- **date: specifies a date of the DATE type.**
- **time: specifies a date of the TIMESTAMP type.**

Description

Extract the year from the specified date.

Examples

Table 3-233: Input example

tsStr(VARCHAR)	dateStr(VARCHAR)	tdate (DATE)	ts(TIMESTAMP)
2017-10-15 00:00:00	2017-09-15	2017-11-10	2017-10-15 00:00:00

Sample code

```
SELECT YEAR(TIMESTAMP '2016-09-15 00:00:00') as int1,
       YEAR(DATE '2017-09-22') as int2,
       YEAR(tdate) as int3,
       YEAR(ts) as int4,
       YEAR(CAST(dateStr AS DATE)) as int5,
       YEAR(CAST(tsStr AS TIMESTAMP))  as int6
FROM T1
```

Table 3-234: Output example

int1 (BIGINT)	int2 (BIGINT)	int3 (BIGINT)	int4 (BIGINT)	int5 (BIGINT)	int6 (BIGINT)
2016	2017	2017	2017	2015	2017

3.1.11.4 Conditional functions

3.1.11.4.1 CASE WHEN

Syntax

```
CASE WHEN a THEN b [WHEN c THEN d]* [ELSE e] END
```

Input parameters

Parameter	Data type
a	BOOLEAN
b	BOOLEAN
c	BOOLEAN
d	BOOLEAN
e	BOOLEAN

Description

- If a is true, b is returned.
- If a is false and c is true, d is returned.
- If both a and c are false, e is returned.

Example

Note:

If the CASE WHEN function returns a constant string, spaces are added after the string. An example is described as follows. When the return value is "ios", several spaces are added after this string.

```
case when device_type = 'android'
then 'android'
else 'ios'
end as os
```

You can resolve the issue in the following two ways:

- **Use the trim() method to remove the spaces. As shown in the following example , you can change os to trim(os) in the statement.**
- **Use the cast() method to convert the constant string into the VARCHAR data type .**

- **Input example**

device_type (VARCHAR)
android
ios
win

- **Sample code 1: using the trim() method**

```
SELECT
   trim(os), // The trim() method is used.
   CHAR_LENGTH(trim(os)) // The trim() method is used.
from(
   SELECT
     case when device_type = 'android'
     then 'android'
     else 'ios'
end as os
FROM T1
);
```

Sample code 2: using the cast() method

```
SELECT
 os,
CHAR_LENGTH(os)
from
(SELECT
 case when device_type = 'android'
 then cast('android' as varchar) // The cast() method is used.
 else cast('ios' as varchar) // The cast() method is used.
end as os
FROM T1
);
```

- **Output example**

os (VARCHAR)	length (INT)
android	7
ios	3
ios	3

3.1.11.4.2 COALESCE

Syntax

```
COALESCE(A,B,...)
```

Arguments

A and B: specify values to be checked. NULL values are allowed in the list of values . Non-NULL values in the list must be of the same type. Otherwise, an exception occurs. The return type is the same as the argument type.

Description

Return the first non-NULL value in the specified list. If all values in the list are NULL, the return value is NULL.

Note:
The list must contain at least one argument. Otherwise, an exception occurs.

Examples

Table 3-235: Input example

var1(VARCHAR)	var2(VARCHAR)
null	30

Sample code

```
SELECT COALESCE(var1,var2) as aa
FROM T1;
```

Table 3-236: Output example

aa(VARCHAR)
30

3.1.11.4.3 IF

Syntax

```
T IF(BOOLEAN testCondition, T valueTrue, T valueFalseOrNull)
```

Note:

T indicates any return type.

Arguments

- **testCondition: BOOLEAN type**
- **valueTrue and valueFalseOrNull: These two arguments must be of the same type. The specific type is not restricted.**

Description

Use the BOOLEAN value of testCondition as the criterion. If the value is true , valueTrue is returned. If the value is false, valueFalseOrNull is returned. If testCondition is NULL, valueFalseOrNull is returned. If any other argument is NULL , the operation is performed based on normal semantics, and the return value is of the T type.

Examples

Table 3-237: Input example

int1(INT)	int2(INT)	str1(VARCHAR)	str2(VARCHAR)
1	2	Jack	Harry
1	2	Jack	null
1	2	null	Harry

Sample code

```
SELECT IF(int1 < int2,str1, str2) as int1
FROM T1
```

Table 3-238: Output example

int1(VARCHAR)
Jack
Jack
null

3.1.11.4.4 IS_ALPHA

Syntax

```
BOOLEAN IS_ALPHA(VARCHAR str)
```

Arguments

str: specifies a string of the VARCHAR type.

Description

Check whether the specified string contains only letters. If it contains only letters, TRUE is returned. Otherwise, FALSE is returned.

Examples

Table 3-239: Input example

e (VARCHAR)	f (VARCHAR)	g (VARCHAR)
3	asd	null

Sample code

```
SELECT  IS_ALPHA(e) as boo1,IS_ALPHA(f) as boo2,IS_ALPHA(g) as boo3
FROM T1
```

Table 3-240: Output example

boo1 (BOOLEAN)	boo2 (BOOLEAN)	boo3 (BOOLEAN)
false	Yes	false

3.1.11.4.5 IS_DECIMAL

Syntax

```
 BOOLEAN IS_DECIMAL(VARCHAR str)
```

Input parameter

str: specifies a string of the VARCHAR data type.

Description

If a specified string contains only decimal characters, true is returned. Otherwise, false is returned.

Example

Table 3-241: Input example

a (VARCHAR)	b (VARCHAR)	c (VARCHAR)	d (VARCHAR)	e (VARCHAR)	f (VARCHAR)	g (VARCHAR)
1	123	2	11.4445	3	asd	null

Sample code

```
SELECT IS_DECIMAL(a) as boo1,IS_DECIMAL(b) as boo2,IS_DECIMAL(c) as
boo3,
       IS_DECIMAL(d) as boo4,IS_DECIMAL(e) as boo5,IS_DECIMAL(f) as
boo6,IS_DECIMAL(g) as boo7
FROM T1
```

Table 3-242: Output example

boo1 (BOOLEAN)	boo2 (BOOLEAN)	boo3 (BOOLEAN)	boo4 (BOOLEAN)	boo5 (BOOLEAN)	boo6 (BOOLEAN)	boo7 (BOOLEAN)
true	true	true	true	true	false	false

3.1.11.4.6 IS_DIGIT

Syntax

```
BOOLEAN IS_DIGIT(VARCHAR str)
```

Arguments

str: specifies a string of the VARCHAR type.

Description

Check whether the specified string contains only digits. If it only contains digits , TRUE is returned. Otherwise, FALSE is returned. The return value is of the BOOLEAN type.

Examples

Table 3-243: Input example

e(VARCHAR)	f(VARCHAR)	g(VARCHAR)
3	asd	null

Sample code

```
SELECT  IS_DIGIT(e) as boo1,IS_DIGIT(f) as boo2,IS_DIGIT(g) as boo3
FROM T1
```

Table 3-244: Output example

boo1(BOOLEAN)	boo2(BOOLEAN)	boo3(BOOLEAN)
true	false	false

3.1.11.4.7 NULLIF

Syntax

```
 NULLIF(A,B)
```

Arguments

A and B: INT type

Description

If A and B have the same value, null is returned. If A and B have different values, the value of the first argument is returned.

Examples

Table 3-245: Input example

var1(INT)	var2(INT)
30	30

Sample code

```
SELECT NULLIF(var1,var2) as aa
```

```
FROM T1;
```

Table 3-246: Output example

aa(VARCHAR)
null

3.1.11.5 Table-valued functions

3.1.11.5.1 GENERATE_SERIES

Syntax

```
GENERATE_SERIES(INT from, INT to)
```

Arguments

- **from: specifies a lower limit of the INT type.**
- **to: specifies an upper limit of the INT type.**

Description

Generate a series of continuous values from the lower limit to the upper limit minus one.

Examples

Table 3-247: Input example

s(INT)	e(INT)
1	3
-2	1

Sample code

```
SELECT s, e, v
FROM T1, lateral table(GENERATE_SERIES(s, e))
as T(v)
```

Table 3-248: Output example

s(INT)	e(INT)	v(INT)
1	3	1
1	3	2

s(INT)	e(INT)	v(INT)
-2	1	-2
-2	1	-1
-2	1	-0

3.1.11.5.2 JSON_TUPLE

Syntax

```
JSON_TUPLE(str, path1, path2 ..., pathN)
```

Arguments

- **str: specifies a JSON string.**
- **path1 to pathN: specify strings that represent paths, which do not need to begin with a dollar sign ($).**

Description

Obtain the value represented by each path string from a JSON string.

Examples

Table 3-249: Input example

d(VARCHAR)	s(VARCHAR)
{ “qwe” :” asd” ,” qwe2” :” asd2” ,” qwe3” :” asd3” }	qwe3
{ “qwe” :” asd4” ,” qwe2” :” asd5” ,” qwe3” :” asd3” }	qwe2

Sample code

```
SELECT d, v
FROM T1, lateral table(JSON_TUPLE(d, 'qwe', s))
as T(v)
```

Table 3-250: Output example

d(VARCHAR)	v(VARCHAR)
{ “qwe” :” asd” ,” qwe2” :” asd2” ,” qwe3” :” asd3” }	asd

d(VARCHAR)	v(VARCHAR)
{ “qwe” :” asd” ,” qwe2” :” asd2” ,” qwe3” :” asd3” }	asd3
{ “qwe” :” asd4” ,” qwe2” :” asd5” ,” qwe3” :” asd3” }	asd4
{ “qwe” :” asd4” ,” qwe2” :” asd5” ,” qwe3” :” asd3” }	asd5

3.1.11.5.3 STRING_SPLIT

Syntax

```
STRING_SPLIT(VARCHAR , separator)
```

Arguments

separator: specifies a separator of the VARCHAR type.

Description

Use a separator to split a string into multiple substrings.

Examples

Table 3-251: Input example

d (VARCHAR)	s (VARCHAR)
abc-bcd	-
hhh	-

Sample code

```
SELECT d, v
FROM T1, lateral table(STRING_SPLIT(d, s))
as T(v)
```

Table 3-252: Output example

d (VARCHAR)	v (VARCHAR)
abc-bcd	abc
abc-bcd	bcd
hhh	hhh

3.1.11.6 Type conversion functions

3.1.11.6.1 CAST

Syntax

```
CAST(A AS type)
```

Argument

A: For more information about the argument type, see *Data types*.

Description

Convert a value to a specified type.

Examples

Table 3-253: Input example

var1 (VARCHAR)	var2 (INT)
1000	30

Sample code

```
SELECT CAST(var1 AS INT)  as aa
FROM T1;
```

Table 3-254: Output example

aa (INT)
1000

3.1.11.7 Aggregate functions

3.1.11.7.1 AVG

Syntax

```
AVG(A)
```

Argument

A: specifies a value of numeric types including TINYINT, SMALLINT, INT, BIGINT, FLOAT, DECIMAL, and DOUBLE.

Description

Return the average number.

Examples

Table 3-255: Input example

var1 (INT)	var2 (INT)
4	30
6	30

Sample code

```
SELECT AVG(var1)  as aa
FROM T1;
```

Table 3-256: Output example

aa (INT)
5

3.1.11.7.2 CONCAT_AGG

Syntax

```
CONCAT_AGG([linedelimiter, ] value)
```

Argument

linedelimiter: specifies a connector, which currently can only be a string constant.

Description

Use a connector to concatenate multiple fields. The default connector is "\n". The return value is a new concatenated string of the VARCHAR type.

Examples

Table 3-257: Input example

c (VARCHAR)
Hi
Hi

c (VARCHAR)
Hi
Hi
Hi
Hi
Hi
Hi
Hi
Hi

Sample code

```
SELECT concat_agg(c) as var1,
       concat_agg('-', c) as var2
FROM MyTable
GROUP BY c
```

Table 3-258: Output example

var1 (VARCHAR)	var2 (VARCHAR)
Hi\nHi\nHi\nHi\nHi\nHi\nHi\nHi\nHi	Hi-Hi-Hi-Hi-Hi-Hi-Hi-Hi-Hi-Hi

3.1.11.7.3 COUNT

Syntax

```
COUNT(A)
```

Arguments

A

- **Supported data types include numeric types (TINYINT, SMALLINT, INT, BIGINT, FLOAT, DECIMAL, and DOUBLE), BOOLEAN, and VARCHAR.**
- **The DATE, TIME, TIMESTAMP, and VARBINARY data types are not supported.**

Description

Return the number of input parameters.

Examples

Table 3-259: Input example

var1 (VARCHAR)
1000
100
10
1

Sample code

```
SELECT COUNT(var1)  as aa
FROM T1;
```

Table 3-260: Output example

aa (BIGINT)
4

3.1.11.7.4 FIRST_VALUE

Syntax

```
 T FIRST_VALUE(value: T)
```

To obtain the first record based on parameters, define the function as follows:

```
 T FIRST_VALUE(value: T, order: Long)
```

Arguments

- **value: specifies a value of any type. Only one argument is supported.**
- **order: specifies a record with the smallest order value as the first record.**

Description

Obtain the first non-null record of a stream.

Examples

Table 3-261: Input example

a (BIGINT)	b (INT)	c (VARCHAR)
1L	1	"Hello"
2L	2	"Hello"
3L	3	"Hello"
4L	4	"Hello"
5L	5	"Hello"
6L	6	"Hello"
7L	7	"Hello World"
8L	8	"Hello World"
20L	20	"Hello World"

Sample code

```
SELECT
c,
first_value(b) OVER (PARTITION BY c ORDER BY proctime RANGE UNBOUNDED
preceding) as var1
from T1
```

Table 3-262: Output example

c (VARCHAR)	var1 (INT)
Hello	1
Hello	1
Hello	1
Hello	1
Hello	1
Hello	1
Hello World	7
Hello World	7
Hello World	7

3.1.11.7.5 LAST_VALUE

Syntax

```
T LAST_VALUE(value: T)
```

To return the last value in an ordered set of values, define the function as follows:

```
T LAST_VALUE(value: T, order: Long)
```

Arguments

- **value: specifies a value of any type.**
- **order: specifies the order of the values. A value with the greatest order value is considered as the last value.**

Description

Obtain the last data record of a stream.

Examples

Table 3-263: Input example

a(BIGINT)	b(INT)	c(VARCHAR)
1L	1	"Hello"
2L	2	"Hello"
3L	3	"Hello"
4L	4	"Hello"
5L	5	"Hello"
6L	6	"Hello"
7L	7	"Hello World"
8L	8	"Hello World"
20L	20	"Hello World"

Sample code

```
SELECT
c,
last_value(b) OVER (PARTITION BY c ORDER BY proctime RANGE UNBOUNDED
preceding) as var1
```

```
from T1
```

Table 3-264: Output example

c(VARCHAR)	var1(INT)
Hello	1
Hello	2
Hello	3
Hello	4
Hello	5
Hello	6
Hello World	7
Hello World	8
Hello World	20

3.1.11.7.6 MAX

Syntax

```
MAX(A)
```

Arguments

A

- **Supported data types include numeric values (TINYINT, SMALLINT, INT, BIGINT , FLOAT, DECIMAL, and DOUBLE), BOOLEAN, and VARCHAR.**
- **The DATE, TIME, TIMESTAMP, and VARBINARY data types are not supported.**

Description

Return the maximum value of all the input values.

Examples

Table 3-265: Input example

var1(INT)
4
8

Sample code

```
SELECT MAX(a)  as aa
FROM T1;
```

Table 3-266: Output example

aa(INT)
8

3.1.11.7.7 MIN

Syntax

```
 MIN(A)
```

Arguments

A

- **Supported data types include numeric values (TINYINT, SMALLINT, INT, BIGINT , FLOAT, DECIMAL, and DOUBLE), BOOLEAN, and VARCHAR.**
- **The DATE, TIME, TIMESTAMP, and VARBINARY data types are not supported.**

Description

Return the minimum value of all the input values.

Examples

Table 3-267: Input example

var1(INT)
4
8

Sample code

```
SELECT MIN(a)  as aa
FROM T1;
```

Table 3-268: Output example

aa(INT)
4

3.1.11.7.8 STDDEV_POP

Syntax

```
T STDDEV_POP(T value)
```

Argument

value: specifies a number of the BIGINT or DOUBLE type.

Description

Return the standard deviation for the population of all values in the specified expression.

Examples

Table 3-269: Input example

a (DOUBLE)	c (VARCHAR)
0	Hi
1	Hi
2	Hi
3	Hi
4	Hi
5	Hi
6	Hi
7	Hi
8	Hi
9	Hi

Sample code

```
SELECT c, STDDEV_POP(a) as dou
FROM MyTable
GROUP BY c
```

Table 3-270: Output example

c (VARCHAR)	dou1 (DOUBLE)
Hi	2.8722813232690143

3.1.11.7.9 SUM

Syntax

```
SUM(A)
```

Arguments

A: specifies a value of the numeric types including TINYINT, SMALLINT, INT, BIGINT, FLOAT, DECIMAL, and DOUBLE.

Description

Return the sum of all input values.

Examples

Table 3-271: Input example

var1 (INT)
4
4

Sample code

```
SELECT sum(a)  as aa
FROM T1;
```

Table 3-272: Output example

aa (INT)
8

3.1.11.7.10 VAR_POP

Syntax

```
T VAR_POP(T value)
```

Argument

value: specifies a number of the BIGINT or DOUBLE type.

Description

Return the statistical variance for the population of all values in the specified expression.

Examples

Table 3-273: Input example

a (BIGINT)	c (VARCHAR)
2900	Hi
2500	Hi
2600	Hi
3100	Hello
11000	Hello

Sample code

```
SELECT
   VAR_POP(a) as `result`,
   c
FROM MyTable
GROUP BY c
```

Table 3-274: Output example

result (BIGINT)	c
28889	Hi
15602500	Hello

3.1.11.8 Other functions

3.1.11.8.1 UUID

Syntax

```
VARCHAR UUID()
```

Arguments

None

Description

Return a globally unique identifier.

Examples

Sample code

```
SELECT  uuid() as `result`
```

```
FROM T1
```

Table 3-275: Output example

result(VARCHAR)
a364e414-e68b-4e5c-9166-65b3a153e257

3.1.12 UDXs

3.1.12.1 Overview

You can extend the following three types of user-defined functions (UDFs):

- **User-defined scalar function (UDSF)**

  A UDSF can be used in a SQL expression and returns only one value.
- **User-defined aggregation function (UDAF)**

  A UDAF aggregates multiple scalar values into one value.
- **User-defined table function (UDTF)**

  A UDTF takes zero, one, or multiple scalar values as input parameters and returns any number of rows. Among UDFs, UDTFs are the only type that can return multiple fields.

Download JAR files

- **For Realtime Compute versions earlier than 2.0, download the following JAR files:**
  - *flink-streaming-java_2.11*
  - *flink-table_2.11*

  Note:
  After the JAR files are downloaded, you must modify the dependency information in the `pom.xml` file as follows:

```
<dependency> 
      <groupId>com.alibaba.blink</groupId>
      <artifactId>flink-table_2.11</artifactId>
      <version>blink-1.4-SNAPSHOT</version>
      <scope>provided</scope>
  </dependency>
  <dependency>
       <groupId>org.apache.flink</groupId>
       <artifactId>flink-streaming-java_2.11</artifactId>
       <version>blink-1.4-SNAPSHOT</version>
```

```
        <scope>provided</scope>
    </dependency>
```

- **For Realtime Compute version 2.0 and later, download the following JAR files:**
  - *flink-streaming-java_2.11*
  - *flink-table_2.11*
  - *flink-core-blink-2.2.4*

Note:

After the JAR files are downloaded, you must modify the `pom.xml` file as follows:

```
<dependency>
    <groupId>org.apache.flink</groupId>
    <artifactId>flink-core</artifactId>
    <version>blink-2.2.4-SNAPSHOT</version>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.apache.flink</groupId>
    <artifactId>flink-table_2.11</artifactId>
    <version>blink-2.2.4-SNAPSHOT</version>
    <scope>provided</scope>
</dependency>
<dependency>
     <groupId>org.apache.flink</groupId>
     <artifactId>flink-streaming-java_2.11</artifactId>
     <version>blink-2.2.4-SNAPSHOT</version>
     <scope>provided</scope>
</dependency>
```

Register and use a UDF

1. **Log on to the Realtime Compute console. For more information, see Log on to the Realtime Compute console in User Guide.**
2. **Click Development in the top navigation bar to go to the development page.**
3. **Click Resources in the left-side navigation pane.**
4. **On the Resources page, click #Create Resource in the upper right corner to go to the Upload Resource dialog box.**
5. **Specify settings for a resource as follows.**

Field	Description
Location	Currently, you can only upload local resources.
Resource	Click Upload Resource to select a resource to be referenced.
Resource Name	Enter a name for the resource.

Field	Description
Resource Description	Enter the resource description.
Resource Type	Select a type for a resource: JAR, DICTIONARY, or PYTHON.

6. On the Resources page, locate the new resource, and move the pointer over More in the Actions column.
7. Select Reference from the drop-down list to load the resource at runtime.
8. In the code editor, enter a declaration for the user-defined function at the beginning. An example is described as follows:

```
CREATE FUNCTION stringLengthUdf AS 'com.hjc.test.blink.sql.udx.
StringLengthUdf';
```

3.1.12.2 User-defined scalar function (UDSF)

This topic describes how to create a UDSF for Realtime Compute.

Definition

A UDSF maps zero, one, or multiple scalar values to a new scalar value.

Build the development environment

For more information, see *Download JAR files*.

Write code that implements business logic

To define a scalar function, you must extend the ScalarFunction class by implementing one or more `eval()` methods. The `open()` and `close()` methods are optional. An example of Java code is provided as follows:

```
package com.hjc.test.blink.sql.udx;

import org.apache.flink.table.functions.FunctionContext;
import org.apache.flink.table.functions.ScalarFunction;

public class StringLengthUdf extends ScalarFunction {
    // The open() method is optional.
    // To write the open() method, you must import org.apache.flink.
table.functions.FunctionContext.
    @Override
    public void open(FunctionContext context) {
        }
    public long eval(String a) {
        return a == null ? 0 : a.length();
    }
    public long eval(String b, String c) {
        return eval(b) + eval(c);
    }
    // The close() method is optional.
    @Override
```

```
    public void close() {
        }
}
```

Publish and use a UDSF

For more information about how to publish and use a UDSF, see Publish in User Guide.

Sample code of a UDSF

```
-- udf str.length()
CREATE FUNCTION stringLengthUdf AS 'com.hjc.test.blink.sql.udx.
StringLengthUdf';
create table sls_stream(
 a int,
 b int,
 c varchar
) with (
 type='sls',
 endPoint='yourEndpoint',
 accessKeyId='yourAccessId',
 accessKeySecret='yourAccessSecret',
 startTime = '2017-07-04 00:00:00',
 project='yourProjectName',
 logStore='yourLogStoreName',
 consumerGroup='consumerGroupTest1'
);
create table rds_output(
 id int,
 len bigint,
 content VARCHAR
) with (
 type='rds',
 url='yourDatabaseURL',
 tableName='yourDatabaseTableName',
 userName='yourDatabaseUserName',
 password='yourDatabasePassword'
);
insert into rds_output
select
 a,
 stringLengthUdf(c),
 c as content
from sls_stream
```

FAQ

Q: Why does a UDSF that generates random numbers always returns the same value ?

A: If no parameters are defined for a UDSF and you do not declare the function as nondeterministic, the function may be optimized during compilation to return a constant value. To avoid this, you can override the `isDeterministic()` method to make it return `false`.

3.1.12.3 User-defined aggregation function (UDAF)

This topic describes how to create a UDAF for Realtime Compute.

Definition

A UDAF aggregates multiple values into a single value.

Methods of a UDAF

The following code describes the core methods of a UDAF.

Note:
A UDAF can be implemented in Java or Scala. We recommend that you use Java because Scala data types may cause unnecessary overhead when calling functions.

- **createAccumulator() and getValue() methods**

```
/*
* @param <T> The type of the aggregation result returned by a UDAF.
* @param <ACC> The type of a UDAF accumulator. An accumulator stores
 the intermediate computing results of a UDAF. You can design an
accumulator for each UDAF as required.
*/
public abstract class AggregateFunction<T, ACC> extends UserDefine
dFunction {
/*
* Initializes the accumulator of the AggregateFunction.
* Calls the following method once when aggregation is performed for
the first time.
*/
public ACC createAccumulator();
/*
* Calls the following method after each aggregation is complete.
*/
public T getValue(ACC accumulator);
}
```

Note:

- **The** `createAccumulator()` **and** `getValue()` **methods can be defined in the** `AggregateFunction` **abstract class.**
- **A UDAF must contain at least one** `accumulate()` **method.**

- **accumulate() method**

```
public void accumulate(ACC accumulator, ...[ User-specified
parameters]...) ;
```

Note:

- You need to implement an accumulate() method to process input data and update the provided accumulator with the computing result.
- The first parameter of the accumulate() method must be an accumulator of the ACC type as defined in the AggregateFunction class. During processing, you can use the underlying runtime code to send the previous accumulator and the specified upstream data to the operator for calculation. No limits are set for the data types or the number of data records.

- retract() and merge() methods

  The createAccumulator(), getValue(), and accumulate() methods are mandatory for each UDAF. The retract() and merge() methods are also needed in certain Realtime Compute scenarios.

  In many Realtime Compute scenarios, computing is an early firing for an infinite stream. To refine the early fired results, you need to implement a retract() method. The SQL translation optimizer automatically determines the circumstances under which input data needs to be retracted. It also automatically determines the operations you need to process the data with the retraction labels. You must implement a retract() method to retract input data.

```
public void retract(ACC accumulator, ...[ User-specified parameters
]...) ;
```

  Note:

  - The retract() method is a reverse operation of the accumulate() method. For example, in a count UDAF, the computing result increases by 1 when the accumulate() method is called to process a data record. The result decreases by 1 when the retract() method is called to process a data record.
  - Similar to the accumulate() method, the first parameter of the retract() method must be an accumulator of the ACC type as defined in the aggregate function class. During data processing, the runtime code sends the previous value in the accumulator and the specified upstream data to the operator for calculation. No limits are set for the data types or the number of data records.

  The merge() method is required in certain Realtime compute scenarios.
  For example, when you use session windows to aggregate data, you need to implement the merge() method. Realtime Compute can handle out-of-order data. Newly arrived data may fill the gap between two separate sessions, which results

in the merge of the two sessions. In this case, you need to implement the merge() method to integrate multiple accumulators into one accumulator.

```
public void merge(ACC accumulator, Iterable<ACC> its);
```

Note:

- **The first parameter of the merge() method must be an accumulator of the ACC type as defined in the AggregateFunction class. After the merge() method is complete, the state of the AggregateFunction is stored in the first accumulator.**
- **The second parameter of the merge() method is an iterator of one or more ACC-type accumulators.**

Build the development environment

For more information about how to build the development environment, see *Download JAR files*.

Write code that implements business logic

An example of Java code is provided as follows:

```
import org.apache.flink.table.functions.AggregateFunction;

public class CountUdaf extends AggregateFunction<Long, CountUdaf.
CountAccum> {
    // Defines the data schema of the accumulator that stores the
state of the count UDAF.
    public static class CountAccum {
        public long total;
    }

    // Initializes the accumulator of the count UDAF.
    public CountAccum createAccumulator() {
        CountAccum acc = new CountAccum();
        acc.total = 0;
        return acc;
    }

    // Calls the getValue() method to obtain the result of the count
UDAF from the accumulator that stores the UDAF state.
    public Long getValue(CountAccum accumulator) {
        return accumulator.total;
    }

    // Calls the accumulate() method to update the accumulator that
stores the state of the count UDAF based on input data.
    public void accumulate(CountAccum accumulator, Object iValue) {
        accumulator.total++;
    }
```

```
    public void merge(CountAccum accumulator, Iterable<CountAccum> its
) {
          for (CountAccum other : its) {
             accumulator.total += other.total;
          }
    }
}
```

Note:

For a subclass of AggregateFunction, the open() and close() methods are optional. For more information, see the examples of a UDF or UDTF.

Publish and use a UDAF

For more information about how to publish and use a UDAF, see Publish in User Guide.

Sample code of a UDAF

```
-- Uses a UDAF to calculate the count.
CREATE FUNCTION countUdaf AS 'com.hjc.test.blink.sql.udx.CountUdaf';
create table sls_stream(
a int,
b bigint,
c varchar
) with (
type='sls',
endPoint='yourEndpoint',
accessKeyId='yourAccessId',
accessKeySecret='yourAccessSecret',
startTime = '2017-07-04 00:00:00',
project='yourProjectName',
logStore='stream-test2',
consumerGroup='consumerGroupTest3'
);

create table rds_output(
len1 bigint,
len2 bigint
) with (
type='rds',
url='yourDatabaseURL',
tableName='yourDatabaseTableName',
userName='yourDatabaseUserName',
password='yourDatabasePassword'
);

insert into rds_output
select
count(a),
countUdaf(a)
```

```
from sls_stream
```

3.1.12.4 User-defined table function (UDTF)

Definition

Similar to a UDSF, a UDTF uses zero, one, or multiple scalar values as input parameters. The difference is that a UDTF returns any number of rows, rather than a single value. The returned rows can consist of one or more columns.

Build the development environment

For more information about how to build the development environment, see *Download JAR files*.

Write code that implements business logic

To define a table function, you must extend the base class TableFunction by implementing one or more `eval()` methods. The `open()` and `close()` methods are optional. An example of Java code is provided as follows:

```
package com.hjc.test.blink.sql.udx;

import org.apache.flink.table.functions.FunctionContext;
import org.apache.flink.table.functions.TableFunction;

public class SplitUdtf extends TableFunction<String> {

    // The open() method is optional. // To write the open() method,
you must import org.apache.flink.table.functions.FunctionContext.
    @Override
    public void open(FunctionContext context) {
        // ...
        }

    public void eval(String str) {
        String[] split = str.split("\\|");
        for (String s : split) {
            collect(s);
        }
    }

    // The close() method is optional.
    @Override
    Public void close (){
        // ...
        }
}
```

Return multiple rows

You can make a UDTF return multiple rows by calling the `collect()` method multiple times.

Return multiple columns

A UDTF can also return multiple columns. If you want a UDTF to return multiple columns, you can declare the return value as a Tuple or Row object.

- **The return value is declared as a Tuple object.**

  Realtime Compute supports Tuple1 to Tuple25, which defines 1 to 25 columns. For example, you can use Tuple3 to return three columns. The sample code is provided as follows:

```
import org.apache.flink.api.java.tuple.Tuple3;
import org.apache.flink.table.functions.TableFunction;

// If the return value is declared as a Tuple object, you must
explicitly declare the data type of the object, such as STRING, LONG
, and INTEGER as shown in this example.
public class ParseUdtf extends TableFunction<Tuple3<String, Long,
Integer>> {

public void eval(String str) {
String[] split = str.split(",");
// The following code is only used for your reference. In practice,
you need to add code that implements verification logic.
String first = split[0];
long second = Long.parseLong(split[1]);
int third = Integer.parseInt(split[2]);
Tuple3<String, Long, Integer> tuple3 = Tuple3.of(first, second,
third);
collect(tuple3);
}
}
```

  Note:
  If the return value is declared as a Tuple object, column values cannot be null and a maximum of 25 columns are allowed.

- **The returned value is declared as a Row object.**

  For example, you can use Row to return three columns. The sample code is provided as follows:

```
import org.apache.flink.table.types.DataType;
import org.apache.flink.table.types.DataTypes;
import org.apache.flink.table.functions.TableFunction;
import org.apache.flink.types.Row;

public class ParseUdtf extends TableFunction<Row> {

public void eval(String str) {
String[] split = str.split(",");
String first = split[0];
long second = Long.parseLong(split[1]);
int third = Integer.parseInt(split[2]);
Row row = new Row(3);
```

```
row.setField(0, first);
row.setField(1, second);
row.setField(2, third);
collect(row);
}

@Override
// If the return value is declared as a Row object, you must
explicitly declare the data type of the object by overriding the
getResultType() method.
public DataType getResultType(Object[] arguments, Class[] argTypes)
 {
return DataTypes.createRowType(DataTypes.STRING, DataTypes.LONG,
DataTypes.INT);
}
}
```

 **Note:**

If the return value is declared as a Row object, column values can be null. If the return value is declared as a Row object, you must override the `getResultType()` method.

SQL syntax

A UDTF supports CROSS JOIN and LEFT JOIN operations. To perform these JOIN operations, you must use the `lateral` and `table` keywords in SQL statements. You need to provide an alias for a UDTF. For example, you can provide an alias for the preceding `ParseUdtf` function as follows:

```
CREATE FUNCTION parseUdtf AS 'com.alibaba.blink.sql.udtf.ParseUdtf';
```

CROSS JOIN: Each row in the left table is joined with each row of data generated by the UDTF. If the UDTF does not generate any data for a row, the row is not returned.

```
select S.id, S.content, T.a, T.b, T.c
from input_stream as S,
lateral table(parseUdtf(content)) as T(a, b, c);
```

LEFT JOIN: Each row in the left table is joined with each row of data generated by the UDTF. If the UDTF does not generate any data for a row, the UDTF fields in the row are padded with null.

 **Note:**

When you perform LEFT JOIN operations for a UDTF, you must end the statement with an `on true` join condition.

```
select S.id, S.content, T.a, T.b, T.c
from input_stream as S
```

```
left join lateral table(parseUdtf(content)) as T(a, b, c) on true;
```

Publish and use a UDTF

For more information about how to publish and use a UDTF, see Publish in User Guide.

UDTF DEMO

```
-- UDTF str.split("\\|");
create function splitUdtf as 'com.hjc.test.blink.sql.udx.SplitUdtf';

create table sls_stream(
a INT,
b BIGINT,
C VARCHAR
) with (
type='sls',
endPoint='<yourEndpoint>',
accessKeyId='<yourAccessKeyId>',
accessKeySecret='<yourAccessSecret>',
startTime = '2017-07-04 00:00:00',
project='<yourProjectName>',
logStore='<yourLogStoreName>',
consumerGroup='consumerGroupTest2'
);

-- Uses the splitUdtf function to extract data from the c field. The
table T with multiple rows and one column is returned. The column is
named s.
create view v1 as
select a,b,c,s
from sls_stream,
lateral table(splitUdtf(c)) as T(s);

create table rds_output(
id INT,
len BIGINT,
content VARCHAR
) with (
type='rds',
url='yourDatabaseURL',
tableName='<yourDatabaseTableName>',
userName='<yourDatabaseUserName>',
password='<yourDatabasePassword>'
);

insert into rds_output
select
a,b,s
```

```
from v1
```

3.1.12.5 Create a user-defined function (UDF) by using IntelliJ IDEA

This topic takes a Java package named com.hjc.test.blink.sql.udx as an example to describe how to use IntelliJ IDEA to create a UDF for Realtime Compute.

Note:

This example uses IntelliJ IDEA on macOS. You need to download and install IntelliJ IDEA on your Mac before creating user-defined functions.

Preparations

1. **Download Maven.**
   a. **Visit the** *Apache Maven website* **and download** *apache-maven-3.5.3-bin.tar.gz*.
   b. **Decompress the downloaded package to a directory, for example,** */Users/*****/Documents/maven*.
2. **Configure environment variables.**

   Open Terminal on your Mac and perform the following operations:
   a. **Run the** `vim ~/.bash_profile` **command to open the .bash_profile file.**
   b. **Enter the following commands in the file:** `export M2_HOME=/Users/****/Documents/maven/apache-maven-3.5.3` **and** `export PATH=$PATH:$M2_HOME/bin`.
   c. **Run the** `:wq` **command to save the configurations and exit. Run the following command in Terminal to apply the configurations:** `source ~/.bash_profile`.
3. **Check whether the configurations take effect.**

   Run the `mvn -v` **command in Terminal. If the command returns the following result, the configurations have taken effect.**

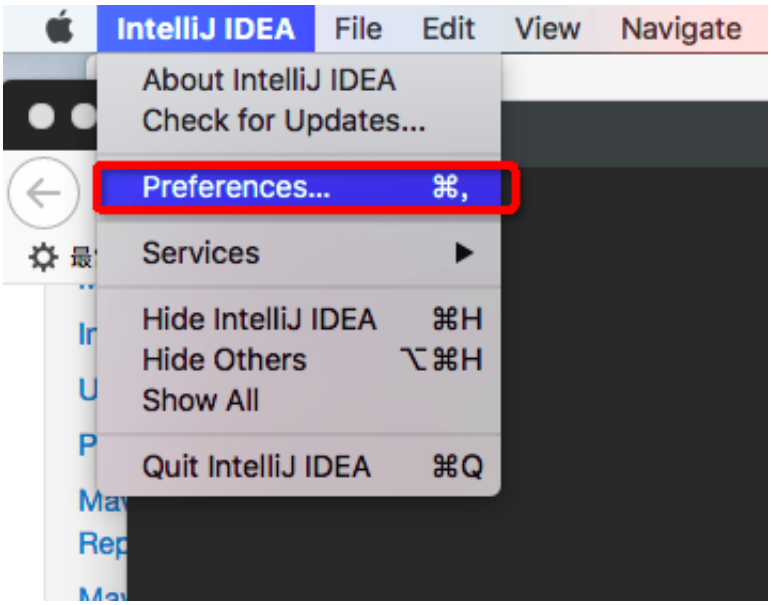
```
Apache Maven 3.5.0 (ff8f5e7444045639af65f6095c62210b5713f426; 2017-
04-04T03:39:06+08:00)
Maven home: /Users/****/Documents/maven/apache-maven-3.5.0
Java version: 1.8.0_121, vendor: Oracle Corporation
Java home: /Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/
Contents/Home/jre
Default locale: zh_CN, platform encoding: UTF-8
```

```
OS name: "mac os x", version: "10.12.6", arch: "x86_64", family: "
mac"
```

4. **Download the required JAR files to a local repository. For more information about the download URL, see** *Download JAR files*.

Configure Maven in IntelliJ IDEA

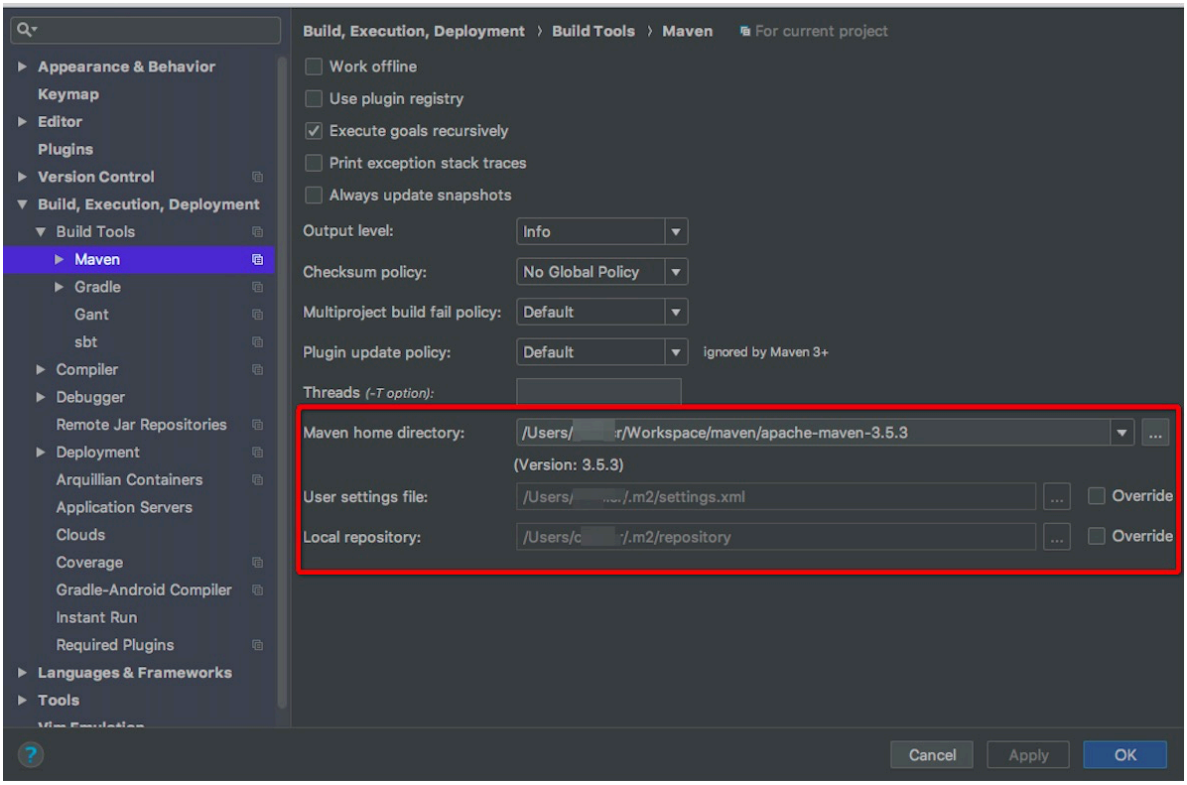
1. **Click IntelliJ IDEA in the top navigation bar.**
2. **Select Preferences from the drop-down list.**



3. **Choose Maven > Maven home directory to configure the Maven home directory.**

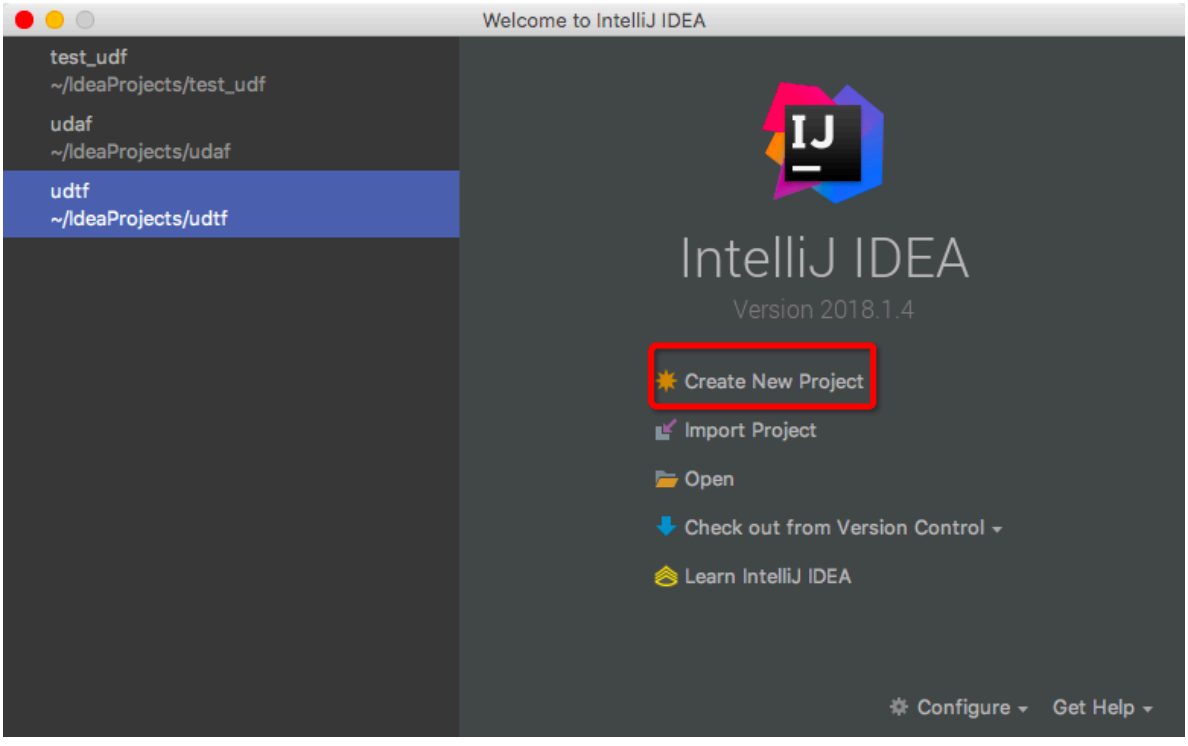
Note:

You can find the Maven home directory `Maven home:/Users/****/Documents/maven/apache-maven-3.5.0` from the output of the `mvn -v` command. For more information, see Preparations.

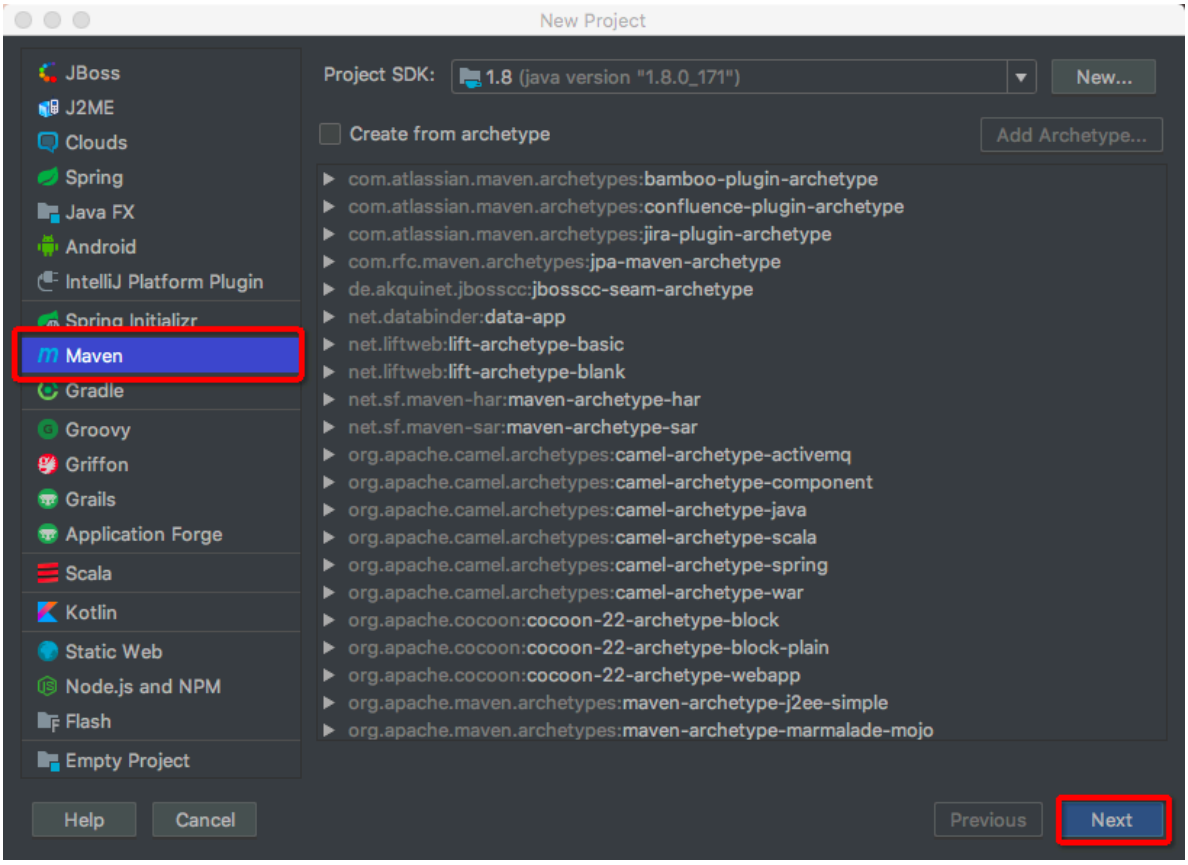


Create a Maven project

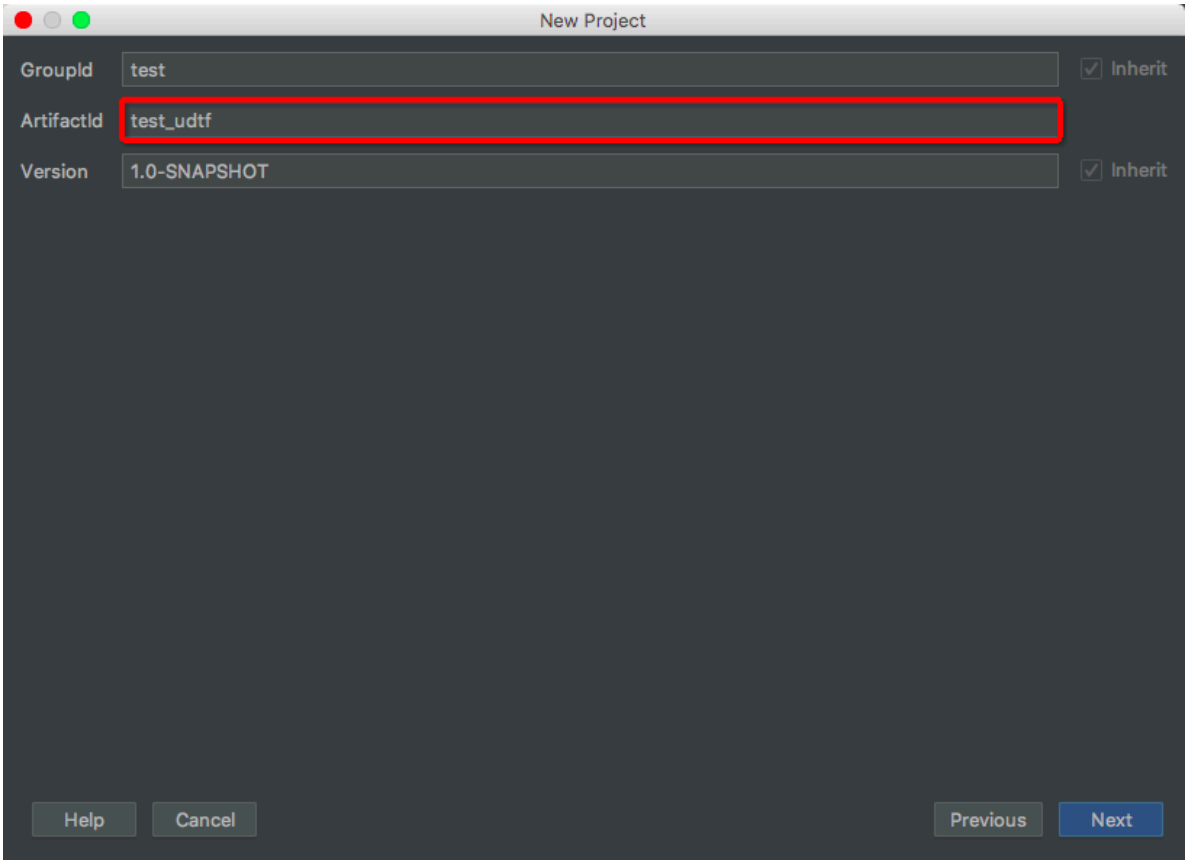
1. **Click Create New Project on the home page of IntelliJ IDEA.**



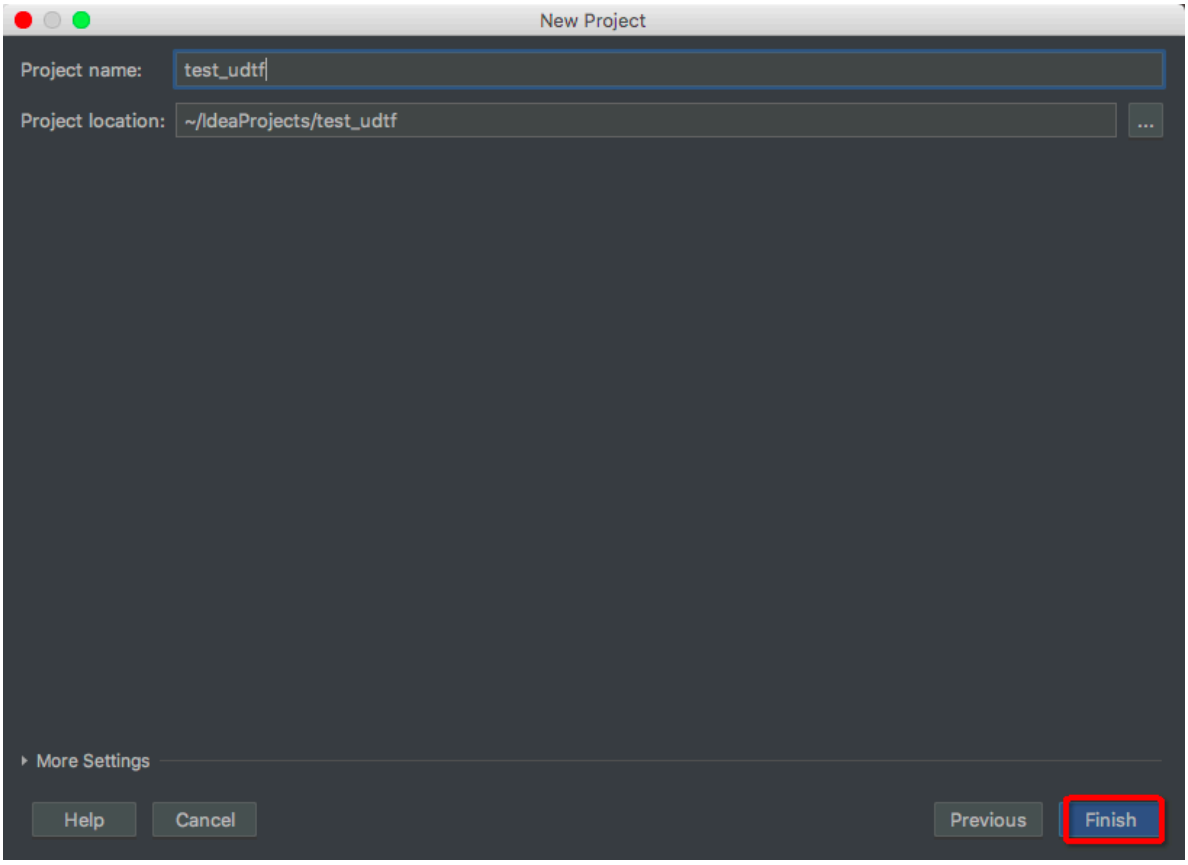
2. **Select Maven.**



3. **Enter a project name in the ArtifactId field.**

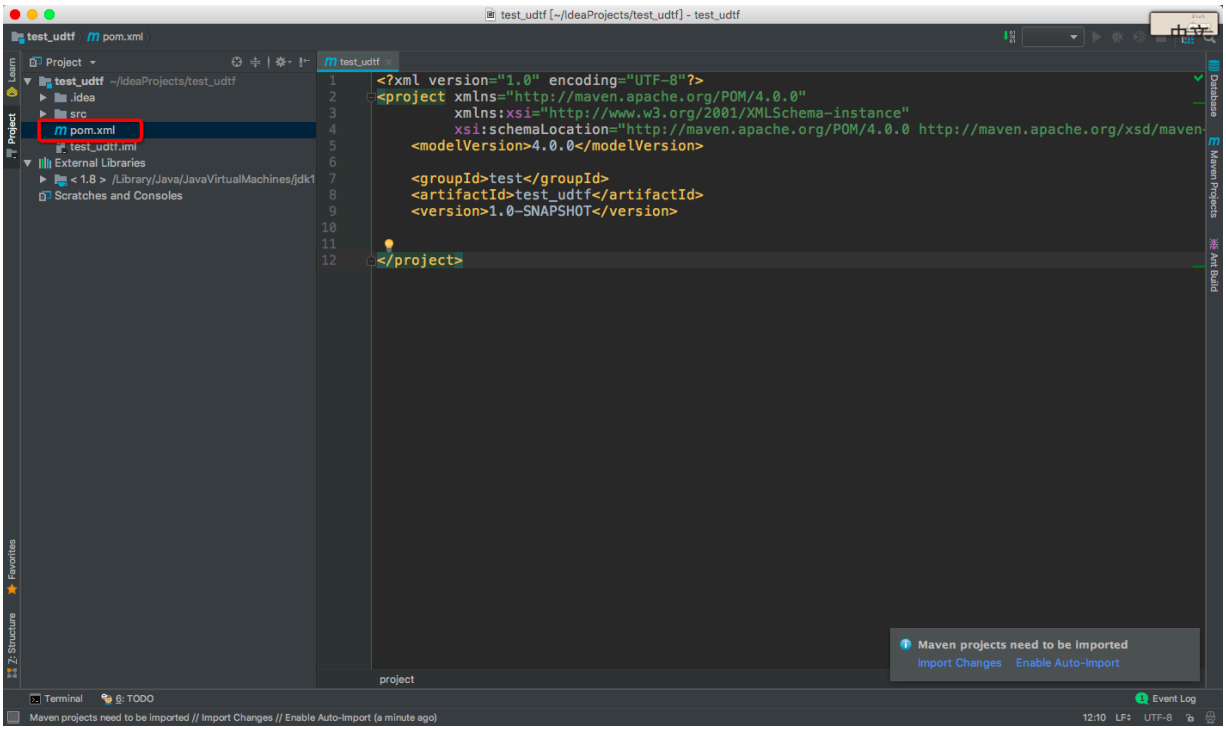


4. **Click Finish.**



Configure dependencies

Open the *pom.xml* file, and enter the following code to declare dependencies in the code editor:



- **For Realtime Compute versions earlier than 2.0**

```
<dependency>
        <groupId>com.alibaba.blink</groupId>
        <artifactId>flink-table_2.11</artifactId>
        <version>blink-1.4-SNAPSHOT</version>
        <scope>provided</scope>
    </dependency>
    <dependency>
         <groupId>org.apache.flink</groupId>
         <artifactId>flink-streaming-java_2.11</artifactId>
         <version>blink-1.4-SNAPSHOT</version>
         <scope>provided</scope>
    </dependency>
```

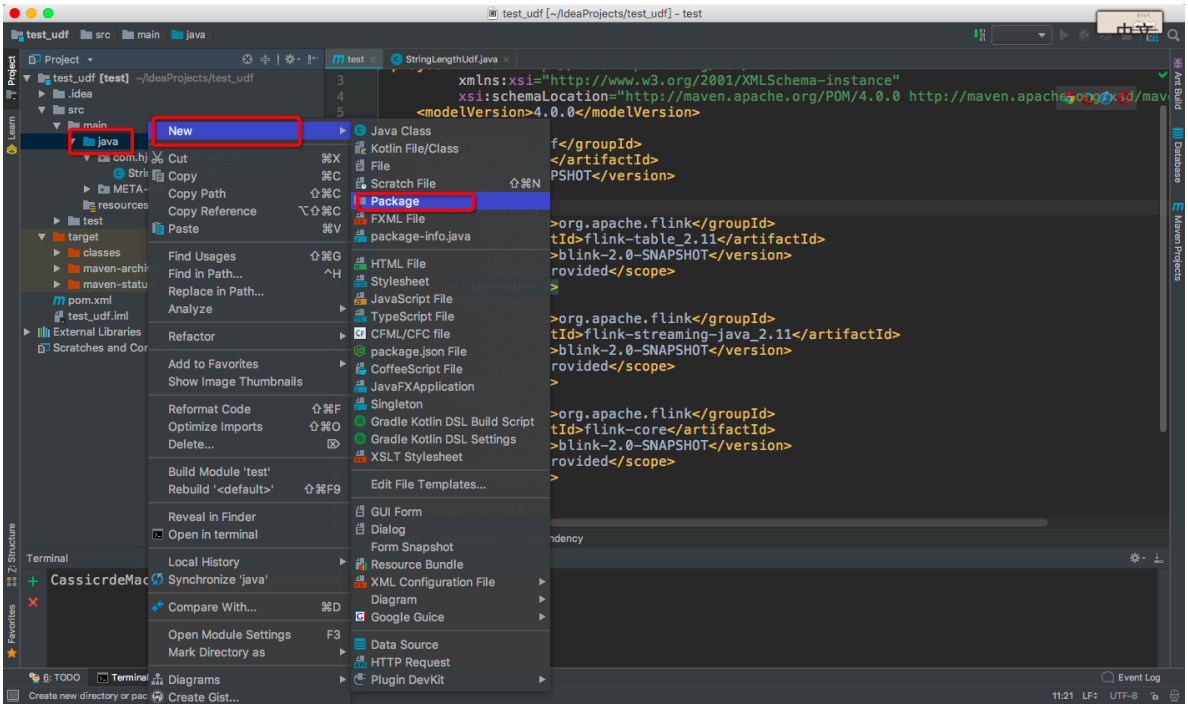
- **For Realtime Compute version 2.0 and later**

```
    <dependency>
        <groupId>org.apache.flink</groupId>
        <artifactId>flink-core</artifactId>
        <version>blink-2.2.4-SNAPSHOT</version>
        <scope>provided</scope>
    </dependency>
    <dependency>
        <groupId>org.apache.flink</groupId>
        <artifactId>flink-table_2.11</artifactId>
        <version>blink-2.2.4-SNAPSHOT</version>
        <scope>provided</scope>
    </dependency>
    <dependency>
         <groupId>org.apache.flink</groupId>
         <artifactId>flink-streaming-java_2.11</artifactId>
         <version>blink-2.2.4-SNAPSHOT</version>
         <scope>provided</scope>
```

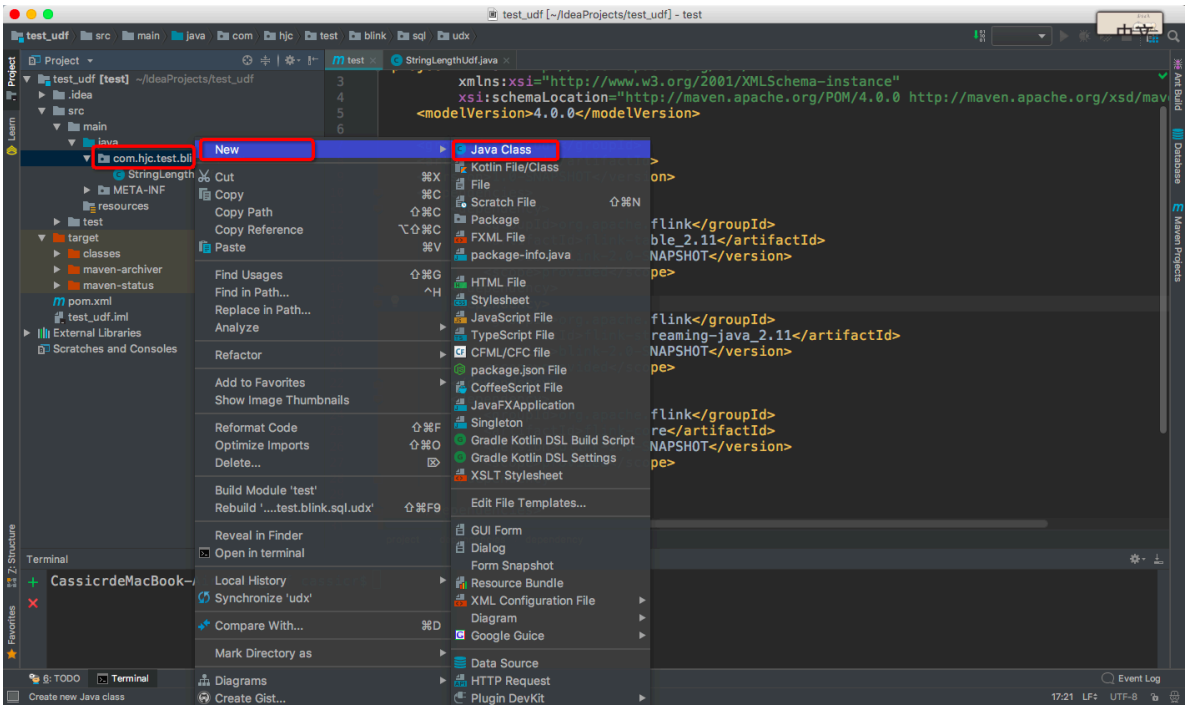
```
        </dependency>
```

Test a UDF

1. **Create a new package.**



2. **Create a new Java class.**



3. **Copy and paste the UDF code you have written to the Java class, and run the code to start the test. An example of UDF code is provided as follows:**

```
import org.apache.flink.table.functions.ScalarFunction;
public class StringLengthUdf extends ScalarFunction {
```

```
    // The open() method is optional.
     // To write the open() method, you must import org.apache.flink.
table.functions.FunctionContext;'.
@Override
public void open(FunctionContext context) {
// ...
  }
public long eval(String a) {
return a == null ? 0 : a.length();
}
public long eval(String b, String c) {
return eval(b) + eval(c);
}
// The close() method is optional.
@Override
Public void close (){
// ...
   }
}
```

4. **Package the project into a JAR file.**

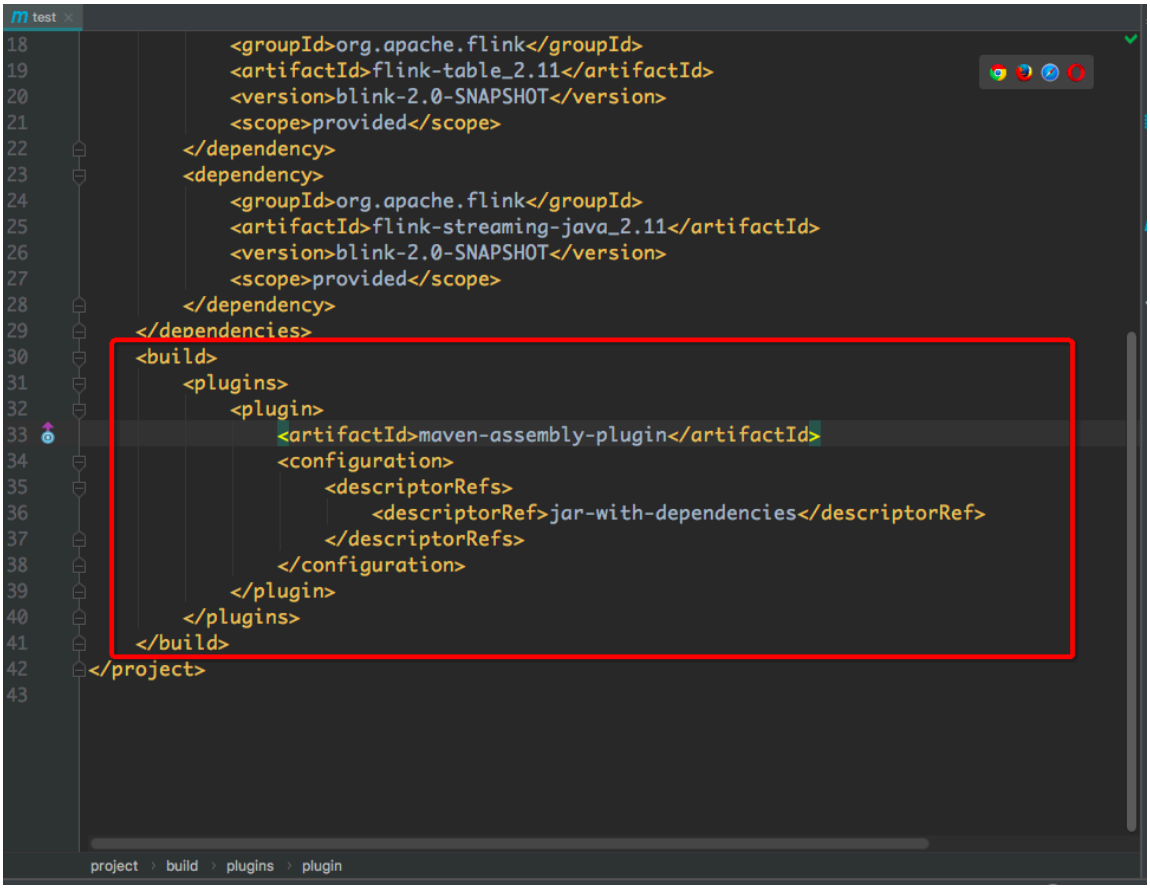
Note:

If your Maven project has other dependencies in addition to the Realtime Compute SDK, you need to package all JAR files in your project. Then, you can export the project as a JAR file.

a. **Enter the following code in the pom.xml file:**

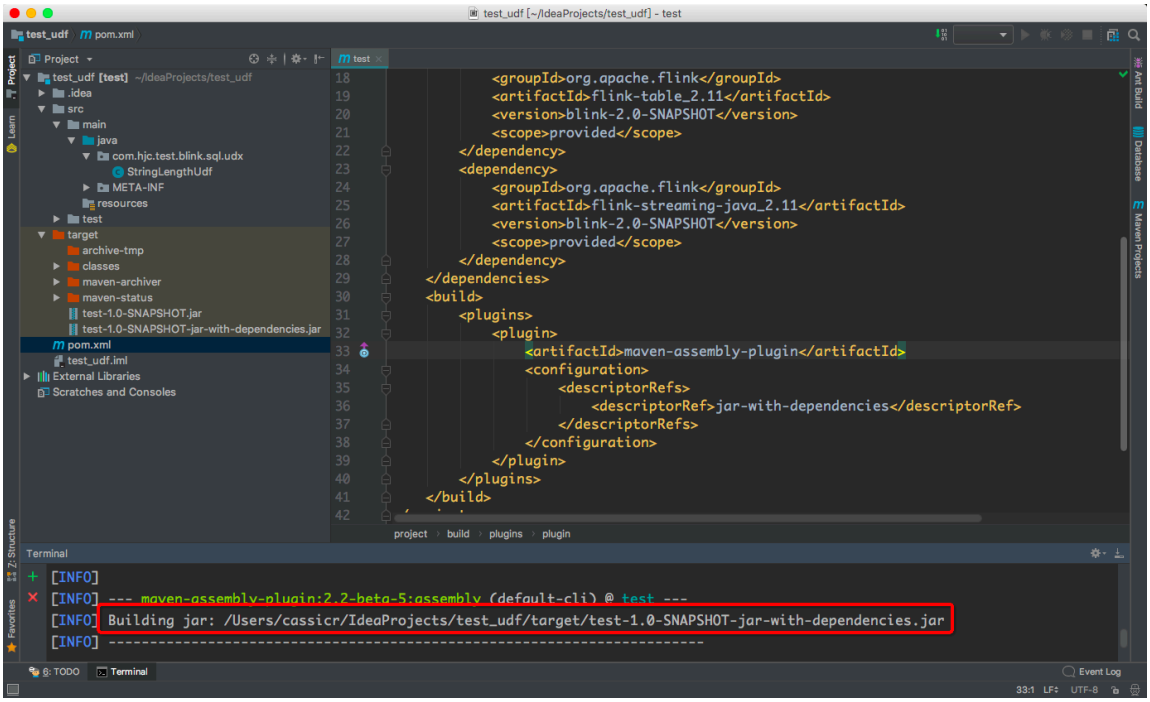
```
<build>
    <plugins>
        <plugin>
            <artifactId>maven-assembly-plugin</artifactId>
            <configuration>
              <descriptorRefs>
                <descriptorRef>jar-with-dependencies</descriptor
Ref>
              </descriptorRefs>
            </configuration>
        </plugin>
    </plugins>
```

```
</build>
```



b. In the Terminal section at the bottom of the page, enter `mvn assembly:assembly`.

The JAR file path is generated, as shown in the following figure.



5. **You can reference the JAR file in a Realtime Compute job. For more information, see** *Register and use a UDF*.