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Data Transmission Service

Change Tracking

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Document conventions

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

Table of Contents

1.Track data changes from ApsaraDB RDS for MySQL

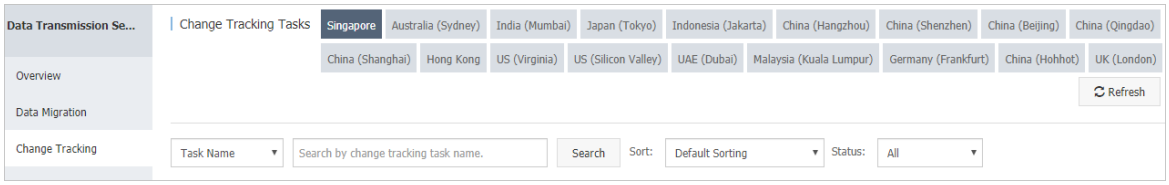
You can use DTS to track data changes in real time. This feature applies to the following scenarios: lightweight cache updates, business decoupling, asynchronous data processing, and real-time data synchronization of extract, transform, and load (ETL) operations. This topic describes how to track data changes from ApsaraDB RDS for MySQL.

Notes

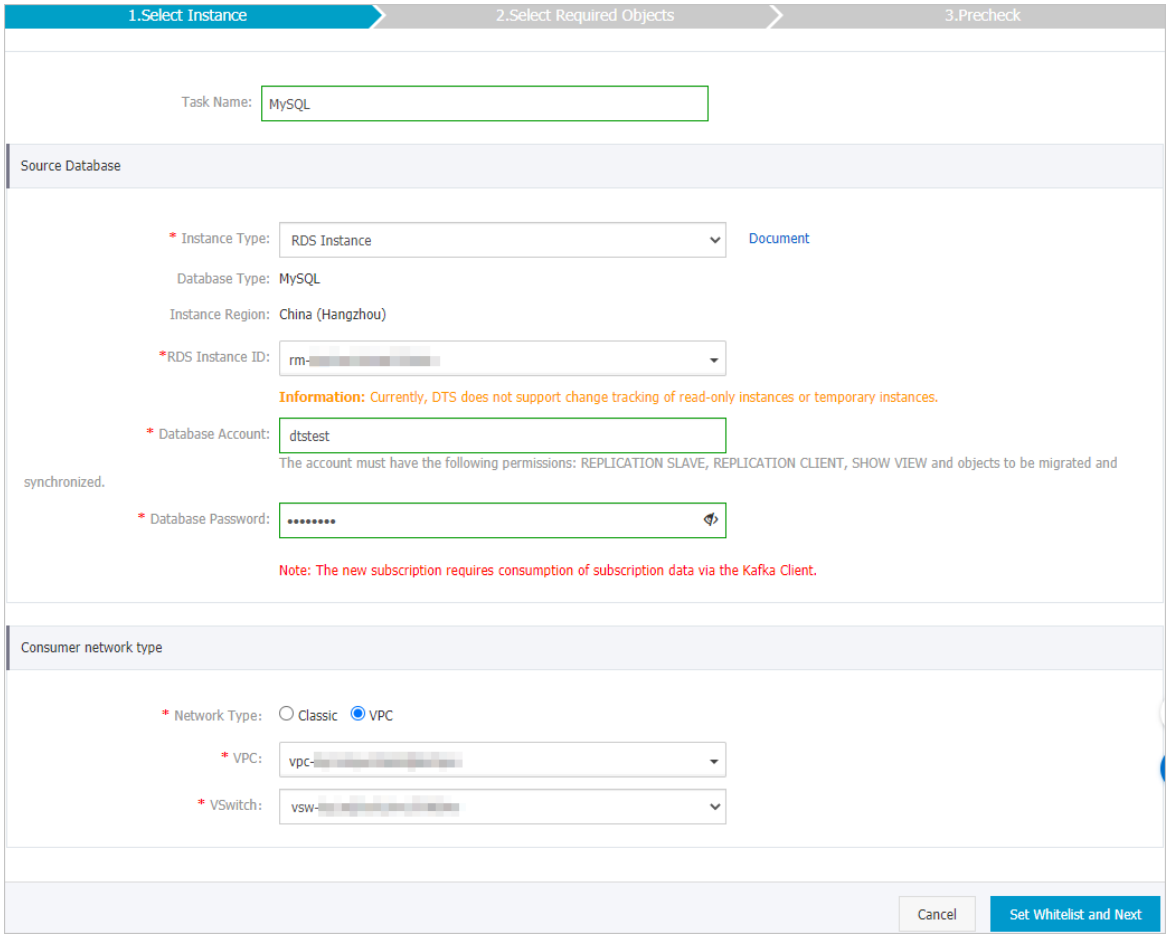
- If you use tools such as gh-ost or pt-online-schema-change to perform DDL changes, these changes will not be subscribed to. Therefore, when a client writes the consumed data to destination table, writing may fail due to the table structure inconsistency.
- If the source database to be subscribed exists in another task (for example, the database exists in a running data migration task), you may subscribe to data other than the subscription object. In such scenarios, you need to filter unwanted data in the change tracking clients.

Procedure

1. Create a change tracking instance. For more information, see Purchase a change tracking instance.
2. Log on to the DTS console.
3. In the left-side navigation pane, click **Change Tracking**.
4. At the top of the **Change Tracking** page, select the region where the change tracking instance resides.



5. Find the change tracking instance and click **Configure Channel** in the Actions column.
6. Configure the source database information and network type for the change tracking task.



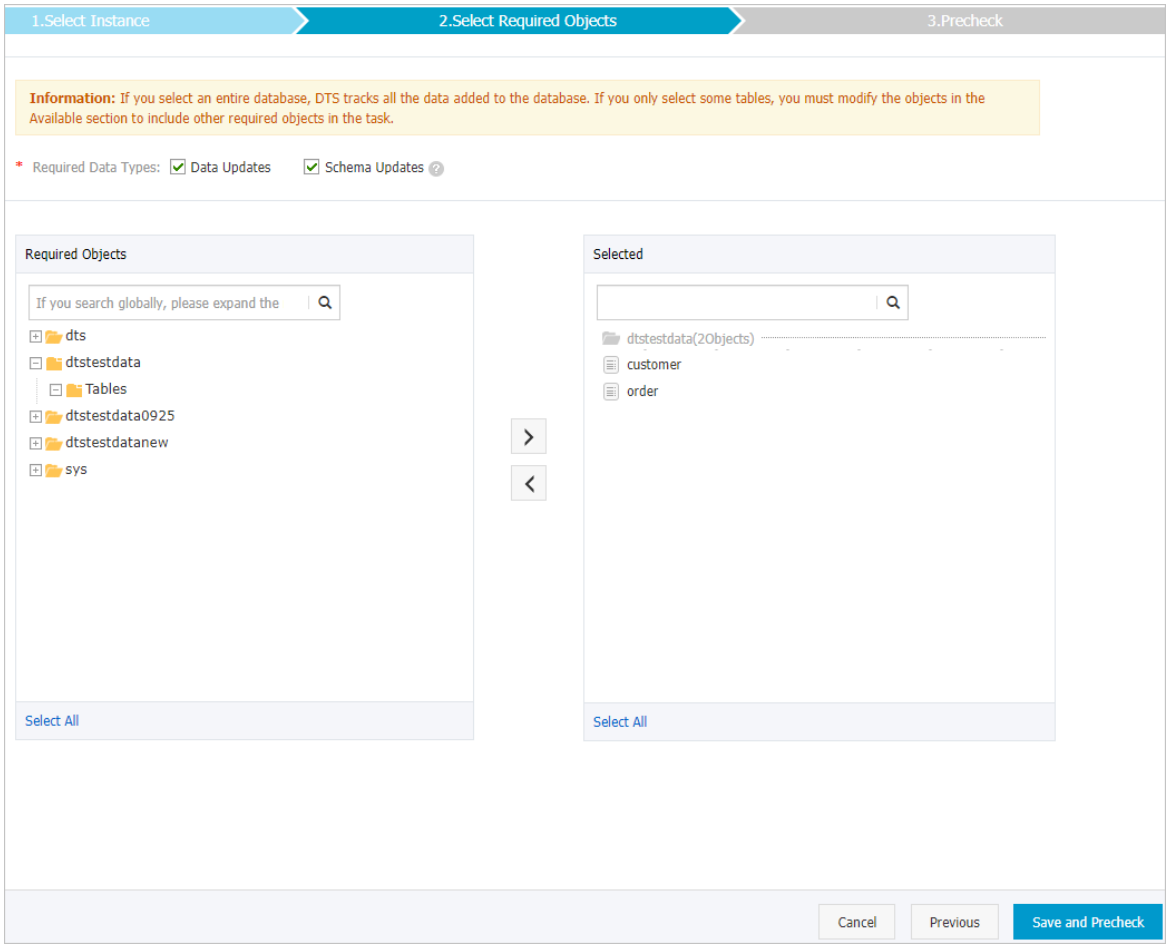
Section	Parameter	Description
N/A	Task Name	DTS automatically generates a task name. We recommend that you use an informative name for easy identification. You do not need to use a unique task name.
	Instance Type	Select **RDS Instance**. **Note** If your source database is a user-created MySQL database, you must prepare the environments that are required for the source database. For more information, see Preparation overview.
	Database Type	The value of this parameter is set to **MySQL**. You cannot change the value of this parameter.
	Instance Region	The **region** of the source instance. The region is the same as the region that you selected when you purchased the change tracking instance. You cannot change the value of this parameter.

Section	Parameter	Description
Source Database	RDS Instance ID	Select the ID of the RDS instance from which you want to track data changes. Note A read-only instance or temporary instance cannot be used as the source instance for change tracking.
	Database Account	Enter the database account for the source RDS instance. Note ◦ The account must have the REPLICATION SLAVE permission, the REPLICATION CLIENT permission, the SHOW VIEW permission, and the permission to perform SELECT operations on the required objects. ◦ If the database engine of the source RDS instance is MySQL 5.5 or MySQL 5.6, you do not need to configure the database account or database password.
	Database Password	Enter the password for the database account of the source RDS instance.
Network Type	◦ Classic ◦ VPC	Select the network type of the change tracking task. Note ◦ We recommend that you select the same network type as the ECS instance on which the change tracking client is installed For example, if the ECS instance is deployed in a VPC, select VPC as the network type and specify the VPC and VSwitch. ◦ If you track data changes over internal networks, the network latency is minimal. ◦ Classic If you select Classic, no other configurations are required. For more information about the classic network, see Classic network. ◦ VPC If you select VPC, you must specify the VPC and VSwitch. For more information about VPC, see VPC.

7. Click Set Whitelist and Next. The following table describes the details about whitelist settings.

Instance type of the source database	Description
ApsaraDB RDS for MySQL	The CIDR blocks of DTS servers are automatically added to the whitelist of the source ApsaraDB RDS for MySQL instance. This ensures that DTS servers can connect to the source RDS instance.
User-created MySQL database hosted on ECS	The CIDR blocks of DTS servers are automatically added to an inbound rule of the ECS instance. This ensures that DTS servers can connect to the source instance.
○ User-created MySQL database with a public IP address ○ User-created MySQL database connected over Express Connect, VPN Gateway, or Smart Access Gateway	If a whitelist is configured for the user-created database, you must add the CIDR blocks of DTS servers to the whitelist of the database. For more information, see Add the CIDR blocks of DTS servers to the security settings of on-premises databases.

8. In the **Create Change Tracking Account** message that appears, click **Next** after the account is created.
9. Select the data change types and objects.



Parameter	Description
Required Data Types	○ **Data Updates** If you select Data Updates, DTS tracks data updates of the selected objects, including INSERT, DELETE, and UPDATE operations. ○ **Schema Updates** If you select Schema Updates, DTS tracks the create, delete, and modify operations that are performed on all object schemas of the source instance. You need to use the change tracking client to filter the required data. **Note** ○ If you select a database as the object, DTS tracks data changes of all objects, including new objects in the database. ○ If you select a table as the object, DTS tracks only data changes in this table. In this case, if you want to track data changes of a new table, you must add the table to the objects for change tracking. For more information, see Modify objects for change tracking.
Required Objects	In the **Required Objects** section, select the required objects and click the icon to add the objects to the **Selected** section. **Note** The objects for change tracking include tables and databases.

10. In the lower-right corner of the page, click **Save and Precheck.**

> **Note**
> ○ Before you can start the change tracking task, a precheck is performed. You can start the change tracking task only after the task passes the precheck.
> ○ If the task fails to pass the precheck, click the icon next to each failed item to view details. Troubleshoot the issues based on the causes and run the precheck again.

11. Close the **Precheck** dialog box after the following message is displayed: **The precheck is passed.**

After the change tracking task is configured, DTS performs initial change tracking, which takes about one minute. After initial change tracking, you can create consumer groups and consume tracked data.

What to do next

- Create consumer groups
- Use a Kafka client to consume tracked data

2.Create consumer groups

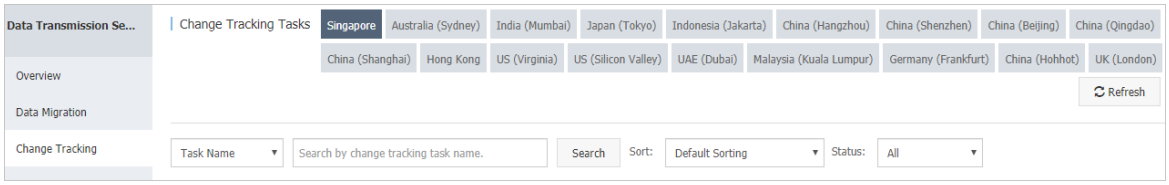
The change tracking feature allows you to create multiple consumer groups. Consumers in different consumer groups can track data changes from the same data source. Consumer groups help you reduce the cost for tracking data changes and improve the efficiency of data consumption.

Note

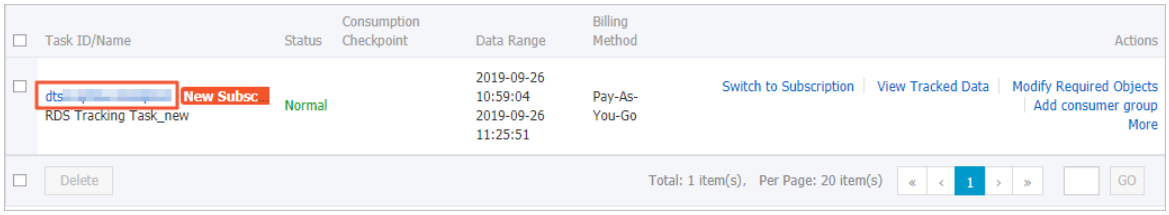
- You can create multiple consumer groups (up to 20) in a change tracking instance to repeatedly consume data.
- A consumer group consumes each message only once, and only one consumer can consume data.

Procedure

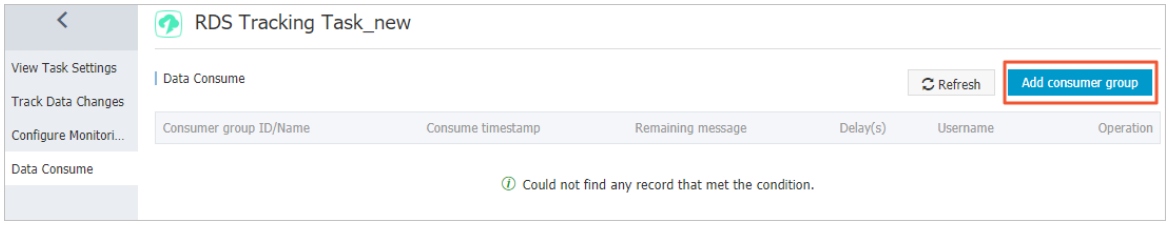
1. Log on to the DTS console.
2. In the left-side navigation pane, click **Change Tracking**.
3. At the top of the **Change Tracking** page, select the region where the change tracking instance resides.



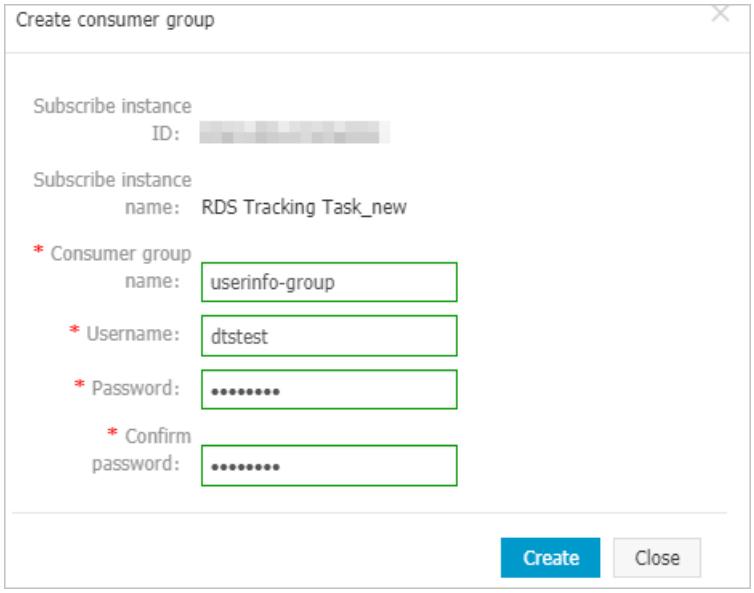
4. Find the change tracking instance and click the instance ID.



5. In the left-side navigation pane, click **Consume Data**.
6. On the **Consume Data** page, click **Add Consumer Group** in the upper-right corner.



7. In the **Create Consumer Group** dialog box that appears, configure the parameters for the consumer group.



Parameter	Description
Consumer Group Name	Enter a new name for the consumer group. We recommend that you use an informative name for easy identification.
Username	Enter the username of the consumer group. ○ A username must contain one or more of the following character types: uppercase letters, lowercase letters, digits, and underscores (_). ○ The username must be 1 to 16 characters in length.
Password	Enter the password that corresponds to the username of the consumer group. ○ A password must contain two or more of the following character types: uppercase letters, lowercase letters, digits, and special characters. ○ The password must be 8 to 32 characters in length.
Confirm Password	Enter the new password again.

8. Click **Create**.

Subsequent operations

Use a Kafka client to consume tracked data

3.Manage consumer groups

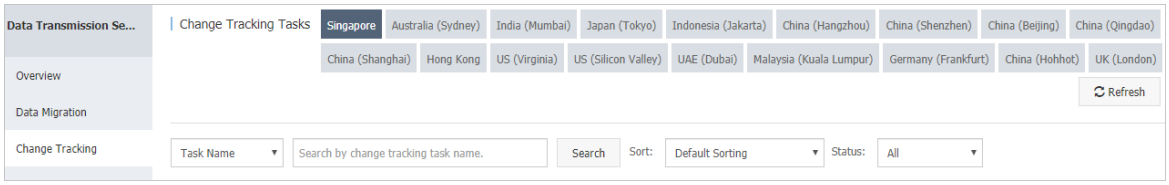
You can manage consumer groups of a change tracking instance in the DTS console. This topic describes how to modify the password of a consumer group and how to delete a consumer group.

Context

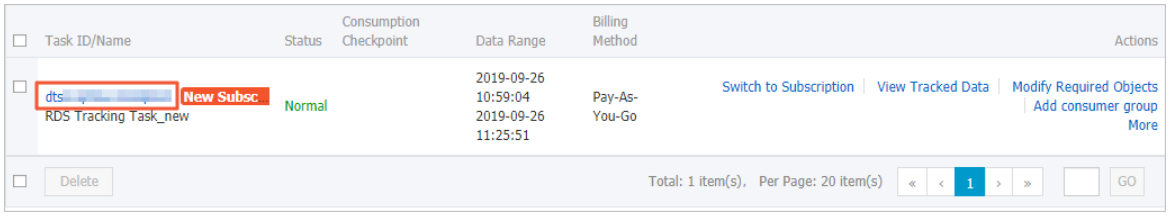
For more information about consumer groups, see Change tracking (new).

Procedure

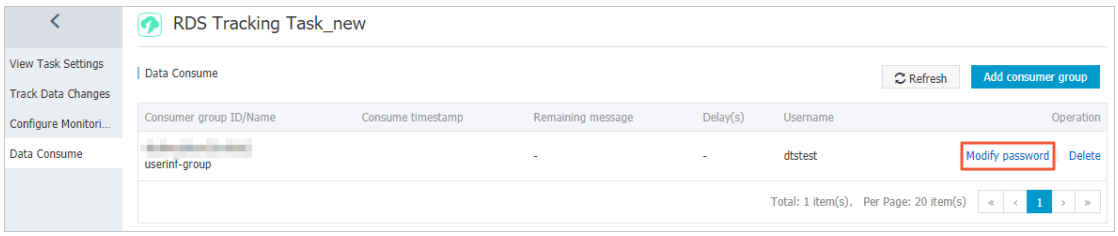
1. Log on to the DTS console.
2. In the left-side navigation pane, click **Change Tracking**.
3. At the top of the **Change Tracking** page, select the region where your change tracking instance resides.



4. Find the change tracking instance and click the instance ID.



5. In the left-side navigation pane, click **Consume Data**.
6. Modify the password of a consumer group or delete a consumer group. Modify the password of a consumer group
   i. On the **Consume Data** page, find the target consumer group and click **Modify Password** in the **Actions** column.



ii. In the **Modify Password** dialog box that appears, enter the **old password** and **new password**, and enter the new password again in the **Confirm Password** field.

> **Note**
>
> - A password must contain two or more of the following character types: uppercase letters, lowercase letters, digits, and special characters.
> - The password must be 8 to 32 characters in length.

iii. Click **Modify**.

Delete a consumer group

> **Note** After a consumer group is deleted, the data in the group will be cleared and cannot be recovered. We recommend that you use caution when performing this operation.

i. On the **Consume Data** page, find the target consumer group and click **Delete** in the **Actions** column.

ii. In the **Delete Consumer Group** message that appears, click **OK**.

4.Reselect objects for change tracking

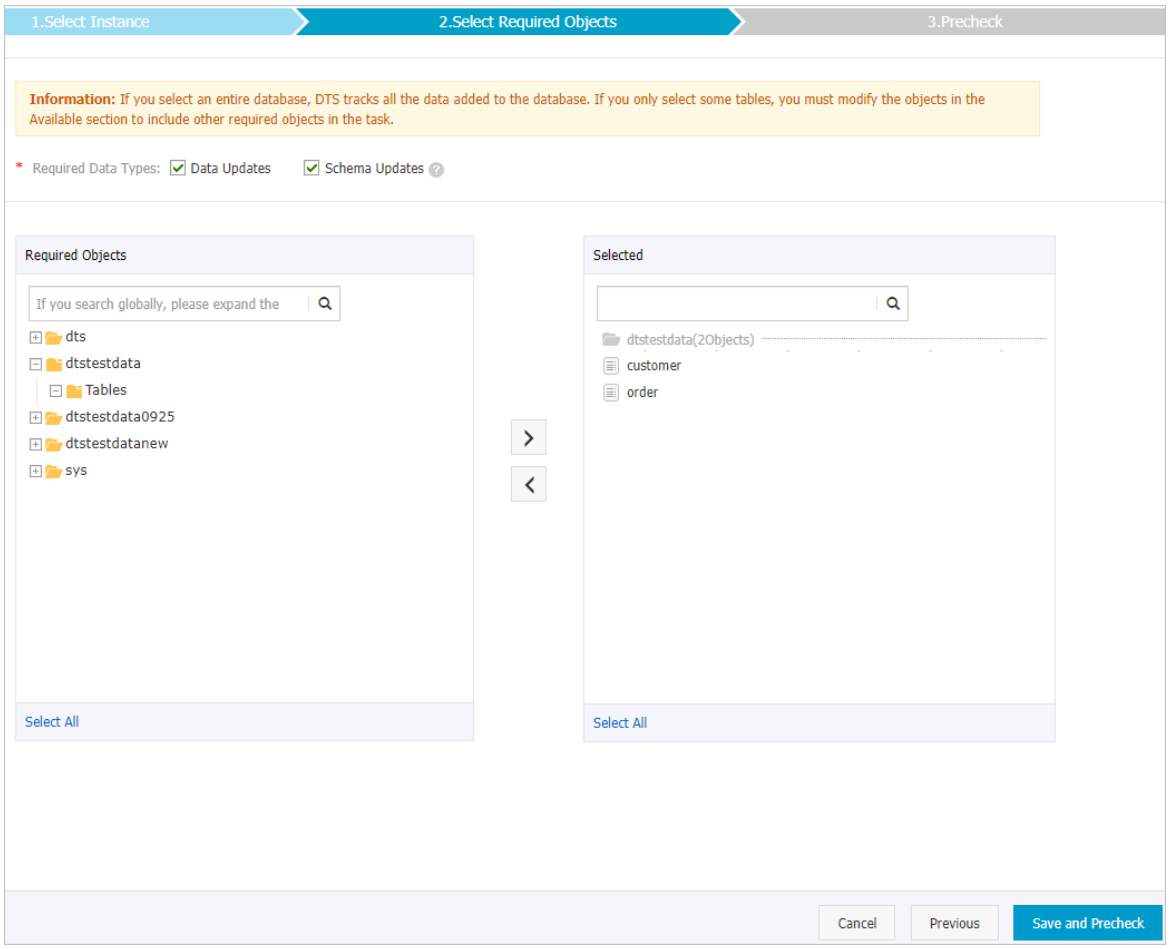
Data Transmission Service (DTS) allows you to add or remove objects for change tracking after you have created a change tracking task. This topic describes how to reselect objects for change tracking.

Note

- After you add an object, the change tracking task captures updates made to the newly selected object starting from the time when the new object was included.
- After you remove an object, if the consumer application continues to receive updates to the removed object, you need to filter out such updates in the consumer application.

Procedure

1. Log on to the DTS console.
2. In the left-side navigation pane, click **Change Tracking**.
3. At the top of the **Change Tracking** page, select the region where the change tracking instance resides.
4. Find the change tracking instance and click the instance ID.
5. Find the target instance and click **Modify Required Objects** in the **Actions** column.
6. In the **Select Required Objects** step, you can add and remove objects for change tracking.



- Add objects for change tracking

  In the **Required Objects** list, select the required objects and click the right arrow icon to add the objects to the **Selected** section.

- Remove objects for change tracking

  In the **Selected** list, select the objects to be removed and click the left arrow icon to remove the objects.

7. In the lower-right corner of the page, click **Save and Precheck**.

   > **Note**
   > - A precheck is performed before you can start the change tracking task. You can start the change tracking task only after the task passes the precheck.
   > - If the task fails the precheck, click the icon next to each failed item to view details. Fix the issues based on the instructions and run the precheck again.

8. Close the **Precheck** dialog box when you receive a **The precheck is passed** message.

After the change tracking task is created, DTS performs initialization. The initialization process takes about one minute to complete. After the initialization is complete, you can use a Kafka client to consume the tracked data. For more information, see Use a Kafka client to consume tracked data.

5.View tracked data changes

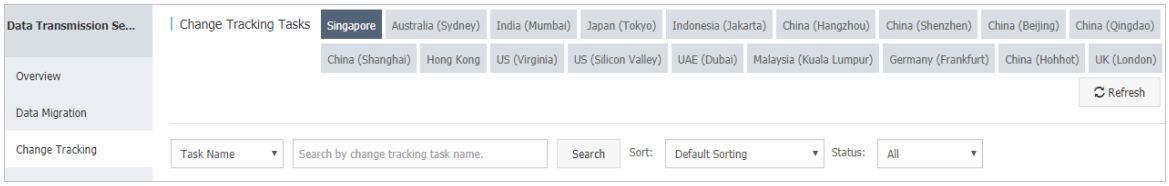
This topic describes how to view the incremental data from a change tracking task in the DTS console. This topic provides the definition of each field in the tracked data changes.

Prerequisites

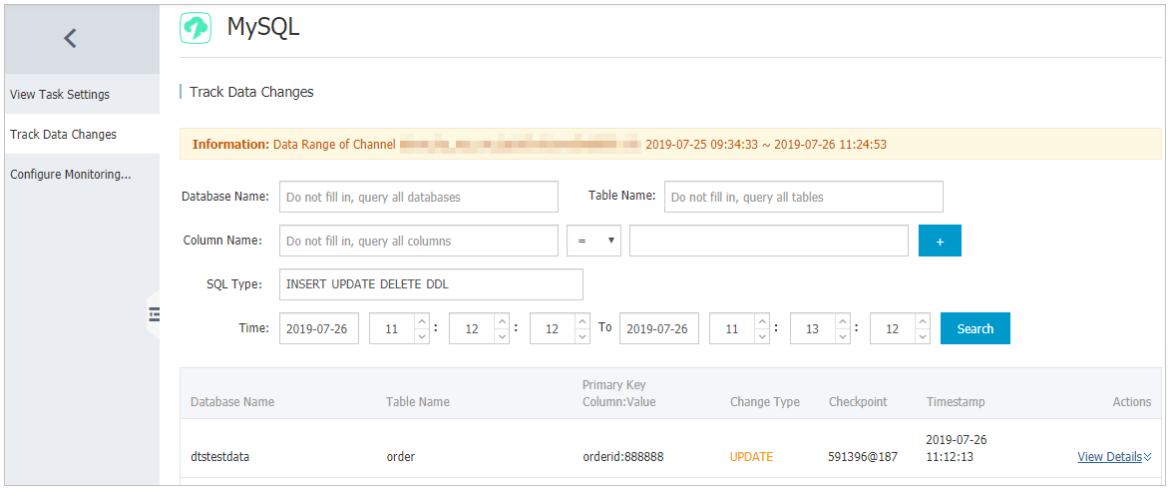
- A change tracking task is created. For more information, see Track data changes from ApsaraDB RDS for MySQL (new).
- The change tracking task is in the Normal or Error state.

Procedure

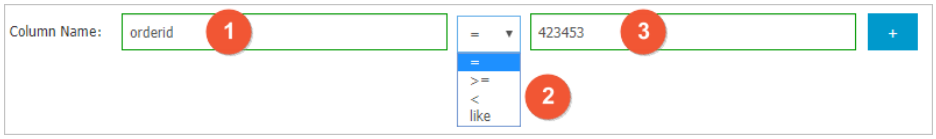
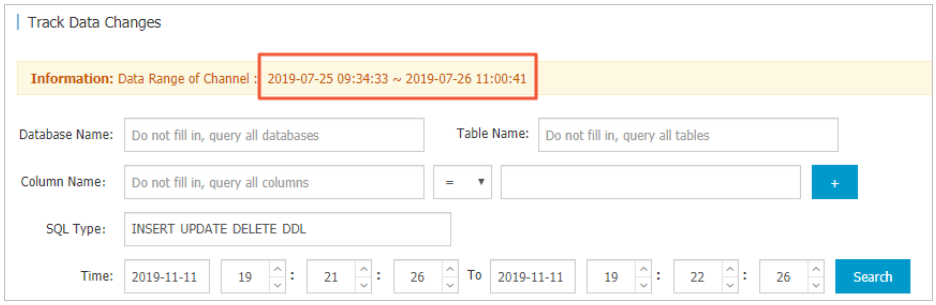
1. Log on to the DTS console.
2. In the left-side navigation pane, click **Change Tracking**.
3. At the top of the **Change Tracking Tasks** page, select the region where the change tracking instance resides.



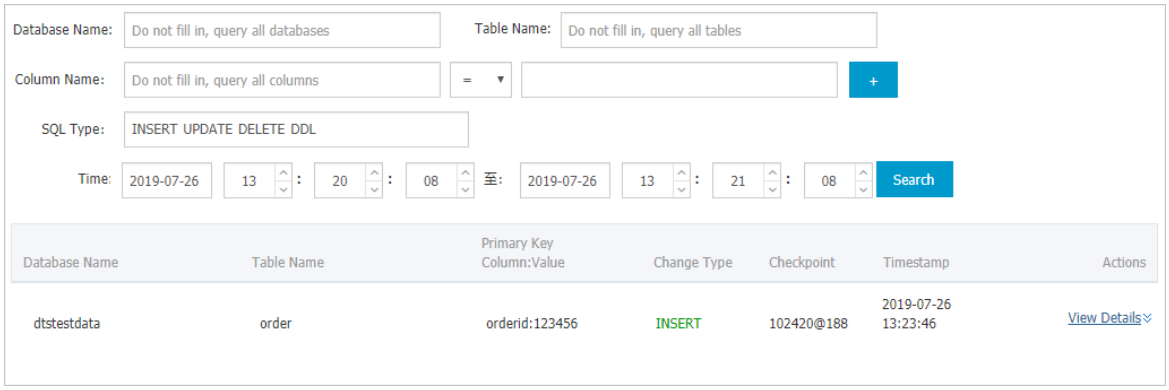
4. Find the change tracking instance and click the instance ID.
5. In the left-side navigation pane, click **Track Data Changes**.
6. On the **Track Data Changes** page, 20 data entries that are tracked in the last minute are displayed by default. You can filter tracked data by using the filter criteria.



Filter	Description
Database Name	Enter the name of the database that you want to query. If you do not specify this filter, all databases are queried.
Table Name	Enter the name of the table that you want to query. If you do not specify this filter, all tables are queried.

Filter	Description
Column Name	Enter the name of the column that you want to query, select an operator, and then enter the column value. If you do not specify this filter, all columns are queried. **Note** You can click the plus sign (+) to add more column filters. 
SQL Type	Select the types of SQL operations that you want to query. INSERT, UPDATE, DELETE, and DDL operations are queried by default.
Time	Select a time range. The selected time range must be within the time range of all tracked data changes. For more information, see the prompt at the top of the page. 

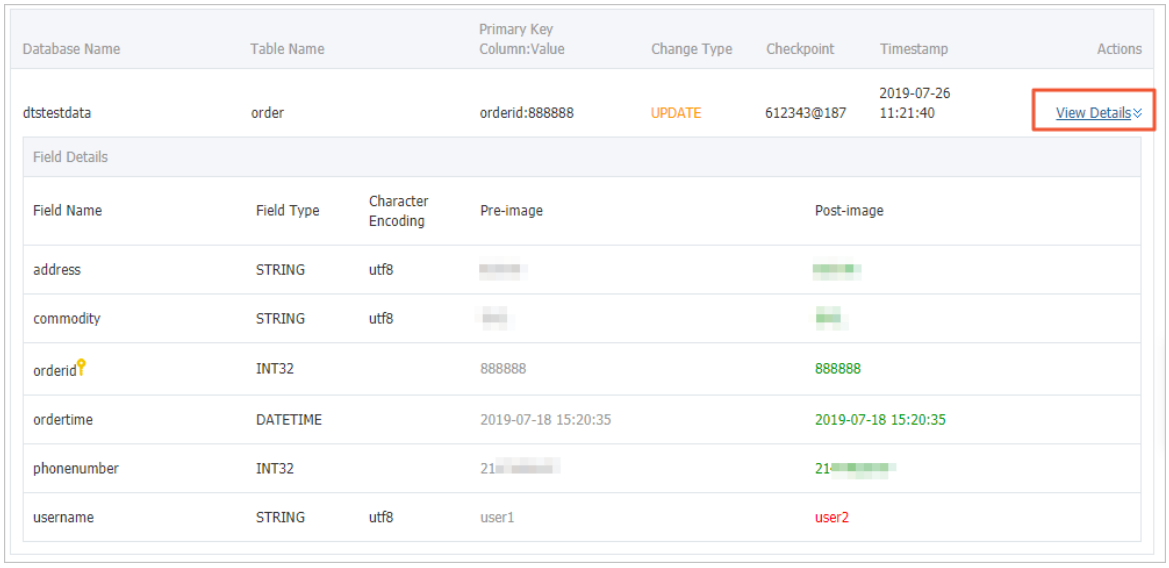
7. Click **Search** to retrieve specific data entries.



Consumption checkpoint and timestamp

Database type	Consumption checkpoint	Timestamp
ApsaraDB RDS for MySQL	The location and time of an incremental data entry in the binary log.	The timestamp when an incremental data entry is written to the binary log file.
Oracle	The location and time of an incremental data entry in the redo or archive log.	The timestamp when an incremental data entry is written to the redo or archive log.

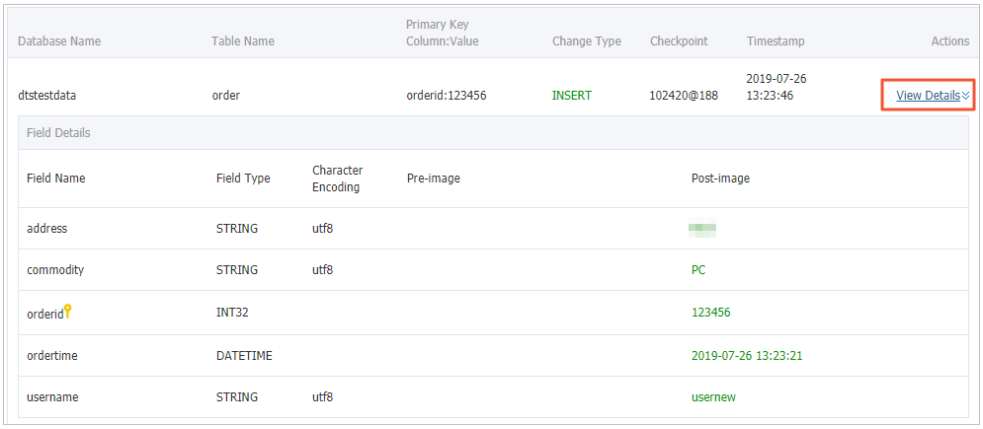
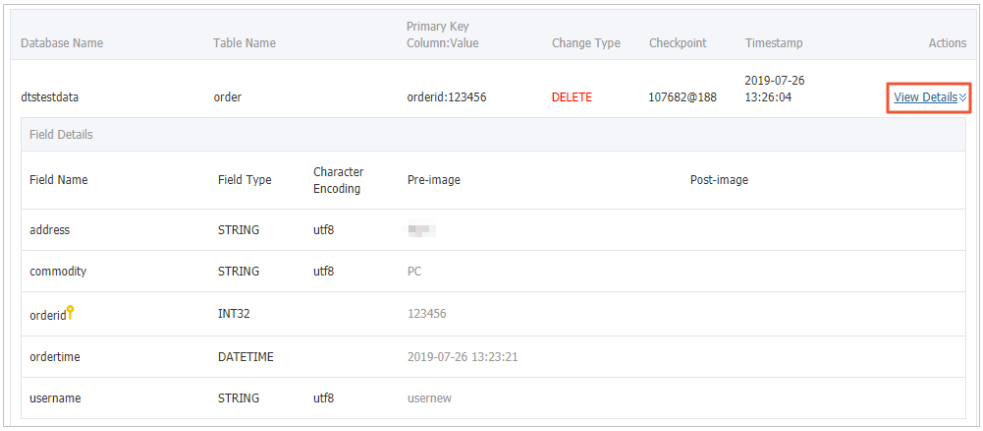
8. Click **View Details** in the Actions column of a data entry to view the details.

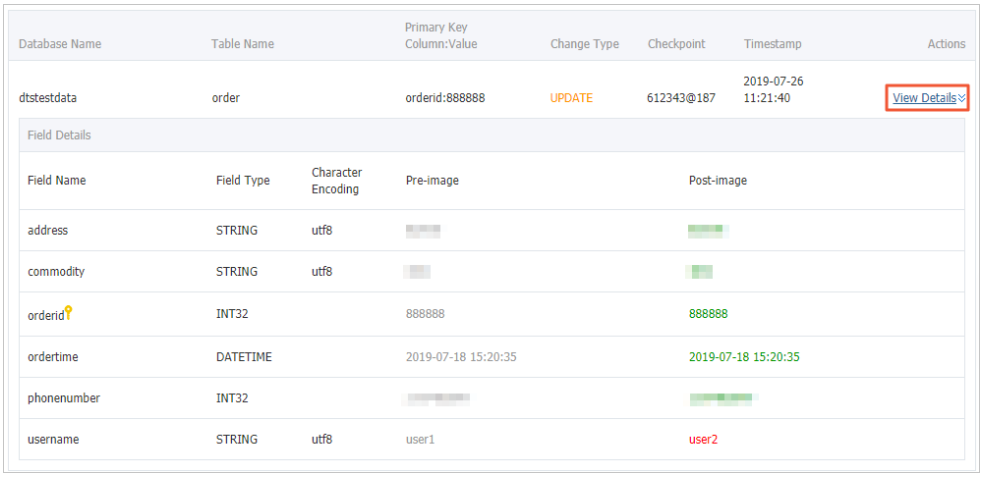
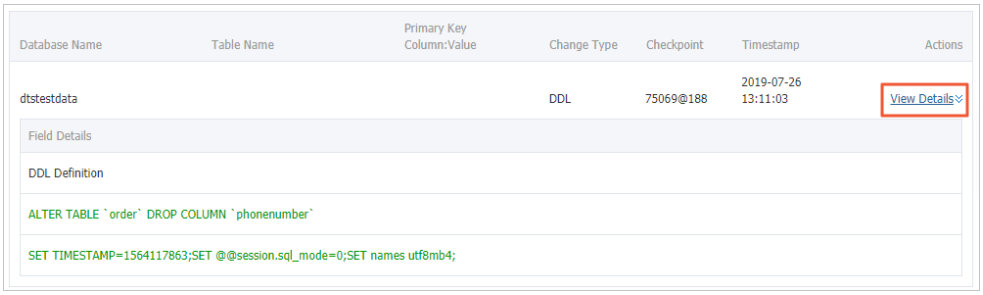


Field	Description
Field Name	The name of the field or column.
Field Type	The type of the field.
Character Encoding	The character encoding of the field, such as UTF-8, GBK, Latin 1, or UTF-8 (MB4).
Pre-image	The value of each field before the data entry is updated.
Post-image	The value of each field after the data entry is updated. The updated values are displayed in red.

Additional information about the pre-image and post-image

Operation type	Value description

Operation type	Value description
INSERT	 The value of the pre-image is empty. The value of the post-image is the data written by the INSERT operation.
DELETE	 The value of the pre-image is the data deleted by the DELETE operation. The value of the post-image is empty.

Operation type	Value description
UPDATE	 The value of the pre-image is the data before update. The value of the post-image is the data after update. **Note** The updated values are displayed in red.
DDL or DML	 The details only contain DDL or DML statements.

6.Use a Kafka client to consume tracked data

This topic describes how to use the demo code of a Kafka client to consume tracked data. The change tracking feature of the new version allows you to consume tracked data by using a Kafka client from V0.11 to V1.1.

Prerequisites

- A change tracking task is created. For more information, see Track data changes from ApsaraDB RDS for MySQL (new).
- One or more consumer groups are created. For more information, see Create consumer groups.

Precautions

- If you enable auto commit when you use the change tracking feature, some data may be committed before it is consumed. This results in data loss. We recommend that you manually commit data.

  > **Note** If data fails to be committed due to a fault, you can restart the client to continue consuming data from the last recorded consumer offset. However, duplicate data may be generated during this period. You must manually filter out the duplicate data.

- Data is serialized and stored in the Avro format. For more information, visit Record.avsc.

  > **Note** If you are not using the Kafka client that is described in this topic, you must parse the tracked data based on the Avro schema.

- The search unit is second when DTS calls the `offsetFotTimes` operation. The search unit is millisecond when a native Kafka client calls this operation.

Download and run the demo code of the Kafka client

Download the demo code of the Kafka client. For more information about how to use the demo code, visit Readme.

Download and run the demo code of the Kafka client

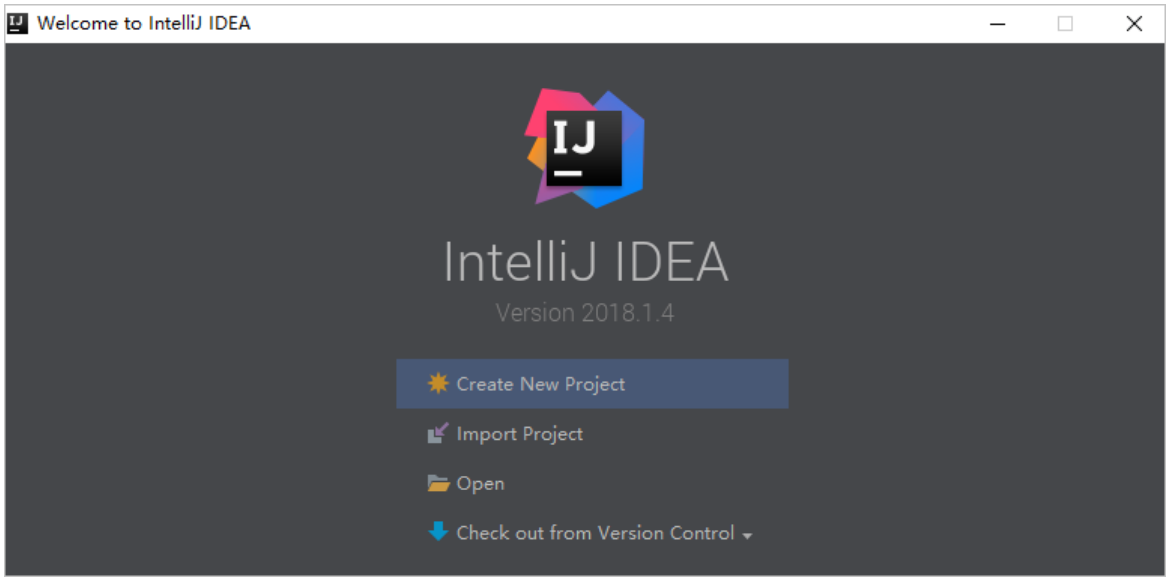
Step	File or directory
1. Use the native Kafka consumer to obtain incremental data from the change tracking task.	subscribe_example-master/javaimpl/src/main/java/recordgenerator/
2. Deserialize the image of the incremental data, and obtain , and other attributes.	subscribe_example-master/javaimpl/src/main/java/boot/MysqlRecordPrinter.java

Step	File or directory
3. Convert the dataTypeNumber values in the deserialized data into MySQL data types. Note For more information, see Mappings between MySQL data types and dataTypeNumber values.	subscribe_example-master/javaimpl/src/main/java/recordprocessor/mysql/

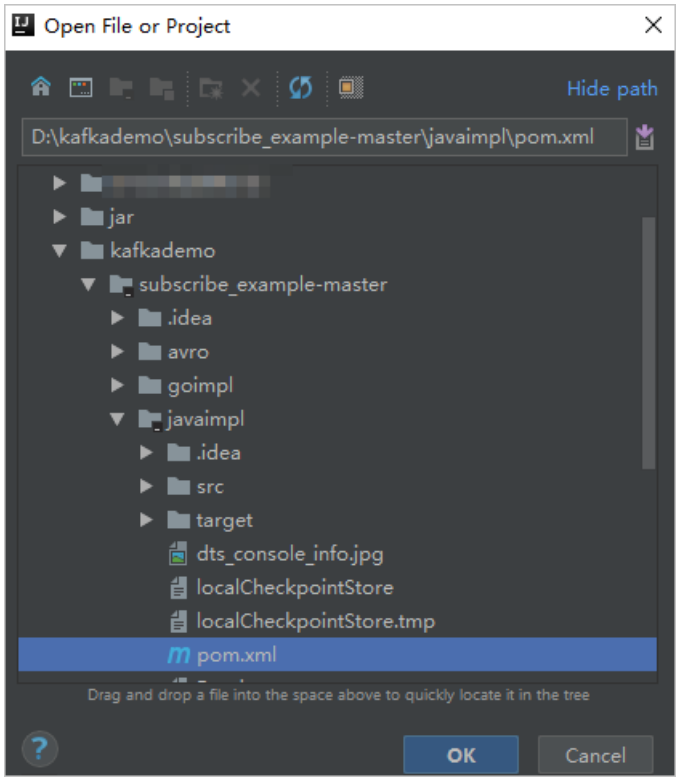
Procedure

IntelliJ IDEA (Community Edition 2018.1.4 Windows) is used in this example.

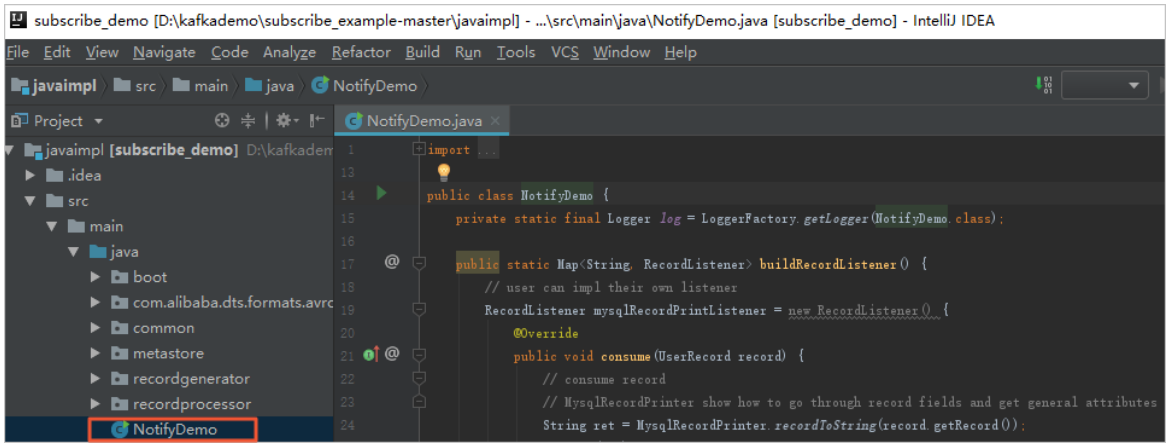
1. Download the demo code of the Kafka client, and then decompress the package.
2. Open IntelliJ IDEA. In the window that appears, click **Open**.



3. In the dialog box that appears, go to the directory in which the downloaded demo code resides. Find the *pom.xml* file.

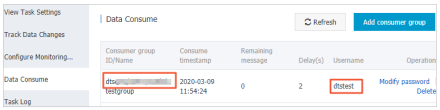


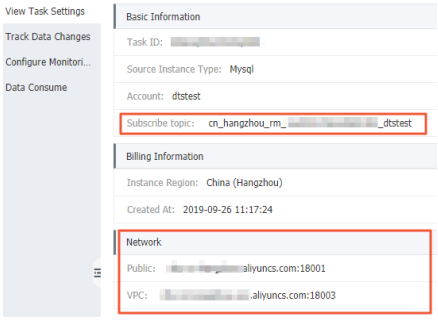
4. In the dialog box that appears, select **Open as Project**.
5. On the IntelliJ IDEA page, expand folders to find the demo file of the Kafka client, and double-click the file. The file name is *NotifyDemo.java*.



6. Set the parameters in the *NotifyDemo.java* file.

```
public static Properties getConfigs() {
    Properties properties = new Properties();
    // user password and sid for auth
    properties.setProperty(USER_NAME, "dtstest");
    properties.setProperty(PASSWORD_NAME, "[redacted]");
    properties.setProperty(SID_NAME, "dts[redacted]");
    // kafka consumer group general same with sid
    properties.setProperty(GROUP_NAME, "dts[redacted]");
    // topic to consume, partition is 0
    properties.setProperty(KAFKA_TOPIC, "cn_hangzhou_[redacted]");
    // kafka broker url
    properties.setProperty(KAFKA_BROKER_URL_NAME, "dts-cn-l[redacted] com:18001");
    // initial checkpoint for first seek(a timestamp to set, eg 1566180200 if you want (Mon Aug 19 10:03:21 CST 2019))
    properties.setProperty(INITIAL_CHECKPOINT_NAME, "1583307907");
    // if force use config checkpoint when start. for checkpoint reset
    properties.setProperty(USE_CONFIG_CHECKPOINT_NAME, "true");
    // use consumer assign or subscribe interface
    // when use subscribe mode, group config is required. kafka consumer group is enabled
    properties.setProperty(SUBSCRIBE_MODE_NAME, "assign");
    return properties;
}
```

Parameter	Description	Method to obtain
USER_NAME	The username of the consumer group. **Warning** If you are not using the Kafka client that is described in this topic, you must specify the username in the following format: `<Consumer group account>-<Consumer group ID>`, for example, `dtstest-dtsae******bpv`. Otherwise, the connection fails.	In the DTS console, click the target instance ID, and then click **Data Consume**. You can view the **Consumer Group ID** and the **Account** information. **Note** The password of the consumer group account is specified when you create a consumer group. 
PASSWORD_NAME	The password of the account.	
SID_NAME	The ID of the consumer group.	
GROUP_NAME	The name of the consumer group. Set this parameter to the consumer group ID.	

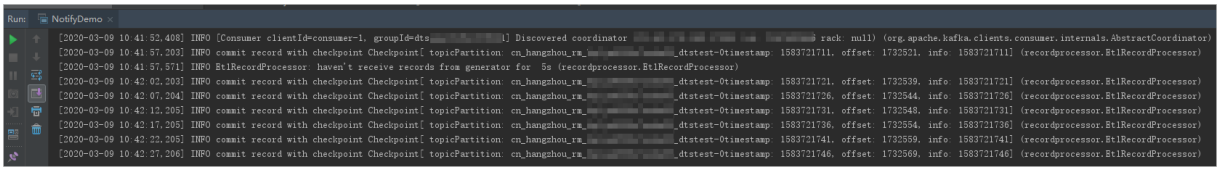
Parameter	Description	Method to obtain
KAFKA_TOPIC	The topic of the change tracking task.	In the DTS console, click the ID of the target instance. On the **Track Data Changes** page, you can obtain the **tracked topic**, network address, and port number. 
KAFKA_BROKER_URL_NAME	The network address and port number of the change tracking task. **Note** If you track data changes over internal networks, the network latency is minimal. This is applicable if the ECS instance where you deploy the Kafka client belongs to the same VPC or classic network as the change tracking instance.	
INITIAL_CHECKPOINT_NAME	The consumer offset of consumed data. The value is a Unix timestamp. **Note** You must save the consumer offset. If the consumption process is interrupted, you can specify the consumer offset on the change tracking client to resume data consumption. This allows you to prevent against data loss. When you start the change tracking client, you can specify the consumer offset to consume data on demand.	When you use the Kafka client to track data changes for the first time, convert the format of the required time point into Unix timestamp.
USE_CONFIG_CHECKPOINT_NAME	Default value: *true*. The default value indicates that the client is forced to consume data from the specified consumer offset. This allows you to retain the data that is received but not processed.	N/A

7. On the top of the IntelliJ IDEA page, choose **Run** > **Run** to run the client.

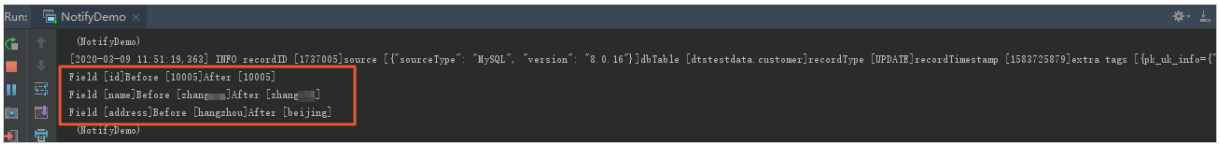
Note When you run IntelliJ IDEA for the first time, it loads and installs the relevant dependency.

Running result of the Kafka client

The following figure shows that the Kafka client can track data changes from the source database.



You can delete the // characters from the `//log.info(ret);` string in line 25 of the `NotifyDemo.java` file. Then, run the client again to view the data change information.



Mappings between MySQL data types and dataTypeNumber values

MySQL data type	Value of dataTypeNumber
MYSQL_TYPE_DECIMAL	0
MYSQL_TYPE_INT8	1
MYSQL_TYPE_INT16	2
MYSQL_TYPE_INT32	3
MYSQL_TYPE_FLOAT	4
MYSQL_TYPE_DOUBLE	5
MYSQL_TYPE_NULL	6
MYSQL_TYPE_TIMESTAMP	7
MYSQL_TYPE_INT64	8
MYSQL_TYPE_INT24	9
MYSQL_TYPE_DATE	10
MYSQL_TYPE_TIME	11
MYSQL_TYPE_DATETIME	12
MYSQL_TYPE_YEAR	13
MYSQL_TYPE_DATE_NEW	14
MYSQL_TYPE_VARCHAR	15

MySQL data type	Value of dataTypeNumber
MYSQL_TYPE_BIT	16
MYSQL_TYPE_TIMESTAMP_NEW	17
MYSQL_TYPE_DATETIME_NEW	18
MYSQL_TYPE_TIME_NEW	19
MYSQL_TYPE_JSON	245
MYSQL_TYPE_DECIMAL_NEW	246
MYSQL_TYPE_ENUM	247
MYSQL_TYPE_SET	248
MYSQL_TYPE_TINY_BLOB	249
MYSQL_TYPE_MEDIUM_BLOB	250
MYSQL_TYPE_LONG_BLOB	251
MYSQL_TYPE_BLOB	252
MYSQL_TYPE_VAR_STRING	253
MYSQL_TYPE_STRING	254
MYSQL_TYPE_GEOMETRY	255

7.Reset a change tracking task

This topic describes how to reset a change tracking task. You can reset a change tracking task to clear the configurations of the task and delete the data that is cached by the task.

Prerequisites

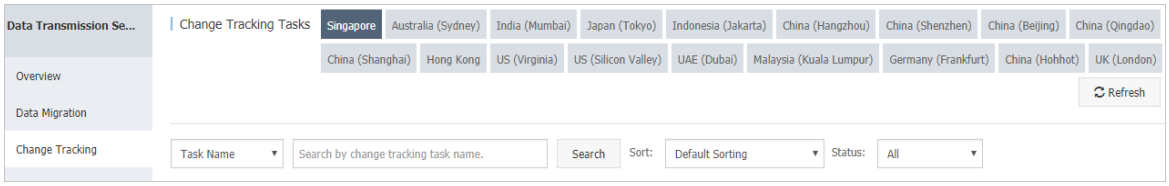
The change tracking task is in the **Normal**, **Initial synchronizing**, or **Error** state.

Impacts on billing

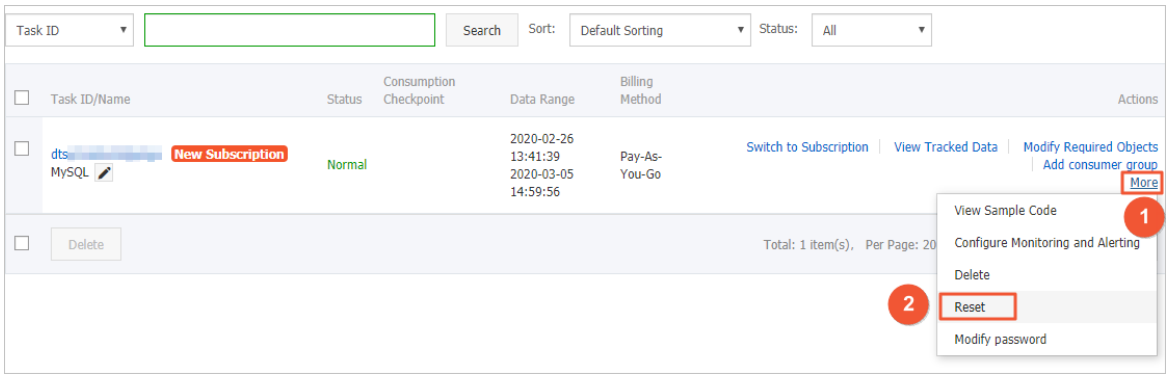
- Subscription: no impact.
- Pay-as-you-go: The change tracking task will enter the **Not Configured** state. You are not billed for the task when it is in this state. The billing restarts only after you configure and start the change tracking task.

Procedure

1. Log on to the DTS console.
2. In the left-side navigation pane, click **Change Tracking**.
3. At the top of the **Change Tracking** page, select the region where your change tracking instance resides.



4. Find the target change tracking task, and choose **More** > **Reset** in the **Actions** column.



> **Warning** Resetting a change tracking task has the following impacts. Proceed with caution.
>
> - The change tracking task stops tracking data changes from the source database.
> - The configurations of the change tracking task are deleted. The status of the change tracking task changes to **Not Configured**.
> - Data changes that are cached by the change tracking task are deleted and cannot be restored.

5. In the dialog box that appears, click **OK**.

References

For information about how to configure a change tracking task, see Overview of data subscription scenarios.