

TaurusDB

FAQs

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1 Product Consulting

1.1 Is There Anything Special I Need to Note When Using TaurusDB?

1. Instance operating systems (OSs) are invisible to you. Your applications can access a database only through an IP address and a port.
2. The backups stored in Object Storage Service (OBS) buckets and the Elastic Cloud Servers (ECSs) used by TaurusDB are invisible to you. They are only visible in the TaurusDB backend management system.
3. When you view your instance in the instance list, select the region where your instance is located.
4. After creating a TaurusDB instance, you do not need to perform basic O&M operations, such as enabling HA and installing security patches. However, you must pay attention to:
 - a. vCPUs and memory of your instance. If they become insufficient, you need to change them in a timely manner.
 - b. Storage space of your instance. If the storage is used up, you will be billed on a pay-per-use basis for any additional storage, but if you scale up storage in advance, you can pay for the additional storage at yearly/monthly rates.
 - c. Performance of your instance. You need to check for slow query SQL statements, SQL statements to be optimized, or redundant or missing indexes regularly.

1.2 What Can I Do About Slow Responses of Websites When They Use TaurusDB?

To solve this problem:

- Check the performance of TaurusDB instances on the TaurusDB console.
- Compare the database connection status of local databases and TaurusDB instances. This problem depends on web applications.

2 Resource Freezing, Unfreezing, Release, Deletion, and Unsubscription

Why Are My Resources Released?

If your subscriptions have expired but not been renewed, or you are in arrears due to insufficient balance, your resources enter a grace period. If you do not renew the subscriptions or top up your account after the grace period expires, your resources will enter a retention period. During the retention period, the resources are not available. If the renewal is still not completed or the outstanding amount is still not paid off when the retention period ends, the stored data will be deleted and the cloud service resources will be released. For details, see [Service Suspension and Resource Release](#).

Why Are My Resources Frozen?

Your resources may be frozen for a variety of reasons. The most common reason is that you are in arrears.

Can I Still Back Up Data If My DB Instance Is Frozen?

No. If your instance is frozen due to arrears, you need to unfreeze the instance first.

How Do I Unfreeze My Resources?

Frozen due to arrears: You can renew your resources or top up your account. Instances frozen due to arrears can be renewed, released, or deleted. Yearly/Monthly instances that have expired cannot be unsubscribed from, while those that have not expired can be unsubscribed from.

What Happens When My Resources Are Frozen, Unfrozen, or Released?

- After your resources are frozen:
 - They cannot be accessed, causing downtime. For example, if your instance is frozen, it cannot be connected.
 - If they are yearly/monthly resources, no changes can be made to them.

- They can be unsubscribed from or deleted manually.
- After your resources are unfrozen, you can connect to them again.
- If your resources are released, your instance will be deleted.

How Do I Renew My Resources?

After a yearly/monthly instance expires, you can renew it on the [Renewals](#) page. For details, see [Renewal Management](#).

Can My Resources Be Recovered After Being Released? /Can I Retrieve an Incorrect Unsubscription?

You can restore your deleted instance from a manual backup or rebuild your instance in the recycle bin during the retention period. For details, see [Rebuilding a DB Instance in the Recycle Bin](#) and [Restoring a DB Instance from Backups](#).

Before unsubscribing from a resource, confirm the resource information carefully. If you have unsubscribed from an instance by mistake, purchase a new one.

How Do I Delete My Instance?

- For pay-per-use instances, see [Deleting a DB Instance](#).
- For yearly/monthly instances, see [Unsubscribing a Yearly/Monthly Instance](#).

3 Database Connections

3.1 What Should I Do If I Can't Connect to My TaurusDB Instance?

Possible Causes

Try the following:

1. **Check whether the DB instance is available.**

for example, the DB instance status is abnormal.

2. **(Common) Check whether the client connection is correct.**

- If you connect to a DB instance over a private network, ensure that the DB instance and ECS are in the same region and VPC.
- If you connect to a DB instance over a public network, bind an EIP to the DB instance and then connect to the DB instance through the EIP.

3. **Check whether the SSL connection is used.**

Run either of the following example commands to enable or disable SSL:

- SSL enabled: `mysql -h 172.16.0.31 -P 3306 -u root -p --ssl-ca=/tmp/ca.pem`
- SSL disabled: `mysql -h 172.16.0.31 -P 3306 -u root -p`

4. **Check whether the parameters in the connection command are correct.**

For example, check whether the following parameters are configured correctly: connection address, port number, username, password, SSL connection parameters, and JDBC connection parameters.

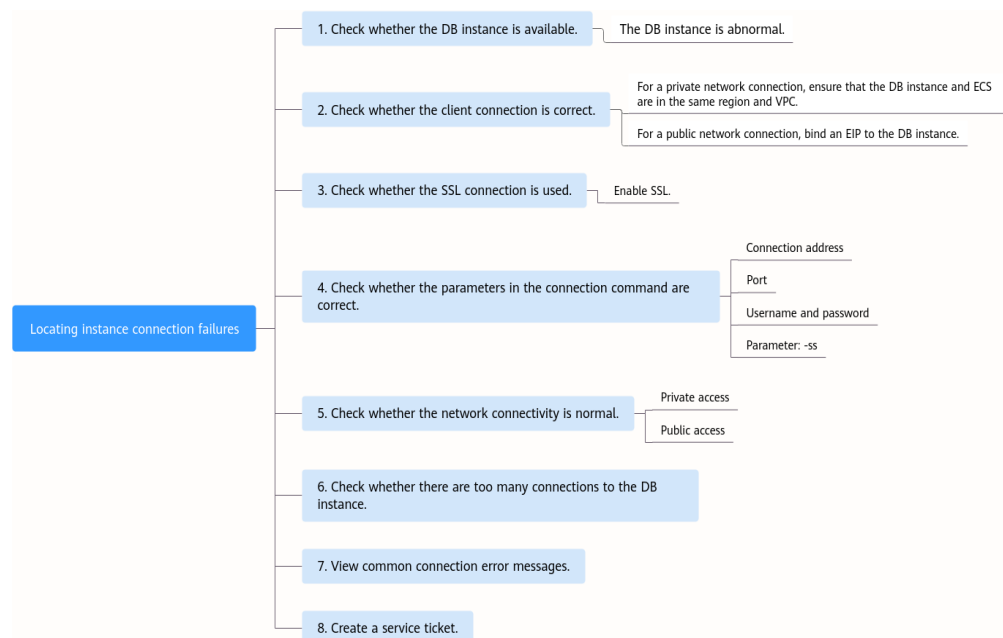
5. **(Common) Check whether the network connectivity is normal.**

- For a private network connection:
 - i. Check whether the ECS and DB instance are in the same region and VPC.
 - ii. Check security group rules.
 - iii. On the ECS, check whether the DB instance port can be connected.

- For a public network connection:
 - i. Check security group rules.
 - ii. Check network ACL rules.
 - iii. Ping the affected EIP from another ECS in the same region.
- 6. **(Common) Check whether there are too many connections to the DB instance.**
If there is an excessive number of database connections, applications may be unable to connect.
- 7. **View common connection error messages.**
Find corresponding solutions based on connection error messages.

Fault Locating

Figure 3-1 Locating instance connection failures



1. **Check whether the DB instance is available.**
Check whether the DB instance is in the **Available** state.
Possible cause: The DB instance is abnormal.
Solution: If the DB instance is abnormal, reboot it.

Figure 3-2 Checking DB instance status

Name/ID	Description	DB Instance...	DB Engine Version	Status	Billing Mode	Private	Operation
		Primary/Standby	TaurusDB V2.0	Available	Pay-per-use	192.16	Log In View Metrics More

2. **Check whether the client connection is correct.**
Install a **MySQL 8.0 client**.
For details about how to connect to a DB instance over a private or public network, see **Can an External Server Access a TaurusDB Instance?**

Table 3-1 Connection model

Connecti on method	Scenario	Example
Private network	A private IP address is provided by default. If your applications are deployed on an ECS that is in the same region and VPC as the DB instance, connect to the ECS and DB instance through a private IP address.	mysql -h <i>private_IP_address</i> -P 3306 -u root -p --ssl-ca=/tmp/ca.pem Go to the Basic Information page of the DB instance and view the private IP address in the Network Information area.
Public network	If you cannot access a DB instance through a private IP address, bind an EIP to the DB instance and connect the instance to the ECS (or a cloud server in a public network) through the EIP. For EIP pricing details, see EIP billing details .	mysql -h <i>EIP</i> -P 3306 -u root -p --ssl-ca=/tmp/ca.pem Go to the Basic Information page of the DB instance and view the EIP in the Network Information area.

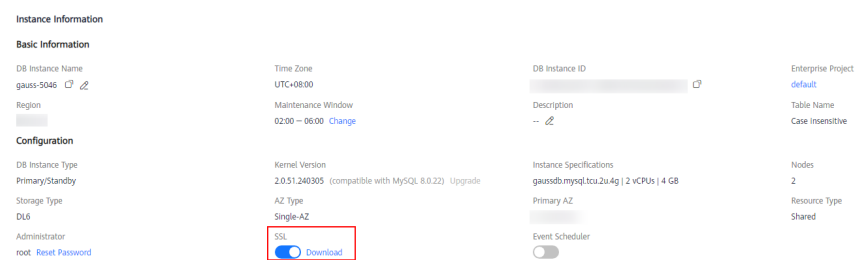
3. Check whether the SSL connection is used.

- (Recommended) Enable SSL for the DB instance, download and decompress the package, and upload the root certificate **ca.pem** to the **/tmp** directory of the ECS.

Example:

```
mysql -h 172.16.0.31 -P 3306 -u root -p --ssl-ca=/tmp/ca.pem
```

Figure 3-3 Enabling SSL



- Disable SSL for the DB instance.

Example:

```
mysql -h 172.16.0.31 -P 3306 -u root -p
```

4. Check whether the parameters in the connection command are correct.

Ensure that the connection address, port, username and password, and SSL certificate are correct, and try to connect to the DB instance again.

– Connecting to a DB instance over a private network

- Connection command

```
mysql -h connection_address -P database_port -u username -p --ssl-ca= SSL_certificate_name
```

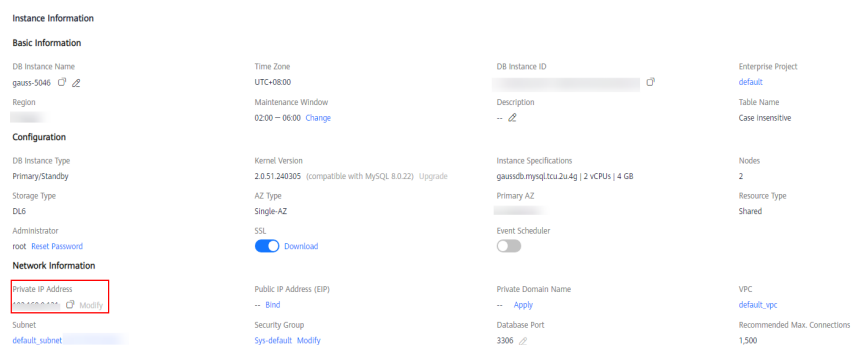
Example:

```
mysql -h 192.168.0.153 -P 3306 -u root -p --ssl-ca=/tmp/ca.pem
```

- *connection_address*

Go to the **Basic Information** page of the DB instance and view the private IP address in the **Network Information** area.

Figure 3-4 Private IP address



- *database_port*

Go to the **Basic Information** page of the DB instance and view the database port in the **Network Information** area.

- *username*

Enter **root** and its password.

Check whether the username or password is correct if an error similar to the following occurs during the database connection:

```
[Warning] Access denied for user 'username'@'yourIp' (using password: NO)
[Warning] Access denied for user 'username'@'yourIp' (using password: YES)
```

- *SSL_certificate_name*

Enter the name of the SSL certificate file. The path and file name must be the same as those in the command.

– Connecting to a DB instance over a public network

- Connection command

```
mysql -h connection_address -P database_port -u username -p --ssl-ca= SSL_certificate_name
```

Example:

```
mysql -h 10.83.34.224 -P 3306 -u root -p --ssl-ca=/tmp/ca.pem
```

- *connection_address*

Go to the **Basic Information** page of the DB instance and view the EIP in the **Network Information** area.

Figure 3-5 EIP

- *database_port*

Go to the **Basic Information** page of the DB instance and view the database port in the **Network Information** area.

- *username*

Enter **root** and its password.

```
[Warning] Access denied for user 'username'@'yourIp' (using password: NO)
[Warning] Access denied for user 'username'@'yourIp' (using password: YES)
```

- *SSL_certificate_name*

Enter the name of the SSL certificate file. The path and file name must be the same as those in the command.

5. **Check whether the network connectivity is normal.**

For a private network connection:

- a. Check whether the ECS and DB instance are in the same region and VPC.
 - If the ECS and DB instance are in different regions, they cannot communicate with each other. Select a region near to your service area to reduce network latency and experience faster access. To connect to the DB instance across regions, use Cloud Connect (CC) or Virtual Private Network (VPN). For details, see [Can I Access a TaurusDB Instance over an Intranet Connection Across Regions?](#)
 - If the ECS and DB instance are in different VPCs of the same region, they cannot communicate with each other through a private network. After a DB instance is created, you cannot change its VPC. In this case, create a VPC peering connection. For details, see [What Should I Do If the Network Connectivity Test Fails?](#)

Figure 3-6 Checking the VPC of an ECS

ECS Information

ID	37144dd6-2d7f-42c4-92bd-e6e1003361e8
Name	ecs-5948
Description	--
Region	
AZ	AZ3
Specifications	General computing 1 vCPU 1 GiB sn3.small.1
Image	CentOS 8.2 64bit Public image
VPC	default_vpc

Figure 3-7 Checking the VPC of a DB instance

Instance Information			
Basic Information			
DB Instance Name gauss-5046	Time Zone UTC+08:00	DB Instance ID 	Enterprise Project default
Region 	Maintenance Window 02:00 ~ 06:00 Change	Description --	Table Name Case insensitive
Configuration			
DB Instance Type Primary/Standby	Kernel Version 2.0.51.240305 (compatible with MySQL 8.0.22) Upgrade	Instance Specifications gaussdb.mysql.t3u.2u.4g 2 vCPUs 4 GB	Nodes 2
Storage Type DLS	AZ Type Single-AZ	Primary AZ 	Resource Type Shared
Administrator root Reset Password	SSL <input checked="" type="checkbox"/> Download	Event Scheduler <input type="checkbox"/>	VPC default_vpc
Network Information			
Private IP Address Modify	Public IP Address (EIP) -- Bind	Private Domain Name -- Apply	Recommended Max. Connections 1,500
Subnet default_subnet	Security Group Sys-default Modify	Database Port 3306	

- b. Check security group rules.
 - If **Destination** is not **0.0.0.0/0** and **Protocol & Port** is not **All** on the **Outbound Rules** page of the ECS, add the private IP address and port of the DB instance to the outbound rules.
 - Add the private IP address and port of the ECS to the inbound rules of the DB instance.
- c. On the ECS, check whether the private IP address of the DB instance can be connected.

telnet *private_IP_address port*

Example:

telnet 192.168.0.153 3306

- If the connection is normal, the network is normal.
- If the connection is abnormal, [submit a service ticket](#).

For a public network connection:



- a. Check security group rules.
 - If **Destination** is not **0.0.0.0/0** and **Protocol & Port** is not **All** on the **Outbound Rules** page of the ECS, add the EIP and port of the DB instance to the outbound rules.
 - Add the EIP and port of the ECS to the inbound rules of the DB instance.
- b. Check network ACL rules.
 - i. Go to the [Network ACLs](#) page.
 - ii. Check whether the NIC to which the DB instance and EIP are bound belongs to the subnet associated with the network ACL.
 - iii. Check whether the network ACL is enabled.
If it is, [add an ICMP rule to allow traffic](#).

The default network ACL rule denies all inbound and outbound packets. This default rule is still applied even if the network ACL is disabled.

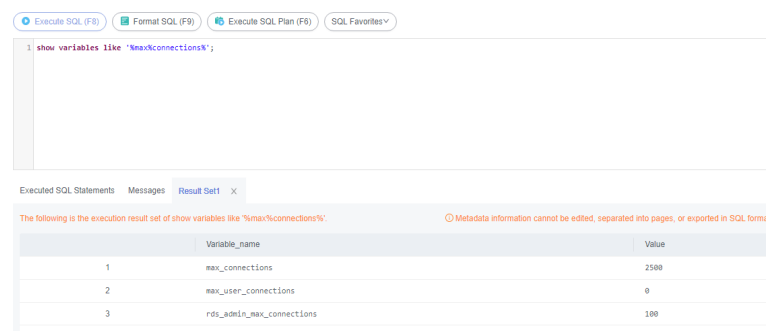
- c. Ping the affected EIP from another ECS in the same region.
If you cannot ping the DB instance's EIP from an ECS, ping it from another ECS in the same region. If the EIP can be pinged, the network is normal. In this case, [submit a service ticket](#).

6. Check whether there are too many connections to the DB instance.

Check method:

- a. [Log in to the management console](#).
- b. Click  in the upper left corner and select a region and project.
- c. Click  in the upper left corner of the page and choose **Databases > TaurusDB**.
- d. On the **Instances** page, locate the DB instance and click **Log In** in the **Operation** column.
- e. Enter the password and click **Test Connection**. After the connection is successful, click **Log In** to access DAS.
- f. Choose **SQL Operations > SQL Query**.
- g. Enter the command and click **Execute SQL** to check the number of instance connections.

show variables like '%max%connections%';



Variable_name	Value
max_connections	2500
max_user_connections	0
rds_admin_max_connections	100

- **max_connections**: the maximum number of clients that can be connected at the same time. If this parameter is set to **default**, the

maximum number of clients depends on the amount of memory configured. For details, see [What Is the Maximum Number of Connections to a TaurusDB Instance?](#)

- **max_user_connections:** the maximum number of concurrent connections allowed for a specific TaurusDB account.
- h. Check whether the total connections and current active connections have reached the upper limits by referring to [Viewing DB Instance Metrics](#). Determine whether to release the connections.

Possible cause: If there are too many database connections, applications may be unable to connect, and full and incremental backups may fail, affecting services.

Solution:

- a. Check whether applications are connected, optimize the connections, and release unnecessary connections.
- b. If this parameter is set to **default**, you can scale up the DB instance to set **max_connections** to a larger value. For details, see [Changing the vCPUs or Memory of a DB Instance or Node](#).
- c. Check whether any metrics are abnormal and whether any alarms are generated on the Cloud Eye console. Cloud Eye monitors database metrics, such as the CPU usage, memory usage, storage space usage, and database connections, and allows you to set alarm policies to identify risks if any alarms are generated. For details about the supported metrics, see [TaurusDB Metrics](#).

7. View common connection error messages.

When you run commands to connect to a DB instance, understanding the error messages can help:

- ERROR 2013: Lost connection to MySQL server during query
If the values of **wait_timeout** and **interactive_timeout** are too small, the TaurusDB client will automatically disconnect the timeout empty connection. For details, see [Client Automatically Disconnected from a DB Instance](#).
- ERROR 1045 : Access denied for user 'root'@'192.168.0.30' (using password: YES)
Check whether the password is correct and whether the ECS has the permission to connect to the DB instance. For details, see ["Access denied" Displayed During Database Connection](#).
- Error message "SSL routines: tls_early_post_process_client_hello:unsupported protocol"
Check the TLS version of TaurusDB and upgrade the TLS version of the client. For details, see [SSL Connection Failed Due to Inconsistent TLS Versions](#).
- Error reported when JDBC is used to connect to the database: "unable to find certification path to requested target"
The JAR package of MariaDB is used to connect to the database, which is slightly different from the official driver package of MySQL. For details, see [Failed to Connect to a Database Using mariadb-connector in SSL Mode](#).

8. If the problem persists, [submit a service ticket](#).

3.2 What Should I Do If an ECS Can't Connect to a TaurusDB Instance?

Perform the following steps to identify the problem:

- Step 1** Check whether the ECS and TaurusDB instance are in the same VPC.
- If they are in the same VPC, go to [Step 2](#).
 - If they are in different VPCs, create an ECS in the VPC where the TaurusDB instance is located.
- Step 2** Check whether a security group has been created for the ECS.
- If a security group has been created, check whether its rules are appropriate. For details, see "Connecting to a DB Instance" > "Configuring Security Group Rules" in *TaurusDB User Guide*. Then, go to [Step 3](#).
 - If no security group has been created, go to the VPC console from the ECS details page and create a security group.
- Step 3** On the ECS, check whether the TaurusDB instance port can be connected.

The default port of a TaurusDB cluster instance is **3306**.

```
telnet <connection_address> {port}
```

- If the ECS can connect to the instance, no further action is required.
- If the ECS still cannot connect to the instance port, contact technical support.

----End

3.3 Can an External Server Access a TaurusDB Instance?

An Instance Bound with an EIP

For a TaurusDB instance that has been bound with an EIP, you can access it through the EIP.

For details, see:

[Connecting to a DB Instance over a Public Network](#)

An Instance Not Bound with an EIP

- Enable a VPN in a VPC and use the VPN to connect to a TaurusDB instance.
- Create a TaurusDB instance and an ECS in the same VPC and access the TaurusDB instance through the ECS.

For details, see:

[Connecting to a DB Instance over a Private Network](#)

3.4 What Is the Maximum Number of Connections to a TaurusDB Instance?

TaurusDB does not have constraints on the number of connections. This number is determined by the default value and value range of the DB engine. For example, you can set **max_connections** and **max_user_connections** in a parameter template to configure the maximum number of connections for a TaurusDB instance.

Changing the Maximum Number of Connections

The number of connections can be changed online. For details, see [Modifying a Parameter Template](#).

You can run commands to change the maximum number of connections.

1. Check the maximum number of connections:
show global variables like 'max_connections';
2. Change the value of **max_connections** under **mysqld** in the **my.cnf** file.
[mysqld]
max_connections = 1000

About max_connections

max_connections indicates the maximum number of clients that can be connected at the same time. If this parameter is set to **default**, it is related to the instance memory (unit: GB). The calculation formula is as follows:

Estimated value of max_connections = Available node memory/Estimated memory occupied by a single connection

- Available node memory = Total memory – Memory occupied by the buffer pool – 1 GB (mysqld process, OS, and monitoring program)
- Estimated memory usage of a single connection (single_thread_memory) = thread_stack (256 KB) + binlog_cache_size (32 KB) + join_buffer_size (256 KB) + sort_buffer_size (256 KB) + read_buffer_size (128 KB) + read_rnd_buffer_size (256 KB) ≈ 1 MB

The following table lists the default values of **max_connections** for different memory specifications.

Table 3-2 max_connections for different memory specifications

Memory (GB)	Connections
512	100,000
384	80,000
256	60,000

Memory (GB)	Connections
128	30,000
64	18,000
32	10,000
16	5,000
8	2,500
4	1,500
2	800

3.5 What Do I Do If There Are Too Many Database Connections?

The number of database connections indicates the number of applications that can be simultaneously connected to a database, and is irrelevant to the maximum number of users allowed by your applications or websites.

If there is an excessive number of database connections, applications may fail to be connected, and the full and incremental backups may fail, affecting services.

Fault Locating

1. Check whether applications are connected, optimize the connections, and release unnecessary connections.
2. Check the specifications and scale them up if needed.
3. Check whether any metrics are abnormal and whether any alarms are generated on the Cloud Eye console. Cloud Eye monitors database metrics, such as the CPU usage, memory usage, storage space usage, and database connections, and allows you to configure alarm policies to identify risks in advance if any alarms are generated. For details, see the *Cloud Eye User Guide*.

Solution

1. Connect to an instance through a private network. Using a private network prevents congestion caused by insufficient bandwidth.
For details, see:
[Connecting to a DB Instance over a Private Network](#)
2. On the console, set the parameter `innodb_adaptive_hash_index` to `off` to reduce lock wait time.
For details, see [Modifying Parameters of a DB Instance](#).
3. Optimize slow queries.

3.6 Are There Any Risks If There Are Too Many Connections to a TaurusDB Instance?

If there is an excessive number of TaurusDB connections, applications may fail to be connected, and the full and incremental backups may fail, affecting workloads.

Solution

1. Check whether applications are connected, optimize the connections, and release unnecessary connections.
2. Cloud Eye monitors database metrics, such as the CPU usage, memory usage, storage space usage, and database connections, and allows you to set alarm policies to identify risks if any alarms are generated.

3.7 What Should I Do If the Network Connectivity Test Fails?

Before connecting to a TaurusDB instance, you need to test the network connectivity to ensure that the client can communicate with the TaurusDB instance.

This section analyzes common causes of network connection failures and provides solutions.

Fault Locating

1. Check whether the ECS and TaurusDB instance are in the same VPC.
2. Check the security group rules, ACL rules, internal network configurations, and ports of the ECS.
3. Check the security group rules of the TaurusDB instance.
4. Ping the affected IP address from another ECS in the same region.

Solution

1. Check whether the ECS and TaurusDB instance are in the same VPC.
 - If they are in the same VPC, go to [2](#).
 - If they are in different VPCs of a region, they cannot communicate with each other through a private network.

To resolve this issue, do as follows:

- i. Create a VPC peering connection. For details, see [VPC Peering Connection Overview](#).
 - ii. Change the VPC of the ECS to that of the TaurusDB instance. For details, see [Changing a VPC](#).
2. Check the ECS configurations.

For details, see [Why Does Communication Fail Between Two ECSs in the Same VPC or Packet Loss Occur When They Communicate?](#)

3. Check the security group rules of the TaurusDB instance.
On the **Inbound Rules** page of the TaurusDB instance security group, add an inbound rule for the private IP address and port of the ECS.
4. Ping the affected IP address from another ECS in the same region.
On the ECS, ping the IP address that failed to be pinged. If the IP address can be pinged, the virtual network is normal.
5. If the problem persists, submit an application by choosing [Service Tickets > Create Service Ticket](#) in the upper right corner of the management console.

3.8 Can I Access a TaurusDB Instance over an Intranet Connection Across Regions?

By default, DB instances cannot be accessed over an intranet across regions. Cloud services in different regions cannot communicate with each other over an intranet. You can use Cloud Connect (CC) or Virtual Private Network (VPN) to connect to instances across regions.

- CC allows you to connect two VPCs of the same account or different accounts even if they are in different regions. For details, see [Communication Among VPCs of the Same Account](#).
- VPN uses an encrypted tunnel to connect VPCs in different regions and sends traffic over the Internet. It is inexpensive, easy to configure, and easy to use. However, the quality of VPN connections depends on the quality of Internet connections. For details, see [Connecting an On-Premises Data Center to a VPC Through a VPN](#).

3.9 How Do I Check the Connections to a TaurusDB Instance?

Use either of the following methods:

- Log in to the instance as user **root** and run the following command to view the threads running on it:
show full processlist;

Figure 3-8 Viewing threads

Id	User	Host	db	Command	Time	State	Info
1	root@ep1	localhost	(Null)	Sync mg	1711669	Synchronizing with master	(Null)
2	root@ep1	localhost	(Null)	Sleep	46	(Empty String)	(Null)
3	root@ep1	localhost	(Null)	Sleep	12	(Empty String)	(Null)
4	root@ep1	localhost	(Null)	Sleep	86	(Empty String)	(Null)
5	root@ep1	localhost	(Null)	Sleep	18	(Empty String)	(Null)
6	root@ep1	localhost	(Null)	Sleep	18	(Empty String)	(Null)

- **Id:** Thread ID. You can use **kill id** to terminate a thread.
 - **User:** User used for connecting to the instance.
 - **Host:** IP address and port of the host that connects to the instance.
 - **db:** Database name.
 - **Command:** Connection status, which is usually **Sleep**, **Query**, or **Connect**.
 - **Time:** Connection duration, in seconds.
 - **State:** Status of the SQL statement being executed.
 - **Info:** SQL statement that is being executed.
 - **CPU_time:** Amount of time for which the current connection has been established.
- On the **Instances** page, locate the instance and click **View Metrics** in the **Operation** column.

Figure 3-9 Viewing metrics

NameID	Description	DB Instance...	DB Engine Version	Status	Billing Mode	Private	Operation
	- 2	Primary/Sta... 2 vCPUs 8 ...	TaurusDB V2.0 Upgrade	Available	Pay-per-use Created on Dec 23...	192.16...	Log In View Metrics More

View **Total Connections**. Generally, a cluster instance occupies two connections. If there are more than two connections, the instance is being connected and used by other users.

Figure 3-10 Viewing total connections



3.10 How Do I Enable Availability Detection for a Connection Pool in the Service Code?

To ensure that your application obtains an available connection from a connection pool, you need to configure how the connection pool will check connection availability.

- For a JDBC or Druid connection pool:
Set **testOnBorrow** to **true**.
- For a HikariCP connection pool:

Set connectionTestQuery to "SELECT 1".

```
<bean id="hikariConfig" class="com.zaxxer.hikari.HikariConfig">
  <property name="poolName" value="spring@hikariCP" />
  <property name="connectionTestQuery" value="SELECT 1" />
  <property name="dataSourceClassName" value="com.mysql.jdbc.jdbc2.optional.MysqlDataSource" />
  <property name="dataSourceProperties">
    <props>
      <prop key="url">${jdbc.url}</prop>
      <prop key="user">${jdbc.username}</prop>
      <prop key="password">${jdbc.password}</prop>
    </props>
  </property>
</bean>

<bean id="dataSource" class="com.zaxxer.hikari.HikariDataSource" destroy-method="close">
  <constructor-arg ref="hikariConfig" />
</bean>
```

4 Client Installation

4.1 How Can I Install the MySQL Client?

MySQL provides client installation packages for different OSs on its official website. Download the [MySQL 8.0 client installation package](#) or [packages of other versions](#). The following uses Red Hat Linux as an example to show how to obtain the required installation package and install it.

Procedure

Step 1 Obtain the installation package.

Find the [link](#) to the required version on the download page. The `mysql-community-client-8.0.21-1.el6.x86_64` is used as an example.

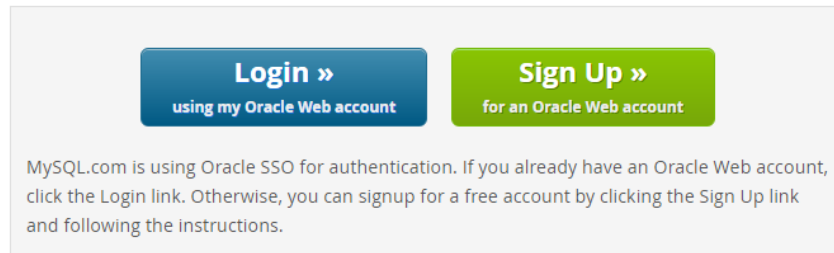
Figure 4-1 Download

MySQL Community Downloads

Login Now or Sign Up for a free account.

An Oracle Web Account provides you with the following advantages:

- Fast access to MySQL software downloads
- Download technical White Papers and Presentations
- Post messages in the MySQL Discussion Forums
- Report and track bugs in the MySQL bug system



No thanks, just start my download.

NOTE

Click **No thanks, just start my download.** to download the installation package.

Step 2 Upload the installation package to the ECS.

NOTE

When you create an ECS, select an OS, such as Red Hat 6.6, and bind an EIP to it. Then, upload the installation package to the ECS using a remote connection tool, and use PuTTY to connect to the ECS.

Step 3 Run the following command to install the MySQL client:

```
sudo rpm -ivh mysql-community-client-8.0.21-1.el6.x86_64.rpm
```

NOTE

- If any conflicts occur during the installation, add the **replacefiles** parameter to the command and try to install the client again. Example:

```
rpm -ivh --replacefiles mysql-community-client-8.0.21-1.el6.x86_64.rpm
```
- If a message is displayed prompting you to install a dependency package, you can add the **nodeps** parameter to the command and install the client again. Example:

```
rpm -ivh --nodeps mysql-community-client-8.0.21-1.el6.x86_64.rpm
```

Step 4 Use the MySQL client to connect to the database and check whether the client can run properly.

```
mysql -h <hostIP> -P <port> -u <userName> -p --ssl-ca=<cafile>
```


Table 4-1 Parameter description

Parameter	Description
<code><hostIP></code>	Private IP address. To obtain this parameter, go to the Basic Information page of the instance and view the private IP address in the Network Information area.
<code><port></code>	Database port. By default, the value is 3306 . To obtain this parameter, go to the Basic Information page of the instance and view the database port in the Network Information area.
<code><userName></code>	Username, that is, the TaurusDB database administrator account. The default value is root .
<code><cafile></code>	SSL certificate file, which should be stored in the same directory where the command is executed.

Example:

To connect to a DB instance through an SSL connection as user **root**, run the following command:

```
mysql -h 172.xx.xx.xx -P 3306 -u root -p --ssl-ca=ca.pem
```

Enter the password of the database account as prompted.

Enter password:

NOTE

If error information similar to "mysql: error while loading shared libraries: libxxx: cannot open shared object file: No such file or directory" is displayed, perform the following steps:
For example, if the error "mysql: error while loading shared libraries: libtinfo.so.5: cannot open shared object file: No such file or directory" is displayed:

1. Query the current version file of the dynamic library that reports the error on the local host.

```
find / -name libtinfo.so*
```

Assume that the query result is as follows:

```
/usr/lib64/libtinfo.so.6.2
```

```
/usr/lib64/libtinfo.so.6
```

2. Set up the soft link of the required version.

```
ln -s /usr/lib64/libtinfo.so.6 /usr/lib64/libtinfo.so.5
```

3. Connect to the database again.

```
mysql -h <hostIP> -P <port> -u <userName> -p --ssl-ca=<cafile>
```

----End

5 Database Migration

5.1 What Types of DB Engines Does TaurusDB Support for Importing Data?

- Exporting or importing data between DB engines of the same type is called homogeneous database export or import.
- Exporting or importing data between DB engines of different types is called heterogeneous database export or import. For example, import data from Oracle to the DB engines supported by TaurusDB.

Generally, data cannot be exported or imported between heterogeneous databases due to the different data formats involved. However, if the data formats are compatible, table data can, in theory, be migrated between them.

Third-party software is usually required for data replication to export and import between heterogeneous databases. For example, you can use a third-party tool to export table records from Oracle in .txt format. Then, you can use Load statements to import the exported table records to the DB engines supported by TaurusDB.

6 Database Permissions

6.1 Does TaurusDB Provide the Root Account or Super Permissions?

TaurusDB provides the administrator user **root**, which has the permissions except **super**, **file**, **shutdown**, and **create tablespace**.

Most cloud database service platforms do not provide super permissions for the **root** user. That's because super permissions allow you to execute management commands, such as **reset master**, **set global**, **kill**, and **reset slave**. These operations may cause unpredictable errors in TaurusDB.

If you need to perform operations that require super permissions, TaurusDB provides alternative methods.

- You can modify parameter values only on the TaurusDB console. You cannot run the following command on a database to modify parameter values.
set global *parameter_name*=*parameter_value*;
If the script contains the **set global** command, delete the **set global** command and modify parameter values on the TaurusDB console.
- An error is reported after you run the following command because the **root** user does not have super permissions. You can delete **definer='root'** from the command.
create definer='root'@'%' trigger(*procedure*)...
You can import and export data using mysqldump. For details, see [Migrating Data to TaurusDB Using mysqldump](#).

7 Database Performance

7.1 What Should I Do If the CPU Usage of My TaurusDB Instance Is High?

If the CPU usage is high or close to 100% when you use TaurusDB, data read/write processing slows down, connections cannot be established, and errors are reported, affecting workloads.

Solution

1. Check slow SQL logs for slow queries and examine their performance characteristics (if any) to locate the cause.
For details on viewing TaurusDB logs, see [Managing Slow Query Logs of a DB Instance](#).
2. View the CPU usage of your TaurusDB instance to facilitate problem locating.
For details, see [TaurusDB Metrics](#).
3. Create read replicas to offload read pressure from the primary node.
4. Add indexes for associated fields in multi-table association queries.
5. Do not use the SELECT statement to scan all tables. You can specify fields or add the WHERE condition.

7.2 How Do I Handle Slow SQL Statements Caused by Inappropriate Composite Index Settings?

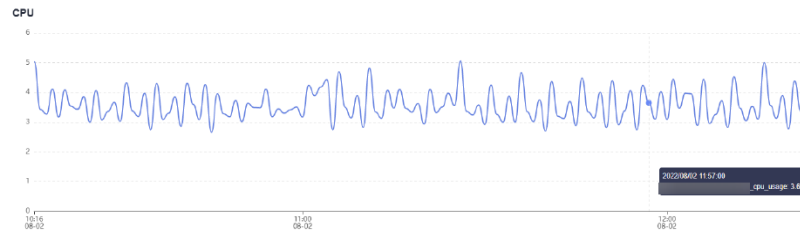
Scenario

On your TaurusDB instance, an SQL query that ran at 11:00 and was expected to take 8 seconds took more than 30 seconds.

Possible Causes

1. Check the CPU usage. In this example, during that time period, the CPU usage of the instance did not increase sharply and remained low, so we know that the slow query was not caused by high CPU usage.

Figure 7-1 CPU usage



2. Analyze slow query logs generated during that period. In this example, shown below, there were several SQL statements that involved millions of rows being scanned. These were the slow statements. But no large amount of data was inserted into the table during that time, so we know that the slow execution was caused by missing or incorrect index settings. By running **EXPLAIN**, you can find that the execution plan of the SQL statement was full table scanning.

Figure 7-2 Slow query logs

select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	6.027128 s	0.000105	125	2119000
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	5.479857 s	0.000104	123	2085096
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	5.288658 s	0.000106	123	2085096
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	33.601792 s	0.000064	140	16961077
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	34.342761 s	0.000171	140	16961077
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	44.536072 s	0.000167	140	16961077
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	46.501796 s	0.000095	140	16961077
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	33.050387 s	0.000099	139	16944097
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	38.523306 s	0.000101	139	16944097
select query_date, sum(queue) queue, sum(server_user_num) serverUserNum, su...	SELECT	1	40.108127 s	0.000090	139	16944097

3. Perform **SHOW INDEX FROM** on the table on the instance to check the cardinality of the three columns.

Figure 7-3 Index cardinality

```
***** 3. row *****
Table: ██████████
Non_unique: 1
Key_name: idx_query_date_channel_group_id
Seq_in_index: 1
Column_name: query_date
Collation: A
Cardinality: 133994
Sub_part: NULL
Packed: NULL
Null: YES
Index_type: BTREE
Comment:
Index_comment:
***** 4. row *****
Table: ██████████
Non_unique: 1
Key_name: idx_query_date_channel_group_id
Seq_in_index: 2
Column_name: channel
Collation: A
Cardinality: 405333
Sub_part: NULL
Packed: NULL
Null: YES
Index_type: BTREE
Comment:
Index_comment:
***** 5. row *****
Table: ██████████
Non_unique: 1
Key_name: idx_query_date_channel_group_id
Seq_in_index: 3
Column_name: group_id
Collation: A
Cardinality: 16213328
Sub_part: NULL
Packed: NULL
Null: YES
Index_type: BTREE
```

The **query_date** field with the smallest cardinality was in the first place of the composite index, and the **group_id** field with the largest cardinality was in the last place of the composite index. In addition, the SQL statement contained the range query of the **query_date** field. As a result, only the **query_date** field was indexed.

The SQL statement could only use the index of the **query_date** column. Additionally, the optimizer may have selected full table scanning during cost estimation because the cardinality was too small.

A new composite index was created with the **group_id** field in the first place and the **query_date** field in the last place. The query time met the expectation.

Solution

1. Check whether the slow query was caused by insufficient CPU resources.
2. Check whether the table structure is properly designed and whether index settings are correct.

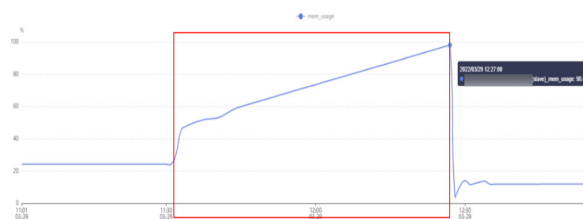
- Execute the **ANALYZE TABLE** statement periodically to prevent incorrect execution plans because performing a large number of INSERT or DELETE operations for table data may result in outdated statistics.

7.3 How Do I Handle a Large Number of Temporary Tables Being Generated for Long Transactions and High Memory Usage?

Scenario

The memory usage of a TaurusDB instance kept increasing from 11:30 to 12:27 and reached the memory limit.

Figure 7-4 Memory usage



Possible Causes

- Check the **processlist.log** file. In this example, shown below, there were two slow SQL statements in that time period.

Figure 7-5 Slow SQL statements

```

2022-03-29 12:27:45
188547 dbankpt dbankptdb Query 3011 executing select app_ver,pro_name,login_status,sum(case login_status
when 'true' then 1 else 0 end)as success,sum(case login_status when 'false' then 1 else 0 end)as failed
,count(login_status),sum(case login_status when 'true' then 1 else 0 end) / count(login_status)
from
where login_status is not null
and (date_format(pt_6,'%Y-%m-%d') BETWEEN '2022-03-21' AND '2022-03-28')
group by app_ver
188575 dbankpt dbankptdb Query 3079 executing select app_ver,pro_name,login_status,sum(case login_status
when 'true' then 1 else 0 end)as success,sum(case login_status when 'false' then 1 else 0 end)as failed
,count(login_status),sum(case login_status when 'true' then 1 else 0 end) / count(login_status)
from
where login_status is not null
and (date_format(pt_6,'%Y-%m-%d') BETWEEN '2022-03-21' AND '2022-03-28')
group by app_ver
    
```

- Analyze slow query logs generated in that time period. There was about 90 GB of data and about 1 billion of data rows in the logs, and there were two SQL statements that took 40 to 50 minutes to execute. The execution time basically overlapped when the memory usage went up in the monitoring results, so we know that the high memory usage was caused by temporary tables.

```

mysql> select select_query,table_name,data_length,data_length from information_schema.tables where table_name=
+-----+-----+-----+
| select_query | table_name | data_length |
+-----+-----+-----+
| select app_ver,pro_name,login_status,sum(case login_status when 'true' then 1 else 0 end)as success,sum(case login_status when 'false' then 1 else 0 end)as failed,count(login_status),sum(case login_status when 'true' then 1 else 0 end) / count(login_status) from where login_status is not null and (date_format(pt_6,'%Y-%m-%d') BETWEEN '2022-03-21' AND '2022-03-28') group by app_ver | dbankptdb | 90GB |
+-----+-----+-----+
    
```

Solution

- Upgrade the instance specifications to maintain the memory usage within a proper range, preventing a sudden increase in traffic from causing an OOM crash. For details, see [Changing vCPUs and Memory of a DB Instance](#).

2. Optimize slow SQL statements as needed.

7.4 What Should I Do If Locks on Long Transactions Block the Execution of Subsequent Transactions?

Scenario

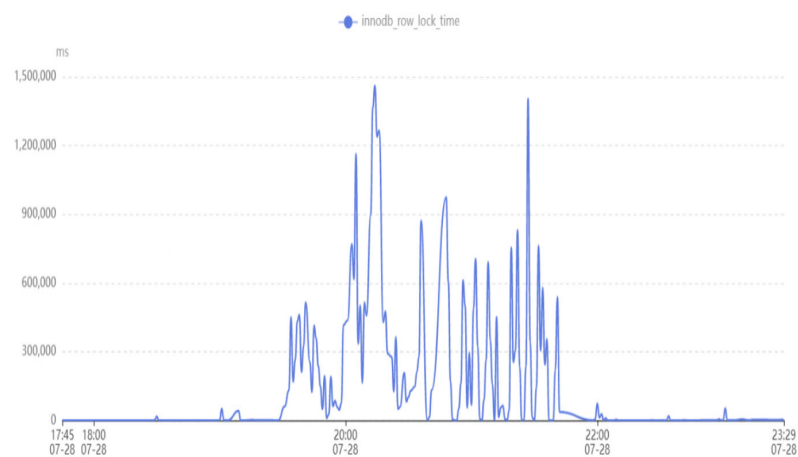
Error code 1205 was reported:

"MySQL error code MY-001205 (ER_LOCK_WAIT_TIMEOUT): **Lock wait timeout exceeded; try restarting transaction**"

Possible Causes

1. Check the value of the metric **Row Lock Time**. In this example, the value of this metric was high, so we know there were lock conflicts in the system.

For details about metrics, see [Viewing DB Instance Metrics](#).



2. Log in to the DB instance and run the following SQL statement to check the long transactions in the system and the row locks held by the transactions:

```
mysql> select trx_mysql_thread_id, trx_id, trx_state, trx_started, trx_tables_locked, trx_rows_locked,
trx_isolation_level, trx_query, trx_operation_state from information_schema.innodb_trx order by
trx_started;
```

trx_mysql_thread_id	trx_id	trx_state	trx_started	trx_tables_locked	trx_rows_locked	trx_isolation_level	trx_query	trx_operation_state
416	51965	RUNNING	2022-07-28 19:27:55	1	1	READ COMMITTED		
415	51967	LOCK WAIT	2022-07-28 08:11:03	1	2	READ COMMITTED		fetching rows

- **information_schema.innodb_trx**: information about transactions that are being executed in the InnoDB.
- **trx_started**: start time of a transaction, which is used to determine whether the current transaction is a long transaction. The execution time of a transaction is the current time minus the start time.
- **trx_state**: Status of the current transaction. The values are as follows:
 - **RUNNING**
 - **LOCK WAIT**

NOTE

If the status of a transaction is **LOCK WAIT**, the transaction holds a row lock.

- **ROLLING BACK**
- **COMMITTING**

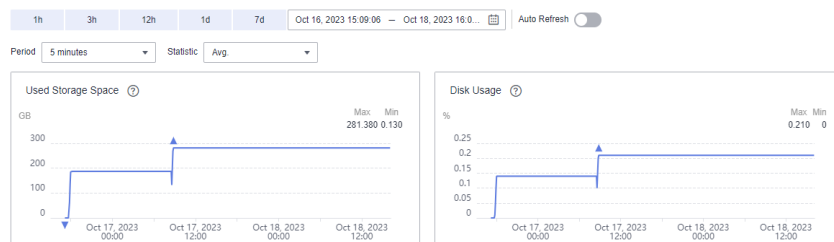
Solution

Kill the long transactions.

7.5 How Can I Use Temporary Disks of TaurusDB?

Temporary disks of TaurusDB instances are used to temporarily store temporary tables, temporary files, and binlog caches generated during database operation. On the management console, you can monitor used temporary disk space and temporary disk usage of your instance in different time periods and granularities in real time, as shown in the following figure.

Figure 7-6 Temporary disk usage



As services fluctuate, you may find that the usage of temporary disks suddenly or continuously increases. To improve database availability and stability, TaurusDB provides up to 500 GB of temporary disk space for a DB instance for free.

To prevent the temporary disk usage from continuously increasing and ultimately getting filled up, you are advised to check services as soon as possible based on the queried disk usage. This section describes the risks, scenarios, and troubleshooting you can perform when temporary disks are full.

Risks

- SQL statements fail to be executed and no results are returned.
- SQL statements occupy lock resources for a long time and block other SQL statements. As a result, the number of connections increases or even reaches the upper limit, affecting other services.
- There are too many temporary files in the binlog cache, which can cause the database to break down. This takes a long time to restore, so services are interrupted for a long time.

Scenarios and Troubleshooting

1. Explicitly creating temporary disk tables

- Scenario

You can run the **create temporary table** statement to explicitly create temporary disk tables. The temporary tables whose storage engine is InnoDB are cached in the buffer pool and flushed to disks by dirty threads.

In TaurusDB, data in disk temporary tables is stored in session temporary tablespace (the path is specified by the **innodb_temp_tablespaces_dir** parameter), and undo logs are stored in the global temporary tablespace (the path is specified by the **innodb_temp_data_file_path** parameter).

To prevent temporary disk tables from occupying too much disk space, you are advised to delete unnecessary temporary disk tables or disconnect unnecessary database connections.

NOTICE

- Session temporary tablespace: It is reclaimed when the current database connection is released.
- Global temporary tablespace: It is reclaimed only after the database is restarted.

- Troubleshooting

i. View information about the temporary tables you created in InnoDB.

```
mysql> select * from information_schema.innodb_temp_table_info;
+-----+-----+-----+-----+
| TABLE_ID      | NAME      | N_COLS | SPACE  |
+-----+-----+-----+-----+
| 18446744069414584311 | #sql055_24_0 | 5 | 4294502266 |
+-----+-----+-----+-----+
```

ii. Check the usage of InnoDB temporary table files.

In a table, the **ID** column indicates the ID of the session that is using the temporary table file. If the value is **0**, the ibt file is not used. The **SIZE** column indicates the size of the ibt file, which automatically increases based on the usage and is reclaimed when the session ends. If the value of the **PURPOSE** column is **INTRINSIC**, the table is an implicit temporary table. If the value of the **PURPOSE** column is **USER**, the table is an explicit temporary table.

```
mysql> select * from information_schema.innodb_session_temp_tablespaces;
+-----+-----+-----+-----+-----+
| ID | SPACE  | PATH                                     | SIZE | STATE | PURPOSE |
+-----+-----+-----+-----+-----+
| 31 | 4294502265 | ./#innodb_temp/temp_9.ibt | 81920 | ACTIVE | INTRINSIC |
| 36 | 4294502266 | ./#innodb_temp/temp_10.ibt | 98304 | ACTIVE | USER      |
| 34 | 4294502264 | ./#innodb_temp/temp_8.ibt | 81920 | ACTIVE | INTRINSIC |
| 0 | 4294502257 | ./#innodb_temp/temp_1.ibt | 81920 | INACTIVE | NONE      |
| 0 | 4294502258 | ./#innodb_temp/temp_2.ibt | 81920 | INACTIVE | NONE      |
| 0 | 4294502259 | ./#innodb_temp/temp_3.ibt | 81920 | INACTIVE | NONE      |
| 0 | 4294502260 | ./#innodb_temp/temp_4.ibt | 81920 | INACTIVE | NONE      |
| 0 | 4294502261 | ./#innodb_temp/temp_5.ibt | 81920 | INACTIVE | NONE      |
| 0 | 4294502262 | ./#innodb_temp/temp_6.ibt | 81920 | INACTIVE | NONE      |
| 0 | 4294502263 | ./#innodb_temp/temp_7.ibt | 81920 | INACTIVE | NONE      |
+-----+-----+-----+-----+-----+
```

2. Querying disk temporary tables or temporary files implicitly created

- Scenario

When selecting an execution plan for a query, the query optimizer may use temporary tables. Temporary memory tables are preferentially used. When the size of temporary memory tables exceeds a certain threshold (either **tmp_table_size** or **max_heap_table_size**, whichever is smaller), temporary disk tables are used.

Disk temporary tables are implicitly created by queries. The data between tables that are implicitly and explicitly created are the same and stored in the session temporary tablespace. If there are complex queries, including but not limited to keywords such as UNION, GROUP BY, and ORDER BY, in larger tables, temporary disk tables may be generated. In addition, when queries involve sorting operations, if the sort buffer cannot store all of the data (the buffer size is specified by **sort_buffer_size**), temporary disk files can be used for auxiliary sorting. In most scenarios, temporary disk tables implicitly created are the main reason disks fill up. If your disk is filling up, you can locate complex queries or long transactions, optimize query statements, add proper indexes, and split long transactions to address the issue.

- Troubleshooting

- i. Check whether there are SQL statements using temporary tables or file sorting.

If **Using temporary** is displayed in the **Extra** column, temporary tables are used. If **Using filesort** is displayed, file sorting is used.

```
mysql> explain {SQL};
+-----+-----+-----+-----+-----+-----+
| id | select_type | table | type | possible_keys | ... | Extra |
+-----+-----+-----+-----+-----+-----+-----+
| 1 | SIMPLE | p | index | PRIMARY,org_contact_fk | ... | Using index; Using temporary; Using filesort |
| 1 | SIMPLE | c1 | eq_ref | PRIMARY | ... | |
| 1 | SIMPLE | t2p | ref | idx_publisher_id | ... | Using where |
| 1 | SIMPLE | t | eq_ref | PRIMARY,active_index | ... | Using where |
| ..... |
```

- ii. Query the usage of implicit temporary tables. The method is the same as that the explicit disk temporary tables.

3. Querying binlogs generated for long transactions

- Scenario

A binlog is a binary that records database changes, such as DDL, DCL, and DML (excluding SELECT). InnoDB caches binlogs in the memory before transactions are committed and writes binlogs to disks only after the transactions are committed. The size of the binlog file for each connection in the memory is specified by the **binlog_cache_size** parameter. When the size of the binlog file recorded by a transaction exceeds the value of this parameter, the binlog file is written to a temporary disk file. Long transactions may cause large binlogs. As a result, the size of temporary binlogs on the disk is large and the disk may be full. You are advised to control the transaction size, split long transactions, or change **binlog_cache_size** to a more appropriate value.

- Troubleshooting

- i. Check whether binlog is enabled.

```
mysql> show variables like 'log_bin';
+-----+-----+
```

```
| Variable_name | Value |
+-----+-----+
| log_bin      | ON   |
+-----+-----+
```

- ii. View the binlog cache usage.

Binlog_cache_disk_use indicates the number of times that temporary disk files are used for caching binlogs due to insufficient memory (specified by **binlog_cache_size**). If the value of **binlog_cache_size** is large, temporary disk files are invoked for caching binlogs multiple times.

```
mysql> show global status like '%binlog_cache%';
+-----+-----+
| Variable_name      | Value      |
+-----+-----+
| Binlog_cache_disk_use | 1335006   |
| Binlog_cache_use    | 264240359 |
+-----+-----+
```

4. Checking temporary files generated by DDLs

- Scenario

During DDL operations on tables, temporary disk files are generated in some phases.

- Sometimes, you need to re-create the tablespace of the original table, which involves the re-creation of the B+ tree index on the table. If a table contains a large amount of data, the sort buffer cannot store all of the data. You need to create a temporary file to assist with the sorting.
- Although some online DDL statements support DML operations on the original table, the original table cannot be directly modified. The modification must be recorded in online logs and applied to the new table after the DDL operations are complete. Online logs are preferentially stored in the memory. The size of online logs is specified by the **innodb_sort_buffer_size** parameter. If the size of online logs exceeds the parameter value, online logs are temporarily stored in a temporary file.
- When the **OPTIMIZE TABLE** statement is executed on a table, the data stored in the clustered index needs to be reorganized, which may generate temporary files.

- Troubleshooting

- Run the **SHOW PROCESSLIST** command to check whether there are DDL statements that have been taking a long time to execute.
- Ensure that there is enough space before performing DDLs for large tables.

7.6 What Is the CPU Usage of a TaurusDB Instance with Empty Load?

A TaurusDB instance has the operating system process, mysqld process, monitoring process, and incremental backup process. The mysqld process contains

multiple threads, such as the primary/standby communications thread, connection thread, and refresh thread. The monitoring process monitors the instance status in real time. The incremental backup process backs up incremental data. Even when an instance is unloaded, there are still multiple processes and threads running in the background, resulting in non-zero CPU usage. Typically, the CPU usage ranges from 10% to 15% in such cases.

8 Database Usage

8.1 Why Are the Results Inconsistent After the MATCH AGAINST Statement Is Executed, Respectively, on Primary Nodes and Read Replicas?

MATCH AGAINST is used to search for MySQL full-text indexes. For rows in the table, MATCH returns relevance values, that is, a similarity measure between the search string (given as the argument to AGAINST() function and the text in that row in the columns named in the MATCH() list). This statement uses the **stat_n_rows** value to calculate the relevance value. Primary nodes and read replicas use different methods to obtain the **stat_n_rows** value. The primary nodes use the persistent method and the read replicas use the transient method. Therefore, the obtained values are slightly different from each other. The execution result of MATCH AGAINST on primary nodes and read replicas are different.

8.2 How Do I Add Columns Using INSTANT?

TaurusDB is compatible with open-source MySQL 8.0.22, so you can use **ALGORITHM=INSTANT** to quickly add columns, preventing lock waiting from affecting workloads or SQL statement execution timeout.

Constraints

- Columns can be added only in one statement. If there are other non-INSTANT operations in the same statement, columns cannot be added immediately.
- Columns can be added only at the end of existing columns.
- COMPRESSED row format is not supported.
- Tables that already have full-text indexes are not supported.


NOTE


If a table has a full-text index, you must run the OPTIMIZE TABLE statement on the table after deleting the full-text index.

- Temporary tables are not supported.
- A new field cannot have a default value.

Procedure

Step 1 [Log in to the management console.](#)

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

Step 3 Click  in the upper left corner of the page, choose **Databases** > **TaurusDB**.

Step 4 On the **Instances** page, locate the instance and click **Log In** in the **Operation** column.

Alternatively, on the **Instances** page, click the instance name to go to the **Basic Information** page. Click **Log In** in the upper right corner of the page.

Step 5 On the displayed login page, enter the correct username and password and click **Log In**.

Step 6 On the top menu bar, choose **SQL Operations** > **SQL Query**.

Step 7 Run the following SQL statement to quickly add a column:

```
ALTER TABLE table_name ADD COLUMN column_name column_definition,  
ALGORITHM=INSTANT;
```

- *table_name*: table name
- *column_name*: column name
- *column_definition*: column remarks

----End

8.3 How Do I Use LOAD DATA to Import Local Data?

You can use LOAD DATA to import local data to TaurusDB.

Syntax

```
LOAD DATA LOCAL  
  INFILE 'file_name'  
  [REPLACE | IGNORE]  
  INTO TABLE tbl_name  
  [CHARACTER SET charset_name]  
  [{FIELDS | COLUMNS}  
   [TERMINATED BY 'string']  
   [[OPTIONALLY] ENCLOSED BY 'char']  
  ]  
  [LINES  
   [TERMINATED BY 'string']  
  ]  
  [IGNORE number {LINES | ROWS}]  
  [(col_name_or_user_var  
   [, col_name_or_user_var] ...)]
```

Parameters

- **file_name**: path of the local file to be imported.
- **REPLACE | IGNORE**: whether to replace or ignore duplicate records.
- **tbl_name**: name of the table to be imported.
- **CHARACTER SET charset_name**: file encoding format. You are advised to use the encoding format of TaurusDB instances to avoid garbled characters.
- **FIELDS TERMINATED BY 'string'**: separator between columns. The default value is `\t`.
- **[OPTIONALLY] ENCLOSED BY 'char'**: used to ignore symbols in data source fields.
- **LINES TERMINATED BY 'string'?**: newline character between lines. The default value is `\n`.

NOTE

On some hosts running the Windows servers, the newline characters of text files may be `\r\n`, which is invisible.

- **IGNORE number LINES**: used to ignore lines at the start of the file.
- **(column_name_or_user_var, ...)**: columns to be imported. If this parameter is not configured, data is imported based on the column sequence by default.
- For other parameters, see the [load data infile](#) on the MySQL official website. The sequence of other parameters must be correct. For sequence details, visit [the MySQL official website](#).

Standard Example

Prerequisites

- The **local_infile** parameter must be enabled on the server. Click the instance name to go to the **Basic Information** page. On the **Parameters** page, change the value of this parameter to **ON**.
- The **local-infile** parameter must be enabled on the client. Configure **local-infile** in the **my.cnf** file or use the `--local-infile=1` option to connect to the database.

```
[mysql]
local-infile
```

1. Import the data in the local file **qq.txt** to the **test** table. The **qq.txt** file contains five rows of data. The column separator is `,` and the row separator is `\n`.

```
1,a
2,b
3,c
4,d
5,"e"
```

2. Create the **test** table.

```
CREATE TABLE test (
  `id` int NOT NULL,
  `a` varchar(4) NOT NULL,
  PRIMARY KEY (`id`)
);
```

3. On the client, run the **LOAD DATA** statement to import data in the **qq.txt** file to the **test** table, set the character set to **utf8**, and ignore the double quotation marks in the data source field.


```
mysql> LOAD DATA LOCAL INFILE '/data/qq.txt' IGNORE INTO TABLE test CHARACTER SET 'utf8'  
FIELDS TERMINATED BY ',' OPTIONALLY ENCLOSED BY '"' LINES TERMINATED BY '\n';  
Query OK, 5 rows affected, 1 warning (0.00 sec)  
Records: 5 Deleted: 0 Skipped: 0 Warnings: 1  
  
mysql> select * from test;  
+----+----+  
| id | a |  
+----+----+  
| 1 | a |  
| 2 | b |  
| 3 | c |  
| 4 | d |  
| 5 | e |  
+----+----+  
5 rows in set (0.00 sec)
```

NOTICE

1. Importing data affects performance of TaurusDB instances. Import data during off-peak hours.
2. Do not to initiate multiple LOAD DATA requests at the same time. When multiple LOAD DATA requests are initiated, SQL transactions may time out due to highly concurrent data write operations, table locking, and system I/O occupation, resulting in failure of all LOAD DATA requests.

8.4 How Do I Write Data to or Create Indexes for an Ultra-large Table?

Writing Data to an Ultra-large Table

For a table with tens of millions or hundreds of millions of data records, you are advised to use the following methods to improve data write efficiency:

- Delete unnecessary indexes.

When data is updated, the index data is also updated. For a table with large amounts of data, avoid creating too many indexes as this can slow down the update process. Delete unnecessary indexes based on service evaluation.

- Use batch insertion to insert multiple data records.

This is because batch insertion only requires a single remote request to the database.

Example:

```
insert into tb1 values(1,'value1');  
insert into tb2 values(2,'value2');  
insert into tb3 values(3,'value3');
```

After optimization:

```
insert into tb values(1,'value1'),(2,'value2'),(3,'value3');
```

- When inserting multiple data records, manually control transactions.

By manually controlling transactions, multiple execution units can be merged into a single transaction, avoiding the overhead of multiple transactions while ensuring data integrity and consistency.

Example:

```
insert into table1 values(1,'value1'),(2,'value2'),(3,'value3');
insert into table2 values(4,'value1'),(5,'value2'),(6,'value3');
insert into table3 values(7,'value1'),(8,'value2'),(9,'value3');
```

After optimization:

```
start transaction;
insert into table1 values(1,'value1'),(2,'value2'),(3,'value3');
insert into table2 values(4,'value1'),(5,'value2'),(6,'value3');
insert into table3 values(7,'value1'),(8,'value2'),(9,'value3');
commit;
```



CAUTION

Having too many merged statements can lead to large transactions, which will lock the table for a long time. Evaluate service needs and control the number of statements in a transaction accordingly.

- When inserting data, insert primary keys in sequential order. You can use `AUTO_INCREMENT`.
Inserting primary keys in a random order can cause page splitting, which can negatively impact performance.
Example:
Inserting primary keys in a random order: 6 2 9 7 2
Inserting primary keys in sequential order: 1 2 4 6 8
- Avoid using UUIDs or other natural keys, such as ID card numbers, as primary keys.
UUIDs generated each time are unordered, and inserting them as primary keys can cause page splitting, which can negatively impact performance.
- Avoid modifying primary keys during service operations.
Modifying primary keys requires modifying the index structure, which can be costly.
- Reduce the length of primary keys as much as possible if the business permits.
- Do not use foreign keys to maintain foreign key relationships. Use programs instead.
- Separate read and write operations. Place read operations on read replicas to avoid slow insertion caused by I/Os.

Creating Indexes for an Ultra-large Table

For a table with tens of millions or hundreds of millions of data records, you are advised to use the following methods to improve index creation efficiency:

- Keep the index field as small as possible.
- Select a column with high distinction as the index column.
- If each field in the table cannot guarantee uniqueness, cannot guarantee NOT NULL, or is not suitable for indexing, create a custom ID auto-increment column as the primary key, which will automatically ensure ordered insertion.
- To create an index, insert data first and then run the **alter table add index** command.

- Use TaurusDB parallel DDL to create an index. When database hardware resources are idle, you can use parallel DDL to accelerate DDL execution, preventing subsequent DML operations from being blocked and shortening the DDL operation window.

8.5 What Are the Risks of Deleting an Index from an Ultra-large Table?

Deleting an index is risky. You are advised not to delete an index unless necessary. The reasons are as follows:

- Deleting an index will deteriorate the performance of queries that use the index. Slow SQL statements consume all system resources, which affects workloads.
- When an index is deleted, the table is locked and other users cannot access the table, which affects system availability.
- When an index is deleted, index data may be lost or damaged, which affects data consistency.
- If workloads are affected after an index is deleted, the index needs to be rebuilt, which is time-consuming for ultra-large tables.

9 Backups

9.1 How Long Does TaurusDB Store Backup Data?

Automated backup data is kept based on the backup retention period you specified. For details, see [Configuring a Same-Region Backup Policy](#).

There is no limit for the manual backup retention period. For details, see [Deleting a Manual Backup](#).

The backup data is stored in OBS and does not occupy the storage space of your buy instance.

9.2 How Can I Check and Clear My TaurusDB Backup Space?

The TaurusDB backup space stores automated backups and manual backups. You can check the backup space usage in the **Storage/Backup Space** area on the TaurusDB console and clear the backup space as needed.

Checking the TaurusDB Backup Space Usage



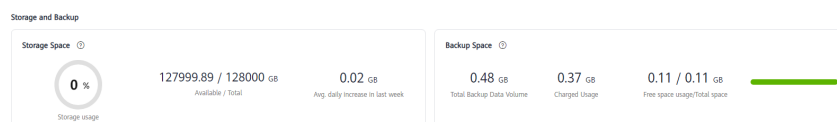
- Step 1** [Log in to the management console](#).
- Step 2** Click  in the upper left corner and select a region and project.
- Step 3** Click  in the upper left corner of the page, choose **Databases** > **TaurusDB**.
- Step 4** On the **Instances** page, click the instance name to go to the **Basic Information** page.
- Step 5** In the **Storage and Backup** > **Backup Space** area, check the backup space usage.

Figure 9-1 Checking the backup space usage



 NOTE

- There are full and incremental backups of a DB instance in the backup space.
- Free backup storage space of the same size as your purchased storage space are provided.

----End

Clearing TaurusDB Backup Space

- **Automated full and incremental backups**
Automated backups cannot be manually deleted. You need to change the backup cycle by referring to [Configuring a Same-Region Backup Policy](#). The backup files that have expired will be deleted.
- **Manual full backups**
You can manually delete manual backups. For details, see [Deleting a Manual Backup](#).

9.3 How Can I Back Up a TaurusDB Database to an ECS?

You can back up data to an ECS in the same way you export SQL statements. The ECS service does not have restrictions on the types of data to be backed up as long as the data complies with local laws and regulations. You can store backup data on an ECS.

However, you are advised to use TaurusDB [automated backups](#) and [manual backups](#) to back up data to OBS for higher data reliability and service assurance.

9.4 Why Did My Automated Backup Fail?

The possible reasons for automated backup failures are as follows:

1. The network environment may be unstable due to problems such as network delay or interruptions. If TaurusDB detects any of these problems, it triggers another automated backup half an hour later. Alternatively, you can perform a manual backup immediately.
2. If multiple tasks are being executed simultaneously, there can be problems such as excessive task wait times or interruptions. If TaurusDB detects any of these problems, it triggers another automated backup half an hour later. Alternatively, you can perform a manual backup immediately.
3. The DB instance is abnormal probably because it is faulty or being modified. If TaurusDB detects any of these problems, it triggers an automated backup when the instance status becomes available. Alternatively, you can perform a manual backup immediately.
4. A parameter change was incorrect. If your DB instance becomes faulty after you modify parameters of a parameter template and apply the template to the instance, check whether the modified parameters are set to correct values and whether there are any associated parameters that need to be changed, or reset the parameters to their defaults and reboot the DB instance.

5. An error occurred during data import. For example, system catalog records get lost due to inappropriate data import. You can import data again by referring to [Migrating Data to TaurusDB Using DRS](#). The system will automatically identify and back up the data again.
6. If the problem persists, submit an application by choosing [Service Tickets > Create Service Ticket](#) in the upper right corner of the management console.

9.5 How Is TaurusDB Backup Data Billed?

All the TaurusDB backups are stored on OBS without occupying the storage of your DB instances. TaurusDB provides free backup space of the same size as your purchased storage.

For example, if you purchase a DB instance with 200 GB of storage, you can get an additional 200 GB of backup space and are only charged for backups in excess of 200 GB. The first 200 GB of backup data is free. When the 200 GB storage is used up, the backups will be billed on a pay-per-use basis. For pricing details, see [Product Pricing Details](#).

NOTICE

If your storage is frozen, it is no longer charged and the free backup space is also unavailable.

If your DB instance is frozen, no free backup space is available. As a result, the original automated backups of the DB instance will be charged.

- If you unfreeze the DB instance, the free backup space will be restored.
 - If you directly delete the frozen DB instance, its automated backups will also be deleted and the backup space will not be charged any longer.
-


10 Database Parameter Modification


10.1 How Do I Change the Time Zone of a TaurusDB Instance?

TaurusDB allows you to select a time zone when you create an instance and change the time zone after the instance is created.

Procedure

Step 1 [Log in to the management console.](#)

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

Step 3 Click  in the upper left corner of the page, choose **Databases** > **TaurusDB**.

Step 4 On the **Instances** page, click the instance name.

Step 5 In the navigation pane, choose **Parameters**.

Step 6 Search for a time zone parameter in the search box, for example, **time_zone**.

Step 7 Select a time zone, and click **Save**.

Step 8 In the displayed dialog box, click **Yes**.

For example, to change the time zone to UTC+08:00, select **Asia/Shanghai** from the drop-down list.

----End

Time Zone Parameters

- **system_time_zone**: operating system (OS) time zone. This parameter cannot be changed and it has no impact on the database time zone.
- **time_zone**: database time zone. You can modify this parameter to change the time zone for your instance.

10.2 How Do I Configure a Password Expiration Policy for TaurusDB Instances?



In TaurusDB kernel version 8.0, you can set the global variable **default_password_lifetime** to control the default validity period of a user password.

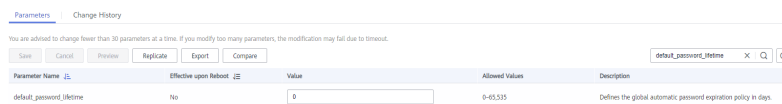
The value of **default_password_lifetime** indicates how many days until a password expires. The default value is **0**, indicating that the created user password will never expire.

```
mysql> show variables like 'default_password_lifetime';
+-----+-----+
| Variable_name | Value |
+-----+-----+
| default_password_lifetime | 0 |
+-----+-----+
1 row in set (0.00 sec)
```

Changing the Global Automatic Password Expiration Policy

You can change the global automatic password expiration policy in either of the following ways:

- Change the value of **default_password_lifetime** on the TaurusDB console.
 - a. [Log in to the management console](#).
 - b. Click  in the upper left corner and select a region and project.
 - c. Click  in the upper left corner of the page, choose **Databases > TaurusDB**.
 - d. On the **Instances** page, click the instance name.
 - e. In the navigation pane, choose **Parameters**.
 - f. Search for **default_password_lifetime** in the search box.



- g. Change its value and click **Save**.
 - h. In the displayed dialog box, click **Yes**.
- Run the following command to change the value of **default_password_lifetime**:
set global default_password_lifetime=0;

Checking the Password Expiration Date of All Users

Run the following command:


```
select user,host,password_expired,password_last_changed,password_lifetime
from user;
```

```
mysql> select user,host,password_expired,password_last_changed,password_lifetime from user;
+-----+-----+-----+-----+-----+
| user          | host      | password_expired | password_last_changed | password_lifetime |
+-----+-----+-----+-----+-----+
| mysql.session | localhost | N                | 2020-01-17 15:02:23   | NULL              |
| mysql.sys     | localhost | N                | 2020-01-17 15:02:23   | NULL              |
| rdsAdmin      | localhost | N                | 2020-01-17 15:02:30   | 0                 |
| root          | %        | N                | 2020-03-05 14:23:54   | NULL              |
| rdsRepl       | 192.168.% | N                | 2020-01-17 15:02:45   | 0                 |
| rdsMetric     | 192.168.% | N                | 2020-01-17 15:02:30   | 0                 |
| rdsBackup     | localhost | N                | 2020-01-17 15:02:30   | 0                 |
| u_test01      | %        | N                | 2020-03-05 14:28:10   | 30                |
| u_test02      | %        | N                | 2020-03-05 14:28:38   | NULL              |
| jeffrey       | localhost | N                | 2020-03-05 15:23:17   | NULL              |
+-----+-----+-----+-----+-----+
10 rows in set (0.00 sec)
```

Checking the Password Expiration Policy of a Specified User

Run the following command:

```
show create user jeffrey@'localhost';
```

```
mysql> show create user jeffrey@'localhost';
+-----+-----+-----+-----+-----+
| CREATE USER for jeffrey@localhost |
| CREATE USER 'jeffrey'@'localhost' IDENTIFIED WITH 'mysql_native_password' AS '*1369F151658FC90255853119A9CB05540B807F' REQUIRE NONE PASSWORD EXPIRE DEFAULT ACCOUNT UNLOCK |
+-----+-----+-----+-----+-----+
1 row in set (0.00 sec)
```

EXPIRE DEFAULT indicates that the password follows the global expiration policy.

Configuring the Password Expiration Policy for a Specified User

- Configuring the password expiration policy during user creation
create user 'script'@'localhost' identified by '***' password expire interval 90 day;**
- Configuring the password expiration policy after user creation
ALTER USER 'script'@'localhost' PASSWORD EXPIRE INTERVAL 90 DAY;
- Setting the password to be permanently valid
CREATE USER 'mike'@'%' PASSWORD EXPIRE NEVER;
ALTER USER 'mike'@'%' PASSWORD EXPIRE NEVER;
- Setting the password to follow the global expiration policy
CREATE USER 'mike'@'%' PASSWORD EXPIRE DEFAULT;
ALTER USER 'mike'@'%' PASSWORD EXPIRE DEFAULT;


10.3 How Do I Ensure that the Database Character Set of a TaurusDB Instance Is Correct?


UTF-8 supports 4 byte characters, but TaurusDB utf8 supports only 3 byte characters. Emojis and newly added Unicode characters cannot be stored using MySQL utf8 character set. MySQL released the utf8mb4 character set in 2010 and added the utf8mb4 code after 5.5.3 to be compatible with the 4-byte unicode. You only need to change utf8 to utf8mb4. No other conversion is required.

Huawei Cloud Data Admin Service (DAS) is a professional database management tool. You can view the database and system character sets through the DAS console.

Procedure

Step 1 Log in to the management console.

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

Step 3 Click  in the upper left corner of the page, choose **Databases** > **TaurusDB**.

Step 4 On the **Instances** page, locate the instance and click **Log In** in the **Operation** column.

Alternatively, on the **Instances** page, click the instance name to go to the **Basic Information** page. Click **Log In** in the upper right corner of the page.

Step 5 On the displayed login page, enter the correct username and password and click **Log In**.

Step 6 On the top menu bar, choose **SQL Operations** > **SQL Window**.

Step 7 Run the following SQL statement in the SQL window to view the database character set:

```
show variables like '%character%';
```

Figure 10-1 SQL execution result



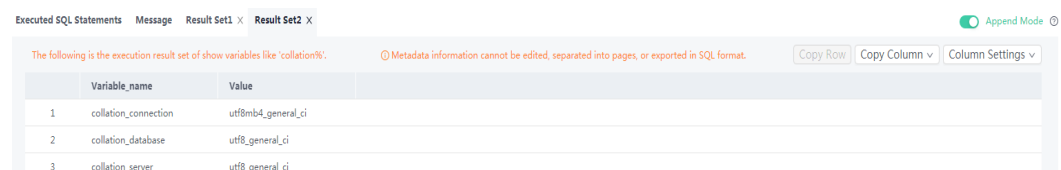
The screenshot shows the execution result of the SQL statement 'show variables like '%character%';'. The result is displayed in a table with two columns: 'Variable_name' and 'Value'. The table contains 8 rows of data. The interface includes a header with 'Executed SQL Statements', 'Message', and 'Result Set1 X'. There are also buttons for 'Copy Row', 'Copy Column', and 'Column Settings', and a toggle for 'Append Mode'.

	Variable_name	Value
1	character_set_client	utf8mb4
2	character_set_connection	utf8mb4
3	character_set_database	utf8
4	character_set_filesystem	binary
5	character_set_results	
6	character_set_server	utf8
7	character_set_system	utf8
8	character_sets_dir	/usr/local/mysql-5.7.27...

Step 8 Run the following SQL statement in the SQL window to view the database coding:

```
show variables like 'collation%';
```

Figure 10-2 SQL execution result



The screenshot shows the execution result of the SQL statement 'show variables like 'collation%';'. The result is displayed in a table with two columns: 'Variable_name' and 'Value'. The table contains 3 rows of data. The interface includes a header with 'Executed SQL Statements', 'Message', 'Result Set1 X', and 'Result Set2 X'. There are also buttons for 'Copy Row', 'Copy Column', and 'Column Settings', and a toggle for 'Append Mode'.

	Variable_name	Value
1	collation_connection	utf8mb4_general_ci
2	collation_database	utf8_general_ci
3	collation_server	utf8_general_ci

Step 9 Change the character set to utf8mb4.

1. Run the following SQL statement to change the database character sets.

```
ALTER DATABASE DATABASE_NAME DEFAULT CHARACTER SET utf8mb4  
COLLATE utf8mb4_general_ci;
```

2. Run the following SQL statement to change the table character sets.
ALTER TABLE *TABLE_NAME* DEFAULT CHARACTER SET utf8mb4 COLLATE utf8mb4_general_ci;

 **NOTE**

The SQL statement just changes the character sets of tables. The character sets of fields in the tables are not changed.

3. Run the following SQL statement to change all the field character sets in tables:

ALTER TABLE *TABLE_NAME* CONVERT TO CHARACTER SET utf8mb4 COLLATE utf8mb4_general_ci;

 **NOTE**

- **character_set_client**, **character_set_connection**, and **character_set_results** are the settings of the client.
- **character_set_system**, **character_set_server**, and **character_set_database** are the settings of the server.
- The priorities of the parameters on the server are as follows: **character_set_database** > **character_set_server** > **character_set_system**.



----End

10.4 How Do I Use the utf8mb4 Character Set to Store Emojis in a TaurusDB Instance?

To store emoji in a TaurusDB instance, ensure that:

- The client outputs the utf8mb4 character set.
- The connection supports the utf8mb4 character set. If you want to use a JDBC connection, download MySQL Connector/J 5.1.13 or a later version and leave **characterEncoding** undefined for the JDBC connection string.
- Configure the TaurusDB instance as follows:
 - Setting **character_set_server** to **utf8mb4**

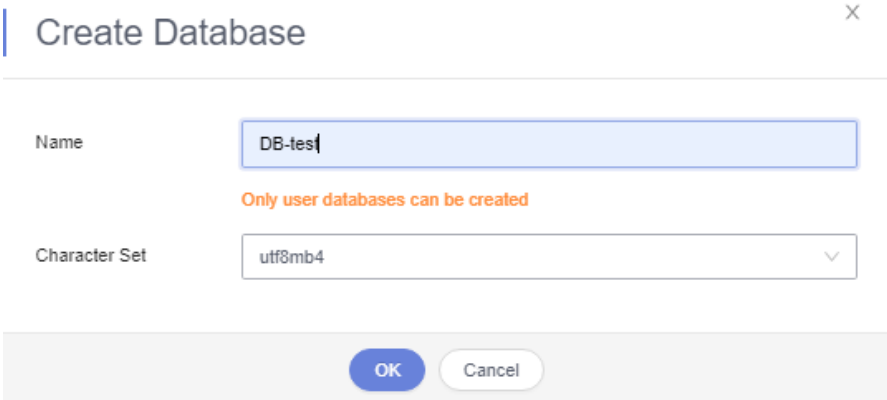
Parameter Name	Effective upon Reboot	Value	Allowed Values	Description
character_set_server	Yes	utf8mb4	utf8, latin1, gbk, utf8mb4	The server's default character set.

- Log in to the management console.**
 - Click  in the upper left corner and select a region and project.
 - Click  in the upper left corner of the page, choose **Databases** > **TaurusDB**.
 - On the **Instances** page, click the instance name.
 - In the navigation pane, choose **Parameters**. On the **Parameters** tab, locate **character_set_server** and change its value to **utf8mb4**.
 - Click **Save**. In the displayed dialog box, click **Yes**.
- Selecting **utf8mb4** for database character set
 - On the **Instances** page, locate the instance and click **Log In** in the **Operation** column.

Alternatively, on the **Instances** page, click the instance name to go to the **Basic Information** page. Click **Log In** in the upper right corner of the page.

- ii. On the displayed login page, enter the correct username and password and click **Log In**.
- iii. On the **Databases** page, click **Create Database**. In the displayed dialog box, enter a database name, select the character set **utf8mb4**, and authorize database permissions for users. Then, click **OK**.

Figure 10-3 Creating a database



The screenshot shows a 'Create Database' dialog box. The 'Name' field is filled with 'DB-test'. Below it, a red warning message says 'Only user databases can be created'. The 'Character Set' dropdown menu is set to 'utf8mb4'. At the bottom, there are two buttons: 'OK' and 'Cancel'.

- Setting the character set of the table to **utf8mb4**

```
(mysql) [root@localhost:~]# mysql -u root -h localhost -P 3306 -e "create table emoji_01 (id int auto_increment primary key, content varchar(255)) default charset utf8mb4;"
Query OK, 0 rows affected (0.01 sec)

(mysql) [root@localhost:~]# mysql -u root -h localhost -P 3306 -e "show create table emoji_01 \G"
+-----+
| Table: emoji_01 |
+-----+
| Create Table: CREATE TABLE `emoji_01` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `content` varchar(255) DEFAULT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
1 row in set (0.00 sec)
```

FAQs

If you have set **characterEncoding** to **utf8** for the JDBC connection string, or the emoji data cannot be inserted properly after you have performed the above operations, you are advised to set the connection character set to **utf8mb4** as follows:

```
String query = "set names utf8mb4";
stat.execute(query);
```

10.5 How Do I Set Case Sensitivity for TaurusDB Table Names?

You can specify case sensitivity for table names when creating an instance on the console or using APIs. It cannot be changed after the instance is created.

- Set **Table Name** to **Case sensitive** or **Case insensitive** on the TaurusDB console during instance creation.

Figure 10-4 Configuring case sensitivity for table names

The screenshot shows a configuration interface with the following elements:

- Administrator: root
- Administrator Password: [input field] Keep your password secure. The system cannot retrieve your password.
- Confirm Password: [input field]
- Parameter Template: [dropdown menu] View Parameter Template ?
- Table Name: Case sensitive (disabled) Case Insensitive (selected) ? This option cannot be changed later.
- Enterprise Project: --Select-- Create Enterprise Project ?

- Set **lower_case_table_names** by invoking an API. For details, see [Creating a DB Instance](#).

Value range:

- **0**: Table names are case sensitive.
- **1** (default value): Table names are stored in lowercase and are case insensitive.


10.6 Can I Use SQL Commands to Modify Global Parameters of My TaurusDB Instance?

Sorry, you cannot use SQL commands to modify global parameters, but you can modify specific parameters on the console.

Procedure

Step 1 [Log in to the management console](#).

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

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

Step 4 On the **Instances** page, click the instance name.

Step 5 In the navigation pane, choose **Parameters**.

Step 6 Change the value of the target parameter and click **Save**.

Step 7 In the displayed dialog box, click **Yes**.

----End

11 Network Security

11.1 How Can I Prevent Untrusted Source IP Addresses from Accessing TaurusDB?

- If you enable public accessibility, your EIP DNS and database port may be vulnerable to hacking. To protect information such as your EIP, DNS, database port, database account, and password, you are advised to specify the range of source IP addresses in a TaurusDB instance security group to ensure that only trusted source IP addresses can access your instance.
- To prevent your database password from being cracked, specify a strong password and periodically change it.

11.2 How Can I Import the Root Certificate to a Windows or Linux Server?

Importing the Root Certificate to a Windows Server

1. Click **Start** and choose **Run**. In the displayed **Run** dialog box, enter **MMC** and press **Enter**.
2. On the displayed console, choose **File > Add/Remove Snap-in**.
3. In the left **Available snap-ins** pane of the displayed dialog box, select **Certificates**. Click **Add** to add the certificate.
4. In the displayed **Certificates snap-in** dialog box, select **Computer account** and click **Next**.
5. In the displayed **Select Computer** dialog box, click **Finish**.
6. In the **Add or Remove Snap-ins** dialog box, click **OK**.
7. On the console, double-click **Certificates**.
8. Right-click **Trusted Root Certification Authorities** and choose **All Tasks > Import**.
9. Click **Next**.

10. Click **Browse** to change the file type to **All Files (*.*)**.
11. Locate the downloaded root certificate (a **ca.pem** file) and click **Open**. Then, click **Next**.

NOTICE

You must change the file type to **All Files (*.*)** because **.pem** is not a standard certificate extension name.

12. Click **Next**.
13. Click **Finish**.
14. Click **OK** to complete the import of the root certificate.

Importing the Root Certificate to a Linux Server

You can use a connection tool (such as WinSCP or PuTTY) to upload the certificate to any directory on a Linux Server.

12 Log Management

12.1 Can I Enable general_log for TaurusDB?

No.

If you need to enable general_log for full SQL audit and troubleshooting, you can use [TOP SQL](#) and [SQL Insights](#).

12.2 How Do I View All SQL Statements Executed by TaurusDB?

You can use the visualized database management service Data Admin Service (DAS) to quickly search for target SQL execution records.

Procedure



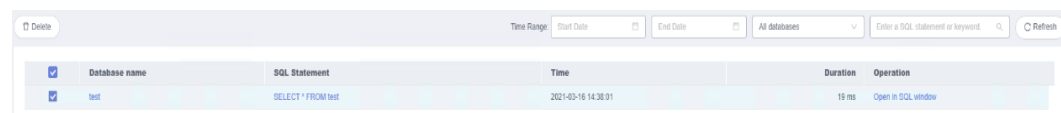
- Step 1** [Log in to the management console](#).
- Step 2** Click  in the upper left corner and select a region and project.
- Step 3** Click  in the upper left corner of the page and choose **Databases > TaurusDB**.
- Step 4** On the **Instances** page, locate the instance you want to log in and click **Log In** in the **Operation** column.
- Step 5** On the displayed login page, enter the correct username and password and click **Log In**.
- Step 6** On the top menu bar, choose **SQL Operations > SQL History**.
- Step 7** On the displayed page, search for execution information about the target SQL statement by time range, database name, or keyword.

Figure 12-1 SQL history



Database name	SQL Statement	Time	Duration	Operation
test	SELECT * FROM test	2021-03-16 14:30:01	15 ms	Open in SQL window

- To access the **Database Management** page, click a database name.
- To copy and use an SQL statement, click it in the **SQL Statement** column.
- To execute an SQL statement, locate the statement and click **Open in SQL Window** in the **Operation** column.

----End

12.3 How Do I Enable and View Binlog of My TaurusDB Instance?

This section describes how to enable and view binlog, and the impact on TaurusDB performance after binlog is enabled.


- [Enabling Binlog](#)
- [Viewing Binlog Files](#)
- [Impact of Enabling Binlog on TaurusDB Performance](#)

Enabling Binlog

Binlog cannot be enabled for TaurusDB read replicas.

Step 1 [Log in to the management console.](#)

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

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

Step 4 Click the instance name to go to the **Basic Information** page.

Step 5 In the navigation pane, choose **Parameters**.

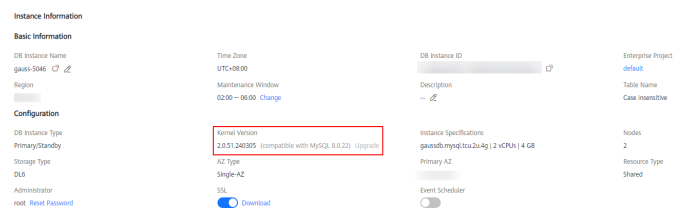
Step 6 Configure parameters as follows:

- If the kernel version is earlier than 2.0.45.230900, search for the **log-bin** parameter, select **ON** from the drop-down list box in the **Value** column, and click **Save**. The modified parameter value is applied only after the DB instance is rebooted. For details about the impact and precautions of rebooting a DB instance, see [Rebooting a DB Instance](#).

NOTE

To view the kernel version, click the instance name to go to the **Basic Information** page. In the **Configuration** area, check the **Kernel Version** field.

Figure 12-2 Viewing the kernel version



- If the kernel version is 2.0.45.230900 or later, search for the **rds_global_sql_log_bin** parameter, select **ON** from the drop-down list box in the **Value** column, and click **Save**. The modified parameter value is applied immediately. You do not need to reboot the DB instance.

After this parameter is changed, connect to the database and run the following command to check whether the binlog is enabled for all threads:

```
select @@session.rds_sql_log_bin_inconsistent_count;
```

NOTE

rds_sql_log_bin_inconsistent_count indicates the number of users whose the value of **sql_log_bin** is inconsistent with the value of **rds_global_sql_log_bin**.

- If the command output is 0, binlog is successfully enabled for all threads, and all statements can be recorded in binlog. Then a full backup can be performed.
- If the command out is not 0, run the following command to check the IDs of the threads that binlog is not enabled for:

```
show warnings;
```

Figure 12-3 Querying the IDs of the threads that binlog is not enabled for

```
mysql> select @@session.rds_sql_log_bin_inconsistent_count;
+-----+
| @@session.rds_sql_log_bin_inconsistent_count |
+-----+
| 1 |
+-----+
1 row in set, 1 warning (0.00 sec)

mysql> show warnings;
+-----+-----+-----+
| Level | Code | Message |
+-----+-----+-----+
| Warning | 7540 | The sql_log_bin is inconsistent with rds_global_sql_log_bin on thread with thread id '53' |
+-----+-----+-----+
1 row in set (0.00 sec)
```

The statements executed in the queried thread IDs may not be recorded in binlog temporarily.

Check your services based on the obtained thread IDs (for example, **53** in [Figure 12-3](#)), submit or roll back transactions and execute new transactions (for example, **SELECT 1**;) in a timely manner based on service requirements, or disconnect idle connections and reconnect them.

----End

Viewing Binlog Files

Step 1 Connect to a DB instance. For details, see [Connecting to a DB Instance](#).

Step 2 Run the following command to view binlog files:

```
SHOW BINLOG EVENTS [IN 'log_name'] [FROM pos] [LIMIT [offset,] row_count];
```

NOTE

If a message indicating that the account permissions are insufficient, use the **root** account.

----End

Impact of Enabling Binlog on TaurusDB Performance

Enabling binlog does not affect SELECT operations, but affects INSERT, UPDATE, DELETE and other write operations.

NOTE


There are no significant differences between TaurusDB binlog and open-source MySQL binlog. The binlog syntax of TaurusDB is fully compatible with that of the open-source MySQL.


12.4 How Do I Change the Binlog Retention Period?

TaurusDB is compatible with the `binlog_expire_logs_seconds` parameter of MySQL Community Edition 8.0. You can change the binlog retention period using this parameter.

Procedure

Step 1 [Log in to the management console.](#)

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

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

Step 4 On the **Instances** page, click the instance name.

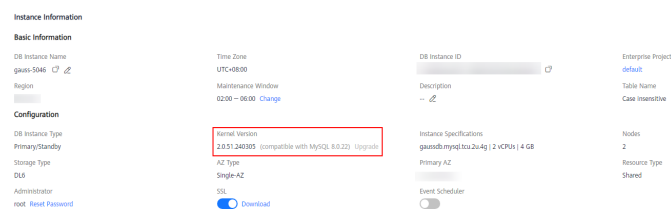
Step 5 In the navigation pane, choose **Parameters**. On the **Parameters** tab, view the following parameters.

- If the kernel version is earlier than 2.0.45.230900, search for the **log-bin** parameter. If the parameter value is **ON**, binlog is enabled.
- If the kernel version is 2.0.45.230900 or later, search for the **rds_global_sql_log_bin** parameter. If the parameter value is **ON**, binlog is enabled.

NOTE

To view the kernel version, click the instance name to go to the **Basic Information** page. In the **Configuration** area, check the **Kernel Version** field.

Figure 12-4 Viewing the kernel version



Step 6 On the **Parameters** tab, configure **binlog_expire_logs_seconds**.

 NOTE

- When a new binlog file is generated, any existing binlog files that have expired will be deleted.
- If no new binlog file is generated, historical binlog files will not be deleted even if they have expired. To delete binlog files manually, connect to the database and run **flush logs**; to forcibly generate a new binlog file.


----End


12.5 How Do I View Deadlock Logs of TaurusDB?

Database deadlock logs are not recorded in error logs. To view deadlock logs, use Data Admin Service (DAS), a visualized and professional database management tool, to quickly execute SQL statements.

Procedure

Step 1 [Log in to the management console.](#)

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

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

Step 4 On the **Instances** page, locate the instance you want to log in and click **Log In** in the **Operation** column.

Step 5 On the displayed login page, enter the correct username and password and click **Log In**.

Step 6 Select the target database and click **SQL Operations > SQL Window**.

Step 7 In the displayed SQL window, run **show engine innodb status** to view the latest deadlock logs of the selected database. Use the keyword **LATEST DETECTED DEADLOCK** to locate the latest deadlock logs. The latest deadlock logs will overwrite the historical deadlock logs.

----End

12.6 Why Are Slow SQL Statements Displayed in Slow Query Log Monitoring, but No Information About Them Is Displayed on the Slow Query Logs Tab Page in the Logs Module?

When **log_slow_admin_statements** is set to **ON**, the database kernel records management SQL statements, such as **Binlog Dump GTID**, **ANALYZE TABLE** and **OPTIMIZE TABLE**, in slow query logs. However, these SQL statements are usually initiated by O&M operations and are not closely related to workloads. So, they are filtered out when uploaded to the **Logs** module, helping users efficiently and accurately check, locate, and analyze slow queries generated on workloads.

13 Version Upgrade

13.1 How Can I Check the Version of a TaurusDB Instance?

This section describes how to check the versions of TaurusDB instances and proxy instances.

Checking the Version of a TaurusDB Instance

Method 1: Checking the Version on the TaurusDB Console



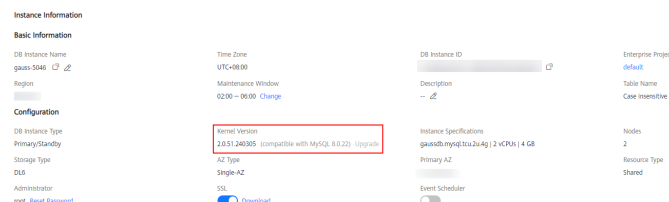
1. [Log in to the management console.](#)
2. Click  in the upper left corner and select a region and project.
3. Click  in the upper left corner of the page and choose **Databases > TaurusDB**.
4. On the **Instances** page, click the instance name to go to the **Basic Information** page.
5. Check the kernel version of the TaurusDB instance.

Figure 13-1 Checking the kernel version



Method 2: Checking the Version on the DAS Console



1. Log in to the target DB instance.

2. On the top menu bar, choose **SQL Operations > SQL Query**.
3. Run the following statement to check the instance version:
select @@version;

Figure 13-2 Checking the instance version on the DAS console



Checking the Version of a Proxy Instance

1. [Log in to the management console](#).
2. Click  in the upper left corner and select a region and project.
3. Click  in the upper left corner of the page and choose **Databases > TaurusDB**.
4. On the **Instances** page, click the instance name to go to the **Basic Information** page.
5. Choose **Database Proxy**, click the proxy instance name, and view its kernel version.

