TencentDB for MySQL

White Paper

Product Documentation
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Testing Tool

The tool used to test the database benchmark performance is sysbench v0.5.

Modifications to the tool:
The OLTP script that comes with sysbench was modified. Specifically, the read/write ratio was changed to 1:1 and controlled by the testing command parameters `oltp_point_selects` and `oltp_index_updates`. In this document, all test cases involve 4 Select operations and 1 Update operation with the read/write ratio at 4:1.

Testing Environment

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical machine</td>
<td>High-availability edition where a single machine can support database instances with up to 488 GB memory and 6 TB disk</td>
</tr>
<tr>
<td>Instance specification</td>
<td>Currently purchasable mainstream specification (please see the test cases below)</td>
</tr>
<tr>
<td>Client configuration</td>
<td>4-core CPU and 8 GB memory</td>
</tr>
<tr>
<td>Number of clients</td>
<td>1–6 (more clients need to be added as the configuration is upgraded)</td>
</tr>
<tr>
<td>Network environment</td>
<td>Data center with 10-Gigabit connection and a network latency below 0.05 ms</td>
</tr>
<tr>
<td>Environment load</td>
<td>Load on the machine where MySQL is installed is above 70% (for non-exclusive instances)</td>
</tr>
</tbody>
</table>

- Note on client specification: high-spec client machines are used so as to ensure that the database instance performance can be measured through stress testing on a single client. For low-spec
clients, it is recommended to use multiple clients for concurrent stress testing and aggregate the results.

- Note on network latency: in the testing environment, it should be ensured that clients and database instances are in the same AZ so as to prevent the testing result from being affected by network factors.

Testing Method

1. Structure of testing tables

```sql
CREATE TABLE `sbtest1` (  `id` int(10) unsigned NOT NULL AUTO_INCREMENT,  `k` int(10) unsigned NOT NULL DEFAULT '0',  `c` char(120) NOT NULL DEFAULT '',  `pad` char(60) NOT NULL DEFAULT ''
) ENGINE=InnoDB DEFAULT CHARSET=utf8;
```

2. Format of testing data rows

id: 1  
k: 2010685  
c: 08566691963-88624912351-16662227201-46648573979-64646226163-77505759394-75470094713-4109736071  
7-15161106334-5053565977  
pad: 63188288836-92351140030-06390587585-66802097351-4928296184

3. Data preparations

```bash
/root//sysbench/sysbench --mysql-host=xxxx --mysql-port=xxxx --mysql-user=xxx --mysql-password=xx  
x --mysql-db=test --mysql-table-engine=innodb --test=tests/db/oltp.lua --oltp_tables_count=20 --o  
ltp-table-size=10000000 --rand-init=on prepare
```

Descriptions of data preparation parameters:

- `--test=tests/db/oltp.lua` indicates to implement the OLTP test by calling the tests/db/oltp.lua script.
- `--oltp_tables_count=20` indicates that the number of tables for testing is 20.
- `--oltp-table-size=10000000` indicates that each testing table is populated with 10 million rows of data.
- `--rand-init=on` indicates that each testing table is populated with random data.
4. Command for performance stress testing

```
/root//sysbench/sysbench --mysql-host=xxxx --mysql-port=xxx --mysql-user=xxx --mysql-password=xxx
--mysql-db=test --test=/root/sysbench_for_z3/sysbench/tests/db/oltp.lua --oltp_tables_count=xx --
oltp-table-size=xxxx --num-threads=xxx --oltp-read-only=off --rand-type=special --max-time=600 --
max-requests=0 --percentile=99 --oltp-point-selects=4 run
```

Descriptions of performance stress testing parameters:

- `--test=/root/sysbench_for_z3/sysbench/tests/db/oltp.lua` indicates to implement the OLTP test by calling the `/root/sysbench_for_z3/sysbench/tests/db/oltp.lua` script.
- `--oltp_tables_count=20` indicates that the number of tables for testing is 20.
- `--oltp-table-size=10000000` indicates that each testing table is populated with 10 million rows of data.
- `--num-threads=128` indicates that the concurrent connections of clients for testing is 128.
- `--oltp-read-only=off` indicates that the read-only testing model is disabled and the hybrid read/write model is used.
- `--rand-type=special` indicates that the random model is specific.
- `--max-time=1800` indicates the execution time of this test.
- `--max-requests=0` indicates that no limit is imposed on the total number of requests and the test is executed according to max-time.
- `--percentile=99` indicates the sampling rate. Here, 99 means discarding 1% long requests of all the requests and taking the maximum value among the remaining 99% requests. The default value is 95%.
- `--oltp-point-selects=4` indicates that the number of Select operations in the SQL testing command in the OLTP script is 4. The default value is 1.

5. Scenario model

All test cases in this document adopt the scenario script `our_oltp.lua` which is modified to run four `Select` operations and one `Update` operation (index column) with the read/write ratio at 4:1.

For the maximum configuration, the parameter tuning model is added to the data scenario. For the test results, please see Test Results below.

### Testing Parameters

<table>
<thead>
<tr>
<th>Instance</th>
<th>Storage Capacity</th>
<th>Number of Tables</th>
<th>Number of Rows</th>
<th>Data Set Size</th>
<th>Concurrency</th>
<th>Execution Time (in Minutes)</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Instance Specification</th>
<th>Storage Capacity</th>
<th>Number of Tables</th>
<th>Number of Rows</th>
<th>Data Set Size</th>
<th>Concurrence</th>
<th>Execution Time (in Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-core, 1 GB</td>
<td>200 GB</td>
<td>4</td>
<td>20 million</td>
<td>19 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>2-core, 4 GB</td>
<td>200 GB</td>
<td>8</td>
<td>40 million</td>
<td>76 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>4-core, 8 GB</td>
<td>200 GB</td>
<td>15</td>
<td>40 million</td>
<td>142 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>4-core, 16 GB</td>
<td>400 GB</td>
<td>25</td>
<td>40 million</td>
<td>238 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>8-core, 32 GB</td>
<td>700 GB</td>
<td>25</td>
<td>40 million</td>
<td>238 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>16-core, 64GB</td>
<td>1 TB</td>
<td>40</td>
<td>40 million</td>
<td>378 GB</td>
<td>256</td>
<td>30</td>
</tr>
<tr>
<td>16-core, 96 GB</td>
<td>1.5 TB</td>
<td>40</td>
<td>40 million</td>
<td>378 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>16-core, 128 GB</td>
<td>2 TB</td>
<td>40</td>
<td>40 million</td>
<td>378 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>24-core, 244 GB</td>
<td>3 TB</td>
<td>60</td>
<td>40 million</td>
<td>567 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>48-core, 488 GB</td>
<td>6 TB</td>
<td>60</td>
<td>40 million</td>
<td>567 GB</td>
<td>128</td>
<td>30</td>
</tr>
<tr>
<td>48-core, 488 GB (tuned)</td>
<td>6 TB</td>
<td>60</td>
<td>10 million</td>
<td>140 GB</td>
<td>128</td>
<td>30</td>
</tr>
</tbody>
</table>

**Test Results**

<table>
<thead>
<tr>
<th>Instance Specification</th>
<th>Storage Capacity</th>
<th>Data Set</th>
<th>Number of Clients</th>
<th>Single-client Concurrence</th>
<th>QPS</th>
<th>TPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-core, 1 GB</td>
<td>200 GB</td>
<td>19 GB</td>
<td>1</td>
<td>128</td>
<td>1757</td>
<td>97</td>
</tr>
<tr>
<td>Instance Specification</td>
<td>Storage Capacity</td>
<td>Data Set</td>
<td>Number of Clients</td>
<td>Single-client Concurrence</td>
<td>QPS</td>
<td>TPS</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------</td>
<td>----------</td>
<td>-------------------</td>
<td>--------------------------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>2-core, 4 GB</td>
<td>200 GB</td>
<td>76 GB</td>
<td>1</td>
<td>128</td>
<td>4,082</td>
<td>816</td>
</tr>
<tr>
<td>4-core, 8 GB</td>
<td>200 GB</td>
<td>142 GB</td>
<td>1</td>
<td>128</td>
<td>6,551</td>
<td>1,310</td>
</tr>
<tr>
<td>4-core, 16 GB</td>
<td>400 GB</td>
<td>238 GB</td>
<td>1</td>
<td>128</td>
<td>11,098</td>
<td>2,219</td>
</tr>
<tr>
<td>8-core, 32 GB</td>
<td>700 GB</td>
<td>238 GB</td>
<td>2</td>
<td>128</td>
<td>20,484</td>
<td>3,768</td>
</tr>
<tr>
<td>16-core, 64 GB</td>
<td>1 TB</td>
<td>378 GB</td>
<td>2</td>
<td>128</td>
<td>36,395</td>
<td>7,279</td>
</tr>
<tr>
<td>16-core, 96 GB</td>
<td>1.5 TB</td>
<td>378 GB</td>
<td>3</td>
<td>128</td>
<td>56,464</td>
<td>11,292</td>
</tr>
<tr>
<td>16-core, 128 GB</td>
<td>2 TB</td>
<td>378 GB</td>
<td>3</td>
<td>128</td>
<td>81,752</td>
<td>16,350</td>
</tr>
<tr>
<td>24-core, 244 GB</td>
<td>3 TB</td>
<td>567 GB</td>
<td>4</td>
<td>128</td>
<td>98,528</td>
<td>19,705</td>
</tr>
<tr>
<td>48-core, 488 GB</td>
<td>6 TB</td>
<td>567 GB</td>
<td>6</td>
<td>128</td>
<td>142,246</td>
<td>28,449</td>
</tr>
<tr>
<td>48-core, 488 GB (tuned)</td>
<td>6 TB</td>
<td>140 GB</td>
<td>6</td>
<td>128</td>
<td>245,509</td>
<td>46,304</td>
</tr>
</tbody>
</table>
Security White Paper

Overview

Last updated: 2020-04-21 09:23:43

TencentDB for MySQL enables you to easily deploy and use scalable instances of MySQL database, the most popular open-source relational database in the world, in the cloud in a matter of minutes. It features high cost performance and elastic hardware scalability without downtime. As a complete database solution with various features such as backup, rollback, monitoring, fast scaling, and data transfer, it simplifies your IT OPS and allows you to focus more on business development.

TencentDB for MySQL provides diversified security reinforcement features to ensure the reliability and security of your data. In order to make your TencentDB for MySQL instances more secure, you are recommended to use the following security features based on your business needs:

- **Network:** security group, VPC, etc.
- **Storage:** data encryption, automatic backup, etc.
- **Disaster recovery:** intra-region disaster recovery, cross-region disaster recovery.

Relevant security features:
- Attack protection, access control, network isolation, data storage encryption, backup and restoration, instance disaster recovery, data termination, version upgrade.
DDoS Attack Prevention

When you use the public network to connect to and access a TencentDB for MySQL instance, you may suffer from DDoS attacks. To address this problem, Tencent Cloud provides traffic cleansing and blocking features that are automatically triggered and stopped by the system. When the Anti-DDoS system detects that your instance is under attacks, it will automatically enable traffic cleansing or block the traffic if the attacks cannot be resisted by cleansing or reach the blocking threshold.

You are recommended to access your TencentDB for MySQL instances over the private network to avoid DDoS attacks.

Traffic cleansing

When the public network traffic of a TencentDB for MySQL instance exceeds the threshold, Anti-DDoS will automatically cleanse the inbound traffic to the instance. Policy-based routing will be used to redirect the traffic from the original network route to the DDoS cleansing devices of Anti-DDoS, which will identify the public network traffic, discard attack traffic, and forward normal traffic to the instance.

Blocking

When the attack traffic suffered by a TencentDB for MySQL instance exceeds the blocking threshold, Tencent Cloud will block all public network access requests to this instance through applicable ISP services to prevent other Tencent Cloud users from being affected. This means that when the bandwidth of the attack traffic suffered by your instance exceeds the maximum protection bandwidth, Tencent Cloud will block all public network access requests to it.

- When the following conditions are met, blocking will be triggered:
  - The bits per second (bps) value reaches 2 Gbps.
  - Traffic cleansing is not effective.
- When the following condition is met, blocking will be stopped:
  - 2 hours elapses after blocking starts.
Access control

Last updated: 2020-04-21 09:23:44

TencentDB for MySQL implements access control through database account management, access management, security group, and other means to ensure MySQL data security.

**Database Account Management**

You can create database accounts in the TencentDB for MySQL Console or through APIs. You can also grant management permissions at different levels to such accounts. You are recommended to authorize accounts based on the principle of least privilege so as to ensure the data security.

**Cloud Access Management**

Cloud Access Management (CAM) helps you securely manage and control access permissions to your Tencent Cloud resources. With CAM, you can create, manage, and terminate users (groups), and control the Tencent Cloud resources that can be used by the specified user through identity and policy management, which implements permission separation.

**Security Group**

Security group mainly helps you implement network access control for your TencentDB for MySQL instances. A security group is a stateful virtual firewall capable of filtering. As an important means for network security isolation provided by Tencent Cloud, it can be used to set network access controls for one or more TencentDB instances.

Instances with the same network security isolation requirements in the same region can be put into the same logical security group. Instances in a security group are matched based on rules. Modifying security group rules does not require restarting the TencentDB for MySQL instances, and the changes will take effect immediately.
Network isolation

Last updated: 2020-04-21 09:23:45

TencentDB for MySQL supports the use of VPC to achieve a higher degree of network isolation and control. Using security group and VPC together can greatly improve the security of access to TencentDB for MySQL instances.

A VPC is a logically isolated network space established for users in Tencent Cloud. In a VPC, you can freely define IP range segmentation, IP addresses, and routing policies to achieve resource-level network isolation.

TencentDB for MySQL instances deployed in a VPC can only be accessed by CVM instances in the same VPC by default. If the CVM and MySQL instances are in different VPCs, they can communicate after you apply for public network access. For the sake of network security, you are not recommended to access your databases over the public network. If you have to do so, please configure appropriate security groups to implement access control for clients.
TencentDB for MySQL supports the transparent data encryption (TDE) feature developed by the Tencent Cloud database team. Transparent encryption means that the data encryption and decryption are imperceptible to you. When creating an encrypted table, you do not need to specify an encryption key, and the data will be encrypted during write to the disk and decrypted during read from the disk.

TDE uses the internationally popular AES algorithm and 256-bit encryption keys, which are managed in Tencent Cloud KMS. You need to be authorized to access KMS and can rotate keys in the KMS Console to further improve the system security.

To try TDE out, please submit a ticket for application.
Backup and Restore

Backup

TencentDB for MySQL supports both automatic and manual backup to ensure data restorability that guarantees data integrity and reliability. It provides data backup and log backup features by default, where the frequency of automatic backup should be set to higher than twice a week. If you have other backup needs, you can initiate manual backup through the console or APIs at any time.

In addition, you can flexibly configure the retention period of backup files as needed, which is 7 days by default and can be up to 732 days. Backup files that exceed the retention period will be automatically deleted.

For more information on how to use this feature, please see Backup Mode.

Restoration

TencentDB for MySQL is capable of data restoration. You can use the rollback feature to restore data to any time point within the retention period as needed. As the time points available for data restoration are subject to the retention period, you should configure a reasonable backup retention policy based on your business needs to ensure data restorability.

For more information on how to use this feature, please see Database Rollback.
Example Disaster recovery

For applications with high requirements for service continuity, data reliability, and compliance, TencentDB for MySQL provides a cross-AZ and cross-region disaster recovery solution to help enhance your capability to deliver continued services at low costs and improve data reliability.

**Intra-Region Disaster Recovery**

TencentDB for MySQL High-Availability Edition allows you to create multi-AZ instances. Physical servers of a multi-AZ instance are deployed in different AZs in the same region. When an AZ fails, the business traffic will be switched to another AZ swiftly, which is imperceptible to the business and requires no changes at the application layer, helping implement intra-region disaster recovery.

As a multi-AZ instance is deployed across multiple AZs, there may be an additional network sync delay of 2–3 ms.

For more information on intra-region disaster recovery, please see [High Availability (Multi-AZ Deployment)](#).

**Cross-Region Disaster Recovery**

The intra-region disaster recovery capability of TencentDB for MySQL is limited to different AZs in the same region. To further improve the availability, TencentDB for MySQL also supports cross-region data disaster recovery.

You can asynchronously replicate data in a TencentDB for MySQL instance in region A to another instance (disaster recovery instance) in region B through DTS. The disaster recovery instance has an independent connection address, account, and permissions. If a major failure occurs in region A and cannot be fixed in a short time, you can perform failover whenever needed. Specifically, you can quickly forward application requests to the disaster recovery instance simply by modifying the database connection configuration in the application, thereby delivering a finance-grade database availability.

For more information on cross-region disaster recovery, please see [Managing Disaster Recovery Instance](#).
Data Terminate

Last updated: 2020-04-21 09:23:48

When you terminate your TencentDB for MySQL instance, all data (including backup data) stored in it will be destroyed. Tencent Cloud will not retain the data or actively recover your instance.

For more information, please see Terminating Instances.
TencentDB for MySQL will provide you with the latest version of database services. When a severe bug or security vulnerability occurs in the system, your TencentDB for MySQL instances will be upgraded during your maintenance time window, and upgrade notifications will be pushed to you in advance. The version upgrade process may cause a momentary disconnection; therefore, please make sure that your business has a reconnection mechanism.