Distributed Cache Service

Performance Whitepaper

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Contents

1 Introduction

1.1 Overview of redis-cli and redis-benchmark

Obtaining redis-cli and redis-benchmark

Create an ECS and install the Redis server matching the OS. The following examples use Ubuntu and CentOS.

NOTE

You can compile and install Redis, or use **yum** and **apt** to install the Redis server. When the Redis server is installed, redis-benchmark is also installed.

- Ubuntu
```
sudo apt update
sudo apt install redis-server
```
- CentOS
```
sudo yum install epel-release
sudo yum update
sudo yum -y install redis
```

You can also download the installation package, decompress it, and then compile it. The following uses redis-6.0.9 as an example:

1. Download the redis-6.0.9 client.

   wget http://download.redis.io/releases/redis-6.0.9.tar.gz
2. Decompress the client installation package.

   tar xzf redis-6.0.9.tar.gz
3. Go to the **src** directory of redis-6.0.9.

   cd redis-6.0.9/src
4. Compile the source code.

   make

   After the compilation is complete, the tool is stored in the **src** directory of **redis-***x.x.x*.

Common redis-cli Options

- **-h** *<hostname>*: host name of the server, which can be an IP address or a domain name.
- **-p** *<port>*: port of the server. The default port is 6379.
- **-a** *<password>*: password for connecting to the server. This parameter is not required for password-free instances.
- **-r** *<repeat>*: number of times that a command is run.
- **-n** *<db>*: DB number. The default value is **0**.
- **-c**: cluster mode (with **-ASK** and **-MOVED** redirections).
- **--latency**: a loop where latency is measured continuously.
- **--scan**: scans the key space without blocking the Redis server. (By contrast, scanning using **KEYS *** blocks Redis server).
- **--eval** *<file>*: sends the **EVAL** command using a Lua script.
- **-x**: reads the last parameter in stdin.
- **--bigscan**: scans big keys in the data set.
- **--raw**: forces raw data output from the hexadecimal format, such as **\xe4\xb8**.

For more information about redis-cli, visit **https://redis.io/docs/manual/cli/**.

Examples of Common redis-cli Commands

- Connect to an instance:

  ./redis-cli -h *{IP}* **-p 6379**
- Connect to a specified DB:

  ./redis-cli -h *{IP}* **-p 6379 -n 10**
- Connect to a Redis Cluster instance:

  ./redis-cli -h *{IP}* **-p 6379 -c**
- Test the latency (by sending the **ping** command):

  ./redis-cli -h *{IP}* **-p 6379 --latency**
- Scan for keys that match the specified pattern:

  ./redis-cli -h *{IP}* **-p 6379 --scan --pattern '*:12345*'**

Common Options in redis-benchmark (redis-6.0.9)

- **-h** *<hostname>*: host name of the server, which can be an IP address or a domain name.
- **-p** *<port>*: port of the server. The default port is 6379.
- **-a** *<password>*: password for connecting to the server. This parameter is not required for password-free instances.
- **-c** *<clients>*: number of concurrent connections. The default value is **50**.
- **-n** *<requests>*: total number of requests. The default value is **100000**.
- **-d** *<size>*: data size of the **SET**/**GET** value, in bytes. The default value is **2**.
- **--dbnum** *<db >*: database number. The default value is **0**.

- **--threads <num>**: multi-thread mode, which is supported only by redis-benchmark compiled in Redis 6.0. In pressure tests, the multi-thread mode outperforms the single-thread mode.
- **--cluster**: cluster mode (required only by Redis Cluster).
- **-k** *<boolean>*: **1**=keep alive; **0**=reconnect. The default value is **1**, indicating that both pconnect and connect can be tested.
- **-r** *<keyspacelen>*: uses random keys for **SET**, **GET**, and **INCR**, and random values for **SADD**. *keyspacelen* indicates the number of keys to be added.
- **-e**: displays server errors to stdout.
- **-q**: displays only the number of queries per second.
- **-l**: runs tests in loops.
- **-t** *<tests>*: tests specified commands.
- **-I**: idle mode. Open *N* idle connections and wait.
- **-P** *<numreq>*: concurrent pipeline requests. The default value is **1**.

For more information about redis-benchmark, visit **https://redis.io/docs/reference/optimization/benchmarks/**.

Examples of Common redis-benchmark Commands

- Test single-node, master/standby, read/write splitting, and Proxy Cluster instances:

  ./redis-benchmark -h *{IP address or domain name}* **-p 6379 -a** *{pwd}* **--threads** *{num}* **-n** *{ nreqs }* **-r** *{ randomkeys }* **-c** *{clients}* **-d** *{datasize}* **-t** *{command}*
- Test Redis Cluster instances:

  ./redis-benchmark -h *{IP address or domain name}* **-p 6379 -a** *{pwd}* **--threads** *{num}* **-n** *{ nreqs }* **-r** *{ randomkeys }* **-c** *{clients}* **-d** *{datasize}* **--cluster -t** *{command}*
- Test connect:

  ./redis-benchmark -h *{IP address or domain name}* **-p 6379 -a** *{pwd}* **--threads** *{num}* **-n** *{ nreqs }* **-r** *{ randomkeys }* **-c** *{clients}* **-d** *{datasize}* **-k 0 -t** *{command}*
- Test idle connections:

  ./redis-benchmark -h *{IP address or domain name}* **-p 6379 -a** *{pwd}* **-c** *{clients}* **-I**

1.2 Using redis-benchmark

This section describes how to use redis-benchmark to test the performance of Distributed Cache Service (DCS) Redis instances. For example, you can test how fast a specific instance responds to high-concurrency **SET** or **GET** operations.

Test Tool

The Redis client includes redis-benchmark, a performance testing utility that simulates N clients concurrently sending M number of query requests.

For details about how to use the redis-benchmark tool, see **Overview of redis-cli and redis-benchmark**.

Downloading and Installing the Tool

1. Download the redis-6.0.9 client.

   wget http://download.redis.io/releases/redis-6.0.9.tar.gz

2. Decompress the client installation package.

   tar xzf redis-6.0.9.tar.gz

3. Go to the **src** directory of redis-6.0.9.

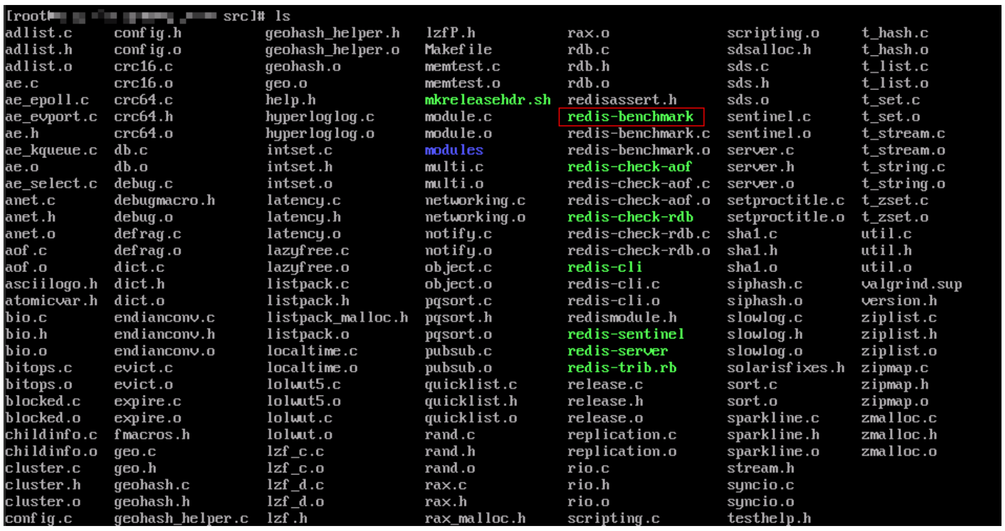
   cd redis-6.0.9/src

4. Compile the source code.

   make

5. Check whether the redis-benchmark executable file exists.

   ls



```
[root[redacted] src]# ls
adlist.c      config.h            geohash_helper.h    lzfP.h            rax.o               scripting.o       t_hash.c
adlist.h      config.o            geohash_helper.o    Makefile          rdb.c               sdsalloc.h        t_hash.o
adlist.o      crc16.c             geohash.o           memtest.c         rdb.h               sds.c             t_list.c
ae.c          crc16.o             geo.o               memtest.o         rdb.o               sds.h             t_list.o
ae_epoll.c    crc64.c             help.h              mkreleasehdr.sh   redisassert.h       sds.o             t_set.c
ae_evport.c   crc64.h             hyperloglog.c       module.c          redis-benchmark     sentinel.c        t_set.o
ae.h          crc64.o             hyperloglog.o       module.o          redis-benchmark.c   sentinel.o        t_stream.c
ae_kqueue.c   db.c                intset.c            modules           redis-benchmark.o   server.c          t_stream.o
ae.o          db.o                intset.h            multi.c           redis-check-aof     server.h          t_string.c
ae_select.c   debug.c             intset.o            multi.o           redis-check-aof.c   server.o          t_string.o
anet.c        debugmacro.h        latency.c           networking.c      redis-check-aof.o   setproctitle.c    t_zset.c
anet.h        debug.o             latency.h           networking.o      redis-check-rdb     setproctitle.o    t_zset.o
anet.o        defrag.c            latency.o           notify.c          redis-check-rdb.c   sha1.c            util.c
aof.c         defrag.o            lazyfree.c          notify.o          redis-check-rdb.o   sha1.h            util.h
aof.o         dict.c              lazyfree.o          object.c          redis-cli           sha1.o            util.o
asciilogo.h   dict.h              listpack.c          object.o          redis-cli.c         siphash.c         valgrind.sup
atomicvar.h   dict.o              listpack.h          pqsort.c          redis-cli.o         siphash.o         version.h
bio.c         endianconv.c        listpack_malloc.h   pqsort.h          redismodule.h       slowlog.c         ziplist.c
bio.h         endianconv.h        listpack.o          pqsort.o          redis-sentinel      slowlog.h         ziplist.h
bio.o         endianconv.o        localtime.c         pubsub.c          redis-server        slowlog.o         ziplist.o
bitops.c      evict.c             localtime.o         pubsub.o          redis-trib.rb       solarisfixes.h    zipmap.c
bitops.o      evict.o             lolwut5.c           quicklist.c       release.c           sort.c            zipmap.h
blocked.c     expire.c            lolwut5.o           quicklist.h       release.h           sort.o            zipmap.o
blocked.o     expire.o            lolwut.c            quicklist.o       release.o           sparkline.c       zmalloc.c
childinfo.c   fmacros.h           lolwut.o            rand.c            replication.c       sparkline.h       zmalloc.h
childinfo.o   geo.c               lzf_c.c             rand.h            replication.o       sparkline.o       zmalloc.o
cluster.c     geo.h               lzf_c.o             rand.o            rio.c               stream.h
cluster.h     geohash.c           lzf_d.c             rax.c             rio.h               syncio.c
cluster.o     geohash.h           lzf_d.o             rax.h             rio.o               syncio.o
config.c      geohash_helper.c    lzf.h               rax_malloc.h      scripting.c         testhelp.h
```

6. Install the tool in the system.

   make install

Test Procedure

Step 1 Create a DCS Redis instance.

Step 2 Create three ECSs and configure the same AZ, VPC, subnet, and security group for the ECSs and the instance.

NOTE

Only one ECS is required for testing on a single-node or master/standby instance.

Step 3 Install **redis-benchmark** on each ECS by referring to **Downloading and Installing the Tool**.

Step 4 Run the following test command on all ECSs:

```
redis-benchmark -h {IP} -p {Port} -a {password} -n {nreqs} -r {randomkeys} -c {connect_number} -d
{datasize} -t {command}
```

Reference values: **-c {connect_number}**: **200**; **-n {nreqs}**: **10,000,000**; **-r {randomkeys}**: **1,000,000**; **-d {datasize}**: **32**

- **-t** indicates the set of commands to be executed. For example, to test only the **set** command, use **-t set**. To test the **ping**, **get**, and **set** commands, use **-t ping,set,get**. Use commas (,) to separate commands.
- **-c** indicates the number of client connections.
- **-d** indicates the size of a single data record in bytes.
- **-n** indicates the number of test packets.
- **-r** indicates the number of random keys.

Step 5 Repeat **Step 4** with different client connections to obtain the maximum number of operations per second.

Step 6 The sum of operations per second of all the three ECSs indicates the performance of the instance specification.

To test on a Redis Cluster instance, launch two benchmark tools on each ECS.

NOTE

- Add the **--cluster** parameter only when testing Redis Cluster instances using redis-benchmark.
- In a test for the maximum number of connections of a Redis Cluster instance, if the performance of the ECSs is insufficient, the program will exit or the error message "Cannot assign requested address" will be displayed when the number of connections reaches 10,000. In this case, check how many ECSs are used in the test. Prepare three ECSs and start three redis-benchmark processes on each ECS.

----End

1.3 Using memtier_benchmark

This section describes how to use memtier_benchmark to test the performance of DCS Redis instances. For example, you can test how fast a specific instance responds to high-concurrency **SET** or **GET** operations.

Test Tool

memtier_benchmark is a command-line tool developed by Redis Labs. It can generate traffic in various modes and supports both Redis and Memcached.

This tool provides multiple options and reporting features that can be easily used through the CLI.

For details, visit **https://github.com/RedisLabs/memtier_benchmark**.

Downloading and Installing the Tool

CentOS 8.0 is used as an example.

1. Preparations
   a. Install the tools required for compilation.

      yum install -y autoconf

yum install -y automake

yum install -y make

yum install -y gcc-c++

yum install -y git

   b. Enable the PowerTools repository.

      dnf config-manager --set-enabled PowerTools

   c. Install the required dependencies.

      yum install -y pcre-devel

      yum install -y zlib-devel

      yum install -y libmemcached-devel

      yum install -y openssl-devel

2. Install the libevent library.

   yum install -y libevent-devel

3. Download, compile, and install the memtier_benchmark library.

   a. Create a folder in the root directory where the memtier_benchmark library will be stored.

      mkdir /env

   b. Download the memtier_benchmark source code.

      cd /env

      git clone https://github.com/RedisLabs/memtier_benchmark.git

   c. Go to the directory where the source code is located.

      cd memtier_benchmark

   d. Compile the source code and generate the executable file **memtier_benchmark**.

      autoreconf -ivf

      ./configure

      make

   e. Install the tool in the system.

      make install

4. Run the following command to check whether the installation is successful:

   memtier_benchmark --help

Test Procedure

Step 1 Create a DCS Redis instance.

Step 2 Create three ECSs and configure the same AZ, VPC, subnet, and security group for the ECSs and the instance.

NOTE

Only one ECS is required for testing on a single-node or master/standby instance.

Step 3 Install **memtier_benchmark** on each ECS by referring to **Downloading and Installing the Tool**.

Step 4 Run the following test command on all ECSs:

```
memtier_benchmark -s {IP} -n {nreqs}  -c {connect_number}  -t 4 -d {datasize}
```

NOTE

Run **memtier_benchmark --cluster-mode -s {IP} -n {nreqs} -c {connect_number} -t 4 -d {datasize}** for a Redis Cluster instance.

Reference values: **-c {connect_number}**: **200**; **-n {nreqs}**: **10,000,000**; **-r {randomkeys}**: **1,000,000**; **-d {datasize}**: **32**

- **-t** indicates the number of threads used in the benchmark test.
- **-c** indicates the number of client connections.
- **-d** indicates the size of a single data record in bytes.
- **-n** indicates the number of test packets.
- **-r** indicates the number of random keys.

Step 5 Repeat **Step 4** with different client connections to obtain the maximum number of operations per second.

Step 6 The sum of operations per second of all the three ECSs indicates the performance of the instance specification.

To test on a Redis Cluster instance, launch two benchmark tools on each ECS.

----End

Test Metric

Queries per second (QPS), which is the number of commands processed per second.

1.4 Comparing redis-benchmark and memtier_benchmark

Tool	Memcached	Customizing Commands	Setting Read/ Write Ratio	Random Payload	Setting Timeout
memtier_benchmark	Supported	Not supported	Supported	Supported	Supported
redis-benchmark	Not supported	Supported	Not supported	Not supported	Not supported

2 Test Data of Master/Standby DCS Redis 4.0 or 5.0 Instances

Test Environment

- Redis instance specifications
  Redis 4.0 or 5.0 | 8 GB | master/standby
  Redis 4.0 or 5.0 | 32 GB | master/standby
- ECS flavors
  General computing-enhanced | c6.2xlarge.2 | 8 vCPUs | 16 GB
- ECS image
  Ubuntu 18.04 server 64-bit
- Test tool
  A single ECS is used for the test. The test tool is redis-benchmark.

Test Command

```
redis-benchmark -h {IP} -p {Port} -a {password} -n {nreqs} -r {randomkeys} -c {connection} -d {datasize} -t
{command}
```

Reference values: **-c {connect_number}: 500**; **-n {nreqs}**: **10,000,000**; **-r {randomkeys}**: **1,000,000**; **-d {datasize}**: **32**; **-t {command}**: **set**

Test Result

NOTE

The following test results are for reference only. The performance may vary depending on the site environment and network fluctuation.

Table 2-1 Test result of running the SET command

Redis Cache Size	CPU Type	Concurrent Connections	QPS	99.99th-Percentile Latency (ms)	First 100th-Percentile Latency (ms)	Last 100th-Percentile Latency (ms)	Average Latency (ms)
8 GB	x86	500	132,068.98	11	18	205	3.298
		10,000	82,386.58	171	178	263	69.275
32 GB	x86	500	131,385.33	9.5	16	17	3.333
		10,000	82,275.41	157	162.18	162.43	62.105

Table 2-2 Test result of running the GET command

Redis Cache Size	CPU Type	Concurrent Connections	QPS	99.99th-Percentile Latency (ms)	First 100th-Percentile Latency (ms)	Last 100th-Percentile Latency (ms)	Average Latency (ms)
8 GB	x86	500	138,652.02	7	11	12	2.117
		10,000	82,710.94	123.7	281.6	282.9	61.078
32 GB	x86	500	139,113.02	6.6	10	11	2.119
		10,000	82,489.36	100	105.66	106	60.968

3 Test Data of Proxy Cluster DCS Redis 4.0 or 5.0 Instances

Test Environment

- Redis instance specifications

  Redis 4.0 or 5.0 | 64 GB | 8 shards | Proxy Cluster
- ECS flavors

  General computing-enhanced | c6.xlarge.2 | 4 vCPUs | 8 GB
- Test tool

  Three ECSs are used for concurrent tests. The test tool is memtier_benchmark.

Test Command

```
memtier_benchmark --ratio= (1:0 and 0:1)-s {IP} -n {nreqs}  -c {connect_number}  -t 4 -d {datasize}
```

Reference values: **-c {connect_number}**: **1000**; **-n {nreqs}**: **10,000,000**; **-d {datasize}**: **32**

Test Result

NOTE

The following test results are for reference only. The performance may vary depending on the site environment and network fluctuation.

Table 3-1 Test result of running the SET command

Redis Cache Size	CPU Type	Concurrent Connections	QPS	95th-Percentile Latency (ms)	99.99th-Percentile Latency (ms)	Maximum Latency (ms)
64 GB	x86	3000	1,323,935.00	3.3	9.4	220
		5000	1,373,756.00	5.3	13	240

Redis Cache Size	CPU Type	Concurrent Connections	QPS	95th-Percentile Latency (ms)	99.99th-Percentile Latency (ms)	Maximum Latency (ms)
		10,000	1,332,074.00	11	26	230
		80,000	946,032.00	110	460	6800

Table 3-2 Test result of running the GET command

Redis Cache Size	CPU Type	Concurrent Connections	QPS	95th-Percentile Latency (ms)	99.99th-Percentile Latency (ms)	Maximum Latency (ms)
64 GB	x86	3000	1,366,153.00	3.3	9.3	230
		5000	1,458,451.00	5.1	13	220
		10,000	1,376,399.00	11	29	440
		80,000	953,837.00	120	1300	2200

4 Test Data of Redis Cluster DCS Redis 4.0 or 5.0 Instances

Test Environment

- Redis instance specifications
  Redis 4.0 or 5.0 | 32 GB | Redis Cluster
- ECS flavors
  General computing-enhanced | c6.xlarge.2 | 4 vCPUs | 8 GB
- Test tool
  Three ECSs are used for concurrent tests. The test tool is memtier_benchmark.

Test Command

```
memtier_benchmark --cluster-mode --ratio=(1:0 and 0:1)-s {IP} -n {nreqs}  -c {connect_number}  -t 4 -d
{datasize}
```

Reference values: **-c {connect_number}**: **1000**; **-n {nreqs}**: **10,000,000**; **-d {datasize}**: **32**

Test Result

NOTE

The following test results are for reference only. The performance may vary depending on the site environment and network fluctuation.

Table 4-1 Test result of running the SET command

Redis Cache Size	CPU Type	Concurrent Connections	QPS	99.99th-Percentile Latency (ms)	First 100th-Percentile Latency (ms)	Last 100th-Percentile Latency (ms)
32 GB	x86	1000	371,780.2	5.6	6.3	44
		10,000	256,073.11	90	220	460

Redis Cache Size	CPU Type	Concurrent Connections	QPS	99.99th-Percentile Latency (ms)	First 100th-Percentile Latency (ms)	Last 100th-Percentile Latency (ms)
32 GB	Arm	1000	317,053.78	17	34	230
		10,000	248,832.33	410	490	750

Table 4-2 Test result of running the GET command

Redis Cache Size	CPU Type	Concurrent Connections	QPS	99.99th-Percentile Latency (ms)	First 100th-Percentile Latency (ms)	Last 100th-Percentile Latency (ms)
32 GB	x86	1000	427,000.04	5.0	5.3	78
		10,000	302,159.03	63	220	460
32 GB	Arm	1000	421,402.06	13	14	65
		10,000	309,359.18	180	260	500

5 Test Data of Master/Standby DCS Redis 6.0 Instances

DCS Redis 6.0 basic edition instances support SSL. This section covers the performance tested with and without SSL enabled.

Test Environment

- Redis instance specifications

  Redis 6.0 | Basic edition | 8 GB | Master/Standby

  Redis 6.0 | Basic edition | 32 GB | Master/Standby
- ECS flavors

  General compute-plus | 8 vCPUs | 16 GiB | c7.2xlarge.2
- ECS image

  Ubuntu 18.04 server 64-bit
- Test tool

  A single ECS is used for the test. The test tool is memtier_benchmark.

Test Command

SSL disabled:

```
./memtier_benchmark -s {IP} -p {port} -c {connect_number} -t {thread}  -n allkeys --key-prefix="xxxx" --key-minimum=1 --key-maximum={max_key} --key-pattern=P:P --ratio=1:0 -d {datasize}
```

Reference values: **-c {connect_number}**: **1000**, **--key-maximum{max_key}**: **2000000**, **-d {datasize}**: **32**

SSL enabled:

```
./memtier_benchmark -s {IP} -p {port} -c {connect_number} -t {thread}  -n allkeys --key-prefix="xxxx" --key-minimum=1 --key-maximum={max_key} --key-pattern=P:P --ratio=1:0 -d {datasize}  --tls --cacert ca.crt
```

Reference values: **-c {connect_number}**: **1000**, **--key-maximum{max_key}**: **2000000**, **-d {datasize}**: **32**

Test Result

NOTE

The following test results are for reference only. The performance may vary depending on the site environment and network fluctuation.

Table 5-1 Test result of the SET command (SSL disabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
8 GB	x86	500	151,047.41	3.355	6.175	12.223
		1000	149,346.86	6.673	11.711	31.743
32 GB	x86	500	143,648.1	3.476	5.215	13.055
		4000	104,517.03	37.881	139.263	175.103

Table 5-2 Test result of the SET command (SSL enabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
8 GB	x86	500	86,827.84	5.537	8.575	9.535
		1000	92,413.99	10.055	15.615	17.279
32 GB	x86	500	87,385.5	5.584	8.383	9.343
		4000	50,813.67	62.623	100.863	104.959

Table 5-3 Test result of the GET command (SSL disabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
8 GB	x86	500	180,413.66	2.764	4.287	11.583
		1000	179,113.5	5.586	8.959	29.823
32 GB	x86	500	175,268.86	2.848	4.079	11.839
		4000	134,755.17	29.161	126.463	166.911

Table 5-4 Test result of the GET command (SSL enabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
8 GB	x86	500	113,637.22	4.316	6.239	7.359
		1000	105,504.55	8.962	13.439	15.295
32 GB	x86	500	100,309.99	4.603	6.559	6.943
		4000	57,007.69	55.052	85.503	89.087

6 Test Data of Redis Cluster DCS Redis 6.0 Instances

DCS Redis 6.0 basic edition instances support SSL. This section covers the performance tested with and without SSL enabled.

Test Environment

- Redis instance specifications
  Redis 6.0 | Basic edition | 32 GB | Redis Cluster
- ECS flavors
  General compute-plus | 8 vCPUs | 16 GiB | c7.2xlarge.2
- ECS image
  Ubuntu 18.04 server 64-bit
- Test tool
  Three ECSs are used for concurrent tests. The test tool is memtier_benchmark.

Test Command

SSL disabled:

```
./memtier_benchmark -s {IP} -p {port} -c {connect_number} -t {thread}  -n allkeys --key-prefix="xxxx" --key-minimum=1 --key-maximum={max_key} --key-pattern=P:P --ratio=1:0 -d {datasize} --cluster-mode
```

Reference values: **-c {connect_number}**: **1000**, **--key-maximum{max_key}**: **2000000**, **-d {datasize}**: **32**.

SSL enabled:

```
./memtier_benchmark -s {IP} -p {port} -c {connect_number} -t {thread}  -n allkeys --key-prefix="xxxx" --key-minimum=1 --key-maximum={max_key} --key-pattern=P:P --ratio=1:0 -d {datasize} --cluster-mode  --tls --cacert ca.crt
```

Reference values: **-c {connect_number}**: **1000**, **--key-maximum{max_key}**: **2000000**, **-d {datasize}**: **32**.

Test Result

NOTE

The following test results are for reference only. The performance may vary depending on the site environment and network fluctuation.

Table 6-1 Test result of the SET command (SSL disabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
32 GB	x86	1000	322,899.21	2.661	4.319	8.511
		3000	360,336.14	7.757	13.055	29.439
		10,000	330,378.22	29.411	97.279	153,599

Table 6-2 Test result of the SET command (SSL enabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
32 GB	x86	1000	238,307.26	3.603	5.151	6.527
		3000	185,455.62	13.196	20.607	352.255
		10,000	111,913.19	57.537	96.767	121.343

Table 6-3 Test result of the GET command (SSL disabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
32 GB	x86	1000	450,422.66	1.875	2.767	6.879
		3000	432,450.2	6.451	12.095	28.415

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
		10,000	507,338.44	23.001	95.231	176.127

Table 6-4 Test result of the GET command (SSL enabled)

Redis Cache Size	CPU Type	Concurrent Connections	QPS	Average Latency (ms)	99th-Percentile Latency (ms)	99.9th-Percentile Latency (ms)
32 GB	x86	1000	274,066.16	3.076	4.255	7.071
		3000	201,063.51	11.743	18.047	387.071
		10,000	116,026.38	51.284	84.479	136.191

7 Test Data of Redis Backup, Restoration, and Migration

Test Environment

- Redis instance specifications
  Redis 5.0 | 8 GB | master/standby
  Redis 5.0 | 32 GB | master/standby
  Redis 5.0 | 64 GB | Proxy Cluster (2 replicas | 8 shards | 8 GB per shard)
  Redis 5.0 | 256 GB | Proxy Cluster (2 replicas | 32 shards | 8 GB per shard)
  Redis 5.0 | 64 GB | Redis Cluster (2 replicas | 8 shards | 8 GB per shard)
  Redis 5.0 | 256 GB | Redis Cluster (2 replicas | 32 shards | 8 GB per shard)
- ECS flavors
  c6s.large.2 2 vCPUs | 4 GB

Test Command

Run the following command on a 256 GB Proxy Cluster instance:

```
redis-benchmark - h {IP} -p{Port} -n 10000000 -r 10000000 -c 10000 -d 1024
```

Run the following command on a 256 GB Redis Cluster instance:

```
redis-benchmark - h {IP} -p{Port} -n 10000000 -r 10000000 -c 40000 -d 1024 -c
```

Test Result

Table 7-1 Migration

Source Instance Type	Source Instance Specifications (GB)	Target Instance Type	Target Instance Specifications (GB)	Migration Type	Data Volume (GB)	Duration (min)
Redis 5.0 | master/standby	8	Redis 5.0 | master/standby	8	Full + incremental	7.78	3
Redis 5.0 | master/standby	32	Redis 5.0 | master/standby	32	Full + incremental	31.9	17
Redis 5.0 | Proxy Cluster	64	Redis 5.0 | Proxy Cluster	64	Full + incremental	62.42	7
Redis 5.0 | Redis Cluster	64	Redis 5.0 | Redis Cluster	64	Full + incremental	57.69	6
Redis 5.0 | Proxy Cluster	256	Redis 5.0 | Proxy Cluster	256	Full + incremental	241.48	23
Redis 5.0 | Redis Cluster	256	Redis 5.0 | Redis Cluster	256	Full + incremental	240.21	22

Table 7-2 Backup

Instance Type	Instance Specifications (GB)	Backup Mode	Data Volume (GB)	Duration (min)
Redis 5.0 | master/standby	8	RDB	7.78	2
Redis 5.0 | master/standby	32	RDB	31.9	5
Redis 5.0 | Proxy Cluster	64	RDB	62.42	9
Redis 5.0 | Proxy Cluster	256	RDB	241.48	37

Instance Type	Instance Specifications (GB)	Backup Mode	Data Volume (GB)	Duration (min)
Redis 5.0 | Redis Cluster	64	RDB	57.69	9
Redis 5.0 | Redis Cluster	256	RDB	255	39
Redis 5.0 | master/ standby	8	AOF	7.9	2
Redis 5.0 | master/ standby	32	AOF	31.15	10
Redis 5.0 | Proxy Cluster	64	AOF	62.42	20
Redis 5.0 | Proxy Cluster	256	AOF	241.48	48
Redis 5.0 | Redis Cluster	64	AOF	57.69	19
Redis 5.0 | Redis Cluster	256	AOF	255	51

Table 7-3 Restoration

Instance Type	Instance Specifications (GB)	Restoration Mode	Data Volume (GB)	Duration (min)
Redis 5.0 | master/ standby	8	RDB	7.9	2
Redis 5.0 | master/ standby	32	RDB	31.15	6
Redis 5.0 | Proxy Cluster	64	RDB	62.42	10
Redis 5.0 | Proxy Cluster	256	RDB	246	42
Redis 5.0 | Redis Cluster	64	RDB	57.69	10

Instance Type	Instance Specifications (GB)	Restoration Mode	Data Volume (GB)	Duration (min)
Redis 5.0 | Redis Cluster	256	RDB	255	40
Redis 5.0 | master/ standby	8	AOF	7.9	3
Redis 5.0 | master/ standby	32	AOF	31.15	10
Redis 5.0 | Proxy Cluster	64	AOF	62.42	10
Redis 5.0 | Proxy Cluster	256	AOF	246	46
Redis 5.0 | Redis Cluster	64	AOF	57.69	10
Redis 5.0 | Redis Cluster	256	AOF	255	43