Most of this document was taken from https://www.mongodb.com/docs/manual/ - prerequisite knowledge is knowing how to set up a project in GCP and the ability to access the GCP console.

Mongodb/ycsb instance info (in GCP):

Basic information

Name: <mark>mongox</mark> - x is instance number (or ycsb)

Instance Id :1334225550581696478

Description None

Type Instance

Status Running

Creation time Mar 25, 2024, 1:49:38 PM UTC-04:00

Zone <mark>us-east1-b</mark>

Instance template None

In use by None

Reservations Automatically choose

Labels goog-ops-a... : v2-x86-tem...

Tags <mark>mongo: admin (or yc:admin)</mark>

Deletion protection Disabled

Confidential VM service Disabled

Preserved state size 0 GB

Machine configuration

Machine type e2-medium

CPU platform Intel Broadwell

Minimum CPU platform None

Architecture x86/64

vCPUs to core ratio —

Custom visible cores —

Display device Disabled

Enable to use screen capturing and recording tools

GPUs None

Basic info

<mark>OS Ubuntu 20.04.6 LTS</mark>
OS version 20.04
OS Config agent version 20230504.00-0ubuntu1~20.04.0

Creating an instance

1. From GCP, select "New VM Instance"
2. Name the instance, and ensure the zone is the same as the details above.
3. Under 'Boot Disk', change the operating system to Ubuntu and the version to 20.04 LTS
4. Once the instance is created, click on the instance and click "edit"
5. Click "manage tags", and add the correct tag for the instance you are creating. If you need to add a tag, click the "add tag" button
6. Confirm changes and save.

Special Consideration - GCP Free Tier

If this experiment is being done on the GCP free tier, only 8 IP addresses can be registered in the same region. This leads to an issue during the 6-node tests (6 shards, 1 mongos, 1 config, and 1 ycsb = 9 nodes). To circumvent this, a new project must be created. Inside this project, create a new subnet (I used 10.100.0.0/20 as the mask) to make new nodes on, in the same region as the first project. Then, configure VPC network peering between the two projects, and allow all traffic between the two subnets in the firewall settings.

Installing MongoDB on machine

1. Connect to instance
2. Run the following command to get the MongoDB public GPG key

```
curl -fsSL https://www.mongodb.org/static/pgp/server-7.0.asc | \
   sudo gpg -o /usr/share/keyrings/mongodb-server-7.0.gpg \
   --dearmor
```

3. Run the following command to get the mongodb apt information

```
echo "deb [ arch=amd64,arm64
signed-by=/usr/share/keyrings/mongodb-server-7.0.gpg ]
```

```
https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/7.0 multiverse" |
sudo tee /etc/apt/sources.list.d/mongodb-org-7.0.list
```

4. Reload the package database and install mongodb

```
sudo apt-get update
sudo apt-get install -y mongodb-org
```

5. Run MongoDB

```
sudo systemctl start mongod
```

6. Verify that it worked.

```
sudo systemctl status mongod
```

7. Run this command to ensure mongodb is always running when the instance is running (DO NOT DO THIS FOR THE ROUTER NODE, IT WILL BE RUNNING MONGOS INSTEAD OF MONGOD)

```
sudo systemctl enable mongod
```

Setting up config server (for multinodal systems)

1. Connect to the instance you want to use as the config server (mongo1 was used in this case).
2. Open the config file

```
sudo vim /etc/mongod.conf
```

3. Make the following edits (uncomment sharding and replication)

```
sharding:
  clusterRole: configsvr
replication:
  replSetName: con0
```

```
net:
  bindIp: 0.0.0.0
  port: 27019
```

4. Use <esc> :wq to exit vim
5. Restart mongod

```
sudo systemctl restart mongod
```

6. Run the following commands to open the mongo shell and start the distributed server:

```
mongosh --host localhost --port 27019
rs.initiate(
  {
    _id: "con0",
    configsvr: true,
    members: [
      { _id : 0, host : "10.142.0.x:27019" } <replace x with local ip>
    ]
  }
)
```

Setting up shard servers (multiple of these)

1. Connect to the shard server instance.
2. Open the config file

```
sudo vim /etc/mongod.conf
```

3. Make the following edits (uncomment sharding and replication)

```
sharding:
  clusterRole: shardsvr
replication:
  replSetName: sh<x> (replace x with number)
net:
  port: 27018
```

```
  bindIp: 0.0.0.0
```

4. Use <esc> :wq to exit vim
5. Restart mongod

```
sudo systemctl restart mongod
```

6. Run the following commands to open the mongo shell and start the distributed server:

```
mongosh --host localhost --port 27018
rs.initiate(
   {
     _id : "sh<x>", <Replace x with number from above>
     members: [
       { _id : 0, host : "10.142.0.x:27018" }, <replace x with local ip>
     ]
   }
 )
```

7. Repeat with other shards.

Setting up mongos/router (only one)

1. Ensure that mongodb is NOT running on your router instance with

```
sudo systemctl stop mongod
```

2. Open a config file (name doesn't matter)

```
vim mongod.conf
```

3. Paste the following text into the file.

```
sharding:
  configDB: con0/10.142.0.x:27019 <replace x with config local ip>
net:
  bindIp: 0.0.0.0
```

4. Use <esc> :wq to exit vim
5. Enter the following command to start mongos

```
mongos --config mongod.conf
```

6. Go to another instance and connect to the mongos shell with the following command:

```
mongosh --host 10.142.0.x --port 27017 #replace x with router local ip
```

7. Use the following command to add the shards to the configuration. **The IP address must match the shard name!** Example:

```
sh.addShard("sh0/10.142.0.5:27018")
```

8. Repeat this process for each additional shard.

9. Enter this command to enable sharding for the ycsb db:

```
sh.enableSharding("ycsb")
```

Installing YCSB on machine

1. Connect to instance

2. Install jdk

```
sudo apt update
sudo apt install default-jre
sudo apt install default-jdk
```

3. Install python2

```
sudo apt install python2.7
```

4. Install maven

```
wget
http://ftp.heanet.ie/mirrors/www.apache.org/dist/maven/maven-3/3.1.1/binaries/apach
e-maven-3.1.1-bin.tar.gz
sudo tar xzf apache-maven-*-bin.tar.gz -C /usr/local
cd /usr/local
sudo ln -s apache-maven-* maven
sudo vi /etc/profile.d/maven.sh
```

5. Add the following to maven.sh

```
export M2_HOME=/usr/local/maven
export PATH=${M2_HOME}/bin:${PATH}
#<ESC>:wq to exit
```

6. Reload bash, check version of maven

```
bash
mvn -version
```

7. Install ycsb

```
cd ~
curl -O --location
https://github.com/brianfrankcooper/YCSB/releases/download/0.11.0/ycsb-0.11
.0.tar.gz
tar xfvz ycsb-0.11.0.tar.gz
cd ycsb-0.11.0
```

Configuration of workloads

1. On the ycsb instance:

```
cd ycsb-0.17.0
vim workloads/workload<x> #x is workload option
#The first line after comments should read:
```

```
mongodb.url=mongodb://10.142.0.2:27017/ycsb
#          <this is mongo router internal IP>
#<esc>:wq
```

Running a workload:

1. Ensure all needed GCP instances are running, mongos is running on the router, and mongod is running on shards + config server
2. Connect to mongodb router + 1 shard instance and ycsb instance
3. Enter the mongo shell for the router (from the shard instance) with:

```
mongosh --host=10.142.0.x --port 27017 #replace x with router local IP
```

4. Enter the following commands:

```
use ycsb
db.dropDatabase();
show dbs
```
You should see 'admin', 'config', and 'local', but NOT ycsb

5. Switch to yscb shell
6. Ensure workload is configured correctly (see 'Configuration of Workloads')
7. To load a workload, use the following command:

```
bin/ycsb.sh load mongodb -s -P workloads/workload<x>
#                              Replace x with workload letter
```

8. To run a workload, use the following command:

```
bin/ycsb.sh run mongodb -s -P workloads/workload<x>
#                             Replace x with workload letter
```

9. Repeat steps 3-8 for each workload

Single-node results

Workload A load/run

```
Loading workload...
Starting test.
2024-04-07 17:58:25:430 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 17:58:29:615 4 sec: 1000 operations; 233.7 current ops/sec; [CLEANUP: Count=1, Max=
2537, Min=2536, Avg=2537, 90=2537, 99=2537, 99.9=2537, 99.99=2537] [INSERT: Count=1000, Max=13
0111, Min=652, Avg=3207.46, 90=4731, 99=6499, 99.9=11127, 99.99=130111]
[OVERALL], RunTime(ms), 4280
[OVERALL], Throughput(ops/sec), 233.6448598130841
[TOTAL_GCS_G1_Young_Generation], Count, 3
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 37
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.8644859813084111
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 3
[TOTAL_GC_TIME], Time(ms), 37
[TOTAL_GC_TIME_%], Time(%), 0.8644859813084111
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 2537.0
[CLEANUP], MinLatency(us), 2536
[CLEANUP], MaxLatency(us), 2537
[CLEANUP], 95thPercentileLatency(us), 2537
[CLEANUP], 99thPercentileLatency(us), 2537
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 3207.46
[INSERT], MinLatency(us), 652
[INSERT], MaxLatency(us), 130111
[INSERT], 95thPercentileLatency(us), 5383
[INSERT], 99thPercentileLatency(us), 6499
[INSERT], Return=OK, 1000
```

```
[TOTAL GCS G1 Old Generation], Count, 0
[TOTAL GC TIME G1 Old Generation], Time (ms), 0
[TOTAL GC TIME % G1 Old Generation], Time (%), 0.0
[TOTAL_GCs], Count, 3
[TOTAL GC TIME], Time (ms), 37
[TOTAL GC_TIME %], Time(%), 0.8644859813084111
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 2537.0
[CLEANUP], MinLatency(us), 2536
[CLEANUP], MaxLatency(us), 2537
[CLEANUP], 95thPercentileLatency(us), 2537
[CLEANUP], 99thPercentileLatency(us), 2537
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 3207.46
[INSERT], MinLatency(us), 652
[INSERT], MaxLatency(us), 130111
[INSERT], 95thPercentileLatency(us), 5383
[INSERT], 99thPercentileLatency(us), 6499
[INSERT], Return=OK, 1000
```

```
Starting test.
2024-04-07 17:59:59:669 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:00:02:951 3 sec: 1000 operations; 294.29 current ops/sec; [READ: Count=494, Max=
32831, Min=695, Avg=1929.9, 90=2867, 99=7403, 99.9=32831, 99.99=32831] [CLEANUP: Count=1, Max=
3645, Min=3644, Avg=3645, 90=3645, 99=3645, 99.9=3645, 99.99=3645] [UPDATE: Count=506, Max=183
679, Min=657, Avg=2124.32, 90=2849, 99=6735, 99.9=14455, 99.99=183679]
[OVERALL], RunTime(ms), 3414
[OVERALL], Throughput(ops/sec), 292.91154071470413
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 64
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.8746338605741066
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 64
[TOTAL_GC_TIME_%], Time(%), 1.8746338605741066
[READ], Operations, 494
[READ], AverageLatency(us), 1929.8987854251013
[READ], MinLatency(us), 695
[READ], MaxLatency(us), 32831
[READ], 95thPercentileLatency(us), 3991
[READ], 99thPercentileLatency(us), 7403
[READ], Return=OK, 494
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3645.0
[CLEANUP], MinLatency(us), 3644
[CLEANUP], MaxLatency(us), 3645
[CLEANUP], 95thPercentileLatency(us), 3645
[CLEANUP], 99thPercentileLatency(us), 3645
[UPDATE], Operations, 506
[UPDATE], AverageLatency(us), 2124.320158102767
[UPDATE], MinLatency(us), 657
[UPDATE], MaxLatency(us), 183679
[UPDATE], 95thPercentileLatency(us), 3821
[UPDATE], 99thPercentileLatency(us), 6735
[UPDATE], Return=OK, 506
```

Workload B load/run

```
Loading workload...
Starting test.
2024-04-07 18:18:28:469 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:18:32:739 4 sec: 1000 operations; 227.38 current ops/sec; [CLEANUP: Count=1, Max
=3751, Min=3750, Avg=3751, 90=3751, 99=3751, 99.9=3751, 99.99=3751] [INSERT: Count=1000, Max=1
36959, Min=745, Avg=3332.07, 90=4847, 99=6435, 99.9=10631, 99.99=136959]
[OVERALL], RunTime(ms), 4401
[OVERALL], Throughput(ops/sec), 227.22108611679164
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 42
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.9543285616905249
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 42
[TOTAL_GC_TIME_%], Time(%), 0.9543285616905249
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3751.0
[CLEANUP], MinLatency(us), 3750
[CLEANUP], MaxLatency(us), 3751
[CLEANUP], 95thPercentileLatency(us), 3751
[CLEANUP], 99thPercentileLatency(us), 3751
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 3332.07
[INSERT], MinLatency(us), 745
[INSERT], MaxLatency(us), 136959
[INSERT], 95thPercentileLatency(us), 5435
[INSERT], 99thPercentileLatency(us), 6435
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-07 18:19:15:870 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:19:18:349 2 sec: 1000 operations; 388.5 current ops/sec; [READ: Count=938, Max=1
72799, Min=478, Avg=1409.32, 90=2225, 99=6587, 99.9=18079, 99.99=172799] [CLEANUP: Count=1, Ma
x=2617, Min=2616, Avg=2617, 90=2617, 99=2617, 99.9=2617, 99.99=2617] [UPDATE: Count=62, Max=21
983, Min=882, Avg=1784.6, 90=1996, 99=6907, 99.9=21983, 99.99=21983]
[OVERALL], RunTime(ms), 2576
[OVERALL], Throughput(ops/sec), 388.19875776397515
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 50
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.9409937888198756
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 50
[TOTAL_GC_TIME_%], Time(%), 1.9409937888198756
[READ], Operations, 938
[READ], AverageLatency(us), 1409.318763326226
[READ], MinLatency(us), 478
[READ], MaxLatency(us), 172799
[READ], 95thPercentileLatency(us), 3351
[READ], 99thPercentileLatency(us), 6587
[READ], Return=OK, 938
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 2617.0
[CLEANUP], MinLatency(us), 2616
[CLEANUP], MaxLatency(us), 2617
[CLEANUP], 95thPercentileLatency(us), 2617
[CLEANUP], 99thPercentileLatency(us), 2617
[UPDATE], Operations, 62
[UPDATE], AverageLatency(us), 1784.5967741935483
[UPDATE], MinLatency(us), 882
[UPDATE], MaxLatency(us), 21983
[UPDATE], 95thPercentileLatency(us), 2457
[UPDATE], 99thPercentileLatency(us), 6907
[UPDATE], Return=OK, 62
```

Workload C load/run

```
Loading workload...
Starting test.
2024-04-07 18:20:25:324 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:20:29:560 4 sec: 1000 operations; 230.52 current ops/sec; [CLEANUP: Count=1, Max
=3003, Min=3002, Avg=3003, 90=3003, 99=3003, 99.9=3003, 99.99=3003] [INSERT: Count=1000, Max=1
45535, Min=726, Avg=3250.93, 90=4879, 99=6851, 99.9=10791, 99.99=145535]
[OVERALL], RunTime(ms), 4338
[OVERALL], Throughput(ops/sec), 230.52097740894422
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 47
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.0834485938220377
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 47
[TOTAL_GC_TIME_%], Time(%), 1.0834485938220377
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3003.0
[CLEANUP], MinLatency(us), 3002
[CLEANUP], MaxLatency(us), 3003
[CLEANUP], 95thPercentileLatency(us), 3003
[CLEANUP], 99thPercentileLatency(us), 3003
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 3250.927
[INSERT], MinLatency(us), 726
[INSERT], MaxLatency(us), 145535
[INSERT], 95thPercentileLatency(us), 5451
[INSERT], 99thPercentileLatency(us), 6851
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-07 18:21:14:814 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:21:16:969 2 sec: 1000 operations; 436.68 current ops/sec; [READ: Count=1000, Max
=111423, Min=517, Avg=1215.15, 90=1755, 99=5131, 99.9=14303, 99.99=111423] [CLEANUP: Count=1,
Max=2557, Min=2556, Avg=2557, 90=2557, 99=2557, 99.9=2557, 99.99=2557]
[OVERALL], RunTime(ms), 2293
[OVERALL], Throughput(ops/sec), 436.1098996947231
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 54
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 2.3549934583515046
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 54
[TOTAL_GC_TIME_%], Time(%), 2.3549934583515046
[READ], Operations, 1000
[READ], AverageLatency(us), 1215.148
[READ], MinLatency(us), 517
[READ], MaxLatency(us), 111423
[READ], 95thPercentileLatency(us), 2491
[READ], 99thPercentileLatency(us), 5131
[READ], Return=OK, 1000
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 2557.0
[CLEANUP], MinLatency(us), 2556
[CLEANUP], MaxLatency(us), 2557
[CLEANUP], 95thPercentileLatency(us), 2557
[CLEANUP], 99thPercentileLatency(us), 2557
```

Workload D load/run

```
Loading workload...
Starting test.
2024-04-07 18:25:05:079 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:25:09:224 4 sec: 1000 operations; 233.97 current ops/sec; [CLEANUP: Count=1, Max
=2499, Min=2498, Avg=2499, 90=2499, 99=2499, 99.9=2499, 99.99=2499] [INSERT: Count=1000, Max=1
23007, Min=733, Avg=3157.95, 90=4727, 99=6115, 99.9=9599, 99.99=123007]
[OVERALL], RunTime(ms), 4277
[OVERALL], Throughput(ops/sec), 233.80874444704233
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 43
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.005377601122282
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 43
[TOTAL_GC_TIME_%], Time(%), 1.005377601122282
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 2499.0
[CLEANUP], MinLatency(us), 2498
[CLEANUP], MaxLatency(us), 2499
[CLEANUP], 95thPercentileLatency(us), 2499
[CLEANUP], 99thPercentileLatency(us), 2499
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 3157.949
[INSERT], MinLatency(us), 733
[INSERT], MaxLatency(us), 123007
[INSERT], 95thPercentileLatency(us), 5207
[INSERT], 99thPercentileLatency(us), 6115
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-07 18:25:13:792 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:25:16:067 2 sec: 1000 operations; 423.37 current ops/sec; [READ: Count=941, Max=
117695, Min=464, Avg=1277.79, 90=1635, 99=6415, 99.9=12671, 99.99=117695] [CLEANUP: Count=1, M
ax=2617, Min=2616, Avg=2617, 90=2617, 99=2617, 99.9=2617, 99.99=2617] [INSERT: Count=59, Max=1
3583, Min=848, Avg=3007.71, 90=4631, 99=5835, 99.9=13583, 99.99=13583]
[OVERALL], RunTime(ms), 2363
[OVERALL], Throughput(ops/sec), 423.1908590774439
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 50
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 2.1159542953872195
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 50
[TOTAL_GC_TIME_%], Time(%), 2.1159542953872195
[READ], Operations, 941
[READ], AverageLatency(us), 1277.7853347502657
[READ], MinLatency(us), 464
[READ], MaxLatency(us), 117695
[READ], 95thPercentileLatency(us), 2899
[READ], 99thPercentileLatency(us), 6415
[READ], Return=OK, 941
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 2617.0
[CLEANUP], MinLatency(us), 2616
[CLEANUP], MaxLatency(us), 2617
[CLEANUP], 95thPercentileLatency(us), 2617
[CLEANUP], 99thPercentileLatency(us), 2617
[INSERT], Operations, 59
[INSERT], AverageLatency(us), 3007.7118644067796
[INSERT], MinLatency(us), 848
[INSERT], MaxLatency(us), 13583
[INSERT], 95thPercentileLatency(us), 4951
[INSERT], 99thPercentileLatency(us), 5835
[INSERT], Return=OK, 59
```

Workload E load/run

```
Loading workload...
Starting test.
2024-04-07 18:26:17:098 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:26:21:405 4 sec: 1000 operations; 225.84 current ops/sec; [CLEANUP: Count=1, Max
=2543, Min=2542, Avg=2543, 90=2543, 99=2543, 99.9=2543, 99.99=2543] [INSERT: Count=1000, Max=1
30111, Min=732, Avg=3311.32, 90=4883, 99=6303, 99.9=7691, 99.99=130111]
[OVERALL], RunTime(ms), 4432
[OVERALL], Throughput(ops/sec), 225.6317689530686
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 45
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.0153429602888087
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 45
[TOTAL_GC_TIME_%], Time(%), 1.0153429602888087
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 2543.0
[CLEANUP], MinLatency(us), 2542
[CLEANUP], MaxLatency(us), 2543
[CLEANUP], 95thPercentileLatency(us), 2543
[CLEANUP], 99thPercentileLatency(us), 2543
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 3311.32
[INSERT], MinLatency(us), 732
[INSERT], MaxLatency(us), 130111
[INSERT], 95thPercentileLatency(us), 5431
[INSERT], 99thPercentileLatency(us), 6303
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-07 18:26:45:451 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:26:48:711 3 sec: 1000 operations; 295.16 current ops/sec; [CLEANUP: Count=1, Max
=3435, Min=3434, Avg=3435, 90=3435, 99=3435, 99.9=3435, 99.99=3435] [INSERT: Count=54, Max=139
75, Min=1136, Avg=3406, 90=4931, 99=6539, 99.9=13975, 99.99=13975] [SCAN: Count=946, Max=13964
7, Min=582, Avg=2300.8, 90=3691, 99=8671, 99.9=13903, 99.99=139647]
[OVERALL], RunTime(ms), 3389
[OVERALL], Throughput(ops/sec), 295.0722927117144
[TOTAL_GCS_G1_Young_Generation], Count, 11
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 67
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.976984361168486
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 11
[TOTAL_GC_TIME], Time(ms), 67
[TOTAL_GC_TIME_%], Time(%), 1.976984361168486
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3435.0
[CLEANUP], MinLatency(us), 3434
[CLEANUP], MaxLatency(us), 3435
[CLEANUP], 95thPercentileLatency(us), 3435
[CLEANUP], 99thPercentileLatency(us), 3435
[INSERT], Operations, 54
[INSERT], AverageLatency(us), 3406.0
[INSERT], MinLatency(us), 1136
[INSERT], MaxLatency(us), 13975
[INSERT], 95thPercentileLatency(us), 5915
[INSERT], 99thPercentileLatency(us), 6539
[INSERT], Return=OK, 54
[SCAN], Operations, 946
[SCAN], AverageLatency(us), 2300.797040169133
[SCAN], MinLatency(us), 582
[SCAN], MaxLatency(us), 139647
[SCAN], 95thPercentileLatency(us), 5603
[SCAN], 99thPercentileLatency(us), 8671
[SCAN], Return=OK, 946
```

Workload F load/run

```
Loading workload...
Starting test.
2024-04-07 18:27:14:750 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.2:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes to track for latenc
y are: []
2024-04-07 18:27:18:808 4 sec: 1000 operations; 240.5 current ops/sec; [CLEANUP: Count=1, Max=
3059, Min=3058, Avg=3059, 90=3059, 99=3059, 99.9=3059, 99.99=3059] [INSERT: Count=1000, Max=14
0287, Min=724, Avg=3201.74, 90=4615, 99=6103, 99.9=10327, 99.99=140287]
[OVERALL], RunTime(ms), 4158
[OVERALL], Throughput(ops/sec), 240.5002405002405
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 49
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.1784511784511784
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 49
[TOTAL_GC_TIME_%], Time(%), 1.1784511784511784
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3059.0
[CLEANUP], MinLatency(us), 3058
[CLEANUP], MaxLatency(us), 3059
[CLEANUP], 95thPercentileLatency(us), 3059
[CLEANUP], 99thPercentileLatency(us), 3059
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 3201.741
[INSERT], MinLatency(us), 724
[INSERT], MaxLatency(us), 140287
[INSERT], 95thPercentileLatency(us), 5115
[INSERT], 99thPercentileLatency(us), 6103
[INSERT], Return=OK, 1000
```

```
[OVERALL], RunTime(ms), 3037
[OVERALL], Throughput(ops/sec), 329.27230819888047
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 49
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.6134343101745143
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 49
[TOTAL_GC_TIME_%], Time(%), 1.6134343101745143
[READ], Operations, 1000
[READ], AverageLatency(us), 1295.241
[READ], MinLatency(us), 504
[READ], MaxLatency(us), 124351
[READ], 95thPercentileLatency(us), 2957
[READ], 99thPercentileLatency(us), 4927
[READ], Return=OK, 1000
[READ-MODIFY-WRITE], Operations, 513
[READ-MODIFY-WRITE], AverageLatency(us), 2491.604288499025
[READ-MODIFY-WRITE], MinLatency(us), 1118
[READ-MODIFY-WRITE], MaxLatency(us), 16607
[READ-MODIFY-WRITE], 95thPercentileLatency(us), 5867
[READ-MODIFY-WRITE], 99thPercentileLatency(us), 9263
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3001.0
[CLEANUP], MinLatency(us), 3000
[CLEANUP], MaxLatency(us), 3001
[CLEANUP], 95thPercentileLatency(us), 3001
[CLEANUP], 99thPercentileLatency(us), 3001
[UPDATE], Operations, 513
[UPDATE], AverageLatency(us), 1265.541910331384
[UPDATE], MinLatency(us), 571
[UPDATE], MaxLatency(us), 13063
[UPDATE], 95thPercentileLatency(us), 2771
[UPDATE], 99thPercentileLatency(us), 4855
[UPDATE], Return=OK, 513
```

3-node results

Workload A load/run

```
Loading workload...
Starting test.
2024-04-10 01:20:35:326 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:20:42:313 7 sec: 1000 operations; 141.06 current ops/sec;
[CLEANUP: Count=1, Max=4151, Min=4148, Avg=4150, 90=4151, 99=4151,
99.9=4151, 99.99=4151] [INSERT: Count=1000, Max=220799, Min=3228,
Avg=5612.79, 90=6887, 99=9791, 99.9=17855, 99.99=220799]
[OVERALL], RunTime(ms), 7090
```

```
[OVERALL], Throughput(ops/sec), 141.04372355430183
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 51
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.7193229901269393
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 51
[TOTAL_GC_TIME_%], Time(%), 0.7193229901269393
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4150.0
[CLEANUP], MinLatency(us), 4148
[CLEANUP], MaxLatency(us), 4151
[CLEANUP], 95thPercentileLatency(us), 4151
[CLEANUP], 99thPercentileLatency(us), 4151
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5612.787
[INSERT], MinLatency(us), 3228
[INSERT], MaxLatency(us), 220799
[INSERT], 95thPercentileLatency(us), 7359
[INSERT], 99thPercentileLatency(us), 9791
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 01:21:43:372 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:21:48:834 5 sec: 1000 operations; 179.18 current ops/sec;
[READ: Count=471, Max=21311, Min=1380, Avg=2891.02, 90=3581, 99=7075,
99.9=21311, 99.99=21311] [CLEANUP: Count=1, Max=4195, Min=4192, Avg=4194,
90=4195, 99=4195, 99.9=4195, 99.99=4195] [UPDATE: Count=529, Max=140159,
Min=3564, Avg=5826.66, 90=7071, 99=9335, 99.9=12695, 99.99=140159]
[OVERALL], RunTime(ms), 5586
[OVERALL], Throughput(ops/sec), 179.01897601145723
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 50
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.895094880057286
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
```

```
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 50
[TOTAL_GC_TIME_%], Time(%), 0.895094880057286
[READ], Operations, 471
[READ], AverageLatency(us), 2891.019108280255
[READ], MinLatency(us), 1380
[READ], MaxLatency(us), 21311
[READ], 95thPercentileLatency(us), 4077
[READ], 99thPercentileLatency(us), 7075
[READ], Return=OK, 471
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4194.0
[CLEANUP], MinLatency(us), 4192
[CLEANUP], MaxLatency(us), 4195
[CLEANUP], 95thPercentileLatency(us), 4195
[CLEANUP], 99thPercentileLatency(us), 4195
[UPDATE], Operations, 529
[UPDATE], AverageLatency(us), 5826.663516068053
[UPDATE], MinLatency(us), 3564
[UPDATE], MaxLatency(us), 140159
[UPDATE], 95thPercentileLatency(us), 7635
[UPDATE], 99thPercentileLatency(us), 9335
[UPDATE], Return=OK, 529
```

Workload B load/run

```
Loading workload...
Starting test.
2024-04-10 01:26:14:859 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:26:21:883 7 sec: 1000 operations; 140.1 current ops/sec;
[CLEANUP: Count=1, Max=3921, Min=3920, Avg=3921, 90=3921, 99=3921,
99.9=3921, 99.99=3921] [INSERT: Count=1000, Max=248703, Min=3646,
Avg=6023.64, 90=7315, 99=9703, 99.9=15319, 99.99=248703]
[OVERALL], RunTime(ms), 7141
[OVERALL], Throughput(ops/sec), 140.0364094664613
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 44
```

```
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.616160201652429
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 44
[TOTAL_GC_TIME_%], Time(%), 0.616160201652429
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3921.0
[CLEANUP], MinLatency(us), 3920
[CLEANUP], MaxLatency(us), 3921
[CLEANUP], 95thPercentileLatency(us), 3921
[CLEANUP], 99thPercentileLatency(us), 3921
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 6023.635
[INSERT], MinLatency(us), 3646
[INSERT], MaxLatency(us), 248703
[INSERT], 95thPercentileLatency(us), 8231
[INSERT], 99thPercentileLatency(us), 9703
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 01:26:34:120 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:26:37:954 3 sec: 1000 operations; 254.91 current ops/sec;
[READ: Count=942, Max=151679, Min=1205, Avg=2595.11, 90=3507, 99=6687,
99.9=12335, 99.99=151679] [CLEANUP: Count=1, Max=4903, Min=4900, Avg=4902,
90=4903, 99=4903, 99.9=4903, 99.99=4903] [UPDATE: Count=58, Max=17519,
Min=3914, Avg=5759.41, 90=7079, 99=9255, 99.9=17519, 99.99=17519]
[OVERALL], RunTime(ms), 3938
[OVERALL], Throughput(ops/sec), 253.93600812595227
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 48
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.218892839004571
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 48
```

```
[TOTAL_GC_TIME_%], Time(%), 1.218892839004571
[READ], Operations, 942
[READ], AverageLatency(us), 2595.108280254777
[READ], MinLatency(us), 1205
[READ], MaxLatency(us), 151679
[READ], 95thPercentileLatency(us), 4127
[READ], 99thPercentileLatency(us), 6687
[READ], Return=OK, 942
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4902.0
[CLEANUP], MinLatency(us), 4900
[CLEANUP], MaxLatency(us), 4903
[CLEANUP], 95thPercentileLatency(us), 4903
[CLEANUP], 99thPercentileLatency(us), 4903
[UPDATE], Operations, 58
[UPDATE], AverageLatency(us), 5759.413793103448
[UPDATE], MinLatency(us), 3914
[UPDATE], MaxLatency(us), 17519
[UPDATE], 95thPercentileLatency(us), 8067
[UPDATE], 99thPercentileLatency(us), 9255
[UPDATE], Return=OK, 58
```

Workload C load/run

```
Loading workload...
Starting test.
2024-04-10 01:28:15:621 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:28:22:342 6 sec: 1000 operations; 146.56 current ops/sec;
[CLEANUP: Count=1, Max=4355, Min=4352, Avg=4354, 90=4355, 99=4355,
99.9=4355, 99.99=4355] [INSERT: Count=1000, Max=205951, Min=3576,
Avg=5711.14, 90=6935, 99=9711, 99.9=15239, 99.99=205951]
[OVERALL], RunTime(ms), 6839
[OVERALL], Throughput(ops/sec), 146.22020763269484
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 51
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.7457230589267436
[TOTAL_GCS_G1_Old_Generation], Count, 0
```

```
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 51
[TOTAL_GC_TIME_%], Time(%), 0.745723058926436
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4354.0
[CLEANUP], MinLatency(us), 4352
[CLEANUP], MaxLatency(us), 4355
[CLEANUP], 95thPercentileLatency(us), 4355
[CLEANUP], 99thPercentileLatency(us), 4355
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5711.144
[INSERT], MinLatency(us), 3576
[INSERT], MaxLatency(us), 205951
[INSERT], 95thPercentileLatency(us), 7587
[INSERT], 99thPercentileLatency(us), 9711
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 01:28:26:906 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:28:30:267 3 sec: 1000 operations; 290.61 current ops/sec;
[READ: Count=1000, Max=179967, Min=1222, Avg=2397.73, 90=3337, 99=6319,
99.9=12391, 99.99=179967] [CLEANUP: Count=1, Max=4535, Min=4532, Avg=4534,
90=4535, 99=4535, 99.9=4535, 99.99=4535]
[OVERALL], RunTime(ms), 3441
[OVERALL], Throughput(ops/sec), 290.6131938390003
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 48
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.3949433304272014
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 48
[TOTAL_GC_TIME_%], Time(%), 1.3949433304272014
[READ], Operations, 1000
[READ], AverageLatency(us), 2397.731
```

```
[READ], MinLatency(us), 1222
[READ], MaxLatency(us), 179967
[READ], 95thPercentileLatency(us), 4143
[READ], 99thPercentileLatency(us), 6319
[READ], Return=OK, 1000
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4534.0
[CLEANUP], MinLatency(us), 4532
[CLEANUP], MaxLatency(us), 4535
[CLEANUP], 95thPercentileLatency(us), 4535
[CLEANUP], 99thPercentileLatency(us), 4535
```

Workload D load/run

```
Loading workload...
Starting test.
2024-04-10 01:29:44:296 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:29:51:017 6 sec: 1000 operations; 146.43 current ops/sec;
[CLEANUP: Count=1, Max=4423, Min=4420, Avg=4422, 90=4423, 99=4423,
99.9=4423, 99.99=4423] [INSERT: Count=1000, Max=194687, Min=3388,
Avg=5732.53, 90=7383, 99=9943, 99.9=16239, 99.99=194687]
[OVERALL], RunTime(ms), 6836
[OVERALL], Throughput(ops/sec), 146.2843768285547
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 56
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.8191925102399065
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 56
[TOTAL_GC_TIME_%], Time(%), 0.8191925102399065
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4422.0
[CLEANUP], MinLatency(us), 4420
[CLEANUP], MaxLatency(us), 4423
[CLEANUP], 95thPercentileLatency(us), 4423
[CLEANUP], 99thPercentileLatency(us), 4423
```

[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5732.533
[INSERT], MinLatency(us), 3388
[INSERT], MaxLatency(us), 194687
[INSERT], 95thPercentileLatency(us), 8279
[INSERT], 99thPercentileLatency(us), 9943
[INSERT], Return=OK, 1000

Loading workload...
Starting test.
2024-04-10 01:30:15:459 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:30:19:017 3 sec: 1000 operations; 273.37 current ops/sec;
[READ: Count=951, Max=137599, Min=1217, Avg=2421.71, 90=3569, 99=6051,
99.9=11575, 99.99=137599] [CLEANUP: Count=1, Max=5135, Min=5132, Avg=5134,
90=5135, 99=5135, 99.9=5135, 99.99=5135] [INSERT: Count=49, Max=16719,
Min=3642, Avg=5781.57, 90=7979, 99=16719, 99.9=16719, 99.99=16719]
[OVERALL], RunTime(ms), 3658
[OVERALL], Throughput(ops/sec), 273.3734281027884
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 54
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.4762165117550574
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 54
[TOTAL_GC_TIME_%], Time(%), 1.4762165117550574
[READ], Operations, 951
[READ], AverageLatency(us), 2421.712933753943
[READ], MinLatency(us), 1217
[READ], MaxLatency(us), 137599
[READ], 95thPercentileLatency(us), 4059
[READ], 99thPercentileLatency(us), 6051
[READ], Return=OK, 951
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 5134.0
[CLEANUP], MinLatency(us), 5132
[CLEANUP], MaxLatency(us), 5135
[CLEANUP], 95thPercentileLatency(us), 5135

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[CLEANUP], 99thPercentileLatency(us), 5135
[INSERT], Operations, 49
[INSERT], AverageLatency(us), 5781.571428571428
[INSERT], MinLatency(us), 3642
[INSERT], MaxLatency(us), 16719
[INSERT], 95thPercentileLatency(us), 8335
[INSERT], 99thPercentileLatency(us), 16719
[INSERT], Return=OK, 49
```

Workload E load/run

```
Loading workload...
Starting test.
2024-04-10 01:31:22:104 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:31:29:383 7 sec: 1000 operations; 134.79 current ops/sec;
[CLEANUP: Count=1, Max=4987, Min=4984, Avg=4986, 90=4987, 99=4987,
99.9=4987, 99.99=4987] [INSERT: Count=1000, Max=223487, Min=3728,
Avg=6243.05, 90=7843, 99=10599, 99.9=16991, 99.99=223487]
[OVERALL], RunTime(ms), 7429
[OVERALL], Throughput(ops/sec), 134.6076187912236
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 59
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.794184950868219
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 59
[TOTAL_GC_TIME_%], Time(%), 0.794184950868219
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4986.0
[CLEANUP], MinLatency(us), 4984
[CLEANUP], MaxLatency(us), 4987
[CLEANUP], 95thPercentileLatency(us), 4987
[CLEANUP], 99thPercentileLatency(us), 4987
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 6243.047
```

```
[INSERT], MinLatency(us), 3728
[INSERT], MaxLatency(us), 223487
[INSERT], 95thPercentileLatency(us), 8495
[INSERT], 99thPercentileLatency(us), 10599
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 01:32:16:219 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:32:21:475 5 sec: 1000 operations; 186.57 current ops/sec;
[CLEANUP: Count=1, Max=3791, Min=3790, Avg=3791, 90=3791, 99=3791,
99.9=3791, 99.99=3791] [INSERT: Count=51, Max=21727, Min=4780, Avg=7949.33,
90=9991, 99=11671, 99.9=21727, 99.99=21727] [SCAN: Count=949, Max=170751,
Min=1661, Avg=4115.66, 90=5707, 99=10279, 99.9=17967, 99.99=170751]
[OVERALL], RunTime(ms), 5365
[OVERALL], Throughput(ops/sec), 186.39328984156572
[TOTAL_GCS_G1_Young_Generation], Count, 11
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 76
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.4165890027958994
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 11
[TOTAL_GC_TIME], Time(ms), 76
[TOTAL_GC_TIME_%], Time(%), 1.4165890027958994
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3791.0
[CLEANUP], MinLatency(us), 3790
[CLEANUP], MaxLatency(us), 3791
[CLEANUP], 95thPercentileLatency(us), 3791
[CLEANUP], 99thPercentileLatency(us), 3791
[INSERT], Operations, 51
[INSERT], AverageLatency(us), 7949.333333333333
[INSERT], MinLatency(us), 4780
[INSERT], MaxLatency(us), 21727
[INSERT], 95thPercentileLatency(us), 10479
[INSERT], 99thPercentileLatency(us), 11671
[INSERT], Return=OK, 51
[SCAN], Operations, 949
```

```
[SCAN], AverageLatency(us), 4115.657534246576
[SCAN], MinLatency(us), 1661
[SCAN], MaxLatency(us), 170751
[SCAN], 95thPercentileLatency(us), 7151
[SCAN], 99thPercentileLatency(us), 10279
[SCAN], Return=OK, 949
```

Workload F load/run

```
Loading workload...
Starting test.
2024-04-10 01:33:20:179 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:33:27:035 6 sec: 1000 operations; 143.45 current ops/sec;
[CLEANUP: Count=1, Max=4235, Min=4232, Avg=4234, 90=4235, 99=4235,
99.9=4235, 99.99=4235] [INSERT: Count=1000, Max=187903, Min=3158,
Avg=5893.55, 90=7339, 99=10143, 99.9=15335, 99.99=187903]
[OVERALL], RunTime(ms), 6971
[OVERALL], Throughput(ops/sec), 143.45144168698894
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 45
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.6455314875914503
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 45
[TOTAL_GC_TIME_%], Time(%), 0.6455314875914503
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4234.0
[CLEANUP], MinLatency(us), 4232
[CLEANUP], MaxLatency(us), 4235
[CLEANUP], 95thPercentileLatency(us), 4235
[CLEANUP], 99thPercentileLatency(us), 4235
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5893.549
[INSERT], MinLatency(us), 3158
[INSERT], MaxLatency(us), 187903
```

```
[INSERT], 95thPercentileLatency(us), 7915
[INSERT], 99thPercentileLatency(us), 10143
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 01:33:32:556 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 01:33:38:585 6 sec: 1000 operations; 162.81 current ops/sec;
[READ: Count=1000, Max=128895, Min=1227, Avg=2516.81, 90=3115, 99=6463,
99.9=13575, 99.99=128895] [READ-MODIFY-WRITE: Count=507, Max=25023,
Min=4772, Avg=7468.64, 90=9439, 99=13407, 99.9=19327, 99.99=25023]
[CLEANUP: Count=1, Max=4803, Min=4800, Avg=4802, 90=4803, 99=4803,
99.9=4803, 99.99=4803] [UPDATE: Count=507, Max=18655, Min=3146,
Avg=5024.78, 90=6271, 99=8647, 99.9=9439, 99.99=18655]
[OVERALL], RunTime(ms), 6146
[OVERALL], Throughput(ops/sec), 162.70745200130165
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 55
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.8948909860071592
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 55
[TOTAL_GC_TIME_%], Time(%), 0.8948909860071592
[READ], Operations, 1000
[READ], AverageLatency(us), 2516.813
[READ], MinLatency(us), 1227
[READ], MaxLatency(us), 128895
[READ], 95thPercentileLatency(us), 3605
[READ], 99thPercentileLatency(us), 6463
[READ], Return=OK, 1000
[READ-MODIFY-WRITE], Operations, 507
[READ-MODIFY-WRITE], AverageLatency(us), 7468.639053254438
[READ-MODIFY-WRITE], MinLatency(us), 4772
[READ-MODIFY-WRITE], MaxLatency(us), 25023
[READ-MODIFY-WRITE], 95thPercentileLatency(us), 10511
[READ-MODIFY-WRITE], 99thPercentileLatency(us), 13407
[CLEANUP], Operations, 1
```

```
[CLEANUP], AverageLatency(us), 4802.0
[CLEANUP], MinLatency(us), 4800
[CLEANUP], MaxLatency(us), 4803
[CLEANUP], 95thPercentileLatency(us), 4803
[CLEANUP], 99thPercentileLatency(us), 4803
[UPDATE], Operations, 507
[UPDATE], AverageLatency(us), 5024.77909270217
[UPDATE], MinLatency(us), 3146
[UPDATE], MaxLatency(us), 18655
[UPDATE], 95thPercentileLatency(us), 7115
[UPDATE], 99thPercentileLatency(us), 8647
[UPDATE], Return=OK, 507
```

6-node results

Workload A load/run

```
Loading workload...
Starting test.
2024-04-10 17:55:52:164 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 17:55:58:897 6 sec: 1000 operations; 146.22 current ops/sec;
[CLEANUP: Count=1, Max=4195, Min=4192, Avg=4194, 90=4195, 99=4195,
99.9=4195, 99.99=4195] [INSERT: Count=1000, Max=273407, Min=3102,
Avg=5659.91, 90=6959, 99=9023, 99.9=14471, 99.99=273407]
[OVERALL], RunTime(ms), 6840
[OVERALL], Throughput(ops/sec), 146.19883040935673
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 42
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.6140350877192983
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 42
[TOTAL_GC_TIME_%], Time(%), 0.6140350877192983
[CLEANUP], Operations, 1
```

```
[CLEANUP], AverageLatency(us), 4194.0
[CLEANUP], MinLatency(us), 4192
[CLEANUP], MaxLatency(us), 4195
[CLEANUP], 95thPercentileLatency(us), 4195
[CLEANUP], 99thPercentileLatency(us), 4195
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5659.91
[INSERT], MinLatency(us), 3102
[INSERT], MaxLatency(us), 273407
[INSERT], 95thPercentileLatency(us), 7479
[INSERT], 99thPercentileLatency(us), 9023
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 17:56:53:340 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 17:56:58:198 4 sec: 1000 operations; 202.31 current ops/sec;
[READ: Count=509, Max=21167, Min=1613, Avg=2561.96, 90=3319, 99=6475,
99.9=8075, 99.99=21167] [CLEANUP: Count=1, Max=4707, Min=4704, Avg=4706,
90=4707, 99=4707, 99.9=4707, 99.99=4707] [UPDATE: Count=491, Max=179199,
Min=3248, Avg=5425.66, 90=6507, 99=7923, 99.9=179199, 99.99=179199]
[OVERALL], RunTime(ms), 4944
[OVERALL], Throughput(ops/sec), 202.26537216828478
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 51
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.0315533980582525
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 51
[TOTAL_GC_TIME_%], Time(%), 1.0315533980582525
[READ], Operations, 509
[READ], AverageLatency(us), 2561.9567779960707
[READ], MinLatency(us), 1613
[READ], MaxLatency(us), 21167
[READ], 95thPercentileLatency(us), 3687
[READ], 99thPercentileLatency(us), 6475
[READ], Return=OK, 509
```

```
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4706.0
[CLEANUP], MinLatency(us), 4704
[CLEANUP], MaxLatency(us), 4707
[CLEANUP], 95thPercentileLatency(us), 4707
[CLEANUP], 99thPercentileLatency(us), 4707
[UPDATE], Operations, 491
[UPDATE], AverageLatency(us), 5425.65784114053
[UPDATE], MinLatency(us), 3248
[UPDATE], MaxLatency(us), 179199
[UPDATE], 95thPercentileLatency(us), 7027
[UPDATE], 99thPercentileLatency(us), 7923
[UPDATE], Return=OK, 491
```

Workload B load/run

```
Loading workload...
Starting test.
2024-04-10 18:00:48:908 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:00:56:487 7 sec: 1000 operations; 130.5 current ops/sec;
[CLEANUP: Count=1, Max=3855, Min=3854, Avg=3855, 90=3855, 99=3855,
99.9=3855, 99.99=3855] [INSERT: Count=1000, Max=267519, Min=3070,
Avg=6690.3, 90=8959, 99=10783, 99.9=16431, 99.99=267519]
[OVERALL], RunTime(ms), 7666
[OVERALL], Throughput(ops/sec), 130.44612575006522
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 43
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.5609183407252805
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 43
[TOTAL_GC_TIME_%], Time(%), 0.5609183407252805
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3855.0
[CLEANUP], MinLatency(us), 3854
[CLEANUP], MaxLatency(us), 3855
```

```
[CLEANUP], 95thPercentileLatency(us), 3855
[CLEANUP], 99thPercentileLatency(us), 3855
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 6690.298
[INSERT], MinLatency(us), 3070
[INSERT], MaxLatency(us), 267519
[INSERT], 95thPercentileLatency(us), 9607
[INSERT], 99thPercentileLatency(us), 10783
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 18:02:05:992 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:02:09:804 3 sec: 1000 operations; 255.17 current ops/sec;
[READ: Count=963, Max=152063, Min=1351, Avg=2693.68, 90=3287, 99=6431,
99.9=11847, 99.99=152063] [CLEANUP: Count=1, Max=3863, Min=3862, Avg=3863,
90=3863, 99=3863, 99.9=3863, 99.99=3863] [UPDATE: Count=37, Max=18143,
Min=4604, Avg=6505.73, 90=7971, 99=18143, 99.9=18143, 99.99=18143]
[OVERALL], RunTime(ms), 3920
[OVERALL], Throughput(ops/sec), 255.10204081632654
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 55
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.403061224489796
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 55
[TOTAL_GC_TIME_%], Time(%), 1.403061224489796
[READ], Operations, 963
[READ], AverageLatency(us), 2693.681204569055
[READ], MinLatency(us), 1351
[READ], MaxLatency(us), 152063
[READ], 95thPercentileLatency(us), 3807
[READ], 99thPercentileLatency(us), 6431
[READ], Return=OK, 963
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3863.0
[CLEANUP], MinLatency(us), 3862
```

```
[CLEANUP], MaxLatency(us), 3863
[CLEANUP], 95thPercentileLatency(us), 3863
[CLEANUP], 99thPercentileLatency(us), 3863
[UPDATE], Operations, 37
[UPDATE], AverageLatency(us), 6505.72972972973
[UPDATE], MinLatency(us), 4604
[UPDATE], MaxLatency(us), 18143
[UPDATE], 95thPercentileLatency(us), 8495
[UPDATE], 99thPercentileLatency(us), 18143
[UPDATE], Return=OK, 37
```

Workload C load/run

```
Loading workload...
Starting test.
2024-04-10 18:04:05:830 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:04:11:901 6 sec: 1000 operations; 161.63 current ops/sec;
[CLEANUP: Count=1, Max=3749, Min=3748, Avg=3749, 90=3749, 99=3749,
99.9=3749, 99.99=3749] [INSERT: Count=1000, Max=251135, Min=2884,
Avg=5172.53, 90=6411, 99=8783, 99.9=12975, 99.99=251135]
[OVERALL], RunTime(ms), 6210
[OVERALL], Throughput(ops/sec), 161.0305958132045
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 44
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.7085346215780999
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 44
[TOTAL_GC_TIME_%], Time(%), 0.7085346215780999
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3749.0
[CLEANUP], MinLatency(us), 3748
[CLEANUP], MaxLatency(us), 3749
[CLEANUP], 95thPercentileLatency(us), 3749
[CLEANUP], 99thPercentileLatency(us), 3749
[INSERT], Operations, 1000
```

```
[INSERT], AverageLatency(us), 5172.526
[INSERT], MinLatency(us), 2884
[INSERT], MaxLatency(us), 251135
[INSERT], 95thPercentileLatency(us), 6879
[INSERT], 99thPercentileLatency(us), 8783
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 18:04:28:523 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:04:31:526 3 sec: 1000 operations; 317.16 current ops/sec;
[READ: Count=1000, Max=129727, Min=1219, Avg=2156.61, 90=2957, 99=5619,
99.9=10879, 99.99=129727] [CLEANUP: Count=1, Max=3989, Min=3988, Avg=3989,
90=3989, 99=3989, 99.9=3989, 99.99=3989]
[OVERALL], RunTime(ms), 3153
[OVERALL], Throughput(ops/sec), 317.1582619727244
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 45
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.4272121788772598
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 45
[TOTAL_GC_TIME_%], Time(%), 1.4272121788772598
[READ], Operations, 1000
[READ], AverageLatency(us), 2156.608
[READ], MinLatency(us), 1219
[READ], MaxLatency(us), 129727
[READ], 95thPercentileLatency(us), 3601
[READ], 99thPercentileLatency(us), 5619
[READ], Return=OK, 1000
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3989.0
[CLEANUP], MinLatency(us), 3988
[CLEANUP], MaxLatency(us), 3989
[CLEANUP], 95thPercentileLatency(us), 3989
[CLEANUP], 99thPercentileLatency(us), 3989
```

Workload D load/run

```
Loading workload...
Starting test.
2024-04-10 18:05:24:679 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:05:32:525 7 sec: 1000 operations; 125.8 current ops/sec;
[CLEANUP: Count=1, Max=4319, Min=4316, Avg=4318, 90=4319, 99=4319,
99.9=4319, 99.99=4319] [INSERT: Count=1000, Max=279551, Min=2856,
Avg=5848.34, 90=7715, 99=14647, 99.9=18831, 99.99=279551]
[OVERALL], RunTime(ms), 7958
[OVERALL], Throughput(ops/sec), 125.65971349585323
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 68
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.8544860517718019
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 68
[TOTAL_GC_TIME_%], Time(%), 0.8544860517718019
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4318.0
[CLEANUP], MinLatency(us), 4316
[CLEANUP], MaxLatency(us), 4319
[CLEANUP], 95thPercentileLatency(us), 4319
[CLEANUP], 99thPercentileLatency(us), 4319
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5848.34
[INSERT], MinLatency(us), 2856
[INSERT], MaxLatency(us), 279551
[INSERT], 95thPercentileLatency(us), 9535
[INSERT], 99thPercentileLatency(us), 14647
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 18:05:38:521 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
```

```
to track for latency are: []
2024-04-10 18:05:41:674 3 sec: 1000 operations; 308.26 current ops/sec;
[READ: Count=934, Max=150783, Min=1062, Avg=2078.57, 90=2595, 99=6539,
99.9=25743, 99.99=150783] [CLEANUP: Count=1, Max=4867, Min=4864, Avg=4866,
90=4867, 99=4867, 99.9=4867, 99.99=4867] [INSERT: Count=66, Max=13991,
Min=3422, Avg=5130.83, 90=6531, 99=7671, 99.9=13991, 99.99=13991]
[OVERALL], RunTime(ms), 3249
[OVERALL], Throughput(ops/sec), 307.7870113881194
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 42
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.2927054478301014
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 42
[TOTAL_GC_TIME_%], Time(%), 1.2927054478301014
[READ], Operations, 934
[READ], AverageLatency(us), 2078.5695931477517
[READ], MinLatency(us), 1062
[READ], MaxLatency(us), 150783
[READ], 95thPercentileLatency(us), 3113
[READ], 99thPercentileLatency(us), 6539
[READ], Return=OK, 934
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4866.0
[CLEANUP], MinLatency(us), 4864
[CLEANUP], MaxLatency(us), 4867
[CLEANUP], 95thPercentileLatency(us), 4867
[CLEANUP], 99thPercentileLatency(us), 4867
[INSERT], Operations, 66
[INSERT], AverageLatency(us), 5130.833333333333
[INSERT], MinLatency(us), 3422
[INSERT], MaxLatency(us), 13991
[INSERT], 95thPercentileLatency(us), 7147
[INSERT], 99thPercentileLatency(us), 7671
[INSERT], Return=OK, 66
```

Workload E load/run

```
Loading workload...
```

```
Starting test.
2024-04-10 18:06:38:732 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:06:46:391 7 sec: 1000 operations; 128.75 current ops/sec;
[CLEANUP: Count=1, Max=4127, Min=4124, Avg=4126, 90=4127, 99=4127,
99.9=4127, 99.99=4127] [INSERT: Count=1000, Max=228991, Min=3402,
Avg=6732.57, 90=8599, 99=10527, 99.9=13999, 99.99=228991]
[OVERALL], RunTime(ms), 7767
[OVERALL], Throughput(ops/sec), 128.74983906270117
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 46
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.5922492596884253
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 46
[TOTAL_GC_TIME_%], Time(%), 0.5922492596884253
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4126.0
[CLEANUP], MinLatency(us), 4124
[CLEANUP], MaxLatency(us), 4127
[CLEANUP], 95thPercentileLatency(us), 4127
[CLEANUP], 99thPercentileLatency(us), 4127
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 6732.567
[INSERT], MinLatency(us), 3402
[INSERT], MaxLatency(us), 228991
[INSERT], 95thPercentileLatency(us), 9007
[INSERT], 99thPercentileLatency(us), 10527
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 18:06:59:473 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:07:04:577 5 sec: 1000 operations; 192.75 current ops/sec;
[CLEANUP: Count=1, Max=4039, Min=4038, Avg=4039, 90=4039, 99=4039,
```

```
99.9=4039, 99.99=4039] [INSERT: Count=61, Max=141823, Min=3966,
Avg=10132.8, 90=9871, 99=15695, 99.9=141823, 99.99=141823] [SCAN:
Count=939, Max=26831, Min=1630, Avg=3861.49, 90=4991, 99=9503, 99.9=20639,
99.99=26831]
[OVERALL], RunTime(ms), 5188
[OVERALL], Throughput(ops/sec), 192.75250578257518
[TOTAL_GCS_G1_Young_Generation], Count, 11
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 59
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.372397841171935
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 11
[TOTAL_GC_TIME], Time(ms), 59
[TOTAL_GC_TIME_%], Time(%), 1.372397841171935
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4039.0
[CLEANUP], MinLatency(us), 4038
[CLEANUP], MaxLatency(us), 4039
[CLEANUP], 95thPercentileLatency(us), 4039
[CLEANUP], 99thPercentileLatency(us), 4039
[INSERT], Operations, 61
[INSERT], AverageLatency(us), 10132.803278688525
[INSERT], MinLatency(us), 3966
[INSERT], MaxLatency(us), 141823
[INSERT], 95thPercentileLatency(us), 11015
[INSERT], 99thPercentileLatency(us), 15695
[INSERT], Return=OK, 61
[SCAN], Operations, 939
[SCAN], AverageLatency(us), 3861.4941427050053
[SCAN], MinLatency(us), 1630
[SCAN], MaxLatency(us), 26831
[SCAN], 95thPercentileLatency(us), 6187
[SCAN], 99thPercentileLatency(us), 9503
[SCAN], Return=OK, 939
```

Workload F load/run

```
Loading workload...
Starting test.
2024-04-10 18:07:49:590 0 sec: 0 operations; est completion in 0 second
```

```
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:07:55:618 6 sec: 1000 operations; 163.21 current ops/sec;
[CLEANUP: Count=1, Max=3783, Min=3782, Avg=3783, 90=3783, 99=3783,
99.9=3783, 99.99=3783] [INSERT: Count=1000, Max=212095, Min=3234,
Avg=5125.31, 90=6299, 99=8679, 99.9=14511, 99.99=212095]
[OVERALL], RunTime(ms), 6133
[OVERALL], Throughput(ops/sec), 163.05233980107616
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 48
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.7826512310451654
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 48
[TOTAL_GC_TIME_%], Time(%), 0.7826512310451654
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3783.0
[CLEANUP], MinLatency(us), 3782
[CLEANUP], MaxLatency(us), 3783
[CLEANUP], 95thPercentileLatency(us), 3783
[CLEANUP], 99thPercentileLatency(us), 3783
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5125.307
[INSERT], MinLatency(us), 3234
[INSERT], MaxLatency(us), 212095
[INSERT], 95thPercentileLatency(us), 6823
[INSERT], 99thPercentileLatency(us), 8679
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-10 18:08:16:106 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27018/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-10 18:08:21:594 5 sec: 1000 operations; 179.05 current ops/sec;
[READ: Count=1000, Max=136447, Min=1204, Avg=2278.89, 90=2599, 99=5975,
99.9=13223, 99.99=136447] [READ-MODIFY-WRITE: Count=485, Max=26255,
Min=4692, Avg=6877.13, 90=8383, 99=13079, 99.9=26255, 99.99=26255]
```

```
[CLEANUP: Count=1, Max=4963, Min=4960, Avg=4962, 90=4963, 99=4963,
99.9=4963, 99.99=4963] [UPDATE: Count=485, Max=19375, Min=3004,
Avg=4705.05, 90=5859, 99=7943, 99.9=19375, 99.99=19375]
[OVERALL], RunTime(ms), 5586
[OVERALL], Throughput(ops/sec), 179.01897601145723
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 47
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.8413891872538489
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 47
[TOTAL_GC_TIME_%], Time(%), 0.8413891872538489
[READ], Operations, 1000
[READ], AverageLatency(us), 2278.888
[READ], MinLatency(us), 1204
[READ], MaxLatency(us), 136447
[READ], 95thPercentileLatency(us), 3115
[READ], 99thPercentileLatency(us), 5975
[READ], Return=OK, 1000
[READ-MODIFY-WRITE], Operations, 485
[READ-MODIFY-WRITE], AverageLatency(us), 6877.129896907217
[READ-MODIFY-WRITE], MinLatency(us), 4692
[READ-MODIFY-WRITE], MaxLatency(us), 26255
[READ-MODIFY-WRITE], 95thPercentileLatency(us), 8943
[READ-MODIFY-WRITE], 99thPercentileLatency(us), 13079
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4962.0
[CLEANUP], MinLatency(us), 4960
[CLEANUP], MaxLatency(us), 4963
[CLEANUP], 95thPercentileLatency(us), 4963
[CLEANUP], 99thPercentileLatency(us), 4963
[UPDATE], Operations, 485
[UPDATE], AverageLatency(us), 4705.051546391753
[UPDATE], MinLatency(us), 3004
[UPDATE], MaxLatency(us), 19375
[UPDATE], 95thPercentileLatency(us), 6427
[UPDATE], 99thPercentileLatency(us), 7943
[UPDATE], Return=OK, 485
```

9-node results

Workload A load/run

```
Loading workload...
Starting test.
2024-04-23 16:31:57:451 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:32:03:719 6 sec: 1000 operations; 157.23 current ops/sec;
[CLEANUP: Count=1, Max=3669, Min=3668, Avg=3669, 90=3669, 99=3669,
99.9=3669, 99.99=3669] [INSERT: Count=1000, Max=209535, Min=3050,
Avg=5320.02, 90=6659, 99=7775, 99.9=18991, 99.99=209535]
[OVERALL], RunTime(ms), 6363
[OVERALL], Throughput(ops/sec), 157.15857300015716
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 49
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.77007700770077
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 49
[TOTAL_GC_TIME_%], Time(%), 0.77007700770077
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3669.0
[CLEANUP], MinLatency(us), 3668
[CLEANUP], MaxLatency(us), 3669
[CLEANUP], 95thPercentileLatency(us), 3669
[CLEANUP], 99thPercentileLatency(us), 3669
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5320.015
[INSERT], MinLatency(us), 3050
[INSERT], MaxLatency(us), 209535
[INSERT], 95thPercentileLatency(us), 6835
[INSERT], 99thPercentileLatency(us), 7775
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
```

```
2024-04-23 16:33:02:213 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:33:07:202 5 sec: 1000 operations; 196.46 current ops/sec;
[READ: Count=508, Max=283647, Min=1532, Avg=3005.87, 90=3063, 99=5423,
99.9=13367, 99.99=283647] [CLEANUP: Count=1, Max=4559, Min=4556, Avg=4558,
90=4559, 99=4559, 99.9=4559, 99.99=4559] [UPDATE: Count=492, Max=122751,
Min=3612, Avg=5189.02, 90=6183, 99=7095, 99.9=122751, 99.99=122751]
[OVERALL], RunTime(ms), 5090
[OVERALL], Throughput(ops/sec), 196.46365422396858
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 53
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.0412573673870333
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 53
[TOTAL_GC_TIME_%], Time(%), 1.0412573673870333
[READ], Operations, 508
[READ], AverageLatency(us), 3005.8700787401576
[READ], MinLatency(us), 1532
[READ], MaxLatency(us), 283647
[READ], 95thPercentileLatency(us), 3497
[READ], 99thPercentileLatency(us), 5423
[READ], Return=OK, 508
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4558.0
[CLEANUP], MinLatency(us), 4556
[CLEANUP], MaxLatency(us), 4559
[CLEANUP], 95thPercentileLatency(us), 4559
[CLEANUP], 99thPercentileLatency(us), 4559
[UPDATE], Operations, 492
[UPDATE], AverageLatency(us), 5189.0203252032525
[UPDATE], MinLatency(us), 3612
[UPDATE], MaxLatency(us), 122751
[UPDATE], 95thPercentileLatency(us), 6615
[UPDATE], 99thPercentileLatency(us), 7095
[UPDATE], Return=OK, 492
```

Workload B load/run

```
Loading workload...
Starting test.
2024-04-23 16:34:27:137 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:34:33:061 6 sec: 1000 operations; 166 current ops/sec;
[CLEANUP: Count=1, Max=4151, Min=4148, Avg=4150, 90=4151, 99=4151,
99.9=4151, 99.99=4151] [INSERT: Count=1000, Max=235647, Min=2930,
Avg=5079.57, 90=6251, 99=7143, 99.9=12143, 99.99=235647]
[OVERALL], RunTime(ms), 6025
[OVERALL], Throughput(ops/sec), 165.97510373443984
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 47
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.7800829875518672
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 47
[TOTAL_GC_TIME_%], Time(%), 0.7800829875518672
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4150.0
[CLEANUP], MinLatency(us), 4148
[CLEANUP], MaxLatency(us), 4151
[CLEANUP], 95thPercentileLatency(us), 4151
[CLEANUP], 99thPercentileLatency(us), 4151
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5079.569
[INSERT], MinLatency(us), 2930
[INSERT], MaxLatency(us), 235647
[INSERT], 95thPercentileLatency(us), 6643
[INSERT], 99thPercentileLatency(us), 7143
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-23 16:34:54:617 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
```

```
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:34:57:648 3 sec: 1000 operations; 317.46 current ops/sec;
[READ: Count=950, Max=158207, Min=1064, Avg=2085.45, 90=2479, 99=5767,
99.9=12143, 99.99=158207] [CLEANUP: Count=1, Max=3317, Min=3316, Avg=3317,
90=3317, 99=3317, 99.9=3317, 99.99=3317] [UPDATE: Count=50, Max=14655,
Min=3470, Avg=4612.06, 90=5687, 99=14655, 99.9=14655, 99.99=14655]
[OVERALL], RunTime(ms), 3152
[OVERALL], Throughput(ops/sec), 317.25888324873097
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 44
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.3959390862944163
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 44
[TOTAL_GC_TIME_%], Time(%), 1.3959390862944163
[READ], Operations, 950
[READ], AverageLatency(us), 2085.4505263157894
[READ], MinLatency(us), 1064
[READ], MaxLatency(us), 158207
[READ], 95thPercentileLatency(us), 3121
[READ], 99thPercentileLatency(us), 5767
[READ], Return=OK, 950
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3317.0
[CLEANUP], MinLatency(us), 3316
[CLEANUP], MaxLatency(us), 3317
[CLEANUP], 95thPercentileLatency(us), 3317
[CLEANUP], 99thPercentileLatency(us), 3317
[UPDATE], Operations, 50
[UPDATE], AverageLatency(us), 4612.06
[UPDATE], MinLatency(us), 3470
[UPDATE], MaxLatency(us), 14655
[UPDATE], 95thPercentileLatency(us), 5791
[UPDATE], 99thPercentileLatency(us), 14655
[UPDATE], Return=OK, 50
```

Workload C load/run

```
Loading workload...
Starting test.
2024-04-23 16:36:10:130 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:36:15:918 5 sec: 1000 operations; 169.49 current ops/sec;
[CLEANUP: Count=1, Max=3693, Min=3692, Avg=3693, 90=3693, 99=3693,
99.9=3693, 99.99=3693] [INSERT: Count=1000, Max=256639, Min=2672,
Avg=4824.44, 90=5923, 99=7751, 99.9=15759, 99.99=256639]
[OVERALL], RunTime(ms), 5908
[OVERALL], Throughput(ops/sec), 169.26201760324983
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 48
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.8124576844955992
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 48
[TOTAL_GC_TIME_%], Time(%), 0.8124576844955992
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3693.0
[CLEANUP], MinLatency(us), 3692
[CLEANUP], MaxLatency(us), 3693
[CLEANUP], 95thPercentileLatency(us), 3693
[CLEANUP], 99thPercentileLatency(us), 3693
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 4824.436
[INSERT], MinLatency(us), 2672
[INSERT], MaxLatency(us), 256639
[INSERT], 95thPercentileLatency(us), 6343
[INSERT], 99thPercentileLatency(us), 7751
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-23 16:36:46:531 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
```

```
to track for latency are: []
2024-04-23 16:36:49:281 2 sec: 1000 operations; 350.51 current ops/sec;
[READ: Count=1000, Max=139263, Min=1095, Avg=1877.35, 90=2299, 99=5039,
99.9=15319, 99.99=139263] [CLEANUP: Count=1, Max=4211, Min=4208, Avg=4210,
90=4211, 99=4211, 99.9=4211, 99.99=4211]
[OVERALL], RunTime(ms), 2861
[OVERALL], Throughput(ops/sec), 349.5281370150297
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 53
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.8524991261796575
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 53
[TOTAL_GC_TIME_%], Time(%), 1.8524991261796575
[READ], Operations, 1000
[READ], AverageLatency(us), 1877.346
[READ], MinLatency(us), 1095
[READ], MaxLatency(us), 139263
[READ], 95thPercentileLatency(us), 3023
[READ], 99thPercentileLatency(us), 5039
[READ], Return=OK, 1000
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4210.0
[CLEANUP], MinLatency(us), 4208
[CLEANUP], MaxLatency(us), 4211
[CLEANUP], 95thPercentileLatency(us), 4211
[CLEANUP], 99thPercentileLatency(us), 4211
```

Workload D load/run

```
Loading workload...
Starting test.
2024-04-23 16:37:28:053 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:37:33:645 5 sec: 1000 operations; 176.21 current ops/sec;
[CLEANUP: Count=1, Max=3587, Min=3586, Avg=3587, 90=3587, 99=3587,
```

```
99.9=3587, 99.99=3587] [INSERT: Count=1000, Max=219647, Min=2606,
Avg=4741.08, 90=6091, 99=8127, 99.9=13751, 99.99=219647]
[OVERALL], RunTime(ms), 5676
[OVERALL], Throughput(ops/sec), 176.18040873854827
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 45
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.7928118393234672
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 45
[TOTAL_GC_TIME_%], Time(%), 0.7928118393234672
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3587.0
[CLEANUP], MinLatency(us), 3586
[CLEANUP], MaxLatency(us), 3587
[CLEANUP], 95thPercentileLatency(us), 3587
[CLEANUP], 99thPercentileLatency(us), 3587
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 4741.078
[INSERT], MinLatency(us), 2606
[INSERT], MaxLatency(us), 219647
[INSERT], 95thPercentileLatency(us), 6819
[INSERT], 99thPercentileLatency(us), 8127
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-23 16:37:59:989 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:38:03:206 3 sec: 1000 operations; 302.11 current ops/sec;
[READ: Count=953, Max=152575, Min=1164, Avg=2159.12, 90=2589, 99=5627,
99.9=12631, 99.99=152575] [CLEANUP: Count=1, Max=4519, Min=4516, Avg=4518,
90=4519, 99=4519, 99.9=4519, 99.99=4519] [INSERT: Count=47, Max=18031,
Min=3576, Avg=5293.3, 90=6295, 99=18031, 99.9=18031, 99.99=18031]
[OVERALL], RunTime(ms), 3328
[OVERALL], Throughput(ops/sec), 300.4807692307692
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 57
```

```
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.7127403846153848
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 57
[TOTAL_GC_TIME_%], Time(%), 1.7127403846153848
[READ], Operations, 953
[READ], AverageLatency(us), 2159.1175236096537
[READ], MinLatency(us), 1164
[READ], MaxLatency(us), 152575
[READ], 95thPercentileLatency(us), 3367
[READ], 99thPercentileLatency(us), 5627
[READ], Return=OK, 953
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4518.0
[CLEANUP], MinLatency(us), 4516
[CLEANUP], MaxLatency(us), 4519
[CLEANUP], 95thPercentileLatency(us), 4519
[CLEANUP], 99thPercentileLatency(us), 4519
[INSERT], Operations, 47
[INSERT], AverageLatency(us), 5293.297872340426
[INSERT], MinLatency(us), 3576
[INSERT], MaxLatency(us), 18031
[INSERT], 95thPercentileLatency(us), 6943
[INSERT], 99thPercentileLatency(us), 18031
[INSERT], Return=OK, 47
```

Workload E load/run

```
Loading workload...
Starting test.
2024-04-23 16:38:49:906 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:38:57:287 7 sec: 1000 operations; 131.75 current ops/sec;
[CLEANUP: Count=1, Max=4335, Min=4332, Avg=4334, 90=4335, 99=4335,
99.9=4335, 99.99=4335] [INSERT: Count=1000, Max=330239, Min=2874,
Avg=5545.25, 90=6855, 99=13551, 99.9=16991, 99.99=330239]
```

```
[OVERALL], RunTime(ms), 7597
[OVERALL], Throughput(ops/sec), 131.6309069369488
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 82
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.0793734368829802
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 82
[TOTAL_GC_TIME_%], Time(%), 1.0793734368829802
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4334.0
[CLEANUP], MinLatency(us), 4332
[CLEANUP], MaxLatency(us), 4335
[CLEANUP], 95thPercentileLatency(us), 4335
[CLEANUP], 99thPercentileLatency(us), 4335
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 5545.246
[INSERT], MinLatency(us), 2874
[INSERT], MaxLatency(us), 330239
[INSERT], 95thPercentileLatency(us), 8171
[INSERT], 99thPercentileLatency(us), 13551
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-23 16:39:26:229 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:39:30:818 4 sec: 1000 operations; 209.95 current ops/sec;
[CLEANUP: Count=1, Max=3401, Min=3400, Avg=3401, 90=3401, 99=3401,
99.9=3401, 99.99=3401] [INSERT: Count=63, Max=22047, Min=3888, Avg=7008.32,
90=8503, 99=9831, 99.9=22047, 99.99=22047] [SCAN: Count=937, Max=166783,
Min=1400, Avg=3537.97, 90=5171, 99=9783, 99.9=15487, 99.99=166783]
[OVERALL], RunTime(ms), 4765
[OVERALL], Throughput(ops/sec), 209.8635886673662
[TOTAL_GCS_G1_Young_Generation], Count, 11
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 69
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.4480587618048268
[TOTAL_GCS_G1_Old_Generation], Count, 0
```

```
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 11
[TOTAL_GC_TIME], Time(ms), 69
[TOTAL_GC_TIME_%], Time(%), 1.4480587618048268
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3401.0
[CLEANUP], MinLatency(us), 3400
[CLEANUP], MaxLatency(us), 3401
[CLEANUP], 95thPercentileLatency(us), 3401
[CLEANUP], 99thPercentileLatency(us), 3401
[INSERT], Operations, 63
[INSERT], AverageLatency(us), 7008.31746031746
[INSERT], MinLatency(us), 3888
[INSERT], MaxLatency(us), 22047
[INSERT], 95thPercentileLatency(us), 9095
[INSERT], 99thPercentileLatency(us), 9831
[INSERT], Return=OK, 63
[SCAN], Operations, 937
[SCAN], AverageLatency(us), 3537.965848452508
[SCAN], MinLatency(us), 1400
[SCAN], MaxLatency(us), 166783
[SCAN], 95thPercentileLatency(us), 6683
[SCAN], 99thPercentileLatency(us), 9783
[SCAN], Return=OK, 937
```

Workload F load/run

```
Loading workload...
Starting test.
2024-04-23 16:40:26:107 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:40:31:992 5 sec: 1000 operations; 167.08 current ops/sec;
[CLEANUP: Count=1, Max=3945, Min=3944, Avg=3945, 90=3945, 99=3945,
99.9=3945, 99.99=3945] [INSERT: Count=1000, Max=246399, Min=2576,
Avg=4975.13, 90=6391, 99=7927, 99.9=12639, 99.99=246399]
[OVERALL], RunTime(ms), 5987
[OVERALL], Throughput(ops/sec), 167.02856188408217
```

```
[TOTAL_GCS_G1_Young_Generation], Count, 4
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 62
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 1.035570836813094
[TOTAL_GCS_G1_Old_Generation], Count, 0
[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 4
[TOTAL_GC_TIME], Time(ms), 62
[TOTAL_GC_TIME_%], Time(%), 1.035570836813094
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 3945.0
[CLEANUP], MinLatency(us), 3944
[CLEANUP], MaxLatency(us), 3945
[CLEANUP], 95thPercentileLatency(us), 3945
[CLEANUP], 99thPercentileLatency(us), 3945
[INSERT], Operations, 1000
[INSERT], AverageLatency(us), 4975.131
[INSERT], MinLatency(us), 2576
[INSERT], MaxLatency(us), 246399
[INSERT], 95thPercentileLatency(us), 6719
[INSERT], 99thPercentileLatency(us), 7927
[INSERT], Return=OK, 1000
```

```
Loading workload...
Starting test.
2024-04-23 16:40:56:019 0 sec: 0 operations; est completion in 0 second
mongo client connection created with mongodb://10.142.0.4:27017/ycsb
DBWrapper: report latency for each error is false and specific error codes
to track for latency are: []
2024-04-23 16:41:01:499 5 sec: 1000 operations; 179.18 current ops/sec;
[READ: Count=1000, Max=144383, Min=1209, Avg=2206.44, 90=2645, 99=5015,
99.9=12319, 99.99=144383] [READ-MODIFY-WRITE: Count=534, Max=26287,
Min=4428, Avg=6450.89, 90=7883, 99=12735, 99.9=17295, 99.99=26287]
[CLEANUP: Count=1, Max=4419, Min=4416, Avg=4418, 90=4419, 99=4419,
99.9=4419, 99.99=4419] [UPDATE: Count=534, Max=19647, Min=2928,
Avg=4348.64, 90=5363, 99=7423, 99.9=12319, 99.99=19647]
[OVERALL], RunTime(ms), 5582
[OVERALL], Throughput(ops/sec), 179.14725904693657
[TOTAL_GCS_G1_Young_Generation], Count, 5
[TOTAL_GC_TIME_G1_Young_Generation], Time(ms), 53
[TOTAL_GC_TIME_%_G1_Young_Generation], Time(%), 0.9494804729487639
[TOTAL_GCS_G1_Old_Generation], Count, 0
```

[TOTAL_GC_TIME_G1_Old_Generation], Time(ms), 0
[TOTAL_GC_TIME_%_G1_Old_Generation], Time(%), 0.0
[TOTAL_GCs], Count, 5
[TOTAL_GC_TIME], Time(ms), 53
[TOTAL_GC_TIME_%], Time(%), 0.9494804729487639
[READ], Operations, 1000
[READ], AverageLatency(us), 2206.441
[READ], MinLatency(us), 1209
[READ], MaxLatency(us), 144383
[READ], 95thPercentileLatency(us), 3111
[READ], 99thPercentileLatency(us), 5015
[READ], Return=OK, 1000
[READ-MODIFY-WRITE], Operations, 534
[READ-MODIFY-WRITE], AverageLatency(us), 6450.89138576779
[READ-MODIFY-WRITE], MinLatency(us), 4428
[READ-MODIFY-WRITE], MaxLatency(us), 26287
[READ-MODIFY-WRITE], 95thPercentileLatency(us), 8671
[READ-MODIFY-WRITE], 99thPercentileLatency(us), 12735
[CLEANUP], Operations, 1
[CLEANUP], AverageLatency(us), 4418.0
[CLEANUP], MinLatency(us), 4416
[CLEANUP], MaxLatency(us), 4419
[CLEANUP], 95thPercentileLatency(us), 4419
[CLEANUP], 99thPercentileLatency(us), 4419
[UPDATE], Operations, 534
[UPDATE], AverageLatency(us), 4348.63670411985
[UPDATE], MinLatency(us), 2928
[UPDATE], MaxLatency(us), 19647
[UPDATE], 95thPercentileLatency(us), 5979
[UPDATE], 99thPercentileLatency(us), 7423
[UPDATE], Return=OK, 534