

# Cómputo de Alto Desempeño

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## 1 Introducción

Este documento describe la ejecución de pruebas de rendimiento utilizando Sysbench para evaluar la capacidad de procesamiento de una infraestructura de base de datos MariaDB.

## 2 Instalación y Configuración del Entorno

Para realizar las pruebas de rendimiento, se debe instalar y configurar MariaDB junto con Sysbench en la infraestructura de prueba. Los pasos son los siguientes:

### 2.1 Instalación de VirtualBox y Ubuntu Server 24.04.1

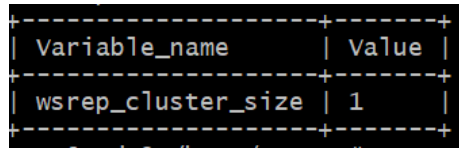
Se debe instalar VirtualBox y configurar una máquina virtual con Ubuntu Server 24.04.1.

### 2.2 Instalación de Herramientas y Dependencias

```
apt -y install net-tools
apt -y install software-properties-common
apt update
apt -y install mariadb-server mariadb-client galera-4
apt -y install galera-arbitrator-4
apt -y install mariadb-client libmariadb3
```

### 2.3 Configuración y Arranque de MariaDB

```
systemctl stop mysql
systemctl status mysql
vi /etc/mysql/mariadb.conf.d/60-galera.cnf
galera_new_cluster
mysql -u root -p -e "SHOW-STATUS-LIKE- 'wsrep_cluster_size'"
```



Variable_name	Value
wsrep_cluster_size	1

Figure 1: Creación del Cluster

```
mysql -u root --execute="SHOW GLOBAL STATUS WHERE Variable_name IN ( 'wsrep_ready'
netstat -tlpn
```

## 2.4 Instalación de Sysbench y Creación de Base de Datos

```
apt -y install sysbench
mysql -uroot -p -e "create database sbtest"
```

## 2.5 Preparación de las Pruebas en Sysbench

```
sysbench --threads=1 --db-driver=mysql --mysql-user=root --events=0 oltp_read_o
```

## 2.6 Ejecución de Pruebas

```
sysbench --threads=1 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --e
```

## 2.7 Configuración de Red

Después de la instalación y configuración, se debe cambiar la configuración de red a "solo-anfitrión" en VirtualBox.

# 3 Set de Pruebas de Sysbench

Las pruebas se ejecutaron con los siguientes tipos de carga:

- bulk\_insert
- oltp\_delete
- oltp\_insert
- oltp\_point\_select
- oltp\_read\_only
- oltp\_read\_write

- oltp\_update\_index
- oltp\_update\_non\_index
- oltp\_write\_only
- select\_random\_points
- select\_random\_ranges

## 4 Resultados de Pruebas

### 4.1 OLTP Delete

```
root@mysql:/home/epiops# sysbench --threads=1 --rand= --rand= --db-driver=mysql --mysql-user=root --mysql-host=localhost --mysql-port=3306 --oltp_delete run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
number of threads: 1
initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
queries performed:
  read:          0
  write:         0
  other:        81818
  total:        81818
transactions:    81818 (1000.00 per sec.)
queries:        81818 (1000.00 per sec.)
ignored errors: 0 (0.00 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      60.0039s
total number of events: 81819

Latency (ms):
min:            0.01
avg:            0.99
max:           18.46
95th percentile: 18.46
sum:           59841.50

Threads fairness:
events (avg/stddev): 81818.0000/0.00
execution time (avg/stddev): 59.9999/0.00
```

Figure 2: OLTP Delete 1 núcleo

```
root@mysql:/home/epiops# sysbench --threads=2 --rand= --rand= --db-driver=mysql --mysql-user=root --mysql-host=localhost --mysql-port=3306 --oltp_delete run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
number of threads: 2
initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
queries performed:
  read:          0
  write:         47
  other:       836840
  total:       836887
transactions:   836887 (13118.11 per sec.)
queries:       836887 (13118.11 per sec.)
ignored errors: 0 (0.00 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      60.1133s
total number of events: 836887

Latency (ms):
min:            0.01
avg:            0.14
max:           180.86
95th percentile: 0.15
sum:          118756.76

Threads fairness:
events (avg/stddev): 418443.5000/777.10
execution time (avg/stddev): 59.3784/0.01
```

Figure 3: OLTP Delete 2 núcleos

### 4.2 OLTP Insert

```
root@mysql:/home/epiops# sysbench --threads=1 --rand= --rand= --db-driver=mysql --mysql-user=root --mysql-host=localhost --mysql-port=3306 --oltp_insert run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
number of threads: 1
initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
queries performed:
  read:          0
  write:       19681
  other:         0
  total:       19681
transactions:    9840 (100.00 per sec.)
queries:        9840 (100.00 per sec.)
ignored errors: 0 (0.00 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      60.0039s
total number of events: 9841

Latency (ms):
min:            1.01
avg:            8.27
max:           18.46
95th percentile: 18.46
sum:          19920.29

Threads fairness:
events (avg/stddev): 9841.0000/0.00
execution time (avg/stddev): 59.9999/0.00
```

Figure 4: OLTP Insert 1 núcleo

```
root@mysql:/home/epiops# sysbench --threads=2 --rand= --rand= --db-driver=mysql --mysql-user=root --mysql-host=localhost --mysql-port=3306 --oltp_insert run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
number of threads: 2
initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
queries performed:
  read:          0
  write:      11470
  other:         0
  total:      11470
transactions:   11470 (131.11 per sec.)
queries:       11470 (131.11 per sec.)
ignored errors: 0 (0.00 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      60.0027s
total number of events: 11470

Latency (ms):
min:            0.93
avg:           10.45
max:           98.14
95th percentile: 22.28
sum:          119872.63

Threads fairness:
events (avg/stddev): 5735.0000/13.00
execution time (avg/stddev): 59.9383/0.01
```

Figure 5: OLTP Insert 2 núcleos

## 4.3 OLTP Point Select

```
root@mod02:/home/garpu# sysbench --threads=2 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --events=0 oltp_point_select run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
  queries performed:
    read:          32005
    write:         0
    other:         0
    total:         32005
  transactions:    32005 (8764.11 per sec.)
  queries:         32005 (8764.11 per sec.)
  ignored errors:  0 (0.00 per sec.)
  reconnects:      0 (0.00 per sec.)

General statistics:
  total time:      60.0099s
  total number of events: 32005

Latency (ms):
  min:            0.01
  max:            37.04
  avg:            10.42
  95th percentile: 10.15
  sum:            93023.12

Threads Fairness:
  events (avg/stddev): 32005.0000/0.00
  execution time (avg/stddev): 59.9713/0.00
```

Figure 6: OLTP Point Select 1 núcleo

```
root@mod02:/home/garpu# sysbench --threads=2 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --events=0 oltp_point_select run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
  queries performed:
    read:          61280
    write:         0
    other:         0
    total:         61280
  transactions:    61280 (13338.14 per sec.)
  queries:         61280 (13338.14 per sec.)
  ignored errors:  0 (0.00 per sec.)
  reconnects:      0 (0.00 per sec.)

General statistics:
  total time:      60.0099s
  total number of events: 61280

Latency (ms):
  min:            0.01
  max:            104.42
  avg:            10.15
  95th percentile: 10.15
  sum:            118756.22

Threads Fairness:
  events (avg/stddev): 40639.0000/1726.00
  execution time (avg/stddev): 59.9713/0.00
```

Figure 7: OLTP Point Select 2 núcleos

## 4.4 OLTP Read Only

```
root@mod02:/home/garpu# sysbench --threads=2 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --events=0 oltp_read_only run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
  queries performed:
    read:          42890
    write:         0
    other:         0
    total:         42890
  transactions:    21445 (707.55 per sec.)
  queries:         42890 (707.55 per sec.)
  ignored errors:  0 (0.00 per sec.)
  reconnects:      0 (0.00 per sec.)

General statistics:
  total time:      60.0326s
  total number of events: 21445

Latency (ms):
  min:            0.35
  max:            190.75
  avg:            4.13
  95th percentile: 4.13
  sum:            119855.37

Threads Fairness:
  events (avg/stddev): 21445.0000/0.00
  execution time (avg/stddev): 59.9277/0.01
```

Figure 8: OLTP Read Only 1 núcleo

```
root@mod02:/home/garpu# sysbench --threads=2 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --events=0 oltp_read_only run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
  queries performed:
    read:          58492
    write:         0
    other:         0
    total:         58492
  transactions:    29246 (707.55 per sec.)
  queries:         58492 (707.55 per sec.)
  ignored errors:  0 (0.00 per sec.)
  reconnects:      0 (0.00 per sec.)

General statistics:
  total time:      60.0326s
  total number of events: 29246

Latency (ms):
  min:            0.35
  max:            190.75
  avg:            4.13
  95th percentile: 4.13
  sum:            119855.37

Threads Fairness:
  events (avg/stddev): 21239.0000/46.00
  execution time (avg/stddev): 59.9277/0.01
```

Figure 9: OLTP Read Only 2 núcleos

## 4.5 OLTP Read Write

```
root@mod02:/home/garpu# sysbench --threads=2 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --events=0 oltp_read_write run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
  queries performed:
    read:          46200
    write:         13124
    other:         0
    total:         59324
  transactions:    29562 (14.99 per sec.)
  queries:         59324 (14.99 per sec.)
  ignored errors:  0 (0.00 per sec.)
  reconnects:      0 (0.00 per sec.)

General statistics:
  total time:      60.0326s
  total number of events: 59324

Latency (ms):
  min:            2.20
  max:            107.19
  avg:            10.15
  95th percentile: 10.15
  sum:            119855.37

Threads Fairness:
  events (avg/stddev): 29562.0000/0.00
  execution time (avg/stddev): 59.9712/0.00
```

Figure 10: OLTP Read Write 1 núcleo

```
root@mod02:/home/garpu# sysbench --threads=2 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --events=0 oltp_read_write run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
  queries performed:
    read:          80822
    write:         19209
    other:         0
    total:         100031
  transactions:    50015 (14.99 per sec.)
  queries:         100031 (14.99 per sec.)
  ignored errors:  0 (0.00 per sec.)
  reconnects:      0 (0.00 per sec.)

General statistics:
  total time:      60.0326s
  total number of events: 100031

Latency (ms):
  min:            2.47
  max:            107.19
  avg:            10.15
  95th percentile: 10.15
  sum:            119855.37

Threads Fairness:
  events (avg/stddev): 2880.0000/95.00
  execution time (avg/stddev): 59.9759/0.00
```

Figure 11: OLTP Read Write 2 núcleos

## 4.6 OLTP Update Index

```
root@node2:/home/egorov# sysbench --threads=1 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --event=oltp_update_index
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 1
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
queries performed:
  read:          0
  write:         60423
  other:         1661
  total:        62084
transactions:    13317 (222.94 per sec.)
queries:        13317 (222.94 per sec.)
ignored errors:  0 (0.00 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      60.0000s
total number of events: 13317

Latency (ms):
min:            0.02
avg:            6.35
max:           20.46
95th percentile: 19937.88

Threads fairness:
events (avg/stddev): 13317.0000/0.00
execution time (avg/stddev): 60.00/0.00
```

Figure 12: OLTP Update Index 1 núcleo

```
root@node2:/home/egorov# sysbench --threads=2 --time=60 --rate=0 --db-driver=mysql --mysql-user=root --event=oltp_update_index run
sysbench 1.0.20 (using system LuaJIT 2.1.0-beta3)

Running the test with following options:
Number of threads: 2
Initializing random number generator from current time

Initializing worker threads...

Threads started!

SQL statistics:
queries performed:
  read:          0
  write:        13692
  other:         2071
  total:        15763
transactions:    13692 (228.12 per sec.)
queries:        13692 (228.12 per sec.)
ignored errors:  0 (0.00 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      60.0197s
total number of events: 13692

Latency (ms):
min:            0.02
avg:            6.76
max:           20.74
95th percentile: 119949.67

Threads fairness:
events (avg/stddev): 6846.0000/26.00
execution time (avg/stddev): 59.9749/0.00
```

Figure 13: OLTP Update Index 2 núcleos

A continuación, se presenta la comparación del desempeño entre la ejecución de pruebas con 1 núcleo y 2 núcleos en Sysbench:

## 5 Conclusiones

Las pruebas realizadas con Sysbench permitieron evaluar el impacto del número de cores en el rendimiento de MariaDB. Se observó que, en todas las cargas de trabajo analizadas, el uso de 2 cores proporcionó una mejora significativa en el número de transacciones procesadas por segundo.

Estos resultados sugieren que, para entornos de bases de datos que requieren alto rendimiento, es recomendable configurar instancias con más de un core. Además, las pruebas resaltan la importancia de ajustar los parámetros de configuración según el tipo de carga de trabajo para optimizar el desempeño.

Table 1: Comparación del rendimiento entre 1 núcleo y 2 núcleos en Sysbench.

Prueba	1 Núcleo	2 Núcleos
OLTP Delete	60423	836887
OLTP Insert	9661	11470
OLTP Point Select	526058	812580
OLTP Read Only	29885	42478
OLTP Read Write	3300	5770
OLTP Update Index	13317	13692
OLTP Update Non-Index	11670	12785
OLTP Write Only	6800	7711
Select Random Points	3679	452193
Select Random Ranges	4285	477519