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# Galera 4 Clúster con MariaDB en Linux

ASIGNATURA:

Cómputo de alto desempeño

PROGRAMA EDUCATIVO:

Ingeniería en Datos e Inteligencia Organizacional

## Creación de un Clúster con Galera 4 y Pruebas de Rendimiento con Sysbench

Este documento es un reporte en donde se podrá observar el proceso de implementación de un clúster de bases de datos en Ubuntu Server utilizando Galera 4 y MariaDB, así como la ejecución de pruebas de rendimiento mediante Sysbench.

### Software Utilizado:

- VirtualBox: Para la virtualización del servidor.
- Ubuntu Server: Sistema operativo base.
- MariaDB: Sistema de gestión de bases de datos.
- Galera 4: Herramienta para la creación de clústeres de bases de datos.
- Sysbench: Utilidad para realizar pruebas de rendimiento.
- OpenSSH: Para la conexión remota al servidor.
- CMD de Windows: Desde aquí se ejecutaron los comandos para interactuar con el servidor.

### Pasos:

**1. Instalación del Servidor Ubuntu Server:** Se configuró una máquina virtual con un núcleo de procesador (1 core) para simular un entorno básico. En donde se la red NAT habilitó para permitir la descarga de paquetes necesarios desde internet. También se configuró el Port Forwarding para permitir conexiones SSH desde el host hacia la máquina virtual.

**2. Configuración Inicial del Sistema:** Se instaló y habilitó el servidor SSH para permitir conexiones remotas, haciendo uso de los siguientes comandos:

```
sudo apt install openssh-server  
sudo apt update  
sudo apt -y install net-tools software-properties-common
```

Los cuales nos fueron de ayuda para actualizar la lista de paquetes disponibles e instalar las herramientas esenciales para la configuración del servidor.

**3. Instalación y Configuración de Galera 4:** Se instalaron los paquetes necesarios para el clúster, con:

```
sudo apt -y install mariadb-server mariadb-client galera-4  
sudo apt -y install galera-arbitrator-4 mariadb-client libmariadb3
```

**4. Configuración del Clúster:** Se modificó el archivo de configuración de Galera con: `/etc/mysql/mariadb.conf.d/60-galera.cnf`. para definir los parámetros del clúster, como la dirección IP de los nodos y el nombre del clúster.

También se inicio del Clúster con:

*galera\_new\_cluster*

Para asegurar que el clúster se creó correctamente, se debe validar su funcionamiento haciendo uso de:

```
mysql -u root -p -e "SHOW STATUS LIKE 'wsrep_cluster_size'"
mysql -u root --execute="SHOW GLOBAL STATUS WHERE Variable_name IN ('wsrep_ready', 'wsrep_cluster_size', 'wsrep_cluster_status', 'wsrep_connected');"
```

Es necesario realizar una confirmación de que los puertos estuvieran abiertos:  
*netstat -tln*

**5. Instalación de Sysbench:** Se instaló sysbench la cual es una herramienta para realizar pruebas de rendimiento, usando:

```
sudo apt -y install sysbench
```

Se creó una base de datos para pruebas llamada sbtest para las pruebas, con:

```
mysql -u root -p -e "create database sbtest"
```

**6. Preparación del Entorno para Pruebas:** Se configuró el entorno para pruebas de sólo lectura, usando los siguientes códigos:

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

**7. Ejecución de Pruebas de Rendimiento**

Se realizaron pruebas de rendimiento con diferentes cargas de trabajo, tanto para un núcleo como para dos núcleos. Cada prueba tuvo una duración de 10 segundos.

Resumen de las Pruebas de Rendimiento						
Comando	Queries totales	Transacciones totales	Transacciones por segundo	Tiempo	Número total de eventos	Latencia Máxima(ms)
Oltp_read_only	206288	12893	1288.88	10.0017s	12893	35.69
Oltp_delete	141139	141139	14110.73	10.0007s	141139	194.42
Oltp_insert	5437	5437	543.40	10.0029s	5437	14.61

Resumen de las Pruebas de Rendimiento						
oltp_point_select	145184	145184	14498.20	10.0013s	145184	17.47
oltp_read_write	41578	2078	207.61	10.0072s	2078	37.13
oltp_update_index	6807	6807	680.43	10.0019s	6807	48.90
oltp_update_non_index	4788	4788	478.54	10.0035s	4788	139.04
oltp_write_only	17328	2888	288.59	10.0052s	2888	50.43
oltp_update_index	5393	5393	539.04	10.0029s	5393	29.88
oltp_update_non_index	5632	5632	562.80	10.0049s	5632	53.79
select_random_points	78220	78220	7814.94	10.0021s	78220	17.07
select_random_ranges	79321	79321	7926.68	10.0026s	79321	8.68

sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 bulk\_insert run

```
root@nodol: /home/yari
Threads fairness:
  events (avg/stddev):    6446.5000/91.50
  execution time (avg/stddev):  9.9849/0.00

root@nodol:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=
root --events=0 bulk_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!

FATAL: mysql_drv_query() returned error 1146 (Table 'sbtest.sbtest2' doesn't exist) for query
'INSERT INTO sbtest VALUES(1,1),(2,2),(3,3),(4,4),(5,5),(6,6),(7,7),(8,8),(9,9),(10,10),(11,1
1),(12,12),(13,13),(14,14),(15,15),(16,16),(17,17),(18,18),(19,19),(20,20),(21,21),(22,22),(23
,23),(24,24),(25,25),(26,26),(27,27),(28,28),(29,29),(30,30),(31,31),(32,32),(33,33),(34,34),(3
5,35),(36,36),(37,37),(38,38),(39,39),(40,40),(41,41),(42,42),(43,43),(44,44),(45,45),(46,46)
(47,47),(48,48),(49,49),(50,50),(51,51),(52,52),(53,53),(54,54),(55,55),(56,56),(57,57),(58,5
8),(59,59),(60,60),(61,61),(62,62),(63,63),(64,64),(65,65),(66,66),(67,67),(68,68),(69,69),(70
,70),(71,71),(72,72),(73,73),(74,74),(75,75),(76,76),(77,77),(78,78),(79,79),(80,80),(81,81),(
82,82),(83,83),(84,84),(85,85),(86,86),(87,87),(88,88),(89,89),(90,90),(91,91),(92,92),(93,93)
(94,94),(95,95),(96,96),(97,97),(98,98),(99,99),(100,100),(101,101),(102,102),(103,103),(104,
104),(105,105),(106,106),(107,107),(108,108),(109,109),(110,110),(111,111),(112,112),(113,113)
(114,114),(115,115),(116,116),(117,117),(118,118),(119,119),(120,120),(121,121),(122,122),(12
3,123),(124,124),(125,125),(126,126),(127,127),(128,128),(129,129),(130,130),(131,131),(132,13
2),(133,133),(134,134),(135,135),(136,136),(137,137),(138,138),(139,139),(140,140),(141,141),(
142,142),(143,143),(144,144),(145,145),(146,146),(147,147),(148,148),(149,149),(150,150),(151,
151),(152,152),(153,153),(154,154),(155,155),(156,156),(157,157),(158,158),(159,159),(160,160)
(161,161),(162,162),(163,163),(164,164),(165,165),(166,166),(167,167),(168,168),(169,169),(17
0,170),(171,171),(172,172),(173,173),(174,174),(175,175),(176,176),(177,177),(178,178),(179,17
9),(180,180),(181,181),(182,182),(183,183),(184,184),(185,185),(186,186),(187,187),(188,188),(
189,189),(190,190),(191,191),(192,192),(193,193),(194,194),(195,195),(196,196),(197,197),(198,
198),(199,199),(200,200),(201,201),(202,202),(203,203),(204,204),(205,205),(206,206),(207,207)
(208,208),(209,209),(210,210),(211,211),(212,212),(213,213),(214,214),(215,215),(216,216),(21
7,217),(218,218),(219,219),(220,220),(221,221),(222,222),(223,223),(224,224),(225,225),(226,22
6),(227,227),(228,228),(229,229),(230,230),(231,231),(232,232),(233,233),(234,234),(235,235),(
236,236),(237,237),(238,238),(239,239),(240,240),(241,241),(242,242),(243,243),(244,244),(245,
245),(246,246),(247,247),(248,248),(249,249),(250,250),(251,251),(252,252),(253,253),(254,254)
(255,255),(256,256),(257,257),(258,258),(259,259),(260,260),(261,261),(262,262),(263,263),(26
4,264),(265,265),(266,266),(267,267),(268,268),(269,269),(270,270),(271,271),(272,272),(273,27
3),(274,274),(275,275),(276,276),(277,277),(278,278),(279,279),(280,280),(281,281),(282,282),(
283,283),(284,284),(285,285),(286,286),(287,287),(288,288),(289,289),(290,290),(291,291),(292,
292),(293,293),(294,294),(295,295),(296,296),(297,297),(298,298),(299,299),(300,300),(301,301)
292),(293,293),(294,294),(295,295),(296,296),(297,297),(298,298),(299,299),(300,300),(301,301)

yari@nodol: ~
top - 07:08:41 up 18 min, 2 users, load average: 0.01, 0.03, 0.00
Tasks: 113 total, 1 running, 112 sleeping, 0 stopped, 0 zombie
%Cpu0 :  0.0 us,  0.0 sy,  0.0 ni,100.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Mem :  0.0 us,  0.7 sy,  0.0 ni, 99.3 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem : 3890.1 total, 3354.1 free, 520.9 used, 230.8 buff/cache
MiB Swap: 3890.0 total, 3890.0 free,  0.0 used, 3369.2 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR   S  %CPU  %MEM    TIME+  COMMAND
    25 root        20   0       0       0       0   I  0.7   0.0   0:03.40 kworker/1:0-events
  1155 yari        20   0   11936   5888   3712  R  0.7   0.1   0:01.74 top
    16 root        20   0   22268   13180  9468  S  0.0   0.3   0:01.67 systemd
    27 root        20   0       0       0       0   S  0.0   0.0   0:00.01 kthreadd
    37 root        20   0       0       0       0   S  0.0   0.0   0:00.00 pool_workqueue_release
    47 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-rcu_g
    57 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-rcu_p
    67 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-slab
    77 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-nets
   107 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/0:0H-events_h+
   117 root        20   0       0       0       0   I  0.0   0.0   0:00.55 kworker/u4:0-events_p+
   127 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-mm_pe
   137 root        20   0       0       0       0   I  0.0   0.0   0:00.00 rcu_tasks_kthreadd
   147 root        20   0       0       0       0   I  0.0   0.0   0:00.00 rcu_tasks_rude_kthreadd
   157 root        20   0       0       0       0   I  0.0   0.0   0:00.00 rcu_tasks_trace_kthre+
   167 root        20   0       0       0       0   S  0.0   0.0   0:00.03 ksoffirqd/0
   177 root        20   0       0       0       0   I  0.0   0.0   0:00.11 rcu_preempt
   187 root        rt    0       0       0       0   S  0.0   0.0   0:00.00 migration/0
   197 root       -51    0       0       0       0   S  0.0   0.0   0:00.00 idle_inject/0
   207 root        20   0       0       0       0   S  0.0   0.0   0:00.00 cpuph/0
   217 root        20   0       0       0       0   S  0.0   0.0   0:00.00 cpuph/1
   227 root       -51    0       0       0       0   S  0.0   0.0   0:00.00 idle_inject/1
   237 root        rt    0       0       0       0   S  0.0   0.0   0:00.48 migration/1
   247 root        20   0       0       0       0   S  0.0   0.0   0:00.06 ksoffirqd/1
   257 root        20   0       0       0       0   I  0.0   0.0   0:00.01 kdevtmpfs
   267 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-inet_
   307 root        20   0       0       0       0   S  0.0   0.0   0:00.00 kauditd
   317 root        20   0       0       0       0   S  0.0   0.0   0:00.00 khungtaskd
   327 root        20   0       0       0       0   S  0.0   0.0   0:00.00 oom_reaper
   337 root        20   0       0       0       0   I  0.0   0.0   0:00.25 kworker/u4:2-Flush-25+
   347 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-write
   357 root        20   0       0       0       0   S  0.0   0.0   0:00.05 kcompactd0
   367 root        25   5       0       0       0   S  0.0   0.0   0:00.00 ksm
   377 root        20   0       0       0       0   I  0.0   0.0   0:00.45 kworker/1:1-cgroup_de+
   387 root        39  19       0       0       0   S  0.0   0.0   0:00.00 khugepaged
   397 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-kint
   407 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-kblc
   417 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-blkc
   427 root       -51    0       0       0       0   S  0.0   0.0   0:00.00 irq/8-acpi
   437 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-tpm_d
   447 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-ata_s
```

sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp\_read\_only run

```
root@nodol: /home/yari
Proto Recv-Q Send-Q Local Address          Foreign Address         State       PID/Program name
tcp        0      0 0.0.0.0:53:53         0.0.0.0:*               LISTEN      579/systemd-re
tcp        0      0 0.0.0.0:4567          0.0.0.0:*               LISTEN      931/mariadb
tcp        0      0 0.0.0.0:54:53         0.0.0.0:*               LISTEN      579/systemd-re
tcp        0      0 0.0.0.0:1:13306       0.0.0.0:*               LISTEN      931/mariadb
tcp6       0      0 :::22                 :::*                   LISTEN      1/init

root@nodol:/home/yari# sysbench --threads=2 --time=10 --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...

SQL statistics:
  queries performed:
    read:          180502
    write:         0
    other:         25786
    total:         206288
  transactions:   12893 (1288.88 per sec.)
  queries:       206288 (20622.06 per sec.)
  ignored errors: 0 (0.00 per sec.)
  reconnects:    0 (0.00 per sec.)

General statistics:
  total time:      10.0017s
  total number of events: 12893

Latency (ms):
  min:            1.20
  avg:            1.55
  max:            35.69
  95th percentile: 1.96
  sum:            19969.89

Threads fairness:
  events (avg/stddev):    6446.5000/91.50

yari@nodol: ~
top - 07:03:43 up 13 min, 2 users, load average: 0.39, 0.08, 0.03
Tasks: 112 total, 1 running, 111 sleeping, 0 stopped, 0 zombie
%Cpu0 :  0.3 us,  0.0 sy,  0.0 ni, 99.7 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Mem :  0.0 us,  0.7 sy,  0.0 ni, 99.3 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem : 3890.1 total, 3373.9 free, 501.7 used, 230.1 buff/cache
MiB Swap: 3890.0 total, 3890.4 free,  0.0 used, 3388.4 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR   S  %CPU  %MEM    TIME+  COMMAND
    25 root        20   0       0       0       0   I  0.7   0.0   0:02.48 kworker/1:0-events
  1145 yari        20   0   15124   6960   4992  S  0.3   0.2   0:00.16 sshd
  1155 yari        20   0   11936   5888   3712  R  0.3   0.1   0:01.21 top
    16 root        20   0   22268   13180  9468  S  0.0   0.3   0:01.86 systemd
    27 root        20   0       0       0       0   S  0.0   0.0   0:00.01 kthreadd
    37 root        20   0       0       0       0   S  0.0   0.0   0:00.00 pool_workqueue_release
    47 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-rcu_g
    57 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-rcu_p
    67 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-slab
    77 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-nets
   107 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/0:0H-events_h+
   117 root        20   0       0       0       0   I  0.0   0.0   0:00.51 kworker/u4:0-events_p+
   127 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-mm_pe
   137 root        20   0       0       0       0   I  0.0   0.0   0:00.00 rcu_tasks_kthreadd
   147 root        20   0       0       0       0   I  0.0   0.0   0:00.00 rcu_tasks_rude_kthreadd
   157 root        20   0       0       0       0   I  0.0   0.0   0:00.00 rcu_tasks_trace_kthre+
   167 root        20   0       0       0       0   S  0.0   0.0   0:00.03 ksoffirqd/0
   177 root        20   0       0       0       0   I  0.0   0.0   0:00.11 rcu_preempt
   187 root        rt    0       0       0       0   S  0.0   0.0   0:00.00 migration/0
   197 root       -51    0       0       0       0   S  0.0   0.0   0:00.00 idle_inject/0
   207 root        20   0       0       0       0   S  0.0   0.0   0:00.00 cpuph/0
   217 root        20   0       0       0       0   S  0.0   0.0   0:00.00 cpuph/1
   227 root       -51    0       0       0       0   S  0.0   0.0   0:00.00 idle_inject/1
   237 root        rt    0       0       0       0   S  0.0   0.0   0:00.47 migration/1
   247 root        20   0       0       0       0   S  0.0   0.0   0:00.06 ksoffirqd/1
   257 root        20   0       0       0       0   I  0.0   0.0   0:00.01 kdevtmpfs
   267 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-inet_
   307 root        20   0       0       0       0   S  0.0   0.0   0:00.00 kauditd
   317 root        20   0       0       0       0   S  0.0   0.0   0:00.00 khungtaskd
   327 root        20   0       0       0       0   S  0.0   0.0   0:00.00 oom_reaper
   337 root        20   0       0       0       0   I  0.0   0.0   0:00.16 kworker/u4:2-events_p+
   347 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-write
   357 root        20   0       0       0       0   S  0.0   0.0   0:00.04 kcompactd0
   367 root        25   5       0       0       0   S  0.0   0.0   0:00.00 ksm
   377 root        20   0       0       0       0   I  0.0   0.0   0:00.45 kworker/1:1-cgroup_de+
   387 root        39  19       0       0       0   S  0.0   0.0   0:00.00 khugepaged
   397 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-kint
   407 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-kblc
   417 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-blkc
   427 root       -51    0       0       0       0   S  0.0   0.0   0:00.00 irq/8-acpi
   437 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-tpm_d
   447 root        0 -20    0       0       0   I  0.0   0.0   0:00.00 kworker/R-ata_s
```

sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp\_delete run

```
root@nodo1: /home/yari
(329,329), (330,330), (331,331), (332,332), (333,333), (334,334), (335,335), (336,336), (337,337), (338,338), (339,339), (340,340), (341,341), (342,342), (343,343), (344,344), (345,345), (346,346), (347,347), (348,348), (349,349), (350,350), (351,351), (352,352), (353,353), (354,354), (355,355), (356,356), (357,357), (358,358), (359,359), (360,360), (361,361), (362,362), (363,363), (364,364), (365,365), (366,366), (367,367), (368,368), (369,369), (370,370), (371,371), (372,372), (373,373), (374,374), (375,375), (376,376), (377,377), (378,378), (379,379), (380,380), (381,381), (382,382), (383,383), (384,384), (385,385), (386,386), (387,387), (388,388), (389,389), (390,390), (391,391), (392,392), (393,393), (394,394), (395,395), (396,396), (397,397), (398,398), (399,399), (400,400), (401,401), (402,402), (403,403), (404,404), (405,405), (406,406), (407,407), (408,408), (409,409), (410,410), (411,411), (412,412), (413,413), (414,414), (415,415), (416,416), (417,417), (418,418), (419,419) FATAL: 'thread_run' function failed: /usr/share/sysbench/bulk_insert.lua:38: db_bulk_insert_next() failed
root@nodo1: /home/yari# AC
root@nodo1: /home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root --events=0 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:         2101
    other:         139038
    total:         141139
  transactions:   141139 (14110.73 per sec.)
  queries:        141139 (14110.73 per sec.)
  ignored errors: 0 (0.00 per sec.)
  reconnects:     0 (0.00 per sec.)

General statistics:
  total time:      10.0007s
  total number of events: 141139

Latency (ms):
  min:            0.06
  avg:            0.14
  max:            194.42
  95th percentile: 0.24
  sum:            19871.42

Threads fairness:
  events (avg/stddev): 70569.5000/363.50

yari@nodo1: ~
top - 07:17:54 up 27 min, 2 users, load average: 0.12, 0.03, 0.01
Tasks: 111 total, 1 running, 110 sleeping, 0 stopped, 0 zombie
%Cpu0 :  0.0 us,  0.3 sy,  0.0 ni, 99.7 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Cpu1 :  0.0 us,  0.4 sy,  0.0 ni, 99.6 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem : 3890.1 total, 3346.4 free, 526.2 used, 233.3 buff/cache
MiB Swap: 3890.0 total, 3890.0 free,  0.0 used, 3363.9 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR   S  %CPU  %MEM     TIME+ COMMAND
    25 root        20   0      0      0      0   I   0.7   0.0   0:05.25 kworker/1:0-mm_percpu+
  1155 yari        20   0  11936   5888   3712   R   0.3   0.1   0:02.68 top
  1369 root        20   0      0      0      0   I   0.3   0.0   0:01.16 kworker/0:3-events
    1 root        20   0  22268  13180  9468   S   0.0   0.3   0:01.88 systemd
    2 root        20   0      0      0      0   S   0.0   0.0   0:00.01 kthreadd
    3 root        20   0      0      0      0   S   0.0   0.0   0:00.00 pool_workqueue_release
    4 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-rcu_g
    5 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-rcu_p
    6 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-slub
    7 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-nets
   10 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/0:0H-events_h+
   11 root        0 -20   0      0      0   I   0.0   0.0   0:00.60 kworker/u4:0-events_p+
   12 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-mm_pe
   13 root        20   0      0      0      0   I   0.0   0.0   0:00.00 rcu_tasks_kthread
   14 root        20   0      0      0      0   I   0.0   0.0   0:00.00 rcu_tasks_rude_kthread
   15 root        20   0      0      0      0   I   0.0   0.0   0:00.00 rcu_tasks_trace_kthre+
   16 root        20   0      0      0      0   S   0.0   0.0   0:00.03 ksoftirqd/0
   17 root        20   0      0      0      0   I   0.0   0.0   0:00.12 rcu_preempt
   18 root        rt    0      0      0      0   S   0.0   0.0   0:00.01 migration/0
   19 root       -51   0      0      0      0   S   0.0   0.0   0:00.00 idle_inject/0
   20 root        20   0      0      0      0   S   0.0   0.0   0:00.00 cpuhp/0
   21 root        20   0      0      0      0   S   0.0   0.0   0:00.00 cpuhp/1
   22 root       -51   0      0      0      0   S   0.0   0.0   0:00.00 idle_inject/1
   23 root        rt    0      0      0      0   S   0.0   0.0   0:00.48 migration/1
   24 root        20   0      0      0      0   S   0.0   0.0   0:00.07 ksoftirqd/1
   27 root        20   0      0      0      0   S   0.0   0.0   0:00.01 kdevtmpfs
   28 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-inet_
   30 root        20   0      0      0      0   S   0.0   0.0   0:00.00 kauditd
   31 root        20   0      0      0      0   S   0.0   0.0   0:00.00 kungtaskd
   32 root        20   0      0      0      0   S   0.0   0.0   0:00.00 oom_reaper
   34 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-write
   35 root        20   0      0      0      0   S   0.0   0.0   0:00.08 kcompactd0
   36 root       25   5      0      0      0   S   0.0   0.0   0:00.00 ksmd
   38 root       39  19      0      0      0   S   0.0   0.0   0:00.00 khugepaged
   39 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-kint
   40 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-kblc
   41 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-blkc
   42 root       -51   0      0      0      0   S   0.0   0.0   0:00.00 irq/9-acpi
   43 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-tpm_d
   44 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-ata_s
   45 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-md
   46 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-edac-
```

sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp\_insert run

```
root@nodo1: /home/yari
Latency (ms):
  min:            0.06
  avg:            0.14
  max:            194.42
  95th percentile: 0.24
  sum:            19871.42

Threads fairness:
  events (avg/stddev): 70569.5000/363.50
  execution time (avg/stddev): 9.9357/0.00

root@nodo1: /home/yari# AC
root@nodo1: /home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root --events=0 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:         5437
    other:          0
    total:         5437
  transactions:   5437 (543.40 per sec.)
  queries:        5437 (543.40 per sec.)
  ignored errors: 0 (0.00 per sec.)
  reconnects:     0 (0.00 per sec.)

General statistics:
  total time:      10.0029s
  total number of events: 5437

Latency (ms):
  min:            2.12
  avg:            3.66
  max:            14.61
  95th percentile: 6.21
  sum:            19914.79

Threads fairness:
  events (avg/stddev): 2718.5000/0.50

yari@nodo1: ~
top - 07:28:05 up 38 min, 2 users, load average: 0.11, 0.04, 0.01
Tasks: 111 total, 1 running, 110 sleeping, 0 stopped, 0 zombie
%Cpu0 :  0.0 us,  0.3 sy,  0.0 ni, 99.7 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Cpu1 :  0.0 us,  0.4 sy,  0.0 ni, 99.5 id,  0.0 wa,  0.0 hi,  1.1 si,  0.0 st
MiB Mem : 3890.1 total, 3338.7 free, 525.3 used, 242.6 buff/cache
MiB Swap: 3890.0 total, 3890.0 free,  0.0 used, 3364.8 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR   S  %CPU  %MEM     TIME+ COMMAND
    25 root        20   0      0      0      0   I   1.0   0.0   0:08.22 kworker/1:0-events
    1 root        20   0  22268  13308  9468   S   0.0   0.3   0:01.90 systemd
    2 root        20   0      0      0      0   S   0.0   0.0   0:00.01 kthreadd
    3 root        20   0      0      0      0   S   0.0   0.0   0:00.00 pool_workqueue_release
    4 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-rcu_g
    5 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-rcu_p
    6 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-slub
    7 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-nets
   10 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/0:0H-events_h+
   11 root        0 -20   0      0      0   I   0.0   0.0   0:00.76 kworker/u4:0-events_u+
   12 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-mm_pe
   13 root        20   0      0      0      0   I   0.0   0.0   0:00.00 rcu_tasks_kthread
   14 root        20   0      0      0      0   I   0.0   0.0   0:00.00 rcu_tasks_rude_kthread
   15 root        20   0      0      0      0   I   0.0   0.0   0:00.00 rcu_tasks_trace_kthre+
   16 root        20   0      0      0      0   S   0.0   0.0   0:00.04 ksoftirqd/0
   17 root        20   0      0      0      0   I   0.0   0.0   0:00.13 rcu_preempt
   18 root        rt    0      0      0      0   S   0.0   0.0   0:00.02 migration/0
   19 root       -51   0      0      0      0   S   0.0   0.0   0:00.00 idle_inject/0
   20 root        20   0      0      0      0   S   0.0   0.0   0:00.00 cpuhp/0
   21 root        20   0      0      0      0   S   0.0   0.0   0:00.00 cpuhp/1
   22 root       -51   0      0      0      0   S   0.0   0.0   0:00.00 idle_inject/1
   23 root        rt    0      0      0      0   S   0.0   0.0   0:00.48 migration/1
   24 root        20   0      0      0      0   S   0.0   0.0   0:00.11 ksoftirqd/1
   27 root        20   0      0      0      0   S   0.0   0.0   0:00.01 kdevtmpfs
   28 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-inet_
   30 root        20   0      0      0      0   S   0.0   0.0   0:00.00 kauditd
   31 root        20   0      0      0      0   S   0.0   0.0   0:00.00 kungtaskd
   32 root        20   0      0      0      0   S   0.0   0.0   0:00.00 oom_reaper
   34 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-write
   35 root        20   0      0      0      0   S   0.0   0.0   0:00.12 kcompactd0
   36 root       25   5      0      0      0   S   0.0   0.0   0:00.00 ksmd
   38 root       39  19      0      0      0   S   0.0   0.0   0:00.00 khugepaged
   39 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-kint
   40 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-kblc
   41 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-blkc
   42 root       -51   0      0      0      0   S   0.0   0.0   0:00.00 irq/9-acpi
   43 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-tpm_d
   44 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-ata_s
   45 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-md
   46 root        0 -20   0      0      0   I   0.0   0.0   0:00.00 kworker/R-edac-
```



sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp\_point\_select run

```
root@nod01:/home/yari# sysbench --threads=2 --time=10 --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:          145184
  write:         0
  other:         0
  total:        145184
transactions:   145184 (14498.20 per sec.)
queries:        145184 (14498.20 per sec.)
ignored errors: 0 (0.00 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      10.0013s
total number of events: 145184

Latency (ms):
min:             0.10
avg:             0.14
max:            17.47
95th percentile: 0.20
sum:            19820.19

Threads fairness:
events (avg/stddev): 72592.0000/498.00
```

```
yan@nod01:~$ top
top - 07:41:42 up 51 min, 2 users, load average: 0.13, 0.05, 0.01
Tasks: 112 total, 1 running, 111 sleeping, 0 stopped, 0 zombie
%Cpu0 :  0.3 us,  0.3 sy,  0.0 ni, 99.3 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Cpu1 :  0.0 us,  0.7 sy,  0.0 ni, 98.9 id,  0.0 wa,  0.0 hi,  0.4 si,  0.0 st
MiB Mem : 3890.1 total, 3338.4 free, 525.3 used, 242.3 buff/cache
MiB Swap: 3890.0 total, 3890.0 free,  0.0 used, 3364.8 avail Mem

  PID USER      PR  NI  VIRT  RES  SHR  S %CPU  %MEM    TIME+  COMMAND
 1307 root        20   0    0     0   0   0   I  0.7   0.0   0:04.67 kworker/1:3-events
 1115 yari       20   0 11936 5888 3712 R  0.3  0.1  0:06.71 top
1269 root        20   0    0     0   0   0   I  0.3   0.0   0:05.83 kworker/0:3-events
   1 root        20   0 22268 13308 9468 S  0.0  0.3   0:01.93 systemd
   2 root        20   0    0     0   0   0   S  0.0   0.0   0:00.01 kthread
   3 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 pool_workqueue_release
   4 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-rcu_g
   5 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-rcu_p
   6 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-slab
   7 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-netns
  10 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/0:0H-events_h+
  12 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-mm_pe
  13 root        20   0    0     0   0   0   I  0.0   0.0   0:00.00 rcu_tasks_kthread
  14 root        20   0    0     0   0   0   I  0.0   0.0   0:00.00 rcu_tasks_rude_kthread
  15 root        20   0    0     0   0   0   I  0.0   0.0   0:00.00 rcu_tasks_trace_kthre+
  16 root        20   0    0     0   0   0   S  0.0   0.0   0:00.04 ksoftirqd/0
  17 root        20   0    0     0   0   0   I  0.0   0.0   0:00.15 rcu_preempt
  18 root        rt    0    0     0   0   0   S  0.0   0.0   0:00.03 migration/0
  19 root       -51   0    0     0   0   0   S  0.0   0.0   0:00.00 idle_inject/0
  20 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 cpuhp/0
  21 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 cpuhp/1
  22 root       -51   0    0     0   0   0   S  0.0   0.0   0:00.00 idle_inject/1
  23 root        rt    0    0     0   0   0   S  0.0   0.0   0:00.50 migration/1
  24 root        20   0    0     0   0   0   S  0.0   0.0   0:00.13 ksoftirqd/1
  25 root        20   0    0     0   0   0   I  0.0   0.0   0:09.10 kworker/1:0-cgroup_de+
  27 root        20   0    0     0   0   0   S  0.0   0.0   0:00.01 kdevtmpfs
  28 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-inet_
  30 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 kauditd
  31 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 khungtaskd
  32 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 oom_reaper
  34 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-write
  35 root        20   0    0     0   0   0   S  0.0   0.0   0:00.21 kcompactd0
  36 root        25   5    0     0   0   0   S  0.0   0.0   0:00.00 ksmd
  38 root        39  19   0     0   0   0   S  0.0   0.0   0:00.00 khugepaged
  39 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-kinte
  40 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-tbloc
  41 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-bkcg
  42 root       -51   0    0     0   0   0   S  0.0   0.0   0:00.00 irq/9-acpi
  43 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-tpm_d
  44 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R-ata_s
```

sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp\_read\_write run

```
root@nod01:/home/yari# sysbench --threads=2 --time=10 --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:          29106
  write:         6745
  other:         5727
  total:        41578
transactions:   2078 (207.61 per sec.)
queries:        41578 (4153.91 per sec.)
ignored errors: 1 (0.10 per sec.)
reconnects:     0 (0.00 per sec.)

General statistics:
total time:      10.0072s
total number of events: 2078

Latency (ms):
min:             4.66
avg:             9.61
max:            37.13
95th percentile: 14.21
sum:            19973.89

Threads fairness:
events (avg/stddev): 1039.0000/4.00
execution time (avg/stddev): 9.9869/0.00
```

```
yari@nod01:~$ top
top - 07:50:39 up 1:00, 2 users, load average: 0.07, 0.08, 0.02
Tasks: 116 total, 1 running, 115 sleeping, 0 stopped, 0 zombie
Cpu0 :  0.0 us,  0.7 sy,  0.0 ni, 97.7 id,  1.3 wa,  0.0 hi,  0.0 si,  0.0 st
Cpu1 :  0.0 us,  0.7 sy,  0.0 ni, 98.5 id,  0.0 wa,  0.0 hi,  0.7 si,  0.0 st
MiB Mem : 3890.1 total, 3160.9 free, 664.8 used, 281.2 buff/cache
MiB Swap: 3890.0 total, 3890.0 free,  0.0 used, 3225.3 avail Mem

  PID USER      PR  NI  VIRT  RES  SHR  S %CPU  %MEM    TIME+  COMMAND
 1307 root        20   0    0     0   0   0   I  0.7   0.0   0:07.97 kworker/1:4+
 931 mysql     20   0 1739768 179748 36352 S  0.3  4.5   0:58.75 mariadb
 1155 yari       20   0 11936 5888 3712 R  0.3  0.1  0:08.49 top
1269 root        20   0    0     0   0   0   I  0.3   0.0   0:08.32 kworker/0:4+
   1 root        20   0 22268 13308 9468 S  0.0  0.3   0:02.01 systemd
   2 root        20   0    0     0   0   0   S  0.0   0.0   0:00.01 kthread
   3 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 pool_work+
   4 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R+
   5 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R+
   6 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R+
   7 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R+
  10 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/0+
  11 root        20   0    0     0   0   0   I  0.0   0.0   0:01.20 kworker/u+
  12 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R+
  13 root        20   0    0     0   0   0   I  0.0   0.0   0:00.00 rcu_tasks+
  14 root        20   0    0     0   0   0   I  0.0   0.0   0:00.00 rcu_tasks+
  15 root        20   0    0     0   0   0   I  0.0   0.0   0:00.00 rcu_tasks+
  16 root        20   0    0     0   0   0   S  0.0   0.0   0:00.05 ksoftirqd+
  17 root        20   0    0     0   0   0   I  0.0   0.0   0:00.18 rcu_preem+
  18 root        rt    0    0     0   0   0   S  0.0   0.0   0:00.04 migration+
  19 root       -51   0    0     0   0   0   S  0.0   0.0   0:00.00 idle_inje+
  20 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 cpuhp/0
  21 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 cpuhp/1
  22 root       -51   0    0     0   0   0   S  0.0   0.0   0:00.00 idle_inje+
  23 root        rt    0    0     0   0   0   S  0.0   0.0   0:00.51 migration+
  24 root        20   0    0     0   0   0   S  0.0   0.0   0:00.17 ksoftirqd+
  27 root        20   0    0     0   0   0   S  0.0   0.0   0:00.01 kdevtmpfs
  28 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R+
  30 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 kauditd
  31 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 khungtaskd
  32 root        20   0    0     0   0   0   S  0.0   0.0   0:00.00 oom_reaper
  34 root        0 -20   0     0   0   0   I  0.0   0.0   0:00.00 kworker/R+
  35 root        20   0    0     0   0   0   S  0.0   0.0   0:00.27 kcompactd0
  36 root        25   5    0     0   0   0   S  0.0   0.0   0:00.00 ksmd
  38 root        39  19   0     0   0   0   S  0.0   0.0   0:00.00 khugepaged
```

```
sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp_update_index run
```

```
root@nodol1:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql  
--mysql-user=root --events=0 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:               5460  
  other:               1347  
  total:              6807  
transactions:         6807 (680.43 per sec.)  
queries:              6807 (680.43 per sec.)  
ignored errors:        0 (0.00 per sec.)  
reconnects:           0 (0.00 per sec.)  
  
General statistics:  
total time:           10.0019s  
total number of events: 6807  
  
Latency (ms):  
  min:                 0.13  
  avg:                 2.93  
  max:                48.90  
  95th percentile:    5.99  
  sum:               19942.89  
  
Threads fairness:  
events (avg/stddev):  3403.5000/36.50  
execution time (avg/stddev): 9.9714/0.00  
root@nodol1:/home/yari#
```

```
op - 08:04:03 up 1:14, 2 users, load average: 0.29, 0.07, 0.02  
asks: 116 total, 1 running, 115 sleeping, 0 stopped, 0 zombie  
Cpu0 : 0.0 us, 1.0 sy, 0.0 ni, 99.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.4 sy, 0.0 ni, 99.3 id, 0.0 wa, 0.0 hi, 0.4 si, 0.0 st  
iB Mem: 3890.1 total, 3156.7 free, 662.0 used, 288.3 buff/cache  
iB Swap: 3890.0 total, 3890.0 free, 0.0 used, 3228.1 avail Mem  
  
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND  
1269 root 20 0 0 0 0 I 1.0 0.0 0:11.40 kworker/0+  
931 mysql 20 0 1739900 184356 40064 S 0.7 4.6 1:06.10 mariadb  
1155 yari 20 0 11936 5888 3712 R 0.3 0.1 0:11.17 top  
1307 root 20 0 0 0 0 I 0.3 0.0 0:13.18 kworker/1+  
1 root 20 0 22268 13308 9468 S 0.0 0.3 0:02.03 systemd  
2 root 20 0 0 0 0 S 0.0 0.0 0:00.01 kthreadd  
3 root 20 0 0 0 0 S 0.0 0.0 0:00.00 pool_work+  
4 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
5 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
6 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
7 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
10 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/0+  
11 root 20 0 0 0 0 I 0.0 0.0 0:01.30 kworker/u+  
12 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
13 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
14 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
15 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
16 root 20 0 0 0 0 S 0.0 0.0 0:00.05 ksoftirqd+  
17 root 20 0 0 0 0 I 0.0 0.0 0:00.20 rcu_preem+  
18 root rt 0 0 0 S 0.0 0.0 0:00.05 migration+  
19 root -51 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
20 root 20 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0  
21 root 20 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1  
22 root -51 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
23 root rt 0 0 0 S 0.0 0.0 0:00.52 migration+  
24 root 20 0 0 0 S 0.0 0.0 0:00.01 kdevtmpfs+  
27 root 20 0 0 0 S 0.0 0.0 0:00.01 kdevtmpfs+  
28 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
30 root 20 0 0 0 S 0.0 0.0 0:00.00 kauditd  
31 root 20 0 0 0 S 0.0 0.0 0:00.00 khungtaskd  
32 root 20 0 0 0 S 0.0 0.0 0:00.00 oom_reaper  
34 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
35 root 20 0 0 0 S 0.0 0.0 0:00.35 kcompactd0  
36 root 25 5 0 0 S 0.0 0.0 0:00.00 ksmd  
38 root 39 19 0 0 S 0.0 0.0 0:00.00 khugepaged
```

```
sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp_update_non_index run
```

```
root@nodol1:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql  
--mysql-user=root --events=0 oltp_update_non_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:              3831  
  other:               957  
  total:              4788  
transactions:         4788 (478.54 per sec.)  
queries:              4788 (478.54 per sec.)  
ignored errors:        0 (0.00 per sec.)  
reconnects:           0 (0.00 per sec.)  
  
General statistics:  
total time:           10.0035s  
total number of events: 4788  
  
Latency (ms):  
  min:                 0.13  
  avg:                 4.17  
  max:                139.04  
  95th percentile:    7.43  
  sum:               19955.04  
  
Threads fairness:  
events (avg/stddev):  2394.0000/8.00  
execution time (avg/stddev): 9.9775/0.00  
root@nodol1:/home/yari#
```

```
op - 08:07:01 up 1:16, 2 users, load average: 0.23, 0.08, 0.02  
asks: 115 total, 1 running, 114 sleeping, 0 stopped, 0 zombie  
Cpu0 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.7 sy, 0.0 ni, 99.3 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
iB Mem: 3890.1 total, 3156.4 free, 656.0 used, 294.7 buff/cache  
iB Swap: 3890.0 total, 3890.0 free, 0.0 used, 3234.1 avail Mem  
  
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND  
1307 root 20 0 0 0 0 I 0.7 0.0 0:14.23 kworker/1+  
1269 root 20 0 0 0 0 I 0.3 0.0 0:12.36 kworker/0+  
1 root 20 0 22268 13308 9468 S 0.0 0.3 0:02.03 systemd  
2 root 20 0 0 0 0 S 0.0 0.0 0:00.01 kthreadd  
3 root 20 0 0 0 0 S 0.0 0.0 0:00.00 pool_work+  
4 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
5 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
6 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
7 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
10 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/0+  
11 root 20 0 0 0 0 I 0.0 0.0 0:01.30 kworker/u+  
12 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
13 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
14 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
15 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
16 root 20 0 0 0 0 S 0.0 0.0 0:00.05 ksoftirqd+  
17 root 20 0 0 0 0 I 0.0 0.0 0:00.21 rcu_preem+  
18 root rt 0 0 0 S 0.0 0.0 0:00.05 migration+  
19 root -51 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
20 root 20 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0  
21 root 20 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1  
22 root -51 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
23 root rt 0 0 0 S 0.0 0.0 0:00.52 migration+  
24 root 20 0 0 0 S 0.0 0.0 0:00.29 ksoftirqd+  
27 root 20 0 0 0 S 0.0 0.0 0:00.01 kdevtmpfs+  
28 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
30 root 20 0 0 0 S 0.0 0.0 0:00.00 kauditd  
31 root 20 0 0 0 S 0.0 0.0 0:00.00 khungtaskd  
32 root 20 0 0 0 S 0.0 0.0 0:00.00 oom_reaper  
34 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
35 root 20 0 0 0 S 0.0 0.0 0:00.37 kcompactd0  
36 root 25 5 0 0 S 0.0 0.0 0:00.00 ksmd  
38 root 39 19 0 0 S 0.0 0.0 0:00.00 khugepaged  
39 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
40 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+
```



sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp\_write\_only run

```
root@nodol:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql  
--mysql-user=root --events=0 oltp_write_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:                0  
  write:              9969  
  other:              7359  
  total:             17328  
transactions:         2888 (288.59 per sec.)  
queries:              17328 (1731.51 per sec.)  
ignored errors:        0 (0.00 per sec.)  
reconnects:           0 (0.00 per sec.)  
  
General statistics:  
total time:           10.0052s  
total number of events: 2888  
  
Latency (ms):  
  min:                 2.87  
  avg:                 6.91  
  max:                50.43  
  95th percentile:    11.45  
  sum:               19959.61  
  
Threads fairness:  
events (avg/stddev): 1444.0000/3.00  
execution time (avg/stddev): 9.9775/0.00  
root@nodol:/home/yari#
```

```
yari@nodol: ~  
Cpu0 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.7 sy, 0.0 ni, 97.8 id, 0.7 wa, 0.0 hi, 0.7 si, 0.0 st  
MiB Mem : 3890.1 total, 3160.9 free, 664.8 used, 281.2 buff/cache  
op - 08:09:53 up 1:19, 2 users, load average: 0.24, 0.10, 0.03  
tasks: 115 total, 1 running, 114 sleeping, 0 stopped, 0 zombie  
Cpu0 : 0.0 us, 1.0 sy, 0.0 ni, 98.7 id, 0.3 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.4 sy, 0.0 ni, 98.9 id, 0.0 wa, 0.0 hi, 0.7 si, 0.0 st  
MiB Mem : 3890.1 total, 3154.2 free, 647.8 used, 305.3 buff/cache  
MiB Swap: 3890.0 total, 3890.0 free, 0.0 used, 3242.3 avail Mem  
  
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND  
1269 root 20 0 0 0 0 0 I 0.7 0.0 0:13.32 kworker/0+  
1155 yari 20 0 11936 5888 3712 R 0.3 0.1 0:12.24 top  
1352 root 20 0 314116 9216 7680 S 0.3 0.2 0:00.71 upowerd  
1 root 20 0 22268 13308 9468 S 0.0 0.3 0:02.04 systemd  
2 root 20 0 0 0 0 0 S 0.0 0.0 0:00.01 kthreadd  
3 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 pool_work+  
4 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
5 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
6 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
7 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
10 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/O+  
12 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
13 root 20 0 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
14 root 20 0 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
15 root 20 0 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
16 root 20 0 0 0 0 0 S 0.0 0.0 0:00.06 ksoftirqd+  
17 root 20 0 0 0 0 0 I 0.0 0.0 0:00.22 rcu_preem+  
18 root rt 0 0 0 0 S 0.0 0.0 0:00.06 migration+  
19 root -51 0 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
20 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0  
21 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1  
22 root -51 0 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
23 root rt 0 0 0 0 S 0.0 0.0 0:00.52 migration+  
24 root 20 0 0 0 0 0 S 0.0 0.0 0:00.34 ksoftirqd+  
27 root 20 0 0 0 0 0 S 0.0 0.0 0:00.01 kdevtmpfs  
28 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
30 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 kauditd  
31 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 khungtaskd  
32 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 oom_reaper  
34 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
35 root 20 0 0 0 0 0 S 0.0 0.0 0:00.39 kcompactd0  
36 root 25 5 0 0 0 0 S 0.0 0.0 0:00.00 ksm
```

sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp\_update\_index run

```
root@nodol:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql  
--mysql-user=root --events=0 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:              4560  
  other:              833  
  total:             5393  
transactions:         5393 (539.04 per sec.)  
queries:              5393 (539.04 per sec.)  
ignored errors:        0 (0.00 per sec.)  
reconnects:           0 (0.00 per sec.)  
  
General statistics:  
total time:           10.0029s  
total number of events: 5393  
  
Latency (ms):  
  min:                 0.15  
  avg:                 3.70  
  max:                29.88  
  95th percentile:    7.56  
  sum:               19938.45  
  
Threads fairness:  
events (avg/stddev): 2696.5000/5.50  
execution time (avg/stddev): 9.9692/0.00  
root@nodol:/home/yari#
```

```
yari@nodol: ~  
Cpu0 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.7 sy, 0.0 ni, 97.8 id, 0.7 wa, 0.0 hi, 0.7 si, 0.0 st  
MiB Mem : 3890.1 total, 3160.9 free, 664.8 used, 281.2 buff/cache  
top - 08:12:23 up 1:22, 2 users, load average: 0.25, 0.13, 0.04  
tasks: 116 total, 1 running, 115 sleeping, 0 stopped, 0 zombie  
Cpu0 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.7 sy, 0.0 ni, 99.3 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
MiB Mem : 3890.1 total, 3148.8 free, 647.4 used, 311.1 buff/cache  
MiB Swap: 3890.0 total, 3890.0 free, 0.0 used, 3242.7 avail Mem  
  
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND  
1269 root 20 0 0 0 0 0 I 0.7 0.0 0:14.09 kworker/0+  
1307 root 20 0 0 0 0 0 I 0.7 0.0 0:16.28 kworker/1+  
1155 yari 20 0 11936 5888 3712 R 0.3 0.1 0:12.69 top  
1 root 20 0 22268 13308 9468 S 0.0 0.3 0:02.05 systemd  
2 root 20 0 0 0 0 0 S 0.0 0.0 0:00.01 kthreadd  
3 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 pool_work+  
4 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
5 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
6 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
7 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
10 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/O+  
12 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
13 root 20 0 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
14 root 20 0 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
15 root 20 0 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
16 root 20 0 0 0 0 0 S 0.0 0.0 0:00.06 ksoftirqd+  
17 root 20 0 0 0 0 0 I 0.0 0.0 0:00.22 rcu_preem+  
18 root rt 0 0 0 0 S 0.0 0.0 0:00.06 migration+  
19 root -51 0 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
20 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0  
21 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1  
22 root -51 0 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
23 root rt 0 0 0 0 S 0.0 0.0 0:00.53 migration+  
24 root 20 0 0 0 0 0 S 0.0 0.0 0:00.43 ksoftirqd+  
27 root 20 0 0 0 0 0 S 0.0 0.0 0:00.01 kdevtmpfs  
28 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
30 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 kauditd  
31 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 khungtaskd  
32 root 20 0 0 0 0 0 S 0.0 0.0 0:00.00 oom_reaper  
34 root 0 -20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
35 root 20 0 0 0 0 0 S 0.0 0.0 0:00.41 kcompactd0  
36 root 25 5 0 0 0 0 S 0.0 0.0 0:00.00 ksm
```

```
sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 oltp_update_non_index run
```

```
root@nodol1:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql  
--mysql-user=root --events=0 oltp_update_non_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:              4729  
  other:               903  
  total:             5632  
transactions:         5632 (562.80 per sec.)  
queries:              5632 (562.80 per sec.)  
ignored errors:        0 (0.00 per sec.)  
reconnects:           0 (0.00 per sec.)  
  
General statistics:  
total time:           10.0049s  
total number of events: 5632  
  
Latency (ms):  
min:                  0.17  
avg:                   3.54  
max:                  53.79  
95th percentile:     6.32  
sum:                 19954.22  
  
Threads fairness:  
events (avg/stddev):  2816.0000/4.00  
execution time (avg/stddev): 9.9771/0.00  
root@nodol1:/home/yari#
```

```
yari@nodol1:~  
Cpu0 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.7 sy, 0.0 ni, 97.8 id, 0.7 wa, 0.0 hi, 0.7 si, 0.0 st  
iB Mem : 3890.1 total, 3160.9 free, 664.8 used, 281.2 buff/cache  
op - 08:16:18 up 1:26, 2 users, load average: 0.08, 0.10, 0.04  
asks: 114 total, 1 running, 113 sleeping, 0 stopped, 0 zombie  
Cpu0 : 0.0 us, 0.7 sy, 0.0 ni, 99.3 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.4 sy, 0.0 ni, 98.9 id, 0.0 wa, 0.0 hi, 0.7 si, 0.0 st  
iB Mem : 3890.1 total, 3140.4 free, 649.1 used, 315.9 buff/cache  
iB Swap: 3890.0 total, 3890.0 free, 0.0 used, 3242.0 avail Mem  
  
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND  
1155 yari 20 0 11936 5888 3712 R 0.7 0.1 0:13.46 top  
1269 root 20 0 0 0 0 I 0.7 0.0 0:15.08 kworker/0+  
1307 root 20 0 0 0 0 I 0.7 0.0 0:17.86 kworker/1+  
1145 yari 20 0 15124 6960 4992 S 0.3 0.2 0:01.31 sshd  
1 root 20 0 22268 13308 9468 S 0.0 0.3 0:02.06 systemd  
2 root 20 0 0 0 0 S 0.0 0.0 0:00.01 kthreadd  
3 root 20 0 0 0 0 S 0.0 0.0 0:00.00 pool_work+  
4 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
5 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
6 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
7 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
10 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/0+  
12 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
13 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
14 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
15 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
16 root 20 0 0 0 0 S 0.0 0.0 0:00.06 ksoftirqd+  
17 root 20 0 0 0 0 I 0.0 0.0 0:00.23 rcu_preem+  
18 root rt 0 0 0 S 0.0 0.0 0:00.06 migration+  
19 root -51 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
20 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0  
21 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1  
22 root -51 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
23 root rt 0 0 0 S 0.0 0.0 0:00.53 migration+  
24 root 20 0 0 0 0 S 0.0 0.0 0:00.47 ksoftirqd+  
27 root 20 0 0 0 0 S 0.0 0.0 0:00.01 kdevtmpfs  
28 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
30 root 20 0 0 0 0 S 0.0 0.0 0:00.00 kauditd  
31 root 20 0 0 0 0 S 0.0 0.0 0:00.00 khungtaskd  
32 root 20 0 0 0 0 S 0.0 0.0 0:00.00 oom_reaper  
34 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
35 root 20 0 0 0 0 S 0.0 0.0 0:00.44 kcompactd0
```

```
sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root  
--events=0 select_random_points run
```

```
root@nodol1:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql  
--mysql-user=root --events=0 select_random_points 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:              78220  
  write:              0  
  other:              0  
  total:            78220  
transactions:       78220 (7814.94 per sec.)  
queries:           78220 (7814.94 per sec.)  
ignored errors:     0 (0.00 per sec.)  
reconnects:         0 (0.00 per sec.)  
  
General statistics:  
total time:         10.0021s  
total number of events: 78220  
  
Latency (ms):  
min:                0.17  
avg:                 0.25  
max:                 17.07  
95th percentile:   0.42  
sum:                19783.20  
  
Threads fairness:  
events (avg/stddev):  39110.0000/719.00  
execution time (avg/stddev): 9.8916/0.00  
root@nodol1:/home/yari#
```

```
yari@nodol1:~  
Cpu0 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 0.0 us, 0.7 sy, 0.0 ni, 97.8 id, 0.7 wa, 0.0 hi, 0.7 si, 0.0 st  
iB Mem : 3890.1 total, 3160.9 free, 664.8 used, 281.2 buff/cache  
op - 08:18:22 up 1:28, 2 users, load average: 0.47, 0.16, 0.06  
asks: 115 total, 1 running, 114 sleeping, 0 stopped, 0 zombie  
Cpu0 : 12.3 us, 4.9 sy, 0.0 ni, 82.8 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
Cpu1 : 11.4 us, 4.7 sy, 0.0 ni, 82.6 id, 0.0 wa, 0.0 hi, 1.3 si, 0.0 st  
iB Mem : 3890.1 total, 3138.8 free, 649.7 used, 319.0 buff/cache  
iB Swap: 3890.0 total, 3890.0 free, 0.0 used, 3240.4 avail Mem  
  
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND  
931 mysql 20 0 1739900 199332 53376 S 84.4 5.0 1:47.58 mariadb  
1307 root 20 0 0 0 0 I 1.0 0.0 0:18.83 kworker/1+  
1155 yari 20 0 11936 5888 3712 R 0.3 0.1 0:13.82 top  
1269 root 20 0 0 0 0 I 0.3 0.0 0:15.55 kworker/0+  
1361 root 20 0 0 0 0 I 0.3 0.0 0:00.45 kworker/u+  
1 root 20 0 22268 13308 9468 S 0.0 0.3 0:02.07 systemd  
2 root 20 0 0 0 0 S 0.0 0.0 0:00.01 kthreadd  
3 root 20 0 0 0 0 S 0.0 0.0 0:00.00 pool_work+  
4 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
5 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
6 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
7 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
10 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/0+  
12 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
13 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
14 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
15 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks+  
16 root 20 0 0 0 0 S 0.0 0.0 0:00.06 ksoftirqd+  
17 root 20 0 0 0 0 I 0.0 0.0 0:00.23 rcu_preem+  
18 root rt 0 0 0 S 0.0 0.0 0:00.06 migration+  
19 root -51 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
20 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0  
21 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1  
22 root -51 0 0 0 0 S 0.0 0.0 0:00.00 idle_inje+  
23 root rt 0 0 0 S 0.0 0.0 0:00.53 migration+  
24 root 20 0 0 0 0 S 0.0 0.0 0:00.47 ksoftirqd+  
27 root 20 0 0 0 0 S 0.0 0.0 0:00.01 kdevtmpfs  
28 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+  
30 root 20 0 0 0 0 S 0.0 0.0 0:00.00 kauditd  
31 root 20 0 0 0 0 S 0.0 0.0 0:00.00 khungtaskd  
32 root 20 0 0 0 0 S 0.0 0.0 0:00.00 oom_reaper  
34 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/R+
```

```
sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql --mysql-user=root
--events=0 select_random_ranges run
```

The screenshot shows a terminal window with the following content:

```

root@nodol:/home/yari# AC
root@nodol:/home/yari# sysbench --threads=2 --time=10 --rate=0 --db-driver=mysql
--mysql-user=root --events=0 select_random_ranges 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:          79321
    write:         0
    other:         0
    total:         79321
  transactions:    79321 (7926.68 per sec.)
  queries:         79321 (7926.68 per sec.)
  ignored errors:  0 (0.00 per sec.)
  reconnects:     0 (0.00 per sec.)

General statistics:
  total time:      10.0026s
  total number of events: 79321

Latency (ms):
  min:            0.17
  avg:            0.25
  max:            8.68
  95th percentile: 0.39
  sum:            19814.89

Threads fairness:
  events (avg/stddev): 39660.5000/420.50
  execution time (avg/stddev): 9.9074/0.00

root@nodol:/home/yari#

```

On the right side of the terminal, there is a window showing system resource usage:

```

Cpu0 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
Cpu1 : 0.0 us, 0.7 sy, 0.0 ni, 97.8 id, 0.7 wa, 0.0 hi, 0.7 si, 0.0 st
iB Mem : 3890.1 total, 3160.9 free, 664.8 used, 281.2 buff/cache
op - 08:20:10 up 1:30, 2 users, load average: 0.22, 0.14, 0.06
asks: 115 total, 1 running, 114 sleeping, 0 stopped, 0 zombie
Cpu0 : 11.2 us, 5.1 sy, 0.0 ni, 83.1 id, 0.0 wa, 0.0 hi, 0.6 si, 0.0 st
Cpu1 : 10.9 us, 4.2 sy, 0.0 ni, 83.6 id, 0.0 wa, 0.0 hi, 1.2 si, 0.0 st
iB Mem : 3890.1 total, 3138.4 free, 650.1 used, 319.0 buff/cache
iB Swap: 3890.0 total, 3890.0 free, 0.0 used, 3239.9 avail Mem

```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
931	mysql	20	0	1739900	199332	53376	S	78.1	5.0	2:03.36	mysqld
1307	root	20	0	0	0	0	I	0.7	0.0	0:19.67	worker/1+
365	root	rt	0	289116	27264	8704	S	0.3	0.7	0:01.15	multipathd
1269	root	20	0	0	0	0	I	0.3	0.0	0:15.91	worker/0+
1458	root	20	0	0	0	0	I	0.3	0.0	0:00.03	worker/ur
1	root	20	0	22268	13308	9468	S	0.0	0.3	0:02.07	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.01	kthreadd
3	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pool_work+
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/R+
5	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/R+
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/R+
7	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/R+
10	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/0+
12	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/R+
13	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks+
14	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks+
15	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks+
16	root	20	0	0	0	0	S	0.0	0.0	0:00.06	ksoftirqd+
17	root	20	0	0	0	0	I	0.0	0.0	0:00.24	rcu_preemr
18	root	rt	0	0	0	0	S	0.0	0.0	0:00.06	migration+
19	root	-51	0	0	0	0	S	0.0	0.0	0:00.00	idle_inj+
20	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/0
21	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/1
22	root	-51	0	0	0	0	S	0.0	0.0	0:00.00	idle_inj+
23	root	rt	0	0	0	0	S	0.0	0.0	0:00.53	migration+
24	root	20	0	0	0	0	S	0.0	0.0	0:00.48	ksoftirqd+
27	root	20	0	0	0	0	S	0.0	0.0	0:00.01	kdevtmpfs
28	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/R+
30	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kauditd
31	root	20	0	0	0	0	S	0.0	0.0	0:00.00	khungtaskd
32	root	20	0	0	0	0	S	0.0	0.0	0:00.00	oom_reaper
34	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	worker/R+

Al implementar un clúster de bases de datos con Galera 4 y MariaDB logramos analizar qué factores afectan su desempeño y estabilidad. A lo largo de las pruebas realizadas con Sysbench, se observó que la variabilidad en los resultados está directamente influenciada por la configuración del clúster, el tipo de carga de trabajo y los parámetros de ejecución de las pruebas.

Uno de los elementos clave en la variabilidad del rendimiento es la cantidad de threads utilizados en las pruebas. A medida que el número de hilos de ejecución aumenta, la carga de procesamiento sobre la CPU y la concurrencia en el acceso a la base de datos también se incrementan, lo que puede mejorar el rendimiento hasta cierto punto, pero eventualmente generar saturación y latencias más altas debido a la competencia por recursos del sistema.

Por otro lado, el tiempo de ejecución de cada prueba influye en la estabilidad de los resultados. Debido a que en las pruebas de corta duración, la variabilidad es mayor debido a la influencia de procesos externos, caché y la inicialización del sistema. A diferencia de las pruebas más prolongadas, las cuales permiten obtener métricas más representativas del desempeño real del clúster, evidenciando patrones de optimización o degradación a lo largo del tiempo.

Debido a ello es importante diseñar pruebas de rendimiento las cuales reflejan condiciones reales de operación, lo cual incluye el considerar tanto los recursos computacionales disponibles como la arquitectura del clúster al interpretar los resultados.