
Servidores Web de Altas Prestaciones.

Práctica 5

Replicación de bases de datos MySQL

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Introducción

Para respaldar bases de datos MySQL, es común utilizar una réplica maestro-esclavo. El servidor en producción actúa como maestro y otro servidor funciona como respaldo, brindando mayor fiabilidad en caso de fallos o interrupciones permanentes. Tener un servidor de respaldo con MySQL como esclavo es una solución asequible que no afecta el rendimiento del sistema en producción.

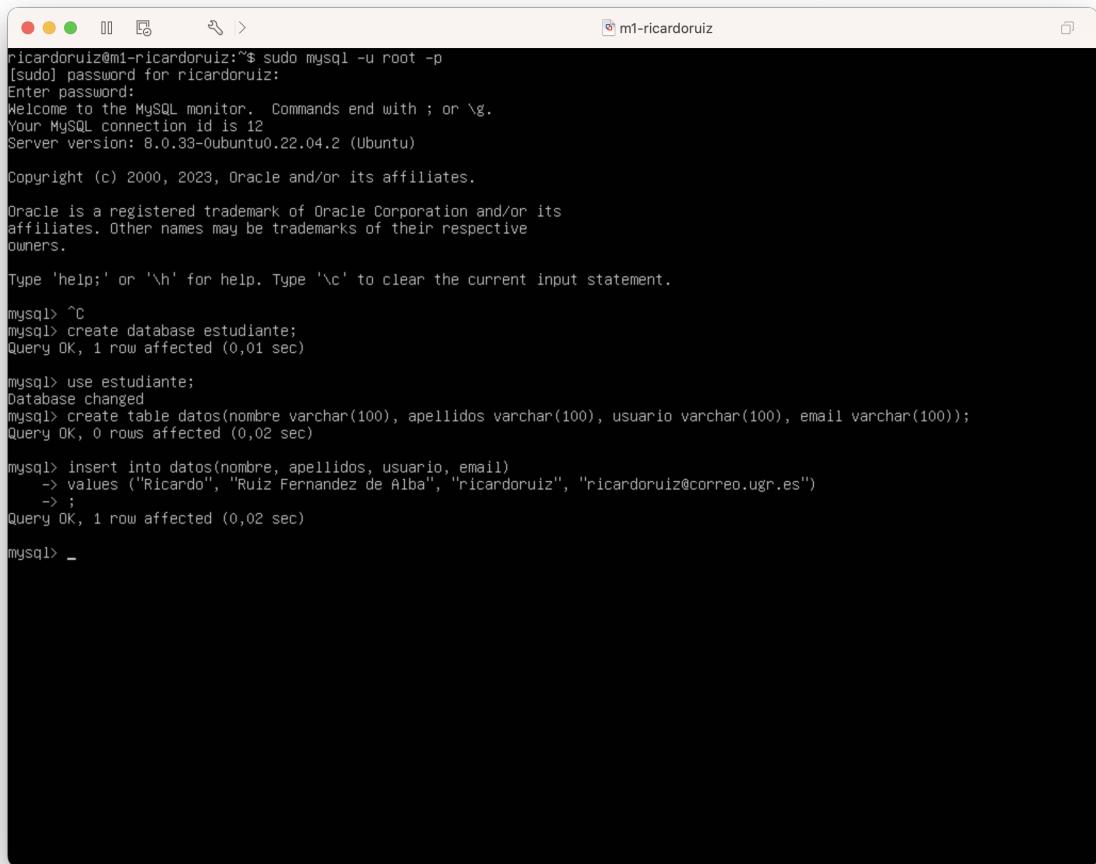
Tareas Básicas

En esta práctica se llevarán a cabo, como tareas básicas:

1. Crear una BD con al menos una tabla y algunos datos.
2. Realizar la copia de seguridad de la BD completa usando mysqldump en la máquina principal y copiar el archivo de copia de seguridad a la máquina secundaria.
3. Restaurar dicha copia de seguridad en la segunda máquina (clonado manual de la BD), de forma que en ambas máquinas esté esa BD de forma idéntica.
4. Realizar la configuración maestro-esclavo de los servidores MySQL en M1 y M2 para que la replicación de datos se realice automáticamente. M1 (maestro) – M2 (esclavo).
5. Añadir regla IPTABLES para permitir tráfico al puerto 3306

Tarea 1. Crear una BD con al menos una tabla y algunos datos.

Ejecutamos las siguiente ordenes en la máquina M1:



```
ricardoruiz@m1-ricardoruiz:~$ sudo mysql -u root -p
[sudo] password for ricardoruiz:
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 12
Server version: 8.0.33-0ubuntu0.22.04.2 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> ^C
mysql> create database estudiante;
Query OK, 1 row affected (0,01 sec)

mysql> use estudiante;
Database changed
mysql> create table datos(nombre varchar(100), apellidos varchar(100), usuario varchar(100), email varchar(100));
Query OK, 0 rows affected (0,02 sec)

mysql> insert into datos(nombre, apellidos, usuario, email)
    -> values ("Ricardo", "Ruiz Fernandez de Alba", "ricardoruiz", "ricardoruiz@correo.ugr.es")
    -> ;
Query OK, 1 row affected (0,02 sec)

mysql> _
```

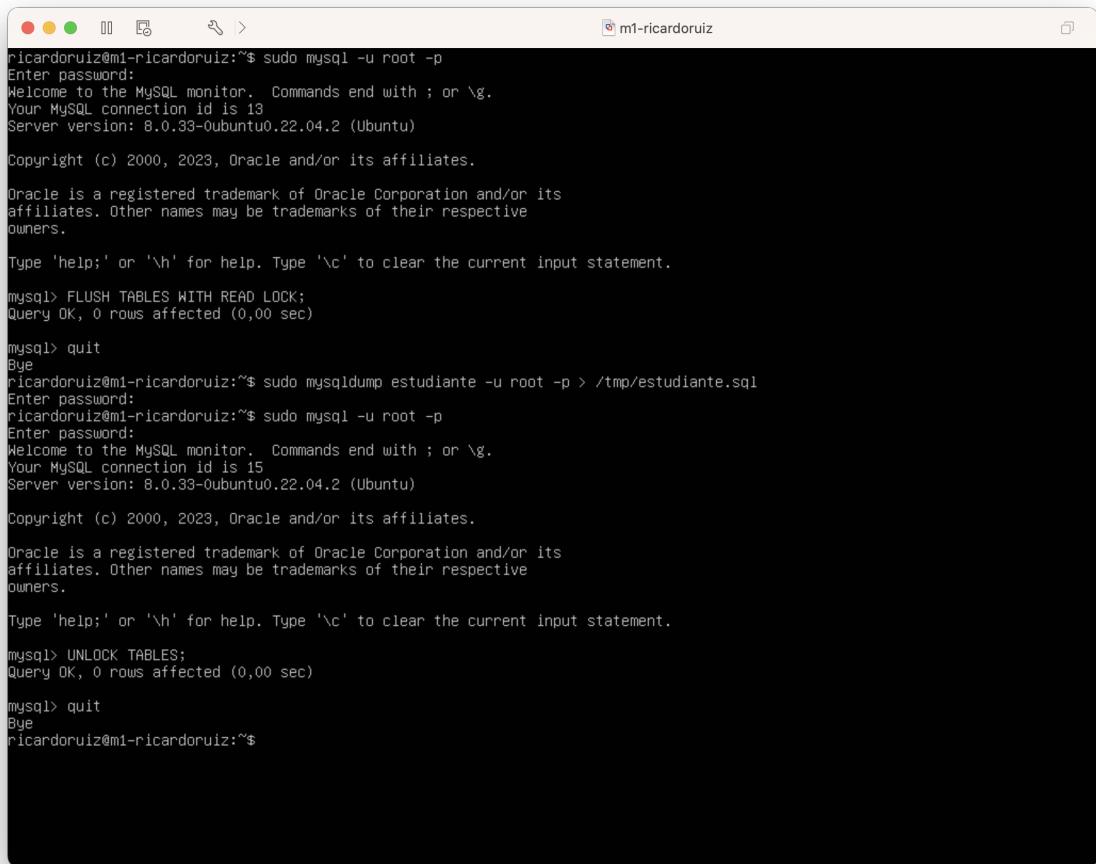
Figura 1: Creación de la base de datos

Tarea 2. Realizar la copia de seguridad de la BD completa.

Utilizaremos mysqldump en la máquina principal y copiaremos el archivo de copia de seguridad a la máquina secundaria.

Seguimos los siguiente pasos en la máquina M1:

- Conectar al servidor mysql para bloquear tablas
- Hacer copia de base de datos “estudiante” en archivo .sql
- Conectar al servidor mysql para desbloquear tablas



```
ricardoruez@m1-ricardoruez:~$ sudo mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 13
Server version: 8.0.33-Ubuntu0.22.04.2 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> FLUSH TABLES WITH READ LOCK;
Query OK, 0 rows affected (0,00 sec)

mysql> quit
Bye
ricardoruez@m1-ricardoruez:~$ sudo mysqldump estudiante -u root -p > /tmp/estudiante.sql
Enter password:
ricardoruez@m1-ricardoruez:~$ sudo mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 15
Server version: 8.0.33-Ubuntu0.22.04.2 (Ubuntu)

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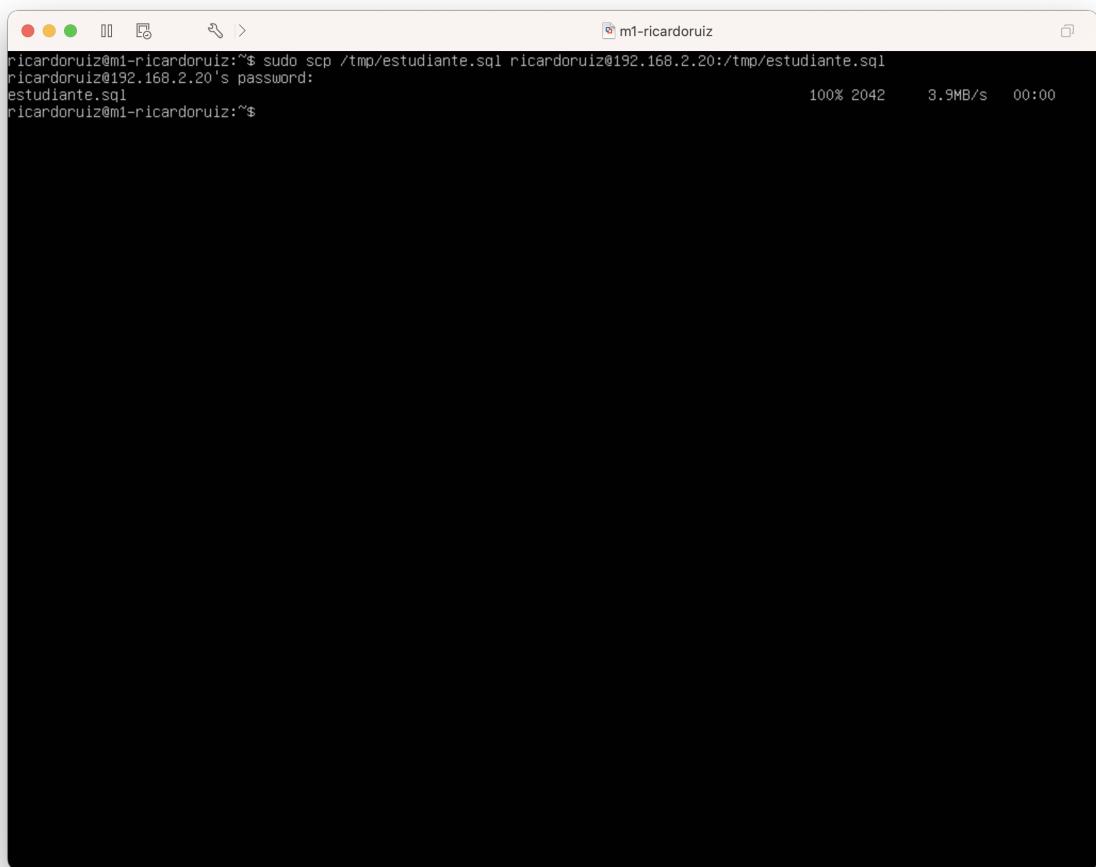
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> UNLOCK TABLES;
Query OK, 0 rows affected (0,00 sec)

mysql> quit
Bye
ricardoruez@m1-ricardoruez:~$
```

Figura 2: Copia de seguridad de la base de datos

Ahora copiaremos el archivo de copia de seguridad a la máquina secundaria:

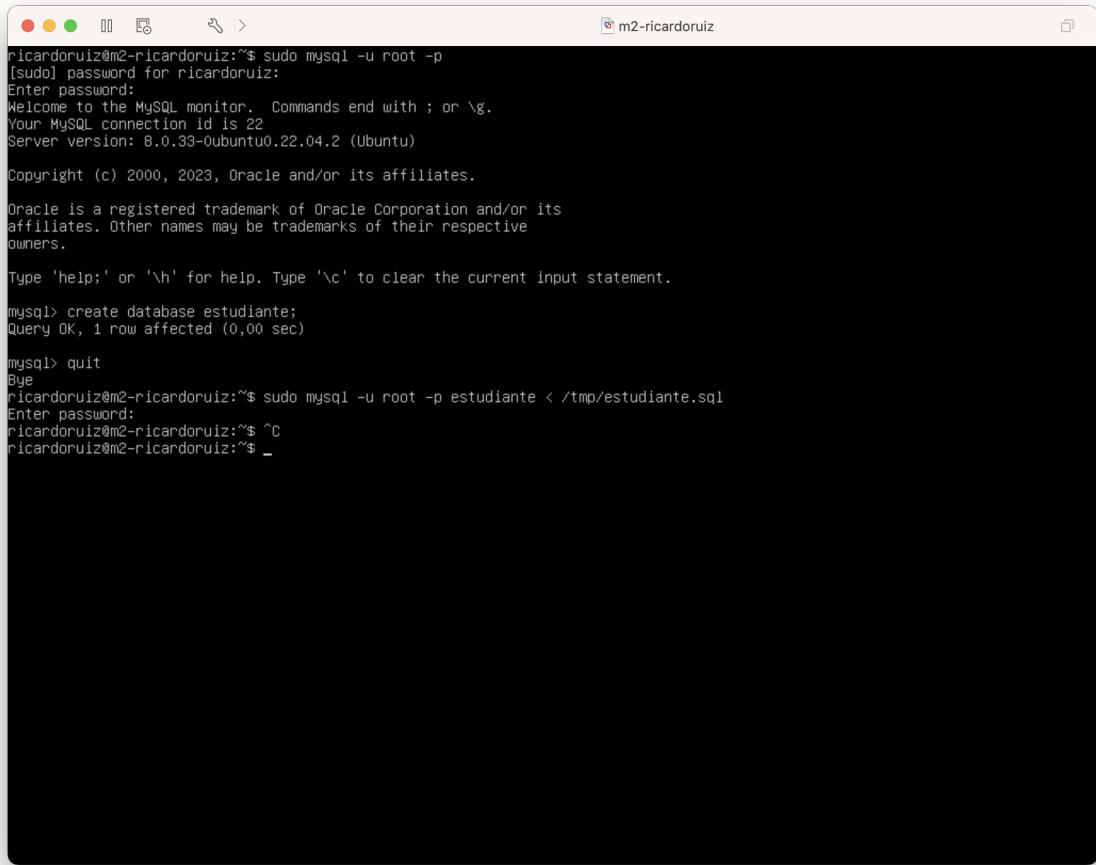


```
ricardoruiz@mi-ricardoruiz:~$ sudo scp /tmp/estudiante.sql ricardoruiz@192.168.2.20:/tmp/estudiante.sql
ricardoruiz@192.168.2.20's password: estudiante.sql
ricardoruiz@mi-ricardoruiz:~$
```

Figura 3: Copia de seguridad de la base de datos

Tarea 3. Restaurar dicha copia de seguridad en la segunda máquina.

Restauraremos la copia de seguridad en la segunda máquina (clonado manual de la BD), de forma que en ambas máquinas esté esa BD de forma idéntica.



```
ricardoruez@m2-ricardoruez:~$ sudo mysql -u root -p
[sudo] password for ricardoruez:
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 22
Server version: 8.0.33-0ubuntu0.22.04.2 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> create database estudiante;
Query OK, 1 row affected (0,00 sec)

mysql> quit
Bye
ricardoruez@m2-ricardoruez:~$ sudo mysql -u root -p estudiante < /tmp/estudiante.sql
Enter password:
ricardoruez@m2-ricardoruez:~$ ^C
ricardoruez@m2-ricardoruez:~$ _
```

Figura 4: Restauración de la base de datos

Tarea 4. Realizar la configuración maestro-esclavo de los servidores MySQL en M1 y M2 para que la replicación de datos se realice automáticamente.

MySQL tiene la opción de configurar el demonio para hacer replicación de las BD sobre un esclavo a partir de los datos que almacena el maestro.

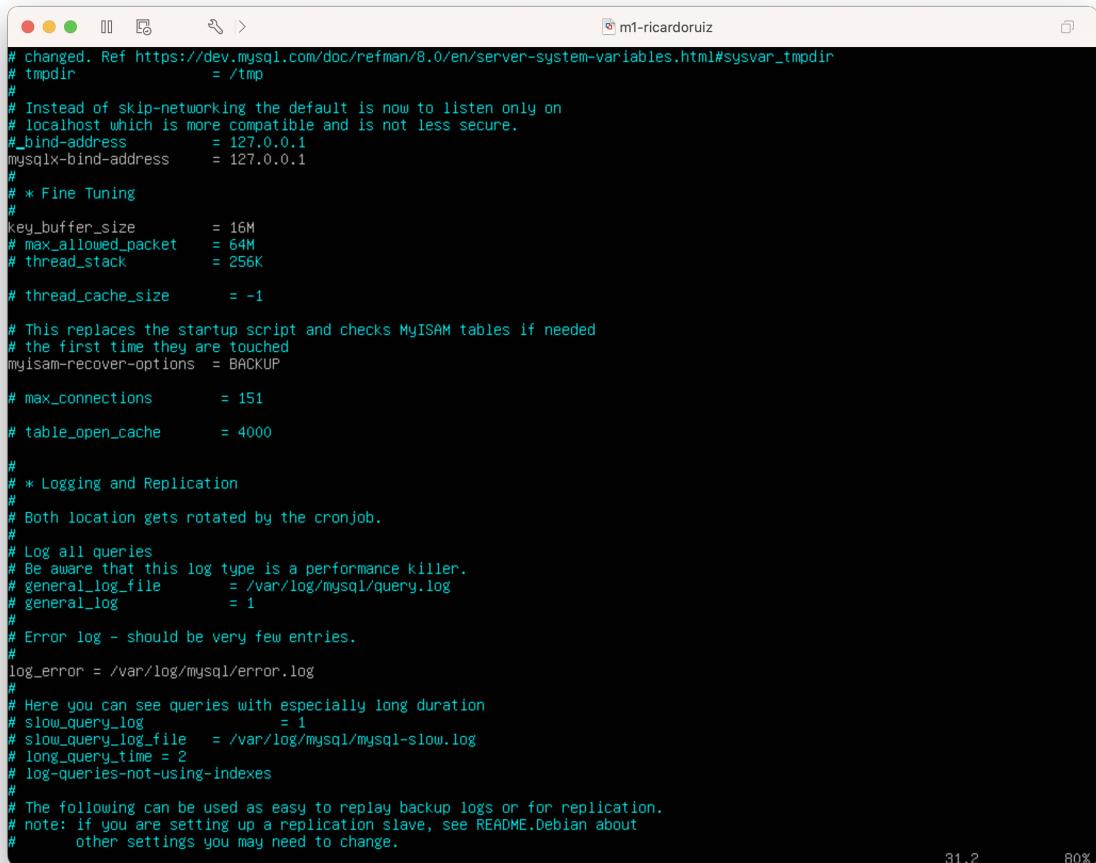
Antes de nada, debemos desactivar las reglas de iptables.

```
1 ricardoruez@m1-ricardoruez $ iptables -F
2 ricardoruez@m1-ricardoruez $ iptables -X
```

En M1, como root editamos el archivo `/etc/mysql/mysql.conf.d/mysqld.cnf`

```
1 [...]
2 #bind-address 127.0.0.1
```

```
3 log_error = /var/log/mysql/error.log
4 server-id = 1
5 log_bin = /var/log/mysql/mysql-bin.log
6 [...]
```



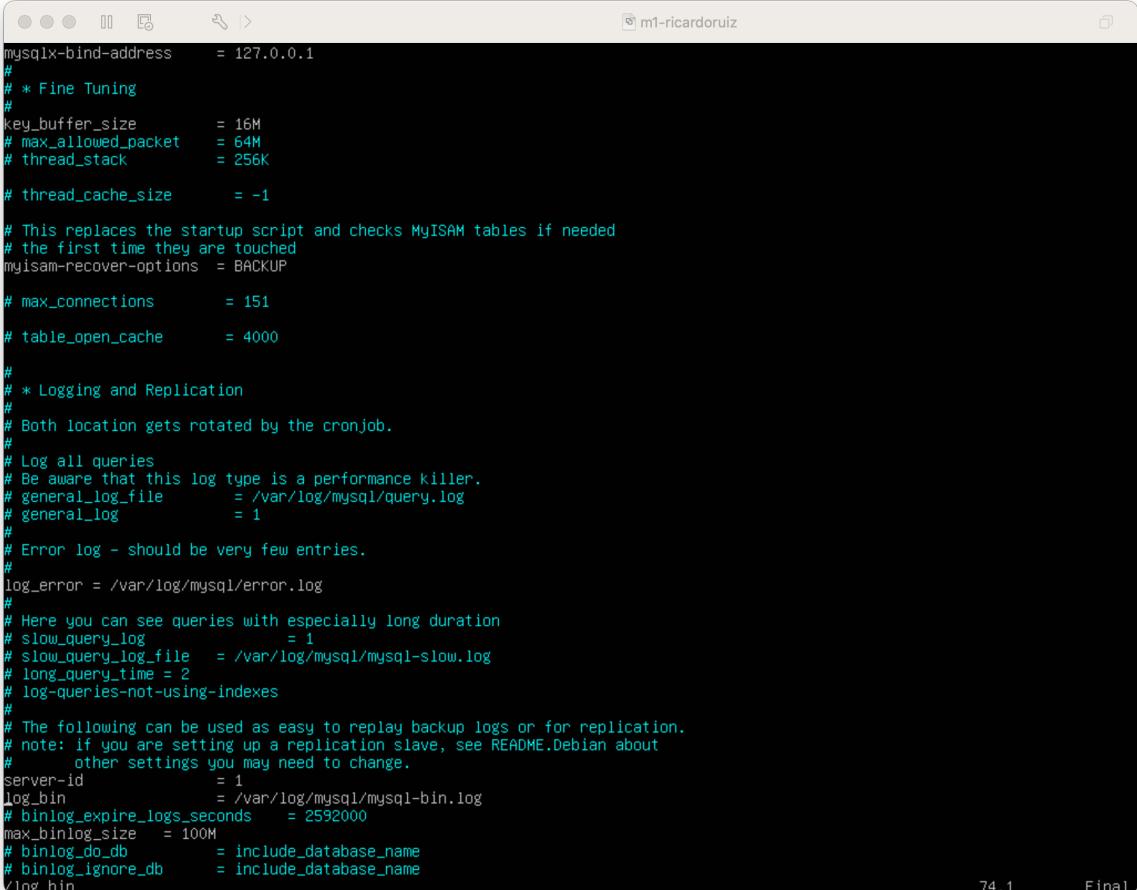
```
# changed. Ref https://dev.mysql.com/doc/refman/8.0/en/server-system-variables.html#sysvar_tmpdir
# tmpdir          = /tmp
#
# Instead of skip-networking the default is now to listen only on
# localhost which is more compatible and is not less secure.
# bind-address    = 127.0.0.1
mysqlx-bind-address = 127.0.0.1
#
# * Fine Tuning
#
key_buffer_size      = 16M
# max_allowed_packet = 64M
# thread_stack        = 256K
# thread_cache_size   = -1

# This replaces the startup script and checks MyISAM tables if needed
# the first time they are touched
myisam-recover-options = BACKUP

# max_connections     = 151
# table_open_cache    = 4000

#
# * Logging and Replication
#
# Both location gets rotated by the cronjob.
#
# Log all queries
# Be aware that this log type is a performance killer.
# general_log_file   = /var/log/mysql/query.log
# general_log        = 1
#
# Error log - should be very few entries.
#
log_error = /var/log/mysql/error.log
#
# Here you can see queries with especially long duration
# slow_query_log     = 1
# slow_query_log_file = /var/log/mysql/mysql-slow.log
# long_query_time    = 2
# log-queries-not-using-indexes
#
# The following can be used as easy to replay backup logs or for replication.
# note: If you are setting up a replication slave, see README.Debian about
#       other settings you may need to change.
```

Figura 5: Configuración MySQL



```
mysqlx-bind-address      = 127.0.0.1
#
# * Fine Tuning
#
key_buffer_size          = 16M
# max_allowed_packet     = 64M
# thread_stack           = 256K
# thread_cache_size      = -1

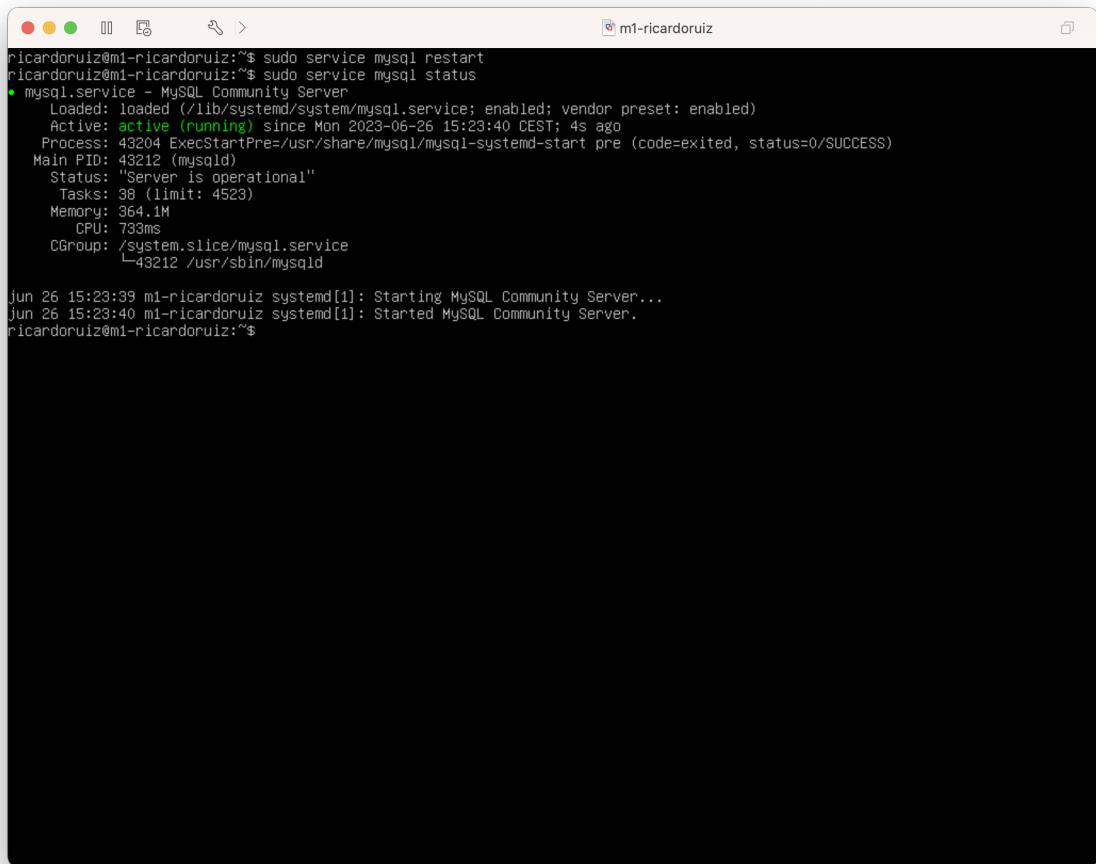
# This replaces the startup script and checks MyISAM tables if needed
# the first time they are touched
myisam-recover-options  = BACKUP

# max_connections         = 151
# table_open_cache        = 4000

#
# * Logging and Replication
#
# Both location gets rotated by the cronjob.
#
# Log all queries
# Be aware that this log type is a performance killer.
# general_log_file        = /var/log/mysql/query.log
# general_log              = 1
#
# Error log - should be very few entries.
#
log_error                = /var/log/mysql/error.log
#
# Here you can see queries with especially long duration
# slow_query_log           = 1
# slow_query_log_file      = /var/log/mysql/mysql-slow.log
# long_query_time          = 2
# log-queries-not-using-indexes
#
# The following can be used as easy to replay backup logs or for replication.
# note: if you are setting up a replication slave, see README.Debian about
#       other settings you may need to change.
server-id                 = 1
log_bin                   = /var/log/mysql/mysql-bin.log
# binlog_expire_logs_seconds = 2592000
max_binlog_size           = 100M
# binlog_db_db              = include_database_name
# binlog_ignore_db          = include_database_name
log_bin
```

Figura 6: Configuración MySQL

Reiniciamos el servicios y comprobamos que no hay errores



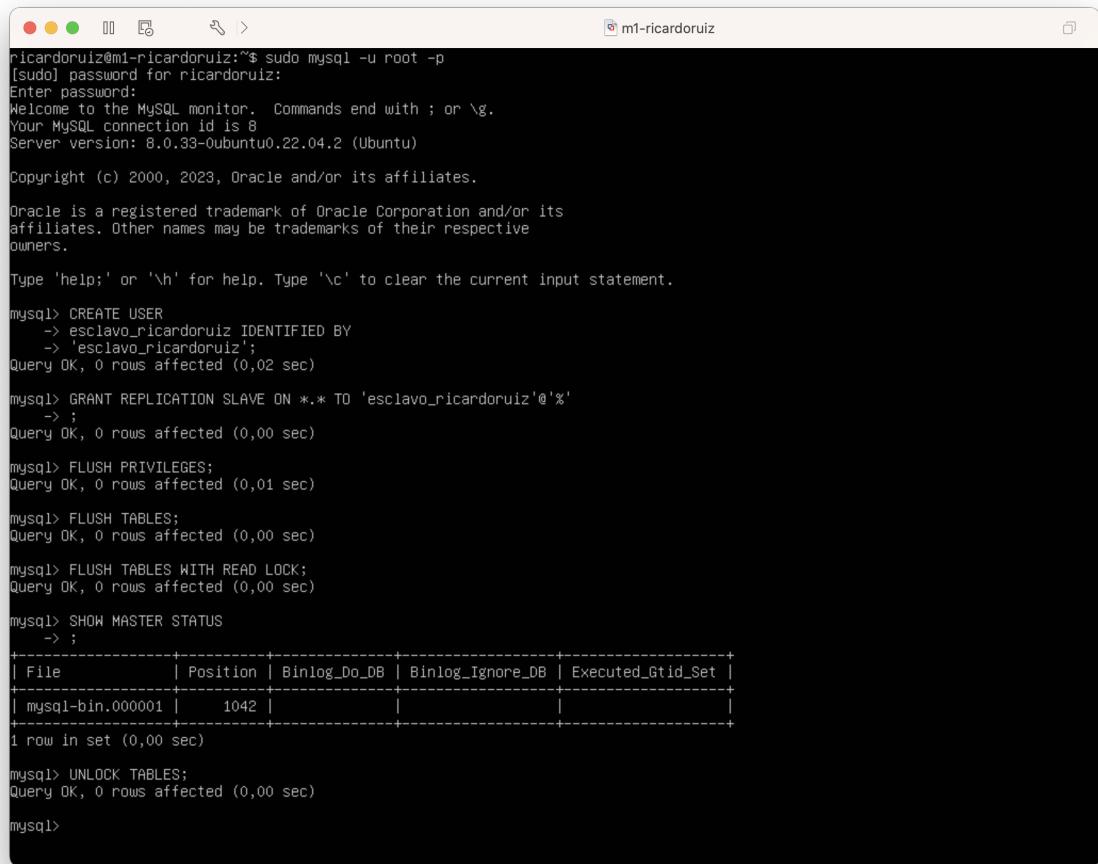
The screenshot shows a terminal window with a dark background and light-colored text. The window title is 'm1-ricardoruez'. The terminal content is as follows:

```
ricardoruez@m1-ricardoruez:~$ sudo service mysql restart
ricardoruez@m1-ricardoruez:~$ sudo service mysql status
● mysql.service - MySQL Community Server
  Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor preset: enabled)
  Active: active (running) since Mon 2023-06-26 15:23:40 CEST; 4s ago
    Process: 43204 ExecStartPre=/usr/share/mysql/mysql-systemd-start pre (code=exited, status=0/SUCCESS)
   Main PID: 43212 (mysqld)
     Status: "Server is operational"
       Tasks: 38 (limit: 4523)
      Memory: 364.1M
        CPU: 730ms
       CGroup: /system.slice/mysql.service
               └─ 43212 /usr/sbin/mysqld

Jun 26 15:23:39 m1-ricardoruez systemd[1]: Starting MySQL Community Server...
Jun 26 15:23:40 m1-ricardoruez systemd[1]: Started MySQL Community Server.
ricardoruez@m1-ricardoruez:~$
```

Figura 7: Reinicio MySQL

Creamos un usuario esclavo, mostramos la configuración maestro y activamos las tablas:



```

ricardoruez@m1-ricardoruez:~$ sudo mysql -u root -p
[sudo] password for ricardoruez:
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.33-0ubuntu0.22.04.2 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> CREATE USER
      -> 'esclavo_ricardoruez' IDENTIFIED BY
      -> 'esclavo ricardoruez';
Query OK, 0 rows affected (0,02 sec)

mysql> GRANT REPLICATION SLAVE ON *.* TO 'esclavo_ricardoruez'@'%'
      -> ;
Query OK, 0 rows affected (0,00 sec)

mysql> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0,01 sec)

mysql> FLUSH TABLES;
Query OK, 0 rows affected (0,00 sec)

mysql> FLUSH TABLES WITH READ LOCK;
Query OK, 0 rows affected (0,00 sec)

mysql> SHOW MASTER STATUS
      -> ;
+-----+-----+-----+-----+
| File      | Position | Binlog_Do_DB | Executed_Gtid_Set |
+-----+-----+-----+-----+
| mysql-bin.000001 |      1042 |           |           |
+-----+-----+-----+-----+
1 row in set (0,00 sec)

mysql> UNLOCK TABLES;
Query OK, 0 rows affected (0,00 sec)

mysql>

```

Figura 8: Usuario esclavo

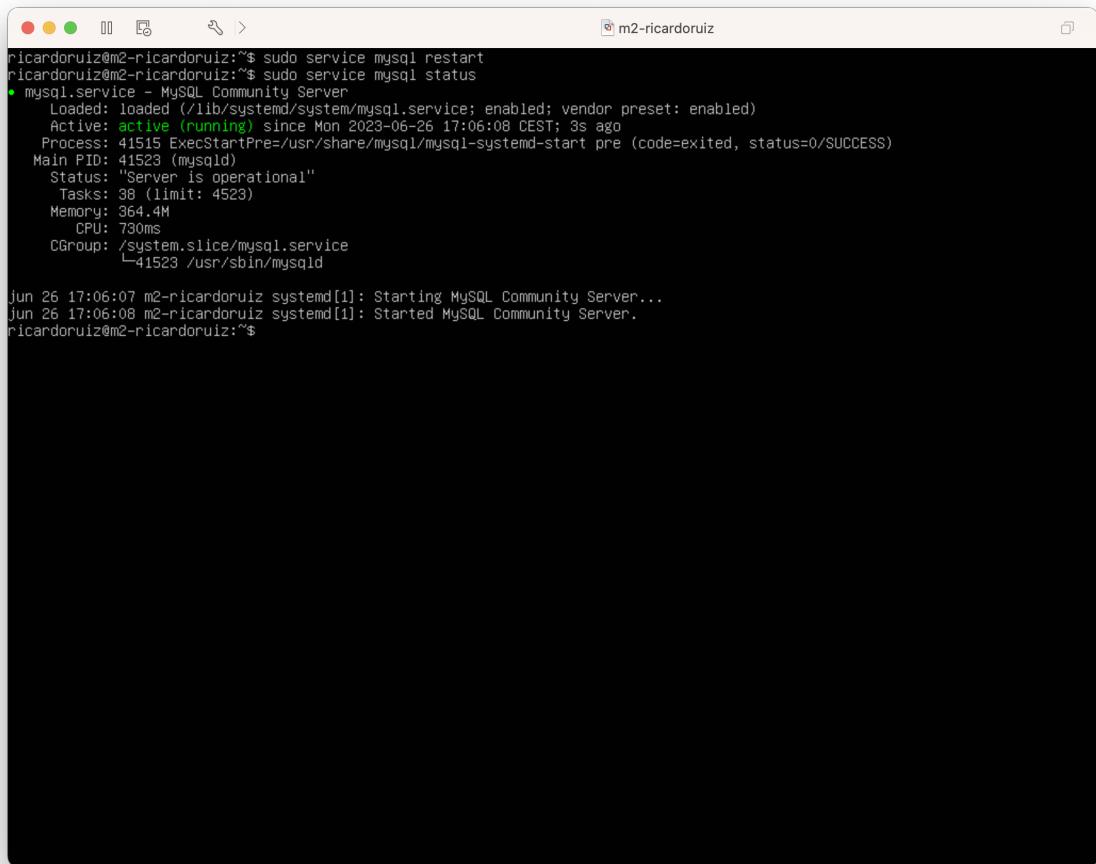
Ahora en M2, como root, editar el archivo `/etc/mysql/mysql.conf.d/mysqld.cnf`

```

1 #bind-address 127.0.0.1
2 log_error = /var/log/mysql/error.log
3 server-id = 2
4 log_bin = /var/log/mysql/mysql-bin.log

```

Reiniciamos el servicio y comprobamos que no hay errores



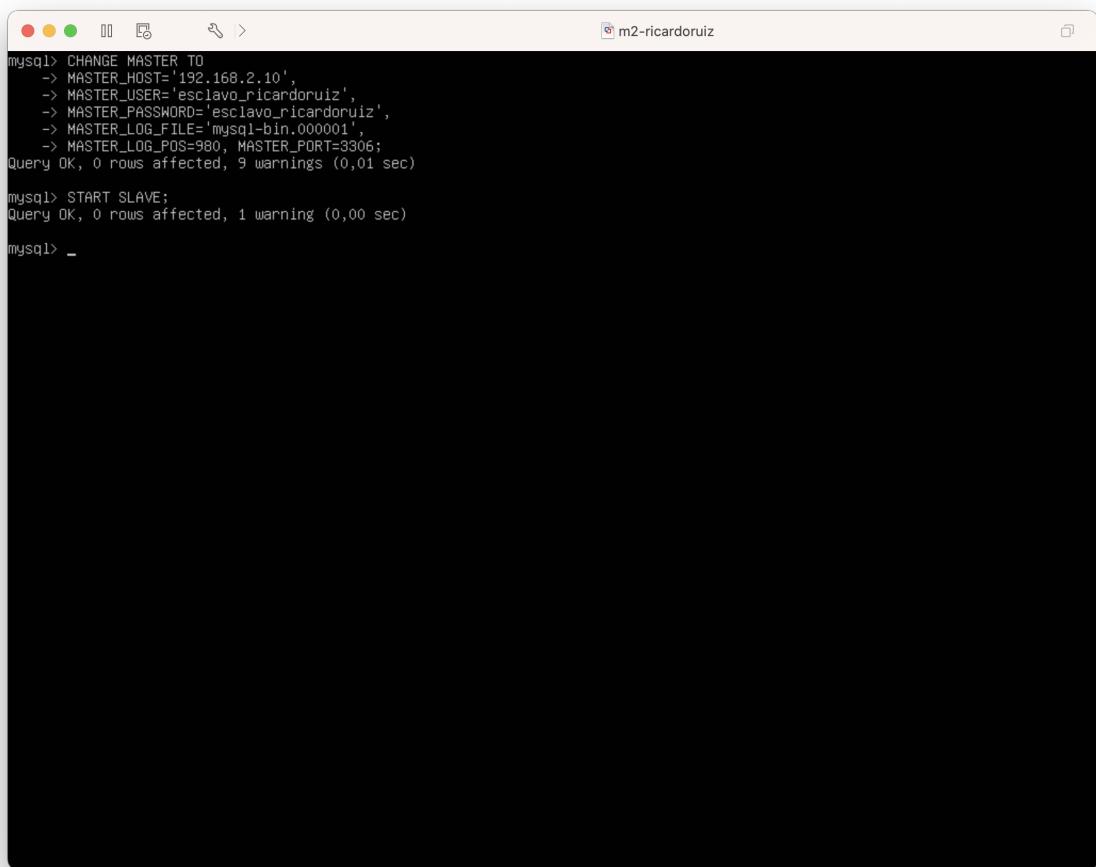
The screenshot shows a terminal window with a black background and white text. The window title is 'm2-ricardoruez'. The terminal displays the following command and its output:

```
ricardoruez@m2-ricardoruez:~$ sudo service mysql restart
ricardoruez@m2-ricardoruez:~$ sudo service mysql status
● mysql.service - MySQL Community Server
  Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor preset: enabled)
  Active: active (running) since Mon 2023-06-26 17:06:08 CEST; 3s ago
    Process: 41515 ExecStartPre=/usr/share/mysql/mysql-systemd-start pre (code=exited, status=0/SUCCESS)
   Main PID: 41523 (mysqld)
     Status: "Server is operational"
       Tasks: 38 (limit: 4523)
      Memory: 364.4M
        CPU: 730ms
       CGroup: /system.slice/mysql.service
               └─ 41523 /usr/sbin/mysqld

Jun 26 17:06:07 m2-ricardoruez systemd[1]: Starting MySQL Community Server...
Jun 26 17:06:08 m2-ricardoruez systemd[1]: Started MySQL Community Server.
ricardoruez@m2-ricardoruez:~$
```

Figura 9: Reinicio MySQL

Configuramos esclavo con los datos del maestro:



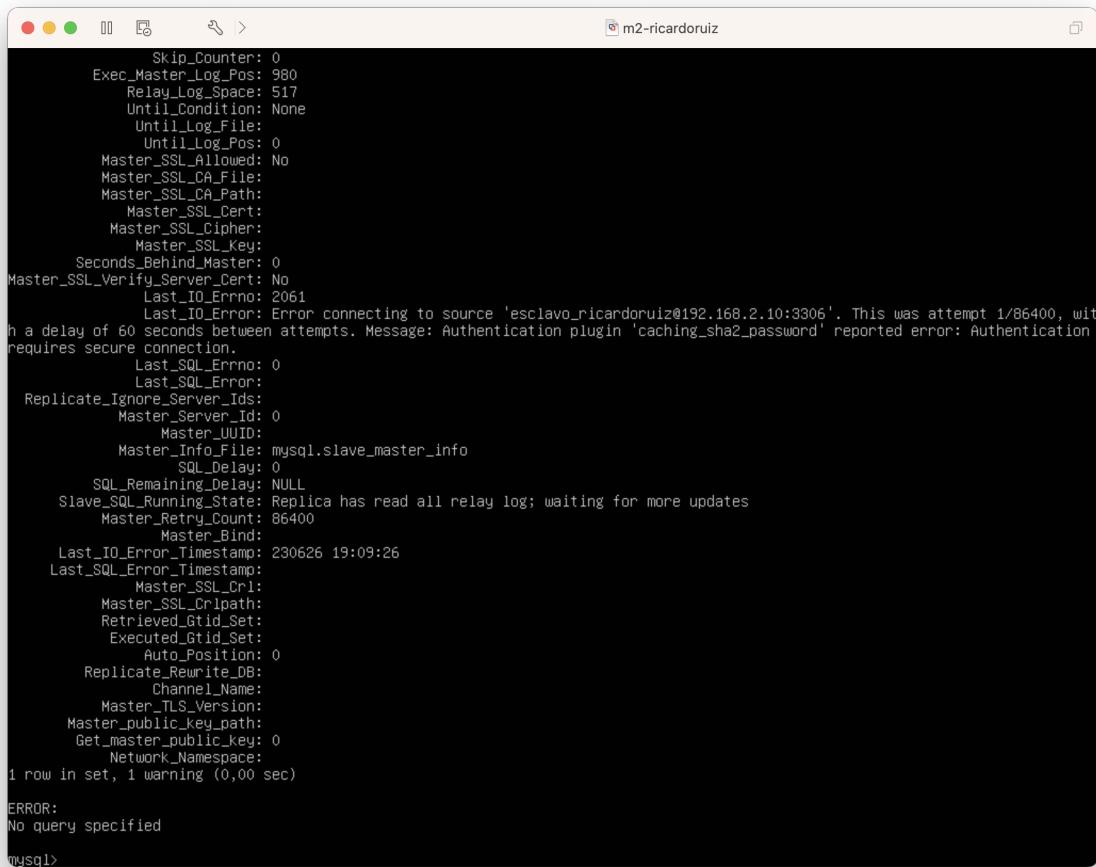
```
mysql> CHANGE MASTER TO
    -> MASTER_HOST='192.168.2.10',
    -> MASTER_USER='esclavo_ricardoruez',
    -> MASTER_PASSWORD='esclavo_ricardoruez',
    -> MASTER_LOG_FILE='mysql-bin.000001'
    -> MASTER_LOG_POS=980, MASTER_PORT=3306;
Query OK, 0 rows affected, 9 warnings (0,01 sec)

mysql> START SLAVE;
Query OK, 0 rows affected, 1 warning (0,00 sec)

mysql> _
```

Figura 10: Configuración esclavo

Y Comprobamos el estado del esclavo



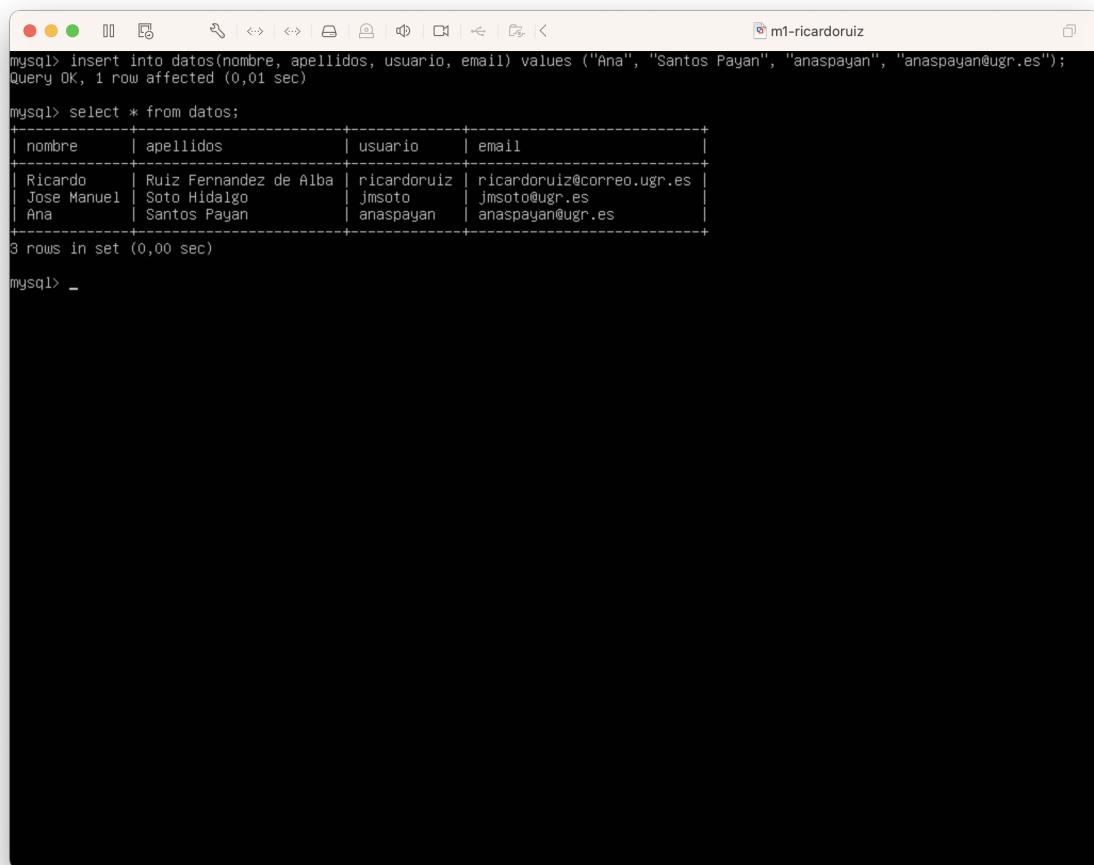
```
Skip_Counter: 0
Exec_Master_Log_Pos: 980
Relay_Log_Space: 517
Until_Condition: None
Until_Log_File:
Until_Log_Pos: 0
Master_SSL_Allowed: No
Master_SSL_CA_File:
Master_SSL_CA_Path:
Master_SSL_Cert:
Master_SSL_Cipher:
Master_SSL_Key:
Seconds_Behind_Master: 0
Master_SSL_Verify_Server_Cert: No
Last_IO_Errorno: 2061
Last_IO_Error: Error connecting to source 'esclavo_ricardoruez@192.168.2.10:3306'. This was attempt 1/86400, with a delay of 60 seconds between attempts. Message: Authentication plugin 'caching_sha2_password' reported error: Authentication requires secure connection.
Last_SQL_Errorno: 0
Last_SQL_Error:
Replicate_Ignore_Server_Ids:
Master_Server_Id: 0
Master_UUID:
Master_Info_File: mysql.slave_master_info
SQL_Delay: 0
SQL_Remaining_Delay: NULL
Slave_SQL_Running_State: Replica has read all relay log; waiting for more updates
Master_Retry_Count: 86400
Master_Bind:
Last_IO_Error_Timestamp: 230626 19:09:26
Last_SQL_Error_Timestamp:
Master_SSL_Crl:
Master_SSL_Crlpath:
Retrieved_Gtid_Set:
Executed_Gtid_Set:
Auto_Position: 0
Replicate_Rewrite_DB:
Channel_Name:
Master_TLS_Version:
Master_public_key_path:
Get_master_public_key: 0
NetworkNamespace:
1 row in set, 1 warning (0,00 sec)

ERROR:
No query specified

mysql>
```

Figura 11: Estado esclavo

Y comprobamos que funciona añadiendo datos al maestro y viendo como se actualizan en el esclavo:

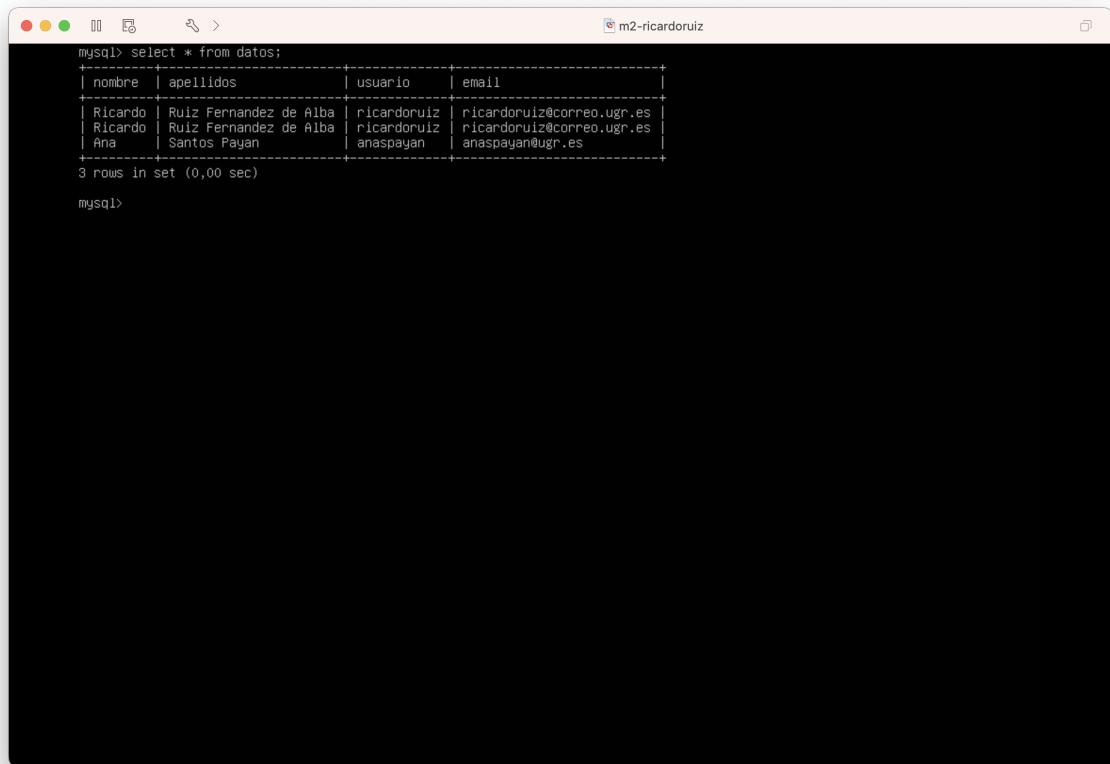


```
mysql> insert into datos(nombre, apellidos, usuario, email) values ("Ana", "Santos Payan", "anaspayan", "anaspayan@ugr.es");
Query OK, 1 row affected (0,01 sec)

mysql> select * from datos;
+-----+-----+-----+-----+
| nombre | apellidos | usuario | email      |
+-----+-----+-----+-----+
| Ricardo | Ruiz Fernandez de Alba | ricardorui | ricardorui@correo.ugr.es |
| Jose Manuel | Soto Hidalgo | jmsoto | jmsoto@ugr.es |
| Ana | Santos Payan | anaspayan | anaspayan@ugr.es |
+-----+-----+-----+-----+
3 rows in set (0,00 sec)

mysql> _
```

Figura 12: Nuevos datos maestro



A screenshot of a terminal window titled "m2-ricardorui". The window displays a MySQL query and its results. The query is "select * from datos;". The results are as follows:

nombre	apellidos	usuario	email
Ricardo	Ruiz Fernandez de Alba	ricardorui	ricardorui@correo.ugr.es
Ricardo	Ruiz Fernandez de Alba	ricardorui	ricardorui@correo.ugr.es
Ana	Santos Payan	anaspayan	anaspayan@ugr.es

3 rows in set (0,00 sec)

mysql>

Figura 13: Actualizacion esclavo