

## Topic 6

# Administering MariaDB

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## Learning objectives

By the end of this topic the learner will be able to

- Discuss the MariaDB database
- Administrate a MariaDB database using SQL

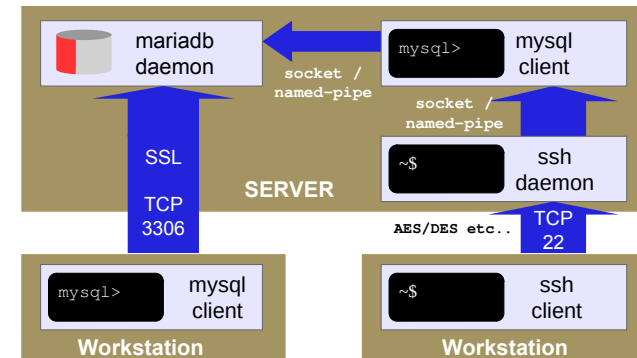
## Structured Query Language (SQL)

- Database query language that was adopted as an industry standard in 1986.
- Standard language for RDBMS.
- SQL statements are used to perform tasks such as update data on a database, or retrieve data from a database.
- An RDBMS contains one or more objects called tables.
  - Tables are uniquely identified by their names and are comprised of columns and rows.
  - Columns contain the column name, data type, and any other attributes for the column.
  - Rows contain the records or data for the columns.

## Relational Database Management System

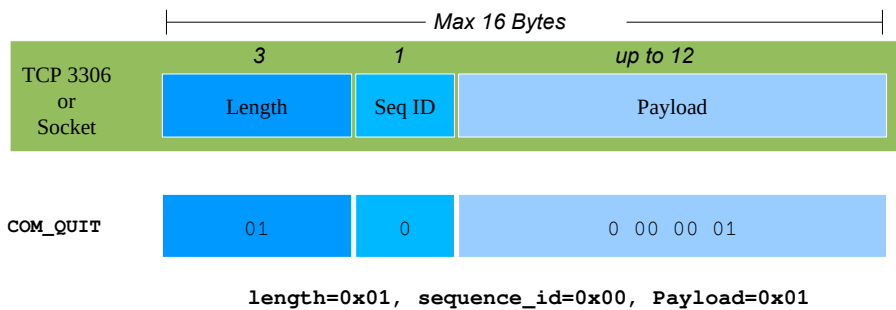
- An RDBMS is a database that support the organisation of data.
- One of the original RSBMS is MySQL which uses the Structured Query Language to query the database.
- MariaDB is an improved fork of MySQL that offers data processing capabilities for both small and enterprise tasks with numerous inbuilt powerful features, security and performance improvements over MySQL.

## MariaDB Server and MySQL Client



```
~$ systemctl list-units --no-pager | grep mariadb
mariadb.service
loaded active running MariaDB 10.6.12 database server
```

## MariaDB / MySQL Segment



## Starting the MariaDB Server

- Starting the MariaDB Server Process on Boot

```
~$ sudo systemctl enable mariadb.service
```

- Starting the MariaDB Server Process

```
~$ sudo systemctl start mariadb.service
```

## Stopping/restarting the MySQL Server

- Starting the MariaDB Server Process on Boot

```
~$ sudo systemctl stop mariadb.service
```

- Re-starting the MariaDB Server Process

```
~$ sudo systemctl restart mariadb.service
```

## Status of the MariaDB Server

```
~$ sudo systemctl status mariadb.service
● mariadb.service - MariaDB 10.6.12 database server
   Loaded: loaded (/lib/systemd/system/mariadb.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2023-12-28 09:21:08 GMT; 7min ago
     Docs: man:mariadb(8)
           https://mariadb.com/kb/en/library/systemd/
   Process: 760 ExecStartPre=/usr/bin/install -m 755 -o mysql -g root -d /var/run/mysql (code=exited, status=0/SUCCESS)
   Process: 783 ExecStartPre=/bin/sh -c systemctl unset-environment _WSREP_START_POSITION (code=exited, status=0/SUCCESS)
   Process: 822 ExecStartPre=/bin/sh -c [ ! -e /usr/bin/galera_recovery ] && VAR= || VAR=cd /usr/bin/./; /usr/bin/galera_recovery; [ $? -eq 0 ] && systemctl set-environment _WSREP_START_POS>
   Process: 1008 ExecStartPost=/bin/sh -c systemctl unset-environment _WSREP_START_POSITION (code=exited, status=0/SUCCESS)
   Process: 1010 ExecStartPost=/etc/mysql/debian-start (code=exited, status=0/SUCCESS)
  Main PID: 899 (mariadbd)
    Status: "Taking your SQL requests now..."
     Tasks: 9 (limit: 9430)
    Memory: 94.2M
       CPU: 782ms
    CGroup: /system.slice/mariadb.service
           └─899 /usr/sbin/mariadbd
```

## Review the MariaDB Server files

```
~$ ls /var/lib/mysql
aria_log.00000001  ibdata1      multi-master.info  phpmyadmin
aria_log_control  ib_logfile0  mysql              tc.log
debian-10.3.flag  ib_logfile1  mysql_upgrade_info
ib_buffer_pool    ibtmp1      performance_schema
```

# SQL Administration



## Login to the database for the first time

```
~$ mysql --user root
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 34
Server version: 10.6.12-MariaDB-0ubuntu0.22.04.1 Ubuntu 22.04
```

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

```
MariaDB [(none)]>
```



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## Database users

- Authentication since MariaDB 10.4 has changed.
- The `mysql_native_password` authentication plugin is the default authentication plugin used for an account created when no authentication plugin is explicitly mentioned and `old_passwords=0` is set.

```
MariaDB [(none)]> show variables like "old_passwords";
+-----+-----+
| Variable_name | Value |
+-----+-----+
| old_passwords | ON    |
+-----+-----+
1 row in set (0.003 sec)
```

```
MariaDB [(none)]> set old_passwords=0;
Query OK, 0 rows affected (0.000 sec)
```



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## Database users

- Confirm the user plugins

```
MariaDB [(none)]> SELECT User, Host, plugin FROM mysql.user;
+-----+-----+-----+
| User      | Host      | plugin                |
+-----+-----+-----+
| mariadb.sys | localhost | mysql_native_password |
| root      | localhost | mysql_native_password |
| mysql     | localhost | mysql_native_password |
| admin     | localhost | mysql_native_password |
| phpmyadmin | localhost | mysql_native_password |
+-----+-----+-----+
5 rows in set (0.004 sec)
```



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## Database users

```
MariaDB [(none)]> CREATE USER 'enguser'@'localhost' IDENTIFIED BY 'engpass';
Query OK, 0 rows affected (0.010 sec)
```

```
MariaDB [(none)]> SELECT USER FROM mysql.user;
```

```
+-----+
| User          |
+-----+
| admin         |
| enguser       |
| mariadb.sys   |
| mysql         |
| phpmyadmin    |
| root          |
+-----+
6 rows in set (0.001 sec)
```

```
MariaDB [(none)]> DELETE FROM mysql.user WHERE USER='enguser';
Query OK, 1 row affected (0.00 sec)
```

## Database users

```
MariaDB [(none)]> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.002 sec)
```

```
MariaDB [(none)]> SELECT USER FROM mysql.user;
```

```
+-----+
| User          |
+-----+
| admin         |
| mariadb.sys   |
| mysql         |
| phpmyadmin    |
| root          |
+-----+
5 rows in set (0.004 sec)
```

## Show and create databases

```
MariaDB [(none)]> SHOW DATABASES;
```

```
+-----+
| Database      |
+-----+
| information_schema |
| mysql         |
| performance_schema |
| phpmyadmin    |
| sys           |
+-----+
5 rows in set (0.010 sec)
```

```
MariaDB [(none)]> CREATE DATABASE Eng;
Query OK, 1 row affected (0.00 sec)
```

```
MariaDB [(none)]> SHOW DATABASES;
```

```
+-----+
| Database      |
+-----+
| Eng           |
| information_schema |
| mysql         |
| performance_schema |
| phpmyadmin    |
| sys           |
+-----+
6 rows in set (0.001 sec)
```

## Database user passwords and rights

```
MariaDB [(none)]> CREATE USER 'enguser'@'localhost' IDENTIFIED BY
'engpass';
Query OK, 0 rows affected (0.007 sec)
```

```
MariaDB [(none)]> SET PASSWORD FOR 'enguser'@'localhost' =
PASSWORD('newengpass');
Query OK, 0 rows affected (0.00 sec)
```

```
MariaDB [(none)]> GRANT ALL ON Eng.* TO 'enguser'@'localhost';
Query OK, 0 rows affected (0.00 sec)
```

## Test user access to database

```
~$ mysql --user enguser --password
Enter password: newengpass
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 38
Server version: 10.6.12-MariaDB-0ubuntu0.22.04.1 Ubuntu 22.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

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

MariaDB [(none)]> USE Eng;
Database changed

MariaDB [Eng]>
```

## Create table

- Create a table on the database
  - Not NULL
  - NULL
  - INT
  - TEXT
  - Primary Key

```
MariaDB [Eng]> CREATE TABLE EngProject (
-> Student_no INT NOT NULL,
-> Username TEXT NULL,
-> FirstName TEXT NULL,
-> LastName TEXT NULL,
-> Email TEXT NULL,
-> Role TEXT NULL,
-> PRIMARY KEY (Student_no)
-> );
Query OK, 0 rows affected (0.00 sec)
```

## Drop tables

- Drop tables

```
MariaDB [Eng]> DROP TABLE EngProject;
Query OK, 0 rows affected (0.028 sec)

MariaDB [Eng]> SHOW TABLES;
Empty set (0.002 sec)
```

## List tables

- List tables

```
MariaDB [Eng]> SHOW TABLES;
+-----+
| Tables_in_Eng |
+-----+
| EngProject     |
+-----+
1 row in set (0.002 sec)
```

## Add values to tables

- Add values to tables

```
MariaDB [Eng]> INSERT INTO EngProject VALUES (  
-> 000000,  
-> 'alovelace',  
-> 'Ada',  
-> 'Lovelace',  
-> 'ada@lovelace.com',  
-> 'Programmer'  
-> );
```

Query OK, 1 row affected (0.010 sec)

```
MariaDB [Eng]> INSERT INTO EngProject VALUES (000001, 'cbabage',  
'Charles', 'Babbage', 'charles@babbage.com', 'Hardware');  
Query OK, 1 row affected (0.009 sec)
```

## View a table

- View tables

```
MariaDB [Eng]> SELECT * FROM EngProject;
```

```
+-----+-----+-----+-----+-----+-----+  
| Student_no | Username | FirstName | LastName | Email | Role |  
+-----+-----+-----+-----+-----+-----+  
|          0 | alovelace | Ada | Lovelace | ada@lovelace.com | Programmer |  
|          1 | cbabage | Charles | Babage | charles@babbage.com | Hardware |  
+-----+-----+-----+-----+-----+-----+
```

2 rows in set (0.002 sec)

## Delete values from tables

- Delete values from tables

```
MariaDB [Eng]> DELETE FROM EngProject WHERE Student_no='0';  
Query OK, 1 row affected (0.010 sec)
```

```
MariaDB [Eng]> SELECT * FROM EngProject;
```

```
+-----+-----+-----+-----+-----+-----+  
| Student_no | Username | FirstName | LastName | Email | Role |  
+-----+-----+-----+-----+-----+-----+  
|          1 | cbabage | Charles | Babage | charles@babbage.com | Hardware |  
+-----+-----+-----+-----+-----+-----+
```

1 row in set (0.00 sec)

## Query to display selected values

- Query to display selected values

```
MariaDB [Eng]> SELECT FirstName, LastName FROM EngProject;
```

```
+-----+-----+  
| FirstName | LastName |  
+-----+-----+  
| Ada | Lovelace |  
| Charles | Babage |  
+-----+-----+
```

2 rows in set (0.002 sec)

- To order the list alphabetically by the **LastName**

```
MariaDB [Eng]> SELECT FirstName, LastName FROM EngProject ORDER BY LastName;
```

```
+-----+-----+  
| FirstName | LastName |  
+-----+-----+  
| Charles | Babage |  
| Ada | Lovelace |  
+-----+-----+
```

2 rows in set (0.002 sec)

## Query to edit a value in the table

- Query to edit a value in the table

```
MariaDB [Eng]> UPDATE EngProject SET LastName='Babbage' WHERE Student_no='1';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0
```

- To check the effect made with the update select everything (\*) from the table where the primary column value is '1'.

```
MariaDB [Eng]> SELECT * FROM EngProject WHERE Student_no='1';
+-----+
| Student_no | Username | FirstName | LastName | Email | Role |
+-----+
| 1 | cbabbage | Charles | Babage | charles@babbage.com | Hardware |
+-----+
1 row in set (0.00 sec)
```

## Counting data

```
MariaDB [Eng]> SELECT COUNT(*) FROM EngProject;
+-----+
| COUNT(*) |
+-----+
| 2 |
+-----+
1 row in set (0.00 sec)
```

```
MariaDB [Eng]> SELECT COUNT(*) FROM EngProject GROUP BY LastName;
+-----+
| COUNT(*) |
+-----+
| 1 |
| 1 |
+-----+
2 rows in set (0.00 sec)
```

## Counting data

```
MariaDB [Eng]> SELECT LastName, Email, COUNT(*) FROM EngProject
GROUP BY LastName, Email;
+-----+
| LastName | Email | COUNT(*) |
+-----+
| Babbage | charles@babbage.com | 1 |
| Lovelace | ada@lovelace.com | 1 |
+-----+
2 rows in set (0.00 sec)
```

## Add an additional table

```
MariaDB [Eng]> CREATE TABLE EngHobbies (Student_no INT NOT NULL, Hobbies TEXT
NULL, PRIMARY KEY (Student_no));
Query OK, 0 rows affected (0.053 sec)
```

```
MariaDB [Eng]> INSERT INTO EngHobbies VALUES (000000, 'camogie, cards');
Query OK, 1 row affected (0.017 sec)
```

```
MariaDB [Eng]> INSERT INTO EngHobbies VALUES (000001, 'football, darts');
Query OK, 1 row affected (0.022 sec)
```

```
MariaDB [Eng]> SELECT * FROM EngHobbies;
+-----+
| Student_no | Hobbies |
+-----+
| 0 | camogie, cards |
| 1 | football, darts |
+-----+
2 rows in set (0.002 sec)
```



## Multiple tables around same dataset

PRIMARY KEY		EngProject				
Student_no	Username	FirstName	LastName	Email	Role	
0	alovelace	Ada	Lovelace	ada@lovelace.com	Programmer	
1	cbabbage	Charles	Babbage	charles@babbage.com	Hardware	

Student_no	Hobbies
0	camogie, cards
1	football, darts

**EngHobbies**

## Joining data from different tables

```
MariaDB [Eng]> SELECT a.LastName, b.Hobbies
-> FROM EngProject a INNER JOIN EngHobbies b
-> ON a.Student_no = b.Student_no;
+-----+-----+
| LastName | Hobbies |
+-----+-----+
| Lovelace | camogie, cards |
| Babbage  | football, darts |
+-----+-----+
2 rows in set (0.003 sec)
```

## Joining data from different tables

```
MariaDB [Eng]> SELECT a.LastName, b.Hobbies
-> FROM EngProject a INNER JOIN EngHobbies b
-> ON a.Student_no = b.Student_no
-> WHERE a.Student_no = 0;
+-----+-----+
| LastName | Hobbies |
+-----+-----+
| Lovelace | camogie, cards |
+-----+-----+
1 row in set (0.002 sec)
```

## Joining data from different tables

```
MariaDB [Eng]> SELECT b.Hobbies
-> FROM EngProject a INNER JOIN EngHobbies b
-> ON a.Student_no = b.Student_no
-> WHERE a.FirstName = 'ada';
+-----+
| Hobbies |
+-----+
| camogie, cards |
+-----+
1 row in set (0.002 sec)
```

## Dumping databases to file

- Use `mysqldump` command to save copy of a database

```
~$ sudo mysqldump -u root -p Eng > EngProject.sql
[sudo] password for ada: ada_pass
Enter password: mariaroot

~$ ls
EngProject.sql

~$ head EngProject.sql
-- MySQL dump 10.19  Distrib 10.3.29-MariaDB, for debian-linux-gnueabihf
(armv7l)
--
-- Host: localhost      Database: Eng
-----
-- Server version      10.3.29-MariaDB-0+deb10u1
```

## Drop the database from the Server

- To demonstrate recovery the database must be dropped

```
~$ sudo mysql -u root -p
[sudo] password for ada: ada_pass
Enter password: mariaroot

MariaDB [(none)]> DROP DATABASE Eng;
Query OK, 2 rows affected (0.058 sec)

MariaDB [(none)]> SHOW DATABASES;
+-----+
| Database |
+-----+
| information_schema |
| mysql |
| performance_schema |
| phpmyadmin |
| sys |
+-----+
5 rows in set (0.000 sec)
```

## Rebuild database

```
~$ sudo mysql -u root -p
[sudo] password for ada: ada_pass
Enter password: mariaroot

MariaDB [(none)]> CREATE DATABASE Eng;
Query OK, 1 row affected (0.00 sec)

MariaDB [(none)]> exit;
Bye
```

## Rebuild database

```
~$ sudo mysql -u root -p Eng < EngProject.sql
[sudo] password for ada: ada_pass
Enter password: mariaroot

~$ mysql -u enguser -p Eng
Enter password: newengpass

MariaDB [Eng]> SELECT * FROM EngProject;
+-----+-----+-----+-----+-----+-----+
| Student_no | Username | FirstName | LastName | Email | Role |
+-----+-----+-----+-----+-----+-----+
| 0 | alovelace | Ada | Lovelace | ada@lovelace.com | Programmer |
| 1 | cbabbage | Charles | Babbage | charles@babbage.com | Hardware |
+-----+-----+-----+-----+-----+-----+
2 rows in set (0.002 sec)
```

**Laboratory #1**  
Build a **MariaDB** Database

**TUS**

## Laboratory – Create database

- Create a database using MariaDB with the following data.
- Database name – Counties
- Table 1 – County Number, County Capital, County highest mountain, and County main river.
  - An arbitrary County number is an integer, the rest are text fields
  - Populate all County rows with data, blanks can exist where a county doesn't have a mountain or a river but the County number and name cannot be empty.
- Table 2 – Sport of prominence in the counties, allow for two sports per county.
  - Again populate all entries.
  - NOTE: Use county number as the Primary Key in each database

## Laboratory – Create database

- Perform an SQL query that returns all counties in alphabetical order.
- Perform SQL query that returns all county names with their river, mountain and sports in alphabetical order.

COUNTY	CAPITAL	RIVER	MOUNTAIN	SPORT
Limerick	Limerick	Shannon	Galtymore	Rugby
Clare	Ennis	Shannon	Moylussa	Hurling
Tipperary	Nenagh	Shannon	Galtymore	Hurling
...	...	...	...	...

- Document each stage.
- Dump the database to a file Counties.sql.
- Document each stage.
- Add the SQL file and the Document to a .zip or .tgz archive and upload to Moodle.

## Learning Objectives

- Discuss the MariaDB database ✓
- Administrate a MariaDB database using SQL ✓

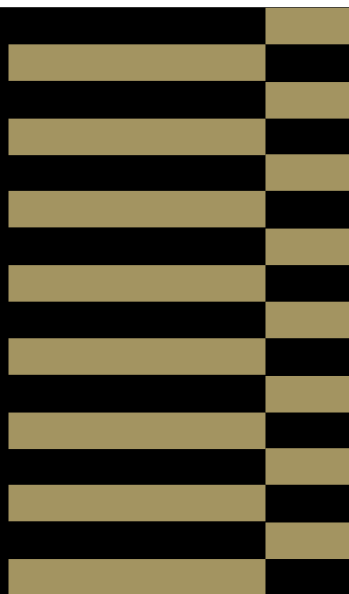


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# Thank you

