DATABASE

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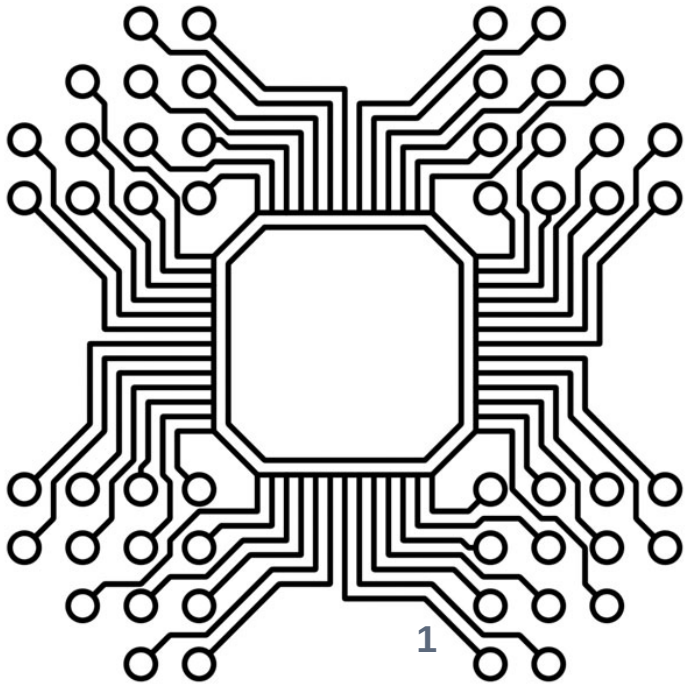


Setting up LAMP Server

- **MySQL:**

  sudo apt-get install mariadb-server mariadb-client

  - During installation, set up password for “root” user or change password later with

    sudo mysql_secure_installation

  - C library for MySQL:

    sudo apt-get install libmariadb-dev

  - Python Library for MySQL:

    pip3 install mysql-connector-python

Setting up MySQL

- Create new account for MySQL

1. sudo mysql -u root –p
2. create user ‘your_name’@’localhost’ identified by ‘your_password’;
3. grant all privileges on *.* to ‘your_name’@’localhost’ with grant option;
4. flush privileges;

Create new database in MySQL

- Open MySQL with:

```
sudo mysql -uroot -p
```

This command will logs into MySQL as the root user (-u) and it will prompt for a password (-p) on entry.

- Create new database:

```
CREATE DATABASE temp_database;
```

- List all databases:

```
SHOW DATABASES;
```

```
+--------------------+
| Database           |
+--------------------+
| information_schema |
| mysql              |
| performance_schema |
| temp_database      |
+--------------------+
```

Create new database in MySQL

- Select temp_database

```
USE temp_database;
```

- Create a new table name “tempLog”

CREATE TABLE tempLog(datetime DATETIME NOT NULL, temperature FLOAT(5,2) NOT NULL);

- Check new table

```
mysql> DESCRIBE tempLog;
```

```
+-------+----------+------+-----+---------+-------+
| Field | Type     | Null | Key | Default | Extra |
+-------+----------+------+-----+---------+-------+
| datetime | datetime | NO |  | NULL |  |
| temperature | float(5,2) | NO |  | NULL |  |
+-------+----------+------+-----+---------+-------+
```

MySQL data types

(Refer to https://www.tutorialspoint.com/mysql/mysql-data-types.htm and https://dev.mysql.com/doc/refman/8.0/en/data-type-overview.html for more detail)

- **Numeric types**
  - **INT**: signed 32bit int, range from -2147483648 to 2147483647
  - **TINYINT**: signed 8bit INT
  - **MEDIUMINT**: signed 24bit INT
  - **FLOAT(M,D)**: floating-point number with display length M and number of decimals D.
- **Date and Time types**
  - **DATE**: a date in YYYY-MM-DD format
  - **DATETIME**: date and time combination in YYYY-MM-DD HH:MM:SS format.
  - **TIME**: store time in HH:MM:SS format

MySQL data types

- **String types**
  - **CHAR(M)**: fixed-length (M) string, max 255 characters
  - **VARCHAR(M)**: variable-length string, max 255 characters
  - **BLOB** or **TEXT**: a field with maximum 65535 characters

Examples

```
CREATE TABLE IF NOT EXISTS tasks (
    task_id INT AUTO_INCREMENT,
    title VARCHAR(255) NOT NULL,
    start_date DATE,
    due_date DATE,
    priority TINYINT NOT NULL DEFAULT 3,
    description TEXT,
    PRIMARY KEY (task_id)
);
```

```
INSERT INTO
 tasks(title,priority)
VALUES
 ('Learn MySQL INSERT Statement',1);
```

```
INSERT INTO tasks(title, start_date, due_date)
VALUES('Insert date into table','2018-01-09','2018-09-15');
```

MySQL Data manipulation

- **Insert data to a table**
  - Insert a single row

    INSERT INTO table(c1,c2,...) VALUES (v1,v2,...);
  - Insert multiple rows:

  INSERT INTO table(c1,c2,...) VALUES (v11,v12,...),(v21,v22,...),
  ..., (vnn,vn2,...);
- **Delete data from a table**
  - Delete rows:

    DELETE FROM table_name WHERE condition;

  e.g. DELETE FROM temperature WHERE ID = 4;

  DELETE FROM temperature WHERE ID < 4;

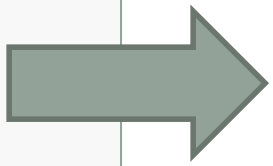
  DELETE FROM diemdanh WHERE name = 'Hieu';

Example

```
CREATE TABLE animals (
     id MEDIUMINT NOT NULL AUTO_INCREMENT,
     name CHAR(30) NOT NULL,
     PRIMARY KEY (id)
);

INSERT INTO animals (name) VALUES
    ('dog'),('cat'),('penguin'),
    ('lax'),('whale'),('ostrich');

SELECT * FROM animals;
```



```
+----+---------+
| id | name    |
+----+---------+
|  1 | dog     |
|  2 | cat     |
|  3 | penguin |
|  4 | lax     |
|  5 | whale   |
|  6 | ostrich |
+----+---------+
```

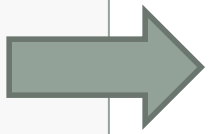
https://dev.mysql.com/doc/refman/8.0/en/example-auto-increment.html

Example

```
CREATE TABLE animals (
    grp ENUM('fish','mammal','bird') NOT NULL,
    id MEDIUMINT NOT NULL AUTO_INCREMENT,
    name CHAR(30) NOT NULL,
    PRIMARY KEY (grp,id)
) ENGINE=MyISAM;

INSERT INTO animals (grp,name) VALUES
    ('mammal','dog'),('mammal','cat'),
    ('bird','penguin'),('fish','lax'),('mammal','whale'),
    ('bird','ostrich');

SELECT * FROM animals ORDER BY grp,id;
```



```
+--------+----+---------+
| grp    | id | name    |
+--------+----+---------+
| fish   |  1 | lax     |
| mammal |  1 | dog     |
| mammal |  2 | cat     |
| mammal |  3 | whale   |
| bird   |  1 | penguin |
| bird   |  2 | ostrich |
+--------+----+---------+
```

MySQL Data manipulation

- **Update data in a table:**
  - Update a row:

```
UPDATE table_name
SET
    column_name1 = expr1,
    column_name2 = expr2,
    ...
[WHERE
    condition];
```

e.g. UPDATE sensor SET temp = 30, humid = 65 WHERE id = 1;

UPDATE table1 SET col1 = col1 + 1, col2 = col1;

MySQL Data manipulation

- **Select data from a table**
  - Select clause:

```
SELECT
    column_1, column_2, ...
FROM
    table_1
WHERE
    conditions
ORDER BY column_1
LIMIT offset, length;
```

e.g. SELECT ho, ten, mssv FROM danhsach;
SELECT temp FROM sensor LIMIT 50,20

Send data to database in C

```
#include <mysql.h>
#include <stdio.h>

float data;  // data you want to send to database
int main(void) {
   MYSQL *conn;
   MYSQL_RES *res;
   MYSQL_ROW row;

   char *server = "localhost";
   char *user = "root";
   char *password = "PASSWORD"; /* set me first */
   char *database = "temp_database";
   while(1){
      // Connect to database
      conn = mysql_init(NULL);
      mysql_real_connect(conn,server,user,password,database,0,NULL,0);
```

Send data to database in C

```
        // Create sql command
        char cmd[200];
        sprintf(cmd,"insert into gyro(Gx) values (%.2f)",data);

        // send SQL query
        mysql_query(conn, cmd);
        mysql_close(conn);
    }
    return 0;
}
```

Send data to database in C

- Compile the program with:

```
$ gcc -o output_file $(mariadb_config --cflags) source_code.c $(mariadb_config --libs)
```

Retrieving data from the DB in C

- **In C** ***(refer to this link for more detail http://zetcode.com/db/mysqlc/)***
  - **Step 1:** select data

```
mysql_query(con, "SELECT * FROM sensor")
```

  - **Step 2:** save data into a variable

```
MYSQL_RES *result = mysql_store_result(con);
```

  - **Step 3:** get number of columns

```
int num_fields = mysql_num_fields(result);
```

  - **Step 4:** retrieve each row data

```
MYSQL_ROW row;
 while ((row = mysql_fetch_row(result)))
 {
      for(int i = 0; i < num_fields; i++)
      {
         // your code
      }
 }
```

Retrieving data from the DB in C

```
#include <mysql.h>
#include <stdio.h>

int main(void) {
   MYSQL *conn;
   MYSQL_RES *res; // variable used to store DB data
   MYSQL_ROW row;

   char *server = "localhost";
   char *user = "root";
   char *password = "PASSWORD"; /* set me first */
   char *database = "temp_database";
   while(1){
      // Connect to database
      conn = mysql_init(NULL);
      mysql_real_connect(conn,server,user,password,database,0,NULL,0);
```

Retrieving data from the DB in C

```
        // Read data from database
        mysql_query(conn, "select * from data_table");
        res = mysql_store_result(conn);
        int num_column = mysql_num_fields(res);
        while (row = mysql_fetch_row(res))
        {
            printf("%s \t %s \t %d \n",row[0], row[1],row[2]);
        }
        // clear result and close the connection
        mysql_free_result(res);
        mysql_close(conn);
    }
    return 0;
}
```

Connecting to SQL using Python

```
import mysql.connector

conn = mysql.connector.connect(
  host="localhost",
  user="your_user",
  password="your_pass",
  database="Temp_db"
)
cursor = conn.cursor()

sql = "insert into sensors(temp,humid) values (32,76)"
cursor.execute(sql)
conn.commit()
cursor.execute("SELECT * FROM sensors")
result = cursor.fetchall()  # fetchone() to read 1 row
for x in result:
  print(x)
```