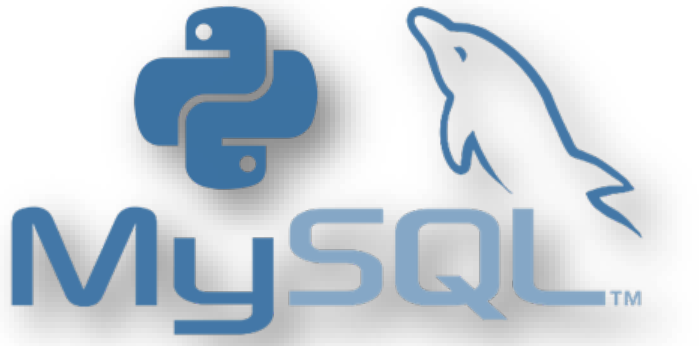
Python and MySQL



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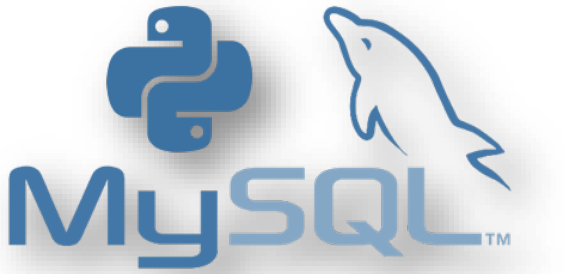
- Introduction
- Install – Connect
- Create – Insert – Query



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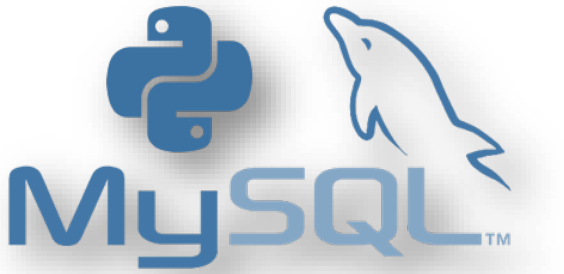

Introduction

Connector

To be able to connect to a MySQL database in Python, a database driver called MySQL Connector/Python is required.

MySQL offers connectors (drivers) for all of the most common programming environments.

Python Application – Client

Connector – Driver

Database – Server

Introduction

Guidelines

➞ MySQL Python Developer Guide

- Do not hardcode login information in your main script. Python has the convention of a config.py module, where you can keep such values separate from the rest of your code.
- Any application that accepts input must expect to handle bad data.
- Data that you choose to store in MySQL is likely to have special characteristics:
  - Too large to all fit in memory at one time.
  - Too complex to be represented by a single data structure.
  - Updated frequently - perhaps by multiple users simultaneously.
- Issuing SQL statements from Python typically involves declaring very long, possibly multi-line string literals.

Introduction

Guidelines – expect to handle bad data (1/2)

The bad data might be accidental, such as out-of-range values or misformatted strings. The MySQL server has most likely already some checks – such as unique constraints and NOT NULL constraints – in place to keep the bad data from ever reaching the database.

In Python, use techniques such as exception handlers to report any problems and take corrective action:

```
# catch bad data
try:
    some SQL action
except:
    show error/warning message
    some corrective action
```

Introduction

Guidelines – expect to handle bad data (2/2)

The bad data might also be deliberate, representing an “SQL injection” attack.

For example, input values might contain quotation marks, semicolons, % and _ wildcard characters and other characters significant in SQL statements.

Validate input values to make sure they have only the expected characters. Escape (i.e. put a backslash \ in front) any special characters that could change the intended behavior when substituted into an SQL statement.

Never concatenate a user input value into an SQL statement without doing validation and escaping first. Even when accepting input generated by some other program, expect that the other program could also have been compromised and be sending you incorrect or malicious data.

```
# escape special characters
import re
my_text = 'blabla % ; blabla "'
escaped_text = re.escape(my_text)
```

Introduction

Guidelines – special characteristics (1/3)

- Too large to all fit in memory at one time.
- Too complex to be represented by a single data structure.
- Updated frequently - perhaps by multiple users simultaneously.

Use SELECT statements to query only the precise items you need.

Introduction

Guidelines – special characteristics (2/3)

- Too large to all fit in memory at one time.
- Too complex to be represented by a single data structure.
- Updated frequently - perhaps by multiple users simultaneously.

The data is divided between different SQL tables. Recombine data from multiple tables by using a JOIN query. Make sure that related data is kept in sync between different tables by setting up FOREIGN KEY relationships.

Introduction

Guidelines – special characteristics (3/3)

- Too large to all fit in memory at one time.
- Too complex to be represented by a single data structure.
- Updated frequently - perhaps by multiple users simultaneously.

The updates might only affect a small portion of the data, making it wasteful to write the whole structure each time. Use the SQL INSERT, UPDATE, and DELETE statements to update different items concurrently, writing only the changed values to disk.

Introduction

Guidelines – very long, multi-line strings

Because string literals within the SQL statements could be enclosed by single quotation, double quotation marks, or contain either of those characters, for simplicity you can use Python's triple-quoting mechanism to enclose the entire statement:

```
# very long string
'''It doesn't matter if this string contains 'single' or
"double" quotes, as long as there aren't 3 in a row.'''
```

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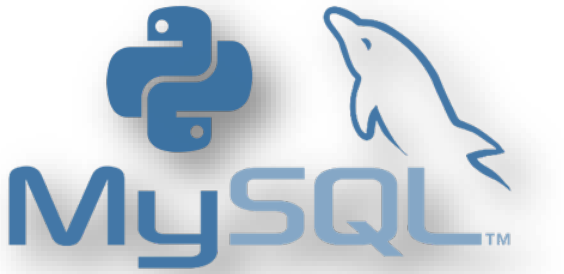
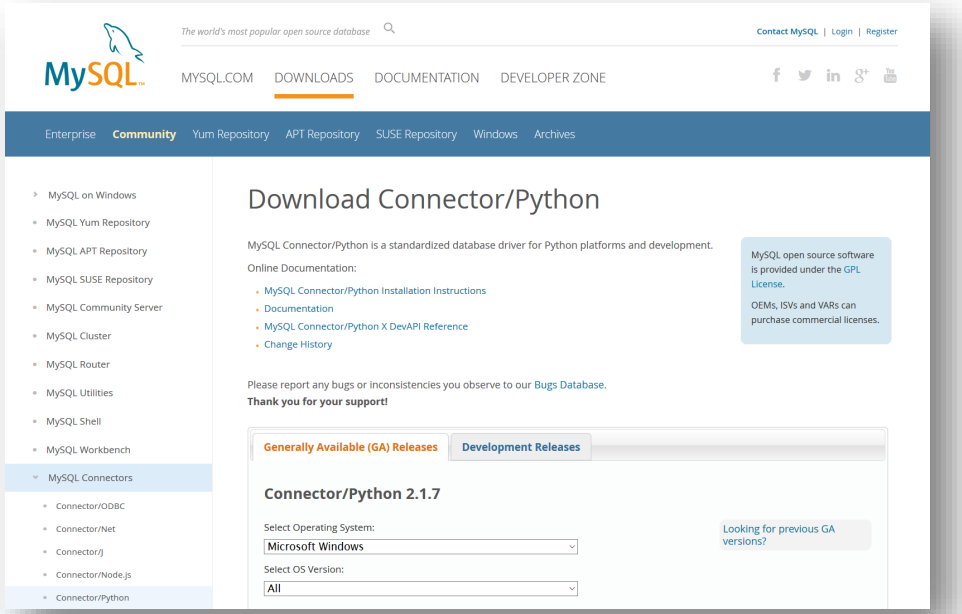
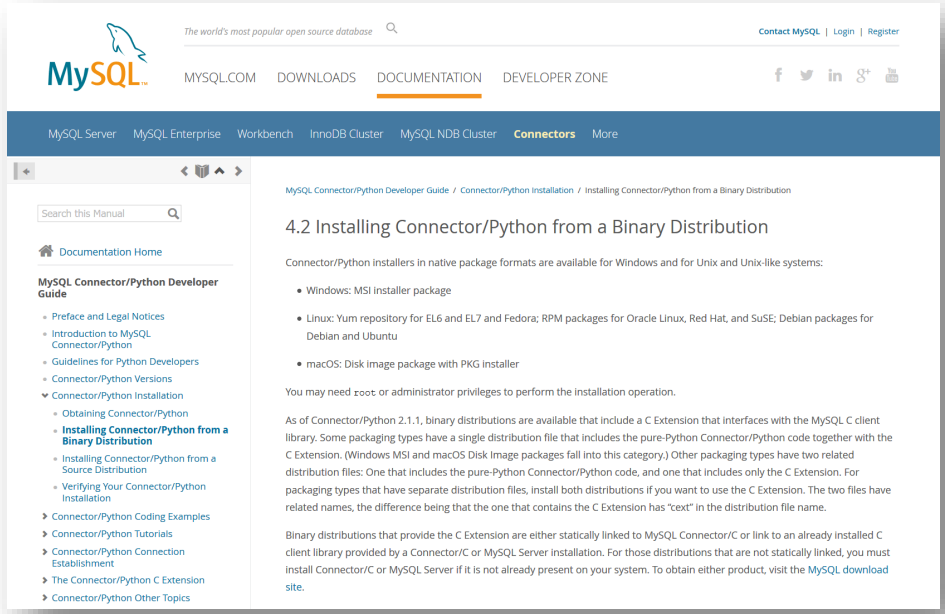


Install

Download



Install



Connect

The first thing to do in Python to access a MySQL database is to establish a connection to the server.

```
# import mysql connector
import mysql.connector

# create a new connection to the database
myConn = mysql.connector.connect(user='user',
                                 password='password',
                                 host='server')

# close the connection to the database
myConn.close()
```

Connect

config.py

config.py

```
# store information
DATABASE = {'host': 'localhost',
            'user': 'user',
            'password': 'password'}
```

myCode.py

```
# import
import config
import mysql.connector

# create a new connection to the database
myConn = mysql.connector.connect(user=config.DATABASE['user'],
                                 password=config.DATABASE['password'],
                                 host=config.DATABASE['host'])
```

Connect

Errors

```
# import
import mysql.connector

# catch errors
try:
    myConn = mysql.connector.connect(user='user',
                                     password='password',
                                     host='server')
except mysql.connector.Error as err:
    if err.errno == mysql.connector.errorcode.ER_ACCESS_DENIED_ERROR:
        print("Something is wrong with your user name or password")
    else:
        print(err)
else:
    myConn.close()
```

Connect

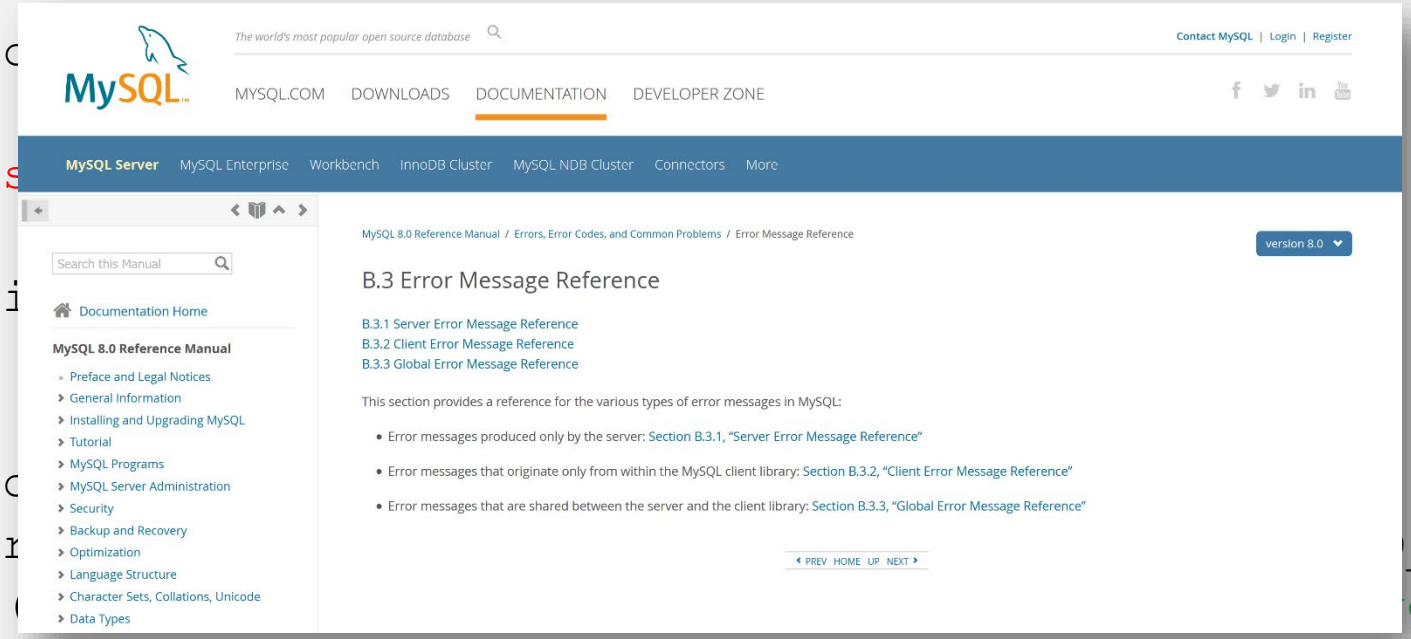
Errors

```
# import
import mysql.c

# catch errors
try:
    myConnecti



except mysql.c
    if err.err
        print(
    else:
        print(err)
else:
    myConnection.close()
```



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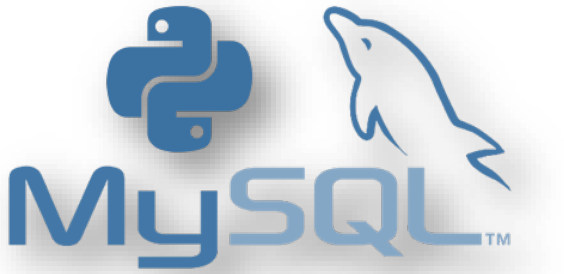

Create

Cursor

The *MySQL Connector/Python* provides the cursor object to pass statements to the server.

In a first step, the curser object has to be created:

```
# connect
myConn = mysql.connector.connect(user='user',
                                 password='password',
                                 host='server')

# create cursor
myCursor = myConn.cursor()
```

Create

Database

Any SQL statement can be sent to the server by calling the execute method of the cursor object.

```
# create database
myCursor.execute('CREATE DATABASE firstPythonDB')
```

no semicolon

Implementing your own method to create databases:

```
def create_database(cursor, dbname):
    try:
        cursor.execute('CREATE DATABASE {}'.format(dbname))
    except mysql.connector.Error as err:
        print('Failed creating database: {}'.format(err))
        exit(1)
```

Create

Database

To tell the server which database to use, the database name should be given to the connector.

```
# use database firstPythonDB
myConn.database = 'firstPythonDB'
```

WARNING: If no database with the given name exists, an error is thrown.

```
try:
    myConn.database = 'firstPythonDB'
except mysql.connector.Error as err:
    if err.errno == mysql.connector.errorcode.ER_BAD_DB_ERROR:
        print('Database does not exist: {}'.format(err))
        exit(1)
```

Create

Tables

It’s always a good idea to define longer strings outside of the code that uses them.

```
# define table
employeesTable = ("CREATE TABLE employees ("
                  "emp_no int(11) NOT NULL AUTO_INCREMENT, "
                  "birth_date date NOT NULL, "
                  "first_name varchar(14) NOT NULL, "
                  "last_name varchar(16) NOT NULL, "
                  "gender enum('M','F') NOT NULL, "
                  "hire_date date NOT NULL, "
                  "PRIMARY KEY (emp_no) "
                  ")")
```

Create

Tables

Again the cursor object is used to send the CREATE TABLE statement to the server:

```
try:
    myCursor.execute(employeesTable)
except mysql.connector.Error as err:
    if err.errno == mysql.connector.errorcode.ER_TABLE_EXISTS_ERROR:
        print("Table already exists.")
    else:
        print(err.msg)
```

Insert

Define String

INSERT statements are executed on the server using the cursor object's execute method:

```
# define new record
addEmployee = ("INSERT INTO employees ("
                        "first_name, last_name, "
                        "hire_date, gender, birth_date) "
                        "VALUES ("
                        "'Tom', 'Smith', "
                        "'1987-02-14', 'M', '1955-05-07') "
                        ")")

# insert record into table
myCursor.execute(addEmployee)
```

Insert

Values

Values should be separated from the SQL string:

```
# define new record
addEmployee = ("INSERT INTO employees ("
                       "first_name, last_name, "
                       "hire_date, gender, birth_date) "
                       "VALUES (%s, %s, %s, %s, %s)")

# set data
dataEmployee = ('Tom', 'Smith', '1987-02-14', 'M', '1955-05-07')

# insert record into table
myCursor.execute(addEmployee, dataEmployee)
```

Insert

Commit

SQL commands that **modify the database** in any way (INSERT, ALTER, UPDATE, DROP, etc.) do not have an immediate effect after running the execute function. To make these commands effective, the commit method of the connector has to be executed.:

```
# insert record into table
myCursor.execute(addEmployee, dataEmployee)

# commit changes
myConn.commit()
```

Query

fetchall

To retrieve data, a SELECT command has to be executed. The resulting table can be fetched in Python using the cursor's fetchall method. The fetchall method returns the data as a list of lists:

```
# get all employees
myCursor.execute("SELECT * FROM employees")
employeesList = myCursor.fetchall()

# get the first employee
firstEmployee = employeesList[0]

# get the first attribute of the first employee
firstAttr = firstEmployee[0]
```