>>

Psycopg2

^ >>

❖ Psycopg2

Psycopg2 is a Python module that provides

- a method to connect to PostgreSQL databases
- a collection of DB-related exceptions
- a collection of type and object constructors

In order to use Psycopg2 in a Python program

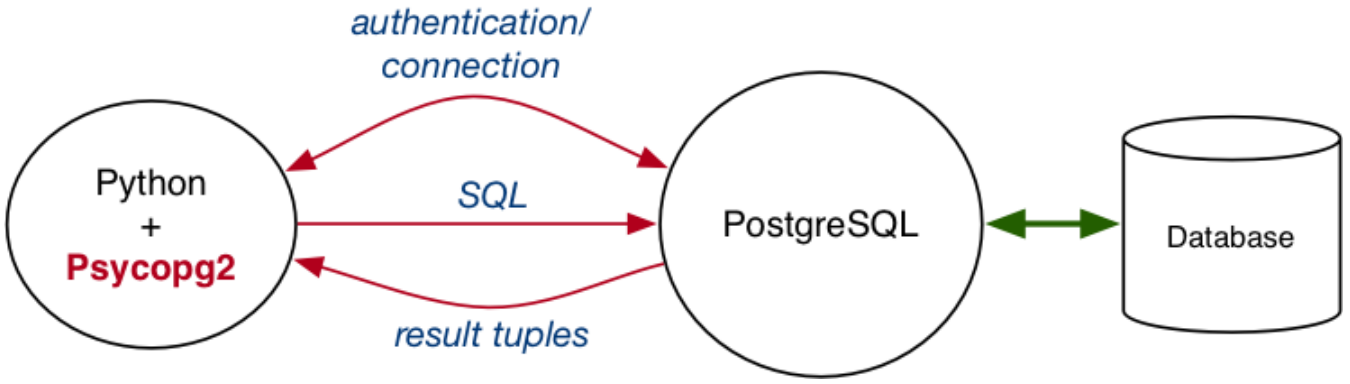
```
import psycopg2
```

Note:

- assumes that the **psycopg2** module is installed on your system
- Psycopg2 is installed on Grieg; installing on a Mac is relatively easy

❖ Psycopg2 (cont)

Where **psycopg2** fits in the PL/DB architecture



<< ^ >>

❖ Database connections

`conn = psycopg2.connect(`*DB_connection_string***`)`**

- creates a **`connection`** object on a named database
- effectively starts a session with the database (cf **`psql`**)
- returns a **`connection`** object used to access DB
- if can't connect, raises an exception

DB connection string components

- **`dbname`** ... name of database
- **`user`** ... user name (for authentication)
- **`password`** ... user password (for authentication)
- **`host`** ... where is the server running (default=localhost)
- **`port`** ... which port is server listening on (default=5432)

On Grieg, only **`dbname`** is required.

❖ Example: connecting to a database

Simple script that connects and then closes connection

```
import psycopg2

try:
   conn = psycopg2.connect("dbname=mydb")
   print(conn)  # state of connection after opening
   conn.close()
   print(conn)  # state of connection after closing
except Exception as e:
   print("Unable to connect to the database")
```

which, if **mydb** is accessible, produces output:

```
$ python3 ex1.py
<connection object at 0xf67186ec; dsn: 'dbname=mydb', closed: 0>
<connection object at 0xf67186ec; dsn: 'dbname=mydb', closed: 1>
```

<< ^ >>

❖ Example: connecting to a database (cont)

Example: change the script to get databaase name from command line

```
import sys
import psycopg2

if len(sys.argv) < 2:
   print("Usage: opendb DBname")
   exit(1)
db = sys.argv[1]
try:
   conn = psycopg2.connect("dbname="+db)
   print(conn)
   conn.close()
   print(conn)
except Exception as e:
   print(f"Unable to connect to database {db}")
```

❖ Operations on connections

```
cur = conn.cursor()
```

- set up a handle for performing queries/updates on database
- must create a **`cursor`** before performing any DB operations

```
conn.close()
```

- close the database connection **`conn`**

```
conn.commit()
```

- commit changes made to database since last **`commit()`**

Plus many others ... see Psycopg2 documentation

<< ^ >>

❖ Database `Cursors`

`Cursor`s are "pipelines" to the database

`Cursor` objects allow you to ...

- execute queries, perform updates, change meta-data

Cursors are created from a database **`connection`**

- can create multiple cursors from the same connection
- each cursor handles one DB operation at a time
- but cursors are not isolated (can see each others' changes)

To set up a **`cursor`** object called **`cur`** ...

```
cur = conn.cursor()
```

<< ^ >>

❖ Operations on cursors

`cur.execute(`*SQL_statement*`,` *Values*`)`**

- if supplied, insert values into the SQL statement
- then execute the SQL statement
- results are available via the cursor's fetch methods

Examples:

```
# run a fixed query
cur.execute("select * from R where x = 1");

# run a query with values inserted
cur.execute("select * from R where x = %s", (1,))
cur.execute("select * from R where x = %s", [1])

# run a query stored in a variable
query = "select * from Students where name ilike %s"
pattern = "%mith%"
cur.execute(query, [pattern])
```

❖ Operations on `cursors` (cont)

`cur.mogrify(`*SQL_statement, Values***`)`**

- return the SQL statement as a string, with values inserted
- useful for checking whether **`execute()`** is doing what you want

Examples:

```
query = "select * from R where x = %s"
print(cur.mogrify(query, [1]))
Produces: b'select * from R where x = 1'

query = "select * from R where x = %s and y = %s"
print(cur.mogrify(query, [1,5]))
Produces: b'select * from R where x = 1 and y = 5'

query = "select * from Students where name ilike %s"
pattern = "%mith%"
print(cur.mogrify(query, [pattern]))
Produces: b"select * from Students where name ilike '%mith%'"

query = "select * from Students where family = %s"
fname = "O'Reilly"
print(cur.mogrify(query, [fname]))
Produces: b"select * from Students where family = 'O''Reilly'"
```

<< ^ >>

❖ Operations on cursors (cont)

list = cur.fetchall()

- gets all answers for a query and stores in a list of tuples
- can iterate through list of results using Python's **for**

Example:

```
# table R contains (1,2), (2,1), ...

cur.execute("select * from R")
for tup in cur.fetchall():
    x,y = tup
    print(x,y)    # or print(tup[0],tup[1])

# prints
1 2
2 1
...
```

❖ Operations on `cursors` (cont)

`tup = cur.fetchone()`

- gets next result for a query and stores in a tuple
- can iterate through list of results using Python's **`while`**

Example:

```
# table R contains (1,2), (2,1), ...

cur.execute("select * from R")
while True:
   t = cur.fetchone()
   if t == None:
      break
   x,y = tup
   print(x,y)

# prints
1 2
```

```
2 1
...
```

❖ Operations on `cursors` (cont)

`tup = cur.fetchmany(`*nTuples*`)`

- gets next *nTuples* results for a query
- stores tuples in a list
- when no results left, returns empty list

Example:

```
# table R contains (1,2), (2,1), ...

cur.execute("select * from R")
while True:
   tups = cur.fetchmany(3)
   if tups == []:
      break
   for tup in tups:
      x,y = tup
      print(x,y)
```

```
# prints
1 2
2 1
...
```

Produced: 26 Oct 2020