BLOG

SQLAlchemy ORM Tutorial for Python Developers

Let's learn how to use SQLAlchemy ORM to persist and query data on Python applications.

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TL;DR: In this article, we will learn how to use SQLAlchemy as the ORM (Object Relational Database) library to communicate with relational database engines. First, we will learn about some core concepts of SQLAlchemy (like engines and connection pools), then we will learn how to map Python classes and its relationships to database tables, and finally we will learn how to retrieve (query) data from these tables. The code snippets used in this article can be found in this GitHub repository.

> "Learn how to use SQLAlchemy ORM to persist and query data on Python applications."
>
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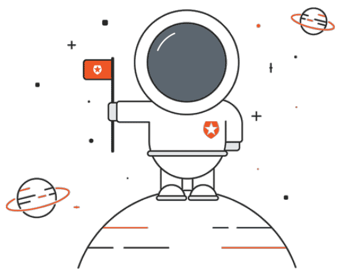
SQLAlchemy is a library that facilitates the communication between Python programs and databases. Most of the times, this library is used as an Object Relational Mapper (ORM) tool that translates Python classes to tables on relational databases and automatically converts function

er ovides a standard interface that allows developers to create database-agnostic code to communicate with a wide variety of database engines.

As we will see in this article, SQLAlchemy relies on common design patterns (like Object Pools) to allow developers to create and ship enterprise-grade, production-ready applications easily. Besides that, with SQLAlchemy, boilerplate code to handle tasks like database connections is abstracted away to let developers focus on business logic.



ided by SQLAlchemy, we need to learn how the core

uce important concepts that every Python developer

SQLAlchemy applications.

Base API) was created to specify how Python modules

se their interfaces. Although we won't interact with this

s a facade to it—it's good to know that it defines how

, `commit` , and `rollback` must behave. Consequently, whenever we use a Python module that adheres to the specification, we can rest assured that we will find these functions and that they will behave as expected.

In this article, we are going to install and use the most popular PostgreSQL DBAPI implementation available: `psycopg` . Other Python drivers communicate with PostgreSQL as well, but `psycopg` is the best candidate since it fully implements the DBAPI specification and has great support from the community.

To better understand the DBAPI specification, what functions it requires, and how these functions behave, take a look into the Python Enhancement Proposal that introduced it. Also, to learn about what other database engines we can use (like MySQL or Oracle), take a look at the

SQLAlchemy Engines

Whenever we want to use SQLAlchemy to interact with a database, we need to create an *Engine*. d nage two crucial factors: *Pools* and *Dialects*. The following two sections will explain what these two concepts are, but for now it suffices to say that SQLAlchemy uses them to interact with DBAPI functions.

To create an engine and start interacting with databases, we have to import the `create_engine` function from the `sqlalchemy` library and issue a call to it:

```
 .
/usr:pass@localhost:5432/sqlalchemy')
```

e to communicate with an instance running locally on es that it will use `usr` and `pass` as the credentials to Note that, creating an engine does *not* connect to the ned to when it's needed (like when we submit a query,

Since SQLAlchemy relies on the DBAPI specification to interact with databases, the most common database management systems available are supported. PostgreSQL, MySQL, Oracle, Microsoft SQL Server, and SQLite are all examples of engines that we can use alongside with SQLAlchemy. To learn more about the options available to create SQLAlchemy engines, take a look at the official documentation.

SQLAlchemy Connection Pools

Connection pooling is one of the most traditional implementations of the object pool pattern. Object pools are used as caches of pre-initialized objects ready to use. That is, instead of spending time to create objects that are frequently needed (like connections to databases) the

The main reason why programs take advantage of this design pattern is to improve performance. In the case of database connections, opening and maintaining new ones is expensive, time-consuming, and wastes resources. Besides that, this pattern allows easier management of

ation might use simultaneously.

There are various implementations of the connection pool pattern available on SQLAlchemy .

For example, creating an `Engine` through the `create_engine()` function usually generates a Q ePool. This kind of pool comes configured with some reasonable defaults, like a maximum pool size of 5 connections.

As usual production-ready programs need to override these defaults (to fine-tune pools to their

ions of connection pools provide a similar set of

shows the most common options with their

ections that the pool will handle.

xceeding connections (relative to `pool_size`) the pool

ium age (in seconds) of connections in the pool.

econds the program will wait before giving up on getting a connection from the pool.

To learn more about connection pools on SQLAlchemy, check out the official documentation.

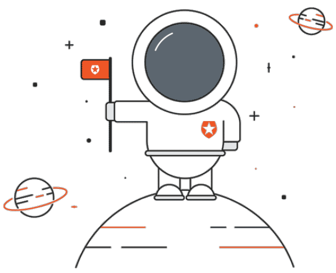
SQLAlchemy Dialects

As SQLAlchemy is a facade that enables Python developers to create applications that communicate to different database engines through the same API, we need to make use of *Dialects*. Most of the popular relational databases available out there adhere to the SQL (Structured Query Language) standard, but they also introduce proprietary variations. These

For example, let's say that we want to fetch the first ten rows of a table called `people`. If our data was being held by a Microsoft SQL Server database engine, SQLAlchemy would need to issue the following query:

```
SELECT TOP 10 * FROM people;
```

B our data was persisted on MySQL instance, then SQLAlchemy would need to issue:



o issue, SQLAlchemy needs to be aware of the type of exactly what *Dialects* do. They make SQLAlchemy

lowing list of dialects:

- Microsoft SQL Server
- MySQL
- Oracle
- PostgreSQL
- SQLite
- Sybase

Dialects for other database engines, like Amazon Redshift, are supported as external projects but can be easily installed. Check out the official documentation on SQLAlchemy Dialects to learn more.

ORM, which stands for *Object Relational Mapper*, is the specialization of the *Data Mapper* design pattern that addresses relational databases like MySQL, Oracle, and PostgreSQL. As explained by Martin Fowler in the article, *Mappers* are responsible for moving data between

in n independent of each other. As object-oriented programming languages and relational databases structure data on different ways, we need specific code to translate from one schema to the other.

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For example, in a programming language like Python, we can create a `Product` class and an `Order` class to relate as many instances as needed from one class to another (i.e. `Product` can contain a list of instances of `Order` and vice-versa). Though, on relational databases, we need

ucts, another one to persist orders, and a third one to

orders.

SQLAlchemy ORM is an excellent *Data Mapper* solution

es and to move data between instances of these classes

sured that we will get support for the most common

For example, booleans, dates, times, strings, and numeric values are a just a subset of the types that SQLAlchemy provides abstractions for. Besides these basic types, SQLAlchemy includes support for a few vendor-specific types (like JSON) and also allows developers to create custom types and redefine existing ones.

To understand how we use SQLAlchemy data types to map properties of Python classes into columns on a relation database table, let's analyze the following example:

```
class Product(Base):
    __tablename__ = 'products'
    id=Column(Integer, primary_key=True)
    title=Column('title', String(32))
    price=Column('price', Numeric)
```

d g a class called `Product` that has six properties. Let's take a look at what these properties do:

- The `__tablename__` property tells SQLAlchemy that rows of the `products` table must be pped to this class.
- The id property identifies that this is the `primary_key` in the table and that its type is `Integer`.
- column in the table has the same name of the property
- t a column in the table has the same name of the .
- t a column in the table has the same name of the .
- column in the table has the same name of the property

Seasoned developers will notice that (usually) relational databases do not have data types with these exact names. SQLAlchemy uses these types as generic representations to what databases support and use the dialect configured to understand what types they translate to. For example, on a PostgreSQL database, the title would be mapped to a `varchar` column.

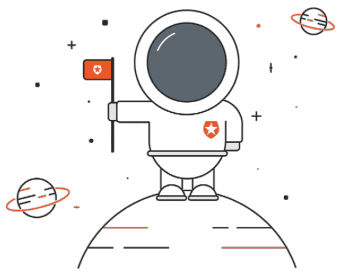
SQLAlchemy Relationship Patterns

Now that we know what ORM is and have look into data types, let's learn how to use SQLAlchemy to map relationships between classes to relationships between tables. SQLAlchemy supports four types of relationships: One To Many, Many To One, One To One, and Many To Many.

ORM in Practice action we will do a hands-on to practice mapping classes into tables and to learn how to insert, extract, and remove data from these tables.

The first type, *One To Many*, is used to mark that an instance of a class can be associated with many instances of another class. For example, on a blog engine, an instance of the `Article` class could be associated with many instances of the `Comment` class. In this case, we would map the mentioned classes and its relation as follows:

```
class Article(Base):
                                                    =True)
                                                    ")



                                                    =True)
                                                    eignKey('articles.id'))
```



he same relationship described above but from the other perspective. To give a different example, let's say that we want to map the relationship between instances of `Tire` to an instance of a `Car` . As many tires belong to one car and this car contains many tires, we would map this relation as follows:

```
class Tire(Base):
    __tablename__ = 'tires'
    id = Column(Integer, primary_key=True)
    car_id = Column(Integer, ForeignKey('cars.id'))
    car = relationship("Car")
```

```
        id = Column(Integer, primary_key=True)
```

ionships where an instance of a particular class may only be associated with one instance of another class, and vice versa. As an example, consider the relationship between a `Person` and a `MobilePhone`. Usually, one person possesses one mobile phone and this mobile phone belongs to this person only. To map this relationship on SQ lchemy, we would create the following code:

```
class Person(Base):


                         =True)
                         ilePhone", uselist=False, back_populates="person"




                         =True)
                         ignKey('people.id'))
                         back_populates="mobile_phone")
```

eters to the `relationship` function. The first one, `uselist=False`, makes SQLAlchemy understand that `mobile_phone` will hold only a single instance and not an array (multiple) of instances. The second one, `back_populates`, instructs SQLAlchemy to populate the other side of the mapping. The official Relationships API documentation provides a complete explanation of these parameters and also covers other parameters not mentioned here.

The last type supported by SQLAlchemy, *Many To Many*, is used when instances of a particular class can have zero or more associations to instances of another class. For example, let's say that we are mapping the relationship of instances of `Student` and instances of `Class` in a system that manages a school. As many students can participate in many classes, we would map the

```
students_classes_association = Table('students_classes', Base.metadata,
    Column('student_id', Integer, ForeignKey('students.id')),
                                   r   ignKey('classes.id'))
)

class Student(Base):
    __tablename__ = 'students'
    id = Column(Integer, primary_key=True)
    classes = relationship("Class", secondary=students_classes_association)

class Class(Base):
    __tablename__ = 'classes'
                                  =True)
```

e to persist the association between instances of

s wouldn't be possible without an extra table. Note that,

table, we passed it in the `secondary` parameter of the

et of the mapping options supported by SQLAlchemy.

take a more in-depth look into each one of the available relationship patterns. Besides that, the official documentation is a great reference to learn more about relationship patterns on SQLAlchemy.

SQLAlchemy ORM Cascade

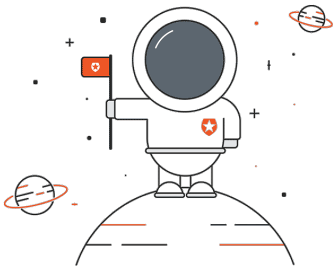
Whenever rows in a particular table are updated or deleted, rows in other tables might need to suffer changes as well. These changes can be simple updates, which are called cascade updates, or full deletes, known as cascade deletes. For example, let's say that we have a table called `shopping_carts`, a table called `products`, and a third one called `shopping_carts_products` that connects the first two tables. If, for some reason, we need to delete rows from `shopping_carts` we will need to delete the related rows from `shopping_carts_products` as well.

To make this kind of operation easy to maintain, SQLAlchemy ORM enables developers to map cascade behavior when using `relationship()` constructs. Like that, when operations are performed on *parent* objects, *child* objects get updated/deleted as well. The following list ... used cascade strategies on SQLAlchemy ORM:

- `save-update`: Indicates that when a parent object is saved/updated, child objects are saved/updated as well.
- `elete`: Indicates that when a parent object is deleted, children of this object will be deleted as well.
- `delete-orphan`: Indicates that when a child object loses reference to a parent, it will get

ations propagate from parent to children.

needed, the SQLAlchemy documentation provides an



mplementation of the Unit of Work design pattern. As explained by Martin Fowler, a Unit of Work is used to maintain a list of objects affected by a business transaction and to coordinate the writing out of these changes. This means that all modifications tracked by Sessions (Units of Works) will be applied to the underlying database together, or none of them will. In other words, Sessions are used to guarantee the database consistency.

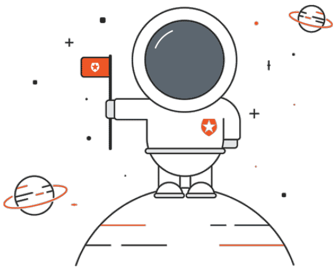
The official SQLAlchemy ORM documentation about Sessions gives a great explanation how changes are tracked, how to get sessions, and how to create ad-hoc sessions. However, in this article, we will use the most basic form of session creation:

```
# create an engine
engine = create_engine('postgresql://usr:pass@localhost:5432/sqlalchemy')

# create a configured "Session" class
Session = sessionmaker(bind=engine)

# create a Session
session = Session()
```

As we can see from the code snippet above, we only need one step to get sessions. We need to

ne SQLAlchemy engine. After that, we can just issue

ions.



of the most important pieces of SQLAlchemy, it's time to

ns, we will create a small project based on `pipenv` —a

ome classes to it. Then we will map these classes to

and learn how to query data.

Starting the Tutorial Project

To create our tutorial project, we have to have Python installed on our machine and `pipenv` installed as a global Python package. The following commands will install `pipenv` and set up the project. These commands are dependent on Python, so be sure to have it installed before proceeding:

```
# install pipenv globally
pip install pipenv

# create a new directory for our project
# change working directory to it
cd sqlalchemy-tutorial

# create a Python 3 project
```

Running PostgreSQL

T able to practice our new skills and to learn how to query data on SQLAlchemy, we will need a database to support our examples. As already mentioned, SQLAlchemy provides support for many different databases engines, but the instructions that follow will focus on PostgreSQL.

f PostgreSQL. One of them is to use some cloud oth of them have free tiers). Another possibility is to environment. A third option is to run a PostgreSQL

ce because it has the performance of an instance use it's easy to create and destroy Docker instances. The to install Docker locally.

ate and destroy *dockerized* PostgreSQL instances with the following commands:

```
# create a PostgreSQL instance
docker run --name sqlalchemy-orm-psql \
    -e POSTGRES_PASSWORD=pass \
    -e POSTGRES_USER=usr \
    -e POSTGRES_DB=sqlalchemy \
    -p 5432:5432 \
    -d postgres

# stop instance
docker stop sqlalchemy-orm-psql
```

The first command, the one that creates the PostgreSQL instance, contains a few parameters that

- `--name` : Defines the name of the Docker instance.
- `-e POSTGRES_PASSWORD` : Defines the password to connect to PostgreSQL.
- `POSTGRES_USER` : Defines the user to connect to PostgreSQL.
- `-e POSTGRES_DB` : Defines the main (and only) database available in the PostgreSQL instance.
- `-p 5432:5432` : Defines that the local `5432` port will tunnel connections to the same port in

er instance will be created based on the official

dencies

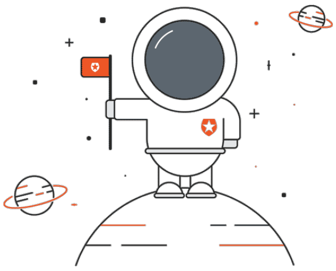
y two packages: `sqlalchemy` and `psycopg2` . The first

and the second one, `psycopg2` , is the PostgreSQL

nunicate with the database. To install these dependencies, we will use `pipenv` as shown:

```
# install sqlalchemy and psycopg2
pipenv install sqlalchemy psycopg2
```

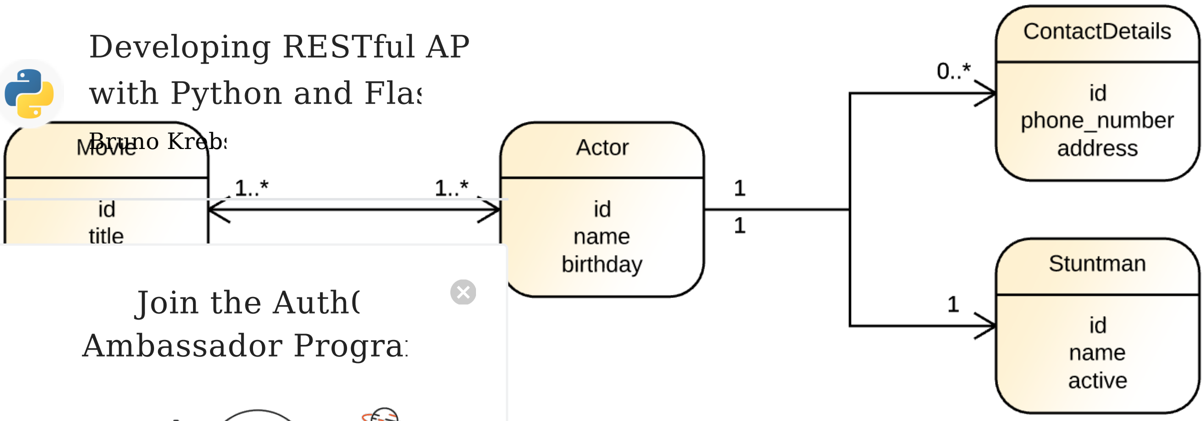
This command will download both libraries and make them available in our Python virtual environment. Note that to run the scripts that we are going to create, we first need to spawn the virtual environment shell. That is, before executing `python somescript.py` , we need to execute `pipenv shell` . Otherwise, Python won't be able to find the installed dependencies, as they are just available in our new virtual environment.



After starting the *dockerized* PostgreSQL instance and installing the Python dependencies, we can begin to map Python classes to database tables. In this tutorial, we will map four simple

pr tmen, and contact details. The following diagram

is d their relations.



py in the main directory of our project and add the

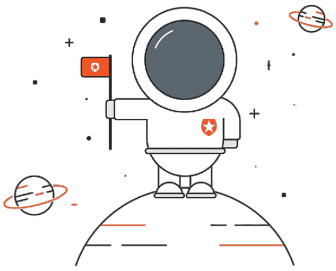
```
from sqlalchemy import create_engine
from sqlalchemy.ext.declarative import declarative_base
from sqlalchemy.orm import sessionmaker

engine = create_engine('postgresql://usr:pass@localhost:5432/sqlalchemy')
Session = sessionmaker(bind=engine)

Base = declarative_base()
```

This code creates:

and a base class for our classes definitions.

ie s. To do this, let's create a new file called `movie.py` and add the following code to it:

```
# coding=utf-8

from sqlalchemy import Column, String, Integer, Date

from base import Base
```



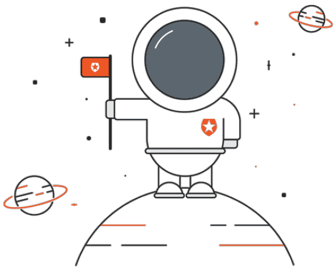
```
=True)

e_date):

date
```

The definition of this class and its mapping characteristics is quite simple. We start by making this class extend the `Base` class defined in the `base.py` module and then we add four properties to it:

1. A `__tablename__` to indicate what is the name of the table that will support this class.
2. An `id` to represent the primary key in the table.
3. A `title` of type `String`.
4. A `release_date` of type `Date`.

The next class that we will create and map is the `Actor` class. Let's create a file called `actor.py`

```
# coding=utf-8

                                    g, Integer, Date

from base import Base


class Actor(Base):
    __tablename__ = 'actors'

    id = Column(Integer, primary_key=True)
    name = Column(String)



                                    y):
```



r to the previous one. The differences are that the a `birthday` instead of a `release_date` , and that it f `movies` .

As many movies can have many actors and vice-versa, we will need to create a *Many To Many* relationship between these two classes. Let's create this relationship by updating the `movie.py` file as follows:

```
# coding=utf-8

from sqlalchemy import Column, String, Integer, Date, Table, ForeignKey
from sqlalchemy.orm import relationship

from base import Base

movies_actors_association = Table(
    Column('actor_id', Integer, ForeignKey('actors.id'))
)
```

```
    __tablename__ = 'movies'

    id = Column(Integer, primary_key=True)
    title = Column(String)
    release_date = Column(Date)
    actors = relationship("Actor", secondary=movies_actors_association)

    def __init__(self, title, release_date):
        self.title = title
                               date
```

he previous one is that:

e , ForeignKey , and relationship ;

ion table that connects rows of actors and rows of

o Movie and configured the movies_actors_association as the intermediary table.

The next class that we will create is Stuntman . In our tutorial, a particular Actor will have only one Stuntman and this Stuntman will work only with this Actor . This means that we need to create the Stuntman class and a *One To One* relationship between these classes. To accomplish that, let's create a file called stuntman.py and add the following code to it:

```
# coding=utf-8

from sqlalchemy import Column, String, Integer, Boolean, ForeignKey
from base import Base


class Stuntman(Base):
                   '

    id = Column(Integer, primary_key=True)
    name = Column(String)
    active = Column(Boolean)
    actor_id = Column(Integer, ForeignKey('actors.id'))
    actor = relationship("Actor", backref=backref("stuntman", uselist=False))

    def __init__(self, name, active, actor):
        self.name = name
```

tor property references an instance of Actor and that

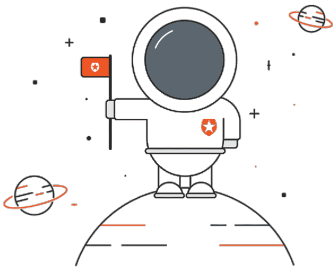
man that is not a list (uselist=False). That is,

n , SQLAlchemy will also load and populate the

p in our tutorial is ContactDetails . Instances of this class will hold a phone_number and an address of a particular Actor , and one Actor will be able to have many ContactDetails associated. Therefore, we will need to use the *Many To One* relationship pattern to map this association. To create this class and this association, let's create a file called contact_details.py and add the following source code to it:

```
# coding=utf-8

from sqlalchemy import Column, String, Integer, ForeignKey
from sqlalchemy.orm import relationship

from base import Base
```

```
class ContactDetails(Base):
    __tablename__ = 'contact_details'

    id = Column(Integer, primary_key=True)
    i
    address = Column(String)
    actor_id = Column(Integer, ForeignKey('actors.id'))
    actor = relationship("Actor", backref="contact_details")

    def __init__(self, phone_number, address, actor):
        self.phone_number = phone_number
        self.address = address
        self.actor = actor
```



sociation is kinda similar to creating a *One To One* atter we instructed SQLAlchemy not to use lists. This ation to a single instance instead of a list of instances.

emy ORM

s create a file called `inserts.py` and generate some database. In this file, let's add the following code:

```
# coding=utf-8

# 1 - imports
from datetime import date

from actor import Actor
from base import Session, engine, Base
from contact_details import ContactDetails
from movie import Movie
from stuntman import Stuntman

# 2 - generate database schema
# 3 - create a new session
session = Session()

# 4 - create movies
                  B    Identity", date(2002, 10, 11))
furious_7 = Movie("Furious 7", date(2015, 4, 2))
pain_and_gain = Movie("Pain & Gain", date(2013, 8, 23))

# 5 - creates actors
 tt_damon = Actor("Matt Damon", date(1970, 10, 8))
  yne_johnson = Actor("Dwayne Johnson", date(1972, 5, 2))
mark_wahlberg = Actor("Mark Wahlberg", date(1971, 6, 5))

# 6 - add actors to movies
                                                ]

                                                on, mark_wahlberg]



                                                55 2671", "Burbank, CA", matt_damon)
                                                  555 5623", "Glendale, CA", dwayne_johnson)
                                                21 444 2323", "West Hollywood, CA", dwayne_johnso
                                                33 9428", "Glendale, CA", mark_wahlberg)



                                                  True, matt_damon)
dwayne_stuntman = Stuntman("John Roe", True, dwayne_johnson)
mark_stuntman = Stuntman("Richard Roe", True, mark_wahlberg)

# 9 - persists data
session.add(bourne_identity)
session.add(furious_7)
session.add(pain_and_gain)

session.add(matt_contact)
session.add(dwayne_contact)
session.add(dwayne_contact_2)
session.add(mark_contact)

session.add(matt_stuntman)
```

```
# 10 - commit and close session
session.commit()
session.close()
```

This code is split into 10 sections. Let's inspect them:

1. The first section imports the classes that we created, the SQLAlchemy engine, the Base class, the session factory, and `date` from the `datetime` module.
2. The second section instructs SQLAlchemy to generate the database schema. This generation occurs based on the declarations that we made while creating the four main

sion from the session factory.

ances of the `Movie` class.

ces of the `Actor` class.

ies. Note that the *Pain & Gain* movie references two

Vahlberg.

s of the `ContactDetails` class and defines what actors

ntmen and also defines what actors these stuntmen are associated to.

9. The ninth section uses the current session to save the movies, actors, contact details, and stuntmen created. Note that we haven't explicitly saved actors. This is not needed because SQLAlchemy, by default, uses the `save-update` cascade strategy.
10. The tenth section commits the current session to the database and closes it.

To run this Python script, we can simply issue the `python inserts.py` command (let's not to run `pipenv shell` first) in the main directory of our database. Running it will create five tables in the PostgreSQL database and populate these tables with the data that we created. In the next section, we will learn how to query these tables.

As we will see, querying data with SQLAlchemy ORM is quite simple. This library provides an intuitive, fluent API that enables developers to write queries that are easy to read and to

, a ries start with a Query Object that is extracted from the

te a particular mapped class. To see this API in action,

let's create a file called `queries.py` and add to it the following source code:

```
oding=utf-8

# 1 - imports
from actor import Actor
```

```
etails
```

```
    print(f'{movie.title} was released on {movie.release_date}')
print('')
```

The code snippet above—that can be run with `python queries.py` ,—shows how easy it is to use SQLAlchemy ORM to query data. To retrieve all movies from the database, we just needed to fetch a session from the session factory, use it to get a query associated with `Movie` , and then call the `all()` function on this query object. The Query API provides dozens of useful functions like `all()` . In the following list, we can see a brief explanation about the most important ones:

`delete()` : Removes from the database the rows matched by a query.

`distinct()` : Applies a distinct statement to a query.

…ra… a subquery.

`first()` : Returns the first row in a query.

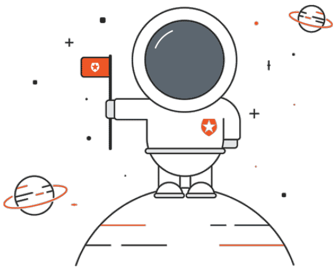
`get()` : Returns the row referenced by the primary key parameter passed as argument.

`join()` : Creates a SQL join in a query.

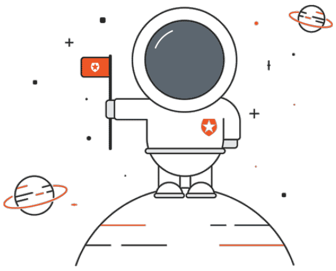
`limit()` : Limits the number of rows returned by a query.

`order_by()` : Sets an order in the rows returned by a query.

…ctions, let's append the following code to the



```
    .filter(Movie.release_date > date(2015, 1, 1)) \
    .all()

print('### Recent movies:')
for movie in movies:
    print(f'{movie.title} was released after 2015')
print('')

# 6 - movies that Dwayne Johnson participated
the_rock_movies = session.query(Movie) \
    .join(Actor, Movie.actors) \
    .filter(Actor.name == 'Dwayne Johnson') \
    .all()
    print(f'The Rock starred in {movie.title}')
print('')

# 7 - get actors that have house in Glendale
                                  y   ) \
    .join(ContactDetails) \
    .filter(ContactDetails.address.ilike('%glendale%')) \
    .all()

 int('### Dwayne Johnson movies:')
    actor in glendale_stars:
    print(f'{actor.name} has a house in Glendale')
print('')
```

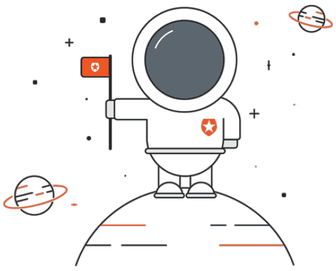


s the filter() function to fetch only movies that . The sixth section shows how to use join() to fetch yne Johnson participated in. The seventh and last ilike() functions to retrieve actors that have houses

ython queries.py) now will result in the following

```
### All movies:
The Bourne Identity was released on 2002-10-11
Furious 7 was released on 2015-04-02
No Pain No Gain was released on 2013-08-23

### Recent movies:
Furious 7 was released after 2015

### Dwayne Johnson movies:
The Rock starred in No Pain No Gain
The Rock starred in Furious 7
```

```
Mark Wahlberg has a house in Glendale
```



a rward and generates a code that is readable. To see other functions supported by the Query API, and their description, take a look at the official documentation.

"Querying data with SQLAlchemy ORM is easy and intuitive."

TWEET THIS

uth0

easy and brings a lot of great features to the table. With f code to get:

, including single sign-on

like Facebook, GitHub, Twitter, etc.)

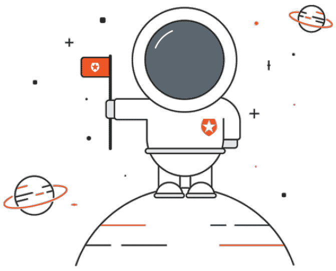
Directory, LDAP, SAML, etc.)

Our own database of users

For example, to secure Python APIs written with Flask, we can simply create a `requires_auth` decorator:

```
# Format error response and append status code

def get_token_auth_header():
    """Obtains the access token from the Authorization Header
    """
    auth = request.headers.get("Authorization", None)
    if not auth:
```

```
                              "Authorization header is expected"}, 401)

    parts = auth.split()

                              e
        raise AuthError({"code": "invalid_header",
                        "description":
                            "Authorization header must start with"
                            " Bearer"}, 401)
    elif len(parts) == 1:
        raise AuthError({"code": "invalid_header",
                        "description": "Token not found"}, 401)
    elif len(parts) > 2:
        raise AuthError({"code": "invalid_header",
                                  ":
                                  zation header must be"
                                   token"}, 401)

                                  n is valid

        token = get_token_auth_header()
        jsonurl = urlopen("https://"+AUTH0_DOMAIN+"/.well-known/jwks.json")
        jwks = json.loads(jsonurl.read())
        unverified_header = jwt.get_unverified_header(token)
        rsa_key = {}
        for key in jwks["keys"]:
            if key["kid"] == unverified_header["kid"]:
                rsa_key = {
                    "kty": key["kty"],
                    "kid": key["kid"],
                    "use": key["use"],
                    "n": key["n"],
                    "e": key["e"]
                }
```



```
        payload = jwt.decode(
            token,
            rsa_key,
            algorithms=ALGORITHMS,
                   A     IENCE,
            issuer="https://"+AUTH0_DOMAIN+"/"
        )
    except jwt.ExpiredSignatureError:
        raise AuthError({"code": "token_expired",
                        "description": "token is expired"}, 401)
    except jwt.JWTClaimsError:
        raise AuthError({"code": "invalid_claims",
                        "description":
                            "incorrect claims,"
                            "please check the audience and issuer"}, 401)

                           de": "invalid_header",
                           cription":
                            "Unable to parse authentication"
                            " token."}, 400)

                           nt_user = payload
                           )
                           valid_header",
                           ": "Unable to find appropriate key"}, 400)
```

Then use it in our endpoints:

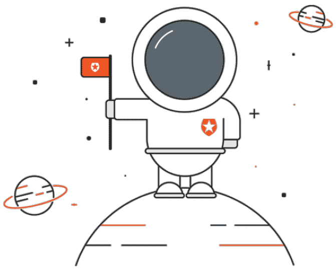
```
# Controllers API

# This doesn't need authentication
@app.route("/ping")
@cross_origin(headers=['Content-Type', 'Authorization'])
def ping():
    return "All good. You don't need to be authenticated to call this"
```

```
@cross_origin(headers=["Content-Type", "Authorization"])
@requires_auth
def secured_ping():
    return "All good. You only get this message if you're authenticated"
```

To learn more about securing *Python APIs* with Auth0, take a look at this tutorial. Alongside with tutorials for backend technologies (like Python, Java, and PHP), the *Auth0 Docs* webpage also provides tutorials for *Mobile/Native apps* and *Single-Page applications*.

Next Steps

rticle. We've learned about basic SQLAlchemy concepts ects. After that, we've learned about how SQLAlchemy atterns, Cascade strategies, and the Query API. In the l exercise. In summary, we had the chance to learn and LAlchemy and SQLAlchemy ORM. In the next article, plement RESTful APIs with Flask—the Python



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Bruno Krebs

Lee Gaines • 16 days ago

Lovely tutorial... Thank you so much! I am confused about something, though...

"""

In this case, we had to create a helper table to persist the association between instances of Student and instances of Class, as this wouldn't be possible without an extra table.

"""

› in a many-to-many relationship?

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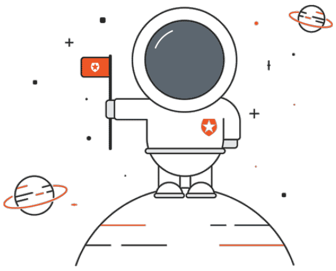

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ra table, where would we keep the information about which
ich records on table B?

e a "customers" table and a "products" table. Different
oducts and, as such, there is a many-to-many association here.
no way to persist the information of which customer bought

ssociation, we could save on the "customers" table what
ould buy just one. So, it would be a many-to-one association
ducts".

Not sure if my explanation was clear enough, so I point you to this reference (I swear it was a coincidence that they use the same example :D).

^ | ⌄ • Reply • Share ›

Lee Gaines ➦ Bruno S. Krebs • 16 days ago

That is very helpful... I'm starting to see the light... But still just a bit confused...

In a many-to-many relationship, wouldn't it still be possible to create a relationship between those two tables without bringing in a third? I imagine it'd be a huge mess with a whole bunch of columns, one for each transaction between a customer and a product for example.

Is the idea of JOINs to avoid that mess? Or is it actually impossible to create a many-to-many association without a new table?

Thank you for your patience :)

^ | ⌄ • Reply • Share ›

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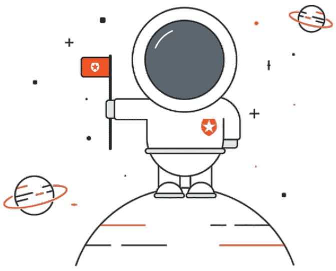

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