SQLAlchemy in Flask

Many people prefer SQLAlchemy for database access. In this case it's encouraged to use a package instead of a module for your flask application and drop the models into a separate module (Larger Applications). While that is not necessary, it makes a lot of sense.

There are four very common ways to use SQLAlchemy. I will outline each of them here:

Flask-SQLAlchemy Extension

Because SQLAlchemy is a common database abstraction layer and object relational mapper that requires a little bit of configuration effort, there is a Flask extension that handles that for you. This is recommended if you want to get started quickly.

You can download Flask-SQLAlchemy from PyPI.

Declarative

The declarative extension in SQLAlchemy is the most recent method of using SQLAlchemy. It allows you to define tables and models in one go, similar to how Django works. In addition to the following text I recommend the official documentation on the declarative extension.

Here's the example `database.py` module for your application:

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

engine = create_engine('sqlite:////tmp/test.db', convert_unicode=True)
db_session = scoped_session(sessionmaker(autocommit=False,
                                         autoflush=False,
                                         bind=engine))
Base = declarative_base()
Base.query = db_session.query_property()

def init_db():
    # import all modules here that might define models so that
    # they will be registered properly on the metadata.  Otherwise
    # you will have to import them first before calling init_db()
    import yourapplication.models
    Base.metadata.create_all(bind=engine)
```

To define your models, just subclass the *Base* class that was created by the code above. If you are wondering why we don’t have to care about threads here (like we did in the SQLite3 example above with the `g` object): that’s because SQLAlchemy does that for us already with the **`scoped_session`**.

To use SQLAlchemy in a declarative way with your application, you just have to put the following code into your application module. Flask will automatically remove database sessions at the end of the request or when the application shuts down:

```
from yourapplication.database import db_session

@app.teardown_appcontext
def shutdown_session(exception=None):
    db_session.remove()
```

Here is an example model (put this into `models.py`, e.g.):

```
from sqlalchemy import Column, Integer, String
from yourapplication.database import Base

class User(Base):
    __tablename__ = 'users'
    id = Column(Integer, primary_key=True)
    name = Column(String(50), unique=True)
    email = Column(String(120), unique=True)

    def __init__(self, name=None, email=None):
        self.name = name
        self.email = email

    def __repr__(self):
        return '<User %r>' % (self.name)
```

To create the database you can use the *init_db* function:

```
>>> from yourapplication.database import init_db
>>> init_db()
```

You can insert entries into the database like this:

```
>>> from yourapplication.database import db_session
>>> from yourapplication.models import User
>>> u = User('admin', 'admin@localhost')
>>> db_session.add(u)
>>> db_session.commit()
```

Querying is simple as well:

```
>>> User.query.all()
[<User u'admin'>]
>>> User.query.filter(User.name == 'admin').first()
<User u'admin'>
```

Manual Object Relational Mapping

Manual object relational mapping has a few upsides and a few downsides versus the declarative approach from above. The main difference is that you define tables and classes separately and map them together. It's more flexible but a little more to type. In general it works like the declarative approach, so make sure to also split up your application into multiple modules in a package.

Here is an example `database.py` module for your application:

```
from sqlalchemy import create_engine, MetaData
from sqlalchemy.orm import scoped_session, sessionmaker

engine = create_engine('sqlite:////tmp/test.db', convert_unicode=True)
metadata = MetaData()
db_session = scoped_session(sessionmaker(autocommit=False,
                                         autoflush=False,
                                         bind=engine))
def init_db():
    metadata.create_all(bind=engine)
```

As in the declarative approach, you need to close the session after each request or application context shutdown. Put this into your application module:

```
from yourapplication.database import db_session

@app.teardown_appcontext
def shutdown_session(exception=None):
    db_session.remove()
```

Here is an example table and model (put this into `models.py`):

```
from sqlalchemy import Table, Column, Integer, String
from sqlalchemy.orm import mapper
from yourapplication.database import metadata, db_session
```

```
class User(object):
    query = db_session.query_property()

    def __init__(self, name=None, email=None):
        self.name = name
        self.email = email

    def __repr__(self):
        return '<User %r>' % (self.name)

users = Table('users', metadata,
    Column('id', Integer, primary_key=True),
    Column('name', String(50), unique=True),
    Column('email', String(120), unique=True)
)
mapper(User, users)
```

Querying and inserting works exactly the same as in the example above.

SQL Abstraction Layer

If you just want to use the database system (and SQL) abstraction layer you basically only need the engine:

```
from sqlalchemy import create_engine, MetaData, Table

engine = create_engine('sqlite:////tmp/test.db', convert_unicode=True)
metadata = MetaData(bind=engine)
```

Then you can either declare the tables in your code like in the examples above, or automatically load them:

```
from sqlalchemy import Table

users = Table('users', metadata, autoload=True)
```

To insert data you can use the *insert* method. We have to get a connection first so that we can use a transaction:

```
>>> con = engine.connect()
>>> con.execute(users.insert(), name='admin', email='admin@localhost')
```

SQLAlchemy will automatically commit for us.

To query your database, you use the engine directly or use a connection:

```
>>> users.select(users.c.id == 1).execute().first()
(1, u'admin', u'admin@localhost')
```

These results are also dict-like tuples:

```
>>> r = users.select(users.c.id == 1).execute().first()
>>> r['name']
u'admin'
```

You can also pass strings of SQL statements to the **`execute()`** method:

```
>>> engine.execute('select * from users where id = :1', [1]).first()
(1, u'admin', u'admin@localhost')
```

For more information about SQLAlchemy, head over to the website.