Python REST APIs With Flask, Connexion, and SQLAlchemy – Part 2

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Most modern web applications are powered by a **REST API** under the hood. That way, developers can separate the front-end code from the back-end logic, and users can interact with the interface dynamically. In this three-part tutorial series, you're building a REST API with the **Flask web framework**.

You've created a foundation with a basic Flask project and added endpoints, which you'll connect to a **SQLite database**. You're also testing your API with **Swagger UI API documentation** that you're building along the way.

In the [first part](), you used Flask and Connexion to create a REST API providing CRUD operations to an in-memory structure called `PEOPLE`. By doing so, you learned how the Connexion module helps you build a nice REST API and interactive documentation.

In the second part of this tutorial series, you'll learn how to:

- Write **SQL commands** in Python
- Configure a **SQLite database** for your Flask project
- Use **SQLAlchemy** to save Python objects to your database
- Leverage the **Marshmallow library** to serialize data
- Connect your **REST API** with your database

After finishing the second part of this series, you'll move on to the third part, where you'll extend your REST API with the functionality to add notes to a person.

You can download the code for the second part of this project by clicking the link below:

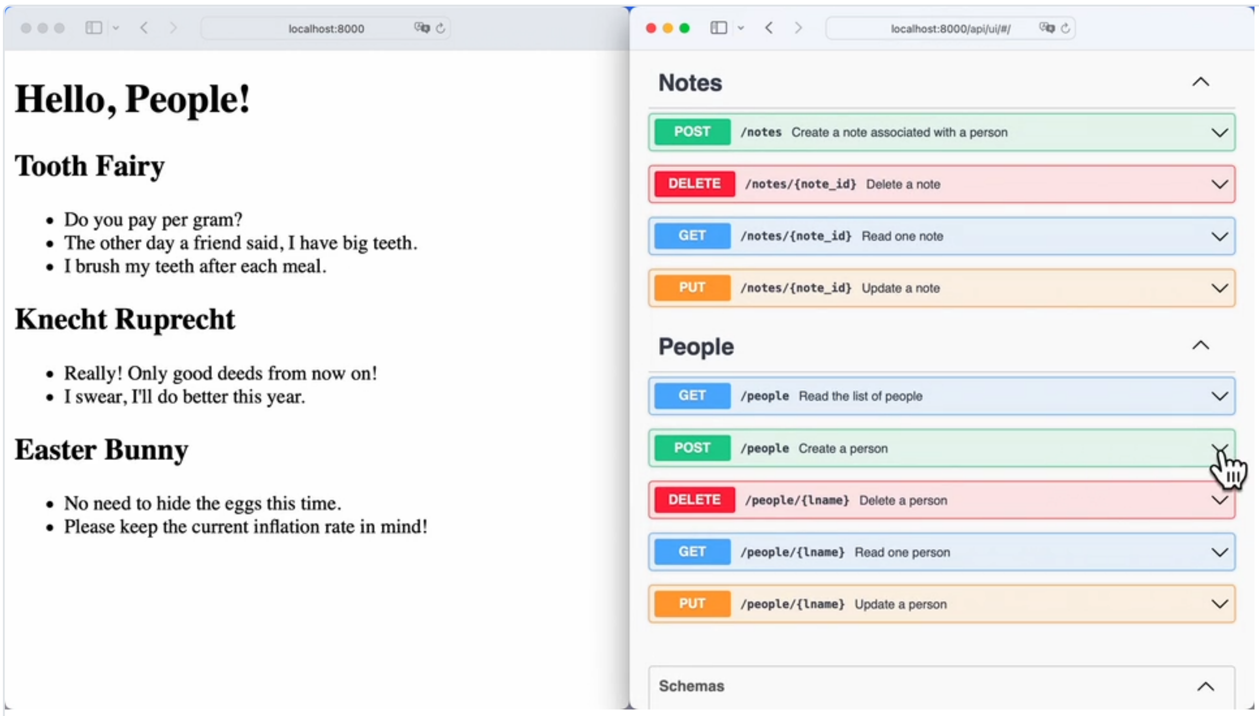
Source Code: Click here to download the free source code that you'll use to continue building a REST API with the Flask web framework.

Demo

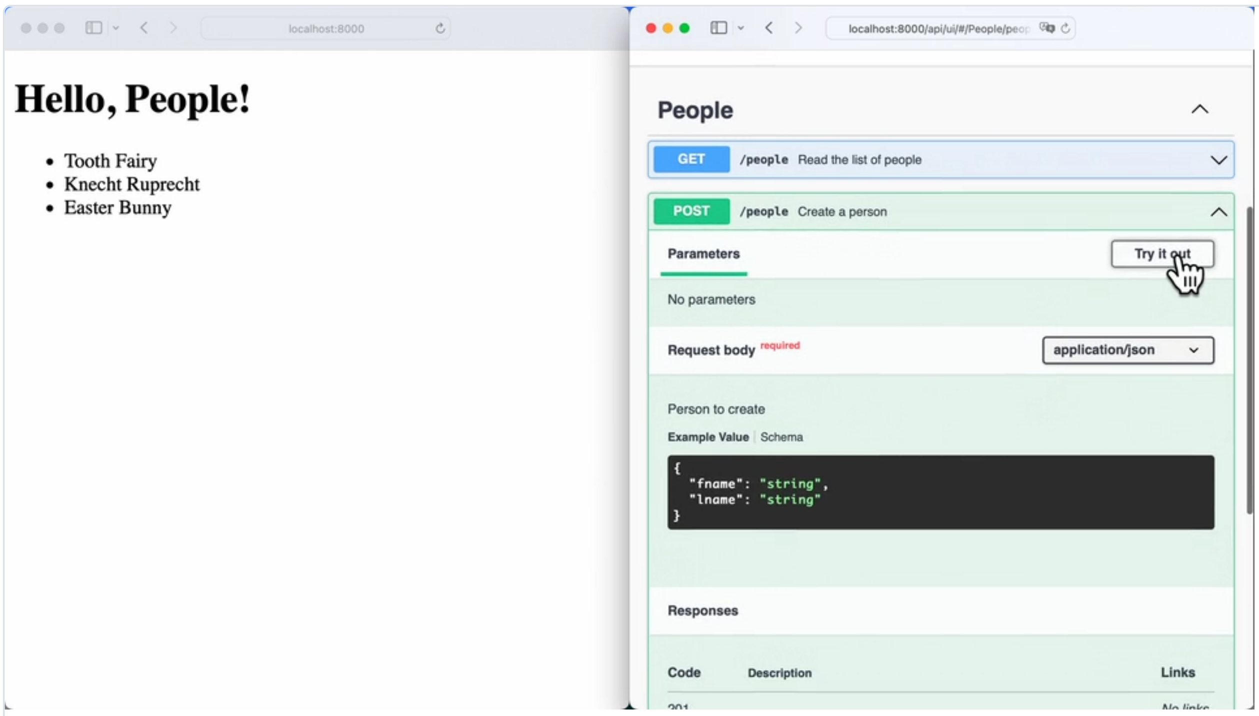
In this three-part tutorial series, you're building a REST API to keep track of notes for people that may visit you throughout the year. You'll create people like the Tooth Fairy, the Easter Bunny, and Knecht Ruprecht.

Ideally, you want to be on good terms with all three of them. That's why you'll send them notes, to increase the chance of getting valuable gifts from them.

You can interact with your application by leveraging the API documentation. Along the way, you're also building a basic front end that reflects the contents of your database:



In the second part of this series, you'll enhance the back end of your application by adding a proper database. That way, you'll persist your data even when you restart your app:



With your Swagger UI documentation, you'll be able to interact with your REST API and make sure that everything works as intended.

Planning Part Two

In the first part of this tutorial series, you worked with a `PEOPLE` dictionary to store your data. The dataset looked like this:

Python

```python
PEOPLE = {
    "Fairy": {
        "fname": "Tooth",
        "lname": "Fairy",
        "timestamp": "2022-10-08 09:15:10",
    },
    "Ruprecht": {
        "fname": "Knecht",
        "lname": "Ruprecht",
        "timestamp": "2022-10-08 09:15:13",
    },
    "Bunny": {
        "fname": "Easter",
        "lname": "Bunny",
        "timestamp": "2022-10-08 09:15:27",
    }
}
```

This data structure was handy to get your project up to speed. However, any data that you added with your REST API to `PEOPLE` got lost when you restarted your app.

In this part, you'll be translating your `PEOPLE` data structure into a database table that'll look like this:

id	lname	fname	timestamp
1	Fairy	Tooth	2022-10-08 09:15:10
2	Ruprecht	Knecht	2022-10-08 09:15:13
3	Bunny	Easter	2022-10-08 09:15:27

You won't make any changes to your REST API endpoints in this tutorial. But the changes that you'll make in the back end will be significant, and you'll end up with a much more versatile codebase to help scale your Flask project up in the future.

Getting Started

In this section, you'll check in with the Flask REST API project that you're working on. You want to make sure that it's ready for the next steps in this tutorial series.

To convert complex data types to and from Python data types, you'll need a **serializer**. For this tutorial, you'll use Flask-Marshmallow. **Flask-Marshmallow** extends the Marshmallow libary and provides additional features when you work with Flask.

Grab the Prerequisites

Ideally, you followed the first part of this tutorial series before continuing with the second part, which you're reading right now. Alternatively, you can also download the source code from part one by clicking the link below:

> **Source Code: Click here to download the free source code** that you'll use to build a REST API with the Flask web framework.

If you downloaded the source code from the link above, then make sure to follow the installation instructions within the provided `README.md` file.

Before you continue with the tutorial, verify that your folder structure looks like this:

```
rp_flask_api/
│
├── templates/
│   └── home.html
│
├── app.py
├── people.py
└── swagger.yml
```

Once you've got the Flask REST API folder structure in place, you can read on to install the dependencies that you'll need in this part of the tutorial series.

Add New Dependencies

Before you continue working on your Flask project, it's a good idea to create and activate a virtual environment. That way, you're installing any project dependencies not system-wide but only in your project's virtual environment.

Select your **operating system** below and use your platform-specific command to set up a virtual environment:

Windows | Linux + macOS

Windows PowerShell

```
PS> python -m venv venv
PS> .\venv\Scripts\activate
(venv) PS>
```

With the commands shown above, you create and activate a virtual environment named `venv` by using Python's built-in `venv` module. The parenthesized `(venv)` in front of the prompt indicate that you've successfully activated the virtual environment.

> **Note:** If you haven't worked through part one of this tutorial series, then make sure to download the source code by clicking the link below:
>
> > **Source Code: Click here to download the free source code** that you'll use to build a REST API with the

Flask web framework.

Before continuing, install the dependencies by following the instructions listed in the provided `README.md` file.

Next, install `flask-marshmallow` with the `sqlalchemy` option:

Shell
```
(venv) $ python -m pip install "flask-marshmallow[sqlalchemy]==0.14.0"
```

Flask-Marshmallow also installs `marshmallow`, which provides functionality to serialize and deserialize Python objects as they flow in and out of your REST API, which is based on JSON. Marshmallow converts Python class instances to objects that can be converted to JSON.

By using the `sqlalchemy` option, you also install packages that helps your Flask app leverage the powers of SQLAlchemy.

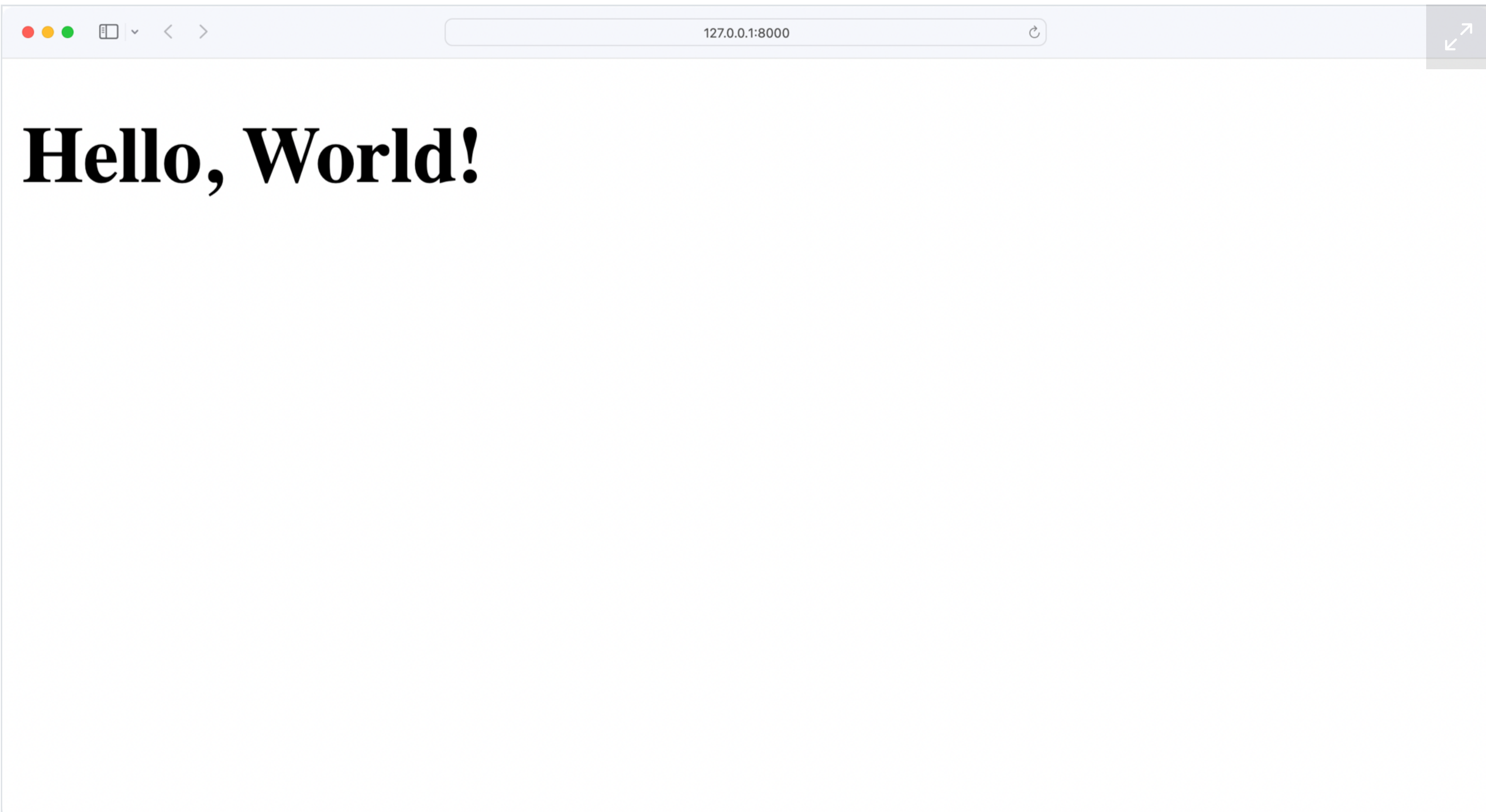
SQLAlchemy provides an object-relational model (ORM), which stores each Python object to a database representation of the object's data. That can help you continue to think in a Pythonic way and not be concerned with how the object data will be represented in a database.

Check Your Flask Project

After following the steps above, you can verify that your Flask application is running without errors. Execute the following command in the directory containing the `app.py` file:

Shell
```
(venv) $ python app.py
```

When you run this application, a web server will start on port 8000, which is the default port used by Flask. If you open a browser and navigate to `http://localhost:8000`, you should see *Hello, World!* displayed:



Perfect, your app is running flawlessly! Now it's time to go into the back end and work with a proper database.

Initializing the Database

Currently, you're storing the data of your Flask project in a dictionary. Storing data like this isn't persistent. That means that any data changes get lost when you restart your Flask application. On top of that, the structure of your dictionary isn't ideal.

In this section, you'll add a proper database to your Flask project to fix these shortcomings.

Inspect Your Current Data Structure

Currently, you're storing your data in the `PEOPLE` dictionary in `people.py`. The data structure looks like this in the code:

```python
# people.py

# ...

PEOPLE = {
    "Fairy": {
        "fname": "Tooth",
        "lname": "Fairy",
        "timestamp": get_timestamp(),
    },
    "Ruprecht": {
        "fname": "Knecht",
        "lname": "Ruprecht",
        "timestamp": get_timestamp(),
    },
    "Bunny": {
        "fname": "Easter",
        "lname": "Bunny",
        "timestamp": get_timestamp(),
    }
}

# ...
```

The modifications that you'll make to the program will move all the data to a database table. This means that the data will be saved to your disk and will exist between runs of the `app.py` program.

Conceptualize Your Database Table

Conceptually, you can think of a database table as a two-dimensional array where the rows are records, and the columns are fields in those records.

Database tables usually have an auto-incrementing integer value as the lookup key to rows. This is called the **primary key**. Each record in the table will have a primary key whose value is unique across the entire table. Having a primary key independent of the data stored in the table gives you the freedom to modify any other field in the row.

You're going to follow a database convention of naming the table as singular, so the table will be called `person`.

Translating your `PEOPLE` structure above into a database table named `person` will look like this:

id	lname	fname	timestamp
1	Fairy	Tooth	2022-10-08 09:15:10
2	Ruprecht	Knecht	2022-10-08 09:15:13
3	Bunny	Easter	2022-10-08 09:15:27

Each column in the table has a field name as follows:

- **`id`:** Primary key field for each person
- **`lname`:** Last name of the person
- **`fname`:** First name of the person
- **`timestamp`:** Timestamp of the last change

With this database concept in place, it's time to build the database.

Build Your Database

You're going to use **SQLite** as the database engine to store the PEOPLE data. SQLite is a widely used **relational database management system** (RDBMS) that doesn't need a SQL server to work.

In contrast to other SQL database engines, SQLite works with a single file to maintain all the database functionality. Therefore, to use the database, a program just needs to know how to read and write to a SQLite file.

Python's built-in `sqlite3` module allows you to interact with SQLite databases without any external packages. This makes SQLite particularly useful when starting new Python projects.

Start a new Python interactive shell to create the `people.db` SQLite database:

```python
>>> import sqlite3
>>> conn = sqlite3.connect("people.db")
>>> columns = [
...     "id INTEGER PRIMARY KEY",
...     "lname VARCHAR UNIQUE",
...     "fname VARCHAR",
...     "timestamp DATETIME",
... ]
>>> create_table_cmd = f"CREATE TABLE person ({','.join(columns)})"
>>> conn.execute(create_table_cmd)
<sqlite3.Cursor object at 0x1063f4dc0>
```

After you import the `sqlite3` module, you can create a new database with `.connect()`. If you have a look at your file system after defining the `conn` variable, then you'll notice that Python created the `people.db` database file right away.

With `conn.execute()` you're running the **SQL command** to create a `person` table with the columns `id`, `lname`, `fname`, and `timestamp`.

Note that you include a `UNIQUE` constraint for `lname`. That's important because you use the last name in your REST API to identify a person. Therefore, your database must ensure the uniqueness of `lname` to prevent inconsistencies in your data.

Now that your database exists, you can add data to it:

```python
>>> import sqlite3
>>> conn = sqlite3.connect("people.db")
>>> people = [
...     "1, 'Fairy', 'Tooth', '2022-10-08 09:15:10'",
...     "2, 'Ruprecht', 'Knecht', '2022-10-08 09:15:13'",
...     "3, 'Bunny', 'Easter', '2022-10-08 09:15:27'",
... ]
>>> for person_data in people:
...     insert_cmd = f"INSERT INTO person VALUES ({person_data})"
...     conn.execute(insert_cmd)
...
<sqlite3.Cursor object at 0x104ac4dc0>
<sqlite3.Cursor object at 0x104ac4f40>
<sqlite3.Cursor object at 0x104ac4fc0>

>>> conn.commit()
```

Once you're connected to the `people.db` database, you declare a **transaction** to insert `people_data` into the `person` table. The `conn.execute()` command creates `sqlite3.Cursor` objects in memory. Only when you run `conn.commit()` do you make the transaction happen.

Interact With the Database

Unlike programming languages like Python, SQL doesn't define how to get the data. SQL describes what data is desired and leaves the *how* up to the database engine.

A SQL query that gets all of the data in your `person` table would look this this:

SQL
```sql
SELECT * FROM person;
```

This query tells the database engine to get all the fields from the `person` table. In the following Python code, you use SQLite to run the above query and display the data:

Python
```python
1 >>> import sqlite3
2 >>> conn = sqlite3.connect("people.db")
3 >>> cur = conn.cursor()
4 >>> cur.execute("SELECT * FROM person")
5 <sqlite3.Cursor object at 0x102357a40>
6
7 >>> people = cur.fetchall()
8 >>> for person in people:
9 ...     print(person)
10 ...
11 (1, 'Fairy', 'Tooth', '2022-10-08 09:15:10')
12 (2, 'Ruprecht', 'Knecht', '2022-10-08 09:15:13')
13 (3, 'Bunny', 'Easter', '2022-10-08 09:15:27')
```

The code above does the following:

- **Line 1** imports the `sqlite3` module.
- **Line 2** creates a connection to the database file.
- **Line 3** creates a cursor from the connection.
- **Line 4** uses the cursor to execute a `SQL` query expressed as a string.
- **Line 7** gets all the records returned by the `SQL` query and assigns them to the `people` variable.
- **Lines 8 and 9** iterate over `people` and print out the data of each person.

In the above program, the SQL statement is a string passed directly to the database to execute. In this case, that may not be a big problem because the SQL is a string literal completely under the control of the program. However, the use case for your REST API will be taking user input from the web application and using it to create SQL queries. This can open your application to attack.

Expand the section below to learn how:

Little Bobby Tables: A Cautionary Tale Show/Hide

It would be much better if what you got back for `person` was a Python object, where each of the fields is an attribute of the object. That way, you make sure that the objects contain the expected value types and not any malicious commands.

When you interact with a database in your Python code, you may think twice about whether you want to write pure SQL commands. As you learned above, writing SQL may not only feel inconvenvient, but it can cause security issues. If you don’t want to worry too much about database interaction, a package like SQLAlchemy can help you out.

Connecting the SQLite Database With Your Flask Project

In this section, you’ll leverage **SQLAlchemy** for help in communicating with your database and connecting `people.db` to your Flask app.

SQLAlchemy handles many of the interactions specific to particular databases and lets you focus on the data models as well as how to use them. SQLAlchemy will sanitize user data for you before creating SQL statements. It’s another big advantage and a reason to use SQLAlchemy when working with databases.

In this section, you’ll also create two Python modules, `config.py` amd `models.py`:

1. **`config.py`** gets the necessary modules imported into the program and configured. This includes Flask, Connexion, SQLAlchemy, and Marshmallow.
2. **`models.py`** is the module where you'll create SQLAlchemy and Marshmallow class definitions.

At the end of this section, you'll be able to remove the former `PEOPLE` data structure and work with the connected database.

Configure Your Database

The `config.py` module is, as the name implies, where all of your configuration information is created and initialized. In this file, you're going to configure Flask, Connexion, SQLAlchemy, and Marshmallow.

Create `config.py` in your `rp_flask_api/` project folder:

Python

```python
1  # config.py
2
3  import pathlib
4  import connexion
5  from flask_sqlalchemy import SQLAlchemy
6  from flask_marshmallow import Marshmallow
7
8  basedir = pathlib.Path(__file__).parent.resolve()
9  connex_app = connexion.App(__name__, specification_dir=basedir)
10
11 app = connex_app.app
12 app.config["SQLALCHEMY_DATABASE_URI"] = f"sqlite:///{basedir / 'people.db'}"
13 app.config["SQLALCHEMY_TRACK_MODIFICATIONS"] = False
14
15 db = SQLAlchemy(app)
16 ma = Marshmallow(app)
```

Here's what the above code is doing:

- **Lines 3 to 6** import the built-in `pathlib` as well as the third-party libraries `connexion`, `SQLAlchemy`, and `Marshmallow`.
- **Line 8** creates the variable `basedir` pointing to the directory that the program is running in.
- **Line 9** uses the `basedir` variable to create the Connexion app instance and give it the path to the directory that contains your specification file.
- **Line 11** creates a variable, `app`, which is the Flask instance initialized by Connexion.
- **Line 12** tell SQLAlchemy to use SQLite as the database and a file named `people.db` in the current directory as the database file.
- **Line 13** turns the SQLAlchemy event system off. The event system generates events that are useful in event-driven programs, but it adds significant overhead. Since you're not creating an event-driven program, you turn this feature off.
- **Line 15** initializes SQLAlchemy by passing the `app` configuration information to `SQLAlchemy` and assigning the result to a `db` variable.
- **Line 16** initializes Marshmallow and allows it to work with the SQLAlchemy components attached to the app.

If you want to learn more about the SQLAlchemy configurations that you can implement here, then you can check out the configuration keys documentation of Flask-SQLALchemy.

Model Data With SQLAlchemy

SQLAlchemy is a big project and provides a lot of functionality to work with databases using Python. One of the features that it provides is an object-relational mapper (ORM). This ORM enables you to interact with the `person` database table in a more Pythonic way by mapping a row of fields from the database table to a Python object.

Create a `models.py` file with a SQLAlchemy class definition for the data in the `person` database table:

Python

```python
1  # models.py
2
3  from datetime import datetime
4  from config import db
5
6  class Person(db.Model):
7      __tablename__ = "person"
8      id = db.Column(db.Integer, primary_key=True)
9      lname = db.Column(db.String(32), unique=True)
10     fname = db.Column(db.String(32))
11     timestamp = db.Column(
12         db.DateTime, default=datetime.utcnow, onupdate=datetime.utcnow
13     )
```

Here's what the above code is doing:

- **Line 3** imports the `datetime` object from [the `datetime` module] that comes with Python. This gives you a way to create a timestamp in the `Person` class in lines 11 to 13.
- **Line 4** imports `db`, an instance of `SQLAlchemy` that you defined in the `config.py` module. This gives `models.py` access to SQLAlchemy attributes and methods.
- **Line 6** defines the `Person` class. Inheriting from `db.Model` gives `Person` the SQLAlchemy features to connect to the database and access its tables.
- **Line 7** connects the class definition to the `person` database table.
- **Line 8** declares the `id` column containing an integer acting as the primary key for the table.
- **Line 9** defines the last name field with a string value. This field must be unique because you're using `lname` as the identifier for a person in a REST API URL.
- **Line 10** defines the first name field with a string value.
- **Lines 11 to 13** define a `timestamp` field with a `datetime` value.

The `default=datetime.utcnow` parameter defaults the timestamp value to the current `utcnow` value when a record is created. The `onupdate=datetime.utcnow` parameter updates the timestamp with the current `utcnow` value when the record is updated. To learn more about UTC timestamps, expand the collapsible section below:

A Note about UTC Timestamps Show/Hide

Using SQLAlchemy allows you to think in terms of objects with behavior rather than dealing with raw SQL. This becomes even more beneficial when your database tables become larger and the interactions more complex.

Serialize the Modeled Data With Marshmallow

Working with SQLAlchemy's modeled data inside your programs is very convenient. However, the REST API works with JSON data, and here you can run into an issue with the SQLAlchemy model.

Because SQLAlchemy returns data as Python class instances, Connexion can't serialize these class instances to JSON-formatted data.

Note: In this context, serializing means converting Python objects, which can contain other Python objects and complex data types, into simpler data structures that can be parsed into JSON data types, which are listed here:

- **`string`:** A string type
- **`number`:** Numbers supported by Python (integers, floats, longs)
- **`object`:** A JSON object, which is roughly equivalent to a Python dictionary
- **`array`:** Roughly equivalent to a Python List
- **`boolean`:** Represented in JSON as `true` or `false`, but in Python as `True` or `False`
- **`null`:** Essentially `None` in Python

As an example, your `Person` class contains a timestamp, which is a Python `DateTime` class. There's no `DateTime` definition in JSON, so the timestamp has to be converted to a string in order to exist in a JSON structure.

You're using a database as persistent data storage. With SQLAlchemy, you can comfortably communicate with your database from within your Python program. However, there are two challenges that you need to solve:

1. Your REST API works with JSON instead of Python objects.
2. You must make sure that the data that you're adding to the database is valid.

That's where the Marshmallow module comes into play!

Marshmallow helps you to create a `PersonSchema` class, which is like the SQLAlchemy `Person` class you just created. The `PersonSchema` class defines how the attributes of a class will be converted into JSON-friendly formats. Marshmallow also makes sure that all attributes are present and contain the expected data type.

Here's the Marshmallow class definition for the data in your `person` table:

Python

```python
# models.py

from datetime import datetime
from config import db, ma

class Person(db.Model):
    __tablename__ = "person"
    id = db.Column(db.Integer, primary_key=True)
    lname = db.Column(db.String(32), unique=True)
    fname = db.Column(db.String(32))
    timestamp = db.Column(
        db.DateTime, default=datetime.utcnow, onupdate=datetime.utcnow
    )

class PersonSchema(ma.SQLAlchemyAutoSchema):
    class Meta:
        model = Person
        load_instance = True
        sqla_session = db.session

person_schema = PersonSchema()
people_schema = PersonSchema(many=True)
```

You import `ma` from `config.py` to enable `PersonSchema` to inherit from `ma.SQLAlchemyAutoSchema`. To find a SQLAlchemy model and a SQLALchemy session, `SQLAlchemyAutoSchema` looks for and then uses this internal `Meta` class.

For `PersonSchema`, the model is `Person`, and `sqla_session` is `db.session`. This is how Marshmallow finds attributes in the `Person` class and learns the types of those attributes so it knows how to serialize and deserialize them.

With `load_instance`, you're able to deserialize JSON data and load `Person` model instances from it. Finally, you instantiate two schemas, `person_schema` and `people_schema`, that you'll use later.

Do Some Cleanup

Now it's time to get rid of the old `PEOPLE` data structure. This will make sure that any changes you're making to people data are performed on the database rather than the obsolete `PEOPLE` dictionary.

Open `people.py` and get rid of the imports, functions, and data structures that you don't need anymore, and use new imports to add `db` and data from `models.py`:

Python

```python
# people.py

# Remove: from datetime import datetime
from flask import make_response, abort

from config import db
from models import Person, people_schema, person_schema

# Remove: get_timestamp():
# Remove: PEOPLE

# ...
```

You remove the `datetime` import, the `get_timestamp()` function, and the `PEOPLE` dictionary. In exchange, you add objects from `config` and `models` that you'll use from now on.

The moment you removed the `PEOPLE` dictionary, your Python code editor may have complained about the undefined `PEOPLE` variable in your code. In the next section, you'll replace all `PEOPLE` references with database queries and make your Python editor happy again.

Connecting the Database With Your API

Your database is connected to your Flask project but not to the REST API yet. Potentially, you could use the Python interactive shell to add more people to your database. But it'll be much more fun to enhance your REST API and utilize existing endpoints to add data!

In this section, you'll connect your API with the database, so you use your existing endpoints with the database to manage people. If you want to recap how you built the API endpoints, then you can hop over to part one of this tutorial series.

This is how your Flask REST API looks at the moment:

Action	HTTP Verb	URL Path	Description
Read	`GET`	`/api/people`	Read a collection of people.
Create	`POST`	`/api/people`	Create a new person.
Read	`GET`	`/api/people/<lname>`	Read a particular person.
Update	`PUT`	`/api/people/<lname>`	Update an existing person.
Delete	`DELETE`	`/api/people/<lname>`	Delete an existing person.

Next up, you'll update the existing functions connected to the endpoints listed above so that they can work with the `people.db` database.

Read From the Database

First, adjust the functions in `people.py` that read data from the database without writing anything to the database. Start with `read_all()`:

Python

```python
# people.py

# ...

def read_all():
    people = Person.query.all()
    return people_schema.dump(people)

# ...
```

The `read_all()` function responds to the REST API URL endpoint `GET /api/people` and returns all the records in the `person` database table.

You're using `people_schema` which is an instance of the Marshmallow `PersonSchema` class the was created with the parameter `many=True`. With this parameter you tell `PersonSchema` to expect an interable to serialize. This is important because the `people` variable contains a list of database items.

Finally, you serialize your Python objects with `.dump()` and return the data of all the people as a response to the REST API call.

The other function in `people.py` that only receives data is `read_one()`:

Python

```python
# people.py

# ...

def read_one(lname):
    person = Person.query.filter(Person.lname == lname).one_or_none()

    if person is not None:
        return person_schema.dump(person)
    else:
        abort(404, f"Person with last name {lname} not found")

# ...
```

The `read_one()` function receives an `lname` parameter from the REST URL path, indicating that the user is looking for a specific person.

You use `lname` in the query's `.filter()` method. Rather than using `.all()`, you use the [`.one_or_none()`] method to get one person, or return `None` if no match is found.

If a person is found, then `person` contains a `Person` object and you return the serialized object. Otherwise, you call `abort()` with an error.

Write to the Database

Another modification to `people.py` is creating a new person in the database. This gives you an opportunity to use the Marshmallow `PersonSchema` to deserialize a JSON structure sent with the HTTP request to create a SQLAlchemy `Person` object. Here's part of the updated `people.py` module showing the handler for the REST URL endpoint `POST /api/people`:

Python

```python
# people.py

# ...

def create(person):
    lname = person.get("lname")
    existing_person = Person.query.filter(Person.lname == lname).one_or_none()

    if existing_person is None:
        new_person = person_schema.load(person, session=db.session)
        db.session.add(new_person)
        db.session.commit()
        return person_schema.dump(new_person), 201
    else:
        abort(406, f"Person with last name {lname} already exists")

# ...
```

Instead of receiving only a last name like in `read_one()`, `create()` receives a `person` object. This object must contain `lname`, which must not exist in the database already. The `lname` value is your identifier for your person, so you can't have a person with the same last name multiple times in your database.

If the last name is unique, then you deserialize the `person` object as `new_person` and add it `db.session`. Once you commit `new_person` to the database, your database engine assigns a new primary key value and a UTC-based timestamp to the object. Later, you'll see the created dataset in the API response.

Adjust `update()` and `delete()` similarly to how you adjusted the other functions:

Python

```python
# people.py

# ...

def update(lname, person):
    existing_person = Person.query.filter(Person.lname == lname).one_or_none()

    if existing_person:
        update_person = person_schema.load(person, session=db.session)
        existing_person.fname = update_person.fname
        db.session.merge(existing_person)
        db.session.commit()
        return person_schema.dump(existing_person), 201
    else:
        abort(404, f"Person with last name {lname} not found")

def delete(lname):
    existing_person = Person.query.filter(Person.lname == lname).one_or_none()

    if existing_person:
        db.session.delete(existing_person)
        db.session.commit()
        return make_response(f"{lname} successfully deleted", 200)
    else:
        abort(404, f"Person with last name {lname} not found")
```

With all these changes in place, it's time to update your front-end code and leverage Swagger UI to try out if your database works as expected.

Display Data in Your Front End

Now that you've added the SQLite configuration and defined your `Person` model, your Flask project contains all the information to work with your database. Before you can display data in the front end, you need to make some adjustments to `app.py`:

Python

```python
 1 # app.py
 2 
 3 from flask import render_template
 4 # Remove: import connexion
 5 import config
 6 from models import Person
 7 
 8 app = config.connex_app
 9 app.add_api(config.basedir / "swagger.yml")
10 
11 @app.route("/")
12 def home():
13     people = Person.query.all()
14     return render_template("home.html", people=people)
15 
16 if __name__ == "__main__":
17     app.run(host="0.0.0.0", port=8000, debug=True)
```

You're now working with `config.py` and `models.py`. So you remove the import in the line 4 and add the imports for `config` in line 5 and `Person` in line 6.

The `config` module provides the Connexion-flavored Flask app for you. Therefore, you don't create a new Flask app in `app.py` anymore, but reference `config.connex_app` in line 8.

In line 13 you query the `Person` model to get all the data from the `person` table and pass it on to `render_template()` in line 14.

To show the `people` data in the front end, you need to adjust the `home.html` template:

HTML

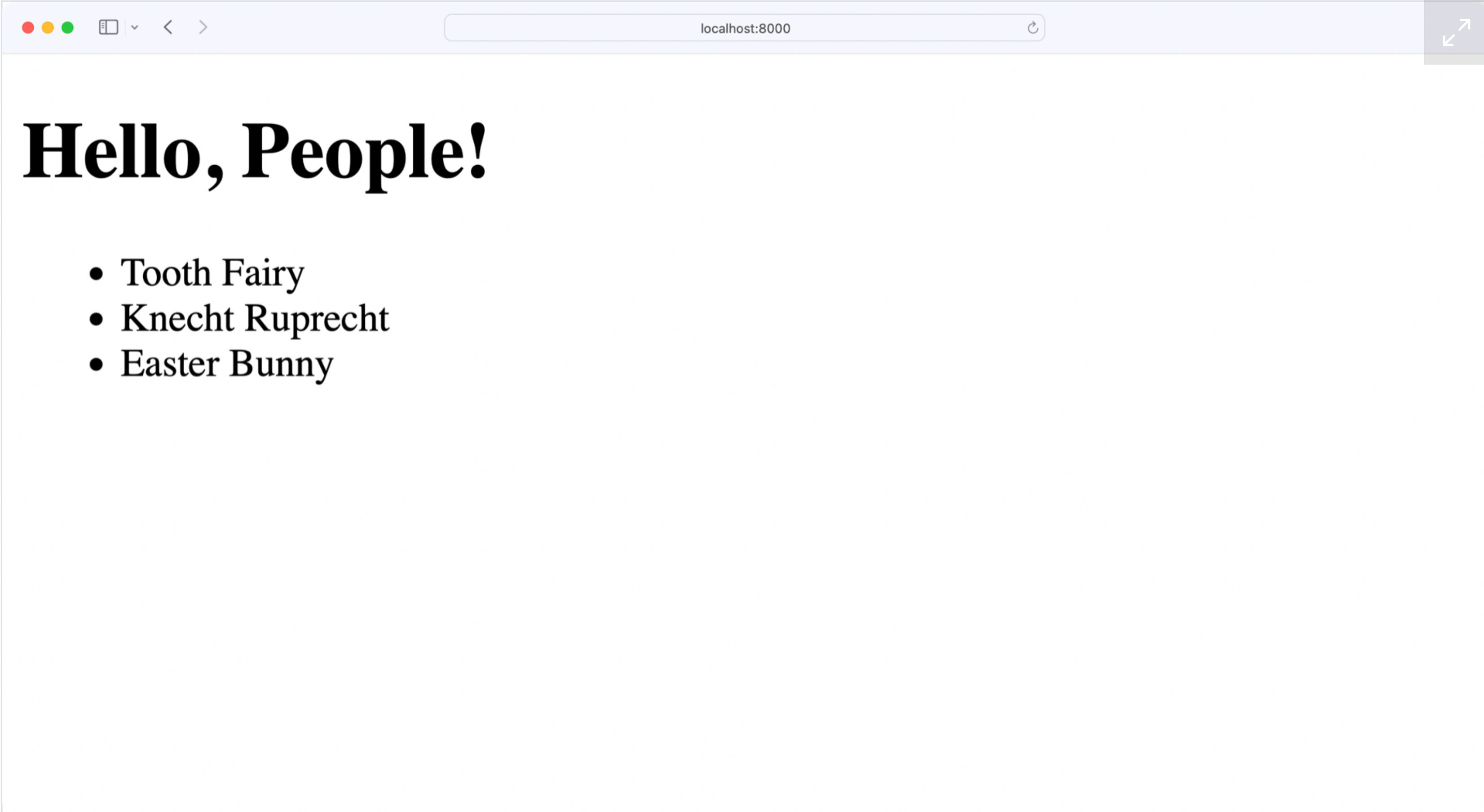
```html
<!-- templates/home.html -->

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>RP Flask REST API</title>
</head>
<body>
    <h1>
        Hello, People!
    </h1>
    <ul>
        {% for person in people %}
        <li>{{ person.fname }} {{ person.lname }}</li>
        {% endfor %}
    </ul>
</body>
</html>
```

You can run your application with this command in the directory containing the `app.py` file:

Shell

```shell
(venv) $ python app.py
```

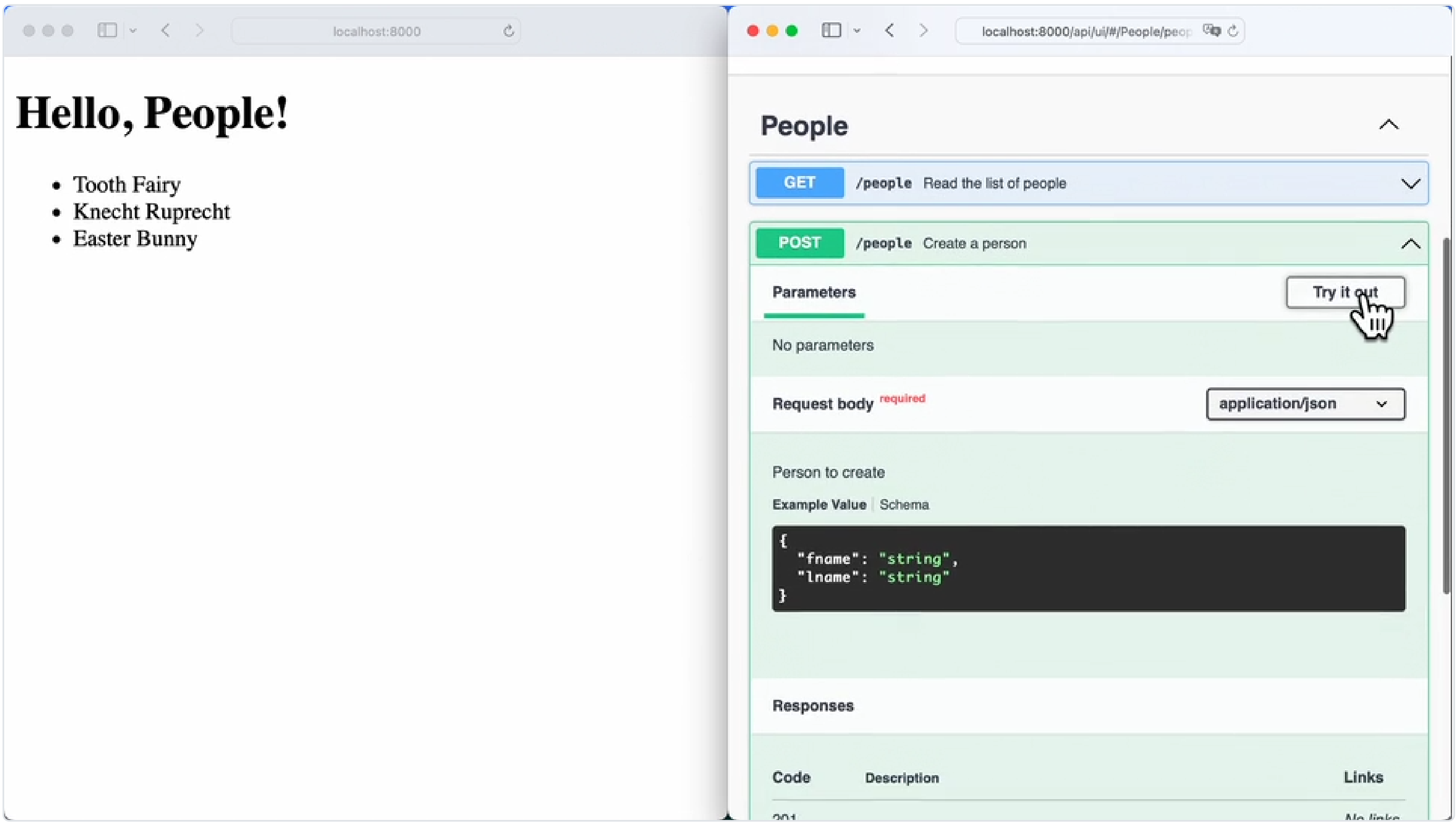
When you run this application, a web server will start on port 8000, which is the port that you defined in `app.py`. If you open a browser and navigate to `http://localhost:8000`, you'll see the data from your database:



Awesome! Your home page lists all three people who are currently in your database. Finally, you can use Swagger UI to create, update, and delete people and see the changes reflected on the home page.

Explore Your API Documentation

With the above changes in place, your database is now functional and persists the data even when you restart your application:



You can leverage your API to add, update, and remove people. With the changes that you made to the front end, you're able to see all the people who are currently stored in your database.

When you restart your Flask app, you don't reset the data anymore. Since you now have a database attached to your Flask project, your data is saved.

Conclusion

Congratulations, you've covered a lot of new material in this tutorial and added useful tools to your arsenal!

In the second part of this tutorial series, you learned how to:

- Write **SQL commands** in Python

- Configure a **SQLite database** for your Flask project
- Use **SQLAlchemy** to save Python objects to your database
- Leverage the **Marshmallow library** to serialize data
- Connect your **REST API** with your database

The skills that you've learned have certainly been a step up in complexity from the REST API of part one, but that step has given you powerful tools to use when creating more complex applications. Using them will give you a great leg up to create your own web applications backed by a database.

To review the code for the second part of this tutorial series, click below:

Source Code: Click here to download the free source code that you'll use to continue building a REST API with the Flask web framework.

In the next part of this series, you'll extend your REST API so that you can create, read, update, and delete notes. The notes will be stored in a new database table. Every note will be connected to a person, so you'll add relationships between notes and people to your database.

Part three will mark the last part of this tutorial series. At the end, you'll have a full-fledged Flask REST API with related database tables in the background.

« Part 1: REST APIs With Flask + Connexion | Part 2: Database Persistence | Part 3: Database Relationships »

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