FastAPI

Lecture 22

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FastAPI - Basic Example

ex1/app.y

```python
from fastapi import FastAPI

app = FastAPI()

@app.get("/")
async def root():
    return {"message": "Hello World"}

@app.get("/add")
async def add(x: int, y: int = 0):
    return {"result": x+y}

@app.get("/user/{user_id}")
async def user_id(user_id: int, name: str | None = None):
    res = {"user_id": user_id}
    if name is not None:
      res["name"] = name

    return res
```

Defining endpoints

Similar to plumber, FastAPI transforms basic Python functions into API endpoints which are made available by a python based webserver (uvicorn).

This transformation is performed used decorators that are used to specify the endpoints via a url path and http method.

For example,

```python
@app.get("/")
async def root():
    return {"message": "Hello World"}
```

Creates an endpoint at `/` that responds to http GET requests with the json `{"message": "Hello World"}`.

Running a FastAPI app

There are a couple of options for running your app,

- Running from Python using uvicorn (a http server based on uv):

```
1 uvicorn.run(app, host="0.0.0.0", port=8181)
```

```
INFO:     Started server process [84680]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:8181 (Press CTRL+C to quit)
```

- Running from the command line using uvicorn

```
1 uvicorn ex1.app:app --host 0.0.0.0 --port 8080
```

```
INFO:     Started server process [99168]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:8080 (Press CTRL+C to quit)
```

- Running from the shell using fastapi

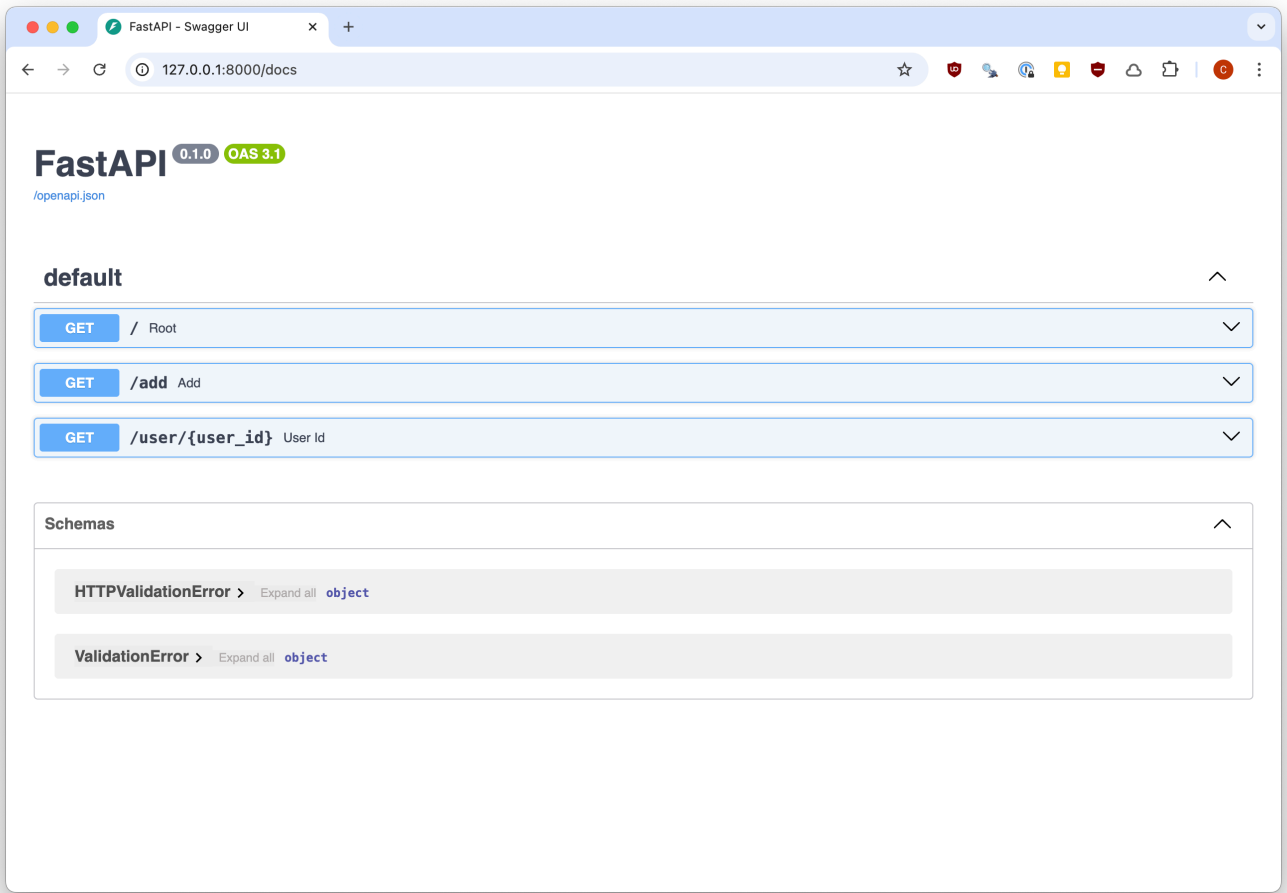
```
1 fastapi run ex1/app.py
```

```
FastAPI   Starting production server 🚀

          Searching for package file structure from directories with __init__.py files
          Importing from /Users/rundel/Desktop/Sta663-Sp25/website/static/slides/Lec22/ex1

 module   🐍 app.py

   code   Importing the FastAPI app object from the module with the following code:

          from app import app

    app   Using import string: app:app

 server   Server started at http://0.0.0.0:8000
 server   Documentation at http://0.0.0.0:8000/docs

          Logs:

   INFO   Started server process [99526]
```

Either `run` or `dev` commands can used for production vs development mode. The primary difference is the latter has auto-reload enabled which restarts the server when the underlying code changes. `dev` also binds `127.0.0.1` by default

API Docs

`/docs` `/redoc` `/openapi.json`



`async`?

You may have noticed that all of the function definitions make use of `async def f(...)` - this allows FastAPI to execute these functions asynchronously.

If you don't know what this is generally you don't need to worry about it, but some general advice is:

- If you are using a third party library that tells to you make calls using the `await` keyword then you definitely need `async`.
- If your function, or a library your function uses, communicates with something (e.g. a database, an API, the file system, etc.) and *does not* support `await` then don't use `async`.
- If neither of the above apply, generally you should default to using `async`.

Query parameters

Like plumber, endpoint functions' arguments are interpreted as query parameters, all arguments without defaults are assumed to be required.

```
1 import requests
2 url = "http://0.0.0.0:8000"
```

```
1 requests.get(url+"/add?x=1&y=1").json()
```

```
{'result': 2}
```

```
1 requests.get(url+"/add?x=-7&y=12").json()
```

```
{'result': 5}
```

```
1 requests.get(url+"/add?x=-7").json()
```

```
{'result': -7}
```

```
1 r = requests.get(url+"/add?y=-7")
2 r.status_code
```

```
422
```

```
1 r.json()
```

```
{'detail': [{'type': 'missing', 'loc': ['query', 'x'], 'msg': 'Field required', 'input': None}]}
```

Type hinting

If type hinting is used when defining your function then FastAPI will attempt to validate the users inputs based on those type.

```
1 r = requests.get(url+"/add?x=abc&y=1")
2 r.status_code
```

422

```
1 r.json()
```

```
{'detail': [{'type': 'int_parsing', 'loc':
['query', 'x'], 'msg': 'Input should be a valid
integer, unable to parse string as an integer',
'input': 'abc'}]}
```

```
1 r = requests.get(url+"/add?x=1.0&y=2.0")
2 r.status_code
```

200

```
1 r.json()
```

```
{'result': 3}
```

```
1 r = requests.get(url+"/add?x=1.5&y=2.")
2 r.status_code
```

422

```
1 r.json()
```

```
{'detail': [{'type': 'int_parsing', 'loc':
['query', 'x'], 'msg': 'Input should be a valid
integer, unable to parse string as an integer',
'input': '1.5'}, {'type': 'int_parsing', 'loc':
['query', 'y'], 'msg': 'Input should be a valid
integer, unable to parse string as an integer',
'input': '2.'}]}
```

Path parameters

Again like plumber, arguments can be passed to the API using the request path - these are indicated using `{}` in the path definition and then having a matching argument name in the function definition.

```
r = requests.get(url+
  "/user/1234/?name=Colin")
r.status_code
```

```
200
```

```
r.json()
```

```
{'user_id': 1234, 'name': 'Colin'}
```

```
r = requests.get(url+"/user/3141/")
r.status_code
```

```
200
```

```
r.json()
```

```
{'user_id': 3141}
```

```
r = requests.get(url+"/user/Colin/")
r.status_code
```

```
422
```

```
r.json()
```

```
{'detail': [{'type': 'int_parsing', 'loc':
['path', 'user_id'], 'msg': 'Input should be a
valid integer, unable to parse string as an
integer', 'input': 'Colin'}]}
```

Request body

When making a `PUT`, `POST`, or `PATCH` requests we are usually sending data to the API via the body of our request.

FastAPI makes use of `pydantic` models to define the expected body content. I would like to avoid getting into the weeds of `pydantic` and `typing` as much as possible, so we will go with the most basic use case.

The following `pydantic` model specifies an expected body that contains a `name` and `price` entries that are a string and float respectively and optionally a `description` string and `tax` float.

```
1 from pydantic import BaseModel
2
3 class Item(BaseModel):
4     name: str
5     description: str | None = None
6     price: float
7     tax: float | None = None
```

Usage

The preceding data model can be used as an argument for our endpoint function, and FastAPI will take of processign everything for us.

```
items = {}

@app.post("/items/")
async def add_item(item: Item):
    items.append(item)
    return items
```

What's happening?

From FastAPI's Request body docs:

> With just that Python type declaration, FastAPI will:
>
> - Read the body of the request as JSON.
> - Convert the corresponding types (if needed).
> - Validate the data.
>   - If the data is invalid, it will return a nice and clear error, indicating exactly where and what was the incorrect data.
> - Give you the received data in the parameter item.
>   - As you declared it in the function to be of type Item, you will also have all the editor support (completion, etc) for all of the attributes and their types.
> - Generate JSON Schema definitions for your model, you can also use them anywhere else you like if it makes sense for your project.
> - Those schemas will be part of the generated OpenAPI schema, and used by the automatic documentation UIs.

Body vs path & query parameters

Endpoints can use any mixture of body, path, and query parameters.

FastAPI uses the following rules to determine what each argument is:

> The function parameters will be recognized as follows:
>
> - If the parameter is also declared in the path, it will be used as a path parameter.
> - If the parameter is of a singular type (like int, float, str, bool, etc) it will be interpreted as a query parameter.
> - If the parameter is declared to be of the type of a Pydantic model, it will be interpreted as a request body.

Example 2 - A model API

Example 3 - Putting it all together (HW5)