LEARNINGS FROM MIGRATING A FLASK APP TO FASTAPI

PyCon DE & PyData

Orell Garten

24.04.2025

LET'S START WITH SOME QUESTIONS

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Who has used Flask?

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Who has used FastAPI?

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Who has used Flask?

Who has used FastAPI?

Has anyone migrated an app?

/WHOAMI

/WHY

Are there any good reasons to migrate from Flask to FastAPI?

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Are there any good reasons to migrate from Flask to FastAPI?

Performance?

Data Validation?

Async?

Developer Experience?

GOALS

Migration from Flask to FastAPI was not the main goal.

- We wanted:
  - Database integration
  - Better code quality
  - Better testibility

Migration to FastAPI was helping us achieve this.

DISCLAIMER

- This talk is about **my** experiences.
- Your experience might be different

/AGENDA

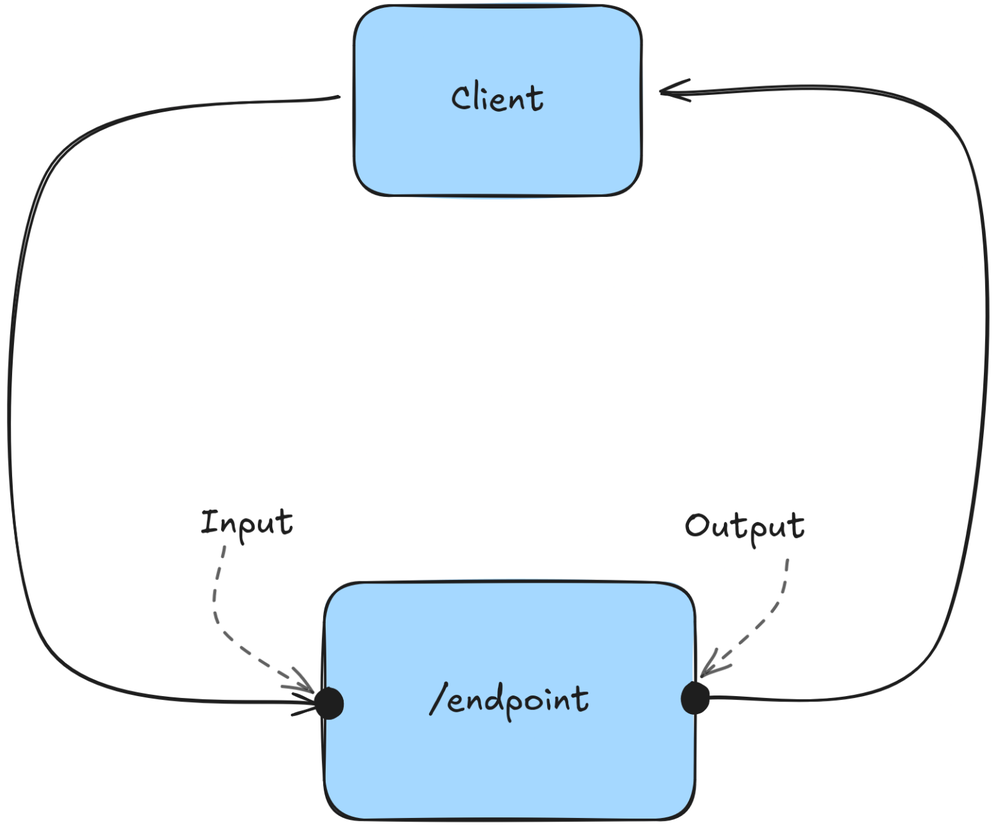
1. Data modeling
2. async is overrated
3. Problems you will encounter
4. Migration strategy
5. Q&A

MATERIAL

Material on github.com/orgarten

DATA MODELING

THE SITUATION



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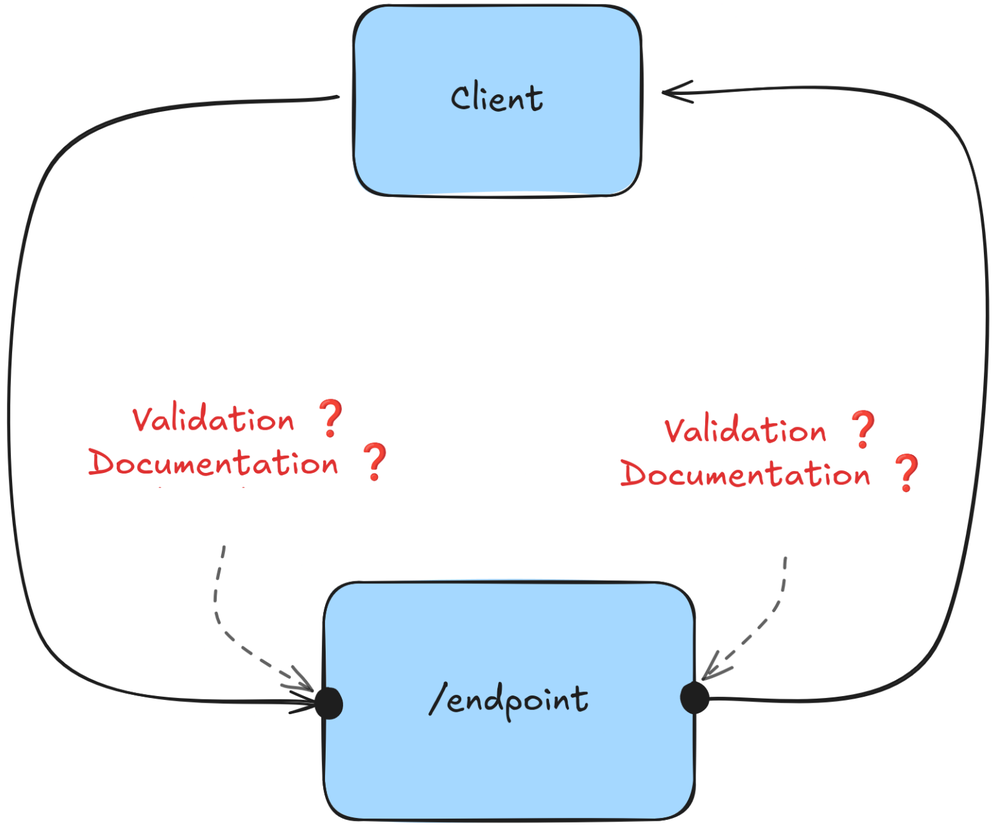

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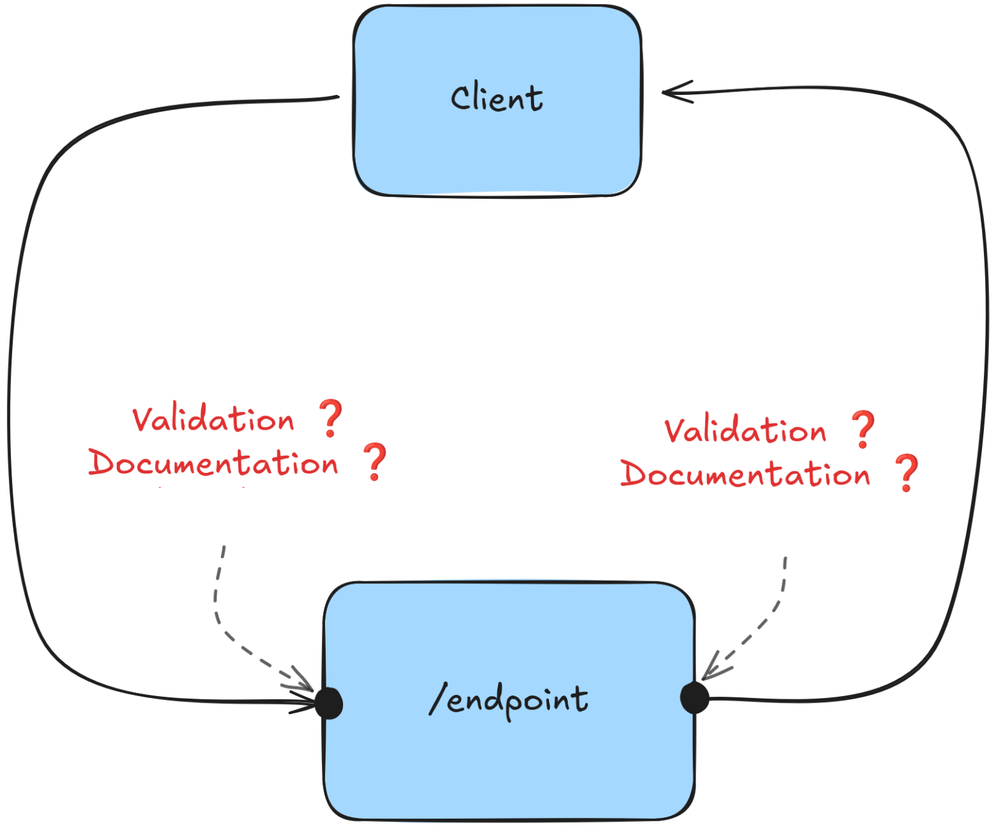

How do we deal with input and outputs in a good way?

INPUTS WITH FLASK

```python
@app.route('/user', methods=['POST'])
def create_user():
    data = request.get_json()
    username = data.get('name')
    email = data.get('email')
    password = data.get('password')

    # Create user in DB
    db[1] = {"name": username, "email": email, "password": password}

    return jsonify({'message': 'User created successfully','id': 1}), 201
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```
$ curl -X 'POST' \
  'http://localhost:8000/user' \
  -H 'accept: application/json' \
  -H 'Content-Type: application/json' \
  -d '{"name": "Orell", "email": "hello@orellgarten.com", "password": "test"}'

{"id":1,"message":"User created successfully"}
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OUTPUTS WITH FLASK

```python
@app.route("/user/<int:id>", methods=['GET'])
def get_user(id: int):
    # do something, e.g. create user in database
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{"email":"hello@orellgarten.com","name":"Orell","password":"test"}
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Oops, password in response!

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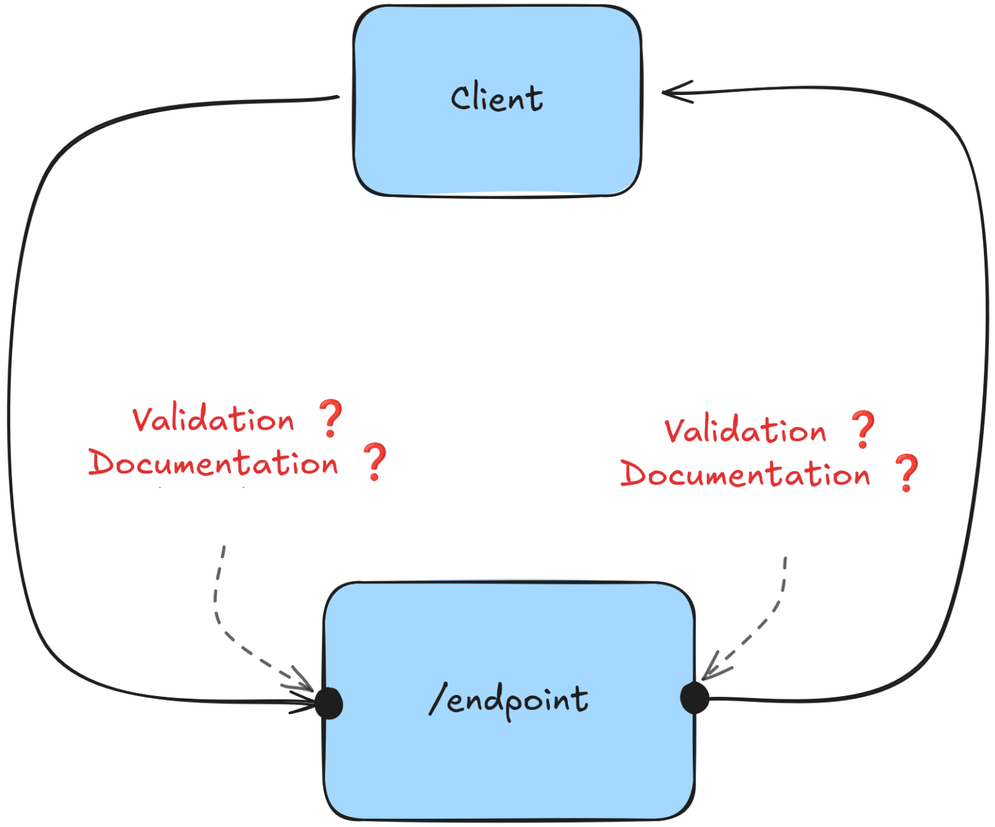

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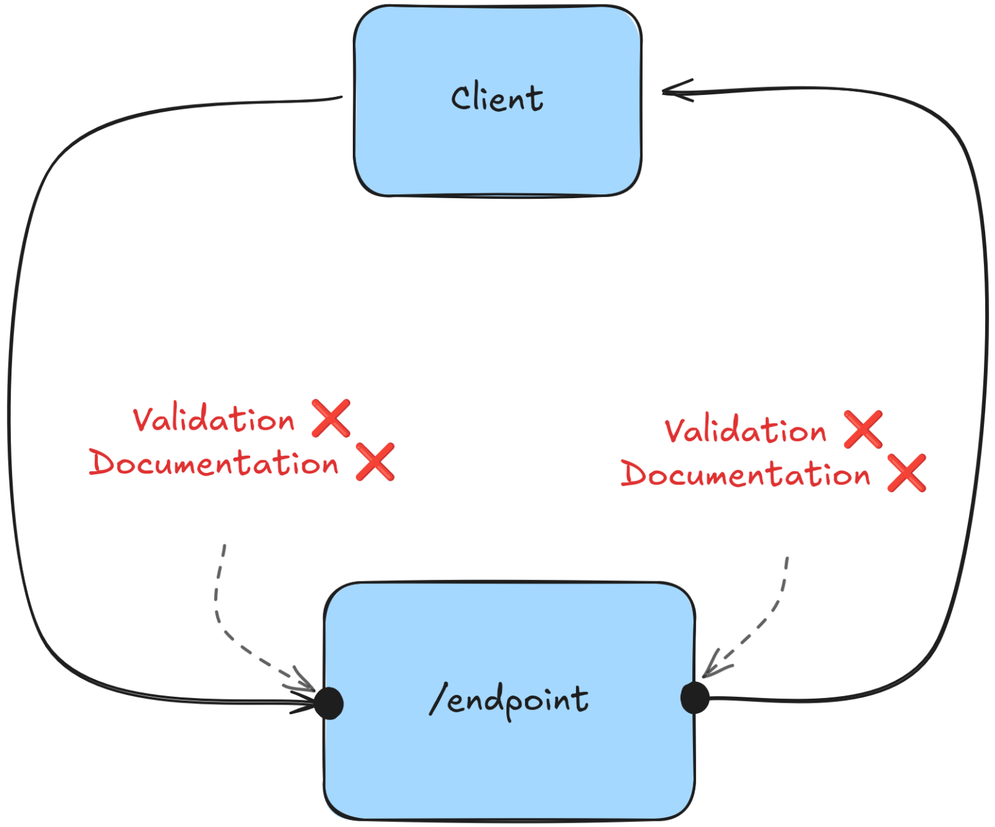

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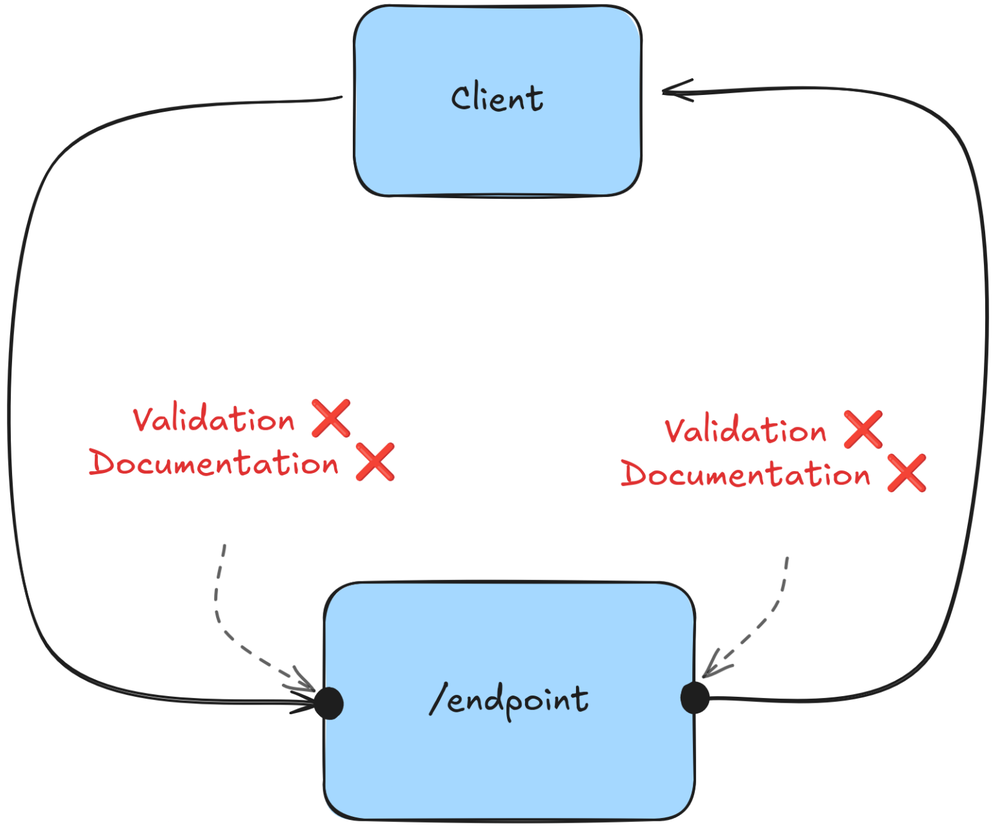

- No automatic input validation
- Manual data validation requires more boilerplate/libraries

INPUTS WITH FASTAPI

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class UserIn(BaseModel):
    name: str
    email: str
    password: str

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def create_user(
    user: UserIn,
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{"message":"User created successfully","id":1}
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OUTPUTS WITH FASTAPI

```python
class UserOut(BaseModel):
    name: str
    email: str

@app.get("/user/{id}",
     response_model=UserOut,
     status_code=status.HTTP_200_OK
 )
def get_user(
    id: int,
    db: Annotated[Dict, Depends(get_db)]
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    # get user from database
    user = db.get(id)

    return UserOut.model_validate(user, from_attributes=True)
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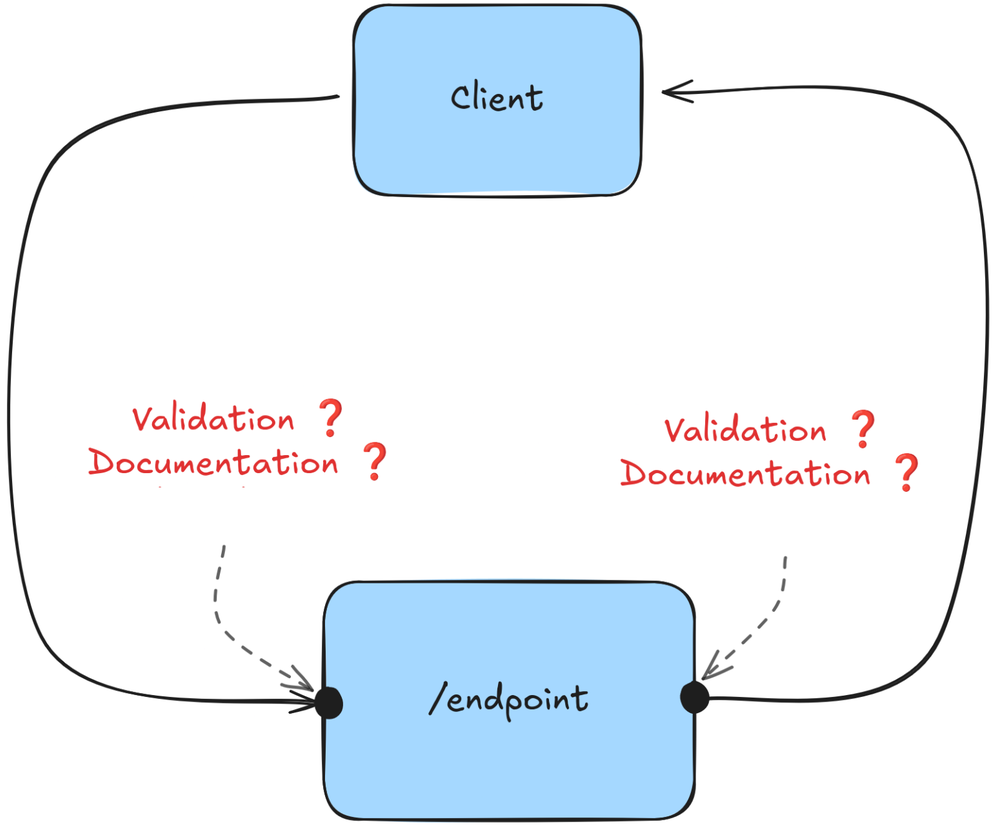
Data Transfer Object: Password not leaked

FASTAPI IN/OUT

- Works with Pydantic Models
- Automatic OpenAPI docs



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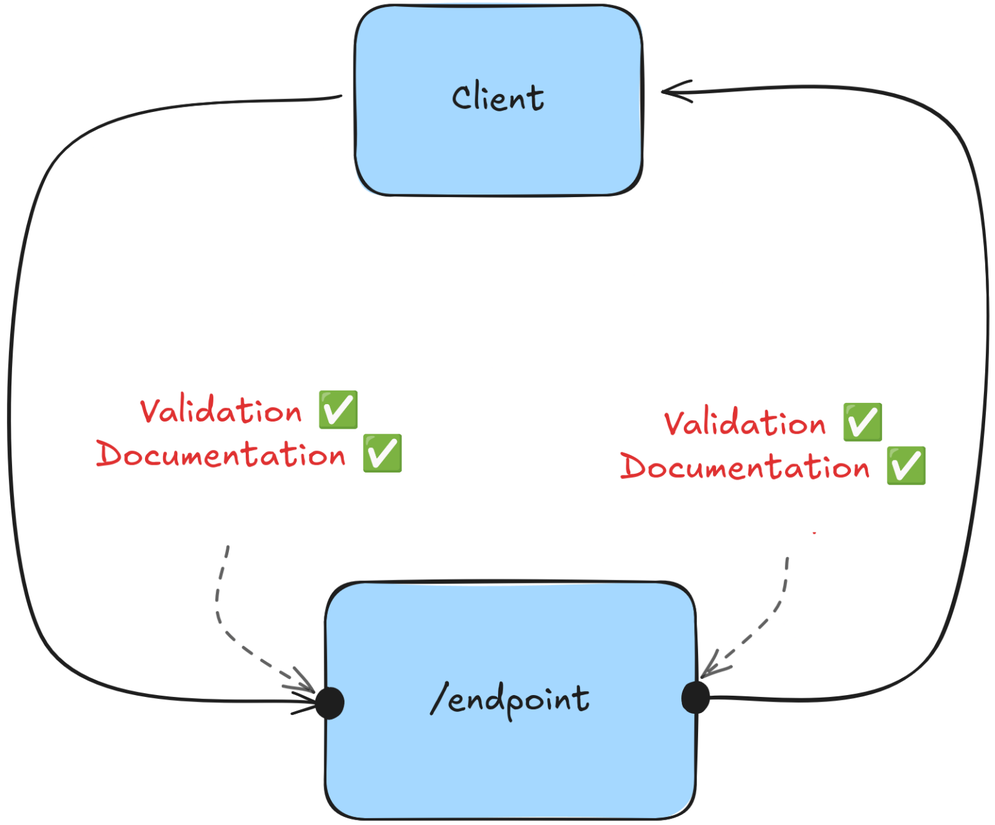

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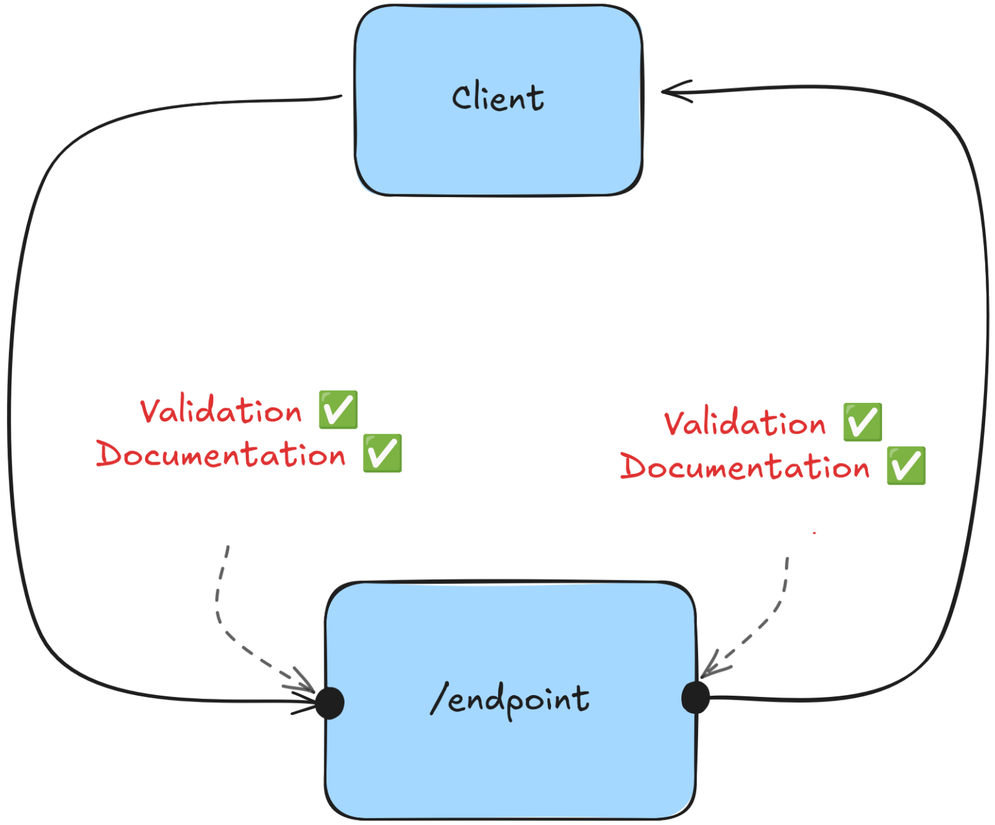

- Data modeling forces you to think about your application

LEARNING 1

Data modeling is not something you can do, it's something you must do.

async IS OVERRATED

ASYNC MEANS HIGH PERFORMANCE

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THE PROBLEM

Code in tutorials usually looks like this:

```python
from fastapi import FastAPI

app = FastAPI()

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ASYNC

- Single-threaded event loop
- Async runtime makes sure event loop is busy

THE PROBLEM

```python
from fastapi import FastAPI

app = FastAPI()

@app.get("/")
async def root():
    time.sleep(5) # Simulate long-running blocking op
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What will happen here?

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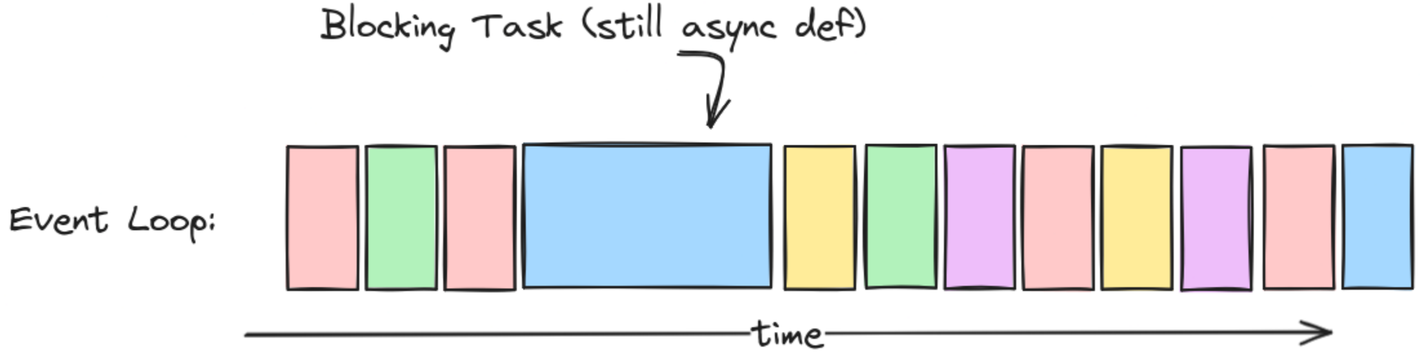
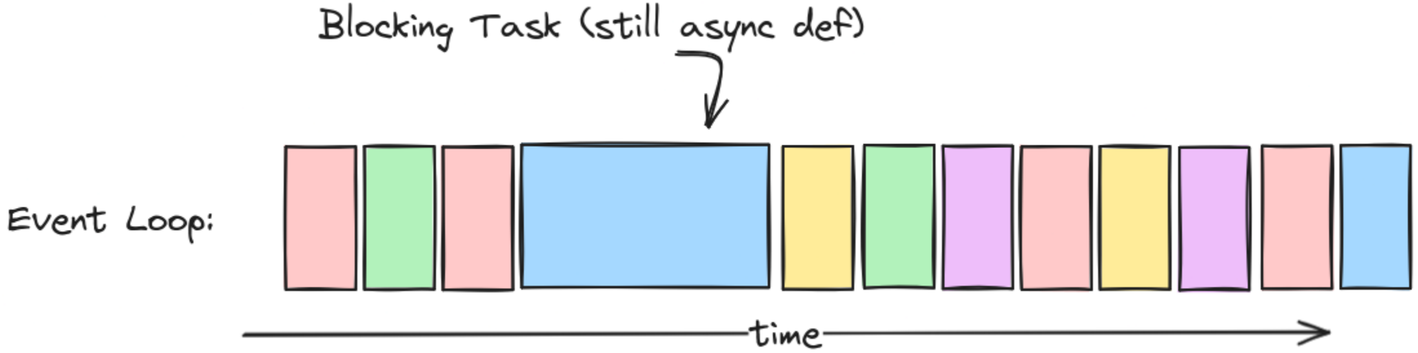
Async Task (async def)
Event Loop:
time


Blocking Task (still async def)
Event Loop:
time

ASYNC



The entire API is unresponsive

THE SOLUTION

- Only use awaitable functions (coroutines)
- blocking functions need to be fast

```python
from fastapi import FastAPI

app = FastAPI()

@app.get("/")
async def root():
    await asyncio.sleep(5) # long-running non-blocking operation
    return {"message": "Hello World"}
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THE OTHER SOLUTION

- Do not use async and FastAPI knows what to do:

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- This does not block the API
- Path operation runs in thread-pool and is awaited

THE OTHER SOLUTION

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- This does not block the API
- Path operation runs in thread-pool and is awaited

LEARNING 2:

async does not mean high performance

REMARKS

- Async require a different mental model of programming
- Easy to make mistakes, e.g. call blocking functions by accident
- Async is not the silver bullet for performance

WHEN TO USE async?

WHEN TO USE async?

- Only if you are sure it's non-blocking
- Middleware and dependencies
- Trivial code

LEARNING 3:

If in doubt use `def` instead of `async def`.

PROBLEMS YOU WILL ENCOUNTER

OVERVIEW

- Problem 1) Global objects
- Problem 2) Server-side sessions
- Problem 3) Flask plugins

1) FLASK - GLOBAL OBJECTS

Not-untypical deep inside the call stack in a Flask application:

```python
# core/processing/files.py
def enrich_file(file):

    # TODO: don't use request here
    tag = request.args.get('tag', 'unidentified')

    # do more things

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PROBLEMS?

- `request` being used in modules relatively unrelated to actual API
- `tag` is a query parameter!

1) FLASK - GLOBAL OBJECTS

- `request` and `g` are global states available in the entire call-chain
- Find use of global state in you application
  - `grep -nri request` (request context)
  - `grep -nri 'import g'` for application context

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- Solution in FastAPI:
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- Supports various backends for session storage
- Use like a key-value storage object
- Automatically sets cookies

No equivalent solution in FastAPI:

- Session management needs to be done manually
- Ideally, you don't want server-side session anyway
- MSAL auth is session based

3) PLUGINS

Flask:

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- Understand how to use that package
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FastAPI:

- Very few plugins available
- Dependency injection to extent function
- "plug'n'play" with normal packages

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2. Create endpoints in FastAPI app
3. Identify locations where global state is used
4. Move that state to endpoint and explicitely call functions with required information
5. Identify input and output models and create Pydantic models
6. Implement FastAPI endpoint

THANK YOU & LET'S CONNECT

hello@orellgarten.com