Flask Tutorial

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20/05/2025

Learning Goals

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1. Learn what is Flask, and some basic Flask concepts
2. Learn the Model View Control (MVC) pattern
3. Learn basic Docker

Flask Introduction

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  - Framework: a set of modules and libraries that provide basic functionalities
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  - In/for Python

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Other frameworks out there

- Ruby on Rails
- Django (Python)
- Java Spring
- Symfony (PHP)

Who uses Flask?

Prerequisites

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- Very basic Python
  - Variables, functions, indentation, lists, maps (dictionaries), if-then-else, for loops, class (OO programming), import libraries
- Terminal commands: `ls`, `cd`, `pwd`...
- Basic HTML
- CSS (optional)
- SQL

Flask Concepts

The App Variable

- Our app is an instance of the `Flask` class
- `__name__` is a default configuration telling that the files of the project are in the current directory

```python
from flask import Flask

app = Flask(__name__)
```

Routing

```
1  from flask import Flask
2
3  app = Flask(__name__)
4
5  @app.route("/")
6  def hello_world():
7      return "<p>Hello, World!</p>"
```

- `@app.route("/")` is Python decorator: extends the behavior of a function
  - Tells Flask what URL should trigger our function
  - The `"/"` is the root of our web site domain
    http://127.0.0.1:5000 takes us to this route
  - We can have other routes: `@app.route("/register")`
    http://127.0.0.1:5000/register takes us to this other route

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What else to learn:

- Variable rules:
  https://flask.palletsprojects.com/en/stable/quickstart/#variable-rules
- HTTP methods:
  https://flask.palletsprojects.com/en/stable/quickstart/#http-methods

Templates

File ./app.py:

```python
1  from flask import render_template
2
3  @app.route('/hello/')
4  @app.route('/hello/<name>')
5  def hello(name=None):
6      return render_template('hello.html', person=name)
```

File ./templates/hello.html:

```html
1  <!doctype html>
2  <title>Hello from Flask</title>
3  {% if person %}
4    <h1>Hello {{ person }}!</h1>
5  {% else %}
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  (Jinja2 template engine)

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- The function has a named argument

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- Import render_template (Jinja2 template engine)
- 2 routes for the same function
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- render_template passes the named arguments
- The template has access to the Python variables.
  Inside of {% %} is Jinja2 code
  Inside of {{ }} is to print as HTML

What else to learn about templates?

- If statements: `https://jinja.palletsprojects.com/en/stable/templates/#if`
- For loops: `https://jinja.palletsprojects.com/en/stable/templates/#for`
- Template Inheritance
  `https://jinja.palletsprojects.com/en/stable/templates/#template-inheritance`

MVC (extra)

Model View Controller

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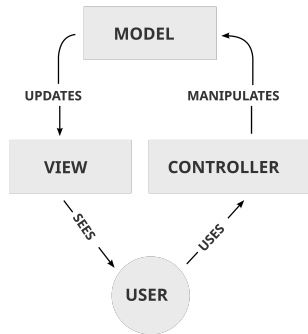
We split the applications in:

- Model: The internal representation of the information
  - Interacts with the database
  - Business logic (e.g. transfer money)
- View: The interface for the user
  - Builds the HTML/Javascript/JSON/Text
- Controller: Links model and view
  - Routes
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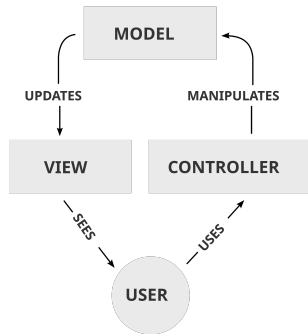
MVC in Flask

The Flask terminology does not quite fit the MVC model!

- Model: Python classes in a models folder
- View: Templates in the templates folder

- Controller:
  Flask views in a controllers folder, or a single app.py file

Docker (extra)

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- What Docker is not: A virtual machine
- It is a container solution based on a Linux kernel feature called cgroups
- It is also runs on MacOS and Windows

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Why use Docker?

- Like git, it is a standard in the industry
- It will make the life of the TAs way easier

Docker basics

More concepts

- Docker container: isolated process with its own file system
- Docker image: is a package that includes all of the files, binaries, libraries, and configurations to run a Docker container
    - Built on layers: make your own image on top of existing ones
- Docker volume: persistent data stores for containers

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An usual setup:

- `Dockerfile`: The Docker image in which you main app will run on
- `entrypoint.sh`: The script that the Dockerfile calls when its container is starting up
- `docker-compose.yml`: Organizes all the different Docker container of your application

A Minimal MVC Flask app with Docker Project

- App

Let's write our web apps!

Hands-on

- Follow my step-by-step guide: `https://github.com/rafaelcgs10/dis2025`
- Follow the official Flask tutorial:
  `https://flask.palletsprojects.com/en/stable/tutorial/`