INTRO APP WEB

Politecnico di Torino

Introduction to Web Applications

Flask

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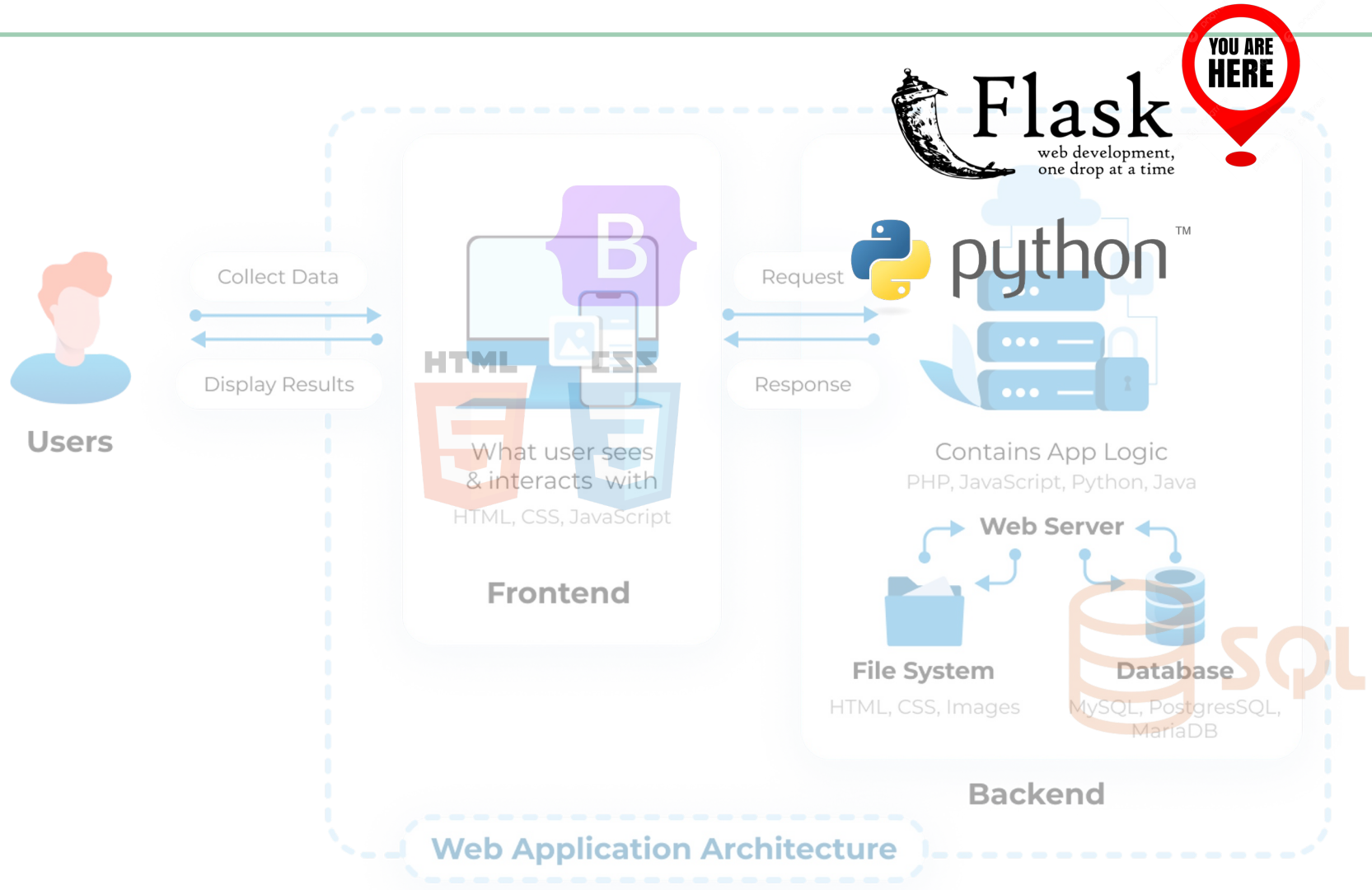
Goals

- Understand **what Flask is** and where it fits within the **web architecture**
- **Install** and **set up** Flask in our development environment
- Create a basic Flask application and **handle routes**
- **Integrate Flask** with the webpages we have developed so far

Flask: where are we?



🗺️ Web architecture components: Backend

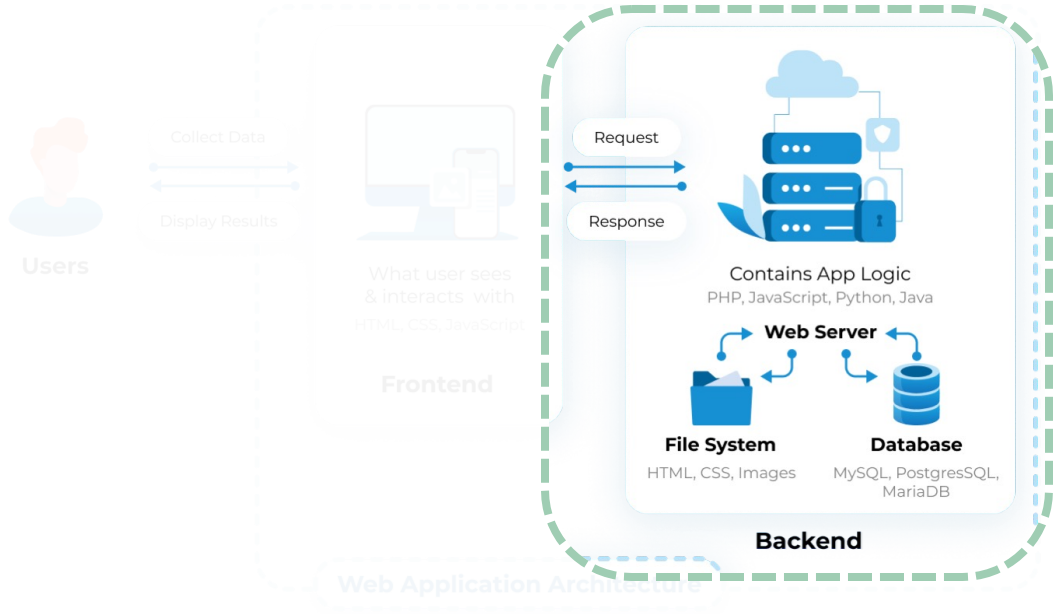
Backend: The part of a web application that works behind the scenes, handling **data**, **logic**, and server **communication**.

🧩 **Components**:

Server: a computer or system that provides **resources**, **data**, **services**, or **programs** to other computers, known as clients, over a network.

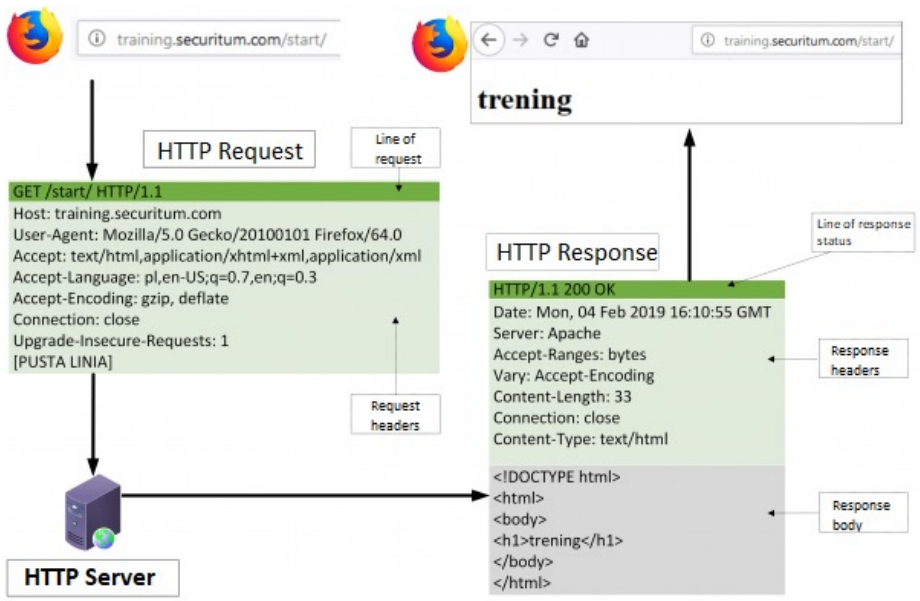
Web server: **hosting websites**, **handling HTTP requests** from clients (like browsers), and **delivering web pages**, images, and other content to the client's device.

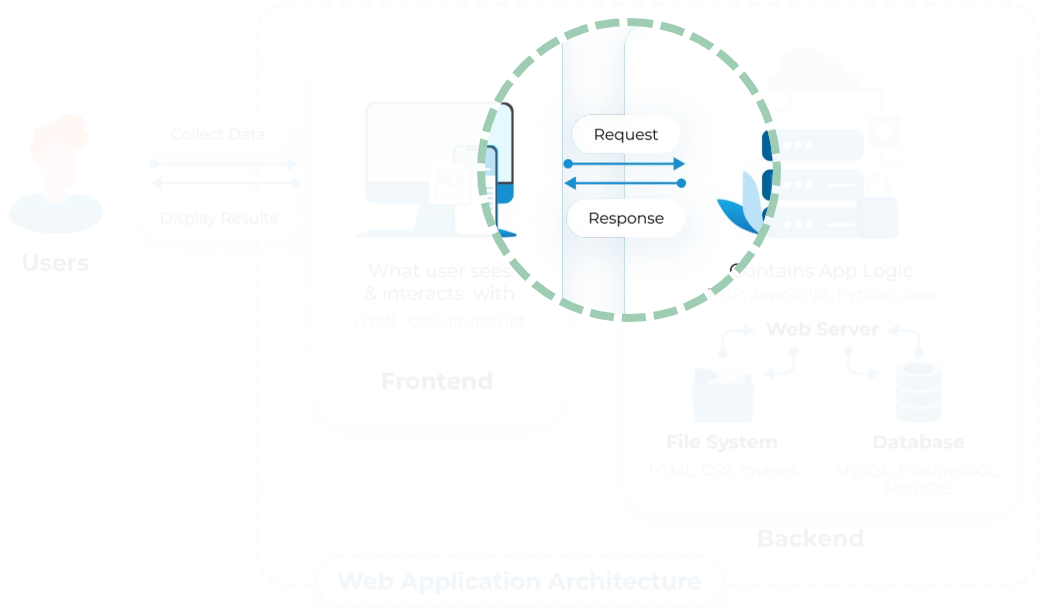
Intermediary between the client and the **database**



Web architecture components: HTTP Protocol

HTTP Protocol: the protocol used for **transferring data over the web**, allowing communication between **clients** (like browsers) and **servers** by sending requests and receiving responses

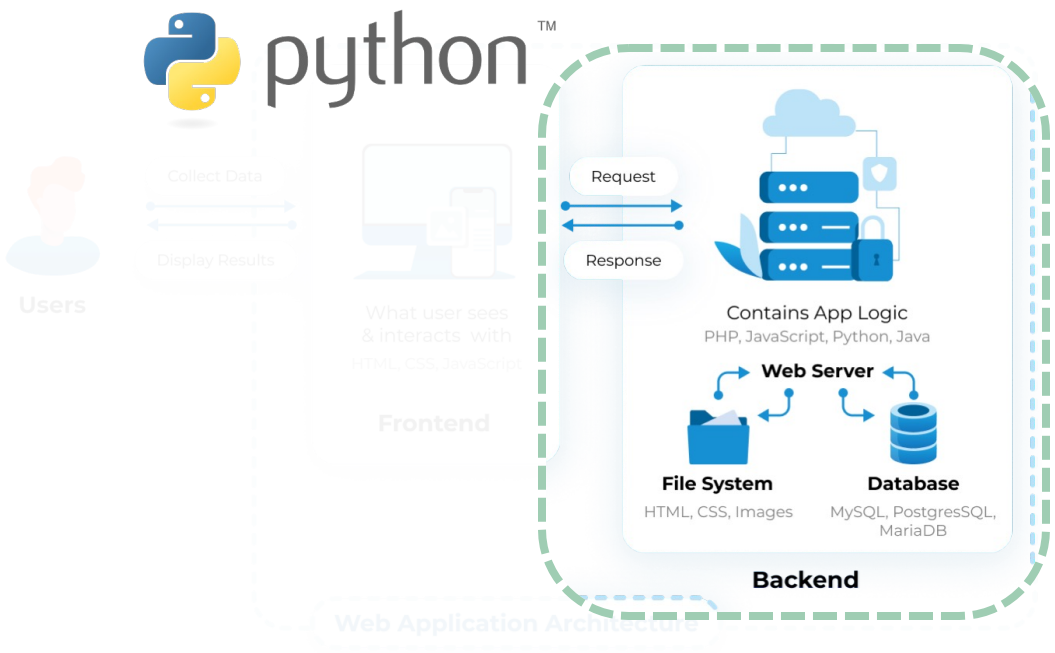




Why Flask?

Python includes **`SimpleHTTPServer`** to activate a **basic web server**

- it is **low-level** and **NOT** very **developer-friendly**



Flask

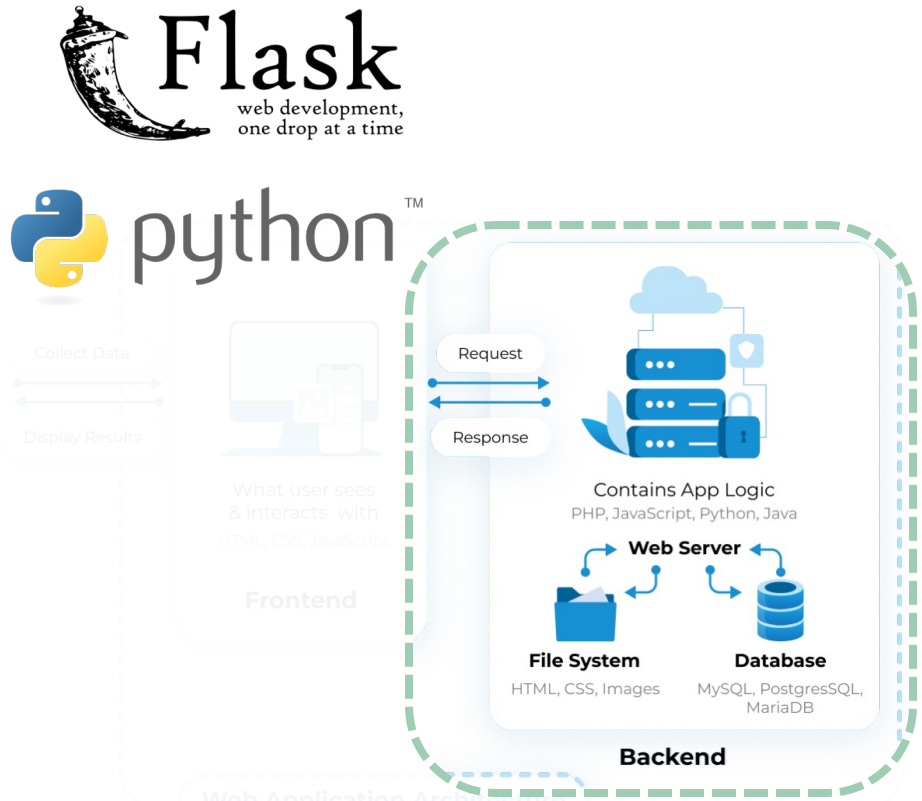
Flask is a lightweight and flexible **web framework** for **Python**

Designed to be **simple** and **minimal**

🔗 **https://flask.palletsprojects.com/en/stable/**

It provides tools to:

- Handle **HTTP requests**
- **Define routes** to map **URLs** to **functions**
- **Render templates** for dynamic content
- Manage **sessions** and **user data**
- Integrate with **databases**



Flask Installation and Setting Up

📌 Prerequisite

Ensure **Python is installed** (recommended: Python 3.7 or later)

- 🔗 **https://www.python.org/downloads/**

Check **Python version** (running the command in the terminal)

> 👉 If the '**python**' command is not found, use '**python3**' instead

```
python --version

python3 --version
```

Flask Installation and Setting Up

Step 1: Install Flask using `pip` (by running a terminal command)

- **`pip`** is a **package manager** for **Python**, used to install and manage **external libraries** and **dependencies** for Python projects

Step 2: Verify installation

```
pip install Flask

pip3 install Flask


python -m flask --version

python3 -m flask --version
```

Flask Installation and Setting Up

Step 3: Create a basic Flask application

- Create a Python file (**app.py**)

```python
from flask import Flask

app = Flask(__name__)

@app.route("/")
def home():
    return "Hello, Flask!"
```

Flask Installation and Setting Up

Step 4: Run the application

- If the Python file is named **`app.py`**, you can run it with the command **`flask run`**
- In the first option, "**`main`**" is the name (with the path, and without extension) of the Python file

🎉 **The web server starts and listens for incoming HTTP requests!**

- It is accessible via a web browser at **`http://127.0.0.1:5000`** by default

```
flask --app main run

flask run
```

Let's see it in practice

Understanding Flask

Importing and initializing Flask:

The **Flask class** is used to define the app instance that handles incoming requests and manages the routing

Defining a route:

`@app.route("/")` is a **decorator**

A function that modifies the behavior of another function or method

`@app.route("/")` creates a **route** for the homepage (URL `/`), which **triggers** the **`home()`** function

```python
# Import the Flask class from the
flask module
from flask import Flask

# Initialize the Flask application
app = Flask(__name__)

# Define a route for the homepage
(URL "/")
@app.route("/")
def home():
    return "Hello, Flask!"
```

Understanding Flask

Defining a route:

Each web page is represented by a **route decorator** and its corresponding **function**

Returning a response:

the **`home()`** function returns **"Hello, Flask!"** to be displayed in the browser

HTML is the default content type

```
# Import the Flask class from the
flask module
from flask import Flask

# Initialize the Flask application
app = Flask(__name__)

# Define a route for the homepage
(URL "/")
@app.route("/")
def home():
    return "Hello, Flask!"
```

Re-running it

Run the application

- If the Python file is named **`app.py`**, you can run it with the command **`flask run`**
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🎉 **The web server starts and listens for incoming HTTP requests!**

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```
flask --app main run

flask run

flask run --debug
```

Flask Routes Returning HTML Content as Strings 🤢

The **Flask app** defines two **routes**:

- The **homepage** «**/**»
- The **About** page «**/about**»

Each route returns **a complete HTML page** as a response using triple-quoted **strings**

```
@app.route('/')
def index():
    return """<html>
    <head><title>IAW App Home</title></head>
    <body><h1>My IAW App</h1>
    <p>Welcome</p>
    </body>
    </html>
    """
@app.route('/about')
def about():
    return """<html>
    <head><title>IAW App About</title></head>
    <body><h1>Who are we?</h1>
    </body>
    </html>
    """
```

Flask Routes Returning HTML Content Using Templates 🤩

Flask supports **Jinja** out of the box.
https://palletsprojects.com/projects/jinja/

- A templating engine for rendering **dynamic content** in HTML
- Templates are **HTML files**, with **`.html`** extension
- To render a template you can use the **`render_template()`** method

⚠️ **Flask** will look for templates in the «**`templates`**» subfolder

```
@app.route('/')
def index():
    return render_template('index.html')

@app.route('/about')
def about():
    return render_template('about.html')
```

Flask Routes Returning HTML Content Using Templates 🤩

Jinja allows you to embed **Python-like expressions** in HTML files

Supports features like:

- **loops**, **conditionals**, **filters**, and template **inheritance**,

making it powerful for generating **dynamic** web pages

Jinja features: Loops

`{% statement %}`

- **controls** the template's execution flow

`{{ expression }}`

- **evaluates** a variable or expression and outputs the result in the HTML
- **`|  e`**: to escape **>**, **<**, &, and "

```python
# app.py
@app.route("/")
def index():
  items = ["Apple", "Banana", "Cherry"]
  return render_template("index.html", p_items=items)
```

```jinja
<!-- templates/index.html -->
<ul>
  {% for item in p_items %}
    <li>{{ item | e}}</li>
  {% endfor %}
</ul>
```

Jinja features: Conditionals

Welcome, John!

- If **`user=None`**, it displays «**Welcome, Guest!**» instead

`{% elif another_condition %}` is also possible

```
# app.py
@app.route('/')
def index():
  return render_template('index.html', user='John')
```

```
{% if user %}
  <p>Welcome, {{ user }}!</p>
{% else %}
  <p>Welcome, Guest!</p>
{% endif %}
```

Jinja features: Inheritance (extending a base template)

```
<!-- templates/base.html -->
<!DOCTYPE html>
<html>
  <head>
    <title>My Website - {% block title %}{%
endblock %}</title>
  </head>
  <body>
    <header>
      <h1>Welcome to My Website</h1>
    </header>
    <main>{% block content %}{% endblock
%}</main>
  </body>
</html>
```

```
<!-- templates/index.html -->
{% extends 'base.html' %}

{% block title %}Home{% endblock %}

{% block content %}
<p>This is the homepage.</p>
{% endblock %}
```

Jinja features: Inheritance (extending a base template)

In more complex web applications, multiple pages share **common elements** such as:

- Navigation bars
- Footers
- Page layouts

Jinja provides **blocks** and **template inheritance** to handle this efficiently

Jinja features: Inheritance (extending a base template)

{% block <block_name> %}…{% endblock %}

- Defines a reusable HTML block in a template
- **<block_name>** must be unique within the template

{% extends "filename.html" %}

- Extends a parent template for reuse in a child template

```
<!-- templates/about.html -->
{% extends 'base.html' %}

{% block title %}About{% endblock %}

{% block content %}
<p>Who we are?</p>
{% endblock %}
```

Jinja features: `url_for`

- **`url_for('route_name')`**: generates a URL for a Flask route
- **`url_for('static', filename='path/to/file')`**: links to static assets like images, CSS, and JS

```
<!DOCTYPE html>
<head>
<title>Example</title>
</head>
<body>
<!-- Link to another page -->
<a href="{{ url_for('about') }}">Go to
About Page</a>
<!-- Display an image from the static
folder -->
<img src="{{ url_for('static',
filename='images/logo.png') }}" alt="Logo">
</body>
</html>
```

Folder Structure for a Flask Project

- 📦 project_root
  - 📁 static
    - 📁 images
      - 🌟 logo.png
  - 📁 templates
    - 📄 index.html
    - 📄 about.html
  - 🐍 app.py

```
<!DOCTYPE html>
<head>
<title>Example</title>
</head>
<body>
<!-- Link to another page -->
<a href="{{ url_for('about') }}">Go to
About Page</a>
<!-- Display an image from the static
folder -->
<img src="{{ url_for('static',
filename='images/logo.png') }}" alt="Logo">
</body>
</html>
```

Let's see it in practice

Flask Dynamic Routes

- **Dynamic routes** capture values **from the URL** and pass them to **view functions**
- They provide flexibility for creating **reusable routes** in web applications

```
@app.route("/user/<username>")
def show_user_profile(username):
    return f"User {username}"
```

Flask Dynamic Routes

- **Dynamic routes** capture values **from the URL** and pass them to **view functions**
- They provide flexibility for creating **reusable routes** in web applications
- The **`int:`** in **`<int:post_id>`** specifies the type of value expected in the URL

  `string:` – Expects a string (default behavior)

  `float:` – Expects a floating-point number

```
@app.route('/post/<int:post_id>’)
def show_post(post_id):
    return f'Post {post_id}'
```

Flask Dynamic Routes

- The **`url_for`** function generates a URL for a specific view function based on its name and any dynamic parameters.
- This would generate a URL like **`/user/jpsaenzmo`**, which can be used to navigate to the user's profile.

```
url_for('show_user_profile',
username='jpsaenzmo')
```

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