Flask Fun

Intro to Web Servers

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UWB HACKS THE INTERNET

Before We Begin

Intended audience:

- Beginners (no server dev. exp. needed)
- Folk who can read basic Python*

Recommended software:

- Python3
- Git

Scan QR code to find sample code

https://bit.ly/2OLGuX6

(https://github.com/UWB-ACM/flask-barebones)

*If you don't know Python, that's okay!

Before We Begin

As with all of the other presentation materials today, you can download these slides and read more at

http://docs.uwbhacks.com/

If you have questions, I'll be happy to answer them at the end.

Before We Begin

This presentation will focus on Flask, a Python web service microframework. Many of the same concepts exist in other frameworks, available in other languages and tech stacks.

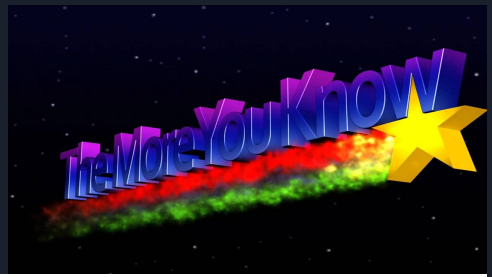
- C#: ASP.NET
- Java: Spring
- C++: CppCMS
- Node.JS: HTTP Module
- Go: net/http
- Python: **Flask**, Django
- And many others that I can't list here

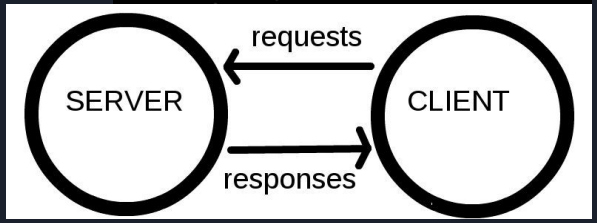
Agenda

- Web Servers?
- Flask?
- API Endpoints
- Serving Content
  - Static || Dynamic
- Deploy Your Server
  - WSGI
  - Ngnix && gunicorn
- What Next?

What is a Web Server?

Web servers serve web content!





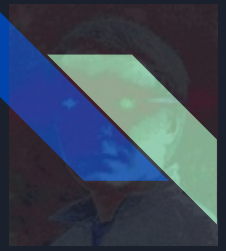
- "Hosts" HTML & media
  - HTML, CSS, JS, media
  - JSON/XML APIs
- Enables communication among services
- Responds to client requests using HTTP

What is Flask?

Flask is a Web Microframework

- Written in Python
- Simple!
- Efficient (Fast)

Use it to build web applications!



What is Flask?

Why would I want to use a “**micro**” framework?
http://flask.pocoo.org/docs/1.0/foreword/#what-does-micro-mean

“Micro” = simple and extensible.

- Provides only it’s own functionality
- Extensible using other libraries
- No point in redoing the work of other libraries.

Routes (API Endpoints)

Routes are hierarchical sections of a website

Full path specifies resource requested from server

URL*	http://flask.pocoo.org/community/poweredby
URL Expansion	http ://flask.pocoo.org /community /poweredby
Annotated URL Parts	PROTOCOL ://HOST_NAME /ROUTE /SUB_ROUTE

*URL – Uniform Resource Locator

PROTOCOL :: Rules that govern communication
HOST_NAME :: Name of service (e.g., google.com)
ROUTE :: Specific page on website/service
SUB_ROUTE :: Page “deeper” in the hierarchy

HTTP Methods

The HyperText Transfer Protocol (HTTP) has several methods of operation. Here are some of the most common ones, with their expected behavior.

GET - Fetch specified resource
POST - Submit information to resource
DELETE - Deletes specified resource
… and more!

HTTP Request format (including URL):

METHOD PROTOCOL://HOST_NAME/ROUTE/SUB_ROUTE
E.g., GET http://127.0.0.1:5000/static/index.html

“PaaS” Example Project

We made an example project which contains the code that we are going to refer to.

https://bit.ly/2OLGuX6

https://github.com/UWB-ACM/flask-barebones

Setup Project

1. Clone project from GitHub

```
git clone https://github.com/UWB-ACM/flask-barebones.git
```

2. Enter project repo

```
cd flask-barebones/
```

3. Install dependencies

```
python3 -m pip install -r requirements.txt
```

Launching Dev Server

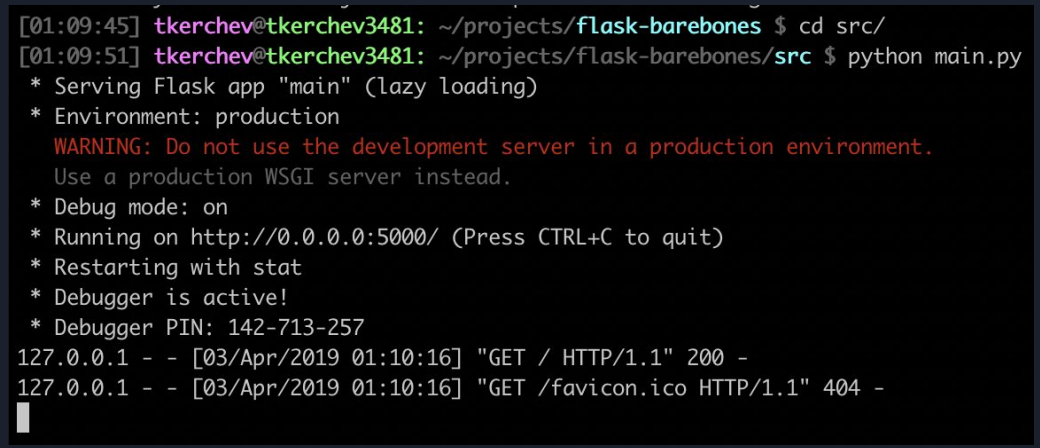
1. Enter `src/` directory

   ```
   cd src/
   ```

2. Launch dev server

   ```
   python3 main.py
   ```

3. Visit `127.0.0.1:5000/`



Live Demo

Let’s hope that this works.

I’m using ngrok to host a version off of my laptop.

Poke around at this site, next we’ll look into how it works.

TODO post ngrok link

Defining a Route (in Flask)

```
from flask import Flask
app = Flask(__name__)

@app.route('/test')
def testing():
    return 'Hello, Flask!'

if __name__ == '__main__':
    app.run(debug=True,
            host='0.0.0.0')
```

Import web microframework

Get WSGI application instance

Define “test” route as a simple hello world

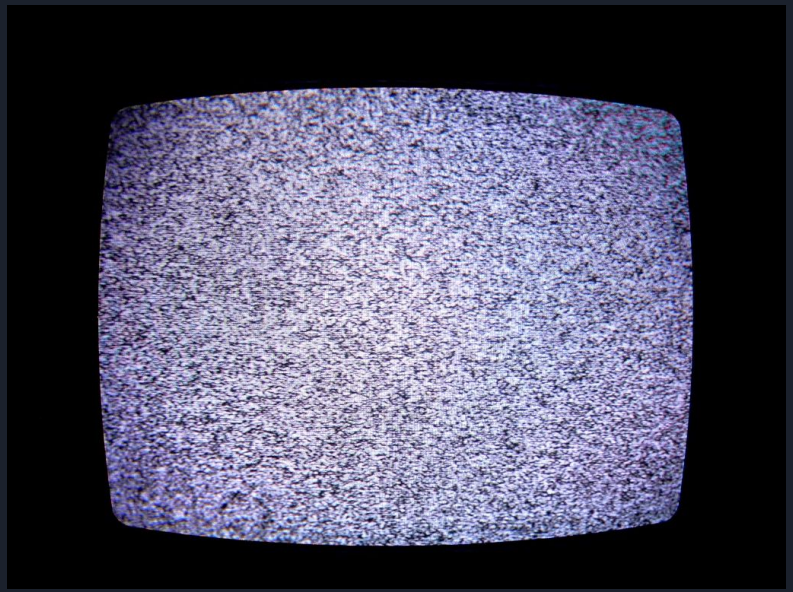
This just returns plain text, not HTML.

Start Dev server, when script is run directly.

Serving Static Content

Static content…

- Does not change based on behavior
- Sending files to client on request
- HTML, images, videos



Efficient!*

- No additional compute required

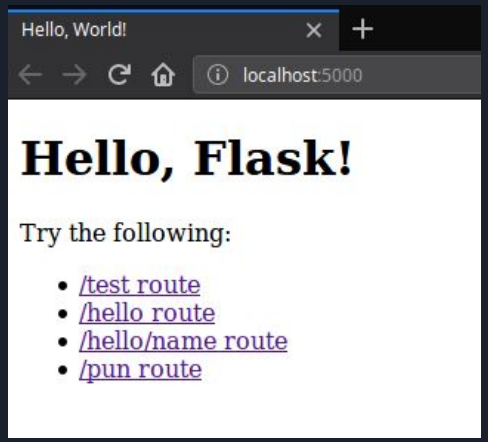
*Static content is best served upstream (e.g., w/Nginx, more later)

Serving Static Content (cont...)

1. Choose a directory to serve from
   - I chose `src/static/`
2. Create a HTML file
   - e.g., `src/static/hello.html`
3. Setup a route to serve static content
4. Start the dev server
5. Request resource from browser –>

src/main.py

```python
@APP.route("/")
def index():
    """
    Responds with the "Hello World" page for the default endpoint.
    """
    return send_from_directory("static", filename="hello.html")
```

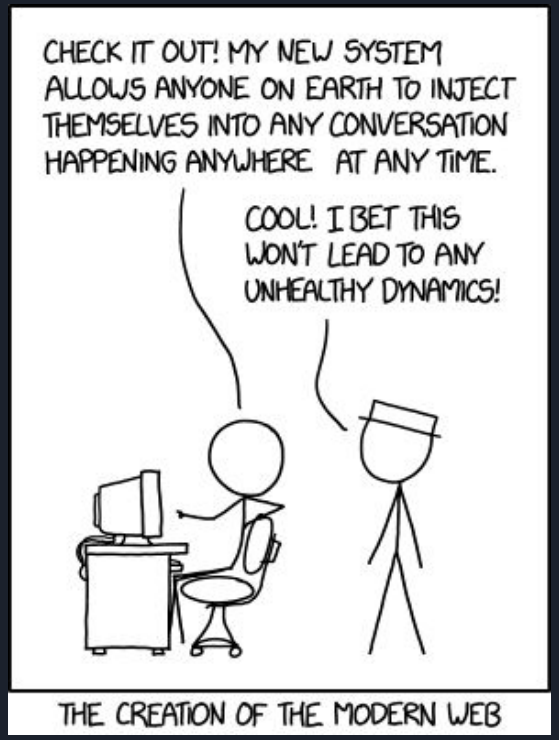


Serving Dynamic Content

Dynamic content changes based on user behavior!

Examples of dynamic content...

- User account information
- Live weather information
- Content that requires a database call



Serving Dynamic Content (cont...)

HTML Templates in Flask

- Insert *{{ variables }}* into HTML
- Jinja2 - Template Engine
- Rendered at runtime

src/templates/name.html

```
<!doctype html>
<html>
   <body>

      <h1>Hello, {{ name }}!</h1>

   </body>
</html>
```

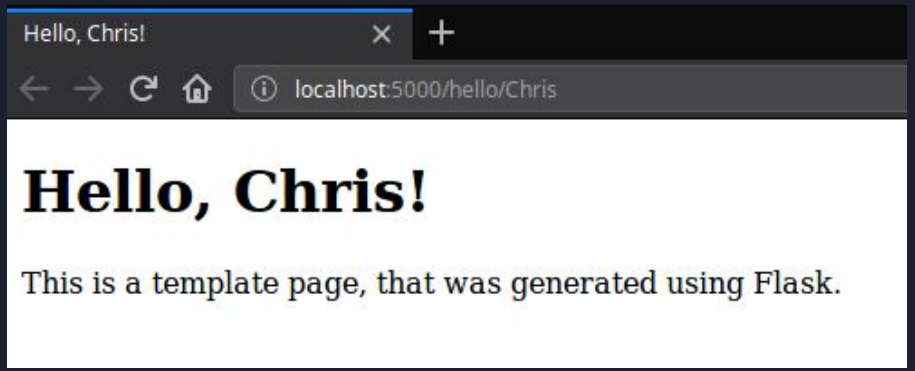
1. Create `templates/` directory
2. Create HTML file, with variable "**{{ name }}**"

Serving Dynamic Content (cont.....)

3. Setup route to accept a parameter
4. Render HTML file
   - Flask will look in `/templates` dir
   - Pass in keyword arguments
   - Keyword matches var name in HTML
5. Start dev server
6. Request resource from browser –>

src/main.py

```
@APP.route('/hello')
@APP.route('/hello/<string:name>')
def hello(name = "Anonymous"):
    return render_template('name.html', name=name)
```



Deploying Your Application

Why do I need another server?

- Flask is ***NOT*** a web server
    - Flask is an app microframework
- Flask's built-in "dev" server is ***NOT*** meant to scale to production
- Upstream servers typically handle connections and HTTP validation

Static content is best served by upstream servers

Deploying Your Application

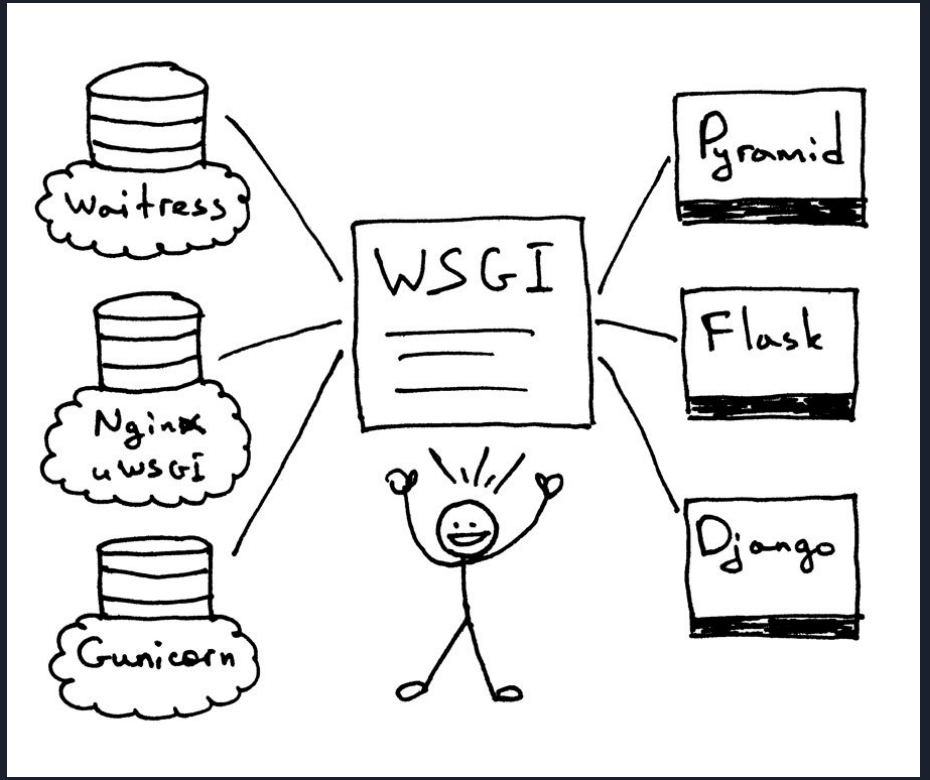
From the flask docs:

> While lightweight and easy to use, Flask's built-in server is not suitable for production as it doesn't scale well and by default serves only one request at a time.

WSGI

Web Server Gateway Interface

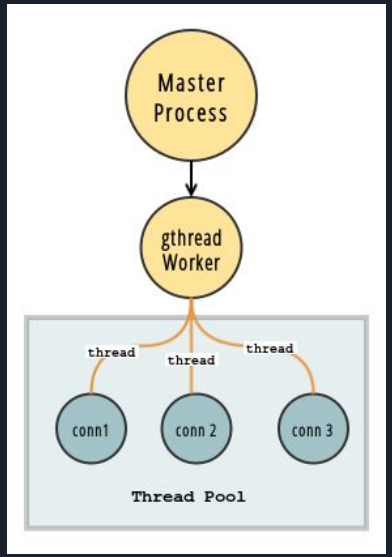
- Interface for upstream servers
  to talk to Python frameworks
- Enables separation of concerns
  for app and server devs
- Defined in PEP 3333



Gunicorn Deployment

Gunicorn is a WSGI compliant HTTP server

- Listens for client requests and runs your Flask app
- Helps handle multiple connections
- Pre-fork worker model
  - Thread per worker



Use gunicorn with sample project!

- Run `./gunicorn_start.sh`

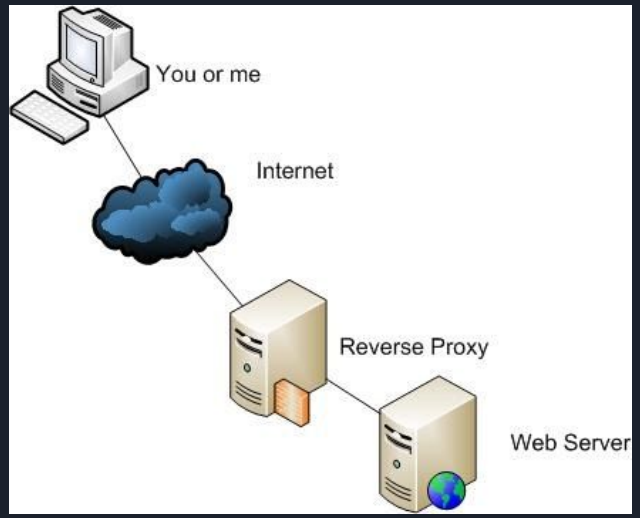
Nginx Deployment

Nginx is a reverse proxy! (yxorp)

- A reverse proxy is an upstream server
- Serves static content VERY efficiently
- Handles HTTP request validation
  - Stops malformed/malicious HTTP
- SSL/TLS termination

Not included in sample Flask project

- Try it yourself!



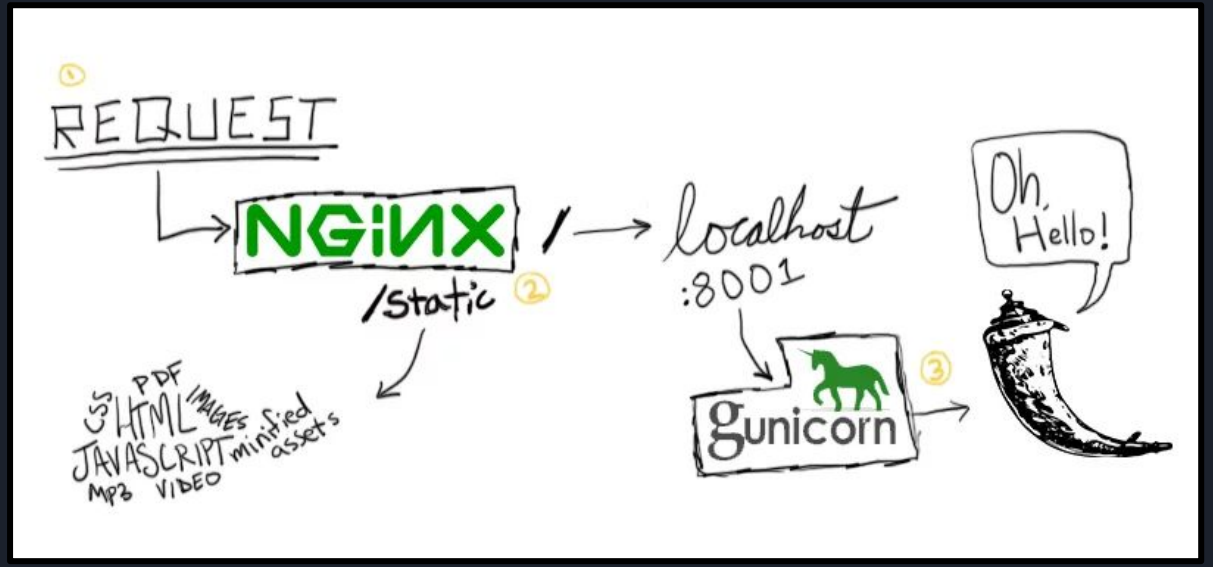
Gunicorn + Nginx

Use both gunicorn and Nginx, for great justice!

Nginx serves static

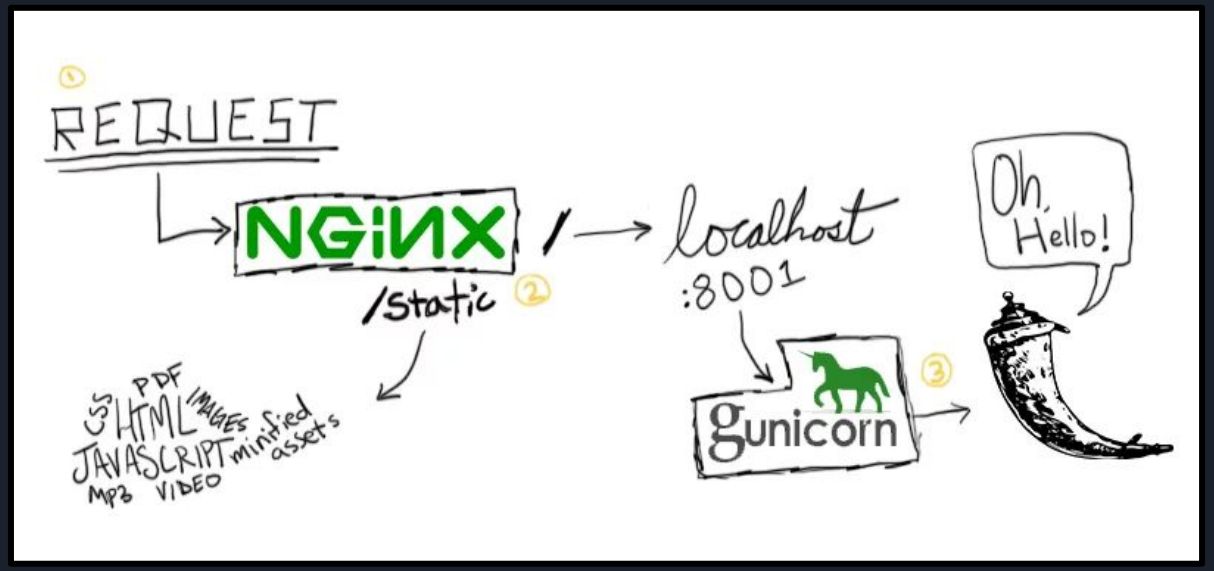
gunicorn implements WSGI

Flask handles app logic



Do it and your friends ***WILL*** think you're cool

Gunicorn + Nginx



Hosting using Docker

Configuring many separate services can be difficult to deploy. Containers can make setup and deploying easier.

https://github.com/tiangolo/uwsgi-nginx-flask-docker

Next Steps - Cloud Deployment

Are you interested in learning about Cloud technology? Now's a great time to try it and learn! You can deploy Flask applications with AWS Elastic Beanstalk or Azure App Services.

Free when you use student credits! (GitHub Education Pack)

You can also deploy to any virtual machine, including those hosted on AWS, Azure, Google Cloud Platform, DigitialOcean, etc. ...

Next Steps

Create your own Flask app!

- Blog!
- TODO List!
- Something else!

Setup Nginx/gunicorn!

Have fun!

Questions?
Comments?
Concerns?

Anything you would like me to explain in the example application?

References

The Flask documentation is great!

http://flask.pocoo.org/docs/1.0/