

Web Services We describe anything that provides data back from an HTTP endpoint as a “web service”. Three main categories:

[1]:

```
1 GET /cs240/sp2022/ HTTP/1.1\r\n
2 Host: courses.grainger.illinois.edu\r\n
... ..
```

Advantages:

Disadvantages:

[2]:

National Weather Service API:

https://api.weather.gov/points/{latitude},{longitude}

Location of 2215 CIF:

```
1 GET /points/ HTTP/1.1\r\n
2 Host: api.weather.gov\r\n
... ..
```

RESTful Requirements:

[3]:

```
1 POST /q/api/queues/788/staff/1 HTTP/1.1\r\n
2 Host: queue.illinois.edu\r\n
3 Content-Length: 477\r\n
... ..
{ "id": 30540, "startTime": "2021-10-05T15:48:57.000Z", "endTime": null, "createdAt":
"2021-10-05T15:48:57.000Z", "updatedAt": "2021-10-05T15:48:57.000Z", "userId": 1, "queueId": 788,
"user": { "name": "Wade A Fagen-Ulmschneider", "id": 1, "netid": "waf", "universityName": "Wade A
Fagen-Ulmschneider", "preferredName": null, "isAdmin": true, "createdAt": "2018-02-14T05:27:54.000Z",
"updatedAt": "2018-02-21T05:34:33.000Z" } }
```

HTTP Verbs (Defined in [RFC 7231 §4](#))

Every HTTP request has an “action verb” that describes the action requested of the web server:

- **GET**: Requests a representation of the specified resource. Requests using GET should only retrieve data.
- **POST**: Submits an entity to the specified resource, often causing a change in state or side effects on the server.
- **PUT**: Replaces all current representations of the target resource with the request payload.
- **DELETE**: Deletes the specified resource.
- Less Used: **PATCH, CONNECT, OPTIONS, TRACE, HEAD**

Why the Web Works:

Allowing Maximal Flexibility and Acceptance

Containers:

Containers provide an _____ of a system that can be deployed in an isolated environment on heterogeneous systems.

- **As a container developer**, you build a Dockerfile that specifies the **snapshot** of the system you want to provide and then **build** that snapshot into a _____.
- Create a Dockerfile to specify how to build the image:

```
mp3/Dockerfile
1 FROM gcc:latest
2 COPY ./docker/entrypoint.sh /
3 RUN chmod +x entrypoint.sh
4 ENTRYPOINT [ "/entrypoint.sh" ]
```

To build it:

```
$ docker build --tag mp3-docker .
```

- **As a user of a container**, you specify the name of the docker image that you want to use to launch that image:

```
$ docker run -it --rm -v "pwd":/mp3 mp3-docker "make"
$ docker run --rm -it -p 27017:27017 mongo
```

Python Programming

All modern programming languages provide many libraries for quickly and easily working with web requests. In CS 240, we will focus on Python and use the **flask** library for web requests.

Python Overview:

- Python is an “interpreted” programming language:
 - **Note:** Python only allows one thread to access the CPU (others can be blocked or ready, but there is no parallel execution)! *(Simplifies the execution environment, but prevents optimizations that are possible in C/C++.)*
- Python is a “dynamically typed” programming language:
- Python’s control-flow is whitespace delimited:
- Python places heavy emphasis on code readability:

```
13/hello.py
1 s1 = "Hello"
2 s2 = " World"
3
4 for i in range(10):
5     if i < 5:
6         print(s1)
7     elif i < 8:
8         print(s1 + s2)
9     else:
10        print(s2)
```

Flask Library:

The flask library focuses on providing a simple interface to handling web requests:

```
13/app.py
1 from flask import Flask
2 app = Flask(__name__)
3
4 # Route for "/" for a web-based interface to this
  micro-service:
5 @app.route('/')
6 def index():
7     from flask import render_template
8     return render_template("index.html")
9
10 # Extract a hidden "uiuc" GIF from a PNG image:
11 @app.route('/extract', methods=["POST"])
12 def extract_hidden_gif():
13     # ...
```

Import Statements (Line 1, 7):

Python Comments (4, 10):

Python Function Definitions (Lines 6, 12):

Python Decorator (Lines 5, 11):

Running a Python program:

Flask is widely used, lots of great resources available! *(This is why we use widely used libraries!)*