LECTURE 39

HTTP REQUESTS

MCS 275 Spring 2022

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LECTURE 39: HTTP REQUESTS

Course bulletins:

- Project 4 is due 6pm CDT Friday 29 April.
- Prepare for Wednesday: Install `beautifulsoup4` with

```
python3 -m pip install beautifulsoup4
```

SWITCHING SIDES

Recently, we've talked a lot about making HTTP **servers** in Python (e.g. web applications).

This week we'll switch to talking about Python as an HTTP **client**, parsing HTML, and extracting data (scraping).

URLS

A **Uniform Resource Locator** or URL specifies the location of a "resource", such as a document, a data file, or a coffee machine.

Basic structure is

```
protocol://hostname[:port]/path/filename?nam=val&nam2=val2
```

Everything after hostname is optional.

Sample URL:

```
https://www.dumas.io/teaching/2022/spring/mcs275/slides/lectur
```

DECODING A URL

```
https://www.dumas.io/teaching/2022/spring/mcs275/slides/lectur
```

- **Protocol** is HTTPS (which is HTTP over an encrypted connection)
- **Hostname** is `www.dumas.io`
- **Path** is `/teaching/2022/spring/mcs275/slides/`
- **Filename** is `lecture39.html`
- No query parameters

URLLIB

Module `urllib` can retrieve resources from URLs.

E.g., it can open a file if you give it a `file://` URL.

Most often it is used to make HTTP and HTTPS GET requests, to retrieve web pages from web servers and data from HTTP APIs.

`urllib.request.urlopen(url)` retrieves the resource and returns a file-like object

HTTP RESPONSE

Response consists of a numeric **status code**, some **headers** (an associative array), then a **body** or **payload**.

E.g. GET a web page, the HTML will be in the body.

There are lots of codes; first digit gives category:

- 2xx — success
- 3xx — redirection; more action required (e.g. moved)
- 4xx — client error; your request has a problem
- 5xx — server error; cannot handle this valid request

Formal definition of the response structure is in RFC 2616.

PARTS OF A HTTP RESPONSE

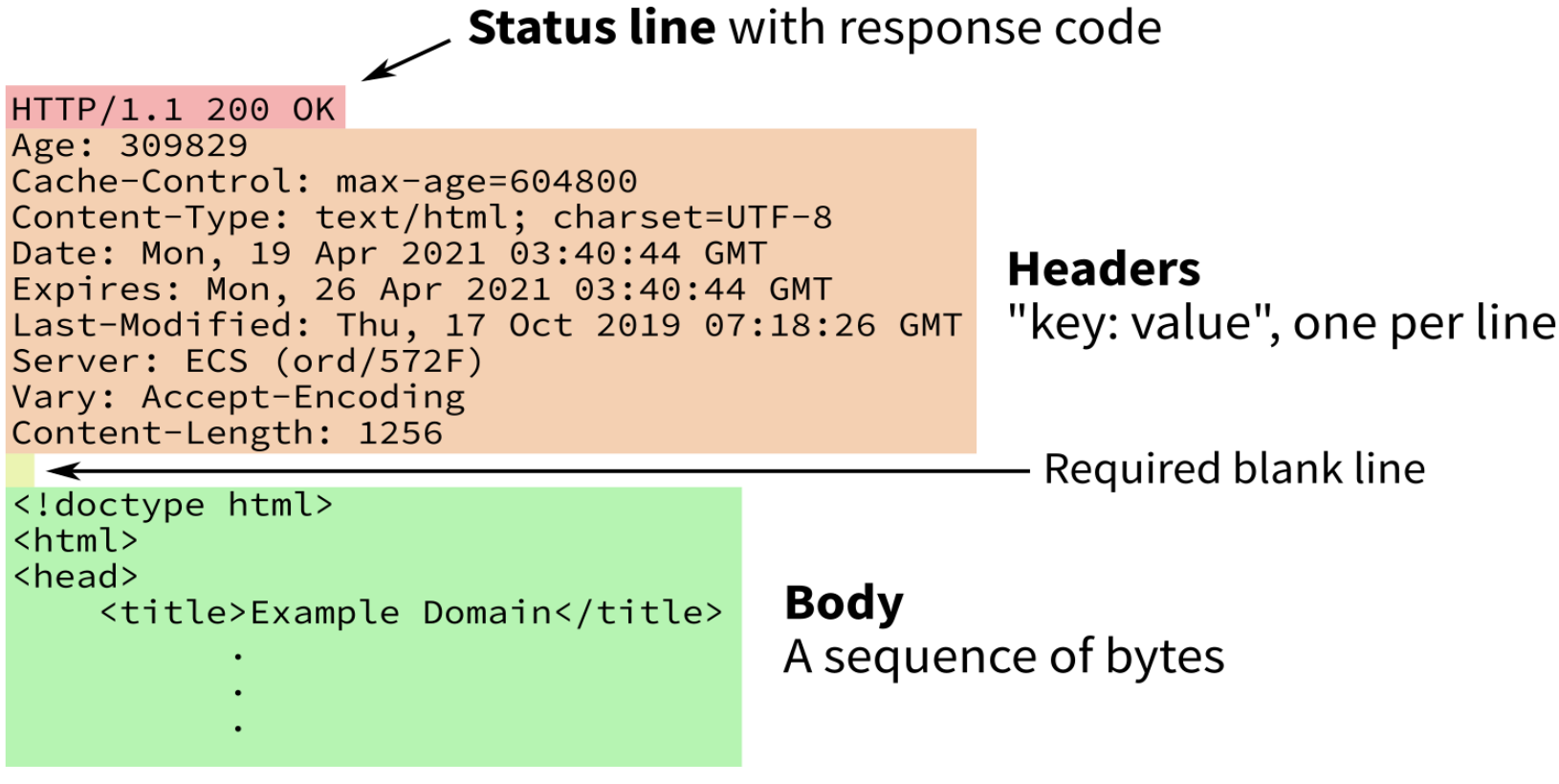
Response to GET `http://example.com/`

```
HTTP/1.1 200 OK
Age: 309829
Cache-Control: max-age=604800
Content-Type: text/html; charset=UTF-8
Date: Mon, 19 Apr 2021 03:40:44 GMT
Expires: Mon, 26 Apr 2021 03:40:44 GMT
Last-Modified: Thu, 17 Oct 2019 07:18:26 GMT
Server: ECS (ord/572F)
Vary: Accept-Encoding
Content-Length: 1256

<!doctype html>
<html>
<head>
    <title>Example Domain</title>
          .
          .
          .
```

PARTS OF A HTTP RESPONSE

Response to GET `http://example.com/`



HTTP BODY VS HTML BODY

An HTTP request has several parts, the last of which is the body (an array of bytes).

Often, the body is an HTML document.

An HTML document has several parts, one of which is the body (contained in the tag `<body>`).

GET DATA FROM AN API

Use the Bored JSON API to get a suggestion of an activity.

```
import json
from urllib.request import urlopen

with urlopen("https://www.boredapi.com/api/activity") as respo
    data_bytes = response.read() # returns the body
    data = json.loads(data_bytes)
print("Maybe you could... ",data["activity"])
```

GET A WEB PAGE

```
from urllib.request import urlopen

with urlopen("https://example.com/") as response:
    html = response.read()
```

This gives the body as a `bytes` object (an array of integers in the range 0...255).

If you want a string, you need to know the encoding.

And it might not be HTML! Can check `response.headers.get_content_type()`

GET A WEB PAGE

```
from urllib.request import urlopen

with urlopen("https://example.com/") as response:
    html = response.read()
    # Determine encoding from Content-Type header
    # (recommended)
    charset = response.headers.get_content_charset()
    htmlstr = html.decode(charset)
```

The encoding is **usually** specified in the Content-Type header, but this is not actually required.

GET A WEB PAGE

```
from urllib.request import urlopen

with urlopen("https://example.com/") as response:
    html = response.read()
    # If we're sure it is UTF-8
    # (not recommended)
    htmlstr = html.decode("UTF-8")
```

GETTING DATA FROM THE WEB

HTML is a language for making documents, meant to be displayed to humans. Avoid having programs read HTML if at all possible.

Web pages often contain data that might be useful to a computer program.

The same data is often available in a structured format meant for consumption by programs, e.g. through an API that returns a JSON object.

What do you do if there is no API, and you need to extract information from an HTML document?

Sigh with exasperation, then...

HTML PARSING

Level 0: Treat the HTML document as a string and use search operations (`str.find` or regexes) to locate something you care about, like `<title>`.

HTML is complicated, and this approach is very error-prone.

HTML PARSING

Level 1: Use a **parser** that knows how to recognize start/end tags, attributes, etc., and tell it what to do when it finds them (e.g. call this function...)

`html.parser` is in the standard library.

This approach is event-based. You specify functions to handle things when they are found, but you don't get an overall picture of the entire document.

HTML PARSING

Level 2: Use a higher-level HTML data extraction framework like Beautiful Soup, Scrapy, or Selenium.

These frameworks create a data structure that represents the entire document, supporting various kinds of searching, traversal, and extraction.

REFERENCES

- The urllib documentation
- Examples of using urllib.request
- Beautiful Soup home page
- MCS 260 Fall 2020 Lecture 34 - Requesting URLs in Python

REVISION HISTORY

- 2022-04-18 Initial publication
- 2022-04-20 Correct project 4 link, deadline