Intro to Programming for Public Policy Week 7
Introduction to Websites and Scraping

Eric Potash

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The Internet

The Internet and World Wide Web

- The **Internet** is a *physical network* of cables and routers, and a set of protocols for moving information across that network.
- The **World Wide Web** (WWW) is an *information space* on the Internet. It combines several concepts:
  - Uniform Resource Locator (url)
  - Hypertext Transfer Protocol (http)
  - Hypertext Markup Language (html)

The Internet

- Started as a Defense Advanced Research Projects Agency (DARPA) ARPANET project to interconnect computers
- First transmission between nodes at UCLA in 1969; by 1970 reached across the US to Boston.
- Transmission Protocol/Internet Protocol (TCP/IP) developed during the 1970s
- ARPANET declared "operational" in 1975 and transferred to military
- Ethernet (transmission on wires) standard written 1981
- During 1980s, shift to National Science Foundation
  - NSFNET provided the backbone of Internet from 1985 to 1995
- Internet backbone privatized under Clinton in 1994

TODO: image of early internet

TODO: image of later internet

Uniform Resource Locator

URLs are a system of globally unique identifiers for resources on the Web and elsewhere.

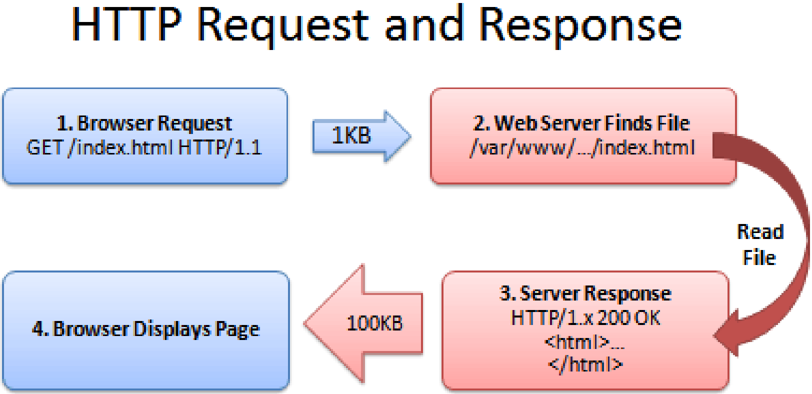
`scheme://host[:port]/path[?query][#fragment]`

- `scheme` is a protcol such as `http`, `https`, etc.
- `host` is something like `google.com` or `localhost`
- `:port` is optional, allows a single host to have separate websites
- `path` is the path to a particular resource like `index.html`
- More on queries later

Hypertext Transfer Protocol (HTTP)

HTTP Overview

- HTTP is the core communications protocol for retrieving data
- Consists of messages– requests and responses– sent between a client and a server



HTTP Request and Response

1. Browser Request
GET /index.html HTTP/1.1

1KB

2. Web Server Finds File
/var/www/.../index.html

Read File

3. Server Response
HTTP/1.x 200 OK
<html>...
</html>

100KB

4. Browser Displays Page

Figure 1: Source: opensourcevaristy.com

HTTP Request

```
GET /index.html HTTP/1.1
User-Agent: Mozilla/5.0
...
```

- First line contains:
  - HTTP method, here `GET`
  - Requested URL
  - HTTP version
- Rest of request may contain:
  - User-Agent: description of the client
    - Used e.g. to determine whether to serve mobile website version

HTTP Methods

- `GET`
  - Most common method, used to get data
- `POST`
  - Used to send data to server, e.g. form entries, search queries

HTTP Responses

```
HTTP/1.1 200 OK
...
```

- First line contains:
  - HTTP version
  - HTTP response code
- Rest of response contains:
  - Additional headers: `Server`, `Content-Type`, etc.
  - Requested Content

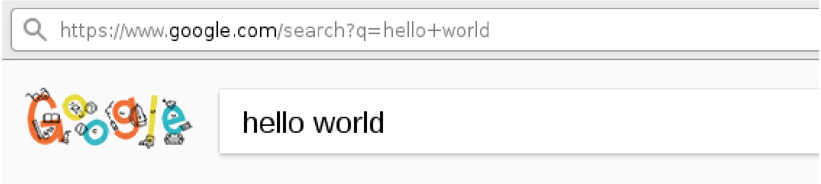
HTTP Response Codes

- 1xx: Informational
- 2xx: Success
  - 200: OK
- 3xx: Redirection
  - 301: Redirect
- 4xx: Errors
  - 404: File not found
  - 403: Forbidden

HTTP GET Request Parameters

```
/index.php?name1=value1&name2=value2
```

- Query string with parameters sent in the URL of a GET request
- Parameter names and values are like a python dictionary
- Shouldn't use with sensitive data

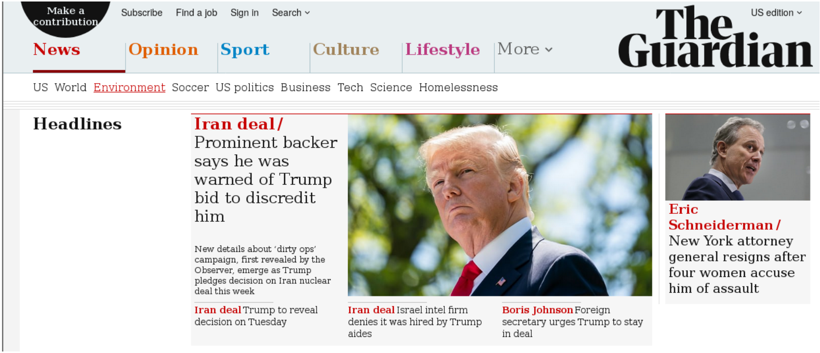


https://www.google.com/search?q=hello+world

hello world

Hypertext Markup Language (HTML)

Web browser



Headlines

Iran deal / Prominent backer says he was warned of Trump bid to discredit him

New details about 'dirty ops' campaign, first revealed by the Observer, emerge as Trump pledges decision on Iran nuclear deal this week

Iran deal Trump to reveal decision on Tuesday

Iran deal Israel intel firm denies it was hired by Trump aides

Boris Johnson Foreign secretary urges Trump to stay in deal

Eric Schneiderman / New York attorney general resigns after four women accuse him of assault

Figure 2: guardian.com rendered in a web browser

HTML sourcecode

HTML overview

- Language that webpages are written in
- Consists of *tags*
- Most tags come in pairs (opening and closing):
    - `<html></html>`
    - `<head></head>`
    - `<body></body>`
    - `<a></a>`
- Some do not:
    - `<img>`
    - `<br>`
- Whitespace doesn't matter (unlike Python)

Basic HTML webpage

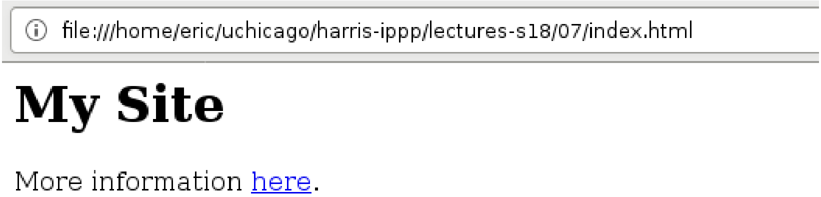
```html
<html>

<head>
    <title>My Title</title>
</head>

<body>
<h1>My Site</h1>
<p>
More information <a href="main.html">here</a>.
</p>

</body>
</html>
```

Basic webpage



file:///home/eric/uchicago/harris-ippp/lectures-s18/07/index.html

My Site

More information here.

Figure 3: Webpage rendered in browser

More HTML tags

HTML links

TODO

HTML Tables

TODO: list tags

Other web technologies

- Javascript
  - `.js` files sourced or code directly embedded in `<script>...</script>` tags
  - Used to make content dynamic
- CSS
  - `.css` files or code embedded in `<style></style>` tags
- Server-side languages
  - Ruby, PHP, Python (Django), Java, etc.

Web Scraping

Web scraping overview

TODO

Ethical considerations

When is scraping useful?

`curl` revisited

Scraping in python

- `urllib`: module for handling URLs
  - `urllib.request()` function for opening and reading data from URL
- `Beautiful Soup`: for structuring data from HTML files