How the Interweb Works

A Short Overview of Basic Web Technologies

Keith Lancaster, Ph.D.

In Today's Episode

- HTTP
- The Browser and the DOM

Some Quick Definitions to Get Started

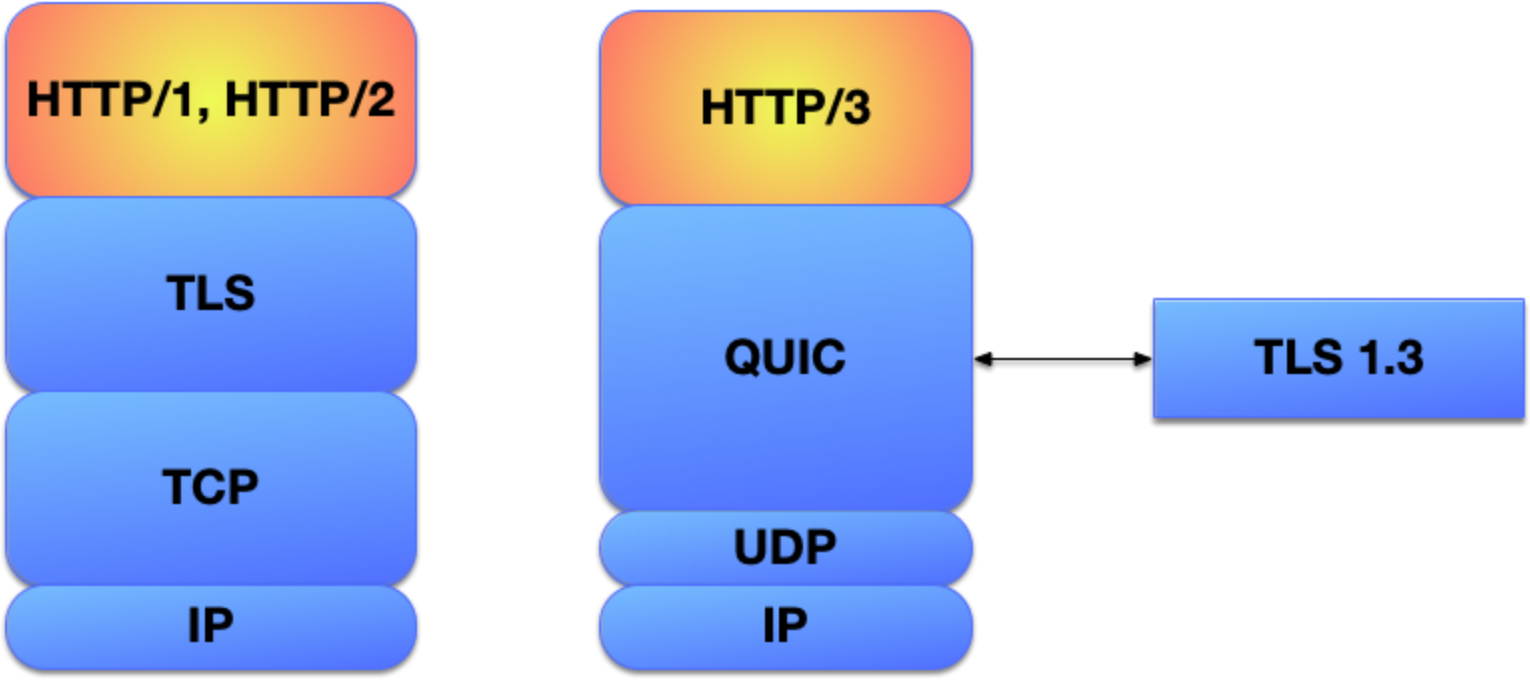
- TCP (Transmission Control Protocol): A protocol that establishes and maintains a network conversation for transmitting data between devices. TCP works with the Internet Protocol (IP), which defines how computers send packets of data to each other
- TLS (Transport Layer Security): A protocol that provides secure communication over a network by encrypting transmitted data.
- UDP (User Datagram Protocol): A connectionless protocol for transmitting packets of data between devices, often used for real-time applications.
- IP (Internet Protocol): A set of rules for devices to communicate with each other over a network, including the format of transmitted packets and how they should be handled.

HTTP Protocol

HTTP is the protocol used to send and receive data between the *user-agent*, typically a browser, and the web server.

- HTTP/1 and /2 are designed to work over TCP/IP
  - Technically, HTTP/2 can be used without TLS encryption, however no browsers (that I know of..) support it
- HTTP/3 replaces TCP with QUIC/UDP
  - For a detailed overview of HTTP/3, see HTTP/3 over QUIC
  - For a high level overview, see Learn HTTP/3 in 5 Minutes
  - For those *really* interested in the protocols, see https://httpwg.org/specs/
- The primary differences between these versions is the way that the data is packaged, the use of compression, and in the case of http3, the replacement of TCP by UDP and QUIC in the stack.

HTTP Overview (2)



HTTP Request/Response

- HTTP/1 uses readable text over the wire. HTTP ≥ 2 uses uses binary and cannot be read directly.
- The basic concepts are the same

HTTP1 Request

```
GET / HTTP/1.1
Host: developer.mozilla.org
Accept-Language: fr
```

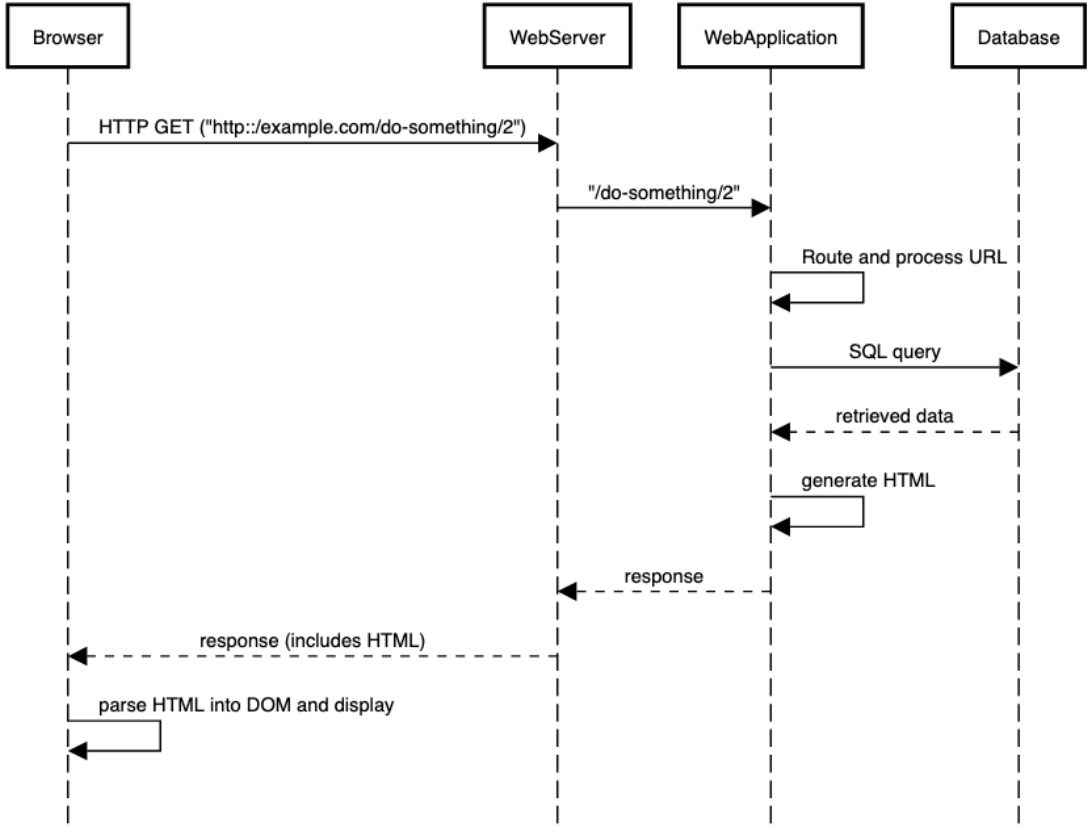
Response

```
HTTP/1.1 200 OK
Date: Sat, 09 Oct 2010 14:28:02 GMT
Server: Apache
Last-Modified: Tue, 01 Dec 2009 20:18:22 GMT
ETag: "51142bc1-7449-479b075b2891b"
Accept-Ranges: bytes
Content-Length: 29769
Content-Type: text/html
```

HTTP Request Methods (verbs)

- GET: Requests a representation of the specified resource. Requests using GET should only retrieve data.
- HEAD: Asks for a response identical to a GET request, but without the response body.
- 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.
- PATCH: Applies partial modifications to a resource.
- CONNECT: Establishes a tunnel to the server identified by the target resource.
- OPTIONS: Describes the communication options for the target resource.

Basic Data Flow for a GET Request



Demo

Browser Tools Demo: http://www.unr.edu

HTML

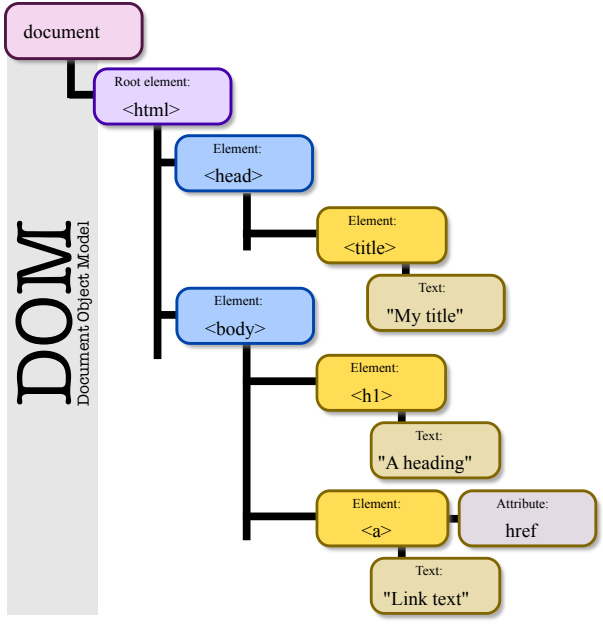
- HTML forms the basis of all web pages
- As reflected in the DOM, HTML is hierarchical
- By itself, HTML does not dictate the exact way a page is to be displayed, but rather it gives the page structure.
  - Cascading Style Sheets (CSS and embedded styles) provide page layout, color schemes, etc.

For the most part, CSS will *not* be covered in class lectures. Supplemental material and references will be provided to assist in learning these technologies through self-study

The Document Object Model (DOM)

The DOM is the browser's internal representation of a page.

- The browser parses the HTML to build the DOM
- Changes made to components in the DOM are immediately reflected in the displayed page
- Front-end Javascript frameworks work by manipulating aspects of the DOM



HTML and CSS Demo

- An example of what *can* be done with CSS
  - http://www.csszengarden.com
- CSS Frameworks
  - https://tailwindcss.com