HTTP Overview

Roadmap

- The physical Internet
  - The Internet is a network of networks
  - Physically connected by cables and routers
- Internet Protocol (IP)
  - How routers move data through the Internet
  - Best effort basis
- Transport Control Protocol (TCP)
  - Transport information reliably through an unreliable network
  - Used by the client and server

Network Stack (A simplified view)

- Enter HTTP

Packet Structure
IP Headers
TCP Headers
HTTP Headers
Content

HyperText Transfer Protocol (HTTP)

- HTTP is an application layer protocol
  - Protocols used by our applications
  - Protocols that are not concerned with the transmission of data
- [Almost] Always uses TCP for reliable communication
  - Always in this course

- Today:
  - A quick overview of many HTTP topics
  - We'll spend several week exploring these topics in more detail

HTTP

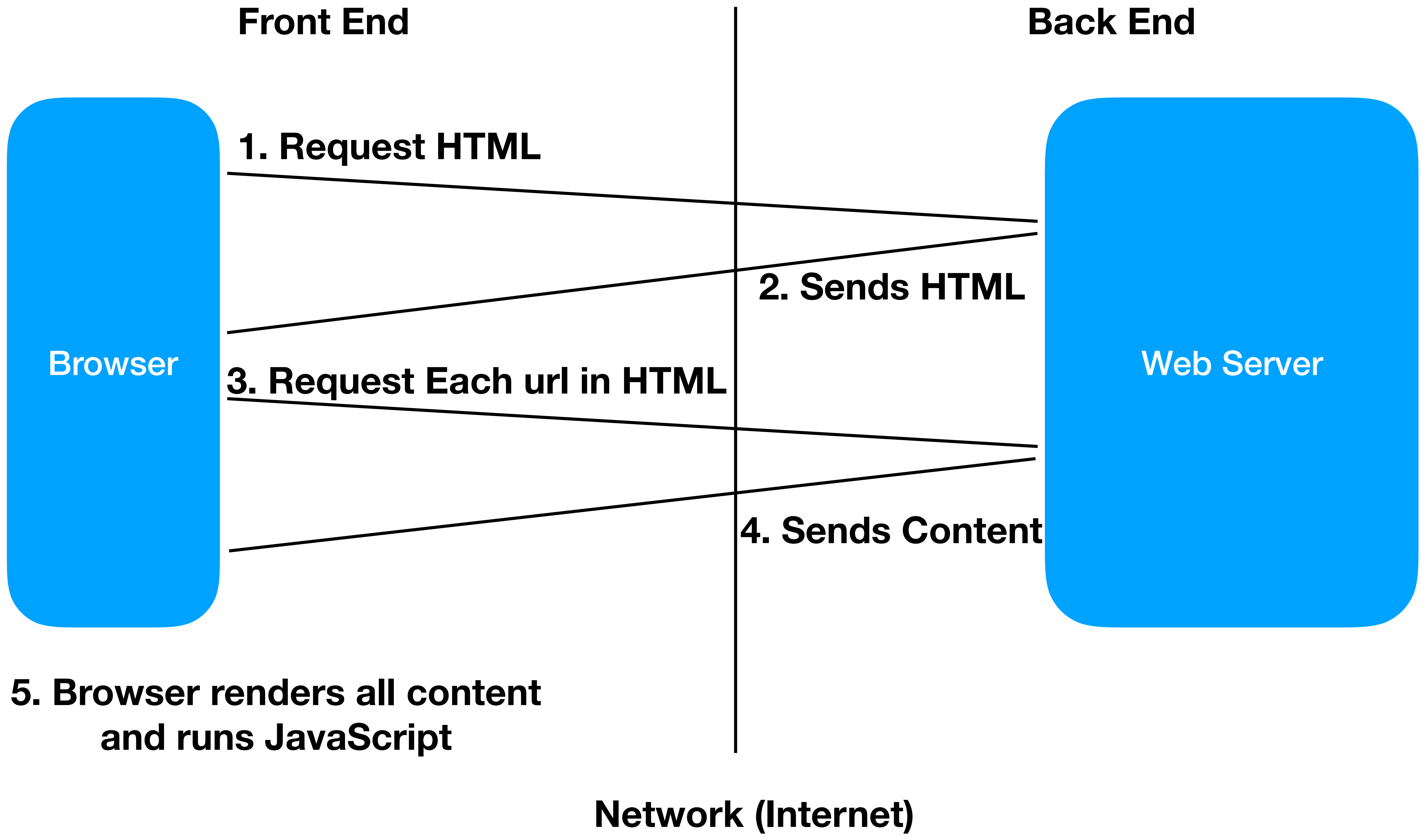
- HTTP is a protocol used by the browser to access content from a web server
- Protocol: An agreed upon set of rules
  - HTTP: Defines the format of messages sent to/from a web server
- HTTP is a Request - Response protocol
  - Client makes request to server
  - Server returns a response
- Ex. Request The latest tweets from a user. Twitter server returns the tweets in its response
- Response can require more requests
  - Ex. Get HTML which requires CSS/JS/Images

Web Server

- Software that "speaks" HTTP
- Listens for HTTP requests and responds with HTTP responses

- We've been opening web pages by loading *.html files in the browser
  - This uses the 'file' protocol which loads a file from disk
- We want to host our web pages/apps on the Internet using HTTP
- Terminology:
  - Front End - The part a web app that runs in the browser (HTML/CSS/JS)
  - Back End - The web server and all software that does not run on the user's machine

Loading a Web Site



HTTP Request

- Each HTTP request will contain the request type:
  - GET: Request information from a server
  - POST: Send information to a server
  - PUT (less common): Add information to a service
  - DELETE (less common): Delete information form a service
  - etc.
- We'll focus on GET/POST requests

HTTP Request

- HTTP GET Request
  - Used when requesting content from a server
  - Contains only a URL [And HTTP headers]
  - All examples on the query string/fragment slide were GET requests
  - Whenever you click a link your browser makes a get request
  - Requesting HTML/CSS/Javascript/Images/etc are GET requests
- HTTP POST Request
  - Used when sending data to a website
  - Contains a URL and a body [And HTTP headers]
  - When you submit a form your browser [typically] makes a POST request
  - The contents of the form are sent in the body of the request

HTTP Request

Protocol://host:port/path?query_string#fragment

- Each request is made to a specific URL (Uniform Resource Location)
  - A URL uniquely identifies a web resource and has the following parts
- Protocol - The protocol being used (ex. file, HTTP, HTTPS)
- Host - The IP address or domain name of the server
  - Used to route the request to appropriate machine
- Port - The TCP port number of the host server
  - Defaults to 80/443 for HTTP/HTTPS respectively
- Path - Specifies the specific resource being requested from the server

HTTP Request

Protocol://host:port/path?query_string#fragment

- Query String - [Optional] Contains key-value pairs set by the client
- https://www.google.com/search?q=web+development
  - HTTPS request to Google search for the phrase "web development"
- https://duckduckgo.com/?q=web+development&ia=images
  - An HTTPS request to Duck Duck Go image search for the phrase "web development"

- Fragment - [Optional] Specifies a single value commonly used for navigation
- https://en.wikipedia.org/wiki/Uniform_Resource_Identifier
  - HTTPS Request for the URI Wikipedia page
- https://en.wikipedia.org/wiki/Uniform_Resource_Identifier#Definition
  - HTTPS Request for the URI Wikipedia page that will scroll to the definition of URI

HTTP Request

- Head of request
  - A Request-Line
    - <Request_Method> <Path> <HTTP_Version>
  - Header Fields
    - Contains additional information about the request in key-value pairs
    - <Header_Name>: <Header_Value>
- Body of request [Optional]
  - Content to be sent to the server

```
GET / HTTP/1.1
Host: cse312.com
```

```
POST /path HTTP/1.1
Host: cse312.com
Content-Length: 48

{"data": "Some data in the body of the request"}
```

HTTP Request

- Head and body of request are separated by a blank line
- If the request has a body, the Content-Length header will be set to the size of the body
  - Lets the server know when the request ends
  - https://www.google.com/search?q=hello+google&oq=hello+google&aqs=chrome..69i57.2494j0j1&sourceid=chrome&ie=UTF-8

```
GET / HTTP/1.1
Host: cse312.com
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Host: cse312.com
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{"data": "Some data in the body of the request"}
```

HTTP Response

- When the server receives an HTTP request
    - Process the request and send a response to the client
- Whether the request was GET or POST, the response will have a body containing the requested content
- Response also contains HTTP headers including meta information about the response and the server
    - Must include the content length and type
- Response includes a response code indicating the status of the response

HTTP Response

- Mostly the same format as a request
- Response line
  - <HTTP_Version> <Response_Code> <Response_Text>
- Specify the content length and type in headers
- Response itself goes in the body

```
HTTP/1.1 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 152

<html> ... </html>
```

HTTP - Response

Common Response codes include:

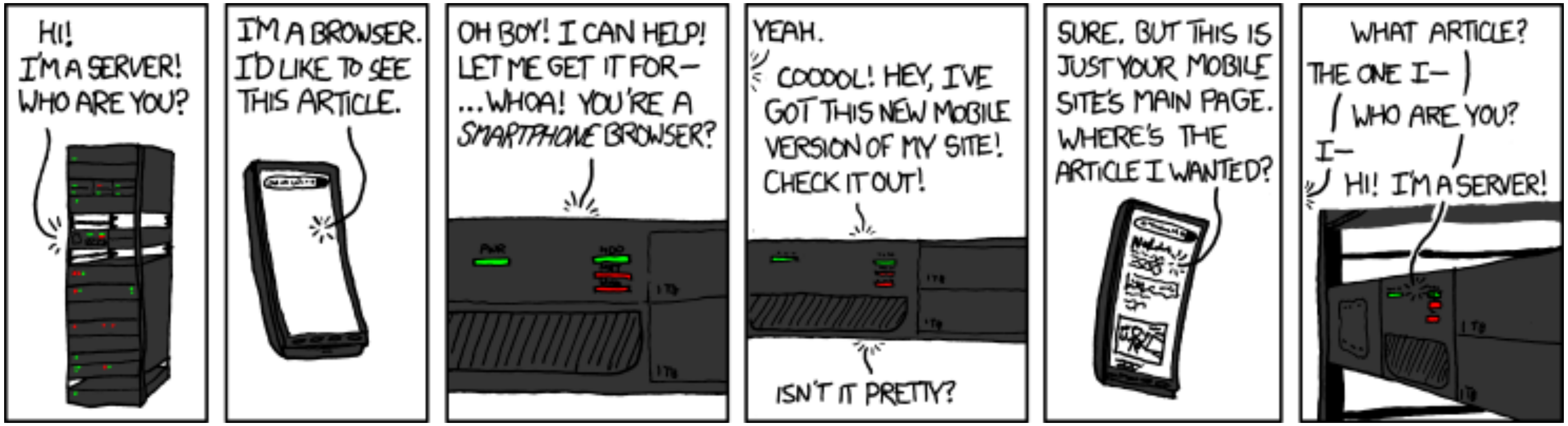
- 200 OK
  - Request was handled as expected
- 301 Moved Permanently
  - Redirect to the new location
- 304 Not Modified
  - File in local cache can be used
- 403 Forbidden
  - You don’t have access to the requested page
- 404 Not Found
  - Requested data could not be found
- 500
  - Internal server error

HTTP

- HTTP is a stateless protocol
  - Saves time and memory on the server
  - Each request is handled in isolation even if a client just made another request
- If state is desired (ex. Login) it must sent the state with each request
  - Cookies
  - Tokens

HTTP

- HTTP is a stateless protocol
- Each request is handled in isolation even if a client just made another request
- If state is desired (ex. Login), the state must be sent with each request
- Cookies
- Tokens
- When handling an HTTP request, do not have to care who sent it


HI! I'M A SERVER! WHO ARE YOU?
I'M A BROWSER. I'D LIKE TO SEE THIS ARTICLE.
OH BOY! I CAN HELP! LET ME GET IT FOR— ...WHOA! YOU'RE A SMARTPHONE BROWSER?
YEAH.
COOOOL! HEY, I'VE GOT THIS NEW MOBILE VERSION OF MY SITE! CHECK IT OUT!
ISN'T IT PRETTY?
SURE. BUT THIS IS JUST YOUR MOBILE SITE'S MAIN PAGE. WHERE'S THE ARTICLE I WANTED?
WHAT ARTICLE?
THE ONE I—
WHO ARE YOU?
I—
HI! I'M A SERVER!

https://xkcd.com/869/