Networking with TCP and HTTP

OR

How To Build The Internet

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AGENDA

Layers of the Internet

TCP/IP & Below

Simple Chat Server

HTTP Fundamentals

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Layers of the Internet

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The Internet

- A the global system of interconnected computer networks

The Internet

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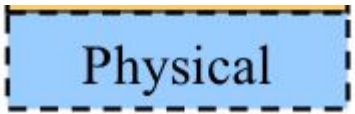
1. A Physical Network
    a. Copper Cables
    b. Fiber Optic Cables
    c. Satelites



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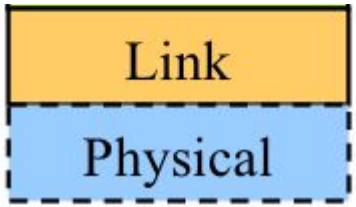
    a. Ethernet
    b. WiFi



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3. The Software Network
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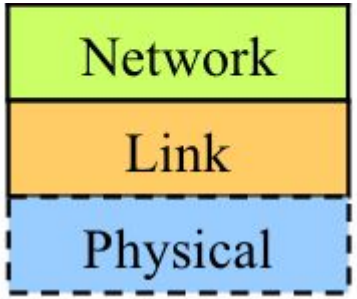
    b. IPv6



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3. Addresses and Routing Across the Network [Software]
    a. IPv4
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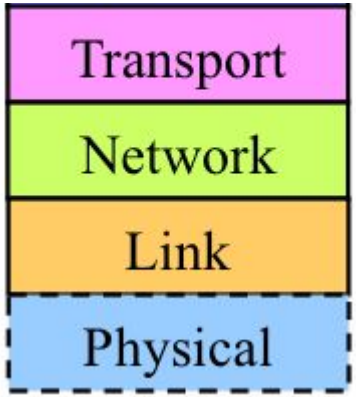
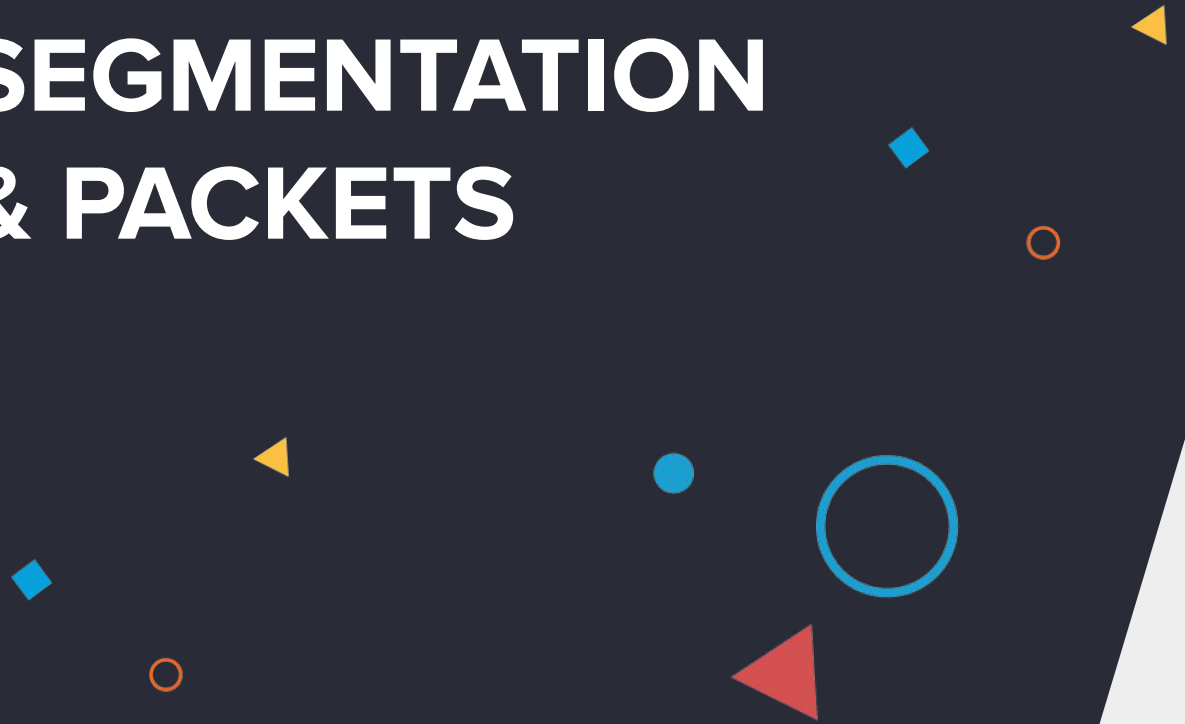
4. Transport Protocols [Software]
    a. TCP
    b. UDP



SEGMENTATION & PACKETS



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TCP/IP Segmentation

It’s much simpler to send fixed sized messages:

- Easy to confirm that the whole message has been received
- Each message takes less memory
- Less time tied up in sending/receiving

Segmentation

Segmentation

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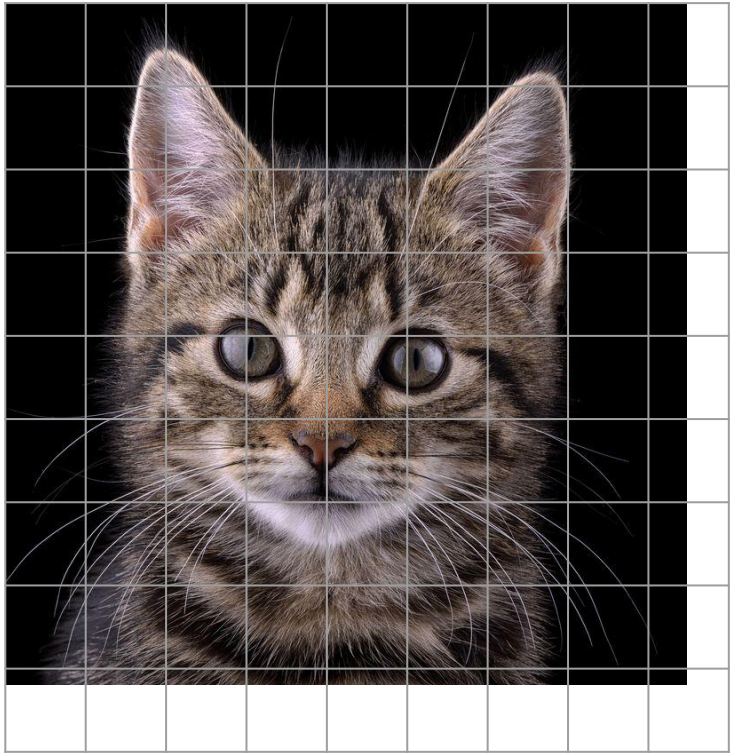

Packets - like an envelope

- A packet is made up of the segment of data and a variety of headers
  - IP information - who sent it, and where is it destined?
  - Sequence number - what segment of data is this
  - Acknowledgement number - to ensure reception
  - Checksum data - to ensure data integrity

TCP/IP

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TCP

- TCP allows us to send a message made of **many** packets with guarantees.

- Your message will arrive **quickly and reliably**
  - Unreliable network retransmission - Dupack/Timeout
  - Error Detection - Hash functions
  - Packet Ordering - Sequence Numbers
  - Flow Control - Network Speed Mismatches
  - Congestion Control - Various Mechanism

Client / Server Communication

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Demo

HTTP

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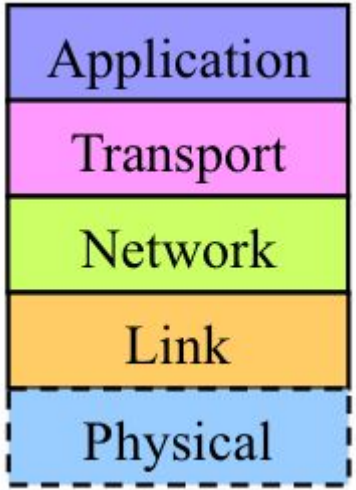
   - IPv4, IPv6
4. Transport Protocols [Software]
   - TCP, UDP
5. Application Layer [Software]
   a. HTTP
   b. FTP
   c. telnet
   d. NFS
   e. SMTP
   f. SSH



What is HTTP

- HTTP is a request-response communication protocol
- It utilizes TCP for client-server communication
- HTTP is stateless

Your browser is the client:

- Request a website, image, js, css
- Upload a file
- Submit a form

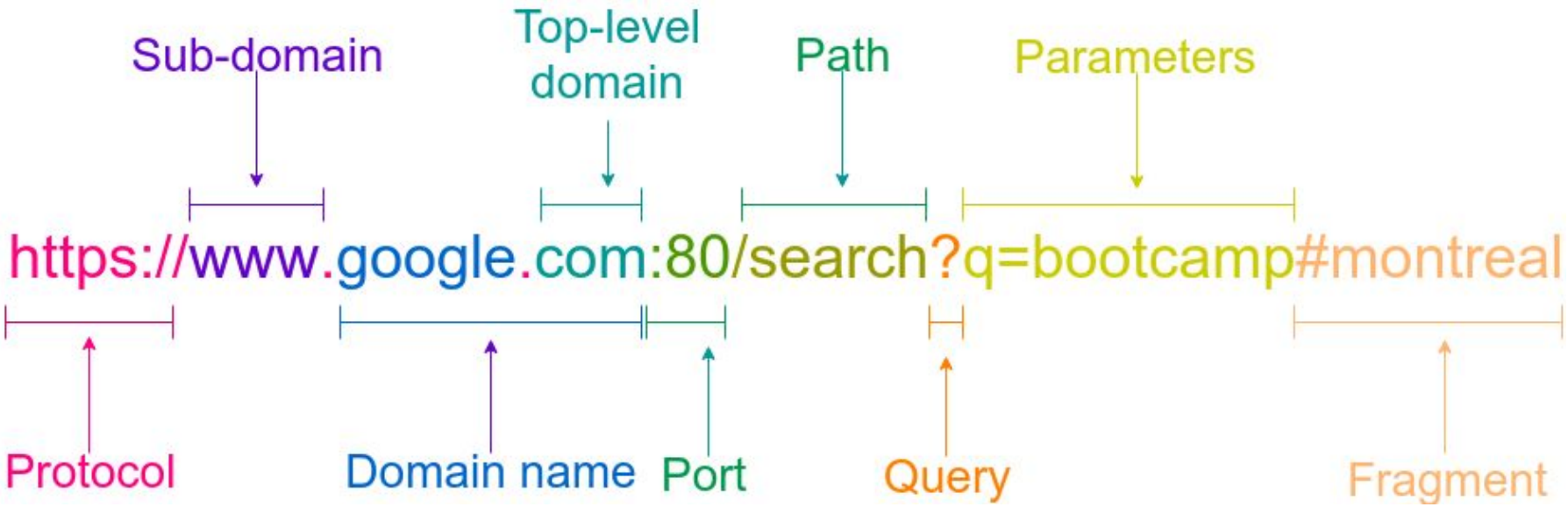
The website’s backend is the server:

- Respond with website, image, js, css
- Receive a form submission or file upload

Anatomy of HTTP request

- A URL
- A METHOD
- HEADERS [optional]
- BODY [optional]

URL


Sub-domain
Top-level domain
Path
Parameters
https://www.google.com:80/search?q=bootcamp#montreal
Protocol
Domain name
Port
Query
Fragment

METHOD

- GET - A request to **read** resource
- POST - A request to **write** resource
- PUT - A request to **update** resource
- PATCH - A request to **partially update** resource
- DELETE - A request to **delete** resource
- OPTION - A request to **read** information about a path

HEADERS

HTTP headers allow us to specify additional information in a request.

- Authorization - used to specify credentials
- Cookie - used to maintain session between client and server
- Caching - used to improve performance
- Accept - used to specify acceptable response types
- CORS - used to specify security preferences

BODY

HTTP allows you to specify a body along with your request.

- Usually used with POST/PUT/PATCH requests to **write** a resource
- This payload could contain
  - Form data - automatically generated from a form submission or through JS/AJAX
  - structured data like JSON through JS/AJAX
  - Multipart form data - for uploading larger images through your browser

Anatomy of HTTP response

- A STATUS
- HEADERS [optional]
- BODY [optional]

HTTP STATUS CODE

- 200 range: success
  - 200 OK - generic success
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- 500 range: server error
  - 500 INTERNAL SERVER ERROR - something is wrong with the server

BODY

The body of an HTTP response is the data you requested

- HTML/CSS/JS
- JSON - structured data
- Image

Your browser will receive this data, and do it’s best to display it to the user

Questions?

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