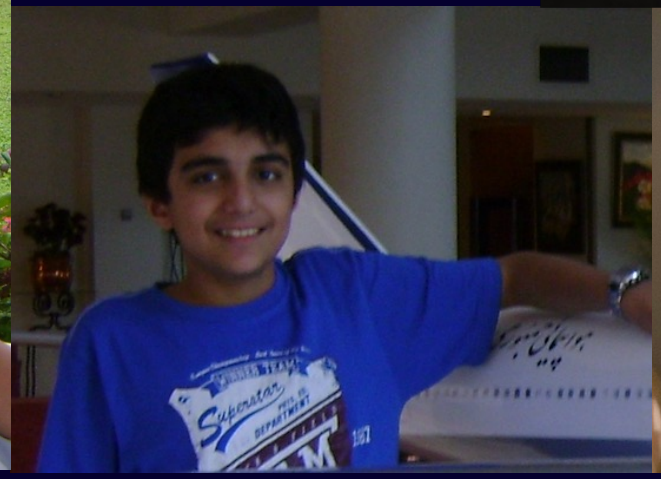
CSC309: Programming on the Web

Kianoosh Abbasi

Fall 2022

About me



Why take a web programming course?

What is it about?

- How does web work?
  Client/server concepts, browsers, protocols
- Components of a website
  Server, backend engine, frontend, stylesheets
- Website design
  Design models, frameworks, data management
- Client-side and Server-side development

Course assumptions

- No prior knowledge/experience in web development is assumed

- Requirements
  - Programming experience & Python (CSC108)
  - Advanced programming & OOP (CSC207 & CSC148)
  - Basic shell & system programming (CSC209)

- Recommended Corequisite
  - Database systems (CSC343)

What will we do?

- How does web work?
  Client-server model, requests, HTTP, browsers
- Static webpages
  HTML + CSS
- Dynamic website
  Backend framework: Django
- Interactive webpages
  JavaScript
  Single-page with React
- System administration(Optional)
  Website deployment
  DevOps

What will we actually do?

- Week 1
  - Course intro, web architecture,
  - HTML
- Week 2
  - CSS styling
- Week 3-4
  - JavaScript
  - jQuery
  - Advanced JS
- Week 5-8
  - Django setup
  - MVC design pattern
  - Database models & ORM
  - Restful APIs
- Week 9-11
  - Single-page applications
  - React
  - NodeJS
- Week 12
  - Deployment & DevOps (optional)

That's a lot, isn't it?

- Yes, it is!
- Focus on the knowledge and concepts
- Some coding at the lectures
- The rest is up to you!
  - Online materials
  - Google things often!
  - Practice with online tutorials
  - Attend lab sessions
  - Doing the assignments
  - Incorporate your knowledge to the course project

Course delivery

- Monday, Wednesday, Friday 3-4 and 4-5

- Two sections are the same
  - Attend either lectures
  - Same TA's, assessments, etc.

- Fridays are usually tutorials
  - Except for Thanksgiving week or if otherwise announced

Contact points

- Course website
  www.cs.toronto.edu/~kianoosh/courses/csc309
  We will not use Quercus

- Piazza page
  https://piazza.com/utoronto.ca/fall2022/csc309
  Announcements + Q&A

- Markus page
  Submissions through the git repository

- IBS (Interview Booking System)
  Grades, interviews, mentor sessions

Contact points

- Email: csc309-2022-09@cs.toronto.edu
- Discord server
  https://discord.gg/6RgTVxYzyA
  Informal Q&A and chat
- In person office hour
  Wednesdays 5:00 – 6:00
- Online office hour
  Fridays 9:00 – 10:00

Assignments

- Educational questions to get you started with coding
  - Challenges your understanding of the concepts
  - Automatically-tested

- A1: HTML+CSS, A2: JavaScript, A3: Django

Assignments

- You are allowed (even encouraged) to Google things or check out online resources

- BUT all the code MUST be written by yourself
  Except for the skeleton or parts that are provided by the IDE

- Assignments are individual work
  No discussion, help, or code from other students

- Get help from TA's, labs, office hours, or online sources

Project

- A full (but small) website
  Toronto Fitness Club (TFC): A website for a gym chain
- Search for studios and amenities, sign up for classes, etc.
- Individually (not recommended) or in groups of 2 or 3
  You may team up with people from the either sections
- Two parts
  Back-end: Django, Front-end: React + CSS

Project

- Each part is delivered and graded separately
  - Meetings with TA's
- Members are graded individually
- Regular Q&A sessions with TA's
- Teams are allowed to use online codes, libraries, or packages
  - Each piece of copied code must include a reference to its source
  - No uploading or sharing of code between teams
- Start looking for teammates now!

Grade breakdown

- Assignments: 45%
  A1: 10%, A2: 15%, A3: 20%

- Project: 55%
  PB: 25%, PF: 30%

- No final or midterm exam!

Late submissions

- Negligible penalty in the first hours
  p(6) = 0.048% p(12) = 0.4%

- Small penalty in the first day
  p(24) = 3.35%

- Significant increase afterwards
  p(36) = 11.57% p(48)=27.9% p(72)=96.49%

$$p = 0.0002x^{3.06}$$

Important heads-up!

- Designed to accommodate unforeseen situations
- Do NOT automatically push deadline in your minds!
- Most extension requests will NOT be approved
  - You almost have one penalty-free day
- Start early: assignments and projects are big!
- Everything must be graded before holidays
  - A very tight hard deadline

Schedule Overview

Also available on course website

Lecture Number	Class Dates	Title	Deadlines
Week 1	Sep 12, 14	Intro + HTML	
Week 2	Sep 19, 21	CSS	
Week 3	Sep 26, 28	JavaScript #1	A1: HTML + CSS (Sunday)
Week 4	Oct 3, 5	JavaScript #2	
Week 5	**Oct 12, 14 (Friday)**	Django #1	A2: JavaScript (Sunday)
Week 6	Oct 17, 19	Django #2	
Week 7	Oct 24, 26	Django #3	A3: Django (Sunday)
Week 8	Oct 31, Nov 2	Django #3	
Reading week			
Week 9	Nov 14, 16	React #1	PB: Django (Thursday)
Week 10	Nov 21, 23	React #2	
Week 11	Nov 28, 30	React #3	
Week 12	Dec 5, 7	DevOps (optional)	PF: React + CSS (Thursday)

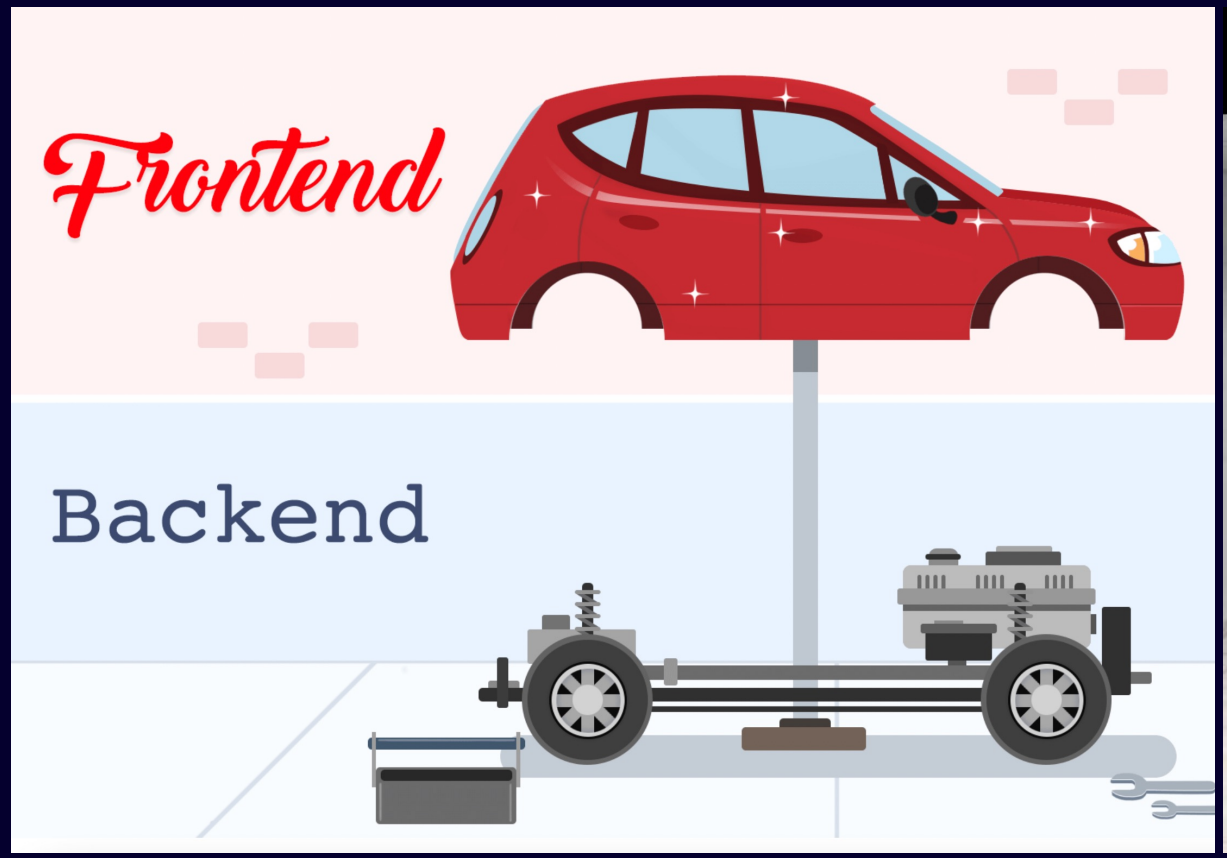
Academic integrity

- University's policy takes it very seriously
  - Violations will result in failing the course

- Rules
  - No code sharing at assignments or project
  - No discussion at assignments
  - No online/pre-written code at assignments
  - No copied code without reference at project

Questions?

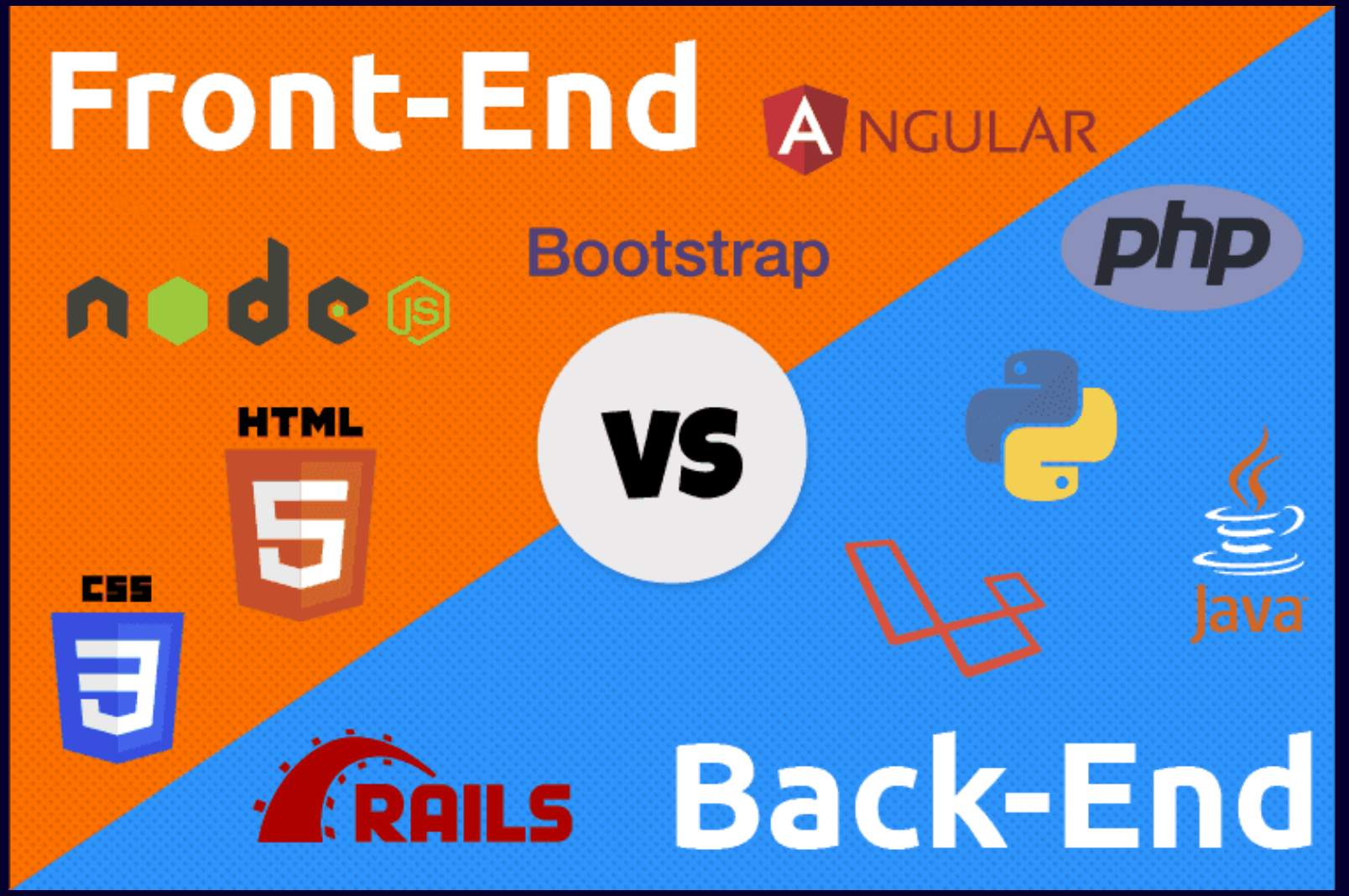
Web development



Source: blog.back4app.com

Source: https://www.reddit.com/r/ProgrammerHumor/comments/m187c4/backend_vs_frontend/

Web development



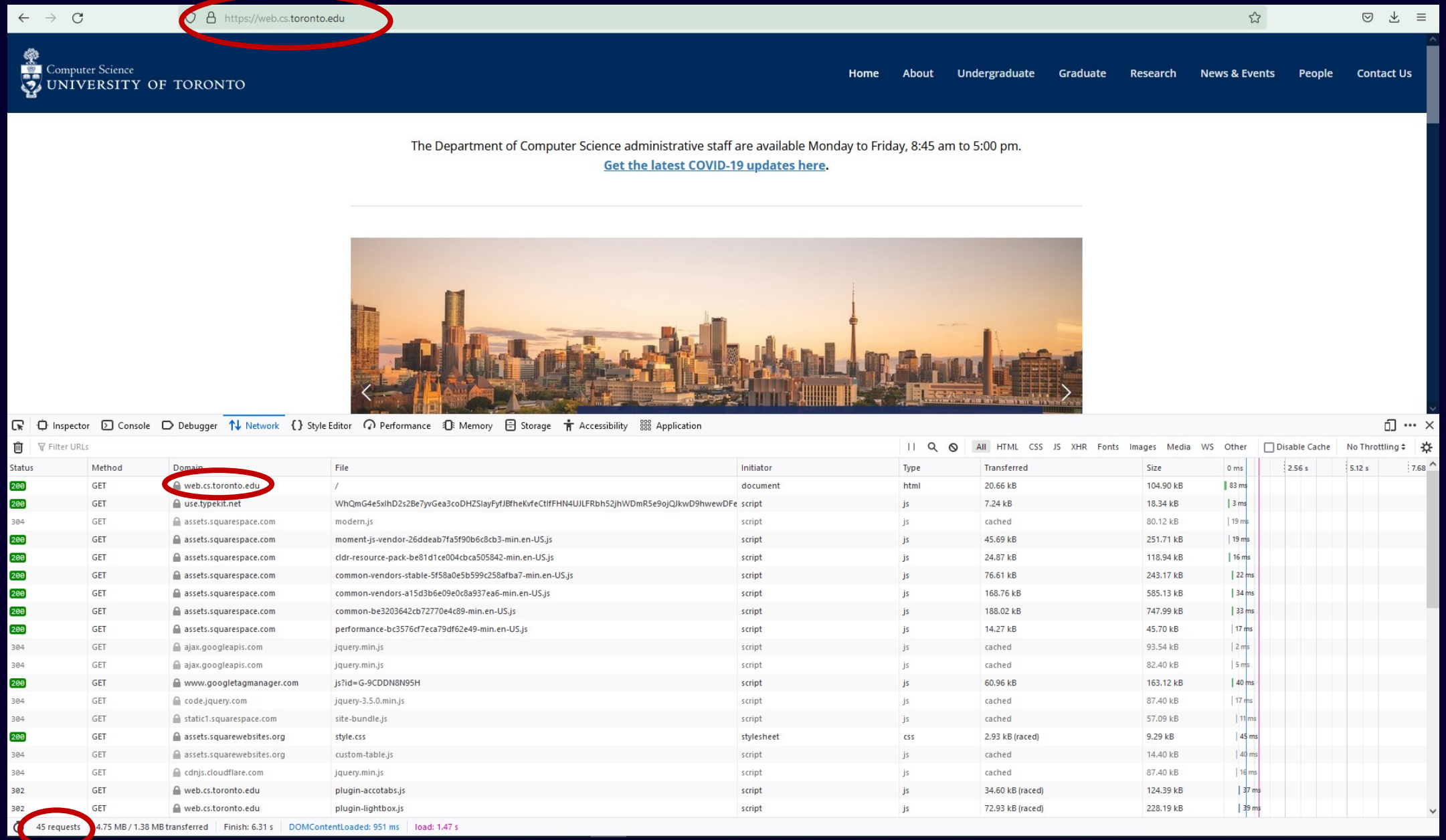
Source: nimapinfotech.com

Front-end development

- What user can see
  - User interface (UI)
  - User experience (UX)

- What is run on the client-side
  - HTML/CSS rendering
  - Javascript codes

How web works



How web works

- A lot of things happen when a single webpage is loaded!
- Lots of HTML/CSS/JS is fetched
- All in the form of requests & responses
  - Browser (client) sends requests to one or more servers and receives responses

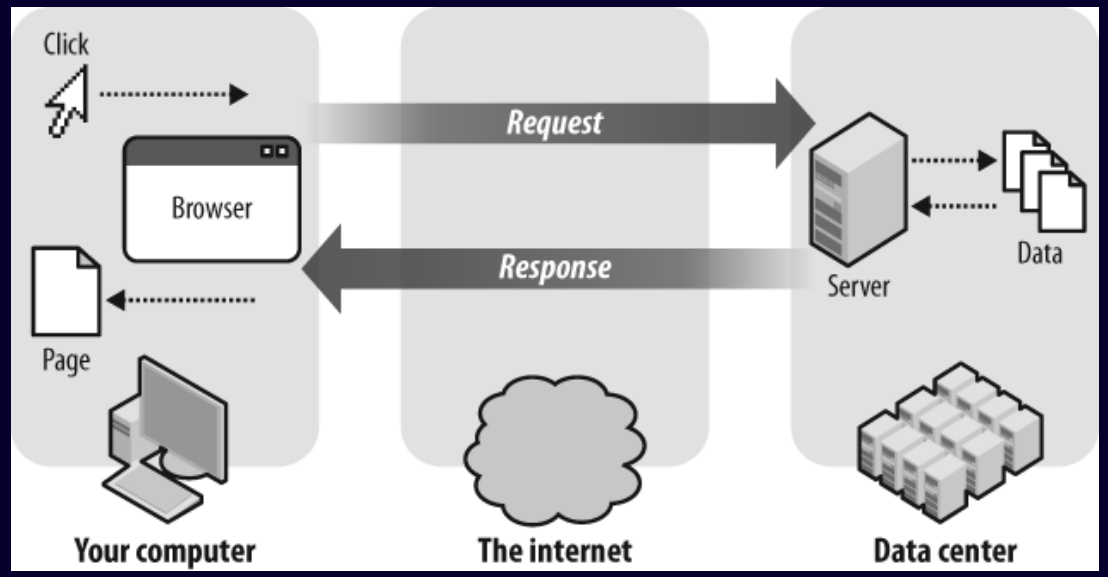
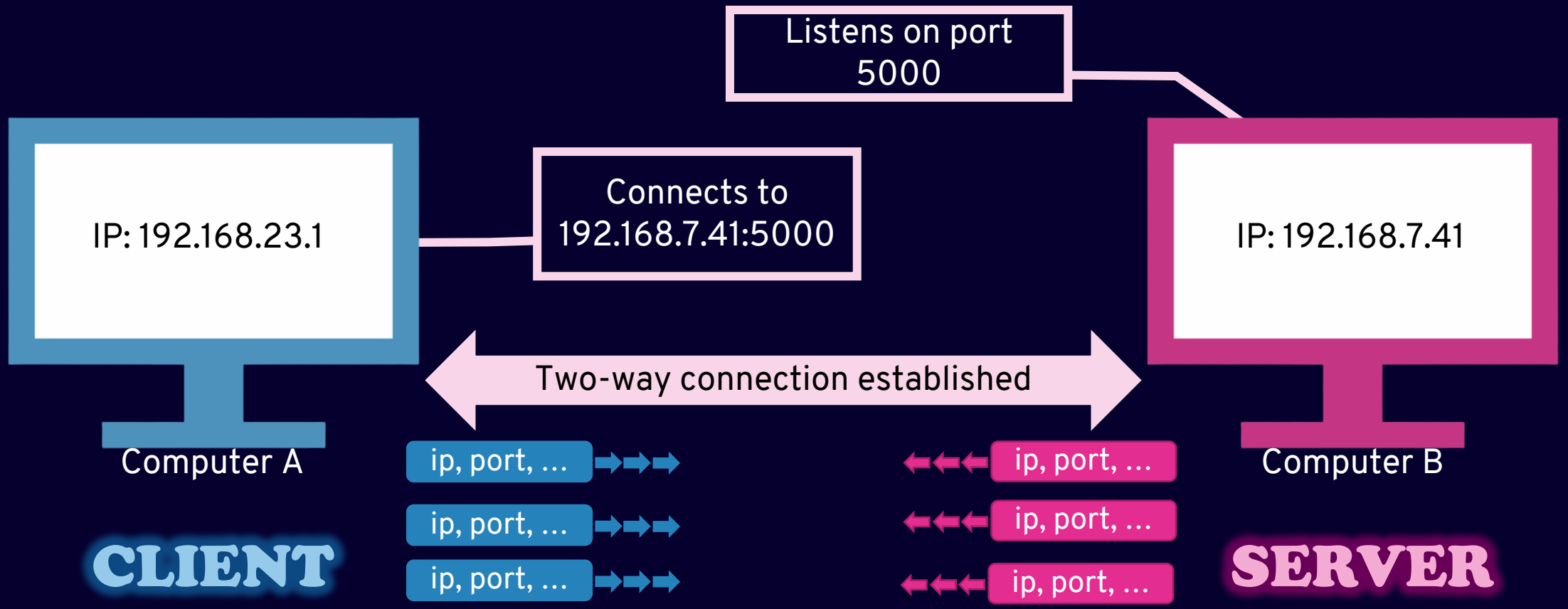


Image source: https://medium.com/@lokeshchinni123

How computers talk to each other?



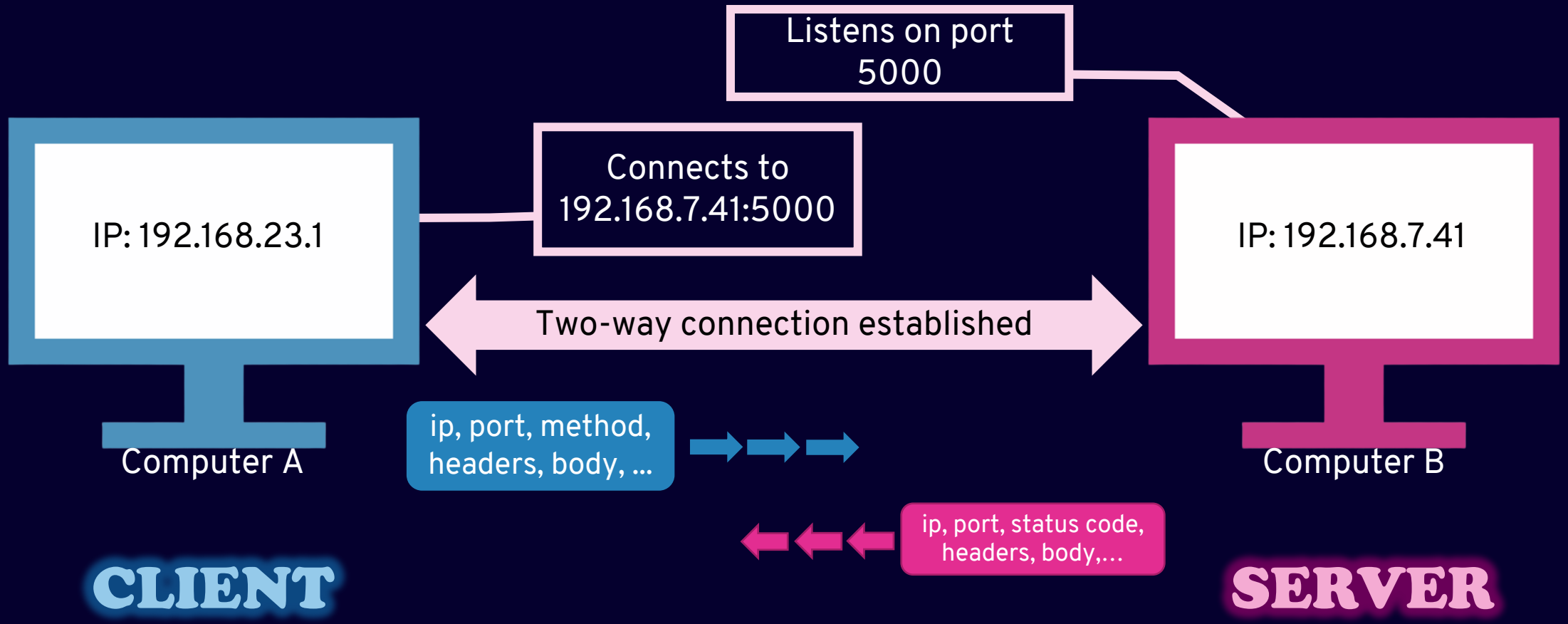
Domains

- Mapped to IP addresses
  www.google.com -> 142.251.41.78
- Stored in Domain Name Servers (DNS)
- Clients first resolve the domain, then connect to the IP address
- Already knows which DNS server to talk to

Stateful vs Stateless

- Two-way open connection is stateful
- What the server responds depends on previous request/responses
- Server should keep track of thousands of open connections
- If connection breaks, all the state is lost
- A stateless protocol is preferred

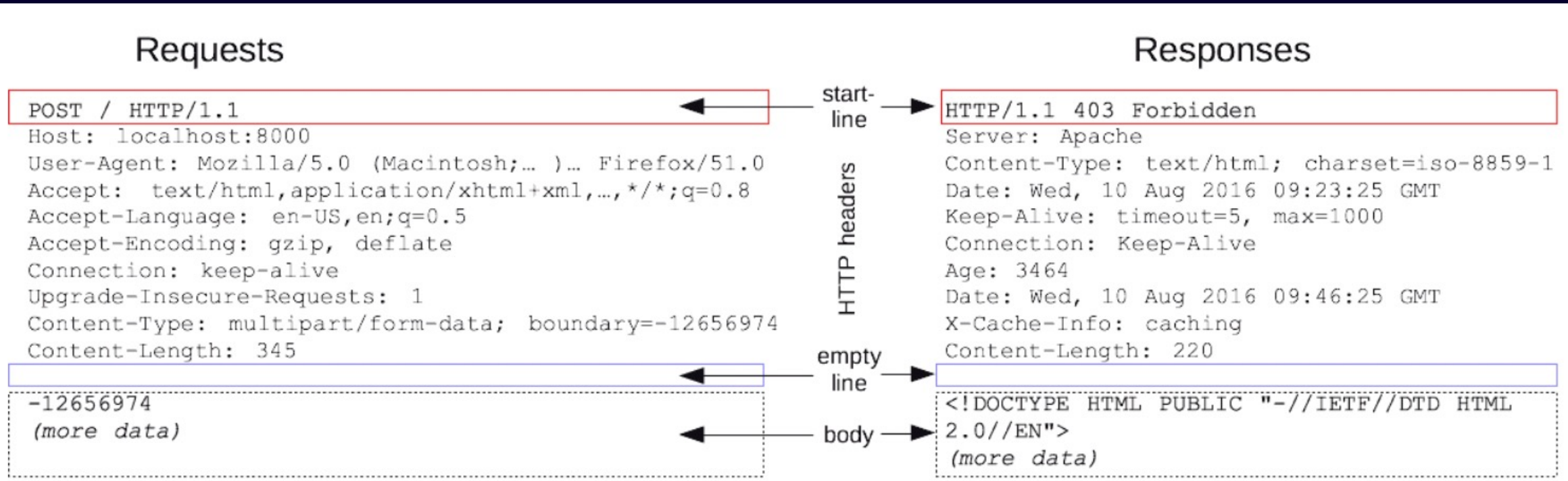
Stateless Protocol



HTTP Message

- A string with a special format
- Request a more specific target
  Path: /, /signup, /account/index.html, …
  Method: GET, POST, PUT, …
- Headers & Body
- Default port is 80

HTTP Message



Response codes

- Success: 200-299
  200 OK, 201 Created
- Redirection: 300-399
  301 moved Permanently
- Client errors: 400-499
  404 Not Found, 400 Bad Request, 403 Permission Denied
- Server errors: 500-599
  500 Internal Server Error, 502 Bad Gateway

HTML

- A specific form of Extensible Markup Language (XML)
  Data is annotated with nested tags

- HTML has specific tags for a webpage to describe what the page contains

- More on HTML later today

Web browser

- Connects, sends requests to server, and receives responses

  Upon entering the Uniform Resource Locator (URL)

- Renders the response

  HTML

  Image

  PDF

So far...

- Server listens on a specific port, client(s) connect to IP and port
- Stateless HTTP protocol: Request & Response
- HTTP response body can be in HTML format
- Browsers understand this format and renders accordingly

Questions?

HTML

- Focusing on the renderer side of a browser!
- Plain HTML files, no server/clients
- HTML file surrounded by the <html> tag
  <body> and <head> tags
- Tags and elements
- Elements can have attributes

HTML tags

Visit https://www.w3schools.com/html/

- Headings: <h1> to <h6>
- Paragraphs: <p>
- Links: <a>
  Stands for anchor
- Images: <img />
- Lists: <ol> and <ul>
- Tables: <table>
- Navigation Bar: <nav>
- New line:

HTML attributes

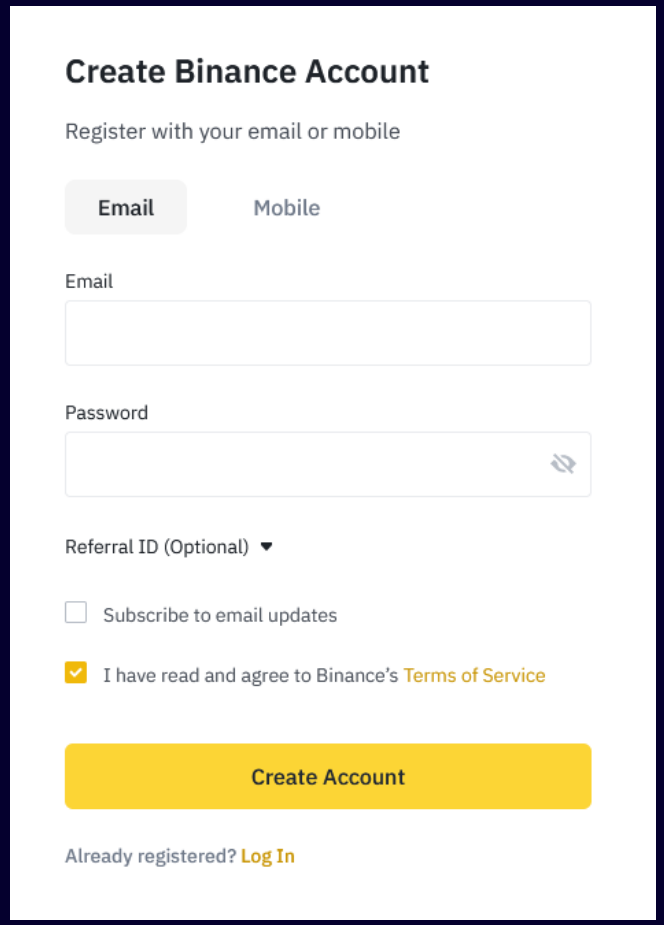
- style attribute: next session
- Identifiers: id vs class
- Other attributes: src for <img /> and href for <a>
- You can put any custom attribute you want

Other HTML tags

- and
- Select part of document to apply specific attributes
- : inline organization
- : block-level organization

Forms

- Primary way to send user data to server
- On submit, a request is often sent
- Comprised of many inputs



Inputs

- Text field
  `<input type="text" />`
- Passwords, emails, etc.
  `type="password", ...`
- Radio button
  `<input type="radio" />`
- Checkbox
  `<input type="checkbox" />`
- Textarea
  `<textarea>`
- Submit button
  `<button type="submit">`

Forms

- Action attribute defines the URL/path of the HTTP request
- Method attribute: HTTP method parameter
- Inputs: name and value attributes

GET vs POST

- GET is usually used for queries and retrievals
  Google search

- The query params are appended to the end of the URL
  Why?

- POST: sending private user data (name, password, etc.)

This session

- Course intro
- Client/Server model
- HTTP request/response model
- HTML tags and elements

Next session

- Adding style to HTML
- Basic CSS rules
  Styles, selectors, precedence, units
- Spacing
  Box model: margin, border, padding
- Layout
  Positioning, flexbox, grid