Web Introduction

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https://i.imgflip.com/2uj8rv.jpg

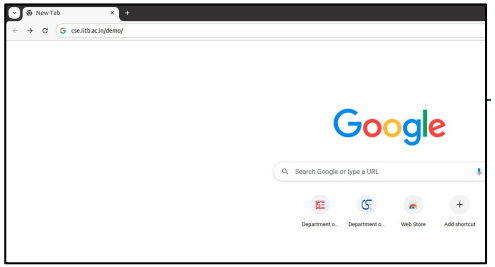
World Wide Web (WWW)

- A service provided over Internet, enabling users to access and interact with a vast array of information and services

Terminology

- Web Server: a software application hosted on a machine, that delivers web content/service
  - Browser requests arrive here
- Web Client (Browser): Application running on user's device
  - Sends out requests to server, processes received responses and renders web pages

- Web Application: a software program or set of programs that run on a web server
  - Help **dynamically** generates content in response to requests
  - Involve server-side scripting, database interactions, and complex business logic
  - E.g. Amazon, Facebook, Google docs, BodhiTree etc



HTTP Request

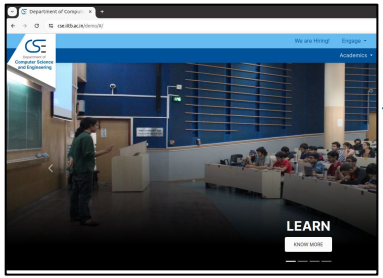
Time

Browser

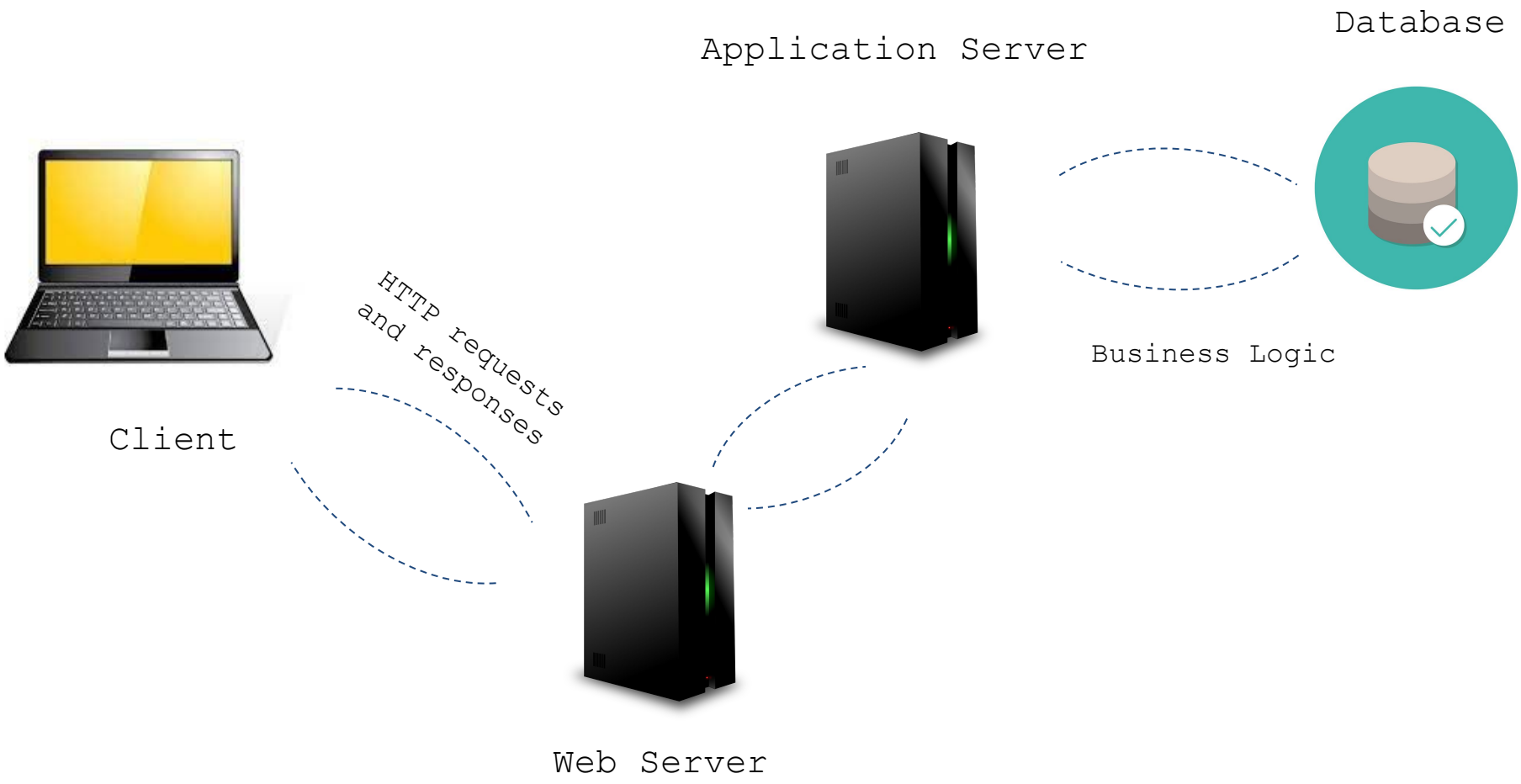
WWW

CRUNCH!!
CRUNCH!!
CRUNCH!!

Web Server



HTTP Response


Database
Application Server
HTTP requests
and responses
Business Logic
Client
Web Server

Web Client-Server Interaction

Typical Workflow (At high level)

- Web Request:
  - A user enters a web address (URL) in their browser
    - Web address corresponds to some website
  - One or more requests are sent to the web server hosting the website
- Processing:
  - Server processes each request
    - May run server-side scripts, query databases, or performing other tasks to generate a response

- Response:
  - The generated response(s) are sent back to user's browser
- Delivery:
  - Browser interprets each response, combines them and displays the web page
- Repeat above steps:
  - User interacts with the page causing more requests to be sent out
  - Receives corresponding responses and sees new information, and so on

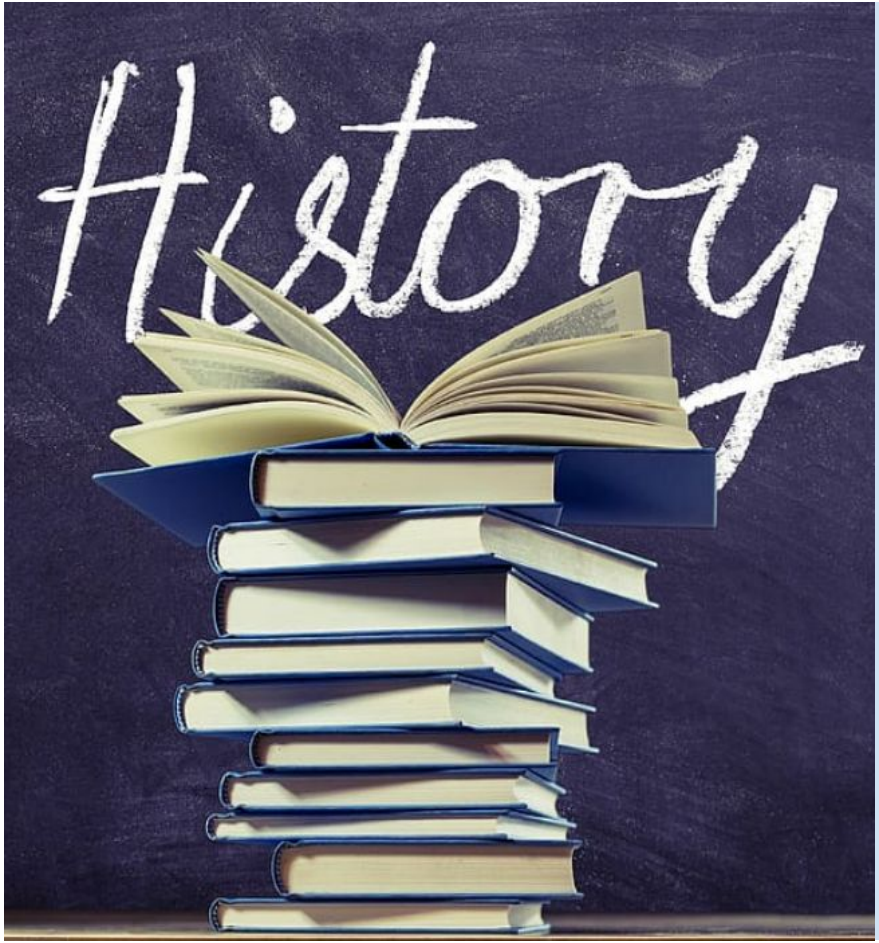
More Terminology

- Frontend - Part of web application used directly by the browser
  - Markup which is interpreted and displayed or Code which is executed inside the browser
    - E.g. HTML, CSS and in-browser JavaScript
    - Note: Backend code can be used to assemble such HTML responses to be sent to browser for execution

- Backend: Part of web application not directly visible to user
  - Backend code runs on a server (never on user machine)
  - Receives requests and prepares data transmitted back to browser
  - Uses programming languages and frameworks
    - Python (Django, Flask), PHP (Laravel), Javascript (node.js), Java (Spring) etc

Outline

- What constitutes a webpage?
- What goes on inside a Browser?
  - What standard security mechanisms implemented?
- How do client and server communicate?
  - HTTP/HTTPs protocol
  - Session Management via cookies and tokens
- How does a web server process requests and generate responses?
  - Static vs Dynamic content



You have to know the past to understand the present!

– Carl Sagan

History

- Early Years (1989-1995)
  - 1989: Tim Berners-Lee, a British scientist, invented WWW at CERN
    - An automated way to share information between scientists around the world
    - Created first web browser and first web server
  - 1993: First graphical web browser Mosaic released
    - Developed at the National Center for Supercomputing Applications (NCSA)
    - Marks the beginning of the commercialization of the web.
    - Late 1994, Mosaic lost market share to Netscape Navigator

The World Wide Web project

WORLD WIDE WEB

The WorldWideWeb (W3) is a wide-area hypermedia[1] information retrieval initiative aiming to give universal access to a large universe of documents.

Everything there is online about W3 is linked directly or indirectly to this document, including an executive summary[2] of the project, Mailing lists[3] , Policy[4] , November's W3 news[5] , Frequently Asked Questions[6] .

What's out there?[7]	Pointers to the world's online information, subjects[8] , W3 servers[9], etc.
Help[10]	on the browser you are using
Software Products[11]	A list of W3 project components and their current state. (e.g. Line Mode[12] ,X11 Viola[13] , NeXTStep[14] , Servers[15] , Tools[16] , Mail robot[17] , Library[18])
Technical[19]	Details of protocols, formats, program internals etc

<ref.number>, Back, <RETURN> for more, or Help:

https://home.cern/science/computing/birth-web

- Browser Wars (1995-2000)
  - 1995: Microsoft releases Internet Explorer and killed Netscape Navigator
    - Microsoft's antitrust trial
      - Microsoft's bundling of Internet Explorer with the Windows operating system was monopolistic and illegal
      - Court decision too late for Netscape
  - Mid-1990s: web directories and search engines were created to index pages and allow people to find things
    - Yahoo! Directory became the first popular web directory
    - Yahoo! Search was the first popular search engine
    - 1997: Google Search engine was a breakthrough in search technology
      - Used Link analysis to determine relevance and authority of web pages.

- Mid-1990s: Apache open-source web server software for hosting websites
  - First web servers supported only static files, such as HTML (and images)
  - Together with Linux and MySQL, it became known as the LAMP platform.
    - L: Linux; A: Apache, M: MySQL and P: PHP (later: Python and Perl)
- 1996: CSS (Cascading Style Sheets) introduced
- 1998: World Wide Web Consortium (W3C) founded to standardize web technologies

- Dot-Com Boom and Web 2.0 (Early 2000s):
  - Dot-com boom saw a major surge in web development and e-commerce
  - Term "Web 2.0" emerged : major shift towards dynamic content
    - Technologies like Javascript, AJAX (Asynchronous JavaScript and XML) developed
- Rise of Frameworks and CMS (mid-2000s-2010s)
  - Mid-2000s: JavaScript libraries like jQuery gained popularity
    - Simplify client-side scripting
  - Late 2000s: Content Management Systems (CMS) like WordPress and Drupal made web development more accessible
  - 2010s: Front-end frameworks like Angular, React, and Vue.js gained prominence
    - Emphasize the importance of a responsive and interactive user interface

- Modern Trends (2010s-2020s)
  - Mobile Responsive Design (2010s): Widespread adoption of smartphones lead to focus on mobile-responsive design
  - 2015-2016: Progressive Web Apps (PWAs) gain popularity, offering a more app-like experience on the web
    - Part of the broader movement towards creating a more responsive, reliable, and engaging web

- 2016: HTTP/2 is standardized, improving website performance
- 2020s: Continued emphasis on performance optimization, security, and accessibility.
  - Increased use of serverless, microservice based architecture
  - Increased use of AR/VR, ML technologies
  - Web 3.0: a vision of a more intelligent, interconnected, and decentralized web
    - a decentralized Web based on public blockchains, smart contracts, digital tokens and digital wallets