Web Technologies (CSC336)

Lecture 1

Overview of Generation, Platforms and HTTP

Web Generations Overview

- The term "web generations" refers to the different stages or phases of the World Wide Web's development since its inception.
- There is no universally agreed-upon categorization, generally, the web has been divided into three main generations:
  - **Web 1.0 (The Static Web)**
  - **Web 2.0 (The Social Web)**
  - **Web 3.0 (The Semantic Web or the Decentralized Web)**

Web 1.0 (The Static Web)

- This era spanned from the early 1990s to the early 2000s.
- Websites were primarily static, consisting of simple HTML pages with limited interactivity.
- Information was presented in a one-way manner, with little to no user interaction or contribution.
- Search engines like Yahoo! and early versions of Google emerged to help users find information.
- Constraints:
  - Websites were largely static,
  - Limited interactivity and functionality.
  - Developers were constrained by the capabilities of HTML and early web browsers.
  - Design options were limited, and multimedia content like images and videos were often slow to load due to dial-up internet connections.

Web 2.0 (The Social Web)

- This era emerged in the mid-2000s and continues to evolve.
- Characterized by the rise of dynamic and interactive websites, social media platforms, and user-generated content.
- Users became active participants, contributing content, sharing information, and engaging in online communities.
- Key technologies and platforms include social networking sites like Facebook and Twitter, blogging platforms like WordPress, and collaborative platforms like Wikipedia.
- Web 2.0 also saw the advent of AJAX (Asynchronous JavaScript and XML), enabling more seamless and responsive web applications.
- Constraints:
  - Developers still faced constraints related to browser compatibility and performance.
  - They also had to consider accessibility standards to ensure that websites were usable by people with disabilities.
  - Additionally, the proliferation of user-generated content brought new challenges related to content moderation and privacy.

Web 3.0 (The Semantic Web or Decentralized Web)

- This concept is still emerging and evolving, with various interpretations and implementations.
- Web 3.0 aims to create a more intelligent, interconnected, and decentralized web.
- It focuses on technologies like the Semantic Web, which aims to make web content more understandable by machines, enabling smarter search and more automated interactions.
- Decentralized technologies like blockchain are also central to the Web 3.0 vision, aiming to create trustless systems where data and transactions are distributed across a network of nodes rather than controlled by central authorities.
- Other aspects of Web 3.0 may include artificial intelligence, virtual/augmented reality, and more advanced data analytics.
- Constraints:
  - Scalability, security, and privacy in decentralized applications.
  - Additionally, ensuring interoperability and compatibility with existing web infrastructure remains a challenge.

Web Platforms Overview

- Web platforms are software systems or frameworks that provide developers with the tools and infrastructure needed to build and deploy web applications.
- These platforms often include features such as development environments, libraries, APIs, and hosting services.
- Some popular web platforms.
  - **Content Management Systems (CMS)**
  - **E-commerce Platforms**
  - **Development Frameworks**
  - **Cloud Platforms**
  - **Serverless Platforms**
  - **Static Site Generators (SSG)**

Content Management Systems (CMS)

- Examples: WordPress, Joomla, Drupal
- CMS platforms allow users to create, manage, and publish digital content, such as websites, blogs, and online stores, without needing to write code from scratch.
- They typically offer customizable templates, plugins, and themes to extend functionality.

E-commerce Platforms

- Examples: Shopify, Magento, WooCommerce
- E-commerce platforms are tailored specifically for building online stores and managing product sales.
- They provide features like inventory management, payment processing, order tracking, and customer relationship management (CRM)

Development Frameworks

- Examples: Ruby on Rails, Django, Laravel, Express.js
- Development frameworks provide a foundation for building web applications by offering pre-written code, libraries, and tools to streamline the development process.
- They often follow a Model-View-Controller (MVC) architecture and support rapid prototyping and scalability.

Cloud Platforms

- Examples: Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure
- Cloud platforms offer a range of services for building, deploying, and managing web applications in scalable and cost-effective ways.
- They provide infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) solutions, including computing resources, storage, databases, and machine learning tools.

Serverless Platforms

- Examples: AWS Lambda, Google Cloud Functions, Azure Functions
- Serverless platforms enable developers to build and deploy applications without managing server infrastructure.
- They allow developers to focus on writing code in the form of functions or microservices, which are automatically scaled and executed in response to events or triggers.

Static Site Generators (SSG)

- Examples: Jekyll, Hugo, Gatsby
- SSGs generate static HTML files from templates and content, which can then be hosted on any web server or content delivery network (CDN).
- They offer simplicity, security, and performance advantages over traditional CMS platforms for certain types of websites, such as blogs and documentation sites.

Headless CMS

- Examples: Contentful, Strapi, Sanity
- Headless CMS decouples the content management backend from the frontend presentation layer, allowing developers to use any technology stack or framework to consume and display content via APIs.
- This approach offers flexibility, scalability, and improved performance for modern web applications.

HTTP Overview

HTTP (Hypertext Transfer Protocol) is a protocol used for transmitting hypertext documents, such as HTML pages, over the internet. It is the foundation of data communication on the World Wide Web and serves as the basis for exchanging various types of content between web servers and clients, typically web browsers.

HTTP Overview (cont.)

- **Client-Server Model:** HTTP follows a client-server model, where clients (such as web browsers) send requests to servers, and servers respond with the requested resources (such as web pages, images, or data).
- **Stateless Protocol**: HTTP is stateless, meaning each request from a client to a server is treated independently, without any knowledge of previous requests. This simplifies implementation and improves scalability but also requires additional mechanisms (such as cookies or sessions) to maintain state between requests.

HTTP Overview (cont.)

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- **HTTP Headers**: HTTP headers are used to transmit additional metadata along with the request or response. They provide information such as the content type, content length, caching directives, cookies, and authentication credentials.

HTTP Request-Response Cycle

- The typical HTTP transaction involves a request from a client and a response from a server.
- The client initiates the request by specifying a method (e.g., GET, POST, PUT, DELETE) and a Uniform Resource Identifier (URI) that identifies the desired resource.
- The request may also include headers, which provide additional information about the client's capabilities or preferences, and optionally a message body, which contains data to be sent to the server (e.g., form data).
- Upon receiving the request, the server processes it and returns a response, which includes an HTTP status code indicating the outcome of the request (e.g., 200 OK for success, 404 Not Found for a missing resource) and possibly a message body containing the requested resource or an error message.

HTTP Methods

- HTTP defines several methods or verbs that indicate the desired action to be performed on a resource. The most commonly used methods include:
  - GET: Retrieves a resource from the server.
  - POST: Submits data to be processed by the server.
  - PUT: Updates an existing resource on the server.
  - DELETE: Removes a resource from the server.
  - Other methods include HEAD, OPTIONS, PATCH, etc.

HTTP Versioning & Security

Versioning:

- HTTP has undergone several revisions over the years. The most widely used versions are HTTP/1.1 and HTTP/2. Each version introduces improvements and new features to enhance performance, security, and efficiency.

Security:

- While HTTP transmits data in plain text, which can be intercepted and read by malicious actors, HTTPS (HTTP Secure) provides a secure version of the protocol by encrypting data using Transport Layer Security (TLS) or its predecessor, Secure Sockets Layer (SSL).

Client Server Communication