

CHAPTER 1 :

Introduction to

the World Wide

Web



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Chapter1

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I CHAPTER 1 :

Introduction to the World Wide Web

1. Chapter1 specific objectives

At the end of Chapter 1, the student will be able to:

- **Define** Web 1.0, Web 2.0, and Web 3.0.
- **Identify** the components of client/server architecture.
- **Explain** the evolution and characteristics of the different versions of the Web.
- **Describe** how an HTTP request works.
- **Compare** Web 1.0, 2.0, and 3.0 based on specific criteria.
- **Analyze** client/server architecture in different contexts

2. Introduction

This chapter offers a comprehensive overview of the World Wide Web, from its foundational technologies to its historical evolution through Web 1.0, 2.0, and 3.0. It highlights the Web's structure, purpose, and distinction from the Internet. Key elements such as URLs, HTML, and HTTP are explained, along with the client-server model that underpins web communication. The chapter also explores the main features of HTTP and its different versions, helping readers understand how information flows across the web today.

3. Definition, History and Features of Web

3.1. Web Definition

Definition

The World Wide Web is a global information system that can be accessed through the Internet. Its architecture enables the sharing and viewing of digital resources through web pages that are connected by hyperlinks.

The advent of the World Wide Web has fundamentally reshaped information usage among individuals and institutions.

Extra

Three essential pillars form the basis of its functioning:

- Uniform Resource Locators (URL^{*}s): give each resource a unique identity,
- The HyperText Markup Language (HTML^{*}): organizes web page content.
- The HyperText Transfer Protocol (HTTP^{*}): which permits data transfer between a client and a server

Warning

Even though the terms "Web" and "Internet" are sometimes used interchangeably in ordinary speech, it is important to distinguish between the two. Comprising numerous interconnected sub-networks, the Internet is a massive worldwide computer network that uses standardized protocols like TCP^{*}/IP^{*} to facilitate device communication. The Web, on the other hand, is just one of the Internet's numerous uses, mainly for the dissemination of information through web pages that are viewable by web browsers.

The Web acts as a virtual, interactive platform where data can be displayed in textual, visual, or multimedia formats, while the Internet provides the underlying hardware and software infrastructure that permits data transmission. This results in a dynamic, changing the way we communicate and interact with information.

3.2. History and versions of Web

The World Wide Web was first created in 1989 when British researcher Tim Berners-Lee, who was employed at CERN (European Organization for Nuclear Research), proposed a novel system aimed at making it easier for scientists to share information. His original plan was to develop a platform that would allow users to access and connect data over the Internet's computer network by relying on documents through hypertext links. With the launch of the first website in 1991, this project marked the beginning of a significant technological revolution.

Since its inception, the Web has undergone several significant stages of development, each of which significantly altered its functions and uses.

3.2.3. Web 3.0

With the help of technologies like artificial intelligence and knowledge graphs, web 3.0 also known as Web semantics has begun to take shape and promises a more intelligent Internet where computers can understand and analyze data material.

* In addition to redefining how we create and consume information, this transformation is also redefining how digital systems communicate with one another to deliver experiences that are ever more individualized and intuitive*.



Web 3.0

Advice

I invite you to watch this video, explains the difference between web versions

See "The difference between web versions"

Note

Although it is still in the conceptualization and development stages, Web 4.0 is a significant advancement above Web 3.0 that goes beyond its current capabilities. Their goals are to create a digital ecosystem in which human-machine and system interactions become completely transparent, intuitive, and immersive. This future version of the Web is based on the integration of cutting-edge technology including artificial intelligence (AI)*, Augmented Reality* (AR), Virtual Reality* (VR), the Internet of Things* (IoT), and Brain-Computer Interfaces* (BCI).

3.3. Features of web versions

This section will compare each version of the Web by focusing on its unique features, such as time period, content type, user interaction, platform examples, technologies used, user role, security and confidentiality, digital economy, and user experience.

3.3.1. Period

Web 1.0, which began in the 1990s, was primarily made up of static pages. The focus has since shifted to interactive and collaborative content from the advent of Web 2.0 in the early 2000s until 2010, enabling users to contribute and communicate through social media, blogs, and wikis. From 2010 to the present, Web 3.0 has added a more intelligent dimension by utilizing artificial intelligence and blockchain technology.

3.3.2. Content type

In terms of content type, Web 1.0 was primarily made up of static pages with only textual content, which limited user involvement. With the advent of Web 2.0, content has become collaborative and interactive, encouraging user participation through social media networks, blogs, and sharing platforms. According to him, Web 3.0 introduced intelligent and personalized content

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3.3.3. Interaction and user experience

Web 1.0 offered weak, unidirectional interaction*, with a static user experience. Web 2.0, on the other hand, introduced two-way interaction, allowing users to create and share content, making the experience more dynamic, social and participative thanks to social networks. Subsequently, Web 3.0 enabled more intelligent interaction based on artificial intelligence and context analysis, offering a personalised experience tailored to the preferences and needs of each user.

3.3.4. The technologies used

In terms of the technologies used, Web 1.0 relied mostly on HTML, CSS, and centralized servers*, which limited content personalization and interaction. With the shift to Web 2.0, technologies like AJAX, JavaScript, and cloud computing* have made it possible to enhance user responsiveness and experience, making websites more dynamic and interactive. Major technologies like blockchain, RDF (Resource Description Framework), artificial intelligence, and big data were introduced by Web 3.0, enabling intelligent and decentralized information management.

3.3.5. Security and confidentiality

Due to its strong data centralization and lack of encryption, Web 1.0 was not very secure in terms of security and confidentiality. This element has been improved by Web 2.0, however the vast data collection by large platforms has raised concerns about users' privacy.

Web 3.0 has strengthened data protection by providing solutions through decentralization, cryptography, and blockchain

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3.3.6. The digital economy

In terms of the digital economy, Web 1.0 relied on direct sales and basic advertising, with websites offering goods and services in a static manner without any real interactive monetization strategy.

With the advent of Web 2.0, a platform economy has emerged that enables the monetization of content through targeted advertising, subscriptions, and services based on user data

*. Blockchain technology has made transactions more decentralized and transparent by introducing innovations like cryptomonnaies, NFTs (Non-Fungible Tokens), and smart contracts with Web 3.0.

3.3.7. Examples of platforms

Regarding to platform examples, Web 1.0 consisted primarily of websites and forums where users could only consult information. With the advent of social media platforms like Facebook, Twitter, blogs, YouTube, and collaborative Wikipedia, Web 2.0 has made it easier to create and share content. With Web 3.0, technologies like blockchain, artificial intelligence, semantic web, and voice assistants (like Alexa and Siri) have emerged to provide a more intelligent and automated experience.

3.3.8. Summary of the features of the various Web generations

A comparative summary of the features of the various Web generations is shown in Table 1.

Features	Web 1.0	Web 2.0	Web 3.0
Period	1990 - early 2000	Early 2000 - 2010	2010 - Today
Type of content	Static pages, read-only	Interactive and collaborative content	Intelligent and personalised content
User Interaction & user Experience	Unidirectional, with static and limited content	Bi-directional, encouraging creation, sharing and a dynamic, social and engaging experience.	Based on AI and context, offering an intelligent, personalised experience.
Examples of platforms	Showcase sites, basic forums	Social networks, blogs, YouTube, collaborative Wikipedia	Blockchain, AI, semantic web, voice assistants
Technologies used	HTML, CSS, centralized servers	JavaScript, AJAX	Blockchain, RDF, AI, Big Data
Security and confidentiality	Low (centralisation, no encryption)	Medium (massive data collection)	High (decentralisation, cryptography)
Digital economy	Basic advertising, direct sales	Platform economy, content monetisation	Cryptocurrencies, NFT, smart contracts

Summary of the features of the various Web generations

4. Client/Server architecture

4.1. Client/Server architecture principle

Definition

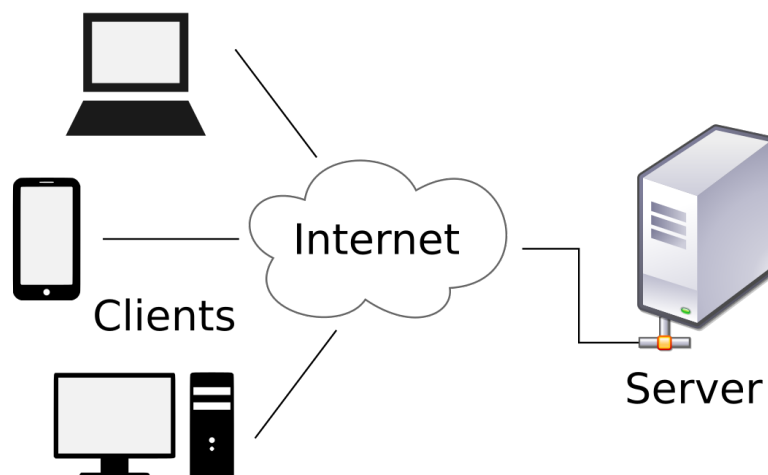
The client-server model is a fundamental paradigm in computer system architecture, especially prevalent on the web. It ensures an efficient distribution of tasks and serves as the foundation for many contemporary online apps.

In this model, a client, typically represented by a web browser, submits a request to access particular resources, such as web pages, photos, or data. This request is sent to a server, which serves as a resource provider by hosting the requested data. The server processes the request, retrieves the relevant resource, and sends the client the appropriate response.

4.2. Principle client and server role

The respective roles of the client and server are clearly defined:

- The client provides a user interface for initiating and receiving interactions
- The server manages, stores and distributes the resources requested.



Client/server architecture

As shown in the diagram, clients send requests to the server over the network. The server then processes these requests and sends the corresponding responses back to the clients.

4.3. Concrete examples

In this subsection, we will look at a concrete example of the steps involved in a client/server request.

Example

Entering the URL:

The user enters a web address (URL) in the browser's address bar.

Sending the request:

The browser, acting as a client, sends a request to the server hosting the requested page via the network.

Processing the request:

The server receives the request, identifies the resources requested and prepares an appropriate response.

Sending the response:

The server sends the client the necessary data, such as HTML, CSS or JavaScript code, as well as any additional files (images, videos, etc.).

Display of the web page:

The browser interprets the data received and displays the complete web page to the user.

5. HTTP protocol

5.1. What is HTTP?

Definition

HTTP (HyperText Transfer Protocol) is a communication protocol used for online data transfers. It specifies the rules that allow web browsers and servers to exchange information, including HTML pages, photos, videos, and other resources. In the client-server model of HTTP, the client (often a browser) sends a request, and the server provides the requested data.

5.2. HTTP protocol features

Owing to its ease of use, adaptability, and efficiency, HTTP has emerged as a crucial standard for online communication. Among its features is its fundamental protocol, which makes it easier for users and servers to access and exchange information.

Extra

The characteristics of the HTTP protocol include

- **Stateless protocol:**
HTTP retains no memory of previous exchanges between client and server. Each request is processed independently, unless additional mechanisms such as cookies or sessions are put in place to ensure a certain persistence.
- **Request-response model:**
The interaction between client and server follows a strict pattern where the client sends a request and the server provides a corresponding response.
- **Text-based:**
HTTP requests and responses are generally structured in the form of readable text, facilitating analysis and debugging.
- **Use of standardised methods:**
HTTP defines several request methods, such as: GET, POST, PUT, DELETE

5.3. HTTP protocol versions

The HTTP protocol has evolved over time to enhance performance, optimize connection management, and incorporate new features. Below is an overview of the main versions:

- **HTTP/1.0 (1996):**
The first official version of the protocol, HTTP/1.0 follows a simple request-response model in which each request opens and closes a separate connection. This design leads to high latency due to the overhead of repeatedly establishing and terminating connections.
- **HTTP/1.1 (1997):**

This version introduced persistent connections (keep-alive), allowing multiple requests to be sent over a single TCP connection, thereby reducing connection overhead. It also implemented pipelining, enhanced cache control, and more efficient handling of request headers.

- **HTTP/2 (2015):**

Based on Google's SPDY protocol, HTTP/2 significantly improves performance through request multiplexing, enabling multiple requests and responses to be sent simultaneously over a single connection. It reduces latency and uses HPACK for efficient header compression.

- **HTTP/3 (2023):**

HTTP/3 builds on the QUIC protocol, which replaces TCP with a UDP-based transport layer. It provides faster and more secure connections by natively integrating TLS 1.3, while also reducing latency and improving packet loss recovery.

5.4. Common HTTP methods

HTTP methods define the types of actions that a client can perform on a server resource. Among the most common are:

- **GET:**

Used to retrieve a resource without modifying its state. It is commonly used to load web pages, images or files. Parameters can be passed in the URL, but this method should not be used to send sensitive data, as this will appear unencrypted in the URL.

- **POST:**

Used to send data to the server to create a new resource or process a submission (e.g. registration form, sending comments). Unlike GET, the data is sent in the body of the request, offering greater security and flexibility.

- **PUT:**

Used to update or create a resource by sending a complete version of it. If the resource does not exist, the server can create it. This method is idempotent, which means that sending the same request repeatedly produces the same effect.

- **DELETE:**

Used to remove a specific resource from the server. Like PUT, it is idempotent, because deleting a resource several times does not change the final result (if the resource no longer exists, the operation has no additional effect).

6. Conclusion

In summary, this chapter has traced the origins, structure, and evolution of the World Wide Web, emphasizing the technologies and protocols that make it work. From the early days of static content in Web 1.0 to the intelligent, decentralized systems of Web 3.0, the Web has continuously transformed how we interact with information. By understanding the client-server architecture and the HTTP protocol, learners gain a solid foundation for exploring more advanced web technologies. These concepts are essential for anyone aiming to work with or develop for the modern Internet.

7. Exercise : Do you understand chapter1 !! lets answer the quiz

Exercise : Web Basics – Single-Choice Quiz

What does "WWW" stand for?

- ☐ World Wireless Web
- ☐ Wide World Web
- ☐ World Wide Web

Exercise

In an HTTP, what is the purpose of the GET method?

Exercise

Name one common protocol used between clients and servers.

Exercise

In a client-server model, which of the following is responsible for handling requests and providing responses?

- ☐ Client
- ☐ Server
- ☐ Database
- ☐ Router

Exercise

Which of the following is typically considered the "client" in a web application?

- ☐ Web browser
- ☐ Database
- ☐ Web server
- ☐ Operating system

Exercise

In the client-server model, which component sends a request to access a web page?

- ☐ Server
- ☐ Router
- ☐ Database
- ☐ Client

Glossary

Augmented Reality

is a technology that overlays digital information or virtual objects onto the user's view of the real world in real time to enhance perception and interaction.

brain-computer interfaces

is a system that translates real-time neural activity into commands enabling direct communication and control of external devices.

Internet of Things

is a network of interconnected physical devices embedded with sensors, software, and connectivity that collect, exchange, and act on data.

Virtual Reality

is a computer-generated simulation of a three-dimensional environment that users can interact with in a seemingly real or physical way using specialized hardware.

Abbreviation

AI: Artificial Intelligence

HTML: HyperText Markup Language

HTTP: HyperText Transfer Protocol

IP: Internet Protocol

TCP: Transmission Control Protocol

URL: Uniform Resource Locators

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