Network: Is a group of connected devices

Network Type:

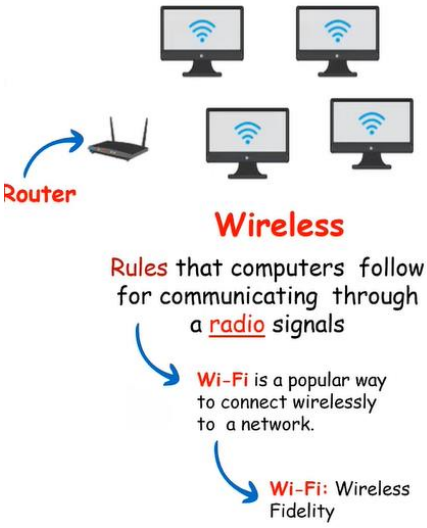
- **LAN** (Local Area Network): That has a group of connected devices
- WAN (Wide Area Network):

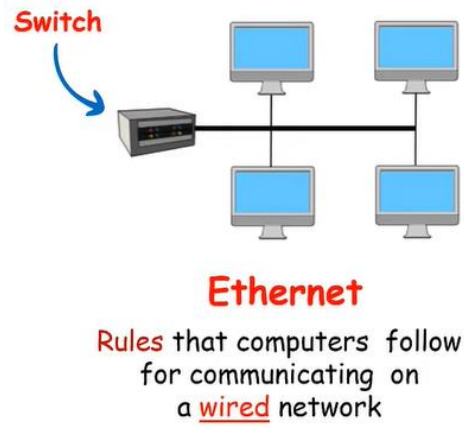
Communicating On LAN:

Connection Types:

- Wired: using wires or cables with Ethernet
- Wireless: Without using wires wi-fi (wireless fidelity).

Communication Ways:





Protocol: is a standard set of rules for how devices communicate through wires or wireless.

WAN: is made of connected **LAN**s that are far from each other (like in different part of countries or world)

MAN (Metropolitan Area Network): It is a medium-sized network larger than LAN and smaller than WAN.

- MAN can cover a broad area such as cities and towns.

Server: is a type of computer that shares information with other computers

- The ultimate function of a server is to receive, store, process, and share data.
- It provides services to other.

Your laptop can be a server 😊

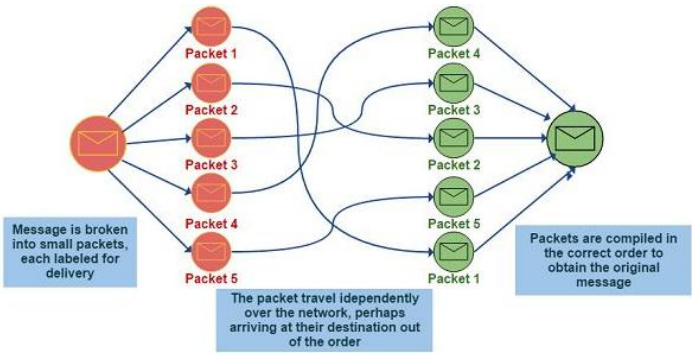
PC + Apache HTTP Server = Web Server

Server	PC
High reliability & Dependability	Less reliability & Dependability
High performance	Less performance
Can run for years without shutdown	Cannot run for years without shutdown
Less maintenance cost	High maintenance cost
High price	Less price

Some type of servers:

1. Web server
2. Application server
3. Mail server
4. Database server
5. File server
6. Image server
7. VoIP server
8. Game server
9. Printing Fax server

How Data is Transferred? (Packets)



- When we want to send a file (photo, video, game, PDF, etc.), the computer will divide the file into parts (packets) using a splitter. Each part is named a packet. Computer 1 informs Computer 2 that it will send 36 packets, and each packet contains information specifying its order to reconstruct the original file.

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TCP (Transmission Control Protocol):

- TCP defines how applications can create channels of communication across a network.
- It also manages how a message is assembled into smaller packets before they are then transmitted over the internet.
- And reassembled in the right order at the destination address.

What is IP Address ?

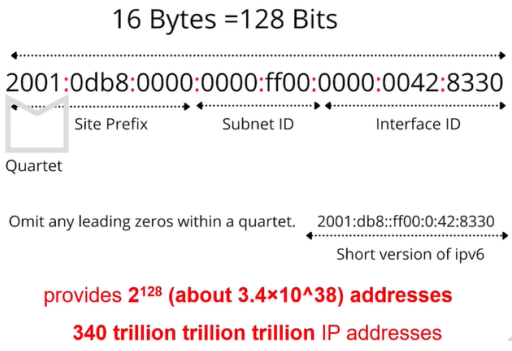
- Every computer on an Ethernet network is given an IP address.
- An IP address, like your home's street address, identifies network machines.
- Because each computer has its own IP address, it aids traffic flow between them.
- (IP address) is a numerical identifier that is connected with a certain computer or computer network.
- When computers are connected to the internet or Network, the IP address allows them to send and receive data

IPv4 Address Format (Dotted Decimal Notation)

IP: is Internet Protocol.

- The acronym IP stands for "Internet Protocol," which is a collection of rules that regulate the format of data transferred over the internet or a local network.

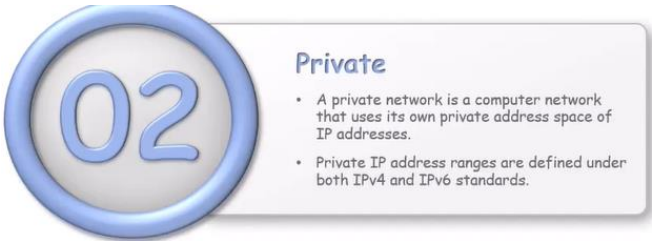
IPv6 Address Format (Hexadecimal Notation)

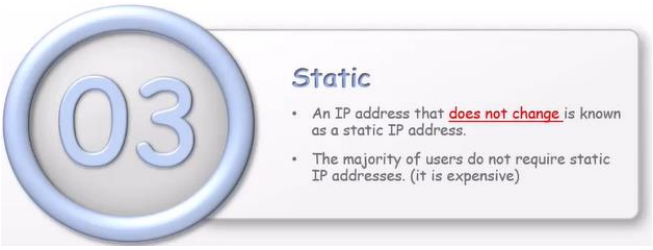


provides 2^{128} **(about 3.4×10^38) addresses**

340 trillion trillion trillion IP addresses

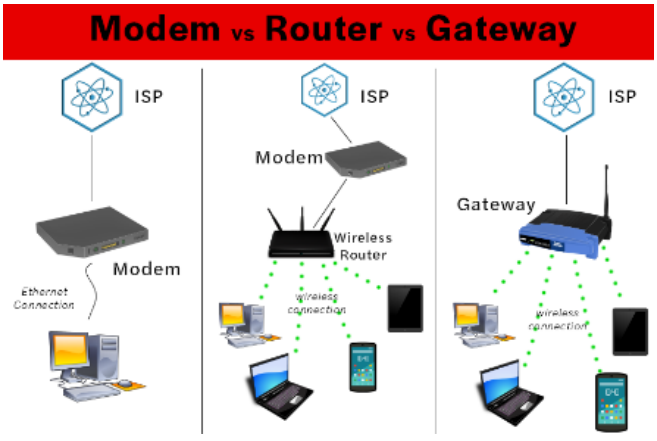
IP ADDRES TYPES





USE WITH SERVERS (STATIC IP)

- **MODEM VS GATEWAY VS ROUTER**



The **modem** does not spread the network. It connects the Internet to the device via an Internet cable and can be connected to only one device.

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Mesh Network : A network system where multiple devices, called nodes, work together to extend Wi-Fi coverage across a larger area.

Modem:

- **Function:** Connects your home network to the internet.
- **Connection:** Interfaces with your Internet Service Provider (ISP).
- **Ports:** Typically has one port for connecting to the ISP and one port for connecting to a router or single device.
- **Example:** Cable modem.

Router:

- **Function:** Distributes the internet connection from the modem to multiple devices within your home network.
- **Connection:** Connects to the modem via Ethernet and provides Wi-Fi and/or additional Ethernet ports.
- **Ports:** Multiple Ethernet ports for wired connections, Wi-Fi for wireless connections.
- **Example:** Wireless router.

- **2.4 GHz:** Longer range, more interference, slower speeds, fewer channels.
- **5 GHz:** Shorter range, less interference, faster speeds, more channels.

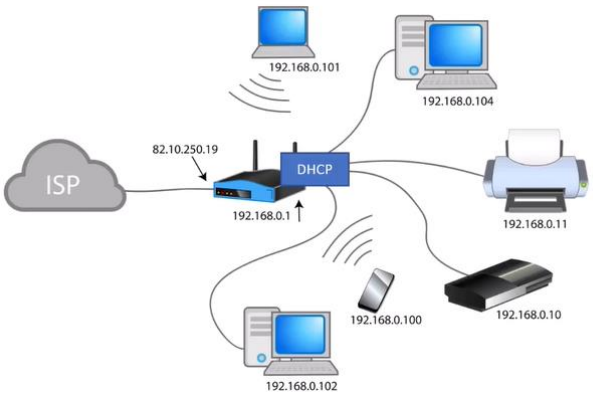
Gateway:

- **Function:** Combines the functions of both a modem and a router in one device.
- **Connection:** Connects directly to the ISP and provides Wi-Fi and Ethernet connections to multiple devices.
- **Ports:** Similar to a router, with ports for both ISP connection and multiple devices.
- **Example:** Modem/router combo provided by an ISP.

Switch:

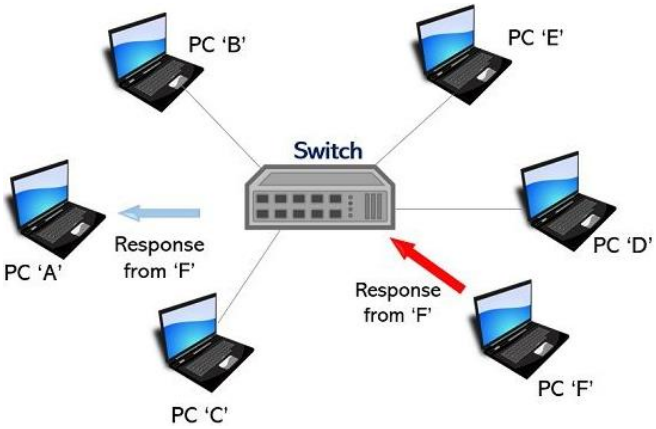
- **Function:** Expands the number of available Ethernet ports, allowing more wired devices to connect to the network.
- **Connection:** Connects to a router to receive internet access and distribute it to multiple devices.
- **Ports:** Typically has many Ethernet ports (4, 8, 16, etc.) for connecting multiple devices.
- **Example:** Network switch used in offices or large homes for wired connections.

DHCP (Dynamic Host Configuration Protocol):



DHCP: Protocol that automatically assigns IP addresses to devices on a network for efficient management and reduced configuration errors.

SWITCH

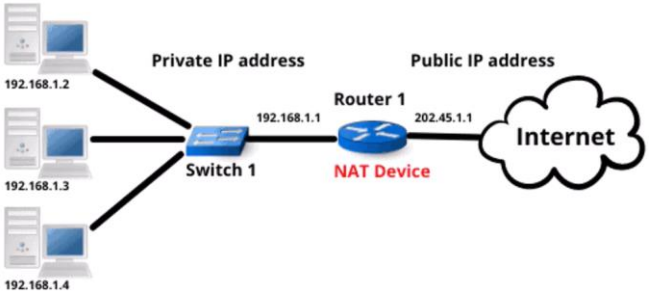


NAT (Network Address Translation):

Function: Allows multiple devices on a local network to share a single public IP address for accessing the internet.

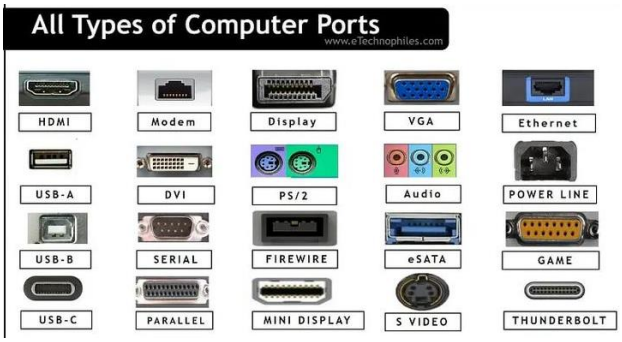
Operation:

- **Translation:** NAT translates private IP addresses of devices in the local network to a public IP address and vice versa.
- **Mapping:** Maintains a mapping table to track which private IP address corresponds to which public IP address/port combination.

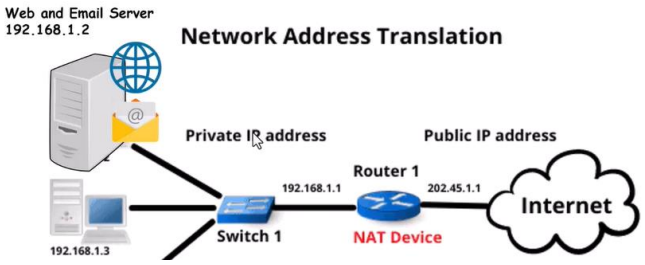


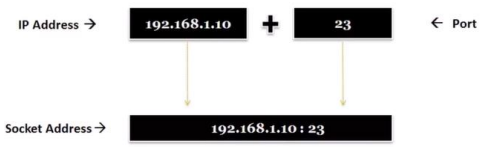
ISP (Internet Service Provider): Provides internet access to individuals, businesses, and other organizations.

HARDWARE PORTS:



Software Port: A virtual communication endpoint identified by a number, allowing multiple applications to use the same IP address for network communication.



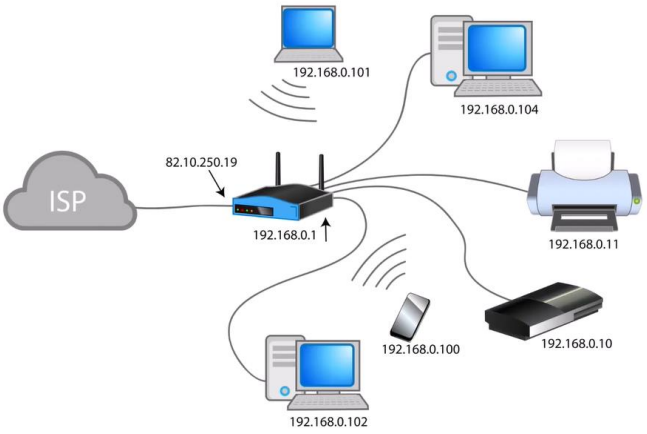


In networking, a **socket** is used to allow many processes within a single or different host to use TCP communication simultaneously.

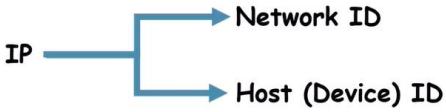
SOFTWARE PORTS:

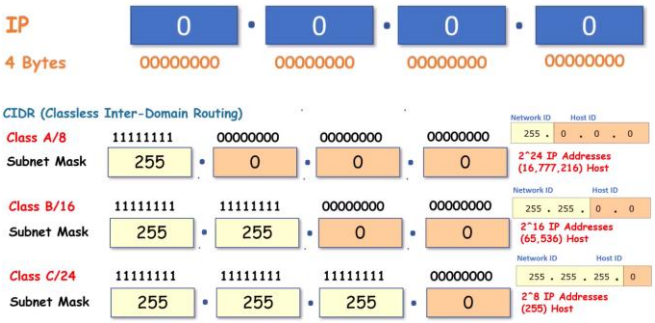
Port Number	Process Name	Protocol Used	Description
20	FTP-DATA	TCP	File transfer---data
21	FTP	TCP	File transfer---control
22	SSH	TCP	Secure Shell
23	TELNET	TCP	Telnet
25	SMTP	TCP	Simple Mail Transfer Protocol
53	DNS	TCP & UDP	Domain Name System
69	TFTP	UDP	Trivial File Transfer Protocol
80	HTTP	TCP & UDP	Hypertext Transfer Protocol
110	POP3	TCP	Post Office Protocol 3
123	NTP	TCP	Network Time Protocol
143	IMAP	TCP	Internet Message Access Protocol
443	HTTPS	TCP	Secure implementation of HTTP

Subnetting: Dividing a larger network into smaller subnets to improve management, performance, and security by segmenting traffic and reducing broadcast domains.



203.177.100.2





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ISP: Internet Service Provider
ISP is a company that provides Internet connections and services to individuals and organizations.

A MAC (Media Access Control) address is a unique identifier assigned to a network interface controller (NIC) for communications on a network. Here are some key points about MAC addresses:

Characteristics of a MAC Address:

Format:

A **MAC address** is typically represented as a 12-digit hexadecimal number.

It is usually written in one of the following formats:

1. MM:MM:MM:SS:SS
2. MM-MM-MM-SS-SS-SS
3. MMMM.MMSS.SSSS

Components:

- The first half (24 bits) of the MAC address identifies the manufacturer of the NIC, known as the Organizationally Unique Identifier (OUI).
- The second half (24 bits) is assigned by the manufacturer and is unique to the specific NIC.

Purpose of a MAC Address:

Unique Identification:

- Ensures that each device on a local network can be distinctly identified.

Layer 2 Communications:

- Operates at the Data Link Layer (Layer 2) of the OSI model.
- Used for communication within the same local area network (LAN).

Network Segmentation:

- Helps in directing data packets within a subnet.

Uses of a MAC Address:

Network Security:

- Used in MAC address filtering to allow or deny network access to specific devices.

Network Management:

- Helps administrators monitor and troubleshoot network traffic.

DHCP Assignments:

- DHCP servers use MAC addresses to assign static IP addresses to known devices.

Address Resolution Protocol (ARP):

- Translates IP addresses to MAC addresses, enabling devices to find each other on a LAN.

Example of a MAC Address:

- A typical MAC address might look like this: 00:1A:2B:3C:4D:5E.

A **VPN** (Virtual Private Network) is a technology that creates a secure and encrypted connection over a less secure network, typically the internet. Here are the main points about VPNs:

Key Features of a VPN:

1. **Encryption:**
   - Encrypts data transmitted between your device and the VPN server, ensuring privacy and security.
2. **Remote Access:**
   - Allows users to access resources on a private network remotely as if they were directly connected to it.
3. **Anonymity:**
   - Masks your IP address with the IP address of the VPN server, enhancing online privacy and anonymity.
4. **Bypassing Geo-Restrictions:**
   - Enables users to access region-restricted content by connecting to servers in different locations.

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What is the İnternet?

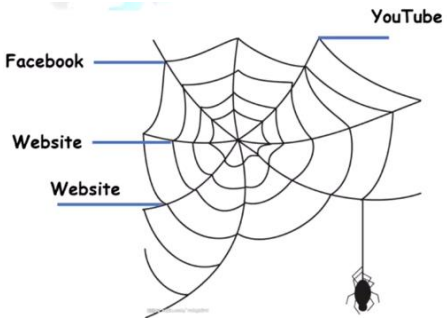
The **Internet** or Net (Network of Networks) is the largest computer network in the world that connects billions of computer users.

- Internet is a giant network of smaller network.
- Word internet came from Interconnection + Network.
- No one owns the internet.

What is WWW?

WORLD WIDE WEB, or web, is a collection of websites that are linked together through the internet.

- The web is the content you can view, read, listen to, stream, and download.
- Most websites have links that connect them to other websites.
- If you were to draw an image of all these links, it would look like a spiderweb made of websites around the globe. That 's why it 's called the World Wide Web.

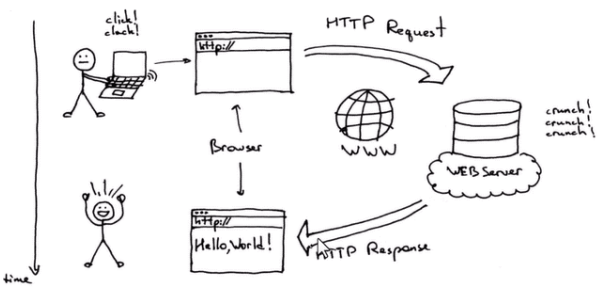


What is browser?

Borwser is a software application that lets people access the World Wide Web.

It is used to locate, fetch and display content on the internet, including web pages, images, videos, documents, and other files.

In other words browser is the program that request a webpage and download it, interpret it and show it on the screen in the right format



What is Http?

Hypertext Transfer Protocol (HTTP) is an application-layer protocol for transmitting hypermedia documents, such as HTML.

It is a protocol used to access the data on the World Wide Web (www).

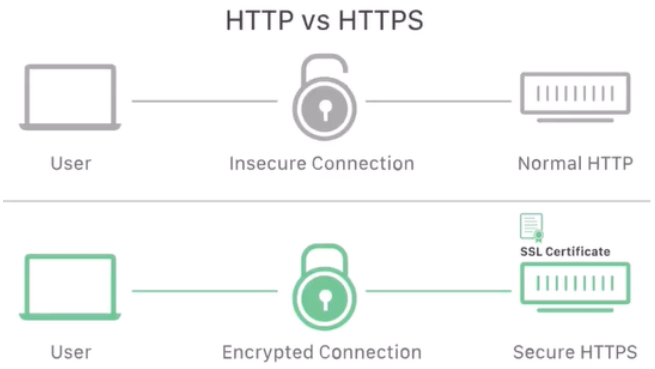
The HTTP protocol can be used to transfer the data in the form of plain text, hypertext, audio, video, and so on.

What is Https?

HTTPS is HTTP with encryption and verification.

The only difference between the two protocols is that HTTPS uses TLS (Transport Layer Security) or SSL (Secured Socket Layer) to encrypt normal HTTP requests and responses, and to digitally sign those requests and responses. As a result, HTTPS is far more secure than HTTP.

TLS is higher security than SSL and more reliable and faster.



- **Google**: 172.217.0.0
- **YouTube**: 142.250.64.78
- **Facebook**: 31.13.71.36
- **Twitter**: 104.244.42.65
- **Instagram**: 157.240.229.174

These IP addresses are subject to change due to the use of content delivery networks (CDNs) and other network optimizations. Always verify the current IP address if you need it for specific technical purposes.

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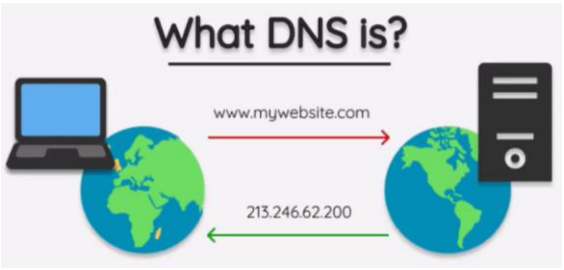
Domain Name:

A domain name is the human-readable address of a website, like "example.com." It translates into an IP address, which computers use to locate websites on the internet. Domain names make it easier for users to access websites without needing to remember numerical IP addresses.

What is DNS?

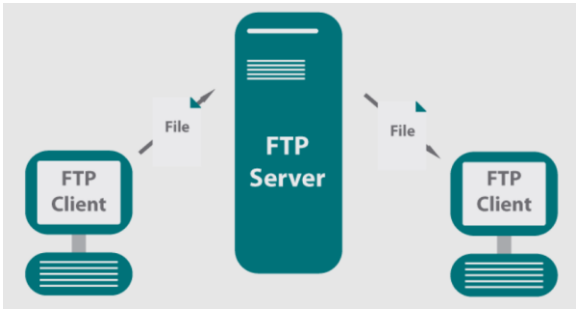
DNS (**Domain Name System**) is like the phonebook of the internet. It translates human-friendly domain names (e.g., "example.com") into IP addresses (e.g., 192.0.2.1) that computers use to locate and connect to websites. This system ensures that when you type a website address, your browser can find and load the correct website.



A Subdomain is a prefix added to a domain name to create a separate section of a website, like "blog.example.com." It helps organize content within the main site.

A **URL** (**Uniform Resource Locator**) is the web address used to access resources on the internet, like a webpage. It includes the protocol (e.g., "https://"), the domain name (e.g., "example.com"), and often additional paths or parameters to specify content or actions.

FTP (File Transfer Protocol) is a standard network protocol used to transfer files between a client and a server over the internet. It's commonly used for uploading or downloading files to and from websites or servers.



XML (eXtensible Markup Language) and **JSON** (JavaScript Object Notation) are both data formats used for storing and exchanging information.

- **XML** is a markup language with a more rigid, hierarchical structure, often used in web services and document formats. It uses tags (like HTML) to define data.
- **JSON** is a lightweight data-interchange format that's easier for humans to read and write. It's widely used in web APIs and is built on key-value pairs.

XML vs. JSON:

Readability: JSON is simpler and more human-readable, while XML can be more verbose.

Data structure: JSON is better suited for simpler, data-centric formats; XML supports more complex data structures with attributes and metadata.

Usage: JSON is commonly used in modern web applications (like RESTful APIs), whereas XML is used in older systems and specific cases like document storage or SOAP-based services.

Speed: JSON is faster to parse and process due to its simplicity.

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