Unit-1 Basic of Network

Subject-Principles of Internet

[1]Network:

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

Advantages of Computer Networks

1. **Computer Networking helps to develop more opportunities for the field of information security.**
   → A device can be the most influential tool to safeguard personal information.

2. **Being on the cheaper side, almost every person can bear the expense of a computer network.**
   → A family can get a new device/node for less than Rs 17000/- and still enjoy the advantages of a network.
3. **A network provides a better-personalized experience.**
   → Modern Computers give a very diverse user experience.
   → One can have more computing power in their pocket as compared to that of astronauts flying in space.
4. **It allows us to collaborate on projects.**
   → Most companies use computer networking to connect with the teams to get all the updates and get the shared documents.
   → The same document can be shared among many people.

5. **It can ease us to send/receive large-sized files in a few blinks of the eye.**
   → Nowadays, we've facilities like iCloud, google cloud, dropbox, etc. With the help of these, we can send and receive files, regardless of the size of the file.

Disadvantages of Computer Networks

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1. **It can lead us to lose access to information very quickly.**
   → If a file crashes over a computer network, we will not be able to access that information instantly.
   → Managing an extensive network is complex.
2. **Work-life balance gets changed due to computer networking.**
   → Computer network makes each of the tasks handy in our device and contributes to changing the work-life balance.
   → It can lead us to lose access to information very quickly.

3. **The cost of computer networking is very high.**
   → Executing the network as a whole, along with the cables, is pretty expensive.
   → The equipments used in computer networking are also expensive.

4. **Computer Networking can direct us to various types of distractions.**
   → If self-discipline is not present with personal interactions with the technology.
   → Switching between tasks can lose up to 40% productivity.

5. [2]**It requires a specific type of setup.**
   → It requires a minimum range of electromagnetic impedance to get appropriate coverage for a network.
   → Exceptional care is required during the installation.

Computer network means to connect multiple computer systems with each other through physical medium (Cable or Wire) or wireless medium and this architecture is known as "**Computer Network**".

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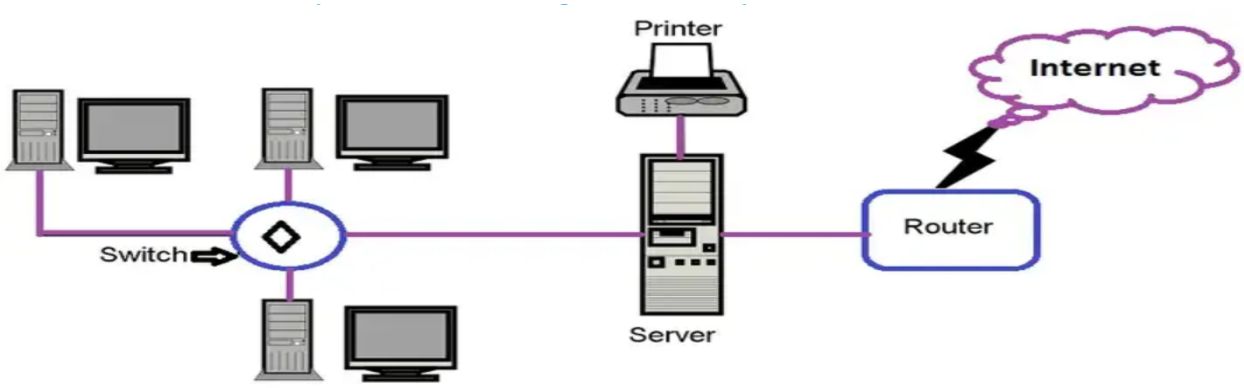
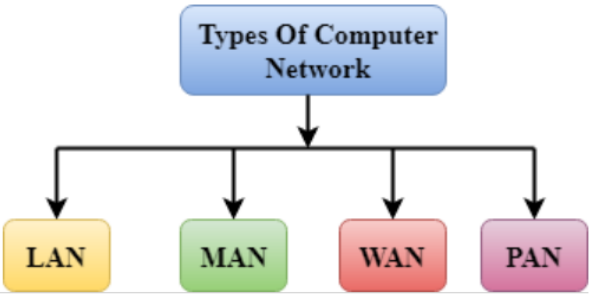


Computer Network Diagram

A computer network can be categorized by their size. A **computer network** is mainly of **four types**:

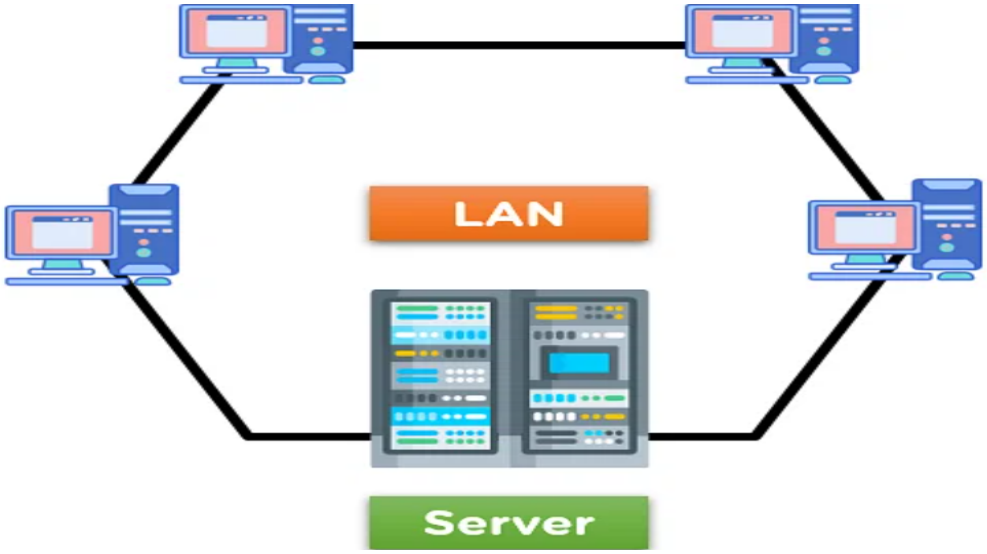
- LAN(Local Area Network)
- PAN(Personal Area Network)
- MAN(Metropolitan Area Network)
- WAN(Wide Area Network)



LAN

The Local Area Network (LAN) is designed to connect multiple network devices and systems within a limited geographical distance. The devices are connected using multiple protocols for properly and efficiently exchanging data and services.

Advantage	Disadvantage
Transmission of data and services is relatively higher than other network connections.	Need constant administration of experienced engineers for functioning.
The Network Server acts as a central unit for the whole network.	Probability of leak of sensitive data by LAN administration.



What Is Metropolitan Area Network (MAN)?

The Metropolitan Area Network (MAN) is a network type that covers the network connection of an entire city or connection of a small area. The area covered by the network is connected using a wired network, like data cables.

Advantage	Disadvantage
Provides Full-Duplex data transmission in the network channel for devices.	High probability of attack from hackers and cybercriminals due to large networks.
The network connection area covers an entire city or	The need for good quality hardware and the

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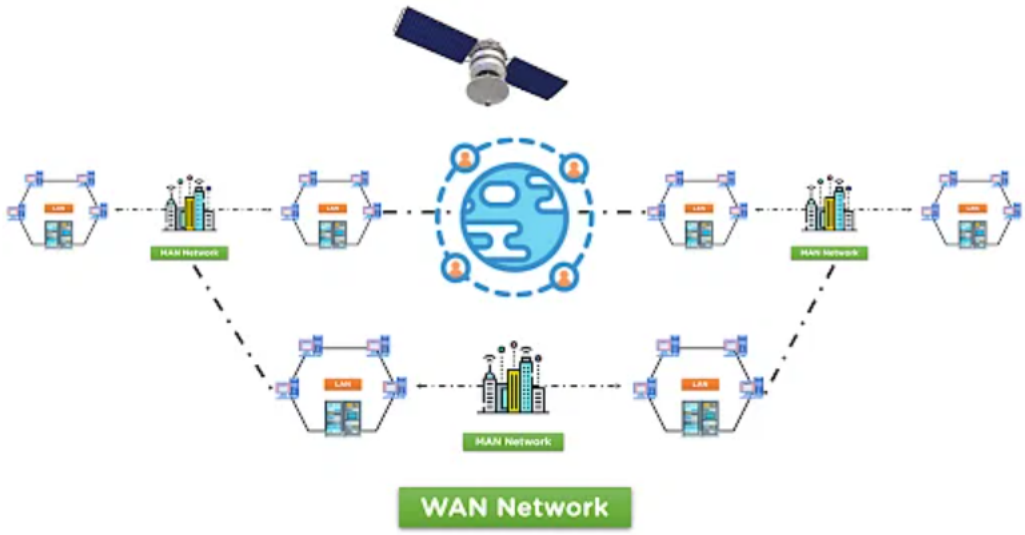
some parts u[4]sing the optic cables.	installation cost is very high.

What Is Wide Area Network (WAN)?



[5]

The Wide Area Network (WAN) is designed to connect devices over large distances like states or between countries. The connection is wireless in most cases and uses radio towers for communication.

The WAN network can be made up of multiple LAN and MAN networks.

Advantage	Disadvantage
This network covers a high geographical area and is used for large-distance connections.	High cost to set up the network and the Support of experienced technicians is needed to maintain the network.
They also use radio towers and connect channels	It is difficult to prevent hacking and debug a

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for users.	large network.

What is a network topology?

A network topology is the physical and logical arrangement of nodes and connections in a network. Nodes usually include devices such as switches, routers and software with switch and router features. Network topologies are often represented as a graph.

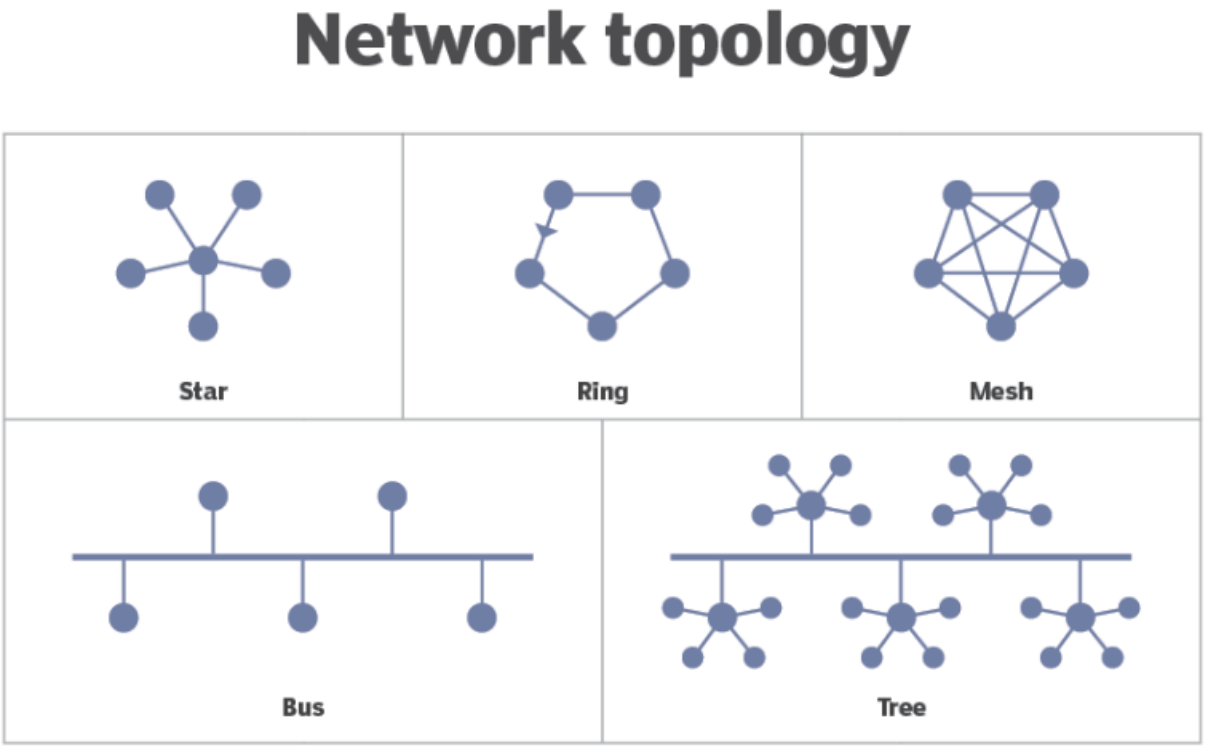
Network topologies describe the arrangement of networks and the relative location of traffic flows. Administrators can use network topology diagrams to determine the best placements for each node and the optimal path for traffic flow. With a well-defined and planned-out network topology, an organization can more easily locate faults and fix issues, improving its data transfer efficiency.

Network geometry can be defined as the *physical topology* and the *logical topology*. Network topology diagrams are shown with devices depicted as network nodes and the connections between them as lines.

Why is network topology important?

Network topology plays a major role in how a network functions. Namely, the topology has a direct effect on network functionality. Choosing the right topology can help increase performance, as a properly chosen and

maintained network topology increases energy efficiency and data transfer rate[6]s.



There are several types of topologies. For example, physical topologies include the following:

1. **Bus network.** In the bus network topology, every node is connected in series along a single cable. This arrangement is found today primarily in [7]cable broadband distribution networks.

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1) Bus Topology

- The bus topology is designed in such a way that all the stations are connected through a single cable known as a backbone cable.
- Each node is either connected to the backbone cable by drop cable or directly connected to the backbone cable.
- When a node wants to send a message over the network, it puts a message over the network. All the stations available in the network will receive the message whether it has been addressed or not.
- The bus topology is mainly used in 802.3 (ethernet) and 802.4 standard networks.
- The configuration of a bus topology is quite simpler as compared to other topologies.
- The backbone cable is considered as a "**single lane**" through which the message is broadcast to all the stations.
- The most common access method of the bus topologies is **CSMA** (Carrier Sense [8]Multiple Access).

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2. **Ring network.** In the ring network topology, the nodes are connected in a closed-loop configuration. Some rings pass data in one direction only, while others are capable of transmission in both directions. These bidirectional ring networks are more resilient than bus networks since traffic can reach a node by moving in either direction. Metro networks based on Synchronous Optical Network technology are the primary example of ring networks.

2) Ring Topology

- Ring topology is like a bus topology, but with connected ends.
- The node that receives the message from the previous computer will retransmit to the next node.
- The data flows in one direction, i.e., it is unidirectional.
- The data flows in a single loop continuously known as an endless loop.
- It has no terminated ends, i.e., each node is connected to other node and having no termination point.

- The data in a ring topology flow in a clockwise direction.

3. **Star network.** In the star network topology, a central device connects to all other nodes through a central hub. Switched local area networks based on Ethernet switches and most wired home and office networks have a physical star topology.

- Star topology is an arrangement of the network in which every node is connected to the central hub, switch or a central computer.
- The central computer is known as a **server**, and the peripheral devices attached to the server are known as **clients**.
- Coaxial cable or RJ-45 cables are used to connect the computers.
- Hubs or Switches are mainly used as connection devices in a **physical star topology**.

- [9]Star topology is the most popular topology in network implementation.

4. Tree network. The tree network topology consists of one root node, and all other nodes are connected in a hierarchy. The topology itself is connected in a star configuration. Many larger Ethernet switch networks, including data center networks, are configured as trees.

- Tree topology combines the characteristics of bus topology and star topology.
- A tree topology is a type of structure in which all the computers are connected with each other in hierarchical fashion.
- The top-most node in tree topology is known as a root node, and all other nodes are the descendants of the root node.
- There is only one path exists between two nodes for the data transmission. Thus, it forms a parent-child hierarchy.

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5. **Mesh network.** The mesh network topology links nodes with connections so that multiple paths between at least some points of the network are available. A network is considered to be *fully meshed* if all nodes are directly connected to all other nodes and *partially meshed* if only some nodes have multiple connections to others. Meshing multiple paths increases resiliency but also increases cost. However, more space is needed for dedicated links.

- Mesh technology is an arrangement of the network in which computers are interconnected with each other through various redundant connections.
- There are multiple paths from one computer to another computer.
- It does not contain the switch, hub or any central computer which acts as a central point of communication.
- The Internet is an example of the mesh topology.
- Mesh topology is mainly used for WAN implementations where communication failures are a critical concern.
- Mesh topology is mainly used for wireless networks.

[10]**Mesh topology is divided into two categories:**

- Fully connected mesh topology
- Partially connected mesh topology
- **Full Mesh Topology:** In a full mesh topology, each computer is connected to all the computers available in the network.
- **Partial Mesh Topology:** In a partial mesh topology, not all but certain computers are connected to those computers with which they communicate frequently.

6. **Hybrid network.** The hybrid network topology is any combination of two or more topologies. Hybrid topologies typically provide exceptional flexibility, as they can accommodate a number of setups. For example, different departments in the same organization may opt for personalized network topologies that are more adaptable to their network needs.

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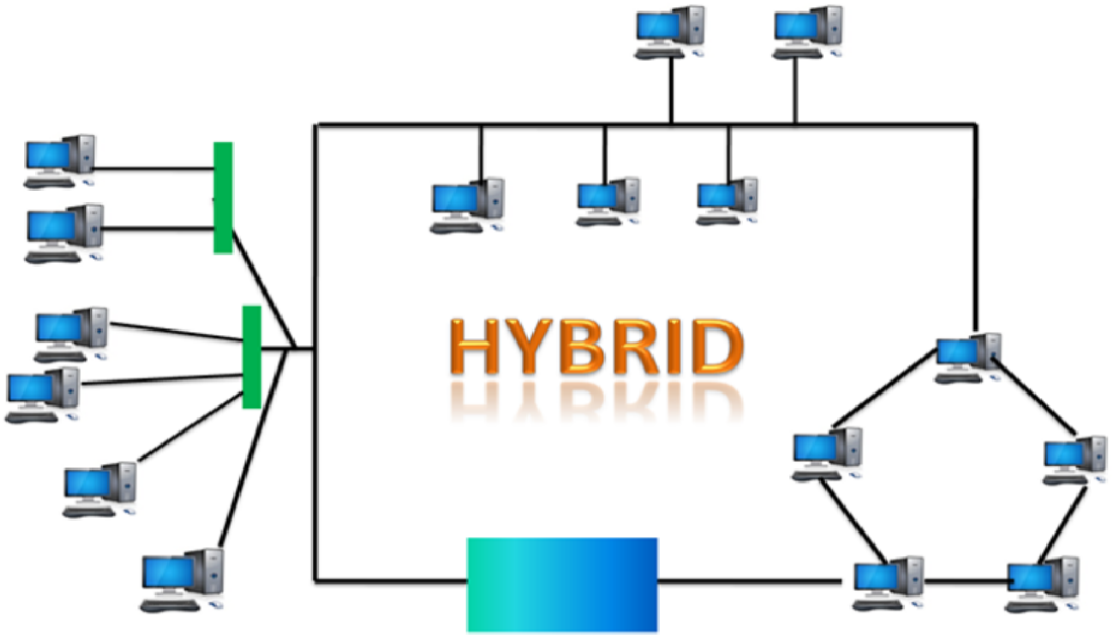
6) Hybrid Topology



- The combination of various different topologies is known as **Hybrid topology**.
- A Hybrid topology is a connection between different links and nodes to transfer the data.
- When two or more different topologies are combined together is termed as Hybrid topology and if similar topologies are connected with each other will not result in Hybrid topology. For example, if there exist a ring topology in one branch of ICICI bank and bus topology in another branch of ICICI bank, connecting these two topologies will result in Hybrid topology.

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A logical topology for a network refers to the relationship between nodes and logical connections -- defining how data should transfer.

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UNIT-2 Internet Basics

Subject-Principles of Internet

Internet:

The Internet is a global collection of computer networks that are linked together by devices called routers and use a common set of protocols for data transmission known as TCP/IP (transmission control protocol / Internet protocol). The primary purpose of the Internet is to facilitate the sharing of information. There are many different tools used on the Internet to make this possible. Some of the more common tools include email, list servers, newsgroups, telnet, gopher, FTP, and the World Wide Web. Probably the most popular of all Internet tools is the World Wide Web.

Protocols: A network protocol is **an established set of rules that determine how data is transmitted between different devices in the same network**. Essentially, it allows connected devices to communicate with each other, regardless of any differences in their internal processes, structure or design.

Advantages of Internet

1. Connectivity – As we know we are connected to the internet to stay connected with our family, friends, colleagues, services, etc.
2. Information – We can search and get many search results for our questions and the information can increase knowledge.
3. Online Payment – Using payment modes such as Paytm, [1]GPay, and Bhim UPI are many payment methods to pay online.

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4. Digital Marketing – We are making our websites and making business online.

5. Net Banking Services – Banking services such as payment, debit, credit, changing our details, and scheduling payment are an integral part of secure payment.

Disadvantages Of Internet

1. Wastage of time – Considering today's lifestyle, one prominent advantage of the Internet is addiction. People are getting addicted to the internet, watching videos and reels without realizing they are wasting so much of their time.

2. Cybercrime – It is increasing rapidly as more information is shared and getting leaked.

3. Identity theft – It is one major concern on a bigger level such as [2]higher organizations, government, and private sectors.

4. Increase in cyber attacks in the banking sector and corporate sector – Information is getting leaked, shared, and misused for harm, theft, privacy violation, and harassment.

Internet Applications:

The Internet has many important applications. Of the various services available via the Internet, the three most important are e-mail, web browsing, and **peer-to-peer services** . E-mail, also known as electronic mail, is the most widely used and successful of

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Internet applications. Web browsing is the application that had the greatest influence in dramatic expansion of the Internet and its use during the 1990s. Peer-to-peer networking is the newest of these three Internet applications, and also the most controversial, because its uses have created problems related to the access and use of copyrighted materials.

1. **E-mail:** E-mail has become an important part of personal communications for hundreds of millions of people, many of whom have replaced it for letters or telephone calls. In business, e-mail has become an important advertising medium, particularly in instances where the demand for products and services is time sensitive. For example, tickets for an upcoming sporting event are marketed by sending fans an e-mail message with information about availability and prices of the tickets.
2. **Web Browsing:** The web browser is another Internet application of critical importance. Unlike email, which was developed and then standardized in the early, noncommercial days of the Internet, the web browser was developed in a highly commercialized environment dominated by such corporations as Microsoft and Netscape, and heavily influenced by the World Wide Web Consortium (W3C). While Microsoft and Netscape have played the most obvious parts in the development of the web browser, particularly from the public perspective, the highly influential role of the W3C may be the most significant in the long term.
3. **Peer to Peer Computing**: One of the fastest growing, most [3]controversial, and potentially most important areas of Internet

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applications is peer-to-peer (P2P) networking. Peer-to-peer networking is based on the sharing of physical resources, such as hard drives, processing cycles, and individual files among computers and other intelligent devices. Unlike client-server networking, where some computers are dedicated to serving other computers, each computer in peer-to-peer networking has equivalent capabilities and responsibilities.

IP Address: All the computers of the world on the Internet network communicate with each other with underground or underwater cables or wirelessly. If I want to download a file from the internet or load a web page or literally do anything related to the internet, my computer must have an address so that other computers can find and locate mine in order to deliver that particular file or webpage that I am requesting. In technical terms, that address is called IP Address or Internet Protocol Address.

The working of IP addresses is similar to other languages. It can also use some set of rules to send information. Using these protocols we can easily send, and receive data or files to the connected devices. There are several steps behind the [4]scenes. Let us look at them

- Your device directly requests your Internet Service Provider which then grants your device access to the web.
- And an IP Address is assigned to your device from the given range available.
- Your internet activity goes through your service provider, and they route it back to you, using your IP address.

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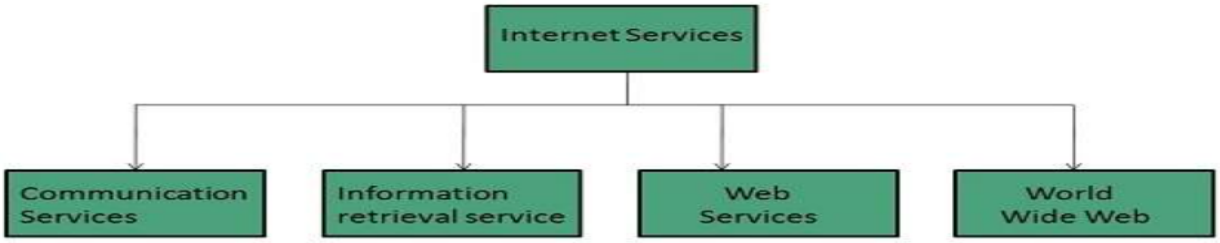
- Your IP address can change. For example, turning your router on or off can change your IP Address.
- When you are out from your home location your home IP address doesn't accompany you. It changes as you change the network of your device.

Internet Services: Internet Services allows us to access huge amounts of information such as text, graphics, sound and software over the internet. Following diagram shows the four different categories of Internet Services.



1. Communication Services

There are various Communication Services available that offer exchange of information with individuals or groups. The following table gives a brief introduction to these services:

[5]S. N.	Service Description
1	Electronic Mail Used to send electronic message over the internet.
2	Telnet Used to log on to a remote computer that is attached to internet.
3	Newsgroup Offers a forum for people to discuss topics of common interests.
4	Internet Relay Chat (IRC) Allows the people from all over the world to communicate in real time.
5	Mailing Lists Used to organize group of internet users to share common information through e-mail.
6	Internet Telephony (VoIP) Allows the internet users to talk across internet to any PC equipped to receive the call.

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7	Instant Messaging Offers real time chat between individuals and group of people. Eg. Yahoo messenger, MSN messenger.

2. Information Retrieval Services

There exist several Information retrieval services offering easy access to information present on the internet. The following table gives a brief introduction to these services:

S.N.	Service Description
1	File Transfer Protocol (FTP) Enable the users to transfer files.
2	Archie It's updated database of public FTP sites and their content. It helps to search a file by its name.
3	Gopher Used to search, retrieve, and display documents on remote sites.

[6]4	Very Easy Rodent Oriented Netwide Index to Computer Achieved (VERONICA) VERONICA is gopher based resource. It allows access to the information resource stored on gopher's servers.

3. Web Services

Web services allow exchange of information between applications on the web. Using web services, applications can easily interact with each other.

The web services are offered using the concept of Utility Computing.

4. World Wide Web (WWW)

WWW is also known as W3. It offers a way to access documents spread over several servers over the internet. These documents may contain texts, graphics, audio, video, hyperlinks. The hyperlinks allow the users to navigate between the documents.

URL: A URL is a type of uniform resource identifier and is address of a resource on the World Wide Web and the protocol used to access it. It is used to indicate the location of a web resource to access the web pages.

The URL sends users to a specific resource online such as video, webpage, or other resources. When you search any query on Google, it will display the multiple URLs of the resource that are all related to your search query. The displayed URLs are the hyperlink to access the web pages.

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A URL (Uniform Resource Locator) contains the information, which is as follows:

- The port number on the server, which is optional.
- It contains a protocol that is used to access the resource.
- The location of the server
- A fragment identifier
- In the directory structure of the server, it contains the location of the resource.

http:// or https://

The http is a protocol that stands for Hypertext Transfer Protocol. It tells the browser to which protocol will be preferred to use for accessing the information that is specified in the domain.

The https (Hypertext Transfer Protocol Secure) is an enhanced protocol as compared to http as it concerned with security. It provides the surety that the information, which is transmitted over HTTP is secure and encrypted. The colon (:) and two forward slashes (//) are used to separate the protocol from the rest of the part of the URL.

www.

The www is used to distinguish the content, which stands for World Wide Web. This portion of the URL can be left out many times, as it is not required. For instance, if you type "http://javatpoint.com," you will still get the javatpoint website. For an important subpage, this portion can also be substituted, which is known as a subdomain.

Email: Email stands for Electronic Mail. It is a method to send messages from one computer to another computer through the internet. It is mostly used in business, education, technical communication, and document interactions. It allows communicating with people all over the world without bothering them.
In 1971, a test email sent Ray Tomlinson to himself containing text.
It is the information sent electronically between two or more people over a ne[7]twork. It involves a sender and receiver/s.

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An email is communication that happens in real time and can get important data across to people in various geographies. An email is a record of the communications that has happened and is stored in the server of the organization. One has to be very cautious while typing out a mail.

Email Features:

Here are some key features of an email:

1. Sender and recipient: An email consists of a sender who initiates the email and a recipient who receives it. Each email has a "From" field specifying the sender and a "To" field specifying the recipient(s).
2. Subject: The subject line provides a brief summary or description of the email's content. It helps recipients quickly understand the purpose or topic of the message.
3. Body: The body of an email contains the actual content or message. It can include text, links, images, and attachments. Email messages can be formatted using fonts, colors, and other styling options.
4. Attachments: Emails can include attachments, which are files or documents attached to the message. Common types of attachments include documents, images, spreadsheets, and presentations.
5. CC (Carbon Copy) and BCC (Blind Carbon Copy): These fields allow you to send copies of the email to additional recipients. CC recipients are visible to all other recipients, while BCC recipients are not visible to others.
6. Reply and Forward: Email clients provide options to reply to or forward an email. Reply allows you to respond directly to the sender, while Forward enables you to send the email to other recipients.
7. Signature: Email signatures are personalized blocks of text that appear at the end of the email. They often contain the sender's contact information, job title, company name, or other relevant details.
8. Inbox and folders: Emails are organized in an inbox, which serves as the primary location for received messages. Users can create folders to categorize and store emails based on different criteria such as projects, topics, or senders.
9. Spam filtering: To combat unwanted or unsolicited emails (spam), email services employ spam filters that automatically detect and divert such messages to a separate spam or junk folder.

10. Search functionality: Email clients offer search features that allow users to search for specific emails or content within emails. This helps users locate past conversations or important information.
11. Read receipts: Some email systems support read receipts, which notify the sender when the recipient has opened or read their email. However, read receipts are often optional and can be disabled by recipients.
12. Encryption and security: Email providers and clients may offer encryption options to secure the content of emails during transmission and storage. This helps protect sensitive information from unauthorized access.

Email Providers:

Email providers, also known as **email service providers (ESPs),** are companies or organizations that offer email services to individuals and businesses. They provide the infrastructure, servers, and software required for sending, receiving, and managing emails. Email providers typically offer email accounts, storage space, and various features and functionalities related to email communication. Some of the popular email providers include:

1. Gmail: Provided by Google, Gmail is one of the most widely used email services. It offers a user-friendly interface, ample storage, powerful search capabilities, integration with other Google services, and advanced security features.
2. Outlook.com: Outlook.com, formerly known as Hotmail, is a web-based email service provided by Microsoft. It offers a clean interface, integration with Microsoft Office applications, spam filtering, and a generous amount of storage.
3. Yahoo Mail: Yahoo Mail is an email service provided by Yahoo. It offers features such as a customizable interface, large storage capacity, attachment previews, filters, and integration with Yahoo's news and entertainment services.
4. Apple Mail: Apple Mail is the default email client for Apple devices, including iPhones, iPads, and Mac computers. It offers seamless integration with other Apple services and features like Siri voice commands, advanced search, and encryption.

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UNIT-3 Introduction to Internet Protocol
Subject-Principles of internet

[1]Internet Protocol:

Internet Protocol (IP) is a set of rules and protocols that govern how data is transmitted and received over the internet. It provides the foundation for data communication by defining how packets of information are addressed, routed, and delivered between devices on a network.

IP operates at the network layer of the TCP/IP protocol suite, which is the standard communication protocol used for internet connectivity. It enables devices to send and receive data across interconnected networks by assigning a unique numerical address, called an IP address, to each device connected to the network.

IP is responsible for breaking down data into small packets and attaching necessary information to each packet, such as the source and destination IP addresses. These packets are then transmitted across the internet independently and reassembled at the destination. IP also handles routing, determining the most efficient path for packets to travel from the source device to the destination device through a series of routers.

In addition to IP, other protocols such as Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) work in conjunction with IP to provide reliable and connection-oriented (TCP) or connectionless (UDP) communication services. Together, these protocols form the foundation of internet communication and enable devices to exchange data reliably and efficiently across the global network.

TCP:

TCP stands for ***Transmission Control Protocol***. It is one of the core protocols of the Internet Protocol Suite (TCP/IP) and operates at the transport layer. TCP provides reliable, connection-oriented communication between devices over an IP-based network.

TCP ensures that data packets transmitted over a network are delivered accurately, in the correct order, and without errors. It achieves this by establishing a virtual connection between the sender and receiver before data transmission begins. This connection-oriented approach is different from the connectionless nature of User Datagram Protocol (UDP)

Some key features and functionalities of TCP:

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1. ***Reliable Delivery***: TCP guarantees reliable delivery of data by implementing error detection, retransmission of lost packets, and acknowledgment mechanisms. It ensures that data is received correctly and in the intended sequence.

2. ***Flow Control***: TCP employs flow control mechanisms to manage the rate at which data is transmitted between sender and receiver. It prevents the receiver from being overwhelmed with more data than it can handle by using techniques such as windowing and sliding windows.

3. ***Congestion Control:*** TCP is designed to handle network congestion by adjusting the rate of data transmission. It monitors the network for signs of congestion, reduces the transmission rate when necessary, and increases it again when congestion subsides. This helps to maintain network stability and prevent packet loss.

4. ***Connection Establishment and Termination:*** Before data transfer can occur, TCP establishes a connection between the sender and receiver. This process involves a three-way handshake, where the sender and receiver exchange control messages to synchronize sequence numbers and other parameters. Similarly, when the communication is complete, TCP terminates the connection gracefully.

5. ***Full Duplex Communication***: TCP supports full-duplex communication, which means that data can be sent and received simultaneously in both directions between the sender and receiver.

UDP:

UDP stands for ***User Datagram Protocol***. It is a core protocol of the Internet Protocol Suite (TCP/IP) and operates at the transport layer, just like TCP. However, unlike TCP, UDP is a connectionless and unreliable protocol.

UDP is designed for applications that prioritize speed and efficiency over the reliability and ordering of data delivery. It provides a simple, low-overhead mechanism for sending data packets between devices on an IP-based network

[2]Here are some key characteristics of UDP:

1. ***Connectionless***: Unlike TCP, UDP does not establish a dedicated connection between the sender and receiver before data transmission. Each UDP packet, also known as a datagram, is treated as an independent unit and can be sent without any prior setup.

2. ***Unreliable***: UDP does not provide mechanisms for error detection, retransmission, or acknowledgment of data packets. Once a UDP packet is sent, the sender assumes it has reached the destination, regardless of whether it was successfully received or not. This makes UDP faster than TCP since it does not have the overhead associated with reliability mechanisms.

3. ***No Flow Control or Congestion Control:*** UDP does not implement flow control or congestion control mechanisms like TCP. It does not regulate the rate of data transmission or react to network congestion. As a result, UDP packets can be lost, delivered out of order, or duplicated without any correction at the protocol level.

4. ***Low Overhead***: UDP has a minimal protocol overhead, as it does not include the complex mechanisms of TCP. This makes it suitable for applications that require fast and efficient data transmission, such as real-time streaming, online gaming, DNS (Domain Name System) queries, and voice or video communication.

5. ***Broadcast and Multicast Support***: UDP supports broadcasting, which allows a single packet to be sent to all devices within a specific network segment. It also supports multicasting, which enables a packet to be sent to multiple recipients who have joined a multicast group.

FTP:

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FTP stands for ***File Transfer Protocol.*** It is a standard network protocol used for the transfer of files between a client and a server over a computer network, typically the internet. FTP provides a simple and reliable method for uploading, downloading, and managing files on remote servers.

[3]Here are some key features and functionalities of FTP:

1. ***Client-Server Architecture:*** FTP follows a client-server model, where one device acts as the FTP client and another as the FTP server. The client initiates a connection to the server and sends commands to request file transfers and perform various operations.

2. ***Authentication:*** FTP supports various methods of user authentication, including username and password, as well as anonymous access. Anonymous access allows users to connect to an FTP server without providing explicit credentials.

3. ***File Operations***: FTP allows users to perform a range of file operations on the server, including uploading (putting) files from the client to the server, downloading (getting) files from the server to the client, renaming files, deleting files, creating directories, and listing directory contents.

4. ***Passive and Active Modes:*** FTP can operate in passive or active mode. In passive mode, the client initiates both the command and data connections, while in active mode, the server establishes the data connection back to the client. Passive mode is more commonly used today because it is more firewall-friendly.

5. ***Binary and ASCII Modes:*** FTP supports two transfer modes: binary and ASCII. Binary mode is used for transferring binary files, such as images or executable programs, while ASCII mode is used for text-based files to ensure proper line-ending conversions between different operating systems (e.g., Windows, Unix).

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TELNET:

[4]

Telnet is a network protocol that allows remote access to devices or systems over a network, typically the internet. It provides a virtual terminal connection, enabling a user to log in to and interact with a remote device or server as if they were directly connected to it.

Here are some key aspects of Telnet:

1. ***Client-Server Architecture:*** Telnet follows a client-server model. The Telnet client runs on the user's device and establishes a connection to the Telnet server running on the remote device or server.
2. ***Terminal Emulation***: Telnet emulates a text-based terminal on the client device, allowing users to access and control the remote device's command-line interface (CLI) or text-based applications. It provides a bidirectional communication channel for transmitting keyboard input and receiving text-based output.
3. ***Unencrypted Communication***: By default, Telnet transfers data in plain text, which means that the information, including usernames, passwords, and commands, is transmitted in an unencrypted format over the network. This lack of encryption makes Telnet insecure for use over public or untrusted networks, as the transmitted data can be intercepted and read by malicious actors.
4. ***Port 23***: Telnet uses TCP (Transmission Control Protocol) and typically operates on port 23. The Telnet client connects to the Telnet server on the remote device by specifying the IP address or domain name and the port number.
5. ***Remote Management***: Telnet is often used for remote management and administration of devices, such as routers, switches, servers, and other network equipment. It allows administrators to configure, monitor, and troubleshoot these devices remotely.
6. ***Telnet Alternatives***: Due to the security vulnerabilities associated with Telnet's lack of encryption, more secure alternatives have been developed. SSH (Secure Shell) is a widely used replacement for Telnet, providing encrypted communication and enhanced security features.

It's important to note that the use of Telnet is becoming less common, particularly in public networks and the internet at large, due to its security weaknesses. Organizations and

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individuals are encouraged to use more secure protocols like SSH whenever possible to protect sensitive information and maintain the security of their network communications.

[5]USENET:

Usenet is a global network of online discussion forums and newsgroups where users can exchange messages, share files, and engage in conversations on a wide range of topics. It predates the World Wide Web and remains an active platform for communication and file sharing.

Here are some key aspects of Usenet:

1. ***Newsgroups:*** Usenet consists of thousands of individual discussion forums called newsgroups. Each newsgroup focuses on a specific topic of interest, such as technology, science, arts, sports, or hobbies. Users can join and participate in these newsgroups by posting messages and reading and responding to others' posts.
2. ***Hierarchical Structure***: Newsgroups are organized in a hierarchical structure based on a system of categories and subcategories. The hierarchy begins with top-level categories like "comp" for computer-related discussions, "rec" for recreational topics, and "sci" for scientific subjects. Each category can have numerous subcategories, allowing for more specific discussions.
3. ***NNTP Protocol***: Usenet operates using the Network News Transfer Protocol (NNTP). NNTP enables users to access and post messages to newsgroups. Usenet servers synchronize with each other, exchanging new messages and propagating them across the network to ensure widespread distribution.
4. ***Text-Based Discussions***: Usenet primarily consists of text-based discussions, where users post messages in plain text format. These messages can include questions, answers, opinions, and other forms of communication. Usenet discussions often involve threaded conversations, where replies are organized hierarchically beneath the original post.
5. ***File Sharing***: Usenet has long been used for file sharing. Users can upload and download files, such as software, documents, images, and multimedia content, to and from Usenet servers. Files are typically divided into smaller parts called "articles" and distributed across multiple servers to facilitate efficient and reliable transfers.
6. ***Usenet Clients***: To access Usenet, users need a Usenet client, also known as a newsreader. Newsreaders provide an interface for browsing and participating in newsgroups, reading and composing messages, and downloading files. There are

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various newsreader software applications available, both free and commercial, for different operating systems.

7. [6]***Binary Newsgroups***: In addition to text-based discussions, Usenet includes binary newsgroups dedicated to file sharing. These groups are specifically designed for the distribution and retrieval of binary files, such as movies, music, software, and images. Users can download these files using specialized newsreaders that handle the decoding and reassembly of the binary content.

It's important to note that Usenet is a decentralized network, meaning there is no central authority or control over its content. While Usenet remains active, its popularity has diminished in recent years due to the rise of other communication platforms, social media, and file-sharing services. However, Usenet continues to be valued by certain communities for its long-standing history, extensive archives, and dedicated user base.

Internet Chat:

Internet chat, also known as ***online chat or chat rooms***, refers to real-time communication between individuals over the internet using text-based messages. It provides a platform for people to engage in conversations, share ideas, and connect with others who have similar interests or goals.

Here are some key aspects of internet chat:

1. ***Real-Time Communication***: Internet chat allows users to engage in conversations in real time. Messages are typically exchanged instantly, enabling participants to have interactive and dynamic discussions.
2. ***Text-Based Messages***: Internet chat primarily relies on text-based messages, where participants type and send messages to each other. These messages can be seen by all participants in the chat room or directed to specific individuals through private messages.
3. ***Chat Rooms***: Chat rooms are virtual spaces where multiple users can join and participate in conversations. Chat rooms are often organized based on specific topics, interests, or communities. Users can enter a chat room, read ongoing conversations, and contribute by posting their own messages.
4. ***Moderation***: Some internet chat platforms have moderators who enforce rules and guidelines within chat rooms to ensure a safe and respectful environment. Moderators

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monitor conversations, address any violations or inappropriate behavior, and maintain order in the chat room.

5. [7]***Emoticons and Emoji:*** To express emotions and add context to text-based messages, internet chat often incorporates the use of emoticons and emoji. Emoticons are typographic representations of facial expressions (e.g., :-) for a smiley face), while emoji are graphical icons representing a wide range of emotions, objects, or symbols.
6. ***Voice and Video Chat***: While internet chat traditionally relies on text-based communication, many platforms now also support voice and video chat capabilities. These features enable participants to have more interactive and immersive conversations using voice and video streams in addition to text messages.
7. ***Instant Messaging***: Internet chat is often associated with instant messaging, where users can have one-on-one conversations or create small groups for private discussions. Instant messaging allows for more intimate and focused interactions, separate from the larger chat room environment.

Internet chat has evolved over time, with various platforms and applications offering different features and functionalities. It has become an integral part of online communities, social networking, customer support, and collaborative work environments, enabling people to connect, communicate, and share information across distances in real time.

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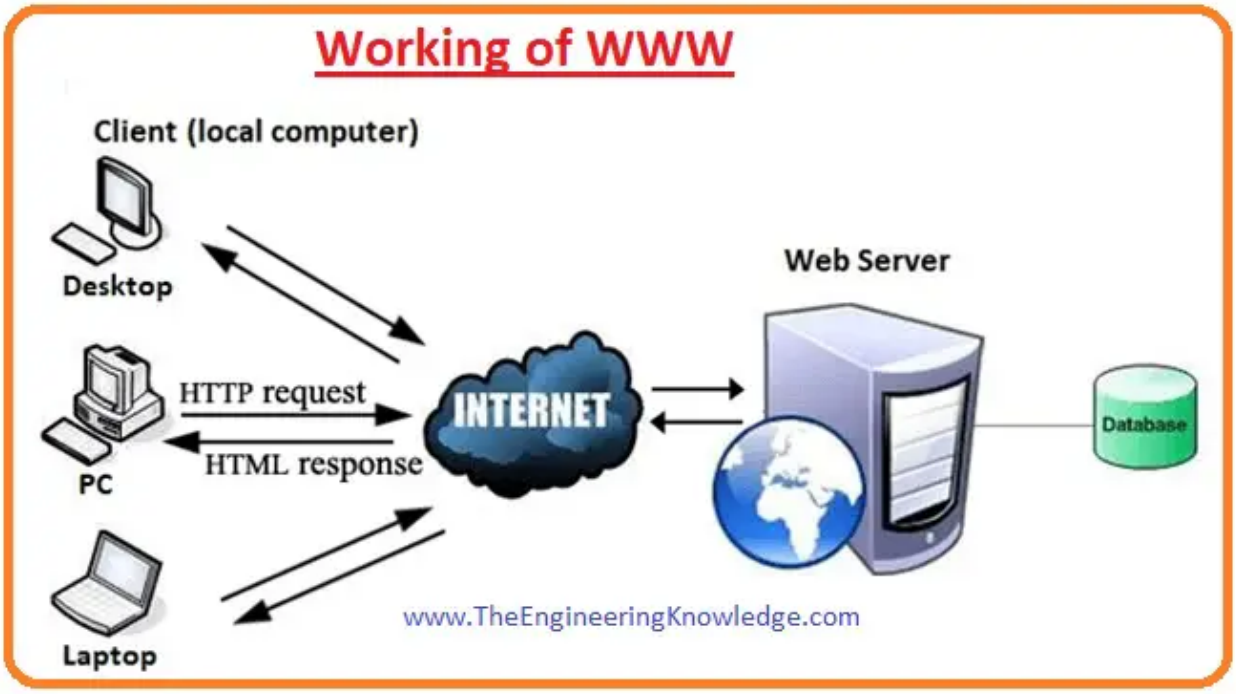
UNIT-4 WWW Overview
Subject- Principles of Internet

[1]*WWW Overview:*

World Wide Web, which is also known as a Web, is a collection of websites or web pages stored in web servers and connected to local computers through the internet. These websites contain text pages, digital images, audios, videos, etc. Users can access the content of these sites from any part of the world over the internet using their devices such as computers, laptops, cell phones, etc. The WWW, along with internet, enables the retrieval and display of text and media to your device.



History:

It is a project created, by Timothy Berner Lee in 1989, for researchers to work together effectively at CERN. is an organization, named the World Wide Web Consortium (W3C), which was developed for further development of the web. This organization is directed by Tim Berner's Lee, aka the father of the web.

Working of WWW:

The World Wide Web is based on several different technologies: Web browsers, Hypertext Markup Language (HTML) and Hypertext Transfer Protocol (HTTP).

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[2]A Web browser is used to access web pages. Web browsers can be defined as programs which display text, data, pictures, animation and video on the Internet. Hyperlinked resources on the World Wide Web can be accessed using software interfaces provided by Web browsers. Initially, Web browsers were used only for surfing the Web but now they have become more universal. Web browsers can be used for several tasks including conducting searches, mailing, transferring files, and much more. Some of the commonly used browsers are Internet Explorer, Opera Mini, and Google Chrome.

Features of WWW:

- HyperText Information System
- Cross-Platform
- Distributed
- Open Standards and Open Source
- Uses Web Browsers to provide a single interface for many services
- Dynamic, Interactive and Evolving.
- “Web 2.0”

Components of the Web: There are 3 components of the web:

1. **Uniform Resource Locator (URL):** serves as a system for resources on the web.
2. **HyperText Transfer Protocol (HTTP):** specifies communication of browser and server.
3. **Hyper Text Markup Language (HTML):** defines the structure, organisation and content of a webpage.

Web pages:

A **webpage** is a digital document that is linked to the World Wide Web and viewable by anyone connected to the internet having a web browser. It can contain any type of information, such as text, color, graphics, animations, videos, sounds, etc.

A **webpage** is a document that is written in the HTML, it can be viewed from the Internet. It can be accessed by entering the URL on the address bar of the web browser.

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[3]*Characteristics of a Web Page:*

Following are some characteristics of a Web page:

- A simple webpage can be created very quickly.
- It takes very little time to create a webpage compared to a Website.
- A web page and a website should be compatible with any device, such as Mobile, Desktop, Laptop, etc.
- The search engine provides a web page through a link, and when a user clicks on that link, it is redirected to the webpage of a website.
- A webpage can have any type of information including videos, and audios.
- It can be made up of only HTML(Hypertext Markup Language), or CSS, or JavaScript for dynamic and attractive behavior.

How does a Web Page Work?

A simple web page is created using HTML, which is a markup language. However, we can also use CSS and JavaScript to add more functionalities and make it more attractive.It is created using HTML, hence containing different markup tags that specify how the data should be formatted on screen.The webpage is contained within the webserver. To load this webpage, a client sends the request to the server, and generally, the browser is known as the client, which can request the page on the internet.

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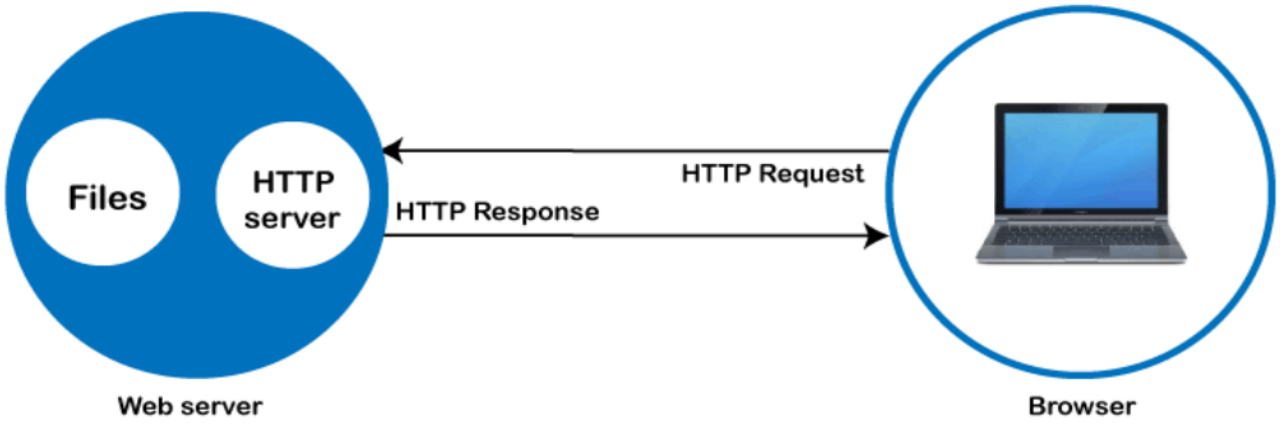

[4]The browser sends the request for a page or a file via **an HTTP request.** The HTTP is the **Hypertext Transfer Protocol**, a network protocol that allows transferring hypermedia documents over the internet between a browser and server.

Once the request reaches the server, the HTTP server accepts the request, finds the requested page, and sends it back to the browser through **the HTTP response**. If a server is unable to find the requested page, it returns a **404 response**.

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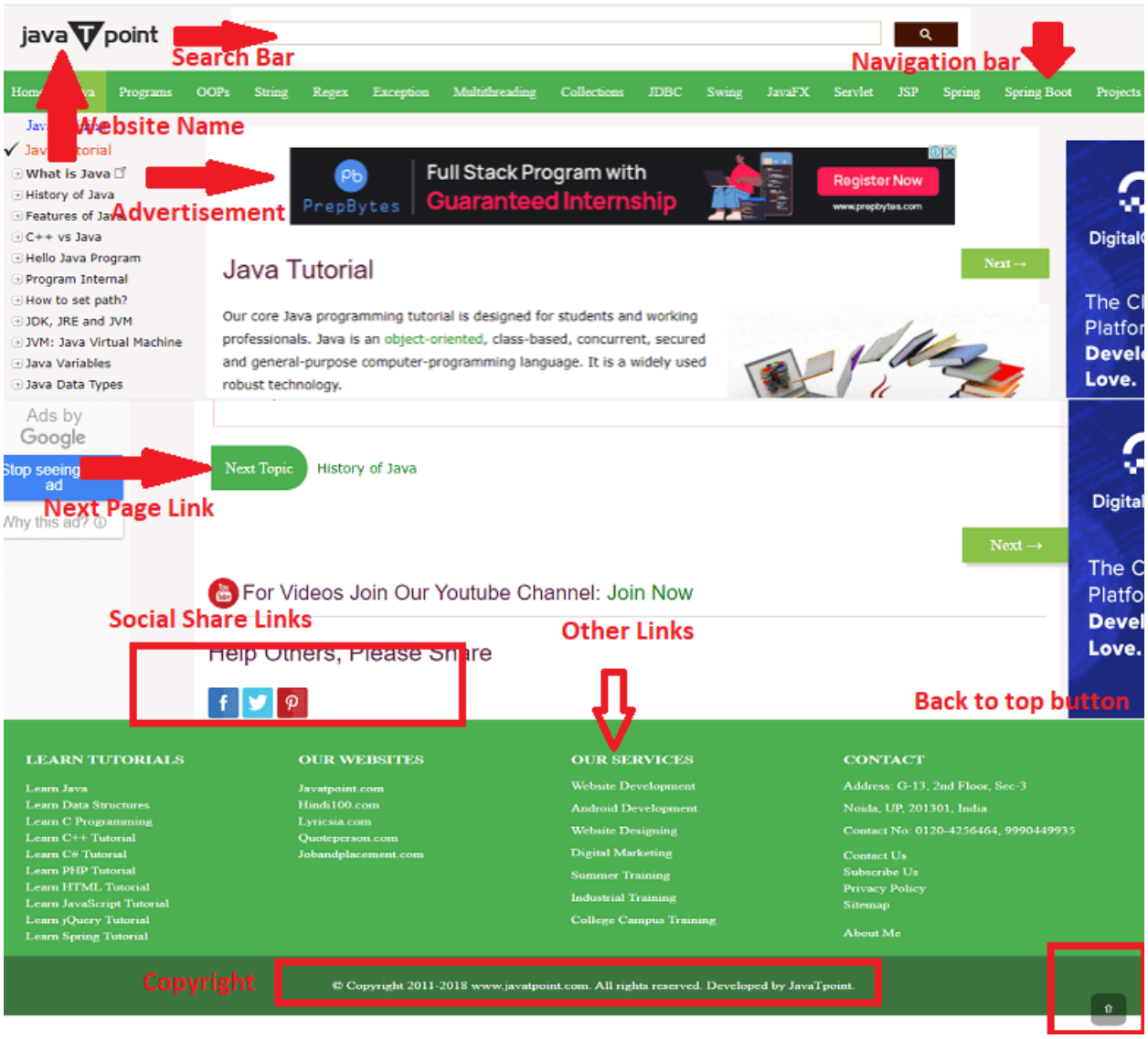

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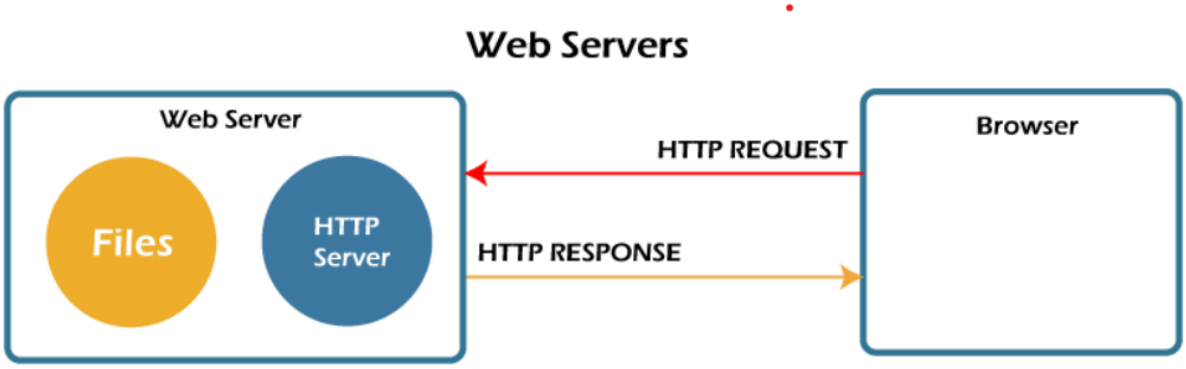
Webpage	Website
• A webpage is a single document on the Internet that is linked to a specific URL under the respective domain.	• A website is a collection of several documents associated with a specific domain.
• Webpage is the content that is displayed on the website.	• A website is a place to put and display content.
• A webpage usually contains content related to a single entity type.	• A website usually contains content related to different entities.
• Examples: login page, sign up page, about page, contact page, privacy policy, etc.	• Examples: Amazon.com, Quora.com, Wikipedia.org, Tutorialsmate.com, etc.

[6]

The Web Servers: A web server is software and hardware that uses HTTP (Hypertext Transfer Protocol) and other protocols to respond to client requests made over the World Wide Web. The main job of a web server is to display website content through storing, processing and delivering webpages to users.



Web pages are a collection of data, including images, text files, hyperlinks, database files etc., all located on some computer (also known as server space) on the Internet. A web server is dedicated software that runs on the server-side. When any user requests their web browser to run any web page, the webserver places all the data materials together into an organized web page and forwards them back to the web browser with the help of the Internet. Therefore, we can conclude that:

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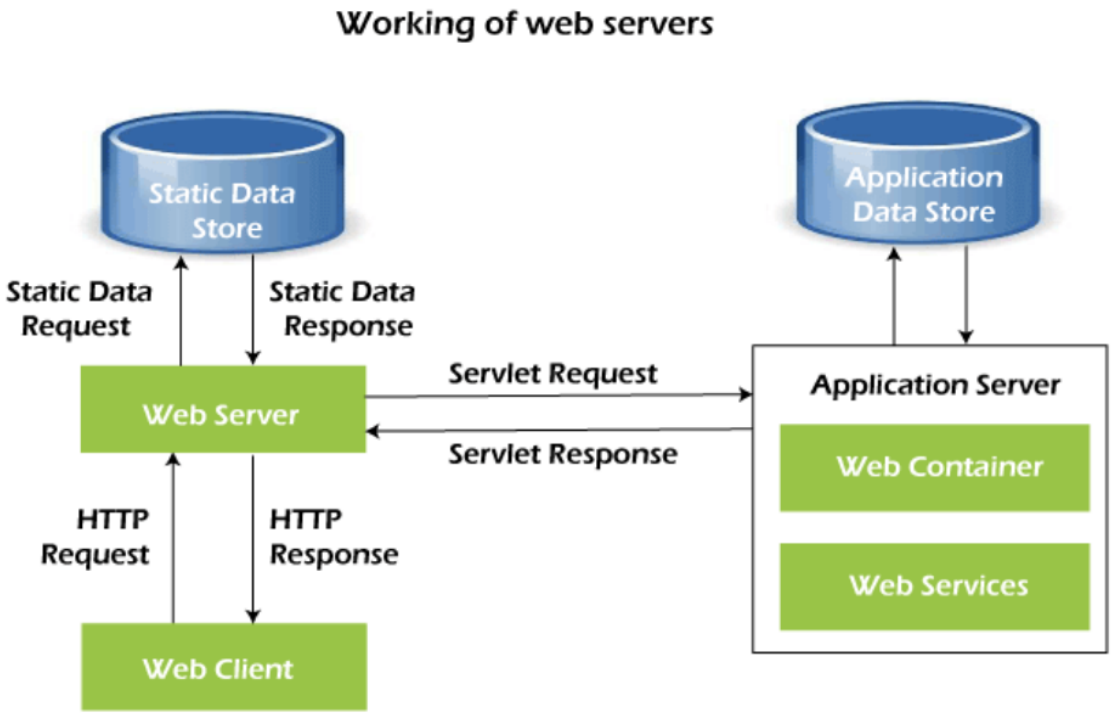
[7]A web server is a dedicated computer responsible for running websites sitting out on those computers somewhere on the Internet. They are specialized programs that circulate web pages as summoned by the user. The primary objective of any web server is to collect, process and provide web pages to the users.



1. ***On the hardware side***, a web server is defined as a computer that stores software and another website raw data, such as HTML files, images, text documents, and JavaScript files. The hardware of the web servers are connected to the web and supports the data exchange with different devices connected to the Internet.
2. ***On the software side***, a web server includes server software accessed through website domain names. It controls how web users access the web files and ensures the supply of website content to the end-user. The web server contains several components, including an HTTP server.

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[8]Web Browsers: A web browser is a software application that is used to access the world wide web(www) or as known by everyone on the Internet. It is an interface between us and the information available on the web.

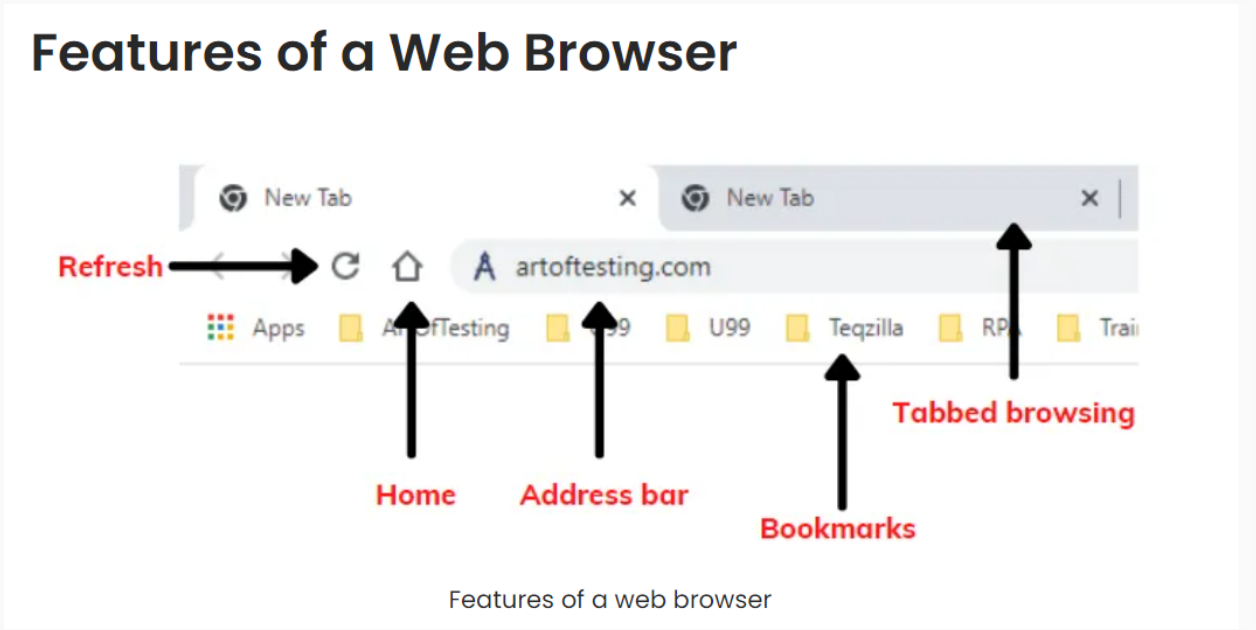
How does a browser work?

The whole process of gathering information begins with the user when enters the URL of the desired website in the address bar. The browser is a part of the client-server model where it plays the part of the client.

It sends the requested information to the web server through HTTP- hypertext transfer protocol. Once the request is received, the server gathers the related information it forwards it through web pages.

When a URL is entered, supposedly artoftesting.com the web browser first requests the DNS (Domain name server) the IP address of the artoftesting.com. The DNS is a phonebook of the internet and therefore, it stores the system names and their corresponding IP addresses.

Next, once the IP address is found the address is used to request the servers of the 'ArtOfTesting' website for the content. This is then fulfilled and displayed on the client's screen.



Features of a web browser

Popular Web Browsers

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[9]Google Chrome

Google Chrome is the most popular and used web browser. There is a high chance you are using it yourself right now. The reason behind its popularity is its speed. It is one of the fastest browsers – opens and loads quickly, and the search results are retrieved within seconds. Another reason might be its simple and easy-to-use UI.

Safari

Although Safari is specially created for Apple users it can be used on PCs as well. However, its uniqueness can only be seen on Mac or Apple devices. It is a cross-compatible software and can integrate your data on multiple platforms. Another fascinating feature is the iCloud keychain that lets you access the passwords saved on your Apple device.

Mozilla Firefox

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[10]This one is another popular choice among users. Although people have always preferred this one as an option due to its speed. It takes much more time than Chrome or Safari.

Opera

Opera is also one of the commonly used browsers. It has its own range of add-on extensions that you might need to check out. It also can be synced among multiple devices. So do not miss out on this one.

Microsoft Edge

This one comes pre-installed on Windows 10 devices. This was developed to replace internet explorer and thus acts as a default browser. It is gaining popularity because of

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[11]its new rendering feature, easy-to-use UI, freestyle writing over webpage displays, and much more.

Search Engines: A search engine is a software program, which is designed to perform web searches on the World Wide Web (www). You can call the search engines as an **answering machine**. Search engines discover, process and organize internet content and provide it to users when searching for any information.

- A search engine is a platform on which a user can search the internet content.
- **Google, Yahoo, Bing, Baidu**, and **DuckDuckGo** are popular search engines. Google is one of the most used search engines worldwide that is used with the Chrome browser. So, almost everyone is familiar with it.
- According to the research, around 92.16% of searches are happening on Google, 2.18 on Bing, 1.52 on Yahoo, 1.14 on Baidu, and so on.

How does a search engine work?

The three important tasks are performed by a search engine when a user search for anything on it: **Crawling, Indexing**, and **Ranking**.

Whenever a user searches for information on Google, he/she needs to type a query in the search bar. The search engine crawls the thousands of web pages on behalf of the user using their own crawlers.

Note: The web crawlers are commonly referred to as the search engine spiders or bots.

Crawl: Scour the internet for data.

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[12]**Index:** This process stores and organizes the content that is found from the crawling process. Basically, this step indexes the web pages which are relevant for the user's query to be displayed.

Rank: This process ranks the best content at the top, which is the best answer for the user's query. It means that the most relevant result shows on top of the web.

Introduction to Firewalls:

A firewall is one such security device that can help you safeguard your network and device from an outsider. In this tutorial on ‘what is a firewall’, you will learn all you need to know about a firewall and how it acts as a shield to protect your network.

Firewalls prevent unauthorized access to networks through software or firmware. By utilizing a set of rules, the firewall examines and blocks incoming and outgoing traffic.

Fencing your property protects your house and keeps trespassers at bay; similarly, firewalls are used to secure a computer network. Firewalls are network security systems that prevent unauthorized access to a network. It can be a hardware or software unit that filters the incoming and outgoing traffic within a private network, according to a set of rules to spot and prevent Cyber attacks.
Firewalls are used in enterprise and personal settings. They are a vital component of network security. Most operating systems have a basic built-in firewall. However, using a third-party firewall application provides better protection.

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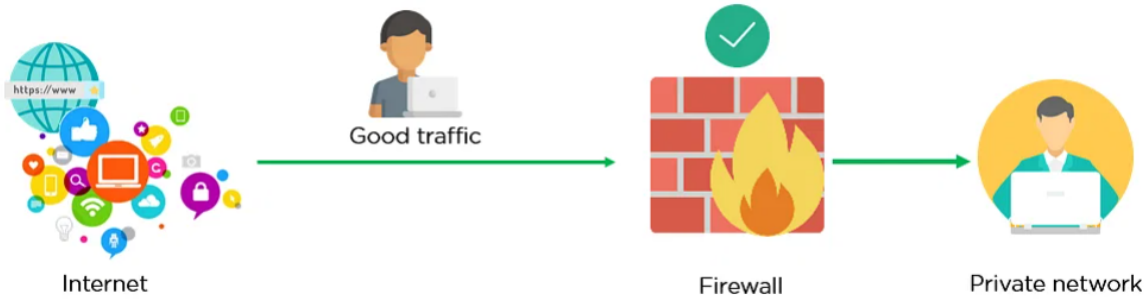

Fig: Firewall allowing Good Traffic

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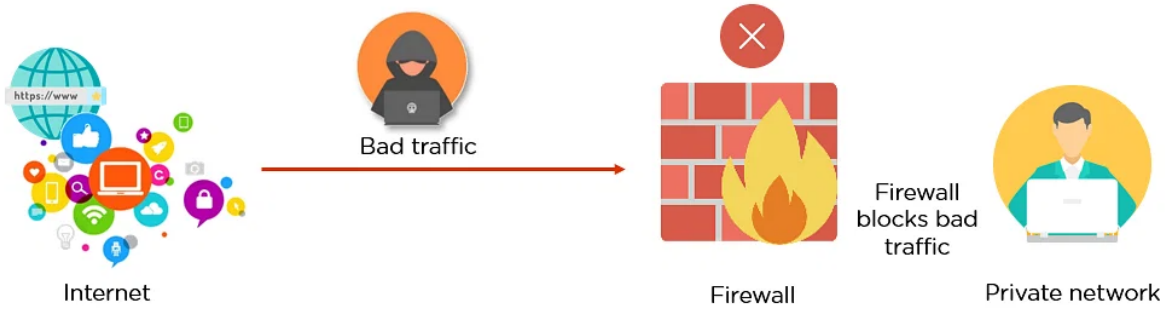

Fig: Firewall blocking Bad Traffic

Uses of Firewalls:

- Firewalls can be used in corporate as well as consumer settings.
- Firewalls can incorporate a security information and event management strategy (SIEM) into cybersecurity devices concerning modern organizations and are installed at the network perimeter of organizations to guard against external threats as well as insider threats.

- [14]Firewalls can perform logging and audit functions by identifying patterns and improving rules by updating them to defend the immediate threats.
- Firewalls can be used for a home network, Digital Subscriber Line (DSL), or cable modem having static IP addresses. Firewalls can easily filter traffic and can signal the user about intrusions.
- They are also used for antivirus applications.
- When vendors discover new threats or patches, the firewalls update the rule sets to resolve the vendor issues.
- In-home devices, we can set the restrictions using Hardware/firmware firewalls.

Types of Firewalls:

There are multiple types of firewalls based on their traffic filtering methods, structure, and functionality. A few of the types of firewalls are:

- ***Packet Filtering***

A packet filtering firewall controls data flow to and from a network. It allows or blocks the data transfer based on the packet's source address, the destination address of the packet, the application protocols to transfer the data, and so on.

- ***Proxy Service Firewall***

This type of firewall protects the network by filtering messages at the application layer. For a specific application, a proxy firewall serves as the gateway from one network to another.

- ***Stateful Inspection***

Such a firewall permits or blocks network traffic based on state, port, and protocol. Here, it decides filtering based on administrator-defined rules and context.

- ***Next-Generation Firewall***

According to Gartner, Inc.'s definition, the next-generation firewall is a deep-packet inspection firewall that adds application-level inspection, intrusion prevention, and information from outside the firewall to go beyond port/protocol inspection and blocking.

- ***Unified Threat Management (UTM) Firewall***

A UTM device generally integrates the capabilities of a stateful inspection firewall, intrusion prevention, and antivirus in a loosely linked manner. It may include additional services and, in many cases, cloud management. UTMs are designed to be simple and easy to use.

- ***Threat-Focused NGFW***

[15]These firewalls provide advanced threat detection and mitigation. With network and endpoint event correlation, they may detect evasive or suspicious behavior.

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[15]

Unit-5 ART OF CREATING WEBSITES SUBJECT: PRINCIPLES OF INTERNET

Creating a website involves using various technologies and languages, with Hypertext and HTML (HyperText Markup Language) being the foundation. Here's an overview of some key concepts related to creating a website using HTML:

Hypertext and HTML: Hypertext is a system where text is linked together through hyperlinks, allowing users to navigate between different pieces of content by clicking on these links. HTML is the markup language used to create web pages. It uses tags to structure content and define the elements of a webpage.

Features of HTML: HTML allows you to create text-based content, images, hyperlinks, forms, multimedia, and more. It is a versatile language for structuring and presenting information on the web.

Elements and Attributes: HTML consists of elements, which are defined by tags. Tags are enclosed in angle brackets and are usually written in pairs, such as <tagname>content</tagname>. Elements can have attributes that provide additional information or settings. Attributes are added within the opening tag and modify the behavior or appearance of the element.

***Elements:** An HTML element is defined by a start tag, some content, and an end tag.

HTML Elements

The HTML element is everything from the start tag to the end tag:

```
<tagname>Content goes here...</tagname>
```

Examples of some HTML elements:

```
<h1>My First Heading</h1>

<p>My first paragraph.</p>
```

***Attributes:** HTML attributes provide additional information about HTML elements.

HTML Attributes

All HTML elements can have attributes
Attributes provide additional information about elements
Attributes are always specified in the start tag
Attributes usually come in name/value pairs like: name="value"

*The href Attribute

The <a> tag defines a hyperlink. The href attribute specifies the URL of the page the link goes to:

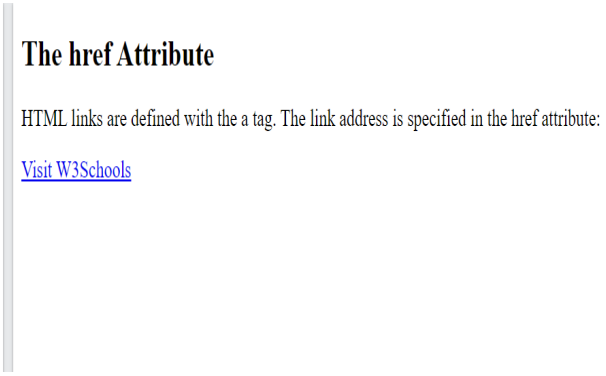
```
<!DOCTYPE html>
<html>
<body>

<h2>The href Attribute</h2>

<p>HTML links are defined with the a tag. The link address is specified
in the href attribute:</p>

<a href="https://www.w3schools.com">Visit W3Schools</a>

</body>
</html>
```



*The src Attribute

The <img> tag is used to embed an image in an HTML page. The src attribute specifies the path to the image to be displayed:

*The width and height Attributes

The <img> tag should also contain the width and height attributes, which specify the width and height of the image (in pixels):

*The alt Attribute

The required alt attribute for the <img> tag specifies an alternate text for an image, if the image for some reason cannot be displayed.

*The style Attribute

The style attribute is used to add styles to an element, such as color, font, size, and more.

*The title Attribute

The title attribute defines some extra information about an element.

Structure of HTML: An HTML document starts with a <!DOCTYPE> declaration, followed by the <html> element, which contains the entire document. The document is further divided into the <head> and <body> sections. The <head> section includes metadata and links to external resources, while the <body> section contains the visible content of the web page.

Basic Tags in HTML: Some fundamental HTML tags include:

- <h1> to <h6>: Headings of varying sizes.
- <p>: Paragraph.
- <a>: Anchor (creates hyperlinks).
- <img>: Image.
- : Unordered list.
- : Ordered list.
- : List item.

Formatting Tags in HTML: HTML also provides tags to format text and control the layout of the page, such as:

- <b>: Bold text.
- <i>: Italic text.
- <u>: Underlined text.
-
: Line break.
- <hr>: Horizontal rule (a horizontal line).

HTML Lists: HTML supports two types of lists:

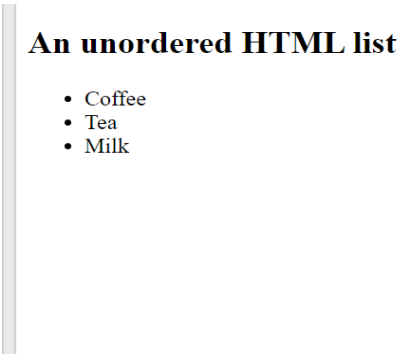
- **Unordered lists (<ul>):** A bullet-pointed list where the order of items doesn't matter.
- An unordered list starts with the <ul> tag. Each list item starts with the <li> tag.

```html
<!DOCTYPE html>
<html>
<body>

<h2>An unordered HTML list</h2>

<ul>
  <li>Coffee</li>
  <li>Tea</li>
  <li>Milk</li>
</ul>

</body>
</html>
```



Example of an unordered list:

html Copy code

```html
<ul>
  <li>Item 1</li>
  <li>Item 2</li>
  <li>Item 3</li>
</ul>
```

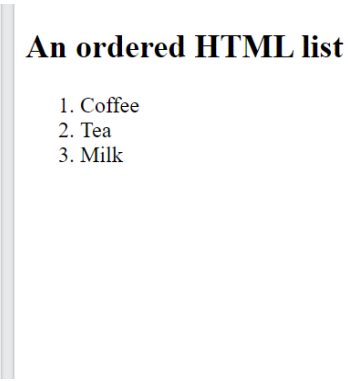
- **Ordered lists (<ol>):** A numbered list where the order of items is significant.
- An ordered list starts with the <ol> tag. Each list item starts with the <li> tag.

```html
<!DOCTYPE html>
<html>
<body>

<h2>An ordered HTML list</h2>

<ol>
  <li>Coffee</li>
  <li>Tea</li>
  <li>Milk</li>
</ol>

</body>
</html>
```



Example of an ordered list:

```html
<ol>
  <li>First item</li>
  <li>Second item</li>
  <li>Third item</li>
</ol>
```

[1]These are some of the basic concepts in HTML. As you progress in web development, you'll learn more about CSS (Cascading Style Sheets) to enhance the appearance of your web pages and JavaScript for interactivity and dynamic content.

HTML Description Lists

HTML also supports description lists.

A description list is a list of terms, with a description of each term.

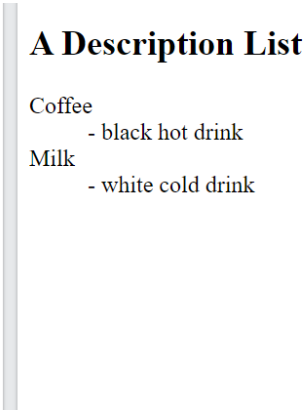
The <dl> tag defines the description list, the <dt> tag defines the term (name), and the <dd> tag describes each term:

```html
<!DOCTYPE html>
<html>
<body>

<h2>A Description List</h2>

<dl>
  <dt>Coffee</dt>
  <dd>- black hot drink</dd>
  <dt>Milk</dt>
  <dd>- white cold drink</dd>
</dl>

</body>
</html>
```



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HTML List Tags

Tag	Description
	Defines an unordered list
	Defines an ordered list
	Defines a list item
<dl>	Defines a description list
<dt>	Defines a term in a description list
<dd>	Describes the term in a description list