

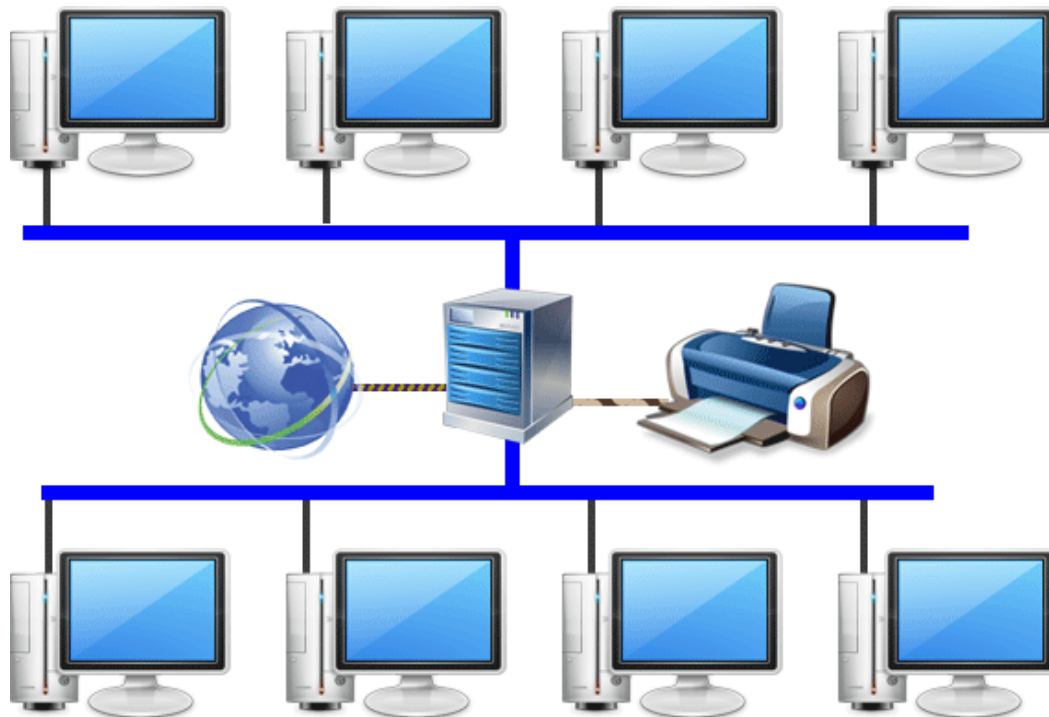
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Unit-3

Introduction to Computer Networks

Introduction to Networks

The collection of interconnected computers is called a computer network. Two computers are said to be interconnected if they are capable of sharing and exchanging information.



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Need of Computer Network

Resource Sharing :- Resource Sharing means to make all programs, data and peripherals available to anyone on the network irrespective of the physical location of the resources and the user.

Reliability :- Reliability means to keep the copy of a file on two or more different machines, so if one of them is unavailable (due to some hardware crash or any other) then its other copy can be used.

Cost Factor :- Cost factor means it greatly reduces the cost since the resources can be shared.

Application of Computer Networks

1. Sharing of data, services and resources
2. Access to remote database
3. Communication facilities
4. Time saving

Elementary Terminology of Networks :-

1. **Nodes (Workstations)**:- The term nodes refer to the computers that are attached to a network and are seeking to share the resources.

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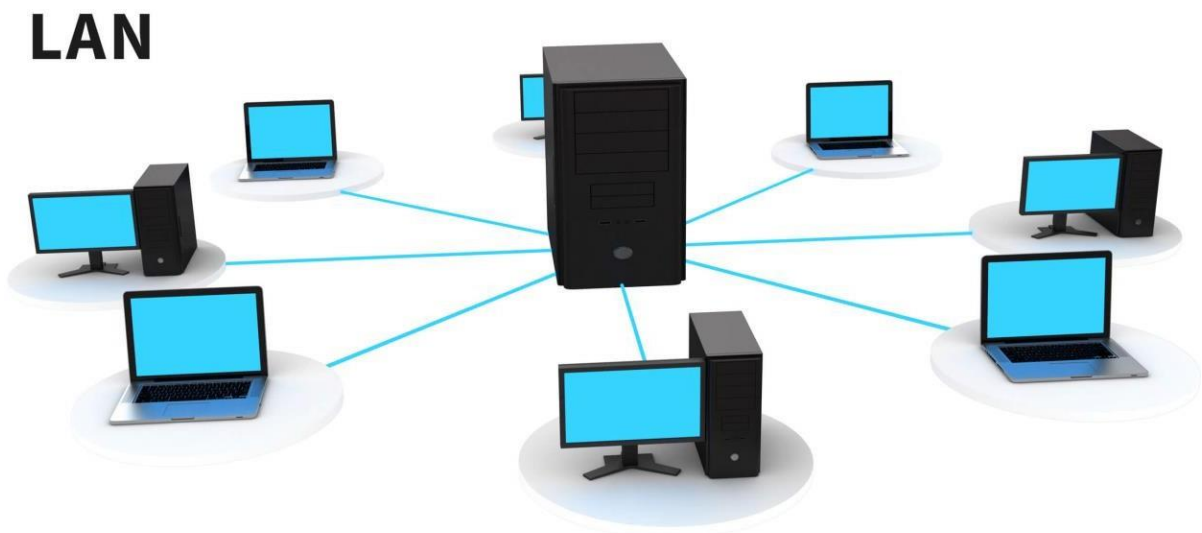
Server:- A computer that facilitates the sharing of data, software and hardware resources on the network.

MAC Address: A (Media access Control) address is a hardware identification number that uniquely identifies each device on a network (assigned to a NIC by the manufacturer).

IP Address: Each computer on internet is identified by a unique number called IP Address. E.g: 192.168.1.1

Types of Computer Networks

LAN (Local Area Network): A Local Area Network (LAN) is a network that is limited to a relatively small area. It is generally limited to a geographic area such as a school building, office or a university campus. It is generally privately owned networks over a distance not more than 5 Km. e.g. network in a college, school, hospital etc.

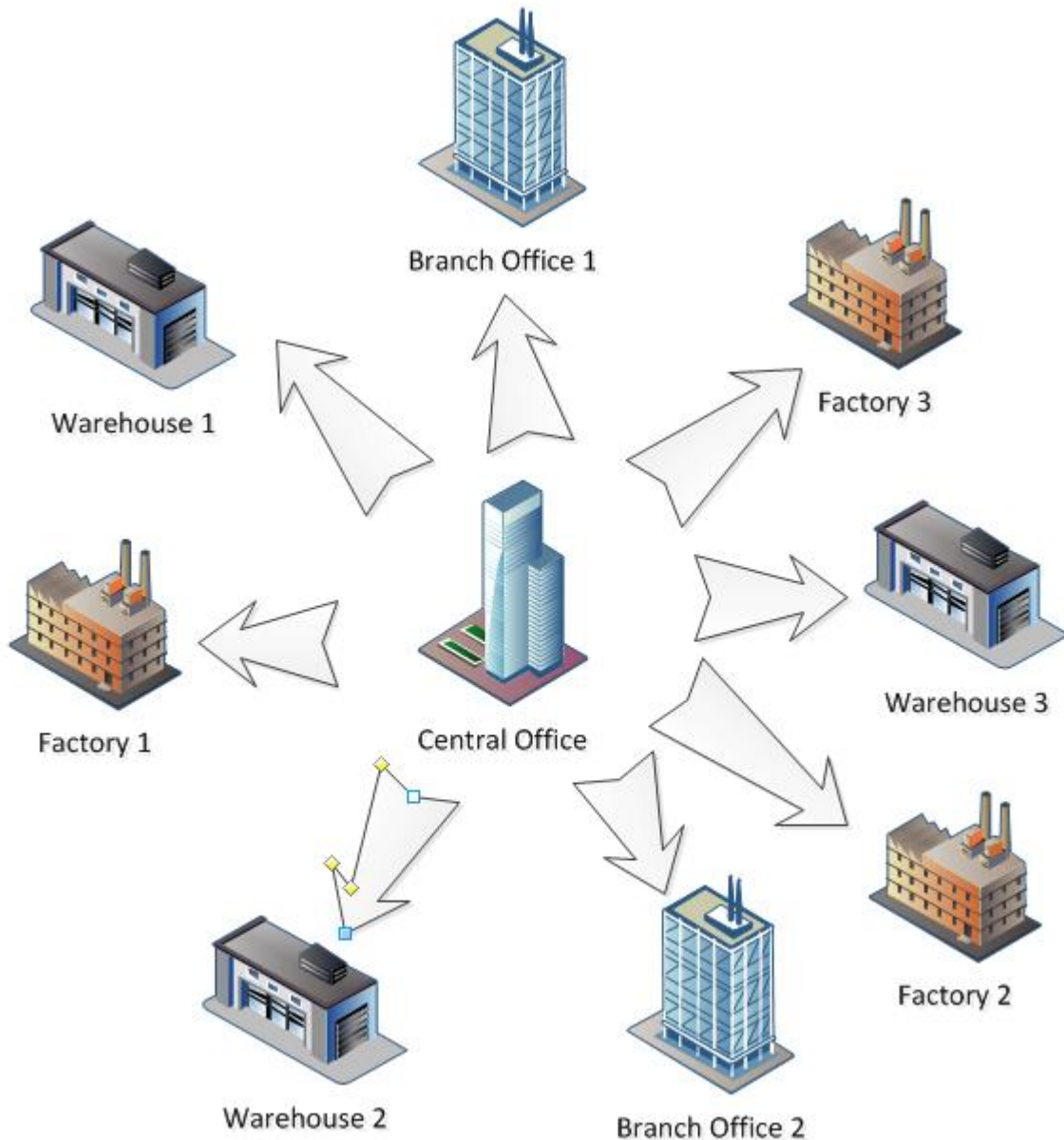


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MAN (Metropolitan Area Network): MAN is the networks that cover a group of nearby corporate offices or a city and might be either private or public. E.g. Cable TV Network in a city.



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WAN (Wide Area Network): These are the networks spread over large distances, say across countries or even continents through cabling or satellite uplinks are called WAN. E.g. Internet

PAN (Personal Area Network): A PAN is a network of communicating devices (Computer, Phone, MP3/MP4 Player, Camera etc.) organized around an individual person. A PAN can be set up using guided media (USB cable) or unguided media (Bluetooth, Infrared).

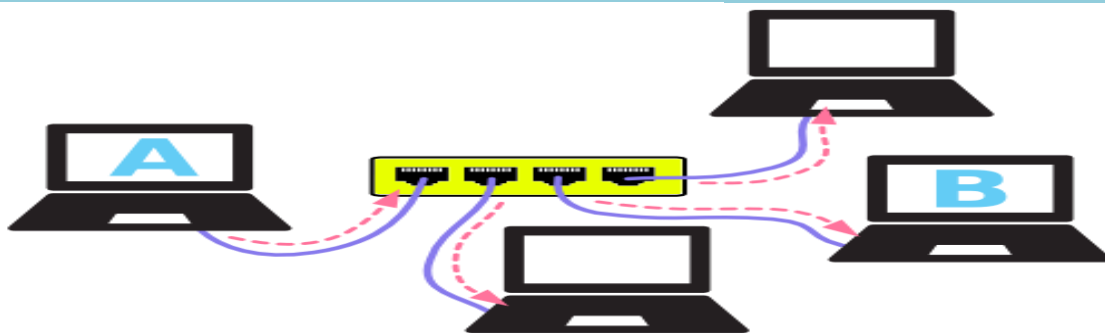


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Network Devices

1. **Modem**:-A modem (modulator/demodulator) is a hardware device that allows a computer to send and receive information over telephone lines. When sending a signal, the modem converts (modulates) digital data to an analog signal and transmit it over a telephone line. Similarly when an analog signal is received, the modem converts it back (demodulates) to a digital signal.
2. **Hub** :- A **Hub** is an electronic device that connects several computers together to form a network and redirects the received information to all the connected nodes in broadcast mode. The computer(s) for which the information is intended receive(s) this information and accept(s) it. Other computers on the network simply reject this information.

Example of how a hub works is shown below. Computer A wants to send a message to computer B. It sends the message through the Ethernet cable to the hub, then the hub repeats the message to all of the connected computers.



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Types of Hub-

Passive Hub: This type of does not amplify or boost the signal. It does not manipulate or view the traffic that crosses it.

Active Hub: It amplifies the incoming signal before passing it to the other ports.



3. **Switch** :- A switch is a network device which is used to interconnect computers or devices on a network. It filters and forwards data packets across a network. The main difference between hub and switch is that hub replicates what it receives on one port onto all the other ports while switch keeps a record of the MAC addresses of the devices attached to it and forwards data packets onto the ports for which it is addressed across a network, that's why switch is intelligent Hub.

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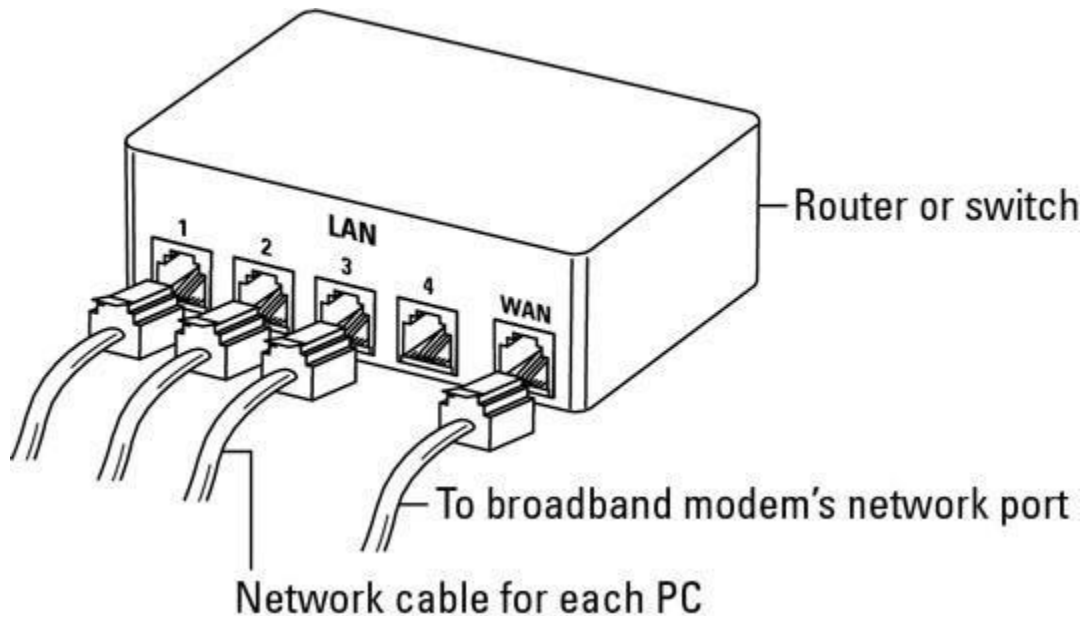
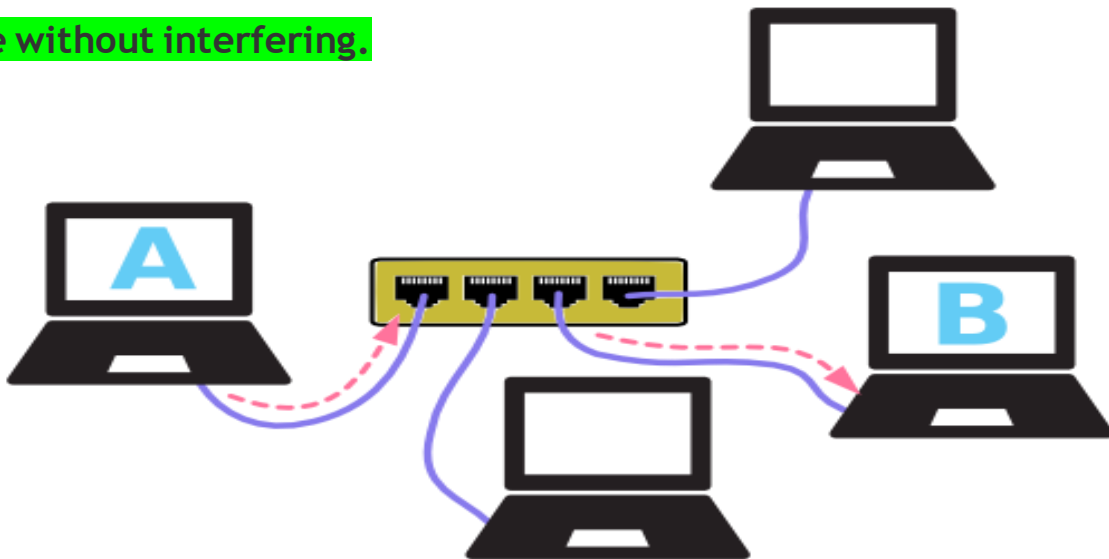


Diagram of A 4-Port Switch

Example of how a switch works is shown below. Using a switch, computer A sends a message to computer B—the other computers do not see the message. Those computers can send other messages at the same time without interfering.

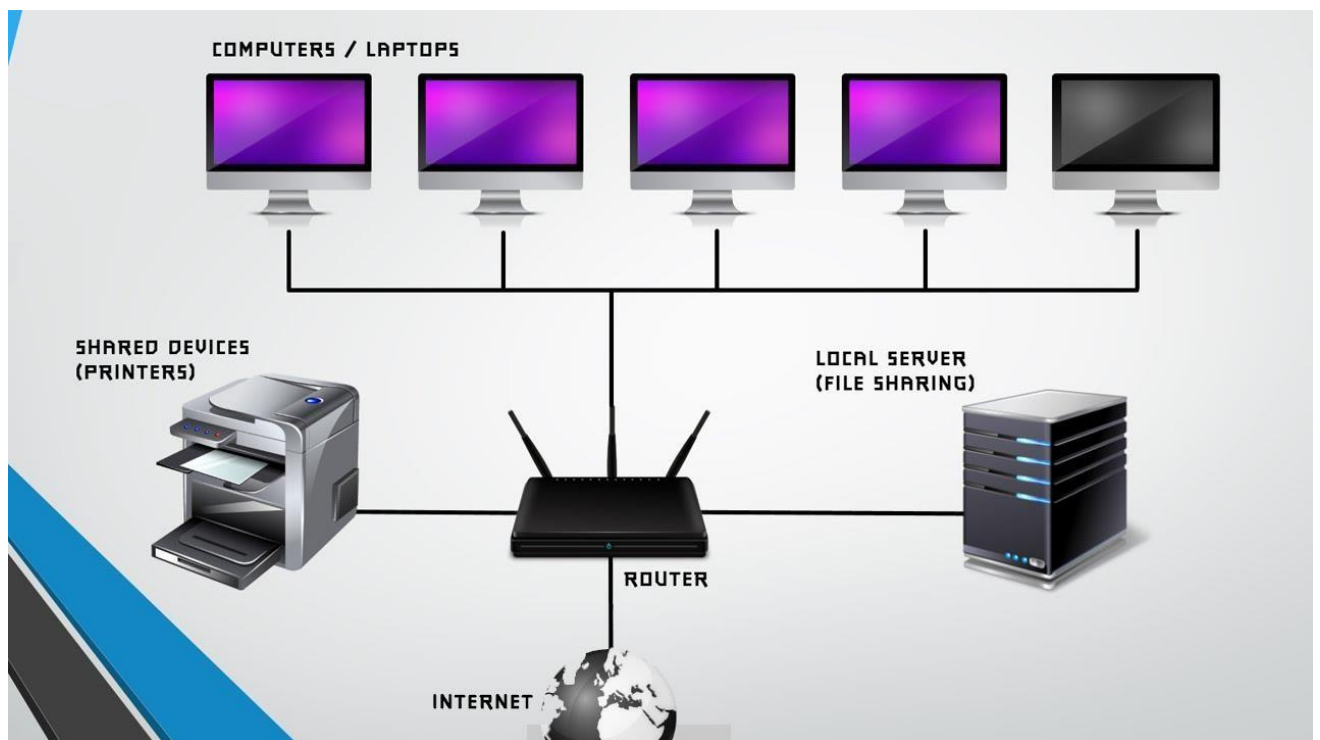


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4. **Repeater** :- A **Repeater** is a device that is used to amplify and regenerate a signal which is on its way through a communication channel. A repeater regenerates the received signal and re-transmits it to its destination.

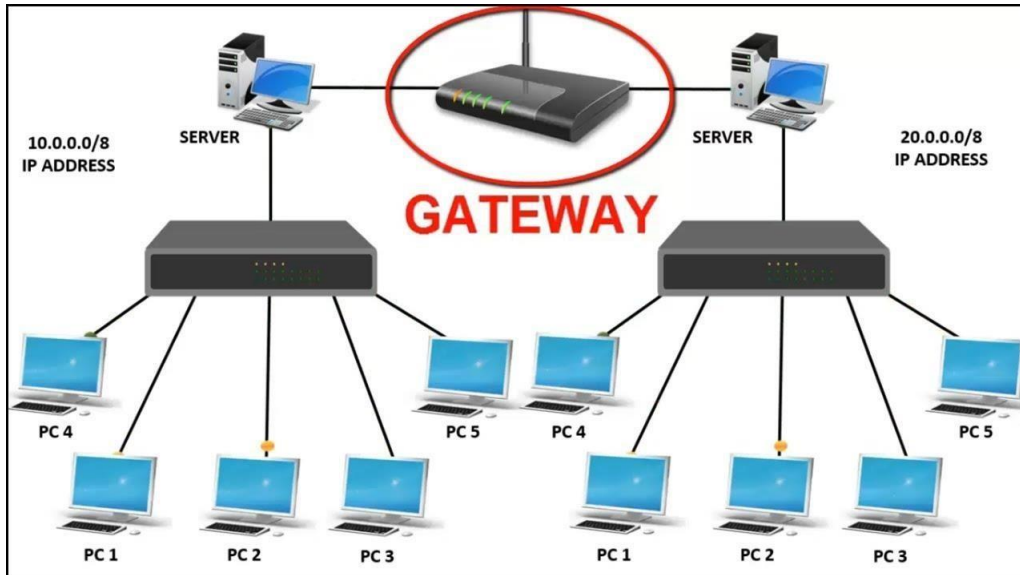
5. **Router** :- A device that forwards data packets from one network to another by finding the shortest route, based on an internal routing table and the address of the destination network in the incoming packet, the router determines whether to send the packet out (in other network) or keep it or forward within the own network.



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Gateway :- A gateway is a device that connects dissimilar networks (Networks with different software and hardware configurations and with different transmission protocol).

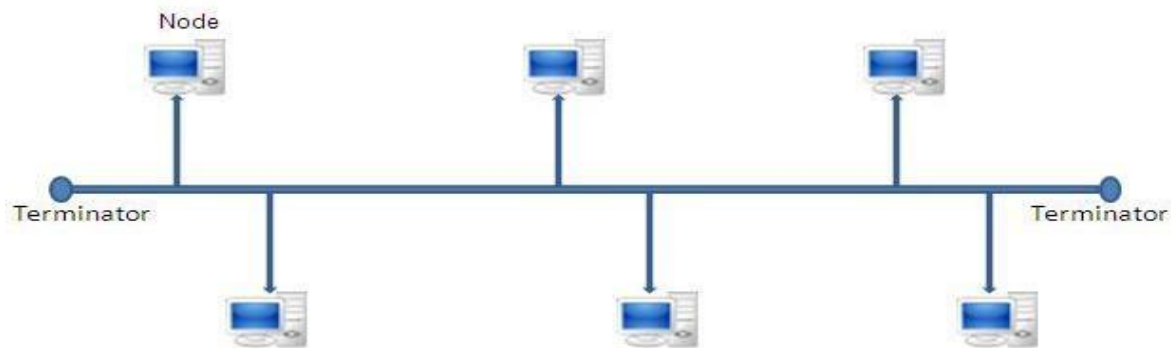


Network Topologies

Topology means the way by which a network is formed.

1. Bus Topology

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Bus Topology :- Bus topology is a topology for a Local Area Network (LAN) in which all the nodes are connected to a single cable. The starting and ending point of cable is called terminator.

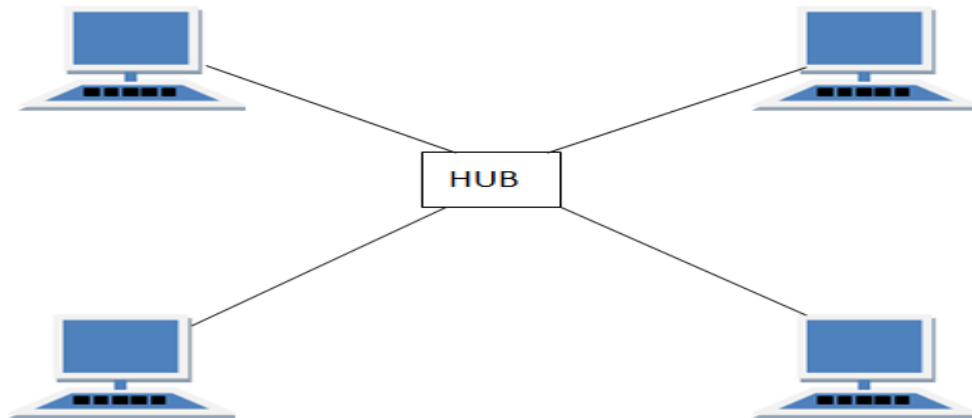
ADVANTAGES

- It is easy to install.
- It requires less cable length and hence it is cost effective.
- Failure of a node does not affect the network.

DISADVANTAGES

- In case of cable or terminator fault, the entire network breaks down.
- Not suitable for large number of computers.
- At a time only one node can transmit data.

The STAR Topology: -



A STAR topology is based on a central node which acts as a hub. In star topology each node is directly connected to a Hub/Switch.

Advantages:

- Easy to troubleshoot
- A single node failure does not affect the entire network.
- Fault detection and removal of faulty parts is easier.
- In case a workstation fails, the network is not affected.

Disadvantages:-

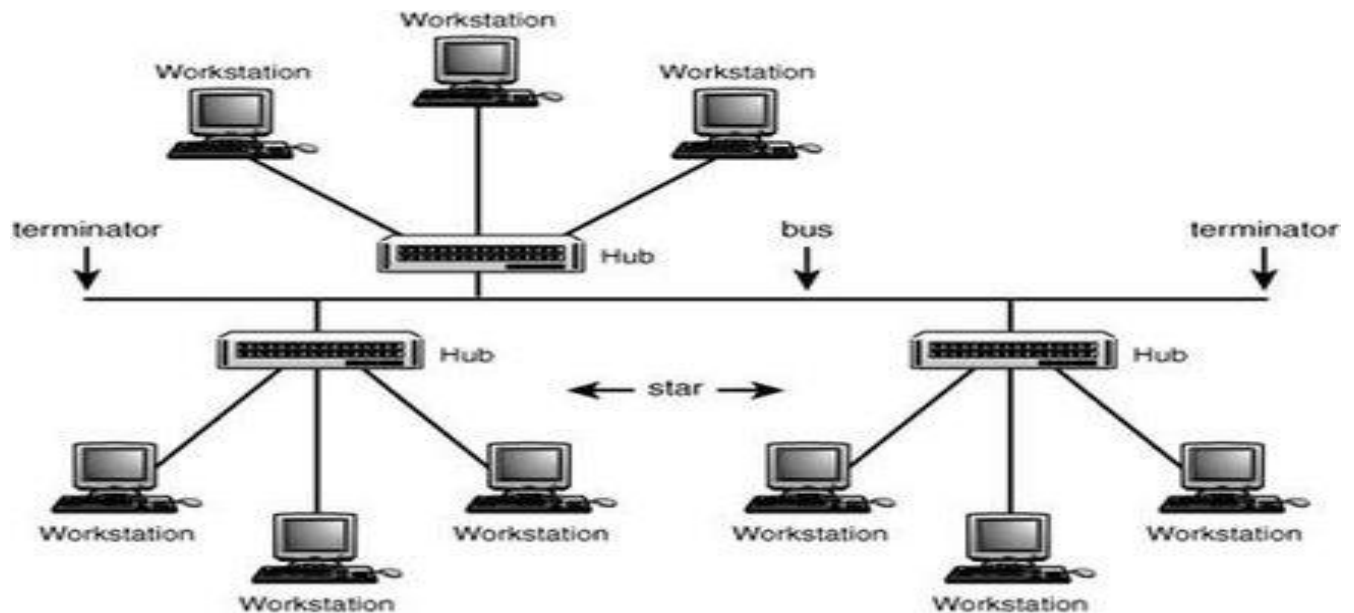
- Difficult to expand.
- Longer cable is required.

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- The cost of the hub and the longer cables makes it expensive over others.
- In case hub fails, the entire network stop working.

TREE Topology

Tree topology is a combination of bus and star topologies. It is used to combine multiple star topology networks. All the stars are connected together like a bus.



Features of Tree Topology

- Ideal if workstations are located in groups.
- Used in Wide Area Network.

Advantages of Tree Topology

- Extension of bus and star topologies.
- Expansion of nodes is possible and easy.
- Easily managed and maintained.

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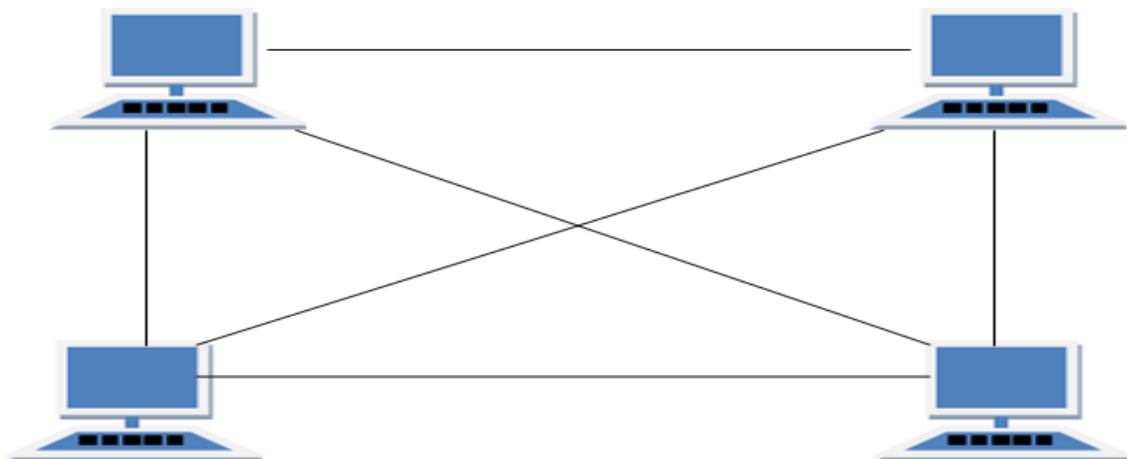
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- Error detection is easily done

Disadvantages of Tree Topology

- Heavily cabled.
- Costly.
- If more nodes are added maintenance is difficult.
- Central hub fails, network fails.

Mesh Topology :-



Mesh topology is a group of nodes which are all connected to each other and many types of connections are possible in a mesh topology.

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Advantage of Mesh Topology

- The arrangement of the network nodes is such that it is possible to transmit data from one node to many other nodes at the same time.
- Fault is diagnosed easily.

Disadvantage of Mesh Topology

- Installation and configuration is difficult.
- Cabling cost is more.
- Bulk wiring is required.

Introduction to Internet

The Internet is a massive network of networks, a networking infrastructure. It connects millions of computers together globally, forming a network in which any computer can communicate with another computer as long as they are both connected to the Internet. The World Wide Web, or simply Web is a way or medium of accessing information over the Internet. It is an information sharing model that is built on top of the Internet.

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” The Internet emerged in the United States in the 1970s but did not become visible to the general public until the early 1990s. By 2020, approximately 4.5 billion people, or more than half of the world’s population, were estimated to have access to the Internet”.

The Internet provides a capability so powerful and general that it can be used for almost any purpose that depends on information, and it is accessible by every individual who connects to one of its associated networks.

URL :- URL stands for Uniform Resource Locator. A URL is nothing more than the address of a given unique resource on the Web or address of a website. The URL is an address that matches users to a specific resource online, such as webpage.

Example- <http://www.python4csip.com>

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WWW : The World Wide WEB (WWW), commonly known as the 'Web'. It is an information system where all the web resources are identified by Uniform Resource Locator (URL). Tim Berners-Lee invented the WWW in 1989. He wrote the first web browser in 1990.

The World Wide WEB (WWW) or 'Web' is a collection of WebPages found over the internet. Web browser uses the internet to access the 'Web'.

Application of Internet

Web 2.0 :

The term web 2.0 is used to refer to a new generation of websites that are supposed to let people to publish and share information online. It aims to encourage the sharing of information and views, creativity that can be consume by the other users. E.g:Youtube

The Main characteristics of web 2.0 are:

- ✓ Makes web more interactive through online social media web-based forums, communities, social networking sites.
- ✓ It is a website design and development world which aim to encourage sharing of information and views, creativity and user interactivity between the users.
- ✓ Video sharing possible in the websites

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Web 3.0: It refers to the 3rd Generation of web where user will interact by using artificial intelligence and with 3-D portals. Web 3.0 supports semantic web which improves web technologies to create, connect and share content through the intelligent search and the analysis based on the meaning of the words, instead of on the keywords and numbers.

e-mail: email (or e-mail) is defined as the transmission of messages over communications networks. Typically the messages are notes entered from keyboard and sent over internet using computer or mobile.

Chat : Chat may refer to any kind of communication over the Internet that offers a real-time transmission of text messages from sender to receiver. Chat messages are generally short in order to enable other participants to respond quickly.

Voip :- Voice over Internet Protocol (VoIP), is a technology that allows you to make voice calls using a broadband Internet connection instead of a regular (or analog) phone line. VoIP services convert your voice into a digital signal that travels over the Internet. If you are calling a regular phone number, the signal is converted to a regular telephone signal before it reaches the destination. VoIP can allow you to make a call directly from a computer. Examples of Voip:-Whatsapp, Skype, Google Chat etc.

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Advantage of Voip:

- ✓ Save a lot of money.
- ✓ More than two people can communicate or speak.
- ✓ Supports great audio transfer.
- ✓ Provide conferencing facility.
- ✓ More than voice (can transfer text, image, video along with voice).

Disadvantages of Voip:

- ✓ Reliable Internet connection required.
- ✓ No location tracking for emergency calls.

Website :- a website is a group of web pages, containing text, images and all types of multi-media files.

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Difference between Website and Webpage :-

Website	Webpage
1. A collection of web pages which are grouped together and usually connected together in various ways, Often called a "web site" or simply a "site."	A document which can be displayed in a web browser such as Firefox, Google Chrome, Opera, Microsoft Internet Explorer etc.
2. Has content about various entity.	Has content about single entity.
3. More development time is required.	Less development time is required.
4. Website address does not depend on Webpage address.	Webpage address depends on Website address.

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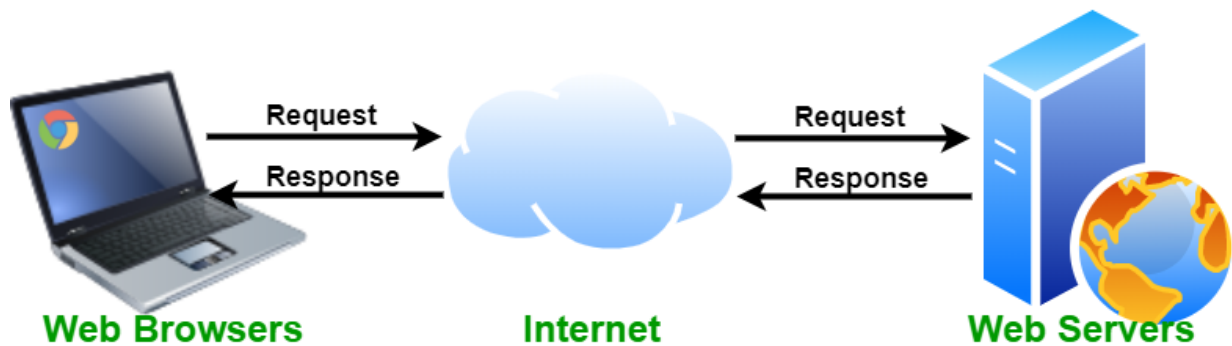
Difference between Static and Dynamic webpage :-

Static Webpage	Dynamic Webpage
The static web pages display the same content each time when someone visits it.	In the dynamic Web pages, the page content changes according to the user.
It takes less time to load over internet.	Dynamic web pages take more time while loading.
No Database used.	A database is used in at the server end in a dynamic web page.
Changes rarely.	Changes frequently.

Web Server :- a web server is a computer that stores web server software and a website's component files (e.g. HTML documents, images, CSS style sheets, and JavaScript files).

When client sends request for a web page, the web server search for the requested page if requested page is found then it will send it to client with an HTTP response. If the requested web page is not found, web server will the send an HTTP response :Error 404 Not found.

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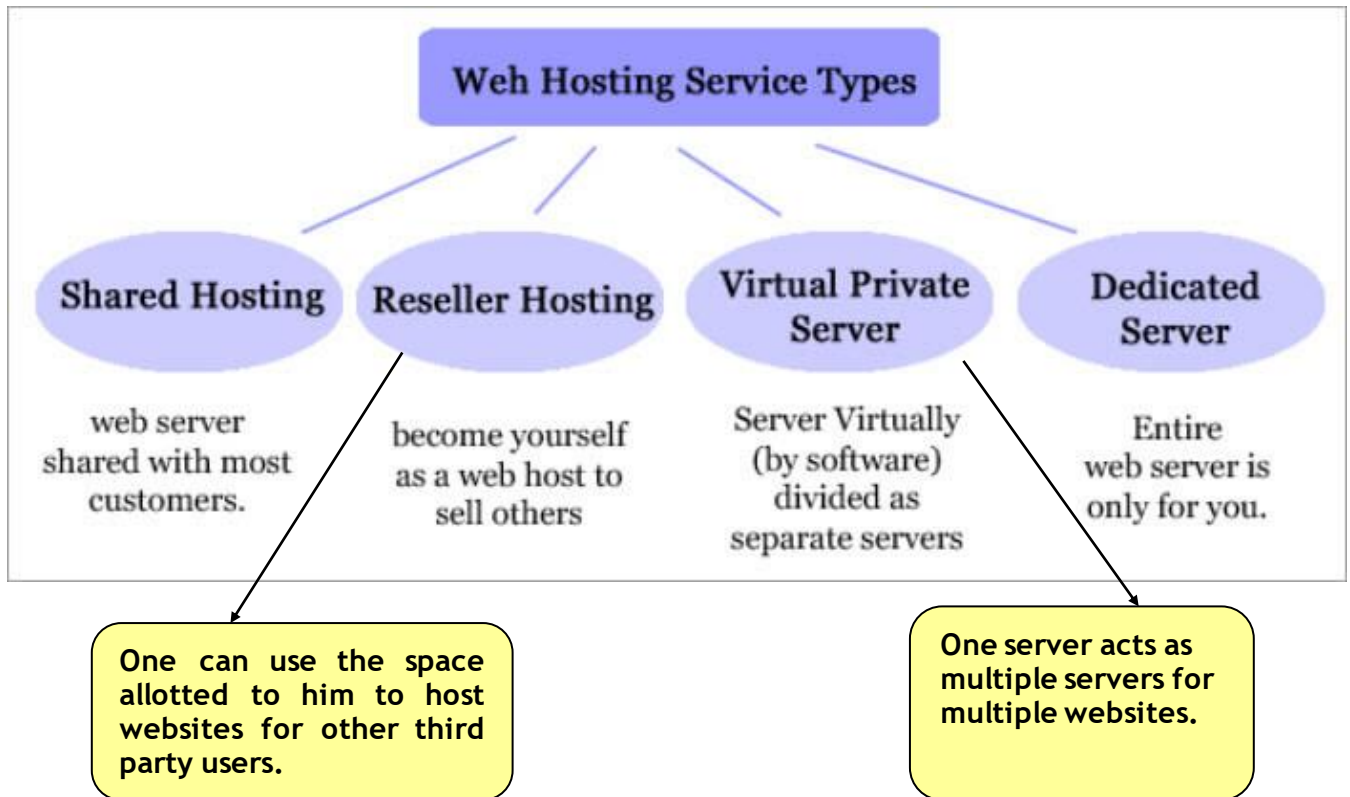
The basic objective of the web server is to store, process and deliver web pages to the users using Hypertext Transfer Protocol (HTTP). Apart from HTTP, a web server also supports SMTP (Simple Mail transfer Protocol) and FTP (File Transfer Protocol) protocol for e-mailing, for file transfer and storage.

Web Hosting :- Web hosting is an online service that enables you to publish your website or web application on the internet. When you sign up for a hosting service, you basically rent some space on a server on which you can store all the files and data necessary for your website to work properly.

A server is a physical computer that runs without any interruption so that your website is available all the time for anyone who wants to see it.

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Types of Web Hosting:



Web Browser :- A web browser, or simply "browser," is an application used to access and view websites. Common web browsers include Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, and Apple Safari.

Plug-ins:- a plug-in (or plugin, add-in, add-on) is a software component that adds a specific feature to an existing computer program. When a program supports plug-ins, it enables customization. Plug-ins are commonly used in Internet browsers but also can be utilized in numerous other types of applications.

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Add-ons(in terms of H/W): An Add-on is either a hardware unit that can be added to a computer to increase the capabilities or a program unit that enhances primary program. Some manufacturers and software developers use the term add-on.

Examples of add-ons for a computer include card for sound, graphic acceleration, modem capability and memory. Software add- ons are common for games, word-processing and accounting programs.

Cookies :- cookies are small files which are stored on a user's computer and contains information like which Web pages visited in the past, logging details Password etc. They are designed to hold a modest amount of data specific to a particular client and website and can be accessed by the web server or the client computer.

Cookies are stored in Hard-drive and are referenced by web browser.

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