M1-R5.1 Information Tech. Tools & Networking basics

Chapter:6 Internet & WWW

Introduction to Internet:-

Internet is an interconnection between several computers of different types belonging to various networks across the world. It is a network of networks. Millions of people use the Internet to search and share information and idea, etc.

History of Internet:

The Internet, popularly called the Net, was created in 1969 for the U.S. defense department. Funding from the Advanced Research Projects Agency (ARPA) allowed researchers to experiment with methods for computers to communicate with each other. Their creation, the Advanced Research Projects Agency Network (ARPANET), originally linked only four separate computer sites at U.S. universities and research institutes, where it was used primarily by scientists.

The National Science Foundation (NSF) assumed responsibility for linking these users of ARPANET, which was dismantled in 1990. The NSF Network (NSFNET) now serves as the technical backbone for all Internet communications in the United States.

Basics of Computer Networks:-

Computer Network is a group of computers connected with each other through wires, optical fibers or optical links so that various devices can interact with each other through a networks.

Difference between LAN, MAN, WAN

Key	LAN	MAN	WAN

Definition	LAN stand for local area network	MAN stand for Metropoliton area network	WAN Stand for Wide area network
Ownership	LAN is often owned by private organization	MAN Ownership can be private or public	WAN ownership can be Private or public.
Speed	LAN speed is quiet High.	MAN speed is Average.	WAN speed is quiet Slow
Delay	Network propagation delay is short	Network propagation delay in medium	Network propagation delay is high.
Congestion	LAN has low congestion as compared to WAN	MAN has higher congestion than LAN	WAN has higher congestion than LAN & MAN.
Maintenance	Maintenance cost is very low in LAN	Maintenance cost is higher than the LAN	Maintenance is complex and cost is very higher in WAN.
Transfer Rate	Data transfer rate can be upto 100 to 1000mbps	Data transfer rate can be upto 10 to 100 mbps	Data transfer rate in WAN is 5mbps to 10 mbps.
Media	Used guided median most of the time	MAN uses both guided and unguided media	WAN uses unguided and guided median.
Area covered	Small area like building, school, institutes, bank & offices.	Large area of university and Campus.	An unlimited area across the global.

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Transmission Media:-

There are two types of transmission media.

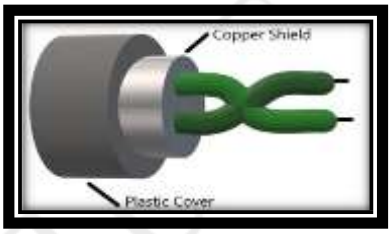
1. **Guided media**
2. **Unguided media**

Guided media:

These are used to connect computers in a network. Eg. twisted pair wires, coaxial cables and optical fiber cables. These are also known as channels, links or lines.

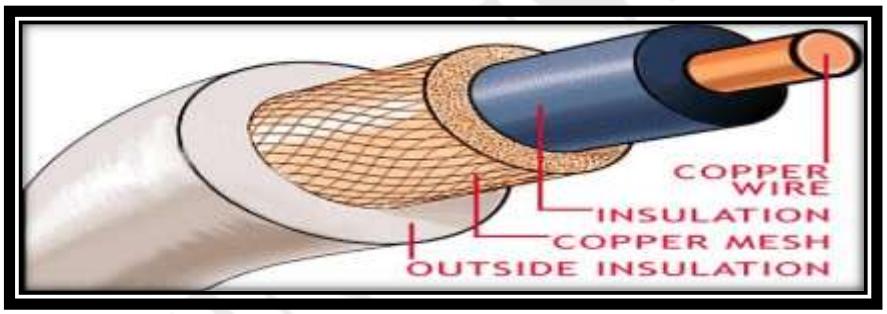
Twisted Pair Cable:

It includes two separately protected conductor wires. Normally, some pairs of cables are packaged jointly in a protective cover. This is the most frequently used type of transmission media.



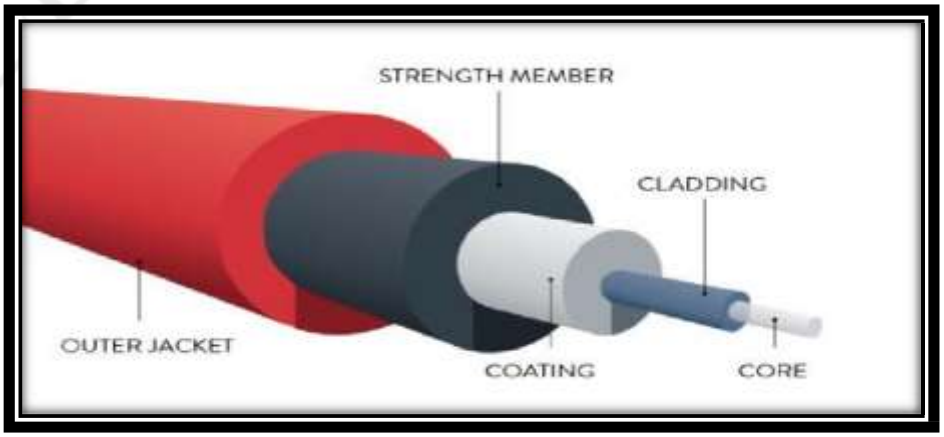
Coaxial Cable:-

This cable contains an external plastic cover and it includes two parallel conductors where each conductor includes a separate protection cover. This cable is used to transmit data in two modes like baseband mode as well as broadband mode. This cable is widely used in cable TVs & analog TV networks.



Optical Fibre Cable:-

This cable uses the notion of light reflected through a core that is made with plastic or glass. The core is enclosed with less thick plastic or glass and it is known as the cladding, used for large volume data transmission,



Unguided media

Unguided Media:-

It is also known as unbounded otherwise wireless transmission media. It doesn't require any physical medium to transmit electromagnetic signals. The main features of this media are less secure, the signal can be transmitted through air, and applicable for large distances. There are three types of unguided media.

Radiowaves:-

These waves are very easy to produce as well as penetrate through buildings. In this, the transmitting & receiving antennas no need to align. The frequency range of these waves ranges from 3 kHz to 1GHz. These waves are used in AM & Fm radios for transmission. These waves are classified into two types namely Terrestrial & Satellite.

Microwaves:-

It is a sightline transmission which means the transmitting & receiving antennas need to align correctly with each other. The distance which is covered through the signal can be directly proportional to the antenna's height. The frequency range of microwaves ranges from 1GHz to 300GHz. These are extensively used in TV distribution & mobile phone communication

Infrared Waves:-

Infrared (IR) waves are used in extremely small distance communication as they cannot go through obstacles. So it stops intrusion between systems. The range of frequency of these waves is 300GHz to 400THz. These waves are used in TV remotes, keyboards, wireless mouse, printer, etc.

Network Topology:-

Topology is the method in which networks are physically connected together. Topology determines the complexity of connecting computers and, therefore, the cost of network cable installation. Topology also determines the strategy for physically expanding the network in future.

Bus Topology:-

Bus topology is a network type in which every computer and network device is connected to a single cable. When it has exactly two endpoints, then it is called Linear Bus topology.

Features of Bus Topology:

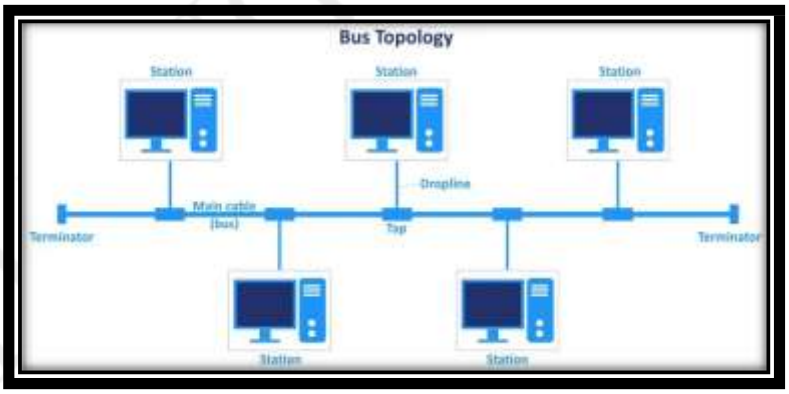
- The data signal is available to all computers connected to the bus.
- It carries the address of the destination computer.
- Bus topology is good for connecting 15-20 computers.
- Each computer on the network checks the destination address as the data signal travels through the bus.

Advantage of Bus Topology:-

- Bus topology cost is very low
- Required less cable length compared to other networks such as start topology.
- Easy to connected computer peripheral to a linear bus.
- It is easy to extend a bus.
- It works well for small networks.

Disadvantages of Bus Topology:-

- If there is a break in the main cable, the entire network will be shut down.
- If network gets heavy traffic, a node's performance of the network falls.
- The length of cable is limited.
- It is difficult to troubleshoot a bus.



Ring Topology:-

It is called ring topology because it forms a ring as each computer is connected to the other computer, with the last one connected to the first.

Note:- In Ring topology, computers are arranged in a circle. Data travels around the ring in one direction, with each device n the ring acting as a repeater, Ring networks typically use a token-passing protocol.

Features of Ring Topology:-

- Ring network does not have terminated ends.

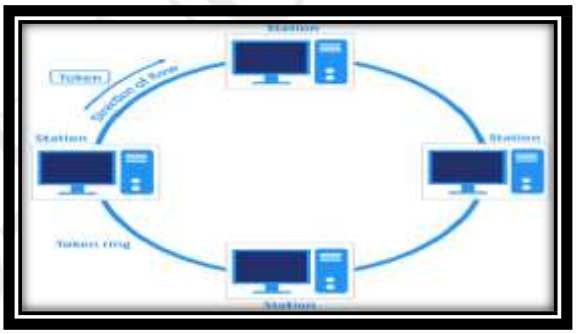
- The computers or devices are connected in the ring using twisted pair cables, coaxial cables or optic fibers.
- The protocols used to implement ring topology are Token Ring and Fiber Distributed Data Interface.
- Bit-by-bit data is transferred in a sequential manner.

Advantages of Ring Topology:-

- It is a more reliable network, because the communication system is not dependent on the single host computer.
- Easy to install and the maintenance is much easier compared to the bus network.
- Adding components such as nodes will not affect the performance of network.
- Because every computer is given equal access to the token, no one computer can monopolize the network.
- Troubleshoot is easy because cable faults can be easily located.

Disadvantages of Ring Topology:-

- Failure of one computer on the ring affects the whole network.
- Adding or removing devices to the networks would slow down the network activity.
- It is difficult to troubleshoot because it required special equipment to default the cable faults.
- If any one of the node fails, it disturbs all other networks.



Star Topology:-

A Star network, every host is connected to a central connection point, like a hub or a Switch. The connection between a node and hub device is a point-to-point.

The device takes a signal from any node and passes it to all other nodes in the network. It works as a server and it controls the entire function of the network, It is used to connect a computer through Coaxial cable.

Features of Star Topology:-

- Every node has its own dedicated connection to the hub.

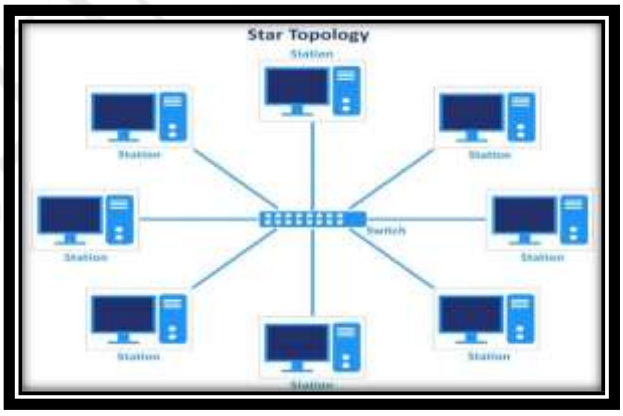
- Hub acts as a repeater for data flow.
- Can be used with twisted pair, optical fiber or coaxial cable.
- The data signal is transmitted from the source computer to the destination computer via the hub or switch.
- The common protocols used in star topology are Ethernet, Token Ring, and Local Talk.

Advantages of Star Topology:-

- It is much easier to modify or add new computers to a star network without disturbing the rest of the network.
- Single computer failures do not necessarily bring down the whole star network.
- Easy to manage and maintain the network because each node has separate cable
- It supports a high-speed data bandwidth of approximately 100 Mbps.
- Cost effective as it uses inexpensive coaxial cable.

Disadvantages of Star Topology:-

- If the central hub goes down, then all other connected nodes will not be able to communicate with each other.
- It requires more wires compared to the ring and bus topology because it is expensive to use
- If the hub gets failed then all the connected nodes will not be able to communicate with each other.



Tree Topology:-

It has a root node, and all other nodes are connected to it, forming a hierarchy. It is also called hierarchical topology. It should have at least three levels to the hierarchy.

Features of Tree Topology:-

- It combines characteristics of linear bus and star topologies.

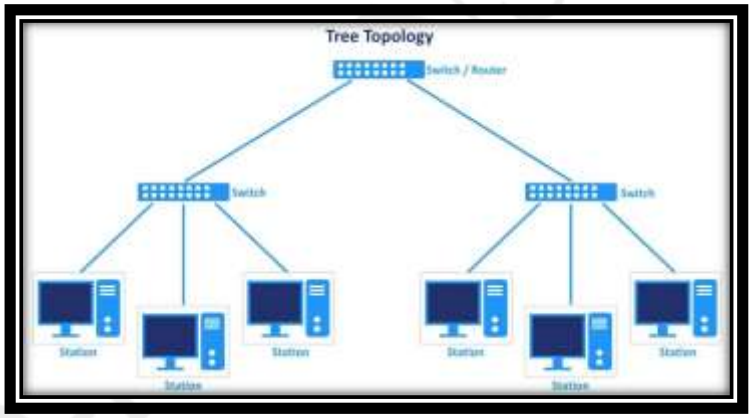
- It is arranged in a group of star workstations connected to a linear bus backbone cable.
- The top-level node in tree topology is known as a root node, and all other nodes are hierarchy of the root node

Advantages of Tree Topology:-

- Point-to-point connection of each computer is connected to each part of hub network.
- It is easy to add computer by extending the cables to connect computers.
- Error detection is an easy process.
- Fast expansion of nodes.

Disadvantages of Tree Topology:-

- If any faults occur in the node, it is difficult to maintain.
- Requires high cost devices for broadband transmission.
- If new or more nodes are added, then it becomes difficult to reconfigure.
- Failure in the main bus cable will damage the overall network.



Mesh Topology:-

In a Mesh topology, every node has point-to-point connection to the other node. All the computers are interconnected to each other in a network. This type of mesh topology is very expensive and it is difficult to establish the connections. The connection in mesh topology can be used in wireless network.

Features of Mesh Topology:-

- In a mesh network topology, each of the network node, computer and other devices, are interconnected with one other
- Every node not only send its own signals but also relays data from other nodes
- This type of topology is very expensive as there are many redundant connections.

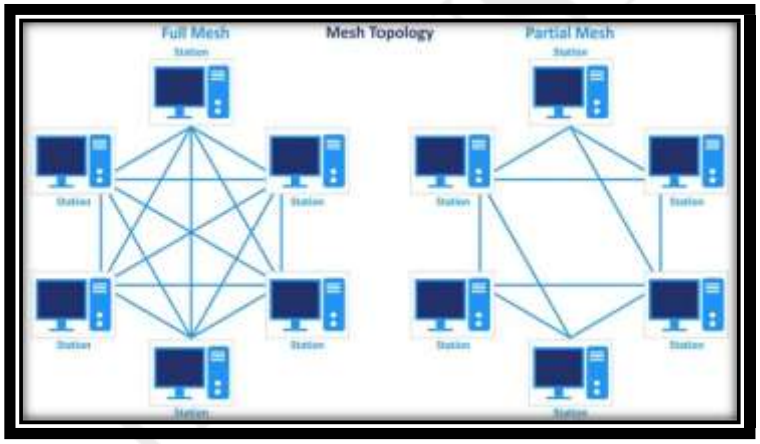
- The internet is an example of mesh topology.

Advantages of Mesh Topology:-

- The networks are very reliable because if any link breaks, it will not affect the other connected computers
- There is no link between point-to-points because it is secure.
- Fault is diagnosed easily.
- It is very fast communication between the nodes.

Disadvantages of Mesh Topology:-

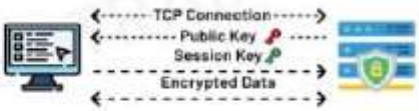
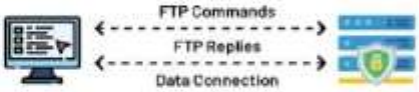
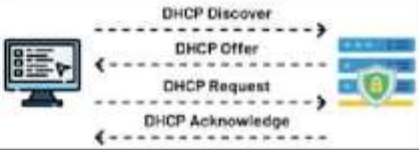
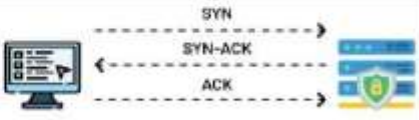
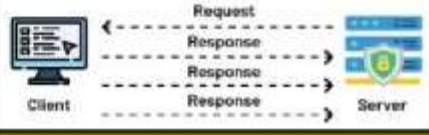
- It requires space to run the cables.
- Installation process is difficult, as each node is connected to every node.
- It requires number of cables and Input-output ports for communication.
- The Management of mesh network is very large and difficult to maintain and manage. If not monitored carefully, then the communication link in the network fails.



Protocol:-

Different types of networking operating systems use different languages to control the communication process languages to control the communication process between the computers. These languages recalled protocols, each one governing the way a certain technology works. A protocol is a **set of rules** that governs the communications between computers on a network. There are many types of Protocols E.g FTP, HTTP, SMTP, POP, NNTP, etc.

Common Network Protocols

HTTPS		**What:** The foundations of web browsing, enabling website access and secure data transfer. **Why:** Safeguard sensitive information online.
FTP		**What:** Standard for file transfer over a network. Uses separate control and data connections. **Why:** Transfer large files efficiently between systems.
Telnet		**What:** Offers remote access to servers. **Why:** Network management and troubleshooting.
DNS		**What:** Acts as the internet's phonebook, translating domain names to IP addresses. **Why:** Ensure easy web navigation.
DHCP		**What:** Automates IP address assignment **Why:** Simplify network configuration and connectivity.
SMTP		**What:** Powers email delivery **Why:** Ensure messages reach their intended recipients across the internet.
POP & POP3		**What:** Enables email downloading to local clients for offline access **Why:** Optimize email storage.
IMAP		**What:** Offers flexible email access across multiple devices. **Why:** Enhance email management and collaboration.
TCP		**What:** Core transport mechanisms **Why:** Ensure reliable data transmission across networks.
UDP		**What:** Core transport mechanisms **Why:** Ensure speed across networks.

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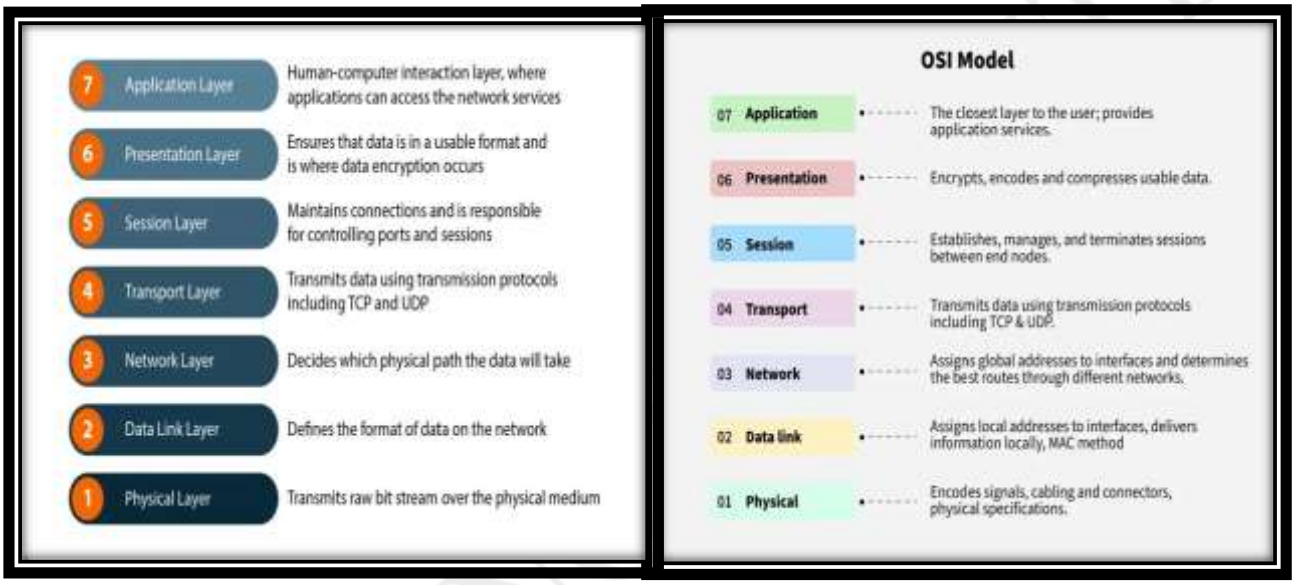
OSI(Open system interconnection)

OSI Model:-

OSI stands for Open Systems Interconnection. It has been developed by ISO - **'International Organization of Standardization'**, in the year **1984**. It is a 7 layer architecture with each layer having specific functionality to perform. All these **7 layers** work collaboratively to transmit the data from one person to another across the globe. In the OSI reference model, the communications between a computing system are split into seven different abstraction layers: **Physical, Data Link, Network, Transport, Session, Presentation, and Application.**



WWW

WWW (World Wide Web):-

The **world wide web** is the part of the Internet that contains websites and webpages. It was invented in **1989** by **Tim Berners-Lee at CERN**, **Geneva, Switzerland**. It is basically a system of Interne servers that supports specially formatted documents. The documents are formatted in a markup language called **Hyper Text Markup Language (HTML**) that supports links to other documents as well as graphics, audio and video files.

Web address(URL):

A **website address** is known as a **URL**. It is an Internet name that points to a location where a file, directory or website page is hosted. The first page of the website is called the **Home page.**

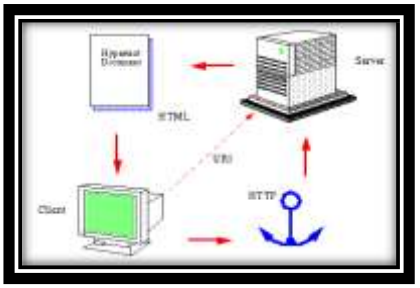
Every page on the web has a unique address called URL.

1. Transfer Protocol

2. Server Name

3. Directory path

4. File Name



http://www.tabasco.com/html/ap_pendix.html.

Absolute URL:-

A fully qualified URL that specifies the location of a resource that resides on the Internet is called an absolute URL. It is the complete path including the domain -filename.

Example:- http://www.ibdhost.co/images/logo.gif
This type of URL is what you must use when you want to link a file that is on another server.

Relative URL:-
A partially qualified URL is the one that specifies a resource on the Internet whose location is relative to the starting point specified by an absolute URL.

ISP and Role of ISP:-

An Interne Service Provider is a company which allows you to connect to the Internet. It provides the gateway to the internet and everything that you do online. You also connect to an ISP by using a PC modem to dial into the ISP modems over a standard telephone line. Your modem connects to a single modem among a bank of modems at your ISP. This a called a dial-up connection.

Some of the popular ISPs in India are:

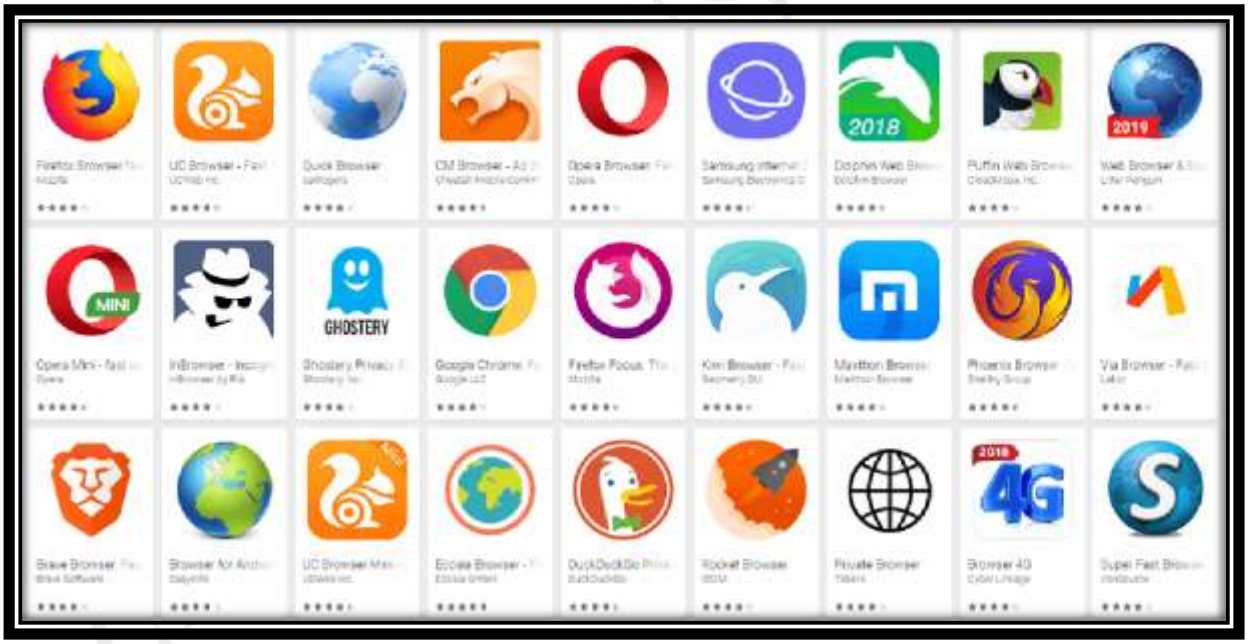
BSNL, MTNL, Airtel, Jio, VI etc.

Web Browsers:-

A web browser is a software application which enables a user to display and view web pages such as images, videos, music and other information. Text and images on a web page can contain hyperlinks which allow a user to quickly and easily access information provided on many web pages at many websites.

Some popular web browsers:-

Internet Explorer	Microsoft Edge	Mozilla Firefox
Opera Mini	Google Chrome	Netscap Navigator
Lynx	Chromium	Epic
Apple Safari	Brave	Vivaldi
Avant	NCSA Mosaic	UC browser



Search Engine:-

A web search engine is used to search for information on the Internet. The search results are generally presented in a list and are often called hits. The information may consist of web pages, images, text and other types of files.

How Search Engine Works?

Search Engine is the software program that helps users find information stored on a personal computer, or a network of computers, such as the

Internet. A user enters a keyword or a phrase. The search engine retrieves a list of web sites.

A search engine makes search in the following order:

Web Crawling:-

Search engine works by matching the required information from different websites and storing many web pages. These pages are then retrieved by a Web crawler (also known as a spider).

The contents of each page are then analyzed to check how it should be indexed. Data collected on web pages is stored in an index database for use in later queries. The purpose of an index is to get information as quickly as possible.

Indexing:-

The indexing software collects the document as well as URLs from the agent. The software then extracts information from the documents and indexes. It each search engine extracts and indexes different types of information.

Search Algorithm:-

Search using Boolean operators allow you to combine words and phrases using the words AND, OR and NOT to specify the search more accurately.

When we perform the search by entering keywords, the search engine searches its database using search algorithm.

IP Address:-

IP stands for **Internet Protocols**. It is a numerical label or value that is used to uniquely identify a computer on the Internet that uses the Internet protocol for communication. The address is made up of 32-binary bits in an IP address. The numbers are grouped into four octets and are separated by **dots**. Each octet consists of 8 bits each, that is, **4*8=32**

bits. In a decimal format, each octet has a minimum value of O and maximum value of 255. It starts from **0.0.0.0** and the end is **255.255.255.255** in a decimal format.

In IP addressing scheme, a static IP address is permanent address which will never change, whereas a dynamic IP address device changes its IP address every time when accessing internet.

The 32-bit IP address is grouped into eight bits, each separated by dots, and represented in decimal format (known as dotted decimal notation).

Important Point:-

i. IP Address is divided into 4 parts

ii. Each Part is known as octet

iii. Each octet is equal to 8 bit

iv. Each part is separated by. (dot)

v. IP Address is of 32

vi. IP address is divided into 4 bytes

Note:- IP Address range available 0-255.

Class	Range	Identity	Subnet	Net id	Host id	No. of Nid	No. of Hid
A	0-126	0	255.0.0.0	1	3	126	16777214
B	128-191	10	255.255.0.0	2	2	16382	65534
C	192-223	110	255.255.255.0	3	1	2097150	256
D	224-239	1110	Reserved for Multicasting				
E	240-255	1111	Experimental; used for research				

Note:-

1. **(127.0.0.1)** is Loop Back Ip Address

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2. Class C IP Address is used by smaller and mid sized network (companies).

3. **Class A** IP Address networks are only used by Large

4. IP address is identify by the first byte.

IPv6:-

IPv6 is the latest level of the Internet Protocol and is now included as part of the IP support in many products including the major computer operating systems. IPv6 is a set of specifications from the **Internet Engineering Task Force (IETF)**. IPv6 was designed as an evolutionary set of improvements to the current **IP version 4.**

The most obvious improvement in IPv6 over **the IPv4** is that IP addresses are lengthened from **32 bits to 128 bits**. This extension will take care of future growth of the Internet. The **128 bit** address is divided in to **16 bits**, and each **16 bit block** is converted to a **4 digit hexadecimal** number and separated by colons.

MAC Address:-

Mac stands for **Media Access Control.** It is a unique identifier assigned to a network interface card (NIC) by the manufacturer. It is used to connect to the Ethernet network, and it has its own unique MAC address. The MAC addresses are assigned permanently to adapters and cannot be changed as they are a unique identification of the hardware interface of network. They are the physical addresses. This address is sent to your local network, ie, to your router or ISP, where it is used to route information to your computer and serves as identification print on your network

MAC address is a 48 bit hexadecimal address. The format of a MAC address is MM:MM:MM:SS:SS:SS, where MM:MM:MM: the first 3 byte include address of the manufacturer, and the second half is the serial number of NIC card. MAC address of each computer on a network is unique. MAC address is used at the data link layer of OSI/TCP/IP model.

IMEI:-

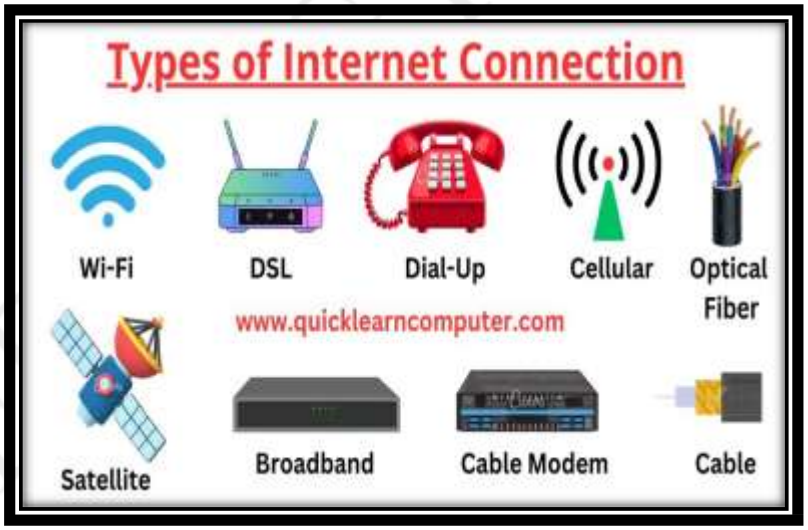
An International Mobile Equipment Identity (IMEI) number is a globally unique identification or serial number that is given to all mobile phones and smart phones. It is a **15 digit number** assigned to all cellular devices, which identifies your device within the mobile network. We can use this number to present a mobile phone from being used by another person or phone company if it has been lost or stolen.

The IMEI can be displayed on the screen of the phone by entering ***#06#** into the keypad on most phones. It can also be printed behind the battery of the phone.

```
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek PCIe GbE Family Controller
   Physical Address. . . . . . . . . : 8C-32-23-10-2A-54
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::e918:e5c4:869b:2070%12(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.19(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 22 March 2025 07:59:45
   Lease Expires . . . . . . . . . . : 23 March 2025 08:22:58
   Default Gateway . . . . . . . . . : fe80::1%12
                                       192.168.1.1
   DHCP Server . . . . . . . . . . . : 192.168.1.1
   DHCPv6 IAID . . . . . . . . . . . : 126628387
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2D-D4-71-9A-8C-32-23-10-2A-54
   DNS Servers . . . . . . . . . . . : 192.168.1.1
   Primary WINS Server . . . . . . . : 192.168.1.1
   NetBIOS over Tcpip. . . . . . . . : Enabled

Wireless LAN adapter Wi-Fi:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) Dual Band Wireless-AC 3165
   Physical Address. . . . . . . . . : 5C-E0-2A-84-90-38
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
```

Modes of Connecting Internet:-

There are different types of Internet Access techniques like Hatspot, Wireless fidelity (Wi-Fi), LAN cable, Broadband and USB Tethering.