



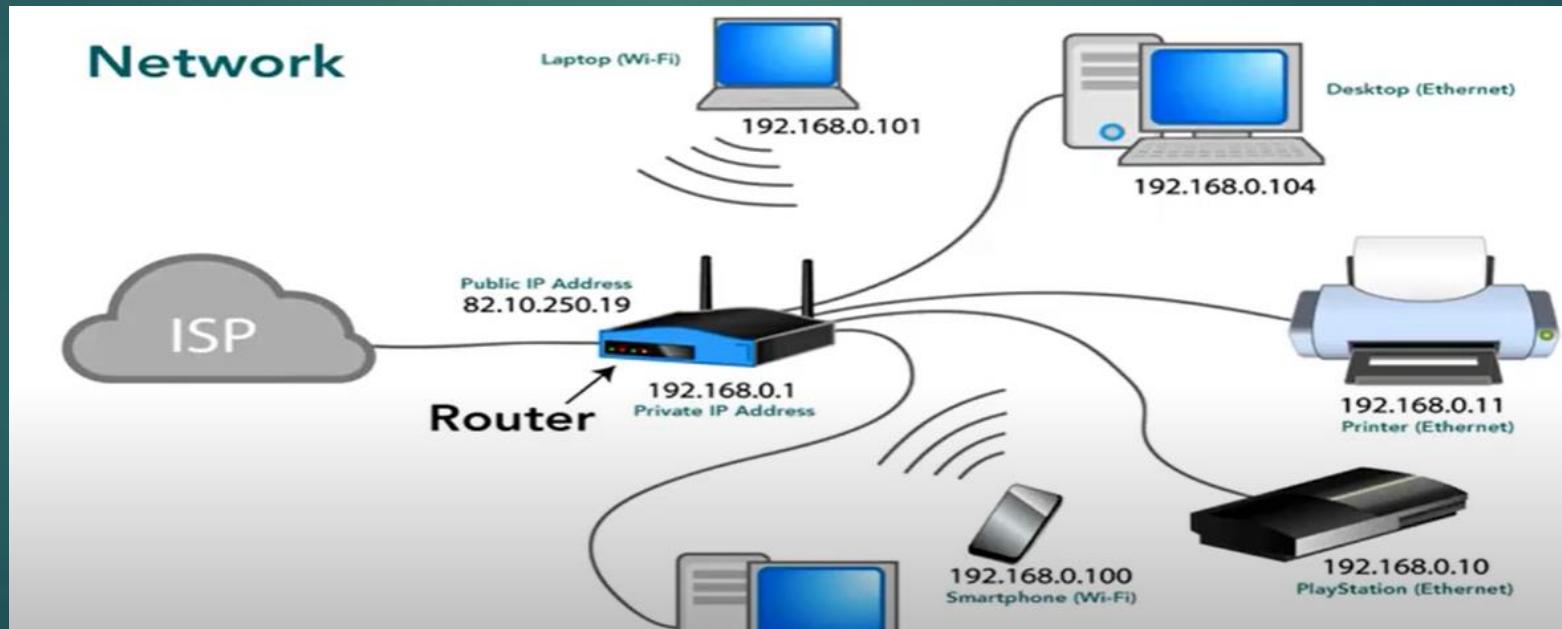
COMPUTER FUNDAMENTALS AND
APPLICATION.

BCA 1ST SEMESTER (UNIT 5)

NETWORK AND INTERNET

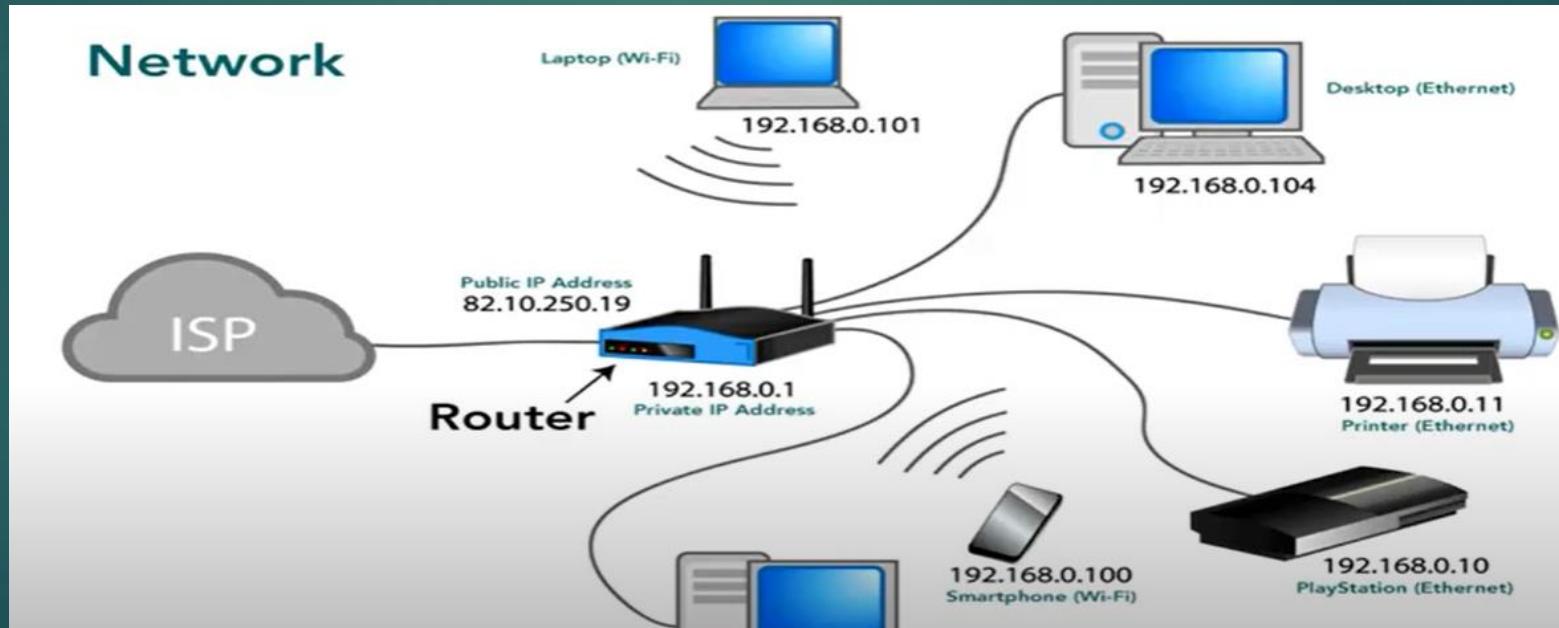
❖ Introduction to computer Network.

- computer network is a group of computer systems and other computing hardware devices that are linked together through communication channels to facilitate communication and resource-sharing among a wide range of users.
- The connection between networked computing devices is established using either cable media or wireless media.



❖ Introduction to computer Network.

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❖ Introduction to computer Network.

- Importance of computer Network.
 - Resource Sharing (File, hardware or software, printers, scanners , CD ROM drive, Hard drive etc.)
 - User communication (Effective communication, email, news group, video conferencing among user or staff)
 - Speed (Sharing and transferring files within networks are very rapid).
 - Cost.
 - Security (Password protected)
 - Centralized software management.
 - Email
 - Workgroup computing.

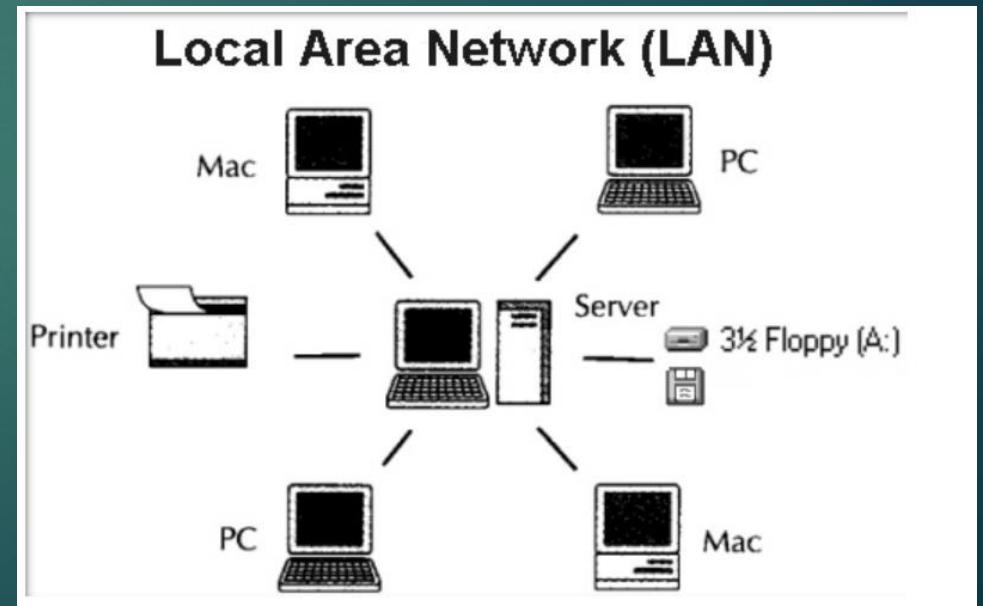
❖ Types of computer Network.

- Personal Area Network
 - It is a small network established for communication between different devices such as laptops, computers , mobiles, and PDAs.
 - Within few meters like 10 meters only
 - Medium : Bluetooth, Infrared
 - Only very few connections will be available



❖ Types of computer Network.

- Local Area network
- A LAN is a network that connects computers and devices in a limited geographical area such as a home , school, office building etc.
- Ethernet is the most commonly used technology in LAN.
- Network of college is an example of LAN.



❖ Types of computer Network.

- Local Area network
- LANs consist of the following components:
- Computers
- Network interface cards
- Peripheral devices
- Networking media
- Network devices

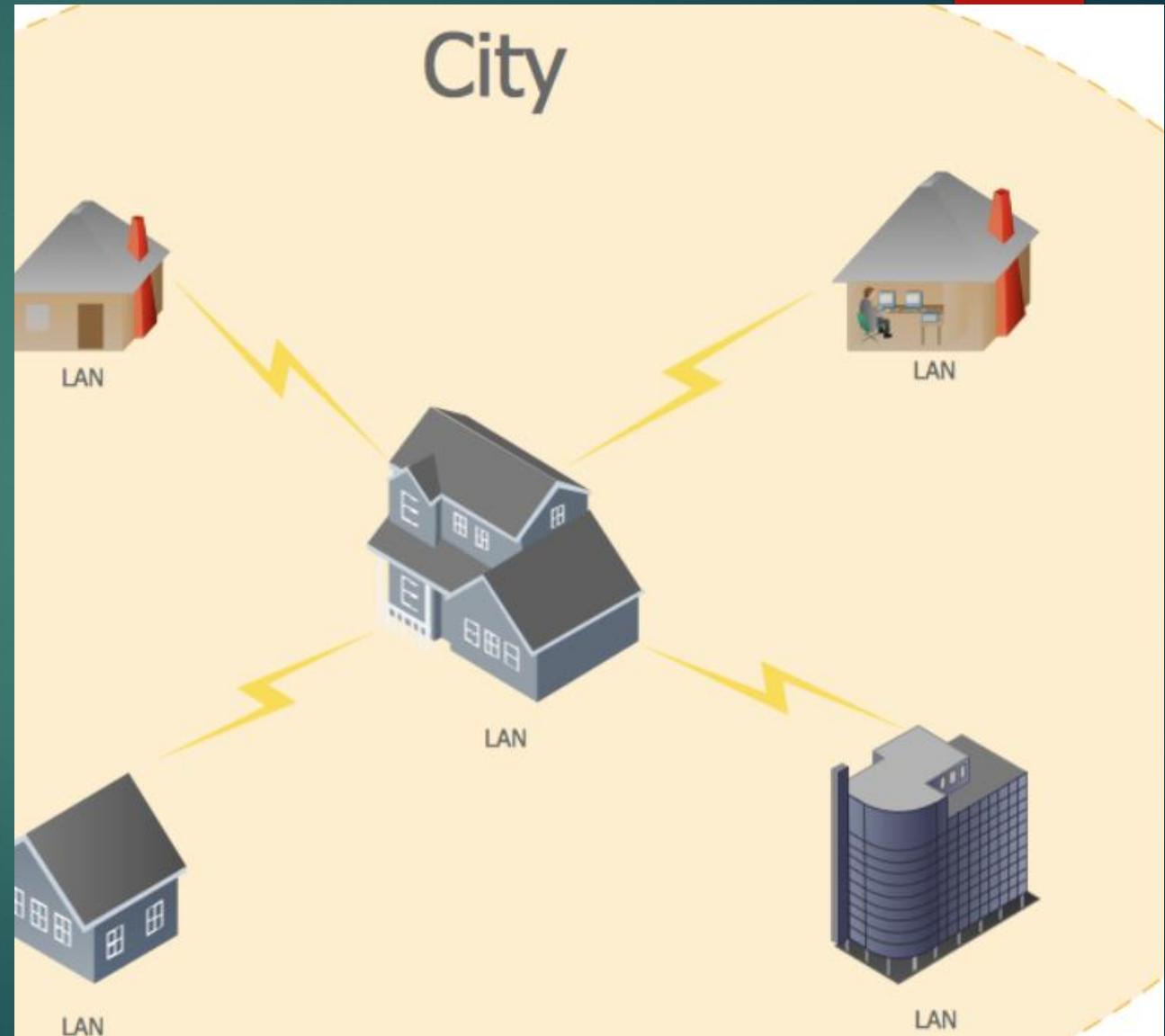


❖ Types of computer Network.

- Metropolitan Area Network.
 - It is relatively larger than LAN and extends across a city or metropolitan.
 - It is created by connecting two or more LANS located at different locations in a city.
 - MAN uses optical fiber, coaxial cable or may be wireless technology for connectivity.
 - Network of cable television is an example of MAN.
 - Generally covers towns and cities (50 kms)
 - Medium: optical fibers, cables.

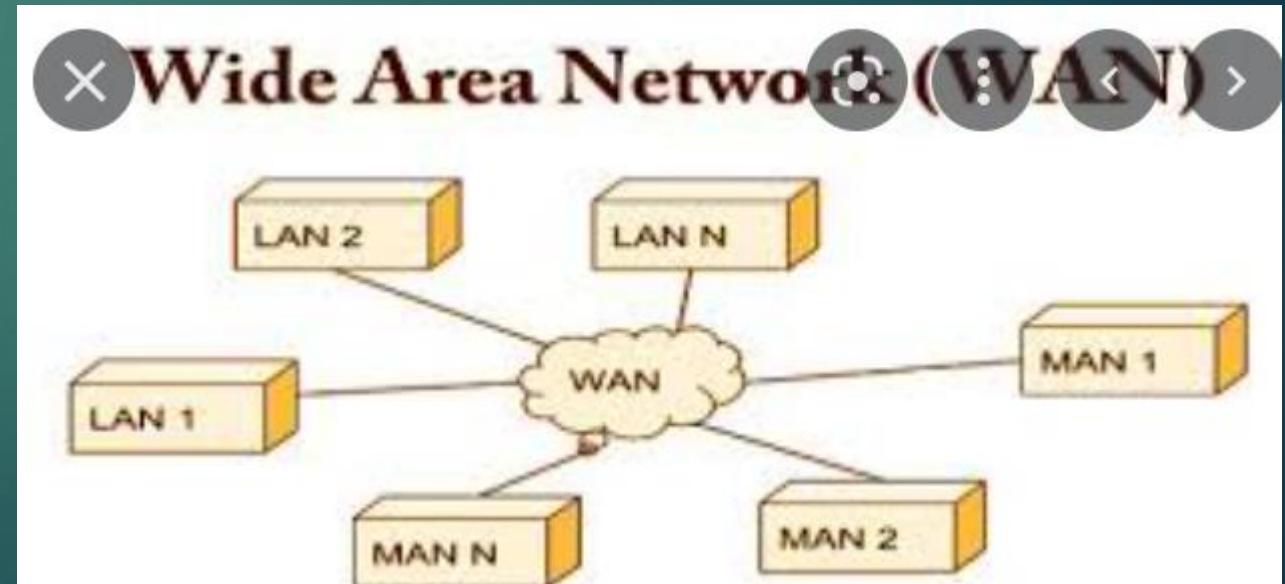
❖ Types of computer Network.

- Metropolitan Area Network.



❖ Types of computer Network.

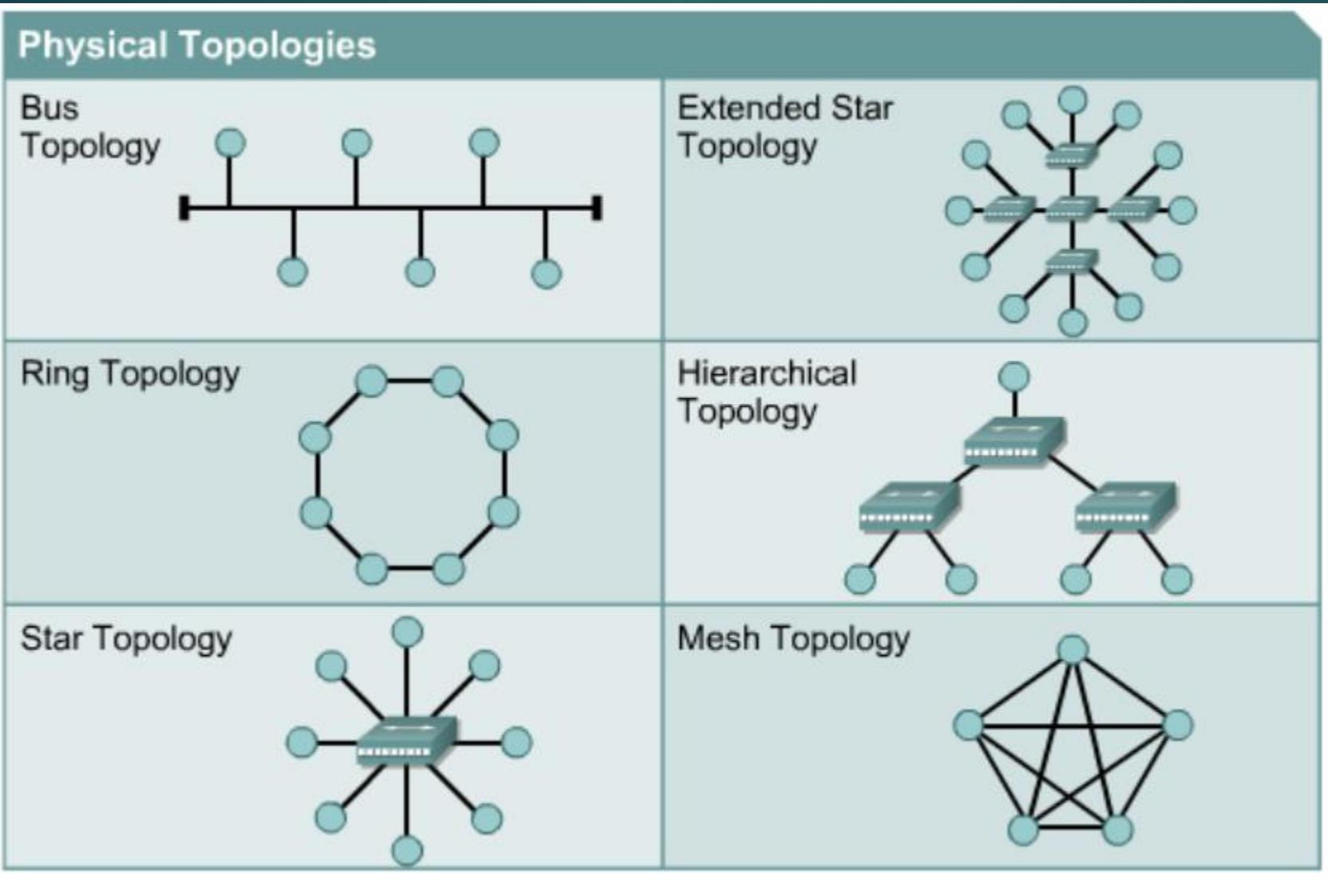
- Wide Area Network.
 - A wide area network (WAN) is a computer network that covers a large geographic area such as a city , country or even intercontinental distances.
 - Network connectivity used in WANs may be optical fiber or wireless like satellite or terrestrial microwaves.
 - Internet is an example of WAN.



❖ Network Topology .

- The term topology refers to the way in which a network is laid out physically. The actual layout of the wire or media. Two or more devices connect to a link; two or more links form a topology.
- Defines how the hosts access the media to send data. Shows the flow of data on a network.

❖ Network Topology .



❖ Network Devices.

- Components used to connect computers as well as other electrical devices together in order to share resources such as printers.

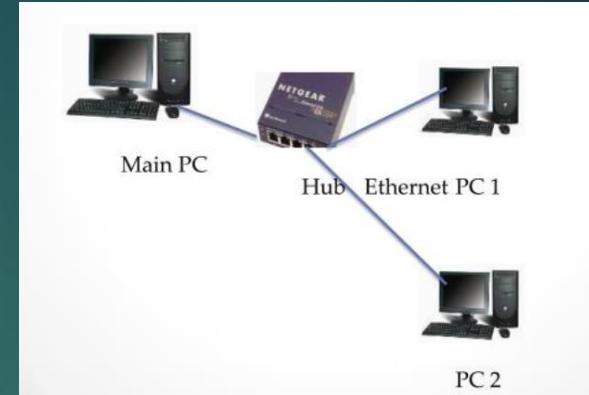
The different devices or components used in networks include.

1. Hubs
2. Switch
3. Routers
4. Network bridges
5. Gateways
6. Firewalls
7. Wireless AP (Access point)
8. Modem

❖ Network Devices.

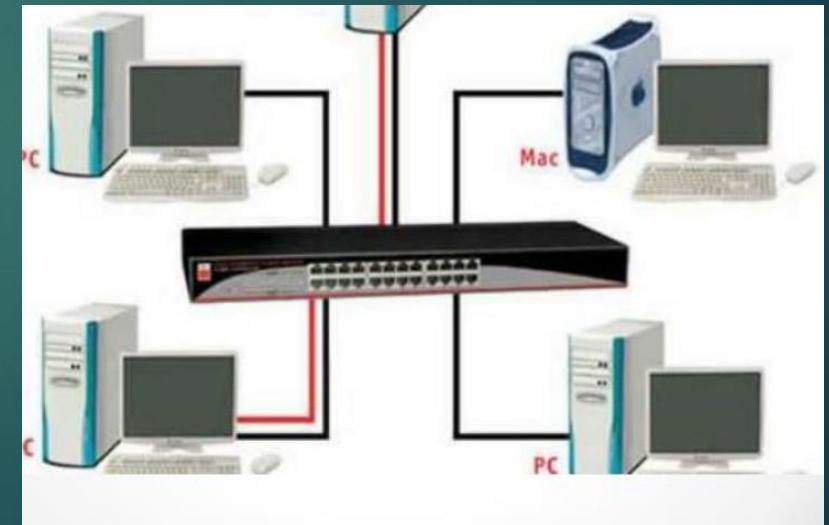
□ Hubs

- A small rectangular box that joins computers together through ports on the back of the hub.
- A hub is an unintelligent network device.
- A hub receives data packets and passes on all the information it receives to all the other computers connected to the hub.
- Example: if computer1 wants to communicate with computer 3 , the data will be sent to all the computers on the network since hubs do not know the destination of the information it receives.
- Hub operate at layer 1 (physical layer of the OSI reference Model).



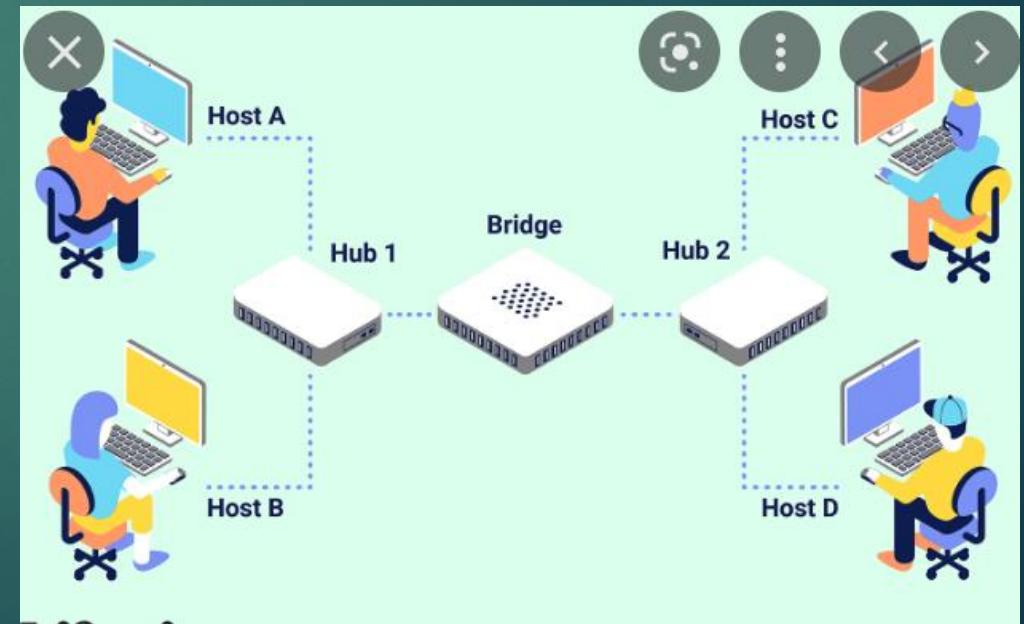
❖ Network Devices.

- Switch (Layer 2 data link layer)
 - Switches look similar to hubs in that they are rectangular in shape.
 - Switches work about the same way as hubs, unlike hubs, switches can identify the destination of a packet.
 - Switches can also send and retrieve information at the same time which makes sending information faster to retrieve than hubs.



❖ Network Devices.

- Bridge (Layer 2 data link layer)
 - Bridge is a networking device which is used to divide a LAN into multiple segments or used to connect two LANs.
 - Bridge is used to reduce the collision (Traffic).
 - Bridge works under data link layer of OSI model.

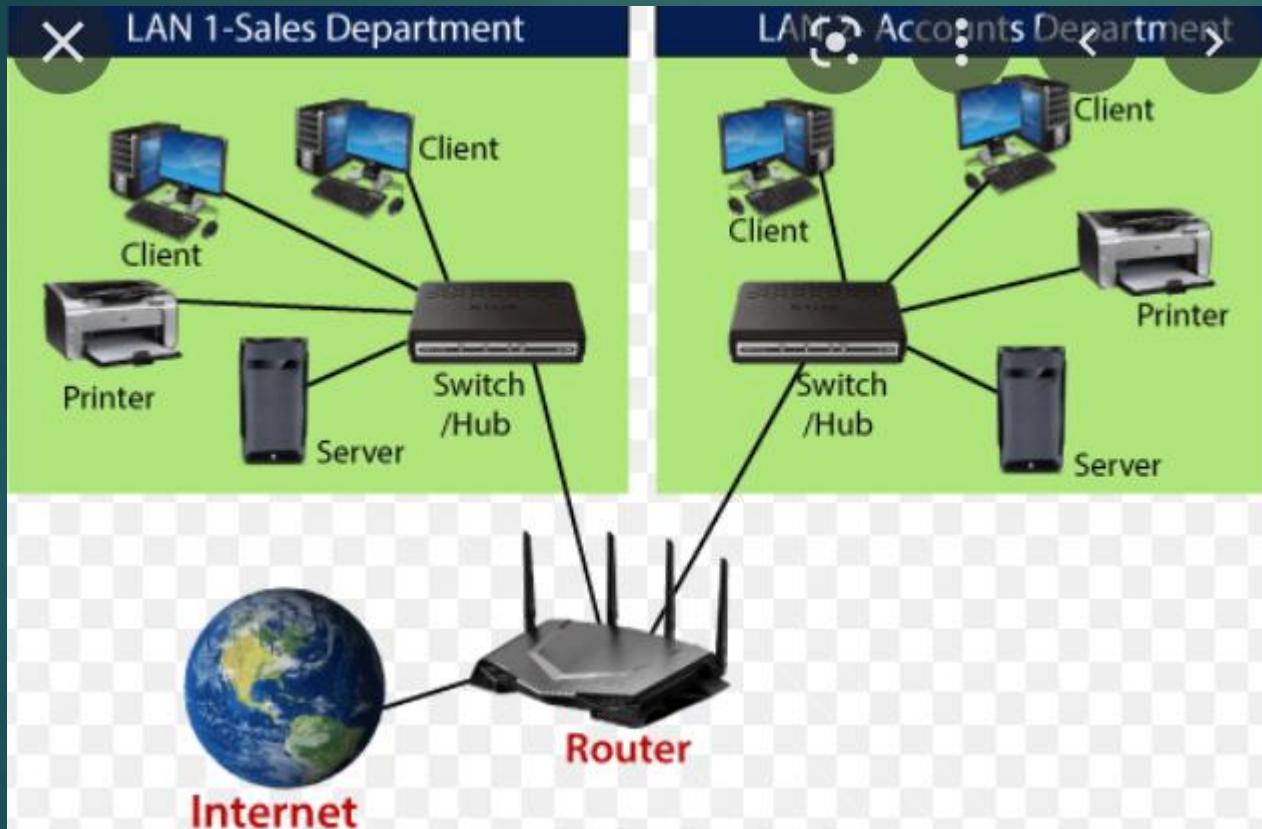


❖ Network Devices.

- Router
 - A router is a device that is used to connect different networks having different protocols.
 - A router operate at the layer 3 (Network layer) of the OSI reference model.
 - It connects different networks together and sends data packets from one network to another.
 - A router can be used both in LANs (Local Area Networks) and WANs (Wide Area Networks).
 - It transfers data in the form of IP packets.
 - In order to transmit data, it uses IP address mentioned in the destination field of the IP packet.

❖ Network Devices.

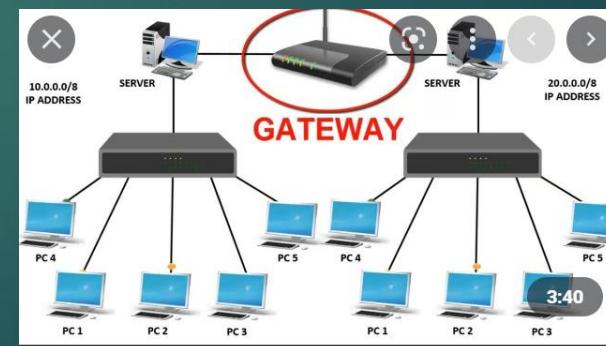
□ Router



❖ Network Devices.

□ Gateways

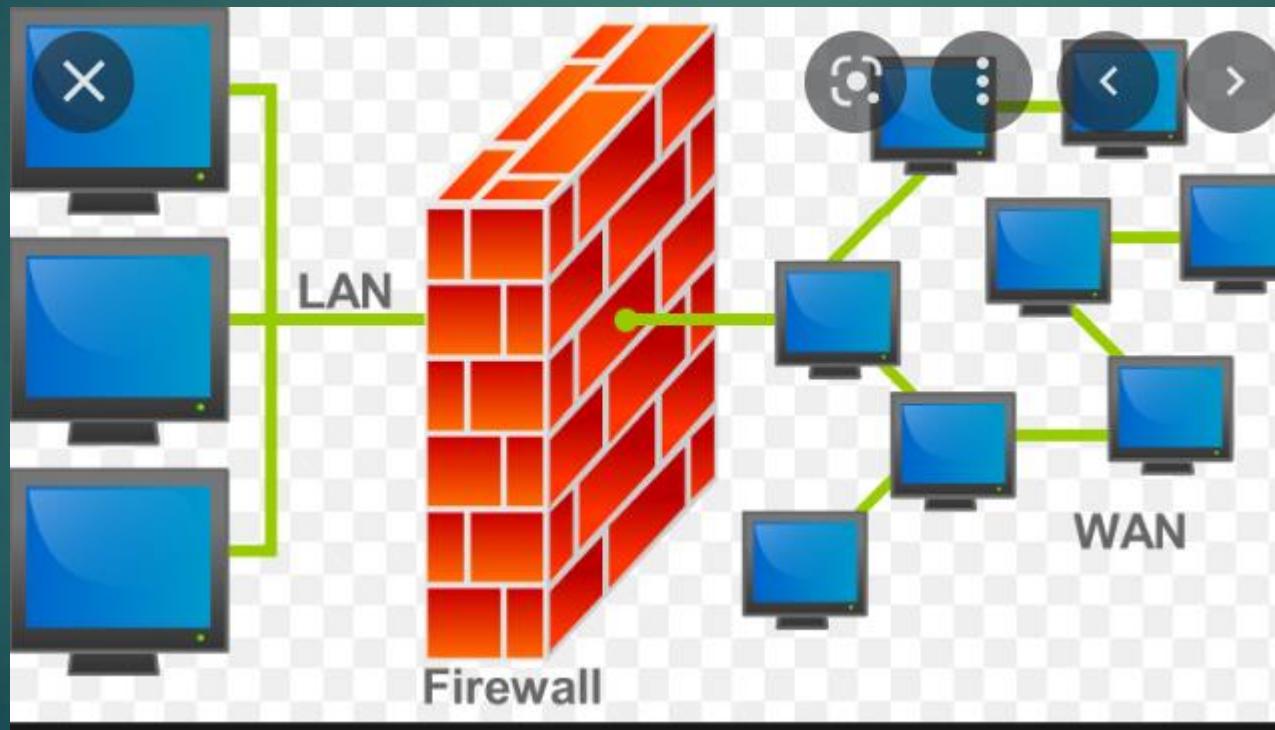
- A gateway is a network node that connects two networks using different protocols together.
- It may be router , firewall server or other device.
- Router can communicate between two different network using the same protocol on the other hand a gateway is a network node that connects two network using different protocols together.



❖ Network Devices.

❑ Firewall

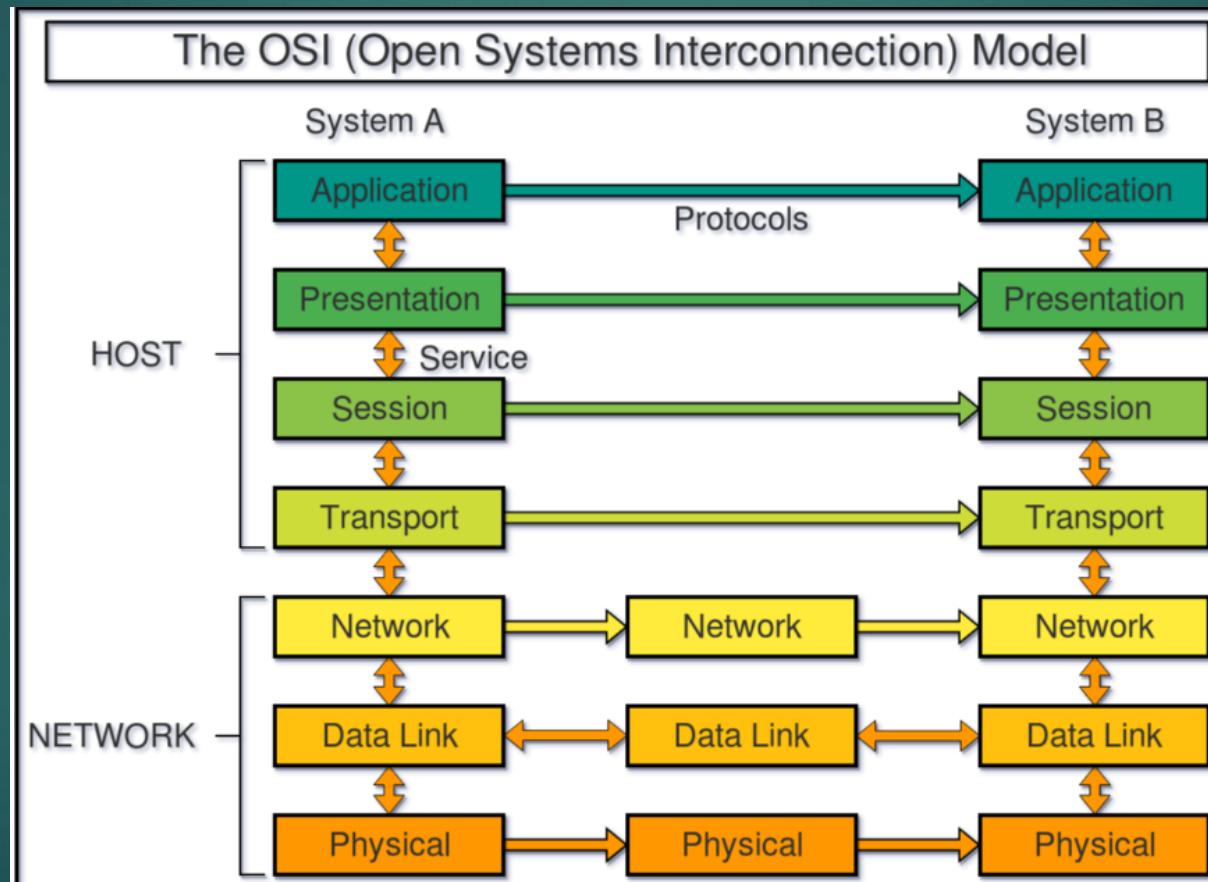
- Firewall protects the entire network.
- A firewall is software or firmware that prevents unauthorized access to a network.



❖ OSI reference model

- ▶ OSI (Open system Interconnect) Model defines and used to understand how data is transmit through one computer to another computer in a network.
- ▶ This model is developed by international organization of standardization (ISO) in 1984.
- ▶ This model is called the ISO OSI reference model because it deals with connecting open system . i.e the systems that are open for communication with other systems.
- ▶ It uses the Modular concept by providing different functionalities in different layers required to communicate another system.
- ▶ The OSI model has seven layers.

❖ OSI reference model



❖ OSI reference model

□ Benefits of OSI Model:

- It breaks network communication into smaller, more manageable parts.
- It standardizes network components to allow multiple vendor development and support.
- It allows different types of network hardware and software to communicate with each other.
- It prevents changes in one layer from affecting other layers.
- It divides network communication into smaller parts to make learning it easier to understand.

❖ OSI reference model

- Application layer (Layer 7)
 - This is the layer with which end users interact.
 - user-controlled software is implemented—for example, e-mail, file transfer utilities, terminal access , Web surfing.
 - Used by network application such as web browser , outlook skype etc.
 - Examples of protocols that run at the application layer include File Transfer Protocol (FTP), Hypertext Transfer Protocol (HTTP), telnet, SMTP, DHCP, POP, SNMP etc.

❖ OSI reference model

- Presentation layer (Layer 6)
 - The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems.
 - The presentation layer performs the following functions.
 - Translation: for example ASCII to EBCDIC
 - Encryption: Encrypt data for security purpose Decryption reverses the original process to transform.
 - Compression: (lossy or lossless)

❖ OSI reference model

- Session layer (Layer 5)
 - Enables sessions between computers on a network to be established and terminated.

Functions:

- Dialog control: The session layer allows two systems to enter into a dialog. It allows the communication between two processes to take place in either half-duplex (one way at a time) or full-duplex (two ways at a time) mode.
- Authentication: (Who you are)
- Authorization : (permission)
- Session management:
- APIS and NetBios (network services that enables application to communicate with each other on a network) protocol are used.

❖ OSI reference model

- Transport layer (Layer 4)
 - This layer guarantees transmission of data from one end to other end. The transport layer performs following function:
 - Segmentation: It breaks the data groups into smaller units so that they are handled more efficiently by the network layer.
 - Flow control: Control the data transmission flow.
 - Error Control : If transmitted data is corrupted then retransmit the data.

TCP (connection oriented provide feedback) , UDP (connection less) protocol is used for data transmission.

❖ OSI reference model

- Network layer (Layer 3)
 - The network layer is responsible for functions such as the following:
 - Logical addressing (IPv4 or Ipv6): IP address is assign for transmission of data packet in destination. (unique IP address)

Routing:

- Routing is the process of moving data packet from source to network destination.
- It is based on logical addressing of host IP address.

Path determination:

- Choose the best possible path for the data delivery.

Network layer protocol IP, ARP etc.

❖ OSI reference model

- Data link (Layer 2)
 - Access to media .
 - Controls how data is placed and received from the media.
 - Error Detection. (CSMA)
 - Media Access control.

❖ OSI reference model

- Physical layer (Layer 1):
 - It is responsible for the following activities.
 - Defining voltages and data rates needed for transmission.
 - Converting digital bits into electrical signal.
 - Deciding whether the connection is simplex, half duplex or full duplex.
 - Signal generated in this layer depends upon the type of media that is connected on device.

❖ Internet History (continue...)

- After the difficulties of Circuit switched network DOD (Department of defense) started its research as ARPA (Advanced research Project Agency)
- Due to lack of expertise and lab ARPA did work issuing grants and contracts to universities and companies.
- It have a packet switched network consisting of a subnet and host computers.
- Subnet would consists of minicomputers called IMPs (Interface message processors).

❖ Internet

- ▶ The network formed by the co-operative interconnection of a large number of computer networks.
- ▶ It is a global networks of computer to exchange information.
- ▶ It is a “ Network of Networks ” that includes millions of private and public network linked by copper wires , wireless connections and other technology.
- ▶ There is no central administration of the Internet.
- ▶ A machine is said to be on the internet if it runs the TCP/IP protocol stack, has an IP address and has the ability to send IP packets to all the other machines on the internet.
- ▶ Governing bodies of the internet are internet Society(ISOC), internet Architecture Board (IAB), Internet Engineering Task Force (IETF) etc.

❖ Feature of Internet

- Accessibility
 - Global service and accessible to all.
- Easy to use
 - Software (web browser), easily learned.
- Interaction with other media.
- Low cost
- Extension of existing IT technology.
 - Sharing of IT technology by multiple users in organization.
- Flexibility of communication.
 - Sharing of IT technology by multiple users in organization.
- Security

❖ Application of Internet

- World wide web.
- Electronic mail (E-mail)
- File transfer protocol (FTP)
- Telnet (Log into the computer located remotely)
- Internet relay chat (voice, video, text)
- Bank (E-banking)
- Education (E-learning)
- E-commerce
- E-governance
- Health sectors

❖ Intranet

- An Intranet can be defined as a private network located within a single organization connecting an affiliated set of clients for the purpose of communication and information sharing.
- Intranet also uses standard Internet Protocols and basically, runs on top of TCP/IP and HTTP and filters out any illegal access through firewall connected by secure, possibly virtual networks.



Extranet

- Extranet An Extranet is actually an Intranet that is partially accessible to authorized users outside the company. Extranets are formed when firms permit outsiders to access their internal TCP/IP networks.
- Companies can use an Extranet to: Share product catalogs exclusively with wholesalers or those “in the trade”. Collaborate with other companies on joint development efforts. Jointly develop and use training programs with other companies.

❖ Protocols

- A protocol is a set of rules and regulations that governs data communication.
- Protocols represents an agreement between the communicating devices.
- Without a protocol two devices may be connected but cannot communicate.
- A protocol defines:
 - Syntax : what is communicated
 - Semantics: How it is communicated and
 - Timing: When it is communicated.

❖ Network Protocols

- A network protocol is an established set of rules that determine how data is transmitted between different devices in the network.
- It allows connected devices to communicate with each other.
- Network protocols are the reason you can easily communicate with people all over the world, and thus play a critical role in modern digital communications.
- Similar to the way that speaking the same language simplifies communication between two people, network protocols make it possible for devices to interact with each other.
- (IP,TCP/IP, HTTP, HTTPS,FTP,SMTP,POP3, IMAP are some of the example of network protocols.

❖ IP (Internet protocols)

- ▶ An unique strings of numbers separated by full stops that identifies each computer using the internet protocol to communicate over a network.
- ▶ That identifies a device on the internet.

for eg: 192.168.100.1

❖ IPv4

- Internet protocol version 4 .
- IPv4 address are 32 bit long (4 bytes).
- The maximum value of ipv4 address is 2^{32}
- Number range from 0 to 255.
- For eg: 192.168.0.1

❖ IP v6

- ▶ 128 bit and no (16 bytes)
 - ▶ The maximum value of IPv6 address is 2^{128}
- IPv6 format :
- 2001 : db8 : 3333 : 4444 : CCCC : DDDD : EEEE : FFFF

❖ IP Address class

- Class A : Ranges (0- 126) subnet mask: (255.0.0.0)
- Class B: Ranges (128-191) subnet mask: (255.255.0.0)
- Class C: Ranges (192-223) Subnet mask: (255.255.255.0)
- Class D: 192-223 used for multicasting. (multicasting allows a single host to send a single stream of data to thousand of host across the internet.)
- Class E: ranges (240 to 255) : Reversed for the reach purpose.

❖ IP Address

- ▶ What is the difference between a dynamic and static IP address?
- ▶ When a device is assigned a *static* IP address, the address does not change. Most devices use *dynamic* IP addresses, which are assigned by the network when they connect and change over time.

❖ Define Subnet Mask

- It is a number that defines a range of IP address available within a network.
- Subnet mask hides (or masks) the network part of system IP address and leaves only the host part as the machine identifier.
- It is an address used to identify the network and host portion of the IP address.

For eg: 255.255.255.0

❖ TCP / IP protocols

- Transmission control protocol (TCP) is a network communication protocol designed to send data packets over the internet.
- TCP is used to connect network devices to the internet , it can also used as a communication protocol. For private intranet or extranet.
- TCP provides communication between an application program and the internet protocol.
- TCP is a connection oriented protocol.

What does TCP do ?

- Breaks the data into packets .
- Assembling of packets.
- Resemble in proper order.
- Detect error and lost data.

❖ TCP / IP protocols

What does TCP do ?

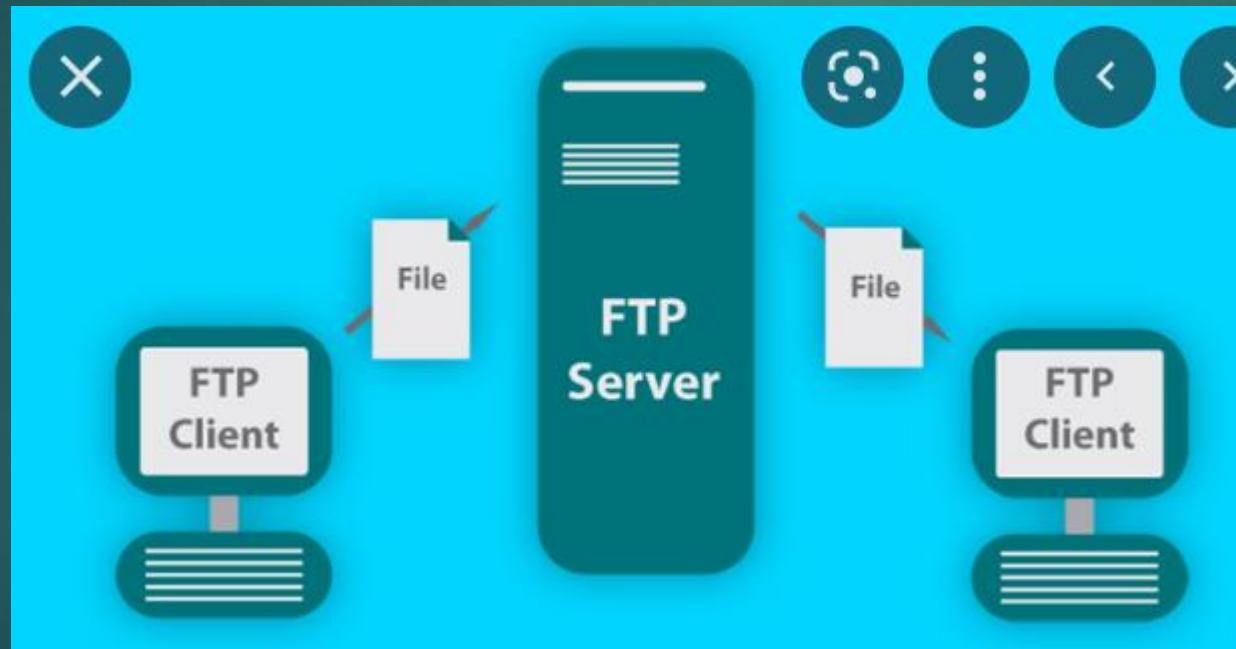
- Breaks the data into packets .
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What does IP do ?

- Handle the address part of each packet to reach the right destination.

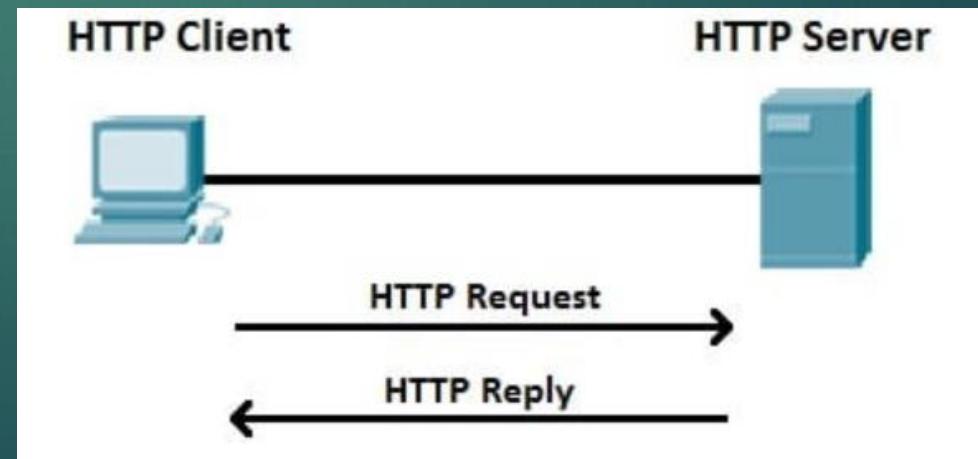
❖ File transfer protocols (FTP,SFTP,TFTP)

- The file transfer protocol (FTP) is a standard network protocol used for the transfer of computer files between a client and server over a network.
- websites use FTP for the uploading and downloading of files from their website's servers.



❖ HTTP

- Hypertext is the text that is specially coded using a standard coding language called hyper text markup language (HTML).
- Protocol used to transfer hypertext between two computers.
- It is used by the world wide web.
- The protocol that is used to viewing webpages.
- HTTP uses a server-client model. A client for example, may be a home computer, laptop, or mobile device.
- The HTTP server is typically a web host running web server software.



❖ HTTPs

- Encrypts the data that is being retrieved by HTTP.
- HTTPs is used for the secure connection.

❖ Telnet

- Telnet is an application protocol that allows a user to communicate with a remote device.
- Protocol for remote login.
- Telnet is often used by network administrators to access and manage remote devices.

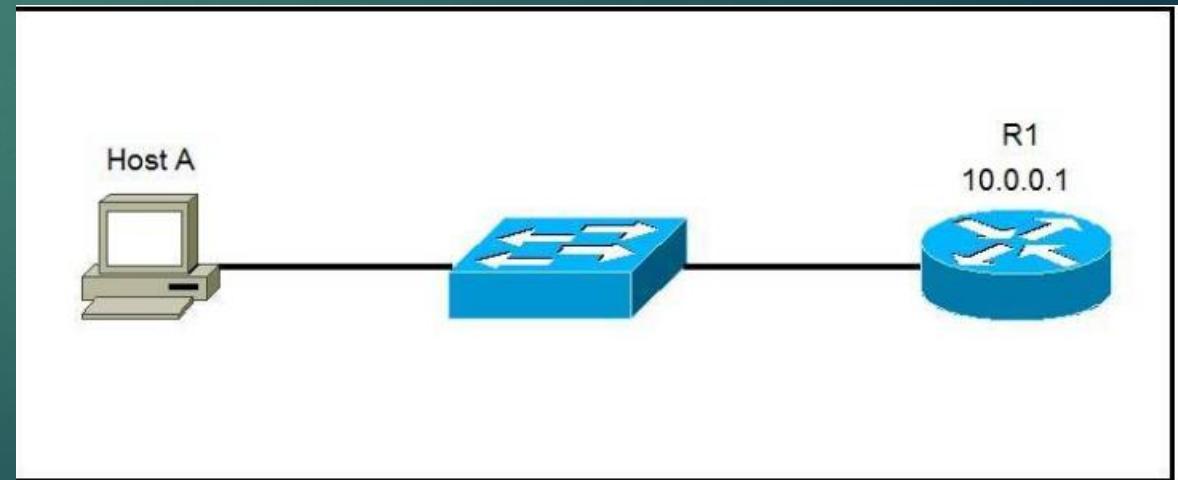
❖ Telnet

- To use telnet, you must have a software (Telnet client) installed. On a remote device, a Telnet server must be installed and running. Consider the following example:
- The network administrator wants to use his computer (**Host A**) to access and manage the router (**R1**). The administrator will start a Telnet client program on Host A and enter the IP address of the router R1 (**telnet 10.0.0.1**):

```
telnet 10.0.0.1
Trying 10.0.0.1 ...Open

User Access Verification

Password:
```



❖ URL (Uniform Resource Locator)

- URL is the abbreviation of uniform resource locator and is define a global Address of documents and other resources on the world wide web.
- Web address
- We all uses URLs to visit webpage and other resources on the web.

Eg: <http://www.youtube.com/weather/Kathmandu/ktm.html>

❖ E-mail

- ▶ Stands for electronic mail.
- ▶ Email is a method of exchanging messages “Mail” between people using electronics devices (Email is used electronics devices. (Email is used in 1960 s) .
- ▶ In order to send and receive e-mail, you will need an email address.
- ▶ Eg: outlook.com, gmail yahoo mail, inbox.com, mail.com, AOL mail, Loho mail.

❖ Protocols used in email

1. SMTP

- Stands for simple mail transfer protocols.
- Connection oriented application layer protocols.
- Used to send and receive email message.
- Mail servers and mail transfer agents use smtp to both send and receive message.

❖ Protocols used in email

2. POP3

- Stands for post office protocols version 3.
- Application layer protocol used by email clients to retrieve email message from mail servers over TCP/IP network.
- POP3 supports only one mail server for each mailbox.

❖ Protocols used in email

3. IMAP (Internet message Access Protocols)

- IMAP stands for internet message Access Protocols .
- Enable email clients to retrieve email messages from mail server over a TCP/IP.
- Designed to retrieve message from multiple mail servers.
- All modern email clients and servers like Gmail, outlook, and yahoo mail.

❖ Gophers

- Gopher protocol is a communication protocol is designed for distributing , searching and retrieving documents.
- It is an application layer protocol that provides the ability to extract and view web documents.
- The gopher protocol was presented an alternative to the World wide web in early stages , but HTTP become dominant protocol.

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❖ World wide web

- 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 video etc.
- The building blocks of the web pages which are formatted in HTML and connected by links called “Hypertext” and accessed by HTTP.
- A web page is given an online address called a uniform resource Locator.
- A particular collection of web pages that belong to a specific URL is called a website e.g www.Facebook.com ,
www.google.com.