



DATA COMMUNICATION AND NETWORKING

OBJECTIVES

At the end of this chapter, you will be able to:

- Describe the basic components of a telecommunication system
- Define and identify the components of a successful communication
- Understand the various communications technologies
- Describe the features of the various types of communications networks and network services.

INTRODUCTION

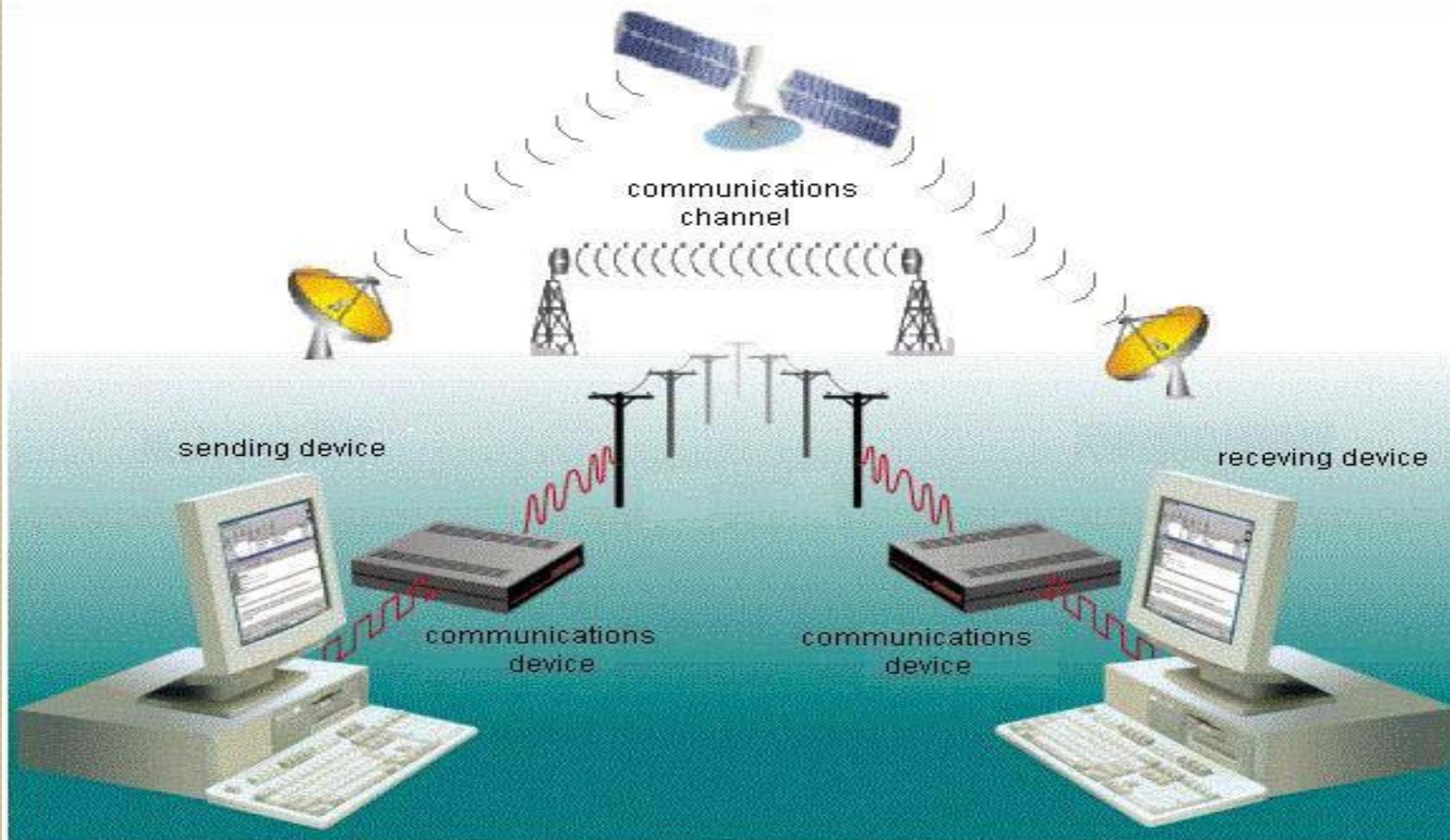
When computers were first introduced, they were **stand-alone** devices but as they became widely used, hardware and software were designed so that computers could exchange data, information, and instructions with other computers - a process called **data communication**.

Computer communication (also called telecommunication **or** Data communication) describe a process in which one computer transfers data, information and instructions to another computer.

Today, even the smallest computers and devices communicate directly with one another, with hundreds of computers on a **company network**, or with millions of other computers around the globe—often via the **Internet**. Computer communication is accomplished through the use of a **Telecommunications system**.

A telecommunications system is a collection of compatible hardware and software arranged to communicate data, information and instructions from one location to another.

Figure below illustrates a general model of a typical telecommunications system



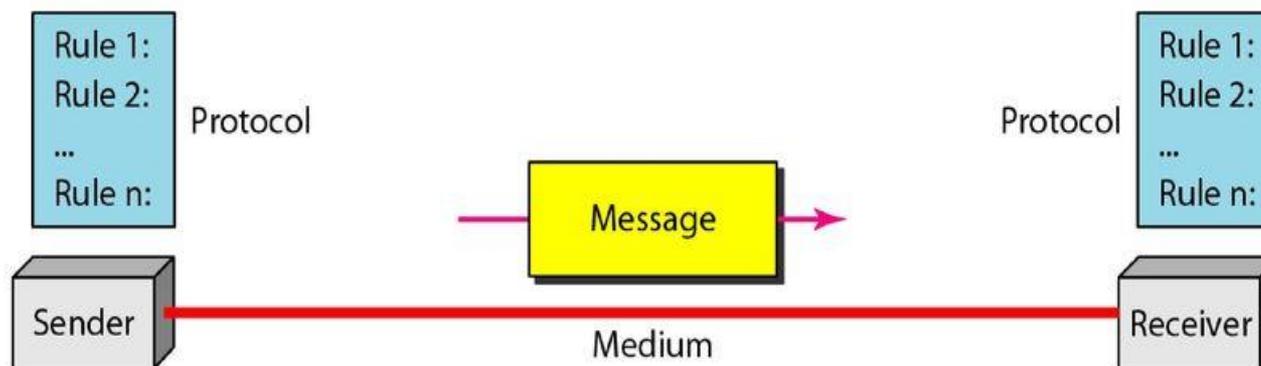


THE TELECOMMUNICATIONS MODEL CONSISTS OF THE FOLLOWING:

- i. A **sending device** that initiates an instruction to transmit data, information, or instructions. It can be a computer system, a terminal, a cellular telephone, a WebTV™, a GPS receiver, an Internet-enabled PDA, or another device that originates the message.
- ii. A **communications device** Eg a switch, hub or router which connects the communications channel to a receiving device/a sending device..
- iii. A **communications channel** or transmission media, are pathways on which the data, instructions, or information travel. This can be wireless or wired medium.
- iv. A **receiving device** that accepts the transmission of data, information, or instructions.
- v. A **communications software** that controls and manages the activities and functions of the communications network eg web browsers.

Five Components of Data Communication

- Message: Information(data) to be communicated
- Sender
- Receiver
- Transmission medium: Physical path by which a message travels
- Protocol: A set of rules that govern data communication



Assignment I

1. **Which of the following describes a computer network?**
 - A. Connection of computers
 - B. Collection of computers
 - C. Arrangement of computers
 - D. Laboratory of computers
2. **Computers that are not connected to the computer networks are referred to as?**
 - A. Server computers
 - B. Standalone computers
 - C. Client computers
 - D. Workstations
3. **Which of the following network topologies has its nodes connected to a single cable?**
 - A. Star topology
 - B. Mesh topology
 - C. Bus topology
 - D. Ring topology
4. **Wireless media can also be referred to as**
 - A. Guided media
 - B. Unguided media
 - C. Bounded media
 - D. Physical media
5. Outline any five elements of a telecommunication model
6. Describe any three advantages and disadvantages of using Fiber optic cables in telecommunication

COMPUTER NETWORKS

A **Computer network** is a collection of **computers** and **devices** connected by communication channels that facilitate communication among users, and allow sharing of **resources**. In a networked environment, any authorized user can use a computer on a network to:-

- i. Access data and information stored on other computers in the network.
- ii. Access hardware that is shared in the network.
- iii. Use software stored on a server's hard disk.
- iv. Transfer funds
- v. Communicate efficiently and easily via e-mail, chat, and videoconferencing.

Advantages/benefits of computer Networks

1. **File Sharing:** It allows file sharing and remote file access. It is easy for a person sitting on one networked computer to see and access files on another networked computer.
2. **Software sharing:** Software can be installed on one server computer that can be used by the different client computers instead of purchasing a copy for each computer.
3. **Easy Communication:** People on a computer network can communicate easily with each other. For example with the internet, network users can use Emails, Instant messaging, etc.

4. Sharing of Hardware / Peripheral

devices: Computers on the network can share devices such as printers, scanners.

5. Central storage for data: In a client-server network, all the data can be stored in one place (on the server) and this makes it easy to manage it.

6. Makes data back up easy since all the data is stored on the file server.

7. Enforcing security policies on data is easy, since each and every user has his own set of privileges to prevent them accessing restricted files.

Disadvantages of computer Networks

1. **Expensive to set up:** The initial set up cost can be high depending on the number of computers to be connected. Devices like switches, routers, and cables are always expensive.
2. **Failure of the server:** In case the main file server of a computer network breaks down, the whole system becomes useless.
3. **Rapid spread of computer virus:** If any computer on a network gets affected by a computer virus, there is a possible threat of other computers getting affected too.
4. **Insecurity of information:** If a computer is on a network, a computer hacker can get unauthorized access of information by using different tools.
5. Managing a large network is complicated, requires training and a network manager needs to be employed

TYPES OF COMPUTER NETWORKS

Computer networks can be classified according to the size of area covered by that network. This includes:

- i. Personal Area Network(PAN)
- ii. Local Area Network(LAN)
- iii. Metropolitan Area Network(MAN)
- iv. Wide area network (WAN)

The main difference among these classifications is their area of coverage.

PERSONAL AREA NETWORK

A *personal area network* (**PAN**) is a computer network organized around an individual person. Personal area networks typically involve a mobile computer, a cell phone and/or a handheld computing device such as a PDA or smart phone. You can use these networks to transfer files including digital photos, music and even email. PANs are mainly wireless although some can be constructed with cables. USB and FireWire technologies often link together a wired PAN, while wireless PANs typically use Bluetooth or sometimes infrared connections. Bluetooth PANs are also sometimes called *piconet*.

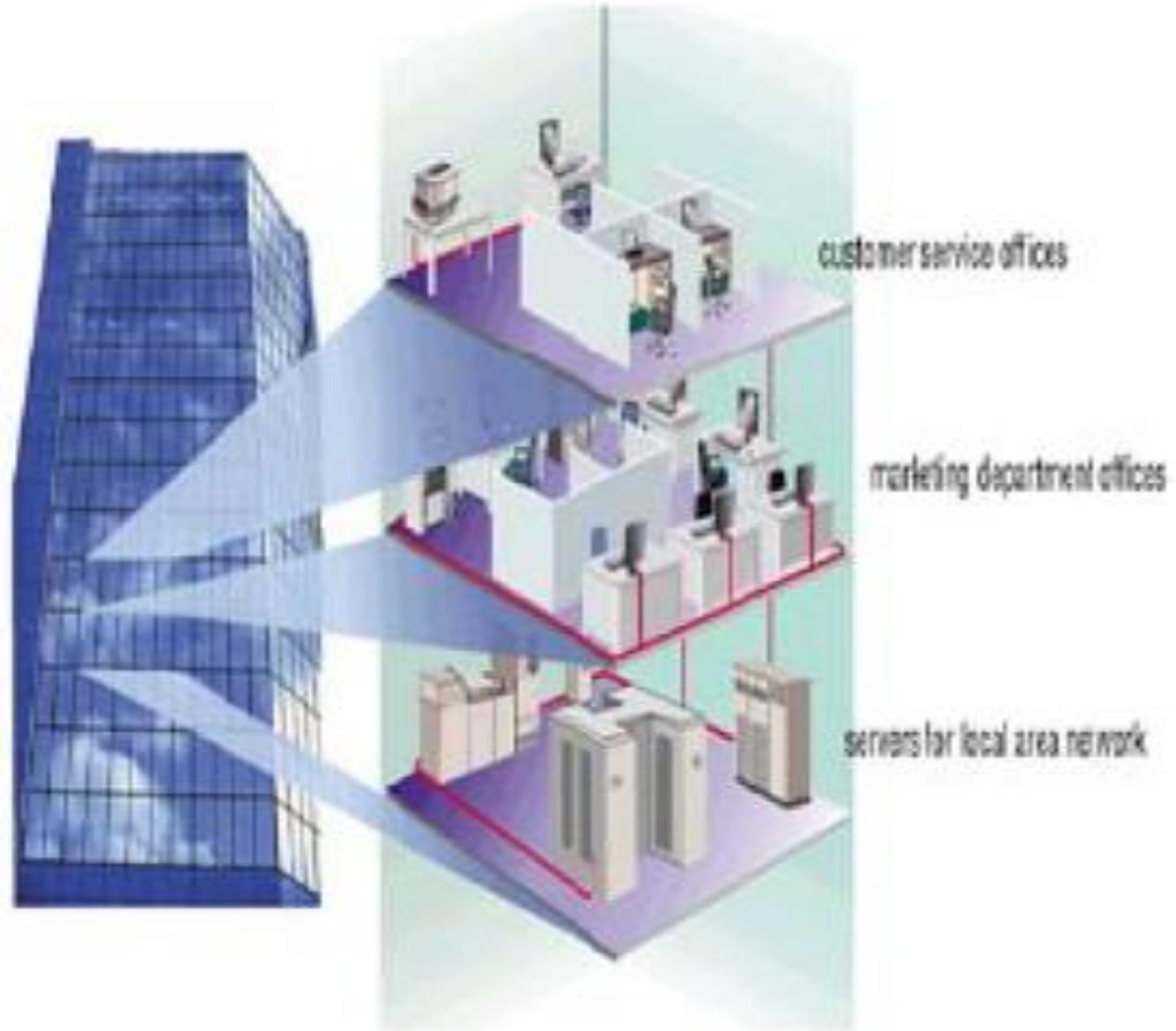
NOTE: A piconet is a network of devices connected using Bluetooth technology. The network ranges from two to eight connected devices.

LOCAL AREA NETWORK

A **local area network** (LAN) is a network that connects computers over a relatively small distance or limited geographical area, such as a school computer laboratory, within a single building or closely positioned group of buildings. A LAN, the most common network, consists of a communications channel, networked computers and devices, a network interface card, and a network operating system. The most common use of LANs is for linking personal computers within a building or office to share information and expensive peripheral device.

Another popular application of LANs is in factories, in which they link computers and computer-controlled machines. A local area network can be a ring, bus, or star network. It can be built around powerful personal computers, minicomputers, or mainframe computers. Each computer in the LAN usually requires a network interface card, which is a board that is placed in a computer's expansion slot to allow it to communicate with the network. A LAN uses the network gateway to connect to public networks or other corporate networks so that the LAN can exchange data with networks external¹⁷ to it.

LOCAL AREA NETWORK



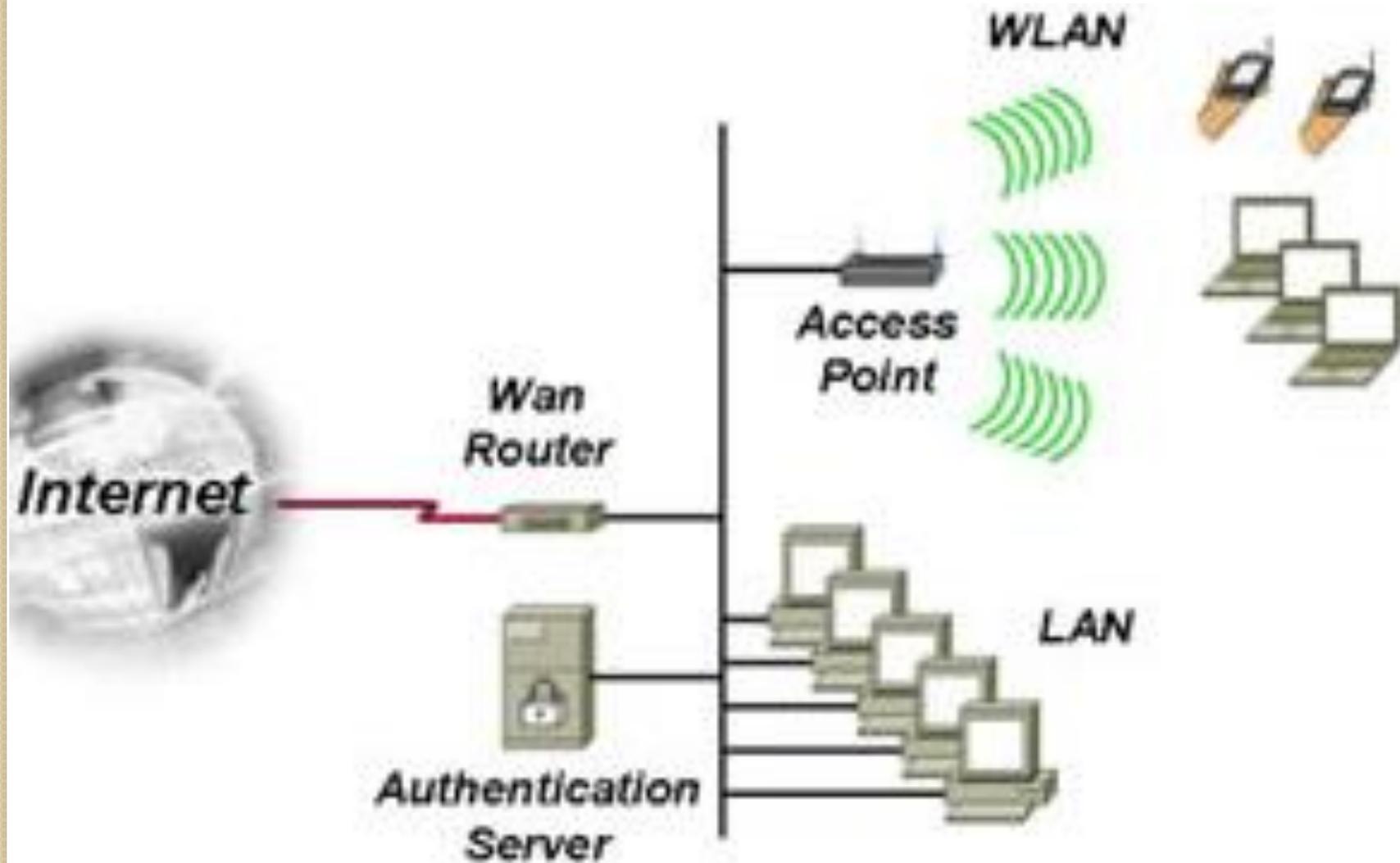
Wireless Local Area Network

A wireless LAN (WLAN) is a LAN that uses no physical wires, it works using wireless network technology such as **Wi-Fi**. Computers and devices that access a wireless LAN must have built-in wireless capability or the appropriate wireless network card, PC Card, Express Card module, USB network adapter. Very often, a WLAN communicates with a wired LAN for access to its resources, such as software, hardware, and the Internet.

Wireless Local Area Network



Wireless Local Area Network

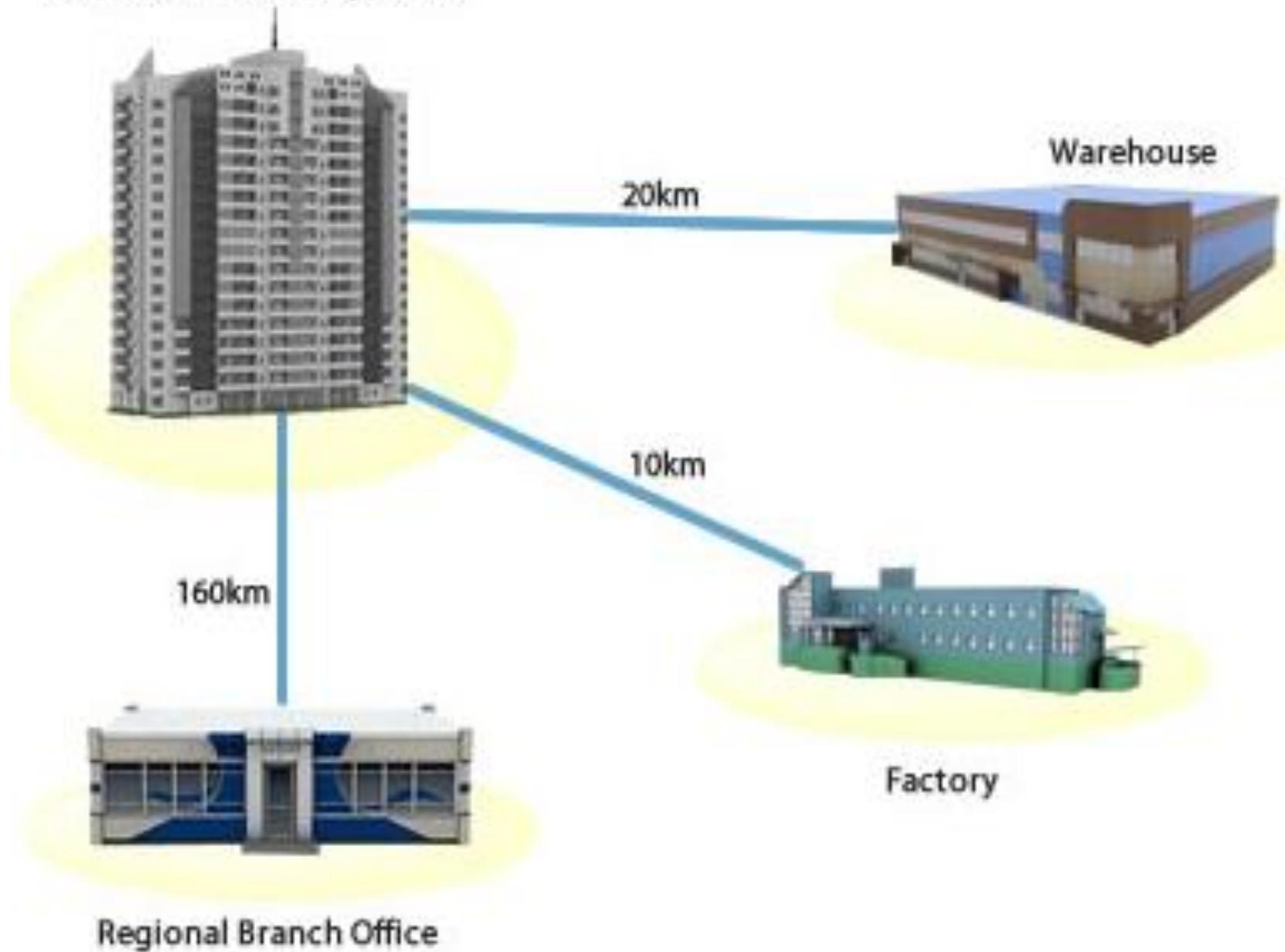


METROPOLITAN AREA NETWORK

A **metropolitan area network** (MAN) is a network designed for a city. It typically spans a town or city and is owned by a single person or company, such as a local council or a large company. It connects local area networks in a metropolitan area. A MAN typically includes one or more LANs but covers a smaller geographic area than a WAN.

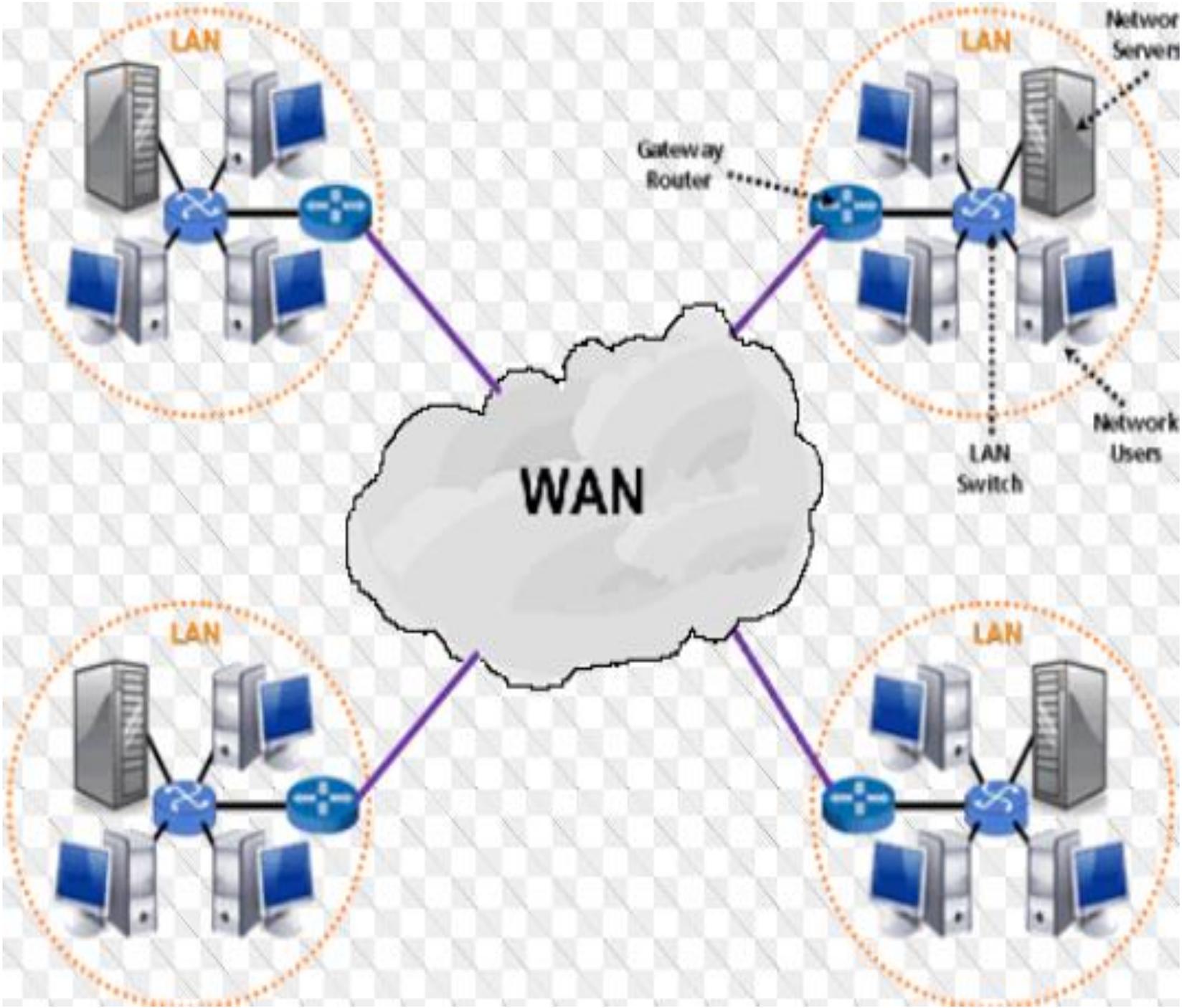
E.g, businesses such as banks can tap into fiber optic network resources and extend their Local Area Network (LAN) up to 160km, therefore enabling a MAN. This type of network extension allows organizations to continue using their Ethernet LAN systems throughout multiple locations in a metropolitan area.

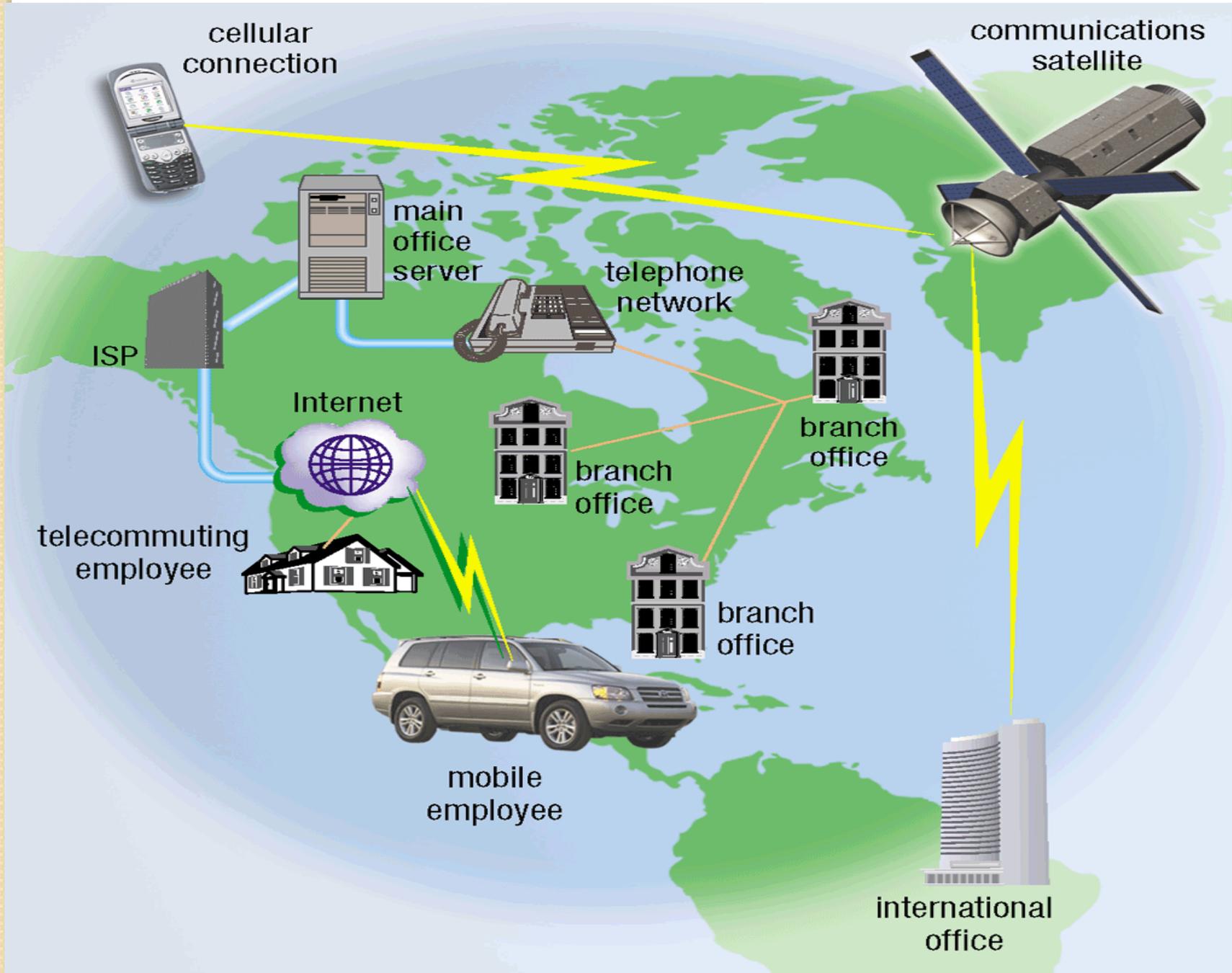
Central office headquarters



WIDE AREA NETWORK

A **wide area network** (WAN) is a network that covers a very large geographical area such as an entire country or the entire world. A WAN can contain multiple LANs (smaller networks) connected together by a router which ensures that data is delivered to the correct destination. The Internet is the best-known example of a Wide Area Network





APPLICATION OF COMPUTER NETWORKS

The fundamental purpose of computer networks is to provide access to shared resources, such as printers and data storage.

Business Applications:

- Used for data/information and resource sharing. Resources such as Printers, Scanners, CD drives
- Communication Medium among employees. For example Email
- E-Commerce. This is doing business with people over the internet

Home Applications:

- Mainly for Internet Access to:
 - i. Access to remote information
 - ii. Person-to-person communication
 - iii. Interactive entertainment
 - iv. Electronic Commerce

Mobile Users-laptops/notebooks and PDAs

- Access internet regardless of location-wired connection is limited in cars, airplanes
- Provides a portable office. One can carry out office business even when not at the base.

Social Issues

- News groups and bulletin boards where people can exchange messages

NETWORK TOPOLOGY

Network Topology refers to the physical layout of a network and how different nodes in a network are connected to each other and how they communicate. **A node** refers to any device connected to a network, including the server, computers, telephones, and other devices.

Below are some of the common types of network topologies

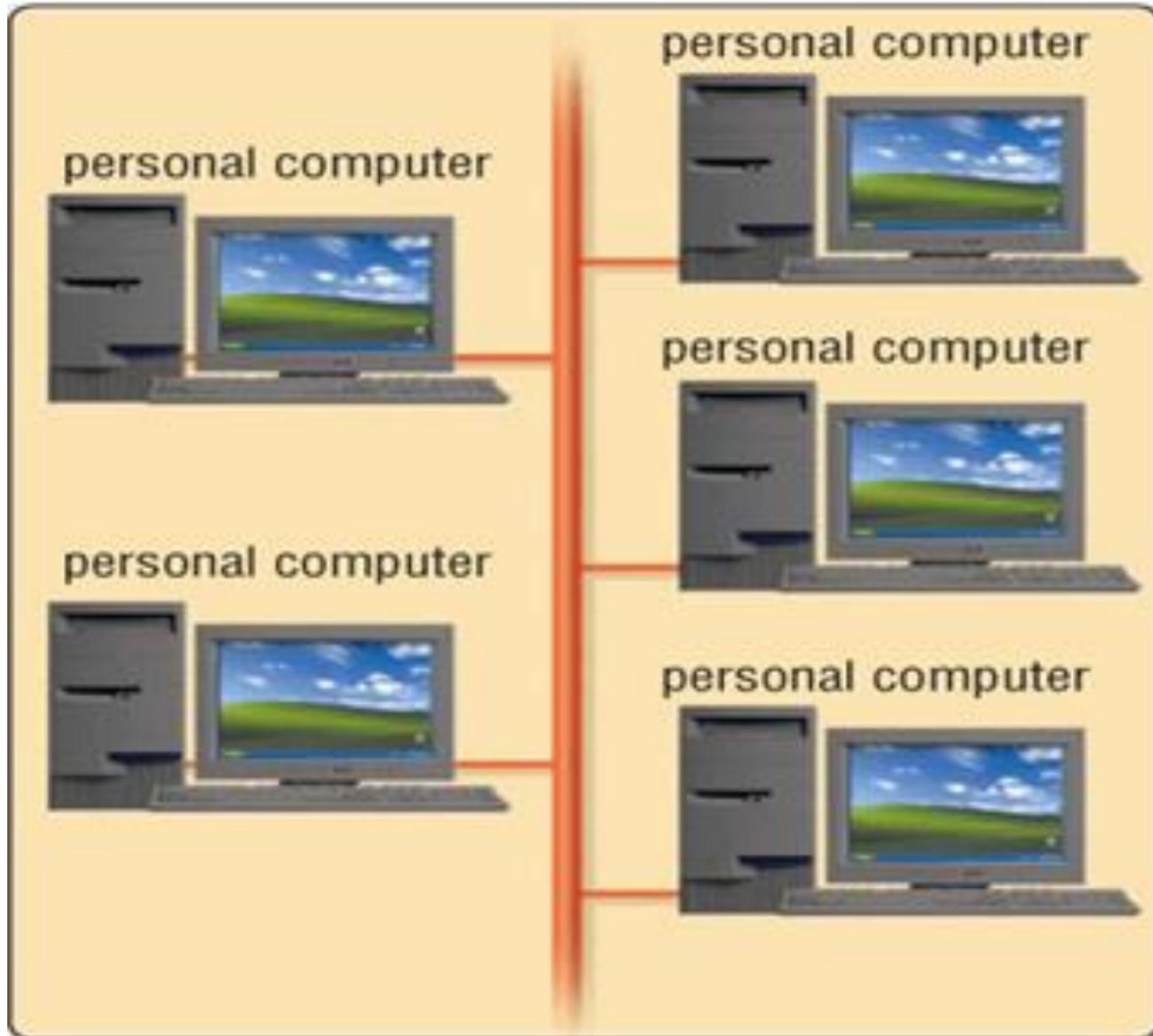
- i. Bus Network Topology
- ii. Star Network Topology
- iii. Ring Network Topology
- iv. Mesh Network Topology

BUS NETWORK TOPOLOGY

A bus network topology consists of a single central cable, to which all the network nodes are attached. The bus is the physical cable that connects the computers and other devices. The bus in a bus network transmits data, instructions, and information in both directions. When a sending device transmits data, address of the receiving device is included with the transmission so that the data is routed to the appropriate receiving device. All the signals are broadcast in both directions to the entire network, with special software to identify which nodes receive each message.

NOTE: There is no central host computer to control the network. Nodes can be attached to or detached from the network without affecting the network.

BUS NETWORK TOPOLOGY



Advantages Of A Bus Topology

- 1) Easy to install.
- 2) Easy to connect nodes to a linear bus.
- 3) It works well for a small network.
- 4) Cheaper compared to other topologies since it requires less cable lengths.

DISADVANTAGES

- 1) Entire network shuts down if there is a break in the main cable.
- 2) Not suitable for large networks
- 3) Large Amount of packet collisions on the network, which results in high amounts of packet loss.
- 4) There is a limit on central cable length and number of nodes that can be connected
- 5) Terminators are required at both ends of the backbone cable to absorb the signal.

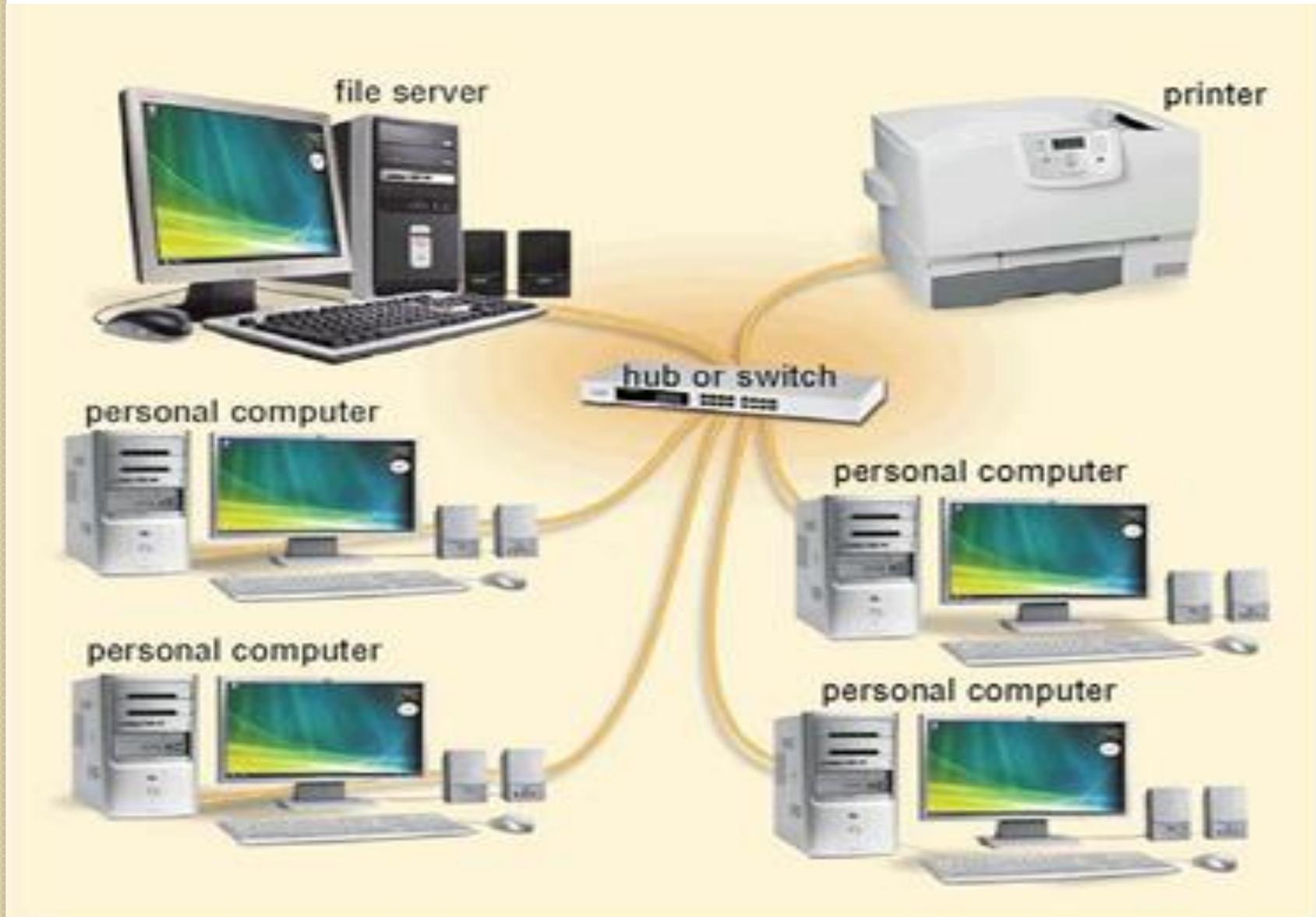
STAR NETWORK TOPOLOGY

This is a network topology where each node connected directly to a central device such as a network switch or a hub. Each node has a cable that goes from its network card to a network switch, thus forming a star.

Two types of **network devices** that provide a common central connection point for nodes on the network are a **hub** and a **switch**. The hub/switch is responsible for managing the network, ie all data that transfers from one node to another node passes through the hub/switch.

Nodes can be added to and removed from the network with little or no disruption to the network. On a star network, if one node fails, only that node is affected. Any connection failure between a node and the hub will not affect the overall system.

STAR NETWORK TOPOLOGY



Advantages Of A Star Topology

1. It gives far much better performance as compared to Bus topology, because a sent signal reaches the intended destination without necessarily get transmitted to all the nodes, especially if a switch is used.
2. No disruptions to the network when connecting or removing devices.
3. It offers centralized management thus making it easy in monitoring the network.
4. Failure of one node doesn't affect the rest of network.
5. Its easy to detect the failure and troubleshoot it.

DISADVANTAGES

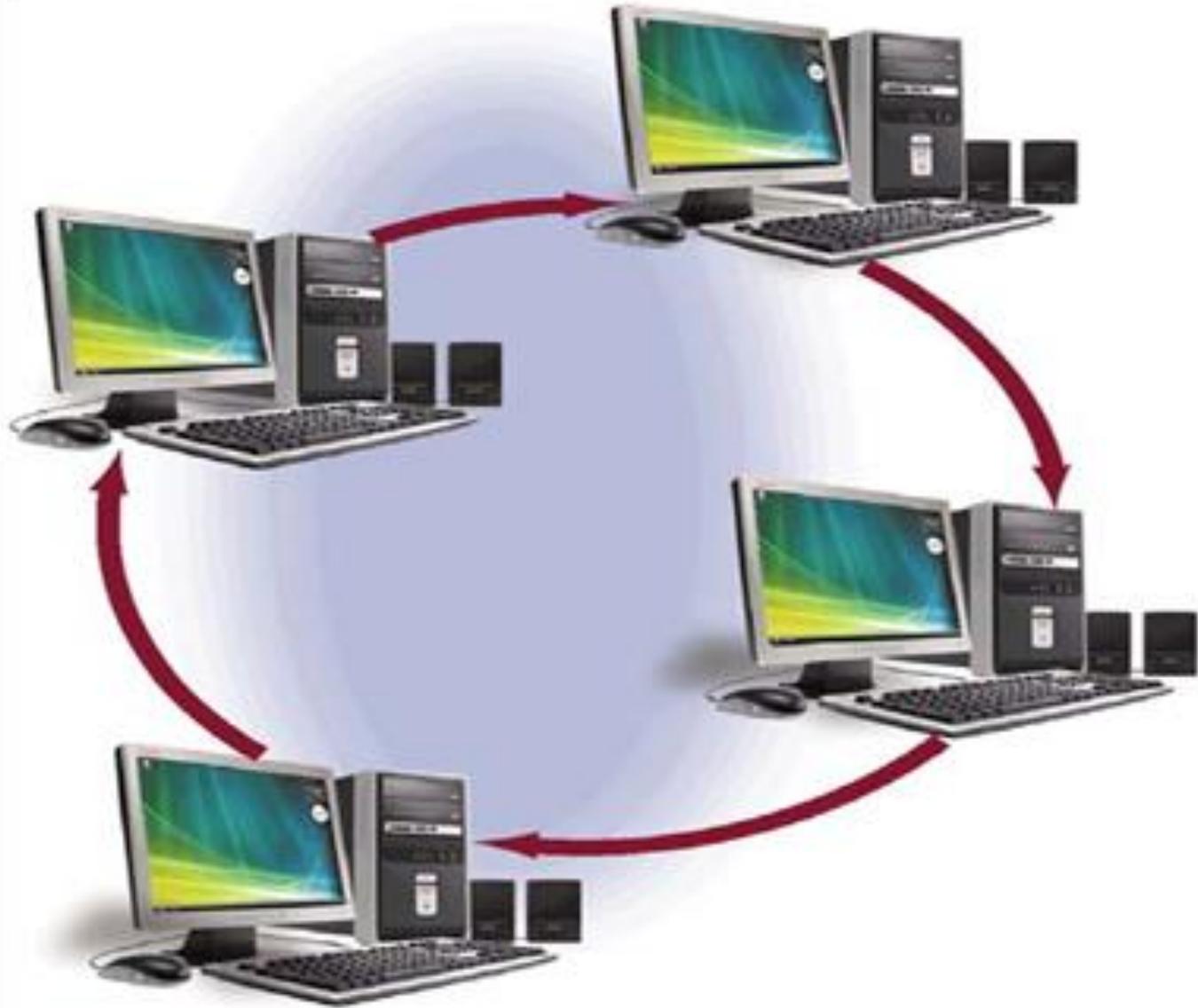
1. The use of hub or a switch as central device increases the overall cost of the network.
2. Too much dependency on central device (hub, switch) if it fails, the whole network goes down.
3. Requires more cable length than a bus topology

RING NETWORK TOPOLOGY

A **ring network topology** links all nodes together in a circular chain. Each node is connected to two other nodes on either side, and it communicates with these two adjacent neighbours. Data messages travels in only one direction from device to device around the entire ring. The node examines any data that passes by to see if it is the addressee; if not, the data is passed on to the next node in the ring. If a node on a ring network fails, all nodes before the failed node are unaffected, but those after the failed nodes cannot function. Sending and receiving of data takes place by the help of a **TOKEN**.

A ring network can span a larger distance than a bus network, but it is more difficult to install. The ring topology primarily is used for LANs, but can also be used in wide area network

RING NETWORK TOPOLOGY



Advantages of a Ring topology

- 1) There is no data collision. Each node gets to send the data when it receives an empty token.
- 2) Additional components do not affect the performance of network. Thus one can create a much larger network.
- 3) Each computer on the network has equal opportunity to transmit data.

Disadvantages

- 1) Each packet of data must pass through all the computers between source and destination. This makes it slower than Star topology.
- 2) If one workstation or port goes down, the entire network gets affected.
- 3) Network is highly dependent on the wire which connects different components.
- 4) MAU's and network cards are expensive as compared to Ethernet cards and hubs.

MESH NETWORK TOPOLOGY

In mesh topology, every node has a direct point-to-point connection to every other node. Because all connections are direct, the network can handle very high-volume traffic. It is also robust because if one connection fails, the others remain intact. Security is also high since data travels along a dedicated connection.

This type of topology requires a lot of cables and is, therefore, expensive. Many of the connections are also redundant since there are several different paths for data to travel from one node to another.

MESH NETWORK TOPOLOGY



Advantages of a Mesh Topology

- 1) Data can be transmitted from different devices simultaneously. This topology can withstand high traffic
- 2) Even if one of the components fails there is always an alternative present. So data transfer doesn't get affected.
- 3) Expansion and modification in topology can be done without disrupting other nodes

Disadvantages

- 1) There are high chances of redundancy in many of the network connections.
- 2) Overall cost of this network is way too high due to the redundant cables required.
- 3) Set-up and maintenance of this topology is very difficult.

NETWORK HARDWARE & TRANSMISSION (COMMUNICATION) MEDIA

Network Hardware

Network hardware also known as computer networking devices, refers to the physical devices used in setting up a computer network.

Networking devices include:-

- 1). **Hub:** Is a networking device used for connecting multiple devices together in a Local Area Network. It has multiple input/output (I/O) ports, in which a signal introduced at the input of any port appears at the output of every port except the original incoming. Hubs are now largely out-dated, having been replaced by network switches except in very old installations.



2). **Switch**: Is a computer networking device that connects devices together on a computer network. It uses packet switching to receive, process and forward data to the destination device.

Unlike network hubs, a network switch forwards data only to one or multiple devices that need to receive it, rather than broadcasting the same data out of each of its ports.

3). **Router**: Is a networking device that forwards data packets between computer networks by determining the best route to the receiving device/network.

Routers perform the "traffic directing" functions on the Internet.

A data packet is typically forwarded from one router to another until it reaches its destination node.

4). **Gateway**: A node on a computer network that serves as an entrance to another network. The gateway is associated with a router

5). **Repeater**: Is a networking device that receives a signal and retransmits it at a higher level or higher power so that the signal can cover longer distances

6). **Bridge**: Is a device that connects multiple network segments in the same location

7). **Modem**: It is a device used to change digital signals to analog signals and vice versa. Therefore it connects a computer to a telephone line.

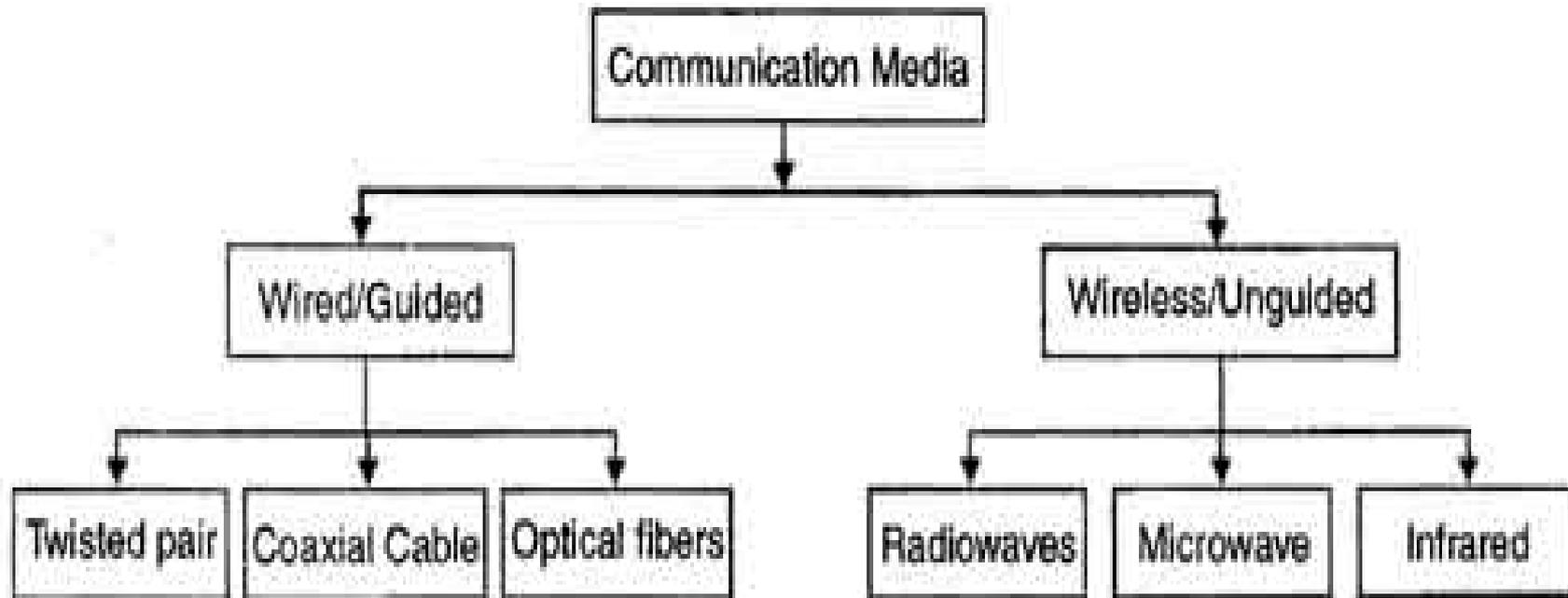
8). **Network Interface Card(NIC)**: Is an expansion board inserted into a computer so the computer can be connected to a network

Transmission (Communications) Media

Various devices on the network are linked together by means of communications or transmission media.

Transmission media, are pathways on which the data, instructions, or information travel in a computer network.

The transmission media can either be guided/bounded (wired) or unguided/unbounded(wireless)



Guided or Bounded Transmission Media

It is a transmission media in which data signals are confined to a specific path using a cable or wires. The types of Bounded/Guided include:

- a) Twisted Pair Cable
- b) Coaxial Cable
- c) Fiber Optic Cable

Twisted Pair Cable: Is a cable with a pairs of copper wires, twisted together and wrapped with a plastic coating. Twisted pair cables are of two types, i.e. Shielded twisted pair and Unshielded twisted pair

1. Shielded twisted pair (STP) cable has a metal foil covering which covers each pair of insulated conductors. The metal covering prevents electromagnetic noise penetration or interference.

2. Unshielded twisted pair (UTP) cable does not have the metal foil cover for shielding cables against noise.

Advantages of twisted pair cables

1. It is inexpensive compared to coaxial and fiber optic cables
2. They are easy to install
3. It has high mobility and flexible

Disadvantages of twisted pair cables

- 1) It offers poor noise/interference immunity
- 2) They have the lowest data carrying capacity compared to coaxial and fiber optic cable.
- 3) Twisted pair is distance limited. As distance between network element increases, attenuation (signal loss) increases.

Coaxial cable

A type of wire that consists of a centre copper wire surrounded by insulation and then a grounded shield of braided wire. The shield minimizes electrical and radio frequency interference.

Coaxial cabling is the primary type of cabling used by the cable television industry.

Advantages

- i. High resistance to electromagnetic interference
- ii. Higher data transfer rate
- iii. Can carry many different signals simultaneously

Disadvantages

- i. It is more expensive than twisted pair cable.
- ii. It is difficult to install



Fiber Optic cable: This cable consisted of dozens or hundreds of thin strands of glass that are used to transmit signals.

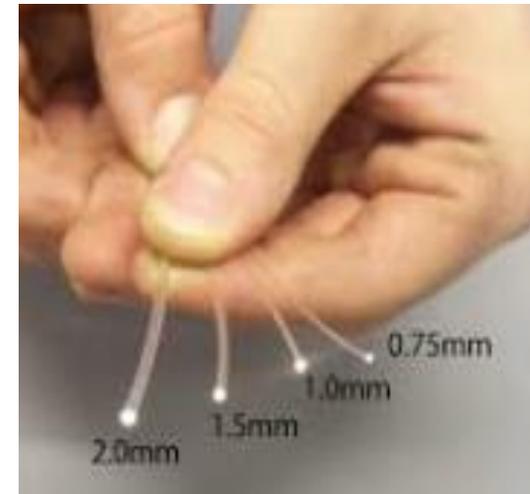
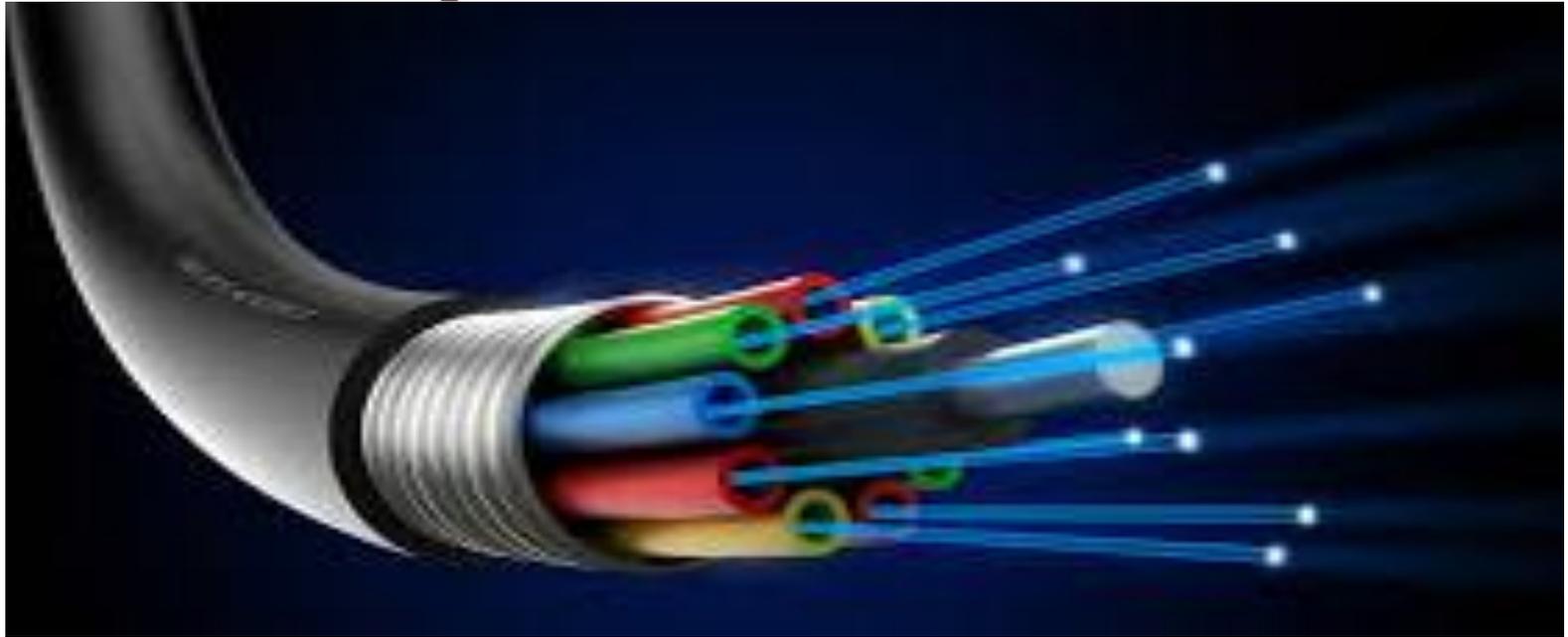
Advantages

- i. Enables fast transmission of data since they use light to transmit data.
- ii. It has high data carrying capacity (larger bandwidth)
- iii. Suffers low attenuation, therefore good for long distances.
- iv. More secure because they are less susceptible to interference
- v. Lighter than copper cable

Disadvantages

- i. It is very expensive to acquire compared to twisted pair and coaxial.
- ii. They easily break being glass.

Fibre Optic Cable



Unguided or Unbounded Transmission Media

- It is a transmission media which doesn't use any physical connectors between the two devices communicating.
- It transmits data by sending the electromagnetic signals through the atmosphere. The signals are not confined in any specific medium.
- This type of communication is commonly referred to as wireless communication. The types of unguided media include:-
 - i. Radio waves
 - ii. Microwaves
 - iii. Infrared waves

Infrared

Infrared is a wireless transmission medium that sends signals using infrared light waves.

Infrared signals can be used for short range communication in a closed area using line of sight propagation.

The infrared waves are relatively directional. Example of Infrared wave is TV remote, DVD remote

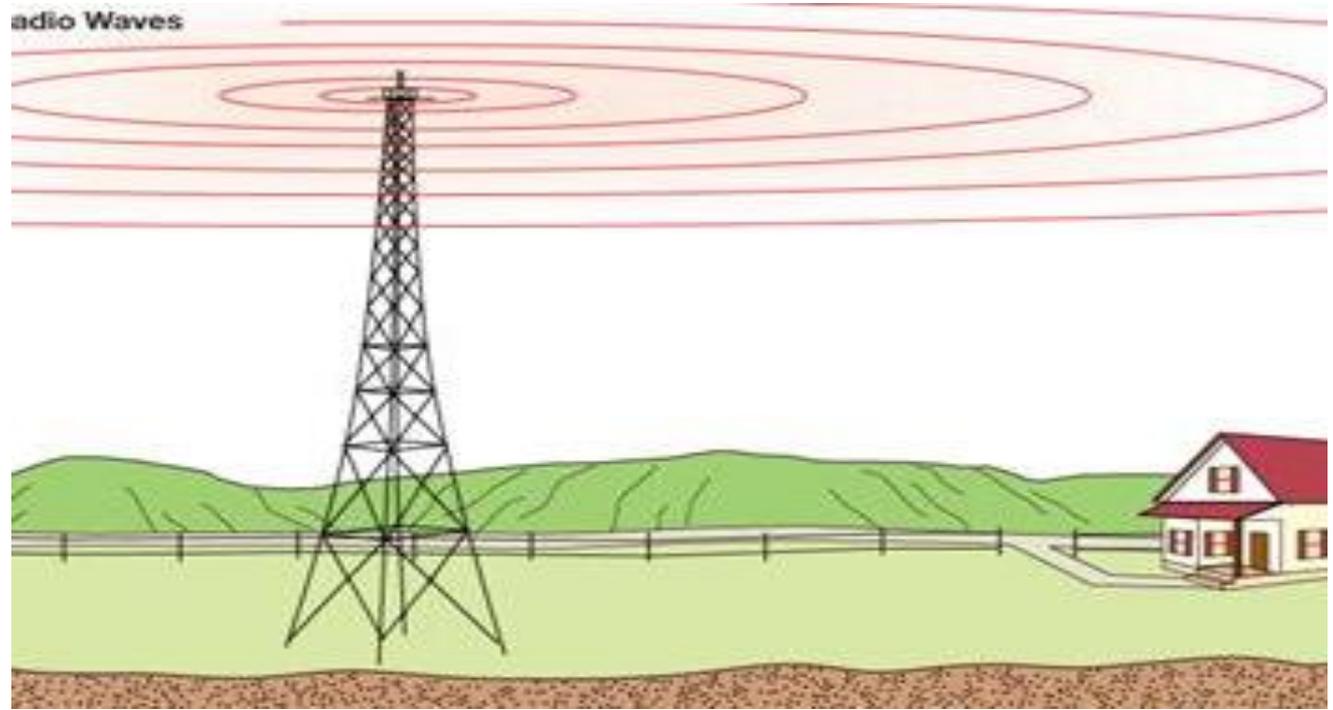


Infrared



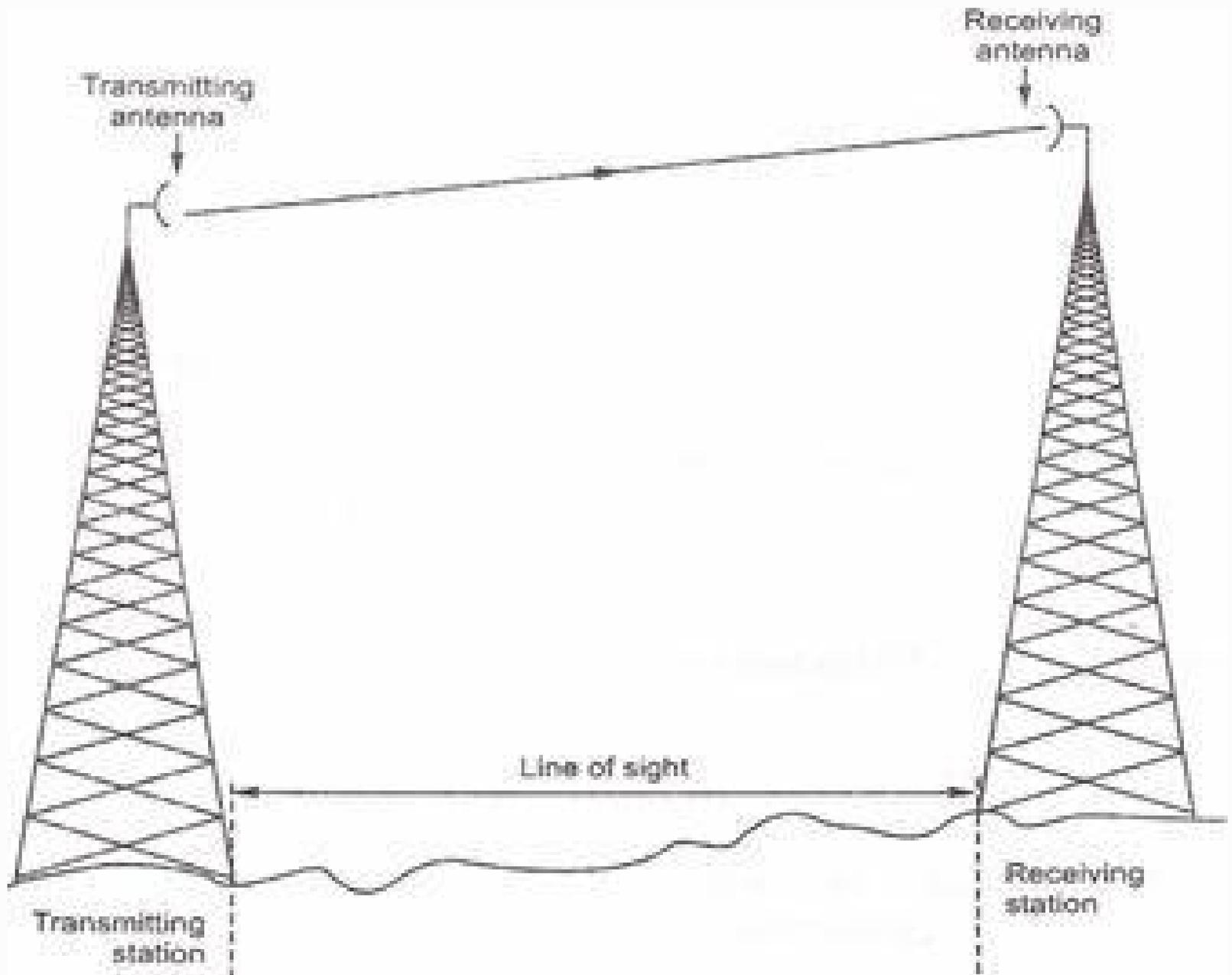
Radio waves

This is a wireless transmission that is used for multicast communications, such as radio and television systems. They can penetrate through walls. Use omnidirectional antennas, meaning they can travel in all directions from the source to the receiver.



Microwave

- Microwaves is a wireless transmission that facilitates point-to-point transmission of huge amounts of data between remote communication sites without the need to lay cables between them.
- The Microwaves propagation is line-of-sight which means that waves travel in straight lines. Therefore, the transmitting and receiving antennas must be accurately aligned with each other.
- Before the advent of fiber optics, these microwaves formed the heart of the long distance telephone transmission system.
- Microwaves cannot penetrate walls.
- Microwave signals are used for both satellite and ground-based communications.



Exercise 2

1. Which of the following computer networks has network coverage of a small city or suburb
A. LAN B. WAN C. MAN D. PAN
2. The physical layout of a computer network can be referred to as
A. Network architecture C. Network Topology
B. Network Structure D. Network Design
3. Which of the network topologies that if a node has data to send to another node it broadcasts it to all other nodes
A. Ring network topology C. Mesh network topology
B. Bus network topology D. Star network topology
4. Which type of computer network that the Bluetooth standard can be best used to enable transmission?
A. Wireless Personal network C. Wide Area network
B. Local Area Network Wireless D. Personal Area Network
5. Which type of computer network needs a device called Access Point(Hotspot) in order to access information on the internet
A. WLAN B. WAN C. MAN
D. Internet and the World Wide Web

6. Which of the following types of computer networks is having the highest data transfer rate?

A. Local Area Network

C. Wide Area Network

B. Metropolitan Area Network

D. Internet

7. Write down any five components of a Local Area Network

8. (a) Write the following in full

(i) BIOS

(ii) CMOS

(iii) ALU

(iv) ICT

(b) Give the function of each of the following

(i) ROM-BIOS (ii) CMOS

more qtns

1. List three differences between a WAN and a LAN
2. Mention three advantages and disadvantages of wireless communication in an organization.

NETWORK ARCHITECTURE

The design of computers, devices, and media in a network, sometimes called the network architecture, is categorized as either **client/server** or **peer-to-peer**. The major difference between these two types of LANs lies in how the data and information is stored.

- **CLIENT/SERVER NETWORK**

A client/server network is a network in which one or more computers are designated as **a server(s)** and other computers on the network, called **clients**, can request services from the server. For example providing database access or queuing print jobs.

A SERVER

A server, is a host or central computer that controls access to the hardware and software on the network and provides a centralized storage area for programs, data, and information.

The other computers (clients) on the network rely on the servers for these resources, such as files, devices, and storage.

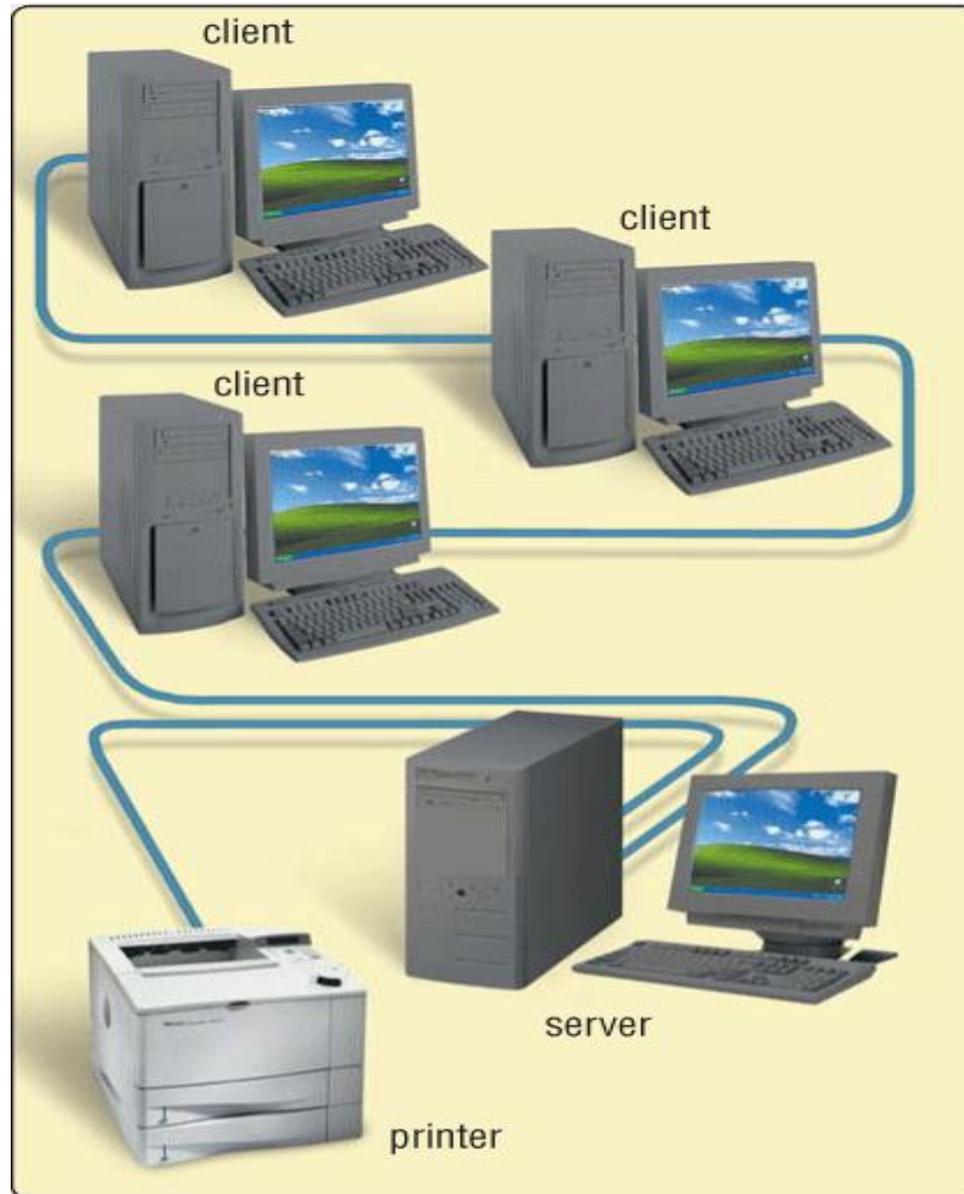
The major difference between the server and the client computers is that the server ordinarily is faster and has more storage capacity. Thus, the server generally performs most of the processing tasks. Sometimes the server and the client computers share processing.



Some servers are dedicated to performing a specific task. For example,

- ❖ A file server stores and manages files
- ❖ A print server manages printers and print jobs
- ❖ A database server stores and provides access to a database.

CLIENT/SERVER ARCHITECTURE



Advantages of a client/server network

- **Accessibility** - Server can be accessed remotely and across multiple platforms.
- **Centralized** - Resources and data security are controlled through the server.
- **Scalability** - Any or all elements can be replaced individually as needs increase.
- **Flexibility** - New technology can be easily integrated into system.
- **Interoperability** - All components (client/network/server) work together.
- **Hardware and software sharing** - This reduce on costs since no individual copies/devices are bought.

Disadvantages of a client/server network

- **Expense** - Requires initial investment in dedicated server.
- **Maintenance** - Large networks will require a staff to ensure efficient operation hence increasing the maintenance costs.
- **Dependence** - When server goes down, operations will cease across the network.

PEER –TO – PEER

- A peer-to-peer network is a simple, inexpensive network.

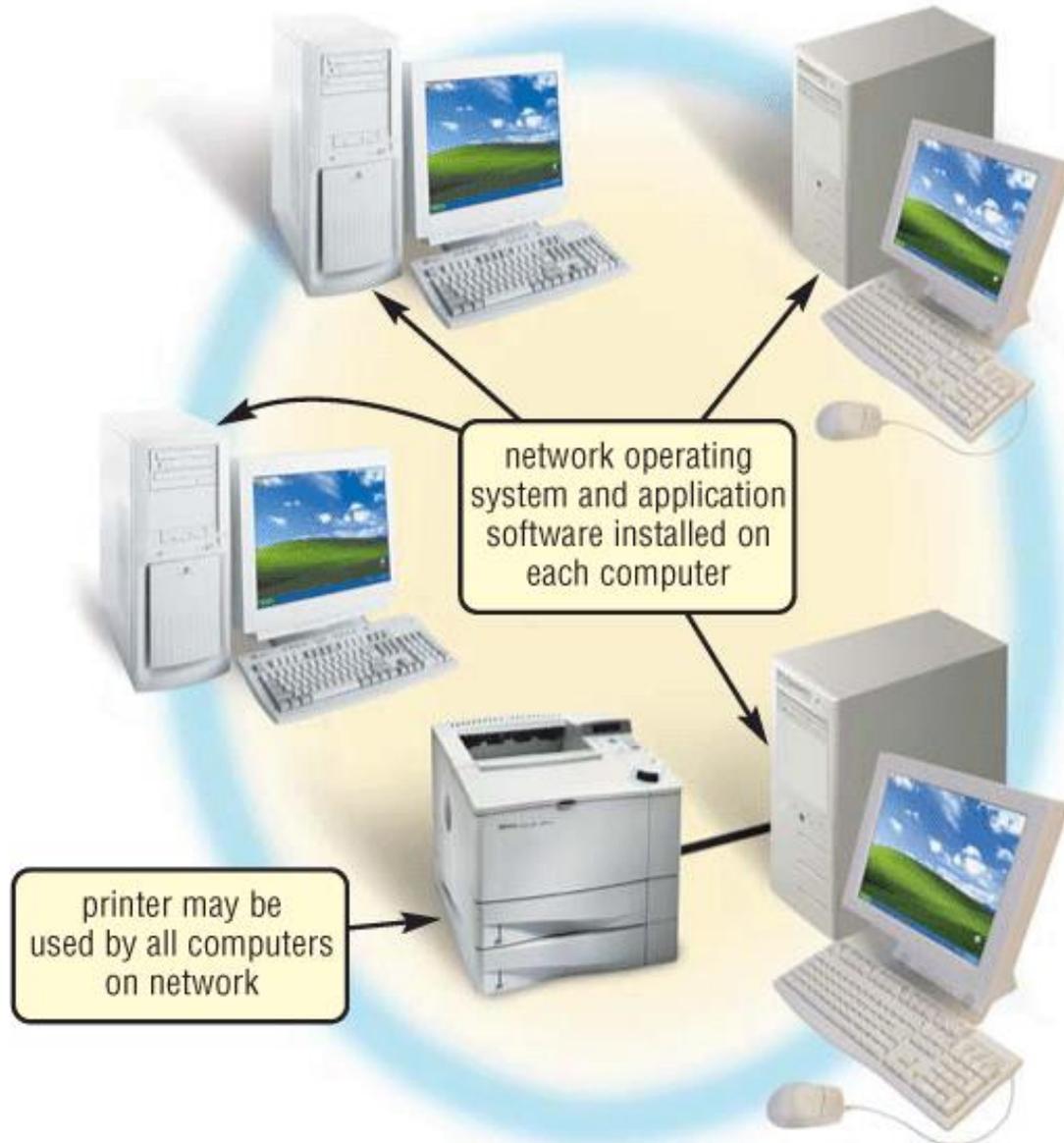
It is a network in which all computers have equal status, they all have the same abilities to use the resources available on the network. in other words, no one computer is in control.

- Each computer, called a peer in the network can share the hardware, data, or programs located on any other computer in the network.
- Each computer stores files on its own storage devices.
- Each computer in the network also must install an operating system and application software.



However, only one computer on the network needs to connect to peripherals; the other computers in the network share these hardware resources. Peer-to-peer networks are typically used in very small business and organizations.

PEER - TO - PEER ARCHITECTURE



Advantages of a peer-to-peer network

- **Less initial expense** - No need for a dedicated server.
- **Setup** – Easy and simple to set-up. An operating system (such as Windows XP) already in place may only need to be reconfigured for peer-to-peer operations.

Disadvantages of a peer-to-peer network

- **Decentralized** - No central store for files and applications.
- **Security** - Does not provide the security available on a client/server network.

Exercise 3

1. State the difference between a peer to peer and client to server network relationship.
2. Mention advantages and disadvantages of running a client / server network relationship.
3. Mention three factors you will consider before setting up a computer network.

Methods of Data Transmission

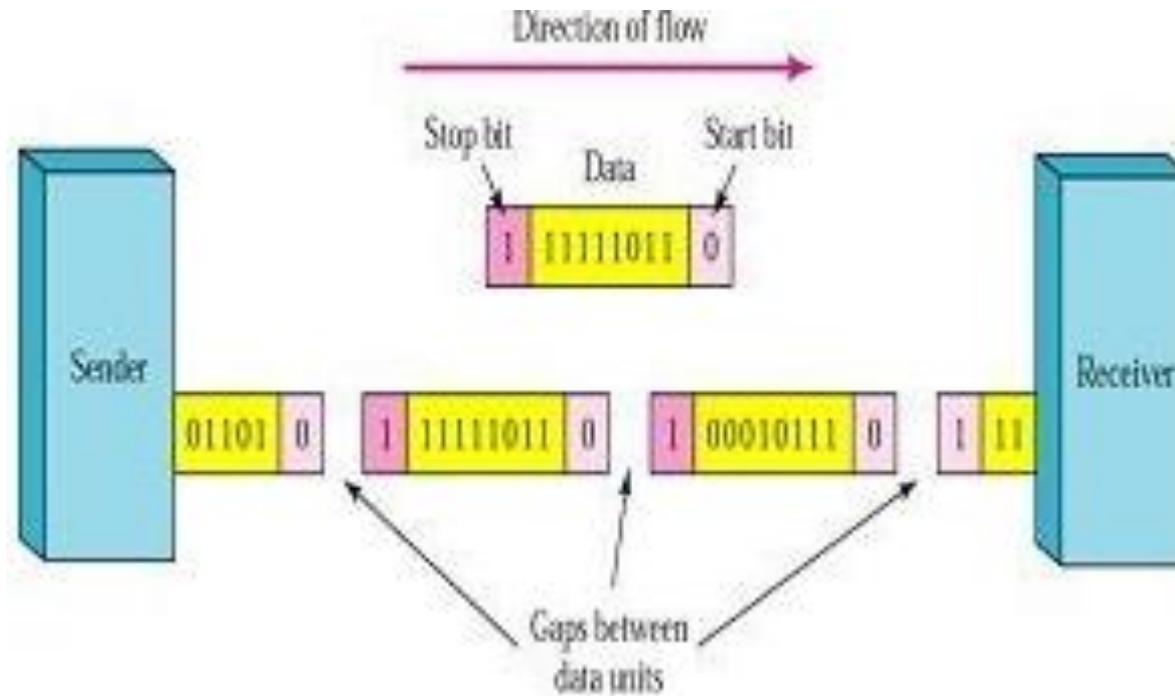
- When two devices exchange data, the data flows between the devices as a continuous stream of bits. There are two basic transmission techniques for data exchange, i.e

i. Asynchronous transmission

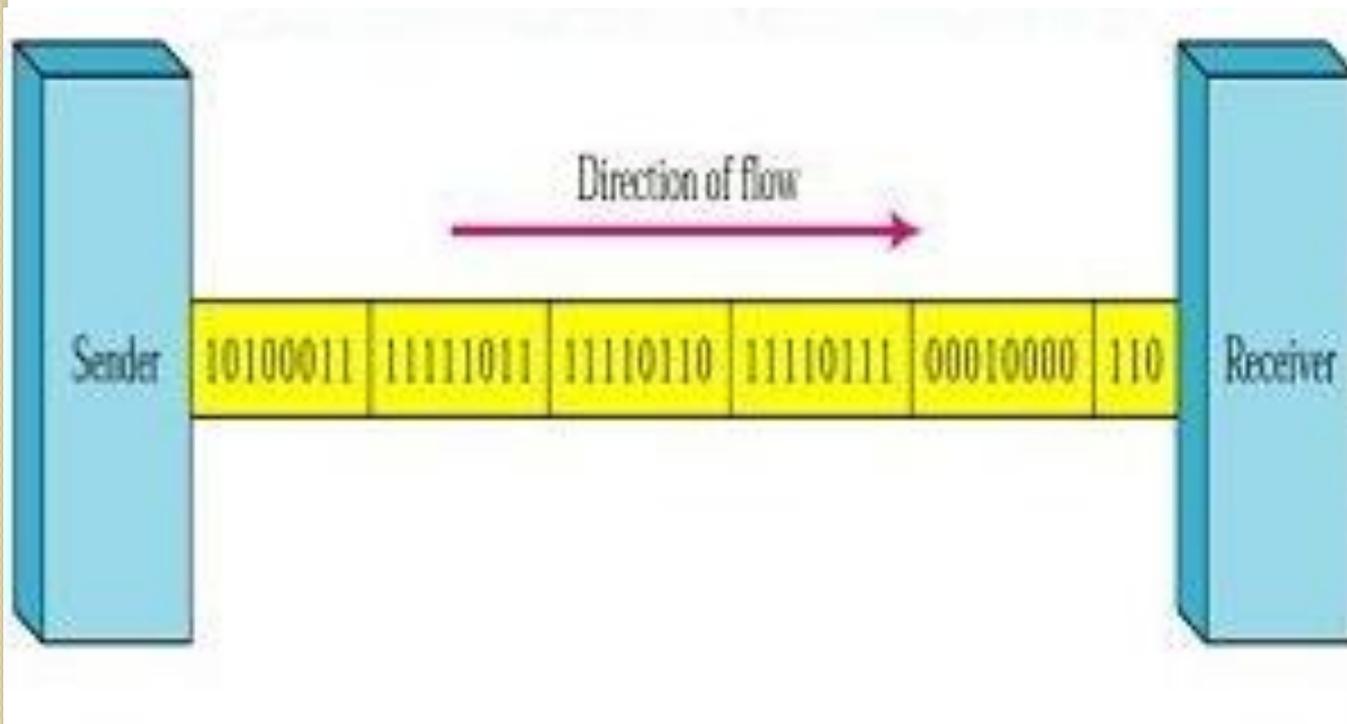
ii. Synchronous transmission

Asynchronous transmission

- **Asynchronous transmission** a method in which data is transmitted one byte at a time with its particular begin and stop bits. Each byte has a **start bit** for marking the beginning of the byte and a **stop bit** for marking the end of the byte, as well as a **parity bit** for error checking.



- **Synchronous transmission** is a method of transmission in which data is transmitted as **groups** of bytes simultaneously at regular intervals.
- The beginning and ending of a block of bytes is determined by the timing circuitry (clocking signal) of the sending device and receiving devices.



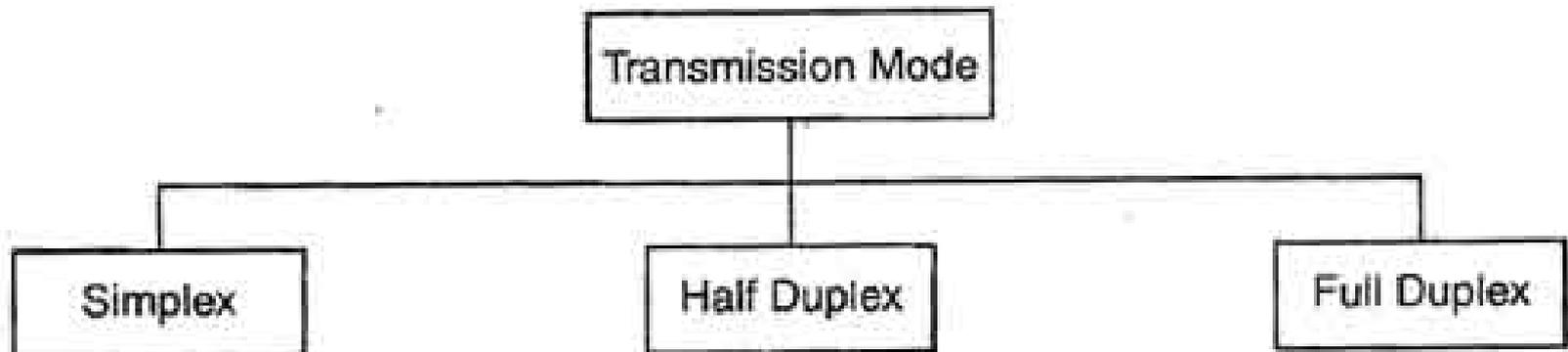
Transmission Modes In Computer Network

This refers to the way or mechanism in which data is transmitted from one device to another. It is also called ***communication mode***. These modes indicate the direction of flow of information. Sometimes, data transmission modes are also called *directional modes*.

There are three types transmission modes, these are:

- i. Simplex mode
- ii. Half-duplex mode
- iii. Full-duplex mode

Illustration



1). Simplex Mode

In simplex mode, data flows in only one direction. In this mode, a sender can only send data and cannot receive it. Similarly, a receiver can only receive data but cannot send it.

NOTE: In this mode, it is not possible to confirm successful transmission of data. It is also not possible to request the sender to re-transmit information.

Examples of simplex mode:

- i. Data sent from computer to printer
- ii. Radio and T.V transmissions.

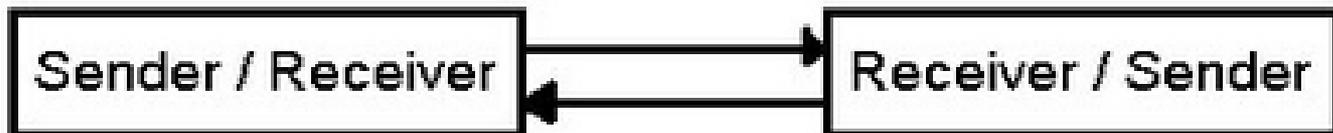
Illustration of simplex mode



2). Half-Duplex Mode

In half-duplex mode, data can flow in both directions **but only in one direction at a time**. In this mode, data is sent and received alternatively. It is like a one-lane bridge where two-way traffic must give way in order to cross the other. Examples

- i. Radio call communication
- ii. Internet browsing. The user sends a request to a Web server for a web page. It means that information flows from user's computer to the web server. Web server receives the request and sends data of the requested page. The data flows from the Web server to the user's computer.



3) Full-Duplex Mode

In full duplex-mode, data can flow in both directions at the same time. It is the fastest directional mode of data communication.

For example

The telephone communication system where two persons can talk at the same time.

Illustration of a Full-Duplex Mode



NETWORK COMMUNICATION SOFTWARE & PROTOCOLS

(a) Network Communication software

This is an application software used to establish a connection to another computer or network, and manage the transmission of data and information between them. This type of software offers remote access to computers and transmits files in many formats (such as text, audio and video formats) between different computers or users. Examples of communication software are:-

- i. E-mail applications
- ii. Live chat and instant messaging applications
- iii. Chat room software
- iv. Video conferencing software
- v. Voice over Internet Protocol (VoIP) applications: *VoIP enables users to utilize the internet to make phone calls at an affordable rate.*

(b) Network Standards & Protocols

In order to ensure compatibility of hardware and software components so that they can be integrated into any network, organization such as ANSI and IEEE propose, develop, and approve network standards.

A **network standard** defines guidelines that specify the way computers access the medium to which they are attached, the types of medium used, the speeds used on different types of networks, and the types of physical cable and/or the wireless technology used.

ETHERNET NETWORKING STANDARD

- ❖ **Ethernet** is a standard for connecting computers on a network over a wired connection. Ethernet is a local area network (LAN) technology, with networks usually operating within a single building, connecting devices in **close proximity**.
- ❖ Ethernet is the most widely used local area network (LAN) technology (standard).



TOKEN RING

- ❖ This standard specifies that computers and devices on the network share or pass a special signal, called a token, in a unidirectional manner and in a preset order.

802.11 (WI-FI)

- ❖ This network standards that specifies how two wireless devices communicate over the air with each other.
- ❖ Using the 802.11 standard, computers or devices that have the appropriate wireless capability communicate via radio waves with other computers or devices.

BLUETOOTH

- ❖ Bluetooth is a network standard that defines how two Bluetooth devices use short-range radio waves to transmit data.
- ❖ A Bluetooth computer and device contain a small chip that allows it to communicate with other Bluetooth devices. For computers and devices not Bluetooth-enabled, you can purchase a Bluetooth wireless port adapter that will convert an existing USB port or serial port into a Bluetooth port.
- ❖ To communicate with each other, Bluetooth devices often must be within about 10 meters..

Different components in a network can communicate by adhering to a common set of rules that enable them to communicate to each other.

- **Network Protocol:** This is a set of rules and procedures governing transmission of data between components in a network.

A protocol is a based on, agreed-upon and established standard, and in this way all manufacturers of hardware and software that are using the protocol do so in a similar fashion to allow for interoperability.

Interoperability is the capability of two or more computer systems to share data and resources, even though they are made by different manufacturers.



The principal functions of protocol in a telecommunications network include:-

- 1) Identifying each device in the communication path.
- 2) Securing the attention of the other device.
- 3) Verifying correct receipt of the transmitted message.
- 4) Determining that a message requires retransmission if it is incomplete or has errors.
- 5) Performing recovery when errors occur.

TCP/IP

- ❖ TCP/IP (Transmission Control Protocol / Internet Protocol) is the internet communication protocol. It is a standard that sets the rules computers must follow in communicating with each other on a network. Some refer TCP/IP as the Internet Protocol Suite.
- ❖ When you use any applications or programs to access the Internet, these application will use TCP/IP to achieve the task. **For example**, when you want to surf a network, you will use the internet browser. Your browser then uses TCP/IP to request services from Internet servers. These servers will use TCP/IP to send the web pages you requested back to your browser.

client (your computer)



COMMUNICATIONS SOFTWARE:

Using a Web browser program, you request a Web page on a Web server be displayed on your computer screen.



TCP/IP:

Your computer uses the TCP/IP standard to establish a connection with the Web server that stores the requested Web page, divide the Web page into packets, provide an address for each packet, and reassemble the Web page once it arrives at your computer. Routers send the packets over the Internet from the Web server to your computer.

ETHERNET:

The Ethernet standard controls how devices (adapter cards, routers, modems, etc.) share access to the media (cables and lines) and how devices transmit data over the communications channel.

Web server





The TCP/IP suite include some of the following protocols:

Transmission Control Protocol(TCP) enables two computers to establish a connection and exchange streams of data. TCP guarantees delivery of data and also guarantees that packets will be delivered in the same order in which they were sent.

Internet Protocol (IP) – This important protocol is responsible for providing logical addressing called IP address to route information between networks.

File Transfer Protocol (FTP)

FTP is responsible for allowing files to be copied between devices.



Hypertext Transfer Protocol (HTTP): It allows Web browsers and servers to send and receive Web pages.

Simple Mail Transfer Protocol (SMTP)

This protocol is used for transferring e-mail between computers.

Telnet Protocol: It provides terminal emulation that allows a personal computer or workstation to act as a terminal, or access device, for a server.

Simple Network Management Protocol

(SNMP): It allows the management of networked nodes to be managed from a single point.

EXERCISE ONE

Distinguish between **data communication** and **computer network**?

State five benefits of networking

Give any four *limitations* of networking

Differentiate between a baseband and broadband signal

State the difference between a **network server** and **workstation**.

What is a **stand alone** computer?

Why is a network more reliable than stand alone computers

Explain the **three** most common types of networks used today

What is **bandwidth**?

What is a “*resource*” in networking?

Differentiate between **half duplex** and **full duplex**

EXERCISE TWO

Define the term transmission media

Differentiate between a router and gateway

Why is a switch preferred to hub on a network?

Describe five devices used in data communications.

What is the function of a repeater on a network?

Give one area of application of infrared transmission.

What is the importance of a gateway on a network?

State four advantages of satellite communications.

Mention five advantages of fibre optic media

State three advantages of coaxial cables

State the difference between STP and UTP

Explain the concept of line of sight in wireless comm.

EXERCISE THREE

- What is meant by the term network software
- State two types of network software
- State any four examples of networking operating systems.
- Outline the functions of network operating systems
- Give any three examples of protocols used in networking
- Define the term network topology
- Distinguish between logical and physical network topologies
- Explain any five network topologies used in networking.
- What five factors would you consider before choosing a topology for your network?
- Define the term protocol

EXERCISE FOUR

Distinguish between asynchronous and synchronous transmissions

What is noise?

Distinguish between peer-peer and client-server architecture

Why would you install a server in a network?

What is a wireless network?

Mention five merits and demerits of wireless networks.

State the advantages and of electronic transmission over disadvantages manual transmissions



MR. DAVIDS BUJAASI LUKONGE@ICT DEPT

The Internet And The World Wide Web

The Internet

The world's largest network is the **Internet** which is defined as:-

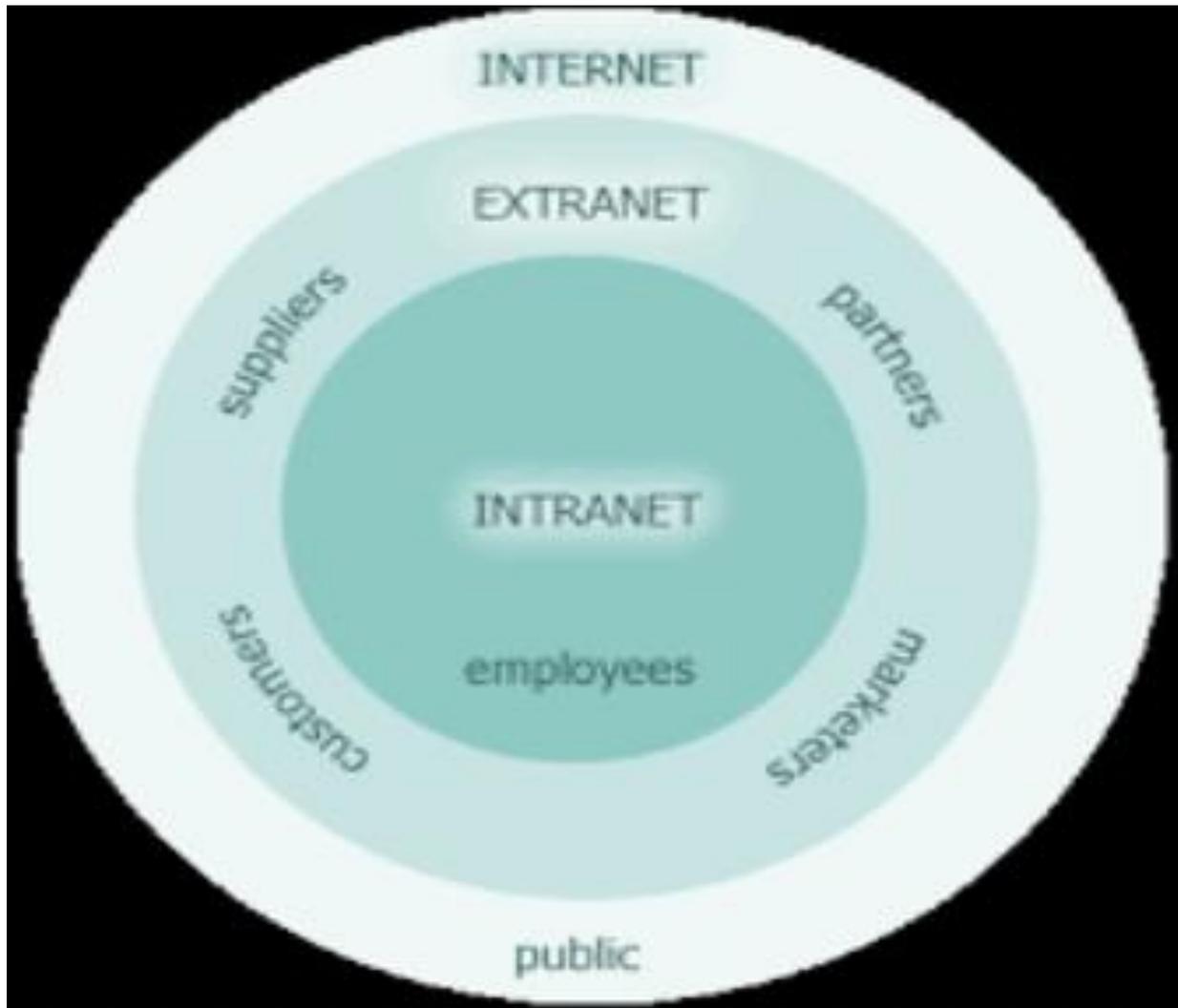
1. A global system of interconnected computer networks that use the standard Internet protocol suite (often called TCP/IP) to serve billions of users worldwide.
2. The network of all networks that connects computers all over the world.

Each of these networks provides resources that add to the abundance of goods, services, and information accessible via the Internet.



Terminologies used in relation to the internet

- **Intranet** This is a private network that is not available to the world outside of a given organisation. It is used by members of the same company or organisation. In its simplest form, an Intranet can be set up on a networked PC without any PC on the network having access to the Internet.
- **Extranet** This is a network that is partially accessible to authorised outsiders. The actual server (the computer that serves up the web pages) will reside behind a firewall. The access can be based on a username and password or an IP address



Intranet

An internal network accessible by authorised individuals within an organisation.

Connects within an organisation. Intranets generally make company information accessible to employees and facilitate group activities.

Internet

Used to access global information and for instant communication by anyone, anywhere and anytime.

Connects and links to various organisations like business, government agencies, educational institutions and individuals.

Internet

Uses Internet technology

Serves everybody

With or without firewall

Low security

Extranet

Uses Internet/intranet technology

Serves extended enterprise, including defined sets of customers or suppliers or other partners

With firewall

Tight security

Internet Connectivity Requirements

- **NIC Network Interface Card:** enables the computer to connect and be able to communicate.
- An account with an **Internet Service Provider (ISP)**

ISP is a company that supplies connections to the Internet for a fee.

- **A computer:** On which the internet is to be accessed
- **A modem:** to convert analog signals into digital signals format for the computer to use.
- **Transmission media:** These are physical or wireless pathways used for information transfer from one point to another.

- 
- **Software:** To access internet services, a computer must be installed with a browser and/or e-mail client.

A browser is a program with a graphical user interface for displaying HTML files. It is used to navigate the World Wide Web.

Internet Service Providers

An ISP is a licensed company that has a permanent Internet connection and provide access for subscribers to the internet for a fee.

Types of Internet Service Providers:

Access ISPs — Employ a variety of technologies to facilitate consumers' connection to their network. These technologies may include broadband or dialup. Always-on types of broadband connections comprise cable, fiber optic service (FiOS), DSL (Digital Subscriber Line) and satellite. A number of access providers also provide email and hosting services.

- **Mailbox ISPs** — Offer email mailbox hosting services and email servers to send, receive and store email. Many mailbox ISPs are also access providers.
- **Hosting ISPs** — Offer email, File Transfer Protocol (FTP), web-hosting services, virtual machines, clouds and physical servers.
- **Virtual ISPs (VISPs)** — Purchase services from other ISPs to allow customers Internet access.
- **Free ISPs (freenets)** – Provide service free of charge and often display advertisements while users are connected.

Services Offered by Internet Service Providers

Internet Service Providers deliver a variety of services to their customers. Some of these services include:

- Offers Internet access/connection.
- Web hosting services
- Domain name registration.
- Domain name hosting.
- Electronic mail services.
- Network installation, maintenance and troubleshooting

Advantages Of The Internet

- (1.) Fast Communication:** The internet provides the fastest and very convenient way of communicating. For example through the use of E-mail which allows one to send and receive electronic messages.
- (2.) E-news:** The internet provides online news from various news channels world wide. News events (videos and images) can also be accessed from different sites as they happen.
- (3.) Convenient way to advertise:** Through the internet, companies have widened their business opportunities. Today companies own websites on which they provide information regarding their products.

(4.) Research:- The Internet facilitates online research since it has powerful search engines e.g. google.com that enable users locate specific information in a short time.

(5.) Source of income:- With the internet, there are several open opportunities of making money. For example website authoring, internet cafes, Internet Service Providers, etc.

(6.) Source of Entertainment

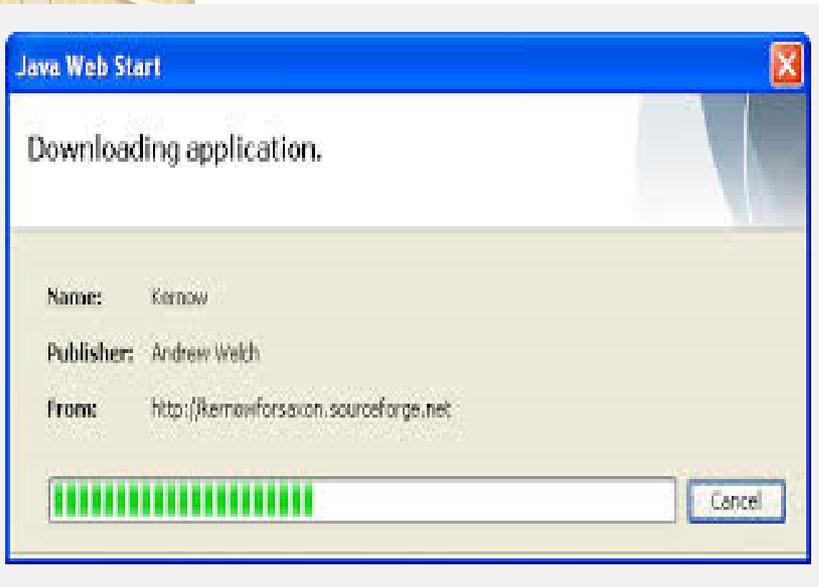
There is plenty of entertainment on the internet, such as the latest music, movies, updates about celebrities, numerous games that can be downloaded, either for a price or for free. Therefore entertainment is one of the foremost reasons why people prefer surfing the Web.



(7.) Social Networking and staying connected

Online social networks such as Facebook, Twitter help



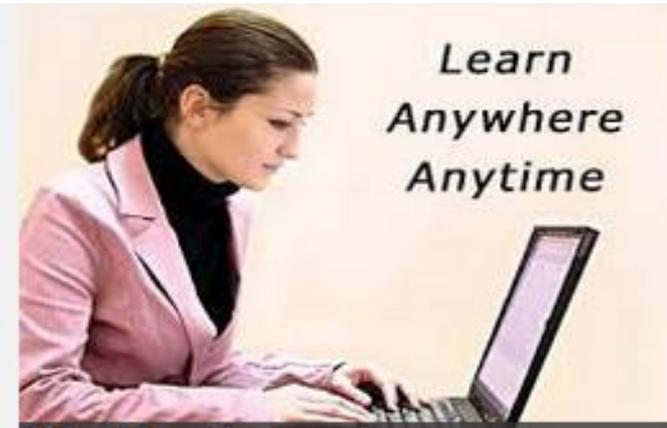


.) software downloads and
the internet enables

software is free). It also helps

(9.) Online Learning

The internet facilitates Online learning where by people from any part of the world can take up courses with the course material available online, learn, and do exams without physically being in a classroom.



NB: Online learning is a method of delivering educational information via the internet instead of in a physical classroom

(10.) Electronic Commerce (E-Commerce)

- E-commerce refers to buying and selling of goods and/or services over the Internet. This has closed the geographical gap between the seller and buyer hence a cheap and convenient way to do shopping.



Models or types e-commerce

E-commerce businesses can be grouped into three basic models

- **Business-to-consumer (B2C)** e-commerce consists of the sale of goods to the general public.
- **Consumer-to-consumer (C2C)** e-commerce occurs when one consumer sells directly to another, such as in an online auction.
- **Business-to-business (B2B)** e-commerce consists of businesses providing goods and services to other businesses.

Advantages of e-commerce

- Transactions can occur immediately and globally, thus save time for participants on both ends.
- Transactions can occur 24 hours per day.
- Businesses have access to millions of people with Internet connections.
- Businesses have the ability to gather customer information, analyze it, and react if appropriate.
- Customers can compare prices easily.
- Feedback can be immediate.
- Manufacturers can buy and sell directly, avoiding the cost of the middleman.



DISADVANTAGES OF THE INTERNET

(I) Theft of Personal Information (electronic fraud)

The internet makes it easy for crackers gain personal information through unsecured connections by planting phishing software. Especially if services such as online-banking, social networking are used.



(2.) Malware Threats

t's

computer virus corrupt important

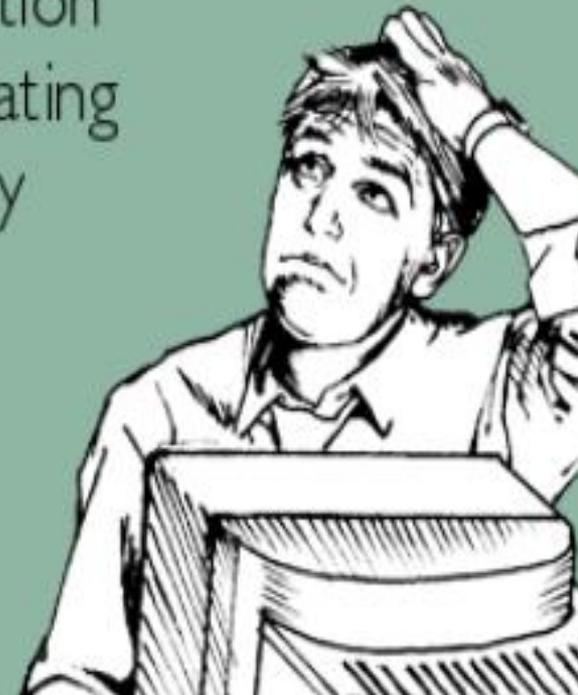


(3). Wrong/misleading information

❖ There is a lot of wrong/misleading information on the internet since anyone can post anything, and much of it is not correct.

????????????

Hmmm what other misleading dishonest information can I add to my dating profile? I've already posted the standard old photo nothing like me now.
someecards



(4) Moral Decay due to pornographic material

The internet has made it very easy for young children to access pornographic content which may lead to moral decay .

This is because there is no control over the distribution and access of such content to children.



(5.) Health Issues

Since everything on the internet is addictive, people tend to use the computers for long hours which results into health problems, such as sight problems especially due to over bright monitors.



(6.) Social Isolation

Some people are getting addicted to the internet and thus causing problems with their interactions of friends and loved ones.



Trial Qtns

1. Internet is a harmful tool to man, what is your opinion?
2. Explain the merits and demerits of using the internet.
3. Explain the factors that affect internet speeds

How Data Travels Over The Internet

- ❖ The Internet operates with a technique called **packet switching**.
- ❖ Packet switching is a method of slicing digital messages into discrete units called packets before they are sent over a network.
- ❖ Each packet is then transmitted individually and can even follow different routes to its destination.
- ❖ Once all the packets forming a message arrive at the destination, they are recompiled into the original message



In packet-switched networks, messages are first broken down into packets. Appended to each packet are digital codes that indicate a source address and a destination address, as well as sequencing information and error-control information for the packet.

- The address information is used to route the packets of data to their destination.
- The sequencing information is used to help reassemble the packets into their original order for presentation to the recipient.

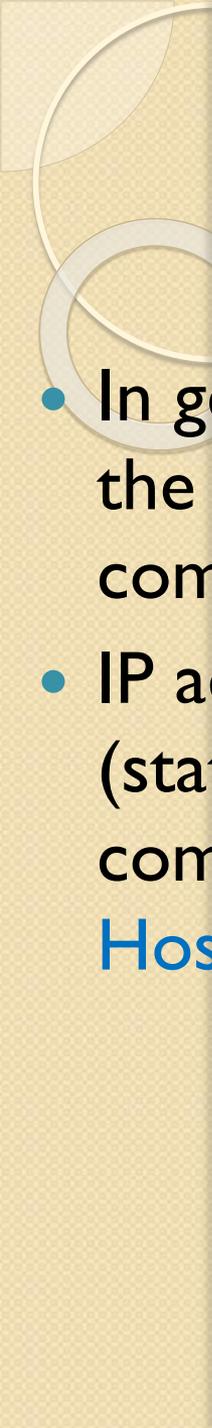
- 
- The packets travel from computer to computer until they reach their destination. These computers are called routers.
 - A router is a device that interconnects the different computer networks that make up the Internet and routes packets along to their ultimate destination as they travel. To ensure that packets take the best available path toward their destination, routers use a computer program called a **routing table**.

Internet Addresses

An Internet address uniquely identifies a computer on the internet.

1. IP(internet protocol) address. An Internet Protocol address (IP address) is a unique number assigned to each device participating in a computer network for easy identification during communication.

- The IP address usually consists of four groups of numbers, each separated by a period. For example, 192.168.1.223 is an IP address.

- 
- In general, the first portion of each IP address identifies the network and the last portion identifies the specific computer.
 - IP addresses can be assigned to computers manually (static) or dynamically using a LAN server. The most common IP assignment server is called **DHCP (Dynamic Host Configuration Protocol) server**.

2. Uniform resource locator (URL)

- URL is the global address for documents and other resources on the World Wide Web.
- It is the name given to a particular website. Example: www.google.com.
- A URL has two main parts
 - The first part of the URL is called a *protocol identifier* and it indicates what protocol to use.
 - resource name and it specifies the IP address or the domain name

Domain Name

- ❖ Domain name is text or words that stand-in for numeric IP addresses. For example, in the **URL <http://www.google.com>**, the domain name is **[google.com](http://www.google.com)**.

Top level domain (TLD)

- ❖ The highest level domain category in the Internet domain naming system. The portion of a domain name that comes after the **dot**. So, **www.google.com**, the top level domain is **[.com](http://www.google.com)**
- ❖ Every domain name has a TLD that identifies the type of organization that operates the site.



Second-level domain (SLD)

- ❖ The portion of a domain name that comes before the dot. So, **www.google.com**, the second level domain is **google**
- ❖ In other words, a second-level domain is often thought of as the "name" of the domain.
- ❖ In addition to these common SLD, there is also the idea of a country code second-level domain (ccSLD). Here, the second-level domain is actually to the right of the **dot**.
- ❖ For example, in a domain like **"google.co.uk,"** the country code top-level domain is the **"uk"** portion, whereas the ccSLD is the **".co"**

Examples of TLDs include:

- i. gov - Government agencies
- ii. edu - Educational institutions
- iii. org - Organizations (nonprofit)
- iv. mil - Military
- v. com - commercial business
- vi. net - Network organizations

Internet Services

The most commonly used Internet services include;

- I. World Wide Web
- II. Instant messaging
- III. Chat rooms
- IV. Voice over IP (VoIP)
- V. Video conference
- VI. FTP
- VII. Search engines
- VIII. Message/discussion boards,
- IX. Electronic mail (e-mail), etc

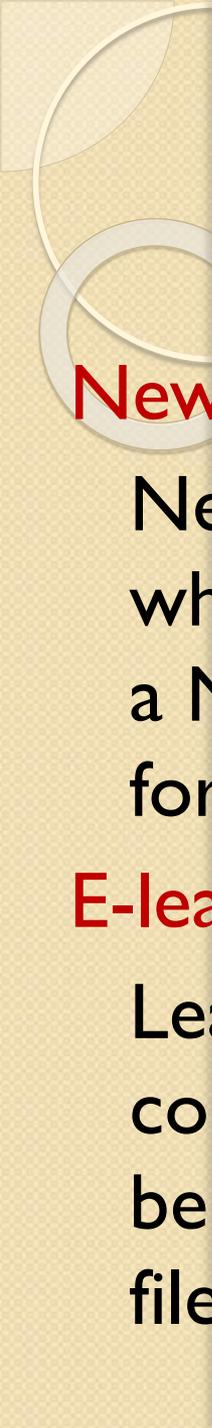
World Wide Web (WWW)

WWW or Web refers to a virtual space on internet that contains information. This information is made available as:

- A website: A website is a group of related web pages or other resources located on a web server. The first page on a website is called a home page.

TYPES of WEBSITES

- **Web Portals** is a website that brings information from different sources into a single user interface. They offer services such as searching, e-mail, sports updates, financial, news and links to selected websites.
- **A blog** is a website that contains personal information which can easily be updated.
- **Multimedia sites** contain photos, movies, music, web TV and internet radio. They are meant for entertainment.



Newsgroups

Newsgroups are organized groups of Internet users who wish to share ideas and interests. Once you join a Newsgroup, you can participate in discussion forums, and debates.

E-learning

Learning on the net is becoming more popular with courses for high school, colleges and universities being conducted on-line or accessed from selected files on the Internet

Search engines

Search engines are specialized programs that help the user to easily search for any information on the internet. Common search engines include Google, Bing, Yahoo, Excite, AOL, etc. Here are a few tips on a good search strategy:

- Identify a search engine.
- Enter the keywords in the search text box. Be precise as possible.
- Use quotation marks to identify the keywords.
- From the displayed search result, identify the site that contains the information you want.

E-mail

E-mail (electronic mail) is the transmission of messages and files via a computer network.

E-mail software is software is used to create, send, receive, forward, store & delete email messages

Depending on the hardware and software of both the sender and recipient, users can embed images, sound and video in the message and attach files that contain text documents, spreadsheets, graphics, audio, video, or executable programs. You use an e-mail program to create, send, receive, forward, reply, print, delete and store messages. In order to use e-mail, one needs an e-mail address.

- 
- ❑ An e-mail address is a combination of a user name and a domain name that identifies the user who will receive the e-mail.
 - ❑ A user name is a unique combination of characters that identifies you. Your user name must be different from the other user names in the same domain. An @ symbol separates the user name from the domain name.
 - ❑ Examples of email address johnwalker@yahoo.com,
opio@gmail.com

Terms To Note When Using Email

- **Compose:** Used creating (composing) a new email
- **Subject.** Subject is a description of the topic of the message to be sent or received
- **Sender (From).** This is the sender's Internet email address.
- **Recipient (To:).** First/last name of email recipient, as configured by the sender.
- **Recipient email address.** The Internet mail address of the recipient, or where the message was actually sent.
- **Attachments.** Files that are attached to the message.

Mail System Folders

- **Inbox:** is a folder where new email messages are stored.
- **Sent:** Is where a copy of each message you send is saved.
- **Drafts:** Messages that you have composed but have not yet sent can be saved in the **Drafts** folder.
- **Junk:** This is a folder in which any mail which is restricted from reaching your in box is sent.
- **Trash:** To contain e-mails deleted from your inbox.

The e-mail will only be permanently deleted if you delete it in the Trash folder or empty the trash .

CC vs BCC

- CC and BCC are both ways of sending copies of an email to additional people
- **Carbon Copy(CC):** is a way of sending additional copies of an email to other people. When you CC people on an email, the CC list is visible to all other recipients. For example, if you CC bob@yahoo.com and jake@ura.com on an email, Bob and Jake will both know that the other received the email, as well.
- **Blind Carbon Copy(BCC):** Unlike with CC, no one but the sender can see the list of BCC recipients. For example, if you have bob@yahoo.com and jake@ura.com in the BCC list, neither Bob nor Jake will know that the other received the email. (the BCC list is secret—no one can see this list except the sender)

When to Use CC and BCC

CC is useful when:

- You want someone else to receive a copy of an email, but they aren't one of the primary recipients.
- You want the recipients of the message to know the other people who have been sent the message.

BCC is useful when:

- You want someone else to receive an email, but you don't want the primary recipients of the email to see you've sent this other person a copy.
- You want to send a copy of an email to a large number of people.

Other terms

- A **soft bounce** is a condition where the email fails to reach the destination because the inbox of the receiver is full
- A **hard bounce** is a situation where the e-mail is not sent because of an invalid email address

Advantages of e-mail communication over ordinary means of sending postal mails

- **It's faster to send an e mail and it takes seconds to reach the recipient compared to ordinary postal mails.**
- **E-mail communication cheaper compared to postal mails since no courier fees are involved.**
- **It is easier to send the same message to many recipients at once by use of carbon copy and blind carbon copy features compared to postal mails.**
- **Messages can be replied to or forwarded with speed and ease because the software automatically inputs the address of the sender.**

- 
- **Other files can be sent as attachments which has increased the popularity of email in business unlike with postal mails.**
 - **It is convenient because a message can be sent anywhere in the world without having to leave one's desk.**
 - **It is possible to send multimedia content as e-mail**
 - **The sender is informed in case the email is not sent so that is able to find other ways of delivering the message.**
 - **A copy of the message is kept for future reference unlike postal mails**

Draw backs of using e-mail communication

- **The sender and receiver both need internet access and e-mail accounts which most people lack.**
- **Some people are not keen on checking their mail boxes. So an urgent message may not be read in time.**
- **E-mails are prone to computer viruses. Most viruses are spread via email as attachments.**
- **The privacy of an email message cannot be guaranteed. So confidential messages ought not to be sent via e-mail.**
- **Requires knowledge of computers and can only be**

Instant Messaging

This is a more enhanced real time messaging service that allows two or more people to communicate directly while on-line. To get the services, you must first register with an instant messenger.

Chat Rooms

A chat room is a facility on an Internet server that enables two or more people to engage in interactive "conversation" over the Internet. Anyone in the chat room can participate in the conversation.



Qtns: What is a website?
What is a webpage?

WEBSITE

What are the advantages/benefits of having a website?

What are the limitations of a website?

Explain the characteristics of a good website?

A website is a collection of related web pages that contain information such as images, words and digital media.

COMMON TERMS USED IN RELATION TO WEBSITES

- 1) Web page:-** This is a document written in HTML that is suitable for the World Wide Web.
- 2) Home page:-** This is the main page of any website. It is the first page that appears when ever a web site is accessed.
- 3) Sub page:-** Is any other page that a website may contain other than the home page

(4) **Hyperlinks:-** a hyperlink is an image or text on the web page that when clicked connect a user to another web page or website.

(5) **HTML:-** Is an acronym for Hypertext Mark-up Language. This is a standard markup language used to create web pages.

(6) **Web browser:-** This is a program used to surf the internet. For example Internet explorer, Mozilla fire fox, Opera, Safari, etc.

(7) **File Server:-** Is a network computer on which websites are stored. The process of keeping a website on a server is called **web hosting**.

World Wide Web (WWW) or Web

It is important to know that www is not another word for Internet.

- **Definition:** The World Wide Web, is an Internet service which consists of pages that can be accessed using a Web browser.
- The Hyper-Text Transfer Protocol (HTTP) is the method used to transfer Web pages to your computer. All Web pages are written in the hyper-text mark-up language (HTML), which works in conjunction with HTTP.

(9) Uniform Resource Locator (URL):- This is a unique address of a web page.

It is the global address of documents and other resources on the World Wide Web. E.g.

<http://www.google.com>

Http:// - Begins most web addresses. Tells the internet browser what protocol to use.

www- Stands for "World Wide Web." Most web addresses have it although it is not necessary. It indicates a web page.

. (dot)- Separates parts of the address so it does not all run together and the computer can distinguish the different parts of the address.

Domain name- Example: "Google" - A series of numbers, letters or hyphens "-" that identifies the owner of the address.

"," (dot)- See previous Definition

The Domain- At the end of a web address. Tells what type of web page you are viewing.
.com - Commercial
.org - Non-For-Profit Organization
.edu - Education (Collages/Universities)
.net - Internet Related
.mil - US Military
.gov - US Government
.us - United States
.uk - United Kingdom

Features /x-tics of Good Website

(1.) The layout should Be Consistent: This is extremely important for usability. Use a consistent layout and repeat certain elements throughout the site.

(2.) Good use of color: An appropriate color scheme will contain 2 or 3 primary colors that blend well and create a proper mood or tone for your business. Don't overdo the color, as it can distract from the written content.

(3) Text that is easily read: The most easily read combination is black text on a white background, but many other color combinations are also acceptable. Use fonts that are easy to read and are found on most of today's computer systems. depending on your audience. Keep font size for paragraph text between 10 and 12 pts.

(4) Meaningful graphics: Graphics are important, as they lend visual variety and appeal to an otherwise boring page of text. However, don't over-use them, and make sure it is relevant to the written content. Don't overload any one page with more than 3 or 4 images.

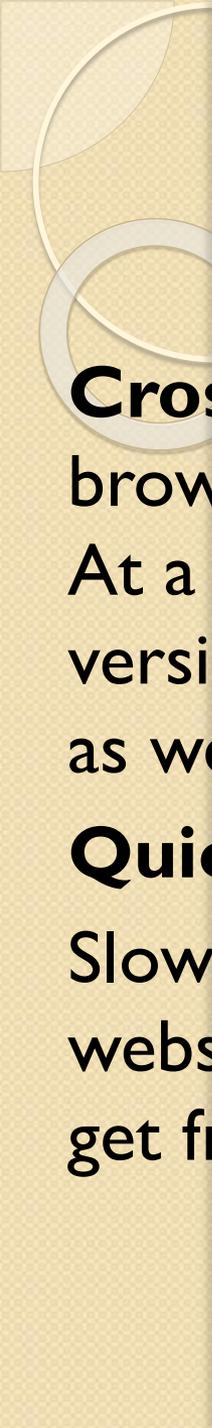
(5) Should be Up to date:- Update your content regularly. No one likes to read the same thing over and over again. Dead or static content will not bring visitors back to your site!

(7) Simplicity: The best way to keep visitors glued to your site is through valuable content, good organization and attractive design. Keep your site simple and well organized.

(9) Error-free copy: Remember the exposure your website will get. Double-check your facts and figures. Spelling mistakes and bad grammar are as unforgivable on a website as they are in other company materials.

(10) Descriptive link text: Long link text makes it much easier for visitors to find their way around a site. Back links are important to give users a sense of direction and to keep them from feeling lost.

(8) Minimal scroll: This is particularly important on the first page. Create links from the main page to read more about a particular topic.



Cross-platform/browser compatibility: Different browsers often have different rules for displaying content. At a minimum, you should test your site in the latest versions of Internet Explorer (currently, versions 8 and 9), as well as Firefox and Safari.

Quick Load Times

Slow speed is one of the top reasons visitors leave a website. A load time of less than 6 seconds is good. Visitors get frustrated with slow load times.

(14) Effective Navigation

Good navigation is an important aspect of website usability. The navigation needs to be free of confusion, and try to limit the number of menu items. A drop-down menu or sub-navigation may work better on a large site with many sections.

(15) Screen Resolution: Screen resolution for the typical computer monitor continues to increase. A good website must be same and work nicely on different monitor sizes. Today, the average web surfer uses a resolution of 1024 x 768 pixels.

Benefits of having a website

(1) Increased Customer Base

A primary advantage of having a website means your business will have a web presence. That means you can now compete with those farms that also have a website. It also means that you now have access to a new customer base – those who prefer to use the Internet to research and buy products and services.

(2) Cheaper and Flexible way of Advertising:

Internet advertising is extremely cheaper from print advertising.

(3) Market Expansion:

Websites have allowed businesses to break through the geographical barriers and become accessible almost, from any country in the world by a potential customer that has Internet access.

(4) Source of Revenue:

A website can be used as a form of media from which everybody can acquire information. You can use this media to sell advertising space to other businesses. Website such as yahoo.com

(5) Increased Communication with Customers

A website provides many new ways to interact with

(6) Increased Presence

The website, which is an extension of your business, is open to customers 24/7. That means information customers typically ask for, such as contact information, address, directions, hours of operation, and information about your company, and your products and services is available even when the business is closed.

(7) Offer Convenience

It is far more convenient for a person to research a product on the Internet than going there physically and look for or ask someone for information on a product. Potential customer can visit your website whenever they like in their own privacy and comfort

(8) Improve credibility

A website gives you the opportunity to tell potential customers what you are about and why you deserve their trust and confidence. Many people use the internet for pre-purchase research so that they can determine for themselves whether a particular supplier or brand is the best.

(9) Two-Way Communicative Marketing

Customers can quickly and easily give feedback on your product and/or marketing approach.

(12) Growth Opportunity

A website serves as a great place to refer potential investors to, to show them what your company is about, what it has achieved and what it can achieve in future.

(13) Cheap Market Research

You can use features on your website such as visitor polls, online surveys and your website statistics to find out what your customers like more and how they feel about certain aspects of your business to

LIMITATIONS OF A WEBSITE

- (1) Cost:-** Start-up and maintenance costs of a websites are relatively high. Since it requires constant updating of its content.
- (2) Requires some expertise:-** For example knowledge of computers and the Internet in general. This applies to both the potential clients and website owners.
- (3) Availability of internet:-** Website services may not be of any use in an area where there is no internet connection.

(4) Security:- This can also be an issue with online businesses, and can manifest itself as a threat in several ways. For example security can be compromised, allowing a cracker to manipulate the information there.

(5) Copyright:- Online businesses that use websites experience the threat of Internet law which does not provide the same protection for copyright violation as trade regulations do for physical items. Such as, product ideas, logos, slogans, written content, design, concept, are vulnerable in an online business.

Trial Qtns

1. Explain why a school should have a website