Date :.....
Page :.....

Chapter 2 Data communication and computer Network

Data communication

The transferring of data from one computer to another computer is called data communication.

Computer Network

A group of interconnected computer which can share data, software and hardware and also communicate with other people is called computer Network.

Advantages of computer Network

- Data sharing
- software and hardware sharing
- Remote accessing facility
- Communication facility
- workgroup computing
- Backup and recovery

Disadvantages of computer Network

- leakage of private information
- Spreading of computer viruses
- security problem

Date :.....
Page :.....

- Needs skilled manpower to operate
- software piracy

Components / Elements of data communication

1. message
2. sender
3. Receiver
4. communication media
5. protocol

Communication mode / transmission mode

Communication mode defines the direction of dat flow in the communication.

There are three communication mode

1. Simplex mode

In this mode transmission is possible in only one direction similar to a one-way street. For e.g. radi television, etc.

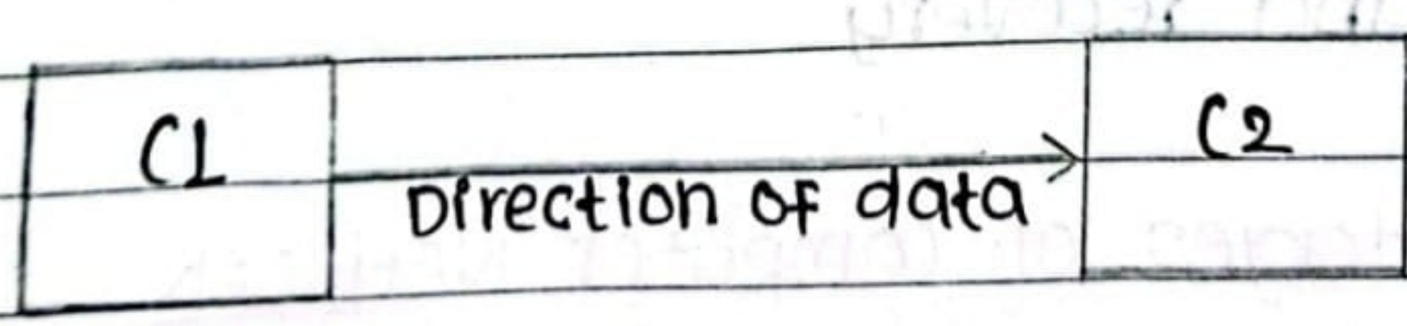


fig: Simplex mode

Date :.....
Page :.....

2. Half-duplex

In this mode, transmission is possible in both direction, but not simultaneously (i.e. one direction at a time). For e.g. walkie-talkie.

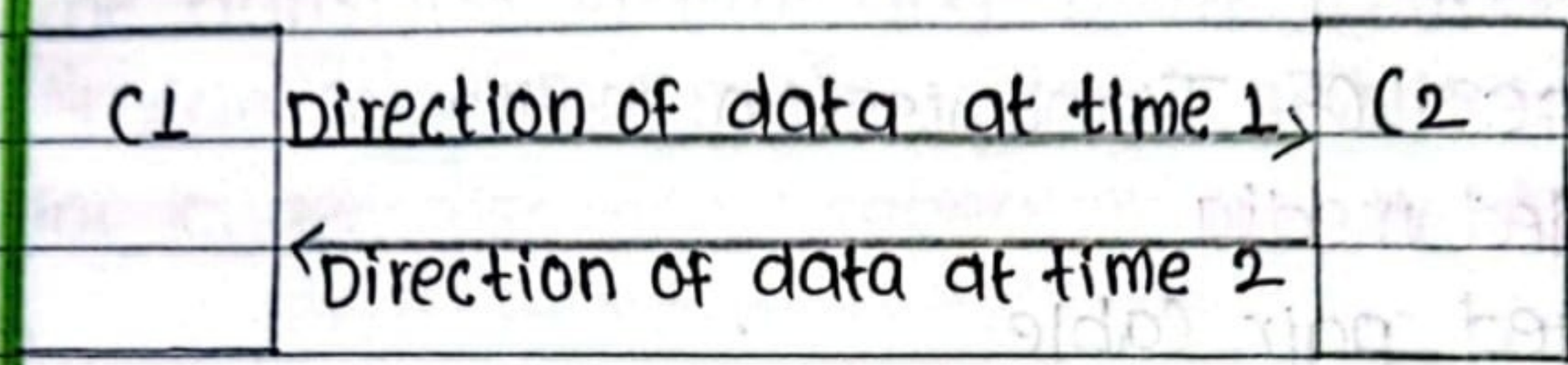


fig: Half-duplex

3. Full duplex

In this mode, transmission is possible in both directions at a time similar to two way street. For e.g. mobile and telephone communication.

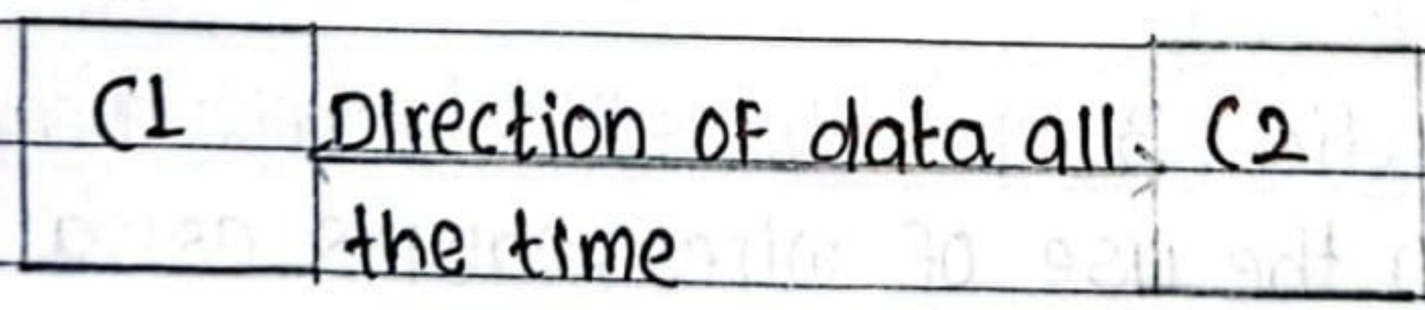


fig: Full duplex

Date :.....
Page :.....

Transmission media / communication media

It refers to the wires, cable and other means through which data transfer from its source to destination.

Types of Transmission media

1. Guided media
a. Twisted pair cable
b. coaxial cable
c. Fiber optic cable

2. Unguided media
a. Radio wave
b. Micro wave
c. Infrafred technology
d. satellite communication

1. Guided media / Bounded media / wired media

It refers to the use of wires, cables as a media to transfer data from its source to its destination.

Types of Guided media
a. Twisted pair cable
b. coaxial cable
c. Fiber optic cable

Date :.....
Page :.....

a. Twisted pair cable

It is the oldest and still most common transmission media. It contains a pair of cables, twisted with each other. Tighter the twisting cables, greater the transmission rate and fewer system and LAN. It can cover few meter without amplification, but for longer distances, repeater are needed.

Advantages of twisted pair cable

1. It is light, thin and more flexible.
2. It is cheaper than other cables.
3. It can transmit data at a higher bandwidth for short distance.

Disadvantages of twisted pair cable

1. It cannot be used for long distance transmission.
2. It is slowed for data transmission than other cables.

Note: This cable is connected with the help of RJ45.

Date :.....
Page :.....

Types OF Twisted pair cable

Unshield Twisted pair cable (UTP)	Shield Twisted pair cable (STP)
1. It is the most common twisted pair.	It is rarely used.
2. It doesn't contain extra covering.	It contains an extra covering.
3. It cannot carry data signals for longer distances compared to STP.	It can carry data signals for longer distances.
4. It is cheaper.	It is expensive.

b. Coaxial cable (COAX)

It carries data signals at a faster speed than twisted pair cable. It's common use is for the transmission of signals in cable television system.

Coaxial cable is of two types

1. Thin COAX
2. Thick COAX

Date :.....
Page :.....

1. Thin coax

It is also known as thinnest which has the speed of 10 mbps and covers distance upto 200 meters.

2. Thick coax

It is also known as thickest which has the speed of 10 mbps and covers distance upto 500 meters.

Note: This cable is connected with the help of BNC connector (Bayonet - Nell - concelman).

Advantages of coaxial cable

1. It provides faster data transmission.
2. It can transmit data over medium range distance.
3. It is easy to install

Disadvantages of coaxial cable

1. It is expensive to install.
2. It is not appropriate for long distance transmission.
3. It is rarely used at present for a computer Network.

Date :.....
Page :.....

C. Fiber optic cable

A fiber optic cable is made up of glass or plastic and transmits signals in the form of light. It is about 200 times faster than coax cable and 200 times faster than twisted pair cable. It is used for services like telecommunication, video conference and interactive services.

Advantages of Fiber optic cable

1. It provides the fastest data transmission.
2. It can be used for both short to long distance transmission.
3. It provides error free and highly secured transmission.

Disadvantages of Fiber optic cable

1. It is the most expensive and difficult to install
2. It is not preferred to use in the hillside area.
3. Skilled manpower is required to install.

Note: This cable is connected with the help of S-T connector (straight Tip connector)

Date :.....
Page :.....

2. Unguided media / unbounded media / wireless media

It refers to the use of wireless media to transfer data from its source to its destination.

Types of unguided media:

a) Microwave system: It uses very high frequency radio signals to transmit data through the air. The transmitting and receiving antennas must be placed on tall buildings or towers, hills and mountains peaks.

- For long distance transmission, repeaters are used at different intervals.
- When one repeating tower receives the signal, it amplifies the signal and sends it to the new tower.

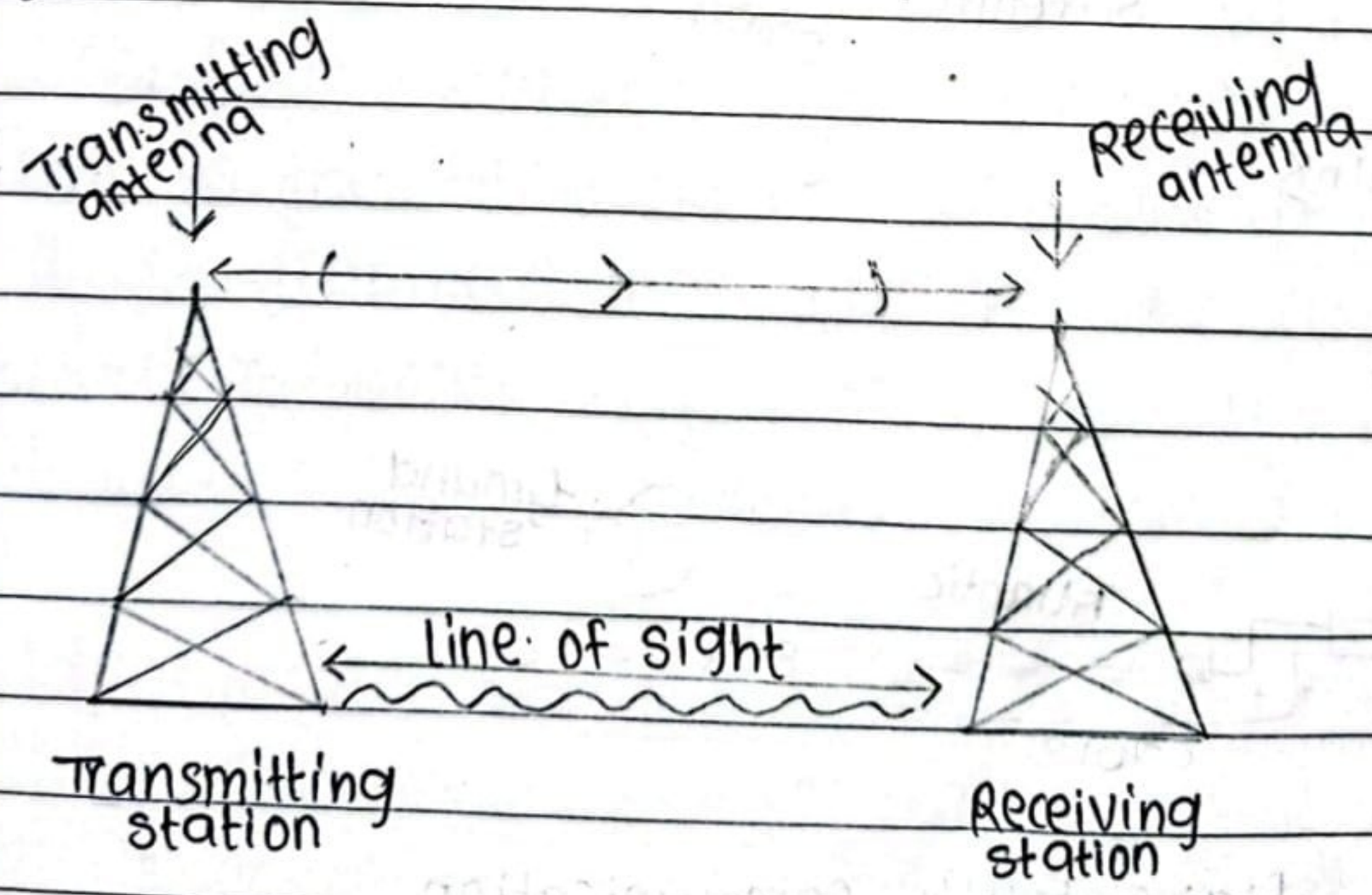


fig: microwave system

Date :.....
Page :.....

b) Satellite communication

- It is the most common world wide communication system at present.
- It uses a satellite as a repeater.
- The satellite is a repeater that orbits in space
- It has receivers and transmitters located in the ground station.
- The satellite amplifies the weak signal and transmits it back to the receiver.
- multiple satellite are used for longer distance transmission.

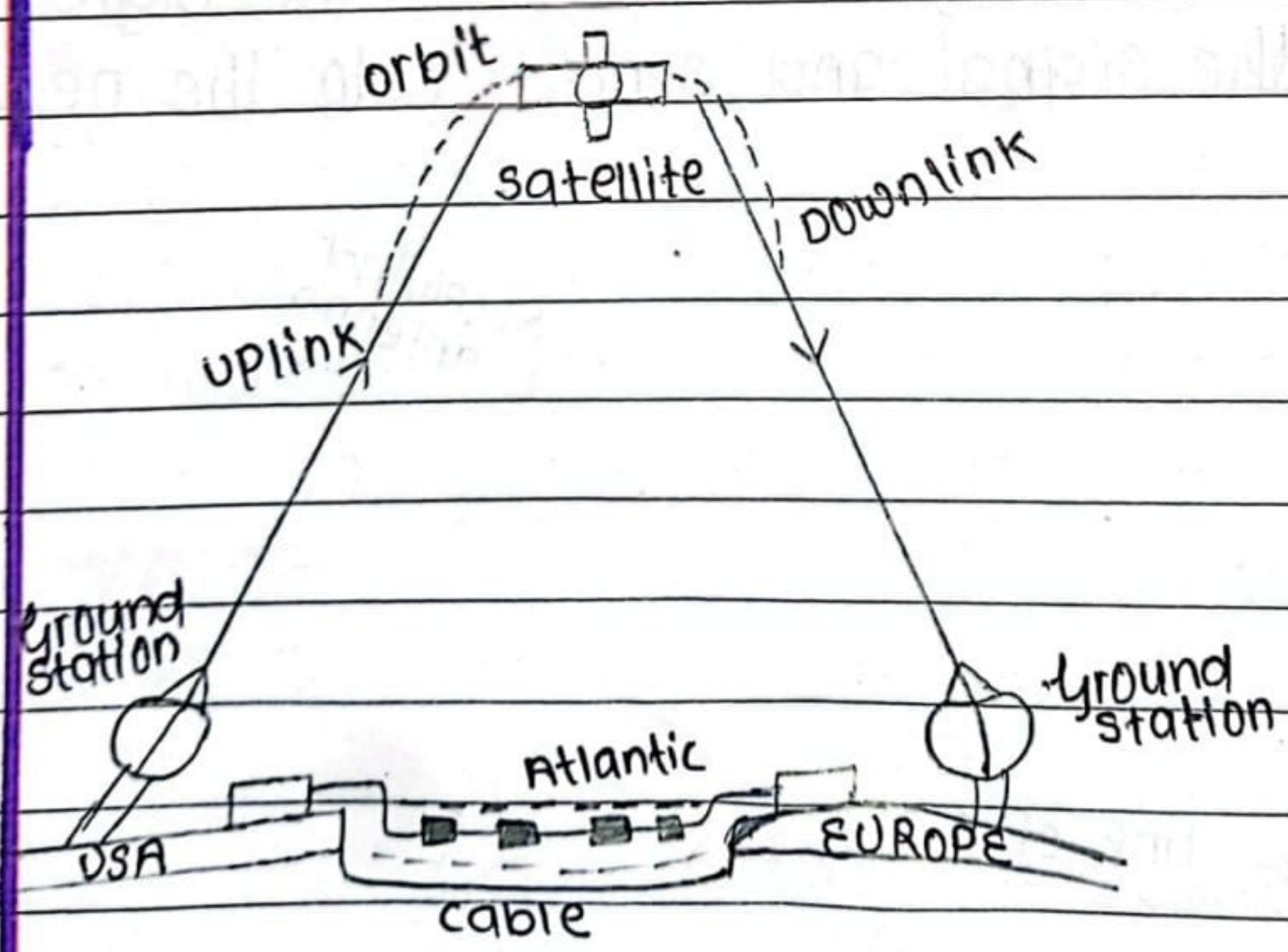


fig: satellite communication

Date :.....
Page :.....

c) Infrared technology

- It can be used for short distance transmission.
- It is mainly used in wireless remote control, wireless LAN, wireless mouse and keyboard, bluetooth, etc.
- They cannot penetrat the wall or any solid objects.
- It cannot be used outside the buildings because sun rays contains infrared ways that can interfered with communication.

Types of computer Network on the basis of geographical area coverage.

1. Local Area Network (LAN)
2. Metropolitian Area Network (MAN)
3. Wide Area Network (WAN)

1. Local Area Network (LAN)

LAN is the interconnection of computers in a limited geographical area like in a office, college, building, home.

→ It ranges about 100 meter

Advantages of LAN

a. It is cheaper to established.
b. It is easier to manage and operate.
c. Data transmission speed is faster than MAN & WAN.

Disadvantages of LAN

a) It is limited only to a small area
b) It connects a small number of computers
c) Lack of backup provision

2. Metropolitan Area Network (MAN)

Metropolitan Area Network (MAN) is the interconnection of computers within a city or between neighbouring cities.

- It ranges upto 100 km.

Advantages of the MAN

a) It covers large area than LAN.
b) It can connect dissimilar systems and networks.
c) It connects many numbers of computers than LAN.

Disadvantages of the MAN

a) It is complex to manage and provide security
b) It is expensive to run than LAN.
c) Transmission speed is usually slower compared to LAN.

3. Wide Area Network (WAN)

- WAN is the interconnection of computers within a country or neighbouring country.
- It covers very large geographical area. It is

Date :.....
Page :.....

also known as internet. It is a network within a whole world.

- It ranges above 1000 KM.

Advantages of the WAN

a. It covers very large geographical area.
b. It also connects dissimilar system and networks.
c. It connects larger number of computers than LAN and MAN.

Disadvantages of the WAN

a. It is more complex to establish, manage and operate.
b. It provides less security.
c. Transmission speed is usually slower.
d. It is expensive to establish.

Date :.....
Page :.....

Imp

Difference between LAN and WAN

Different categories	LAN	WAN
1. physical distance	It is limited within a small geographical area.	It covers very large geographical area.
2. Numbers of computers connected.	Small numbers of computers can be connected.	larger numbers of computers can be connected.
3. Data transmission speed	faster	slower
4. Error rate	very low error rate.	comparatively higher error rate.
5. Cost of data transmission	cheaper	Expensive
6. Device used	Hub, switch, NIC, etc.	Gateway, bridge, router, etc.

Date :.....
Page :.....

Types of computer network on the basis of network architecture:

a) Client - server Architecture

In a client - server architecture server always provides its resources to the clients and client always receives resources from the server. In a client - server architecture, there must be at least one dedicated server and client computers.

b) peer to peer architecture

In a peer to peer architecture, all computers have equal authority to access data and therefore are known as peers. Each computer functions as both client and a server.

Date :.....
Page :.....

V. V. IMP

Differences between client-server archiceture and peer-to peer architecture

Client-server architecture	peer to peer architecture
1. This type of networks contains two types of computer called a client work station and server.	It is the connection of similar types of computers called peers.
2. It is complex and expensive to establish and manage.	It is easier and cheaper to establish and manage.
3. It ~~con~~ contains dedicated sever.	It doesn't contain dedicated server.
4. It is appropriate for large organizations.	It is appropriate for small organization.
5. Highly skilled manpower is required to operate.	Skilled manpower is not required to operate.

Date :.....
Page :.....

* Network Topology

The physical and logical arrangement of nodes on a network is called network topology.

Nodes usually includes routers, computers, switch, software, etc.

Types of Network Topology

a. Bus topology
b. Star topology
c. Ring topology
d. Mesh topology
e. Tree topology
f. Hybrid topology

a. Bus topology

In bus topology, all the computers are connected to the main cable called "Trunk" or "Bus". Coaxial cable is used in this topology.

Terminators are used in the both ends of trunk. Trunk is used to absorb the signal.

Date :.....
Page :.....

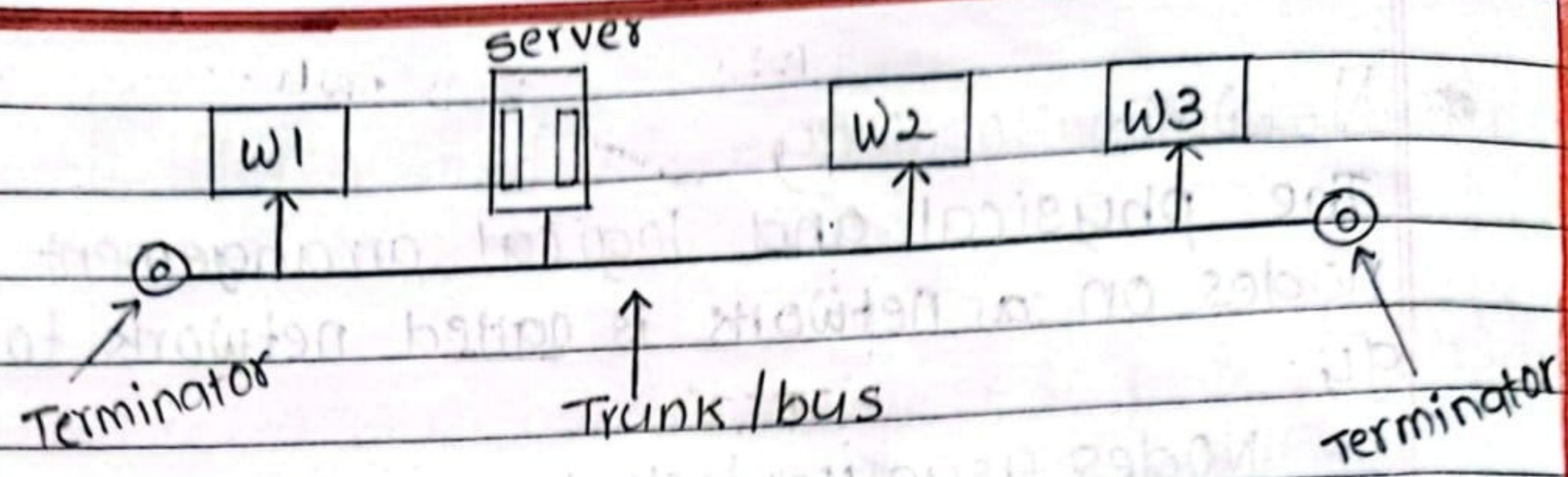


fig: Bus topology

Advantages of Bus topology

1. It is cheaper and easier to implement
2. Failure in one computer doesn't affect other.

Disadvantages of Bus topology

1. Difficult to troubleshoot
2. A main cable break can disable the entire network.

b. Star topology

In star topology, each computer is connected to the central device such as hub/switch. Twisted pair cable is commonly used. When data is transmitted from one computer to another, it reaches hub/switch. Hub/switch amplifies the data signal and broadcast it.

Date :.....
Page :.....

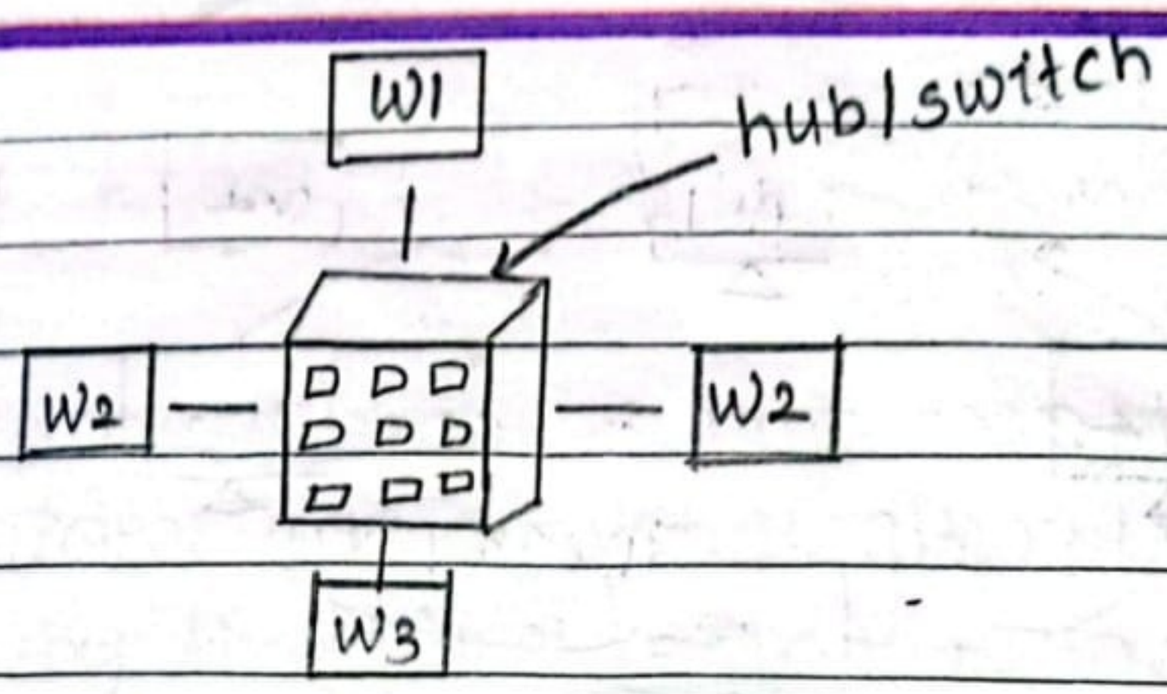


Fig: Star topology

Advantages of star topology

1. Easier to add or remove computer.
2. Easier to monitor and troublesheet.
3. Failure to one computer doesn't affect entire network.

Disadvantages of star topology

1. Failure of hub/switch affect all computers.
2. It is more expensive than bus topology because of the cost of hub/switch.

C. Ring topology

In this ring topology, each computer is connected on a point basis so that entire system is in the form of a ring. In this topology, data are transmitted in only one direction (clockwise or anti-clock wise). A twisted pair or optical fibre is used as transmission.

Date :.....

Page :.....

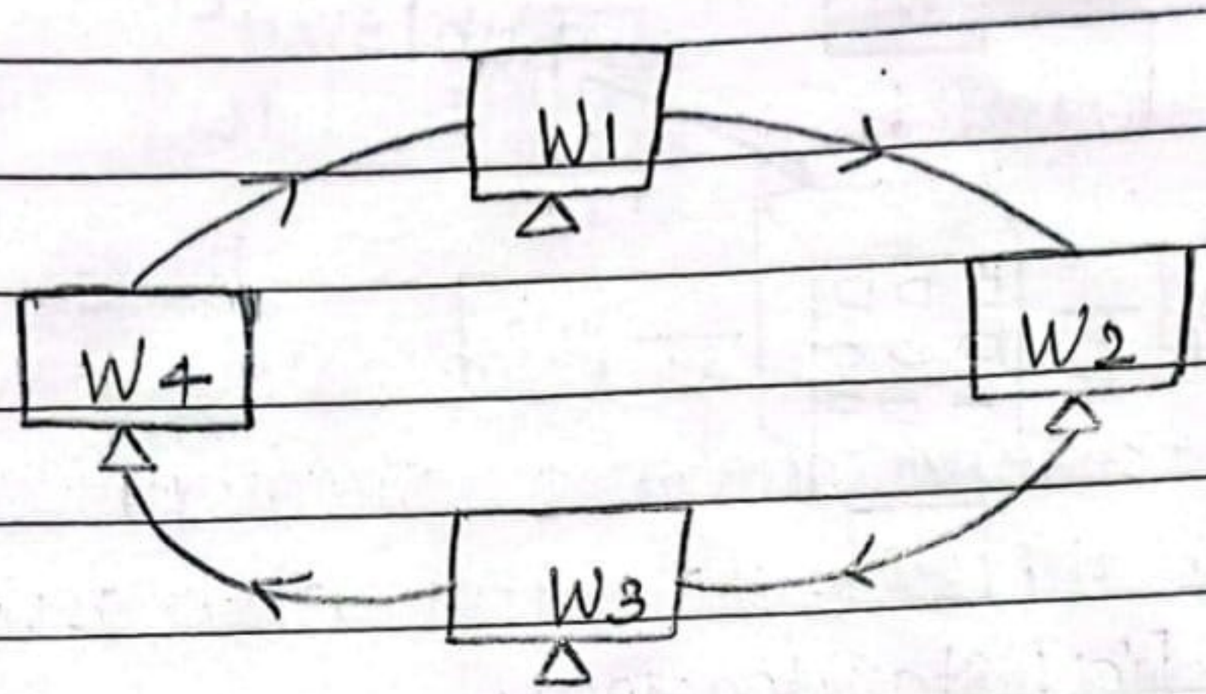


fig: Ring topology

Advantages of Ring topology

a. Terminator are not necessary as in bus topology.
b. Each computer has equal priority to communicate on the network.

Disadvantages of Ring topology

a. Failure of a computer affects the entire network.
b. less flexible, difficulty in adding and removing the computers.

Date :.....
Page :.....

V.V.I for short qsn.

Network tools

a. Packet Tracer

Packet Tracer is a visual simulation program developed by the Cisco network academy. It simulates a Cisco network without a physical network. It's drag and drop interface is easy to use. This feature makes the tools useful accross institutions and people around the world. It also helps to complete CCNA lab training. We can use it to monitor packet transfer, data transfer and more in real time(topology). We can also create all network to pologies easily in a data packet tracer.

b. Remote login

Remote login, also known as remote access, is the ability to access the data stored on a computer from a remote location. It enables you to open, edit and save files located on your device from anywhere in the world. This ability is handy for offsite workers, travelers, and those who work out the office.

Remote accessing is possible as long as there is a connection

Date :.....
Page :.....

between devices. Employees can access a server in the office when they're outside from the office.

Remote accessing is possible as long as there is a connection between devices. Employees can access a server in the office when they're outside.

V. V. I

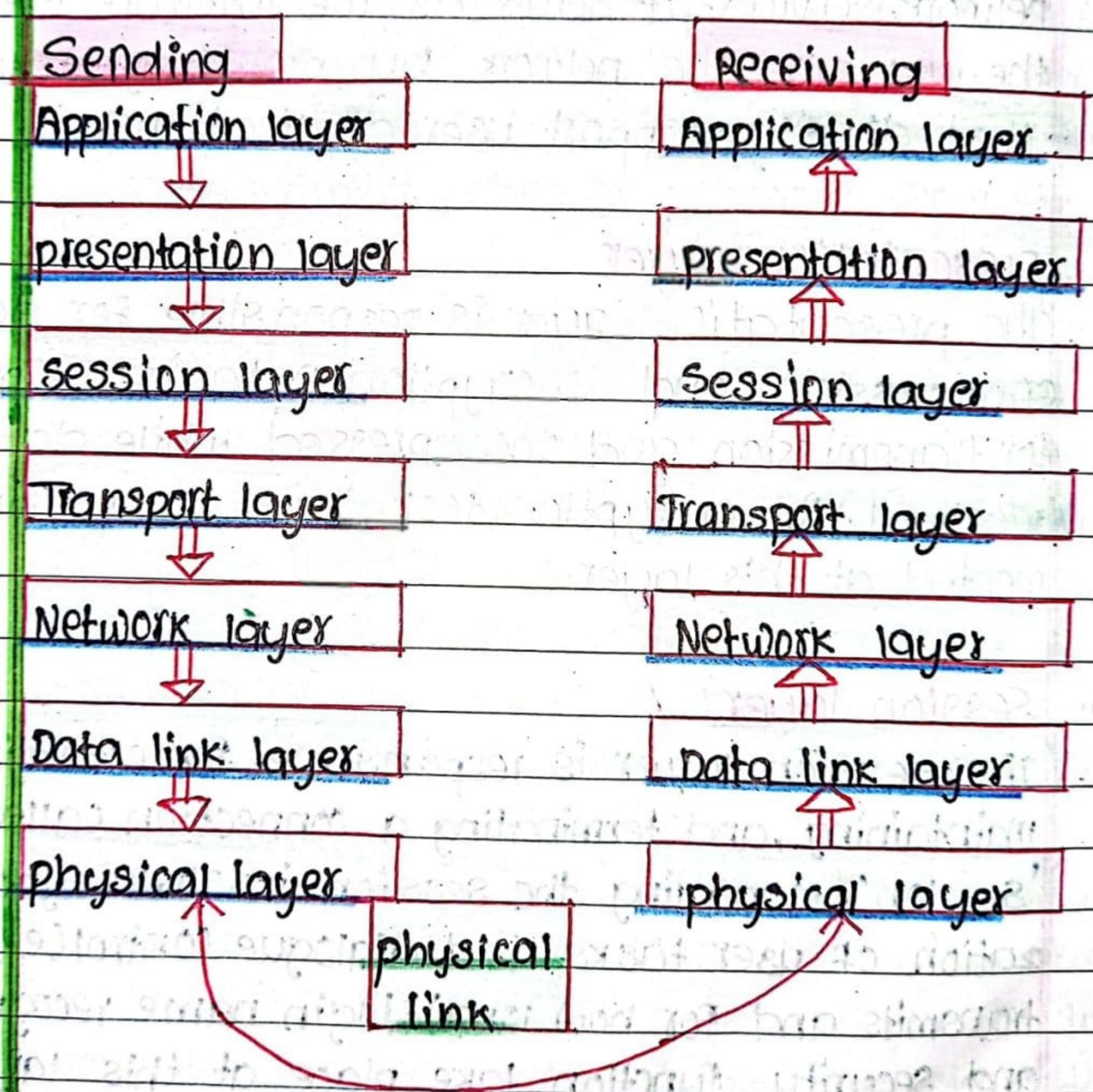
8 marks sure (final)

Date :.....

Page :.....

1. Explain 7 layers of OSI reference model.

→ The OSI model is a concept that describe how data communications should take place. It divides the process into seven group called layers. (Open system Inter-connection)



Date :.....
Page :.....

The following figure lists the seven layers of the OSI (open system Interconnection) model.

1. Application layer
The application layer provides direct access to network services. It serves as the interface between the user and the network by providing services that directly support user applications.

2. Presentation layer
The presentation layer is responsible for data compression and encryption. Data is compressed for transmission and uncompressed while data is received. An encryption technique is also implemented at this layer.

3. Session layer
The session layer is responsible for establishing, maintaining, and terminating a connection called a 'session'. Managing the session involves synchronization of user tasks and dialogue control (e.g. who transmits and for how long) (login name recognition and security function take place at this layer.)

Date :.....
Page :.....

4. Transport layer

The transport layer is responsible for source to destination [end-to-end] delivery of the entire message. On the sending side, messages are packaged to from data packets for efficient transmission at this layer and assigned a tracking number (packet number) so they can be ressambled in proper order. On the receiving side, the packets are reassembled, checked for errors, and acknowledged.

5. Network layer

Network layer is responsible for the source to destination delivery of packet possibly across multiple networks. It is at the network layer where the route from the source to the destination computer is determined. Routes are determined based on packet addresses and network conditions.

6. Data link layer

In this layer, the data frame is broken down into individual bits that can be translated into electronic signals and sent over the network. On the receiving side, the bits are reassembled into frames for processing by upper layers. Error detection and correction are also performed at this

Date :.....
Page :.....

layer.

7. physical layer

The physical layer is connecerned with transmitting raw bits over communication medium. It also defines the electrical characteristics of the signals used to transmit the data. The physical layer transmits the binary data (bits) as electrical or optical signals depending on the medium.

Date :.....
Page :.....

V.V.I

Difference between Internet, Intranet & Extranet

Internet	Intranet	Extranet
• It is a public network.	It is a private Network.	It is semi/virtual private Network.
• Anyone can access the internet.	Only authorized employees of an organization can access the intranet.	employees of organization, business partners, suppliers, customers can access the extranet.
• Information can be shared across the world.	Information can be shared only with an organization.	Information can be shared between employees and other authorized people.
• It is not owned by anyone.	It is owned by an organization.	It is owned by one or more organizations.
• It is less secured.	It is strongly secured by fairewall.	It is less secure than intranet.

Date :.....
Page :.....

For eg:- remote accessing facility, Chat www, news group, etc.	For e.g.: the networking of computer among different branches.	For eg:- the ATM network of a book where the basic provide access to other bank & customers

Network connecting Device

a. NIC (Network Interface card)

It is a device that connects the computers and Network cable. It coordinates the transfor of information between the computer and the network. Desktop computer has NIC whereas laptop and smartphones have wireless NIC. Each NIC is assigned with unique MAC (media Access control) or physical address.

b. Modem (MODEM)

The word modem stands for modulator and Demodulator. MODEM is a network device that translate the digital signal into Analog ~~an~~ Signal and vice-versa. The process of translating digital signal into analog signal is called modulation and the process of translating analog signal into digital signal is called demodulator. MODEM is rarely used in present because it is replaced by router.

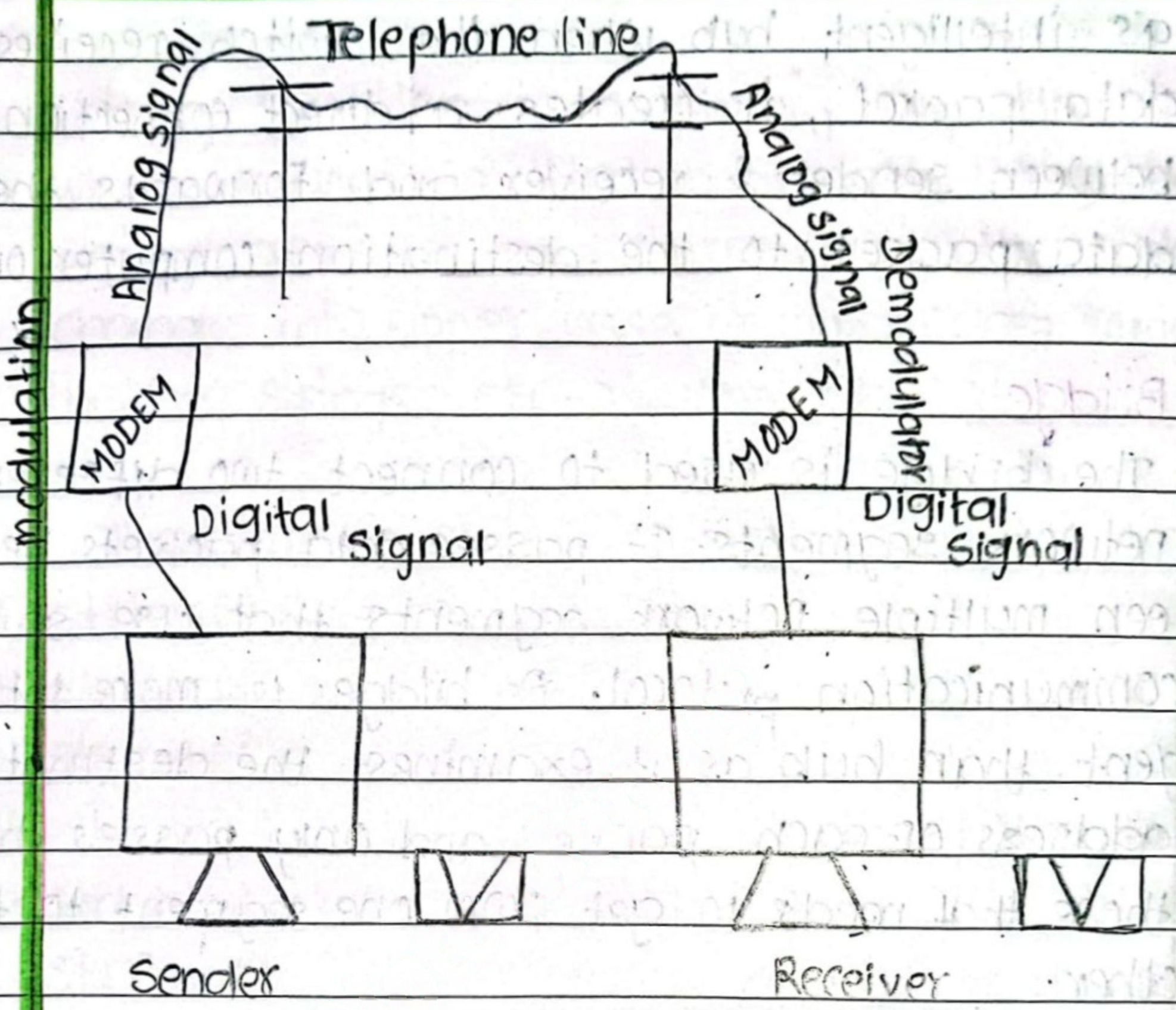


fig: MODEM implementation

c. Hub

Hub is a network device with multiple parts for connecting computers in star topology. It accepts data, amplifies them, and then broad costs to all the computers on the network.

d. Switch

A switch is a device that accepts data and send a data to its destination. It is also known

Date :.....
Page :.....

as intelligent hub when the switch receives a data packet, it creates a direct connection between sender & receiver and forwards the data packet to the destination computer only.

e. Bridge

The bridge is used to connect two different network segments. It passes data packets between multiple network segments that use same communication protocol. A bridge is more intelligent than hub as it examines the destination address of each packet and only passes through those that need to get from one segment to the other.

f. Gateway

Gateway enables communication between networks using different network architecture. It acts as a translator between networks is using in compatible transport protocol such as between TCP/IP and SNA or between SNA and x-25.