-:(Intro To ICT):-

Semester # 01:-

Data Communications / Transmission:-

Data communication is a process of sharing / exchange or transferring of data electronically from one place to another place. Data can be transferred by using different medium.

-:Components:-

(i) Message:-

The message is the data or information to be communicated. It may consists of text, numbers, Image, sounds, videos etc.

(ii) Sender:-

Sender is the device that sends the message. It is also called source and transmitter. The computer is usually used as sender in data communication system.

(iii) **Reciever:-**

Reciever is the device that recieves the message. It is also called sink. The reciever can be a computer, printer, fax machine or mobile phone etc.

(iv) **Transmission Medium:-**

Transmission is the path through which the message are transferred. It is used to carry message from one place to another. It is also called communication channel.

Signals:-

Signal is an electromegnatic or light wave that represent data. It is used to transfer data from one device to another through a communication medium.

:- Types :-

- **Analog Signals:-**

Analog signal is a count continous electric signal in the form of wave. The wave is known as carrier wave. Telephone line is most commonly used media for analog transmission of data.
e.g. Light, sound and microwaves

- **Digital Signals:-**

Digital signals is a sequence of voltage represented in binary form. The digital signals are in the form of electrical pulses of ON and OFF. These signals are in discrete form. They also provide high transmission speed and high quality voice transmission.

:- Types of Data :-

Textual data:-

Textual data consists of word, sentence and paragraphs.

Example: Some examples of text data is Usman Khalid, Pakistan, Islam etc.

Numeric data:-

Numeric data consists of numbers, digits from 0 to 9. It may also contain decimals and symbols.

Image:-

This type of data consist of charts, graph, pictures and drawings.

Audio:-

Sound is a representation of audio. Audio data includes music, speech and voice.

Video:-

Video is a set of full-motion images played at a high speed. Video is used to displayed actions and movements.

Asynchronous Transmission:-

In Asynchronous Transmission, data is transmitted character by character. It is cheaper to implement because data is not saved before it is sent. It uses special start signal. The start signal is sent when the character is about to be transmitted. A start bit has a value of 0.

Synchronous Transmission:-

In Synchronous Transmission, the saved data is transmitted block by

block. Each block may consists of many characters. It uses a clock to control the timing of bits being sent.

Types of Transmission media:-

- Guided media
- Un-Guided media

Guided Media:-

Guided transmission media consists of physical connection between source and destination through a wire or a cable.

Example / Types:-

- Twisted pair cables
- Co-axial Cable
- Fiber optic cable

Unguided media:-

Unguided transmission media are method that allows the transmission of data without

the use of physical transmission media. It use waves to transmit the data.

Example :-

Radio - waves

Micro - waves

Infrared - Waves

Carrier - Waves

Transmission Mode:-

The way or path in which data is transmitted one place to another place is called data transmission mode.

Types:-

- **Simplex Mode:-**

In Simplex mode, data can flow in only one direction. It cannot be moved in both direction. A device with simplex mode can either send or recieve

data. It cannot perform both actions.

Examples:-

TV, Radio, speech

- **Half-Duplex Mode:-**

In Half-Duplex Mode, data can flow in both directions but not at the same time. It is transmitted one-way to one time. A device with the Half-Duplex Mode can send or recieve data but not in the same time.

Examples:-

Web pages

- **Full-Duplex Mode:-**

In Full-Duplex mode, data can travel in both direction at the same times. Full-Duplex mode is a faster way of data transmission

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as compare to half-duplex mode. Time is not wasted in changing the direction of data flow.

Example:—

Telephone

:(Computer):-

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:- Computer Network :-

A computer network is a connection between two or more network devices, like computers, routers and switches, to share network resources.

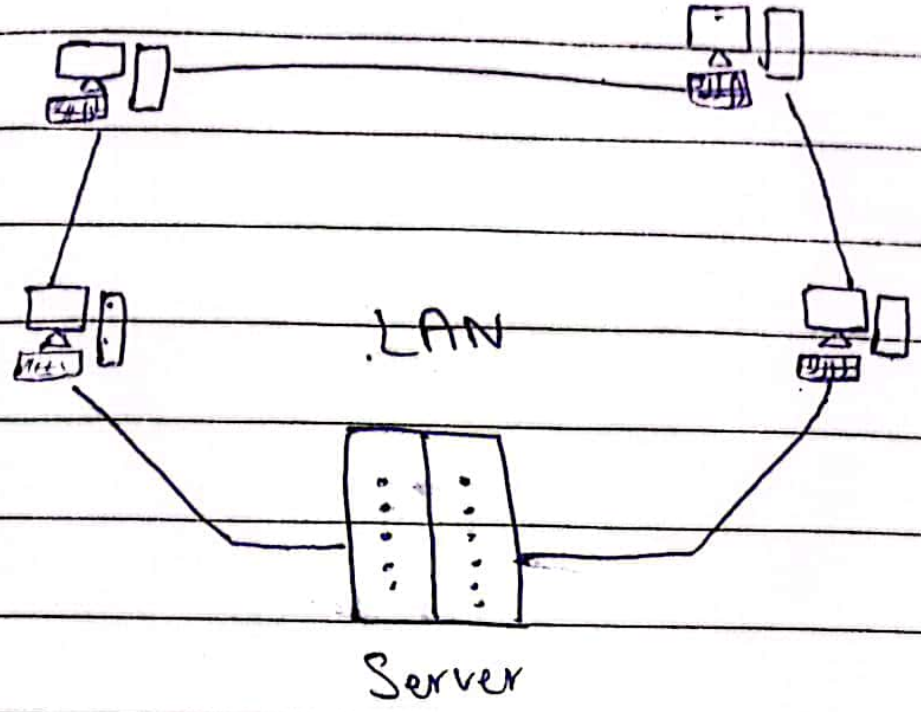
A computer network depends on the requirement of the communication channel i.e, the network can be wired or wireless.

:- Types :-

Below mentioned are different types of computer Networks:

- PAN (Personal area network)
- LAN (Local area network)
- MAN (Metropolitan area network)
- WAN (Wild area network)

(i) Local Area Network:-



The local area network (LAN) is designed to connect multiple network device and system within a limited geographical distance
The data transmit speed in the LAN is higher than the other networks types, MAN or WAN.
LAN uses private network addresses.

Advantages:-

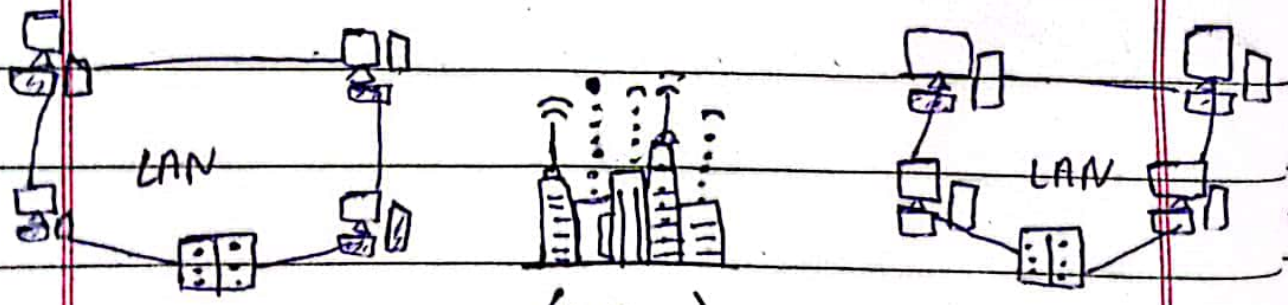
- The transmission of data and services is higher than other networks.

- The network server act as a central unit for the whole network.

Disadvantages:-

- Its need constant administration of experienced engineers for functioning.
- Probability of leak of sensitive data by LAN administration

(ii) Metropolitan Area Network:-



(MAN)

The metropolitan area network (MAN) is a network type that covers the network connections of an entire city or connections of a small area. The area covered by

the network is connected using a wired network.

MAN networks covers an entire town area or a portion of city. Data transmission speed is high due to the installation of optical cables and wired connections.

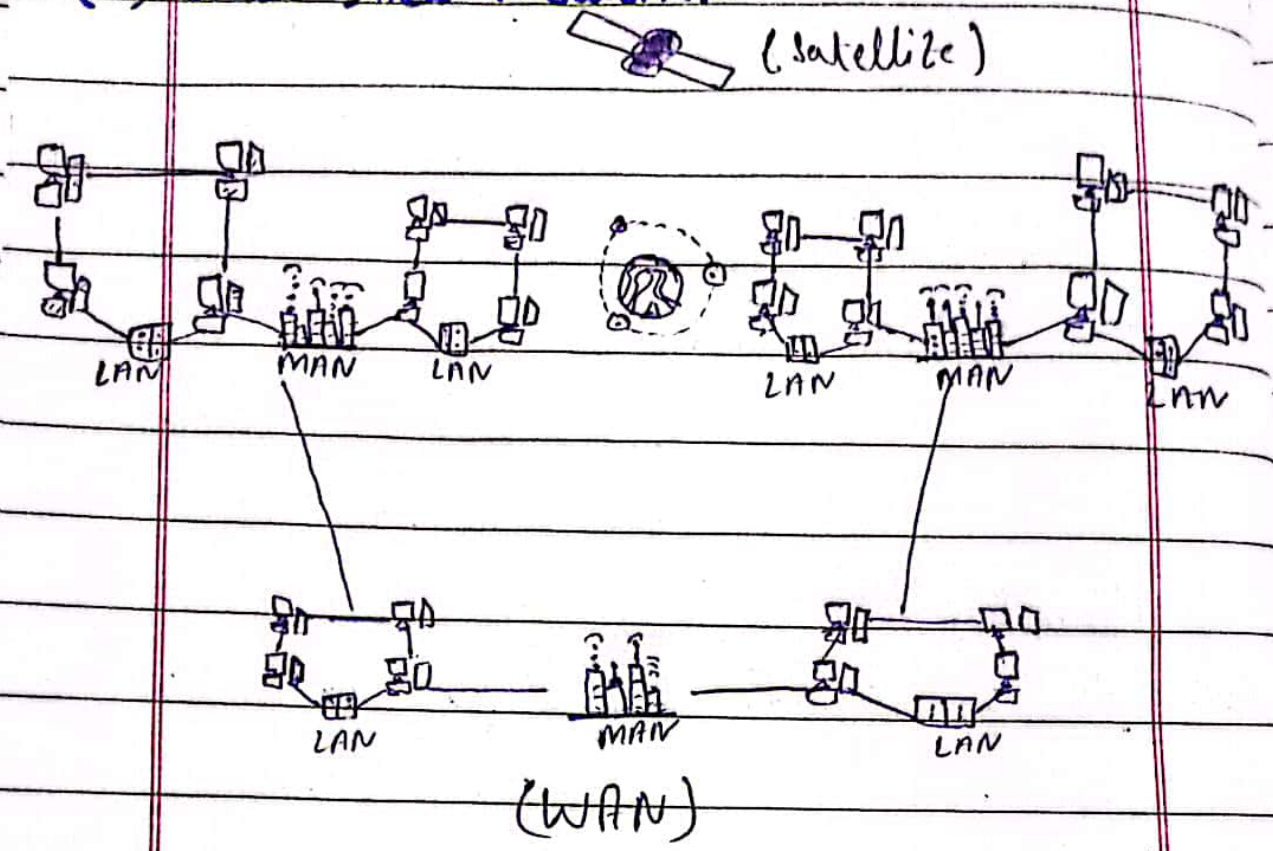
Advantages:-

- It provides Full-Duplex data transmission in the network channel for devices.
- The network connection area covers an entire city by using cables.

Disadvantages:-

- High probability of attack from hackers and cybercriminals due to large network.
- Its need good quality of hardware.
- The installation cost is very high.

(iii) Wild Area Network:-



(WAN)

The wide area network (WAN) is designed to connect device over large distance like states or between countries. The connection is wireless in most cases and uses radio towers for communications. The WAN networks can be made up of multiple LAN and WAN networks.

The speed of the WAN data tranfer is lower than MAN or LAN, due to very large distance.

The WAN network uses a satellite medium to transmit data.

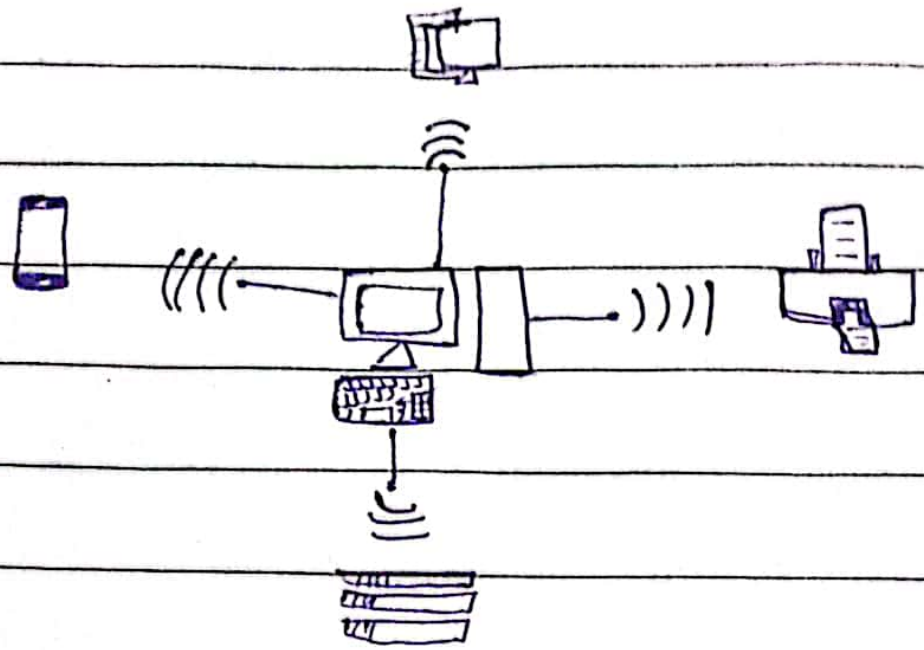
Advantages:-

- This network covers a high geographical area and used for large distance.
- They also uses radio towers or satellite.

Disadvantages:-

- High cost to set up the network.
- It support experienced technicians is needed to maintain network.
- It is difficult to prevent hacking and debug a large network.

(iv) Personal Area Network:-



A personal area computer is a computer network for interconnecting electronic devices within person's workspace.

A PAN provides data transmission among devices such as computers smartphones, tablets etc.

Advantages:-

- It is cost-effective, simplicity and data protection.
- It uses less storage space.

Disadvantages:-

- Incompability
- Uses Interference with radio signals.
- It is insufficient network coverage region or range.

(v) Internet:-

The internet is a vast network that connect computers all over the world.

"Internet is the network of networks in which user at any computer can get information from any other computer.

:-Network Topologies:-

Network topology is the arrangement of the elements of a communication network. It can be used to define or describe

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-:Network Topology:-

Network Topology is the arrangement of the elements of a communication network. It can be used to define or describe the arrangement of various types of telecommunication networks.

-: Types:-

- Bus Topology
- Star Topology
- Ring Topology
- Mesh Topology
- Tree Topology
- Hybird Topology

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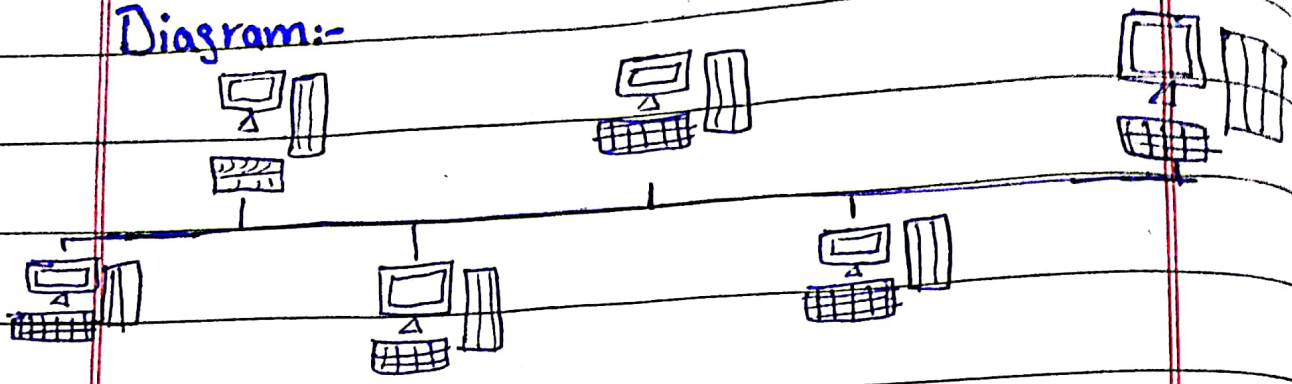
(i) Bus Topology:-

Diagram:-



Bus Topology is the line or horizontal topology in the network. In Bus topology, all the nodes (computer) are connected to single backbone or bus with some medium like twisted pair or co-axial cable. This topology is mostly used in local area networks.

When a nodes wants to communicates with the other node, it simply sends a message to the common bus. then all the nodes recieve the message

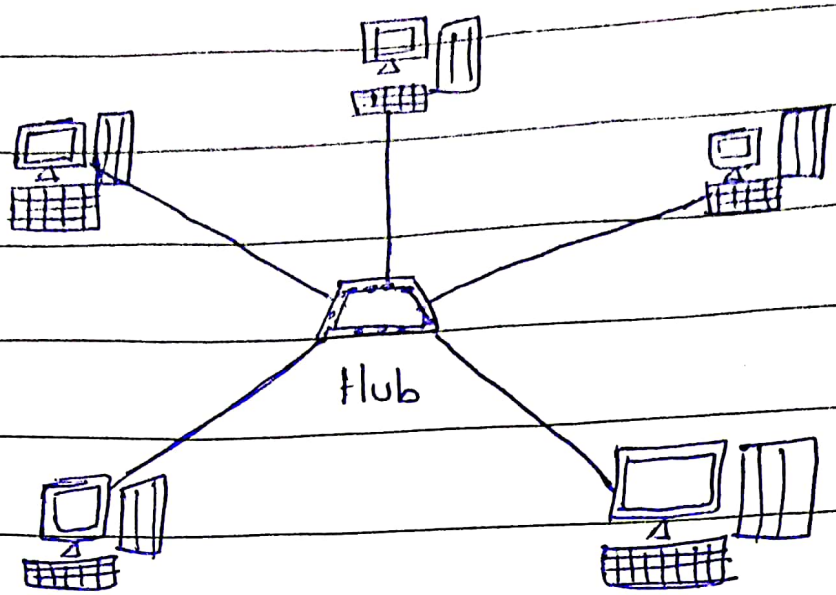
Advantages:-

- The bus Topology requires less cabling.
- The bus Topology is easily to configure and install.
- In bus Topology the failure of one computer does not affect the other computers.

Disadvantages:-

- In Bus Topology, the failure of Backbone cable can breakdown all the network
- In Bus Topology, the addition of computer decrease the performance of network.
- The bus Topology is difficult to rebuilt in case of faults.

(ii) Star Topology:-



Star Topology is a network layout in which all devices are connected to a central hub or switch. This central hub acts as a central point of communication and controls the flow of data between devices. This topology is oftenly used in small to medium-sized networks, such as home networks or small office networks.

In star Topology, if a nodes wants to communicate with

the other node. if it' firstly send the message to the hub and then hub sends the same message to the other nodes.

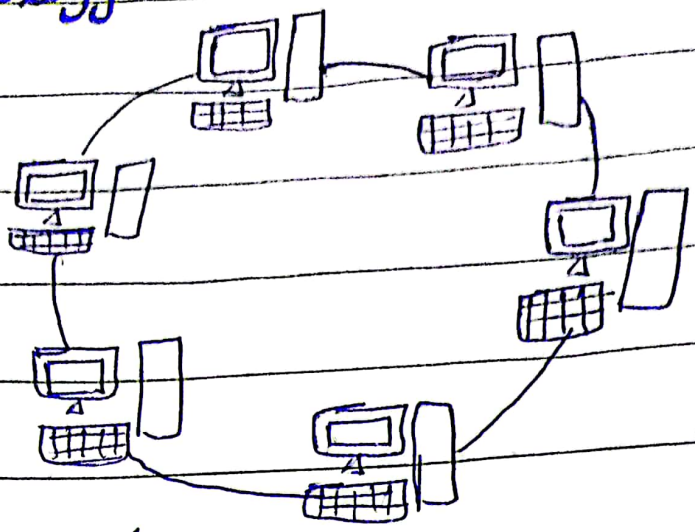
Advantages:-

- It is easy to install and configure.
- It is easy to troubleshoot by disconnecting the device from the hub.
- Star Topology can improve network performance
- Star Topology can provide high Security.

Disadvantages:-

- If the central hub fails, the entire network will be down.
- It is very expensive
- Star Topology is limited in distance.
- It is limited in Bandwidth.

(iii) Ring Topology:-



(Ring Topology)

In Ring Topology, all the nodes are connected each other in the shape of ring via cable. In this Topology, when one node tries to send a message to other node, then all the nodes discard the message and the desired node recieve the message. For Example If a node (C1) wants to communicate with the the node (C4), then it sends a message, to C4. The nods

C3 and C2 discard the message and C4 recieve it. Only one extra cable may be needed to connect new node.

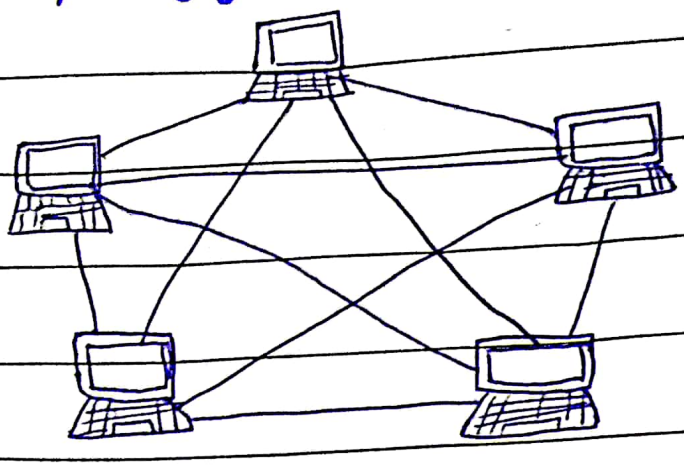
Advantages:-

- We can achieve the ring topology by executing the network with less effort.
- There are no limitations to the number of nodes.
- It is high-speed data transfer
- It is easy to troubleshoot.

Disadvantages:-

- It requires expensive hardwares.
- The addition of a node can affect the speed of data transmission
- It is not properly secured.
- In the Ring Topology failure of one node breakdown the all network.

(iv) Mesh Topology:-



Mesh Topology is a type of network topology in which every node is connected to every other nodes in the network.
Each computer not only sends its own signals but also relays data from other computers.
Every node features a point-to-point connection to the opposite node. The nodes are connected via cables and wireless.

:- Types :-

Full mesh Topology
Partial Mesh Topology.

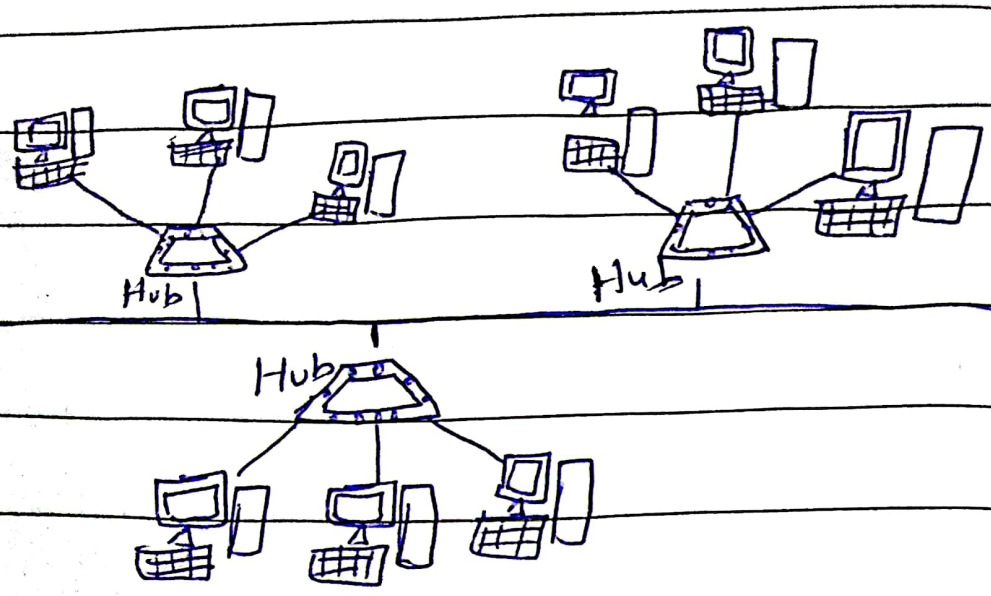
Advantages:-

- The failure of one node does not affect the network.
- They provides multiple path for data transmission.
- The addition of new device does not affect the network.
- It is very easy to add other mesh Topology.
- It is flexible.

Disadvantages:-

- The implementing cost is very high.
- They consumed a large number of time to build and maintain.
- The initial setup of mesh topology is very difficult.
- It is very costly.

(v) Tree Topology:-



(Tree Topology)

It is the combination of Bus and star topology. So, it is also known as Bus-star topology. It is not commonly used in networks. Since it appears like a tree, the structure of a tree topology is quite different from others. The many central hubs are used for data communications in tree topology.

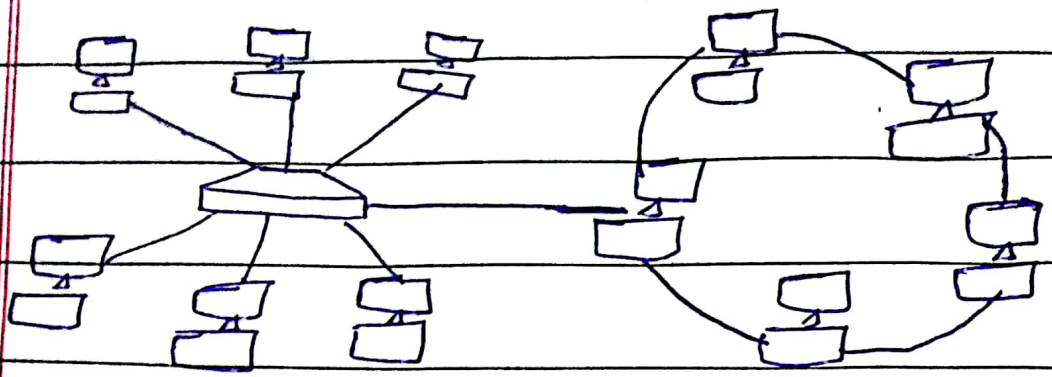
Advantages:-

- Error detection in tree topology is more accessible.
- The expansion of a tree topology is a straightforward method.
- It require low cables.

Disadvantages:-

- It is difficult to install.
- Weak security is present in tree topology.
- If the main backbone is defective or fail, then the whole network will collapse.
- Maintenance and configuration of tree topology is difficult due to its large size.

(vi) Hybird Topology:-



A hybrid topology combines two or more network topologies, including ring, bus, star and mesh Topologies.

It offers a complicated structure and a range of technologies are require for its pratical execution, it has the benefit of increased flexibility.

It is used to create a large networks.

Advantages:-

- It can be modified as per requirements.
- It is extremely flexible
- It is very reliable.
- It handles a large volume of traffics.
- The speed of the topology becomes fast when two topologies are put together.

Disadvantages:-

- The design of hybird topology is very complex.
- The installation is a difficult process in hybird topology.