

Computer network:

A network set of by connecting two or more computers and other supporting hardware devices through communication channels is called computer network.

Each computing device in the network is called a node or a station.

Network hardware:

Network hardware is defined as set of physical ~~all~~ or ^{network} devices that are essential for interaction and communication between hardware units on a computer network.

Fundamental devices on a computer network:

1. Routers:

Routers connects two or more networks. A router is to connect a home or office network to the internet.

2. Hub:

A hub broadcasts data to all the devices on the network. It consumes lot of bandwidth. If there are many computers, they might not need to receive the data.

3. Bridges:

A bridge connects to separate LAN networks. It scan for the receiving device before sending a message. It avoids unnecessary data transfer and also check whether the receiving device has already received the message or not.

4. Switch:

A switch is more powerful than hub and bridge to perform a similar job, and transfer the data only to the devices that have requested for data. Switch become more efficient than all.

Modem:

A Modem enable a computer to connect all the internet via a telephone lines. A modem is used to convert the computer digital signal into analog ~~and~~ signal ^{and send} to telephone ~~that~~ lines. The abbreviation of modem is modulator and demodulator.

18112123

Data Communication:

1. Data:

The word data refers to the information in an understandable form. ~~by~~ two parties how one creating and using it. The data may be any form of texts, symbols, images, videos, signals and so on.

2. Communication:

Communication is referred as exchanging information from one entity to another entity in a ~~meaning~~^{meaningful} way. An entity may be human being, words, animals, machines etc.

3. Data communication:

Communication is exchanging the information (data) in a meaningful way. This can be made up ^{by} both hardware and software.

There are some fundamental characteristics for effective communication, they are,

1. Accuracy - Data should be delivered accurately has it is without alteration.

2. Delivery - The data to be communicated must be delivered to the correct destination.

3. Timeliness - The communication system must delivered the data without any delay.

4. Jitter:

* It refers as the variation in the arrival of the ~~data~~^{path} of the data.

* In network the data are split into smaller groups (packets) and send them separately.

* The variation of the arrival between to packets is referred as jitter.

Components of data Communication:

These are five components ~~are~~ essential part in communication system.

1.) Data / Message:

It is the primary part of the communication system. The information communicated between the source and destination is called data or message.

2.) Source:

The source is the device which generate and sends the data to the destination.

3. Destination:

It is the device that receive the data.

4. Medium:

It acts as a carrier to carry the data from source to destination. A carrier provides the ~~path~~ path through wire or wireless.

5. Protocol:

It is a set of rules that govern the data communication in a correct manner.

1.) Artificial intelligence

2.) Neural network

3.) Machine Learning

4.) Deep Learning

5.) Cloud Computing

6.) Big data analytics

7.) Nano Computing

8.) IoT

1.) Artificial intelligence: Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

2.) Neural network: A neural network is a method in artificial intelligence that teaches computers to process data in a way that is inspired by the human brain.

3.) Machine Learning: Machine learning is a branch of artificial intelligence and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy.

4.) Deep Learning: Deep learning is a method in artificial intelligence that teaches computers to process data in a way that is inspired by the human brain.

5.) Cloud Computing: cloud computing is the delivery of computing services including servers, storage, databases, networking and so on.

6.) Big data analytics: It describes the process of uncovering trends, patterns, and correlations in large amounts of raw data to help make data-informed decision.

7.) Nano Computing: It is a term used for the representation and manipulation of data by computers smaller than a microcomputer.

8.) IIoT: It describes the network of physical objects that are embedded with sensors, software and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.

Computer network:

A computer network is a system in which, a large number of computers are interconnected together to communicate with each other via a communication medium.

LAN (Local area network):

A network of computers connected through some guided media and covers limited area is called local area network.

WAN (Wide Area Network):

A wide area network is a network of geographically distant computers and terminals.

Network Topology:

The arrangement of computers in a network is called network topology.

There are 4 types of topology,

* Bus Topology

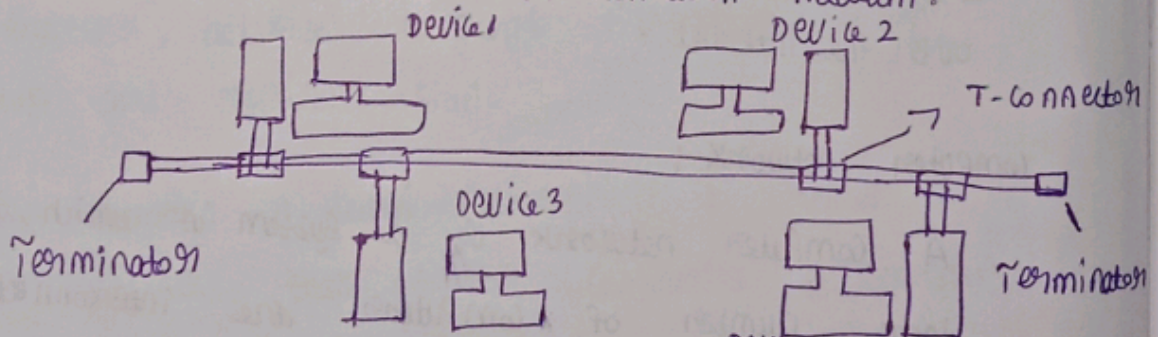
* Star Topology

* Ring Topology

* Mesh Topology

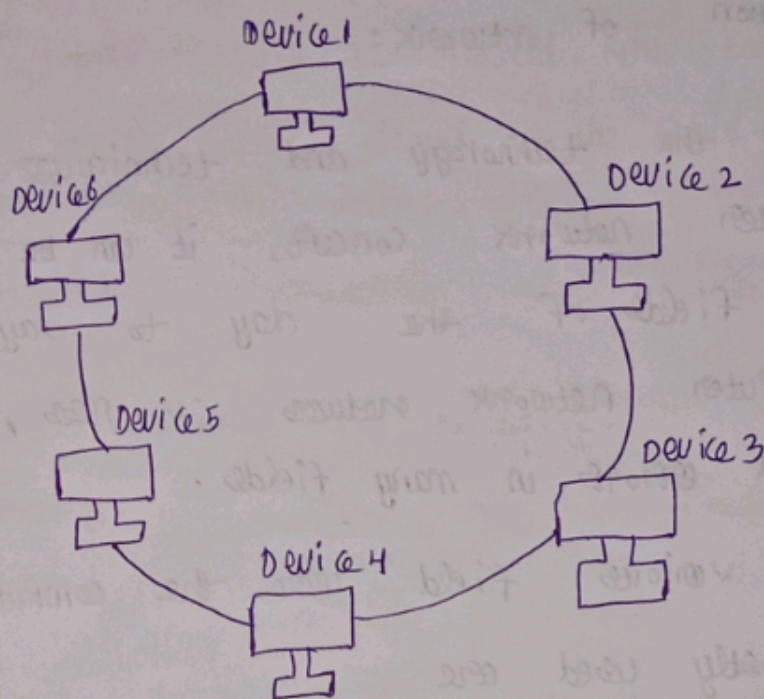
Bus Topology:

In bus topology, all computers or nodes are connected to a common communication medium.



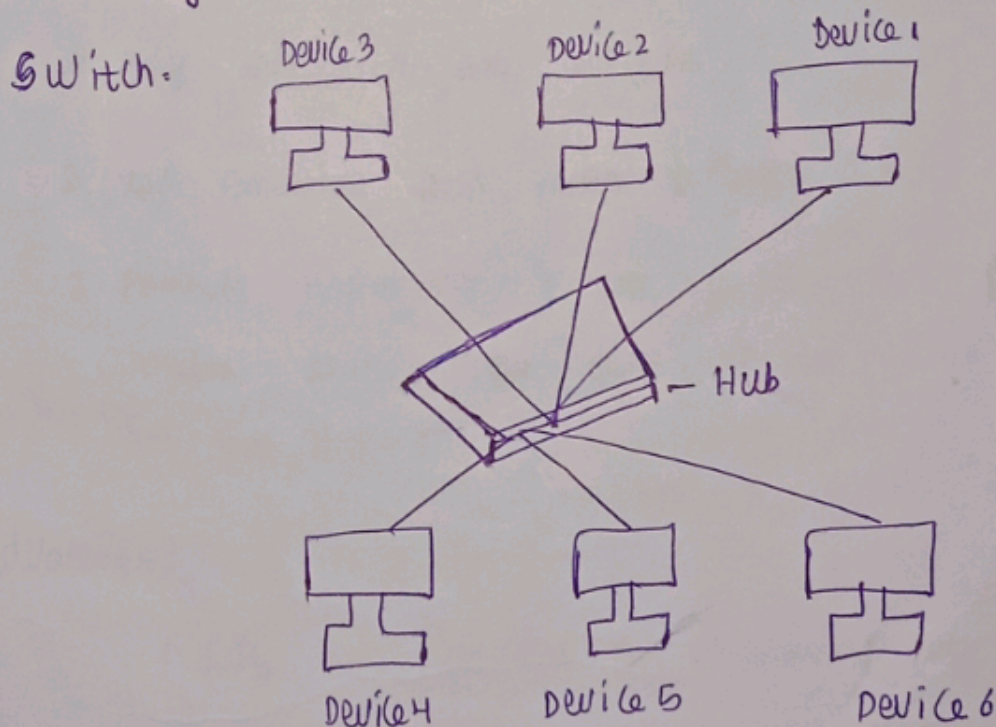
The nodes are connected to the medium via drop line with a tap. The tap provide a connectivity to drop line and main cable (medium).

In ring topology, each computer is connected to two adjacent nodes. Each computer or node is connected to the next computer and the last computer is connected to the first. Thus a ring topology formed.



Star Topology:

In star topology, all the computers or nodes are directly connected to a central device. The devices that normally used as central device ^{are} called hub and switch.



* The device send data to any other device through the control. The control is acting as exchange between the devices.

Application of network:

Due to the technology and techniques of computer network concept, it can be used in all fields of the day to day life.

Computer network reduces slowness, hardness and errors in many fields.

The various field were the computer network mostly used are

1. Business Application

Bus topology:

- * The number of taps will be limited the tap consumes more power signal travel on the cable.

advantage:

1. easy intallization.
2. ~~less~~ cable utilization and expensive.
3. Data redundancy.

Disadvantage:

1. ~~●~~ fault of break in cable stops all transmission
2. Adding new device is difficult.
3. Failure of node on dropline creates noise on the cable.

Star topology:

advantage:

1. easy intallation and configure
2. ~~less~~ expensive than mesh topology
3. provide Robustness - if any one link fail that connected devices the data transmission fail for that link.

disadvantage:

1. fully depended on hub for forwarding data.
2. if hub goes down, the entire network get fail.

mesh topology;

* In mesh topology each and every device is connected with ~~dedicated~~ ^{dedicated} point-to-point link.

* The number of links in mesh topology with n nodes is $\frac{n(n-1)}{2}$.

* Each node has $(n-1)$ link connection.

Advantage:

* It provides robustness - if any one link fails that connected device data transmission fails.

* Secure and privacy provided through dedicated links.

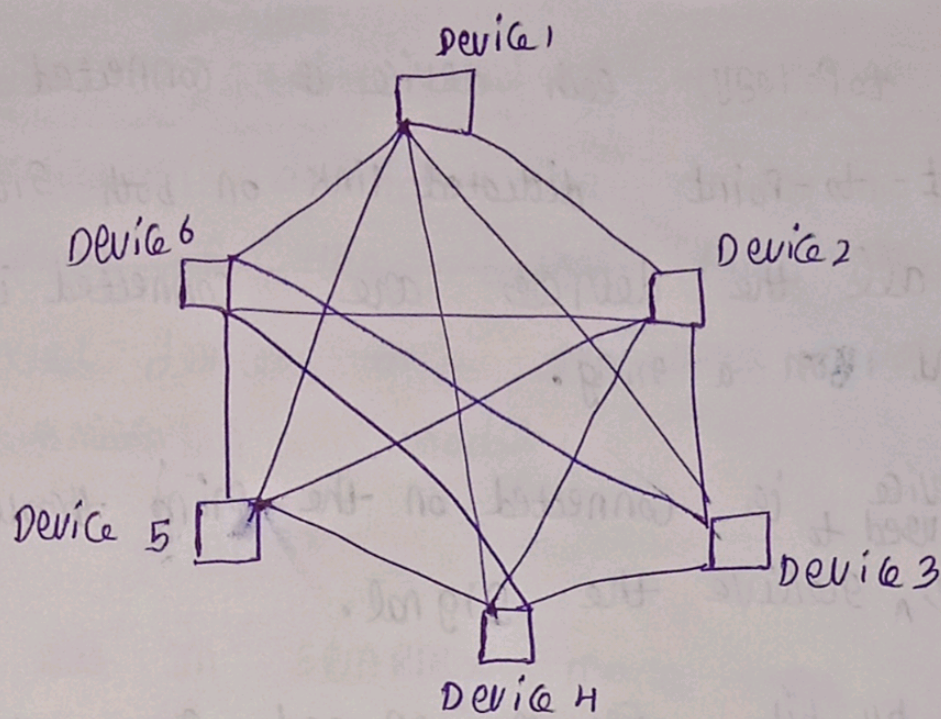
* Accurate guarantee for data delivery.

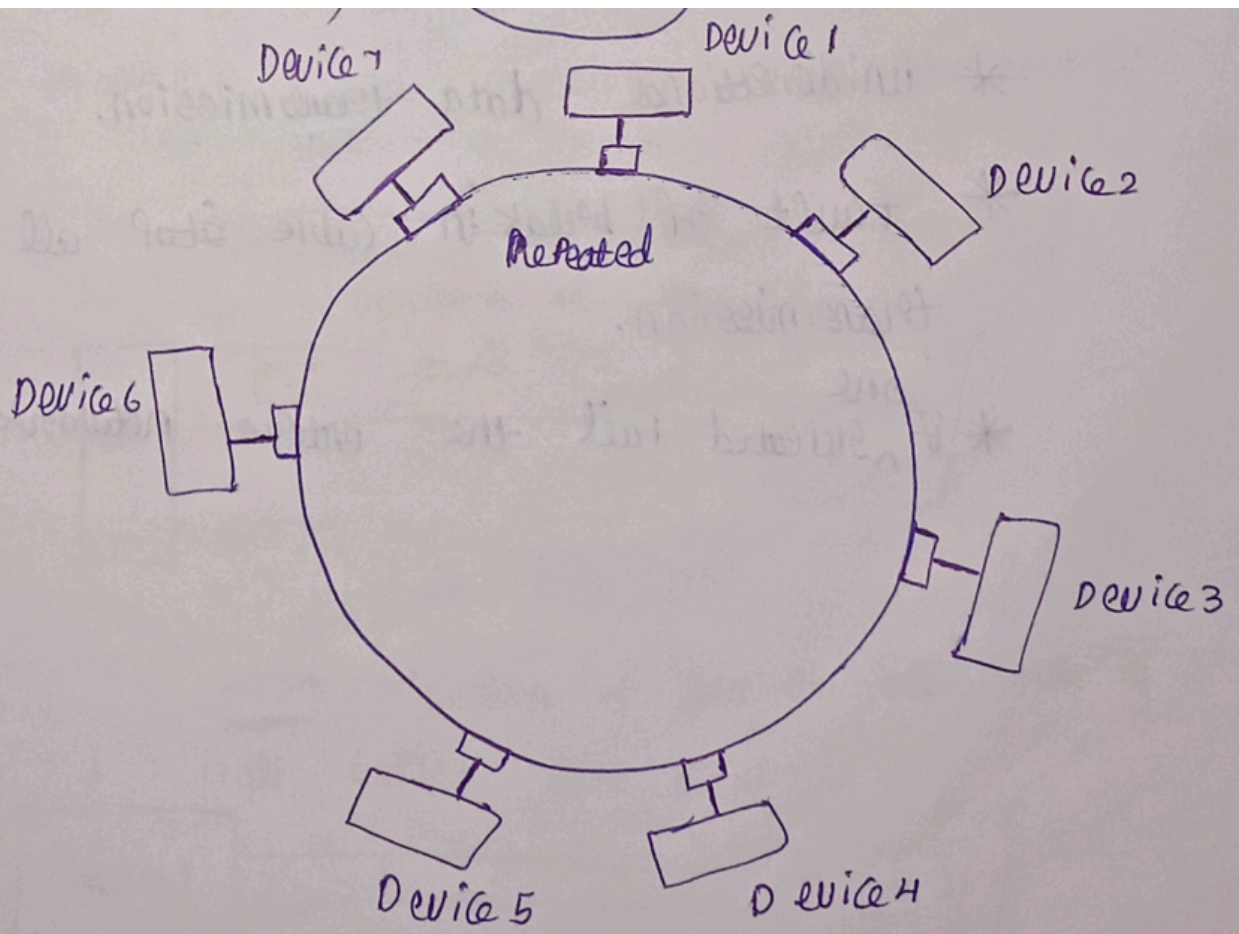
Disadvantage:

* more expensive due to separate link for each device connection.

* more number of ports require for each device

* ~~expensive~~ ^{expansion} of network require more hardware and cabling.





* In Ring topology each device is connected by a point-to-point dedicated link on both side devices all the devices are connected in this manner and form a ring.

* Each device is connected on the ring through repeaters used to receive the signal.

* As bit by bit from an end, generate the bit and transmit on the other end.

Advantage:

* Easy installation and configure.

* Less cable utilization and expensive.

* Easy identification of fault.

Disadvantage:

* unidirectional data transmission.

* fault of break in cable stop all transmission.

* if ^{one} repeated fail the entire network fail.

Classification of network based on transmission mode:

Transmission defines the direction of the signal. Direction of the signal flow between two linked devices there are three types of transmission modes.

1. simplex

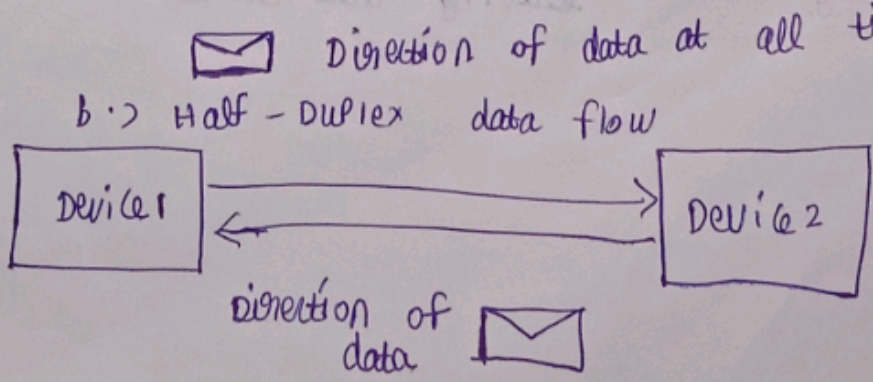
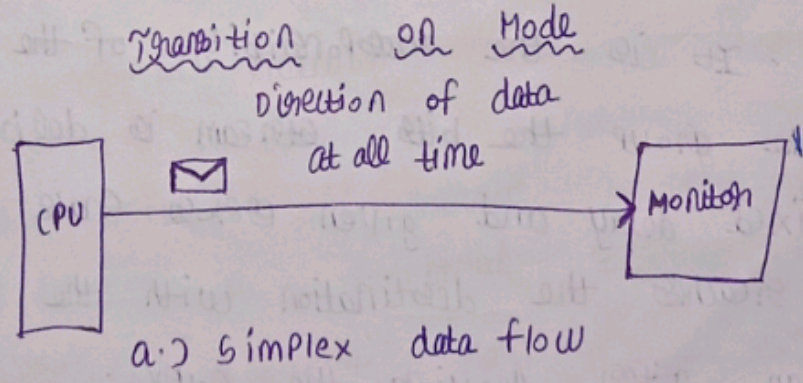
In simplex mode, the communication is unidirectional among the stations only one can transmit and the other can only receive.

2. half duplex

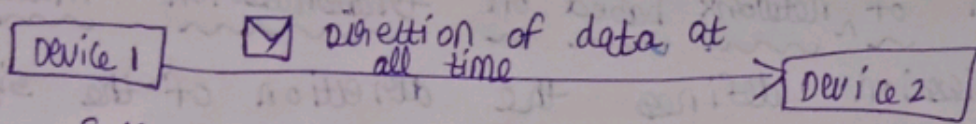
In half duplex the communication is bidirectional, in this both station can send and receive that not at the same time.

3. full duplex:

In full duplex mode, both stations can transmit and receive simultaneously.



b.) Half-Duplex

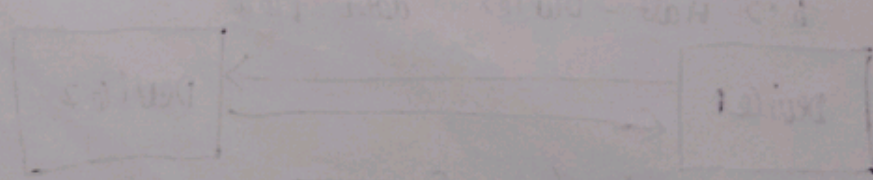


c.) Full-Duplex Data flow

Based on time in transmission type

1.) Synchronous transmission

In synchronous transmission both the sender and the receiver use the same time cycle for the transmission. We send bits and affairs another without start/stop bits or gaps. It is the responsibility of the receiver to group the bits stream is delivered with a fixed delay and given error rate each bit reaches the destination with the same time delay after leaving the source.



2.2 Asynchronous transmission:

In Asynchronous transmission we send one start bit at the beginning and one stop bit at the end of each byte. There may be a gap between each byte bit stream as divided into packets are received with varying delays so packets can arrive out of order. Some packets are not received correctly.

3. Based Authentication:

1. Peer to Peer connection

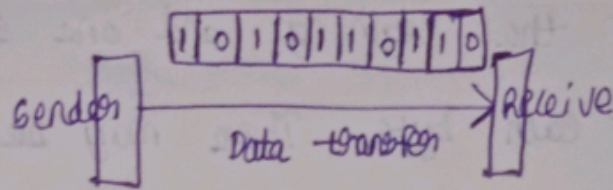
In peer to peer network there are no dedicated servers. All the computers are equal and therefore are termed as normally, each computer function as both a client and a server. No one can control the computer.

2. Server based connection

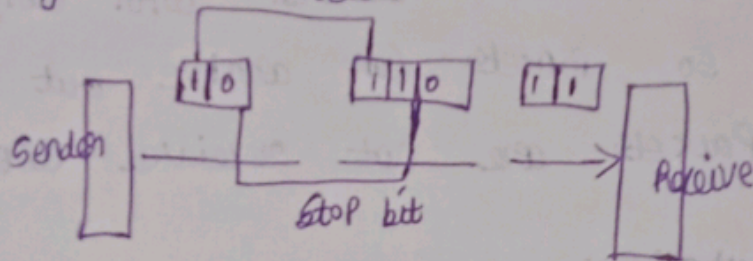
Most networks have a dedicated server which is a computer on a network which functions as a server and cannot be used as a client workstation. A dedicated server is optimized to service requests sent from network clients. As server can control the clients for this services.

Transmission on Time

a.) Synchronous data transfer

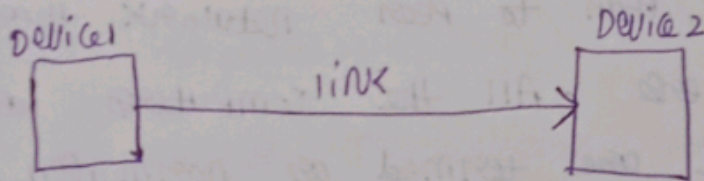


b.) Asynchronous data transfer

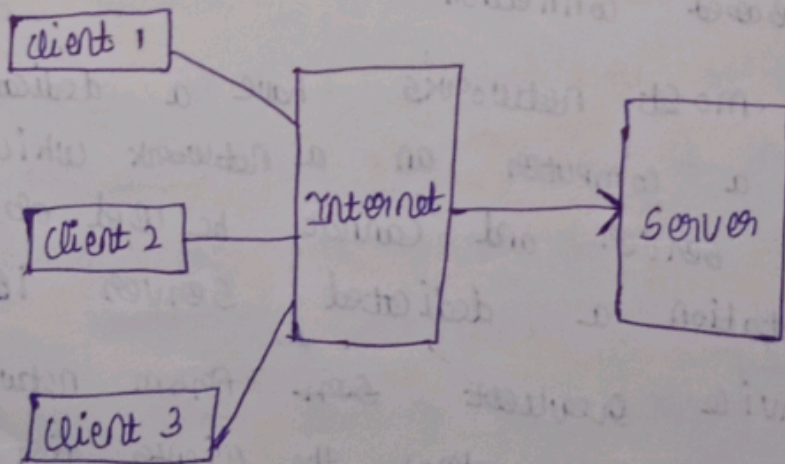


Transmission on Authentication

a.) Peer to Peer



b.) Server-client



Network hardware

Network or internet is formed using hardware or network device and network software or application and protocols.

Network devices:

1. Hub:

- * It is used to connect system or nodes or network
- * It has direct connection to a node.
- * It suffers from collision of data, results to data loss.
- * A hub takes data from input port and retransmits the input data on output port.

Guided transmission media:

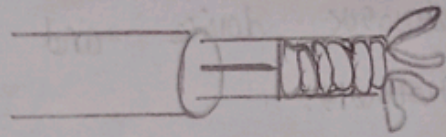
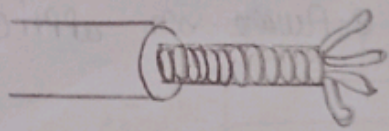
The Guided media provide the physical connection from one device to another device. The signal transmitted along the media properly.

Types of guided transmission media:

1. Twisted - Pair
2. Coaxial Cable
3. Fiber - optic Cable

1. Twisted - Pair Cable:

Twisted - Pair Cable is a physical media which has pair of cables twisted each other. Each cable is containing copper conductor. The copper conductor is insulated by plastic. This two insulated cables are covered by outer insulation.



* IN Twisted Pair cable one of the wire used to send data signal and another one is used as ground reference

* Hence the cable is twisted to cancel the interference, it avoids the cross^{talk} of and noise.

* The most common use of twisted pair cable is UTP (unshielded twisted pair).

* The STP (shielded twisted pair) cable is introduced by IBM.

* It improve the quality of cable by preventing the penetration of the noise or cross talk from other cables.

* The STP cable is expensive than their UTP cable.

Advantages:

* Easy to install and maintain.

* Cheapest cable

* reduce the ~~cross~~ cross talk

* Preventing the electrical noise

Disadvantages:

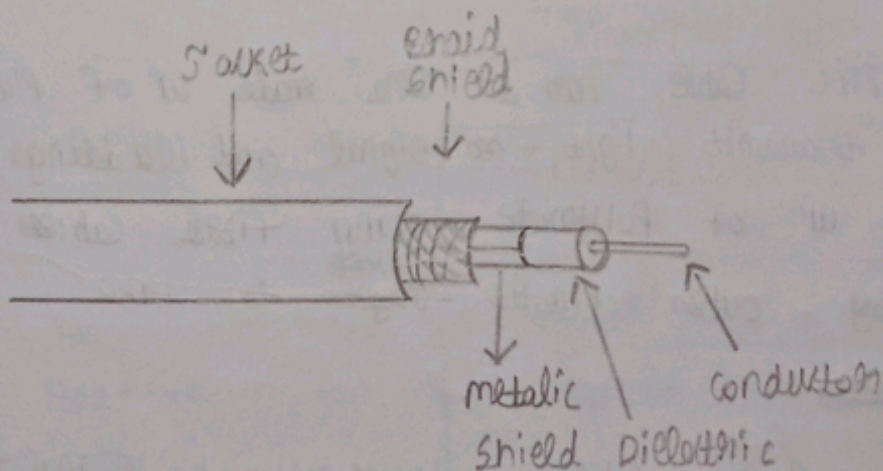
- * limited distance covered
- * difficult to connect the terminal block
- * The difference in pair of cables creates delay and interference.

② Coaxial Cable:

* Coaxial cable has a central solid ^{Conduction} core ~~to~~ core metallic wire covered by an insulating coating.

* The insulating coating is covered by a metal foil, braid or both the entire cable is insulated by outer plastic cover.

* It prevents the noise and serve as a second conduction to complete the circuit.



* A coaxial cable carry signal at ^{the} high frequency range and longer distance compared with UTP cables. The connectors in coaxial cable are used to connect the coaxial cable of another device. The connectors are called BNC (Bogone - Neill - Concelmon) connectors.

Advantage:

* covered the larger distance and high bandwidth compared with twisted-pair cable.

* shielded for cross talk and noise.

Disadvantage:

* It is the heavy cable and rigid

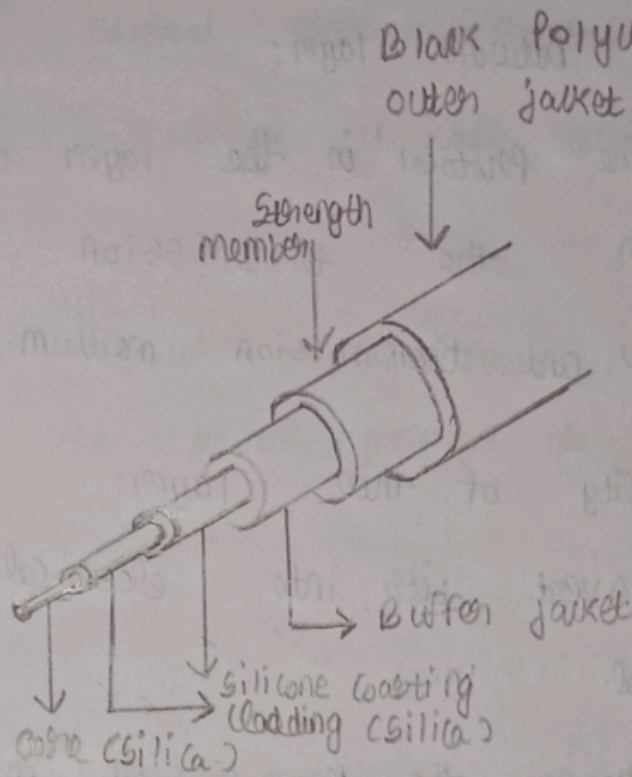
* high cost compared with twisted-pair cable

③ fibre-optic cable:

* A fibre-optic cable has a core made up of plastic or glass to transmit light as signal and cladding layer made up of polymide. Many fibre cables are covered by outer plastic ~~sheet~~ ^{Jacket} to take more signals.

* The fibre-optic cable transmit the signal for long distance without loss.

* It work on frequency around 180 THz - to 300 THz and wavelength from 850 nanometers to 1500 nm



TCP/IP Model Protocol

Application layer
 Presentation layer
 Session layer

SMTp FTP HTTPS
 H T T B N B Application
 layer

Transport

SCTP TCP UDP
 Transport layer

Network

ICMP / Icmp
 internet layer

Data-link
 Physical

host to network
 layer

host to network layer;

The protocol in the layer define by the network based on the transmission mode (Simple/full/full) topologies and transmission medium.

functionality of this layer:

1. Convert bits into electrical or optical signal.
2. Choose the transmission model.
3. Synchronization of bits.
4. Error Control
5. flow control
6. Mac Address or physical address

Internet network layer:

* This layer used to transmit the data to the end device using the IP Address. It has following protocols.

1. IP (Internet Networking Protocol) - It is unreliable, ~~connectionless~~ connectionless protocol.
2. It transfer data as ~~packet~~ datagram
3. ARP (Address Resolution Protocol) - ~~to~~ find the Mac address by known IP address.
4. RARP (Reverse Address Resolution Protocol) - find the IP address by known MAC address.

5. ICMP (Internet Control Message Protocol) - send the error reporting message by host and gateways to the sender.

6. IGMP (Internet Group Message Protocol) - It is used to transmit the group message to recipients simultaneously.

Transport layer:

granted ~~forward~~ on best effort delivery using the port address the functionality performed are

1. Connection establishment / management.
2. Error Control.
3. flow Control.
4. Multiplexing.
5. segmentation and reassembly.

Protocol:

1. UDP (User Datagram Protocol):

- * It is unreliable and connectionless.
- * It had check some and length information of the data.

2. TCP (Transmission Control Protocol):

- * It is reliable connection oriented, granted, delivery protocol, acknowledgement added in TCP.
- * ~~Acknowledgem~~

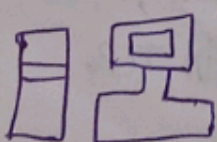
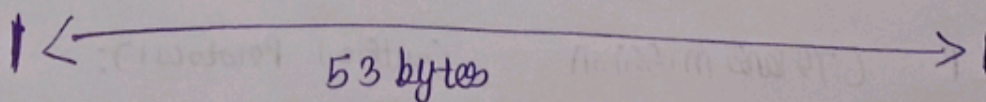
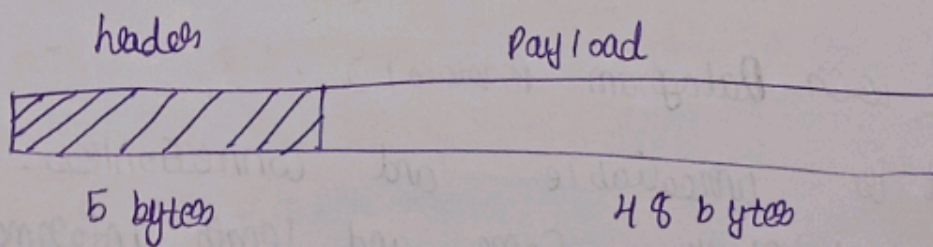
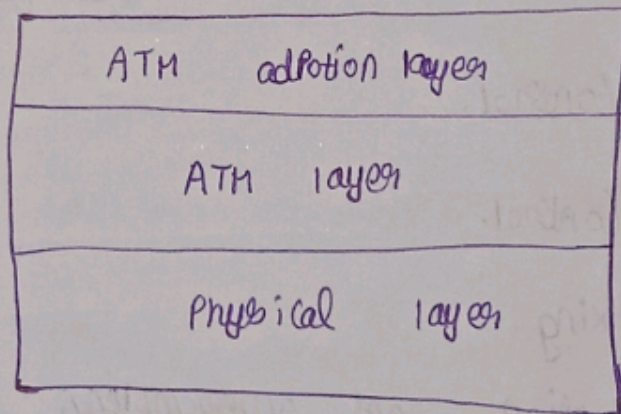
Secure Control Transmission Protocol:

It supports voice over internet connect.

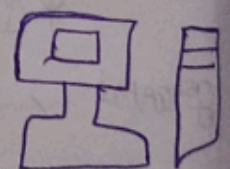
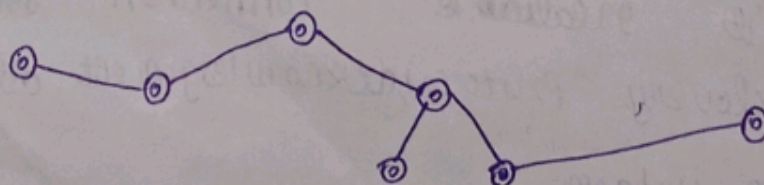
Application Layer:

1. SMTP - simple Mail Transfer Protocol
2. FTP - File Transfer Protocol
3. HTTP - Hyper Text Transfer Protocol
4. HTTPS - Secure transmission
5. DNS - Domain Mail System

ATM Asynchronous Transfer Mode:



UNI



Ethernet: The Network interface card (NIC) is either

~~Types of Ethernet:~~ integrated into the ^{mother} board of the computer or inserted separately into the device is called Ethernet card or MAC card.

Types of Ethernet:

1. Fast Ethernet - 100 Mb per second

2. Giga bit Ethernet 1000 Mb PS (or) 1 Gbps

3. Switch Ethernet or hub needed to data transfer