

# Computer Networks

Internet: Interconnection b/w no of computers connected all over the world

Intranet: network which is used <sup>for communication</sup> with in a single organization

Ethernet: LAN cables are Ethernet

Extranet: We can communicate all over the cities  
eg LIC, SBI etc

Terms of Computer <sup>Network</sup> → Peers  
 ↓  
 host  
 Nodes

Network is a team in which no of computers that connected with each other

Network consist of no of networks

Advantages: Easy to communicate  
Less time in communicating

Disadvantages: It is a costly way, Security  
 ② System crash.

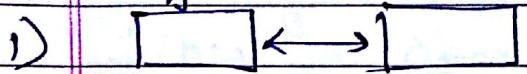
Various approaches for network

Approach (i) Peer to Peer + No main controller, Security <sup>poor</sup>

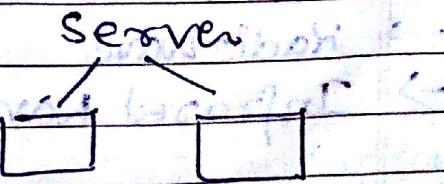
ii) Client Server + all the system and server connected to each other, Data sharing is possible but Resource sharing is not each system should have their individual resource

→ Main controller exist, execution → Server

→ Log record Maintain



Peer to Peer



Peer to Peer

process of interchange data or information

Medium : Communication Medium  $\rightarrow$  These are Known as Media

Two different Categories of Media

- $\rightarrow$  Guided Media  $\rightarrow$  System to System, which provides delivery of Packets
- $\rightarrow$  Unguided Media  $\rightarrow$  Via Bluetooth

### Guided Media

Twisted pair

Coxial cable

Optical fibre

Twisted pair  $\rightarrow$  It is also known as Ethernet  
RJ 45 connectors; 8 cables are used.

Register Jack

4 pairs of cables  $\rightarrow$  8 cables are used

- (1) green - white green
- (2) orange - white orange
- (3) Brown - white Brown
- (4) Blue - white Blue

Cat5, Cat6 twisted pair

Cat6 size little large than Cat5

RJ11 - Telephone Register jack

RJ45 - Internet

Unguided Media

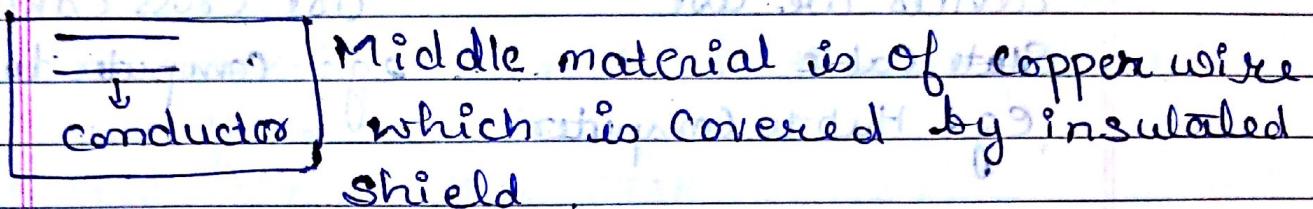
- $\rightarrow$  Satellite
- $\rightarrow$  Radio wave
- $\rightarrow$  Infrared waves

Twisted pair  $\rightarrow$  It is a wire that mainly used in LAN, used in small size of

## network equipment building

Optical path for Co-axial cables : used to cover long area of network in a cities , Metropolitan area networks eg T.V cables

BNC connector is used for Co-axial cable.



→ higher band width than twisted pair to transfer the data , Rate of transferring the data within the second is band width

Frequency : Carrying the data within the Second

Optical fiber : consist of no. of fiber cables which is created by a glass material , Laser Light beam is used.

Advantages : travel data in higher range

→ used to long distance

→ bandwidth high.

Disadvantages : Damage

→ use of light source to check that our fiber is connected upto end.

Range , bandwidth , mbps. of Twisted , optical , Co-axial .

Ethernet cables are divided into two part

Ethernet cables

For difference we devices we use  
Straight cable  
eg: Hub to Computer

Cross cable

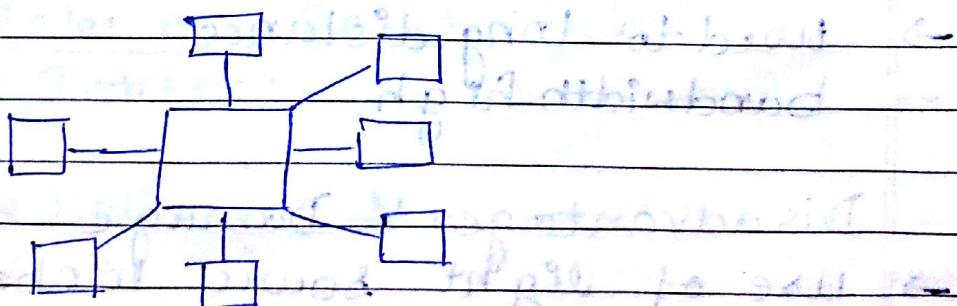
for same devices we use Cross cable  
eg: computer to computer

Topologies: The architectural (setup/layout) design of a system for the purpose of communication is known as topologies

Way to connect a network | Types of Topologies

- ① STAR
- ② RING
- ③ BUS
- ④ MESH

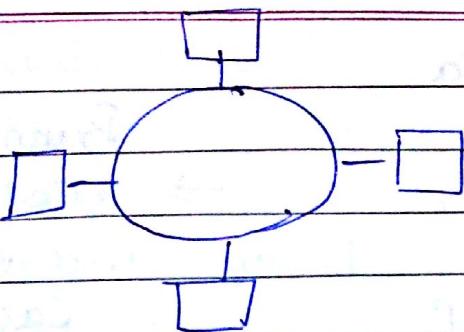
① STAR: It has a centralised controller i.e. Hub, Switch



Drawback: If centralised controller crash then all network crash

- It is costly method
- It is not easy to manage

2) RING :

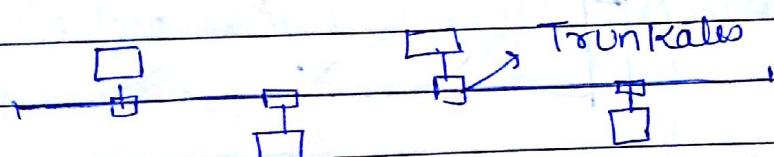


It is in circular format i.e why it is called Ring.

Drawback: If system crash then no packet is transferred

- It is cheaper than STAR
- No of nodes increase but terminate at first point
- Transmission of data is higher than STAR topologies

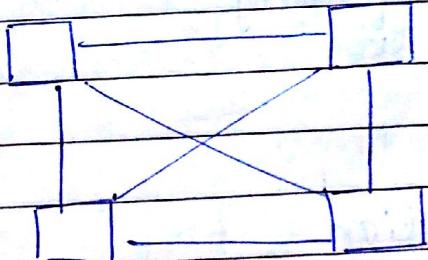
3) BUS :



Drawback: Single medium is used from starting point to end point

- Back of Network is crash then all network crash
- Data transmission is higher because single wire is used to provide communication

4) MESH :

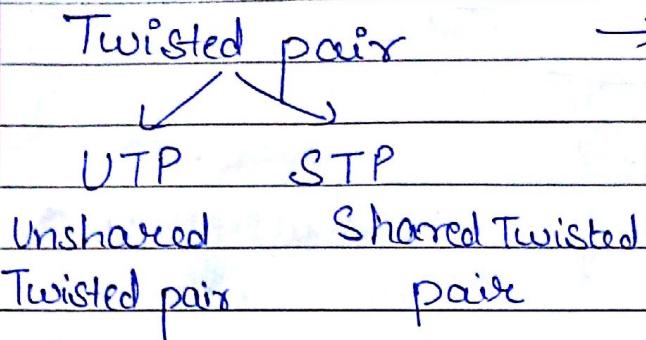


Complicated to design because each node are attached to all system

Advantage: If one node crash then we have alternate way is available for packet delivery

## → Guided Media.

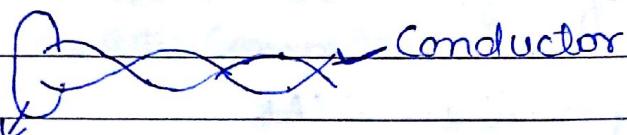
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Bandwidth

- Categories 4 → 16 Megahertz
- Categories 5 → 100 megahertz
- Categories 6 → 250 megahertz
- Categories 7 → 600 megahertz

UTP

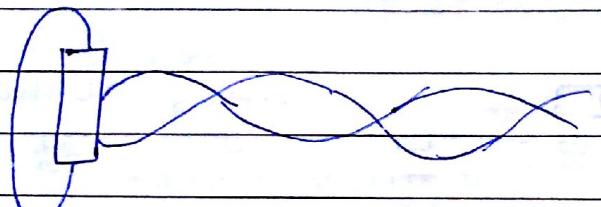


Insulator

of data

Advantages [Insulator] No disturbance, no cross talk between two wires

STP



Plastic material

Coating

### Characteristics of UTP

- 1) Cost is low
- 2) Easy to install
- 3) High Speed Capacity
- 4) Up to 100m limit

### Advantages

- 1) Easy to installation
- 2) Capable of High speed LAN
- 3) Low cost

### Disadvantages

- 1) Short distance due to distortion

## Characteristic of STP

- 1) Medium Cost
- 2) Easy to install
- 3) Higher Capacity than UTP
- 4) 100 m limits

## Advantages

- 1) Shielded
- 2) Faster than UTP

## Disadvantage

- 1) More expensive than UTP & Co-axial
- 2) More difficult installation
- 3) Higher attenuation range i.e. high packet delivery delay.

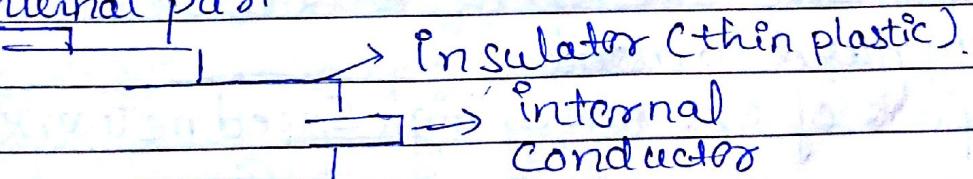
II Coaxial cable : Bandwidth  $\rightarrow$  1 giga Hz.

RJ45

Male Female

Connected to wire      Laptops etc

### Internal part



outer shield.

Outer  
plastic  
Shield

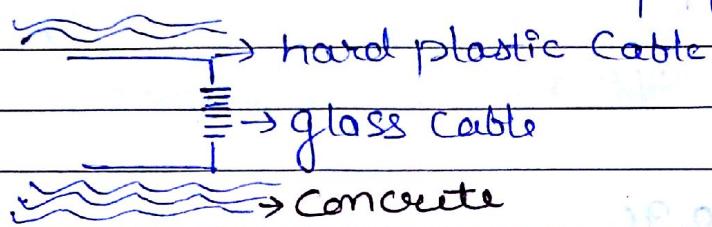
If insulation is :

BNC connector stands for Bayonet Neil Concelmen

III) Fiber optics: Higher Bandwidth than both Twisted pair & Co-axial Cable

Bandwidth: It is ability to transferred a data in a Unit OR capability to travel data.

Internal Conductor made up of Glass cable.



In optical fiber light Beams with the help of Spectrum

Concrete is used to protect the material so that damage does not occur.

→ Connector used for optical fiber:  
ST Connector

BandWidth → 50 Tera bytes per Sec

Characteristic of optical fiber

- 1) Expensive
- 2) Very Hard to install
- 3) Capable of extremely High Speed network

Advantages:

- 1) It is fast

Disadvantage

- 1) Difficult to Troubleshoot

UnGuided Media : For packet delivery we does not any kind of <sup>physical</sup> path.

(1) Radio waves : To establish a network we use Antennas.

e.g. FM Radio

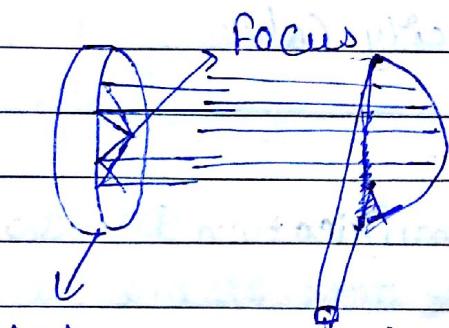
Radio wave is a multimedia



Radio waves move in circular waves. Antennas are capable to catch signal from any direction that's why it is called omnidirectional.

(2) Microwaves : It is medium used that is unicast. Antennas.

It is used Unicast



Dish Antennas → Horn antennas (H-Type antennas)

Wave  
guide

It uses directional antennas : point to point line of sight communication.

3) Infrared (1) Wireless medium

2) No physical structure is used.

3) For short network infrared is used

4) It is firstly used in mobiles

Types of networks :

- 1) LAN
- 2) MAN
- 3) WAN

1) LAN : ① Bridge is used to connect two LAN Segments.

- ② In one LAN Segment 20 nodes are attached.
- ③ Limited access is provided, security is high.

- 2) MAN

- To provide a network from one building to another.
- Maximum nodes are used for communication, little buffer - security.

- 3) WAN : ① Security is less

- ② High capacity cables.

### Communication Devices :

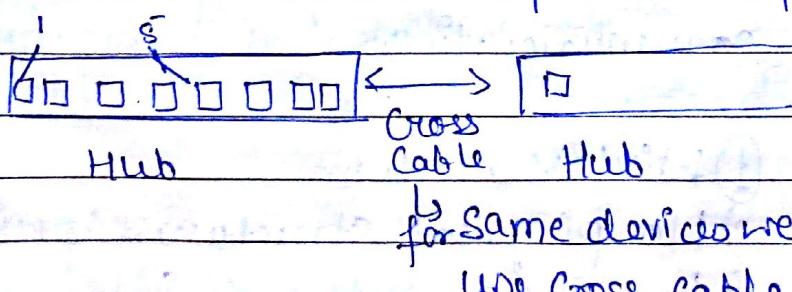
- ① Introduction about Communication Devices.

- ① HUB : ① Layer one device

- ② It is a device based on Broadcast.

- ③ Security level is poor due to Broadcast.

- ④ It is a device which is not managed. It is available in 8 port or 16 port.



- Advantage : ① provides connectivity  
② we can connect same device.

- Drawback : ① Use in small network

**Disadvantage:** ① Security is poor  
② Broadcasting itself is a disadvantage

**Switch:** ① It is available in 8 port, 16, 24, 48 ports

is device which performs IP management  
② Layer two device  
③ It is based on Unicasting.  
④ point to point Communication because Switch manage IP table

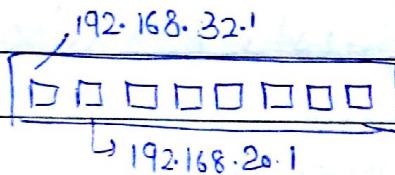
**Manageable switch**

Switch ~~are~~ which are to be managed

**Non Manageable switch**

Switch ~~are~~, which need not be managed

Each port have to assign an I.P.



① It is used to create a Multiple network with in same class of I.P.

These are known as V-LAN i.e Virtual LAN.

**Switch:** In switch, if which I.P is communicating with each other eg 32.1 → 32.3 can't communicate. Then this can be done only when it have IP table. In that point-to-point communication is possible

**Advantages:** ① Large network design.  
② Security is high.

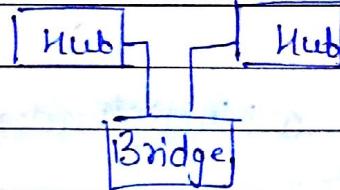
**Disadvantages:** ① Chance of hang network

② Congestion is high

Network Traffic

- (3) Router :- It provides a shortest path for packet delivery.
- (4) Congestion is low.
- (5) Layer 3 device.
- (6) To provide a shortest path, Routing algorithm is used.
- (7) It is a device which is used for long distance range.
- (8) It is a device which provides connectivity b/w two different networks.
- ↓  
mean different classes.
- (9) It is used to configure/manage.
- (10) 24 port is used.

- (4) Bridge :- It is a device which is also a layer 2 device.



- (5) It is used to connect two different line segments with same IP.

- (6) Repeater :-
- (1) Layer one device.
  - (2) It is used to regenerate signals.

Packet delivered at 100 mbps → 80 mbps  
 ↳ Regenerating signal.

- (7) Gateway :- It is a device through which port is in or out.

- (2) It is port / device which is act as protocol interchanger
- (3) It provide platform ~~connectivity~~ compatibility.

**OSI Model → OSI Reference Model**

For the purpose of communication How the information flow so OSI Model is design. It Reference model because it is a theoretical approach not practical  
 ↳ TCP/IP

Protocol stack = In each layer some protocol is work

From 1 to 4 layer → lower layer

5 to 7 Layer → upper Layer.

- 7 Application Layer
- 6 Presentation Layer
- 5 Session Layer
- 4 Transport Layer
- 3 Network Layer
- 2 Data Link Layer
- 1 Physical Layer

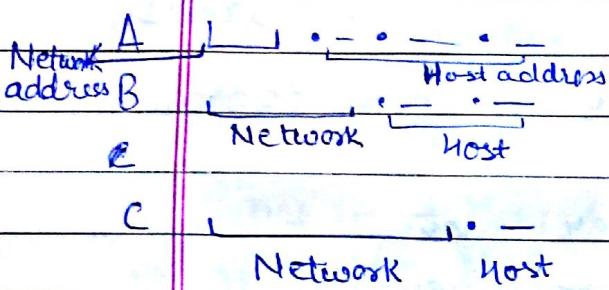
1) Physical layer : (1) Based on electromagnetic trans-task  
 (2) Data travel in the form of Bits.  
 (3) Provide Specification for variety of hardware

2) Data Link layer : (1) Point to Point Connectivity  
 (2) It is categorised in two sublayer.  
 (1) LLC      (2) MAC

- logical Link Control      ↳ Media Access Control
- IP address is known      ↳ NIC card
- as logical link
- 32 bit      • 48 bit

Router / Switch is responsible for this layer

- ERROR control & flow control.
  - Bits are again formed into frames.
- 3) Network Layer :- (1) provide interconnection b/w two different network on the basis of T.P.
- IPV4 is divided into part :- basis of T.P.
- Network address
  - Host address
- It is divided in four Octet



- Router is used to provide a connectivity b/w two different network
- Data travel in form terms of packets
- Router is used to provide a shortest path

#### 4) Transport Layer :-

##### ① Responsible for Delivery of packet

- It is a layer which is based on two different Connection

- (1) Connection oriented →  $\xrightarrow{\text{TCP}}$  physical connectivity provided
- (2) Connectionless →  $\xrightarrow{\text{UDP}}$  no physical connectivity is provided

- TCP & UDP is used in this layer

TCP → Provide acknowledgement to the user

- Data travel in terms of segments

- If all the segment is of same length then sequence no is given to recognise

5) Session Layer: When two process communicate to each other is known as session.

② These session are based on 3 terms simplex.

1) Duplex

2) Half Duplex

3) Full Duplex

Simplex

① Duplex: Only side communication is possible →

② Half Duplex: Both side communication is possible  
Only one by one <sup>Sender</sup>  $\leftrightarrow$  Receiver

③ Full Duplex → Both side communication simultaneously

N/w

6) Presentation: It is layer how to represent a data in front of user No use of protocol

Data in the form of TEXT → ASCII, RTF (Rich Text Format)

② IMAGE → GIF, JPEG

③ Audio → MP3

④ Video → MPEG

7) Application Layer: It is a topmost layer of OSI Model  
It is responsible to provide interconnection b/w user and global world / Network

- Web browser is used, it is application Software.
- Data access on web browser with the help of HTTP, FTP

~~XX~~ Application Layer: Top most Layer to provide interaction between user and network / global world.

In web browser all data access through HTTP, PTP through application Software our protocols are work not directly by application Software

→ DataLink Layer: Data Link Layer package the higher-layer data into frames, so that the data can be put onto the physical wire. This packaging process is referred to as framing and encapsulation

The data-link frame contains the source & destination hardware address. Hardware address uniquely identify a host within a network.

The LLC sublayer serves as the intermediary b/w the physical link and all higher layer protocols.

The LLC sublayer can perform flow control & error-checking although such function are often provided by Transport Layer protocols such as TCP

Network layer: The N/w layer (Layer-3) Controls internetwork communication.

- Logical addressing: provides a unique address that identifies both the host & the network that host exists on
- Routing: Determines the best path to a particular destination network and then routes data

accordingly.

Two most common network layer protocols are:

\* Internet protocol (IP)

\* Internetwork Packet Exchange (IPX)

Transport layer:

Segmentation & Sequencing: Data is segmented into smaller pieces for transport. Each segment is assigned a sequence number.

Connection Establishment: Connections are established, maintained & ultimately terminated b/w devices.

Acknowledgements: Receipt of data is confirmed through the use of acknowledgements.

Flow Control: Data transfer scale is negotiated to prevent congestion.

→ TCP/IP: It is also known as Internet model. It is a practical approach. Designing of TCP/IP we use layered approach.

7 → Application Layer [HTTP] [FTP] [SMTP] [DNS]

6 → Transport Layer [TCP] [UDP]

5 → Internet Layer [ARP] [RARP] [IP] [ICMP]

4 → Link Layer | Host to host | point to point | Network Layer

[Ethernet] [802.11 wireless LAN]

Wireless LAN: 802.11

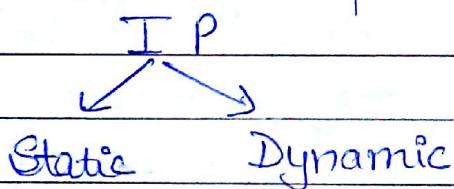
2) Internet layer: ARP → Address Resolution protocol. we when we IP with us and need to find identify MAC address we use ARP.

- RARP → Reverse Address Resolution protocol. we have MAC with us and need to identify IP address we use RARP.
- IP ÷ Unique identification of each and every node in a network.
- ICMP + Internet Control Message Protocol.

Application layer: It is a combination of three layers

→ IP ÷ ① Stands for Internet Protocol.

② Unique Identification means



① Admin is responsible to assign IP      ① Server is responsible to assign IP

② with are manually assign      • Automatic generation of IP with the help of DHCP

③ changes are there in static

IP are based on classes

To check to network and connectivity

- 1) Class A → 0 - 126
- 2) Class B → 128 - 191
- 3) Class C → 192 - 223
- 4) Class D → Reserved for R&D 224 - 239
- 5) Class E → 240 - 255

127 is not assign. It is a loop back address → PING → Packet Internet Gopher

→ for multitasking.

## TPV4

- ① IPV4 is used
- ② 32 bit
- ③ It is divided in 4 octet and for separation we use dot

11101111.11111111.11111111.11111111 binary form of IP address

## Class A

e.g. 10.1.1.3, where 10 is network address and 1.1.3 is host address.

## Class B

130.144.12.5,  
Network Host address.  
address

## Class C

192.168.32.1,  
Network Host address.  
address

From each IP we can assign different IP by the process of subnetting To increase Range of IP

TCP/IP → IP is Unique Identification and doesn't provide acknowledgement & guarantee so it is unreliable. When it combine with TCP/IP so that it provide acknowledgement & guarantee so TCP is reliable protocol.

- o TP: It stands for Internet protocol which defines the unique identification of each and every system (computer) within the network

192.168.0.1 is called default gateway

Q Why IPv6 is introduced? Diff. b/w IPv4 & IPv6 & MAC

→ IPv6 → ① It is of 128 bit

② Its Representation in form of Hexadecimal Coding  
For define each range ~~columns~~ ~~.....~~

DLL → It is used to analysis the packet, detect error and correct the error

- Virtual path travel data from datalink layer
- Parity bit is assign which is also known as ~~checksum~~. Major interface of DLL is with Network layer

In datalink layer frame are travel from sender to Recivers in between there is a set of protocol called ~~call~~ ④ Elementary link protocol.

- ① → An Unrestricted Simplex protocol. → (No Sequence no or Flow Control (acknowledgements are used) only  
② error detection is not done info field of the frame is used by this protocol, because other fields have to do

Error and flow control To over come the problem of flow Control & Error detection Stop & wait protocol is used.

③ Stop & wait protocol:

If acknowledgement is not send by Recievers then sender is in wait state

- For Each segment the sequence no is assigned

④ Noisy Configuring Protocols

Same sequence no is assign by sender to receiver then one sequence no is discard and give acknowledgement to the sender

ARQ → [Automatic Repeat request]

PR → Packet Retransmission

ARQ & PR → It used as responsible to analysis the sequence no of segment  
 These are also known as Noiseless protocol.

HDLC : Higher level data link control protocol.

Transmission of data is with the help of frame

- ① It support a network which is managed by a switch or without switch.
- ② It is a protocol which is also known as bit oriented protocol. It uses frame structure.
- ③ It is designed by ISO (International organisational standardization)

Technical points +

- ① Stations and its Configuration

Stations : (1) Primary Station : These are the nodes which are configured to control the rest of the nodes.

(2) There is primary station to primary station communication or it has ability to communicate with primary station

- ② Secondary Stations : They are bounded within restriction provided by primary station

They are provided with restriction under the provision of primary station. These are controlled by 1<sup>o</sup> station.

- ③ Combined Stations : In combined station, it is very difficult to analyze to find out that which is primary & secondary station because it is in single unit.

Configurations :- It is of three type

- (1) Unbalanced Configuration :- It is a approach which consist of 1 Primary station & one or more Secondary station
  - It is an approach which provide an operation of full duplex or half duplex.
  - It is a Configuration which provide point to point configuration and multipoint configuration.
  
- (2) Balanced Configuration :- It is a Configuration which consist of two or more combined Station.
  - (1) HDLC control the interruption.
  - (2) Full duplex or half duplex operation.
  - (3) It provide point to point Configuration.
  
- (3) Symmetric Configuration :- It consist of point to point unbalanced station Configuration.
  - It consist of two independent point to point unbalanced Configuration.

Two unbalanced configuration communicate to each other by primary station

HDLC frame Structure :- It Consist of data, address of sender & receiver. (It is known as. Frame structure of point to point oriented protocol)

A frame structure is divided into no of sub-fields.

F	A	C	I	FCS	F
↓					

Flag field → It is of 8 bit, It is responsible to

provide the information about link is active or not

01111110 → These 0's & 1's recognised as signal

= 111111 or 15 → There is problem in link setup.

More than 15 → ~~for sender side~~ Ideal state and ready to transmit data

② A → Address : It is of 8 bit, It is responsible to provide the information that who is primary station or secondary station

③ C → Control : It is of 8 or 16 bits, It provide a congestion free path.

It consist of three different format.

① Information transfer format

② Supervisory format

③ Unnumber format

① Information transfer format : It consist information about actual data.

② Supervisory : Control field contains as a supervisory.

③ Unnumber : Connection and dis-connection of link.

④ I → Information : It depend upon variable length, It is actual data / information

⑤ FCS → Frame Check Sequence : It of 16 or 32 bit  
It is responsible for error free connection and detection. It provide error free data.

Datalink layer  $\rightarrow$  ATM

Asynchronous Transfer Mode

- (1) Data Transfer depend on a digital way
- (2) It is a single protocol which support / delivered any type of data such voice, video, text
- (3) It is Standardised by ITU-T (International Telecommunication Union - Telecommunications)
- (4) It is Capable to transfer the data in the form of cells. Size of cell is 53 bytes.
- (5) It is protocol which is also capable to transfer the data at higher rate eg from MBps ~~to~~ to GBps
- (6) One Single Cell consists of two part

Header	Payload
15 bytes	48 bytes

Contain info. that who is sender or receiver

Hop Count  $\rightarrow$  How many routers is used to transfer the data to reach at destination

- 1) Network devices of ATM
  - ATM Switches
  - End Points
- 2) The path way requires smallest no of relays is called hop Count routing in which every link is considered to be of equal length and given the value