

# Computer Networks

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

**Intranet** :- network which is used <sup>for communication</sup> within a single or

**Ethernet** :- LAN cables are ethernet

**Extranet** :- we can communicate all over the cities  
eg LIC, SBI etc

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

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 consuming

**Disadvantages** :- It is a costly way, Security  
③ System crash

Various approaches for network

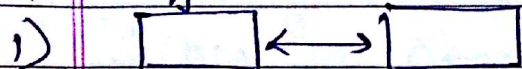
It is a costly Approach (i)

Peer to Peer + No main controller, security range poor

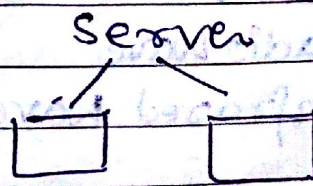
ii) Client Server + all the system and server connected to each other, Data sharing is possible but Resource sharing is not each system should have their individual resource

→ Main Controller exist, execution → server

→ Log record Maintain



Peer to Peer



Peers Peer

process of interchange data or information

Puttin

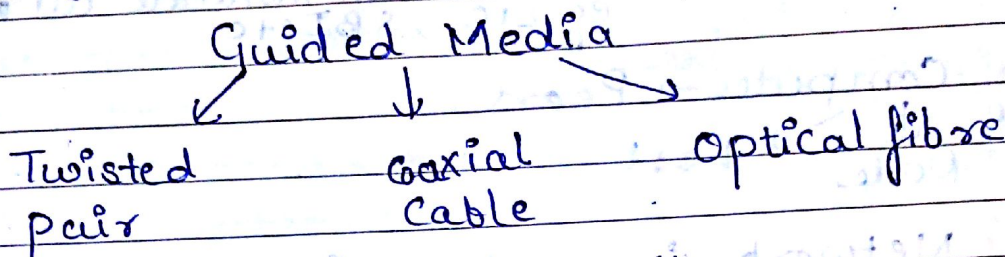
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Medium  $\div$  Communication Medium  $\rightarrow$  These are known as Media

Two different categories of Media

- $\rightarrow$  Guided Media  $\rightarrow$  System to System, which provide physical path of Packet
- $\rightarrow$  Unguided Media  $\rightarrow$  Via Bulethoth



Twisted pair  $\div$  It is also known as ethernet RJ 45 connector, 8 cable 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  $\rightarrow$  white blue

Cats, cat 6 twisted pair

cat 6 size little large than cat 5

RJ 11 - Telephone Register Jack

RJ 45 - Internet

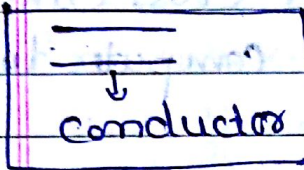
Unguided Media  $\div$

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

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

Media network eg building

ical path for Packet. 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.



Middle material is of copper wire which is covered by insulated shield.

→ 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 divide into two part.

### Ethernet cables

#### Straight Cable

For difference we devices we use

State Cable

Eg: Hub-to Computer

#### Cross Cables.

For same devices we use Cross Cable

Eg: Computer to Computer

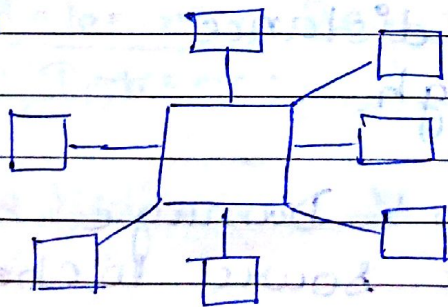
### Unregre,

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

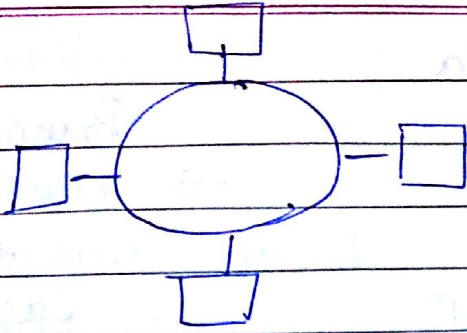
① STAR :- It has a centralised controller i.e Hub, Switch



Drawback :- If centralised controller crash then all network crash

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

## 2) RING:

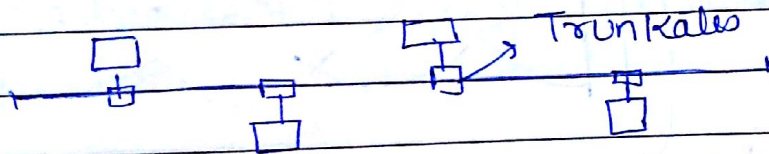


It is a circular format i.e why it is called Ring.

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

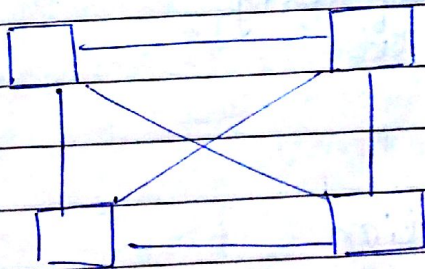
## 3) BUS:



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.

I

Twisted pair

Bandwidth

Categories 4 → 16 MHz

Categories 5 → 100 MHz

Categories 6 → 250 MHz

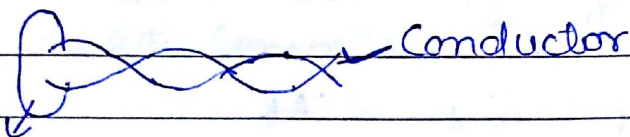
Categories 7 → 600 MHz

UTP

STP

Unshared  
Twisted pairShared Twisted  
pair

UTP

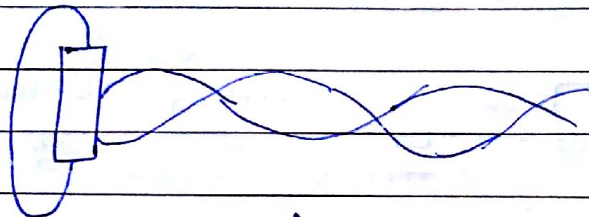


Insulator

of data

Advantages of Insulator No disturbance, is create ~~best~~ two wire

STP

Plastic material  
Coating

### Characteristics of UTP

- 1) Cost is low
- 2) Easy to install
- 3) High speed Capacity
- 4) Upto 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 done.

## II

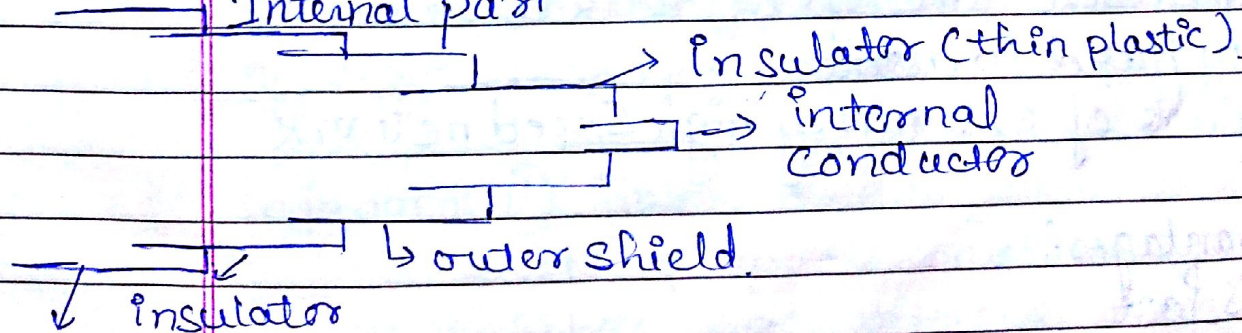
Coaxial Cable :-  
RJ45

Bandwidth  $\rightarrow$  1 giga Hz.

Male Female

Connected to wire      Laptops etc

Internal part



If insulator is


BNC connector stands for Breyonnet Niel  
Concelmen

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

Bandwidth: It is ability to transferred a data in a Unit <sup>OR</sup> Capability to travel data.

Internal conductor made up of Glass cable.

 → hard plastic cable

 → glass cable

 → concrete

In optical fiber light beams with the help of Spectrum

Concrete is used to protect the material so that damage doesnot 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

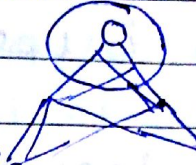


Unguided Media  $\div$  For packet delivery we does not any kind of <sup>Physical</sup> path.

① Radiowaves  $\div$  To establish a network we use Antennas.

eg: FM Radio

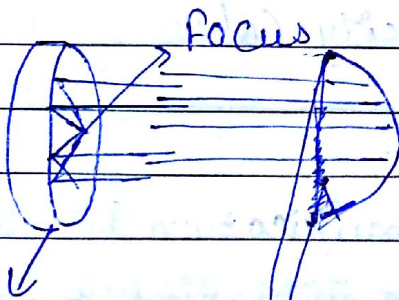
Radiowave is a multimedia



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

② Microwaves  $\div$  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 structured is used

③ For short network infrared is used

④ It is firstly ~~is~~ used in Mobiles

Types of networks  $\div$

- 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 provide, security is high

## 2) MAN

- To provide a network from one building to another
- Maximum nodes are used for communicate, little bit suffer - security

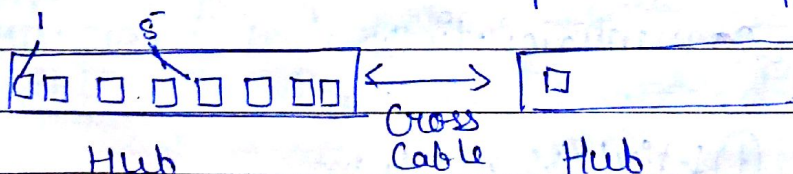
- 3) WAN: ① Security is less  
 ② High Capacity cables

## Communication Devices:

### ① Introduction about Communication Devices

#### ① HUB: ① Layer one device

- ② It is device based on Broadcast
- ③ security level is poor due to Broadcast
- ④ It is device which is not manage it is available in 8 port or 16 port



for same devices we use cross cable

- Advantage: ① provide connectivity  
 ② we can connect same device

Drawback: ① Use in small network

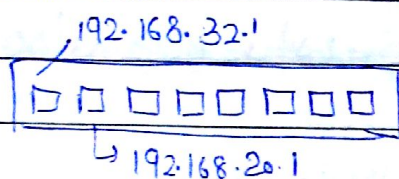
Disadvantage:- ① Security is poor  
② Broadcasting itself is a disadvantage

Switch:- ① It is available in 8 port, 16, 24, 48 ports  
is device which performed IP management  
② Layer two device  
③ It is based on Unicasting  
④ point to point Communication because Switch manage IP table

Managable Switch  
Switch ~~are~~ which  
are to be manage

Non Managable Switch  
Switch ~~are~~ which  
need not be manage

Each port have to assign  
an IP



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

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

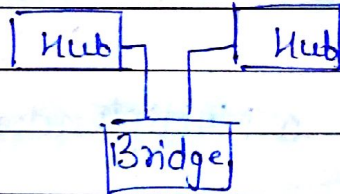
Switch:- In switch, it which IP is communicate each other eg 32.1  $\rightarrow$  32.3 want to communicate. Then this can be done only when it have IP table so that point-to point communication is possible

Advantages ① Large network design.  
② Security is high.

Disadvantages:- ① Chance of hang network.  
② Congestion is high  
Network Traffic

- ③ Router: It is provide a shortest path for packet of delivery
- ① Confection is low
  - ② Layer 3 device
  - ④ To provide a shortest path, Routing algorithm is use.
  - ⑤ It is a device which is use for long distance range
  - ⑥ It is a device which provide connectivity b/w two different network  
↓  
mean different classes.
  - ⑦ It is used to configure/manage.
  - ⑧ 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 segment with same IP.

- ⑤ Repeater: ① Layer one device  
② It is used to regenerate signals

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

- ⑥ 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 is 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 ~~tran~~-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

• 48 bit

• 32 bit

Switch is responsible for this layer

- ERROR control & flow control.

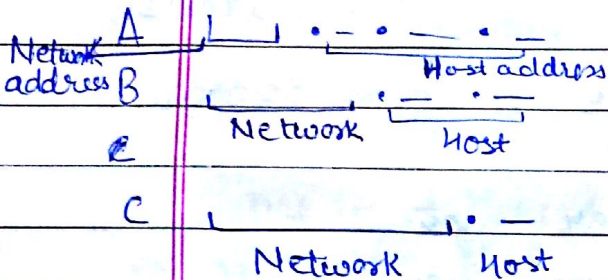
- Bits are again formed into frames.

3) Network layer  $\div$  ① provide interconnection b/w two different network on the basis of I.P.

IPv4 is divided into two part:

- Network address
- Host address

It is divided in four Octet



- Router is used to provide a connectivity b/w two different
- Data travel in form terms of packets
- Router is used to provide a shortest path  $\rightarrow$  Conjunction is taken

4) Transport Layer  $\div$

① <sup>Responsible for</sup> Delivery of packet

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

① Connection oriented  $\rightarrow$  <sup>TCB</sup> physical connectivity provided

② Connectionless  $\rightarrow$  no physical connectivity is provided  $\rightarrow$  UDP

- TCP & UDP is used in this layer

TCP  $\rightarrow$  Provide acknowledgement to the user

- Data travel in form terms of segments

- If All the segment is of same segment that 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

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  $\xleftarrow{\text{Sender}} \xrightarrow{\text{Receiver}}$

③ Full Duplex → Both side communication simultaneously  $\longleftrightarrow$

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

Data in the form of ① TEXT → ASCII, RTF (Rich Text Format)

② IMAGE → GIF, JPEG

③ Audio → MP3

④ Video → MPEG

7) Application Layer: ① It is a topmost layer of OSI Model. It is responsible to provide interconnection b/w user and global world / Network

- Webbrowser is used, it is a application software.
- Data access on webbrowser with the help of HTTP, FTP

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

In web browser all data access through HTTP, FTP through application software our protocols are work not directly by application software.

→ Data Link 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 ~~thru~~ though 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.

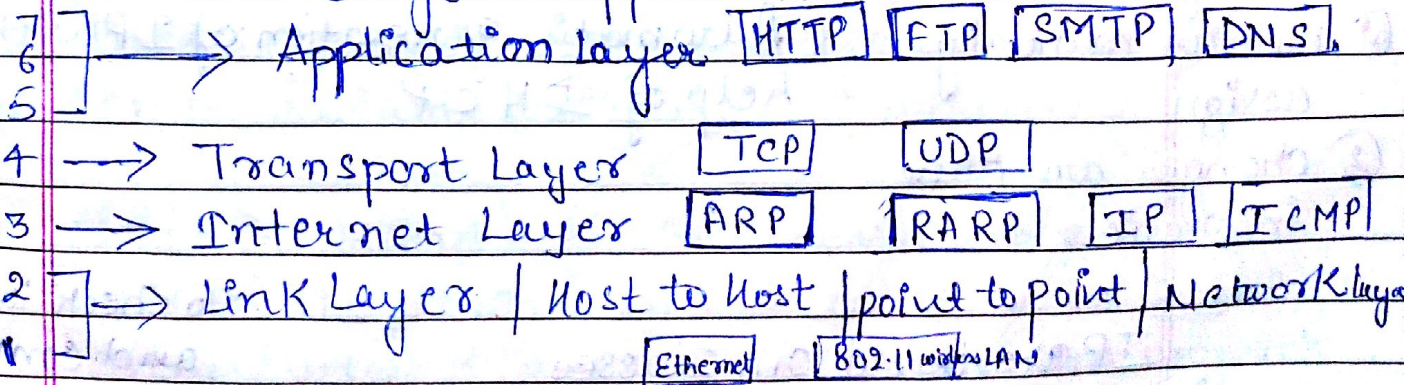
Connection Establishment: Connections are established, maintained & ultimately terminated b/w devices.

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

Flow Control: Data ~~trans~~ transfer rate is negotiated to prevent congestion.

@ -> is a separator

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



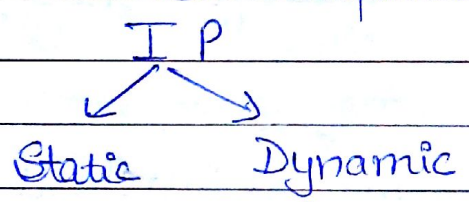
Wireless LAN ÷ 802.11

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 an network
- ICMP ÷ Internet Control Message Protocol.

Application layer: It is a combination of three layer

→ IP ÷ ① Stands for Internet Protocol.  
② Unique Identification. means



- ① Admin is responsible to assign IP
- ② with are manually assign
- ③ changes are there in static

- ① server is responsible to assign IP
- Automatic generation of IP with the help of DHCP

IP are based on classes

- 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
- To check to network and connectivity  
127 is not assign It is a loop back address → PING → Packet Internet Gopher
- ↳ for multitasking.

## IPv4

- ① IPv4 is used
- ② 32 bit
- ③ It is divided in 4 octet and for separation <sup>of octet</sup> we use
  - dot

11101111.11111111.11111111.11111111

Class A eg:  $10 \cdot 1 \cdot 1 \cdot 3$   
                   └─┬─┘   └─┬─┘  
                   Network   Host address  
                   address

Class B  $130 \cdot 144 \cdot 2 \cdot 5$   
                   └─┬─┘   └─┬─┘  
                   Network   Host address  
                   address

Class C  $192 \cdot 168 \cdot 32 \cdot 1$   
                   └─┬─┘   └─┬─┘  
                   Network   Host  
                   address   address

From each IP we can ~~divide~~ <sup>assign</sup> the ~~in~~ different IP ~~by~~ by the

process of Subnetting To increase Range of IP.

TCP/IP → IP is Unique Identification and <sup>TCP</sup> doesn't  
 provide acknowledgement & Guarantee so it a  
 unreliable. <sup>so</sup> when it combine with TCP/IP so  
 that it provide acknowledgement & Guarantee  
 so TCP is reliable protocol.

o IP: 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

① Why IPv6 is introduced? Diff. b/w IPv4 & IPv6 & MAC

→ IPv6 :- ① It is of 128 bit

② It's Representation in form of Hexadecimal Coding are used

③ For define each range column xxxxxxxxxxxxxxxx :-

DLI :- It is used to analysis the packet, detect errors and correct the error

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

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

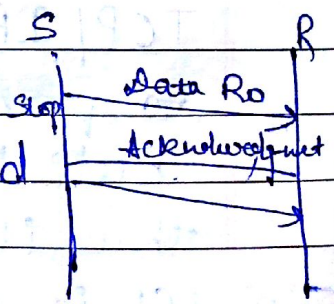
① → An Unrestricted Simplex protocol :- (No Sequence no or flow control (acknowledgements are used) only

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

② Stop & wait protocol :-

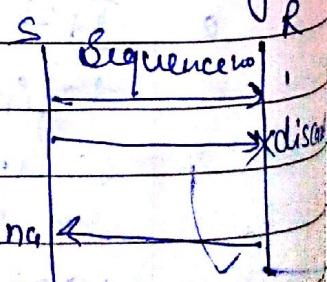
If acknowledgement is not send by Receiver then sender is in wait state



• For Each segment the sequence no is assign

③ 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 is 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 <sup>which</sup> with is managed by a switch or without switch.
- ② It is a protocol which is also known as bit oriented protocol. It use frame structure
- ③ It is design 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 control 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.

② HDLC control the interruption.

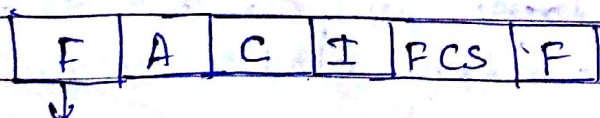
③ Full duplex or half duplex operation.

④ 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 <sup>Structure</sup> Segment: It consist of data, address of sender & receiver. (It is known as For transfer of packet bit ~~or~~ oriented protocol) A frame structure is divided into no of sub-field.



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

provide the information about link is active or not

01111110  $\rightarrow$  These 0 & 1 recognised as signal  
= 11111111 or 15  $\rightarrow$   $\pi$  problem in link setup.

More than 15  $\rightarrow$  ~~for sender side~~ Ideal state and ready to transmit data

② A  $\rightarrow$  Address  $\div$  It is of 8 bit, It is responsible to provide the information that who is primary station or secondary station

③ C  $\rightarrow$  Control  $\div$  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  $\div$  Control field Control as a Supervisory

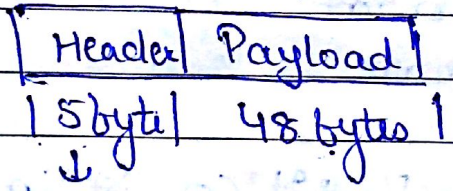
③ Unnumber  $\div$  Connection and dis-connection of link.

④ I  $\rightarrow$  Information  $\div$  It depend upon variable length, It is actual data / information

⑤ FCS  $\rightarrow$  Frame Check Sequence  $\div$  It of 16 or 32 bit It is responsible for error free connection and detection. It provide error free data.

Datalink layer → 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 ~~to~~ transfer the data in the form of cells. Size of cell is 53 bytes
- ⑤ It is protocol which is also capable to ~~to~~ transfer the data at higher rate eg from MBps ~~to~~ to Gbps
- ⑥ One single cell consist of two part



It contain  
It provide the  
info. that who  
is sender or receiver

Hop Count → How many router is used to transfer the data to reach at destination

- Network devices of ATM:
- 1) ATM Switches  The path way requiring Smallest no. of relays is called hop count routing in which every link is considered to be of equal length and given the value
  - 2) End points