

Computer Networks

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

Internet: network which is used ^{for communication} with in a single or ^{multi} location

Ethernet: LAN cables are Ethernet

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

Terms of Computer ^{Network} → 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
② System crash

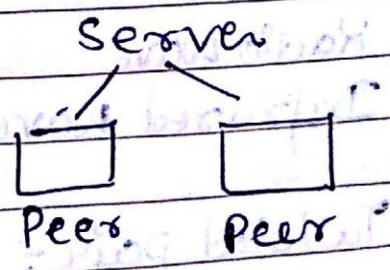
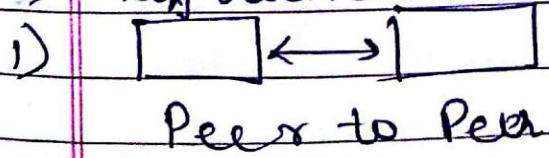
Various approaches for network

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

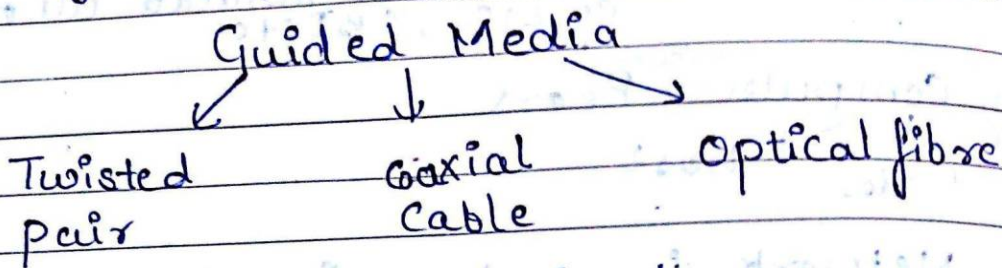
→ Main Controller exist, execution → server
→ Log record maintain



Medium: Communication Medium → These are known as Media

Two different categories of Media

- Guided Media → System to System, which provides defined physical path of packets
- Unguided Media → Via Bluetooth



Twisted pair: It is also known as ethernet RJ 45 connector; 8 cables are used

Register Jack

4 pairs of cables → 8 cables are used

- ① green — white green
- ② orange — white orange
- ③ brown — white brown
- ④ blue → 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:

- Satellite
- Radio wave
- Infrared waves

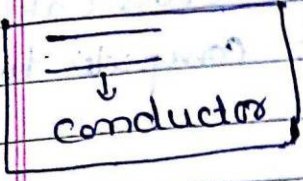
Twisted pair: It is a wire that mainly used to LAN, used in small size of

network eg building

Media

Physical 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

State Table

For difference ~~are~~ devices we use

State Cable

eg:- Hub to Computer

Cross cables.

For same devices we use Cross Cable

eg:- Computer to Computer

Usage

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:-

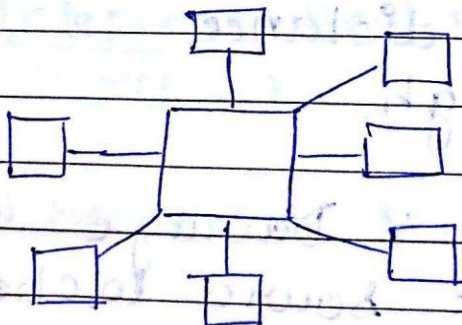
① STAR

② RING

③ BUS

④ MESH

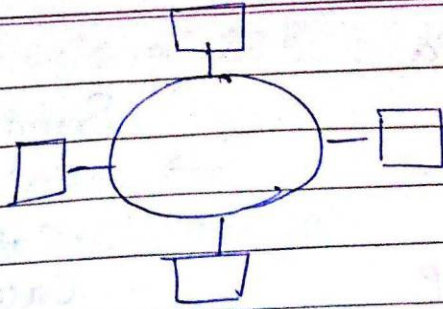
① STAR :- It has a centralised controller i.e Hub, Switch



Drawback :- If centralised controller crash then all network crash

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

2) RING:

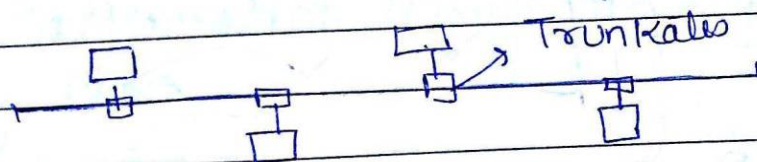


It is a circular format i.e why it is called Ring

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

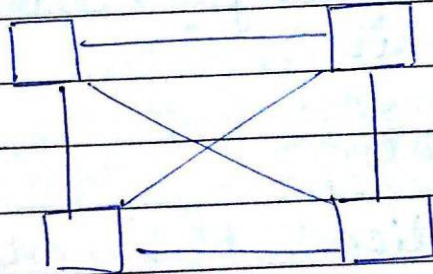
3) BUS:



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 use alternate way is available for packet delivery

→ Guided Media.

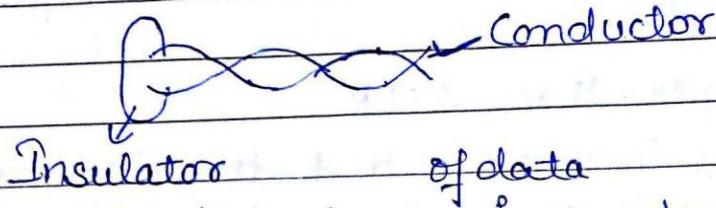
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Bandwidth

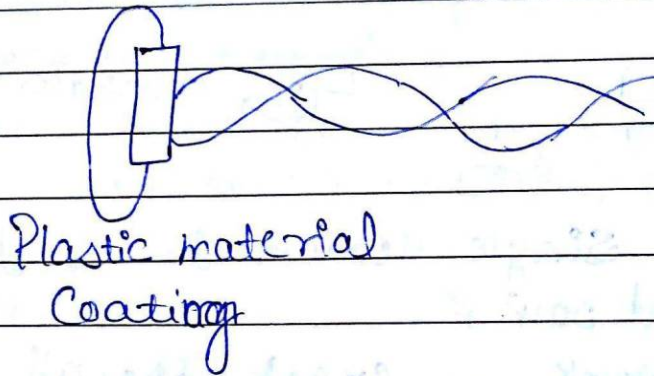
- Categories 4 → 16 Megabit/s
- Categories 5 → 100 megabit/s
- Categories 6 → 250 megabit/s
- Categories 7 → 600 megabit/s

UTP



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

STP



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) 100m 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.

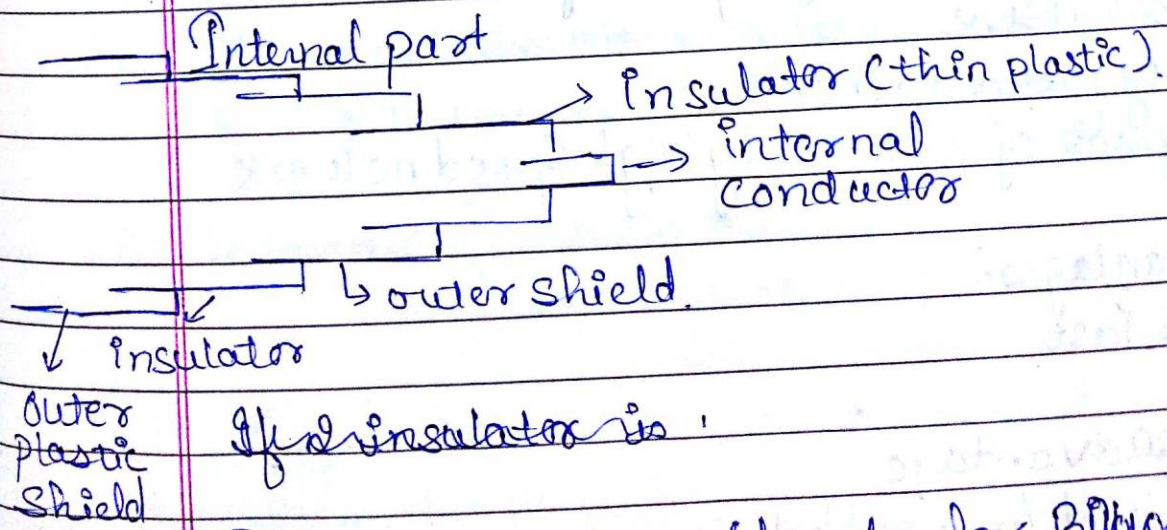
II Coaxial Cable :-

Bandwidth \rightarrow 1 giga Hz.

RJ45

Male Female

Connected to wire
Laptops etc



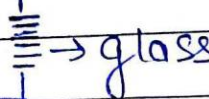
BNC connector stands for Billionet Niel Concelmen

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

Bandwidth: It is ability to transferred a data in a Unit ^{OR} 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 ^{physical} path.

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

eg: FM Radio

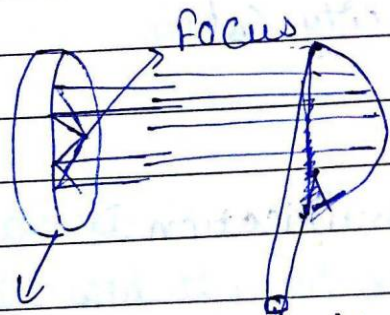
Radiowave is a multimedia



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

② Microwaves: It is medium used that is ~~unicast~~ Antennas.

It is ~~used~~ Unicast



Dish Antennas

Wave guide
Horn antennas (H-Type antennas)

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 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

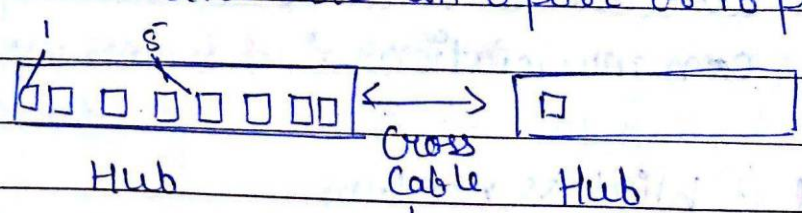
- To provide a network from one building to another
- Maximum nodes are used for communication, bit suffer - security

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

② Layer two device

③ It is based on Unicast

④ point to point Communication because Switch manage IP table

Managable Switch

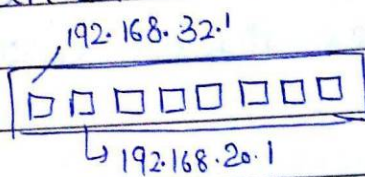
Switch ~~are~~ which are to be manage

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 → 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 delivery

② Confection is low

③ 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

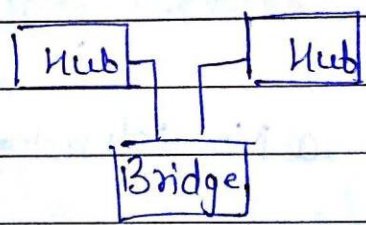
⑥ It is a device which provide connectivity between two different network

↓
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 signal

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 ~~trans~~-task
② Data travel in the form of Bits.

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 as Logical link • NIC card
 - 32 bit • 48 bit

~~Switch~~ Switch is responsible for this layer

• ERROR control & flow control.

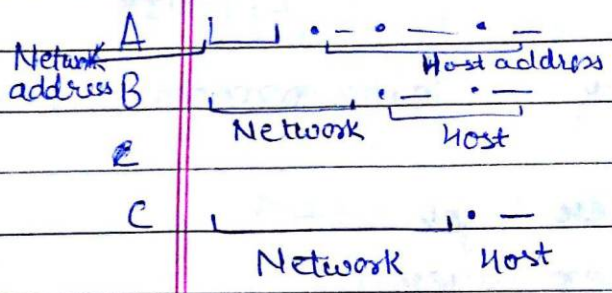
• Bits are again formed into Frames.

3) Network layer :- (1) provide interconnection b/w two different network on the basis of 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 → Connection is best

4) Transport Layer :-

(1) ^{Responsible for} Delivery of packet

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

- (1) Connection oriented → ^{→ TCP} physical connectivity provided
- (2) Connectionless → ^{→ UDP} no physical connectivity is provided

• TCP & UDP is used in this layer

TCP → 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

① ^{Simplex} Duplex: Only side communication is possible →

② Half Duplex: Both side communication is possible only one by one $\xleftrightarrow{\text{Sender}}$ Receiver

③ Full Duplex → Both side communication simultaneously \longleftrightarrow

N/w

6) Presentation: It is layer How to represent a data in front of user

Data in the form of ① TEXT → ASCII, RTF (Richer 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 though such functions 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.

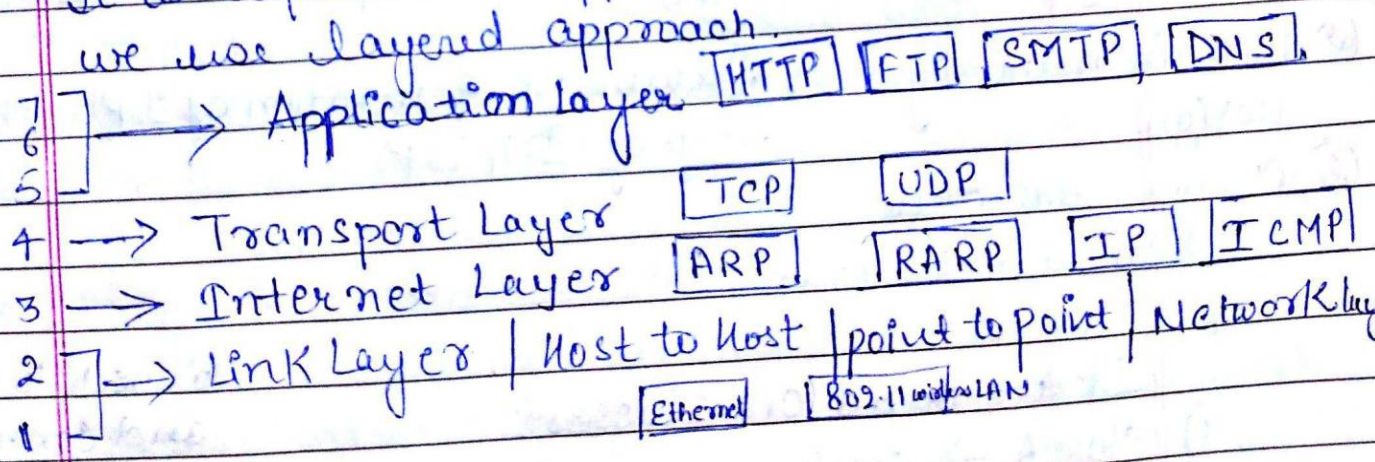
Connection Establishment: Connections are established, maintained & ultimately terminated b/w devices.

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

Flow Control: Data transfer 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.

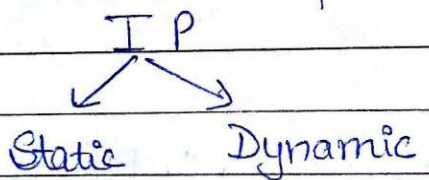
• RARP → Reverse Address Resolution protocol. We have MAC with us and need to identify IP address we use RARP.

• IP ÷ Unique identification of each and every node in an network

• ICMP ÷ Internet Control Message Protocol.

Application layer: It is a combination of three 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

1) Class A → 0-126

2) Class B → 128-191

3) Class C → 192-223

4) Class D → Reserved for RFD 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 Groper

IPv4

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

11101111.11111111.11111111.11111111

Class A eg: $\underbrace{10}_{\text{Network address}} \cdot \underbrace{1 \cdot 1 \cdot 3}_{\text{Host address}}$

Class B $\underbrace{130 \cdot 144}_{\text{Network address}} \cdot \underbrace{2 \cdot 5}_{\text{Host address}}$

Class C $\underbrace{192 \cdot 168 \cdot 32}_{\text{Network address}} \cdot \underbrace{1}_{\text{Host address}}$

From each IP we can ~~divide~~ ^{assign} the different IP ~~by~~ 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. ^{so} when it combine with TCP/IP so that it provide acknowledgement & Guarantee so TCP is reliable protocol.

IP: It stands for Internet protocol which defines the Unique identification of each and every system (computer) with in the network

192.168.0.1 is called default gateway

- Why IPv6 is introduced? Diff. b/w IPv4 & IPv6
- ① It is of 128 bit
 - ② Its Representation in form of Hexadecimal Code are used
 - ③ For define each range columns

DLL ÷ It is used to analysis the packet, detect errors and correct the error.

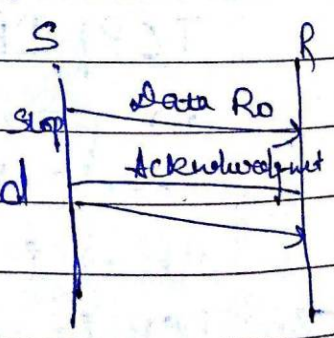
- Virtual path travel data from datalink layer
- Parity bit is assign which is also known as Checksum

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

- ① An Unrestricted Simplex protocol.
 - ① flow control
 - ② error detection is not done

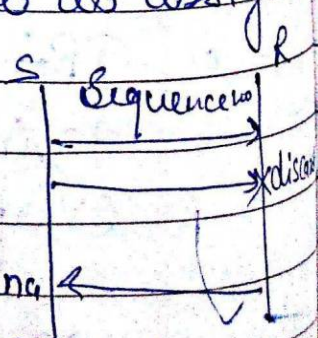
To overcome the problem of flow control & error detection stop & wait protocol is used.

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



Page _____

ARQ → [Automatic Repeat request]
PR → Pack et Retransmission

ARQ & PR → It used is responsible to analysis the sequence no of segment
is 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} with is managed by a switch or without switch.
- ② It is a protocol which is also known as bit oriented protocol.
- 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

③ Combined Stations ÷ In Combined station it is very difficult to ~~analyze~~ to find out that which is primary & secondary station

provide the information about link is active or not

0111110 → These 0 & 1 recognised as signal

= 1111111 or 15 → π

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 Control as a Supervisory

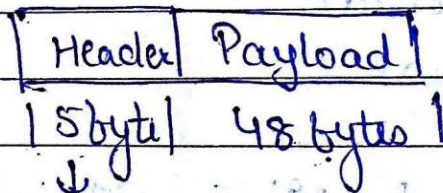
③ Unnumber ÷ Connection and dis-connection of link.

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 ~~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} provide the info. that who is sender or receiver

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

Network devices of ATM:

- 1) ATM Switches 
- 2) End points

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

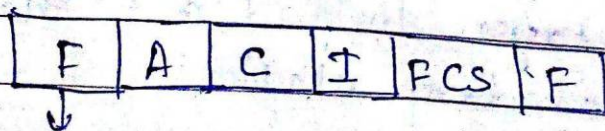
④ It provide point to point Configuration

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

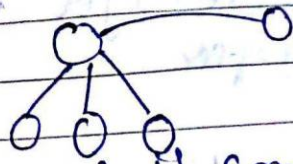
HDLC frame Structure Segment: It consist of data, address of sender & receiver. (It is known as For transfer of packet bit oriented protocol)

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



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

ATM switches \div ATM switches can directly communicate with other ATM switches.



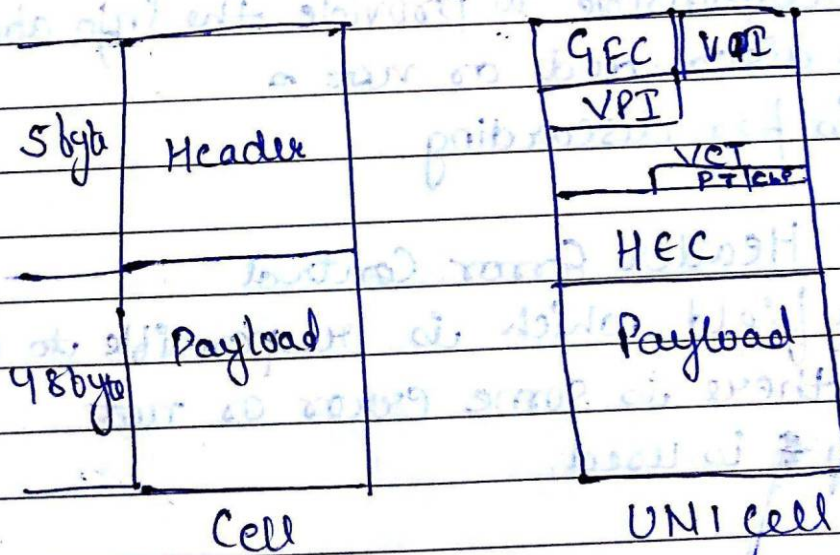
End point \div Communication within the single ATM switches.

Payload \div 48 byte, which is used to carry actual data which is being transferred.

Two interface

- 1) UNI \rightarrow Communication between ATM switch and end points
- 2) NNI \rightarrow ATM switch directly communicate with other ATM switch.

Header part consist no of fields \div



It consist info about which IP is exist in a header part

GFC \div General flow control

- It is a field which provide the info. how many end points are connected with ATM switch.
- It is set on 0

- VCI → Virtual Channel Identifier & in particular way. How many routes and IP address are used.
- VPI → virtual path Identifier, it a way through which data is transfer.
- PT → Payload Type It consist of actual data or controlled data. Bits are used to notify the data.
Bit set in actual data is 1 and Bit set for controlled data is 0

Conjestion :- If there is conjestion i.e 1 other

Cell receive is last or more cell.
bit 1 bit 0

CLP :- Stand for Cell loss priority
It is responsible to provide the info about when cell is discarded or not
1 bit is for discarding.

HEC → Header Error Control
It is a field which is responsible to check whether there is some error or not
Checksum is used.

In ~~UNI~~ NNI Cell there is GFC field is not available

Layered Architecture of ATM or ATM Reference Model:

It consists of three layers.

ATM Adoption layer. It is also known as AAL

ATM layer

Physical layer

ATM Adoption layer: Classes of AAL: i.e

AAL1

AAL2

AAL3/4

AAL5