

## UNIT - 1 :- Introduction

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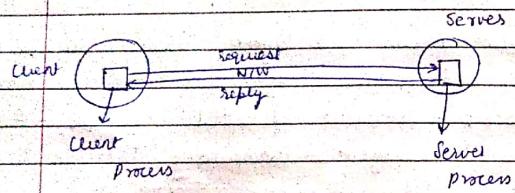
## Computer Networks :-

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Class lecture - 1.0

### \* Data Communication :-

- (1) Sender      (2) Receiver      (3) Transmission Medium
- (4) Protocols



### \* Client - Server Processes

### Types of Transmission Modes :-

#### 1. Simplex

In simplex transmission data is transmitted only in 1 direction i.e. it is a 1 way communication e.g.:- TV Signal

(I) Half Duplex Transmission: Data can be transmitted both ways but only 1 at a time.

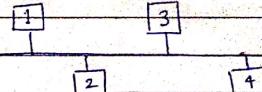
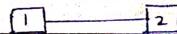
Eg.

(II) In full Duplex: Transmission data can be simultaneously Transmitted in both directions

Eg:- chatting, phone calls

### \* Types of Network Connections:-

- (1) Point to point (peer to peer) [P2P]
- (2) Multipoint



→ In point to point connection 2 hosts are connected through a dedicated line.

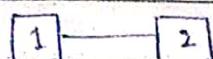
→ In a multipoint network a link is shared among more than 2 devices.

\* Types of Transmissions:-

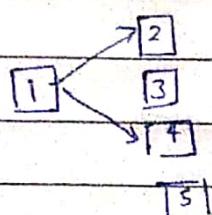
(i) Unicast

(ii) Multicast

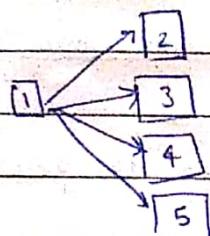
(iii) Broadcast



Unicast (1 to 1)



Multicast (1 to many)



Broadcast (1 to all)

## Computer Networks

### Class lecture - 1.1

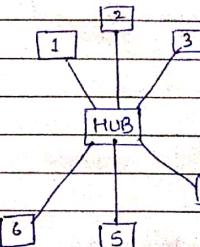
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#### \* Network Topologies :-

1. Mesh
2. Star
3. Ring
4. Bus
5. Hybrid
6. Tree.

#### \* Star Topology

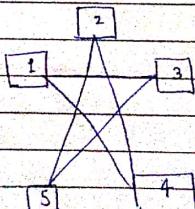
- No. of i/o port required is 1 at each node
- The no. of link required is 1.



1. Robust
2. Point to Point
3. No. of port = 1
4. No. of links = n

#### \* Mesh Topology

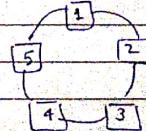
No. of i/p o/p ports at each node required to connect n devices in a mesh network is equal to  $n-1$  ports. No. of links required in a mesh is  $\frac{n(n-1)}{2}$ .



1. It is Robust
2. It is point to point
3. It is secure
4. It is reliable

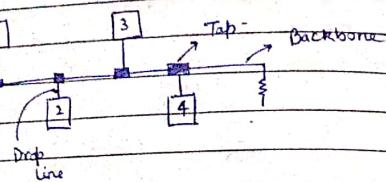
#### \* Ring Topology

No. of i/p port required is 2 at each node & the no. of link required is n.



1. Non-Robust
2. We won't be able to detect the fault easily.
3. It is <sup>not</sup> Reliable
4. It is because
5. No. of ports required = 2
6. No. of links = n

#### A. Bus Topology



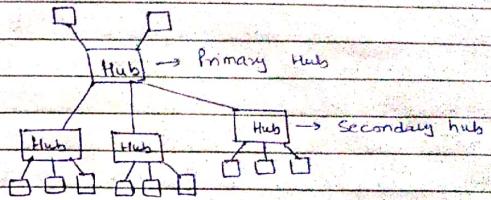
1. Multipoint
2. Non-Robust
3. Easy to detect faults
4. No. of I/O ports per node = 1
5. No. of links required =  $n+1$ .
6. Secure.
7. Only one node can transfer data through backbone at a time

#### 5. Hybrid Topology:-

It is the combination of any two above mentioned topologies.

#### 6. Tree Topology:-

Tree Topology is also called hierarchical topology & it is the variation of star topology.



1. Point to Point
2. It is not robust
3. \*

#### \* Categories of Network :-

1. Personal area network (PAN) ( Bluetooth mouse, Bluetooth keyboard )
2. Local area network ( LAN ) ( In office building )
3. Metropolitan area network (MAN) ( Whole city using h/w )
4. Wide Area network (WAN) ( Inter cities or Inter continent )

#### \* Connection oriented & connection less service

- In a connection oriented service, in order to exchange information, a connection is established b/w a sender and receiver

1. Establish a connection
2. Transmit the data
3. Release the connection

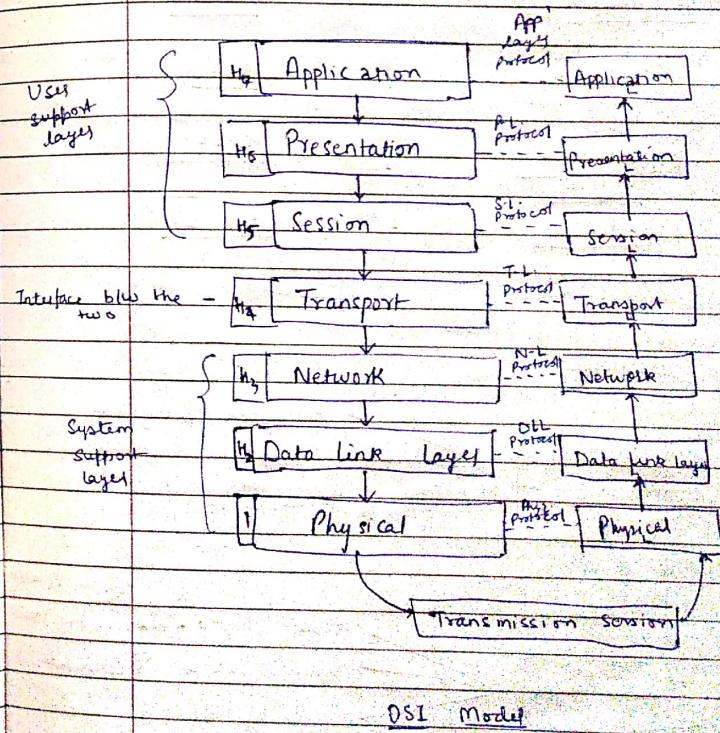
- In a connectionless network:-  
Each service can be categorized by a quality of service. Services can be of two types.
1. Reliable Services Those services that never lose data. Generally reliable services are implemented generally receives sending the acknowledgement of the received service.
  2. Unreliable Services - Unacknowledged services are unreliable connection less services, such devices are called datagram services which is similar to the telegram services.
  3. Reply and Request service-

\* Books:-

- ① CN - Tarien Baum
- ② CN - U. Black,

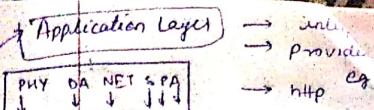
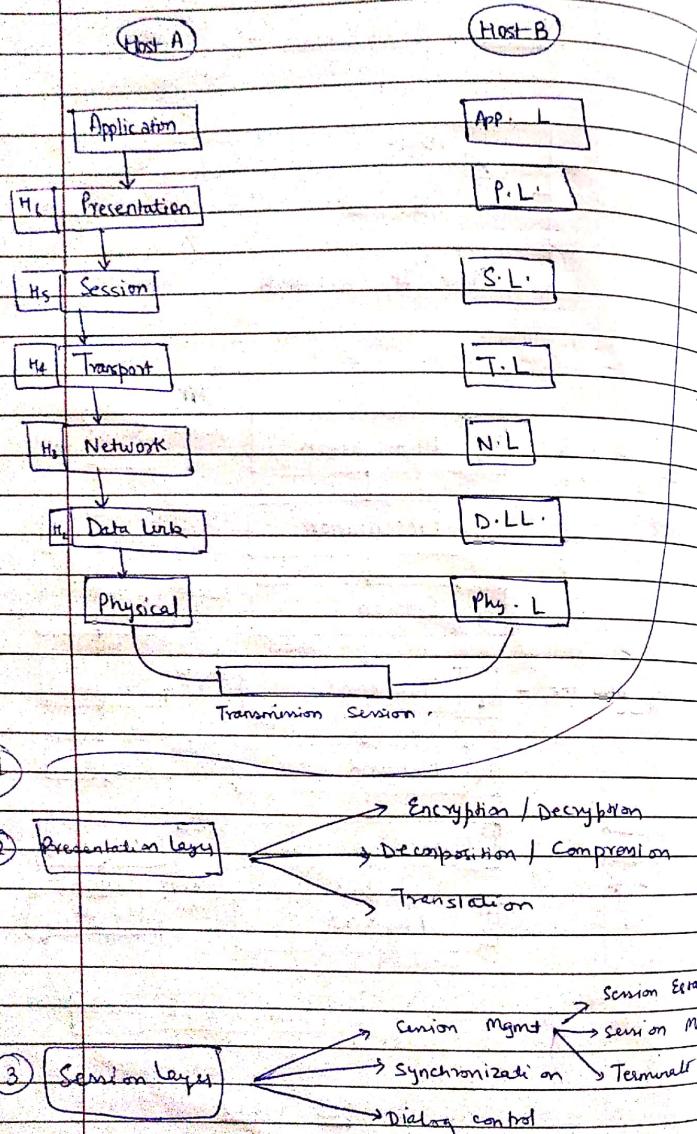
Network Architecture :-

- 7 layers:
- OSI (Open System Interconnection) Network
  - TCP / IP Network



## Class Lecture-2

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\* Session layer: allows users client-server machine to establish a session. The job of the session layer is to establish, maintain & synchronize the session b/w the comm. systems. When data is transmitted b/w the two systems, the session will now be terminated.

• Dialogue control keeps track of whole time it is to initiate or transmit the data & how this initiation is done.

• Session layer allows addition of checkpoints that is synchronization pts. into a stream of data being transferred, so that in case of a system crash or the when a link is broken, the data being transmitted can be retransmitted from that checkpoint instead of retransmitting it from the beginning.

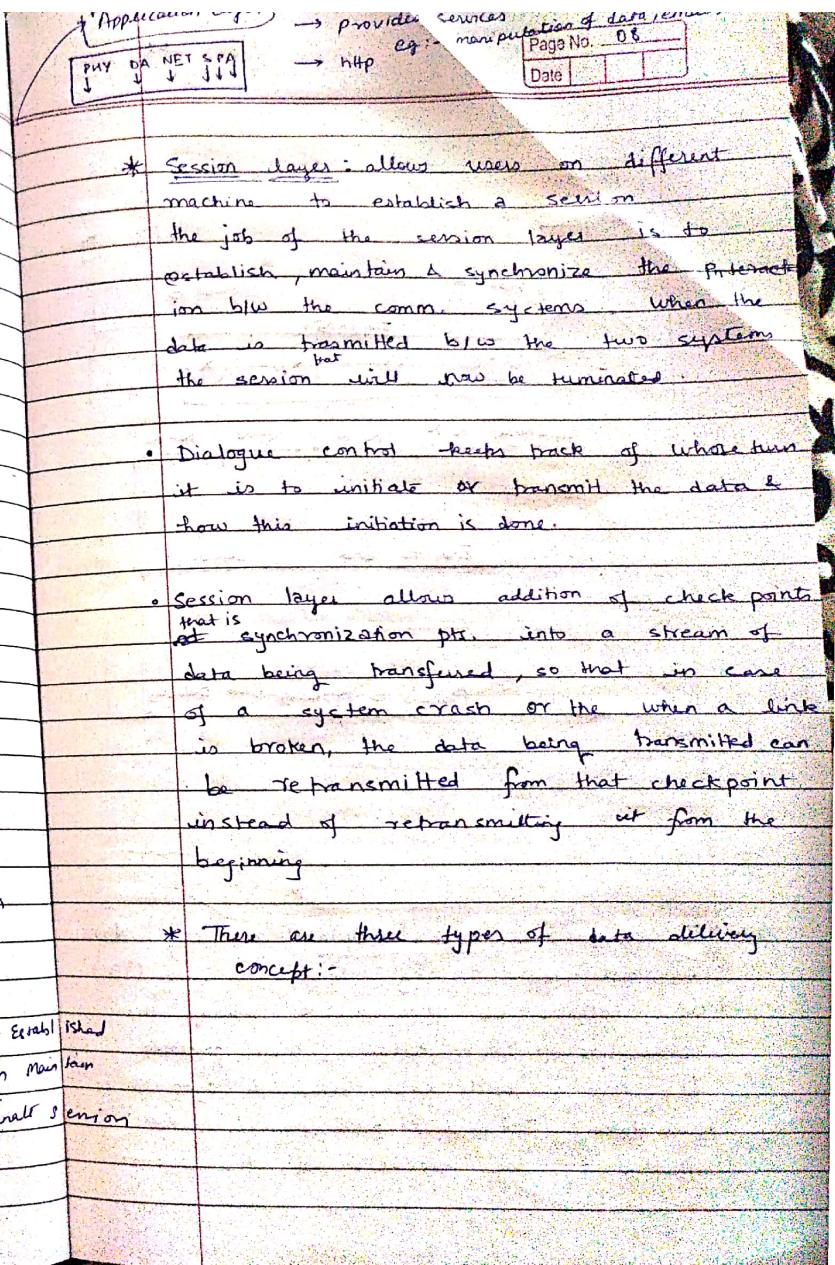
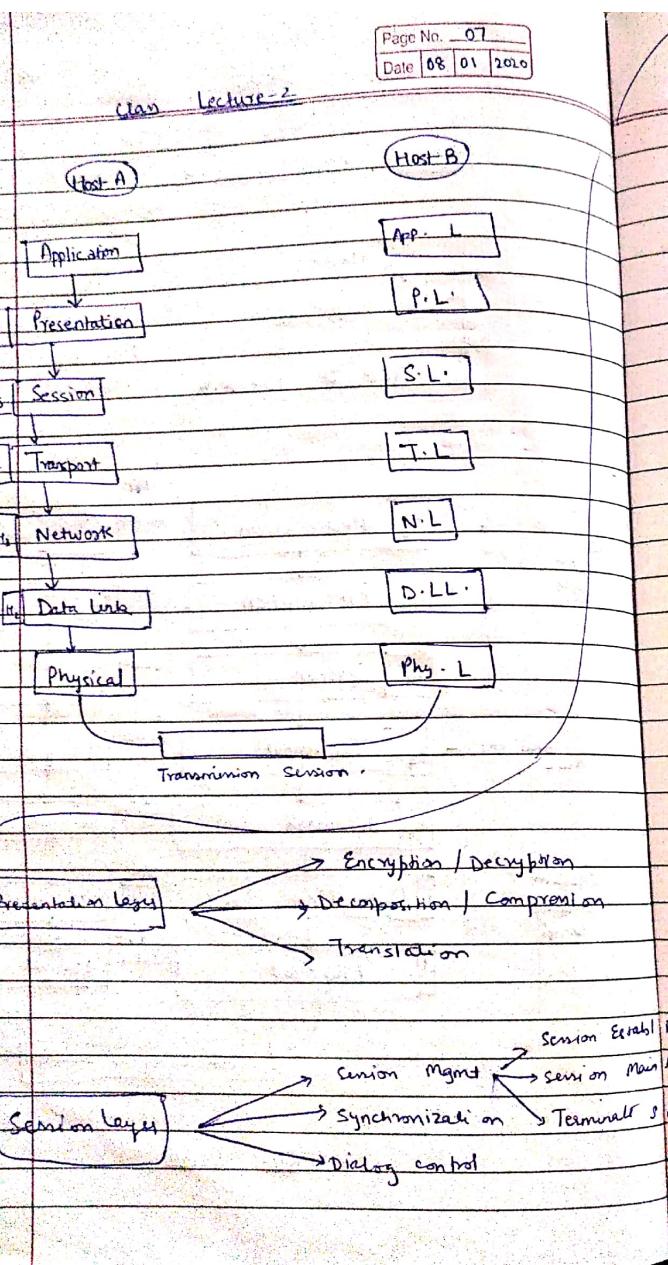
\* There are three types of data delivery concept:-

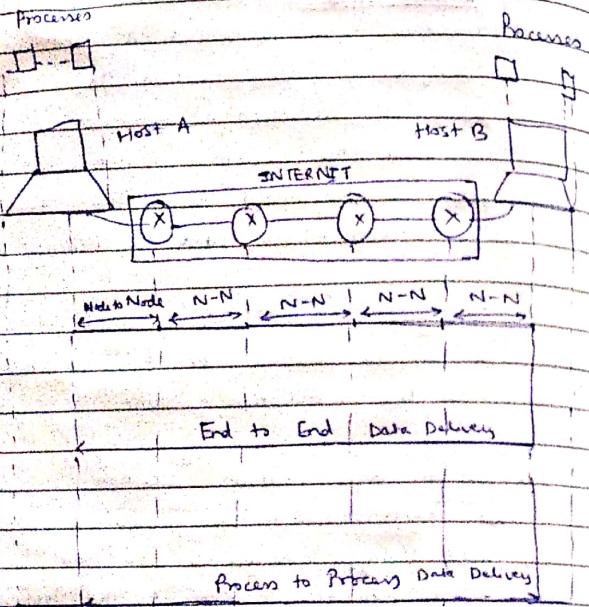
Session Etabl. ished

Session Mgmt

Session Main

Terminal Session





Two processes comm in a client-server relationship.

- In End-to-End data delivery, the data is delivered from sender host to receiver host. The sender has the address of the receiver thus the data is sent only to that particular host carrying that address. In node-to-node data delivery, the data is transmitted from source to destination via intermediate nodes such as routers.

#### Types of Addressing:-

- Physical Address (MAC Address)
- Logical Address (IP Address)
- Port Address

① Physical Address is a 48-bit address, ethernet and LAN uses this address for communication.

Eg: MAC Address:

00 : 1B : 22 : 18 : 48 : 3C

- In Process-to-Process data delivery data is delivered during Interprocess Comm. (IPC) which allows the processes to manage the shared data. IPC allows the processes to comm. with each other & synchronize their data. Independent processes is not affected by the execution of other processes.

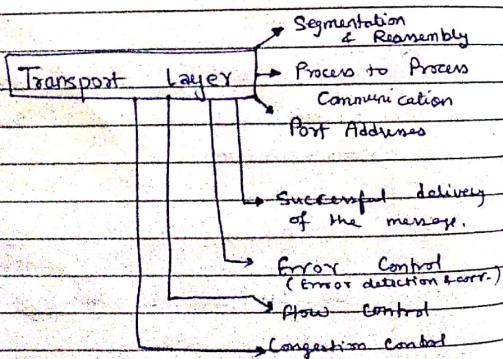
e.g. IP Address

0.0.11.120

- The label assigned to a process is called a port address.

(16 bit address)

#### \* 4. TRANSPORT LAYER \*



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#### • Error Control

Error detection & Error correction

#### \* Flow control

- To handle the speed in the flow of the data, it is required when fast generation of information is done by the sender but the receiver is slow. In order to handle such speed mismatch flow control is used.

#### \* Congestion Control

- Traffic control over the transmission medium, the Header in the transport layer i.e. IP includes a source port address to deliver a specific process from source to a specific destination.

### Class Lecture-3

- (5) Network layers
- Routing
  - end to end communication
  - logical addressing
  - Packets (segments in the prev. layer)
  - Congestion Control
  - traffic control not used

Packet is routed from source to destination across different network.

Main function of the layer is to deliver data packets from source to destination across diff. network.

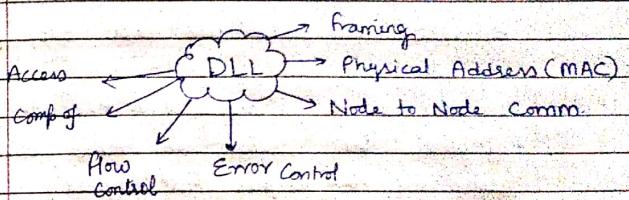
Congestion control, if too many packets are present in the subnet at the same time they will interfere with each other's way controlling such a congestion traffic network layer is responsible.

### (6) Data Link Layer

Error control = Error detection + correction

It is responsible for reliable node to node delivery of data packets.

It accepts packet from N/W layer and forms data units called frame this is called framing.

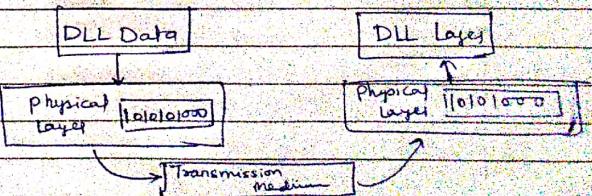


DLL port determines which of the devices has connected over the shared link at any given time.

MAC sublayer helps deal of Access control via the DLL.

- (7) Physical layers
- Actual Transmission of Data
  - conversion of frames to signals
  - Synchronization

Deals of physical connection between the N/W for transmission & reception of bits over a common channel in the form of signals.



It defines the type of encoding i.e. have 0's & 1's are changed into signals.

It deals the transmission rates (Bits/sec)

Synchronization of Transmitter & Receiver

- Defines the transmission mode b/w 2 devices (Simplex, Half Duplex, Full Duplex)

### TCP / IP Model

OSI Model

Internet

TCP/IP model (for satellite)

Transfer control

Application
Presentation
Session
Transport
Network
DLL
Physical

Application
Transport
Network
Host to N/W

#### ① Host to N/W

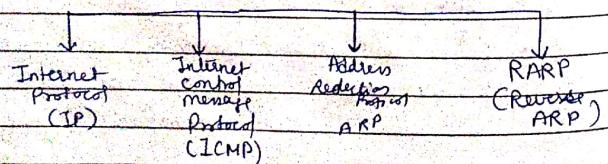
- AKA N/W access layer
- Combination of DLL & physical layer of OSI model.
- Deals with H/W addressing and protocol present which connects the host to the N/W and allows physical transmission of I/P packets
- The protocol in this layer varies from host to host and N/W to N/W.

(2) Network layer / Internet layer → delivers I/P packets  
→ avoid congestion  
→ Routing

- f<sup>n</sup> of this layer is to allow host to insert packets into the NW and then have them travel independently to the destination.
- The order of recovering the packets can be diff. from the sequence in which they were sent. If it is the ~~first~~ role of the sublayer to rearrange them if in order delivery is used.

(3) The major issue while sending packets from source to destination i.e. congestion is to be avoided.

Protocols used in this layer



### Class Lecture - 4

#### (III) A Transfer Transport layers: TCP & UDP

Transmission Control Protocol & User Datagram Protocol.

TCP: Is reliable, connection oriented protocol that allows a byte screen to be transmitted , error free , to another machine in the internet . It performs sequencing & segmentation of data.

It fragments the byte screen into discrete messages and passes each one onto the internet layers at the destination, the receiving TCP process reassembles the received messages into the o/p screen.

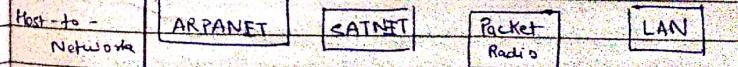
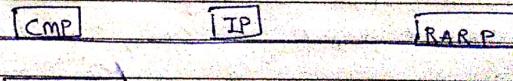
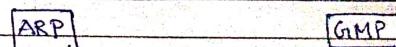
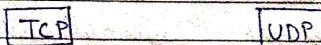
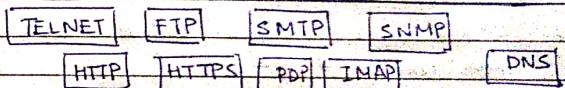
It also takes care of flow control .

UDP: Unreliable, connection less protocol , for app' that do not require TCP's sequencing or flow control. Transmits data in form of UDP datagram.

#### IV \* Application Layer

It is responsible for session management and controls user interface specification.

- Protocols and Networks in TCP/IP Model:



(Terminal Network)

# TELNET is a virtual terminal connection protocol used to login to a remote computer on the internet.

# FTP - File Transfer Protocol : It is used to transfer files from one host to another. Port 20 is used for data transfer, port 21 is used for control information.

# HTTP - Hypertext Transfer Protocol : It is used to fetch pages from World Wide Web.

# HTTPS - It uses secure socket layer that is SSL (HTTP secure) message to be send using, HTTPS has an SSL code added to it, the receiver then deciphers the post in order to read the original message.

# SMTP - Simple Mail Transfer Protocol, it is a standard protocol for sending emails efficiently & reliably. It is a connection oriented protocol, it handles exchange of msgs b/w email servers over TCP/IP network. In case the msg is not delivered, error report is send to the sender, which makes SMTP a reliable protocol.

# POP - Post Office Protocol, It is generally used to support a single client. Here in order to access the msg, it is necessary to download them. There is no search facility in POP later version of POP is POP3.

# IMAP - Internet Mail Access Protocol, it allows client to manipulate e-mail message on the server without downloading them on the local comp., it enables us to download & delete <sup>search</sup> email without downloading it.

# SNMP - Simple Network Management Protocol. It is used for Network management. It is used to collect information from & configure network devices such as servers, hubs, switches etc.

# DNS - Domain Name system : It provides a name to a URL or IP Address.

# TCP - Transmission Control Protocol is a standard that defines how to establish and maintain a network connection via what approach two hosts can exchange data.

# UDP - It transmits data in the form of UDP Datagram.

## UDP

Datagram

Source Port	Destination Port
Length	Checksum
Data	

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- # IGMP - Internet Group Management Protocol  
It is an internet protocol that handles group membership, it helps multi-cast routers, to create an updated list of members related to each router's interface.

# IP - Internet Protocol- It is a connectionless unreliable protocol, it is a host to host network layer delivery protocol for the internet. Data is transmitted in the form of IP Datagram.

# ARPANET (Advanced Research Project Agency Network)

# SATNET (Satellite Network)

# Packet RADIO

# LAN (Local Area Network)

# ARP - Address Resolution Protocol- It is used for association or to map IP address to its mac address.

# RARP (Reverse ARP) - To map mac address to IP Address.

# ICMP - Internet Control Message Protocol , it is used in Network Management and Administration. It is a networking protocol after control protocol.

(In Detail)

## Unit 2:- Physical Layer

**Signal:** It is a mix. 1 or more independent variables which contains some information. It can be of two types analog and digital.

**Analog:** It is a continuous signal which varies smoothly and continuously of time.

Properties of Analog signal:

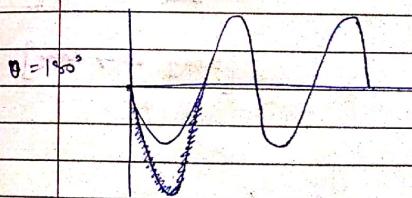
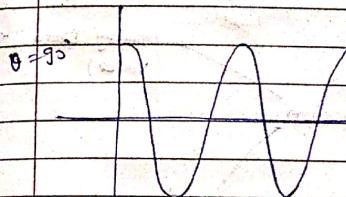
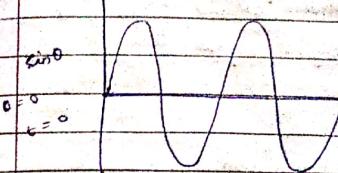
**Amplitude :-** It is the value of voltage or level of signal at time  $t$ .

**frequency :-** No. of cycles per unit time  $\left[ \text{Hz} = \frac{1}{\text{s}} \right]$

**Phase :-** Pos<sup>n</sup> of waveform at time  $t=0$ .

**Digital :** It is discrete in nature.  
Signal

Properties:



**Periodic Signal:** This signal has a pattern with a measurable time called period & repeats the pattern over successive periods.

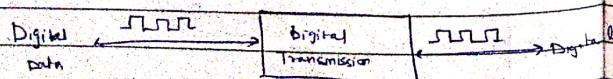
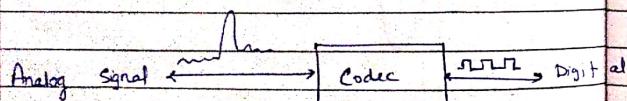
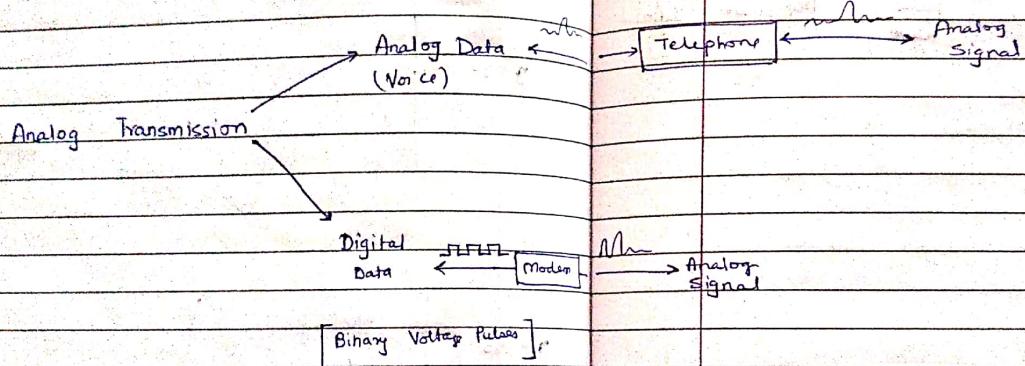
**Cycle:** One full pattern is called a cycle.

**A periodic signal:** Varies without exhibiting a pattern may repeat over time.

Data Comm. - Periodic Analog signal ] preffect signal  
A periodic Digital signal

Analog and Digital Data Transmission:

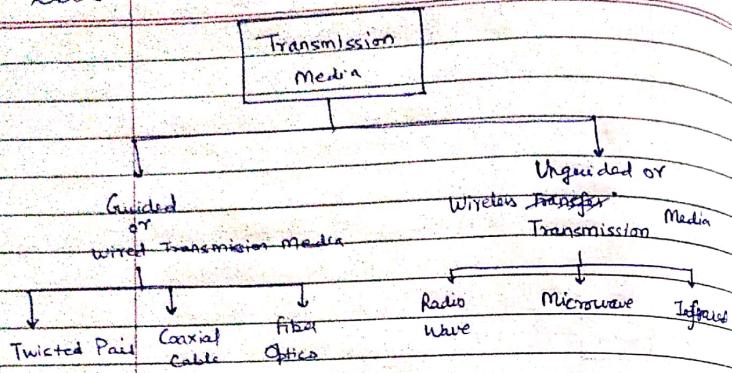
(HW)



Physical

Layers Transmission Media

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Class Lecture 5

### (1) Guided media

In this type of media signal energy is contained and guided within curved media. Used in point to point communication.

### (2) Twisted pair cable

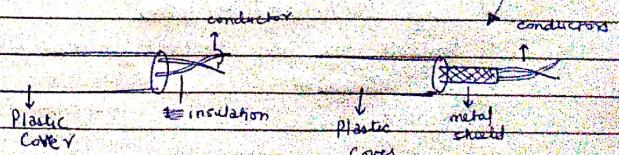
It consists of 2 insulated copper wires typically about 1mm thick. Each which is twisted together in a helical form. It can sum upto several kms w/o amplification but for longer distances repeaters are used.

Twisted pair  
① (i) Unshielded Twisted Pair (UTP)  
② (ii) shielded Twisted Pair (STP)

Category 3  
2 insulated wires generally twisted together

Category 5  
similar to Cat 3 but more twists per cm.  
(less crosstalk)(quality)

More no. of twists  $\Rightarrow$  less chance of crosstalk



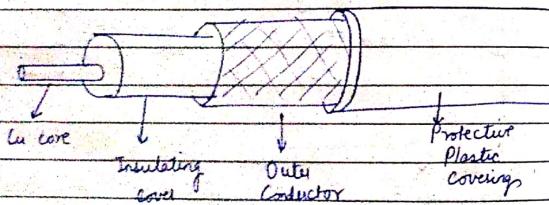
### Applications of Twisted Pair :-

1. Telephone lines
2. ISDN (Integrated Service Digital N/W)

most common UTP connector is RJ45 (Rag Jap)

### (b) Co-axial Cable

- Used for longer distances at higher speeds.
- It consists of Cu wire at a part surrounded by an insulating material, insulator is enclosed by a cylindrical conductor, outer conductor is covered in a protective class sheath.



### \* Advantage :-

- Due to shield it has less noise immunity.
- Large Bandwidth & low losses
- Suitable for point to point or multipoint application
- less attenuation.

### \* Disadvantages :-

- Costlier

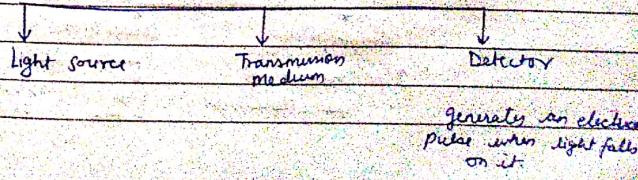
### Applications :-

1. Telephone (Analog)
2. Telephone (Digital)
3. Cable TV
4. Thick & thin star net

### (c) fibre Optics

It is an ultra thin fibre of glass transmission medium. It consists of an inner glass core surrounded by a glass cladding, which has a lower refractive index.

Digital signals are transmitted in the form of intensity modulated light signal which is trapped in the glass core.



By attaching a light source to one end of FO and detector to the other we have a unidirectional Data T<sup>x</sup> system that accepts an electrical signal, converts and transmits it into light pulses then reconverts the off to an electrical signal at the receiving end.

#### Application - LAN

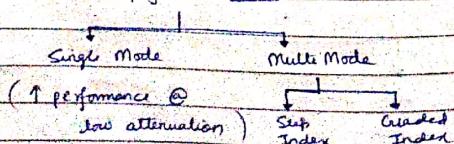
T<sup>x</sup> can from 45 Mbps to 9.6 Gbps.

SC connector	Subscriber Channel	Cable TV
ST Connector	Straight Tip	N/W devices
MT-RJ Connector		

#### Applications:-

- (1) Small Size
- (2) Light Weight
- (3) No EM interference
- (4) Large BW
- (5) No crosstalk

#### Propagation modes



#### Attenuation and Dispersion

##### MF, LF, VLF band

These radio waves are ground Ans radio waves MF band to Leeward coast.

##### HF & VHF band

These are ground and tend to be absorbed by these wave reach the ionosphere, a layer of charged particles is reflected & sent back to earth.  
Eg. Military Communicator.

#### Microwave Communication (1 - 3 GHz)

Uses lower GHz frequency of electromagnetic signals these are higher than radio frequencies produces better throughput & performance.

#### Applications:-

- (1) Installation of towers is cheaper
- (2) lesser maintenance
- (3) Noise is less bcz of repeats.

Eg. WLAN, Comm.

#### Infrared

For short range communication,  
Eg:- Remote Control.  
Features:- Cannot penetrate through solids.