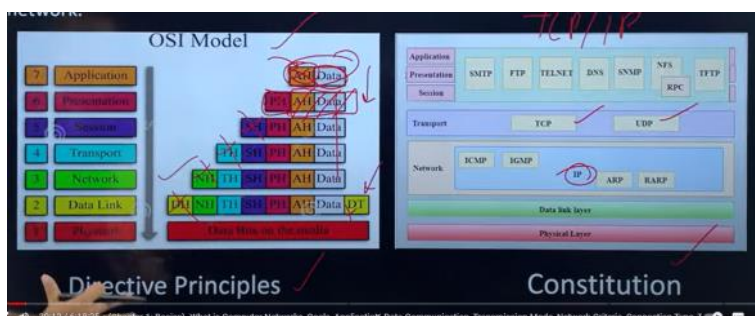


Two types of communication service

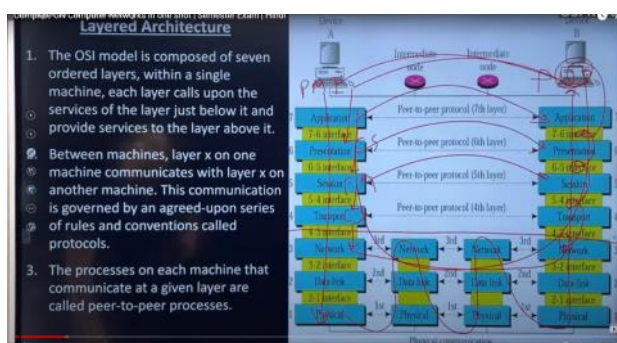
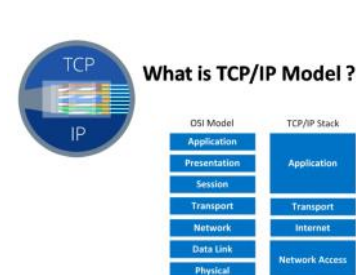
Connectionless and connection-oriented service

TCP	UDP
Connection oriented	1) Connectionless
Reliable <u>Ordering</u>	2) Less Reliable (No ordering)
Error Control is mandatory	3) Error Control is optional
Slow transmission	4) Fast transmission
More overhead	5) Less overhead
Flow control, Congestion control	6) No FC, CC



This is the approach

This is the principle



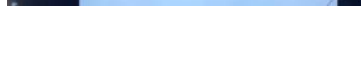
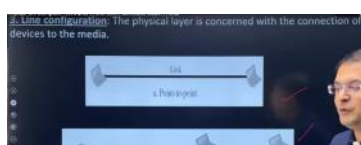
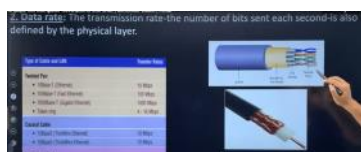
OSI Layers (7)

Physical

- 1) Data rate
- 2) Synchronization of bits
- 3) Transmission medium
- 4) Physical topology
- 5) Physical mode

Example :- Modem, Hubs, Ethernet

Analog to digital and vice versa yeh kaam hota hai physical Layer ka



OSI Layers (6)

Datalink

- A Reliable link
- Means of activating, maintaining and deactivating
- Framing (Header and Trailer)
- Flow control



- A Reliable link
- Means of activating, maintaining and deactivating
- **Framing (Header and Trailer)**
- Flow control
- Error Control
- Access Control

Physical Addressing

- MAC address 48 bit
- Example :-Switch

Speed ka dhyaan rakhna

Data link layer

4. **Flow control:** If the rate at which the data are absorbed by the receiver is less than the rate at which data are produced in the sender, the data link layer imposes a flow control mechanism to avoid overwhelming the receiver.



3. **Access control:** When two or more devices are connected to the same link, layer protocols are necessary to determine which device has control over the link at any given time.

Multiple-access protocols

- Random-access
- Controlled-access
- Channelization

Data link layer

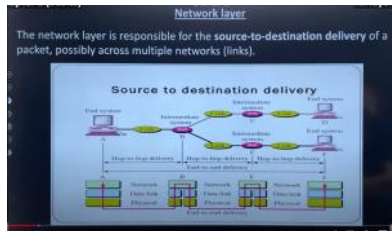
5. **Error control:** The data link layer adds reliability to the physical layer by adding mechanisms to detect and retransmit damaged or lost frames. It also uses a mechanism to recognize and discard duplicate frames. Error control is normally achieved through a trailer added to the end of the frame.

Error Control

OSI Layers (5)

Network

- Logical addressing and Routing
 - IP address :- 32 bit
 - Transport of information.
 - Both connection-less and connection-oriented
- Example :-Router



OSI Layers (4)

Transport

- Exchange of data between end systems
- No losses
- No duplicates
- Quality of service(Throughput, transit delay, error rate)
- Port addressing and socket addressing ko pehchanana
- Segmentation and reassembly
- Traffic management between the network

Jo kaam datalink layer karta hai local level par wahi kaam transport layer karta hai bade level par

OSI Layers (3)

Session

- Control of dialogues between applications/Dialogue discipline
- Grouping
- Synchronization/check points
- Recovery

OSI Layers (2)

Presentation

- Provide conversion from one encoding
- schema to another encoding schema
- Translation
- **Encryption**
- **Compression**

OSI Layers (1)

Application

- Means for applications to access OSI environment
- E mail, web browsers,

Store-and-forward: illustration

- distance = d meters; speed of propagation = s m/sec
- transmission rate of link = R bits/s



delay (one packet only)
 $= L/R + d/s$

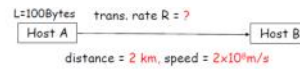
delay (one packet only)
 $= L/R + \frac{1}{2}d/s + L/R + \frac{1}{2}d/s$
 $= 2L/R + d/s$

Example:

- $d/s = 0.5$ sec
- $L = 10$ Mbits
- $R = 1$ Mbps
- delay = 10.5 sec

Example:

- $d/s = 0.5$ sec
- $L = 10$ Mbits
- $R = 1$ Mbps
- delay = 20.5 sec



Question:

- At what rate (bandwidth) R would the propagation delay equal the transmission delay?

How much time will it take to send a packet of size L bits from A to B in given setup if Bandwidth is R bps, propagation speed is t meter/sec and distance b/w any two points is d meters (ignore processing and queuing delay) ?
 $A \rightarrow R1 \rightarrow R2 \rightarrow B$

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- Total time = $3 \cdot (L/R + d/t)$ sec

Answer:

- Propagation delay = 2×10^3 (m) / 2×10^8 (m/s) = 10^{-5} sec
- Transmission delay = 100×8 (bits) / R
- Prop. delay = trans. delay $\Rightarrow R = 10^5 \times 100 \times 8 = 80$ Mbps

Suppose two hosts A and B are separated by 10,000 kilometers and are connected by a direct link of $R=1$ Mbps. Suppose the propagation speed over the link is 2.5×10^8 m/sec.
a) Calculate the bandwidth-delay product $R \cdot t$