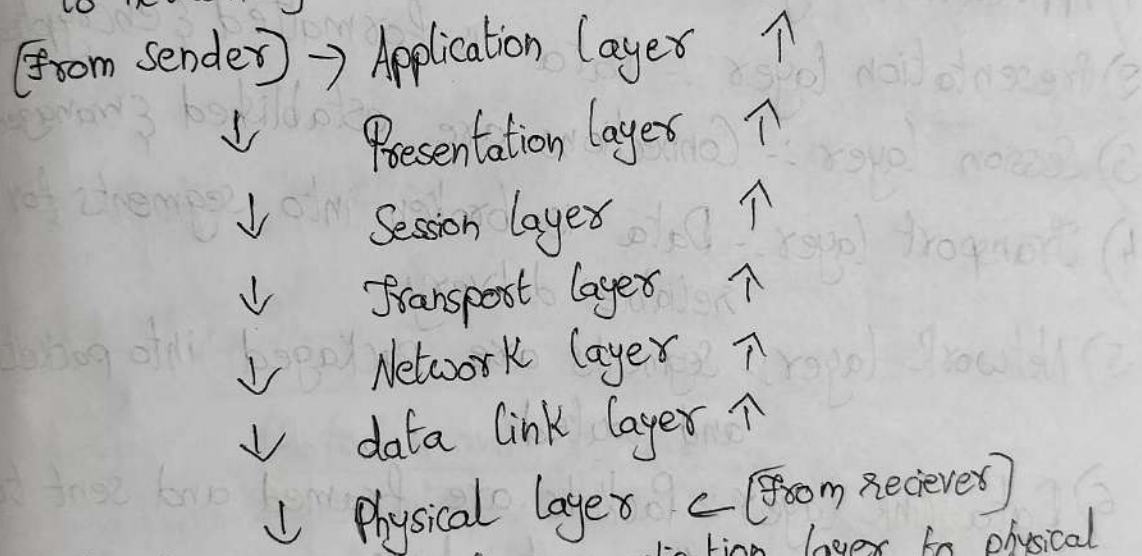


Data Communications

• OSI Model:-

⇒ OSI stands for open System Interconnection. It is a 7 layer architecture with each layer having specific functionality to perform

⇒ The OSI model created in 1984 by ISO, is a reference framework that explains the process of transmitting data between computers. It is divided into seven layers that work together to carry out specialized network functions, allowing for a more systematic approach to networking



⇒ The transfer goes from application layer to physical layer in sender

⇒ The transfer takes place from physical layer to application layer in receiver.

• Open System:-

⇒ A Computer System where user access is not controlled by the same people responsible for its contents

⇒ Open System mean an environment in which system access is not controlled by the person who are responsible for the content of electronic records that are on the system

• Closed Systems:-

⇒ A Computer System whose user access is controlled by the same people responsible for its contents

⇒ Closed system means an environment in which system access is controlled by the person who is responsible for the content of electronic records that are on the system.

• Layers:-

1) Application layer :- Apps create the data

2) Presentation layer :- Data is formatted & encrypted

3) Session layer :- Connections are established & managed

4) Transport layer :- Data is broken into segments for reliable delivery.

5) Network layer :- Segments are packaged into packets and routed.

6) Data Link layer :- Packets are framed and sent to the next device.

7) Physical layer :- Frames are converted into bits and transmitted physically.



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Data Link layers

Framing Control of Media (MAC)

Controls how data is placed
Media access control
Error detection

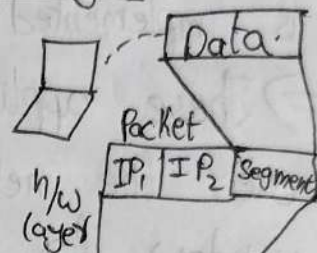
Carrier Sense Multiple Access

(LAN cable, fibre, Wi-Fi)

CSMA (ca)

Data Link layer

Physical layer



Data Link layer MAC1 MAC2 Packet FCS

Air, LAN, optical BITS → Media

Frame checking sequence

MAC = Media Access Control

Networking of data Communications:-

Protocols and Standards	
Data communication	Networking
Components	LANs & WANs
Data representation	Distribution process
Data flow	Criteria Structure

★ 7 layers

1) Application layer:-

⇒ At the very top of the OSI reference model stack of layer, we find the application layer which is implemented by the network application

⇒ These application produce the data to be transfer over the network. This layer also serve as a window for the application services to access the network and for displaying the received information to the user.

Eg:- 1) Google Mozilla



FTP

[File transfer protocol]

3) Email

↓
SMTP [Simple Mail Transfer Protocol]

2) Skype

↓
Web Surfing

[HTTP/HTTPS]

4) Virtual terminal

↓
Telnet

2) Presentation layer:-

⇒ Presentation layer is also called as transmission layer

⇒ The data from the application layer is extracted here manipulated as per the required format to transmit over network

Functions:-

→ Translation:- For example, ASCII to Binary

→ Encryption/Decryption:-

- Data encryption translates the data into another form or code

★ Note:-

C TCP/

- The encrypted data is known as the cipher text & the decrypted data is known as plain text.
- Key value is used for encrypting as well as decrypting data

→ Compression :-

- Reduces the number of bits that need to be transmitted on the network.

3) Session layer :-

→ Authentication :-

- The layer allows the two process to establish, use, and terminate a connection.

→ Authorisation :-

- The layer allows a process to add checkpoints that are considered synchronization points in the data.
- These synchronization points helps to identify the error so that the data is re-synchronized properly, and data loss is avoided

→ Session Management/Dialog Control :-

- The session layer allows 2 system to start communication with each other in half-duplex or full duplex

Note :- All the above 3 layers are integrated as a single layer in the TCP/IP model as the "Application layer"

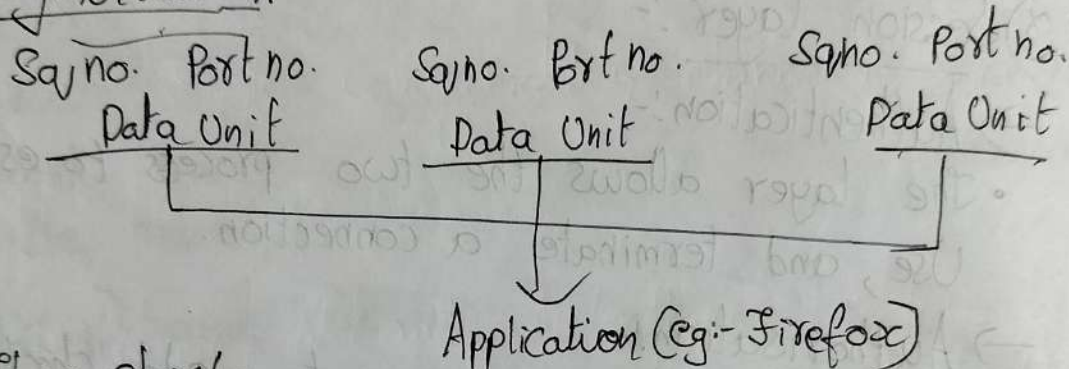
• These are also known as "Upper layer" or "software layer"

C TCP/IP model :- Transmission Control protocol / Internet Protocol

4) Transport layer:-

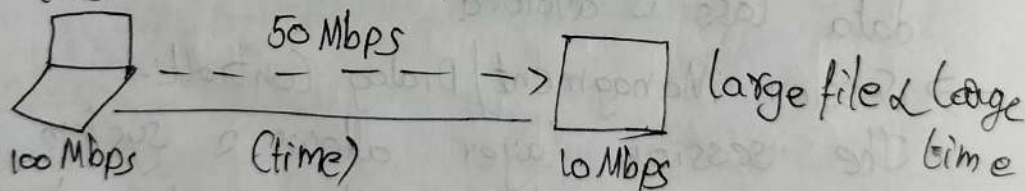
- The transport layer provides services to the application layer and takes services from network layer. The data in transport layer is formed as segments.
- It is responsible for the end-to-end delivery of the complete message.

★ → Segmentation:-

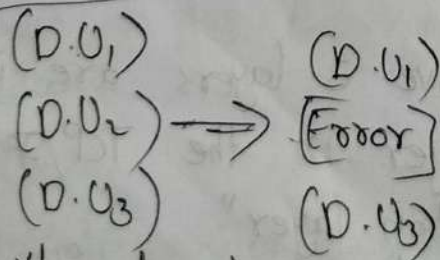


★ → Flow Control:-

It ensures the file which is getting transmitted in mbps speed from the sender end control the flow of file for the receiver end which may have less or more Mbps.



★ → Error Control:-



It will automatically repeat request.

→ Protocol:-

orientation transmission → TCP (Transmission Control Protocol)
 Connected transmission → UDP (User Datagram Protocol)

5) Network layer:-

The network layer works for the transmission of data from one host to other located in different networks. It also takes care of packet routing i.e. selection of the route to transmit the packet, from the number of routers available.

→ Functions:-

① Routing:- The network layer protocols determine which route is suitable from source to destination. This function of network layer is known as routing.

② Logical addressing:- To identify each device in network uniquely, the network layer defines an addressing scheme. The sender and receiver IP addresses are placed in the header by the network layer.

6) Data link layer:-

[IPv4 & IPv6]

→ Framing:-

Framing is a function of the data link layer. It provides a way for a sender to transmit a set of bits that has meaning to the receiver. This can be accomplished by attaching special bit patterns to the beginning and end of the frame.

→ Physical Addressing:-

After creating frames, the data link layer adds physical address of the sender and/or receiver in header of each frame.

→ Error Control:-

The data link layer provides the mechanism of error control in which it detects and retransmits damaged or lost frames.

→ Flow Control:-

The data rate must be constant on both sides else the data may get corrupted.

→ Access Control:-

When a single communication channel is shared by multiple devices.

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1) Application layer :- Network Applications

File transfer → FTP (File Transfer Protocol)

Web Surfing → HTTP/s (Hypertext Transfer Protocol Secure)

Emails → SMTP (Simple Mail Transfer Protocol)

Virtual Terminal → Telnet

2) Presentation layer :-

Translation (SSL - Secure Sockets Layer)

↓
Data Compression

↓
Encryption/Decryption

eg:- ASCII → EBCDIC

3) Session layer :-

7) Physical Layer:-

⇒ It's main role is to handle the physical connection b/w devices in a network

Transmission of raw data [Converts data into electrical, optical, or radio signals for transmission over physical medium]

↓
Physical Medium [Define characteristics of physical medium used for transmission]

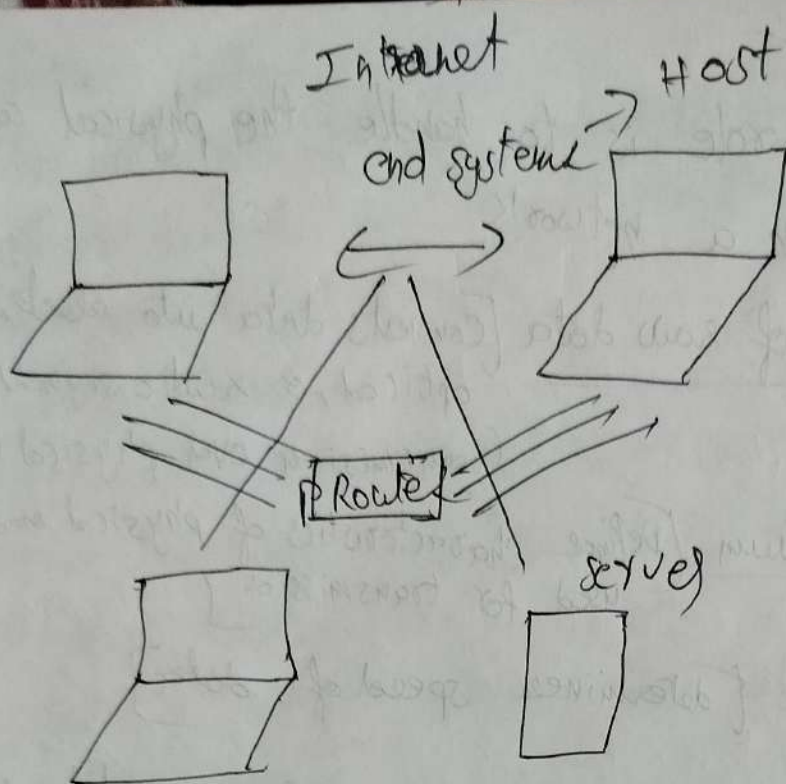
↓
Data rate [determines speed of data]

↓
Signal strength [Manages strength & quality of signals]

↓
Topology:- [Defines the physical layout of devices in the network]

⇒ ~~It's job is to~~

⇒ It is responsible for actual transmission of data over the physical medium, defining how devices connect & communicate at hardware level



CAN (Local area network):-

⇒ Usually for an office and a building or a Campus limit

⇒ Limited access for few kilometers

⇒ Single transmission media

⇒ Topology used are ring, bus, star

MAN (Metropolitan Area Network):-

⇒ Designed to extend over a city

⇒ It may be a single network or a collection of CANS

⇒ Private company ownership

Ex - Private telephone operators or cable operators

WAN (Wide area Network):-

- ⇒ Owned by a single company
- ⇒ Connection of network is also possible for large geographical area
- Eg:- Country, Continent wise

Intranet:-

- ⇒ A network within the network is called intranet
- Eg:- A LAN within the LAN

Internet:-

- ⇒ Interconnection of two or more networks

Network Device & Components

* Four major components

1. End point

- ⇒ PCs, Servers, Printers, Phones etc

2. Interconnections

- ⇒ NIC cards, Media, Cables

3. Switches

- ⇒ Connects endpoints to the local area network (LAN)

4. Router

- ⇒ Connect multiple LANs to form Internetworks
- ⇒ Choose best path between LAN & Wide area Networks (WAN)

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Minor Components

- 1) NI C:- Network Interface Card
- 2) HUB :- Distribution
- 3) Firewall :- Securing Network
- 4) Repeater :- Regenerating Signals
- 5) Modem :- Inway/Outway to network (conversion)

Network edge and core

End Systems of Hosts
(end point of the n/w)

Server client

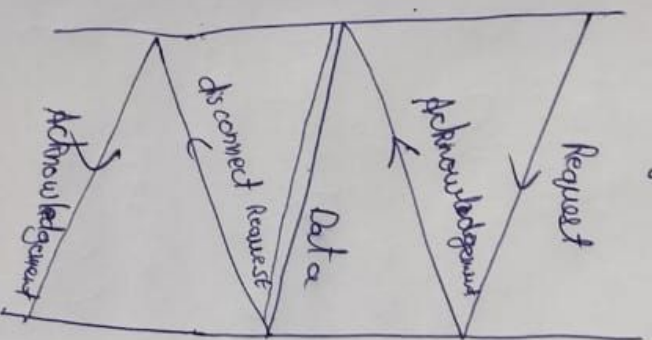
Network Core

Connection of different network segments or the body part

Switching → Packet data gram
→ message
→ circuit

Switching:- The process in which the message is transferred from sender to receiver

Circuit Switching:-



- 1) Circuit establishment
- 2) Data transferring
- 3) Circuit disconnection

(overseer)

Cyber security

How infographics can enhance understanding

→ Infographics :- By presenting complex information in a clear, concise and visually appealing format

→ Here's how infographics can enhance understanding

1. Visual Representation
2. Simplification of complex information
3. Increased retention
4. Comparison & Contrast
5. Storytelling
6. Accessibility
7. Shareability

Network edge :-

Malware:-

* Description :- Malicious software designed to infiltrate, damage, or disrupt computer systems including viruses, worms, Trojans, ransomware, encrypting files

Phishing:-

* Deceptive attempt to trick individual into divulging sensitive information, such as login credentials, by impersonating trusted entities through email, websites or messages

Social engineering :-

* Psychological manipulation exploit techniques used to exploit human vulnerability such as trust or curiosity to getting unauthorized access to systems or information

Insider Threats:-

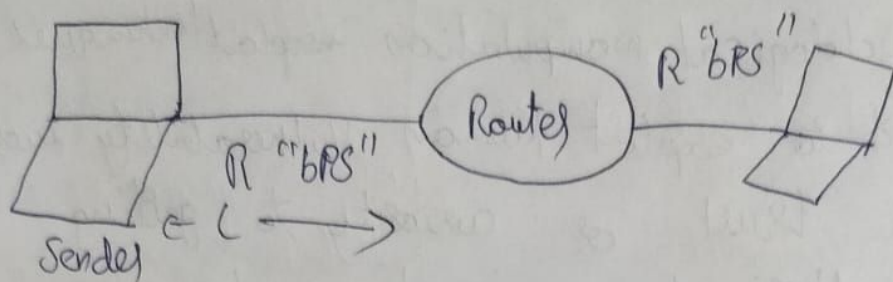
* Risk posed by individuals within an organization who misuse their access privileges to intentionally or unintentionally compromise data, systems or network

Dos :-

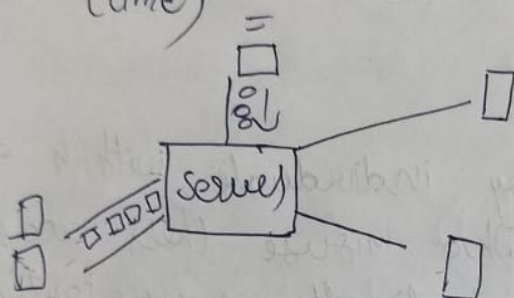
Attempts to disrupt the availability of functionality of online services by overwhelming targeted systems or network with an excessive volume of traffic or requests

Subject line:-

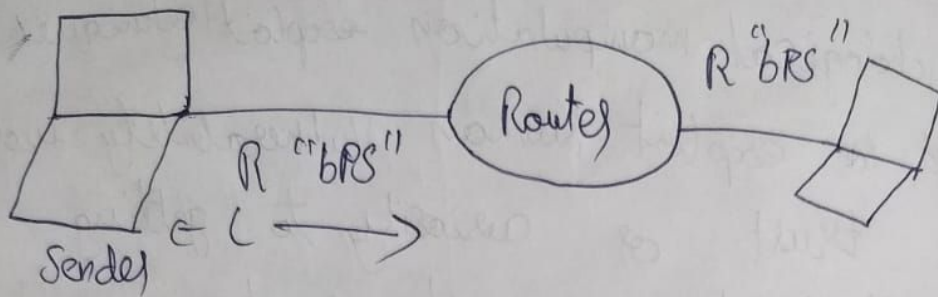
(S@80398148809042)*



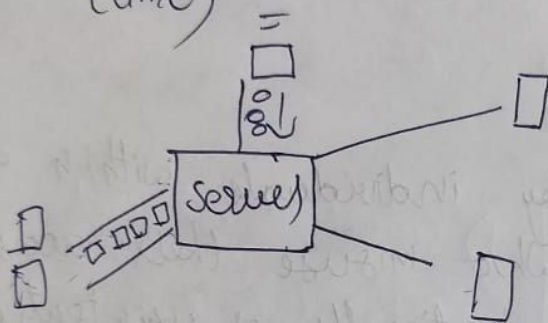
Normal Delay = $\frac{L}{R}$; end to end $\rightarrow \frac{2L}{R}$
(time)



Eg:- $\frac{7.5 \text{ mbps}}{\text{sender}} \xrightarrow{5 \text{ sec}} \frac{1.5 \text{ mbps}}{\text{receiver}}$



Normal Delay = $\frac{L}{R}$; end to end $\rightarrow \frac{2L}{R}$
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Eg:- $\frac{7.5 \text{ mbps}}{\text{sender}} \xrightarrow{5 \text{ sec}} \frac{1.5 \text{ mbps}}{\text{receiver}}$

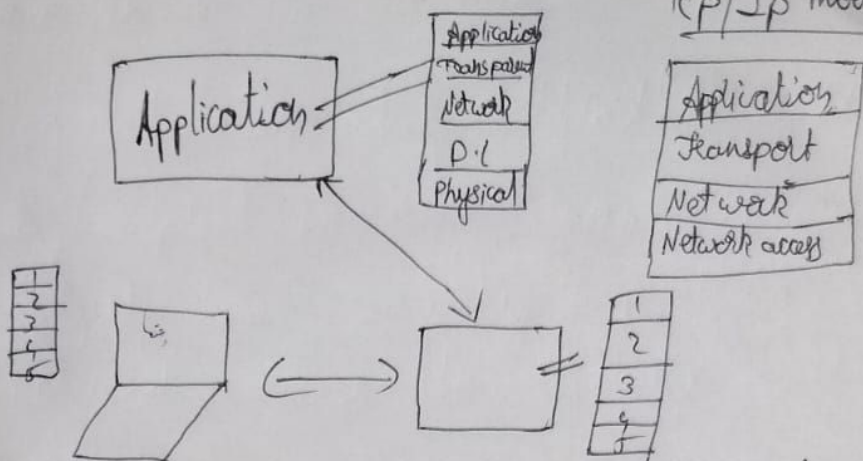
Application layer principle and architecture

- ① \Rightarrow Overall layout and shape
- i) client-Server Architecture (Purchase & Server)
- ii) Peer to Peer ~~server~~ architecture \rightarrow Each element is a purchaser \rightarrow One client
- iii) Three tier architecture \rightarrow Consumer, middle ware element, data base
- iv) Micro service architecture \rightarrow (group of small \rightarrow service)

1. Generate
2. Error
3. Sender
4. Add

→ 21
R

all & server)
ch element is
urchase → one server
es, middle ware
data base for
up of small
service)



Tcp/Ip model

1. Generate the data & represent request connection
2. Error free Data communication segments
3. Send packets
4. Add destination to mac