CN Notes by :- JPwebdevelopers

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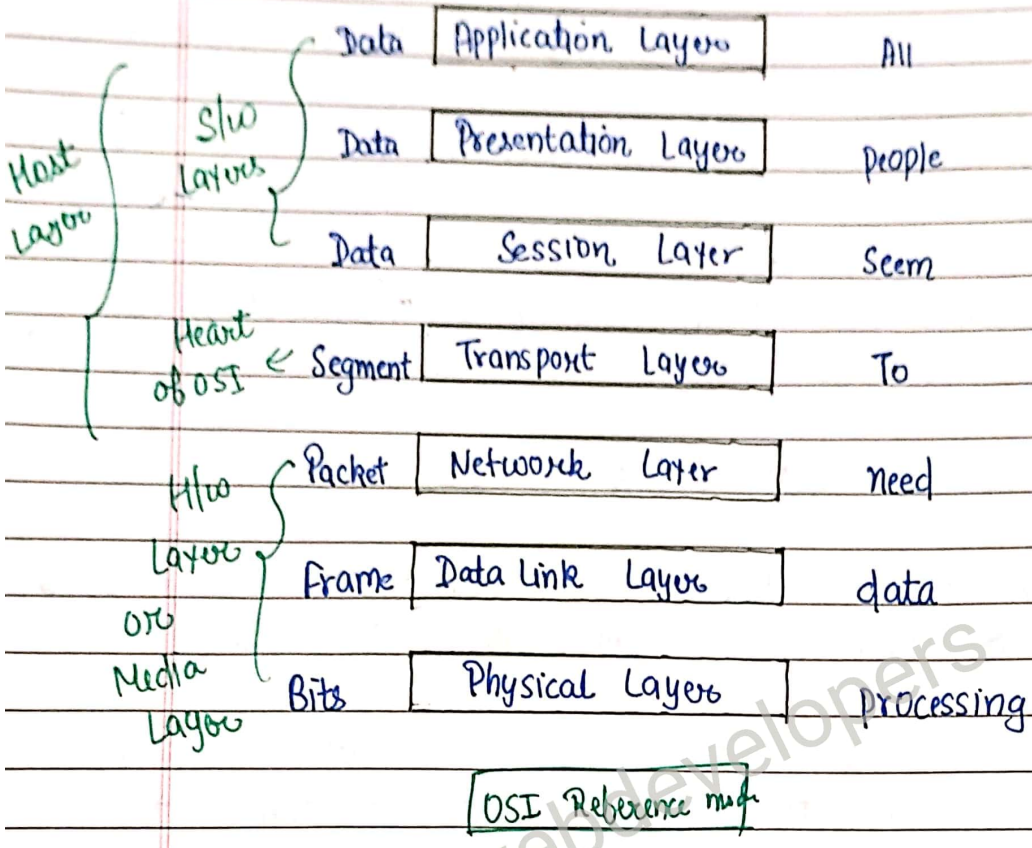
OSI REFERENCE MODEL

- OSI stands for Open System Interconnection. It is a reference model.
- Introduced in late 1970s. → 1983
- An International standards Organization (ISO) covers aspects of network communication of OSI.
- This model is called OSI because this model allows any two different systems to communicate regardless of their underlying architecture.
- It consists seven separate but related layers.
  1. Physical layer
  2. Data link layer
  3. Network layer
  4. Transport layer
  5. Session Layer
  6. Presentation layer
  7. Application Layer.



OSI Reference model

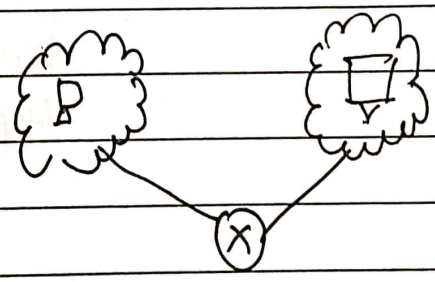
First Layer of OSI Model

At sender side → Application Layer.

At receiver side → Physical Layer.

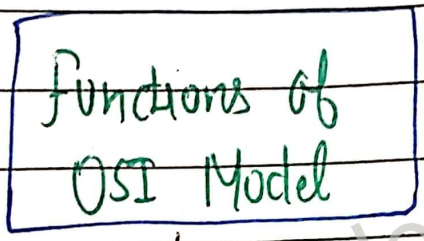
Minimum 3 Connections are required for data communication:-

- N/w to N/w
- Host to Host
- Port to Port



Functions of OSI Model

The functions of OSI Model that are needed for Proper communication can be divided into two types:-



- Mandatory Functions
  - Error Control
  - Flow Control
  - Access Control
  - Multiplexing & Demultiplexing
  - Addressing
- Optional Functions
  - Encryption / Decryption
  - Check pointing
  - Routing

Layers in OSI Model

Physical Layer

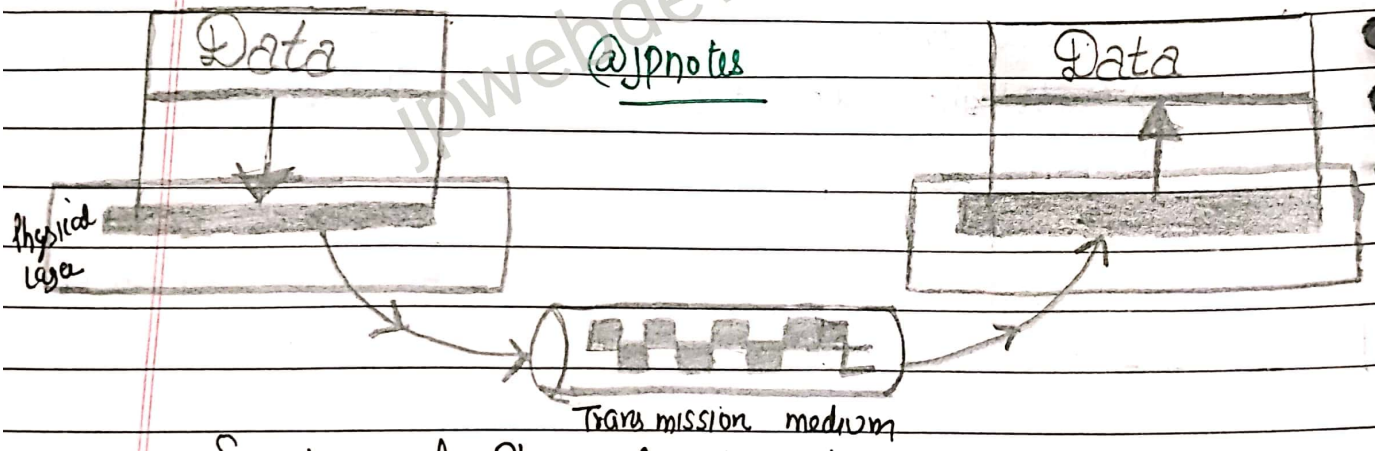
Sender side Last Layer, Receiver side first layer

→ Physical Layer is the bottom (layer 1) of OSI model.

→ It is responsible for the actual physical connection between the devices.

Such Physical connection may be made by using twisted pair cable, fiber optic, coaxial cable or wireless comm^n media.

→ This layer comes under the category of hardware layer, since this layer is responsible for all the physical connection establishment and processing too.



Functions of Physical Layer:

1. Transmission Media
2. Topology
3. Multiplexing
4. Encoding
5. Cables & Wires
6. Modulation / Demodulation

IEEE, Thomas → standards

↑ Signal format & share

7. Circuit Switching
8. Network Type

carries ← Hubs, Repeaters

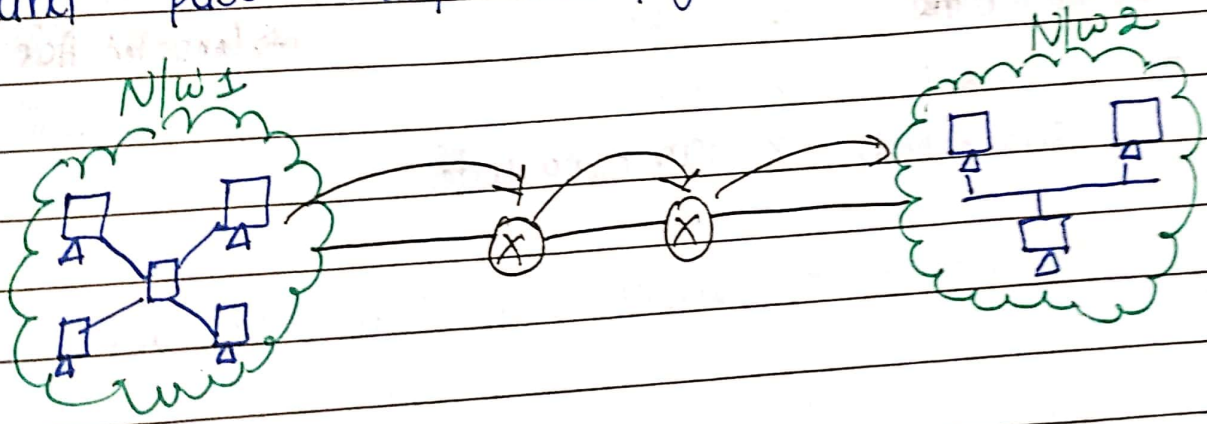
Protocols
- DSL (Digital subscriber line)
- ISDN (Integrated Services Digital N/ws)
- Bluetooth
- Wifi
- Ethernet

(2) Layer 2:- Data Link layer

hop to hop
P2P
node to node

(Bottom)

- Second layer of OSI model.
- Responsible for reliable node to node (Point to Point) delivery of data from network layer and creates frames, add physical address to these frames and pass them to physical layer.



Data Unit - frames ← delivery of frames.

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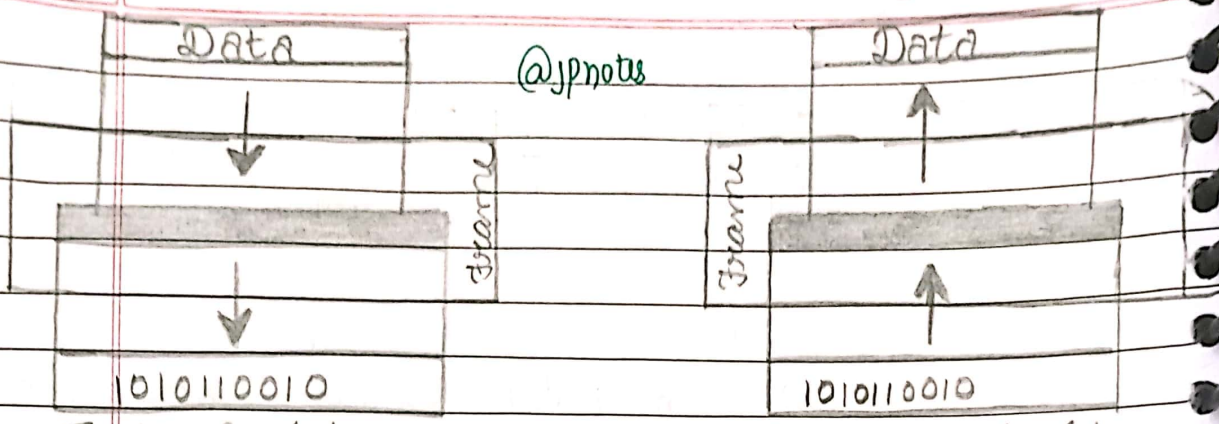

* Data link layer consists of two sub layers

- Logical link layer (LLC)
  - functions
    - Flow Control
      - → Stop & Wait
      - → Go back N
      - → Selective Repeat
    - Error Control
      - → Checksum
      - → CRC
      - → Hamming Code
- Medium Access Control (MAC)
  - ↳ Adds MAC address (Physical address)
  - Protocols
    - → Random Access Protocol
      - → Controlled Access Protocol
      - → Channelization Protocol

N/w Devices :- Switch, Modem, Bridge.

Protocols :- SDLC (Synchronous data link control)
HDLC (High level data link control)
SLIP (Serial line Interface Protocol)
LIP (Link control Protocol)
PPP (Point to Point ")
NCP (N/w control Protocol)

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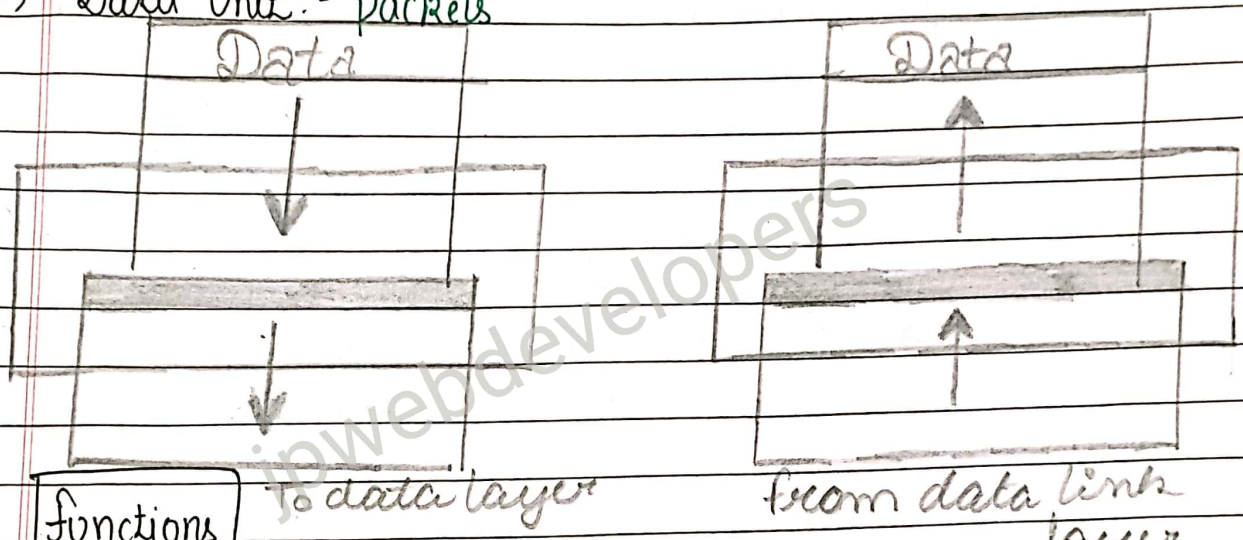
③ Network Layer

→ Third layer of OSI Model.
→ Responsible for host to host or source to destination delivery of packet accross multiple networks (links).

→ Data Unit :- packets



Functions

↳ Provide logical Addressing
↳ Path determination (Routing of Packets & forwarding)
↳ Internetworking
↳ Fragmentation

Protocols

↳ ARP (Address Resolution Protocol)
↳ ICMP (Internet Control Message Protocol)
↳ BGP (Border Gateway Protocol)
↳ IP (Internet Protocol)
↳ IGMP (Internet Group Protocol)
↳ RARP (Reverse Address Resolution Protocol)
IPSec

Network devices

↳ Routers
↳ Gateway
Layer 3- switches

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It translates logical N/w address into physical machine address i.e. the number used as destination IDs in the physical network cards

Example N/w layer → Produce billing information

Problems
↳ inefficient path selection algorithms
↳ incorrect data formats
↳ " routing information.

* **Layer - 4** **Transport Layer.**

(End to End connection) ↳ Data Unit :- Segment

→ fourth (Layer 4) of OSI model.

→ Responsible for end to end process to process and port to port communication (delivery of entire message) (source to destination).

→ It also looks after **error control** and **flow control** and connection control at source to destination level.

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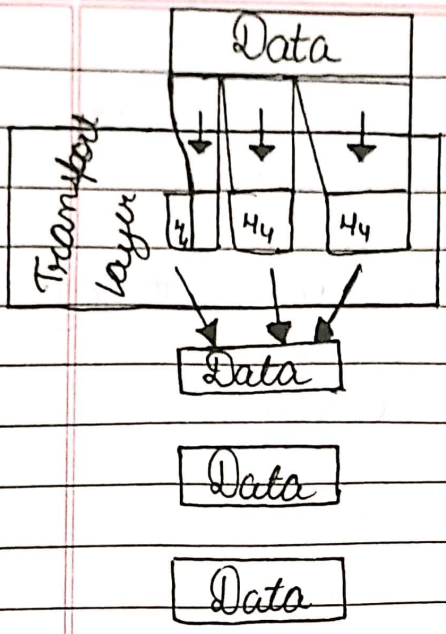

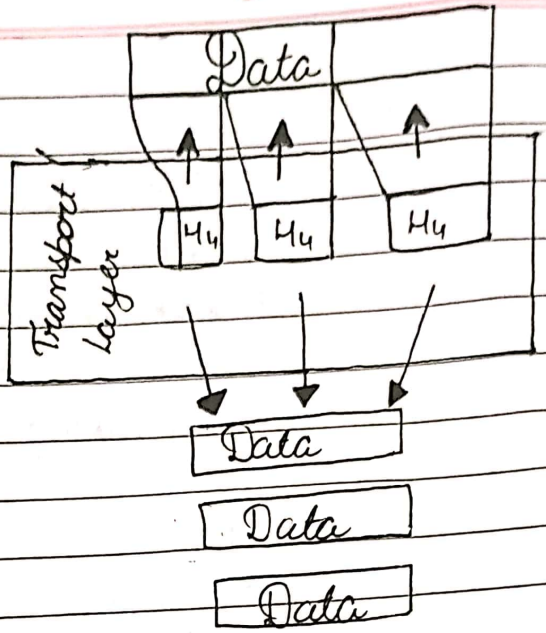

Transport layer provides two types of services?

Connection Oriented Transmission

→ sends an Acknowledgement back to the source after a packet or group of packet is received.

Connectionless Transmission

→ Receiver does not acknowledge receipt of a packet

Functions

- Segmentation
- Service Point Addressing
- Multiplexing & Demultiplexing
- Congestion Control
- Error Control → checksum
- end to end connection
- Flow Control

Protocol

→ TCP (Transmission Control Protocol)
→ UDP (User datagram Protocol)
→ DCCP (Datagram Congestion Control Protocol)
→ SSL (Secure Socket Layer)
→ TLS (Transport Layer Security)

N/w Devices	H/w devices
→ Gateways	N/w cards
→ Firewall	Routers

Problems

→ Inefficient path selection algorithms.
→ Incorrect data formats.

TCP vs UDP

TCP	UDP
→ Connected	Connectionless
→ State memory	Stateless
→ Byte Stream	Packet / Datagram
→ Ordered Data delivery	No Sequence gaurnted
→ Reliable	Lossy
→ Error free	Error packed discarded
→ Handshake	No Handshake
→ Flow Control	No Flow Control
→ Relatively Slow	Relatively fast
→ P2P	Multicast
→ Security ← SSL, TLS	Security :- DTLS

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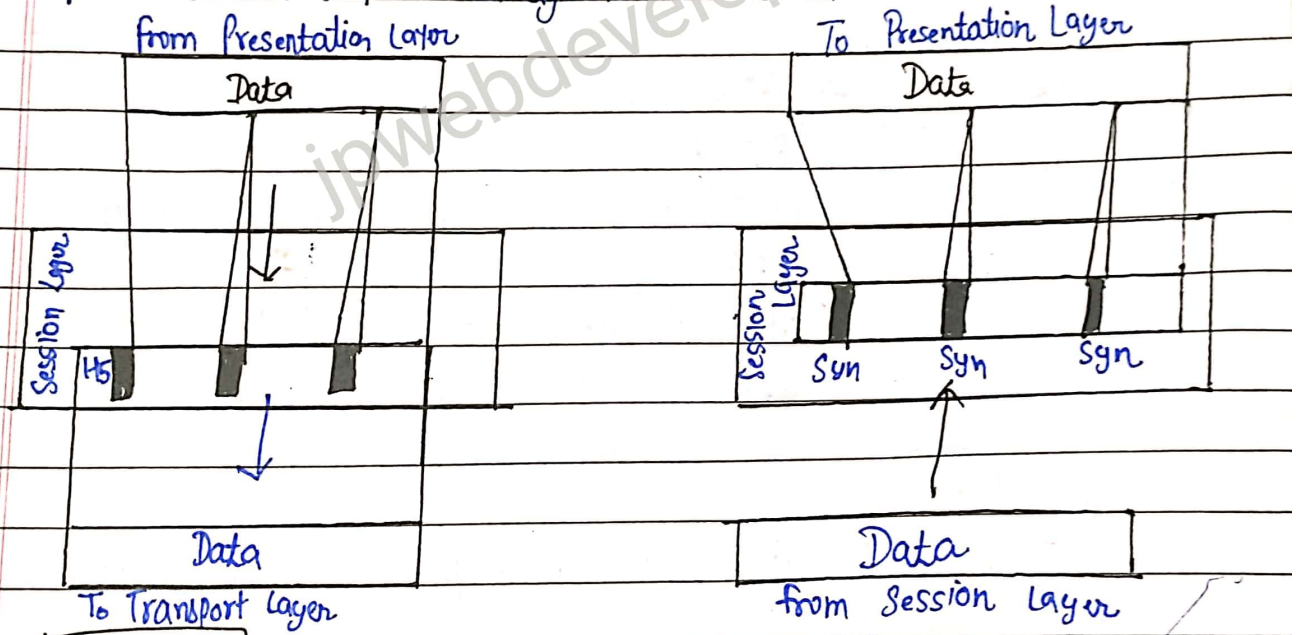
⑤ Session Layer

→ Session Layer is the fifth, (Layer 5) of OSI model.

→ Responsibility of beginning, maintaining and ending the communication between two devices, which is called Session.

→ This layer allows users on different machine to establish active communication session between them.

→ Provide token management service.



Functions

↳ Authorization & Authentication

→ ~~Digit~~ Dialog Control → It determines which device will communicate first and the amount of data that will be sent (either half or full duplex mode).

→ **Synchronization** :- Synchronizing information from different sources.

→ **Token Management** :- It prevents two users to simultaneously access or attempting the same critical operation.

→ **Checkpoints** responsible for adding checkpoint or markers within the message.
→ also enables communication sessions which are to be resumed from that particular checkpoint at which communication failure has occured.

Protocols → ADSP (Apple Talk Data Stream Protocol)
RTCP (Real Time Transport Control Protocol)
PPTP (Point to Point Tunneling Protocol)
PAP (Password Authentication Protocol)
*RPCP (Remote Protocol call)
SDP (Sockets Direct Protocol).

Problem

Missing or corrupted session data.

Hardware

N/w cards, routers and gateways.

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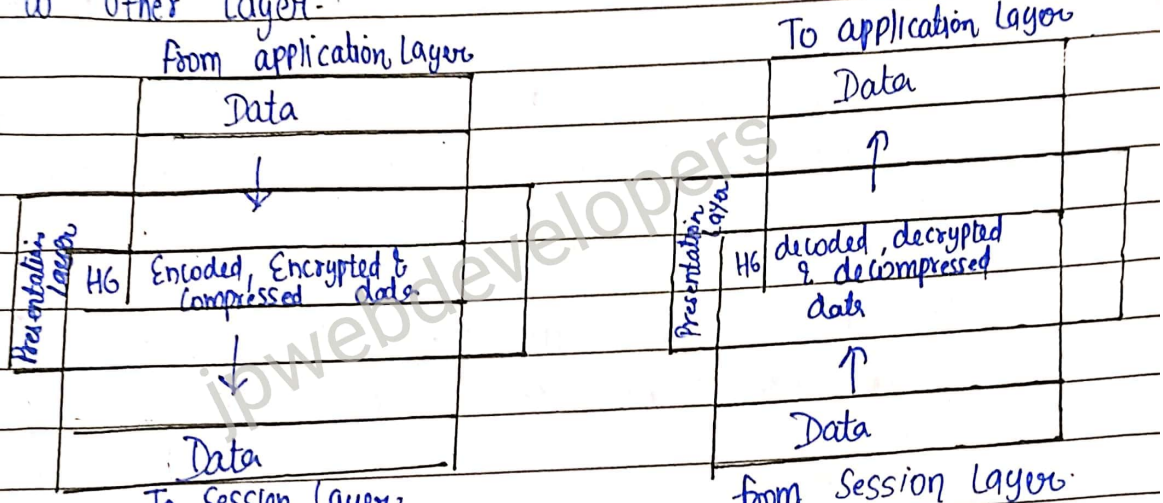
(6) Presentation Layer

→ Presentation layer is sixth (Layer 6) of OSI Model.

→ also known as Translation layer. (Syntax Layer).

→ It is responsible for maintaining the proper syntax of the data which it either receives or transmits to other layer.



Functions

→ Encryption / Decryption
→ Data Compression
→ Data Encryption
→ formatting
→ Serialization

Protocols

→ AEP (Apple Filing Protocol)
→ LPP (lightweight Presentation Protocol)
→ NCP (Network core Protocol)
→ NDR (Network Data Representation)
→ XDR (External Data Representation)

Problems: Conversions errors (caused by incorrect data format)
coding errors

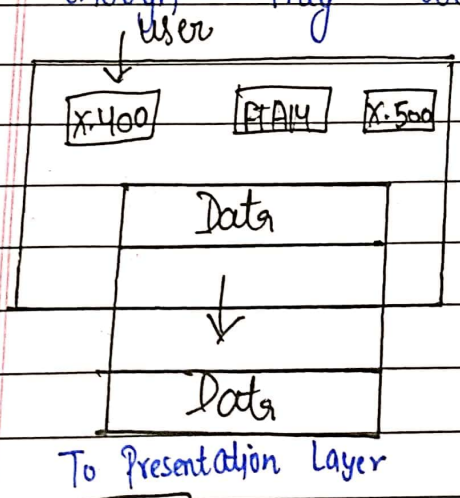
Hardware/- N/w cards
gateways, routers.

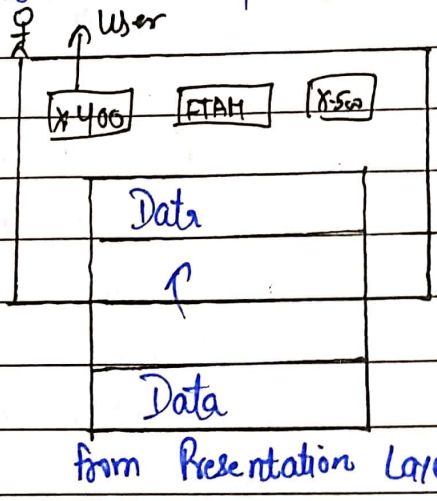
⑦ **Application Layer**
↳ End User layer

→ It is the topmost i.e. seventh layer of OSI model.

→ Application layer interface directly interacts with application and provides common web applications services.

→ It allows the applications to communicate with applications on other computers as though they were on same computer.





Functions

→ Mail services
→ Network Virtual Terminal
→ Directory Services
→ File Transfer, Access & Management (FTAM)

Protocols

→ Telnet (Tele Type N/w Protocol)
→ FTP (File Transfer Protocol)
→ TFTP (Trivial File Transfer Protocol)
→ NFS (Network File System)
→ SMTP (Simple Mail Transfer Protocol)
→ SNMP (Simple N/w Management Protocol)
→ DNS (Domain Name System)
→ DHCP (Dynamic Host Configuration Protocol)
→ HTTP (Hyper Text transfer Protocol).

Telnet:-

↳ helps in terminal emulation.
↳ allows telnet clients to access the resources of the Telnet server.
→ used for managing files on internet.
→ intial setup of devices like switches.
→ Port no. of telnet is 23.

FTP

↳ Promotes sharing of files via remote computers with reliable and efficient data transfer.
↳ Port no. for FTP is 20 for data and 21 for control.

TFTP:-

↳ stock version of FTP, but it's the protocol of choice if you know exactly what you want and where to find it
→ 69 Port number.

④ NFS :-

→ This enables system administrators to consolidate resources onto centralized servers on the network.

→ 2049 Port number.

⑤ SMTP

↳ Part of TCP/IP Protocol.

↳ Using a process called "store and forward"

↳ works closely with [MTA] Mail Transfer Agent.

↳ 25 Port number.

Imp ⑥ SNMP

↳ Servers can share information about their current state.

↳ Port no. 161 (TCP) and 162 (UDP).

⑦ DNS

↳ DNS service must translate the name into the corresponding IP address.

↳ Port no. is 53.

⑧ DHCP :-

↳ give IP address to hosts.

↳ DHCP server can provide to a host when the host is registring for an IP address with the DHCP server.

↳ Port number for DHCP is 67, 68.

⑨ HTTP/HTTPS: (HTTPS ← more secure)

↳ access data from the world wide web.

↳ hypertext is the well-organized documentation system that is used to link pages in the text document.

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⑩ POP:-

↳ Post office Protocol.

↳ POP3 (latest version)

↳ used by user agent for message retrieval from mail servers.

↳ Port number 110.

⑪ MIME:-

↳ Multipurpose Internet Mail Extension.

↳ It is designed to extend the capabilities of the existing internet email protocol like SMTP.

↳ It is not a standalone protocol, it works in collaboration with other protocols to extend their capabilities.

⑫ SIP:-

↳ Session initiation protocol.

↳ enables the Voice over internet protocol (VOIP)

Others

↳ LPD (Line Printer Daemon).

IRC (Internet Relay chat).