



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

19CSB302- COMPUTER NETWORKS

UNIT-1 FUNDAMENTALS AND PHYSICAL LAYER



OSI Architecture



OSI stands for **Open Systems Interconnection**. It has been developed by ISO – ‘**International Organization for Standardization**’, in the year 1984. It is a 7-layer architecture with each layer having specific functionality to perform.

Seven Layers

- Physical layer
- Data link layer
- Network layer
- Transport layer
- Session layer
- Presentation layer
- Application layer

(Please Do Not Touch Stephens Pet Animal)

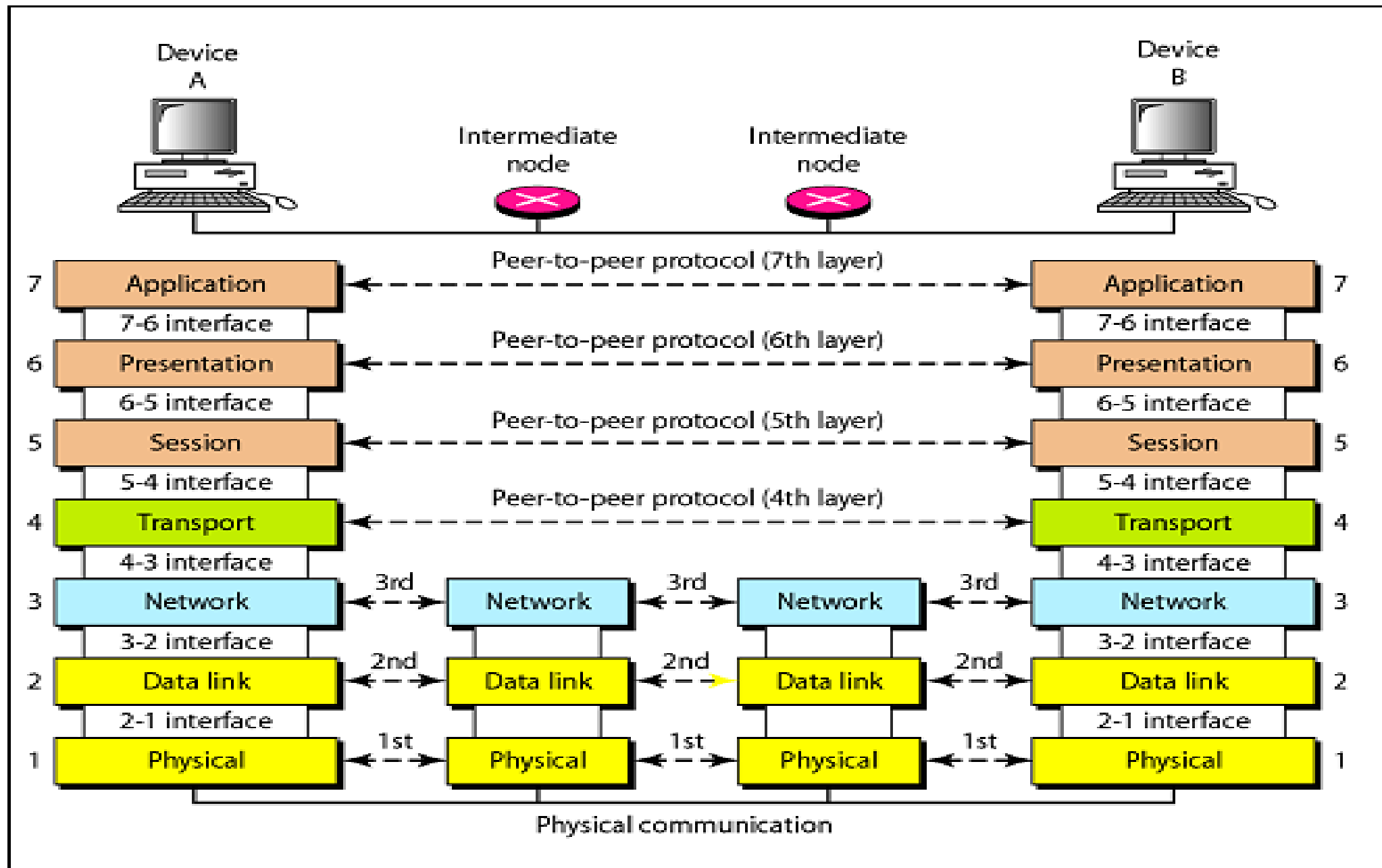


Fig: Communication & Interfaces in the OSI model



Application Layer(Layer 7)



- The application layer is used by end-user software such as web browsers and email clients. It provides protocols that allow software to send and receive information.
- An application layer is not an application, but it performs the application layer functions.
- This layer enables the users to access network resources.
- Hyper Text Transfer Protocol(HTTP), File Transfer Protocol (FTP), Post Office Protocol (POP), Simple Mail Transfer Protocol (SMTP), and Domain Name System (DNS).

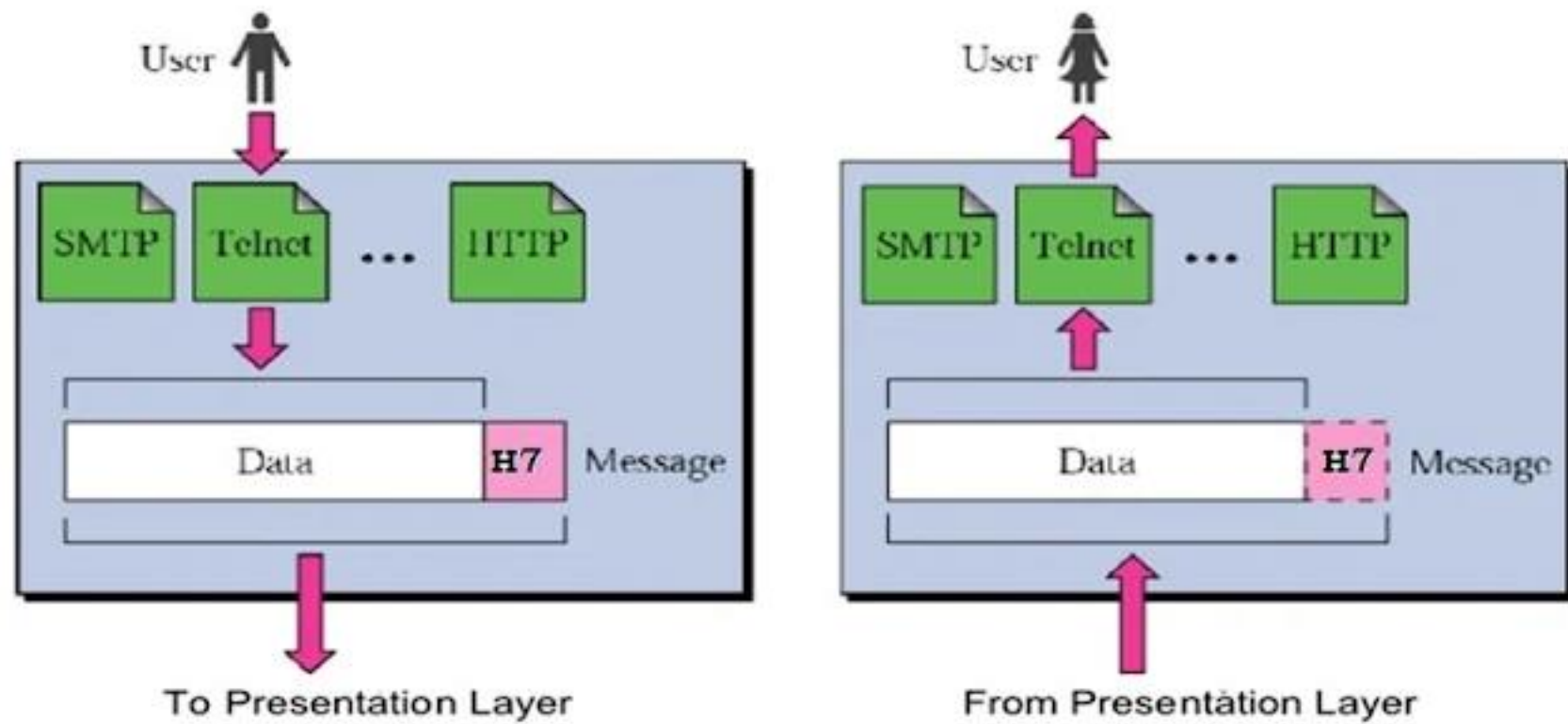


Fig: Application Layer



Functions



- **FTAM** File Transfer Access and Management : This application allows a user to access file in a remote host, retrieve files in remote host and manage or control files from a remote computer.
- **Mail Services** : Provide email service.
- **Directory Services:** This application provides distributed database sources and access for global information about various objects and services.



Presentation Layer(Layer 6)



- A Presentation layer is mainly concerned with the syntax and semantics of the information exchanged between the two systems.
- It acts as a data translator for a network.
- This layer is a part of the operating system that converts the data from one presentation format to another format.
- The Presentation layer is also known as the **syntax layer or translation Layer**



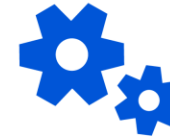
The Presentation Layer



Encryption



Compression



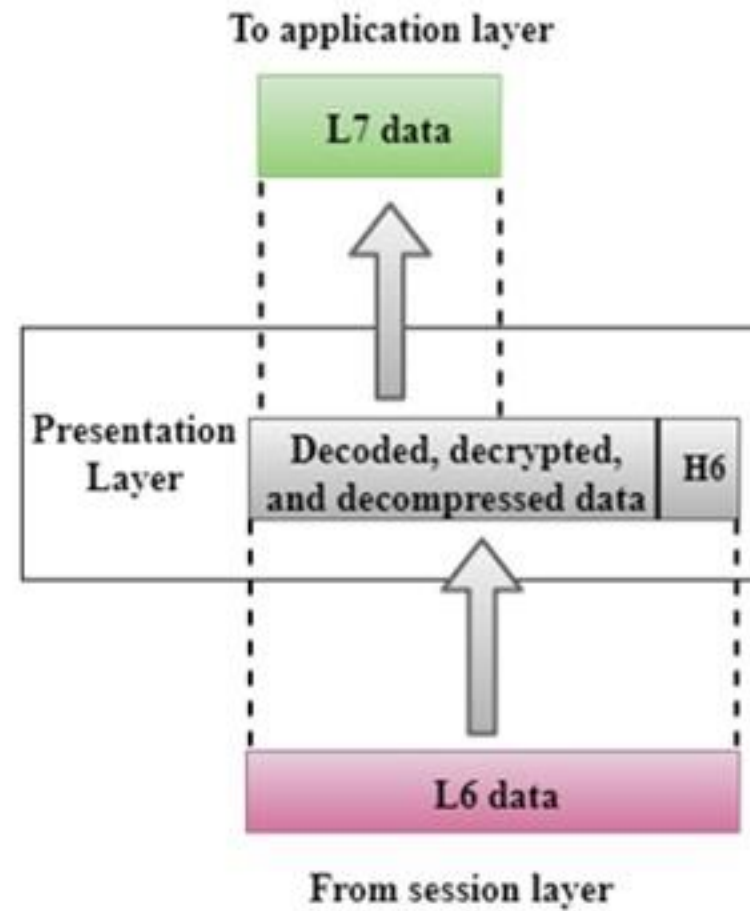
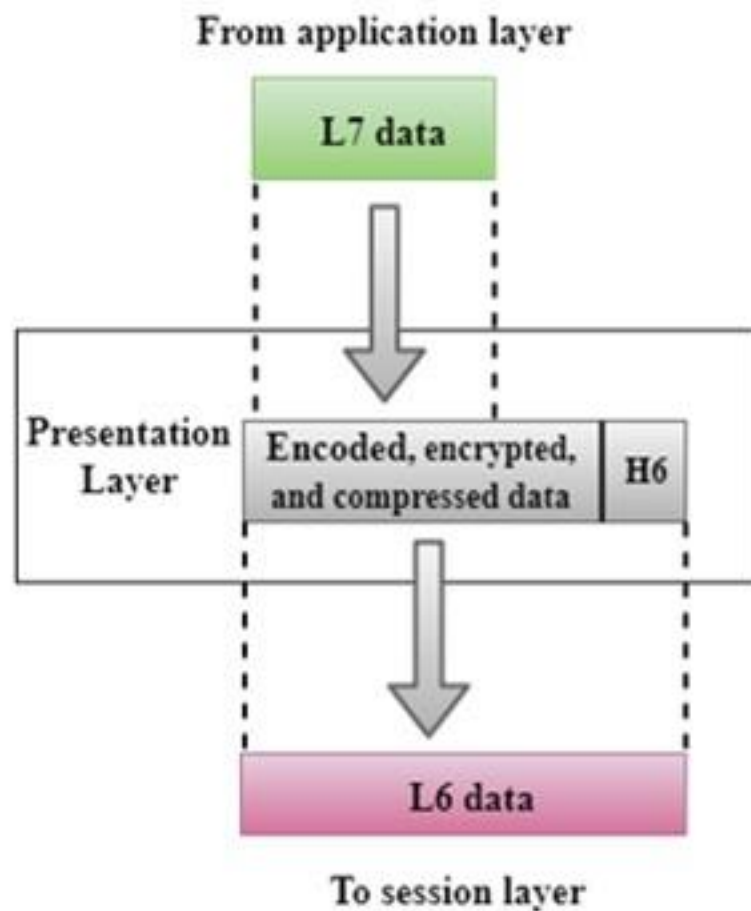
Translation



Functions



- **Translation:** The processes in two systems exchange the information in the form of character strings, numbers and so on. It converts the data from sender-dependent format into a common format and changes the common format into receiver-dependent format at the receiving end.
- **Encryption:** Encryption is needed to maintain privacy. Encryption is a process of converting the sender-transmitted information into another form and sends the resulting message over the network.
- **Compression:** Data compression is a process of compressing the data, i.e., it reduces the number of bits to be transmitted. Data compression is very important in multimedia such as text, audio, video.



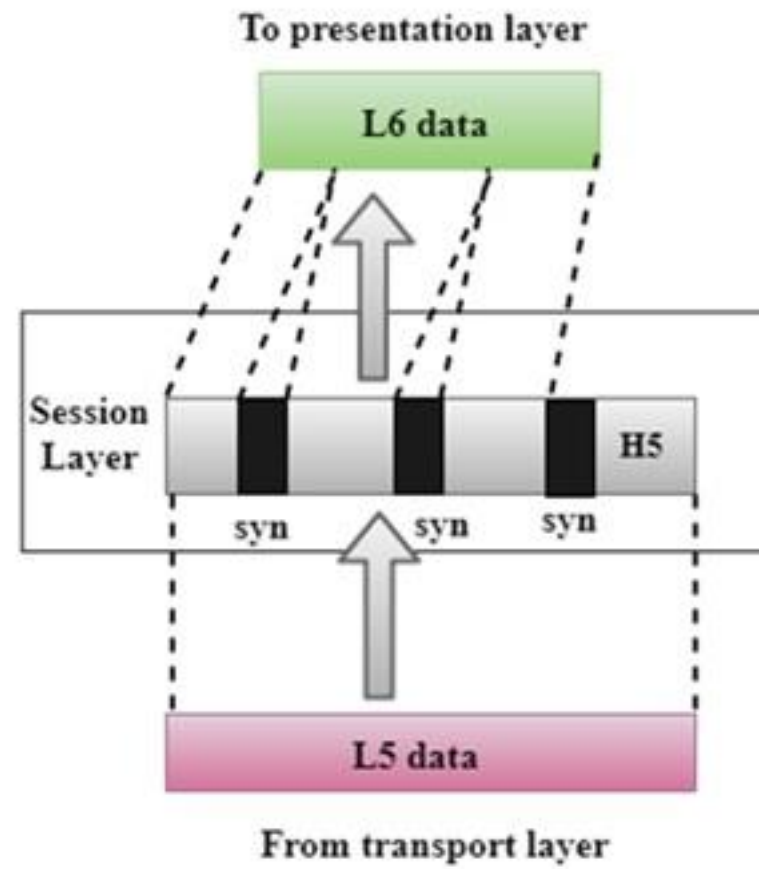
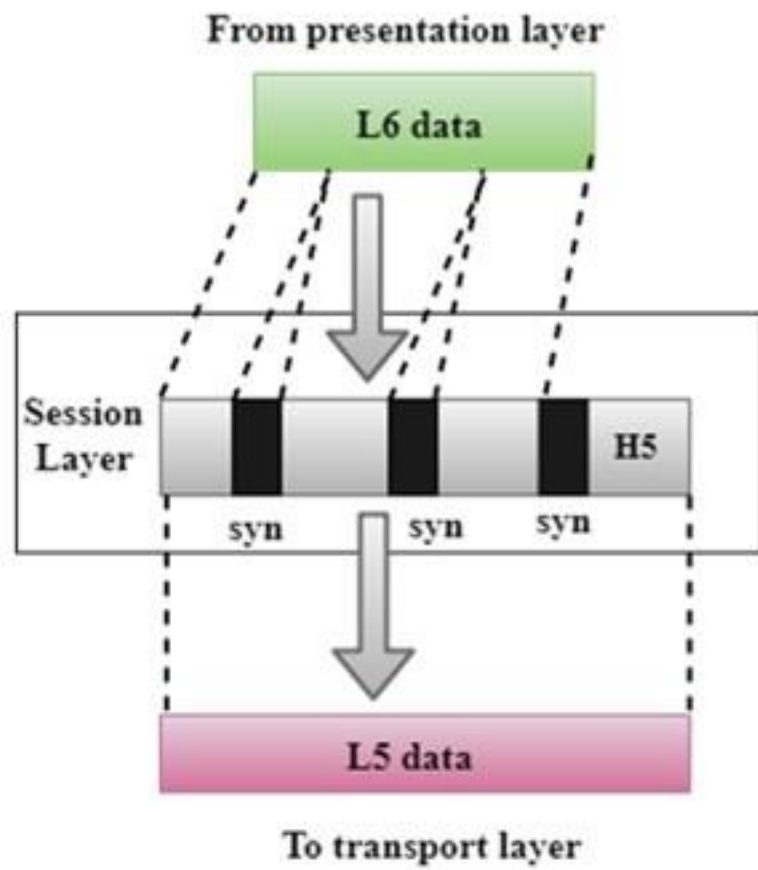


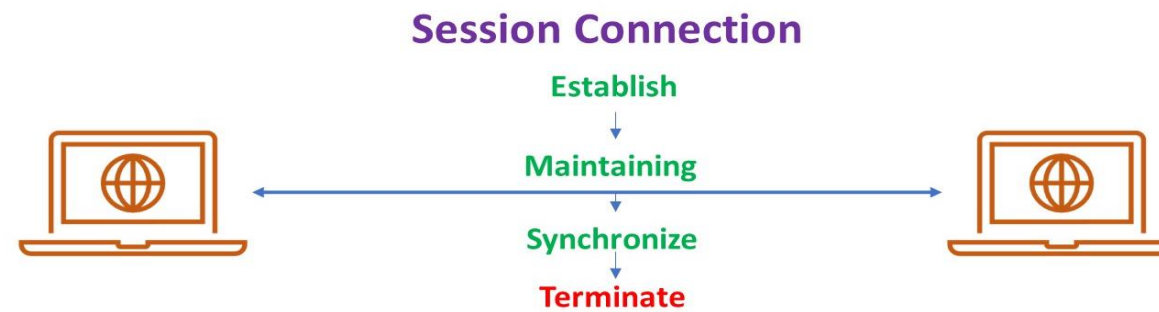
Session Layer(layer 5)



This layer is responsible for the establishment of connection, maintenance of sessions, and authentication, and also ensures security.

- **Dialog control:** Session layer allows the communication between two processes which can be either half-duplex or full-duplex.
- **Synchronization:** Session layer adds some checkpoints when transmitting the data in a sequence. If some error occurs in the middle of the transmission of data, then the transmission will take place again from the checkpoint. This process is known as Synchronization and recovery.





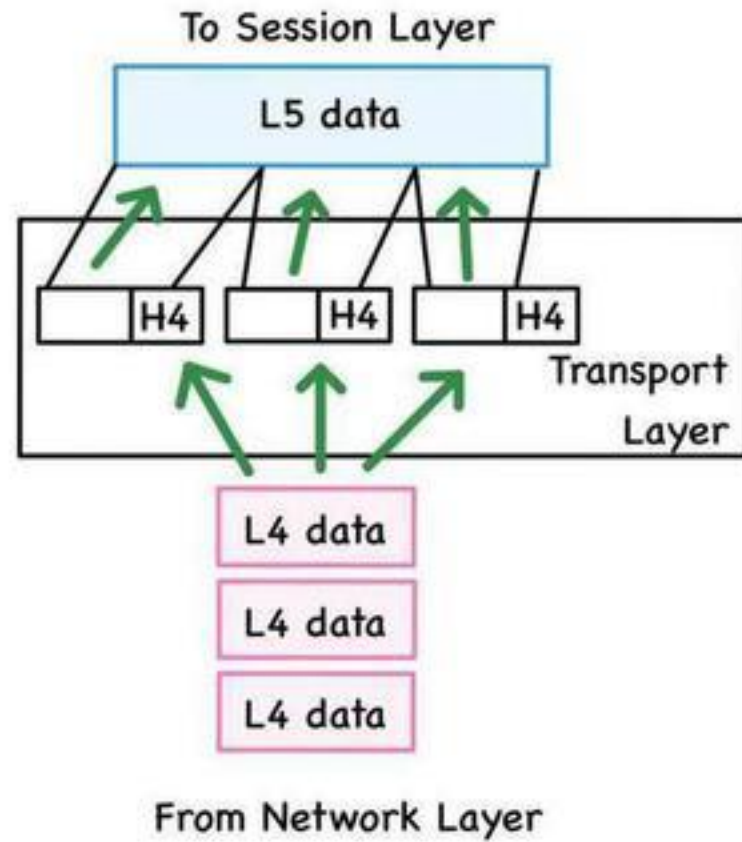
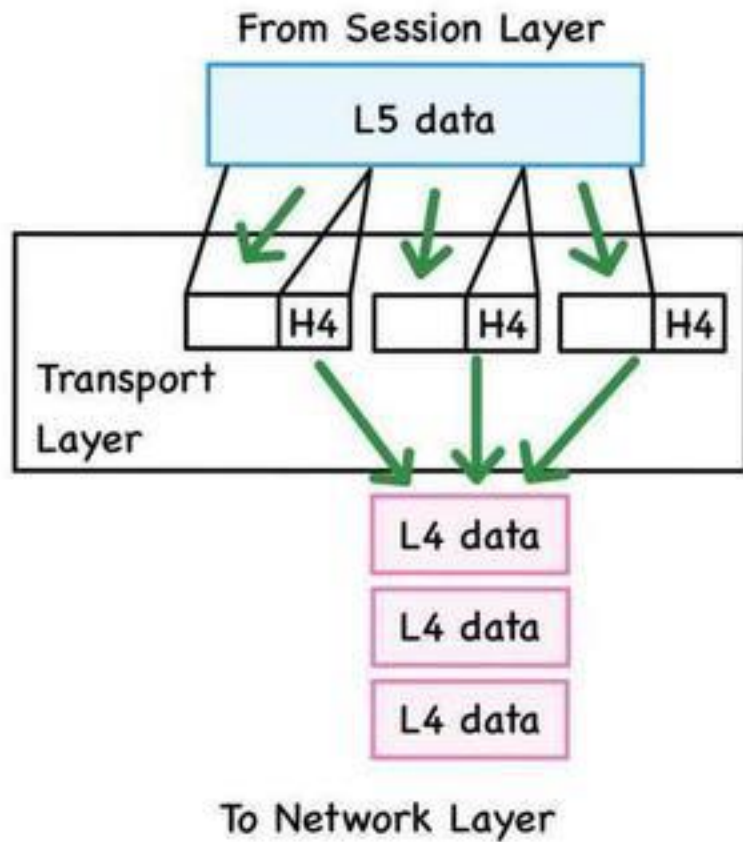
DATA



Transport Layer(Layer 4)



- It is responsible for the process to process delivery of the message.
- The Transport layer ensures that messages are transmitted in the order in which they are sent and there is no duplication of data.
- The main responsibility of the transport layer is to transfer the data completely.
- It receives the data from the upper layer and converts them into smaller units known as **Segments**.
- This layer can be termed as an end-to-end layer as it provides a point-to-point connection between source and destination to deliver the data reliably.



Services

- Port addressing
- Segmentation and Reassembly
- Connection Control(Connection oriented/connectionless)
- End-End Flow Control(Speed matching mechanism)
- Error Control(Transmission Errors)



Connection-Oriented Service: It is a three-phase process that includes

- Connection Establishment
- Data Transfer
- Termination/disconnection

In this type of transmission, the receiving device sends an acknowledgment, back to the source after a packet or group of packets is received. This type of transmission is reliable and secure.

Connectionless service: It is a one-phase process and includes Data Transfer. In this type of transmission, the receiver does not acknowledge receipt of a packet. This approach allows for much faster communication between devices. Connection-oriented service is more reliable than connectionless Service.



Protocols



Transmission Control Protocol(TCP)

- It is a standard protocol that allows the systems to communicate over the internet.
- It establishes and maintains a connection between hosts.
- Reliable and packets are received in order
- Slow Transmission compared to UDP
- File transfer,Email,Web browsing

User Datagram Protocol(UDP)

- User Datagram Protocol is Connectionless protocol.
- It is an unreliable transport protocol as in this case receiver does not send any acknowledgment when the packet is received also the sender does not wait for any acknowledgment. Therefore, this makes a protocol unreliable.
Online Gaming, Video Chat, Live streaming





Network Layer(Layer 3)



The network layer works for the transmission of data from one host to the other located in different networks.

- **Routing:** The network layer protocols determine which route is suitable from source to destination. Finding the best route for the packet to be transmitted.
- **Logical Addressing:** To identify each device on Internet network uniquely, the network layer defines an addressing scheme. The sender & receiver's IP addresses are placed in the header by the network layer.





Data Link Layer(Layer 2)



- This layer is responsible for moving the data from one node to another.
- It makes sure data transfer is error free from one node to another
- When a packet arrives in a network, it is the responsibility of the DLL to transmit it to the Host using its MAC address.
- The packet received from the Network layer is further divided into frames
- It also encapsulates Sender and Receiver's MAC address in the header.





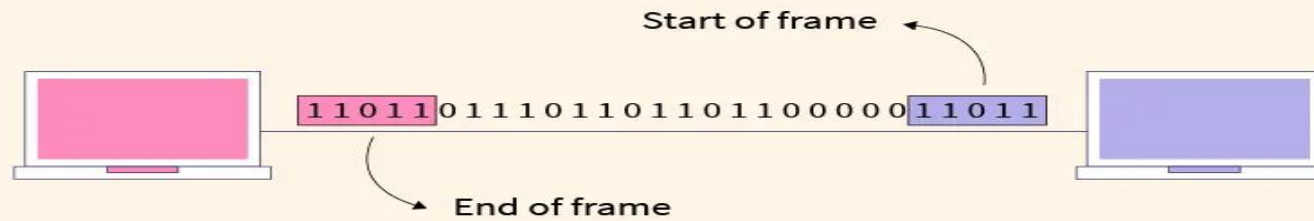
Functions of the Data Link Layer



- **Framing:** A special bit pattern is attached to the beginning and end of the frame.
- **Physical addressing:** After creating frames, the Data link layer adds physical addresses (MAC addresses) of the sender and/or receiver in the header of each frame.
- **Error control:** Detects and retransmits damaged or lost frames.
- **Flow Control:** The data rate must be constant on both sides else the data may get corrupted thus flow control coordinates the amount of data that can be sent before receiving an acknowledgment.
- **Access control:** When a single communication channel is shared by multiple devices, the MAC sub-layer of the data link layer helps to determine which device has control over the channel at a given time.



Framing In Data Link Layer





Sub layers



Logical Link Control Layer(LLC)

- It is responsible for transferring the packets to the Network layer of the receiver that is receiving.
- It also provides flow control. flow control coordinates the amount of data that can be sent before receiving an acknowledgment.

Media Access Control Layer(MAC)

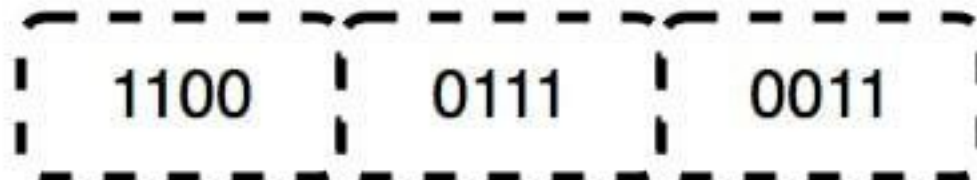
- When a single communication channel is shared by multiple devices, the MAC sub-layer helps to determine which device has control over the channel at a given time.
- It is used for transferring the packets over the network.



Physical Layer(Layer 1)



- The lowest layer of the OSI reference model is the physical layer.
- It is responsible for transmitting the bits over a medium(wired/wireless).
- The physical layer contains information in the form of **bits**.
- It is responsible for transmitting individual bits from one node to the next.
- When receiving data, this layer will get the signal received and convert it into 0s and 1s and send them to the Data Link layer.



Functions

- **Physical Characteristics of the media:** It defines the type of media(wired/wireless).
- **Line Configuration:** It defines the way how two or more devices can be connected physically(point to point/multipoint).
- **Topology:** It defines the way how network devices are arranged.
- **Signals:** It determines the type of the signal used for transmitting the information.
- **Bit Rate Control:** The Physical layer also defines the transmission rate i.e. the number of bits sent per second.

What is OSI model

