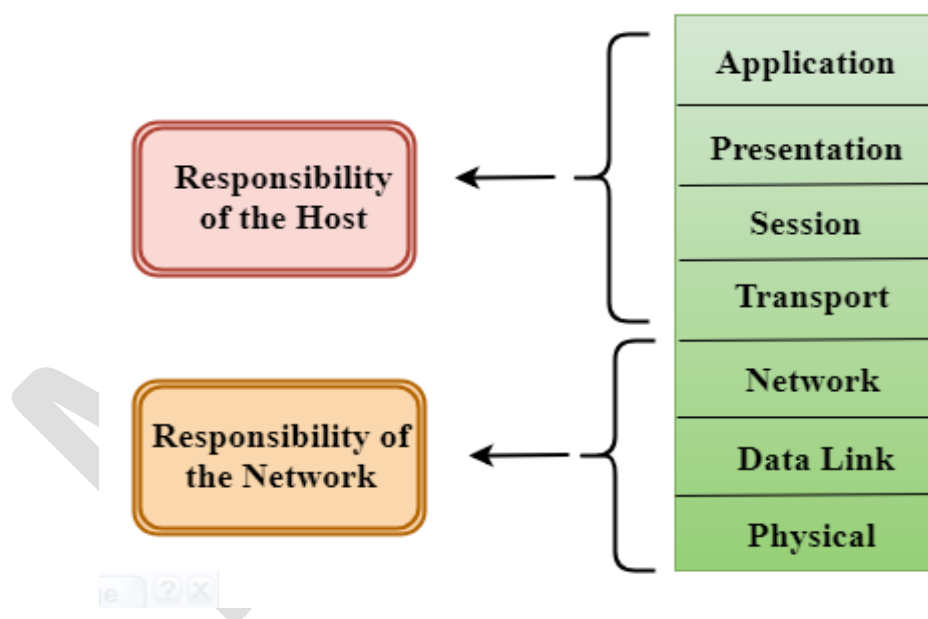


OSI Model:

1. OSI stands for Open System Interconnection
2. It has been developed by ISO – ‘International Organization for Standardization, in the year 1984
3. It is a reference model that describes networking or telecommunications systems as seven layers, each with its own function.
4. Each layer is self-contained, so that task assigned to each layer can be performed independently.
5. All these 7 layers work collaboratively to transmit the data from one person to another across the globe.

7 Layers of The OSI Model:

Seven Layers of OSI Model are divided into two Parts. Upper layers and Lower layers.



The upper layers of the OSI model mainly deals with the application related issues, and they are implemented only in the software.

The lower layers of the OSI model deals with the data transport issues. The data link layer and the physical layer are implemented in hardware and software.

Layer 1 – Physical layer:

The physical layer is the first and bottom-most layer of the OSI Reference Model.

Responsibilities/functions of Physical Layer:

1. **Defining bits:** Determines how bits are converted from 0s and 1s to a signal.
2. **Data rate:** Determines how fast the data flows, in bits per second.
3. **Synchronization:** Ensures that sending and receiving devices are synchronized.
4. **Transmission mode:** Determines the direction of transmissions whether those are simplex, half-duplex or full-duplex.
5. **Interface:** It provides an interface between devices (like PC's or computers) and transmission medium.
6. **Determine Topology:** It helps to determine the physical topology (Mesh, Star, Bus, Ring) of Network.
7. **Determine Media type:** It also specify the media type, connector type and signal type to be used for communication.

Protocols Used at Physical Layer:

1. **Ethernet:** Ethernet is a standard communication protocol used to create local area networks. It transmits and receives data through cables i.e coaxial cable, twisted pair cable, fiber optic.
2. **Bluetooth:** Bluetooth is a standard protocol for sending and receiving data via a 2.4GHz wireless link. it's perfect for short-range wireless transmissions between electronic devices.
3. **USB:** Universal Serial Bus (USB) is standard protocol that provide common interface to connect multiple peripheral devices (printers, keyboards) to a host.
4. **DSL:** DSL (Digital Subscriber Line) is a modem technology that uses existing telephone lines to transport high-bandwidth data.
5. **IEEE 802.11:** IEEE 802.11 refers to the set of standards that define communication for wireless LANs (wireless local area networks, or WLANs). It is also known as wifi.

Devices used at Physical Layer:

1. Hubs
2. Repeaters
3. Modem
4. Cables and Connectors

Layer 2 – Datalink layer:

Data-link layer is the second layer from the bottom of the OSI Reference Model.

Responsibilities/functions of Datalink Layer:

1. **Framing:** The layer divides the stream of bits received from the network layer into manageable data units called frames.
2. **Physical addressing:** It adds a header to the frame to define the physical address of the sender and/or receiver of the frame.
3. **Flow Control:** It provides a flow control mechanism to avoid a fast transmitter from over-running a slow receiver by buffering the extra bits.
4. **Error control:** The data link layer also deals with damaged or lost frames. By adding mechanisms to detect and retransmit lost frames increases reliability.
5. **Access Control:** The layer determines which device has control over the link at any given time, when two or more devices are connected to the same link.

Protocols Used at Datalink Layer:

1. **ARP:** Address Resolution Protocol (ARP) is used to find the MAC (Media Access Control) address of a device from its IP address in a local-area network (LAN).
2. **ATM:** The Asynchronous Transfer Mode (ATM) protocol is designed to support the transfer of data with a range of guarantees for quality of service.
3. **HDLC:** High-Level Data Link Control (HDLC) is a bit-oriented protocol that is used for communication over the point-to-point and multipoint links. With the help of HDLC protocol full-duplex communication is possible.
4. **Frame Relay:** Frame relay is a protocol that defines how frames are routed through a fast-packet network based on the address field in the frame.

5. **SLIP:** SLIP stands for Serial line interface protocol which is used to add framing byte at the end of the IP Packet.

Devices used at datalink Layer:

1. Bridges
2. Layer-2 Switches
3. Network Interface Card (NIC)

Layer 3 – Network layer:

Network layer is the third layer from the bottom of the OSI Reference Model.

Responsibilities/functions of Network Layer:

1. **Translation of Addresses:** It translates logical network address (IP) into physical machine address (MAC) i.e. the numbers used as destination IDs in the Network Interface cards.
2. **Division of larger Packets:** It breaks the larger packets into smaller packets if the packet is larger than the largest data frame the data link will accept.
3. **Routing of Packets:** Routers and gateways operate in the network layer. Mechanism is provided by Network Layer for routing the packets to final destination.
4. **Congestion Control:** This layer also provides mechanisms for congestion control, in situations when too many packets overload the subnets.

Protocols Used at Network Layer:

1. **IP:** The Internet Protocol (IP) is a protocol, used for routing and addressing packets of data so that they can travel across networks and arrive at the correct destination.
2. **IPSEC:** IPSEC is a group of protocols that are used together to set up encrypted connections between devices. It helps keep data sent over public networks secure.
3. **ICMP:** Internet Control Message Protocol (ICMP) is an error-reporting protocol that network devices such as routers use for sending error messages and operations information indicating success or failure of requested service.
4. **RIP:** Routing Information Protocol (RIP) is a distance vector protocol that uses hop count as a routing metric to find the best path between the source and the destination network.

Devices used at Network Layer:

1. Layer-3 Switches
2. Routers
3. Bridge Router or Brouter

Layer 4 – Transport layer:

Transport layer is the fourth layer from the bottom of the OSI Reference Model.

Responsibilities/functions of Transport Layer:

1. **Segmentation and Re-assembly:** It divides each message into packets at the source and reassembles them at the destination.
2. **Service-point addressing:** The transport layer adds a specific type of address to its header, referred to as a service point address or port address to deliver a specific process from source to a specific process at the destination. (Means WhatsApp ka msg WhatsApp main hi receive ho na k email main).
3. **Connection Control:** The layer can be either connectionless or connection oriented.
 - **Connectionless Transport Layer** treats each packet as an individual and delivers it to the destination machine without establishing connection.
 - **Connection Oriented Transport Layer** creates a connection with the Transport Layer at the destination machine before transmitting the packets to the destination.
4. **Error Detection:** The transport layer checks for errors in the messages coming from the application layer by using error detection codes and computing checksums.
5. **Flow Control:** Transport layer provides a flow control mechanism to prevent data loss due to a fast sender and slow receiver.

Protocols Used at Transport Layer:

1. **TCP:** Transmission Control Protocol (TCP) is a layer 4 protocol which provides acknowledgement of the received packets and is also reliable as it resends the lost packets.
2. **UDP:** User Datagram Protocol (UDP) is also a layer 4 protocol but unlike TCP it doesn't provide acknowledgement of the sent packets. Therefore, it isn't reliable. It is used in video and voice streaming.

3. **SCTP:** Stream Control Transmission Protocol (SCTP) is a connection-oriented network protocol for transmitting multiple-streams (full-duplex) of data simultaneously between two end points.

Devices used at Transport Layer:

1. Gateways
2. Firewalls

Layer 5 – Session layer:

Session layer is the fifth layer from the bottom of the OSI Reference Model.

Responsibilities/functions of Session Layer:

1. **Dialog Controller:** Session Layer works as a dialog controller through which it allows systems to communicate in either half-duplex mode or full duplex mode of communication.
2. **Token Management:** This layer is also responsible for token management through which it prevents two users to simultaneously access or attempting the same critical operation.
3. **Synchronization:** It adds synchronization points or checkpoints in data streams and ensures that data streams up to the checkpoints are successfully received and acknowledged.

Protocols Used at Session Layer:

RPC: Remote procedure call protocol (RPC) protocol is used for requesting a service from one computer to another computer over the network.

PPTP: Point-to-Point Tunneling Protocol (PPTP) is used for establishing Virtual Private Network (VPN) tunnels in between other public network.

SMB: The Server Message Block (SMB) protocol is a client-server communication protocol that is used for shared access to files, directories, printers, serial ports, and other resources on a network.

Devices used at Session Layer:

- Gateways
- Firewalls
- PC's

Layer 6 – Presentation layer:

Presentation layer is the sixth layer from the bottom of the OSI Reference Model.

Responsibilities/functions of Presentation Layer:

1. **Translation:** On the sender's end, the presentation layer translates the data from a user-dependent format to the common binary format. On the receiver's end, the presentation layer translates the data from common binary format to receiver-dependent format.
2. **Encryption and Decryption:** It is responsible for data encryption and decryption of sensitive data before they are transmitted over common channels.
3. **Data Compression:** It is also responsible for data compression. Data compression is done at the source to reduce the number of bits to be transmitted. It reduces the storage space and increases the file transfer rate.
4. **Standardized Format:** The presentation layer is also responsible for integrating all the formats into a standardized format for effective communication.

Protocols Used at Presentation Layer:

1. **SSL:** Secure Sockets Layer (SSL) is an encryption based security protocol that provides privacy, authentication, and integrity to Internet communications.
2. **TLS:** Transport Layer Security (TLS) protocol is used for implementing cryptography on the web. TLS uses a combination of cryptographic processes to provide secure communication over a network.
3. **MIME:** Multipurpose Internet Mail Extensions (MIME) is an e-mail extension protocol, i.e., it does not operate independently, but it helps to extend the capabilities of e-mail in collaboration with other protocols such as SMTP.

Devices used at Presentation Layer:

1. Gateways
2. Firewalls
3. PC's

Layer 7 – Application layer:

Presentation layer is the seventh layer from the bottom of the OSI Reference Model.

Responsibilities/functions of Application Layer:

1. **Mail Services:** This layer provides the basis for E-mail forwarding and storage.
2. **Network Virtual Terminal:** It allows a user to log on to a remote host. The application layer creates software emulation of a terminal at the remote host.
3. **Directory Services:** This layer provides access for global information about various services.
4. **File transfer, access, and management:** An application layer allows a user to access the files in a remote computer, to retrieve the files from a computer and to manage the files in a remote computer.
5. **Authentication:** It provides authentication to occur between devices for an extra layer of security and it authenticates the sender or receiver's message or both.

Protocols Used at Application Layer:

1. **DNS:** Domain Name System - translates network address (such as IP addresses) into terms understood by humans (such as Domain Names) and vice-versa.
2. **DHCP:** Dynamic Host Configuration Protocol - can automatically assign Internet addresses to computers and users.
3. **FTP:** File Transfer Protocol - a protocol that is used to transfer and manipulate files on the Internet.
4. **HTTP:** Hyper Text Transfer Protocol - An Internet-based protocol for sending and receiving webpages.
5. **IRC:** Internet Relay Chat - a protocol used for Internet chat and other communications.
6. **POP3:** Post Office protocol Version 3 - a protocol used by e-mail clients to retrieve messages from remote servers.
7. **SMTP:** Simple Mail Transfer Protocol - A protocol for e-mail messages on the Internet.

Devices Used at Application Layer:

- 1. Gateways**
- 2. Firewalls**
- 3. All End devices (PC's, Mobiles, Servers)**

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