

Open System Interconnection Model (OSI Model)

The Open Systems Interconnection (OSI) Model is an intangible and logical arrangement that describes network communication between two systems by using different layer protocols. The OSI model developed by the International Standards Organization (ISO). It has seven layers to transmit data from one to another.

Layers in The OSI Model

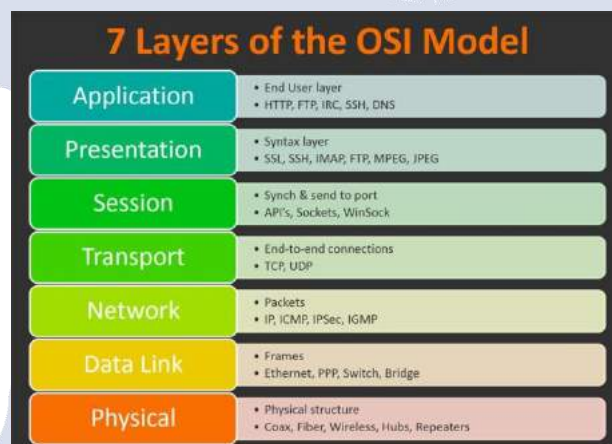
Physical Layer (Layer 1)

It is the lowest layer in the OSI model. It deals with the bit-level transmission between the devices. It supports mechanical and electrical specifications of the interface and transmission medium. Hub, Repeater, Modem, Cables are Physical Layer devices. The data unit of this layer is Bit. It converts the signal into 0s and 1s and sends them to the next layer. Simplex, half-duplex and full-duplex are the transmission modes for this layer.

Protocols used - ATM, RS232, and Ethernet.

Data Link Layer

It is used for the encoding, decoding and logical organization of data bits. It makes the physical layer appear error-free. It converts the bits into the frames depending on the frame size of Network Interface Card (NIC). Switch and Bridge is Data Link Layer devices. HDLC, LSL, and ATM are the implemented protocols on this layer. It has two sub-layers.



- **Media Access Control (MAC)** – It is responsible to the physical address of the sender and/or receiver in the header of each frame. CSMA/CD, Ethernet are used as protocol.
- **Logical Link Control (LLC)** – It is responsible for frame management, error checking, and flow control of data.

Network Layer

This network provides the shortest path for transmitting data for network communication to avoid congestion. Data is transmitted in the form of packets through the logical network path. The IP address of the sender/receiver is placed in the header. Routers are used as networking devices. The IPX and TCP/IP are the implemented protocols on this layer. Routing and Logical Addressing are the functions of this layer.

- **Routing** – Finding the shortest path for data transmission.
- **Logical Addressing** – Placing the IP address of the sender/receiver in the header. Physical Layer, Data Link Layer, and Network Layer are also known as Hardware Layer.



Transport Layer

This layer is called as Heart of OSI model. It is responsible for end-to-end network communication, flow control of data, error recovery and reliability and quality of data. The data in the transport layer is referred to as Segments. It is operated by the Operating System. SPX, TCP/IP's, DNS are examples of implemented protocols on this layer.

Session Layer

This layer is responsible for the establishment of the connection, maintenance of sessions, synchronization and ensures security. It allows adding checkpoints (synchronization points) into the data to identify the error. This layer is the network dialog controller which allows two systems into the dialog in either half duplex or full duplex mode. RPC, PPTP, SCP, SDP are some protocols of this layer.

Presentation Layer

This layer performs encryption and decryption of data. It gives the data in a readable format from an application layer perspective. It reduces the number of bits that need to be transmitted on the network. It offers liberty from compatibility troubles. It is called the Translation layer and Syntax layer.

Example - ASCII code to EBCDIC coded text file.

Application Layer

This layer focuses on process-to-process communication across an IP network and provides a firm communication interface and end-user services. It supports services such as electronic mail, remote file access, and transfer, shared database management, Web chat and surfing, Directory services and Network Virtual Terminal. HTTP, FTP, Telnet, SMTP, and DNS have used protocols of this layer. It is also called as Desktop Layer.

Session Layer, Presentation Layer, and Application layer are also known as Upper Layers or Software Layers.

TCP/IP Model

TCP model is a tangible, client-server model. It is one of the most used protocols in digital network communications. It has only four layers in a data communication network.

Host-to-Network Layer – In this layer, the host has connected to the network using the protocol to send IP packets. Ethernet, Token Ring, FDDI, X.25, Frame Relay are used.

Internet Layer – It transfers the Internet Protocol packets (IP datagrams) to the destination. IP, ICMP, ARP, RARP, and IGMP have used protocols.

Transport Layer – It is like as transport layer in the OSI model. Two end-to-end transport protocols are used. Transmission Control Protocol (TCP) and Use Datagram Protocol (UDP).

Application Layer – It contains high-level protocols. TELNET, FTP, SMTP, DNS, HTTP, NNTP, DHCP are used.

Data Transmission Modes

Data Transmission modes refer to the way of transferring the information or data between two connected devices. Three types of transmission modes are:

- Simplex Mode
- Half Duplex Mode
- Full Duplex Mode

Simplex Mode – In this type, the data can be transferred in only one direction. The only one can transmit and the other can receive the data.

Example – Keyboard (Input) and Monitor (output), Loud Speaker, Television, Fire alarm system etc.

Half Duplex Mode – In this type, the data can be transferred in both directions, but not at the same time. Example – Walkie-talkie



Full Duplex Mode – In this type, the data can be transferred in both directions on the same transmission path. Two lines are used for sending and receiving the data.

Example – Telephone network

Data Transmission Media

Data or information is transferred to one place from another through the physical/wireless media which is known as Transmission Media. Guided Media and Unguided Media are two types of Transmission Media.

Guided Media/Bounded Media

The signals are transmitted through the narrow path which made by physical links. Twisted Pair cable, Coaxial Cable and Fiber-Optic Cable are the types of Bounded Media. Twisted-pair and coaxial cable accept signals in the form of electric current. Optical fiber accepts signals in the form of light.

Unguided/Unbounded Media

The signals are transmitted without using any cables. This type of transmission is known as wireless communication. Radio waves, Infrared, Micro waves are some popular type of unbound transmission media.

- **Microwave** – Mobile phone, Satellite networks, Wireless LANs.
- **Radio Wave** – Radio, Television and Paging system
- **Infrared** – Short range communication (TV remote control, IRD port etc)

Network Devices

Hub - Hub is a networking device which connects multiple network hosts. It is used to transfer data. The hub sends data packets (frames) to all devices on a network. Active Hub (Repeaters) and Passive Hub are two categories of Hub.

Switch - Switch is a small hardware device that works at the layer of LAN (Local Area Network). It receives incoming data packets, filters the packet and sends only to the interface of the intended receiver. It maintains a CAM (Content Addressable Memory) table and has own system configuration and memory. CAM table is also known as forwarding table or forwarding information base (FIB).

Modem (Modulator-Demodulator) - It is a hardware component that allows a computer to connect to the Internet. It converts analog signal to digital signal.

Router – It is a hardware device which is responsible for routing traffic from one to another network. It is designed to receive, convert and move packets to another network.

Bridge – Bridge is a network device that connects a local area network to another local area network that uses the same protocol.

Gateway - A gateway is a network node that connects two dissimilar networks using different protocols together.

Repeater – It is an electronic device that magnifies the signal it receives. It is implemented in computer networks to expand the coverage area of the network. It is also known as signal boosters.

Firewall - A firewall is a network security system that monitors and controls overall incoming and outgoing network traffic based on advanced and a defined set of security rules.