

# SEVEN LAYERS OF OSI REFERENCE MODEL

## 1. Physical Layer:

physical layer is the bottom layer of the OSI reference model. The physical layer has four important characteristics.

**Mechanical.** Relates to the physical properties of the interface to a transmission medium. Typically, the specification is of a pluggable connector that joins one or more signal conductors, called circuits.

**Electrical.** Relates to the representation of bits (e.g., in terms of voltage levels) and the data transmission rate of bits. It defines the voltage, current, modulation, bit synchronization, connection activation and deactivation, and various electrical characteristics for the transmission media (such as unshielded or shielded twisted-pair cabling, coaxial cabling, and fiber-optic cabling).

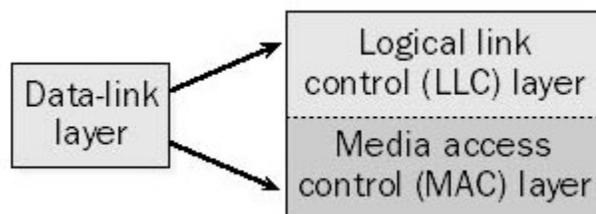
**Functional.** Specifies the functions performed by individual circuits of the physical interface between a system and the transmission medium.

**Procedural.** Specifies the sequence of events by which bit streams are exchanged across the physical medium.

## 2. Data Link Layer:

The physical layer provides only a raw bit-stream service, the data link layer attempts to make the physical link reliable while providing the means to activate, maintain, and deactivate the link .

For LANs, the Project 802 standards of the Institute of Electrical and Electronics Engineers (IEEE) separate the data-link layer into two sublayers:



- The logical link control (LLC) layer, the upper of the two layers, which is responsible for flow control, error correction, and resequencing functions for connection-oriented communication, but which also supports connectionless communication
- The media access control (MAC) layer, the lower of the two layers, which is responsible for providing a method for stations to gain access to the medium

### Functions:

**Framing.** The data link layer divides the stream of bits received from the network layer into manageable data units called frames.

**Physical addressing.** If frames are to be distributed to different systems on the network, the data link layer adds a header to the frame to define the sender and/or receiver of the frame. If the frame is intended for a system outside the sender's network, the receiver address is the address of the device that connects the network to the next one.

**Flow control.** If the rate at which the data are absorbed by the receiver is less than the rate at which data are produced in the sender, the data link layer imposes a flow control mechanism to avoid overwhelming the receiver.

**Error control.** The data link layer adds reliability to the physical layer by adding mechanisms to detect and retransmit damaged or lost frames. It also uses a mechanism to recognize duplicate frames. Error control is normally achieved through a trailer added to the end of the frame.

**Access control.** When two or more devices are connected to the same link, data link layer protocols are necessary to determine which device has control over the link at any given time

Examples of data-link protocols for local area networking include the following:

- IEEE 802.3, which provides the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method for baseband Ethernet networks
- IEEE 802.5, which provides the token-passing access method for baseband token ring implementations

For WANs, data-link layer protocols encapsulate LAN traffic into frames suitable for transmission over WAN links. Common data-link encapsulation methods for WAN transmission include the following:

- Point-to-point technologies such as Point-to-Point Protocol (PPP) and High-level Data Link Control (HDLC) protocol
- Multipoint technologies such as frame relay, Asynchronous Transfer Mode (ATM), Switched Multimegabit Data Services (SMDS), and X.25

### **3. Network Layer:**

Layer 3 of the Open Systems Interconnection (OSI) reference model for networking. The network layer is responsible for functions such as the following:

- Logical addressing and routing of packets over the network
- Establishing and releasing connections and paths between two nodes on a network
- Transferring data, generating and confirming receipts, and resetting connections

The network layer also supplies connectionless and connection-oriented services to the transport layer above it. The network layer functions closely with the physical layer (layer 1) and data-link layer (layer 2) in most real-world network protocol implementations.

On TCP/IP-based networks, IP addresses and network numbers are used at the network layer, and IP routers perform their routing functions at this layer. An example of an OSI model network layer protocol is the X.25 packet-switching network layer protocol, which is built on the X.21 physical layer protocol.

### **4. Transport Layer:**

Layer 4 of the Open Systems Interconnection (OSI) reference model. The transport layer is responsible for providing reliable transport services to the upper-layer protocols. These services include the following:

- Flow control to ensure that the transmitting device does not send more data than the receiving device can handle.

- Packet sequencing for segmentation of data packets and remote reassembly.
- Error handling and acknowledgments to ensure that data is retransmitted when required.
- Multiplexing for combining data from several sources for transmission over one data path.
- Virtual circuits for establishing sessions between communicating stations.

The Transmission Control Protocol (TCP) of the TCP/IP protocol suite resides at the transport layer.

*A connection between two devices that acts as though it's a direct connection even though it may physically be circuitous. The term is used most frequently to describe connections between two hosts in a packet-switching network. In this case, the two hosts can communicate as though they have a dedicated connection even though the packets might actually travel very different routes before arriving at their destination. An X.25 connection is an example of a virtual circuit.*

*Virtual circuits can be either permanent (called PVCs) or temporary (called SVCs).*

## 5. Session Layer:

Layer 5 of the Open Systems Interconnection (OSI) reference model, which enables sessions between computers on a network to be established and terminated. The session layer does not concern itself with issues such as the reliability and efficiency of data transfer between stations because these functions are provided by the first four layers of the OSI reference model.

### Functions:

**Dialog control:** The session layer allows two systems to enter into a dialog. It allows the communication between two processes to take place in either half- duplex (one way at a time) or full-duplex (two ways at a time) mode.

**Synchronization:** The session layer allows a process to add checkpoints, or synchronization points, to a stream of data. For example, if a system is sending a file of 2000 pages, it is advisable to insert checkpoints after every 100 pages to ensure that each 100-page unit is received and acknowledged independently. In this case, if a crash happens during the transmission of page 523, the only pages that need to be resent after system recovery are pages 501 to 523. Pages previous to 501 need not be resent.

## 6. Presentation Layer:

The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems .

### Specific responsibilities of the presentation layer include the following:

**Translation.** The processes (running programs) in two systems are usually exchanging information in the form of character strings, numbers, and so on. The information must be changed to bit streams before being transmitted. Because different computers use different encoding systems, the presentation layer is responsible for interoperability between these different encoding methods. The presentation layer at the sender changes the information from its sender-dependent format into a common format. The presentation layer at the receiving machine changes the common format into its receiver-dependent format.

**Encryption.** To carry sensitive information, a system must be able to ensure privacy. Encryption means that the sender transforms the original information to another form and sends the resulting message out over the network. Decryption reverses the original process to transform the message back to its original form.

**Compression.** Data compression reduces the number of bits contained in the information. Data compression

becomes particularly important in the transmission of multimedia such as text, audio, and video.

## 7. Application layer:

Layer 7 of the Open Systems Interconnection (OSI) reference model, in which network-aware, user-controlled software is implemented—for example, e-mail, file transfer utilities, and terminal access. The application layer represents the window between the user and the network. Examples of protocols that run at the application layer include File Transfer Protocol (FTP), Hypertext Transfer Protocol (HTTP), telnet, and similar protocols that can be implemented as utilities the user can interface with.

**File transfer, access, and management.** This application allows a user to access files in a remote host (to make changes or read data), to retrieve files from a remote computer for use in the local computer, and to manage or control files in a remote computer locally.

**Mail services.** This application provides the basis for e-mail forwarding and storage.

**Directory services.** This application provides distributed database sources and access for global information about various objects and services.

### Summary:

**Physical Layer:** How to transmit bits.

**Data Link Layer:** How to transmits frames

**Network:** How to route packets to the node.

**Transport:** How to send packets to the applications.

**Session:** Manage connections.

**Presentation:** Encode/Decode messages, security.

**Application:** Everything else.

### Devices and Protocols on each Layer:

Layer	Protocols	Devices
Physical		Hub, Repeater, Cables
Data-link	LLC,MAC,Ethernet	Switch
Network	IP,Routing protocol(RIP, OSPF)	Router
Transport	TCP,UDP	
Session		
Presentation	ASCII,Encryption, Decryption	
Application	DNS,NFS,TELNET,NFS	

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