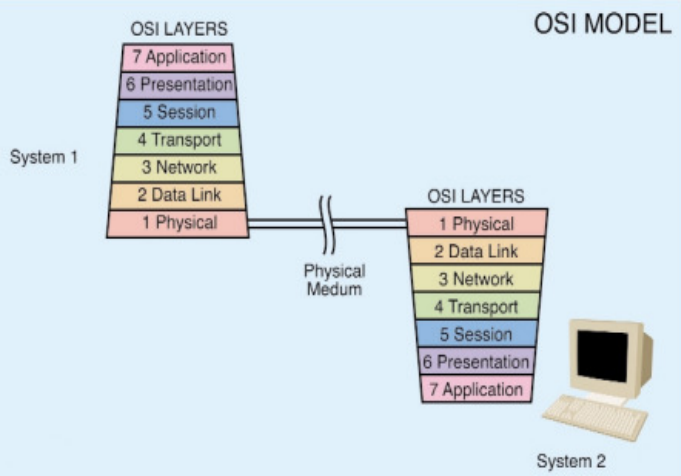
The OSI 7-layer model

First introduced in 1978, the OSI (Open Systems Interconnection) 7-layer model was developed by the ISO (International Standards Organization) in the days when all communications protocols were proprietary and inter-manufacturer communication almost impossible.

The concept behind the Open Systems Interconnection model was to enable any device or system operating with any protocol to communicate with another device or system using its own protocol. This removed the restrictions on users of being forced to operate with a specific set of proprietary hardware or software.

The OSI model defines seven distinct 'layers'. Each layer has a set of specifications and functions that it performs.



PHYSICAL LAYER

The physical layer, the lowest layer of the OSI model, is concerned with the transmission and reception of the unstructured raw bit stream over a physical medium.
It describes the electrical/optical, mechanical, and functional interfaces to the physical medium, and carries the signals for all of the higher layers. It provides:

- Data encoding: modifies the simple digital signal pattern (1s and 0s) used by the PC to better accommodate the characteristics of the physical medium, and to aid in bit and frame synchronization.
- Physical medium attachment, accommodating various possibilities in the medium:
- Transmission technique: determines whether the encoded bits will be transmitted by baseband (digital) or broadband (analog) signaling.
- Physical medium transmission: transmits bits as electrical or optical signals appropriate for the physical medium.

DATA LINK LAYER

The data link layer provides error-free transfer of data frames from one node to another over the physical layer, allowing layers above it to assume virtually error-free transmission over the link. To do this, the data link layer provides:

- Link establishment and termination: establishes and terminates the logical link between two nodes.
- Frame traffic control: tells the transmitting node to "back-off" when no frame buffers are available.
- Frame sequencing: transmits/receives frames sequentially.
- Media access management: determines when the node "has the right" to use the physical medium.

NETWORK LAYER

The network layer controls the operation of the subnet, deciding which physical path the data should take based on network conditions, priority of service, and other factors. It provides:

- Routing: routes frames among networks.
- Subnet traffic control: routers (network layer intermediate systems) can instruct a sending station to "throttle back" its frame transmission when the router's buffer fills up.
- Logical-physical address mapping: translates logical addresses, or names, into physical addresses.

TRANSPORT LAYER

The transport layer ensures that messages are delivered error-free, in sequence, and with no losses or duplications. It relieves the higher layer protocols from any concern with the transfer of data between them and their peers.

The transport layer provides:

- Message segmentation: accepts a message from the (session) layer above it, splits the message into smaller units (if not already small enough), and passes the smaller units down to the network layer. The transport layer at the destination station reassembles the message.
- Message acknowledgment: provides reliable end-to-end message delivery with acknowledgments.
- Message traffic control: tells the transmitting station to "back-off" when no message buffers are available.

SESSION LAYER

The session layer allows session establishment between processes running on different stations. It provides:

- Session establishment, maintenance and termination: allows two application processes on different machines to establish, use and terminate a connection, called a session.
- Session support: performs the functions that allow these processes to communicate over the network, performing security, name recognition, logging, and so on.

PRESENTATION LAYER

The presentation layer formats the data to be presented to the application layer. It can be viewed as the translator for the network. This layer may translate data from a format used by the application layer into a common format at the sending station, then translate the common format to a format known to the application layer at the receiving station.

The presentation layer provides:

- Character code translation: for example, ASCII to EBCDIC.
- Data conversion: bit order, CR-CR/LF, integer-floating point, and so on.
- Data compression: reduces the number of bits that need to be transmitted on the network.
- Data encryption: encrypt data for security purposes. For example, password encryption.

APPLICATION LAYER

The application layer serves as the window for users and application processes to access network services. This layer contains a variety of commonly needed functions:

- Resource sharing and device redirection
- Remote file access
- Remote printer access
- Inter-process communication
- Network management
- Directory services
- Electronic messaging (such as mail)
- Network virtual terminals

Network Protocols

- A set of rules agreed by both transmit and receive ends

Protocol – Examples

Layer	Protocols
Application Layer	HTTP, FTP, SMTP, SNMP
Presentation Layer	X.216
Session Layer	X.215
Transport Layer	NetBEUI, TCP, UDP, X.214
Network Layer	IP, IPX, X.213
Data Link Layer	PPP, HDLC, X.212
Physical Layer	X.21, X.21 bis, V.24

Transport layer protocol – TCP

- Transport Control Protocol
- Connection Oriented : Connection is establish between client and server
- Then only data is transferred
- An acknowledgement is received for each data segment
- Error control and flow control can be done
- After data transfer, the connection is terminated
- Data transfer is reliable

Transport layer protocol – UDP

- User Datagram Protocol
- Connectionless : No connection is established prior to sending data
- Data will go through the network and reach server
- Server does not send any acknowledgement
- Data transfer is unreliable

Network layer protocol - IP

- Internet Protocol
- IP protocol is unreliable, connectionless
- No error control and flow

- TCP and IP together - reliable
- UDP and IP together - not reliable

Application Layer Protocols

- Dynamic Host Configuration Protocol (DHCP)
- Domain Name System (DNS)
- TELNET
- File Transfer Protocol (FTP)
- Simple Network Management Protocol (SNMP)
- Simple Mail Transfer Protocol (SMTP)
- Hyper Text Transfer Protocol (HTTP)

Exercise:

1. Write three functions of each layer in OSI reference model.
2. Prepare the detailed report about application layer protocols given above.

Deadline: 10th September 2015