The OSI Model: An Overview

The Open Systems Interconnection (OSI) reference model has served as the most basic elements of computer networking since the inception in 1984. The OSI Reference Model is based on a proposal developed by the International Standards Organization (ISO). The original objective of the OSI model was to provide a set of design standards for equipment manufacturers so they could communicate with each other. The OSI model defines a hierarchical architecture that logically partitions the functions required to support system-to-system communication.

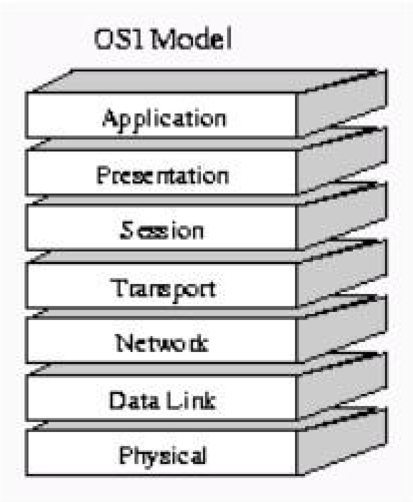
The OSI model has seven layers, each of which has a different level of abstraction and performs a well-defined function. The principles that were applied to arrive at the seven layers are as follows:

- A layer should be created where a different level of abstraction is needed.•
- Each layer should perform a well-defined function.•
- The function of each layer should be chosen with an eye toward defining• internationally standardized protocols.
- The layer boundaries should be chosen to minimize the information flow across• the interfaces.
- The number of layers should be large enough that distinct functions need not be• thrown together in the same layer out of necessary, and small enough that the architecture does not become unwieldy.

The layered approach offers several advantages. By separating networking functions into logical smaller pieces, network problems can more easily be solved through a divide-and-conquer methodology. OSI layers also allow extensibility. New protocols and other network services are generally easier to add to a layered architecture.

The seven OSI layers are defined as follows:

7. Application: Provides different services to the application
6. Presentation: Converts the information6.
5. Session: Handles problems which are not communication issues5.
4. Transport: Provides end to end communication control4.
3. Network: Routes the information in the network3.
2. Data Link: Provides error control2.
1. Physical: Connects the entity to the transmission media



Application Layer (Layer 7)

The application layer is the top layer of the OSI model. It provides a set of interfaces for applications to obtain access to networked services as well as access to network services that support applications directly. This layer also provides application access security checking and information validation.

Presentation Layer (Layer 6)

The presentation layer is responsible for the format of the data transferred during network communications. This layer is concerned with the syntax and semantics of the information transmitted. For outgoing messages, it converts data into a generic format for the transmission. For the incoming messages, it converts the data from the generic form to a format understandable to the receiving application. Different computers have different codes for representing data. The presentation layer makes it possible for computers with different representations to communicate. The presentation layer provides common communication services such as encryption, text compression, and reformatting.

Session Layer (Layer 5)

The session layer permits two parties to hold ongoing communications called a session across a network. The applications on either end of the session can exchange data or send packets to another for as long as the session lasts. The session layer handles session setup, data or message exchanges, and tear down when the session ends. It also monitors session identification so only designated parties can participate and security services to control access to session information. A session can be used to allow a user to log into a remote time-sharing system or transfer a file between two machines.

Transport Layer (Layer 4)

The basic function of the transport layer is to accept data from the session layer, split it up into smaller units, pass it to the network layer, and ensure that the bits delivered are the same as the bits transmitted without modification, loss or duplication. If an error occurs during transmission, the transport layer must correct it. There is a set of rules to follow that detail the handling of the error and how to correct it. The correction may mean re-sending just the damaged data or restarting from the beginning. This can be achieved because the transport layer protocol includes the capability to acknowledge the receipt of a packet. “If no acknowledgement is received, the transport layer can retransmit the packet or time-out the connection and signal an error. The transport protocol can also mark packets with sequencing information so that the destination system can properly order the packets if they are received out of order.

Network Layer (Layer 3)

The network layer controls the operation of a sub-net, provides routing, congestion control and accounting. The network layer provides both connectionless and connection-oriented services. A key design issue is determining how packets are routed from source to destination. Routes can be based on static tables that are within the network and rarely change. They could also be determined at the start of each conversion. Finally, they could be highly dynamic, being newly determined for each packet to reflect the current network load.

Data Link Layer (Layer 2)

The main task of the data link layer is to take a raw transmission and transform it into a line that appears free of transmission errors in the network layer. It accomplishes this task by having the sender break the input data up into data frames, transmit the frames sequentially, and process the acknowledgment frames sent back by the receiver. The protocol packages the data into frames that contain source and destination addresses. These frames refer to the physical hardware address of each network card attached to the network cable.

Physical Layer (Layer 1)

The physical layer is concerned with transmitting raw bits over a communication channel. The design issues have to do with making sure that when one side sends a 1 bit, it is received by the other side as a 1 bit, not as a 0 bit. Typical questions are how many volts should be used to represent a 1 and how many for a 0, how many microseconds a bit lasts, whether transmission may proceed simultaneously in both directions, how the initial connection is established and how it is torn down when both sides are finished, and how may pins the network connector has and what each pin is used for. The design issues deal largely with mechanical, electrical, functional, and procedural interface.