The OSI Layers

Background Information

The OSI architecture was set up by the ISO (International Standards Organization) as the first formally defined way of connecting computers. The OSI architecture divides network functionality up into seven layers, where various protocols implement the functionality assigned to a given layer.

The Layers

The Physical Layer

This is the first layer of standards. It's a set of rules regarding the hardware used to transmit data. Among items covered at this layer are the voltages used, the timings of transmission, and the rules used for the initial handshaking connection.

The Data Link Layer

The physical layer provides the data link layer with bits. Now this layer provides the bits with some meaning. We no longer deal with bits but instead with data frames - packets, containing data as well as control information. The data link layer adds flags to indicate the start and end of messages.

This layer's standards perform two important tasks. It ensures that data is not mistaken for flags, and that it checks for errors within the frame.

The Network Layer

The network layer, is concerned with packet switching. It establishes virtual circuits (Paths between terminals) for data communications. As the sending end, the network layer repackages messages from the transport layer above it into data packets, so the lower layers can transmit them.

The Transport Layer

The transport layer of the OSI model has many functions, including several order f error recognitions and recoveries. As the highest order, the Transport layer can detect errors, identify packets that have been sent in the incorrect order, and then rearrange them. The transport layer also regulates the information flow by controlling the messages movements.

The Session Layer

The session layer is concerned with the management of the network. The user communicates directly with this layer. It can verify passwords entered by the user. It can determine who uses the network, for how long, and for what purpose. It controls data transfers and even handles recovery from system crashes.

The Presentation Layer

This layer is concerned with the network security, file transfers and formatting functions. At the bit level it is capable of encoding data in a variety of different forms including ASCII and EBCDIC.

For true Communication, both communicating computers must contain the same protocols. This level handles protocol conversions between different computers using different formats.

The Application layer

The application layer handles messages, remote logons and the responsibility of network management statistics. At this level are the database management programs, electronic mail, file server and printer server programs. The operating systems command and response language.

OSI Vs TCP/IP

Unfortunately (for the many people and companies that spent so much time and money on the effort), the TCP/IP suite of protocols has eclipsed OSI, and you don't hear much about OSI anymore (except for a few applications, such as the X.500 directory service).

When work began (in the late 1970s) on providing a standard method for communications between different hardware platforms, TCP/IP was not considered an option for serious commercial applications, since TCP/IP:

Required you to run UNIX (which, at the time, was not used for commercial applications and had only a command-line user interface)

Had poor security and management features

Had too small an address size

Therefore the ISO promoted development of OSI.

Although all major (and many minor) computer vendors now have OSI products, the OSI protocols were never widely implemented, and TCP/IP has become the first choice for multi-vendor networking, because of its:

Lower-cost and more-efficient implementation (less CPU time required, smaller programs)

Availability for most operating systems

Fast standardization and development cycle (usually using the Internet to facilitate communications) when a new requirement is identified

Familiarity among college graduates (universities use TCP/IP, so once out of school, a graduate's first choice when designing a system is to use TCP/IP)

Easier-to-access (and zero-cost) documentation and standards (they are all available on the Internet)

OSI Translation of TCP/IP Terms

The following table shows the OSI name for the protocol, standard, or function of the homologous TCP/IP-based networking component.

TCP/IP Abbreviation	OSI Abbreviation	OSI Full name
FTP	FTAM	File Transfer, Access, and Management
Host	ES	End System
IP	IP	Internet Protocol
OSPF	IS-IS	Intermediate System to Intermediate System
Router	IS	Intermediate System
SMTP	X.400	ITU-T's Electronic Mail Standard
SNMP	CMIP	Common Management Information Protocol
TCP	CONP	Connection-oriented Protocol
TELNET	VTS	Virtual Terminal Service
UDP	CNLP	Connectionless Protocol