The OSI and TCP/IP Models

During and before the 1980s, there were only a handful of protocols and standards that were around and they belonged to different manufacturers who didn't have much dialogue with each other. Though eventually computer science and technology continued to be further innovated and become more readily available to companies and the public, it became necessary that a widespread standard would be needed in place to ensure compatibility between all machines. This was especially true about networks, and networking technology. A network is designed to share data and information between machines, a standard that dictates how this information is formatted, transmitted, and received would make it easy for data to be shared openly, even when sending or receiving from networks that are not similar. Requirements for a new standard of implementing open communications led the International Organization for Standardization (ISO) and American Nation Standards Institute (ANSI) to develop a 7 layer network communications model known as Open Systems Interconnect or the OSI. The OSI became a link that allows data to be reliably exchanged and transmitted since guidelines were created to set a standard in how network equipment is manufactured and network OS's to communicate to each other on a network. The OSI model doesn't actually perform any tasks or functions but it dictates HOW the work should be performed by other hardware or software between networks so that communication can occur.

The OSI model is made up of these seven layers; the physical layer, data link layer, network layer, transport layer, session layer, presentation layer, and application layer. These 7 parts of the model are called a 'stack'.

Here are the 7 layers in further detail:

Physical Layer The physical layer defines all the mechanical, procedural, functional and electrical specifications for activating, deactivating and maintaining the link between each system . Such characteristics as voltage levels, the timing of voltage changes, physical data rates, maximum transmission distances, and physical connectors, are defined by physical layer specifications.

Data Link Layer The data link layer provides error-free transfer of data frames from one computer to another over the physical layer. The layers above this layer can assume virtually error-free transmission over the network. The data-link layer provides the following functions. - Establishing and terminating a logical link between two computers identified by their unique network interface card. - Controlling frame flow by instructing the transmitting computer not to transmit frame buffers - Sequentially transmitting and receiving frames - Providing and

expecting frame-acknowledgment, and detecting and recovering from errors that occur in the physical layer by retransmitting non-acknowledged frames and handling duplicate frame receipts - Managing media access to determine when the computer is permitted to use the physical medium - Eliminating frames to create and recognize frame boundaries - Error-checking frames to confirm the integrity of the received frame - Inspecting the destination address of each received frame and determining if the frame should be directed to the layer above

Network Layer The network layer controls the operation of the subnet. It determines which physical path the data takes, based on the network conditions, the priority of service, and other factors. The network layer provides the following functions.

- Transferring the frame to a router if the network address of the destination does not indicate the network to which the station is attached
- Controlling subnet traffic to allow an intermediate system to instruct a sending station not to transmit its frame when the router's buffer fills up. If the router is busy, the network layer can instruct the sending station to use an alternate destination station.
- Resolving the logical computer address with the physical network interface card address.
- Keeping an accounting record of frames forwarded to produce billing information

Transport Layer

The transport layer makes sure that messages are delivered in the order in which they were sent and that there is no loss or duplication. It removes the concern from the higher layer protocols about data transfer between the higher layer and its peers. The size and complexity of a transport protocol depend on the type of service it can get from the network layer or data link layer. For a reliable network layer, a minimal transport layer is required. Functions of the transport layer include the following.

- Accepting messages from the layer above and, if necessary, splitting them into frames
- Providing reliable, end-to-end message delivery with acknowledgments
- Instructing the transmitting computer not to transmit when no receive buffers are available
- Multiplexing several process-to-process message streams or sessions onto one logical link and keeping track of which messages belong to which sessions

Session Layer

The session layer establishes a communications session between processes running on

different computers and can support message-mode data transfer.

Functions of the session layer include:

- Allowing application processes to register unique process addresses. It provides the means by which these process addresses can be resolved to the network-layer or data-link-layer NIC addresses, if necessary.
- Terminating, establishing and monitoring a virtual-circuit between two processes identified by their specific addresses. A virtual-circuit session is a direct link that exists between the sender and receiver to add header information that indicates where a message starts and ends. The receiving session layer can then refrain from indicating any message data to the overlying application until the entire message has been received.
- Informing the receiving application when buffer space is insufficient for the entire message and that the message is incomplete. The receiving session layer may also use a control frame to inform the sending session layer how many bytes of the message has been successfully received. The sending session layer can then resume sending data at the byte following the last byte acknowledged as received. When the application provides another buffer, the session layer can place the remainder of the message in that buffer and indicate to the application that the entire message has been received.

Presentation Layer

The presentation layer ensures that information sent by the application layer of one system will be readable by the application layer of another system. If necessary, the presentation layer translates between multiple data representation formats by using a common data representation format. The presentation layer concerns itself not only with the format and representation of actual user data but also with data structures used by programs. In addition to actual data format transformation, the presentation layer negotiates data transfer syntax for the application layer.

Application Layer

The application layer is the OSI layer closest to the user. It differs from the other layers because it does not provide services to any other OSI layer, but rather to application processes lying outside the scope of the OSI model. Examples include spreadsheet programs, word-processing programs, banking terminal programs, etc. The application layer identifies and establishes the availability of intended communication partners, synchronizes cooperating applications, and establishes agreement on procedures for error recovery and control of data integrity. Also, the application layer determines whether sufficient resources for the intended communication exist.

The TCP/IP model

Transmission Control Protocol/Internet Protocol was developed in the 60's as a method that connects large mainframes computers together for the simple purpose of sharing data or information. In the present, most computer operating systems manufactures to incorporate the TCP/IP suit into their software programs allowing for each individual workstation to encompass the ability to transmit, receive, and share information through the largest mainframe available, the Internet. The TCP/IP model is made up of 4 layers, a few layers less than the OSI model. The TCP/IP model consists of from highest to lowest: The Application layer, The Transport layer, The Internet layer and the Link layer or Subnet layer.

The Application layer

Just like the OSI model, the Application layer in the TCP/IP model performs the same sort of function. Only that the Application layer for the TCP/IP corresponds to the Application layer, Presentation layer and Session layer of the 7 layer OSI model.

The Transport Layer

Transport layers exist in both TCP/IP and OSI model. Even though both models have Transport layers they differ. The TCP/IP model consists of two standard transport protocols: Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP uses a reliable data-stream protocol which is connection-oriented and UDP uses an unreliable data-stream protocol which is connectionless oriented.

The Internet layer

The Internet layer is a group of protocols and specifications that are used to transport packets from the host across a network, the host specified by a network address (IP address).

The Link Layer

The lower level layer of the TCP/IP model, this layer is used by a suite of protocols for the "Internet". This is used to connect hosts or nodes to a network. This layer is compared to the "Data Link" layer and the "Physical " layer of the OSI model.

TCP/IP Application Layer VS OSI Application, Presentation, and Session layer.

The similarities in both models are comparable but different at the same time. All though they

exist in both, the approach each uses to construct applications is different. In the OSI model the Application layer, Presentation layer and Session layer correspond to the Application layer of the TCP/IP model. They somewhat do the same job but use different protocols, TCP/IP uses FTP, SMTP, TELNET, DNS and SNMP where the OSI model uses: FTAM, VT, MHS, DS, CMIP.

TCP/IP Transport layer VS OSI Transport layer.

UDP and TCP defined by TCP/IP Transport Layer correspond to many of the requirements of the OSI Transport Layer. Some issues occur over the requirements in the session layer of OSI since sequence numbers and port values can help the Operating System to keep track of active sessions. Most of the TCP and UDP functions and specifications map to the OSI Transport Layer. The TCP/IP and OSI architecture models both employ all connection and connectionless models at the transport layer. The architecture calls the 2 models in TCP/IP simply Connections and Datagrams. The OSI model uses the terms “Connection-mode” and “Connection-oriented” for the connection model and the term “Connectionless-mode” for the connectionless model.

TCP/IP Internet layer VS OSI Network layer

The Network layer of the OSI model is compared to the Internet layer of the TCP/IP model. Both models support “Connectionless” network services, but only the Network layer in the OSI supports connected services. The OSI layer is a “catch-all” for all protocols that assist in network functionality, where the “Internet” layer of the TCP/IP model assist in internetworking using Internet Protocol.