# Written Assignment #1: The OSI Model

The OSI (Open Systems Interconnections) Reference Model is an important framework for understanding how computers communicate over a network. The model divides data communications into seven layers, including the physical, data link, network, transport, session, presentation, and application layers. The first three layers are considered to primarily involve hardware, while the upper four layers involve mostly software. Communication is understood to flow from the application layer of the initiating machine down to the physical layer, and then up from the physical layer of the receiving machine up to the application layer (Bora et. al 2014). Dividing up the data transmission process in this way makes it easier for engineers to conceptualize the data transmission process, and provides a common terminology and architectural framework for troubleshooting and designing network-based applications. The remainder of this paper will focus on describing each layer of the OSI Model, identifying core network protocols, components, and devices associated with each layer, and explaining how each layer works together.

# **The Physical Layer**

The primary role of the physical layer is to send bit streams over the network. To this end, core protocols associated with this layer include rules governing the voltage, number of bits per second, and interfaces, cables, and connectors used for data transmission, as well as “radio signals used in wireless communication” (Bora et. all, 2014; Ciccarelli et. al 2013). Key hardware components associated with the physical layer include: “cabling system components; adapters that connect media to physical interfaces; connector design and pin assignments; hub, repeater, and patch panel specifications; wireless system components; parallel SCSI (Small Computer System Interface); [and the] Network Interface Card (NIC)” (Simoneau 2006).

# **The Data Link Layer**

Moving up one layer, the data link layer allows a machine to access the network so that it can send bit streams generated by the physical layer over a network. This layer is responsible for encapsulating data packets to convert them into frames, as well as for providing error-detection services. In the event that errors are detected, the data link layer will correct and retransmit messages.

The data link layer consists of two sub-layers, including the Media Access Control (MAC) sub-layer, which is a physical address that is used to direct and filter network traffic, and the Logical Link Control sub-layer (LLC), which connects the MAC to higher-level protocols that can be configured to facilitate both connectionless and connection-oriented transmission services. In the case of the former, it is assumed that data sent over the network will arrive correctly, whereas in the case of the latter, checks are performed to ensure a message has arrived correctly at its intended destination (Ciccarelli et. al 2013; Simoneau 2006). Key components that are associated with the data link layer include: “network interface cards [NICs], Ethernet and Token Ring switches, [and] bridges” (Simoneau, 2006).

# **The Network Layer**

The network layer is the third layer of the OSI model, and is primarily responsible for providing logical address for packets so that data can be successfully transferred, received, and reassembled as it is transmitted across multiple layer 2 networks (i.e., Ethernet, Wi-Fi, Token Ring). Internet Protocol (IP) addresses are the current standard for level 3 addresses; many companies also subdivide their network layers addresses into smaller pieces to make the traffic easier to manage. These smaller pieces are called subnets, and routers use the network and/or subnet portions of an IP address to direct traffic across multiple networks (Simoneau 2006). Routers communicate with one another to identify other networks and determine the best way to send the datagram from the host to the destination machine. Typically, routing algorithms focus on identifying the shortest path between these two nodes. Additionally, the network layer also performs validation checks regarding packet contents, and breaks up packets if needed so that they can be compatible with the network they are entering. Routers, brouters, and switches are key components associated with the network layer (Ciccarelli et. al 2013).

# **The Transport Layer**

The transport layer is the fourth layer of the OSI model, and its primary purpose is to facilitate end-to-end transmission of data packets through the network. If the network in question is connection-oriented, the transport layer checks to ensure the entire message has been transmitted, and re-sends if necessary. On the other hand, in the case of connectionless transmissions, the transport layer simply assumes the message has arrived, and does not require confirmation from the recipient. This sort of transmission is faster, but less reliable, than connection-oriented transmission. The transport layer also controls the flow of data over the network by monitoring to that recipient computers are not overloaded by the speed or size of the messages they receive. The TCP/IP protocol is a key network protocol of the transport layer (Ciccarelli et. al 2013).

# **The Session Layer**

The session layer is the fifth layer of the OSI model, and its primary role is to initiate, maintains, and terminate connections between machines. This layer is also responsible for session accounting, which essentially entails tracking the number of bytes that each party acknowledges receiving during the session. In the event that transmitted data has not been received, this layer is also charged with retransmission. The session layer also creates dialogue units and manages flow (i.e. which party in the transaction is transmitting during a dialogue). This layer may also provide exception handling in the event that a dialogue is terminated abruptly or accidentally.

# **The Presentation Layer**

The presentation layer governs

# **The Application Layer**

The application layer is the seventh and final layer of the OSI model, and it

Simoneau 2006

Ciccarelli et. al 2013