

OSI Reference Model: An Overview

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ABSTRACT:

A reference model is a conceptual blueprint of how communication should take place. It addresses all the process required for effective communication and divides these processes into logical grouping called layers. When a communication system is designed in this manner, it is known as layered architecture. The OSI isn't a physical model, though. Rather, it's a set of guidelines that application developers used to create and implement application that run on a network. It also provides a framework for creating and implementing networking standards, devices, and internetworking schemes. This paper explains the OSI Reference Model, which comprises of seven different layers. Each layer is having its own responsibilities.

1. INTRODUCTION-

An Open System Interconnection model commonly known as an OSI model ratified in 1984, is like an INTERFACE between two parties i.e., one sender and other receiver. The OSI model was basically developed to simplify network complexity, facilitate network training and introduce easy network troubleshooting. The OSI model is not real network architecture, because it does not really specify the services and protocols each layer should use. It rather describes what the layers must do.

“Short for Open System Interconnection, an ISO standard for worldwide communications that defines a networking framework for implementing protocols in seven layers.”[13]

“The OSI, or Open System Interconnection, model defines a networking framework to implement protocols in seven layers. This article explains the 7 Layers of the OSI Model.

The OSI, or Open System Interconnection, model defines a networking framework to implement protocols in seven layers. Control is passed from one layer to the next, starting at the application layer in one station, and proceeding to the bottom layer, over the channel to the next station and back up the hierarchy.”[2]

2. LITERATURE SURVEY:

OSI is a standard description or a reference model for defining how messages should be transmitted between any two points in a telecommunication network.

Kayri et al., [12] proposed that, possible troubles on the related layer vary and possible troubles on each layer are categorized for functional network administration and they are standardized in an eligible way.

Zimmermann et al., [16] proposed a model for architecture for Opens Systems Interconnection developed by SC16. In it he gave some indications on initial sets of protocols which now have been developed in OSI reference model.

Scheidell et al., [17] proposed a theory which seeks to help the reader understand how the traditional OSI model applies to security, realize that three additional layers exert a powerful influence over security programs and decisions, and leverage tips for navigating OSI Layers 8, 9 and 10 to become more effective security professionals.

Aschenbrenner et al., [18] briefly defined what OSI is, the interrelationships of the various standards bodies, and the goals and benefits to users, vendors, country post telephone and telegraph bodies, common carriers, and governments.

3. Ever Wondered How a message travels from a device to another??

Well, the answer is an OSI model itself. An Open Systems Interconnection (OSI) reference model is the world's major used networking architecture model.

“The OSI reference model adopts a layered approach where a communication subsystem is broken down into seven layers, each one of which performs a well-defined function.”[3]

It serves as a model in which then actual services and protocol can be drafted. An OSI model is a combination of 7 different layers, each having a specific role.

The layers are as followed:

1. Application layer,
2. Presentation layer,
3. Session layer,
4. Transport layer,
5. Network layer,
6. Data link layer and,
7. Physical layer.

The upper layers

Application
Presentation
Session

The Lower layers

Transport
Network
Data Link
Physical

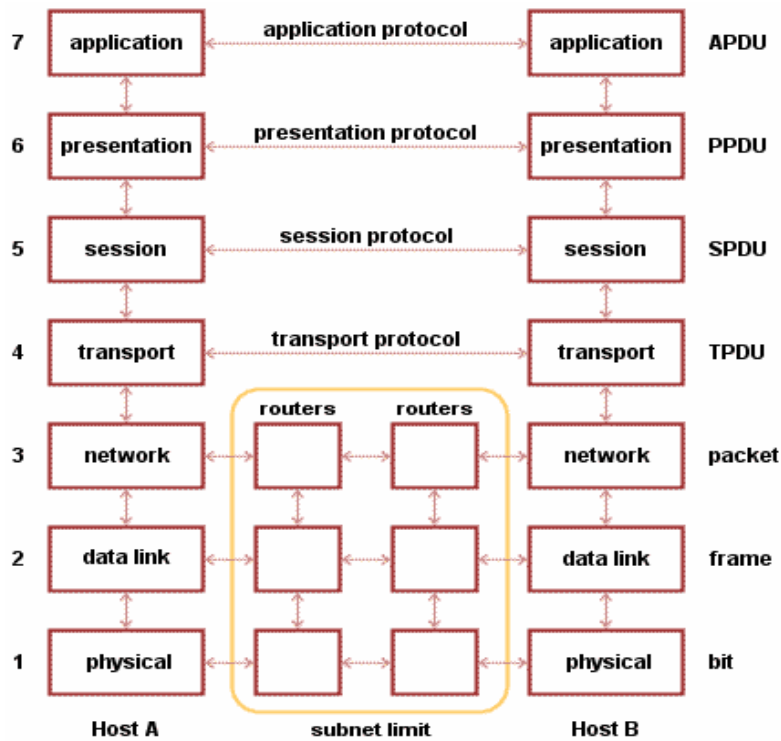
WORKING OF THE 7 LAYERS OF OSI MODEL:

OSI divides telecommunication into seven layers. The layers are in two groups. The upper four layers are used whenever a message passes from or to a user. The lower three layers (up to the network layer) are used when any message passes through the host computer. Messages intended for this computer pass to the upper layers. Messages destined for some other host are not passed up to the upper layers but are forwarded to another host.

“Virtually all networks in use today are based in some fashion on the Open Systems Interconnection (OSI) standard. OSI was developed in 1984 by the International Organization for Standardization (ISO), a global federation of national standards organizations representing approximately 130 countries.

The core of this standard is the OSI Reference Model, a set of seven layers that define the different stages that data must go through to travel from one device to another over a network.” [4]

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[6]

An OSI reference model

4. DESCRIPTION OF THE SEVEN LAYERS:

- *Physical Layer*

The functions of physical layer is to convert signals into bits, that can be used by other layer and adjusting the signal to allow for multiple users to use the same connection.

Also, it specifies how a device sends and receives information; examples of this include the wires used to connect various components of a computer or even the radio signals used in wireless communication.

- *Data Link Layer*

The main function of this layer is to provide a method by which information from the network is broken down into frames and transmitted over the physical layer. This layer is also responsible for some Error detection and correction.

“The data link is responsible for node to node validity and integrity of the transmission. The transmitted bits are divided into frames; for example, an Ethernet, Token

“This layer conveys the bit stream - electrical impulse, light or radio signal -- through the network at the electrical and mechanical level. It provides the hardware means of sending and receiving data on a carrier, including defining cables, cards and physical aspects.”[7]

“The physical layer is responsible for passing bits onto and receiving them from the connecting medium. This layer has no understanding of the meaning of the bits, but deals with the electrical and mechanical characteristics of the signals and signalling methods. For example, it comprises the RTS and CTS signals in an RS-232 environment, as well as TDM and FDM techniques for multiplexing data on a line. SONET also provides layer 1 capability.”[8]

Ring or FDDI frame in local area networks (LANs). Frame relay and ATM are also at Layer 2. Layers 1 and 2 are required for every type of communications. For more on this layer, see data link protocol.”[8]

- *Network Layer*

While the data link layer deals with the method in which the physical layer is used to transfer data, the network layer deals with organizing that data for transfer and reassembly.

In short, the main function of this layer is Path determination and logical Addressing. This layer provides logical addresses to the packets received which in turn helps them to find their path.

“The network layer provides the functional and procedural means of transferring variable length data sequences (called datagrams) from one node to another connected to the same *network*. A network is a medium to which many nodes can be connected, on which every node has an *address* and which permits nodes connected to it to transfer messages to other nodes connected to it by merely providing the content of a message and the address of the destination node and letting the network find the way to deliver ("route") the message to the destination node. In addition to message routing, the network may (or may not) implement message delivery by splitting the message into several fragments, delivering each fragment by a separate route and reassembling the fragments, report delivery errors, etc.”[9]

“The session layer is responsible for establishing, managing, and terminating connections between applications at each end of the communication.”[10]

- *Presentation Layer*

This layer works by taking care of the directions given by the user at the application layer. It is where the human readable programming languages are translated into machine code instructions used by the lower layers.

In general the main work of Presentation is Data representation, security encryption, and converts computer code to network formatted code.

“This layer (i.e. presentation layer) provides independence from data representation (e.g., encryption) by translating between application and network formats. The presentation layer transforms data into the form that the application accepts. This layer formats and encrypts data to be sent across a network. It is sometimes called the syntax layer.”[9]

- *Application Layer*

This is the level that the user often interacts with. This is where data turns into websites, chat programs and so on. Many protocols run at this layer, such as DNS, FTP, HTTP, HTTPS, NFS, POP3, SMTP, and SSH.

“This layer supports application and end-user processes. Communication partners are identified, quality of service is identified, user authentication and privacy are considered, and any constraints on data syntax are identified. Everything at this layer is application-specific. This layer provides application services for file transfers, e-mail, and other network software services.”[7]

- *Transport Layer*

This layer is mainly concerned with Reliability (security like encryption/decryption, firewall etc.), maintenance of flow of packets by reducing CONGESTION* and performs error checking ensuring quality of service by resending data when data has been corrupted.

***Congestion**-When a Network receives more packets than its capacity (Traffic in excess of network capacity).

“This layer provides transparent transfer of data between end systems, or hosts, and is responsible for end-to-end error recovery and flow control. It ensures complete data transfer.”[7]

- *Session Layer*

This layer creates a session like environment between the two parties (sender/receiver) and programs to create and control conversation.

A conversation consists of many REQUEST/RESPONSE. If we say about the disadvantages in an OSI model so we can say that there are no real disadvantages to the OSI model, since it is a reference model to how data is represented. It has many advantages, such as helping to determine networking issues. Perhaps the only drawback would be that it does not reference any type of implementation, such as the TCP/IP model.

Benefits of the OSI Model:

“By separating the network communications into logical smaller pieces, the OSI model simplifies how network protocols are designed. The OSI model was designed to ensure different types of equipment (such as network adapters, hubs, and routers) would all be compatible even if built by different manufacturers.”[11]

The OSI model has many benefits which include:

- a. **Compatibility:** The OSI model can fit to any compatible software/hardware from different users in other parts of the world. As software/hardware differs among various users so OSI is a model that is compatible to all.
- b. **Easy Troubleshooting:** Since each layer in an OSI is independent of each other so it makes it easier to detect and solve all errors prevailing in it.
- c. **Easy Understanding Nature:** OSI model is very interactive and even guides us to know what a model is, how it operates, and common methodologies, how new technologies are developed in existing networks.
- d. **Security:** OSI model have functionality for Encryption and Decryption which has a major

contribution for security purpose. This makes it Reliable.

- e. Add multiple network models: The OSI model is designed in such a way that user can further extend

new protocols within the process. This implies that we can even use other different architecture in it other than the existing one.

5. CONCLUSION:

In this paper we have tried to explain what exactly an OSI reference model is, why it is used and contribution of various researchers in this reference. OSI is basically an architecture which only gives us an idea how packets transfer over the network during any communication. OSI enhancements are done time to time for developing new technologies. Scheidell et al., [17] proposed three different layers in his paper for improvising security in any network. Future implementation in OSI will lead to enhancement in security and many other fields.

REFERENCES-

- 1- Margaret Rouse, "OSI (Open Systems Interconnection)", in <http://searchnetworking.techtarget.com/definition/OSI>.
- 2- Webopedia (http://www.webopedia.com/quick_ref/OSI_Layers.asp)
- 3- Regan (<http://www.antiessays.com/free-essays/96912.html>) in 2004.
- 4- <http://computer.howstuffworks.com/osi.htm>
- 5- <http://whatis.techtarget.com/reference/OSI-Reference-Model-illustrated>
- 6- <http://media.techtarget.com/digitalguide/images/Misc/osi.gif>
- 7- <http://www.escotal.com/osilayer.html>
- 8- <http://encyclopedia2.thefreedictionary.com/Seven-layer+OSI+model>
- 9- Wikipedia(http://en.wikipedia.org/wiki/OSI_model)
- 10- <http://www.omnisecu.com/tcpip/osi-model.php>
- 11- Bradley Michell(<http://compnetworking.about.com/cs/designosimodel/a/osi-model.htm>)
- 12- Murat Kayri1 and Ismail Kayri, "International Journal of Next-Generation Networks (IJNGN) Vol.2, No.3, September 2010".
- 13- "OSI" <http://www.webopedia.com/TERM/O/OSI.html> (15 Mar. 2002).
- 14- Hubert Zimmermann, "OSI Reference Model- The ISO Model of Architecture for Open System Interconnection" IEEE transaction on communications, vol.28, issue 4, April 1980.
- 15- Mizanian, K, Vasef, M. and Analoui, M. (2010) "Bandwidth modeling and estimation in peer to peer networks", International Journal of Computer Networks & Communications (IJCNC), Vol. 2, No. 3, pp. 65-83.
- 16- Hubert Zimmermann, "OSI Reference model-An ISO model Architecture for OSI", in IEEE transaction on Communications, Vol. Com-28, No.4, April 1980.
- 17- Michael Scheidell, "Three Undocumented Layers of the OSI Model and Their Impact on Security", SECNAP Network Security Corporation.
- 18- J.R. Aschenbrenner. "Open Systems Interconnections", IBM SYSTEMS JOURNAL, VOL 25. NOS 3/4, 1986.