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Mode of Data Flow in the OSI Model

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Abstract

As the urgency in the need for standards in different computer networks was more, International Standard Organization (ISO) created a new subcommittee for "Open System Interconnection" in 1977. The first priority of subcommittee was to develop architecture for Open System Interconnection which could serve as a frame work for the definition of standard protocols. In July 1979 the specifications of this architecture, established. That was passed under the name of "OSI Reference Model" to Technical committee .These recommendations were adopted at the end of 1979 as the basis for the following development of standards for Open System Interconnection within ISO. This paper explains the OSI reference Model, which comprises of seven different layers & their own responsibilities.

Keywords: - Open System Interconnection (OSI), International Standard Organization (ISO), Protocol.

History of OSI

In the late 1970s, two projects began independently, with the same goal: to define a unifying standard for the architecture of networking systems One was administered by the International Organization for Standardization (ISO), while the other was undertaken by the International Telegraph and Telephone Consultative Committee, or CCITT .These two international standards bodies each developed a document that defined similar networking models.

In 1983, these two documents were merged to form a standard called The Basic Reference Model for Open Systems Interconnection. The standard is usually referred to as the Open Systems Interconnection Reference Model, the OSI Reference Model, or simply the OSI model. It was published in 1984 by both the ISO, as standard ISO 7498, and the renamed by CCITT as standard X.200. OSI had two major components, an abstract model of networking, called the Basic Reference Model or seven-layer model, and a set of specific protocols.

Within each layer, one or more entities implement its functionality. Each entity interacted directly only with the layer immediately beneath it, and provided facilities for use by the layer above it.

Protocols enabled an entity in one host to interact with a corresponding entity at the same layer in another host. Service definitions abstractly described the functionality provided to an (N)-layer by an (N-1) layer, where N was one of the seven layers of protocols operating in the local host.

The OSI reference model was a major advance in the teaching of network concepts. It promoted the idea of a consistent model of protocol layers, defining interoperability between network devices and software.

It is a way of sub-dividing a communications system into smaller parts called layers. It provides a set of design standards for equipment manufacturers so they can communicate with each other

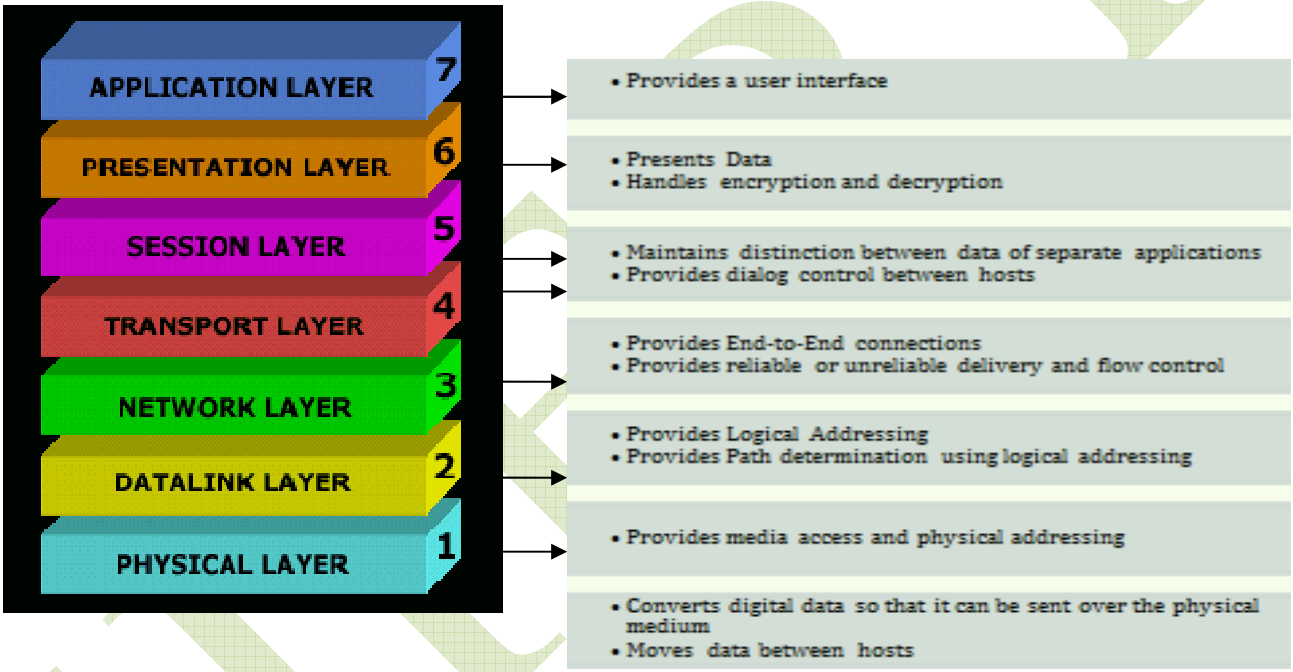


Fig. 1. OSI Seven Layer Model

Mode of Data Flow in the OSI Model

A) Physical Layer of OSI Model

"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 converts data from the upper layers into 1s and 0s for transmission over media. As well as defines how data is encoded onto the media used to transmit the data. Conveys the bit stream through the network at the electrical and mechanical level & interfaces between network medium and devices

Device example: Hub

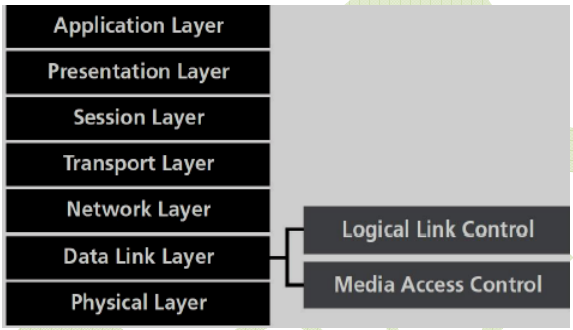
Used to transmit data:-Copper wiring, fiber optic cable, radio frequencies, anything that can be used to transmit data is defined on the Physical layer of the OSI Model

B) Data link Layer of OSI Model

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 is responsible for moving frames from node to node or computer to computer. It can move frames from one adjacent computer to another, cannot move frames across routers. It requires MAC address. or physical address

Device example: Switch

Two sub layers: Logical Link Control (LLC) and the Media Access Control (MAC)



Logical Link Control (LLC)

–Data Link layer addressing, flow control, address notification, error correction

Media Access Control (MAC) determines which computer has access to the network media at any given time.

C) Network Layer Of OSI Model

The network layer deals with organizing that data for transfer and reassembly.

It is responsible for moving packets (data) from one end of the network to the other, called end-to-end communications. it requires logical addresses such as IP addresses . **Device example**: Router .Routing is the ability of various network devices and their related software to move data packets from source to destination.

D) Transport Layer of OSI Model

It takes data from higher levels of OSI Model and breaks it into segments that can be sent to lower-level layers for data transmission .Conversely, reassembles data segments into data that higher-level protocols and applications can use .Also puts segments in correct order (called sequencing) so they can be reassembled in correct order at destination. May use a connection-

oriented protocol such as TCP to ensure destination received segments .It use a connectionless protocol such as UDP to send segments without assurance of delivery. It uses port addressing divides streams of data into chucks or packets. Reassembles the message from packets. Provide error-checking to guarantee error- free data delivery, with no losses or duplications. Provides acknowledgment of successful transmissions, requests retransmission if some packets don't arrive error-free. Provides flow control and error-handling

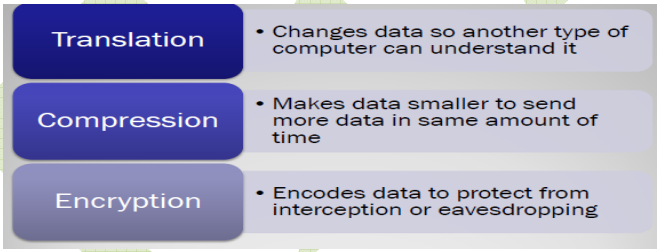
E) Session Layer of OSI Model

It is Responsible for managing the dialog between networked devices, & establishes, manages, and terminates connections. Also provides duplex, half-duplex or simplex communications between devices. Its other function is to provide procedure for establishing checkpoints, adjournment, termination, and restart or recovery procedures. Moreover it is responsible for name recognition (identification) so only the designated parties can participate in the session.

If session fails, It not only determines data after the most recent checkpoint that need to be transmitted, but also manages who can transmit data at a certain time and for how long.

F) Presentation Layer of OSI Model

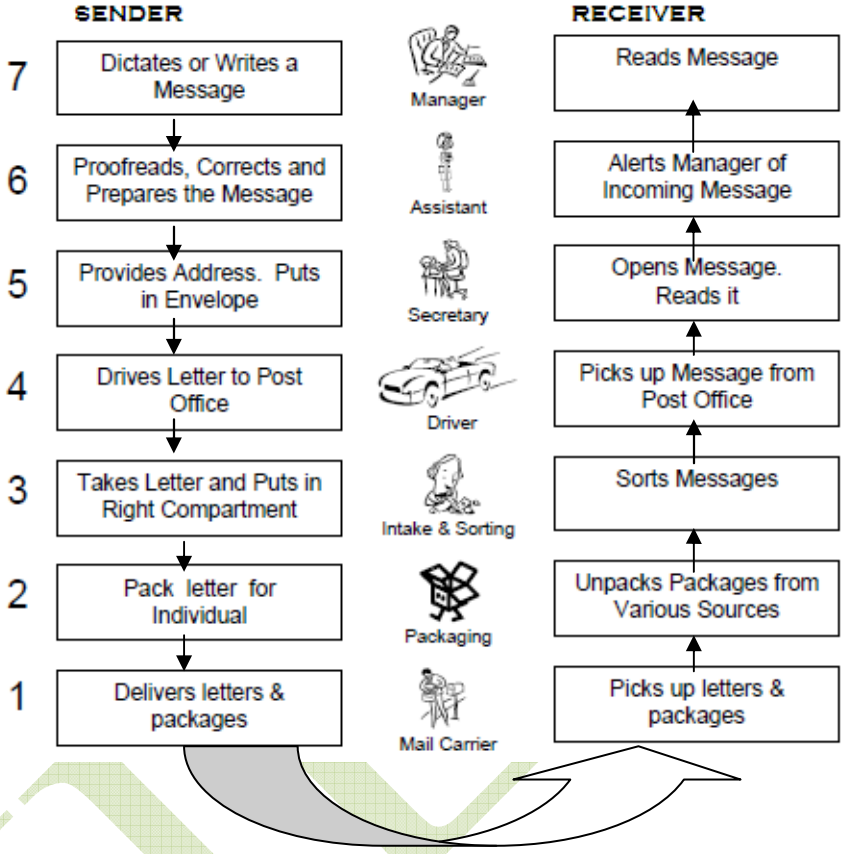
It is Concerned with how data is presented to the network .For this it handles three primary tasks [a] Translation [b] Compression [c] Encryption



G) Application Layer of OSI Model

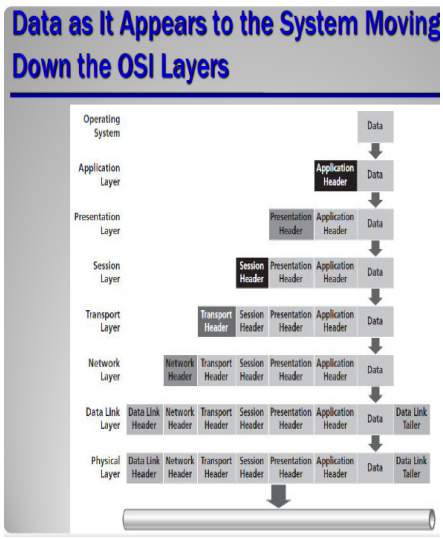
It contains all services or protocols needed by application software or operating system to communicate on the network .It is used for applications specially written to run over the network. It allows access to network services that support applications. It not only directly represents the services that directly support user applications (e.g., file transfer and email) but also looks what the user sees or does

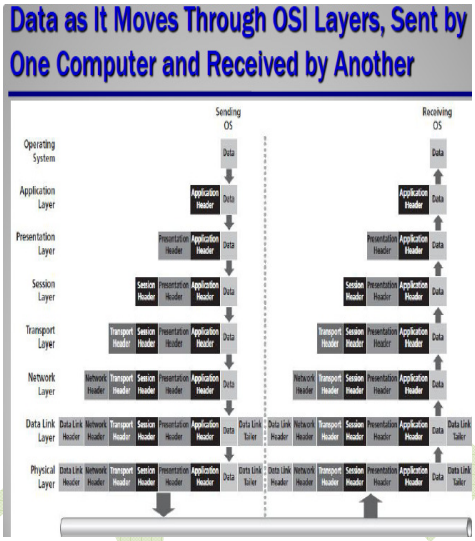
Practical Approach of OSI model



•Examples
–Firefox web browser uses HTTP (Hyper-Text Transport Protocol)

–E-mail program may use POP3 (Post Office Protocol version 3) to read e-mails and SMTP (Simple Mail Transport Protocol) to send e-mails





Encapsulation: Data > segment > packet > frame > bits (data bits)

De-encapsulation: Bits > frame > packet > segment > data (bits data)

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." 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. 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.. Security: OSI model have functionality for Encryption and Decryption which has a major

Advantages of OSI Model

Reduces complexity: It breaks network communication process into smaller and simpler components, thus aiding component development, design, and troubleshooting.

Standardizes interfaces: It standardizes network components to allow multiple vendor development and support.

Facilitates modular engineering: It allows different types of network hardware and software to communicate with each other.

Interoperability between Vendors: It allows multiple-vendor development through standardization of network components.

Ensures interoperable technology: It prevents changes in one layer from affecting the other layers, allowing for quicker development.

Accelerates evolution: It provides for effective updates and improvements to individual components without affecting other components or having to rewrite the entire protocol.

Simplifies teaching and learning: It breaks network communication into smaller components to make learning easier.

Disadvantages of OSI Model

1. Many LANs are powerful (high speed) and has low error rates, so no need of the data integrity provided by OSI.
2. Many LAN applications need very fast setup with each other but comparatively it is slow.
3. The OSI model is too complex. Whereas, at the implementation level, TCP/IP is much more optimized and effective.
4. OSI model is not adapted at all to telecommunication applications on computer.
5. Due to the complexity of the model, the first implementations were pretty heavy and slow.

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