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Decentralization of networking and processing

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Abstract

Due to a misguided notion, many networking sources which cite about networking tries to conceal the OSI model unfavourable by treating it briefly or representing it misleadingly. While it is appropriate that the OSI is by nature theoretical and the networking protocols aren't always designed to fit truly within the confines of its layers, it is hence spoken falsely especially the OSI model has little to no applicability in the real world. In fact, it would be impossible to understand about network technology and all its subjects today without referring to the OSI model and its layers, this is because the OSI model aids to frame discussion and opinion on protocols and contrast various other technologies.

Keywords: Spoken falsely, OSI model

Introduction

Due to the above-stated reason, it is crucial to know the paraphernalia of the OSI model and not just its facade. This is because the OSI model furnishes us with the comprehension of understanding how technologies like Ethernet, Wi-Fi, optic cable technology, data transmission, and Home PNA have some similarities; this also gives us an elaborative insight into how a PC can communicate and share data using several distinct sets of protocols, even simultaneously that will be discussed in this article; it is an important part of comprehending the dissimilarities and the distinction between interconnection devices such as bridges, hubs, switches, routers, and repeaters; This would subsequently explain the interoperation of many WAN technologies.

Due to the pre-relevant increase in development in such fields, the OSI model layers are now being discussed more so ever often in conference and discussions of technologies. Many of the protocols mentioned in this source are designated specifically in terms of their use and their position in the OSI reference model.

The OSI Model

During the infancy of network computing it was created, the OSI was published in 1948. The open systems interconnection (OSI) Model is a theoretical model created by the International Organization for Standardization which authorizes manifold diverse communication systems to communicate using standard protocols. In plain text, the OSI provides a level for various computer systems to be able to communicate with one another. Though it does not always apply directly to a specific system. The OSI model serves as a universal language in the world of computer networking. The sole basis of the whole concept is splitting up a communication system into seven abstract and distinct layers, each one stacked upon the last. However, due to modern times, not all networking concepts follow the OSI model but works as the backbone for most concept models as it is a conceptual framework with the sole purpose to describe the functions of a networking system.

Due to change in times, The OSI model does consist of other protocols too, however we'll be focusing on:

- Application Layer
- Presentation Layer
- Session Layer
- Transport Layer
- Network Layer
- Datalink Layer
- Physical Layer

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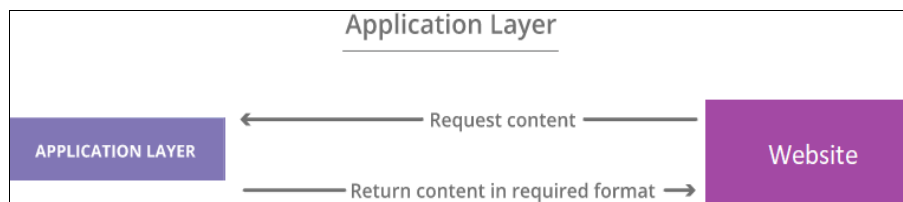
A detailed analysis will be conducted in this paper for each layer of the OSI model. The OSI model is still extremely helpful for most troubleshooting network problems. Whether it is a site crash, leaving thousands of users not to access the website, or a person not able to connect their laptop to the internet, the OSI model can help to breakdown or at times even solve the problem and isolate the source of the trouble to rectify it manually. This is done so that no unnecessary work will be done and can only be achieved by focusing on one layer, which is the source of the problem. [1].

We will now be looking at each layer and analysing it in detail in [2-50].

The Application Layer

The first layer from the top is the only one that directly interacts and communicates with the user. The software applications like web browsers and email clients rely on this very layer, the application layer to initiate the process of communicating. It should be made explicit that the above client software is not a part of the application layer, and the layer is solely used to better the experience of the user while using it. The application layer is responsible for the protocols and the data manipulation that the software depends on to present meaningful data to the user.

The application layer finds the communication partners, resources available and synchronizes communication. In the OSI model, this application layer is attenuated in terms of its scope. The application layer in the OSI model in general acts only like the user interface which is accountable for communication with host-based and user-facing programs.



The Presentation Layer

This layer is first and foremost accountable for putting together data so that it can be utilized by the application layer; in other words, the 6th layer of the OSI model is accountable to make the data presentable for applications to consume. The presentation layer is in control of translation, encryption, and compression of the data which is being sent. Two communication devices in a network communicating may be using different encoding methods, so the 6th layer of the OSI model is in control of translating incoming data by formulating it into a syntax that the application layer of the other end system understands.

If the communication is done over an encrypted connection bridge, the 6th layer is responsible for adding the encryption on the sender's end in addition to decoding the encryption on the other end, the receiver's end so that it can present the application layer with unencrypted, readable, and usable data. The Presentation Layer manages distinct and abstract data structures, which are to be defined or exchanged during the communication period and most string representations are done here, in other words, the Presentation Layer is solely used to deal with the issues of string representation. Serialization is also performed in this layer (The process of translating a data structure or an object into a format that

This is in variance with TCP/IP protocol, consequently, the layers below the application layer, which is the Session Layer, and the Presentation layer are to join forces together and shape a simple unit-layer which is responsible for performing the functions, which includes managing the dialogues between computers, establishing as well as maintaining as well as closing a particular session, providing data compression and data encryption and many more. In the beginning, the client sends a command to the server and when it receives the said command, it allocates a port number to the client. Subsequently, the client sends a commencement connection request to the server and when the server receives the request, it sends back an ACK (Acknowledgement) signal to the client through the medium, and hence the client now has successfully established a connection with the server and, therefore, now the client has access to all the service the server is willing to provide, however, the most basic services are to send any types of file or documents or to upload some files or documents on the server itself [2].

To make sure a smooth connection is established, Application Layer protocols are established at both ends of the connection medium that is the source host and the destination host. The application layer protocols include HTTP (Hypertext Transfer Protocol), SMTP (Simple Mail Transfer Protocol, protocol that enables email communications), TELNET (Telecommunication Network), DNS (Domain Name System), DHCP (Dynamic Host Configuration Protocol), FTP (File Transfer Protocol), NFS (Network File System), SNMP (Simple Network Management Protocol).

can be stored or transmitted easily). The Presentation Layer also features to apply certain sophisticated compression techniques, so fewer bytes of data are needed to represent the data when it is transmitted over the network. The layer formats and encrypts data to be transmitted over a network, providing freedom from compatibility problems. This layer also can conclude with the Transfer syntax. The layer converts the data transmitted by the application layer of the node into an acceptable and agreeable data format based on the appropriate network protocols and the needed architecture. Upon the arrival of data at the receiving computer in the network, the presentation layer translates data into a format usable by the application layer [3]. In general, the presentation layer is responsible for any issues occurring when the transmitted data must be viewed in a format different from the former format. Being the utilitarian layer of the OSI model, the presentation layer carries out many data conversion algorithms and character translation methods. This layer is responsible for managing two network characteristics: the set of rules (Protocols) and the architecture that it follows.

The presentation layer, to carry out all its functions, needs to use a certain set of protocols, the protocols are Apple Filing Protocol (AFP); Lightweight Presentation Protocol

(LPP); Netware Core Protocol (NCP); Network Data Representation (NDR); External Data Representation (XDR); Secure Socket Layer (SSL).

The Session Layer

The Session Layer is the 5th Layer of the OSI model (Interconnection System Interconnection). The session layer authorizes users on different computers to form active communication sessions between the two users. It is responsible for maintaining, establishing, terminating, and synchronizing sessions between the two end users' applications. In the Session Layer, a cascade of data is received and further marked, which is then resynchronized properly, so that the ends of the messages are not cut initially and to avoid data that is pre-relevant in old times. The session entities of both users are connected via the session layer. This layer manages and manipulates data that is received from the session layer and the presentation layer. The very initiation process of the session layer is to map the address to the shipping address and then it proceeds to lay us choices to select the required transport quality of the service parameters which is also referred to as QoS. We further are required to transmit limited transparent user data. And at the end, monitoring of the Data Transfer phase should be done properly and precisely to predict loss of data or avoid the issue itself. This is uniquely made to send a larger amount of data files as it is very important. This layer works as dialogue control, it allows systems to communicate in either two modes of communication: half-duplex mode or full-duplex mode [6].

This is also responsible for token management, through which it stops two users from simultaneously accessing or attempting the same critical operations. Through the process of adding checkpoints, the session layer allows synchronization, these checkpoints are considered as synchronization points to the streams of data being transmitted in the network. Most services provided by the session layer are generally implemented in application environments using RPCs (Remote Procedure Calls). This layer also controls single and even multiple connections for each end-user application and directly communicates with both the previous two layers which are the Presentation Layer and the Application Layer. Transmission of data within layers is also a responsibility of the session layer. To ensure the transmission of data is done in a safe, secure, and accurate, the session layer uses some protocols during communication between the two-end user applications: ADSP (AppleTalk Data Stream Protocol); RTCP (Real-time Transport Control Protocol); PPTP (Point-to-Point Tunnelling Protocol); PAP (Password Authentication Protocol); Remote Procedure Call Protocol (RPCP); SDP (Sockets Direct Protocol) [5].

The Transport Layer

The transport layer is the fourth layer of the OSI model. The transport layer is responsible for making the stream of data packets, sending, and checking the received data is correct or not, and contains no error. The transport layer governs the end-to-end control which is determining whether all packets have successfully been received or not. It also ensures if the data is successfully sent and received in both the nodes sender's end as well as the receiver's end. If there is an error to be found in the received information or if it is sent incorrectly, the transport layer authorizes to ask the

sender for a retransmission of the data. To the application groups, it provides a well-founded network independent message interchange service to the application group. The transport layer acts as an interface between the bottom and top three layers of the OSI model. The transport layer follows TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) [7].

The TCP (Transmission Control Protocol) is an important network protocol that lets two hosts connect and exchange streams of data. This guarantees the delivery of data and packets in the same order as they were sent. UDP (User Datagram Protocol) is a network protocol that is primarily used to inaugurate low latency and loss-tolerating connections between the applications on the internet or a network. UDP increases the speed of transmission by enabling the transmission of data by an agreement that is provided during the initiation of the connection to the receiving party [8]. streams of data first enter the physical layer over the agreed data. The physical layer maintains

The Network Layer

The network layer is the third layer of the OSI model. The Network Layer is responsible for anything that revolves around inter-network connections that takes place at the network layer. This appends assembling the routes for data packets to take, checking if a server in another network is ready to accept requests and all its services, and addressing and receiving IP packets from all the other networks available nearby. However, the network layer is only used in local area networks (LAN) or Wide Area Networks (WAN), not on the internet, this is because in the TCP/IP model there is no network layer. As they come from different models of how the internet works this is in comparison with the internet layer which is a part of the TCP/IP model. A protocol is a way of formatting data so that the two end-users can communicate with and understand each other. For the smooth running of the network layer, it must follow some protocols: IP (Internet Protocol); IPsec (Inter Protocol Security); ICMP (Internet Control Message Protocol); IGMP (Internet Group Management Protocol); GRE (Generic Routing Encapsulation) [9, 10, 11]. ains various components which make up the physical unit of the communication system,

The Data-Link Layer

The data-link layer is the second layer of the OSI model. The data-link layer is one of the most complex layers compared to the rest of the OSI model layer since it carries complex functionalities and liabilities. The Data-Link Layer hides the details of the underlying hardware and shows itself as the upper layer as the medium to communicate between the end-users. Data Layer acts as a mediator between two hosts which are connected via a network. This connection could be a point-to-point or a broadcast. Systems on broadcast networks are called or termed to be on the same link. The very purpose of the data link layer is to tend to get complex when it comes to working with multiple end-users or hosts on a single collision domain. The Data-link layer is accountable for changing data streams to signal bits by bits and sending the reduced bit-sized data via the underlying hardware through a given medium of communication. At the receiving end-user, the data layer picks up the received data from the hardware which are in most cases are of electrical signals (unless optic fiber is used as the medium of

communication), assembles, and forms them in a recognizable frame format, and proceeds to move the data to the upper layer which is the physical layer. The Data-Link Layer consists of two other sub-layers, they are logical link control (This is responsible for dealing with protocols, overflow of data, and error control by doing error checks); Media Access Control (This is responsible for actual control of the media). On behalf of the upper layer, the Data-Link Layer does many tasks, these are framing, addressing, synchronization, error control, flow control, and multi-access. The data-link layer fetches data packets from the network layer and packages them into frames. Then it proceeds to send each frame bit by bit on the hardware of the senders through a given medium of communication. [12, 13, 14] At the receiver's end, the data-link layer receives those signals up from the receiver's hardware and rearranges the received data frame by frame in the correct order. The data-link layer facilitates two-layer hardware addressing mechanism. The hardware address is always designated to be unique on the link established in the entire network. During the time of manufacturing, it is encoded onto the hardware itself, hence it will never change. Due to the packet frames being sent frame by frame, the two end-users of the established communication must agree to be synchronized (Synchronization), that way both the machines will be synchronized for the transmission of data to take place during the communication period. Due to network traffic and network collision and various other issues during the time of communication, an error is bound to occur due to these various reasons, this happens during the period we refer to as the transition period and the bits are either lost or are flipped (0's as 1's and vice-versa), The Data-Link Layer is responsible for detecting and tries to recover the lost bits to its original state. In case the recovery fails, a reporting mechanism is established to report it to the sender and the receiver to make them wary of the error which has occurred, to stop it from happening again as this could also be a hardware malfunction too (Variables which could be controlled by the end-users are only referred in this report along with an error code for the end-user to contact professional regarding it). When there are nodes on a shared link tries to initiate transmission of data, there is a high probability of collision, The Data-Link Layer is also facilitated with a mechanism such as CSMA (Carrier Sense Multiple Access) and CD (Collision Detection), however, these things have been improvised and new versions have come out with better error control. This layer ensures that the flow of transmission is the same on both sides by controlling the exchange speed of both the end-user data packets [15, 16, 17].

The Physical Layer

The Physical Layer is the bottom and the last layer in the OSI model which is the embodiment of the physical and the electrical representation of the system. It contains various components which make up the physical unit of the communication system, these include power supplies, connectors, wires, various cable types (optic fibre, ethernet cable, etc.) packets are sent and received (one device to another device) from this very layer of the OSI and it's a physical unit. All the unstructured, mismatched, unorganized streams of data first enter the physical layer over the agreed medium of communication between the two end-users partaking in the transmission and receiving of

data. The physical layer maintains the data rate of the communication between the two users and the direction of the data transfer itself. The physical topology is also decided here, this is a system for the betterment of the flow of data between nodes in a network (mesh, star, bus, and ring), this also facilitates synchronization of packets, however, the degree of this synchronization differs for each layer of the OSI model. In the initial state of the communication, to decide the medium for transmission, the physical layer decides this model and, in the decision, making of the interface though it differs from model to model. The most important perk of the physical layer is that it facilitates modulation, which is a process of converting the data into the given medium of transmission which is agreed upon by adding it into a carrier wave (carries the data packets), this wave can be of any form radio wave, electrical wave, optic nerve signal, etc. [18, 19] The switching mechanism is also used in the physical layer where the data can be forwarded from one port to the designated destination port.

Conclusion

Due to a misguided notion, many networking sources which cites about networking tries to conceal the OSI model unfavourable by treating it briefly or representing it misleadingly. While it is appropriate that the OSI is by nature theoretical and the networking protocols aren't always designed to fit truly within the confines of its layers, it is hence spoken falsely especially the OSI model has little to no applicability in the real world. In fact, it would be impossible to understand about network technology and all its subjects today without referring to the OSI model and its layers, this is because the OSI model aids to frame discussion and opinion on protocols and contrast various other technologies.

The most common reference used widely is the OSI model which depicts how different sets of protocol (mainly referred to as layer) interact and communicate with each other during the process of sharing data. The TCP/IP model not only maps obviously into the OSI model, but it also makes it feel comfortable to sense and understand in terms of the OSI model when citing protocols [20].

The management of Session Layer, Presentation Layer and the Application layer is surprisingly handled solely by the 7th Layer of the OSI model, the application layer of TCP/IP model, the entire concept of this is to make sure a reliably sense of delivery happens during packet transmission at the transport level compared to UDP which is a not so reliable protocol handled directly under the TCP/IP model, thus incorporating these too will result in a faster and a reliable delivery of packets. The building blocks of a large network which we refer to as internet now was fundamentally based on the TCP/IP model, thus it holds much more creditability compared to the OSI model which revolves around the fact that most network are not built using its structure.

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