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A Comparative Study of OSI and TCP/ IP Models

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ABSTRACT

The Internet protocol suite is the computer networking model and set of communications protocols used on the Internet and similar computer networks. It is commonly known as TCP/IP, because it's most important protocols, the Transmission Control Protocol (TCP) and the Internet Protocol (IP), were the first networking protocols defined in this standard. Often also called the Internet model, it was originally also known as the DOD model, because the development of the networking model was funded by DARPA, an agency of the United States Department of Defense. TCP/IP provides end-to-end connectivity specifying how data should be packetize, addressed, transmitted, routed and received at the destination. This functionality is organized into four abstraction layers which are used to sort all related protocols according to the scope of networking involved. From lowest to highest, the layers are the link layer, containing communication technologies for a single network segment (link); the internet layer, connecting hosts across independent networks, thus establishing inter-networking; the transport layer handling host-to-host communication; and the application layer, which provides process-to-process application data exchange. Our aim is describe operation & models of TCP/IP suite in data communication networking.

***Keywords*--** TCP/IP, OSI, Networking, Protocols, Reference Models, Layers, Interfaces

I. INTRODUCTION

Computer networking is a collection of computers or devices connected to share resources. Networking can be done in the layered manner. Network protocols are used by computer for communication. These protocols describe how one computer communicates with other computer at bit and byte levels. A protocol tells us the rules between network devices. Some protocols support acknowledgement and data compression designed for high performance communications. These protocols are on the top level [1]. Layered architecture is needed so that the data can be maintained well, is made flexible, and can scale to any levels in the architecture. Solutions are built in different components so that inter operations can be made with different layers with flexible implementation. The function of each layer is to provide services to the higher layers each layer acts as virtual machine to above layer. These concepts are known as object oriented programming, abstract data types, information hiding and data encapsulations .The main idea to provide service to its users and other internal state and algorithms are hidden. A network protocol is important since it allows two data communication devices for communicating with each other. Communication systems established by sending and receiving data [2]. Systems do not use a single protocol for handling a transmission they use a set of protocols known as protocol family or protocol suite. Protocols are layered in modern design. The advantages of layered protocols is passing the information from one layer to another and changes in a protocols layers prevents from affecting the other layer. A five layer network is given. In this figure each layers passes data and information below it until the lowest layer is reached. A set of different layers and protocols is called as network architecture. It is simpler to replace one layer with a completely different implementation since the new implementation offers the same set of services to the upstairs neighbor as the old implementation. [3]

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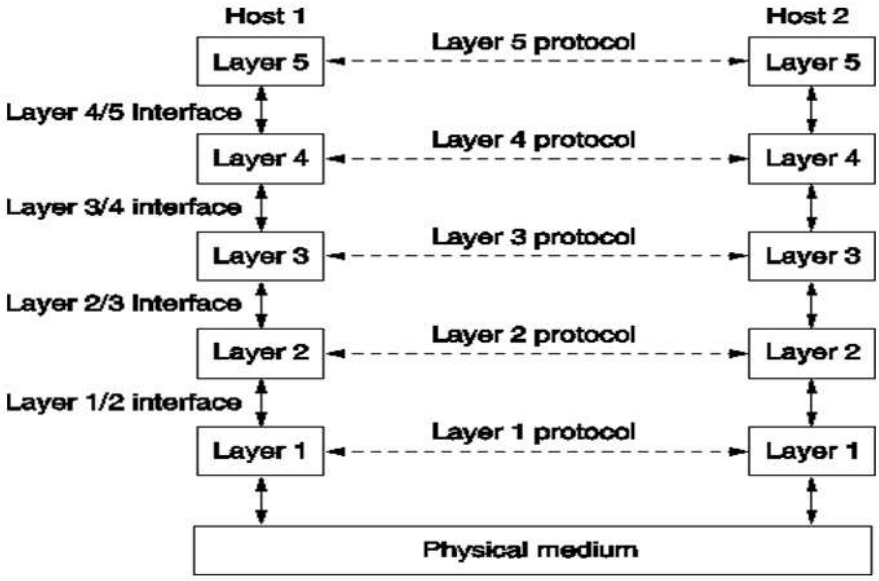

Figure 1: Layers , Protocols And Interfaces[3]

Two important networks architecture are the OSI reference model and TCP/IP model. In section 2 there is a brief description of OSI reference model. Section 3 describes the TCP/IP reference model. Section 4 will differentiate the two of models and Section 5 will have the conclusion.[4]

II. OSI REFERENCE MODEL

The Open System Interconnection Model was introduced by ISO (International Organization for Standardization) in 1984. The OSI reference model consists of seven layers . it is a conceptual reference model that describes the entire flow of information from one computer to another computer. The basic idea of OSI reference model is to divide the model into smaller pieces.

A layer serves the layer above it and is served by the layer below it. The principles applied to reach to the seven layers are:-

1. Each layer should perform a well defined functions.
2. A layer should be created where a different abstraction is needed.
3. The function of each layer should define internationally standardized protocols.
4. The layer boundaries should minimize the information flow across the interfaces.
5. The number of layers should be large that distinct functions need not to be thrown together in the same layer out of necessity and small enough that the model does not become unwieldy [5].

The layers of OSI model are described in figure 2 below:

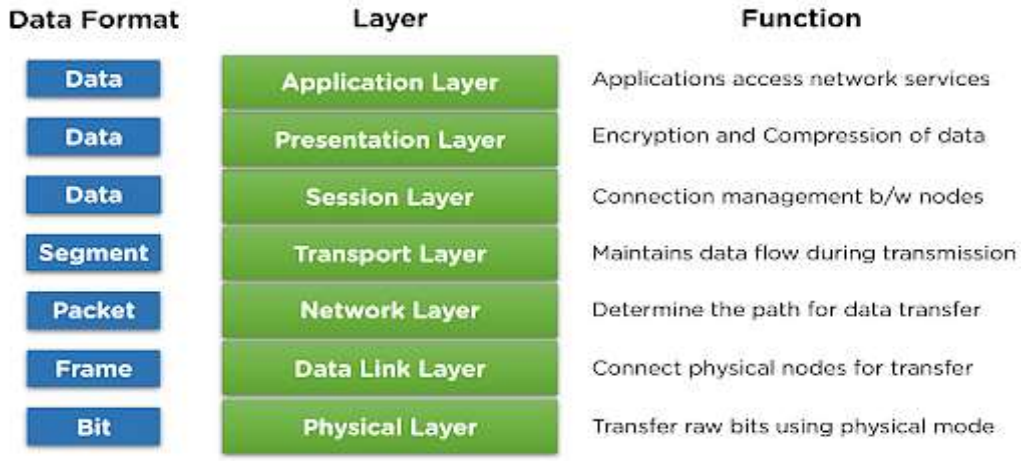

Figure 2: Layers OSI Model [3]

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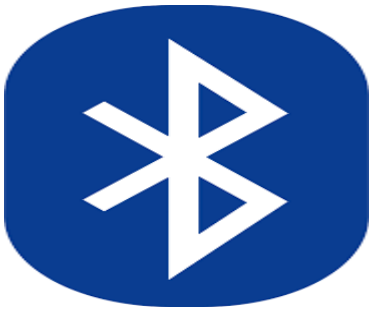
1. The Physical Layer

The physical layer is the ground layer of the OSI model .It is responsible for transmitting individual bits over a medium . This layer convert bits into signals .The bit rate or data rate control function is done at the physical layer .
Some of the functions of the physical layer are:-

- **PHYSICAL TOPOLOGY-** It defines how the devices are arranged in a network.
- **DATA RATE:-**In this the number of bits per second is controlled by the physical layer.
- **TRANSMISSION MODE:-**It is the flow of data between two devices .It is of three types:- a>simple mode

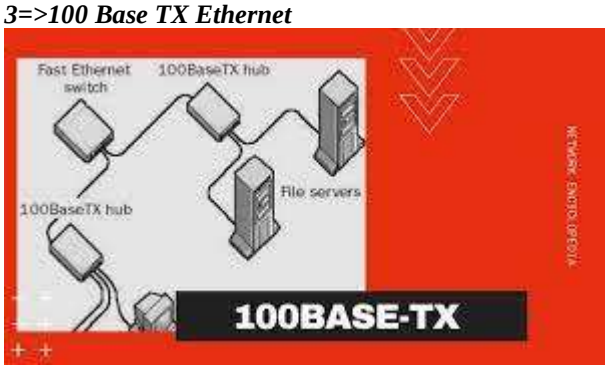
b>half duplex mode
C>full duplex mode

For Example:-1=>BLUETOOTH



2=> Universal Serial Bus

3=>100 Base TX Ethernet



2. Data Link Layer

The data link layer is the smallest layer at which meaning is allocated to the bits that are send out on top of the network .The main chore of the data link layer is to modify a raw transmission facility into a line that seem free of undiscovered transmission delusion to the network layer.

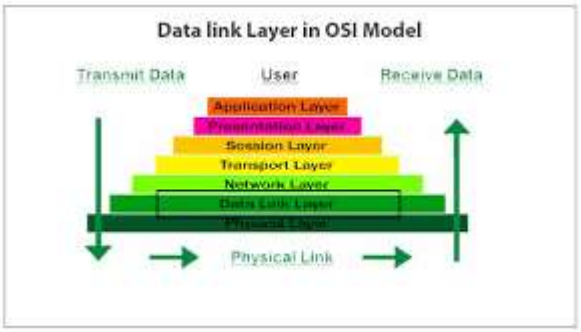


Figure: Data Link Layer [6]

The data link layer is further divided into two sub layers :-

1. Logical Link Control(LLC): This sub layer of the data link layer trade in with multiplexing , the flow of data between applications and further services ,and more services ,and LLC is answerable for providing fallacy messages and acknowledgments as well.

2. Media Access Control(MAC): MAC sub layer direct the devices interaction ,to blame for addressing frames and also controls physical media access[7].

For Example:- 1. FDDI:-fiber distributed data interface

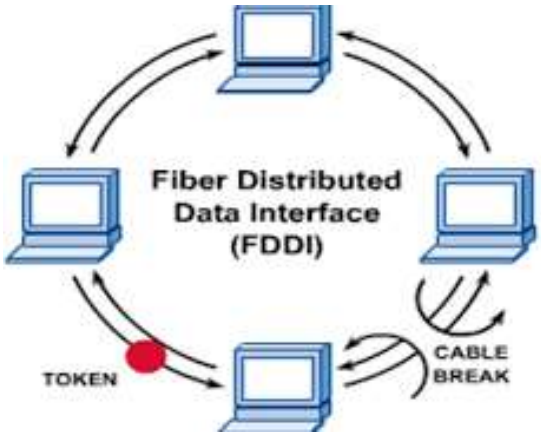


Figure: FDDI [8]

3. The Network Layer

The network layer pickup the task of routing network communication from one computer to another. It controls the functioning of sub net .

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The network layer protocol translates logical addresses to mac addresses .one more important function of the network layer is routing, finding an suitable path through the network. [9]

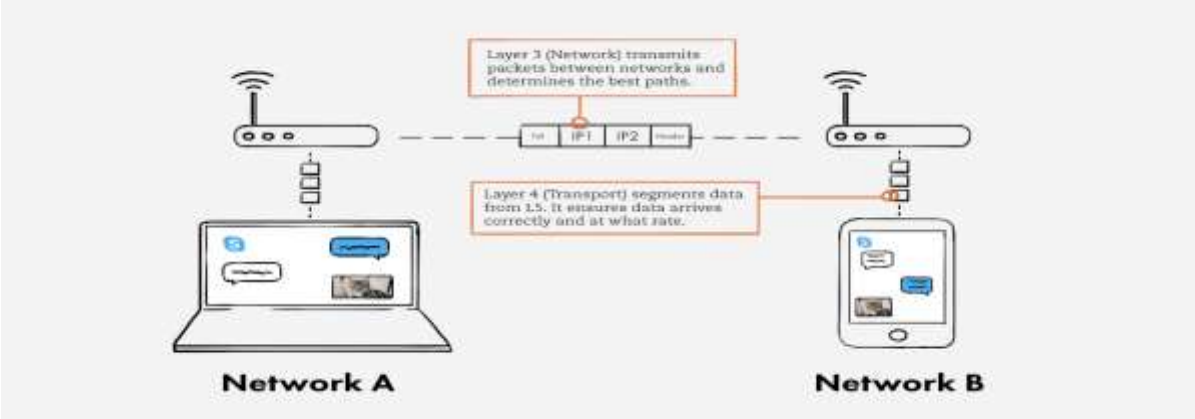

Figure: Network Layer[10]

For Example:- Arouter can be used to connect a local -area network that uses ether-net to a wide area network that runs on a different set of low level protocols.

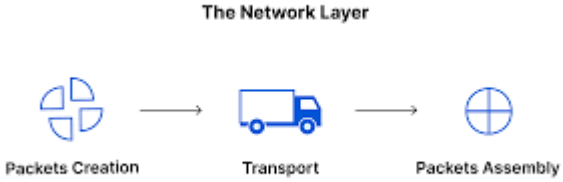

Figure: Network Layer [11]

4. The Transport Layer

The transport layer is the rudiments at which one network computer convey with another network computer. This layer give 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 .it also decide what types of services to provide to the session layer and ultimately to the users of the network .

In many cases, the transport layer protocol divides large messages into smaller packets that can be sent over the network skillfully. The transport layer protocol retrofit the message on the receiving end, making sure that all packets suppressed in a single transmission are collect and no data is stray.

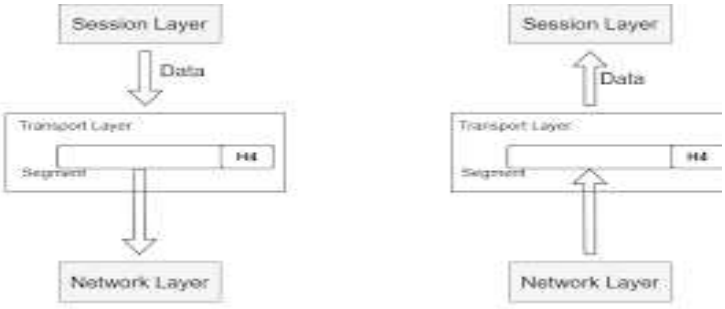

Figure: Transport Layer[12]

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5. The Session Layer

The session layer set up sessions between network nodes. A session must be demonstrates before data can be send out over the network. The session layer makes sure that these session are adequately confirmed and keep up.

This layer entrenched ,manages and terminates connections between applications . The session layer sets up, coordinates, and terminates conversations, exchanges and dialogues between the applications at each end. It deals with session and connection coordination.

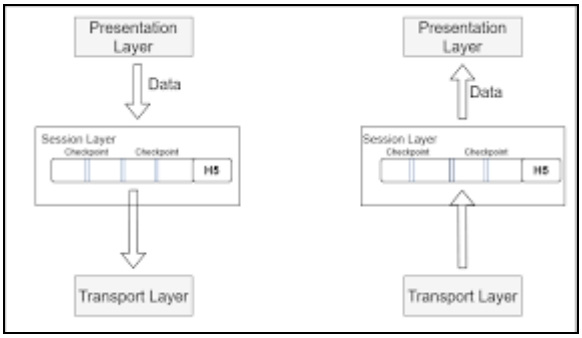

Figure: Session Layer[13]

6. The Presentation Layer

The presentation layers accepted a context between application-layer structures, in which the application-layer entities may use unalike syntax and semantics if the presentation service provides a big mapping between them.

If a mapping is available ,presentation service data units are encapsulated into session protocol data units , and passed down the protocol stack. It is also called the syntax layer.

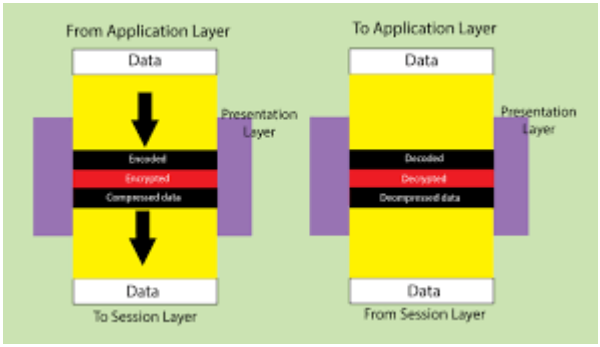

Figure: Presentatiion Layer[14]

7. The Application Layer

The application layer is the OSI layer adjacent to the end user, which means both the OSI applications layer and the user, interconnect directly with the software application. This layer interact with software application. This layer interchange with software application that implements a pass on component .

The application layer contains a variety of protocols that are time and again needed by the users [15].

This layer supports application and end-user processes. One application which is widely used is HTTP(hypertext transfer protocol)which is basis for the, world wide web.

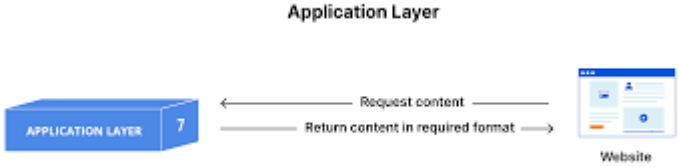

Figure: Application Layer[16]

III. TCP/IP MODEL

The TCP/IP stands for transmission control protocol / internet protocol. It defines how automatic devices should be secured on top of the internet , and how data should be transmitted between them. TCP is in control of for smashing data down into small packets before they can be set over a network ,and for assembling the packets again when they arrives.

IP takes care of the communication joining computers. It is accountable for addressing, sending, and receiving the data packets over the internet. TCP provides reliable, ordered and error-checked delivery of a stream of octets between programs running on computers connected to a local area network, intranet or the public internet . it live in at the transport layer[17].

The APPARNET was a testing network sponsored by the DOD which in dues course connected hundreds of universities and government installations, using leased telephone lines. Later when satellites and radio networks were added, the existing protocols had trouble inter working with them, so new reference architecture was developed. The main goal was to connect multiple networks in a seamless manner .

The layers of this models are:-

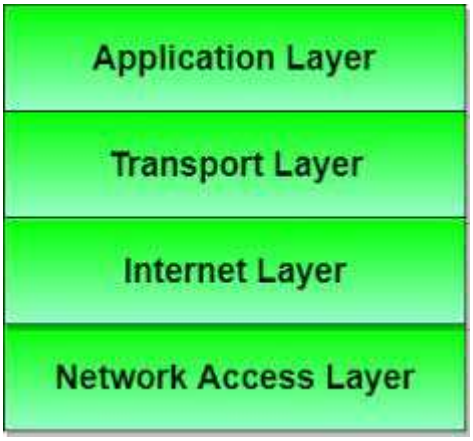

Figure: Layers of this models [18]

1. The Network Access Layer

The network access layer is the first layer of the four layer TCP/IP model. Network layer describes the concept of how data is physically sent through the network, including how bits are automatically signaled by hardware devices that interface directly with a network medium ,such as coaxial cable, optical fiber, or twisted pair copper wire[19].

This layer is responsible for placing TCP/IP packets on the network medium and receiving TCP/IP packets off the network medium.

TCP/IP was designed to be independent of the network access method frame format and medium. In this way, TCP/IP can be used to connect differing network types.

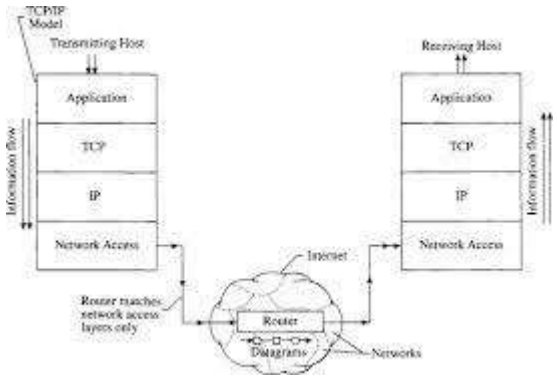

Figure: Network Access Layer[20]

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These includes LAN technologies such as ether net and token ring and wan technologies such as X.25 and frame relay . Independence from any specific network technology gives TCP/IP the ability to be adopted to new technologies such as Asynchronous Transfer Mode(ATM).

2. Internet Layer

The internet layer is the second layer of the four layer TCP/IP Model. The internet layer lies between NETWORK ACCESS LAYER and TRANSPORT LAYER. The internet layer packs data into data packets known as IP data grams,which have start point address and end point address[logical address or IP address] the information that is used to share the data grams between hosts and among networks. The internet layer is also responsible for routing of IP data grams[21].

Packet switching network rely on non-terminal internet layer. This layer is called internet layer.

Its work is to allow hosts to insert packets into any network and have them to reach safely to the address[22].

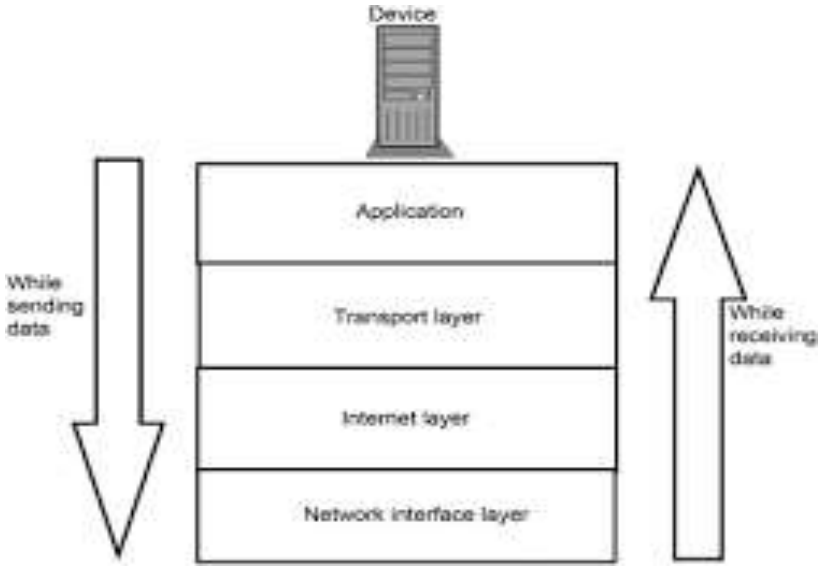

Figure: Internet Layer[23]

3. Transport Layer

The transport layer gives the way for transferring the data among the internet. This layer is perturbed with host to host communication. Transmission control protocol give reliable, connection- oriented transport of data between two sockets on different computers which use internet protocol for sharing data.

The transport layer passes data to the internet layer when transmitting and pass data to the application layer when received[24].

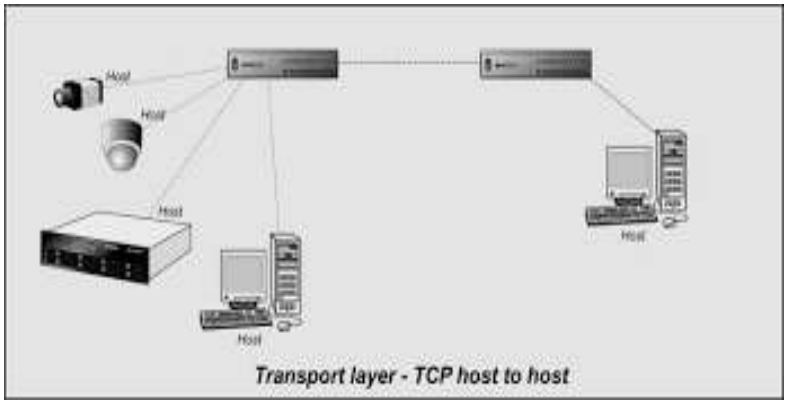

Figure: Transport Layer[25]

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4. Application Layer

Application layer describes TCP/IP application protocols and defines how application layer work with transport layer.

The application layer gives the user interface to share the data .the application layer may be of web browser, e-mail client, or file transfer client[26].

Application layer includes all the upper-level protocols like DNS, TALNET, HTTP.

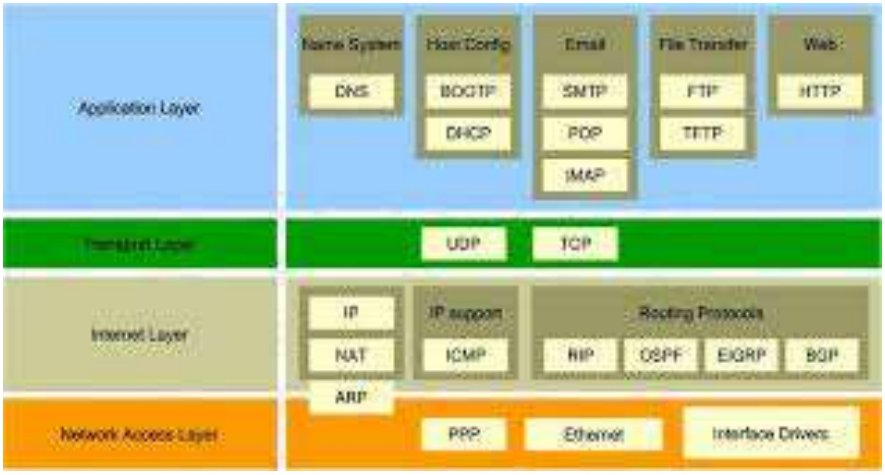

Figure: Application Layer [27]

IV. COMPARISON BETWEEN OSI MODEL AND TCP/IP MODELS

TCP/IP MODEL	OSI REFERENCE MODEL
Has only 4 layers.	Has 7 layers.
Considered more reliable.	Considered a reference tool
Horizontal approach	Vertical approach
Protocol dependent standard	Protocol independent standard
Protocols are developed first and then model was developed.	Model was developed before the development of protocol.
Model around which internet is developed	This is the theoretical model.
Supports only connection less communication in the network layer	Supports connection less and connection oriented communication in network model.

V. CONCLUSION

In this paper an attempt has been made to explain the differences in TCP/IP and OSI models. OSI model is an architecture which gives an idea how packets transfer over the network during any communication. The Transmission Control Protocol / Internet Protocol (TCP/IP) was created by the Department of Defense (DoD) to make sure and protect dataintegrity, and also maintained communications in the time of disastrous war. However, if designed and deployed properly according to standard, a TCP/IP network can be a truly reliable and flexible one Efficiency and feasibility. The OSI norms tend to be prescriptive (for instance the "layer N" must go through "all layers below it"), whereas the TCP/IP protocols are descriptive, and leave a maximum of freedom for the implementers. One of the advantages of the TCP/IP approach is that each particular implementation can use operating system-dependent features, generally resulting in a greater efficiency (fewer CPU cycles, more throughput for similar functions), while still ensuring "interoperability" with other. The TCP/IP and OSI architecture models both employ all connection andconnectionless models at transport layer. However, the internet architecture refers to the two models in TCP/IP as simply “connections” and data grams. But the OSI reference model, with its penchant for “precise” terminology, uses the terms connection-mode and connection-oriented for the connection model and the term connectionless-mode for the connectionless model TCP/IP is the older of the two approaches to data communications and is well established throughout the world. The OSI model, however, is a proven concept that is used in all other data communications protocols. It will continue to be used as a

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guideline for all other communications applications. TCP/IP combines the presentation and session layer into its application layer. TCP/IP combines the OSI data link and physical layers into one layer. TCP/IP appears simpler because it has fewer layers. TCP/IP transport layer using UDP does not always guarantee reliable delivery of packets as the transport layer in the OSI model does.

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