iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2 **Issue:** XI **Month of publication:** November 2014

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Comparative Study of OSI & TCP/IP Reference Model

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Abstract: A reference model is a virtual model which defines how communication should take place. It logically divides the processes which are required for the communication into layers. This concept is known as layered architecture. A network reference model helps us understand the functions of communication software which relate to network product development activities.it also provide the basic scheme for creating and implementation of network devices. This paper explains the 2 popular reference models: OSI Reference model and TCP/IP model, by comparing the functionality of each layer in both models.
Keywords: - Application, Presentation, Session, Transport, Network, Data link, Physical

I. INTRODUCTION

The most important reference models are: 1. The OSI reference model and 2. The TCP/IP reference model, in 1977, the international Standards Organizations (ISO) decided to create a new committee on Open Systems Interconnections (OSI) model. An OSI model is a layered framework for the design of network systems that allow for communication across all types of computer networks. It has 7 layer architecture where function of each layer is already defined; It is a layered model not a standard which networking protocol must follow. The other reference model known as TCP/IP model was developed and used earlier by ARPANET and then for the internet. TCP/IP is Transmission Control protocol and internet protocol. ARPANET is Advance Research Project Agency Network was a research network sponsored by U.S. department of defence. The existing protocols at that time was unable to handle the development in network, hence a new model was needed which also includes satellite and radio networks. The new model is known as TCP/IP reference model as model uses two protocols TCP and IP. The goals needed to achieve while designing this models are: - 1. Ability to connect multiple networks together in a seamless way 2. Network should be able to survive loss of subnet hardware with existing conversation not being broken 3. The architecture should be flexible to meet requirements of various applications. Both of these reference models work on the principle of layered architecture.

II. THE REFERENCE MODELS

A. OSI Reference Model

There are multiple users present all over the world using computer network. Hence we need a standard to ensure that worldwide communication system can be developed and are compatible with each other. For this we require a framework called as “Model for open system interconnection (OSI)” and normally referred as “OSI Reference Model”.

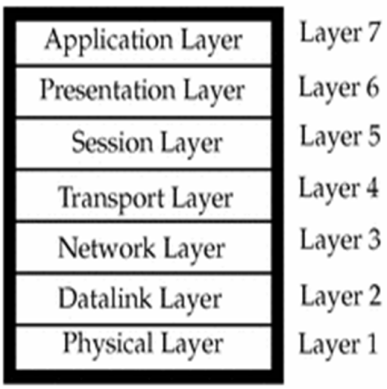

Figure 1: OSI REFERENCE MODEL

Fig (1) shows the 7 layer architecture of ISO-OSI reference model.it defines 7 layers where lowest layer is physical and highest one is application layer.

7 layers of OSI Model:-

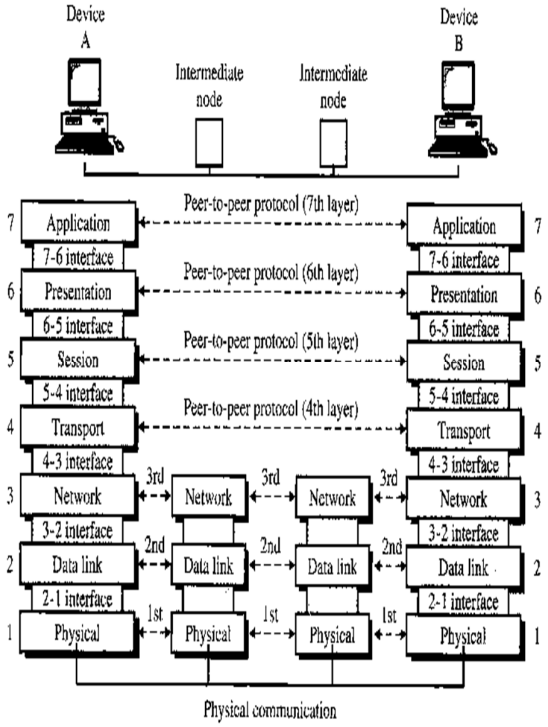

Figure 2: Architecture of OSI reference model

1) *Physical layer:-The* physical layer sends the bit from one node to another.it is not concerned with meaning of bits, but it maintains physical connection between transmitter and receiver. Passive hubs, simple active hubs, terminators, couplers, cable and cabling, connectors, repeaters, multiplexers, transmitters, receivers, transceivers are associated with physical layer. It has the functions to make and break connections, define data rates, convert data bit in electrical form. Also determine whether system in simplex, half duplex or full duplex.
2) *Data link Layer:-It* provides reliability of our data between the nodes. It also generates frames of packets it receives from network layer and provides them to physical layer. It does the functions like synchronization, error detection and correction. Also it assembles outgoing messages into frames.
3) *Network layer:*-The function of this layer is to deliver packets from source to destination across multiple network links. It done the functions like routing of signals, divide the outgoing message into packets, to act as network controller to routing data.
4) *Transport layer:* - This layer is Concerned with the reliability of the transport of sent data .it also ensures that the whole message arrives intact and in order. This layer decides whether transmission should be parallel or single path. It does functions like multiplexing, splitting or segmenting the data. This layer breaks the data into smaller units so that it can be easily handled by network layer.
5) *Session layer:* - This layer establishes a session between two parties i.e. establishes, maintains and synchronises the communication. This layer manages and synchronizes communication between two systems.it controls logging on and off, user identification, billing and session management.
6) *Presentation layer:* - The Presentation Layer handles data format information for networked communications. This is done by converting data into a generic format that could be understood by both sides. It also takes care of syntax and semantics of the information exchanged between two communication systems. This layer works as a translating layer.
7) *Application layer:* - This is the topmost layer of OSI model. It provides application based services like database access, e-mail and file transfer. The functions like LOGIN and password checking are also done by this layer.

B. The TCP/IP Reference Model

TCP/IP is a set of protocols which allow share of resources across the network. Since the development of the ARPANET, TCP/IP has emerged as the language of the internet as it is being used all over the world for all types of computers.TCP and IP are two protocols: Transmission control protocol and Internet protocol. These two protocol together known as TCP/IP protocol.

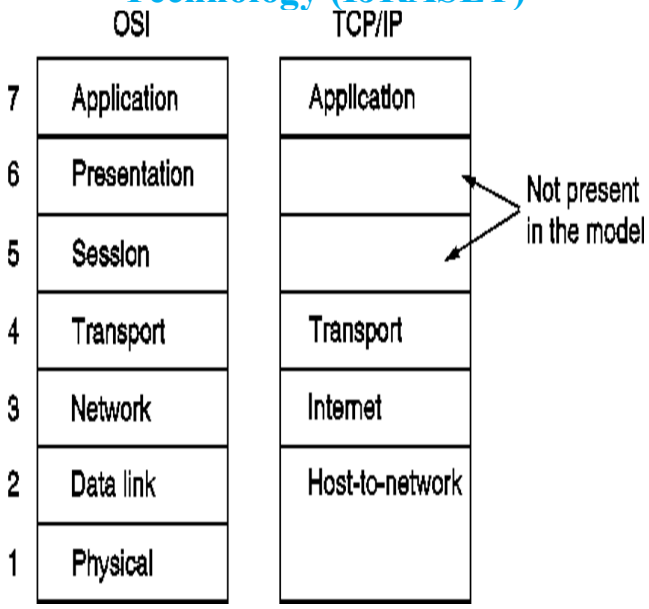

Figure 3: TCP/IP Reference Model

TCP/IP uses simple naming and addressing scheme which make it easy to locate resources on network. Fig (3), shows the TCP/IP reference model along with OSI reference model. The TCP/IP model has four layers.

1) *Network Interface Layer:*-This is the lowest layer of TCP/IP architecture, also called the data link layer or host to network layer. It corresponds to OSI physical and data link layer. User uses many protocols at this layer, including token ring, Ethernet and LAN's and WAN's protocols.

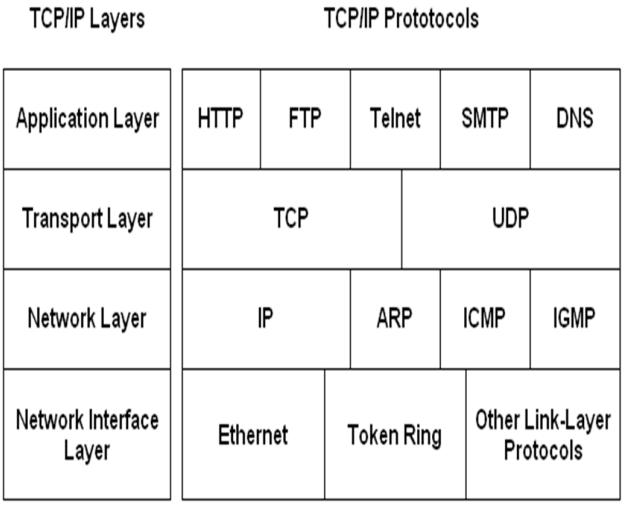

Figure 4: Protocols of TCP/IP

2) Network Layer:-This layer put the message into the packet and packet switching network is established which is based on connectionless services. Each packet is independently routed from source to destination. The order of packets received at the destination may differ from the sequence in which they are send. This layer does not provide reliability, error control or flow control. This layer specifies a packet format and a protocol called Internet Protocol (IP). Each packet has the address of both sender and receiver which is known as IP address. Hence this layer is supposed to deliver IP packets to their destination. Hence this layer is very similar to network layer of OSI reference model.

3) Transport Layer:-Transport layer established the session between source and destination machines so that data packets can exchange between them. The end to end protocol used here are TCP (Transmission control protocol) and UDP (User datagram

protocol).Transmission Control protocol provides reliable connection oriented services.TCP establish a session and ensure delivery of packet between hosts .TCP also handles the flow control.UDP is the protocol of the transport layer. It is an unreliable, connectionless protocol used for both one-to-one or one-to-many delivery.

4) Application Layer: - TCP/IP model has application layer corresponds to session, presentation and application layer of OSI reference model. Most common protocols of this layer are:-HTTP (Hypertext Transfer protocol) core protocol of World Wide Web, FTP (File Transfer Protocol) enables a client to send and receive compete files from a server, Telnet, SMTP (Simple Mail Transfer Protocol) and DNS (Domain Name System).

C. OSI VS TCP/IP Model

OSI(Open System Interconnection	**TCP/IP(Transmission Control Protocol / Internet Protocol)**
OSI provides layer functioning and also defines functions of all the layers.	TCP/IP model is more based on protocols and protocols are not flexible with other layers.
In OSI model the transport layer guarantees the delivery of packets.	In TCP/IP model the transport layer does not guarantees delivery of packets.
Follows horizontal approach.	Follows vertical approach.
OSI model has a separate presentation layer.	TCP/IP does not have a separate presentation layer.
OSI is a general model.	TCP/IP model cannot be used in any other application.
Network layer of OSI model provide both connection oriented and connectionless service.	The Network layer in TCP/IP model provides connectionless service.
OSI model has a problem of fitting the protocols in the model.	TCP/IP model does not fit any protocol.
Protocols are hidden in OSI model and are easily replaced as the technology changes.	In TCP/IP replacing protocol is not easy.
It has 7 layers.	It has 4 layers.

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III. CONCLUSION

In this paper we tried to explain the basic reference models i.e. OSI and TCP/IP reference model. Both of these models have some advantages and disadvantages. Instead of all the factors, OSI reference model is most commonly used model in computer networks. OSI defines layer wise functioning while TCP/IP more based on protocols. Due to increase in protocols a model came into existence to describe these protocols which is TCP/IP model. Enhancement is done in this model with time as new technologies are developing. We can't really decline any one of these models as both of these are equally important and widely use all over the world.

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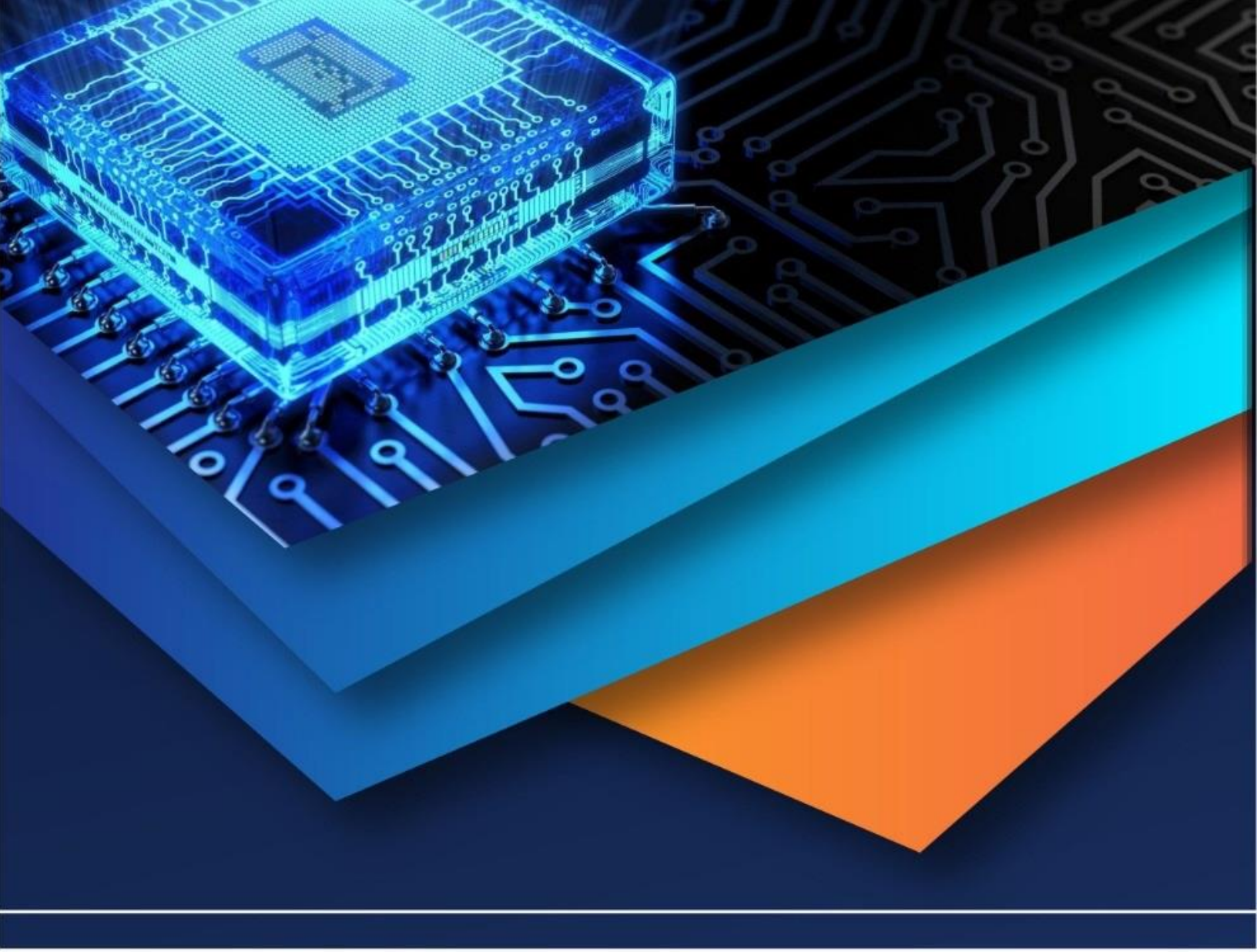

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