

Network Models: TCP/Internet Protocol vs. OSI

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Abstract

Networking your computer dramatically enhances their ability to communicate and most computer are used more for communication than computation. The positive impact of computers grows in direct proportion to the number and type of computers that participate in network. One of the greatest benefits of TCP/IP is that it provides interoperable communication between all types of hardware and operating system. TCP/IP is an abbreviation for transmission control protocol/internet protocol. TCP/IP refers to the entire suite of data communication protocols. This article review majorly looks at how TCP/IP is used as a reliable network transmission protocol all over the world. TCP/IP is also used in a private computer network as a communications protocol. This discussion deals with the structure of TCP/IP, its components, its benefits over the OSI model, and OSI model and its component and difference between both models. We have also discussed its underlying protocol that is IP (Internet Protocol), TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).

Keywords: Internet networking, protocols, TCP, OSI, application layers

INTRODUCTION

TCP/IP is an abbreviation for Transmission Control Protocol/Internet Protocol, and it refers to a set of communication protocols that is used to connect network devices on the internet. TCP/IP is also used in a private computer network as a communications protocol (an intranet or extranet).

TCP/IP refers to the entire IP suite, which is a set of rules and procedures. TCP and IP are the two main protocols in the suite, though others are included. The TCP/IP protocol suite serves as an intermediary between internet applications and the routing and switching fabric [1]. TCP/IP specifies how data is exchanged over the internet by providing end-to-end communications that specifies how packets should be divided, addressed, transmitted, routed, and received at the desired location. TCP/IP is designed to make networks more reliable by allowing them to automatically recover from the failure of any device on a network [2].

OSI Model

The OSI Model is a logical and conceptual model for network communication that defines network communication for systems that can interconnect and communicate with other systems. It was the first standard network communication model, and it was adopted by all major computer and telecommunications companies [3]. Instead of the more complex OSI model, the modern Internet is based on the simpler TCP/IP model. The OSI 7-layer model, on the other hand, is still widely used because it aids in visualizing and communicating network operations, as well as isolating and troubleshooting networking issues [4].

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Difference Between TCP/IP

TCP and IP are two distinct network protocols. The IP portion obtains the address to which data is sent. Once that IP address is found, TCP is in charge of data delivery. It is possible to separate them, but there is little point in distinguishing

between TCP and IP. Because of their widespread use, the terms "TCP/IP" and "TCP/IP model" have become household names. Consider the following: The IP address functions similarly to the phone number assigned to your smartphone. TCP refers to all the technology that makes the phone ring and allows you to communicate with someone on another phone. They are distinct from one another, but without one another, they are meaningless [5]. All the network models are shown in Figure 1.

Network Models 

TCP/IP Model	OSI Model	Protocols
Application layer	Application layer	FTP, HTTP, Telnet
	Presentation layer	JPEG, MPEG
	Session layer	NFS, SQL, PAP
Transport layer	Transport layer	TCP, UDP
Internet layer	Network layer	IPv4, IPv6
Network Access Layer	Data Link Layer	ARP, CDP, STP
	Physical layer	Ethernet, Wi-Fi

Figure 1. TCP/IP model and OSI model.

WHAT IS PROTOCOL

A protocol is a set of rules and procedures used by two computers to exchange data. A protocol also specifies the format of the data that is exchanged.

- TCP/IP was created very early on. Free documents called "Request for Comments" were widely discussed and circulated, and technologies were widely discussed and circulated (RFC) The UNIX operating system supported TCP/IP [6].
- Because TCP/IP was developed before the OSI 7-layer model, TCP/IP is a simplified form or version of the OSI model. It has four layers, as opposed to the OSI models has seven layers.

Protocol Supported at Each Level

IP Protocol

The IP protocol and its associated routing protocols are the most important of the TCP/IP suite. IP is in charge of:

- *IP addressing*: The IP protocol includes IP addressing conventions [7].
- *Host-to-host communications*: IP determines the path a packet must take based on the receiving host's IP address.
- *Packet formatting*: IP groups packets together into units known as IP datagrams. "Internet Layer" describes datagrams in detail.
- *Fragmentation*: When a packet is too large to be transmitted over network media, IP on the sending host divides it into smaller fragments. The receiving host's IP address then reconstructs the fragments into original packets.

The ARP Protocol

Between the data link and Internet layers, the Address Resolution Protocol (ARP) exists conceptually. By mapping Ethernet addresses (48 bits long) to known IP addresses, ARP assists IP in directing datagrams to the correct receiving host (32 bits long) [8].

ICMP Protocol

The Internet Control Message Protocol (ICMP) is the protocol in charge of detecting and reporting network error conditions. The ICMP publishes data on: Packets were dropped (when packets are arriving too fast to be processed). Failure of connectivity (when a destination host cannot be reached). Rerouting (which tells a sending host to use another router). The "ping Command" contains more information on the operating system commands that use ICMP for error detection [9].

The TCP Protocol

TCP allows applications to communicate with one another as if they were connected by a physical circuit. TCP sends data in a manner that appears to be character-by-character, rather than as discrete packets. This transmission is divided into three parts: a starting point that initiates the connection, the entire transmission in byte order, and a closing point that terminates the connection. TCP appends a header to the data being transmitted. This header includes a plethora of parameters that allow processes on the sending machine to communicate with peers on the receiving machine. TCP establishes an end-to-end connection between sending and receiving hosts to confirm that a packet has arrived at its destination. TCP is thus regarded as a "reliable, connection-oriented" protocol.

The UDP Protocol

UDP, the other transport layer protocol, is responsible for datagram delivery. It does not provide any means of verifying that a connection between the receiving and sending hosts was ever established. UDP is preferred over TCP by applications that send small amounts of data because it eliminates the processes of establishing and verifying connections [10].

Routing Information Protocol

RIP is implemented by the routing daemon `in.routed`, which starts immediately when the machine boots. When run on a router with the `s` option, `in.routed` fills the kernel routing table with routes to all reachable networks and advertises "reachability" across all network interfaces.

`In.routed` extracts routing information but does not advertise reachability when run on a host with the `q` option. There are two methods for extracting routing information from hosts:

If the `S` flag is not specified (capital "S": "Space-saving mode"), `in.routed` creates a full routing table, just like a router.

Why is TCP so Popular and is Being Used?

- TCP/IP model-The TCP/IP model was created before the OSI model and is not identical to the OSI model.
- The TCP/IP model is made up of five layers: the application layer, the transport layer, the network layer, the data link layer, and the physical layer.
- The first four layers provide physical standards, network interface, internetworking, and transport functions, and are represented by a single layer called the application layer in the TCP/IP model.
- TCP/IP is a hierarchical protocol composed of interactive modules, each of which performs a specific function.
- In this case, two or more lower-level protocols support each upper-layer protocol.

Difference Between TCP/IP Model and OSI Model

TCP Model

- TCP is an abbreviation for Transmission Control Protocol.
- TCP/IP consists of four layers and is more dependable.
- TCP/boundaries IPs are not very strict and has a horizontal protocol.
- In the application layer, TCP/IP employs both the session and presentation layers
- TCP/IP protocols were created first, followed by a model

OSI Model

- OSI stands for Open Systems Interconnection.
- It has seven layer and is less dependable.
- OSI has strict guidelines and takes a top-down approach.
- OSI employs various session and presentation layers.
- OSI created a model first and then a protocol.

The TCP/IP 4 Model Layer

The TCP/IP model defines how devices communicate with one another across networks and long distances. The model depicts the exchange and organization of information across networks. It is divided into four layers, each of which defines data exchange standards and represents how data is handled and packaged when delivered between applications, devices, and servers.

The TCP/IP model has four layers, which are as follows (Figure 2):

1. *Datalink layer*: The datalink layer specifies how data should be transmitted and handles the physical act of transmitting and receiving data and is in charge of transmitting data between network applications or devices. Defining how hardware and other network transmission devices, such as a computer's device driver, an Ethernet cable, a network interface card (NIC), or a wireless network, should signal data is part of this. It is the combination of the Open Systems Interconnection (OSI) model's physical and data link layers that standardizes communications functions on computing and telecommunications systems. The network access layer, network interface layer, or physical layer are all names for the link layer.
2. *The internet layer*: It is in charge of sending packets from a network and influencing their movement across the network to ensure they arrive at their destination. It provides the functions and procedures for transferring data sequences between applications and devices across networks.
3. *The transport layer*: It is in charge of establishing a reliable data connection between the original application or device and its intended destination. Data is divided into packets and numbered at this level to form a sequence. The transport layer then decides how much data must be transmitted, where it must be transmitted, and at what rate it must be transmitted. It ensures that data packets are sent correctly and in sequence, and it obtains confirmation that the data packets were received by the destination device.
4. *The application layer*: It refers to program that must use TCP/IP to communicate with one another. The majority of users interact at this level, for example, with email systems and messaging platforms. It combines the OSI model's session, presentation, and application layers.

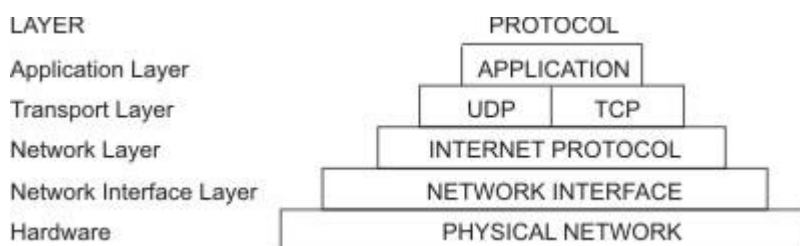


Figure 2. TCP/IP suite of protocol.

7 Layers of OSI Model

The OSI model is a layered server architecture system defined by the function to be performed at each layer. To move data from one layer to the next, all seven layers work together.

Upper Layers

It is mostly used in software and is concerned with application issues. The highest is closest to the system's end user. The interaction between the application layer is used to initiate communication from one end-user to another in this layer. It will go all the way to the end user.

Lower Layers

These layers handle data transport-related activities. Physical and datalink layers are also implemented in software and hardware (Figure 3).

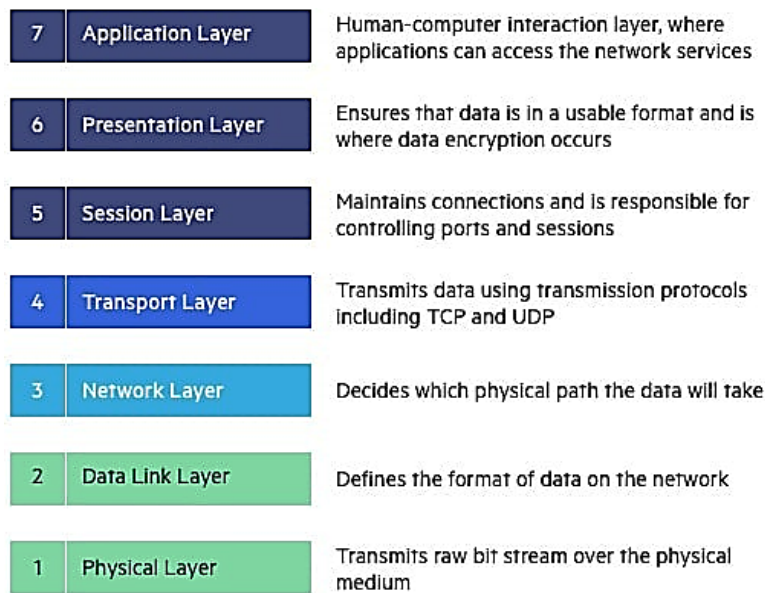


Figure 3. OSI 7 layers explained.

CONCLUSION

In this article, we have discussed about TCP/IP protocols that are built on a four-layered framework, and the seven-layer OSI reference model. The Application layer, Transport layer, Network layer, and Network interface layer are the four layers. TCP/IP has several advantages, including fast failure recovery, the ability to add networks without disrupting existing services, high error-rate handling, platform independence, and low data overhead.

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