

TCP/IP PROTOCOLS

TCP/IP PROTOCOL SUITE/STACK

Overview of TCP/IP Protocol Suite/Stack

- TCP/IP that is Transmission Control Protocol and Internet Protocol was developed by Department of **Defence's Project Research Agency** (ARPA, later DARPA) as a part of a research project of network interconnection to connect remote machines.
- The features that stood out during the research, which led to making the TCP/IP Protocol Suite/Stack were:
- Support for a flexible architecture. Adding more machines to a network was easy.
- The network was robust, and connections remained intact until the source and destination machines were functioning.
- The overall idea was to allow one application on one computer to talk to(send data packets) another application running on different computer.

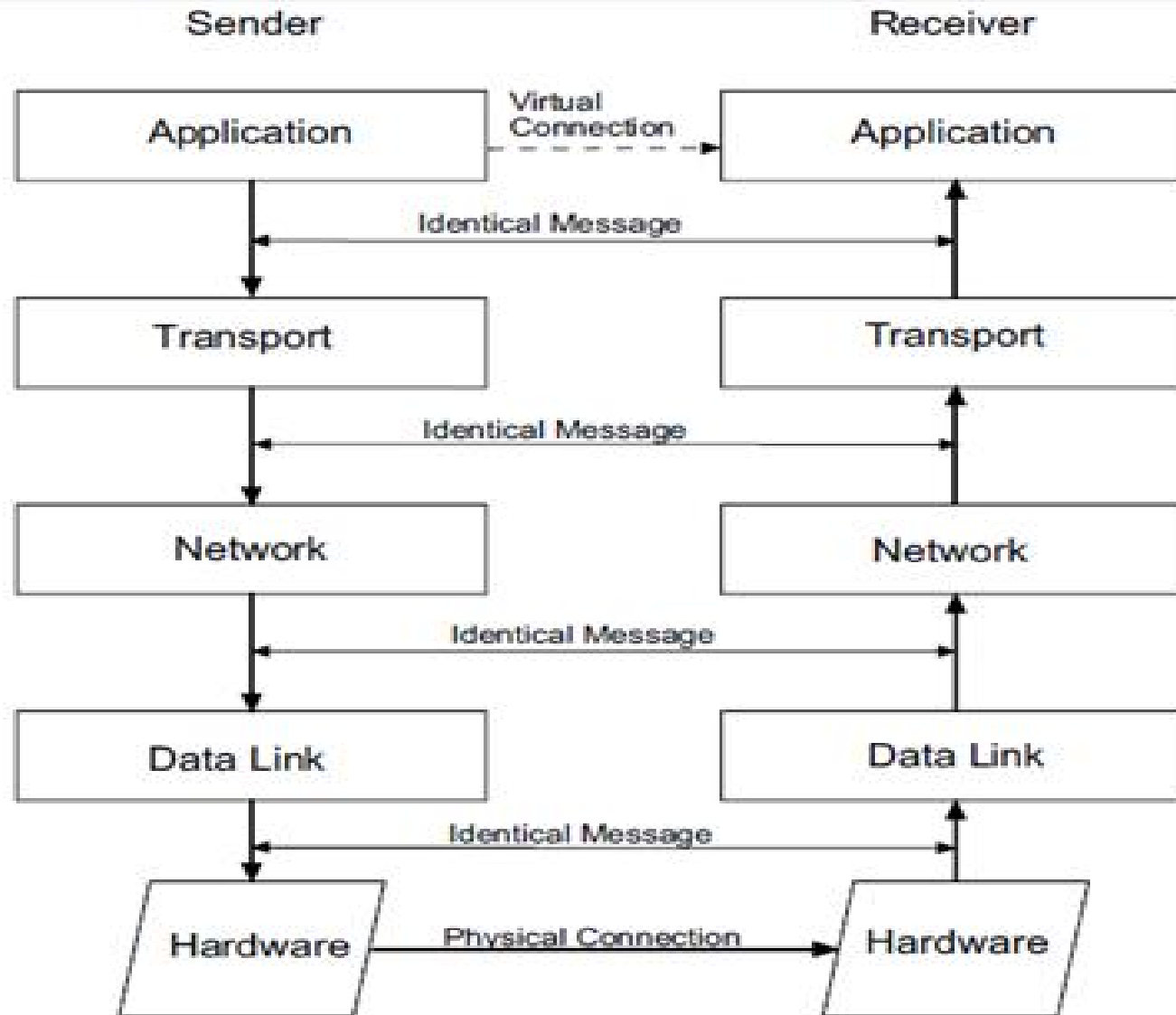
Introduction

- TCP/IP means Transmission Control Protocol and Internet Protocol. It is the network model used in the current Internet architecture as well.
- **Protocols** are set of rules which govern every possible communication over a network. These protocols describe the movement of data between the source and destination or the internet. They also offer simple naming and addressing schemes.

TCP/IP protocol stack

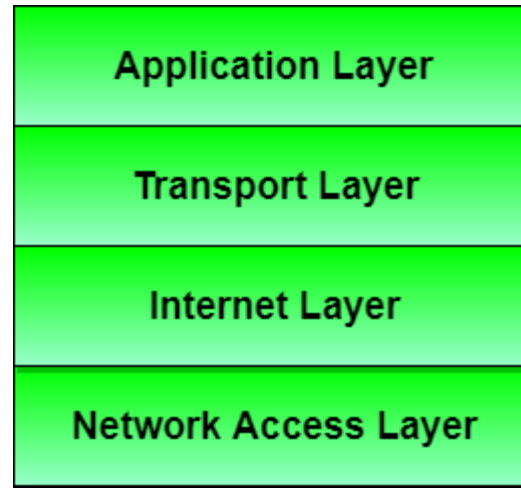
- TCP/IP is the protocol suite upon which all Internet communication is based.
- Different vendors have developed other networking protocols, but even most network operating systems with their own protocols, such as Netware, support TCP/IP.
- It has become the de facto standard.
- Protocols are sometimes referred to as protocol stacks or protocol suites. A protocol stack is an appropriate term because it indicates the layered approach used to design the networking software

TCP/IP protocol stack



- Flow of data between two computers using TCP/IP stacks.

Different Layers of TCP/IP Reference Model



- The 4 layers that form the TCP/IP reference model are:
 - i. Layer 1 (Host-to-network Layer/ Network access layer)
 - ii. Layer 2 (Internet layer)
 - iii. Layer 3 (Transport Layer)
 - iv. Layer 4 (Application Layer)

Different Layers of TCP/IP Reference Model

- Though there are sources that indicate that the model has five layer i.e. Layer 5 (Application), Layer 4 (Transport), Layer 3 (Internet), Layer 2 (Network), and Layer 1 (Physical).

i. Layer 1 (Host-to-network Layer/ Network access layer)

- Lowest layer of the all.
- Protocol is used to connect to the host, so that the packets can be sent over it.
- Varies from host to host and network to network.

Different Layers of TCP/IP Reference Model

ii. Layer 2 (Internet layer)

- Selection of a packet switching network which is based on a connectionless internetwork layer is called a internet layer.
- It is the layer which holds the whole architecture together.
- It helps the packet to travel independently to the destination.
- Order in which packets are received is different from the way they are sent.
- IP (Internet Protocol) is used in this layer.
- The various functions performed by the Internet Layer are:
 - Delivering IP packets
 - Performing routing
 - Avoiding congestion

Different Layers of TCP/IP Reference Model

iii. Layer 3 (Transport Layer)

- It decides if data transmission should be on parallel path or single path.
- Functions such as multiplexing, segmenting or splitting on the data is done by transport layer.
- The applications can read and write to the transport layer.
- Transport layer adds header information to the data.
- Transport layer breaks the message (data) into small units so that they are handled more efficiently by the network layer.
- Transport layer also arrange the packets to be sent, in sequence.

Different Layers of TCP/IP Reference Model

iv. Layer 4 (Application Layer)

The TCP/IP specifications described a lot of applications that were at the top of the protocol stack. Some of them were TELNET, FTP, SMTP, DNS etc.

- **TELNET** is a two-way communication protocol which allows connecting to a remote machine and run applications on it.
- **FTP**(File Transfer Protocol) is a protocol, that allows File transfer amongst computer users connected over a network. It is reliable, simple and efficient.
- **SMTP**(Simple Mail Transport Protocol) is a protocol, which is used to transport electronic mail between a source and destination, directed via a route.
- **DNS**(Domain Name Server) resolves an IP address into a textual address for Hosts connected over a network.
- It allows peer entities to carry conversation.
- It defines two end-to-end protocols: TCP and UDP

Different Layers of TCP/IP Reference Model

- **TCP(Transmission Control Protocol):** It is a reliable connection-oriented protocol which handles byte-stream from source to destination without error and flow control.
- **UDP(User-Datagram Protocol):** It is an unreliable connection-less protocol that do not want TCPs, sequencing and flow control. Eg: One-shot request-reply kind of service.

Merits of TCP/IP model

- It operated independently.
- It is scalable.
- Client/server architecture.
- Supports a number of routing protocols.
- Can be used to establish a connection between two computers.

Demerits of TCP/IP

- In this, the transport layer does not guarantee delivery of packets.
- The model cannot be used in any other application.
- Replacing protocol is not easy.
- It has not clearly separated its services, interfaces and protocols.

PROTOCOLS

Introduction

A Family of Protocols

- TCP/IP is a large collection of different communication protocols based upon the two original protocols TCP and IP.

TCP - Transmission Control Protocol

- TCP is used for transmission of data from an application to the network.
- TCP is responsible for breaking data down into IP packets before they are sent, and for assembling the packets when they arrive.

IP - Internet Protocol

- IP takes care of the communication with other computers.
- IP is responsible for the sending and receiving data packets over the Internet.

Protocols

HTTP - Hyper Text Transfer Protocol

- HTTP takes care of the communication between a web server and a web browser.
- HTTP is used for sending requests from a web client (a browser) to a web server, returning web content (web pages) from the server back to the client.

HTTPS - Secure HTTP

- HTTPS takes care of secure communication between a web server and a web browser.
- HTTPS typically handles credit card transactions and other sensitive data.

Protocols

SSL - Secure Sockets Layer

- The SSL protocol is used for encryption of data for secure data transmission.

SMTP - Simple Mail Transfer Protocol

- SMTP is used for transmission of e-mails.

MIME - Multi-purpose Internet Mail Extensions

- The MIME protocol lets SMTP transmit multimedia files including voice, audio, and binary data across TCP/IP networks.

IMAP - Internet Message Access Protocol

- IMAP is used for storing and retrieving e-mails.

Protocols

POP - Post Office Protocol

- POP is used for downloading e-mails from an e-mail server to a personal computer.

FTP - File Transfer Protocol

- FTP takes care of transmission of files between computers.

NTP - Network Time Protocol

- NTP is used to synchronize the time (the clock) between computers.

DHCP - Dynamic Host Configuration Protocol

- DHCP is used for allocation of dynamic IP addresses to computers in a network.

Protocols

SNMP - Simple Network Management Protocol

- SNMP is used for administration of computer networks.

LDAP - Lightweight Directory Access Protocol

- LDAP is used for collecting information about users and e-mail addresses from the internet.

ICMP - Internet Control Message Protocol

- ICMP takes care of error-handling in the network.

ARP - Address Resolution Protocol

- ARP is used by IP to find the hardware address of a computer network card based on the IP address.

RARP - Reverse Address Resolution Protocol

- RARP is used by IP to find the IP address based on the hardware address of a computer network card.

Protocols

BOOTP - Boot Protocol

- BOOTP is used for booting (starting) computers from the network.

PPTP - Point to Point Tunneling Protocol

- PPTP is used for setting up a connection (tunnel) between private networks.