

- **Protocols: Definition, File Transfer Protocol (FTP), Hyper Text Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol(TCP/IP), Simple Mail Transfer Protocol(SMTP), Post Office Protocol(POP),Remote Login(Telnet).**
- **Application of Networks: Email, E-commerce, Chat Services, Video Conferencing,Usenet.**

**Protocol:** A **network or communication protocol** defines rules and conventions for communication between network devices. Network protocols include mechanisms for devices to identify and make connections with each other, as well as formatting rules that specify how data is packaged into messages sent and received. Some protocols also support message acknowledgment and data compression designed for reliable and/or high-performance network communication.

Modern protocols for computer networking all generally use packet switching techniques to send and receive messages in the form of *packets* - messages subdivided into pieces that are collected and re-assembled at their destination.

**File Transfer Protocol (FTP)** enables file sharing between hosts. It is a client-server application allowing file transfers between the client and server. FTP creates a virtual connection for control information and then creates a separate TCP connection for data transfers. The control connection is used to exchange commands and messages between hosts. FTP, though usable directly by a user at a terminal, is designed mainly for use by programs.

The key functions of FTP are:

- 1) to promote sharing of files (computer programs and/or data);
- 2) to encourage use of remote computers for file storage and download
- 3) to shield a user from variations in file storage systems among hosts; and
- 4) to transfer data reliably and efficiently.

**HTTP (Hypertext Transfer Protocol)** is the set of rules for transferring files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web. HTTP uses a client-server model where the web browser is the client and communicates with the web server that hosts the website. The browser uses HTTP, which is carried over TCP/IP to communicate to the server and retrieve Web content for the user. HTTP is a widely used protocol and has been rapidly adopted over the Internet because of its simplicity. It is a stateless and connectionless protocol.

HTTP concepts include (as the Hypertext part of the name implies) the idea that files can contain references to other files whose selection will make additional transfer requests. A Web browser is an HTTP client, sending requests to server machines. When the browser user enters file requests by either "opening" a Web file (typing in a Uniform Resource Locator or URL) or clicking on a hypertext link, the browser builds an HTTP request and sends it to the Internet Protocol address (IP

address) indicated by the URL. The server machine receives the request and sends back the requested file or files associated with the request.

A basic HTTP request involves the following steps:

1. A connection to the HTTP server is opened.
2. A request is sent to the server.
3. Some processing is done by the server.
4. A response from the server is sent back.
5. The connection is closed.

The Transmission Control Protocol/Internet Protocol (TCP/IP), is a suite of communication protocols used to interconnect network devices on the internet. TCP/IP can also be used as a communications protocol in a private network.

TCP/IP specifies how data is exchanged over the internet by providing end-to-end communications that identify how the data should be broken into packets, addressed, transmitted, routed and received at the destination. TCP/IP requires little central management, and it is designed to make networks reliable, with the ability to recover automatically from the failure of any device on the network.

The two main protocols in the internet protocol suite serve specific functions. TCP defines how applications can create channels of communication across a network. It also manages how a message is assembled into smaller packets before they are then transmitted over the internet and reassembled in the right order at the destination address.

IP defines how to address and route each packet to make sure it reaches the right destination. Each gateway computer on the network checks this IP address to determine where to forward the message.

## **The history of TCP/IP**

The Defense Advanced Research Projects Agency (DARPA), the research branch of the U.S. Department of Defense, created the TCP/IP model in the 1970s for use in ARPANET, a wide area network that preceded the internet. TCP/IP was originally designed for the Unix operating system, and it has been built into all of the operating systems that came after it.

## **How TCP/IP works**

TCP/IP uses the client/server model of communication in which a user or machine (a client) is provided a service (like sending a webpage) by another computer (a server) in the network.

Collectively, the TCP/IP suite of protocols is classified as stateless, which means each client request is considered new because it is unrelated to previous requests. Being stateless frees up network paths so they can be used continuously.

The transport layer itself, however, is stateful. It transmits a single message, and its connection remains in place until all the packets in a message have been received and reassembled at the destination.

## **TCP/IP model layers**

TCP/IP functionality is divided into four layers, each of which include specific protocols.

- *The application layer* provides applications with standardized data exchange. Its protocols include the Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Post Office Protocol 3 (POP3), Simple Mail Transfer Protocol (SMTP) etc.
- *The transport layer* is responsible for maintaining end-to-end communications across the network. TCP handles communications between hosts and provides flow control, multiplexing and reliability. The transport protocols include TCP and User Datagram Protocol (UDP), which is sometimes used instead of TCP for special purposes.
- *The network layer*, also called the internet layer, deals with packets and connects independent networks to transport the packets across network boundaries. The network layer protocols are the IP and the Internet Control Message Protocol (ICMP), which is used for error reporting.
- *The physical layer* consists of protocols that operate only on a link -- the network component that interconnects nodes or hosts in the network. The protocols in this layer include Ethernet for local area networks (LANs) and the Address Resolution Protocol (ARP).

## **Advantages of TCP/IP**

TCP/IP is nonproprietary and, as a result, is not controlled by any single company. Therefore, the internet protocol suite can be modified easily. It is compatible with all operating systems, so it can communicate with any other system. The internet protocol suite is also compatible with all types of computer hardware and networks.

TCP/IP is highly scalable and, as a routable protocol, can determine the most efficient path through the network.

**Simple Mail Transfer Protocol (SMTP)** is the standard protocol for email services on a TCP/IP network. SMTP provides the ability to send and receive email messages. SMTP is an application-layer protocol that enables the transmission and delivery of email over the Internet.

SMTP is one of the most common and popular protocols for email communication over the Internet and it provides intermediary network services between the remote email provider or organizational email server and the local user accessing it. SMTP is generally integrated within an email client application. SMTP works by initiating a session between the user and server.

However, since it is limited in its ability to queue messages at the receiving end, it is usually used with one of two other protocols, POP3 or IMAP, that let the user save messages in a server mailbox and download them periodically from the server. In other words, users typically use a program that uses SMTP for sending e-mail and either POP3 or IMAP for receiving e-mail. On Unix-based systems, sendmail is the most widely-used SMTP server for e-mail.

**Post Office Protocol (POP)** is a type of computer networking and Internet standard protocol that extracts and retrieves email from a remote mail server for access by the client machine.

POP is an application layer protocol that provides end users the ability to fetch and receive email. Post Office Protocol is the primary protocol behind email communication. POP works through a supporting email software client that integrates POP for connecting to the remote email server and downloading email messages to the recipient's computer machine.

POP uses the TCP/IP protocol for network connection and works with Simple Mail Transfer Protocol (SMTP) for end-to-end email communication, where POP receives messages and SMTP sends them to the server. As of 2012, Post Office Protocol is in its third version known as POP 3 and is commonly used in most email client/server communication architecture.

**Telnet** is a user command and an underlying protocol that allows you to connect to remote computers (called hosts) over a TCP/IP network (such as the Internet). Using telnet client software on your computer, you can make a connection to a telnet server (i.e., the remote host). Once your telnet client establishes a connection to the remote host, your client becomes a virtual terminal, allowing you to communicate with the remote host from your computer. In most cases, you'll need to log into the remote host, which requires that you have an account on that system. Occasionally, you can log in as guest or public without having an account. Telnet clients are available for all major operating systems. Command-line telnet clients are built into most versions of macOS, Windows, Unix, and Linux.

- ***Application of Networks: Email, E-commerce, Chat Services, Video Conferencing, Usenet.***

**Email:** (electronic mail) is the exchange of computer-stored messages by telecommunication. E-mail messages are usually encoded in ASCII text. However, you can also send non-text files, such as graphic images and sound files, as attachments sent in binary streams. E-mail was one of the first uses of the Internet and is still the most popular use. A large percentage of the total traffic over the Internet is e-mail. E-mail can also be exchanged between online service provider users and in networks other than the Internet, both public and private.

E-mail is one of the protocols included with the Transport Control Protocol/Internet Protocol (TCP/IP) suite of protocols. A popular protocol for sending e-mail is Simple Mail Transfer Protocol and a popular protocol for receiving it is POP3.

Email messages are comprised of three components, as follows:

- Message envelope: Describes the email's electronic format
- Message header: Includes sender/recipient information and email subject line
- Message body: Includes text, image and file attachments

**Video Conferencing:** It enables direct face-to-face communication across networks via web cameras, microphones, and other communication tools. Video conferencing can enable individuals in distant locations to participate in meetings on short notice, with time and money savings. The technology is also used for telecommuting, in which employees work from home. When video Conferencing is used in education, it is easier to have interactive communications between teacher to teacher, teacher to classroom, or classroom to classroom with students in different places. Consumer services -- like Apple's FaceTime, Google's Hangouts and Microsoft's Skype -- have made video conferencing ubiquitous on desktops and mobile devices that have an embedded camera.

**E-commerce** (electronic **commerce** or EC) is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the Internet. These business transactions occur either business-to-business, business-to-consumer, consumer-to-consumer or consumer-to-business. Largest e-commerce companies in India are Flipkart, Amazon India, Paytm.

**Online chat** is any direct text-based or video-based (webcams), one-on-one chat or one-to-many group chat, using tools such as instant messengers and Internet Relay Chat (IRC) where a central server manages chat communication between different end user clients. The expression *online chat* comes from the word *chat* which means "informal conversation". Chat messages are generally short in order to enable other participants to respond quickly. Thereby, a feeling similar to a spoken conversation is created. Online chat services require users to sign up with a valid email address. After signing up, a user may join a group chat room or send a private message to another individual. Online chat services have purpose-built chat interfaces that manage the entire communication processes.

**Usenet:** is a worldwide system for Internet discussion that consists of a set of newsgroups that are organized by subject. Users post articles or messages to these newsgroups. The articles are then broadcast to other computer systems, most of which now connect via the Internet. Usenet was conceived in 1979, making it one of the oldest network communications systems still in use today. It is also the predecessor of many of the forums online today.

Usenet got its name from Unix-to-Unix Copy (UUCP), a protocol suite for sending data, usually over a dial-up network. Initially, this was the dominant mode of transmission for Usenet, but it has since come to rely on the Internet.

Some newsgroups are moderated, which means that posts are sent to a moderator for approval before being distributed to the group. Usenet users exchange articles by tagging them with universally recognized labels. Many Internet service providers and Internet sites provide news servers, which allow their users to handle Usenet articles. Although Usenet is still used, it has become less important in the face of online forums, blogs and mailing lists.

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