

Transmission Control Protocol / Internet Protocol

This tutorial on TCP/IP is broken up into the following sections:

- ◆ The origins of TCP/IP
- ◆ The TCP/IP Model
- ◆ The Internet Layers

The Origins of TCP/IP

In the early 1960's, The American Department of Defence (DoD) indicated the need for a wide-area, cross platform communication system. Initially the TCP/IP suite of protocols was used to interconnect government; military and educational sites together, slowly connecting to commercial companies as time progressed. It was developed by the US Government to build a heterogeneous (supporting multiple platforms) network across a wide area of the United States.

The TCP/IP Model

Figure 1 illustrates the TCP/IP network with its 4 layers of software. The contents and usage of each of the layers is also indicated.

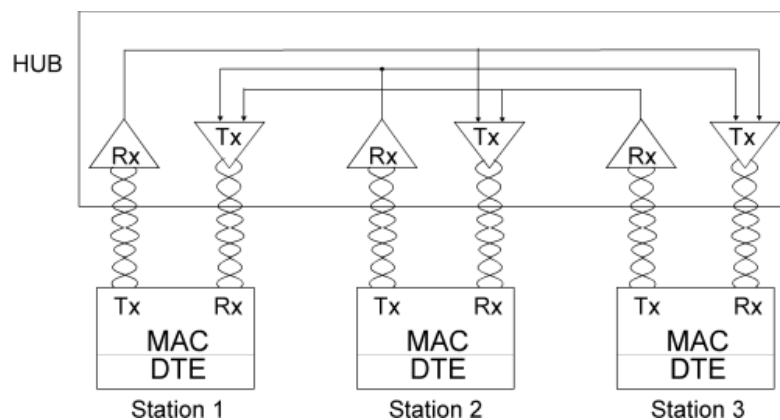


Figure 1 An example of InterNetworking

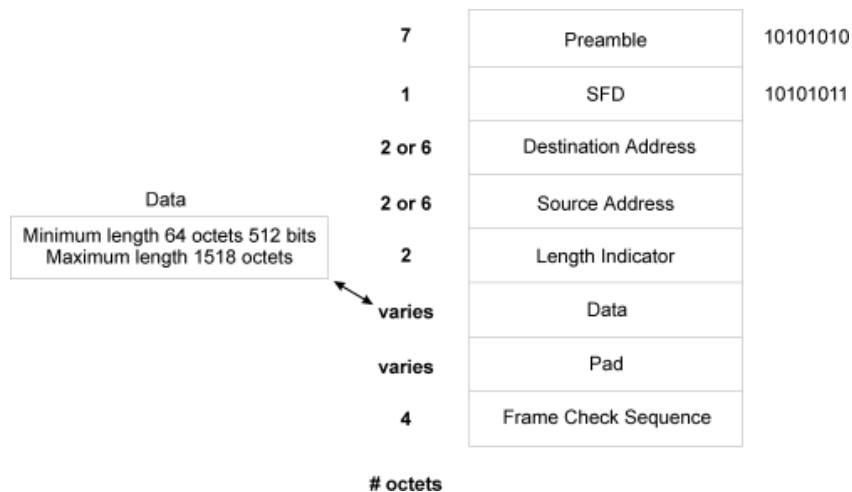


Figure 2 The Basic TCP/IP (or ARPA) Model

The TCP/IP model differs from the OSI model in that it consists of just four and not seven layers. The TCP/IP and the OSI models were developed concurrently, and each model has contributed to the development of the other.

The Internet Layers

The four layers, Network, Internet, Transport and Application are described below. We start at the first layer, the Network Interface Layer, which is sometimes referred to as the Network Access Layer.

The Network Interface

This layer connects the local host to the local area network (LAN). Thus it represents the Physical and Datalink Levels of the OSI Model. It will use the required LAN operating algorithms, such as Carrier Sense Multiple Access with Collision Detect (CSMA/CD) or IBM Token Passing etc. and is responsible for placing the data within a frame.

The frame format is dependent on the system being used, for example Ethernet LAN, Frame relay etc. The frame is the package that holds the data, in the same way as an envelope holds a letter.

The frame holds the hardware address of the host and checking algorithms for data integrity.

The Internet Layer

This performs the transfer of packets from one host to another. This is a “Packet” transfer, and not a frame transfer. A Packet contains the address information needed for its routing through the internetwork to the receiving host.

The address within the frame header gets the frame from host to host on the same LAN. This layer is operated by the Internet Protocol, the IP in TCP/IP.

There are however several other additional protocols required at this level, these being:

- ◆ Address Resolution Protocol (ARP). The translation of an IP address to a Network address, such as required by say Ethernet.
- ◆ Reverse Address Resolution Protocol (RARP). This is the complement of ARP
- ◆ Internet Control Message Protocol (ICMP). This is IP software used for communication from a gateway or host to its peers regarding any problems encountered. One of the best-known applications here is the Ping or Echo Request that is used to test a communications link.

Host-to-Host Layer

This layer is primarily responsible for data integrity between the sender host and receiver host regardless of the path or distance used to convey the message. Communications errors are detected and corrected at this level. It has two protocols associated with it, these being:

- ◆ User Data Protocol (UDP), that is a minimum security and basic protocol used for higher layer port addressing, defining the length and also a checksum. It offers minimal protocol overhead.
- ◆ Transmission Control Protocol (TCP) that has vastly improved protection and error control. This protocol, the TCP component of TCP/IP, is the heart of the TCP/IP suite of applications. It provides a very reliable method of transferring data in an 8-bit data format, known as octets, between two applications.

Process and Application Layer

The end user interacts with the host via this layer. At this level there are many protocols used, some of the more common ones being:

- ◆ File Transfer Protocol (FTP), which as the name implies, is used for the transfer of files between two hosts using TCP.
- ◆ Trivial File Transfer Protocol (TFTP) is an economic version of FTP that uses UDP instead of TCP for reduced overhead.
- ◆ Simple Mail Transfer Protocol (SMTP) is an example of an e-mail application.
- ◆ TELNET (Telecommunications Network) is used to emulate terminals and for remote host access. It can, for example, emulate a VT100 terminal, across a network to a Digital host