**TCP / IP**

In layered network, there are important network architecture model:

1. The OSI Reference Model
2. The TCP / IP Reference Model

The protocols associated with the OSI model are not used any more, the model itself is general but valid and features discussed at every layer are very important. The TCP/ IP model has opposite properties: the model itself is not of much use but the protocols are widely used.

**HISTORY**

The TCP / IP reference model used in the oldest all wide area computer networks, the ARPANET, and its successor, the worldwide Internet. The ARPANET was a research network sponsored by the united states Department of Defense. It then connected many universities and government installations, using paid telephone lines. When satellite and radio etc. networks were added later, the existing protocols had trouble in working with them, so brand new reference architecture was needed. So from nearly the starting, the ability to connect many networks in a seamless way was one of the biggest design goals. This architecture later called as the TCP / IP Reference Model, after its two primary protocols added. It was first described by Cerf and Kahn, and later refined and defined as a standard in the Internet Community by Braden. The design philosophy in the model is discussed by Clark.

Department of Defense is worried that some of its precious hosts, routers and internetwork gateways might get harm in a moment if there is an attack from the Soviet Union, another biggest goal was the network should be able to survive loss of subnet hardware, withstanding conversations being broken off. The Department of Defense wanted connections to remain in work as long as the source and destination machines were working, even some of the machines or transmission medium in between were suddenly destroyed or put out of operation. Due to application with various requirements were expected, like transferring files, real-time speech transmission etc., a flexible architecture was needed.

**INTRODUCTION**

TCP / IP reference model provides end-to-end data communication defining how the data should be packetized, addressed, transmitted, routed and received. This functionality is divided into four abstraction layers. They are used to sort all related protocols according to the scope of networking involved. From lowest layer to highest layer, the link layer, containing communication methods for data that remains in a single link; the internet layer which is connecting independent networks, so that providing internetworking; the transport layer handling host to host communication; and he application layer, which provides process-to-process data exchange for application. An organization of this layered communication system is known as TCP / IP stack.

The TCP / IP model and many of its protocols are under maintained by the Internet Engineering Task Force.

**KEY ARCHITECTURAL PRINCIPLES**

An early architectural document emphasizes architectural principles over layering.

* End-to-end principle: This principle has evolved over time. Its original expression put the maintenance of state and overall intelligence at the edges, and assumed the Internet that connected the edges retained no state and concentrated on speed and simplicity. Real-world needs for firewalls, network address translators, web content caches and the like have forced changes in this principle.
* Robustness Principle: “In general, an implementation must be conservative in its sending behavior and liberal in its receiving behavior. That is, it must be careful to send well-formed datagrams, but must accept any datagram that it can interpret (e.g., not object to technical errors where the meaning is still clear).” ”The second part of the principle is almost as important: software on other hosts may contain deficiencies that make it unwise to exploit legal but obscure protocol features.”

**THE LINK LAYER**

All requirement placed by united states Department of Defense led to the choice of a packet switching network based on a connectionless layer that runs across various networks. The lowest layer in the model, the link layer describes what links must do to meet the needs of this connectionless internet layer. It is not a layer. But an interface between hosts and transmission links.

**THE INTERNET LAYER**

The Internet Layer is the bond that holds the whole architecture model together. Its job is to give permission to hosts to inject packets into ant network and let them travel independently to the destination on a different network. They can even arrive in a completely different order than they were sent, in this case it is the job of high layers to rearrange them, if ordered delivery is desired.

This layer defines an packet format and protocol called IP, plus a companion protocol called ICMP ( Internet Control Message Protocol ) that helps it function. The job of this layer is to send IP packet where they are supposed to go. Packet routing is clearly a major issue here and also crowding because IP is not effective in this case.

**THE TRANSPORT LAYER**

The layer next above the internet layer in the TCP / IP model is called the transport layer. It is designed to allow peer entities on the source and destination hosts to carry on a conversation, just as in the OSI layer. Two end-to-end transport protocols have been defined here. The first TCP is a reliable connection related protocol that allows a data stream originating on one machine to send without error on other machine in the internet. It segments the incoming data stream into discrete messages and passes each on to the internet layer. At the destination, the receiving TCP process looks like the received message into the output. TCP also handles flow control to make sure a fast sender cannot overflow a slow receiver with more messages than it can handle.

UDP ( User Datagram Protocol ) is second protocol in layer. It is an unreliable and connectionless protocol for applications that do not want TCP’s sequencing or flow control and wish to provide their own. It is used for one-shot, client-server-type request-reply queries and applications in which prompt delivery is more important than accurate delivery, such as transmitting speech or video. Since the model was developed, IP has been implemented on many other networks.

**THE APPLICATION LAYER**

The TCP/IP model does not have session type or presentation type layers. Applications simply include any session and presentation functions that they require. Experience with the OSI model has corrected this view that these layers are of little use to most applications.

On top is the Application Layer. It contains all higher-level protocols. The early ones included virtual terminal (TELNET), file transfer (FTP), and electronic mail (SMTP). Many more protocols have been added to these over the years. Some important ones are Domain Name System (DNS) (for mapping host names onto their network addresses), HTTP (the protocol for fetching pages on the World Wide Web) and RTP (the protocol for delivering real-time media such as voice or movies).

**ANALYSIS OF THE TCP / IP REFERENCE MODEL**

The TCP/IP model and protocols have problems too.

1. The model does not clearly distinguish the concepts of services, interfaces and protocols. Good engineering practice requires technique to differentiate between the specification and the implementation, that is the thing that OSI does very carefully, but TCP/IP does not. So, the TCP / IP model is not a good guide for designing brand new networks using new technologies.
2. The TCP / IP model is not so general and is very poorly suited to describing any protocol stack other than TCP / IP. For example, trying to use the TCP / IP model to describe even Bluetooth is completely impossible.
3. The link layer is not really a layer in the normal term as used in the context of many layered protocols. It is an interface between the network and the data link layers. The distinction between an interface and a layer is very crucial, and one should not be worried about it.
4. The TCP / IP model does not distinguish b/w the physical and data link layers. They are different. The physical layer has to do work with the transmission characteristics of only copper wire, fiber optics, and wireless communication. The data link layer’s job is to delimit the start and end of every frame and get them from one side to another with the desired degree of reliability. A proper model should have both as separate layers. The TCP / IP model fails to do this.

However the IP and TCP protocols were very carefully thought out and very well implemented, many of the other protocols were ad hoc, moreover, generally produced by a couple of graduate students hacking away until they got tired. The protocol implementations were then distributed free, which resulted in their becoming very widely used, deeply entrenched and thus very hard to replace. Some of them are a bit of an embarrassment now. For example the virtual terminal protocol TELNET was designed for only a ten character per second mechanical Teletype terminal. It knows nothing of GUI and mouse.