

TCP/IP ARCHITECTURE - AN INTRODUCTION

TCP/IP Architecture

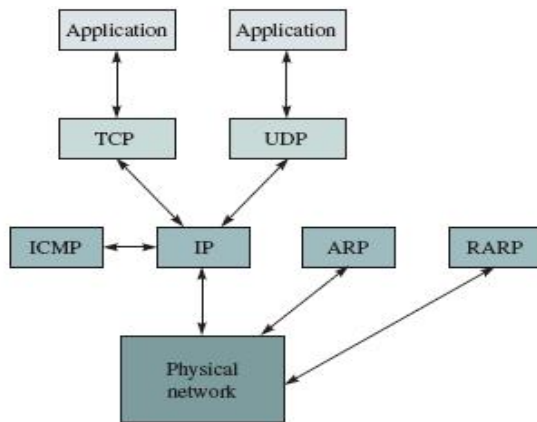


FIGURE 8.1 TCP/IP protocol suite

- The TCP/IP protocol suite usually refers not only to the two most well-known protocols called TCP and IP but also to other related protocols such as UDP, ICMP, HTTP, TELNET and FTP.
- Basic structure of TCP/IP protocol suite is shown in above figure.
- Protocol data unit (PDU) exchanged between peer TCP protocols is called segments.
- Protocol data unit (PDU) exchanged between peer UDP protocols is called datagrams.
- Protocol data unit (PDU) exchanged between peer IP protocols is called packets.

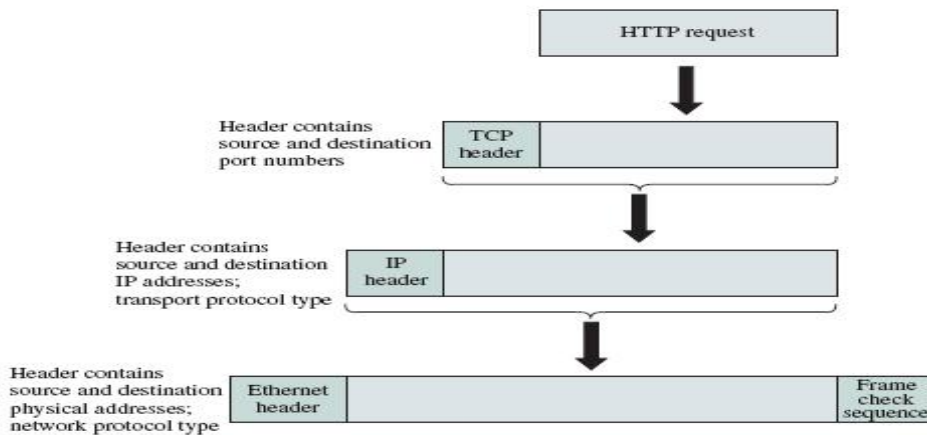


FIGURE 8.2 Encapsulation of PDUs in TCP/IP and addressing information in the headers

- In the above figure an HTTP GET command is passed to the TCP layer, which encapsulates the message into a TCP segment.
- The segment header contains an ephemeral port number for the client process and well known port 80 for HTTP server process.
- The TCP segment is passed to IP layer where it is encapsulated in an IP packet.
- The IP packet contains source and destination network address.
- IP packet is then passed through network interface and encapsulated into PDU of underlying network.
- In the network interface, the IP packet is encapsulated into an Ethernet frame, which contains physical addresses that identify the physical endpoints for the Ethernet sender and receiver.

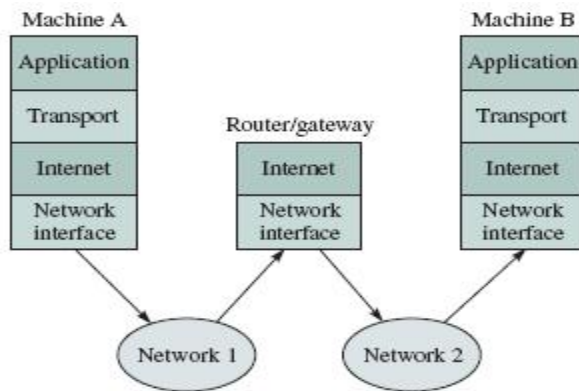


FIGURE 8.3 The Internet and network interface layers

- IP packets transfer information across Internet
- Host A IP router router... router Host B IP
- IP layer in each router determines next hop (router)
- Network interfaces transfer IP packets across networks
- Internet Names
 - Each host has a unique name
 - Independent of physical location
 - Domain Name will facilitates memorization by humans
 - Host Name
 - Name given to host computer
 - User Name
 - Name assigned to user

Internet Addresses

- Each host has globally unique logical 32 bit IP address
- Separate address for each physical connection to a network
- Routing decision is done based on destination IP address
- IP address has two parts:
 - netid and hostid
 - netid unique
 - netid facilitates routing
- Dotted Decimal Notation is used for representation:
Ex: - int1.int2.int3.int4
128.100.10.13
DNS(Domain Name Service) resolves IP name to IP address

Physical Addresses

- LANs (and other networks) assign physical addresses to the physical attachment to the network
- The network uses its own address to transfer packets or frames to the appropriate destination
- IP address needs to be resolved to physical address at each IP network interface
- Example: Ethernet uses 48-bit addresses
 - Each Ethernet network interface card (NIC) has globally unique Medium Access Control (MAC) or physical address
 - First 24 bits identify NIC manufacturer; second 24 bits are serial number
 - 00:90:27:96:68:07 12 hex numbers

Internet Protocol

- It provides best effort, connectionless packet delivery, packets may be lost, out of order, or even duplicated, so it is the responsibility of higher layer protocols to deal with these, if necessary.
- The header is of fixed-length component of 20 bytes plus variable-length consisting of options that can be up to 40 bytes.

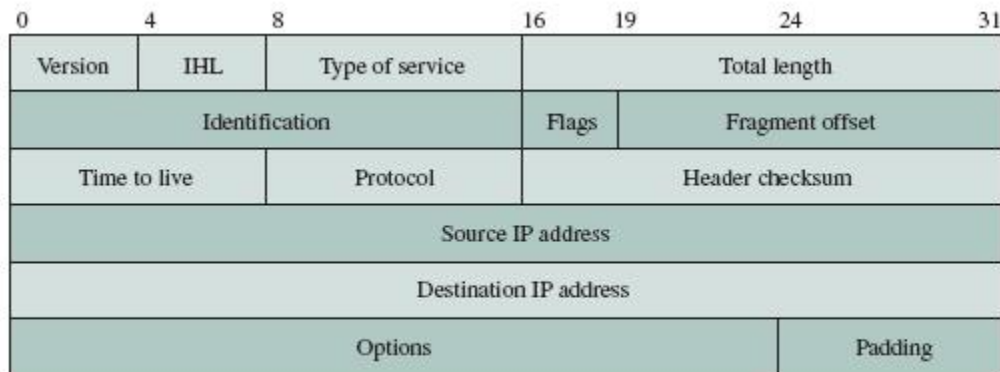


FIGURE 8.4 IP version 4 header

Version: This field identifies the current IP version and it is 4.

Internet header length (IHL): It specifies the length of the header in 32-bit words. If no options are used, IHL will have value of 5.

Type of service (TOS): This field specifies the priority of packet based on delay, throughput, reliability and cost. Three bits are used to assign priority levels and four bits are used for specific requirement (i.e. delay, throughput, reliability and cost).

Total length: The total length specifies the number of bytes of the IP packet including header and data, maximum length is 65535 bytes.

Identification, Flags, and Fragment Offset: These fields are used for fragmentation and reassembly.

Time to live (TTL): It specifies the number of hops; the packet is allowed to traverse in the network. Each router along the path to the destination decrements this value by one. If the value reaches zero before the packet reaches the destination, the router discards the packet and sends an error message back to the source.

Protocol: specifies upper-layer protocol that is to receive IP data at the destination. Examples include TCP (protocol = 6), UDP (protocol = 17), and ICMP (protocol = 1).