Mobile IP Network Layer

Lesson 02

IP Protocol, IP Packets and TCP/IP Suite

Internet Protocol– IP

- The basic protocol at *L*3 which is used for transmission over the Internet
- Designed for use by networks which employ packet-switched data communication

IP

- Provisions the transmission of data packets
- Each packet treated independently
- Every packet must contain complete destination address information

Header fields

- Carry information which is used by the successive layers at the transmitting end and by the corresponding layers at the receiving end
- At a layer at the receiving end, data received from the lower layer can be suitably assembled (for example, packetized IP layer data from *L*4 is assembled at *L*3)

TCP/IP PROTOCOL SUITE

- A suite of protocols for networking for the Internet
- Transmission control protocol (TCP) or User Datagram protocol (UDP) at *L*4
- The Internet protocol (IP) at *L*3
- The suite contains many protocols at L7 or L2 or L1
- L5 and L6 not present

TCP/IP PROTOCOL SUITE

- Originally designed to have four layers but evolved to a five-layer format
- The functions of *L*5 (session layer) incorporated into *L*4 (transport layer)
- *L*6 (presentation layer) incorporated into *L*7 (application layer) in TCP/IP
- The five layers— *L*7, *L*4, *L*3, *L*2, and *L*1

IP at *L*3, functions– Network layer

- Facilitate transmission of data from one system with a common address for the ports (like service access points in a mobile system) to another with a common address for the ports
- The address– called the IP address
- Connections to the Internet employ the IP protocol

IP

- Provides the connection to the router for transmission
- A communication between two addresses on a physical network carried out through routers

IP protocol Header

- Encapsulates data from the upper layers, for example, the *L*3 header encapsulates the *L*4 data after formatting it into packets

Packet Formation in IP

- Packets of maximum size = 2^{16} bytes (2^{14} words) after the data from *L*4 (transport layer) divided
- A packet-switched network can be used for transmission
- Hopping of data packets different routes to reach a destination

Packet Formation in IP

- More packets can be sent simultaneously through the network unlike in a circuit-switched network, where only one data frame can be transmitted at an instant (for example, in GSM or HSCSD

An IP packet transmitted in fragments

- MTU (maximum transferable units per effort) may be much less than 2^{16} bytes in a source-destination path or sub-path in the network

Header, Source, and Destination IP Addressing

- IP specifies certain header fields— a field is a set of bits placed in a word for a specific action, condition, or purpose
- Encoding data from the transport layer at the transmitter
- Decoding the data received from the data-link layer before passing it to the transport layer at the receiver

Header fields– First word

- 32-bit word
- Specify IP version (IPv4 or IPv6 for Internet or broadband Internet)
- Length of the IP header
- Precedence of the IP packet
- Total packet length

IPv4 Header fields– Second word

- 32-bit word
- ID for the packet
- Flags
- Fragment offset for the fragments of same ID

IPv4 Header fields– Third word

- 32-bit word
- Time-to-live (not in seconds but in number of attempts to hop before expiry of packets in the network)
- Type of protocol
- Checksum of the header (for finding transmission errors, if any)

IPv4 Header fields– Fourth word

- 32-bit word
- IP address of the source (as per four decimal numbers, each separated by dots and each lesser than 256)
- IPv4 IP protocol version 4 address of 32-bit each in source and destination in IPv4

IPv4 Header fields– Fifth word

- 32-bit word
- IP address of the destination (four decimal numbers each separated by dots and each lesser than 256)

IP address– Example

- Assume that the source IP address for routing is (*ns*1 . *ns*2 . *ns*3 . *ns*4)
- Destination IP address (*nd*1 . *nd*2. *nd*3 . *nd*4)

Packet transmission

- From the source IP address to the destination by hopping among the various routers on a path
- Paths can be different for different packets of same source
- Path for the routing of a packet depends on the paths and sub-paths which are available in the network at a given instant

Routing between two IP Addresses

- Router receives a packet from a source or a previous stage router
- Gets the destination address from the IP header
- Forwards the packet to the next router or the destination router for that destination address
- Each router maintains a table for selecting the path in the route for the packet

Routing table

- Maintained and regularly updated by the router
- Has a large number of rows depending upon the maximum number of entries possible in it

Routing table entries

- In each row, the destination router's address and the next router's address so that packets for that destination hop to that particular router

Router

- Not possible for a router to hold routing table entries for all the IP destination addresses on the Internet
- Not possible to store information about a large number of source and destination systems each having a distinct IP address

Router

- Belong to either a class *A*, *B*, or *C* subnet
- The Internet consists of class *A*, *B*, and *C* subnets that are connected to the hosts (computers, nodes, and service terminals)
- Each subnet consists of a large number of connected local subnets or hosts

Summary

- TCP/IP suite 5 layer protocol suite
- L7, L4, L3, L2 and L1
- TCP or UDP at L4
- IP protocol for L3 networking layer
- Packetization befor transmission
- Each packet IP header of minimum 5 word
- Size 2^{16}

...

… Summary

- Router for sending packets simultaneously to multiple available paths to destination
- Routing table regularly maintained and updated
- Router belong to a class A or B or C subnet

End of Lesson 02

IP Protocol, IP Packets and TCP/IP Suite