Module 7

Internet And Internet Protocol Suite

Lesson

21

Internet and IPv4

LESSON OBJECTIVE

General

The lesson will discuss a popular network layer protocol, i.e. the Internet Protocol

Specific

The focus areas of this lesson are:

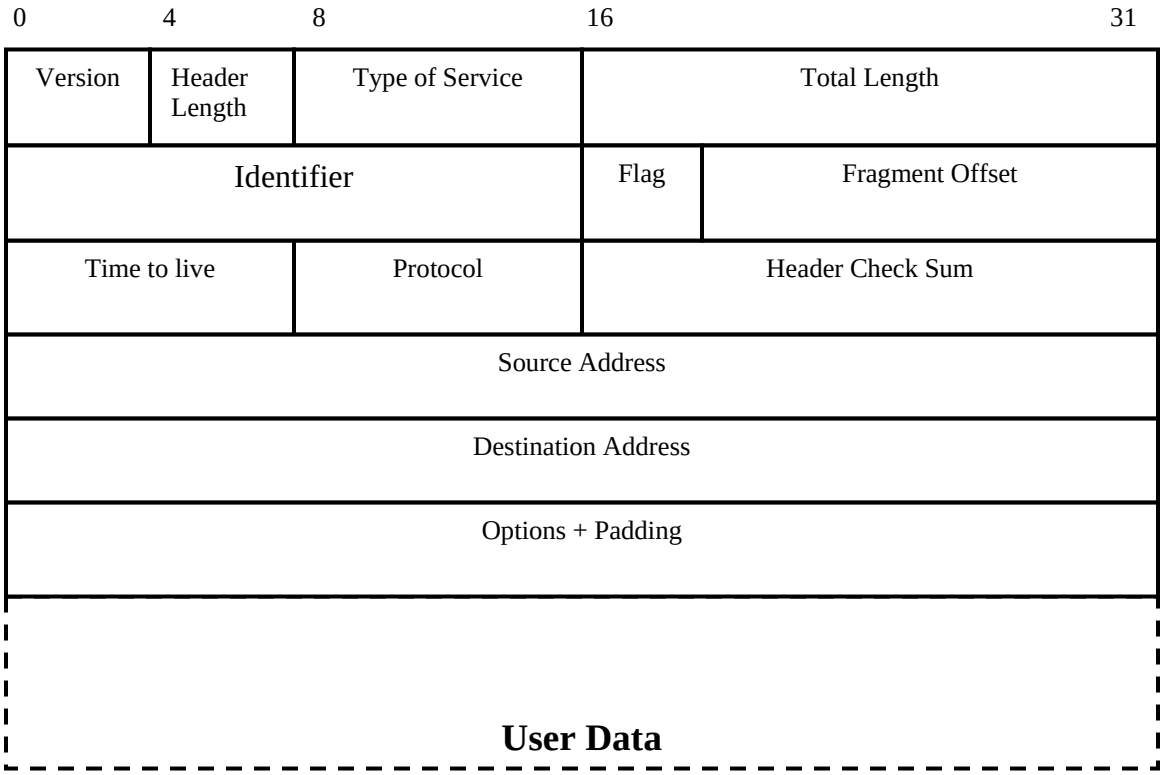
1. Definition of IPv4.
2. Structure of IPv4 header.
3. Idea of VoIP.
4. Various classes of service and types of networks.

7.1.1 INTRODUCTION:

At the X.25 level each fundamental entity is known as a packet. In IP terminology we call it as a datagram. Datagram will have a source and destination address. This address is known as IP address. All devices connected to the internetwork have an IP address. The IP datagram format is as shown in the diagram below

7.1.2 IPV4

IPv4 Header



The various fields in the header may be explained as follows

Version:	This field specifies the IP version being used
IHL	Internet Header Length specifies the total length of the header in 32- bit words. The minimum value is 5.
Type of service	It specifies the type of service being provided. The parameters are

	Parameter	Level
1	Precedence	8
2	Reliability	2
3	Delay	2
4	Throughput	2

Total length	It specifies the total length (including the header and the data)
Identifier	It is used, along with the source and destination address, to uniquely identify the data unit
Flag	The Flag field has 3 bits, two are for More and Don't fragment indicator, the 3rd is not used currently.
Fragment offset	Indicates where in the original datagram this fragment exists
Time-to-live	Specifies, in number of hops, how long a datagram is allowed to remain in the network
Protocol	Specifies the upper level protocol used in the destination.
Header checksum:	One's complement of modulo-16 addition of all 16 bit words in the header.
Source address	32 bits
Destination Address	32 bits
Options and padding	Depending on ISP some options may be available. Padding is used to ensure the datagram header is a multiple of 32 bits.

☞ *Though TCP and IP were developed together by DOD USA they are not really dependent, the protocol field in IP header specifies the transport protocol being used.*

IS VOIP REALLY INEXPENSIVE?

Voice and video are real-time. So if telephone line QoS is to be guaranteed then can VoIP be really cheap? Real time protocol (RTP) along with some reservation (RSVP) is required. But first voice is to be digitized. 64 kbps PCM requires quite large BW. So compression is required for lower bit rate transmission. We also require signaling. The overall process is referred to as IP telephony. In VoIP speaker takes sounds, digitizes, packetizes and then transmit through Internet. VoIP is IP telephony without the signaling

Let us not bother about the cost first. Transmit voice over internet. If VoIP grows then more number of users might help the cost to come down. Beginning with voice gradually any real-time as well as non-real time entity may be sent over IP. This is called Anything-over-IP. Mobile IP may be referred to in this context. Thus unification can be achieved. For unification global forum has decided that any future network, irrespective of its design, will have an IP backbone.

HOW QUALITY OF SERVICE MAY BE IMPROVED UPON?

Quality of service may be improved by

1. Making the network very reliable (cost of network increases)
2. Making the user components more reliable (component cost increases).

It is feasible to implement the second option. Thus we persist with a noisy channel but try to make the customer equipment more reliable. As a result the lower three layers remain cheap. The upper three layers, as well as transport layer, are to be made reliable and to be implemented at each user according to his (her) choice. The user component cost thus goes up. The unreliability and inadequacies of the network have to be compensated by the transport layer. Basically the transport keeps the underlying network transparent to the users. Now-a-days we have networks that are much more reliable than the unreliable networks for which the TCP was originally designed; however people still persist with TCP, as their transport level protocol.

Now depending on the error correction facility provided we can define 4 classes of service for the transport layer

Type of Network	A	B	C
Characteristics	Virtually no errors	Errors take place and they are notified	Errors occur but no notification

Class of Service	Types of Connection
0	Simple Connection establishment and data transfer (Type A)
1	Basic error recovery. The cost of software at user is high (Type B)
2	Multiple transport connection multiplexed on a single network connection. Data flow with no error. (Type A)
3	Multiplexing with error recovery in case of errors. (Type B)
4	No error notification, worst quality, cheapest. (Type C).

Transport layers (*TL*) tasks are reliability, flow control, sequencing. The *TL* may be CO (reliable) or CL (very cheap).

TCP is connection oriented, but IP is connection less. Thus the end-to-end protocol is Connection Oriented but the network is Connectionless.

VoIP uses a CL transport layer to offer service at low costs. This is made possible because voice has a lot of redundancy.

Trivial file transfer (TFTP) uses CL Transport Layer. Any multimedia service should use CL service at TL. Using a combination of CO & CL services we can provide the best effort services.

☞ **UDP USES CL SERVICE.**

☞**BEST EFFORT SERVICE:** *The network will take best effort without any reservation of resources to transfer the user data packet. IP has no quality of service, hence it is the cheapest*

Objective Questions

21.01 The minimum length of the Internet header is _____ bits.

21.02 IP header has ____ Flag bits.

21.03 Type ___ network is most reliable.

21.04 There are ___ classes of service for specifying the type of connection.

Subjective Questions

21.11 Give a brief description of the IP header.

21.12 How can we improve Quality-of-Service?

21.13 Enlist the different types of networks in IP.

21.14 Describe the various class of service in IP.

Source:http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Communication%20network/pdf/7.1%20Lesson%2021.pdf