IPv4, IPv6, UDP & DNS

1) Assume you have a dial-up connection and want to send a UDP datagram of 5000 bytes to a server on the Internet. The connection between the two nodes that includes a PPP link with an MTU of 512 bytes, two Ethernet links with an MTU of 1500 bytes and an FDDI ring with an MTU of 4096 bytes. Draw a diagram of the connections, describe the fragmentation of the datagram as it is transferred to its destination and show the effect of the loss of a fragment. Contrast the behaviour of the 512-MTU-bytes dial-up link with 1500-MTU-bytes ADSL connection.

2) Draw a diagram of the individual headers i.e. UDP, IP, Ethernet header, of an Ethernet packet that includes an UDP packet addressed to an application on host 156.202.34.43 port 21 from the local application on address 134.226.34.85 port 10567. Assume values for fields of the individual headers if these values are not given above. For each value give a short explanation why you chose this particularly value.

3) Assume that your computer located in the residences in TCD has a private IP address. Describe the communication that is involved to resolve the name of the server when you type the URL “www.google.com” into a web browser on your machine?
The output of a name resolution program like nslookup may look like the following:

```
> nslookup www.google.com
Server:  UnKnown
Address:  10.0.19.1

Non-authoritative answer:
Name:    www.google.com
Addresses:  2a00:1450:400b:c01::67
          74.125.193.103
          74.125.193.99
```

4) Discuss how a dual stack implementation handles an Ethernet frame which carries either an IPv4 or an IPv6 packet and write out the details of the Ethernet and IP header in as much detail as possible. The Ethernet type IPv4 payload is 0x0800 and for IPv6 payload 0x86dd; assume all other details as you see fit.

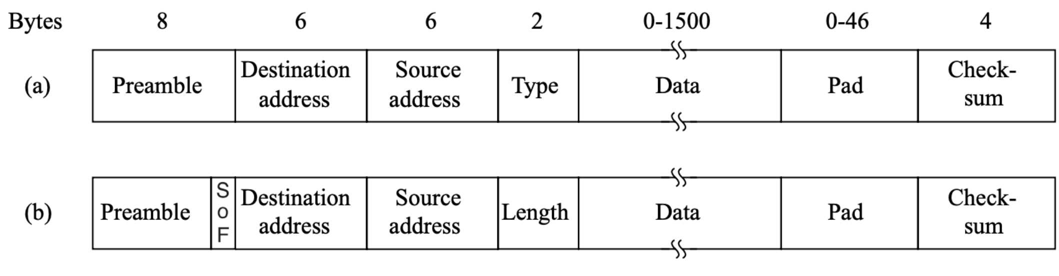

Figure 4-14. Frame formats. (a) Ethernet (DIX). (b) IEEE 802.3.*

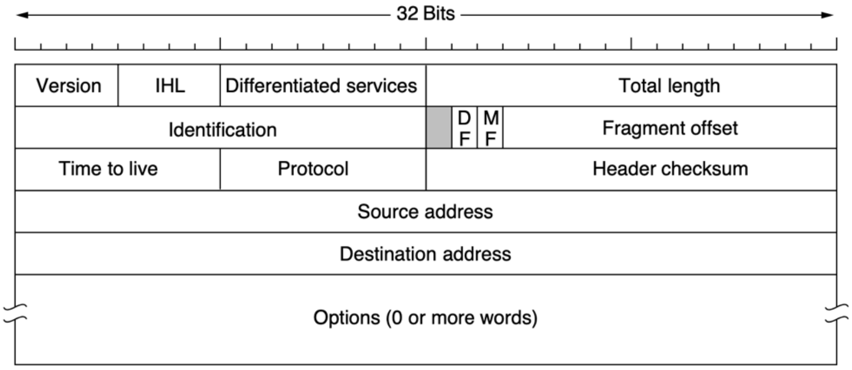

Figure 5-47. The IPv4 (Internet Protocol version 4) header.

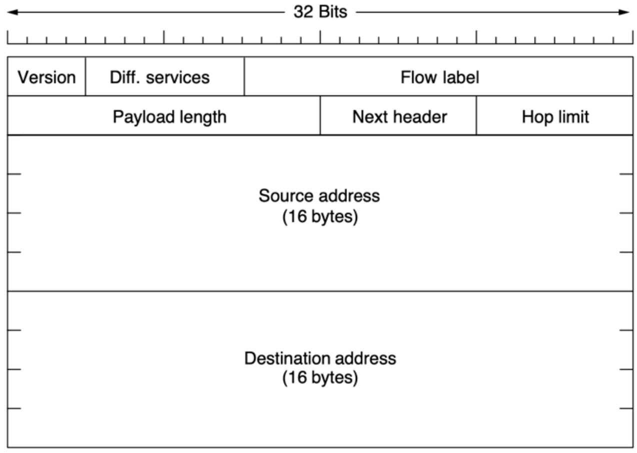

Figure 5-57. The IPv6 fixed header (required).

*Note from Computer Networks: "… Unfortunately, by the time 802.3 was published, so much hardware and software for DIX Ethernet was already in use that few manufacturers and users were enthusiastic about repackaging the Type and Length fields. In 1997, IEEE threw in the towel and said that both ways were fine with it. Fortunately, all the Type fields in use before 1997 had values greater than 1500, then well established as the maximum data size. Now the rule is that any number there less than or equal to 0x600 (1536) can be interpreted as Length, and any number greater than 0x600 can be interpreted as Type."

From "Computer Networks", Tanenbaum, Wetherall, Feamster – Do not answer these questions – they are only listed here as example of questions from other sources:

49. IPv6 uses 16-byte addresses. If a block of 1 million addresses is allocated every picosecond, how long will the addresses last?

50. One of the solutions ISPs use to deal with the shortage of IPv4 addresses is to dynamically allocate them to their clients. Once IPv6 is fully deployed, the address space is large enough to give every device a unique address. To reduce system complexity, IPv6 addresses could be assigned to devices permanently. Explain why this is not a good idea.

51. The *Protocol* field used in the IPv4 header is not present in the fixed IPv6 header. Why not?

52. When the IPv6 protocol is introduced, does the ARP protocol have to be changed? If so, are the changes conceptual or technical?