CHAPTER 21

Network Layer: Address Mapping, Error Reporting, and Multiplexing

Solutions to Odd-Numbered Review Questions and Exercises

Review Questions

1. The size of an ARP packet is ***variable***, depending on the length of the logical and physical addresses used.
3. The size of the ARP packet in Question 2 is 28 bytes. We need to pad the data to have the minimum size of **46**. The size of the packet in the Ethernet frame is then calculated as 6 + 6 + 2 + **46** + 4 = **64 bytes** (without preamble and SFD).
5. This restriction prevents ICMP packets from ***flooding*** the network. Without this restriction an endless flow of ICMP packets could be created.
7. A host would never receive a redirection message if there is only ***one router*** that connects the local network to the outside world.
9. The minimum size of an IP packet that carries an ICMP packet would be **28 bytes** (a 20 byte IP header + an 8 byte router solicitation packet). The maximum size would be **2068 bytes** (a 20 byte IP header + a 2048 byte router advertisement packet).
11. The minimum size would be **64 bytes** if we do not consider the preamble and SFD fields, which are added at the physical layer. The maximum size would be **1518** bytes, again not considering the preamble and SFD fields. Although the maximum size of an ICMP packet can be much more than 1500 bytes (for a router advertisement packet), Ethernet can carry only 1500 bytes of it.

Exercises

13. See Figure 21.1. Note that all values are in hexadecimal. Note also that the hardware addresses does not fit in the 4-byte word boundaries. We have also shown the IP address in parentheses.
15. See Figure 21.2. We have not shown the preamble and SFD fields, which are added in the physical layer.
17. It could happen that host B is unreachable, for some reason. The error message generated by an intermediate router could then be lost on its way back to host A.

Figure 21.1 *Solution to Exercise 13*

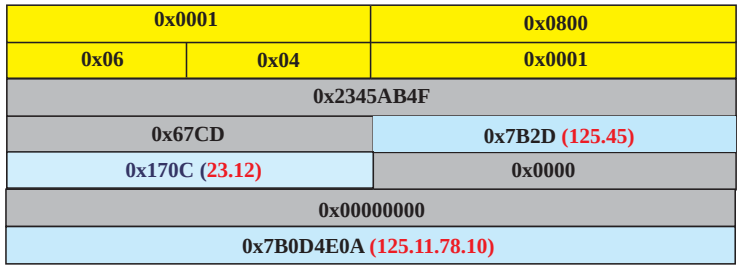
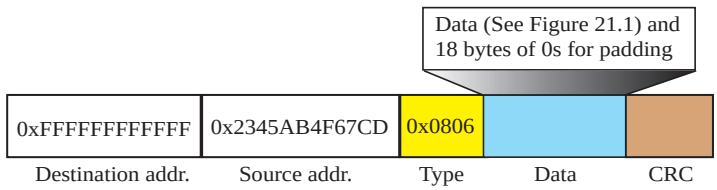


Figure 21.2 *Solution to Exercise 15*



Or perhaps the datagram was dropped due to congestion and the error message generated by an intermediate router was lost.

19. The appropriate ICMP message is ***destination unreachable*** message. This type of message has different types of codes to declare what is unreachable. In this case, the code is **0**, which means the network is unreachable (The codes are not discussed in the chapter; consult references for more information).

21. See the transformation process below:

IP: **11100111 0 0011000 00111100 00001001**
Ethernet: **00000001 00000000 01011110 0 0011000 00111100 00001001**

The Ethernet address in hexadecimal is **0x01005E183C09**

23. The host must send as many as **five different report messages** at random times in order to preserve membership in five different groups.

25. No action should be taken.

27. **Ethernet:**
Supported number of groups using 23 bits = 2^{23} = **8,388,608 groups**
IP:
Supported number of groups using 28 bits =2^{28} = **268,435,456 groups**
Address space lost:
268,435,456 – 8,388,608 = **260,046,848 groups**