CHAPTER 13

Local Area Networks: Ethernet

Solutions to Review Questions and Exercises

Review Questions

1. The ***preamble*** is a 56-bit field that provides an alert and timing pulse. It is added to the frame at the physical layer and is not formally part of the frame. SFD is a one-byte field that serves as a flag.
2. An ***NIC*** provides an Ethernet station with a 6-byte physical address. Most of the physical and data-link layer duties are done by the NIC.
3. A ***multicast address*** identifies a group of stations; a ***broadcast address*** identifies all stations on the network. A ***unicast*** address identifies one of the addresses in a group.
4. A ***bridge*** can raise the bandwidth and separate collision domains.
5. A ***layer-2 switch*** is an N-port bridge with additional sophistication that allows faster handling of packets.
6. In a ***full-duplex Ethernet***, each station can send data without the need to sense the line.
7. The rates are as follows:

Standard Ethernet:	**10 Mbps**
Fast Ethernet:	**100 Mbps**
Gigabit Ethernet:	**1 Gbps**
Ten-Gigabit Ethernet:	**10 Gbps**

8. The common traditional Ethernet implementations are ***10Base5***, ***10Base2***, ***10-Base-T***, and ***10Base-F***.
9. The common Fast Ethernet implementations are ***100Base-TX***, ***100Base-FX***, and ***100Base-T4***.
10. The common Gigabit Ethernet implementations are ***1000Base-SX***, 1000Base-LX, ***1000Base-CX***, and ***1000Base-T***.
11. The common Ten-Gigabit Ethernet implementations are ***10GBase-S***, ***10GBase-L***, and ***10GBase-E***.

Exercises

12. We interpret each four-bit pattern as a hexadecimal digit. We then group the hexadecimal digits with a colon between the pairs:

    5A:11:55:18:AA:0F

13. The bytes are sent from left to right. However, the bits in each byte are sent from the least significant (rightmost) to the most significant (leftmost). We have shown the bits with spaces between bytes for readability, but we should remember that that bits are sent without gaps. The arrow shows the direction of movement.

    ← **01011000 11010100 00111100 11010010 01111010 11110110**

14. The first byte in binary is 0000011**1**. The least significant bit is 1. This means that the pattern defines a **multicast address.**

15. The first byte in binary is 0100000**1**. The least significant bit is 1. This means that the pattern defines a multicast address. ***A multicast address can be a destination address, but not a source address.*** Therefore, the receiver knows that there is an error, and discards the packet.

16. The minimum data size in the Standard Ethernet is 46 bytes. Therefore, we need to add **4 bytes of padding** to the data (46 – 42 = 4)

17. The maximum data size in the Standard Ethernet is 1500 bytes. The data of 1510 bytes, therefore, must be split between two frames. The standard dictates that the first frame must carry the maximum possible number of bytes (1500); the second frame then needs to carry only 10 bytes of data (it requires padding). The following shows the breakdown:

    Data size for the first frame: **1500 bytes**
    Data size for the second frame: **46 bytes** (with padding)

18. The smallest Ethernet frame is 64 bytes and carries 46 bytes of data (and possible padding). The largest Ethernet frame is 1518 bytes and carries 1500 bytes of data. The ratio is (data size) / (frame size) in percent. We can then answer the question as follows:

Smallest Frame	Frame size = 64	Data size ≤ 46	**Ratio ≤ 71.9%**
Largest Frame	Frame size =1518	Data size = 1500	**Ratio = 98.8%**

19. We can calculate the propagation time as t = (2500 m) / (200,000.000) = **12.5 μs**. To get the total delay, we need to add propagation delay in the equipment (10 μs). This results in **T = 22.5 μs.**

20. The smallest frame is 64 bytes or 512 bits. With a data rate of 10 Mbps, we have

    $$T_{fr} = (512 \text{ bits}) / (10 \text{ Mbps}) = \mathbf{51.2\ \mu s}$$

    This means that the time required to send the smallest frame is the same at the maximum time required to detect the collision.