Exercise 3: IEEE 802.x and IP

1. What is the ratio of useful data to the entire frame for
    a. the smallest Ethernet frame?
    b. the largest Ethernet frame?

    Include preamble, SFD and CRC in the calculations.

2. Assume that the length of a 10Base5-segment is 2 500 meters. The propagation speed in a thick coaxial cable is 60 % of the speed of light (300 000 000 meters per second). The Transmissionrate for 10Base5 is 10 Mbps.
    a. How long time does it take for a bit to travel from the beginning to the end of the segment? Ignore any propagation delay in the equipment?
    b. Calculate the maximum time to detect a collision?
    c. How long time does it take to send a frame with minimal size on the segment?
    d. Calculate the minimum required frame size in order to be able to detect collisions on the segment.

3. Assume a Token Ring network with capacity 16 Mbps and with a token of size 3 bits. Assume that the transmission media is a coaxial cable with a propagation speed of 60 % of the speed of light. In order for the network to function, the first bit of the token cannot have travelled the full lap on the ring before the last bit of the token is transmitted.
    a. How long time does it take a connected host to transmit the token?
    b. What is the minimum length of the ring? Assume that there are no delays in the connected hosts.

4. Below is an Ethernet-II frame. The Preamble, Start Frame Delimiter and CRC fields have been removed in the frame below. Two digits represent one byte; e. g. 2E is one byte. Answer the following questions:
    a. To which MAC-address is the frame addressed?
    b. From which MAC-address is the frame transmitted?

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08 00 20 7c 94 1c 00 00 39 51 90 37 08 00 45 00
00 3e 36 00 00 00 80 11 da 4f 82 eb 12 7f 82 eb
12 0a 04 01 00 35 00 2a ee 6a 00 01 01 00 00 01
00 00 00 00 00 00 06 67 65 6d 69 6e 69 03 6c 64
63 02 6c 75 02 73 65 00 00 01 00 01
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5. Assume that a host with 802.11b has been configured such that it always makes a reservation of the channel with RTS/CTS before it transmits. Assume that the host wants to transmit 1000 bytes data and that the channel is idle. Calculate the time to transmit these 1000 bytes and receive an ACK. In the expression, the length of SIFS can DIFS can be included. Also, we assume that the sender and receiver are close to each other so that the propagation time is zero.

6. Assume that we transmit frames with size 64 bytes in an 802.11b-network. Also, assume that the sender always has frames to send in the buffer, that DIFS=200 μs, and that SIFS=10 μs. Further, we assume that there are no bit errors and that we can ignore the propagation time. What is the maximum number of payload bits per second that the sender can transmit?

7. Assume that the bit error probability is 0.001 in the network in exercise 6.
    a. What is the probability that a packet is damaged?
    b. How many times in average must a packet be transmitted before it can be received accurately?
    c. What is the bit rate now compared to in exercise 6 when the bit error probability was assumed to be zero?

8. Determine the class of the following IPv4 addresses:
    a. 208.34.54.12
    b. 238.34.2.1
    c. 114.34.2.8
    d. 129.14.6.8
    e. 241.34.2.8

9. Determine the network id and the host id for the following classfull IPv4 addresses:
    a. 114.34.2.8
    b. 171.34.14.8
    c. 192.8.56.2

10. Determine the network id and host id for the following classless IPv4 addresses:
    a. IP address 130.235.185.49, mask 255.255.0.0.
    b. IP address 130.235.188.247, mask 255.255.192.0.
    c. IP address 120.14.22.16, mask 255.255.128.0
    d. IP address 141.181.14.16, mask 255.255.224.0

11. Write the following IPv4 masks in the */n* format:
    a. 255.255.255.0
    b. 255.0.0.0
    c. 255.255.224.0
    d. 255.255.240.0

12. Calculate the number of IPv4 addresses in the following address blocks:
    a. 200.17.21.128/27
    b. 17.34.16.0/23
    c. 180.34.64.64/30
    d. 123.56.77.55/29

13. Determine the shortest form of the following IPv6 addresses:
    a. 2340:1ABC:119A:A000:0000:0000:0000:0001
    b. 0000:00AA:0000:0000:0000:0000:119A:A231
    c. 2340:0000:0000:0000:0000:119A:A001:0000
    d. 0000:0000:8000:2340:0000:0000:0000:0000

14. Determine the original form of the following IPv6 addresses:
    a. 0::0
    b. 0:AA::0
    c. 0:1234::3
    d. 123::1:2