802.3 Ethernet

1) IEEE 802.3 Ethernet defines a frame format as shown in figure 1 and may include a IEEE 802.2 Link Layer Control (LLC) protocol frame. Figure 2 shows layout of the control field for the types of frames of 802.2 that can be used to implement flow control.

   a) Draw the exchange of the frames in much detail as possible for a Stop-and-Wait approach and for a Selective-Repeat approach. Your diagram should be accompanied by an explanation of the process and of assumptions in case you made any.

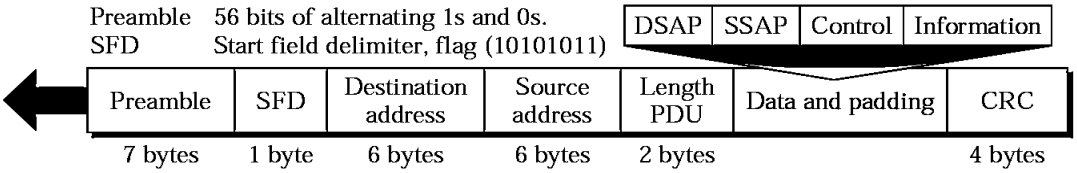

Figure 1: Layout of an 802.3 Ethernet frame

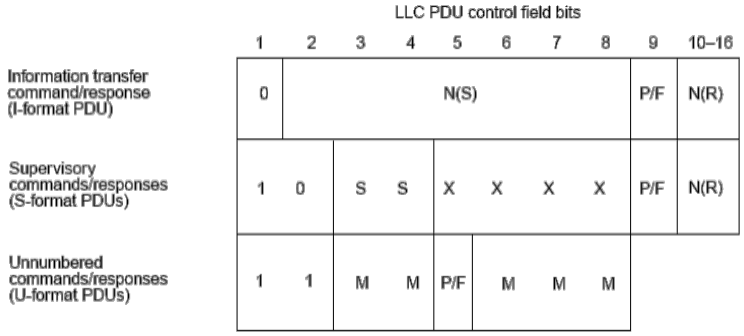

Figure 2: Layout of 802.2 LLC information

802.11 Wireless Networking

2) An access point uses the Point Coordination Function (PCF) of 802.11 to communicate with 10 laptops that are associated with it. After the contention free period has been completed, the laptops attempt to communicate with one another directly using the Distributed Coordination Function (DCF) of 802.11 – see figure 1 for a possible topology. Assume that at least a number of transmission attempts lead to collisions.

   Describe the frames that are exchanged by the stations and the inter frame spaces that are involved in this exchange. Use diagrams to visualise the chronological exchange of the frames and the inter frame spaces.

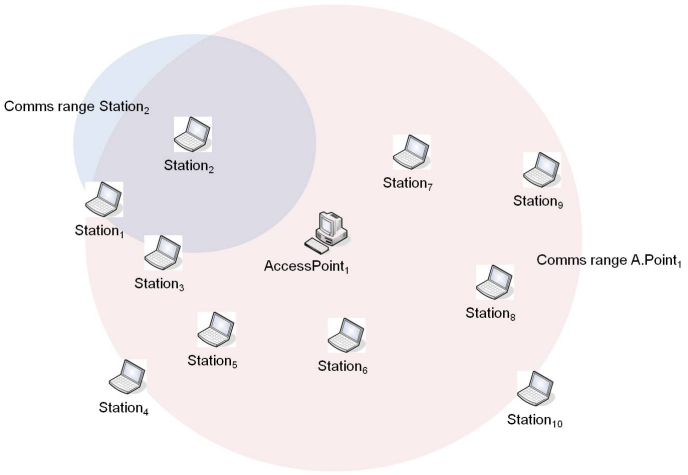

Figure 3: Possible 802.11 topology

3) Three stations using 802.11 intent to transmit each 3 data frames to an access point. The times for the transmission for data frames and the Beacon are 190us, for RTS and Poll 180us, for CTS, ACK and CF-End 132us.

with 802.11a:
slot: 9us
SIFS: 16us
PIFS: 25us
DIFS: 34us
AIFS: >=34us

i) Calculate the total time for the transmissions if the stations use DCF. Assume that the random numbers for backoff slots received by the stations are different for all the stations ie. that no collisions occur because of the same random numbers received by two or more stations. Indicate the random numbers that you are using for your calculations.

ii) Calculate the total time for the transmissions if the stations use PCF. Assume that the access point uses only one contention free period for polling each station 3 times.

Sample Exam Question

a) Carrier Sense Multiple Access (CSMA) with Collision Detection (CD) is being used as mechanism for medium access control in a wired network.

i) Explain the competition for the medium using CSMA/CD and discuss why collision detection is used instead of collision avoidance in wired networks.

ii) Contrast CSMA/CD against an access method of your choice on an example of 3 nodes wanting to transmit over a wired network. Use diagrams to visualize the chronological exchange of the frames.