Point-to-Point Protocol (PPP)

1) The Point-to-Point Protocol (PPP) uses a lifecycle shown in the state diagram in figure 2. Draw a diagram that associates the frames exchanged between to endpoints as every step in the state diagram.

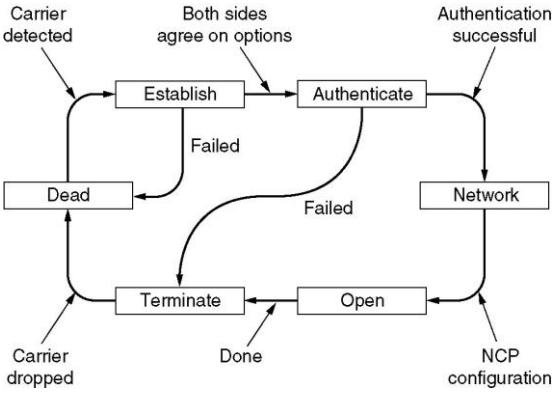

Figure 1: PPP State diagram

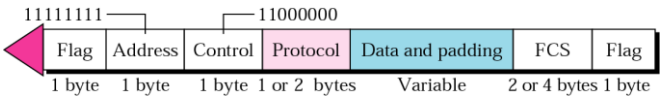

Figure 2: PPP Frame Layout

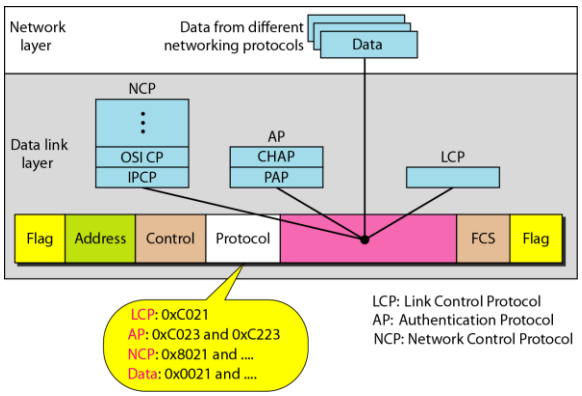

Figure 3: PPP Protocol byte

Medium Access Control (MAC)

2) Time Division Multiple Access (TDMA)

A network employing TDMA uses 50ms time slots. The available slots are split up between 6 stations. During a period of 3 seconds, stations 1, 5 and 6 have data to transmit. Calculate the usage of the available bandwidth for TDMA with and without a reservation access method. Assume that it takes 60us for the reservation frame to be transmitted and that it is negligible in the calculation of the bandwidth usage. Demonstrate the usage in a diagram.

3) Carrier Sense Multiple Access (CSMA)

Both, CSMA with Collision Detection (CSMA/CD) and CSMA with Collision Avoidance (CSMA/CA) use binary exponential backoff. Assume that four stations 1, 2, 3 and 4 want to send data and the transmission of a frame has just been completed. Show in a diagram how the four stations compete for the medium and the times that are involved, using both CSMA/CD and CSMA/CA.

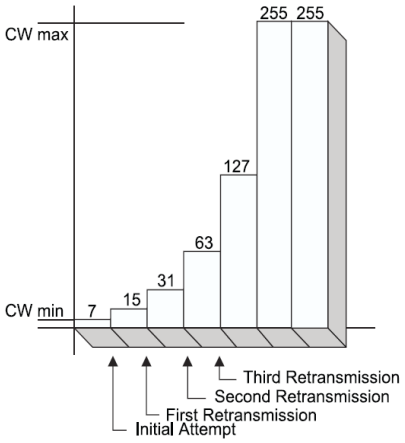

Figure 4: Binary Exponential Backoff

4) Poll

Assume that a wireless network consists of a wireless access point and a set of 6 mobile stations. The wireless access point polls the individual mobile stations for data to transmit. Stations 1, 3, and 4 have data to transmit; stations 2, 5 and 6 have no data to transmit. Show in a diagram the traffic that is exchanged over the wireless medium between the access points and the stations.

5) Code Division Multiple Access (CDMA)

Assume a network with three mobile phones, stations 1, 2 and 4, and a base station, station 3. The three mobile phones want to send 011, 101 and 100 respectively; the base station is silent. A 0 is encoded as -1, a 1 is encoded as +1 and silence is represented by 0. Give the signal that the base station receives.

Chip Sequences:

Station 1: +1 +1 −1 −1
Station 2: +1 −1 +1 −1
Station 3: +1 +1 +1 +1
Station 4: +1 −1 −1 +1

Example from an exam:

Question 2)

a) A number of medium access protocols have been proposed that can be used to determine the access to the medium for a set of stations.
   i) Assume that your wired network currently uses a Time-Division Multiple Access (TDMA) approach that is configured to accommodate 6 stations. Explain how stations in this network gain access to the medium and the advantages and disadvantages of this approach. Your explanation should be accompanied by diagrams that visualise the behaviour of the protocol and its limitations.
   ii) Assume that your supervisor asks you to propose a protocol that could be used instead of TDMA in i) and that would be suitable to accommodate a varying number of stations. Suggest a suitable protocol, explain the procedure by which stations would gain access to the medium by competing with each other and discuss the advantages and disadvantages of this protocol. Your explanation should be accompanied by diagrams that visualise the behaviour of the protocol and its limitations.