EIE 3333 Data and Computer Communications (2019/20)

Tutorial 4

Unit 4: Data Link Layer: Flow Control and Error Control

Review Questions

1. Describe the services provided by the data link layer.
2. Define frame and the reason for the need.
3. Compare and contrast flow control and error control.
4. Explain the reason for moving from the stop-and-wait ARQ protocol to Go-Back-N ARQ protocol.
5. Compare and contrast the Go-Back-N ARQ protocol with Selective-Repeat ARQ.
6. Define Piggybacking and its usefulness.
7. In the stop-and-wait protocol, assume that the sender has only one slot in which to keep the frame to send or the copy of the sent frame. What happens if the network layer delivers a packet to the data-link layer at this moment?
8. Is a negative acknowledgement (REJ) necessary in the stop-and-wait ARQ protocol?

Problems

1. A sender sends a series of packets to the same destination using 5-bit sequence number. If the sequence number starts with 0, what is the sequence number after sending 100 packets?

2. The timer of a system using the Stop-and –Wait ARQ protocol has a time-out of 6ms. Draw the flow diagram for four frames if the round trip delay is 4ms. Assume no data frame or control frame is lost or damaged.

3. A system uses the Stop-and-Wait ARQ protocol. If each data frame carries 1000 bits of data, how long does it take to send 1 million bits of data if the distance between sender and receiver is 5000 Km and the propagation speed is 2×10^8 m? Given the data rate of the link is 1 Mbps. Ignore waiting, and processing delays. We assume no data or control frame is lost or damaged.

4. Repeat Question 3 using the Go-Back-N ARQ protocol with a window size of 7. Ignore the overhead due to the header and trailer.

5. Repeat Question 3 using the Selective-Repeat ARQ protocol with a window size of 4. Ignore the overhead due to the header and trailer.

6. Assume we need to design a Go-Back-N sliding window protocol for a network in which the bandwidth is 100 Mbps and the average distance between the sender and receiver is 10,000km. Assume the average frame size is 100,000 bits and the propagation speed in the media is 2×10^8 m/s. Find the maximum size of the send and receive windows, the number of bits in the sequence number field (m) and an appropriate time-out value for the timer.

7. Draw the sender and receiver windows for a system using Selective Repeat ARQ (3-bits for sequence number), given the following:
   a) Frame 0 is sent; frame 0 is acknowledged.
   b) Frame 1 and 2 are sent; frames 1 and 2 are acknowledged.
   c) Frame 3, 4 and 5 are sent; frame 4 is acknowledged; timer for frame 5 expires.
   d) Frame 5, 6 and 7 are sent; frames 4 through 7 are acknowledged.