ECE 358: Tutorial Set 3

Note: Stop-and-go protocol = Alternate bit protocol = Stop-and-wait protocol

Problem 2*

a) Suppose the Stop-and-go protocol is used with 840 byte data frames and 40 byte ack frames on a link with a 8 ms propagation delay in each direction. In the absence of transmission errors, what are the throughput (in packets per second) and efficiency if the link data rate is 1 kbps? 100 kbps? 10 Mbps? 1 Gbps?

b) You must have found the above protocol to be very inefficient over links with very high data rates. Let's try replacing it by a sliding window protocol. At 1 Gbps, what would the throughput and efficiency be if the window size is 10 packets? 100? 1000? 10,000? What is the ideal window size?

Problem 4*.

Assume that the propagation speed in a coaxial cable is $2 \cdot 10^8 \, m/\sec$

a) Packets are transmitted using the ABP (alternate bit protocol) over a full-duplex 5-km coaxial cable with a 10-Mbps transmission rate. The packets and ACKs are 1500 bits long. The transmitter and receiver use a CRC chip and their processing time is negligible. How many packets are transmitted every second when there is no transmission error?

b) Five transmission lines identical to the one discussed in a) are connected in series. A buffer is used at each connection between the links to store packets as required. How many packets will go through the five lines every second when there is no transmission errors? Now assume that a packet or its acknowledgement is corrupted on any given link with probability p. What is the new packet transmission rate through the five links? Compare the rate when there are no errors with the transmission rate when a single 25-km link is used and when there is no transmission error. Comment.

Problem 6*:

Consider the following plot of TCP window size as a function of time. Assuming TCP Reno is the protocol experiencing the behavior shown below, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

a) Identify the intervals of time when TCP slow start is operating.
b) Identify the intervals of time when TCP congestion avoidance is operating.
c) After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
d) After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
e) What is the initial value of Threshold at the first transmission round?
f) What is the value of Threshold at the 18th transmission round?
g) What is the value of Threshold at the 24th transmission round?
h) During what transmission round is the 70th segment sent?
i) Assuming a packet loss is detected after the 26th round by the receipt o a triple duplicate ACK, what will be the values of the congestion window size and of the threshold?