TELE 4363 Tutorial 6

noon May 2, 2004

(Held in week 9)

Question 1:

Assess, in terms of principles of protocol design, the pros and cons of link layer retransmission as a mechanism to enhance the performance of TCP over wireless networks.

Question 2:

The path between a TCP source and its destination consists of a relatively fast Ethernet connecting the source to an access point, and a relatively slow wireless link connecting the access point to a destination. The source can send one segment (original transmission or retransmission) every millisecond, and the segments are of such a size that this rate does not cause congestion. Every 11th packet sent over the wireless link is lost due to transmission error, and the source retransmits a segment immediately once 1ms has elapsed after the estimated round trip time after transmitting that packet. These segments incur a delay (transmission+propagation) of 1ms over the Ethernet link and 10ms over the wireless link. These delays are incurred in both directions, i.e. the smallest round trip time would be 22ms.

What would be the source's estimate of the round trip time after having sent 35 segments in the following situations?

1. The source does not include timestamps in the segments that it transmits and
    a. The destination immediately acknowledges each received segment.
    b. The destination uses delayed acknowledgements.
2. The source includes timestamps in segments that it transmits, and the access point uses the WTCP approach of modifying the timestamps of acknowledgements that it forwards to the source. Assume that the access point has a buffer that can hold 30 packets, and that it retransmits a packet immediately once 1ms has elapsed after it expected to receive an acknowledgement for that packet. Assume that retransmission does not result in increased delay for other segments arriving from the source. (Adventurous students may want to relax this assumption – i.e. assume that the wireless link can only transmit 1 segment/ms, irrespective of the type of segment.)

For simplicity, assume that the RTT is estimated as per RFC 793:

$$E = aE + (1-a)M$$

where

E is the estimate

a is a smoothing factor (=0.9)

M is the current measurement

Assume that the estimate is initially 30ms.