Assignment 6

CSL 374

Due date: April 26, 2013 (Fri)

Note: *Solve all problems on your own.* Approach the instructor for clarifications.

1. We studied in class how TCP-Vegas reduces packet drops and queuing delays and improves throughput when compared to TCP-Reno. However, if TCP-Vegas flows share a network path with TCP-Reno flows then Reno flows tend to significantly reduce the throughput of the Vegas flows. Your task is to design a new version of TCP with the following properties. State any assumptions you make.

   (a) It is purely an end-to-end congestion control protocol, that is, it does not require any special information from routers or explicit information about other TCP flows in order to perform congestion control.

   (b) It behaves like TCP-Vegas if all other competing flows on its network path employ TCP-Vegas. Let us assume that all TCP flows have the same RTT on the network path.

   (c) It behaves like TCP-Reno if there are some competing flows on its network path that employ TCP-Reno.

   (d) It adjusts its CongestionWindow based on inference of packet losses and/or queuing delays in the network.

2. Design a "replay attack" on TCP-Reno which has the following property. The attacker, who happens to be somewhere on the end-to-end path between sender and receiver of the TCP flow, listens to packets from the TCP flow, captures the packets, and replays (resends) certain packets to the source or destination at some intelligently chosen points in time. Note that the term "TCP flow" refers to the set of all TCP data and ACK packets sent by the sender and receiver. Explain your attack and what consequences it will have on a TCP-Reno flow. How would you modify TCP-Reno to make it robust to your attack?

3. In this problem we study "RTT-fairness" issues in TCP, that is do two TCP flows with different RTT's get the same bandwidth or not. Label two TCP flows $i = 1, 2$. Flow i has congestion window $w_i(t)$ bits at time t, RTT (which does not vary with time) of T_i sec, and instantaneous bitrate of $w_i(t)/T_i$. Assume that $w_i(0) = 0$. Both flows share the bandwidth C bits/sec of a particular link of the network. We say that both flows face "loss" at time t iff $\sum_i w_i(t)/T_i = C$ following which their congestion windows are immediately reset to 0. At all other time instants, the windows are incremented in an additive-increase fashion according to

$$\frac{dw_i(t)}{dt} = \frac{1}{T_i}.$$

   Compute and compare the total amount of data in bits transmitted by the two flows between consecutive "loss" events. Comment on your results.