Homework 3: TCP

Due: 11:59 PM, Nov 14, 2016

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Question 1

TCP Reno which we studied in class will converge to a fair rate given enough time. However, it turns out that TCP is not fair if the RTTs of two competing connections are different. In this question you will use a Chiu-Jain plot to show this.

1. Assume there are two senders, A and B, and that A's RTT is 1/2 of B's RTT. What will A's rate converge to, as a function of B's rate?

   Assume that both A and B do rate adjustments once per RTT, and focus on the additive adjustments. (Assume that the multiplicative adjustments will be instantaneous, and that, like we saw in class, it takes many additive steps to get back to a saturating rate).

2. Now assume that A and B have the same RTT, but different MSS: A can send segments of 1500B and B segments of 750B. Will the two TCPs converge to the same rate? Justify using a Chiu-Jain plot.

Question 2

You are sitting at home and initiate an ssh connection to ssh.brown.edu. All is good, until your roommate starts uploading a large file.

1. What is the effect that this new connection has on your ssh traffic?

2. If you upgrade your router with one that has more buffer space, will this improve the situation of make it worse? Why?

3. What if you buy a router that implements fair queueing, will that improve the situation? Why?

Question 3

Now assume you have a single link between two nodes, with a bandwidth of 1Gbps (10^9 bits/s), an MSS of 1250B, and an RTT of 5ms.

1. If the initial congestion window is 1 MSS, how many RTTs does it take for TCP to saturate the connection, i.e., for the sending rate to be at least as large as the capacity of the link?

2. What is the smallest transfer size so that this happens?

3. If a file is 25KB in size, what is the effective bandwidth you achieve, i.e., the total size divided by the time it takes to transfer the file?

4. Now assume that your connection is in congestion avoidance mode, and you just cut your window in half because of a loss. How many RTTs does it take for your window to grow back to this saturating size? What about if you upgrade your link to 10Gbps?

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