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Lab4: TCP Congestion Control

Introduction

Overview of TCP Congestion Control

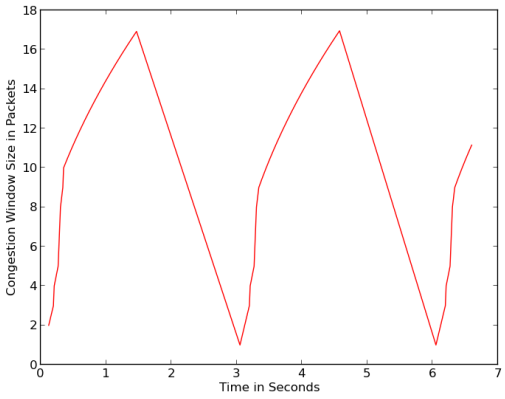
I have built a small simulator for TCP Tahoe congestion control. My TCP implementation works in the following way.

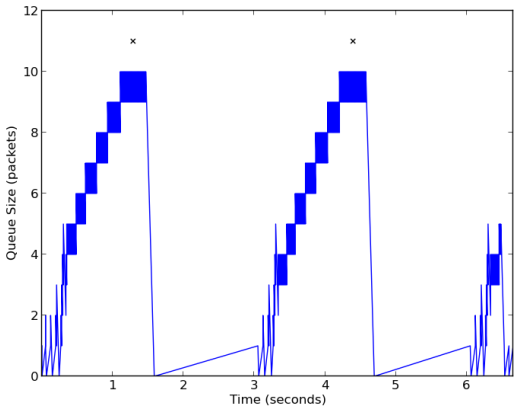
1) Slow Start
    a. My algorithm first begins by increasing the congestion window (the number of out standing packets) multiplicatively. It does this by increasing the congestion window by the number of bytes ACKed for every ACK. This continues until the initial threshold of 15000 bytes (10 Packets) is reached.
2) Additive Increase
    a. After the ssthresh is met my TCP implementation additively increases the congestion window by cwnd += mss * bytesRecieved / self.cwnd.
3) Congestion Avoidance
    a. Once a timeout has occurred my TCP implementation throws away any notion of outstanding packets, cuts ssthresh by setting ssthresh = max(cwnd/2.0, mss), and it sets the cwnd such that the cwnd = mss.
4) Edge Cases
    a. My implementation also only updates (increases) the congestion window by at max the mss for any single ACK.
    b. Due to the way my implementation handles timeouts (throwing away outstanding packets), my implementation also removes any packets in the send buffer that are covered by an incoming ACK.
5) Timeouts
    a. My implementation only has one timer, which is set to one second. This timer upon firing will look in the send window and see if its packet is still out standing, if its packet is still outstanding a timeout has occurred. Otherwise, the timer sets itself for one second in the future for the lowest sequence number in the send window. This will explain why it might take slightly longer than one second to time out a dropped packet.

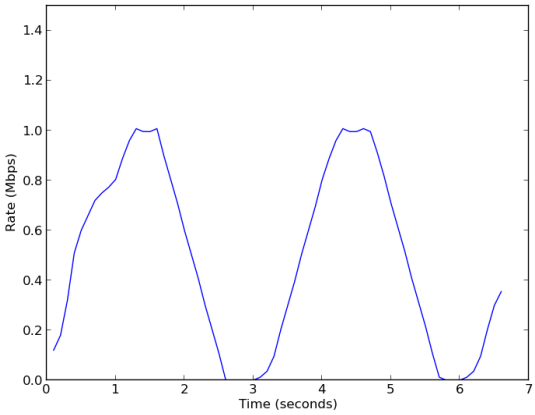
Experiments

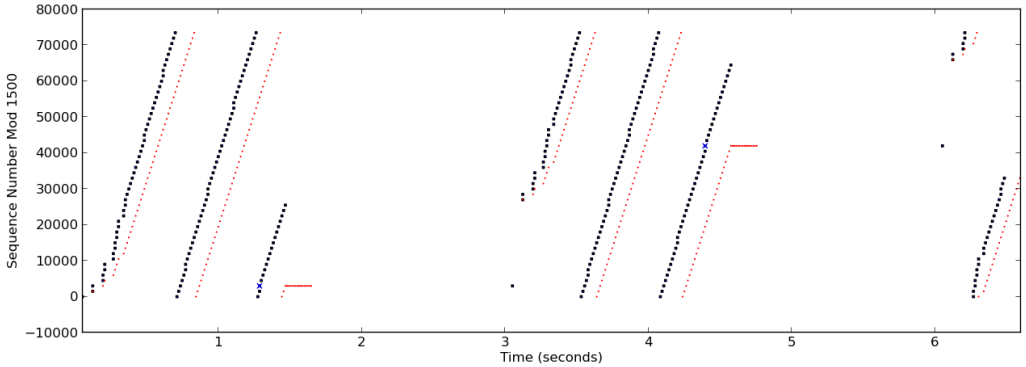
One FLow

Test One:
Prop Delay: 10 ms
Link Band: 1 Mbps
File: 408 KB
Queue Size: 10



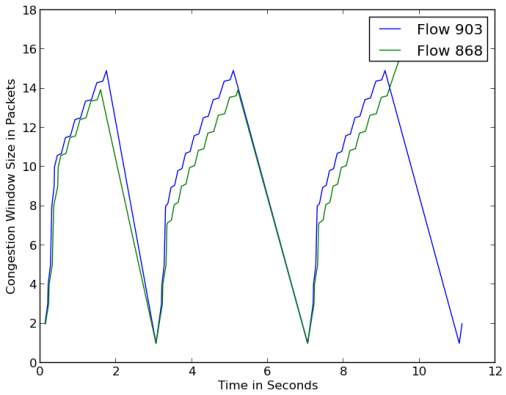


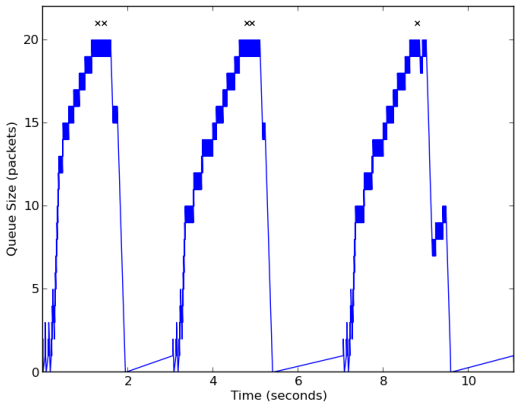


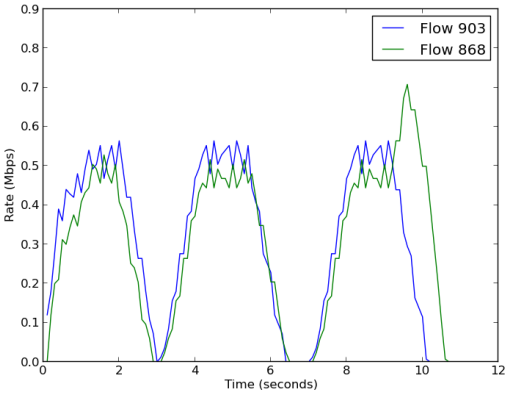


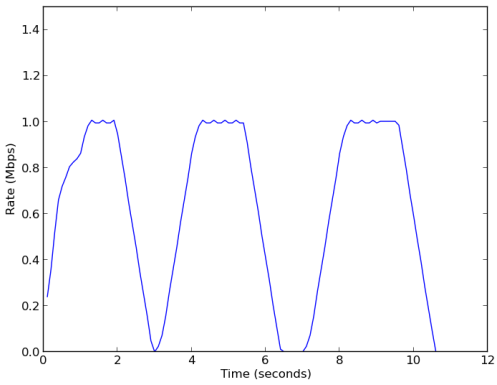
Two Flows

Test One:
Prop Delay: 10 ms
Link Band: 1 Mbps
File: 408 KB
Queue Size: **20**



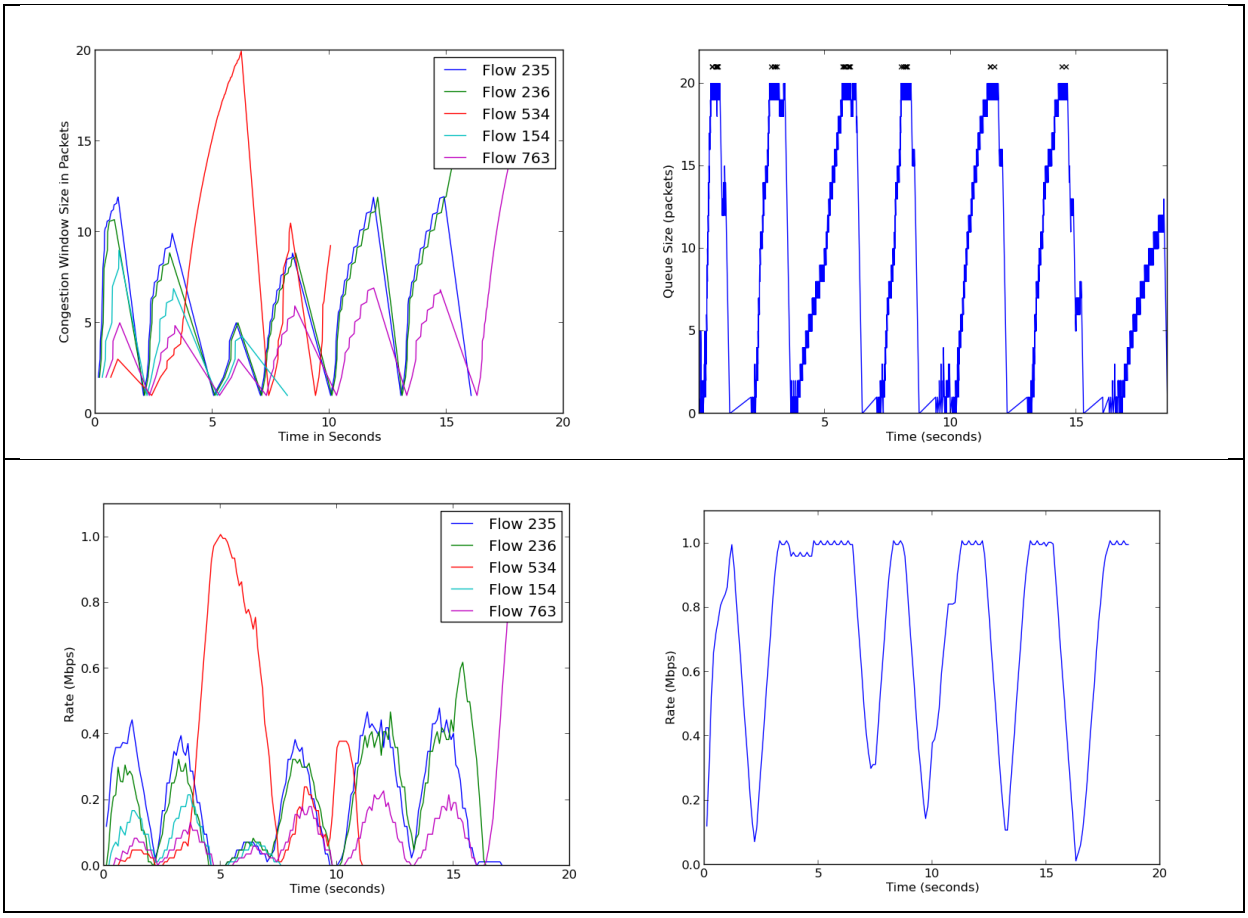






Five Flows

Prop Delay: 10 ms
Link Band: 1 Mbps
File: 408 KB
Queue Size: 20


Flow 235
Flow 236
Flow 534
Flow 154
Flow 763
Congestion Window Size in Packets
Time in Seconds
Queue Size (packets)
Time (seconds)
Rate (Mbps)
Time (seconds)
Rate (Mbps)
Time (seconds)