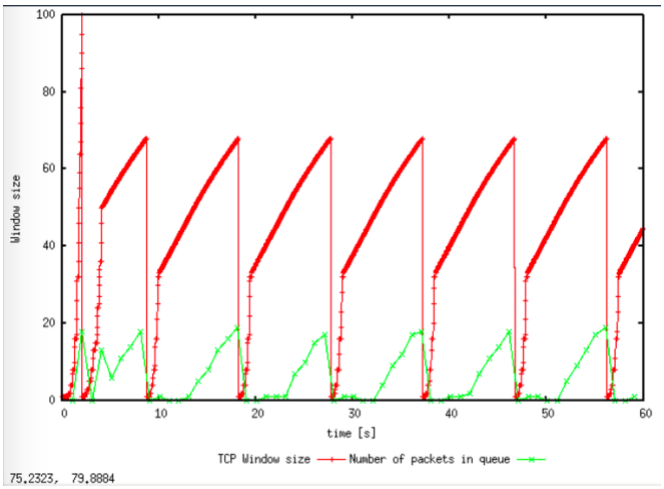
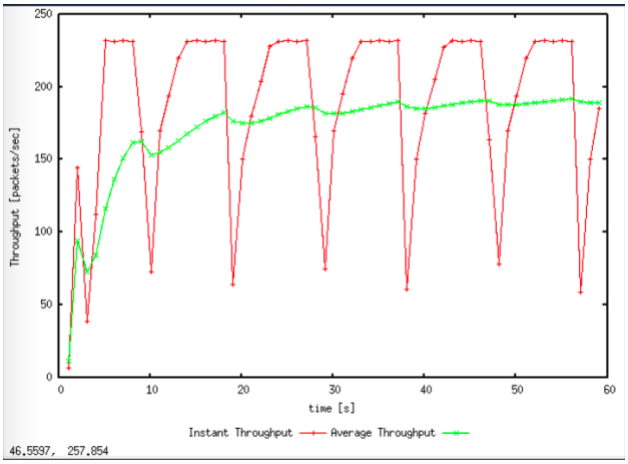
Z5187469
Yiyun Yang

1.1



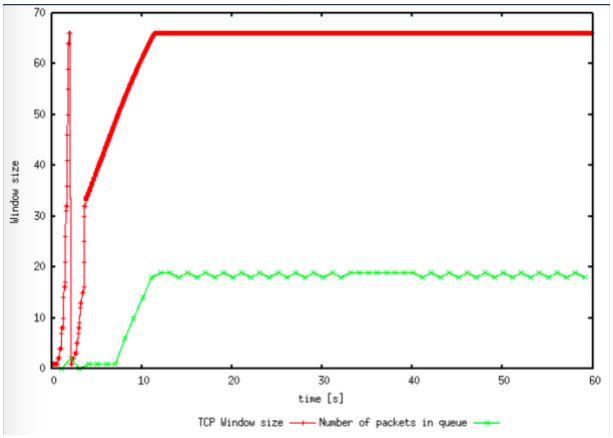
The max window size is 100.
After timeout or triple duplicate ACK, the congestion window size dropped to 1 and the ssthresh is set to 50, which is half of the max window size. Slow start phase will start again with window size 1.

1.2



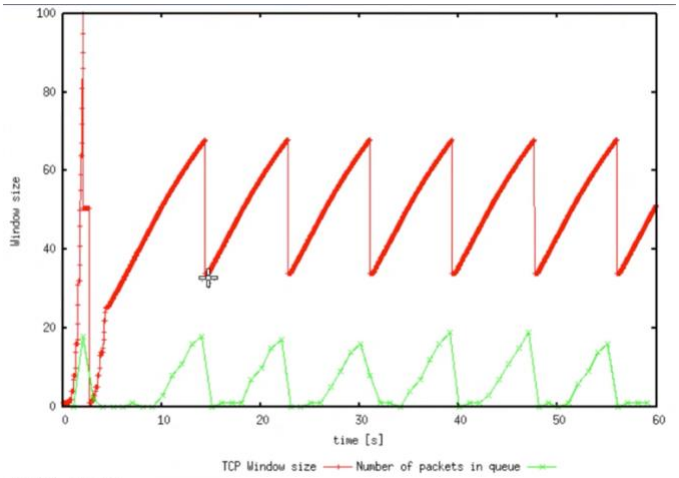
The average throughput in packets/second can be determined from the WindowMon.tr file as 188.97610921501706. Since each packet consists of 500 bytes including the header Packet = payload + headers bytes Packet = 500 + 20 + 20 bytes Packet = 540 bytes (or 540*8 bits) Throughput in bits/second = 540 * 8* 188.97610921501706 bits per second = 816376.791809 bits per second.

1.3



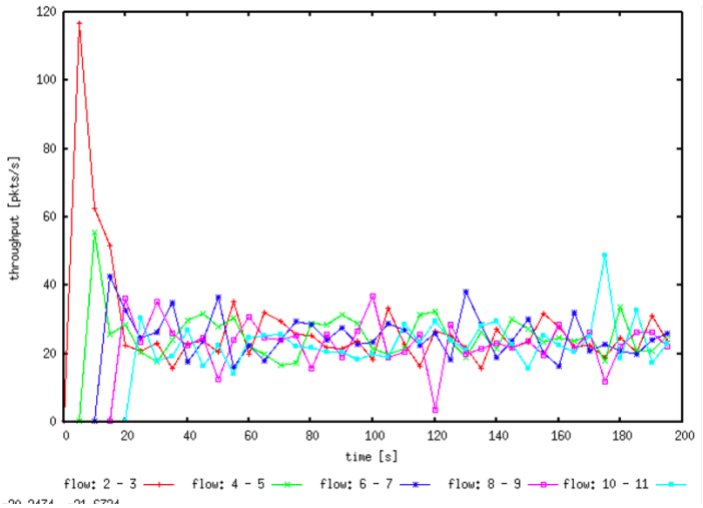
As the window size decreases, the number of oscillating decreases. Once the max window size is down till 66, then there is only one oscillating and if the max window size is lower than 51, there will not be no oscillating. The max window size to avoid oscillating is 66.
The average throughput in packets/second can be determined from the WindowMon.tr file as 220.81911262798636. Since each packet consists of 500 bytes including the header Packet = payload + headers bytes Packet = 500 + 20 + 20 bytes Packet = 540 bytes (or 540*8 bits) Throughput in bits/second = 540 * 8 * 220.81911262798636 bits per second = 953938.566553 bits per second. Link capacity = 100 – 100*(1000000-953938.566553)/(1000000) = 95.3938566553% .

1.4



For TCP reno, the window size for duplicate ACKs events can be half of the max window size however it can only be dropped to 1 in TCP Tahoe.

2.1

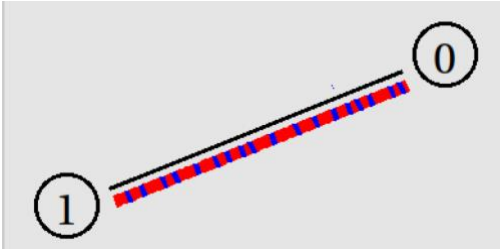


Each flow gets an equal share of the capacity of the common link. Initially each link gets a different amount of the capacity, however as time increases, each flow decreases and increases until they average around a similar value.

2.2

Throughput of pre-existing TCP flows will decrease significantly when a new flow is created to provide equal share. The congestion window size increases rapidly during slow start phase which causes congestion. Thus, all flows will adjust to adapt the network. The behaviour is fair.

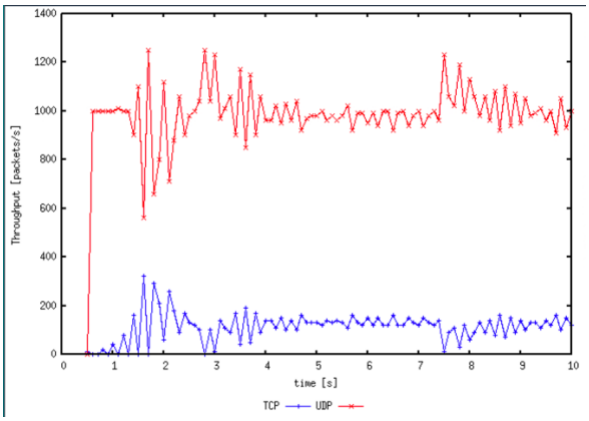
3.1



TCP has congestion control while UDP does not. When TCP detects any lost event, the sending rate will be slowed down, while UDP does not. Therefore, red packet is UDP and blue one is TCP.

3.2

UDP do not have congestion control mechanism so it tries the best to send all the packet. TCP have congestion control mechanism, it provides stable connection and not overloading the link by changing the window size based on conditions, the window size is smaller than UDP as same as the throughput.



3.3

Advantages of UDP over TCP:

- File will be transferred faster with UDP because it can hog bandwidth
- Don’t have to establish a connection with UDP
- Smaller packet size

Disadvantages of UDP over TCP:

- Packet loss
- No congestion control
- Packets arrived out of order