Project 2 Report
Bijo Joseph - bjoseph4
Anush Mohan - ashet

Setup:
For the experiment I had reserved two VCL instances with IP's 152.46.18.199(client) and 152.1.13.245(server).The RTT to send a ping packet was approximately 8 ms, so I set the timeout on the client to 20ms in order to wait before saying a packet has been dropped.
Delay measured includes only the time to send and receive all packets not the reading from file to make packets.
Maximum buffer size on the server side is 1008 bytes, the server can receive a maximum size packet of 1008 bytes.

Case 1 Effect of Window Size N:
RTT for sending the complete file
MSS = 500 bytes
p = 0.05

WindowSize	T1(ms)	T2(ms)	T3(ms)	T4(ms)	T5(ms)	Avg Delay
1	27630	27630	28035	28204	30622	28424.2
2	15694	15862	15858	17109	15823	16069.2
4	10743	10362	10564	10258	10057	10396.8
8	7704	7806	7161	7030	7153	7370.8
16	6168	5360	5713	5790	5927	5791.6
32	5737	5591	5145	5070	5453	5399.2
64	4786	5008	5008	5160	4858	4964
128	5528	4819	5327	5033	5237	5188.8
256	4948	4848	5806	4833	5161	5119.2
512	4986	5497	4366	5166	4523	4907.6
1024	4997	5472	5135	4539	4756	4979.8

As the value of N increases the delay decreases. A large window size will allow us to send more number of packets, as long as we can send packets.So a larger window size should ideally decrease the RTT if there are no packet drops.But in our case as we have packet drops the average delay does not decrease after the window size increases significantly(>32) the reason for this is that retransmission of dropped packets adds to the total delay so larger the window size if a packet gets dropped then all packets sent including the packet dropped will have to be sent again. Figure 2 shows the drop in average delay as window size increase but the average delay does not drop further as retransmissions add further delays.

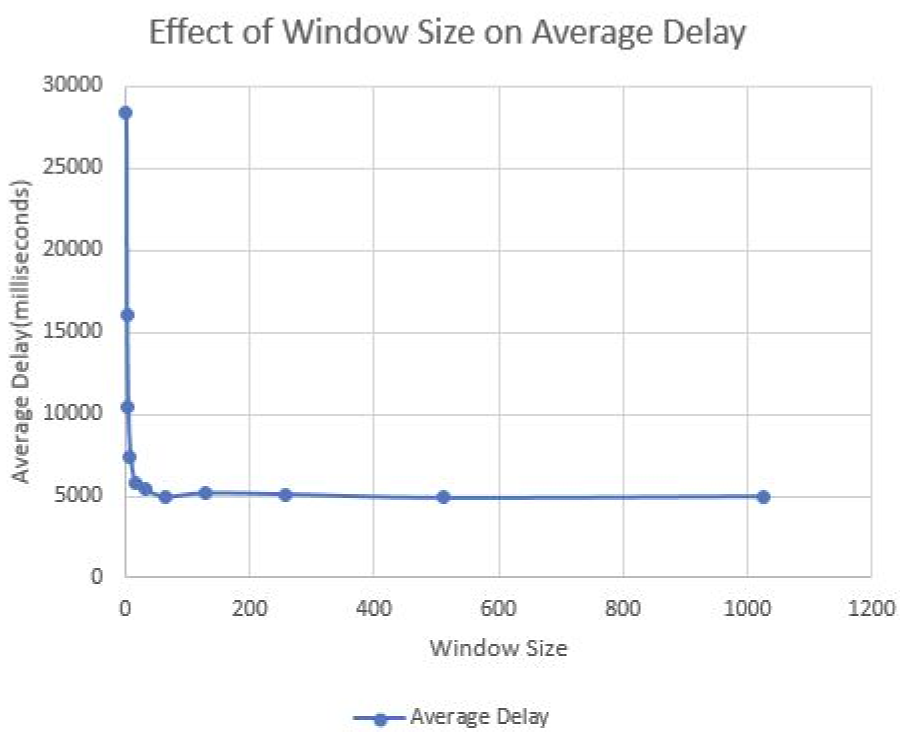

Figure1:Effect of Window Size on Average Delay

Case 2 Effect MSS:
Window Size = 64
Loss probability = 0.05

MSS	T1(ms)	T2(ms)	T3(ms)	T4(ms)	T5(ms)	Avg Delay
100	23876	23861	24794	23778	24507	24163.2
200	11797	13072	11159	13673	11477	12235.6
300	7625	8308	7926	8041	7623	7904.6
400	6425	6337	6724	7354	6294	6626.8
500	5123	4916	5271	4684	5483	5095.4
600	3932	4375	3877	3879	3736	3959.8

700	3731	3400	2998	3681	4402	3642.4
800	3077	3120	3232	3351	2849	3125.8
900	3125	2979	2857	2277	3022	2852
1000	2208	2495	2827	2586	2746	2572.4

As the value of MSS increases number of bytes sent in a packet will also increase. So we need to send fewer packets.Due to this the average delay decreases as the MSS increases(few packets mean less loss given our loss probability).Thus we can conclude that as MSS increases the average delay decreases.(Packet loss still has an effect on the total average delay but not as much as for Case 1).Figure 2 shows that the decrease is linear for the said increments in MSS.

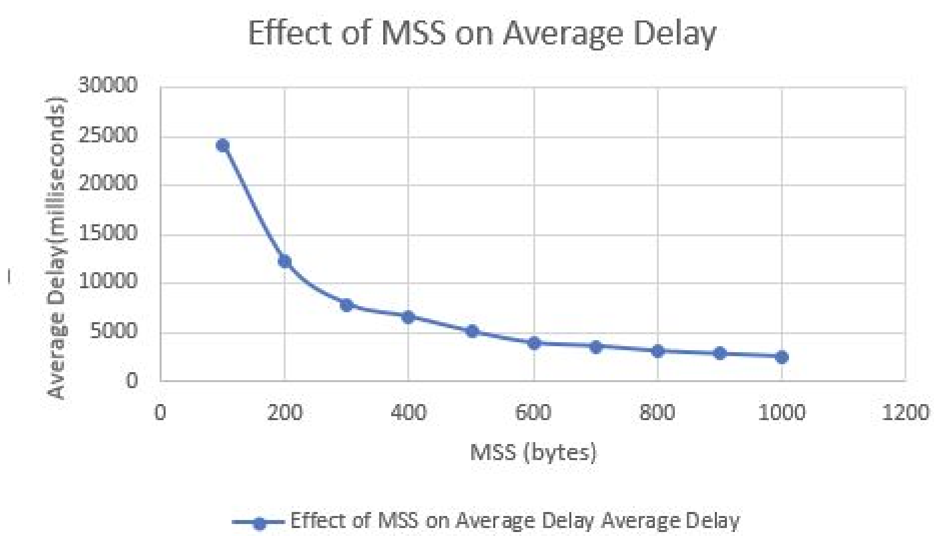

Figure2:Effect of MSS on Average Delay

Case 3 Effect of Loss Probability p:
Window size = 64
MSS = 500

Loss Probability - p	T1(ms)	T2(ms)	T3(ms)	T4(ms)	T5(ms)	Avg Delay
0.01	1302	1206	1350	1473	1401	1346.4
0.02	2228	2009	2598	2227	1821	2176.6
0.03	2938	3404	3621	2805	3187	3191
0.04	4365	4012	3953	3959	4076	4073
0.05	5225	4974	5510	5046	5268	5204.6
0.06	6538	5032	5949	5340	5659	5703.6
0.07	6783	6916	6575	6845	7108	6845.4
0.08	7417	7981	7647	7617	7577	7647.8
0.09	8912	7960	7608	8579	8872	8386.2
0.1	9505	9836	9061	9035	10292	9545.8

As packets keep getting dropped the number of retransmissions increase thus adding to the delay time hence higher the loss probability more time it takes to finish sending data.Figure 3 shows the increase in average delay as loss probability was increased.The increase is almost linear for the increments in drop probability.

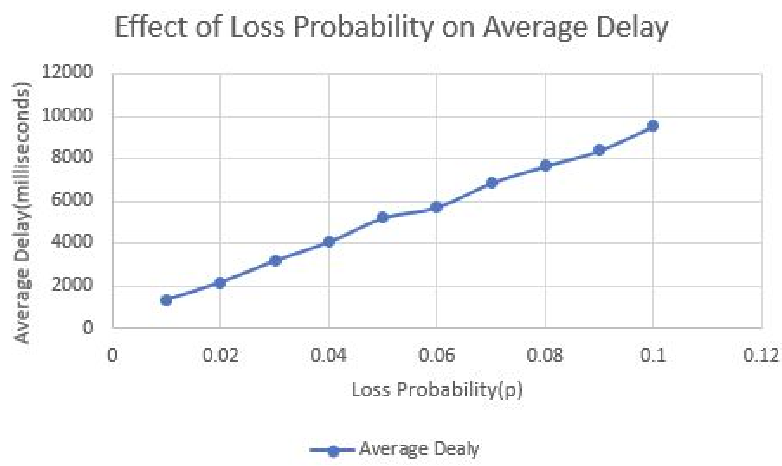

Figure:Effect of Loss Probability on Average Delay