Analysis Report – Programming Assignment 2

Academic Integrity

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Alternating Bit Protocol (ABT)

I have chosen the timeout value as 30 here based on the following assumptions: a message sent from A takes average 5 unit times to reach B when there is no other packet in the medium. This time varies from 0-10 unit time with 5 being the average. So I have assumed that at max ,a packet will reach from one host to another in 10 unit times. After reaching at the destination it will take 10 unit time (worst case) to process(checksum validation and making a new ACK packet etc) the packet. Once processing is done , ACK for the above packet again take 10 unit times to reach the original sender. Hence total timeout = 30 unit times.

Protocol Validation:

In ABT, each of these experiments for protocol validation were run with corruption rate =0.2, time between messages = 50,total messages = 30, timeout =30, seed value = 1234

a) With Loss Probability = 0.2
   Average Throughput = 0.011130
b) With Loss Probability = 0.4
   Average Throughput = 0.007808
c) With Loss Probability = 0.6
   Average throughput = 0.003425
d) With Loss Probability = 0.8
   Average throughput = 0.001152

Experiment 1 :

Following results were obtained for ABT protocol for Experiment 1 (see the table below)

a) With Loss Probability = 0.1
   Average Throughput = 0.0133282

b) With Loss Probability = 0.2
   Average Throughput = 0.0114038

c) With Loss Probability = 0.4
   Average Throughput = 0.0075605

d) With Loss Probability = 0.6
   Average Throughput = 0.0038421

e) With Loss Probability = 0.8
    Average Throughput = 0.0010446

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.1	0.2	50	1000	1245	1142	683	50916.94531	0.013414
2	1000	0.1	0.2	50	1000	1206	1096	671	49858.67188	0.013458
3	1000	0.1	0.2	50	1000	1204	1065	645	49670.01953	0.012986
4	1000	0.1	0.2	50	1000	1181	1061	677	50172.17578	0.013494
5	1000	0.1	0.2	50	1000	1177	1077	686	49714.47266	0.013799
6	1000	0.1	0.2	50	1000	1228	1118	679	50687.07813	0.013396
7	1000	0.1	0.2	50	1000	1240	1093	665	50447.34766	0.013182
8	1000	0.1	0.2	50	1000	1244	1136	665	51261.49609	0.012973
9	1000	0.1	0.2	50	1000	1229	1094	650	50598.44531	0.012846
10	1000	0.1	0.2	50	1000	1171	1063	676	49219.47656	0.013734
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	1310	1038	582	50825.52344	0.011451
2	1000	0.2	0.2	50	1000	1269	1002	558	50427.14844	0.011065
3	1000	0.2	0.2	50	1000	1253	1000	550	48928.10938	0.011241
4	1000	0.2	0.2	50	1000	1320	1057	593	51062.33594	0.011613
5	1000	0.2	0.2	50	1000	1279	1016	592	50457.91406	0.011733
6	1000	0.2	0.2	50	1000	1326	1076	590	51196.78516	0.011524
7	1000	0.2	0.2	50	1000	1290	1012	568	49623.47656	0.011446
8	1000	0.2	0.2	50	1000	1281	1026	564	49171.16016	0.01147
9	1000	0.2	0.2	50	1000	1294	1027	554	49786.27344	0.011128
10	1000	0.2	0.2	50	1000	1319	1059	577	50761.70703	0.011367
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.4	0.2	50	1000	1460	865	371	51162.74219	0.007251
2	1000	0.4	0.2	50	1000	1434	876	374	49766.15234	0.007515
3	1000	0.4	0.2	50	1000	1428	857	376	49388.07031	0.007613
4	1000	0.4	0.2	50	1000	1471	899	414	51418.76953	0.008052
5	1000	0.4	0.2	50	1000	1392	840	376	48919.73047	0.007686
6	1000	0.4	0.2	50	1000	1426	877	383	49500.8125	0.007737
7	1000	0.4	0.2	50	1000	1404	828	356	48420.42969	0.007352
8	1000	0.4	0.2	50	1000	1453	918	386	50681.08594	0.007616
9	1000	0.4	0.2	50	1000	1420	878	374	49828.36328	0.007506
10	1000	0.4	0.2	50	1000	1465	864	368	50570.91797	0.007277
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.6	0.2	50	1000	1574	666	217	51537.21094	0.004211
2	1000	0.6	0.2	50	1000	1556	627	189	49729.32813	0.003801
3	1000	0.6	0.2	50	1000	1579	632	185	50115.42969	0.003691
4	1000	0.6	0.2	50	1000	1566	624	194	49499.44531	0.003919
5	1000	0.6	0.2	50	1000	1521	633	212	49220.01172	0.004307
6	1000	0.6	0.2	50	1000	1575	649	179	50535.21875	0.003542
7	1000	0.6	0.2	50	1000	1534	597	180	48976.42969	0.003675
8	1000	0.6	0.2	50	1000	1509	616	197	48865.96484	0.004031
9	1000	0.6	0.2	50	1000	1554	614	173	49472.16797	0.003497
10	1000	0.6	0.2	50	1000	1587	622	189	50435.80859	0.003747
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	1681	351	54	51436.71094	0.00105
2	1000	0.8	0.2	50	1000	1661	334	60	51003.83203	0.001176
3	1000	0.8	0.2	50	1000	1676	322	56	51430.58203	0.001089
4	1000	0.8	0.2	50	1000	1649	340	57	50008.26563	0.00114
5	1000	0.8	0.2	50	1000	1691	335	52	51392.91016	0.001012
6	1000	0.8	0.2	50	1000	1607	338	58	49436.30078	0.001173
7	1000	0.8	0.2	50	1000	1636	312	52	49869.80859	0.001043
8	1000	0.8	0.2	50	1000	1693	347	48	51440.05469	0.000933
9	1000	0.8	0.2	50	1000	1626	324	46	49557.76563	0.000928
10	1000	0.8	0.2	50	1000	1646	323	45	49882.57031	0.000902

Table for Experiment 1 for ABT

Experiment 2 :

I have chosen the timeout value as 30 (explained in Experiment 1).

Following results were obtained for ABT protocol for Experiment 1 (see the table below)

a) With Loss Probability = 0.2
   Average Throughput = 0.0114038

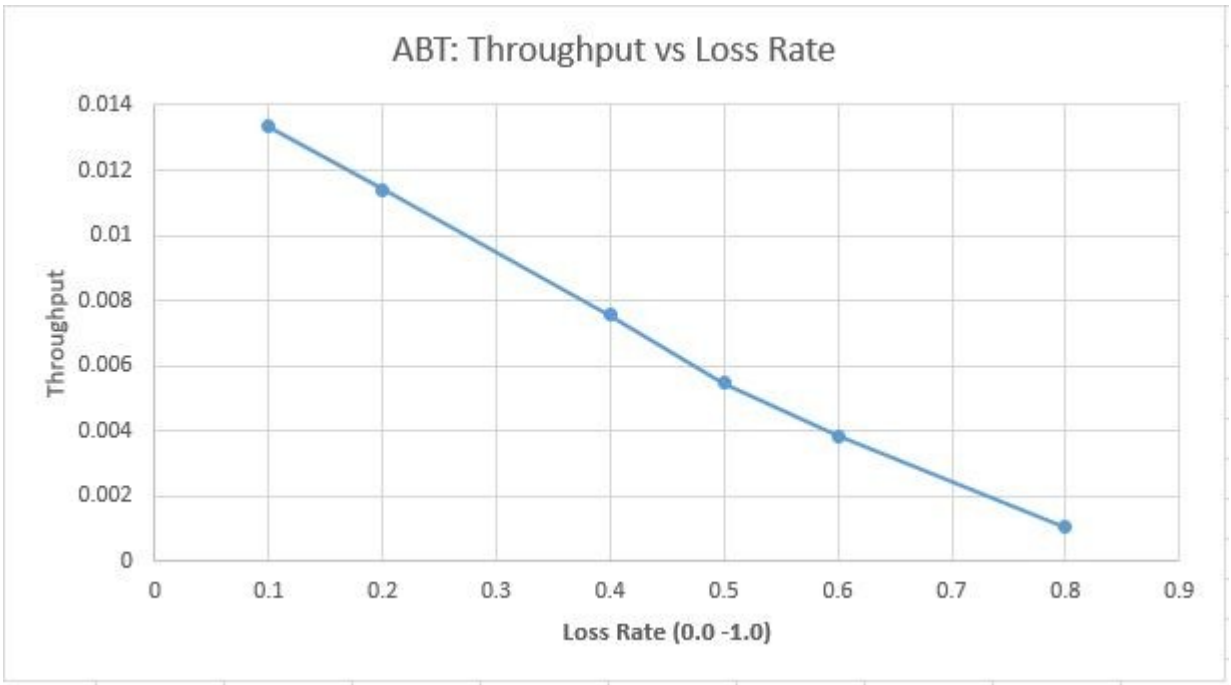
b) With Loss Probability = 0.5
   Average Throughput = 0.0054815

c) With Loss Probability = 0.8
   Average Throughput = 0.0010446

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	1310	1038	582	50825.523438	0.011451
2	1000	0.2	0.2	50	1000	1269	1002	558	50427.148438	0.011065
3	1000	0.2	0.2	50	1000	1253	1000	550	48928.109375	0.011241
4	1000	0.2	0.2	50	1000	1320	1057	593	51062.335938	0.011613
5	1000	0.2	0.2	50	1000	1279	1016	592	50457.914062	0.011733
6	1000	0.2	0.2	50	1000	1326	1076	590	51196.785156	0.011524
7	1000	0.2	0.2	50	1000	1290	1012	568	49623.476562	0.011446
8	1000	0.2	0.2	50	1000	1281	1026	564	49171.160156	0.01147
9	1000	0.2	0.2	50	1000	1294	1027	554	49786.273438	0.011128
10	1000	0.2	0.2	50	1000	1319	1059	577	50761.707031	0.011367
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	1523	752	287	50837.828125	0.005645
2	1000	0.5	0.2	50	1000	1542	748	258	50603.882812	0.005098
3	1000	0.5	0.2	50	1000	1498	746	268	49281.574219	0.005438
4	1000	0.5	0.2	50	1000	1521	760	280	50052.230469	0.005594
5	1000	0.5	0.2	50	1000	1471	755	268	49042.175781	0.005465
6	1000	0.5	0.2	50	1000	1485	792	278	49292.292969	0.00564
7	1000	0.5	0.2	50	1000	1530	748	270	50211.3125	0.005377
8	1000	0.5	0.2	50	1000	1497	773	293	50240.789062	0.005832
9	1000	0.5	0.2	50	1000	1498	754	266	49266.1875	0.005399
10	1000	0.5	0.2	50	1000	1489	733	262	49180.140625	0.005327
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	1681	351	54	51436.710938	0.00105
2	1000	0.8	0.2	50	1000	1661	334	60	51003.832031	0.001176
3	1000	0.8	0.2	50	1000	1676	322	56	51430.582031	0.001089
4	1000	0.8	0.2	50	1000	1649	340	57	50008.265625	0.00114
5	1000	0.8	0.2	50	1000	1691	335	52	51392.910156	0.001012
6	1000	0.8	0.2	50	1000	1607	338	58	49436.300781	0.001173
7	1000	0.8	0.2	50	1000	1636	312	52	49869.808594	0.001043
8	1000	0.8	0.2	50	1000	1693	347	48	51440.054688	0.000933
9	1000	0.8	0.2	50	1000	1626	324	46	49557.765625	0.000928
10	1000	0.8	0.2	50	1000	1646	323	45	49882.570312	0.000902

Table for Experiment 2 for ABT

For the two experiments we can draw following graph for ABT:



Observations for ABT:

In ABT , throughput is decreased as we increase the loss rate.
This can be explained due to the reason following reason:
As we increase the loss rate, probability of simulator dropping a packet increases which causes the more number of retransmissions and waiting for their ACKs which in turn cause the simulator to refuse the data from upper layer as ABT doesn't allow to buffer the data from upper layer till it has received the ACK for the previously sent packet.

Go-Back-N (GBN):

I have chosen **timeout** as 15 time units based on multiple runs that I had run while experimenting with my code. 15 unit time is also justified because of the nature of the Go-Back-N i.e. If packet times out all the packets in the window[gbnBase ..to ..gbnNextSequenceNumber-1] will be retransmitted eventually. Another justification for choosing this as timeout is because I was getting maximum value of B_Application and throughput as compared to other Timeout values that I chose for various seeds.

Protocol Validation:

In GBN, each of these experiments for protocol validation were run with corruption rate =0.2, time between messages = 50,total messages = 30, timeout =30, seed value = 1234 window size = 3

a) With Loss Probability = 0.2
   Average Throughput = 0.016107
b) With Loss Probability = 0.4
   Average Throughput = 0.017563
c) With Loss Probability = 0.6
   Average throughput = 0.018617
d) With Loss Probability = 0.8
   Average throughput = 0.012646

Experiment 1:
For Window Size 10(see the table below)

a) With Loss Probability = 0.1
   Average throughput = 0.0199305

b) With Loss Probability = 0.2
   Average throughput = 0.0200766

c) With Loss Probability = 0.4
   Average throughput = 0.0198083

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.1	0.2	50	1000	2136	1927	999	50017.515625	0.019973
2	1000	0.1	0.2	50	1000	2346	2131	999	49315.089844	0.020257
3	1000	0.1	0.2	50	1000	2216	1990	996	49566.523438	0.020094
4	1000	0.1	0.2	50	1000	2117	1907	998	51241.980469	0.019476
5	1000	0.1	0.2	50	1000	2096	1892	999	50647.628906	0.019725
6	1000	0.1	0.2	50	1000	2173	1966	999	50943.820312	0.01961
7	1000	0.1	0.2	50	1000	2202	1965	998	50748.613281	0.019666
8	1000	0.1	0.2	50	1000	2192	1969	999	49466.4375	0.020196
9	1000	0.1	0.2	50	1000	2298	2067	999	48784.3125	0.020478
10	1000	0.1	0.2	50	1000	2210	1979	999	50378.710938	0.01983
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	2505	2023	999	49039.355469	0.020371
2	1000	0.2	0.2	50	1000	2563	2066	999	48350.496094	0.020662
3	1000	0.2	0.2	50	1000	2612	2054	999	50519.320312	0.019775
4	1000	0.2	0.2	50	1000	2767	2232	999	50273.660156	0.019871
5	1000	0.2	0.2	50	1000	2463	1990	999	50365.15625	0.019835
6	1000	0.2	0.2	50	1000	2610	2109	999	50932.671875	0.019614
7	1000	0.2	0.2	50	1000	2675	2083	999	49470.820312	0.020194
8	1000	0.2	0.2	50	1000	2598	2082	998	50341.152344	0.019825
9	1000	0.2	0.2	50	1000	2685	2130	999	48626.9375	0.020544
10	1000	0.2	0.2	50	1000	2717	2176	999	49763.015625	0.020075
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.4	0.2	50	1000	3996	2374	999	50719.273438	0.019697
2	1000	0.4	0.2	50	1000	4130	2452	999	50841.324219	0.019649
3	1000	0.4	0.2	50	1000	3984	2355	998	50507.964844	0.019759
4	1000	0.4	0.2	50	1000	4034	2440	999	48402.714844	0.020639
5	1000	0.4	0.2	50	1000	4118	2487	999	50412.128906	0.019817
6	1000	0.4	0.2	50	1000	3981	2359	998	51007.007812	0.019566
7	1000	0.4	0.2	50	1000	3934	2361	998	49751.785156	0.02006
8	1000	0.4	0.2	50	1000	3848	2335	998	52241.472656	0.019104
9	1000	0.4	0.2	50	1000	4254	2538	999	50197.292969	0.019901
10	1000	0.4	0.2	50	1000	4093	2419	999	50224.875	0.019891

Table for Experiment 1 for GBN (window size = 10)

For Window Size 50 (see the below table)

a) With Loss Probability = 0.1
Average throughput = 0.0199305

b) With Loss Probability = 0.2
Average throughput = 0.0200766

c) With Loss Probability = 0.4
Average throughput = 0.0198083

Note : For any windows size, I was running the GBN for loss probability 0.6 and 0.8,the code was running for more than 2 hours for each case and I had to forcefully terminate it. So I have not included the throughput for loss probability 0.6 and 0.8 here as I

was not able to gather any throughput for those settings. **It is happening may be because the retransmission was are very high and simulator corrupting each of those retransmissions , gbn base is moving very slowly and causing the code to run for very long time.** I have tried to increase the TIMEOUT value to see if that changes this behavior but still code is running for so long that I have to terminate it.

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.1	0.2	50	1000	2136	1927	999	50017.515625	0.019973
2	1000	0.1	0.2	50	1000	2346	2131	999	49315.089844	0.020257
3	1000	0.1	0.2	50	1000	2216	1990	996	49566.523438	0.020094
4	1000	0.1	0.2	50	1000	2117	1907	998	51241.980469	0.019476
5	1000	0.1	0.2	50	1000	2096	1892	999	50647.628906	0.019725
6	1000	0.1	0.2	50	1000	2173	1966	999	50943.820312	0.01961
7	1000	0.1	0.2	50	1000	2202	1965	998	50748.613281	0.019666
8	1000	0.1	0.2	50	1000	2192	1969	999	49466.4375	0.020196
9	1000	0.1	0.2	50	1000	2298	2067	999	48784.3125	0.020478
10	1000	0.1	0.2	50	1000	2210	1979	999	50378.710938	0.01983
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	2505	2023	999	49039.355469	0.020371
2	1000	0.2	0.2	50	1000	2563	2066	999	48350.496094	0.020662
3	1000	0.2	0.2	50	1000	2612	2054	999	50519.320312	0.019775
4	1000	0.2	0.2	50	1000	2767	2232	999	50273.660156	0.019871
5	1000	0.2	0.2	50	1000	2463	1990	999	50365.15625	0.019835
6	1000	0.2	0.2	50	1000	2610	2109	999	50932.671875	0.019614
7	1000	0.2	0.2	50	1000	2675	2083	999	49470.820312	0.020194
8	1000	0.2	0.2	50	1000	2598	2082	998	50341.152344	0.019825
9	1000	0.2	0.2	50	1000	2685	2130	999	48626.9375	0.020544
10	1000	0.2	0.2	50	1000	2717	2176	999	49763.015625	0.020075
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.4	0.2	50	1000	3996	2374	999	50719.273438	0.019697
2	1000	0.4	0.2	50	1000	4130	2452	999	50841.324219	0.019649
3	1000	0.4	0.2	50	1000	3984	2355	998	50507.964844	0.019759
4	1000	0.4	0.2	50	1000	4034	2440	999	48402.714844	0.020639
5	1000	0.4	0.2	50	1000	4118	2487	999	50412.128906	0.019817
6	1000	0.4	0.2	50	1000	3981	2359	998	51007.007812	0.019566
7	1000	0.4	0.2	50	1000	3934	2361	998	49751.785156	0.02006
8	1000	0.4	0.2	50	1000	3848	2335	998	52241.472656	0.019104
9	1000	0.4	0.2	50	1000	4254	2538	999	50197.292969	0.019901
10	1000	0.4	0.2	50	1000	4093	2419	999	50224.875	0.019891

Table for Experiment 1 for GBN (window size = 50)

Experiment 2:

For Window Size 10 (see the below table)

a) With Loss Probability = 0.2
Average throughput = 0.0200766

b) With Loss Probability = 0.5
Average throughput = 0.0199198

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	2505	2023	999	49039.355469	0.020371
2	1000	0.2	0.2	50	1000	2563	2066	999	48350.496094	0.020662
3	1000	0.2	0.2	50	1000	2612	2054	999	50519.320312	0.019775
4	1000	0.2	0.2	50	1000	2767	2232	999	50273.660156	0.019871
5	1000	0.2	0.2	50	1000	2463	1990	999	50365.15625	0.019835
6	1000	0.2	0.2	50	1000	2610	2109	999	50932.671875	0.019614
7	1000	0.2	0.2	50	1000	2675	2083	999	49470.820312	0.020194
8	1000	0.2	0.2	50	1000	2598	2082	998	50341.152344	0.019825
9	1000	0.2	0.2	50	1000	2685	2130	999	48626.9375	0.020544
10	1000	0.2	0.2	50	1000	2717	2176	999	49763.015625	0.020075
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	5104	2576	999	49935.613281	0.020006
2	1000	0.5	0.2	50	1000	11520	3137	960	49614.886719	0.019349
3	1000	0.5	0.2	50	1000	5595	2775	997	49199.589844	0.020264
4	1000	0.5	0.2	50	1000	4959	2523	998	49507.128906	0.020159
5	1000	0.5	0.2	50	1000	6059	2984	999	49541.039062	0.020165
6	1000	0.5	0.2	50	1000	5782	2883	996	51078.523438	0.019499
7	1000	0.5	0.2	50	1000	5570	2688	999	49461.066406	0.020198
8	1000	0.5	0.2	50	1000	5194	2614	999	50319.304688	0.019853
9	1000	0.5	0.2	50	1000	5603	2736	999	48536.542969	0.020582
10	1000	0.5	0.2	50	1000	5435	2722	999	52241.457031	0.019123

Table for Experiment 2 for GBN (window size = 10)

For Window Size 50 (see the below table)

a) With Loss Probability = 0.2
Average throughput = 0.0200766

a) With Loss Probability = 0.5
Average throughput = 0.019933

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	2505	2023	999	49039.355469	0.020371
2	1000	0.2	0.2	50	1000	2563	2066	999	48350.496094	0.020662
3	1000	0.2	0.2	50	1000	2612	2054	999	50519.320312	0.019775
4	1000	0.2	0.2	50	1000	2767	2232	999	50273.660156	0.019871
5	1000	0.2	0.2	50	1000	2463	1990	999	50365.15625	0.019835
6	1000	0.2	0.2	50	1000	2610	2109	999	50932.671875	0.019614
7	1000	0.2	0.2	50	1000	2675	2083	999	49470.820312	0.020194
8	1000	0.2	0.2	50	1000	2598	2082	998	50341.152344	0.019825
9	1000	0.2	0.2	50	1000	2685	2130	999	48626.9375	0.020544
10	1000	0.2	0.2	50	1000	2717	2176	999	49763.015625	0.020075
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	5104	2576	999	49935.613281	0.020006
2	1000	0.5	0.2	50	1000	9479	3143	967	49637.71875	0.019481
3	1000	0.5	0.2	50	1000	5595	2775	997	49199.589844	0.020264
4	1000	0.5	0.2	50	1000	4959	2523	998	49507.128906	0.020159
5	1000	0.5	0.2	50	1000	6059	2984	999	49541.039062	0.020165
6	1000	0.5	0.2	50	1000	5782	2883	996	51078.523438	0.019499
7	1000	0.5	0.2	50	1000	5570	2688	999	49461.066406	0.020198
8	1000	0.5	0.2	50	1000	5194	2614	999	50319.304688	0.019853
9	1000	0.5	0.2	50	1000	5603	2736	999	48536.542969	0.020582
10	1000	0.5	0.2	50	1000	5435	2722	999	52241.457031	0.019123

Table for Experiment 2 for GBN (window size = 50)

For Window Size 100 (see the below table)

a) With Loss Probability = 0.2
Average throughput = 0.0200766

b) With Loss Probability = 0.5
Average throughput = 0.019933

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	2505	2023	999	49039.355469	0.020371
2	1000	0.2	0.2	50	1000	2563	2066	999	48350.496094	0.020662
3	1000	0.2	0.2	50	1000	2612	2054	999	50519.320312	0.019775
4	1000	0.2	0.2	50	1000	2767	2232	999	50273.660156	0.019871
5	1000	0.2	0.2	50	1000	2463	1990	999	50365.15625	0.019835
6	1000	0.2	0.2	50	1000	2610	2109	999	50932.671875	0.019614
7	1000	0.2	0.2	50	1000	2675	2083	999	49470.820312	0.020194
8	1000	0.2	0.2	50	1000	2598	2082	998	50341.152344	0.019825
9	1000	0.2	0.2	50	1000	2685	2130	999	48626.9375	0.020544
10	1000	0.2	0.2	50	1000	2717	2176	999	49763.015625	0.020075

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	5104	2576	999	49935.613281	0.020006
2	1000	0.5	0.2	50	1000	9479	3143	967	49637.71875	0.019481
3	1000	0.5	0.2	50	1000	5595	2775	997	49199.589844	0.020264
4	1000	0.5	0.2	50	1000	4959	2523	998	49507.128906	0.020159
5	1000	0.5	0.2	50	1000	6059	2984	999	49541.039062	0.020165
6	1000	0.5	0.2	50	1000	5782	2883	996	51078.523438	0.019499
7	1000	0.5	0.2	50	1000	5570	2688	999	49461.066406	0.020198
8	1000	0.5	0.2	50	1000	5194	2614	999	50319.304688	0.019853
9	1000	0.5	0.2	50	1000	5603	2736	999	48536.542969	0.020582
10	1000	0.5	0.2	50	1000	5435	2722	999	52241.457031	0.019123

Table for Experiment 2 for GBN (window size = 100)

For Window Size 200 (see the below table)

a) With Loss Probability = 0.2
Average throughput = 0.0200766

b) With Loss Probability = 0.5
Average throughput = 0.019933

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	2505	2023	999	49039.355469	0.020371
2	1000	0.2	0.2	50	1000	2563	2066	999	48350.496094	0.020662
3	1000	0.2	0.2	50	1000	2612	2054	999	50519.320312	0.019775
4	1000	0.2	0.2	50	1000	2767	2232	999	50273.660156	0.019871
5	1000	0.2	0.2	50	1000	2463	1990	999	50365.15625	0.019835
6	1000	0.2	0.2	50	1000	2610	2109	999	50932.671875	0.019614
7	1000	0.2	0.2	50	1000	2675	2083	999	49470.820312	0.020194
8	1000	0.2	0.2	50	1000	2598	2082	998	50341.152344	0.019825
9	1000	0.2	0.2	50	1000	2685	2130	999	48626.9375	0.020544
10	1000	0.2	0.2	50	1000	2717	2176	999	49763.015625	0.020075

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	5104	2576	999	49935.613281	0.020006
2	1000	0.5	0.2	50	1000	9479	3143	967	49637.71875	0.019481
3	1000	0.5	0.2	50	1000	5595	2775	997	49199.589844	0.020264
4	1000	0.5	0.2	50	1000	4959	2523	998	49507.128906	0.020159
5	1000	0.5	0.2	50	1000	6059	2984	999	49541.039062	0.020165
6	1000	0.5	0.2	50	1000	5782	2883	996	51078.523438	0.019499
7	1000	0.5	0.2	50	1000	5570	2688	999	49461.066406	0.020198
8	1000	0.5	0.2	50	1000	5194	2614	999	50319.304688	0.019853
9	1000	0.5	0.2	50	1000	5603	2736	999	48536.542969	0.020582
10	1000	0.5	0.2	50	1000	5435	2722	999	52241.457031	0.019123

Table for Experiment 2 for GBN (window size = 200)

For Window Size 500 (see the below table)

a) With Loss Probability = 0.2
Average throughput = 0.0200766

b) With Loss Probability = 0.5
Average throughput = 0.019933

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	2505	2023	999	49039.355469	0.020371
2	1000	0.2	0.2	50	1000	2563	2066	999	48350.496094	0.020662
3	1000	0.2	0.2	50	1000	2612	2054	999	50519.320312	0.019775
4	1000	0.2	0.2	50	1000	2767	2232	999	50273.660156	0.019871
5	1000	0.2	0.2	50	1000	2463	1990	999	50365.15625	0.019835
6	1000	0.2	0.2	50	1000	2610	2109	999	50932.671875	0.019614
7	1000	0.2	0.2	50	1000	2675	2083	999	49470.820312	0.020194
8	1000	0.2	0.2	50	1000	2598	2082	998	50341.152344	0.019825
9	1000	0.2	0.2	50	1000	2685	2130	999	48626.9375	0.020544
10	1000	0.2	0.2	50	1000	2717	2176	999	49763.015625	0.020075

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	5104	2576	999	49935.613281	0.020006
2	1000	0.5	0.2	50	1000	9479	3143	967	49637.71875	0.019481
3	1000	0.5	0.2	50	1000	5595	2775	997	49199.589844	0.020264
4	1000	0.5	0.2	50	1000	4959	2523	998	49507.128906	0.020159
5	1000	0.5	0.2	50	1000	6059	2984	999	49541.039062	0.020165
6	1000	0.5	0.2	50	1000	5782	2883	996	51078.523438	0.019499
7	1000	0.5	0.2	50	1000	5570	2688	999	49461.066406	0.020198
8	1000	0.5	0.2	50	1000	5194	2614	999	50319.304688	0.019853
9	1000	0.5	0.2	50	1000	5603	2736	999	48536.542969	0.020582
10	1000	0.5	0.2	50	1000	5435	2722	999	52241.457031	0.019123

Table for Experiment 2 for GBN (window size = 500)

Note : For any windows size, I was running the GBN for loss probability 0.8,the code was running for more than an hour for each case and I had to forcefully terminate it. So I have not included the throughput for loss probability 0.8 here as I was not able to gather any throughput for those settings. **It is happening may be because the retransmissions are very high and simulator corrupting each of those retransmissions , gbn base is moving very slowly and causing the code to run for very long time.** I have tried to increase the TIMEOUT value to see if that changes this behavior but still code is running for so long that I have to terminate it.

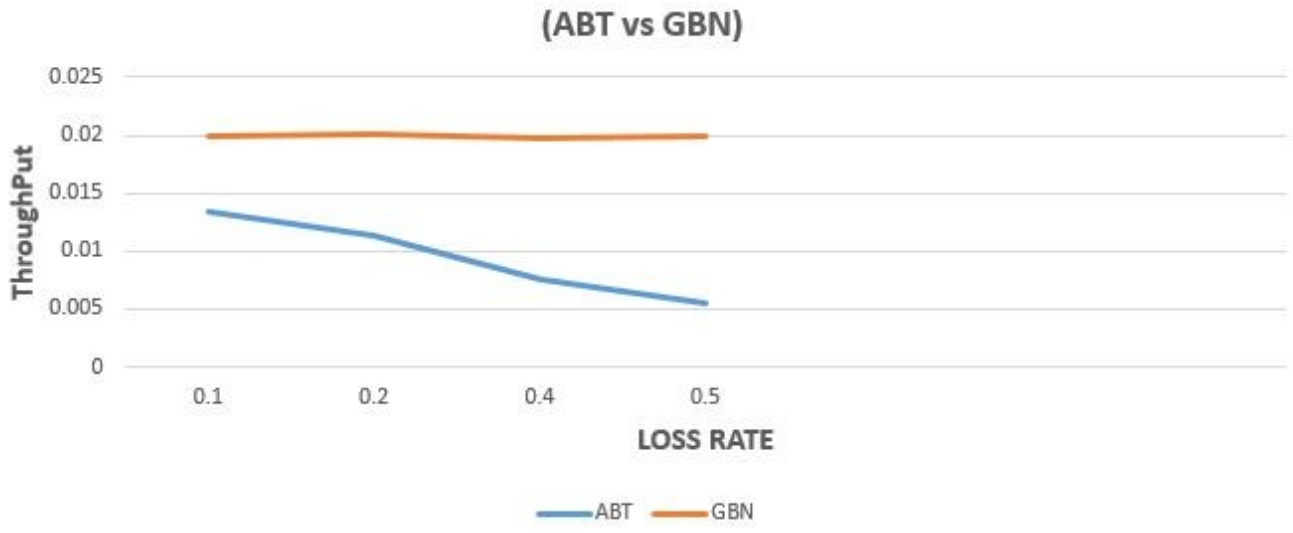
Observations for GBN (for the loss rates 0.1,0.2,0.4,0.5):

From above results, we can see that average throughput is same for a given loss rate across various window sizes. This may be because of the reason that simulator never sent more than 10 packets (as 10 is the minimum window size).

We can draw following graph between throughput and loss rates for GBN (as for a given loss rate between 0.1 to 0.5 , throughput remains same for any window size for the same loss rate . So I have omitted window size here).

Comparison of ABT and GBN

If we compare the throughput of above experiments for both GBN and ABT, we see that GBN's throughtput is almost twice that of ABT in most of the cases. This can be attributed to the pipeline nature of the GBN protocol in which sender keeps on sending certain number of packets (within the current window) and waits for their acknowledgment whereas in ABT , sender stops sending(or refuses) the packet till it correctly recieves the acknowledgement of the previously sent packet.



Selective Repeat :

In case of Selective Repeat, we need 1 timer for each sent packet at sender. But we have only single hardware timer.

Implementing Multiple Logical Timers

To implement multiple single timer , we can think of a following programming structure :

```
struct logicalTimers {
     int packetSeqNumber;  // packet number for which this timer is
associated
     float startTime;      // start time of this logical timer
     float endTime;       // end time of this logical timer
     bool active;         // true or false, based on if this timer is still
active or not.
};
```

Fields of the above structure are described as below:

packetSeqNumber = packet number for which this timer is associated. When we send any packet from A to B (using to layer3()), we set this value equal to the sequence number of the packet.

startTime = start Time for this packet's timer which is generally set to **timer_local** when we send a packet from A to B.

endTime = end time for this packet's timer which is generally set to **timer_local+TIMEOUT** when we send a packet from A to B.

active = represents whether this timer is still active or not. When we send a packet from A to B we set its value as **True.** When we receive UN-corrupted Acknowledgment from B (associated with packet sent) , we set its value as **false** which implies that timer is inactive now for that particular packet.

In the code, I have declared an array of above logicalTimers where each structure represents the logical timer for the sent packet (identified by packetSeqNumber field of the structure).
So this array of structure is basically sorted on both startTime and endTime.

When we receive a timeout from the simulator, we iterate through above array of structure and **compare** the current value of **time_local** with the endTime of each logical timer. If **time_local** is greater

than or equal to **endTime** of any Logical timer **and** that particular logical timer is still **active** , we get the packet's sequence number from logical timer's packetSeqNumber field. Using this sequence number we can index the sender's buffer, and retransmit the correct packet which has timedout.

Protocol Validation:

Without any Loss and Corruption
Average throughput = 0.017672

In SR, each of these experiments for protocol validation were run with corruption rate =0.2, time between messages = 50,total messages = 30, timeout =30, seed value = 1234,window = 3

a) With Loss Probability = 0.2
Average Throughput = 0.004427
b) With Loss Probability = 0.4
Average Throughput = 0.003241
c) With Loss Probability = 0.6
Average throughput = 0.000580

Note : I am getting very less throughput for SR as compared to GBN and ABT. So it seems that there is some logical error in my implementation of SR protocol. So I have not calculated the average throughput for experiments 1 and 2, I have just attached the results of each of those runs here.

Experiment 1

For window Size 10

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.1	0.2	50	1000	44	39	7	49715.949219	0.000141
2	1000	0.1	0.2	50	1000	39	34	3	49109.65625	0.000061
3	1000	0.1	0.2	50	1000	46	45	7	50703.816406	0.000138
4	1000	0.1	0.2	50	1000	58	58	17	48939.039062	0.000347
5	1000	0.1	0.2	50	1000	42	37	6	49793.925781	0.00012
6	1000	0.1	0.2	50	1000	47	43	9	49734.011719	0.000181
7	1000	0.1	0.2	50	1000	39	36	6	49531.992188	0.000121
8	1000	0.1	0.2	50	1000	53	48	10	50107.117188	0.0002
9	1000	0.1	0.2	50	1000	38	30	3	47975.054688	0.000063
10	1000	0.1	0.2	50	1000	35	31	3	50216.035156	0.00006

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	43	33	7	49809.140625	0.000141
2	1000	0.2	0.2	50	1000	23	17	1	48962.394531	0.00002
3	1000	0.2	0.2	50	1000	43	36	7	50798.5625	0.000138
4	1000	0.2	0.2	50	1000	43	35	6	48909.816406	0.000123
5	1000	0.2	0.2	50	1000	43	39	6	49728.011719	0.000121
6	1000	0.2	0.2	50	1000	56	47	13	49869.441406	0.000261
7	1000	0.2	0.2	50	1000	40	30	6	49156.9375	0.000122
8	1000	0.2	0.2	50	1000	35	29	4	49791.601562	0.00008
9	1000	0.2	0.2	50	1000	40	29	3	48264.914062	0.000062
10	1000	0.2	0.2	50	1000	37	28	2	50019.535156	0.00004

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.4	0.2	50	1000	34	21	8	49748.769531	0.000161
2	1000	0.4	0.2	50	1000	25	12	1	48882.746094	0.00002
3	1000	0.4	0.2	50	1000	42	30	5	50781.535156	0.000098
4	1000	0.4	0.2	50	1000	43	27	3	48700.046875	0.000062
5	1000	0.4	0.2	50	1000	49	36	7	50034.265625	0.00014
6	1000	0.4	0.2	50	1000	30	17	4	49433.183594	0.000081
7	1000	0.4	0.2	50	1000	24	14	8	49955.980469	0.00016
8	1000	0.4	0.2	50	1000	43	28	4	49889.285156	0.00008
9	1000	0.4	0.2	50	1000	36	24	2	48407.9375	0.000041
10	1000	0.4	0.2	50	1000	42	24	4	50135.300781	0.00008

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.6	0.2	50	1000	33	15	1	49394.675781	0.00002
2	1000	0.6	0.2	50	1000	27	11	1	48873.910156	0.00002
3	1000	0.6	0.2	50	1000	19	7	1	50635.175781	0.00002
4	1000	0.6	0.2	50	1000	20	3	2	48357.835938	0.000041
5	1000	0.6	0.2	50	1000	41	17	5	50263.761719	0.000099
6	1000	0.6	0.2	50	1000	41	24	2	49524.554688	0.00004
7	1000	0.6	0.2	50	1000	27	9	3	49885.238281	0.00006
8	1000	0.6	0.2	50	1000	33	11	2	50086.710938	0.00004
9	1000	0.6	0.2	50	1000	35	13	4	48145.425781	0.000083
10	1000	0.6	0.2	50	1000	19	2	0	49614.90625	0

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	20	9	1	49228.503906	0.00002
2	1000	0.8	0.2	50	1000	17	2	2	49034.929688	0.000041
3	1000	0.8	0.2	50	1000	19	2	0	50498.890625	0
4	1000	0.8	0.2	50	1000	20	2	2	48378.316406	0.000041
5	1000	0.8	0.2	50	1000	17	4	1	50166.800781	0.00002
6	1000	0.8	0.2	50	1000	36	8	1	49649.277344	0.00002
7	1000	0.8	0.2	50	1000	20	5	1	49882.714844	0.00002
8	1000	0.8	0.2	50	1000	17	8	1	49680.878906	0.00002
9	1000	0.8	0.2	50	1000	31	7	5	48709.183594	0.000103
10	1000	0.8	0.2	50	1000	19	1	0	49585.050781	0

For window Size 50

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.1	0.2	50	1000	183	166	7	50849.503906	0.000138
2	1000	0.1	0.2	50	1000	169	154	3	50270.398438	0.00006
3	1000	0.1	0.2	50	1000	179	165	7	50351.800781	0.000139
4	1000	0.1	0.2	50	1000	196	175	17	51100.652344	0.000333
5	1000	0.1	0.2	50	1000	169	151	6	50642.3125	0.000118
6	1000	0.1	0.2	50	1000	182	162	9	51135.71875	0.000176
7	1000	0.1	0.2	50	1000	182	155	6	48507.03125	0.000124
8	1000	0.1	0.2	50	1000	188	167	10	51348.320312	0.000195
9	1000	0.1	0.2	50	1000	177	156	3	49147.125	0.000061
10	1000	0.1	0.2	50	1000	174	156	3	50306.097656	0.00006

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	180	143	7	50577.230469	0.000138
2	1000	0.2	0.2	50	1000	166	130	1	49282.601562	0.00002
3	1000	0.2	0.2	50	1000	175	140	7	50451.976562	0.000139
4	1000	0.2	0.2	50	1000	177	141	6	51427.578125	0.000117
5	1000	0.2	0.2	50	1000	178	141	6	50712.78125	0.000118
6	1000	0.2	0.2	50	1000	197	155	16	50227.972656	0.000319
7	1000	0.2	0.2	50	1000	175	136	6	49284.894531	0.000122
8	1000	0.2	0.2	50	1000	177	139	4	50435.777344	0.000079
9	1000	0.2	0.2	50	1000	178	136	3	48771.96875	0.000062
10	1000	0.2	0.2	50	1000	175	144	2	49994.230469	0.00004

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.4	0.2	50	1000	189	115	8	50822.195312	0.000157
2	1000	0.4	0.2	50	1000	165	89	1	48773.339844	0.000021
3	1000	0.4	0.2	50	1000	162	108	5	49915.132812	0.0001
4	1000	0.4	0.2	50	1000	167	96	3	50932.007812	0.000059
5	1000	0.4	0.2	50	1000	179	111	7	50270.695312	0.000139
6	1000	0.4	0.2	50	1000	165	85	4	49613.304688	0.000081
7	1000	0.4	0.2	50	1000	180	106	8	49223.171875	0.000163
8	1000	0.4	0.2	50	1000	173	108	4	50615.160156	0.000079
9	1000	0.4	0.2	50	1000	167	101	2	48052.625	0.000042
10	1000	0.4	0.2	50	1000	176	113	4	49814.648438	0.00008

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.6	0.2	50	1000	172	76	1	50769.78125	0.00002
2	1000	0.6	0.2	50	1000	157	63	1	48971.710938	0.00002
3	1000	0.6	0.2	50	1000	168	77	1	50579.644531	0.00002
4	1000	0.6	0.2	50	1000	182	59	6	50170.53125	0.00012
5	1000	0.6	0.2	50	1000	184	70	5	49936.226562	0.0001
6	1000	0.6	0.2	50	1000	164	65	2	50038.640625	0.00004
7	1000	0.6	0.2	50	1000	171	65	3	49428.160156	0.000061
8	1000	0.6	0.2	50	1000	131	52	2	50152.554688	0.00004
9	1000	0.6	0.2	50	1000	174	62	4	48288.421875	0.000083
10	1000	0.6	0.2	50	1000	187	67	10	50875.90625	0.000197

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	172	38	1	50604.199219	0.00002
2	1000	0.8	0.2	50	1000	174	36	5	48957.214844	0.000102
3	1000	0.8	0.2	50	1000	128	19	3	50813.390625	0.000059
4	1000	0.8	0.2	50	1000	178	38	2	49590.855469	0.00004
5	1000	0.8	0.2	50	1000	173	30	5	49473.121094	0.000101
6	1000	0.8	0.2	50	1000	122	25	1	50291.144531	0.00002
7	1000	0.8	0.2	50	1000	94	16	1	49817.558594	0.00002
8	1000	0.8	0.2	50	1000	91	25	7	49901.402344	0.00014
9	1000	0.8	0.2	50	1000	157	33	5	48356.6875	0.000103
10	1000	0.8	0.2	50	1000	137	23	1	50264.695312	0.00002

Experiment 2:

With Window Size 10

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	43	33	7	49809.140625	0.000141
2	1000	0.2	0.2	50	1000	23	17	1	48962.394531	0.00002
3	1000	0.2	0.2	50	1000	43	36	7	50798.5625	0.000138
4	1000	0.2	0.2	50	1000	43	35	6	48909.816406	0.000123
5	1000	0.2	0.2	50	1000	43	39	6	49728.011719	0.000121
6	1000	0.2	0.2	50	1000	56	47	13	49869.441406	0.000261
7	1000	0.2	0.2	50	1000	40	30	6	49156.9375	0.000122
8	1000	0.2	0.2	50	1000	35	29	4	49791.601562	0.00008
9	1000	0.2	0.2	50	1000	40	29	3	48264.914062	0.000062
10	1000	0.2	0.2	50	1000	37	28	2	50019.535156	0.00004
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	25	15	1	49276.175781	0.00002
2	1000	0.5	0.2	50	1000	27	11	1	48873.910156	0.00002
3	1000	0.5	0.2	50	1000	39	20	5	50634.652344	0.000099
4	1000	0.5	0.2	50	1000	26	15	5	48126.78125	0.000104
5	1000	0.5	0.2	50	1000	23	17	7	49939.910156	0.00014
6	1000	0.5	0.2	50	1000	37	26	2	49393.457031	0.00004
7	1000	0.5	0.2	50	1000	24	15	7	49838.917969	0.00014
8	1000	0.5	0.2	50	1000	33	14	4	49879.460938	0.00008
9	1000	0.5	0.2	50	1000	41	23	2	48527.273438	0.000041
10	1000	0.5	0.2	50	1000	19	4	1	49437.089844	0.00002
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	20	9	1	49228.503906	0.00002
2	1000	0.8	0.2	50	1000	17	2	2	49034.929688	0.000041
3	1000	0.8	0.2	50	1000	19	2	0	50498.890625	0
4	1000	0.8	0.2	50	1000	20	2	2	48378.316406	0.000041
5	1000	0.8	0.2	50	1000	17	4	1	50166.800781	0.00002
6	1000	0.8	0.2	50	1000	36	8	1	49649.277344	0.00002
7	1000	0.8	0.2	50	1000	20	5	1	49882.714844	0.00002
8	1000	0.8	0.2	50	1000	17	8	1	49680.878906	0.00002
9	1000	0.8	0.2	50	1000	31	7	5	48709.183594	0.000103
10	1000	0.8	0.2	50	1000	19	1	0	49585.050781	0

With Window Size 50

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	180	143	7	50577.230469	0.000138
2	1000	0.2	0.2	50	1000	166	130	1	49282.601562	0.00002
3	1000	0.2	0.2	50	1000	175	140	7	50451.976562	0.000139
4	1000	0.2	0.2	50	1000	177	141	6	51427.578125	0.000117
5	1000	0.2	0.2	50	1000	178	141	6	50712.78125	0.000118
6	1000	0.2	0.2	50	1000	197	155	16	50227.972656	0.000319
7	1000	0.2	0.2	50	1000	175	136	6	49284.894531	0.000122
8	1000	0.2	0.2	50	1000	177	139	4	50435.777344	0.000079
9	1000	0.2	0.2	50	1000	178	136	3	48771.96875	0.000062
10	1000	0.2	0.2	50	1000	175	144	2	49994.230469	0.00004
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	169	87	1	50559.597656	0.00002
2	1000	0.5	0.2	50	1000	168	83	1	49034.886719	0.00002
3	1000	0.5	0.2	50	1000	176	99	5	50389.972656	0.000099
4	1000	0.5	0.2	50	1000	160	86	8	50199.488281	0.000159
5	1000	0.5	0.2	50	1000	186	100	7	49516.152344	0.000141
6	1000	0.5	0.2	50	1000	173	85	2	49360.222656	0.000041
7	1000	0.5	0.2	50	1000	178	91	7	49144.144531	0.000142
8	1000	0.5	0.2	50	1000	174	76	4	50551.957031	0.000079
9	1000	0.5	0.2	50	1000	180	86	2	48942.300781	0.000041
10	1000	0.5	0.2	50	1000	171	80	1	50546.902344	0.00002
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	172	38	1	50604.199219	0.00002
2	1000	0.8	0.2	50	1000	174	36	5	48957.214844	0.000102
3	1000	0.8	0.2	50	1000	128	19	3	50813.390625	0.000059
4	1000	0.8	0.2	50	1000	178	38	2	49590.855469	0.00004
5	1000	0.8	0.2	50	1000	173	30	5	49473.121094	0.000101
6	1000	0.8	0.2	50	1000	122	25	1	50291.144531	0.00002
7	1000	0.8	0.2	50	1000	94	16	1	49817.558594	0.00002
8	1000	0.8	0.2	50	1000	91	25	7	49901.402344	0.00014
9	1000	0.8	0.2	50	1000	157	33	5	48356.6875	0.000103
10	1000	0.8	0.2	50	1000	137	23	1	50264.695312	0.00002

With Window Size 100

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	359	285	7	52039.359375	0.000135
2	1000	0.2	0.2	50	1000	339	270	1	50291.265625	0.00002
3	1000	0.2	0.2	50	1000	356	282	7	49630.363281	0.000141
4	1000	0.2	0.2	50	1000	352	274	6	49257.878906	0.000122
5	1000	0.2	0.2	50	1000	365	293	6	50658.035156	0.000118
6	1000	0.2	0.2	50	1000	372	292	16	51830.882812	0.000309
7	1000	0.2	0.2	50	1000	352	277	6	49759.09375	0.000121
8	1000	0.2	0.2	50	1000	350	283	4	50346.722656	0.000079
9	1000	0.2	0.2	50	1000	354	283	3	50823.230469	0.000059
10	1000	0.2	0.2	50	1000	344	272	2	50736.425781	0.000039
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	341	171	1	50465.367188	0.00002
2	1000	0.5	0.2	50	1000	328	172	1	50443.460938	0.00002
3	1000	0.5	0.2	50	1000	342	177	5	50640.476562	0.000099
4	1000	0.5	0.2	50	1000	351	175	8	50136.054688	0.00016
5	1000	0.5	0.2	50	1000	361	179	7	49743.601562	0.000141
6	1000	0.5	0.2	50	1000	342	164	2	50383.660156	0.00004
7	1000	0.5	0.2	50	1000	335	168	7	48231.953125	0.000145
8	1000	0.5	0.2	50	1000	344	161	4	51507.398438	0.000078
9	1000	0.5	0.2	50	1000	346	166	2	49383.226562	0.00004
10	1000	0.5	0.2	50	1000	355	180	1	50144.925781	0.00002
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	256	52	1	50824.535156	0.00002
2	1000	0.8	0.2	50	1000	338	68	5	49716.753906	0.000101
3	1000	0.8	0.2	50	1000	216	43	3	50890.492188	0.000059
4	1000	0.8	0.2	50	1000	263	51	2	50688.34375	0.000039
5	1000	0.8	0.2	50	1000	359	69	5	49942.207031	0.0001
6	1000	0.8	0.2	50	1000	326	79	1	49861.097656	0.00002
7	1000	0.8	0.2	50	1000	279	62	1	49304.878906	0.00002
8	1000	0.8	0.2	50	1000	287	56	7	49850.894531	0.00014
9	1000	0.8	0.2	50	1000	339	70	5	48555.757812	0.000103
10	1000	0.8	0.2	50	1000	222	33	1	50631.417969	0.00002

With Window Size 200

Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.2	0.2	50	1000	694	547	7	51597.320312	0.000136
2	1000	0.2	0.2	50	1000	699	545	1	50152.15625	0.00002
3	1000	0.2	0.2	50	1000	704	549	7	50721.097656	0.000138
4	1000	0.2	0.2	50	1000	684	545	6	50024.261719	0.00012
5	1000	0.2	0.2	50	1000	700	554	6	48677.832031	0.000123
6	1000	0.2	0.2	50	1000	716	577	16	48803.957031	0.000328
7	1000	0.2	0.2	50	1000	701	554	6	50303.097656	0.000119
8	1000	0.2	0.2	50	1000	707	578	4	51164.640625	0.000078
9	1000	0.2	0.2	50	1000	702	560	3	49087.269531	0.000061
10	1000	0.2	0.2	50	1000	694	558	2	48860.621094	0.000041
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.5	0.2	50	1000	683	365	1	49750.507812	0.00002
2	1000	0.5	0.2	50	1000	695	352	1	50087.96875	0.00002
3	1000	0.5	0.2	50	1000	695	356	5	49875.710938	0.0001
4	1000	0.5	0.2	50	1000	702	356	8	49328.085938	0.000162
5	1000	0.5	0.2	50	1000	688	346	7	50228.191406	0.000139
6	1000	0.5	0.2	50	1000	706	359	2	50168.507812	0.00004
7	1000	0.5	0.2	50	1000	672	327	7	50105.714844	0.00014
8	1000	0.5	0.2	50	1000	682	339	4	49786.667969	0.00008
9	1000	0.5	0.2	50	1000	680	316	2	50332.535156	0.00004
10	1000	0.5	0.2	50	1000	700	325	1	50430.726562	0.00002
Run	Messages	Loss	Corruption	Time_bw_messages	Application_A	Transport_A	Transport_B	Application_B	Total_time	Throughput
1	1000	0.8	0.2	50	1000	675	134	1	51107.65625	0.00002
2	1000	0.8	0.2	50	1000	607	117	5	50439.605469	0.000099
3	1000	0.8	0.2	50	1000	682	150	3	51343.605469	0.000058
4	1000	0.8	0.2	50	1000	436	98	2	51156.148438	0.000039
5	1000	0.8	0.2	50	1000	672	128	5	50232.902344	0.0001
6	1000	0.8	0.2	50	1000	704	143	1	52189.644531	0.000019
7	1000	0.8	0.2	50	1000	678	137	1	47682.714844	0.000021
8	1000	0.8	0.2	50	1000	699	132	7	50149.492188	0.00014
9	1000	0.8	0.2	50	1000	663	133	5	48352.546875	0.000103
10	1000	0.8	0.2	50	1000	679	120	1	50057.558594	0.00002