

Appendix

Task 1

1.1

UDP Wireless Network

Bandwidth (Mbits/sec)	Throughput (Mbits/sec)	Packets loss (%)
1	0.999	0
2	2	0
3	3	0.039
4	4	0
5	4.99	0.024
6	6	0
7	7	0
8	8.01	0.015
9	8.76	0.8
10	8.96	10
11	10.1	7.7
12	11.6	2.9
13	13	0.14
14	13	7.1
15	14.1	6.2
16	14.8	7
17	14	17
18	14.3	20
19	14.9	21
20	16.8	16
21	16.1	23
22	15.3	30
23	16	30
24	16.5	31
25	17.2	31
26	19.1	27
27	16	41
28	21	25
29	22.7	22
30	21.1	30
31	19.9	36
32	19.1	40
33	20.6	37

34	19.3	40
35	20.3	42
40	23.1	42
45	19.4	57
50	19	62
55	18.5	73

UDP Wired Network

Bandwidth (Mbits/sec)	Throughput (Mbits/sec)	Packets loss (%)
1	1	0
5	4.99	0
10	9.98	0.024
15	15	0
20	20	0.082
25	25	0.0094
30	30	0.0078
35	35.1	0
40	40	0.0059
45	45.1	0.0052
50	50	0.0024
55	55.2	0.017
60	60	0
65	65.2	0.0018
70	69.9	0
75	75.3	0.09
80	79.9	0.01
85	83.7	1.6
90	84.7	6.2
95	85.7	10
100	86	14
105	86.1	18
110	86.3	22
115	87.6	24
120	88.4	26
125	88.9	29

1.2

TCP Delay Wireless Network

TCP Delay ONLY – Wireless				
Delay (ms)	Throughput (Mbits/sec)			
	Trial 1	Trial 2	Trial 3	Average
0				#DIV/0!
100		11.7	12	11.85
200	13.4	11.1	7.74	10.7466667
300	9.43	9.29	7.18	8.63333333
400	6.67	5.07	2.16	4.63333333
500	4.97	3.91	2.4	3.76
600	3.91	2.86	1.45	2.74
700	2.3	2.48	2.2	2.32666667
800	1.9	2.06	1.88	1.94666667
900	1.52	1.54	1.56	1.54
1000	0.757	0.919	1.24	0.972
1100	0.946	0.907	1.04	0.96433333
1200	0.855	0.86	0.949	0.888
1300	0.559	0.712	0.696	0.65566667
1400	0.656	0.657	0.663	0.65866667
1500	0.609	0.608	0.604	0.607
1600	0.486	0.568	0.569	0.541
1700	0.526	0.526	0.521	0.52433333
1800	0.496	0.497	0.497	0.49666667
1900	0.471	0.472	0.465	0.46933333
2000	0.435	0.435	0.435	0.435
2100	0.413	0.414	0.413	0.41333333
2200	0.336	0.394	0.396	0.37533333
2300	0.378	0.377	0.377	0.37733333
2400	0.363	0.361	0.362	0.362
2500	0.334	0.329	0.333	0.332
2600	0.321	0.321	0.321	0.321
2700	0.309	0.256	0.309	0.29133333
2800	0.299	0.297	0.299	0.29833333
2900	0.288	0.286	0.288	0.28733333
3000	0.279	0.278	0.279	0.27866667

UDP Delay Wireless Network

UDP Delay ONLY – Wireless (Bandwidth 54.2 M)				
Delay (ms)	Throughput (Mbits/sec)			
	Trial 1	Trial 2	Trial 3	Average
0				#DIV/0!
100		0.36	0.178	0.269
200	1.3	0.286	0.176	0.58733333
300	1.16	0.31	0.175	0.54833333
400	1.06	0.285	0.142	0.49566667
500	1.13	0.291	0.161	0.52733333
600	0.991	0.273	0.144	0.46933333
700	0.796	0.217	0.138	0.38366667
800	0.647	0.199	0.118	0.32133333
900	0.501	0.176	0.105	0.26066667
1000	0.449	0.152	0.0921	0.23103333
1100	0.387	0.14	0.084	0.20366667
1200	LOSS	0.127	0.0755	0.10125
1300	0.276	0.115	0.0709	0.15396667
1400	0.265	0.105	0.0542	0.1414
1500	LOSS	0.0963	0.0604	0.07835
1600	LOSS	0.09	0.0582	0.0741
1700	0.184	0.0794	0.0542	0.10586667
1800	LOSS	0.0747	0.0542	0.06445
1900	0.163	0.075	0.0542	0.0974
2000	0.135	0.0625	0.0542	0.0839
2100	LOSS	LOSS		#DIV/0!
2200	LOSS	LOSS		#DIV/0!
2300	LOSS	LOSS		#DIV/0!
2400	0.108	LOSS		0.108
2500	LOSS	LOSS		#DIV/0!
2600	LOSS	LOSS		#DIV/0!
2700	LOSS	LOSS		#DIV/0!
2800	LOSS	LOSS		#DIV/0!
2900	LOSS	LOSS		#DIV/0!
3000	LOSS	LOSS		#DIV/0!

1.3

TCP Jitter Wired Network

wire jitter tcp

jiter 10 ms

Delay	1st	2nd	3rd
100	8.34	17.6	13.9
200	7.22	8.57	13.4
300	3.89	4.8	7.72
400	2.72	3.12	4.71
500	1.69	2.08	3.69
600	1.26	1.36	2.55
700	1.03	1.22	1.9
800	0.838	1.12	1.21
900	0.75	0.898	1.06
1000	0.665	0.572	0.667
1100	0.432	0.477	0.759
1200	0.522	0.523	0.435
1300	0.536	0.536	0.42
1400	0.415	0.415	0.415
1500	0.435	0.387	0.388
1600	0.437	0.328	0.363
1700	0.351	0.247	0.274
1800	0.259	0.258	0.258
1900	0.276	0.276	0.245
2000	0.262	0.262	0.299
2100	0.249	0.249	0.285
2200	0.238	0.212	0.212
2300	0.26	0.228	0.228
2400	0.249	0.249	0.249
2500	0.239	0.239	0.186
2600	0.202	0.201	0.201
2700	0.194	0.222	0.201
2800	0.187	0.213	0.187
2900	0.206	0.206	0.181
3000	0.175	0.175	0.155

TCP Jitter Wireless Network

TCP Jitter – Wireless				
Delay with Jitter (± 10 ms)	Throughput (Mbits/sec)			
	Trial 1	Trial 2	Trial 3	Average
0				#DIV/0!
100	8.68	9.2	10.8	9.56
200	5.24	6.64	6.74	6.20666667
300	4.05	4.18	2.78	3.67
400	2.43	3.04	2.55	2.67333333
500	1.64	2.03	1.1	1.59
600	1.53	1.42	1.25	1.4
700	0.866	1.08	1.25	1.06533333
800	0.842	0.919	0.741	0.834
900	0.62	0.797	0.674	0.697
1000	0.593	0.569	0.755	0.639
1100	0.602	0.599	0.602	0.601
1200	0.432	0.606	0.553	0.53033333
1300	0.401	0.402	0.563	0.45533333
1400	0.338	0.443	0.339	0.37333333
1500	0.384	0.436	0.433	0.41766667
1600	0.406	0.363	0.321	0.36333333
1700	0.436	0.307	0.35	0.36433333
1800	0.29	0.258	0.258	0.26866667
1900	0.275	0.22	0.245	0.24666667
2000	0.232	0.261	0.262	0.25166667
2100	0.249	0.249	0.248	0.24866667
2200	0.21	0.315	0.238	0.25433333
2300	0.26	0.224	0.227	0.237
2400	0.218	0.218	0.175	0.20366667
2500	0.21	0.278	0.186	0.22466667
2600	0.201	0.229	0.178	0.20266667
2700	0.194	0.221	0.155	0.19
2800	0.214	0.187	0.187	0.196
2900	0.206	0.24	0.26	0.23533333
3000	0.231	0.155	0.175	0.187

UDP Jitter Wireless Network

UDP Jitter – Wireless (Bandwidth 54.2 M)				
Delay with Jitter (± 10 ms)	Throughput (Mbits/sec)			
	Trial 1	Trial 2	Trial 3	Average
0				#DIV/0!
100	0.0526	0.058	0.0416	0.05073333
200	0.0423	0.0548	0.0233	0.04013333
300	0.0613	0.0575	0.0428	0.05386667
400	0.0501	0.0577	0.0433	0.05036667
500	0.0601	0.0519	0.0421	0.05136667
600	0.053	0.0497	0.0473	0.05
700	0.0533	0.0468	0.0401	0.04673333
800	0.0367	0.0412	0.0359	0.03793333
900	0.0389	0.0363	0.0318	0.03566667
1000	0.0372	0.0321	0.0282	0.0325
1100	0.0336	0.0295	0.0262	0.02976667
1200	0.0258	LOSS	0.021	0.0234
1300	0.0293	0.0221	LOSS	0.0257
1400	LOSS	0.0233	0.0205	0.0219
1500	0.02	LOSS	0.0193	0.01965
1600	0.0237	0.0189	0.0186	0.0204
1700	0.0215	0.0186	LOSS	0.02005
1800	LOSS	LOSS	LOSS	#DIV/0!
1900	0.0207	0.0123	0.0148	0.01593333
2000	0.0177	0.0154	0.0136	0.01556667
2100	LOSS	LOSS	LOSS	#DIV/0!
2200	LOSS	LOSS	LOSS	#DIV/0!
2300	LOSS	LOSS	LOSS	#DIV/0!
2400	LOSS	0.012	LOSS	0.012
2500	LOSS	LOSS	LOSS	#DIV/0!
2600	LOSS	LOSS	LOSS	#DIV/0!
2700	LOSS	LOSS	LOSS	#DIV/0!
2800	LOSS	LOSS	LOSS	#DIV/0!
2900	LOSS	LOSS	LOSS	#DIV/0!
3000	LOSS	LOSS	LOSS	#DIV/0!

Task 5

0	-w 100Kb	-w 125Kb	-w 150Kb	-w 175Kb
Throughput	Throughput	Throughput	Throughput	Throughput
58.1	69.3	82.2	87.7	88.2
58	65.3	84.2	88.2	93
58.1	68.1	84.2	88.1	93
58.1	68.1	84.4	88.2	86.4
58.1	68	84.5	88	81.4
58.1	64	84.5	88.2	88.2
58	70.8	84.3	88.2	88.1
58.1	66.6	84.3	88.1	88.1
58.1	68	84.4	93	88.2
58.1	68.1	84.4	93	88.1
	68			
	68			
	68.1			
	68.1			

Bandwidth	RTT	BDP	w	Buffer Size	Max Adv.Win	Expected Thr	Measure Thr	Accuracy
[Mb/s]	[ms]	[KBytes]	[KBytes]	[KBytes]	[KBytes]	[Mb/s]	[KBytes]	[%]
100	16	200	83	168	126	63	58.1	92
100	16	200	100	200	150	75	68.1	90
100	16	200	125	250	187.5	93.75	84.5	90
100	16	200	150	256	192	96	88.2	91
100	16	200	175	256	192	96	88.4	91

Task 8

Part 1

Session	Average TCP throughput (Mbit/sec)	Average UDP Throughput (Mbits/sec)								Total throughput (Mbits/sec)
		UDP1	UDP2	UDP3	UDP4	UDP5	UDP6	Average	Total	
1 TCP and 0 UDP	95.3	-	-	-	-	-	-	0	0	95.3
1 TCP and 1 UDP	84.67	9.9	-	-	-	-	-	9.9	9.9	94.57
1 TCP and 2 UDP	74.8	9.8	9.93	-	-	-	-	9.87	19.73	94.53
1 TCP and 3 UDP	65.6	9.97	9.68	9.83	-	-	-	9.83	29.48	95.08
1 TCP and 4 UDP	56.3	9.87	9.73	9.93	9.76	-	-	9.82	39.29	95.59
1 TCP and 5 UDP	51.7	9.16	8.67	8.83	8.96	9.03	-	8.93	44.65	96.35
1 TCP and 6 UDP	43.3	8.33	8.67	8.9	7.96	8.83	8.63	8.55	51.32	94.62

Part 2

Session	Average TCP throughput (Mbit/sec)	Average UDP Throughput (Mbits/sec)								Total throughput (Mbits/sec)
		UDP1	UDP2	UDP3	UDP4	UDP5	Average	Total		
1 TCP and 0 UDP	95.3	-	-	-	-	-	-	0	0	95.3
1 TCP and 1 UDP	89.3	9.9	-	-	-	-	-	9.9	9.9	99.2
1 TCP and 2 UDP	85	9.9	9.97	-	-	-	-	9.94	19.87	104.87
1 TCP and 3 UDP	79	9.97	9.86	9.93	-	-	-	9.92	29.76	108.76
1 TCP and 4 UDP	75.3	9.87	9.88	9.93	9.73	-	-	9.85	39.41	114.71
1 TCP and 5 UDP	71.7	8.97	8.67	8.83	8.96	8.47	-	8.78	43.9	115.60