

Report

Written in python (python3 used)

1) How I implemented the STP protocol

Sender	Receiver
Three way Handshake (syn synAck ack)	Three way handshake (syn synAck ack)
Four seg termination (fin ack fin ack)(sender initiated)	Four seg termination (fin ack fin ack)
Single timer for timeout operations (and respective RTO calculations)	Cummulative acknowledgments
PLD module	Buffer out of order packets
Timeout retransmissions	Handle corrupted packets (with checksum)
Fast retransmit	Handle duplicate packets
MWS sliding window (multiple segments being sent and received at once (thread implementation))	Immediate acknowledgment (not delayed as per specs)
STP header with needed fields (explained bellow)	

As far as I am aware all the needed features have been successfully implemented.

My STP works by having 2 clients (i.e the sender file and receiver file).

Within the sender file is three classes, PLD, Packet and Sender as well as a ‘main’ function. These classes hold all the useful and relevant implementation for their specific areas. Initially all the variables needed are initialised as well as a main sender and pld class. The main establishes a connection with the receiver by initiating and completing the ‘three way handshake’. At the end of this process it starts three different threads, a sending thread, a receiving thread, and a thread that handles any delayed or re-ordered packets. The main while loop essentially acts as the fourth ‘thread’ that handles most of the processing. I thought this would be the fastest and easiest way to make sure no packets were lost.

The sender thread/loop is constantly trying to send the next possible packet. A packet is possible to be sent if the number unacknowledged is smaller than the window size. If it is, then a packet is staged for sending and then pushed through the pld module. If it passes through the pld module without anything happening it is successfully sent and it goes back to the beginning of the loop. Otherwise the specific pld error is caused. **Note, whilst the pld module is integrated into main and sender, it uses no information from the sender, i.e it is completely independent of the sender as specified in the specs and could essentially be separated into its own file if needed.**

The receiving thread/loop is constantly trying to receive data using the timeout (RTO) estimation, by setting the socket.settimeout to the RTO value. If at any point a timeout occurs, an exception is thrown and handled by retransmitting the oldest unacknowledged packet. This packet is re-sent through the pld module within the receiving loop. If a packet is timed-out and re-sent it is flagged as

being unable to be used to calculate RTO. If a packet is successfully received it is appended to a queue, which is handled by the main function.

The last thread is used to handle any delayed or re-ordered packets. Any packet that is delayed or re-ordered is flagged by the system. For Delayed packets, it is sent to a deque, and the thread constantly pops the packets in the deque, and calculates if it is time to send them. If it is, it is sent immediately, and if not it is added to the back of the deck. The re-ordered packet is constantly checked to determine if the maxOrder count has been reached (this count is a global count incremented everytime a packet is sent), and when it is reached the re-ordered packet is sent, and a flag is signalled to tell the system that a new packet is now allowed to be re-ordered (count is set back to zero).

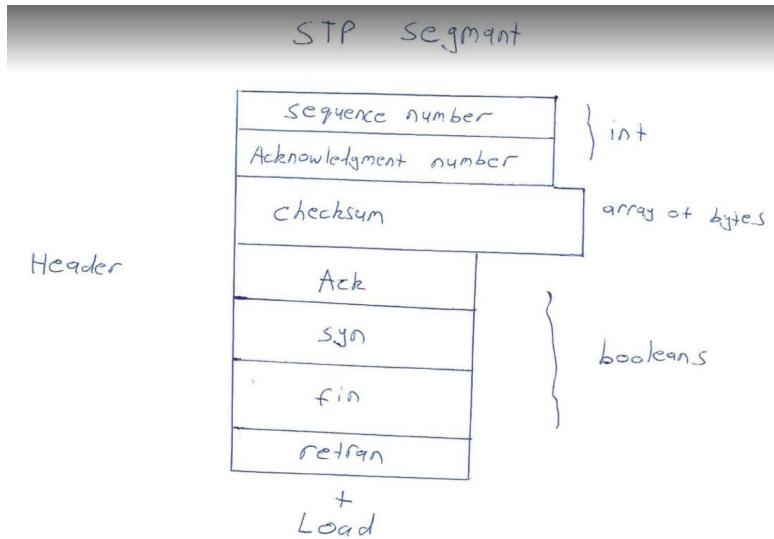
The ‘main’ function is used to do the calculations for the sequence number and acknowledgment received and compare it to the acknowledgment expected. Every loop it pops a packet of the received queue (if it isn’t empty), and does the needed calculations for timeout (if applicable)(min timeout value set to 145ms as per the RFC6298 recommendation), cumulative ack calculation if the ack is greater than sendbase(to decrement number unacknowledged for the sender thread to have max packets (equal to window size)), and also checks if all the data has been successfully sent and acked, so it can start the finishing sequence. If the ack is equal to the sendbase, then the fast retransmission counter is incremented, and if it equals three then the send base packet is retransmitted (pending pld)(fast retransmission count is set back to zero if a timeout occurs). Once all the data has been received the finishing sequence is initiated (fin, ack, fin, ack).

The receiver on the other hand runs with one thread and a main function. The thread is extremely simple, only waiting for a packet to arrive and then adding it to a Deque for the main function to deal with. The main function initialises all the needed variables and then completes the 3 way handshake with the sender. A packet is popped of the Deque if it is not empty and handled in the following way (the next steps are all run as elif statemnts i.e only 1 will occur). First, if the data is corrupted (checked in comparison with the checksum) it is discarded without sending any ack. Next, if the expected Sequence number is received, the data is immediately appended to the copy file, and the necessary stats, counters and expected numbers are incremented. If the buffer is not empty (buffer holding packets that were received out of order) the receiver attempts to clear the buffer by checking if the next expected packet is in the buffer. This loop continues until the buffer is cleared, or the next expected packet is not in the buffer. The cumulative ack is now sent for the next expected packet.

Next, the packet is checked to see if it contains a fin flag, and if so the finishing sequence is initiated. Next, the packet is checked to see if it is a duplicate packet. This is needed because otherwise duplicate packets would be added to the buffer, and also so the log file will be accurate. Lastly, if nothing has run then the else statement is activated, i.e this should only happen when a packet has arrived out of order (a packet arrives with seqNum > expectedSeqNum). A dupe ack is sent (with expectedSeqNum as ackNum) and the out of order packet is added to the buffer (this buffer is handled when an expected seqNum is received).

These steps from both the sender and receiver make sure that the packet is reliably received in the shortest possible steps.

2) STP Header



3) Trade offs considered and Made, extensions

For my PLD module, as discussed above it is not held in a separate file, but rather is run just before any packet (bar packets already delayed and re-ordered) are about to be sent. This is ok when run by the sending thread, however it means that the receiving thread (and main thread for fast retransmit) becomes a fair bit slower when an exception occurs (or three dup ack's) and it then has to run the pld module before retransmitting. Whilst it is running this pld module it cannot receive other packets causing the system to slow down. To improve this I would completely separate the pld module from the sender, sending any packet to be sent to the receiver to the pld, who would then have the responsibility of on-sending it to the receiver address if no errors occurred (or creating the error if needed). However this would only improve the speed of the system, and not in any way affect the implementation (i.e it is simple refactoring).

For the timeout calculation I believe that the single timer per window method for RTT calculations and thus RTO calculation are not very accurate or responsive, and a better method would be to track each packet sent and calculate RTT and RTO every time a packet is successfully received without retransmission or errors. To improve this I would have a deque keeping track of all the send times per packet, and calculate the RTO on each successful return.

4) Snippets borrowed

<https://pymotw.com/2/socket/udp.html> used for implementing my socket code (sending, receiving)

Code snippets for receiving ack from the class textbook (page 248 chapter 3)

Part 5

1)

Startup, 1, 101, 301, 401, 501, 601, 201, 701, 801, 901, 1001, 1101, 1201, 1301, 1401, 1501, 1601, 1701, 1801, 1901, 2101, 2201, 2302, 2401, 2001, 2501, 2601, 2901, 3001, 2701, 29801, fin received

For a pDrop of 0.1, dropping occurred at packet 201, 2001, 2701 and 2801. As seen in the appendix, for the first dropped packet at the receiver, packet 301, 401, 501 and 601 are all received before 201 is received. This makes sense as three dup ack's are sent (401, 501, 601 all send ack 201) causing 201 to be retransmitted and the normal sequence to resume. At the end packet 2701 and 2801 are dropped back to back, and because there is not enough data being sent to cause a fast retransmit, a timeout occurs and both packets are re-sent.

For a pDrop of 0.3 way more packets are dropped (24) causing a much more disordered package arrival at the receiver (see appendix). It is critical to note that in the second experiment much more timeouts occurred compared to fast retransmits, and this is because too many packets were being lost (dropped) that the receiver often did not have a chance to even send three ack's before the timeout occurred.

2)

Gamma	Total Packets Transmitted	Time taken to Transmit (mn)
2	12508	106
4	12446	168
6	12450	239

As seen in the table above, it takes longer to run the simulation as gamma increases. This is due to the timeout interval being larger as gamma increases ($RTO = estRTT + \gamma * devRTT$), causing dropped packets (the main cause of error from pld in this situation) to be picked up much slower. However, less packets are needed to be sent as gamma increases, because delayed packets are acknowledged in time to avoid a timeout (bigger gamma = longer timeout (RTO)). This explains the difference between gamma 2 and 4. However gamma 4 and 6 are roughly equal in terms of packets sent, as clearly a gamma of 4 is sufficient to pick up the majority of packets that have been delayed and not dropped.

3)

The file has been successfully transferred. The transfer took 26 minutes.

Duplicated segments do not cause much stress time wise on the receiver. Similarly, in the majority of cases, re-ordering with a maxOrder of 4 will cause a fast retransmit and also not cause much stress timewise on either the sender or the receiver. Since there was 700 more dropped packets than corrupted packets, and the fact that both are handled similarly by the receiver (i.e the receiver doesn't send an Ack for either case, for dropped packets it doesn't know anything came, and for corrupted packets it discards it), I believe that dropped packets was the single biggest contributing factor for transfer time.

Appendix

a) Sender log file (pDrop 0.1)

1 snd	0	S	0	0	0
2 rcv	0.0017731189727783203	SA	0	0	1
3 snd	0.0029916763305664062	A	1	0	1
4 snd	0.02014946937561835	D	1	100	1
5 snd	0.02581620216369629	D	101	100	1
6 rcv	0.0317535400398625	A	1	0	101
7 drop	0.03772735595703125	D	201	100	2
8 rcv	0.0758674144744873	A	2	0	201
9 snd	0.08642911911010742	D	301	100	3
10 rcv/DA	0.09734725952148438	A	2	0	201
11 snd	0.1131134033203125	D	401	100	3
12 rcv/DA	0.12389993667602539	A	2	0	201
13 snd	0.129286527633667	D	501	100	3
14 snd	0.14035415649414062	D	601	100	3
15 rcv/DA	0.14053936931152344	A	2	0	201
16 snd/RXTF	0.16689252853393555	D	201	100	0
17 rcv/DA	0.2373499333557129	A	2	0	201
18 rcv	0.2898995876312256	A	7	0	701
19 snd	0.36176514625549316	D	701	100	8
20 rcv	0.3942553997039795	A	8	0	801
21 snd	0.39974164962768555	D	801	100	9
22 snd	0.42892370986938477	D	901	100	9
23 rcv	0.42144107818603516	A	9	0	901
24 snd	0.43199992179870605	D	1001	100	10
25 rcv	0.43810081481933594	A	10	0	1001
26 snd	0.4436147212982178	D	1101	100	11
27 rcv	0.4490787982940674	A	11	0	1101
28 snd	0.48008275032043457	D	1201	100	12
29 rcv	0.4801661968231201	A	12	0	1201
30 snd	0.49117588996887207	D	1301	100	13
31 rcv	0.49661898612976874	A	13	0	1301
32 snd	0.5281345844265799	D	1401	100	15
33 rcv	0.5280613899230957	A	14	0	1401
34 snd	0.54423785230965576	D	1501	100	15
35 rcv	0.5496985912322998	A	15	0	1501
36 snd	0.5602138042449951	D	1601	100	16
37 rcv	0.5658931732177734	A	16	0	1601
38 snd	0.5714633464813232	D	1701	100	17
39 rcv	0.5772922039031982	A	17	0	1701
40 snd	0.5981624126434326	D	1801	100	18
41 rcv	0.5983145236968994	A	18	0	1801
42 snd	0.6196174621582031	D	1901	100	19
43 rcv	0.6303627490997314	D	19	0	1901
44 drop	0.63557152462005615	A	2001	100	20
45 rcv	0.63557152462005615	A	20	0	2001

46	snd	0.6414048671722412	D	2101	100	21
47	snd	0.6524896621704102	D	2201	100	21
48	rcv/DA	0.657956386077881	A	20	0	2001
49	rcv/DA	0.6738440990447998	A	20	0	2001
50	snd	0.679288387298584	D	2301	100	21
51	rcv/DA	0.700604915688965	A	20	0	2001
52	snd	0.7007827758789062	D	2401	100	21
53	snd/RXTF	0.7168211936950684	D	2001	100	0
54	rcv/DA	0.7358167171478271	A	20	0	2001
55	rcv	0.7801461219787598	A	25	0	2501
56	snd	0.8258426189422607	D	2501	100	26
57	rcv	0.8383224010467529	A	26	0	2601
58	snd	0.8438758850097656	D	2601	100	27
59	rcv	0.8800511360168457	A	27	0	2701
60	drop	0.8801229000091553	D	2701	100	28
61	drop	0.9063458442687988	D	2801	100	28
62	snd	0.978553535540771	D	2901	100	28
63	rcv/DA	0.9892916679382324	A	27	0	2701
64	snd	0.9895672798156738	D	3001	28	28
65	rcv/DA	1.0008718967437744	A	27	0	2701
66	snd/RXTT	1.9059126377105713	D	2701	100	0
67	rcv	1.917388916015625	A	28	0	2801
68	snd/RXTT	2.8219008445739746	D	2801	100	0
69	rcv	2.8537375926971436	A	31	0	3029
70	snd	2.8648550510406494	F	3029	0	32
71	rcv	2.9659812450408936	A	31	0	3029
72	rcv	2.97202062606681152	F	32	0	3030
73	snd	2.9732019901275635	A	3029	0	33
74						
75	Size of the file (in Bytes)	3028				
76	Segments transmitted (including drop & RXT)	39				
77	Number of Segments handled by PLD	35				
78	Number of Segments dropped	4				
79	Number of Segments Corrupted	0				
80	Number of Segments Re-ordered	0				
81	Number of Segments Duplicated	0				
82	Number of Segments Delayed	0				
83	Number of Retransmissions due to TIMEOUT	2				
84	Number of FAST RETRANSMISSION	2				
85	Number of DUP ACKS received	10				

Receiver log File (pDrop 0.1)

1	rcv	0	S	0	0	0
2	snd	0.0015282630920410156	S	0	0	1
3	rcv	0.0027265548706054688	A	1	0	1
4	rcv	0.02522897720336914	D	1	100	1
5	snd	0.02941441535949767	A	1	0	101
6	rcv	0.030447721482323242	D	101	100	1
7	snd	0.03276705741882324	A	2	0	201
8	rcv	0.08675765991210938	D	301	100	3
9	snd/DA	0.08767414093017578	A	2	0	201
10	rcv	0.113156080824597168	D	401	100	3
11	snd/DA	0.11392641067504883	A	2	0	201
12	rcv	0.13424062728881836	D	501	100	3
13	snd/DA	0.135004949725341797	A	2	0	201
14	rcv	0.1454768180847168	D	601	100	3
15	snd/DA	0.1462407112121582	A	2	0	201
16	rcv	0.17185211181640625	D	201	100	0
17	snd	0.17547321319580078	A	7	0	701
18	rcv	0.36679720878601074	D	701	100	8
19	snd	0.36834216117858887	A	8	0	801
20	rcv	0.4046897888183594	D	801	100	9
21	snd	0.40612316131591797	A	9	0	901
22	rcv	0.4260270595550537	D	901	100	9
23	snd	0.427487850189209	A	10	0	1001
24	rcv	0.4281914234161377	D	1001	100	10
25	snd	0.42963433265686035	A	11	0	1101
26	rcv	0.44859886169433594	D	1101	100	11
27	snd	0.4499826431274414	A	12	0	1201
28	rcv	0.48017001152038574	D	1201	100	12
29	snd	0.48186254501342773	A	13	0	1301
30	rcv	0.4961371421813965	D	1301	100	13
31	snd	0.49753260612487793	A	14	0	1401
32	rcv	0.5333468914031982	D	1401	100	14
33	snd	0.53476428985595	A	15	0	1501
34	rcv	0.5492541790008545	D	1501	100	15
35	snd	0.5506632328033447	A	16	0	1601
36	rcv	0.5653369426727295	D	1601	100	16
37	snd	0.5667593479156494	A	17	0	1701
38	rcv	0.5764153003692627	D	1701	100	17
39	snd	0.5779342651367188	A	18	0	1801
40	rcv	0.598060679101562	D	1801	100	18
41	snd	0.5996189117431641	A	19	0	1901
42	rcv	0.6193215847015381	D	1901	100	19
43	snd	0.6206576824188232	A	20	0	2001
44	rcv	0.6464526653289795	D	2101	100	21
45	snd/DA	0.6471583843231201	A	20	0	2001

46 rcv	0.6574914455413818	D	2201	100	21
47 snd/DA	0.6582129001617432	A	20	0	2001
48 rcv	0.6842374801635742	D	2301	100	21
49 snd/DA	0.68524478986602783	A	20	0	2001
50 rcv	0.7059037685394287	D	2401	100	21
51 snd/DA	0.7067763805389404	A	20	0	2001
52 rcv	0.7217879295349121	D	2001	100	0
53 snd	0.7254538536071777	A	25	0	2501
54 rcv	0.8309977054595947	D	2501	100	26
55 snd	0.832679033279419	A	26	0	2601
56 rcv	0.8488137722015381	D	2601	100	27
57 snd	0.850141268499756	A	27	0	2701
58 rcv	0.983725709533691	D	2901	100	28
59 snd/DA	0.984576940536499	A	27	0	2701
60 rcv	0.9945318698883057	D	3001	28	28
61 snd/DA	0.9952571392059326	A	27	0	2701
62 rcv	1.9109258651733398	D	2701	100	0
63 snd	1.9127628803253174	A	28	0	2801
64 rcv	2.8269145488739014	D	2801	100	0
65 snd	2.8298354148864746	A	31	0	3029
66 rcv	2.870003623962492	F	3029	0	32
67 snd	2.870830774307251	A	32	0	3030
68 snd	2.9720866680145264	F	32	0	3030
69 rcv	2.97454643249517	A	33	0	3029
70					
71 Amount of data received (in Bytes)	3028				
72 Total segments received	35				
73 Data segments received	31				
74 Data segments with Bit Errors	0				
75 Duplicate data segments received	0				
76 Duplicate ACKs sent	10				

Sender Log File (pDrop 0.3)

1 snd	0	S	0	0	0
2 rcv	0.0018813618076994297	SA	0	0	1
3 snd	0.0013321308615234375	A	1	0	1
4 drop	0.010326862335205078	D	1	100	1
5 snd	0.011689424514770508	D	101	100	1
6 snd	0.01729186903076172	D	201	100	1
7 snd	0.035938262939453125	D	301	100	1
8 drop	0.04201245307922363	D	401	100	1
9 rcv/DA	0.036624908447265625	A	0	0	1
10 rcv/DA	0.06206536293029785	A	0	0	1
11 rcv/DA	0.072987575645751953	A	0	0	1
12 FDrop	0.0839226245880127	D	1	100	1
13 drop	1.5768487453466693	D	1	100	1
14 snd/RXTT	3.1398364868164062	D	1	100	0
15 rcv	3.1583299937740776	A	4	0	401
16 snd	3.240262336738996	D	501	100	5
17 rcv/DA	3.240262336738996	A	4	0	401
18 drop	3.2499916553497314	D	601	100	5
19 drop	3.2967889308929443	D	701	100	5
20 snd	3.36364483833313	D	801	100	5
21 rcv/DA	3.3996446675872803	A	4	0	401
22 snd/RXTT	4.893354177474976	D	401	100	0
23 rcv	4.961411714553833	A	6	0	601
24 drop	4.986024618148804	D	901	100	7
25 snd	5.0090599906005859	D	1001	100	7
26 rcv/DA	5.087184429168701	A	6	0	601
27 snd/RXTT	6.590274333953857	D	601	100	0
28 rcv	6.62217187801507	A	7	0	701
29 snd	6.6362155509082	D	1101	100	8
30 rcv/DA	6.694713354110718	A	7	0	701
31 snd/RXTT	8.206872463226318	D	701	100	0
32 rcv	8.294037818908691	A	9	0	901
33 snd	8.330110788345337	D	1201	100	10
34 drop	8.346233367919922	D	1301	100	10
35 rcv/DA	8.351648569107056	A	9	0	901
36 snd/RXTT	9.853125995367432	D	901	100	0
37 rcv	9.910037084071045	A	13	0	1301
38 drop	9.946053981781006	D	1401	100	14
39 drop	9.96363615989685	D	1501	100	14
40 snd	9.97462010383606	D	1601	100	14
41 rcv/DA	9.986377954483032	A	13	0	1301
42 snd	9.991022325567027	D	1701	100	14
43 rcv/DA	10.0022323567027	A	15	0	1301
44 drop	11.514092206954956	D	1301	100	14
45 snd/RXTT	13.032993524932861	D	1301	100	0
46 rcv	13.130041122436523	A	14	0	1401
47 snd	13.182121753692627	D	1801	100	15
48 rcv/DA	13.24361276626587	A	14	0	1401
49 snd/RXTT	14.755342245101929	D	1401	100	0
50 rcv	14.817791223526001	A	15	0	1501
51 drop	14.843486309051514	D	1901	100	16
52 drop	16.32425856590271	D	1501	100	16
53 drop	17.851880073547363	D	1501	100	16

54 drop	19.411656141281128	D	1501	100	16
55 drop	20.937868356704712	D	1501	100	16
56 snd/RXTT	22.472802877426147	D	1501	100	0
57 rcv	22.611042622705078	A	19	0	1901
58 snd	22.66615676198828	D	2001	100	20
59 snd	22.67878246307373	D	2101	100	20
60 rcv/DA	22.678965652216797	A	19	0	1901
61 snd	22.68452024459839	D	2201	100	20
62 rcv/DA	22.700771808624268	A	19	0	1901
63 snd	22.700565614971924	D	2301	100	20
64 rcv/DA	22.71694116592407	A	19	0	1901
65 FRdrop	22.738309621810913	D	1901	100	20
66 rcv/DA	22.749495983123278	A	19	0	1901
67 snd/RXTT	24.234955072402954	D	1901	100	0
68 rcv	24.28603196144104	A	24	0	2401
69 drop	24.321959733963013	D	2401	100	25
70 drop	24.342957258224487	D	2501	100	25
71 drop	24.354134798049927	D	2601	100	25
72 snd	24.365149974822998	D	2701	100	25
73 rcv/DA	24.392184495925903	A	24	0	2401
74 snd	24.4077627658844	D	2801	100	25
75 rcv/DA	24.418615102767944	A	24	0	2401
76 drop	25.930251359939575	D	2401	100	25
77 snd/RXTT	27.465545415878296	D	2401	100	0
78 rcv	27.550894604492188	A	25	0	2501
79 drop	27.5860914190647	D	2901	100	26
80 snd/RXTT	29.03415083885193	D	2501	100	0
81 rcv	29.097023487091064	A	26	0	2601
82 snd	29.143824577331543	D	3001	28	27
83 rcv/DA	29.149702672143555	A	26	0	2601
84 drop	30.656439304351807	D	2601	100	27
85 snd/RXTT	32.17417883872986	D	2601	100	0
86 rcv	32.18562984466553	A	29	0	2901
87 drop	33.68618416786194	D	2901	100	30
88 snd/RXTT	35.22218918800354	D	2901	100	0
89 rcv	35.265167236328125	A	31	0	3029
90 snd	35.28778600692749	F	3029	0	32
91 rcv	35.38890790939331	A	31	0	3029
92 rcv	35.39498209953308	F	32	0	3030
93 snd	35.39601731300354	A	3029	0	33
94					
95 Size of the file (in Bytes)	3028				
96 Segments transmitted (including drop & RXT)	59				
97 Number of Segments handled by PLD	55				
98 Number of Segments dropped	24				
99 Number of Segments Corrupted	0				
100 Number of Segments Re-ordered	0				
101 Number of Segments Duplicated	0				
102 Number of Segments Delayed	0				
103 Number of Retransmissions due to TIMEOUT	22				
104 Number of FAST RETRANSMISSION	2				
105 Number of DUP ACKS received	18				

Receiver Log File (pDrop 0.3)

1 rcv	0	S	0	0	0
2 snd	0.0013802051544189453	SA	0	0	1
3 rcv	0.0029665608978271484	A	1	0	1
4 rcv	0.025099754333496094	D	101	100	1
5 snd/DA	0.026175975799560547	A	0	0	1
6 rcv	0.026996175247192383	D	201	100	1
7 snd/DA	0.0302514651232812	A	0	0	1
8 rcv	0.04087376594543457	D	301	100	1
9 snd/DA	0.042043209975923734	A	0	0	1
10 rcv	3.115478754043579	D	1	100	0
11 snd	3.11890125276582	A	4	0	401
12 rcv	3.2125930786132812	D	501	100	5
13 snd/DA	3.213693857192993	A	4	0	401
14 rcv	3.338324785232544	D	801	100	5
15 snd/DA	3.3392646312713623	A	4	0	401
16 rcv	4.8983213901519775	D	401	100	0
17 snd	4.903478384017944	A	6	0	601
18 rcv	5.0140922269549546	D	1001	100	7
19 snd/DA	5.015094995498657	A	6	0	601
20 rcv	6.59526249511719	D	601	100	0
21 snd	6.596875429153442	A	7	0	701
22 rcv	6.66865754275794	D	1101	100	8
23 snd/DA	6.66965755727913	A	7	0	701
24 rcv	8.21224927992217	D	701	100	0
25 snd	8.21843433380127	A	9	0	901
26 rcv	8.335066965637207	D	1201	100	18
27 snd/DA	8.33596579032898	A	9	0	901
28 rcv	9.858095645904541	D	901	100	0
29 snd	9.861684322357178	A	13	0	1301
30 rcv	9.979738712310791	D	1601	100	14
31 snd/DA	9.98082801589966	A	13	0	1301
32 rcv	9.996954202651978	D	1701	100	14
33 snd/DA	9.99771785736084	A	13	0	1301
34 rcv	13.03702163696289	D	1301	100	0
35 snd	13.046465396881104	A	14	0	1401
36 rcv	13.1870852732833	D	1801	100	15
37 snd/DA	13.18815690858597	A	14	0	1401
38 rcv	14.710638713836567	D	1401	100	0
39 snd	14.7623603343496362	A	15	0	1501
40 rcv	22.472647428512573	D	1501	100	0
41 snd	22.47653341293335	A	19	0	1901
42 rcv	22.67192029953083	D	2001	100	28
43 snd/DA	22.672977924346924	A	19	0	1901
44 rcv	22.683634042739868	D	2101	100	20
45 snd/DA	22.68454647064209	A	19	0	1901
46 rcv	22.690450429916382	D	2201	100	20
47 snd/DA	22.691208839416504	A	19	0	1901
48 rcv	22.70543670654297	D	2301	100	20
49 snd/DA	22.706169366836548	A	19	0	1901
50 rcv	24.245221376419067	D	1901	100	0
51 snd	24.25421643257141	A	24	0	2401
52 rcv	24.370115288151367	D	2701	100	25
53 snd/DA	24.371113061904907	A	24	0	2401

54 rcv	24.40760040283203	D	2801	100	25
55 snd/DA	24.408446311958684	A	24	0	2401
56 rcv	27.47850976753235	D	2401	100	0
57 snd	27.472315549850464	A	25	0	2501
58 rcv	29.03952145576477	D	2501	100	0
59 snd	29.046117305755615	A	26	0	2601
60 rcv	29.143657445907593	D	3001	28	27
61 snd/DA	29.144461393356323	A	26	0	2601
62 rcv	32.17913317680359	D	2601	100	0
63 snd	32.18211102485657	A	29	0	2901
64 rcv	35.22727012634277	D	2901	100	0
65 snd	35.229633888135986	A	31	0	3029
66 rcv	35.29293179512024	F	3029	0	32
67 snd	35.293729066848755	A	32	0	3030
68 snd	35.39493536949158	F	32	0	3030
69 rcv	35.411051750183105	A	33	0	3029
70					
71 Amount of data received (in Bytes)	3028				
72 Total segments received	35				
73 Data segments received	31				
74 Data segments with Bit Errors	0				
75 Duplicate data segments received	0				
76 Duplicate ACKs sent	18				

3) (Sender Log File Snippets, gamma = 2)

1 snd	0	S	0	0	0
2 rcv	0.0009608268737792969	SA	0	0	1
3 snd	0.0017039775848388672	A	1	0	1
4 snd	0.002573728561401367	D	1	50	1
5 drop	0.003306150436401367	D	51	50	1
6 drop	0.003967761993408203	D	151	50	1
7 snd	0.0845855045318603516	D	201	50	1
8 drop	0.085177479863769531	D	251	50	1
9 snd	0.0857735443115234375	D	301	50	1
10 drop	0.0064029693603515625	D	351	50	1
11 snd	0.006981372833251953	D	401	50	1
12 snd	0.00757145881652832	D	451	50	1
13 rcv	0.0917661190032959	A	1	0	51
14 rcv/DA	0.10258007049560547	A	1	0	51
15 rcv/DA	0.11331439018249512	A	1	0	51
16 rcv/DA	0.12402105331420898	A	1	0	51
17 snd/RXTT	0.13480877876281738	D	51	50	0
18 rcv/DA	0.14559388160705566	A	1	0	51
19 rcv	0.15647292137145996	A	2	0	101
20 drop	0.1998147964477539	D	551	50	3
21 snd/delay	0.2518746852874756	D	101	50	1
22 rcv	0.279799699783252	A	3	0	151
23 snd	0.3318600654602051	D	601	50	4
24 rcv/DA	0.36779141426086426	A	3	0	151
25 snd/delay	1.0239777565002441	D	501	50	2
26 rcv/DA	1.0739338397979736	A	3	0	151
27 drop	2.0491104125976562	D	151	50	4
28 snd/RXTT	3.0858376026153564	D	151	50	0
29 rcv	3.146815061569214	A	5	0	251
30 drop	3.1746562915802	D	651	50	6
31 drop	3.210488796234131	D	701	50	6
32 drop	4.151744604110718	D	251	50	6
33 snd/RXTT	5.183029890060425	D	251	50	0
34 rcv	5.280935525894165	A	7	0	351
35 drop	5.327897071838379	D	751	50	8
36 drop	5.345368385314941	D	801	50	8
37 snd/RXTT	6.2703001499176025	D	351	50	0

18688 snd/delay	6375. 0962834358215	D	308051	50	6153
18689 rcv/DA	6375. 107787132263	A	6152	0	307601
18690 snd/RXTF	6375. 1333813661	D	307601	50	0
18691 rcv	6375. 14441801175	A	6156	0	307801
18692 drop	6375. 197826633453	D	308101	50	6157
18693 snd	6375. 205462694168	D	308201	3	6157
18694 rcv/DA	6375. 216596126556	A	6156	0	307801
18695 snd/delay	6375. 783854722077	D	308151	50	6157
18696 rcv/DA	6376. 82679438501	A	6156	0	307801
18697 drop	6376. 479746580124	D	307801	50	6157
18698 snd/RXTT	6377. 159979184096	D	307801	50	0
18699 rcv	6377. 187341451645	A	6157	0	307851
18700 snd/delay	6377. 891353368759	D	307851	50	0
18701 rcv	6377. 90706638475	A	6159	0	307951
18702 drop	6378. 569798707962	D	307951	50	6160
18703 snd/RXTT	6379. 259932279587	D	307951	50	0
18704 rcv	6379. 282785892487	A	6162	0	308101
18705 drop	6379. 9455189704895	D	308101	50	6163
18706 snd/RXTT	6380. 629544258118	D	308101	50	0
18707 rcv	6380. 667129039764	A	6165	0	308204
18708 snd	6380. 6894273757935	F	308204	0	6166
18709 rcv	6380. 790380239487	A	6165	0	308204
18710 rcv	6380. 796459436417	F	6166	0	308205
18711 snd	6380. 797326087952	A	308204	0	6167
18712					
18713 Size of the file (in Bytes)	308203				
18714 Segments transmitted (including drop & RXT)	12508				
18715 Number of Segments handled by PLD	12504				
18716 Number of Segments dropped	6304				
18717 Number of Segments Corrupted	0				
18718 Number of Segments Re-ordered	0				
18719 Number of Segments Duplicated	0				
18720 Number of Segments Delayed	1243				
18721 Number of Retransmissions due to TIMEOUT	6108				
18722 Number of FAST RETRANSMISSION	231				
18723 Number of DUP ACKS received	3086				

Receiver Log File Snippets (Gamma = 2)

1 rcv	0	S	0	0	0
2 snd	0.0806980370422363281	SA	0	0	1
3 rcv	0.001568966428710028	A	1	0	1
4 rcv	0.827930250794589844	D	50	0	1
5 snd	0.03011465072631836	A	1	0	51
6 rcv	0.03892265129893555	D	201	50	1
7 snd/DA	0.03011465133911133	A	1	0	51
8 rcv	0.03730511665344238	D	301	50	1
9 snd/DA	0.03809821545410156	A	1	0	51
10 rcv	0.03879666328430176	D	401	50	1
11 snd/DA	0.039576053619384766	A	1	0	51
12 rcv	0.040287017822265625	D	451	50	1
13 snd/DA	0.041049957275390625	A	1	0	51
14 rcv	0.13988900184631348	D	51	50	0
15 snd	0.14142021259613037	A	2	0	101
16 rcv	0.25695204734862246	D	101	50	1
17 snd	0.25845789909362793	A	3	0	151
18 rcv	0.33696484565734863	D	601	50	4
19 snd/DA	0.33943748474121094	A	3	0	151
20 rcv	1.029043436050415	D	501	50	2
21 snd/DA	1.0299992561340332	A	3	0	151
22 rcv	3.091153621673584	D	151	50	0
23 snd	3.093863010406494	A	5	0	251
24 rcv	5.188104152679443	D	251	50	0
25 snd	5.190259695053101	A	7	0	351
26 rcv	6.275397539138794	D	351	50	0
27 snd	6.278369665145874	A	11	0	551
28 rcv	6.432904958724976	D	1001	50	12
29 snd/DA	6.433567762374878	A	11	0	551
30 rcv	11.66980433460503	D	551	50	0
31 snd	11.672221422195435	A	13	0	651
32 rcv	12.044985294342041	D	1101	50	14
33 snd/DA	12.045841693878174	A	13	0	651

12380 rcv	6371.5716483592999	D	307901	50	6151
12381 snd/DA	6371.572489976883	A	6150	0	307501
12382 rcv	6374.337012529373	D	307501	50	0
12383 snd	6374.339153051376	A	6152	0	307601
12384 rcv	6374.480946302414	D	308001	50	6153
12385 snd/DA	6374.481785297394	A	6152	0	307601
12386 rcv/dup	6374.497263431549	D	307501	50	0
12387 snd/DA	6374.4981009960175	A	6152	0	307601
12388 rcv	6375.096236944199	D	308051	50	6153
12389 snd/DA	6375.09725022316	A	6152	0	307601
12390 rcv	6375.13838338819	D	307601	50	0
12391 snd	6375.14159488678	A	6156	0	307801
12392 rcv	6375.210459947586	D	308201	3	6157
12393 snd/DA	6375.21133685112	A	6156	0	307801
12394 rcv	6375.789093255997	D	308151	50	6157
12395 snd/DA	6375.78998208046	A	6156	0	307801
12396 rcv	6377.165234804153	D	307801	50	0
12397 snd	6377.17178606987	A	6157	0	307851
12398 rcv	6377.896444797516	D	307851	50	0
12399 snd	6377.89849114418	A	6159	0	307951
12400 rcv	6379.265071392059	D	307951	50	0
12401 snd	6379.267978668213	A	6162	0	308101
12402 rcv	6380.63472533226	D	308101	50	0
12403 snd	6380.637104511261	A	6165	0	308204
12404 rcv	6380.694788455963	F	308204	0	6166
12405 snd	6380.695496559143	A	6166	0	308205
12406 snd	6380.796428442081	F	6166	0	308205
12407 rcv	6380.797447919846	A	6167	0	308204
12408					
12409 Amount of data received (in Bytes)			308203		
12410 Total segments received			6204		
12411 Data segments received			6200		
12412 Data segments with Bit Errors			0		
12413 Duplicate data segments received			35		
12414 Duplicate ACKs sent			3086		

Sender Log File (gamma = 4)

1 snd	0	S	0	0	0
2 rcv	0.0011026859263447266	SA	0	0	1
3 snd	0.0016103853149414062	A	1	0	1
4 snd	0.002511739730834961	D	1	50	1
5 drop	0.0032553672790527344	D	51	50	1
6 drop	0.00394343298339844	D	151	50	1
7 snd	0.004635810852050781	D	201	50	1
8 drop	0.0053064823150634766	D	251	50	1
9 snd	0.006021738052368164	D	301	50	1
10 drop	0.006695747375488281	D	351	50	1
11 snd	0.0074384212493896484	D	401	50	1
12 snd	0.008156061172485352	D	451	50	1
13 rcv	0.10666413879394531	A	1	0	51
14 rcv/DA	0.10651922225952148	A	1	0	51
15 rcv/DA	0.17826477485656738	A	1	0	51
16 rcv/DA	0.1991722583770752	A	1	0	51
17 snd/RXTF	0.22525668144226074	D	51	50	0
18 rcv/DA	0.24113845825195312	A	1	0	51
19 rcv	0.25229787826538086	A	2	0	161
20 snd/delay	0.25256824493408203	D	101	50	1
21 drop	0.2680978775024414	D	551	50	3
22 rcv	0.2682020664215688	A	3	0	151
23 snd	0.31586217888249823	D	601	50	4
24 rcv/DA	0.37791013717651367	A	3	0	151
25 snd/delay	1.0299797058105469	D	501	50	2
26 rcv/DA	1.0510187149047852	A	3	0	151
27 drop	2.6097323894508732	D	151	50	4
28 snd/RXTT	4.179250717163086	D	151	50	0
29 rcv	4.31939172744751	A	5	0	251
30 drop	4.371819019317627	D	651	50	6
31 drop	4.392319917678833	D	701	50	6
32 drop	5.862597703933716	D	251	50	6
33 snd/RXTT	7.467935085296631	D	251	50	0
34 rcv	7.548932790756226	A	7	0	351
35 drop	7.583812952041626	D	751	50	8
36 drop	7.59693717956543	D	801	50	8
37 snd/RXTT	9.107626914978027	D	351	50	0
38 rcv	9.147822141647339	A	11	0	551

18579 drop	10118..558006286621	D	307801	50	6148
18580 rcv/DA	10118..558215379715	A	6147	0	307351
18581 snd/RXTT	10119..887626886368	D	307351	50	0
18582 rcv	10119..91937160492	A	6148	0	307401
18583 snd	10119..969974279404	D	307851	50	6149
18584 rcv/DA	10120..019822835922	A	6148	0	307401
18585 snd/RXTT	10121..331877231598	D	307401	50	0
18586 rcv	10121..33381149292	A	6149	0	307451
18587 snd	10121..449858455658	D	307901	50	6150
18588 rcv/DA	10121..4480797567368	A	6149	0	307451
18589 drop	10122..77822266388	D	307451	50	6150
18590 snd/RXTT	10124..114929199219	D	307451	50	0
18591 rcv	10124..279284477234	A	6151	0	307551
18592 snd	10124..319967426834	D	307951	50	6152
18593 rcv/DA	10124..330240249634	A	6151	0	307551
18594 snd	10124..335624933243	D	308001	50	6152
18595 rcv/DA	10124..356833457947	A	6151	0	307551
18596 snd/RXTT	10125..691884756088	D	307551	50	0
18597 rcv	10125..74316740036	A	6156	0	307801
18598 drop	10125..784926891327	D	308101	50	6157
18599 snd	10125..805424928665	D	308151	50	6157
18600 snd	10125..816667318344	D	308201	3	6157
18601 rcv/DA	10125..816723823547	A	6156	0	307801
18602 rcv/DA	10125..838101387024	A	6156	0	307801
18603 snd/delay	10125..871852397919	D	308051	50	6157
18604 rcv/DA	10125..923724412918	A	6156	0	307801
18605 snd/RXTF	10125..964854001999	D	307801	50	0
18606 rcv	10125..995823860168	A	6162	0	308101
18607 drop	10127..29058319664	D	308101	50	6163
18608 drop	10128..643839120865	D	308101	50	6163
18609 snd/RXTT	10129..993810653687	D	308101	50	0
18610 rcv	10130..865427064896	A	6165	0	308204
18611 snd	10130..866230535507	F	308204	0	6166
18612 rcv	10130..167083501816	A	6165	0	308204
18613 rcv	10130..173089265823	F	6166	0	308205
18614 snd	10130..174001216888	A	308204	0	6167
18615	18616 Size of the file (in Bytes)		308203		
18617 Segments transmitted (including drop & RXT)		12446			
18618 Number of Segments handled by PLD		12442			
18619 Number of Segments dropped		6277			
18620 Number of Segments Corrupted		0			
18621 Number of Segments Re-ordered		0			
18622 Number of Segments Duplicated		0			
18623 Number of Segments Delayed		1234			
18624 Number of Retransmissions due to TIMEOUT		6046			
18625 Number of FAST RETRANSMISSION		231			
18626 Number of DUP ACKS received		3088			

Receiver Log File (gamma = 4)

1 rcv	0	S	0	0	0
2 snd	0.0008640289306640625	SA	0	0	1
3 rcv	0.00163231672668457031	A	1	0	1
4 rcv	0.020786285409390625	D	1	50	1
5 snd	0.03952145576477051	A	1	0	51
6 rcv	0.040151119232177734	D	201	50	1
7 snd/DA	0.04073214530944824	A	1	0	51
8 rcv	0.0412974356849805	D	301	50	1
9 snd/DA	0.04188132286871777	A	1	0	51
10 rcv	0.0424234865095473	D	401	50	1
11 snd/DA	0.0430119376281738	A	1	0	51
12 rcv	0.0435683722644043	D	451	50	1
13 snd/DA	0.04414200782775879	A	1	0	51
14 rcv	0.04464889226989746	D	51	50	0
15 snd	0.22788409418395096	A	2	0	101
16 rcv	0.2574191093444824	D	101	50	1
17 snd	0.25846362113952637	A	3	0	151
18 rcv	0.32079362869262695	D	601	50	4
19 snd/DA	0.33141828536987305	A	3	0	151
20 rcv	1.0349085330963135	D	501	50	2
21 snd/DA	1.0357041358947754	A	3	0	151
22 rcv	4.18418288230896	D	151	50	0
23 snd	4.188502073287964	A	5	0	251
24 rcv	7.4729905128479	D	251	50	0
25 snd	7.474895238876343	A	7	0	351
26 rcv	9.1128602732056	D	351	50	0
27 snd	9.15665197372437	A	11	0	551
28 rcv	9.26518865628662	D	1001	50	12
29 snd/DA	9.265036477279663	A	11	0	551
30 rcv	17.2248427867884	D	551	50	0
31 snd	17.22660618612671	A	13	0	651
32 rcv	17.5807604789333	D	1101	50	14
33 snd/DA	17.5814476013183	A	13	0	651
34 rcv	24.088806059692383	D	651	50	0
35 snd	24.09011294575806	A	14	0	701
36 rcv	25.678280353546143	D	701	50	0
37 snd	25.679627656936646	A	15	0	751
38 rcv	25.7807774543762	D	1201	50	16
39 snd/DA	25.781442460379335	A	15	0	751
40 rcv	29.533389806747437	D	751	50	0

12304 rcv	10118.456842422485	D	307251	50	0
12305 snd	10118.45874619484	A	6147	0	307351
12306 rcv	10118.544777870178	D	307751	50	6148
12307 snd/DA	10118.547852039337	A	6147	0	307351
12308 rcv	10119.892532110214	D	307351	50	0
12309 snd	10119.89375925064	A	6148	0	307401
12310 rcv	10119.974895954132	D	307851	50	6149
12311 snd/DA	10119.975611925125	A	6148	0	307401
12312 rcv	10121.336786746979	D	307401	50	0
12313 snd	10121.339780804495	A	6149	0	307451
12314 rcv	10121.424785852432	D	307901	50	6150
12315 snd/DA	10121.42554140091	A	6149	0	307451
12316 rcv	10124.11994606096	D	307451	50	0
12317 snd	10124.121775388718	A	6151	0	307551
12318 rcv	10124.324807882309	D	307951	50	6152
12319 snd/DA	10124.325537204742	A	6151	0	307551
12320 rcv	10124.340604543686	D	308801	50	6152
12321 snd/DA	10124.341239213943	A	6151	0	307551
12322 rcv	10125.69679570198	D	307551	50	0
12323 snd	10125.700346946716	A	6156	0	307801
12324 rcv	10125.810792446136	D	308151	50	6157
12325 snd/DA	10125.811338663101	A	6156	0	307801
12326 rcv	10125.821534872055	D	308201	3	6157
12327 snd/DA	10125.82222032547	A	6156	0	307801
12328 rcv	10125.877173185349	D	308801	50	6157
12329 snd/DA	10125.8778460337	A	6156	0	307801
12330 rcv	10125.964755286707	D	307801	50	0
12331 snd	10125.967906511984	A	6162	0	308101
12332 rcv	10129.998819589615	D	308101	50	0
12333 snd	10130.001148462296	A	6165	0	308204
12334 rcv	10130.071153640747	F	308204	0	6166
12335 snd	10130.07188463211	A	6166	0	308205
12336 snd	10130.172810316086	F	6166	0	308205
12337 rcv	10130.173892259598	A	6167	0	308204
12338					
12339 Amount of data received (in Bytes)	308203				
12340 Total segments received	6169				
12341 Data segments received	6165				
12342 Data segments with Bit Errors	0				
12343 Duplicate data segments received	0				
12344 Duplicate ACKs sent	3088				

Sender Log File (gamma = 6)

1 bnd	0	S	0	0	0
2 rcv	0.0011489391326904297	SA	0	0	1
3 snd	0.002003980157348633	A	1	0	1
4 snd	0.00328373989899658203	D	1	50	1
5 drop	0.015075922012329102	D	51	50	1
6 drop	0.0453035831451416	D	151	50	2
7 rcv	0.05596470832824707	A	1	0	51
8 snd	0.071929931640625	D	201	50	2
9 drop	0.11288595199584961	D	251	50	2
10 rcv/DA	0.11305642127990723	A	1	0	51
11 snd	0.12394356727600099	D	301	50	2
12 rcv/DA	0.15052199363708496	A	1	0	51
13 drop	0.15587615966796875	D	351	50	2
14 snd	0.217535372369644	D	401	50	2
15 rcv/DA	0.240051365697996	A	1	0	51
16 snd	0.2764148712158203	D	451	50	2
17 snd	0.2865326404571533	D	501	50	2
18 snd/delay	0.2767832279205322	D	101	50	1
19 rcv/DA	0.29677677154541016	A	1	0	51
20 rcv/DA	0.3182046413421631	A	1	0	51
21 rcv/DA	0.34937000274658203	A	1	0	51
22 FRdrop	0.42099738121032715	D	51	50	2
23 snd/delay	1.1989002227783203	D	51	50	0
24 rcv	1.2468578815466205	A	3	0	151
25 snd	1.2988922595977783	D	551	50	4
26 rcv/DA	1.3252384662628174	A	3	0	151
27 drop	1.3386972986499268	D	601	50	4
28 snd/RXT	3.518835174051377	D	151	50	0
29 rcv	3.518835174051377	A	5	0	251
30 drop	3.6188316345214844	D	651	50	6
31 drop	3.6364541053771973	D	701	50	6
32 drop	5.731708897216797	D	251	50	6
33 snd/RXT	7.914928674697876	D	251	50	0
34 rcv	8.040905207061768	A	7	0	351
35 drop	8.100078105926514	D	751	50	8
36 drop	8.120750427246694	D	801	50	8
37 snd/RXT	10.2069229922103882	D	351	50	0
38 rcv	10.314737796783447	A	12	0	601
39 drop	10.361004829406738	D	851	50	13
40 drop	10.381664037704468	D	981	50	13
41 drop	10.392861127853394	D	951	50	13
42 drop	10.413865089416504	D	1851	50	13
43 snd/delay	10.442862272262573	D	1801	50	13
44 rcv/DA	10.484569549560547	A	12	0	601

18588 rcv/DA	14375 .0927298069	A	6147	0	307351
18589 drop	14377 .318533182144	D	307351	50	6148
18590 snd/RXT	14379 .577899456924	D	307351	50	0
18591 rcv	14379 .640859127045	A	6149	0	307451
18592 snd	14379 .726997014847	D	307851	50	6150
18593 rcv/DA	14379 .743705511093	A	6149	0	307451
18594 snd	14379 .749139785767	D	307901	50	6150
18595 rcv/DA	14379 .769941091537	A	6149	0	307451
18596 snd/RXT	14382 .063654289597	D	307451	50	0
18597 rcv	14382 .142059803009	A	6154	0	307701
18598 drop	14382 .170929431915	D	308001	50	6155
18599 snd	14382 .196595430374	D	308051	50	6155
18600 snd	14382 .213427066803	D	308101	50	6155
18601 rcv/DA	14382 .213307380676	A	6154	0	307701
18602 snd	14382 .230578184128	D	308151	50	6155
18603 rcv/DA	14382 .235945224762	A	6154	0	307701
18604 rcv/DA	14382 .255471944899	A	6154	0	307701
18605 snd/delay	14382 .255722522736	D	307951	50	6155
18606 FRdrop	14382 .266725063324	D	307701	50	6155
18607 rcv/DA	14382 .282743215561	A	6154	0	307701
18608 drop	14384 .486874818802	D	307701	50	6155
18609 snd/RXT	14386 .738505601883	D	307701	50	0
18610 rcv	14386 .803482532501	A	6160	0	308001
18611 drop	14386 .830868244171	D	308201	3	6161
18612 drop	14389 .014179706573	D	308001	50	6161
18613 snd/RXT	14391 .254966974258	D	308001	50	0
18614 rcv	14391 .266708135605	A	6164	0	308201
18615 snd/RXT	14393 .48693066875	D	308201	3	0
18616 rcv	14393 .529914617538	A	6165	0	308204
18617 snd	14393 .55247592926	F	308204	0	6166
18618 rcv	14393 .753701925278	A	6166	0	308205
18619 rcv	14393 .759650945663	F	6166	0	308205
18620 snd	14393 .760637044907	A	308204	0	6167
18621					
18622 Size of the file (in Bytes)	308203				
18623 Segments transmitted (including drop & RXT)	12450				
18624 Number of Segments handled by PLD	12446				
18625 Number of Segments dropped	6279				
18626 Number of Segments Corrupted	0				
18627 Number of Segments Re-ordered	0				
18628 Number of Segments Duplicated	0				
18629 Number of Segments Delayed	1234				
18630 Number of Retransmissions due to TIMEOUT	6034				
18631 Number of FAST RETRANSMISSION	247				
18632 Number of DUP ACKS received	3114				

Receiver Log File (gamma = 6)

1 rcv	0	S	0	0	0
2 snd	0.0007085800170898438	SA	0	0	1
3 rcv	0.0018854141235351562	D	1	0	1
4 rcv	0.008296012878417969	D	1	50	1
5 snd	0.009854793548583984	A	1	0	51
6 rcv	0.07727885246276855	D	201	50	2
7 snd/DA	0.07813501358832227	A	1	0	51
8 rcv	0.1289818286895752	D	301	50	2
9 snd/DA	0.12982821464538574	A	1	0	51
10 rcv	0.2176520824432373	D	401	50	2
11 snd/DA	0.2183846274810791	A	1	0	51
12 rcv	0.2805309295654297	D	451	50	2
13 snd/DA	0.2812495231628418	A	1	0	51
14 rcv	0.28183984756469727	D	101	50	1
15 snd/DA	0.2824440002441406	A	1	0	51
16 rcv	0.291640043258667	D	501	50	2
17 snd/DA	0.2923400402069992	A	1	0	51
18 rcv	1.2039439678192139	D	51	50	0
19 snd	1.2061147689819336	A	3	0	151
20 rcv	1.3039116859436035	D	551	50	4
21 snd/DA	1.3048267364501953	A	3	0	151
22 rcv	3.518275822506714	D	151	50	0
23 snd	3.5204522609710693	A	5	0	251
24 rcv	7.920252323156635	D	251	50	0
25 snd	7.922428131103516	A	7	0	351
26 rcv	10.212184429168701	D	351	50	0
27 snd	10.21573543548584	A	12	0	601
28 rcv	10.4488004007339478	D	1001	50	13
29 snd/DA	10.448764562666812	A	12	0	601
30 rcv	19.26816964149475	D	601	50	0
31 snd	19.269845724105835	A	13	0	651
32 rcv	21.70818305015564	D	651	50	0
33 snd	21.709571838378906	A	14	0	701
34 rcv	28.4520131574707	D	701	50	0
35 snd	28.453531742095947	A	15	0	751
36 rcv	30.679173231124878	D	751	50	0
37 snd	30.685870885849	A	16	0	801
38 rcv	30.798488987548828	D	1251	50	17
39 snd/DA	30.806476831436157	A	16	0	801
40 rcv	35.81192064285278	D	801	50	0
41 snd	35.816216230392456	A	17	0	851
42 rcv	40.196176528930664	D	851	50	0
12310 rcv	14372.670319088353	D	307751	50	6147
12311 snd/DA	14372.676333994266	A	6146	0	307301
12312 rcv	14374.982256412506	D	307301	50	0
12313 snd	14374.98417854309	A	6147	0	307351
12314 rcv	14375.071841100151	D	307801	50	6148
12315 snd/DA	14375.072585636407	A	6147	0	307351
12316 rcv	14379.562909584045	D	307351	50	0
12317 snd	14379.585204601288	A	6149	0	307451
12318 rcv	14379.73213855689	D	307851	50	6150
12319 snd/DA	14379.732978343964	A	6149	0	307451
12320 rcv	14379.75412607193	D	307901	50	6150
12321 snd/DA	14379.754889996057	A	6149	0	307451
12322 rcv	14382.068946838379	D	307451	50	0
12323 snd	14382.074254989624	A	6154	0	307701
12324 rcv	14382.2028223152079	D	308051	50	6155
12325 snd/DA	14382.219447851181	A	6154	0	307701
12326 rcv	14382.220334768295	D	3080101	50	6155
12327 snd/DA	14382.235813379288	A	6154	0	307701
12328 rcv	14382.2366583324732	D	308151	50	6155
12329 snd/DA	14382.260724544525	A	6154	0	307701
12330 rcv	14382.26142168045	D	307951	50	6155
12331 snd/DA	14382.74531227112	A	6154	0	307701
12332 rcv	14386.743531227112	D	307701	50	0
12333 snd	14386.748057365417	A	6160	0	308001
12334 rcv	14391.260001897812	D	308001	50	0
12335 snd	14391.263415336699	A	6164	0	308201
12336 rcv	14393.491945028305	D	308201	3	0
12337 snd	14393.493413630752	A	6165	0	308204
12338 rcv	14393.557720422745	F	308204	0	6166
12339 snd	14393.558454990387	A	6166	0	308205
12340 snd	14393.759445667267	F	6166	0	308205
12341 rcv	14393.767382383347	A	6167	0	308204
12342					
12343 Amount of data received (in Bytes)	308203				
12344 Total segments received	6171				
12345 Data segments received	6167				
12346 Data segments with Bit Errors	0				
12347 Duplicate data segments received	2				
12348 Duplicate ACKs sent	3114				

Part c Sender Log File

1 snd	0	S	0	0	0
2 rcv	0.001386880874633789	SA	0	0	1
3 snd	0.001996040342382812	A	1	0	1
4 snd/Cor	0.008549213409423828	D	1	50	1
5 snd	0.037778377532958984	D	51	50	1
6 rcv/DA	0.06003689765930176	A	0	0	1
7 snd	0.0756175580358887	D	101	50	1
8 rcv/DA	0.09161257743835449	A	0	0	1
9 snd	0.10261106491088867	D	151	50	1
10 rcv/DA	0.11836743354797363	A	0	0	1
11 snd	0.12375235557556152	D	201	50	1
12 snd/RXT	0.12933945655822754	D	1	50	0
13 snd	0.1447293758392334	D	251	50	1
14 snd/Cor	0.17171168327331543	D	301	50	1
15 snd/DUP	0.1715545654296875	D	1	50	0
16 snd	0.18253421783447266	D	351	50	1
17 rcv/DA	0.18811821937561035	A	0	0	1
18 snd	0.2035686966975708	D	401	50	1
19 rcv	0.214409953024292	A	5	0	251
20 snd	0.219818115234375	D	451	50	6
21 rcv	0.2251069557458496	A	6	0	301
22 snd	0.23891062789917	D	501	50	7
23 rcv/DA	0.2310166358947754	A	6	0	301
24 snd/Cor	0.23645353317260742	D	551	50	7
25 rcv/DA	0.24184560775756836	A	6	0	301
26 snd	0.24716687262453613	D	601	50	7
27 rcv/DA	0.2528359889984131	A	6	0	301
28 snd	0.2583029270172119	D	651	50	7
29 snd/RXT	0.2636866569519043	D	301	50	0
30 snd	0.2693347936998293	D	751	50	7
31 rcv/DA	0.2694422721862793	A	6	0	301
32 rcv/DA	0.2958977222442627	A	6	0	301
33 rcv/DA	0.3168489933013916	A	6	0	301
34 snd/RXT	0.3377835750579834	D	301	50	0
35 snd/DUP	0.37487220764160156	D	301	50	0
82107 snd	1565.6760001182556	D	1605401	50	32101
82108 rcv	1565.6764554977417	A	32101	0	1605051
82109 rcv/DA	1565.6771850585938	A	32101	0	1605051
82110 snd/rord	1565.6762351989746	D	1605201	50	32099
82111 snd	1565.6774451732635	D	1605451	50	32102
82112 rcv/DA	1565.6778593063354	A	32101	0	1605051
82113 rcv/DA	1565.6785893446247	A	32101	0	1605051
82114 snd/RXT	1565.6893348693848	D	1605051	50	0
82115 snd	1565.678704738617	D	1605501	50	32102
82116 rcv/DA	1565.6955609321594	A	32101	0	1605051
82117 snd/DUP	1565.701141834259	D	1605501	50	32102
82118 rcv/DA	1565.7065389156342	A	32101	0	1605051
82119 rcv/DA	1565.7196831703186	A	32101	0	1605051
82120 snd/RXT	1565.7304606437683	D	1605051	50	0
82121 rcv/DA	1565.7412884235382	A	32101	0	1605051
82122 rcv/DA	1565.752204656601	A	32101	0	1605051
82123 rcv/DA	1565.7630457878113	A	32101	0	1605051
82124 rcv/DA	1565.7739112377167	A	32101	0	1605051
82125 rcv	1565.78469193337708	A	32111	0	1605551
82126 rcv/DA	1565.7954668998718	A	32111	0	1605551
82127 snd	1565.7957730293274	D	1605551	35	32112
82128 rcv/DA	1565.80104470253	A	32111	0	1605551
82129 rcv	1565.8122763633728	A	32112	0	1605586
82130 snd	1565.8230636119843	F	1605586	0	32113
82131 rcv	1566.824086713791	A	32113	0	1605587
82132 rcv	1566.8301070213318	F	32113	0	1605587
82133 snd	1566.831002521515	A	1605586	0	32114
82134					
82135 Size of the file (in Bytes)			1605585		
82136 Segments transmitted (including drop & RXT)			44838		
82137 Number of Segments handled by PLD			44834		
82138 Number of Segments dropped			4187		
82139 Number of Segments Corrupted			3353		
82140 Number of Segments Re-ordered			2138		
82141 Number of Segments Duplicated			3678		
82142 Number of Segments Delayed			0		
82143 Number of Retransmissions due to TIMEOUT			2771		
82144 Number of FAST RETRANSMISSION			6273		
82145 Number of DUP ACKS received			26471		

Part c Receiver Log File

	0	S	0	0	0
1 rcv	0.0011267662048339844	S A	0	0	0
2 snd	0.00209656529846191406	A	1	0	1
3 rcv	0.026479482650756836	D	1	50	1
4 rcv/Cor	0.04290890693664551	D	51	50	1
5 rcv	0.0438170430444336	A	0	0	1
6 snd/DA	0.080535888671875	D	101	50	1
7 rcv	0.08123540878295898	A	0	0	1
8 snd/DA	0.10754132270812988	D	151	50	1
9 rcv	0.1081843376159668	A	0	0	1
10 snd/DA	0.12865805625915527	D	201	50	1
11 rcv	0.1295003898991211	A	0	0	1
12 snd/DA	0.13006114959716797	D	1	50	0
13 rcv	0.1331472396850586	A	5	0	251
14 snd	0.14452195167541504	D	251	50	1
15 rcv	0.14595317840576172	A	6	0	301
16 snd	0.1765439510345459	D	1	50	0
17 rcv/dup	0.1776123046875	A	6	0	301
18 snd/DA	0.1781907081604904	D	301	50	1
19 rcv/Cor	0.187389373777929688	D	351	50	1
20 rcv	0.1880810260772705	A	6	0	301
21 snd/DA	0.20878124237060547	D	401	50	1
22 rcv	0.2095693103027344	A	6	0	301
23 snd/DA	0.22473597526550293	D	451	50	6
24 rcv	0.22559428215026855	A	6	0	301
25 snd/DA	0.23587250709533691	D	501	50	7
26 rcv	0.23647546768188477	A	6	0	301
27 snd/DA	0.23707222938537598	D	551	50	7
28 rcv/Cor	0.2521629333496094	D	601	50	7
29 rcv	0.25290989875793457	A	6	0	301
30 snd/DA	0.2632758617401123	D	651	50	7
31 rcv	0.26397252082824707	A	6	0	301
32 snd/DA	0.26454925537109375	D	301	50	0

77920 snd/DA	1565.6633727550507	A	32101	0	1605051
77921 rcv/dup	1565.6639289855957	D	1605251	50	32099
77922 snd/DA	1565.6646523475647	A	32101	0	1605051
77923 rcv	1565.6652069091797	D	1605301	50	32099
77924 snd/DA	1565.6656987667084	A	32101	0	1605051
77925 rcv	1565.6661999225616	D	1605351	50	32099
77926 snd/DA	1565.6666989326477	A	32101	0	1605051
77927 rcv	1565.680932044983	D	1605401	50	32101
77928 snd/DA	1565.6815967559814	A	32101	0	1605051
77929 rcv	1565.6821377277374	D	1605201	50	32099
77930 snd/DA	1565.6827628612518	A	32101	0	1605051
77931 rcv	1565.68337392807	D	1605451	50	32102
77932 snd/DA	1565.6840181350708	A	32101	0	1605051
77933 rcv	1565.6845955848694	D	1605501	50	32102
77934 snd/DA	1565.685210943222	A	32101	0	1605051
77935 rcv	1565.694321155548	D	1605051	50	0
77936 snd	1565.7133116722107	A	32111	0	1605551
77937 rcv/dup	1565.714280128479	D	1605501	50	32102
77938 snd/DA	1565.7149102667836	A	32111	0	1605551
77939 rcv/dup	1565.7373847961426	D	1605051	50	0
77940 snd/DA	1565.7474942207336	A	32111	0	1605551
77941 rcv	1565.8007125854492	D	1605551	35	32112
77942 snd	1565.8025329113007	A	32112	0	1605586
77943 rcv	1565.828084230423	F	1605586	0	32113
77944 snd	1565.828740119934	A	32113	0	1605587
77945 snd	1566.0298051834106	F	32113	0	1605587
77946 rcv	1566.0308418273926	A	32114	0	1605586
77947					
77948 Amount of data received (in Bytes)	1605585				
77949 Total segments received	40650				
77950 Data segments received	40646				
77951 Data segments with Bit Errors	3353				
77952 Duplicate data segments received	4879				
77953 Duplicate ACKs sent	26471				