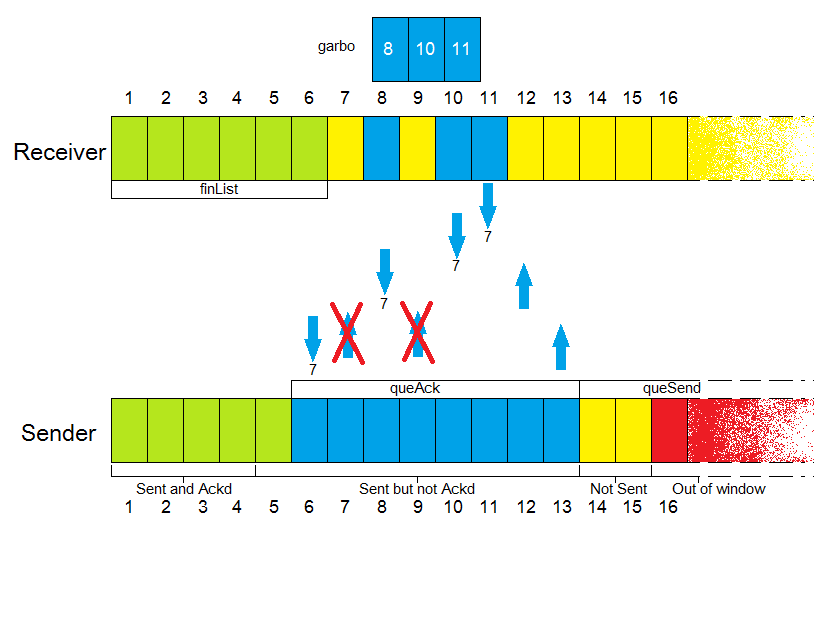
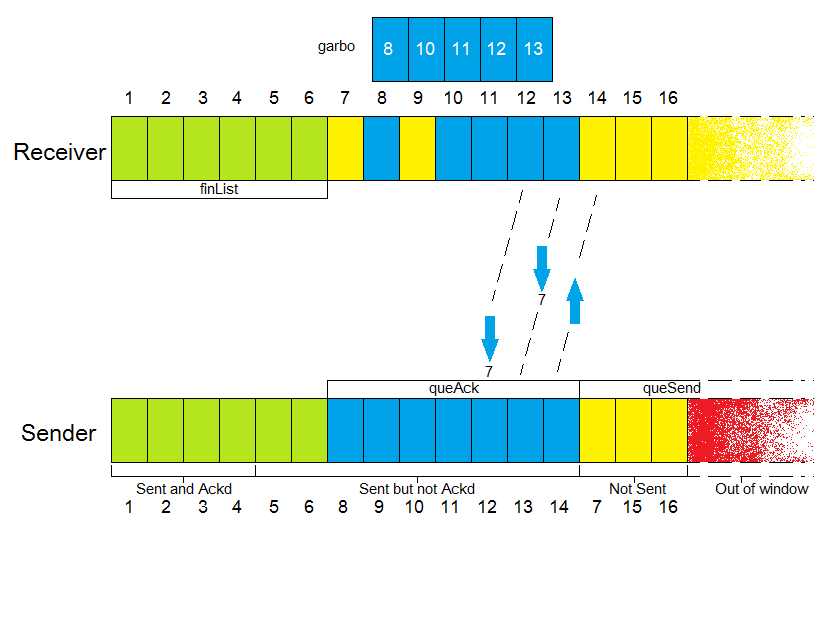
This project was completed using python 2.7.12, but seems to work fine on the uni default (2.7.3). Note that the explanation of how the program works uses packet numbers as segment numbers for readability (and segment numbers are too difficult to do in Microsoft paint). The program uses a byte count for segment and acknowledgement numbers (as you can see in the STP Header section)

The STP protocol has been implemented in five very distinct steps:

1. The receiver binds itself to the port number it was given and waits for a request. Meanwhile, the Sender takes in its arguments and breaks up the text file (that is to be delivered) into chunks that are all of size MSS (except for the last one, which is likely smaller). These chunks are stored in the packet[] list in a class called dataSeg, where they have 5 fields:
   * num (the order that the dataSeg is in, 0 being the first dataSeg),
   * data (the actual text of the dataSeg),
   * size,
   * timeSent and
   * retrains (a flag used solely for logging purposes)
2. Both the sender and receiver go through the formality of the SYN, SYNACK, and ACK handshake. It is worth noting that there is no error-checking or recovery done at this stage
3. The sender sends its data to the receiver. In ending this step, both programs start step 4.
4. Both sender and receiver go through the formality of the FIN, ACK-FIN, ACK teardown process before closing their sockets. Once again, like step 2, since these packets are guaranteed to make it, no error checking is done.
5. The receiver constructs the output file before both programs make their log file and close.

Obviously, some more information about step 3 is required, but it is hoped that this gives enough of an overview over the other four steps. To handle reading and writing from the same socket, I’ve opted to go for a solution that involves polling of the socket using the select.select() call. This allows both programs to constantly loop while checking to see whether or not their respective sockets are available for reading or writing. A diagram showing how the windows and dropped packets are handled is below (window size 10):

The sender maintains two double ended queues, queAck and queSend. QueAck holds packets that have been sent but not acked, while queSend holds packets that have yet to be sent (regardless of whether or not they are in the window or not). When data transferal starts, queSend is filled with all the packets that the sender needs to send. As packets get sent by the sender, those packets get put into queAck. When those packets are acknowledged, they are dropped from queAck. The sender recognizes that is has finished its job when both queAck and queSend are empty.

The receiver also maintains two lists (not queues), finList and garbo. FinList is fairly straightforward; it holds all of the data from the in-order packets it has received from sender. Garbo holds the data and segment number of all of the out-of-order packets. For every packet it receives, it sends out an ACK with the segment number of the next in-order packet it expects. In the previous image, you can see that packets 7 and 9 are not going to make it. Packets 8,10 and 11 are already in garbo (as they have arrived out of order) and it looks like 12 and 13 are also going to end up in garbo, while you can see that receiver is still waiting on packet 7.

When the four ACK packets asking for packet 7 (3 duplicate ACKs) arrive at the sender, the sender performs a fast retransmit and puts packet 7 at the front queSend such that it is the next packet to be sent. While handling the four ACK packets, sender has already sent packet 14 (which will end up in garbo). Notice that because packet 6 has been acknowledged, the window has moved forwards by one packet. Assuming that packet 7 makes it, packet 9 will perform a fast retransmit when packet 17 is acked by the receiver (or it times out). When packet 7 makes it to the receiver, the receiver will add it to finList and look through garbo for packet 8. When it finds packet 8 it will look through garbo for 9. Not finding that, it will then send an ACK for packet 9 in response to packets 7, 15,16 and 17 (as 17 and 18 will have entered the window by then). The size of the window is maintained by the subtracting the last byte acked (6 in this case – because 7 is the next expected one) from the last byte sent (14 in this case). As the window size is 10, the sender will keep transmitting until the window is full.

After the sender has checked its socket to see whether or not it can be written or read from, it then looks through queAck and checks the timeSent field in each of the dataSegs inside queAck. If the timeSent field is more than <timeout> milliseconds ago, it removes that packet from queAck and puts it at the front of queSend again.

It should be worth noting that if a packet has timed out, it can be fast retransmitted by the sender again (two examples of this actually happen in one of the later questions).

The sender will keep looping until queAck and queSend are both empty, whereupon it will send a FIN segment and loop while waiting for a FINACK response from the receiver. The receiver will keep looping until it receives a FIN segment from the sender, whereupon it will send a FINACK in response and prepare to finish connection teardown.

Features implemented:

All of the features detailed in the assignment specification for both the Sender and the Receiver have been implemented. In more detail, this means:

* A three-way handshake is used to establish a connection. It does not recover if the handshake is interrupted by anything, but that feature is not required
* A four-segment connection termination. This is done in three stages (FIN, ACK-FIN, ACK), again because these packets were guaranteed and we were allowed to do so. This occasionally gets broken up by some ACK segments for duplicate packets that the sender has already realized that it doesn’t need to wait for. An example would involve the sender timing out on some packets and sending out the last 3 packets again just as the receiver replies with an ACK for everything. The sender will then send a FIN segment but the receiver will still send three more ACKs before seeing the FIN segment and replying with ACK-FIN
* Timeout operations are conducted using a universal timer (time.time()), timing out based on the supplied argument
* The simplified TCP sender is implement where each segment is the same size as MSS (with the usual exception of the final segment) and labelled accordingly with the correct sequence number
* Fast retransmits are implemented. A packet will only be retransmitted once unless the retransmitted packet also times out, upon which that packet becomes re-eligible for fast retransmit again.
* All packets are immediately acknowledged with cumulative acknowledgements
* Out-of-order packets are all buffered and put into their correct place once the in-order packet is received
* Sequence and acknowledgement numbers are in the STP header and byte-encoded, following a system that is similar to TCP (using 16-bit numbers instead of 32-bit numbers)
* Both sequence and acknowledgement numbers will properly overflow back to 0 if they go above 2^16-1.
* Segment and acknowledgement numbers will increment by 1 during the handshake process
* MSS and MWS restrictions are followed (program sets internal maximum of 20000 for both variables)
* MWS is implemented by following the invariant that
* The PLD module is implemented by an if statement just before the packet is sent. If the randomly generated number is more than pdrop, then the packet is sent. Otherwise, it is not sent, but the program assumes it has been sent.
* Logs are supplied after the completion of a file upload
* The receiver will put the transferred file into the filename given to it in the program arguments

STP Header

Just before a packet is sent, a 5 byte header is tacked onto the front of it using the packHeader(SYN,ACK,FIN,segNum,ackNum) function. When a packet is received, the first 5 bytes are broken back up into their individual pieces using the unpackHeader(header) function. The header is as follows:

* Byte 1: 5x0 (padding bits), SYN, ACK, FIN e.g. 00000110 is SYN+ACK
* Byte 2-3: 16-bit Segment number (first byte sent) e.g. if 500 bytes of data have currently been sent and a 50 byte packet is sent, the segment number of that packet is 500 and segment number of the next packet is 550
* Byte 4-5: 16-bit ACK number (next in-order byte expected) e.g. if 500 bytes of data have already been sent and the sender sends a 50 byte packet (segment number 500) the receiver will respond with an ACK number of 550, which is the segment number of the next expected packet from the sender.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | **SYN** | **ACK** | **FIN** |  |
| 16-bit Segment number (first byte sent) | | | | | | | | |
| 16-bit ACK number (next byte expected) | | | | | | | | |

Program testing

For testing my program, I chose a timeout of 10ms, seeing as picking very low values resulted in a transmission speed that was slightly slower (about 5ms) but making it higher caused the sender to spend too much time idling. Picking a nice round number also makes looking through the logs a lot easier as spotting timeouts is fairly trivial.

Running the previous experiment (pdrop = .1 & .3, MWS = 500, MSS = 50, seed = 300, timeout = 10ms) on test1.txt, I observed these packets at the receiver:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I have marked out duplicate packets in yellow highlighting, fast retransmitted packets in green and retransmitted packets due to timeout in blue. Packets that had to be sent more than twice are in red (for various reasons that will be explored in further detail). When you see two entries in bold, it means that packets have dropped between them.  When pdrop was equal to 0.1 transmission went very smoothly (as one would expect). Dropped packets tended to be spaced out far enough away from each other such that they could be picked up by fast retransmits.  When pdrop was raised to 0.3, things got a little trickier. A much larger number of packets dropped and we also saw 2 packets getting resent more than 2 times (the ones coloured red). A quick rundown of exactly what happened to those two is below.  39619 – drop, timeout (drop), fast retransmit  40319 – drop, timeout (drop), fast retransmit  Both of the packets that got dropped three times got dropped when they timed out (they could not have been fast retransmitted because another fast retransmit had occurred too recently – see packets 39469 and 40269), but got fast retransmitted after they timed out.  It is interesting that in this case none of the fast retransmits dropped (in other runs on older versions of the code a packet had to be resent 3 times), but the sender does have the capability to handle any combination of drops during fast retransmit or timeout retransmissions.  Of course, some of the fast retransmits still worked just fine (packets 39219, 39469, 40269) and once again the timeout at the end was caused by a lack of available duplicate ACKS for the sender to make a fast retransmit. | |  |  |  |  | | --- | --- | --- | --- | | **pdrop = .1** | | **pdrop = .3** | | | **time** | **seq** | **time** | **seq** | | 0 | 39168 | 0 | 39168 | | 0 | 39169 | 0.001 | 39169 | | 0.001 | **39169** | 0.002 | **39169** | | 0.001 | **39269** | 0.002 | **39269** | | 0.001 | 39319 | 0.002 | 39319 | | 0.001 | 39369 | 0.002 | 39369 | | 0.001 | 39419 | 0.002 | **39419** | | 0.001 | 39469 | 0.002 | **39519** | | 0.001 | 39519 | 0.002 | **39219** | | 0.001 | 39569 | 0.003 | **39719** | | 0.001 | 39619 | 0.003 | 39769 | | 0.001 | **39219** | 0.003 | 39819 | | 0.002 | **39719** | 0.003 | 39869 | | 0.002 | 39769 | 0.003 | **39919** | | 0.002 | 39819 | 0.003 | **39469** | | 0.002 | 39869 | 0.003 | 40019 | | 0.002 | 39919 | 0.003 | **40069** | | 0.002 | 39669 | 0.013 | **39569** | | 0.002 | 39969 | 0.013 | **39669** | | 0.002 | 40019 | 0.013 | 40169 | | 0.002 | 40069 | 0.014 | 39719 | | 0.002 | 40119 | 0.014 | 39769 | | 0.002 | **40169** | 0.014 | 39819 | | 0.002 | **40269** | 0.014 | 39869 | | 0.002 | 40319 | 0.014 | **39619** | | 0.002 | 40369 | 0.014 | **39969** | | 0.002 | 40419 | 0.014 | 40019 | | 0.002 | 40469 | 0.014 | 40069 | | 0.002 | 40219 | 0.014 | 40119 | | 0.002 | **40519** | 0.014 | **40219** | | 0.002 | **40619** | 0.014 | **40369** | | 0.002 | 40669 | 0.014 | 40419 | | 0.003 | 40719 | 0.014 | **40469** | | 0.003 | 40569 | 0.015 | **40569** | | 0.003 | 40760 | 0.015 | 40269 | |  |  | 0.015 | 40669 | |  |  | 0.015 | **40719** | |  |  | 0.025 | **40369** | |  |  | 0.025 | 40419 | |  |  | 0.025 | 40469 | |  |  | 0.025 | 40319 | |  |  | 0.026 | **40519** | |  |  | 0.026 | **40619** | |  |  | 0.026 | **40719** | |  |  | 0.026 | 40760 | |

Finally, I ran 3 experiments with pdrop 0.1, MWS = 500, MSS = 50, seed = 300 and timeout values set at 10, 40, 2.5 and 1ms using test2.txt, giving me a table:

|  |  |  |
| --- | --- | --- |
| Timeout (ms) | No. of transmitted packets | Time taken |
| 10 | 44 | 2ms |
| 40 | 44 | 2ms |
| 2.5 | 44 | 3ms |
| 1 | 46 | 3ms |

Note that I do not include the time it took for the handshake since that isn’t affected by the timeout. They also do not count in the number of transmitted packets since again, they aren’t affected by the timeout. That being said, a timeout did not happen for the given values of Tcurrent, 4Tcurrent and Tcurrent/4 (all 4 dropped packets were being fast retransmitted before they could be timed out), so I feel as though the time taken measurement is mostly down to the speed at which my computer could handle the data transfer. To see what would happen if timeouts did occur, I also tested a timeout of 1 millisecond. This DID result in a few timeouts and is reflected in the higher number of retransmitted packets. I would theorise that at higher pdrop values a value between 10 and 2.5ms would be optimal such that fast retransmits would still have time to execute so that timeouts don’t send duplicate packets, but the timeout would not be too high such that the sender spends too long waiting idly for its packets to time out.

# APPENDIX

Sending test1.txt with mss = 50, mws = 500, timeout = 10ms, pdrop = .1, seed = 300

Sender\_log

Action time type seq size ack

snd 0.0 S 39168 0 0

rcv 0.001 SA 6186 0 39168

snd 0.001 A 39169 0 6186

rcv 0.001 A 6187 0 39169

snd 0.002 D 39169 50 6187

drop 0.002 D 39219 50 6187

snd 0.002 D 39269 50 6187

snd 0.002 D 39319 50 6187

snd 0.002 D 39369 50 6187

snd 0.002 D 39419 50 6187

snd 0.002 D 39469 50 6187

rcv 0.002 A 6187 0 39219

snd 0.002 D 39519 50 6187

rcv 0.002 A 6187 0 39219

snd 0.002 D 39569 50 6187

rcv 0.002 A 6187 0 39219

snd 0.002 D 39619 50 6187

rcv 0.002 A 6187 0 39219

snd 0.002 D 39219 50 6187

rcv 0.002 A 6187 0 39219

drop 0.002 D 39669 50 6187

rcv 0.002 A 6187 0 39219

snd 0.002 D 39719 50 6187

rcv 0.002 A 6187 0 39219

snd 0.003 D 39769 50 6187

rcv 0.003 A 6187 0 39219

rcv 0.003 A 6187 0 39219

rcv 0.003 A 6187 0 39669

snd 0.003 D 39819 50 6187

rcv 0.003 A 6187 0 39669

snd 0.003 D 39869 50 6187

rcv 0.003 A 6187 0 39669

snd 0.003 D 39919 50 6187

rcv 0.003 A 6187 0 39669

snd 0.003 D 39669 50 6187

rcv 0.003 A 6187 0 39669

snd 0.003 D 39969 50 6187

rcv 0.003 A 6187 0 39669

snd 0.003 D 40019 50 6187

snd 0.003 D 40069 50 6187

rcv 0.003 A 6187 0 39969

snd 0.003 D 40119 50 6187

rcv 0.003 A 6187 0 40019

snd 0.003 D 40169 50 6187

rcv 0.003 A 6187 0 40069

drop 0.003 D 40219 50 6187

rcv 0.003 A 6187 0 40119

snd 0.003 D 40269 50 6187

rcv 0.003 A 6187 0 40169

snd 0.003 D 40319 50 6187

rcv 0.003 A 6187 0 40219

snd 0.003 D 40369 50 6187

rcv 0.003 A 6187 0 40219

snd 0.003 D 40419 50 6187

rcv 0.003 A 6187 0 40219

snd 0.003 D 40469 50 6187

rcv 0.003 A 6187 0 40219

snd 0.003 D 40219 50 6187

rcv 0.003 A 6187 0 40219

snd 0.003 D 40519 50 6187

rcv 0.003 A 6187 0 40219

drop 0.003 D 40569 50 6187

rcv 0.003 A 6187 0 40519

snd 0.003 D 40619 50 6187

rcv 0.003 A 6187 0 40569

snd 0.003 D 40669 50 6187

snd 0.003 D 40719 41 6187

rcv 0.003 A 6187 0 40569

rcv 0.004 A 6187 0 40569

rcv 0.004 A 6187 0 40569

snd 0.004 D 40569 50 6187

rcv 0.004 A 6187 0 40760

snd 0.004 F 40760 0 6187

rcv 0.005 A 6187 0 40760

rcv 0.005 FA 6187 0 40760

snd 0.008 A 40761 0 6187

Amount of (original) Data Transferred (in bytes): 1591

Number of Data Segments Sent (excluding retransmissions): 32

Number of (all) Packets Dropped (by the PLD module): 4

Number of Retransmitted Segments: 4

Number of Duplicate Acknowledgements received: 22

Receiver\_log

Action time type seq size ack

rcv 0.0 S 39168 0 0

snd 0.0 SA 6186 0 39168

rcv 0.0 A 39169 0 6186

snd 0.0 A 6187 0 39169

rcv 0.001 D 39169 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39269 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39319 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39369 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39419 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39469 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39519 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39569 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39619 50 6187

snd 0.001 A 6187 0 39219

rcv 0.001 D 39219 50 6187

snd 0.001 A 6187 0 39669

rcv 0.002 D 39719 50 6187

snd 0.002 A 6187 0 39669

rcv 0.002 D 39769 50 6187

snd 0.002 A 6187 0 39669

rcv 0.002 D 39819 50 6187

snd 0.002 A 6187 0 39669

rcv 0.002 D 39869 50 6187

snd 0.002 A 6187 0 39669

rcv 0.002 D 39919 50 6187

snd 0.002 A 6187 0 39669

rcv 0.002 D 39669 50 6187

snd 0.002 A 6187 0 39969

rcv 0.002 D 39969 50 6187

snd 0.002 A 6187 0 40019

rcv 0.002 D 40019 50 6187

snd 0.002 A 6187 0 40069

rcv 0.002 D 40069 50 6187

snd 0.002 A 6187 0 40119

rcv 0.002 D 40119 50 6187

snd 0.002 A 6187 0 40169

rcv 0.002 D 40169 50 6187

snd 0.002 A 6187 0 40219

rcv 0.002 D 40269 50 6187

snd 0.002 A 6187 0 40219

rcv 0.002 D 40319 50 6187

snd 0.002 A 6187 0 40219

rcv 0.002 D 40369 50 6187

snd 0.002 A 6187 0 40219

rcv 0.002 D 40419 50 6187

snd 0.002 A 6187 0 40219

rcv 0.002 D 40469 50 6187

snd 0.002 A 6187 0 40219

rcv 0.002 D 40219 50 6187

snd 0.002 A 6187 0 40519

rcv 0.002 D 40519 50 6187

snd 0.002 A 6187 0 40569

rcv 0.002 D 40619 50 6187

snd 0.002 A 6187 0 40569

rcv 0.002 D 40669 50 6187

snd 0.002 A 6187 0 40569

rcv 0.003 D 40719 41 6187

snd 0.003 A 6187 0 40569

rcv 0.003 D 40569 50 6187

snd 0.003 A 6187 0 40760

rcv 0.003 F 40760 0 6187

snd 0.004 FA 6187 0 40760

Amount of (original) Data Received (in bytes): 1591

Number of (original) Data Segments Received: 32

Number of duplicate segments received (if any): 0

Sending test1.txt with mss = 50, mws = 500, timeout = 10ms, pdrop = .3, seed = 300

Sender\_log

Action time type seq size ack

snd 0.0 S 39168 0 0

rcv 0.001 SA 22956 0 39168

snd 0.001 A 39169 0 22956

rcv 0.001 A 22957 0 39169

snd 0.002 D 39169 50 22957

drop 0.002 D 39219 50 22957

snd 0.002 D 39269 50 22957

snd 0.002 D 39319 50 22957

snd 0.002 D 39369 50 22957

rcv 0.002 A 22957 0 39219

snd 0.002 D 39419 50 22957

rcv 0.002 A 22957 0 39219

drop 0.002 D 39469 50 22957

rcv 0.002 A 22957 0 39219

snd 0.002 D 39519 50 22957

rcv 0.002 A 22957 0 39219

snd 0.002 D 39219 50 22957

rcv 0.002 A 22957 0 39219

drop 0.002 D 39569 50 22957

rcv 0.002 A 22957 0 39219

drop 0.002 D 39619 50 22957

drop 0.002 D 39669 50 22957

rcv 0.002 A 22957 0 39469

snd 0.003 D 39719 50 22957

snd 0.003 D 39769 50 22957

snd 0.003 D 39819 50 22957

snd 0.003 D 39869 50 22957

rcv 0.003 A 22957 0 39469

snd 0.003 D 39919 50 22957

rcv 0.003 A 22957 0 39469

drop 0.003 D 39969 50 22957

rcv 0.003 A 22957 0 39469

snd 0.003 D 39469 50 22957

rcv 0.003 A 22957 0 39469

snd 0.003 D 40019 50 22957

rcv 0.003 A 22957 0 39469

rcv 0.003 A 22957 0 39569

snd 0.003 D 40069 50 22957

rcv 0.003 A 22957 0 39569

drop 0.003 D 40119 50 22957

rcv 0.003 A 22957 0 39569

snd 0.013 D 39569 50 22957

drop 0.013 D 39619 50 22957

snd 0.013 D 39669 50 22957

rcv 0.013 A 22957 0 39619

snd 0.013 D 40169 50 22957

rcv 0.013 A 22957 0 39619

rcv 0.013 A 22957 0 39619

snd 0.014 D 39719 50 22957

snd 0.014 D 39769 50 22957

snd 0.014 D 39819 50 22957

snd 0.014 D 39869 50 22957

rcv 0.014 A 22957 0 39619

snd 0.014 D 39619 50 22957

drop 0.014 D 39919 50 22957

rcv 0.014 A 22957 0 39619

snd 0.014 D 39969 50 22957

rcv 0.014 A 22957 0 39619

snd 0.014 D 40019 50 22957

snd 0.014 D 40069 50 22957

rcv 0.014 A 22957 0 39619

snd 0.014 D 40119 50 22957

rcv 0.014 A 22957 0 39969

snd 0.014 D 40219 50 22957

rcv 0.014 A 22957 0 40119

drop 0.014 D 40269 50 22957

rcv 0.014 A 22957 0 40119

drop 0.014 D 40319 50 22957

rcv 0.014 A 22957 0 40119

snd 0.014 D 40369 50 22957

rcv 0.014 A 22957 0 40219

snd 0.014 D 40419 50 22957

rcv 0.014 A 22957 0 40269

snd 0.014 D 40469 50 22957

rcv 0.014 A 22957 0 40269

drop 0.015 D 40519 50 22957

rcv 0.015 A 22957 0 40269

snd 0.015 D 40569 50 22957

rcv 0.015 A 22957 0 40269

snd 0.015 D 40269 50 22957

drop 0.015 D 40619 50 22957

rcv 0.015 A 22957 0 40269

snd 0.015 D 40669 50 22957

snd 0.015 D 40719 41 22957

rcv 0.015 A 22957 0 40319

rcv 0.015 A 22957 0 40319

rcv 0.015 A 22957 0 40319

drop 0.025 D 40319 50 22957

snd 0.025 D 40369 50 22957

snd 0.025 D 40419 50 22957

snd 0.025 D 40469 50 22957

rcv 0.025 A 22957 0 40319

snd 0.025 D 40319 50 22957

rcv 0.025 A 22957 0 40319

rcv 0.025 A 22957 0 40319

rcv 0.025 A 22957 0 40519

snd 0.026 D 40519 50 22957

drop 0.026 D 40569 50 22957

snd 0.026 D 40619 50 22957

drop 0.026 D 40669 50 22957

snd 0.026 D 40719 41 22957

rcv 0.026 A 22957 0 40619

rcv 0.026 A 22957 0 40760

snd 0.026 F 40760 0 22957

rcv 0.028 A 22957 0 40760

rcv 0.028 A 22957 0 40760

rcv 0.028 FA 22957 0 40760

snd 0.031 A 40761 0 22957

Amount of (original) Data Transferred (in bytes): 1591

Number of Data Segments Sent (excluding retransmissions): 32

Number of (all) Packets Dropped (by the PLD module): 16

Number of Retransmitted Segments: 21

Number of Duplicate Acknowledgements received: 31

Receiver\_log

Action time type seq size ack

rcv 0.0 S 39168 0 0

snd 0.001 SA 22956 0 39168

rcv 0.001 A 39169 0 22956

snd 0.001 A 22957 0 39169

rcv 0.002 D 39169 50 22957

snd 0.002 A 22957 0 39219

rcv 0.002 D 39269 50 22957

snd 0.002 A 22957 0 39219

rcv 0.002 D 39319 50 22957

snd 0.002 A 22957 0 39219

rcv 0.002 D 39369 50 22957

snd 0.002 A 22957 0 39219

rcv 0.002 D 39419 50 22957

snd 0.002 A 22957 0 39219

rcv 0.002 D 39519 50 22957

snd 0.002 A 22957 0 39219

rcv 0.002 D 39219 50 22957

snd 0.002 A 22957 0 39469

rcv 0.003 D 39719 50 22957

snd 0.003 A 22957 0 39469

rcv 0.003 D 39769 50 22957

snd 0.003 A 22957 0 39469

rcv 0.003 D 39819 50 22957

snd 0.003 A 22957 0 39469

rcv 0.003 D 39869 50 22957

snd 0.003 A 22957 0 39469

rcv 0.003 D 39919 50 22957

snd 0.003 A 22957 0 39469

rcv 0.003 D 39469 50 22957

snd 0.003 A 22957 0 39569

rcv 0.003 D 40019 50 22957

snd 0.003 A 22957 0 39569

rcv 0.003 D 40069 50 22957

snd 0.003 A 22957 0 39569

rcv 0.013 D 39569 50 22957

snd 0.013 A 22957 0 39619

rcv 0.013 D 39669 50 22957

snd 0.013 A 22957 0 39619

rcv 0.013 D 40169 50 22957

snd 0.013 A 22957 0 39619

rcv 0.014 D 39719 50 22957

snd 0.014 A 22957 0 39619

rcv 0.014 D 39769 50 22957

snd 0.014 A 22957 0 39619

rcv 0.014 D 39819 50 22957

snd 0.014 A 22957 0 39619

rcv 0.014 D 39869 50 22957

snd 0.014 A 22957 0 39619

rcv 0.014 D 39619 50 22957

snd 0.014 A 22957 0 39969

rcv 0.014 D 39969 50 22957

snd 0.014 A 22957 0 40119

rcv 0.014 D 40019 50 22957

snd 0.014 A 22957 0 40119

rcv 0.014 D 40069 50 22957

snd 0.014 A 22957 0 40119

rcv 0.014 D 40119 50 22957

snd 0.014 A 22957 0 40219

rcv 0.014 D 40219 50 22957

snd 0.014 A 22957 0 40269

rcv 0.014 D 40369 50 22957

snd 0.014 A 22957 0 40269

rcv 0.014 D 40419 50 22957

snd 0.014 A 22957 0 40269

rcv 0.014 D 40469 50 22957

snd 0.014 A 22957 0 40269

rcv 0.015 D 40569 50 22957

snd 0.015 A 22957 0 40269

rcv 0.015 D 40269 50 22957

snd 0.015 A 22957 0 40319

rcv 0.015 D 40669 50 22957

snd 0.015 A 22957 0 40319

rcv 0.015 D 40719 41 22957

snd 0.015 A 22957 0 40319

rcv 0.025 D 40369 50 22957

snd 0.025 A 22957 0 40319

rcv 0.025 D 40419 50 22957

snd 0.025 A 22957 0 40319

rcv 0.025 D 40469 50 22957

snd 0.025 A 22957 0 40319

rcv 0.025 D 40319 50 22957

snd 0.025 A 22957 0 40519

rcv 0.026 D 40519 50 22957

snd 0.026 A 22957 0 40619

rcv 0.026 D 40619 50 22957

snd 0.026 A 22957 0 40760

rcv 0.026 D 40719 41 22957

snd 0.026 A 22957 0 40760

rcv 0.026 F 40760 0 22957

snd 0.028 FA 22957 0 40760

Amount of (original) Data Received (in bytes): 1591

Number of (original) Data Segments Received: 32

Number of duplicate segments received (if any): 10

Sending test2.txt with mss = 50, mws = 500, timeout = 10ms, pdrop = .1, seed = 300

Sender\_log

Action time type seq size ack

snd 0.0 S 39168 0 0

rcv 0.0 SA 55845 0 39168

snd 0.0 A 39169 0 55845

rcv 0.001 A 55846 0 39169

snd 0.002 D 39169 50 55846

drop 0.002 D 39219 50 55846

snd 0.002 D 39269 50 55846

snd 0.002 D 39319 50 55846

snd 0.002 D 39369 50 55846

snd 0.002 D 39419 50 55846

rcv 0.002 A 55846 0 39219

snd 0.002 D 39469 50 55846

rcv 0.002 A 55846 0 39219

snd 0.002 D 39519 50 55846

rcv 0.002 A 55846 0 39219

snd 0.002 D 39569 50 55846

rcv 0.002 A 55846 0 39219

snd 0.002 D 39219 50 55846

rcv 0.002 A 55846 0 39219

snd 0.002 D 39619 50 55846

rcv 0.002 A 55846 0 39219

drop 0.002 D 39669 50 55846

rcv 0.002 A 55846 0 39219

snd 0.002 D 39719 50 55846

rcv 0.002 A 55846 0 39219

snd 0.002 D 39769 50 55846

rcv 0.002 A 55846 0 39619

snd 0.003 D 39819 50 55846

rcv 0.003 A 55846 0 39669

snd 0.003 D 39869 50 55846

rcv 0.003 A 55846 0 39669

snd 0.003 D 39919 50 55846

rcv 0.003 A 55846 0 39669

snd 0.003 D 39969 50 55846

rcv 0.003 A 55846 0 39669

snd 0.003 D 39669 50 55846

rcv 0.003 A 55846 0 39669

snd 0.003 D 40019 50 55846

rcv 0.003 A 55846 0 39669

snd 0.003 D 40069 50 55846

rcv 0.003 A 55846 0 39669

snd 0.003 D 40119 50 55846

rcv 0.003 A 55846 0 40019

snd 0.003 D 40169 50 55846

rcv 0.003 A 55846 0 40069

drop 0.003 D 40219 50 55846

rcv 0.003 A 55846 0 40119

snd 0.003 D 40269 50 55846

rcv 0.003 A 55846 0 40169

snd 0.003 D 40319 50 55846

rcv 0.003 A 55846 0 40219

snd 0.003 D 40369 50 55846

rcv 0.003 A 55846 0 40219

snd 0.003 D 40419 50 55846

rcv 0.003 A 55846 0 40219

snd 0.003 D 40469 50 55846

rcv 0.003 A 55846 0 40219

snd 0.003 D 40219 50 55846

rcv 0.003 A 55846 0 40219

snd 0.003 D 40519 50 55846

rcv 0.003 A 55846 0 40219

drop 0.003 D 40569 50 55846

rcv 0.003 A 55846 0 40519

snd 0.003 D 40619 50 55846

rcv 0.003 A 55846 0 40569

snd 0.003 D 40669 50 55846

snd 0.003 D 40719 50 55846

rcv 0.003 A 55846 0 40569

snd 0.003 D 40769 50 55846

rcv 0.004 A 55846 0 40569

snd 0.004 D 40819 50 55846

rcv 0.004 A 55846 0 40569

snd 0.004 D 40569 50 55846

rcv 0.004 A 55846 0 40569

snd 0.004 D 40869 50 55846

rcv 0.004 A 55846 0 40569

snd 0.004 D 40919 50 55846

snd 0.004 D 40969 50 55846

rcv 0.004 A 55846 0 40869

snd 0.004 D 41019 50 55846

rcv 0.004 A 55846 0 40919

snd 0.004 D 41069 50 55846

rcv 0.004 A 55846 0 40969

snd 0.004 D 41119 4 55846

rcv 0.004 A 55846 0 41019

rcv 0.004 A 55846 0 41069

rcv 0.004 A 55846 0 41119

rcv 0.004 A 55846 0 41123

snd 0.004 F 41123 0 55846

rcv 0.006 A 55846 0 41123

rcv 0.006 FA 55846 0 41123

snd 0.008 A 41124 0 55846

Amount of (original) Data Transferred (in bytes): 1954

Number of Data Segments Sent (excluding retransmissions): 40

Number of (all) Packets Dropped (by the PLD module): 4

Number of Retransmitted Segments: 4

Number of Duplicate Acknowledgements received: 24

Receiver\_log

Action time type seq size ack

rcv 0.0 S 39168 0 0

snd 0.0 SA 55845 0 39168

rcv 0.0 A 39169 0 55845

snd 0.001 A 55846 0 39169

rcv 0.002 D 39169 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39269 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39319 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39369 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39419 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39469 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39519 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39569 50 55846

snd 0.002 A 55846 0 39219

rcv 0.002 D 39219 50 55846

snd 0.002 A 55846 0 39619

rcv 0.002 D 39619 50 55846

snd 0.002 A 55846 0 39669

rcv 0.002 D 39719 50 55846

snd 0.002 A 55846 0 39669

rcv 0.002 D 39769 50 55846

snd 0.002 A 55846 0 39669

rcv 0.003 D 39819 50 55846

snd 0.003 A 55846 0 39669

rcv 0.003 D 39869 50 55846

snd 0.003 A 55846 0 39669

rcv 0.003 D 39919 50 55846

snd 0.003 A 55846 0 39669

rcv 0.003 D 39969 50 55846

snd 0.003 A 55846 0 39669

rcv 0.003 D 39669 50 55846

snd 0.003 A 55846 0 40019

rcv 0.003 D 40019 50 55846

snd 0.003 A 55846 0 40069

rcv 0.003 D 40069 50 55846

snd 0.003 A 55846 0 40119

rcv 0.003 D 40119 50 55846

snd 0.003 A 55846 0 40169

rcv 0.003 D 40169 50 55846

snd 0.003 A 55846 0 40219

rcv 0.003 D 40269 50 55846

snd 0.003 A 55846 0 40219

rcv 0.003 D 40319 50 55846

snd 0.003 A 55846 0 40219

rcv 0.003 D 40369 50 55846

snd 0.003 A 55846 0 40219

rcv 0.003 D 40419 50 55846

snd 0.003 A 55846 0 40219

rcv 0.003 D 40469 50 55846

snd 0.003 A 55846 0 40219

rcv 0.003 D 40219 50 55846

snd 0.003 A 55846 0 40519

rcv 0.003 D 40519 50 55846

snd 0.003 A 55846 0 40569

rcv 0.003 D 40619 50 55846

snd 0.003 A 55846 0 40569

rcv 0.003 D 40669 50 55846

snd 0.003 A 55846 0 40569

rcv 0.003 D 40719 50 55846

snd 0.004 A 55846 0 40569

rcv 0.004 D 40769 50 55846

snd 0.004 A 55846 0 40569

rcv 0.004 D 40819 50 55846

snd 0.004 A 55846 0 40569

rcv 0.004 D 40569 50 55846

snd 0.004 A 55846 0 40869

rcv 0.004 D 40869 50 55846

snd 0.004 A 55846 0 40919

rcv 0.004 D 40919 50 55846

snd 0.004 A 55846 0 40969

rcv 0.004 D 40969 50 55846

snd 0.004 A 55846 0 41019

rcv 0.004 D 41019 50 55846

snd 0.004 A 55846 0 41069

rcv 0.004 D 41069 50 55846

snd 0.004 A 55846 0 41119

rcv 0.004 D 41119 4 55846

snd 0.004 A 55846 0 41123

rcv 0.004 F 41123 0 55846

snd 0.006 FA 55846 0 41123

Amount of (original) Data Received (in bytes): 1954

Number of (original) Data Segments Received: 40

Number of duplicate segments received (if any): 0

Sending test2.txt with mss = 50, mws = 500, timeout = 40ms, pdrop = .1, seed = 300

Sender\_log

Action time type seq size ack

snd 0.0 S 39168 0 0

rcv 0.0 SA 56354 0 39168

snd 0.0 A 39169 0 56354

rcv 0.001 A 56355 0 39169

snd 0.002 D 39169 50 56355

drop 0.002 D 39219 50 56355

snd 0.002 D 39269 50 56355

snd 0.002 D 39319 50 56355

snd 0.002 D 39369 50 56355

rcv 0.002 A 56355 0 39219

snd 0.002 D 39419 50 56355

rcv 0.002 A 56355 0 39219

snd 0.002 D 39469 50 56355

rcv 0.002 A 56355 0 39219

snd 0.002 D 39519 50 56355

rcv 0.002 A 56355 0 39219

snd 0.002 D 39219 50 56355

rcv 0.002 A 56355 0 39219

snd 0.002 D 39569 50 56355

rcv 0.002 A 56355 0 39219

snd 0.002 D 39619 50 56355

rcv 0.002 A 56355 0 39219

drop 0.002 D 39669 50 56355

rcv 0.002 A 56355 0 39569

snd 0.002 D 39719 50 56355

rcv 0.002 A 56355 0 39619

snd 0.002 D 39769 50 56355

rcv 0.003 A 56355 0 39669

snd 0.003 D 39819 50 56355

rcv 0.003 A 56355 0 39669

snd 0.003 D 39869 50 56355

rcv 0.003 A 56355 0 39669

snd 0.003 D 39919 50 56355

rcv 0.003 A 56355 0 39669

snd 0.003 D 39669 50 56355

rcv 0.003 A 56355 0 39669

snd 0.003 D 39969 50 56355

rcv 0.003 A 56355 0 39669

snd 0.003 D 40019 50 56355

snd 0.003 D 40069 50 56355

rcv 0.003 A 56355 0 39969

snd 0.003 D 40119 50 56355

rcv 0.003 A 56355 0 40019

snd 0.003 D 40169 50 56355

rcv 0.003 A 56355 0 40069

drop 0.003 D 40219 50 56355

rcv 0.003 A 56355 0 40119

snd 0.003 D 40269 50 56355

rcv 0.003 A 56355 0 40169

snd 0.003 D 40319 50 56355

rcv 0.003 A 56355 0 40219

snd 0.003 D 40369 50 56355

rcv 0.003 A 56355 0 40219

snd 0.003 D 40419 50 56355

rcv 0.003 A 56355 0 40219

snd 0.003 D 40469 50 56355

rcv 0.003 A 56355 0 40219

snd 0.003 D 40219 50 56355

rcv 0.003 A 56355 0 40219

snd 0.003 D 40519 50 56355

rcv 0.003 A 56355 0 40219

drop 0.004 D 40569 50 56355

rcv 0.004 A 56355 0 40519

snd 0.004 D 40619 50 56355

rcv 0.004 A 56355 0 40569

snd 0.004 D 40669 50 56355

rcv 0.004 A 56355 0 40569

snd 0.004 D 40719 50 56355

snd 0.004 D 40769 50 56355

rcv 0.004 A 56355 0 40569

snd 0.004 D 40819 50 56355

rcv 0.004 A 56355 0 40569

snd 0.004 D 40569 50 56355

rcv 0.004 A 56355 0 40569

snd 0.004 D 40869 50 56355

rcv 0.004 A 56355 0 40569

snd 0.004 D 40919 50 56355

rcv 0.004 A 56355 0 40869

snd 0.004 D 40969 50 56355

rcv 0.004 A 56355 0 40919

snd 0.004 D 41019 50 56355

rcv 0.004 A 56355 0 40969

snd 0.004 D 41069 50 56355

rcv 0.004 A 56355 0 41019

snd 0.004 D 41119 4 56355

rcv 0.004 A 56355 0 41069

rcv 0.004 A 56355 0 41119

rcv 0.004 A 56355 0 41123

snd 0.004 F 41123 0 56355

rcv 0.007 A 56355 0 41123

rcv 0.007 FA 56355 0 41123

snd 0.01 A 41124 0 56355

Amount of (original) Data Transferred (in bytes): 1954

Number of Data Segments Sent (excluding retransmissions): 40

Number of (all) Packets Dropped (by the PLD module): 4

Number of Retransmitted Segments: 4

Number of Duplicate Acknowledgements received: 22

Receiver\_log

Action time type seq size ack

rcv 0.0 S 39168 0 0

snd 0.0 SA 56354 0 39168

rcv 0.0 A 39169 0 56354

snd 0.001 A 56355 0 39169

rcv 0.002 D 39169 50 56355

snd 0.002 A 56355 0 39219

rcv 0.002 D 39269 50 56355

snd 0.002 A 56355 0 39219

rcv 0.002 D 39319 50 56355

snd 0.002 A 56355 0 39219

rcv 0.002 D 39369 50 56355

snd 0.002 A 56355 0 39219

rcv 0.002 D 39419 50 56355

snd 0.002 A 56355 0 39219

rcv 0.002 D 39469 50 56355

snd 0.002 A 56355 0 39219

rcv 0.002 D 39519 50 56355

snd 0.002 A 56355 0 39219

rcv 0.002 D 39219 50 56355

snd 0.002 A 56355 0 39569

rcv 0.002 D 39569 50 56355

snd 0.002 A 56355 0 39619

rcv 0.002 D 39619 50 56355

snd 0.002 A 56355 0 39669

rcv 0.002 D 39719 50 56355

snd 0.002 A 56355 0 39669

rcv 0.003 D 39769 50 56355

snd 0.003 A 56355 0 39669

rcv 0.003 D 39819 50 56355

snd 0.003 A 56355 0 39669

rcv 0.003 D 39869 50 56355

snd 0.003 A 56355 0 39669

rcv 0.003 D 39919 50 56355

snd 0.003 A 56355 0 39669

rcv 0.003 D 39669 50 56355

snd 0.003 A 56355 0 39969

rcv 0.003 D 39969 50 56355

snd 0.003 A 56355 0 40019

rcv 0.003 D 40019 50 56355

snd 0.003 A 56355 0 40069

rcv 0.003 D 40069 50 56355

snd 0.003 A 56355 0 40119

rcv 0.003 D 40119 50 56355

snd 0.003 A 56355 0 40169

rcv 0.003 D 40169 50 56355

snd 0.003 A 56355 0 40219

rcv 0.003 D 40269 50 56355

snd 0.003 A 56355 0 40219

rcv 0.003 D 40319 50 56355

snd 0.003 A 56355 0 40219

rcv 0.003 D 40369 50 56355

snd 0.003 A 56355 0 40219

rcv 0.003 D 40419 50 56355

snd 0.003 A 56355 0 40219

rcv 0.003 D 40469 50 56355

snd 0.003 A 56355 0 40219

rcv 0.003 D 40219 50 56355

snd 0.003 A 56355 0 40519

rcv 0.003 D 40519 50 56355

snd 0.003 A 56355 0 40569

rcv 0.004 D 40619 50 56355

snd 0.004 A 56355 0 40569

rcv 0.004 D 40669 50 56355

snd 0.004 A 56355 0 40569

rcv 0.004 D 40719 50 56355

snd 0.004 A 56355 0 40569

rcv 0.004 D 40769 50 56355

snd 0.004 A 56355 0 40569

rcv 0.004 D 40819 50 56355

snd 0.004 A 56355 0 40569

rcv 0.004 D 40569 50 56355

snd 0.004 A 56355 0 40869

rcv 0.004 D 40869 50 56355

snd 0.004 A 56355 0 40919

rcv 0.004 D 40919 50 56355

snd 0.004 A 56355 0 40969

rcv 0.004 D 40969 50 56355

snd 0.004 A 56355 0 41019

rcv 0.004 D 41019 50 56355

snd 0.004 A 56355 0 41069

rcv 0.004 D 41069 50 56355

snd 0.004 A 56355 0 41119

rcv 0.004 D 41119 4 56355

snd 0.004 A 56355 0 41123

rcv 0.005 F 41123 0 56355

snd 0.007 FA 56355 0 41123

Amount of (original) Data Received (in bytes): 1954

Number of (original) Data Segments Received: 40

Number of duplicate segments received (if any): 0

Sending test2.txt with mss = 50, mws = 500, timeout = 2.5ms, pdrop = .1, seed = 300

Sender\_log

Action time type seq size ack

snd 0.0 S 39168 0 0

rcv 0.0 SA 55178 0 39168

snd 0.0 A 39169 0 55178

rcv 0.001 A 55179 0 39169

snd 0.002 D 39169 50 55179

drop 0.002 D 39219 50 55179

snd 0.002 D 39269 50 55179

snd 0.002 D 39319 50 55179

snd 0.002 D 39369 50 55179

rcv 0.002 A 55179 0 39219

snd 0.002 D 39419 50 55179

rcv 0.002 A 55179 0 39219

snd 0.002 D 39469 50 55179

rcv 0.002 A 55179 0 39219

snd 0.002 D 39519 50 55179

rcv 0.002 A 55179 0 39219

snd 0.002 D 39219 50 55179

rcv 0.002 A 55179 0 39219

snd 0.002 D 39569 50 55179

rcv 0.002 A 55179 0 39219

snd 0.002 D 39619 50 55179

rcv 0.002 A 55179 0 39219

drop 0.002 D 39669 50 55179

rcv 0.002 A 55179 0 39569

snd 0.003 D 39719 50 55179

rcv 0.003 A 55179 0 39619

snd 0.003 D 39769 50 55179

rcv 0.003 A 55179 0 39669

snd 0.003 D 39819 50 55179

rcv 0.003 A 55179 0 39669

snd 0.003 D 39869 50 55179

rcv 0.003 A 55179 0 39669

snd 0.003 D 39919 50 55179

rcv 0.003 A 55179 0 39669

snd 0.003 D 39669 50 55179

rcv 0.003 A 55179 0 39669

snd 0.003 D 39969 50 55179

rcv 0.003 A 55179 0 39669

snd 0.003 D 40019 50 55179

snd 0.003 D 40069 50 55179

rcv 0.003 A 55179 0 39969

snd 0.003 D 40119 50 55179

rcv 0.003 A 55179 0 40019

snd 0.003 D 40169 50 55179

rcv 0.003 A 55179 0 40069

drop 0.003 D 40219 50 55179

rcv 0.004 A 55179 0 40119

snd 0.004 D 40269 50 55179

rcv 0.004 A 55179 0 40169

snd 0.004 D 40319 50 55179

rcv 0.004 A 55179 0 40219

snd 0.004 D 40369 50 55179

rcv 0.004 A 55179 0 40219

snd 0.004 D 40419 50 55179

rcv 0.004 A 55179 0 40219

snd 0.004 D 40469 50 55179

rcv 0.004 A 55179 0 40219

snd 0.004 D 40219 50 55179

rcv 0.004 A 55179 0 40219

snd 0.004 D 40519 50 55179

rcv 0.004 A 55179 0 40219

drop 0.004 D 40569 50 55179

rcv 0.004 A 55179 0 40519

snd 0.004 D 40619 50 55179

rcv 0.004 A 55179 0 40569

snd 0.004 D 40669 50 55179

snd 0.004 D 40719 50 55179

rcv 0.004 A 55179 0 40569

snd 0.004 D 40769 50 55179

rcv 0.004 A 55179 0 40569

snd 0.004 D 40819 50 55179

rcv 0.004 A 55179 0 40569

snd 0.004 D 40569 50 55179

rcv 0.004 A 55179 0 40569

snd 0.004 D 40869 50 55179

rcv 0.004 A 55179 0 40569

snd 0.004 D 40919 50 55179

snd 0.004 D 40969 50 55179

rcv 0.004 A 55179 0 40869

snd 0.004 D 41019 50 55179

rcv 0.004 A 55179 0 40919

snd 0.004 D 41069 50 55179

rcv 0.004 A 55179 0 40969

snd 0.004 D 41119 4 55179

rcv 0.004 A 55179 0 41019

rcv 0.004 A 55179 0 41069

rcv 0.004 A 55179 0 41119

rcv 0.004 A 55179 0 41123

snd 0.005 F 41123 0 55179

rcv 0.011 A 55179 0 41123

rcv 0.011 FA 55179 0 41123

snd 0.013 A 41124 0 55179

Amount of (original) Data Transferred (in bytes): 1954

Number of Data Segments Sent (excluding retransmissions): 40

Number of (all) Packets Dropped (by the PLD module): 4

Number of Retransmitted Segments: 4

Number of Duplicate Acknowledgements received: 22

Receiver\_log

Action time type seq size ack

rcv 0.0 S 39168 0 0

snd 0.0 SA 55178 0 39168

rcv 0.0 A 39169 0 55178

snd 0.0 A 55179 0 39169

rcv 0.002 D 39169 50 55179

snd 0.002 A 55179 0 39219

rcv 0.002 D 39269 50 55179

snd 0.002 A 55179 0 39219

rcv 0.002 D 39319 50 55179

snd 0.002 A 55179 0 39219

rcv 0.002 D 39369 50 55179

snd 0.002 A 55179 0 39219

rcv 0.002 D 39419 50 55179

snd 0.002 A 55179 0 39219

rcv 0.002 D 39469 50 55179

snd 0.002 A 55179 0 39219

rcv 0.002 D 39519 50 55179

snd 0.002 A 55179 0 39219

rcv 0.002 D 39219 50 55179

snd 0.002 A 55179 0 39569

rcv 0.002 D 39569 50 55179

snd 0.002 A 55179 0 39619

rcv 0.002 D 39619 50 55179

snd 0.002 A 55179 0 39669

rcv 0.003 D 39719 50 55179

snd 0.003 A 55179 0 39669

rcv 0.003 D 39769 50 55179

snd 0.003 A 55179 0 39669

rcv 0.003 D 39819 50 55179

snd 0.003 A 55179 0 39669

rcv 0.003 D 39869 50 55179

snd 0.003 A 55179 0 39669

rcv 0.003 D 39919 50 55179

snd 0.003 A 55179 0 39669

rcv 0.003 D 39669 50 55179

snd 0.003 A 55179 0 39969

rcv 0.003 D 39969 50 55179

snd 0.003 A 55179 0 40019

rcv 0.003 D 40019 50 55179

snd 0.003 A 55179 0 40069

rcv 0.003 D 40069 50 55179

snd 0.003 A 55179 0 40119

rcv 0.003 D 40119 50 55179

snd 0.003 A 55179 0 40169

rcv 0.003 D 40169 50 55179

snd 0.003 A 55179 0 40219

rcv 0.004 D 40269 50 55179

snd 0.004 A 55179 0 40219

rcv 0.004 D 40319 50 55179

snd 0.004 A 55179 0 40219

rcv 0.004 D 40369 50 55179

snd 0.004 A 55179 0 40219

rcv 0.004 D 40419 50 55179

snd 0.004 A 55179 0 40219

rcv 0.004 D 40469 50 55179

snd 0.004 A 55179 0 40219

rcv 0.004 D 40219 50 55179

snd 0.004 A 55179 0 40519

rcv 0.004 D 40519 50 55179

snd 0.004 A 55179 0 40569

rcv 0.004 D 40619 50 55179

snd 0.004 A 55179 0 40569

rcv 0.004 D 40669 50 55179

snd 0.004 A 55179 0 40569

rcv 0.004 D 40719 50 55179

snd 0.004 A 55179 0 40569

rcv 0.004 D 40769 50 55179

snd 0.004 A 55179 0 40569

rcv 0.004 D 40819 50 55179

snd 0.004 A 55179 0 40569

rcv 0.004 D 40569 50 55179

snd 0.004 A 55179 0 40869

rcv 0.004 D 40869 50 55179

snd 0.004 A 55179 0 40919

rcv 0.004 D 40919 50 55179

snd 0.004 A 55179 0 40969

rcv 0.004 D 40969 50 55179

snd 0.004 A 55179 0 41019

rcv 0.004 D 41019 50 55179

snd 0.004 A 55179 0 41069

rcv 0.004 D 41069 50 55179

snd 0.004 A 55179 0 41119

rcv 0.004 D 41119 4 55179

snd 0.004 A 55179 0 41123

rcv 0.005 F 41123 0 55179

snd 0.011 FA 55179 0 41123

Amount of (original) Data Received (in bytes): 1954

Number of (original) Data Segments Received: 40

Number of duplicate segments received (if any): 0

Sending test2.txt with mss = 50, mws = 500, timeout = 1ms, pdrop = .1, seed = 300

Sender\_log

Action time type seq size ack

snd 0.0 S 39168 0 0

rcv 0.001 SA 11688 0 39168

snd 0.001 A 39169 0 11688

rcv 0.001 A 11689 0 39169

snd 0.003 D 39169 50 11689

drop 0.003 D 39219 50 11689

snd 0.003 D 39269 50 11689

snd 0.003 D 39319 50 11689

snd 0.003 D 39369 50 11689

snd 0.003 D 39419 50 11689

snd 0.003 D 39469 50 11689

rcv 0.003 A 11689 0 39219

snd 0.003 D 39519 50 11689

rcv 0.003 A 11689 0 39219

snd 0.003 D 39569 50 11689

rcv 0.003 A 11689 0 39219

snd 0.003 D 39619 50 11689

rcv 0.003 A 11689 0 39219

snd 0.003 D 39219 50 11689

rcv 0.003 A 11689 0 39219

drop 0.003 D 39669 50 11689

rcv 0.003 A 11689 0 39219

snd 0.003 D 39719 50 11689

snd 0.003 D 39769 50 11689

rcv 0.003 A 11689 0 39219

rcv 0.003 A 11689 0 39219

rcv 0.003 A 11689 0 39219

rcv 0.003 A 11689 0 39669

snd 0.003 D 39819 50 11689

rcv 0.003 A 11689 0 39669

snd 0.003 D 39869 50 11689

rcv 0.003 A 11689 0 39669

snd 0.003 D 39919 50 11689

rcv 0.003 A 11689 0 39669

snd 0.003 D 39669 50 11689

snd 0.004 D 39969 50 11689

rcv 0.004 A 11689 0 39669

snd 0.004 D 40019 50 11689

snd 0.004 D 40069 50 11689

rcv 0.004 A 11689 0 39669

snd 0.004 D 40119 50 11689

snd 0.004 D 40169 50 11689

rcv 0.004 A 11689 0 39969

drop 0.004 D 40219 50 11689

rcv 0.004 A 11689 0 40019

snd 0.004 D 40269 50 11689

snd 0.004 D 40319 50 11689

snd 0.004 D 40369 50 11689

rcv 0.004 A 11689 0 40069

snd 0.004 D 40419 50 11689

rcv 0.004 A 11689 0 40119

snd 0.004 D 40469 50 11689

snd 0.004 D 40519 50 11689

rcv 0.004 A 11689 0 40169

snd 0.004 D 40569 50 11689

rcv 0.004 A 11689 0 40219

drop 0.004 D 40619 50 11689

rcv 0.004 A 11689 0 40219

snd 0.004 D 40669 50 11689

snd 0.005 D 40719 50 11689

snd 0.005 D 40769 50 11689

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40219

snd 0.005 D 40219 50 11689

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40219

rcv 0.005 A 11689 0 40619

snd 0.005 D 40819 50 11689

snd 0.005 D 40869 50 11689

snd 0.005 D 40919 50 11689

snd 0.005 D 40969 50 11689

rcv 0.005 A 11689 0 40619

snd 0.005 D 41019 50 11689

snd 0.005 D 41069 50 11689

rcv 0.005 A 11689 0 40619

snd 0.005 D 41119 4 11689

rcv 0.006 A 11689 0 40619

snd 0.006 D 40619 50 11689

rcv 0.006 A 11689 0 40619

snd 0.006 D 40669 50 11689

snd 0.006 D 40619 50 11689

rcv 0.006 A 11689 0 40619

rcv 0.006 A 11689 0 40619

rcv 0.006 A 11689 0 40619

rcv 0.006 A 11689 0 41123

snd 0.006 F 41123 0 11689

rcv 0.009 A 11689 0 41123

rcv 0.009 A 11689 0 41123

rcv 0.009 A 11689 0 41123

rcv 0.009 FA 11689 0 41123

snd 0.012 A 41124 0 11689

Amount of (original) Data Transferred (in bytes): 1954

Number of Data Segments Sent (excluding retransmissions): 40

Number of (all) Packets Dropped (by the PLD module): 4

Number of Retransmitted Segments: 6

Number of Duplicate Acknowledgements received: 33

Receiver\_log

Action time type seq size ack

rcv 0.0 S 39168 0 0

snd 0.0 SA 11688 0 39168

rcv 0.0 A 39169 0 11688

snd 0.0 A 11689 0 39169

rcv 0.002 D 39169 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39269 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39319 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39369 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39419 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39469 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39519 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39569 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39619 50 11689

snd 0.002 A 11689 0 39219

rcv 0.002 D 39219 50 11689

snd 0.002 A 11689 0 39669

rcv 0.002 D 39719 50 11689

snd 0.002 A 11689 0 39669

rcv 0.002 D 39769 50 11689

snd 0.002 A 11689 0 39669

rcv 0.002 D 39819 50 11689

snd 0.002 A 11689 0 39669

rcv 0.002 D 39869 50 11689

snd 0.002 A 11689 0 39669

rcv 0.003 D 39919 50 11689

snd 0.003 A 11689 0 39669

rcv 0.003 D 39669 50 11689

snd 0.003 A 11689 0 39969

rcv 0.003 D 39969 50 11689

snd 0.003 A 11689 0 40019

rcv 0.003 D 40019 50 11689

snd 0.003 A 11689 0 40069

rcv 0.003 D 40069 50 11689

snd 0.003 A 11689 0 40119

rcv 0.003 D 40119 50 11689

snd 0.003 A 11689 0 40169

rcv 0.003 D 40169 50 11689

snd 0.003 A 11689 0 40219

rcv 0.003 D 40269 50 11689

snd 0.003 A 11689 0 40219

rcv 0.003 D 40319 50 11689

snd 0.003 A 11689 0 40219

rcv 0.003 D 40369 50 11689

snd 0.003 A 11689 0 40219

rcv 0.003 D 40419 50 11689

snd 0.004 A 11689 0 40219

rcv 0.004 D 40469 50 11689

snd 0.004 A 11689 0 40219

rcv 0.004 D 40519 50 11689

snd 0.004 A 11689 0 40219

rcv 0.004 D 40569 50 11689

snd 0.004 A 11689 0 40219

rcv 0.004 D 40669 50 11689

snd 0.004 A 11689 0 40219

rcv 0.004 D 40719 50 11689

snd 0.004 A 11689 0 40219

rcv 0.004 D 40769 50 11689

snd 0.004 A 11689 0 40219

rcv 0.004 D 40219 50 11689

snd 0.004 A 11689 0 40619

rcv 0.004 D 40819 50 11689

snd 0.004 A 11689 0 40619

rcv 0.004 D 40869 50 11689

snd 0.004 A 11689 0 40619

rcv 0.004 D 40919 50 11689

snd 0.004 A 11689 0 40619

rcv 0.005 D 40969 50 11689

snd 0.005 A 11689 0 40619

rcv 0.005 D 41019 50 11689

snd 0.005 A 11689 0 40619

rcv 0.005 D 41069 50 11689

snd 0.005 A 11689 0 40619

rcv 0.005 D 41119 4 11689

snd 0.005 A 11689 0 40619

rcv 0.005 D 40619 50 11689

snd 0.005 A 11689 0 41123

rcv 0.005 D 40669 50 11689

snd 0.005 A 11689 0 41123

rcv 0.005 D 40619 50 11689

snd 0.005 A 11689 0 41123

rcv 0.005 F 41123 0 11689

snd 0.008 FA 11689 0 41123

Amount of (original) Data Received (in bytes): 1954

Number of (original) Data Segments Received: 40

Number of duplicate segments received (if any): 2