

README

This is my implementation of a sliding window, stop and wait, server reliable / unreliable algorithms. Homework 3 for CSS 432.

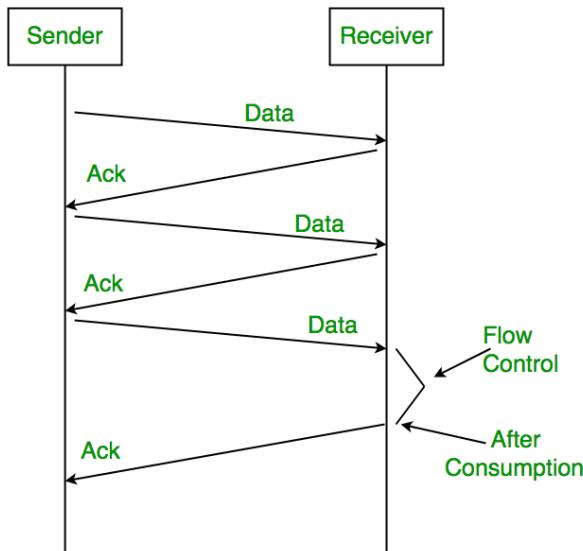
Here's some visuals for the concepts behind the algorithms.

Discussion:

Stop-and-wait is as stated before is a positive acknowledgement with retransmission. The total time taken for this transmission of 20,000 was 3545304 usec. While the sliding window for the same message size (window size 30) was 2643052 usec. There are a lot of factors that contribute to the times, how many people are using the linux lab servers at the same time, the bandwidth that the servers have to communicate with each other, and the algorithm itself. While the sliding window is a more reliable way of sending information, it takes longer because it has to wait for acknowledgment for every data packet that is sent through the wire. The sliding window can send data through the wire that is less than or equal to the window size which allows for the server to get and ACK more data packets. Sliding window is used in practice more than stop-and-wait for this reason. Both Stop and Wait protocol and Sliding Window protocol are the techniques to the solution of flow control handling. The main difference between stop-and-wait protocol and sliding window is that in stop-and-wait, sender send one frame and wait for the acknowledgment from receiver side whereas in sliding window protocol, sender send more than one frames to the receiver side and re-transmit the frame which are damaged or dropped.

Stop and wait:

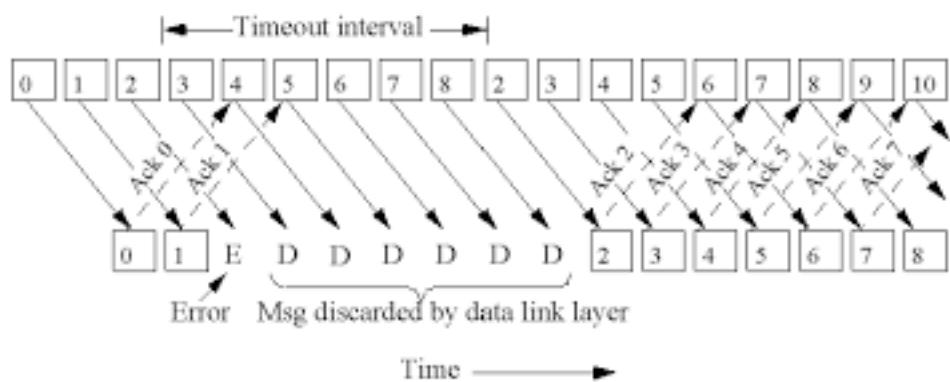
(sometimes known as "positive acknowledgement with retransmission") is the fundamental technique to provide reliable transfer under unreliable packet delivery system. After transmitting one packet, the sender waits for an acknowledgment (ACK) from the receiver before transmitting the next one. In the sliding window technique, each data packet and byte include a unique consecutive sequence number, which is used by the receiving computer to place data in the correct order.



Sliding window:

(tested with window size 1 and 30, with a percent drop of 1-10%)

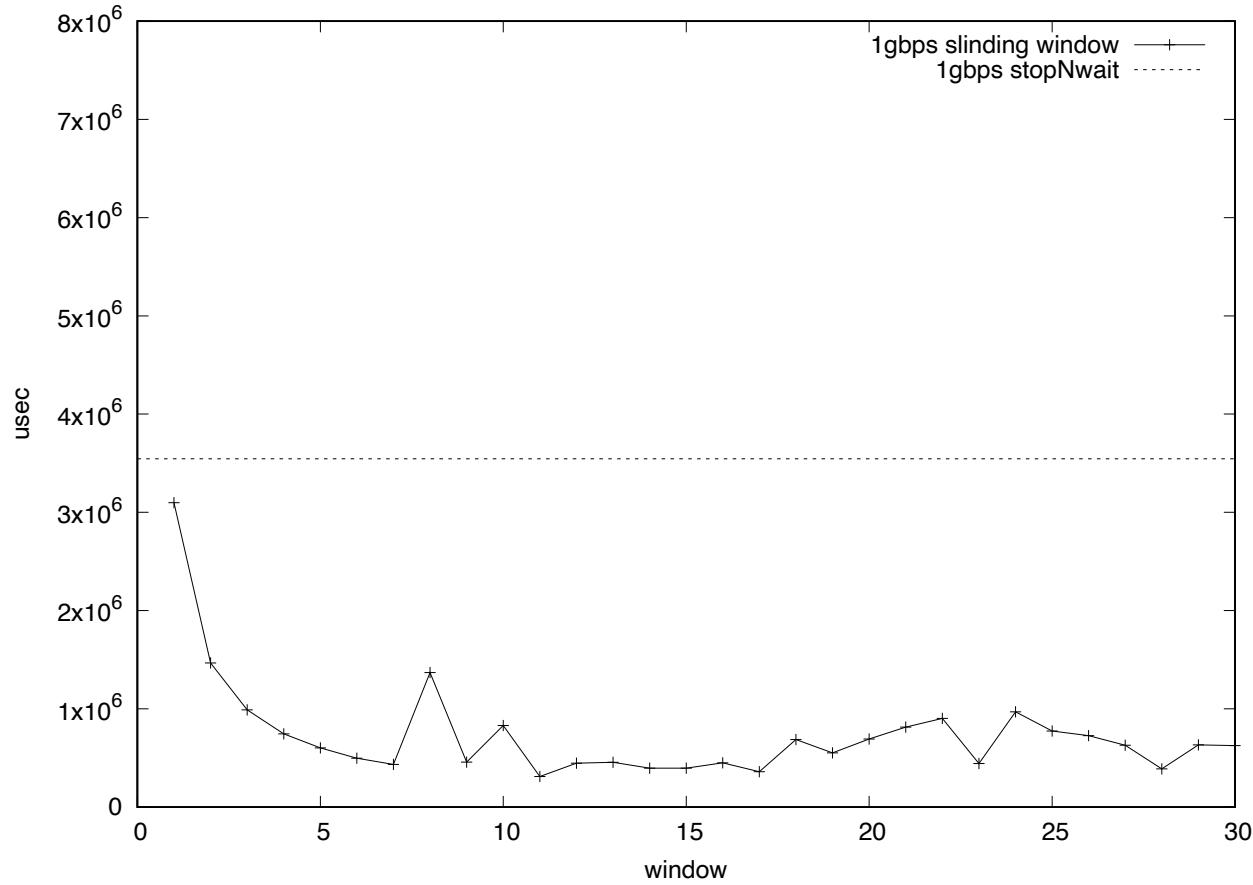
Sliding window is a technique for controlling transmitted data packets between two network computers where reliable and sequential delivery of data packets is required, such as when using the Data Link Layer or Transmission Control Protocol.

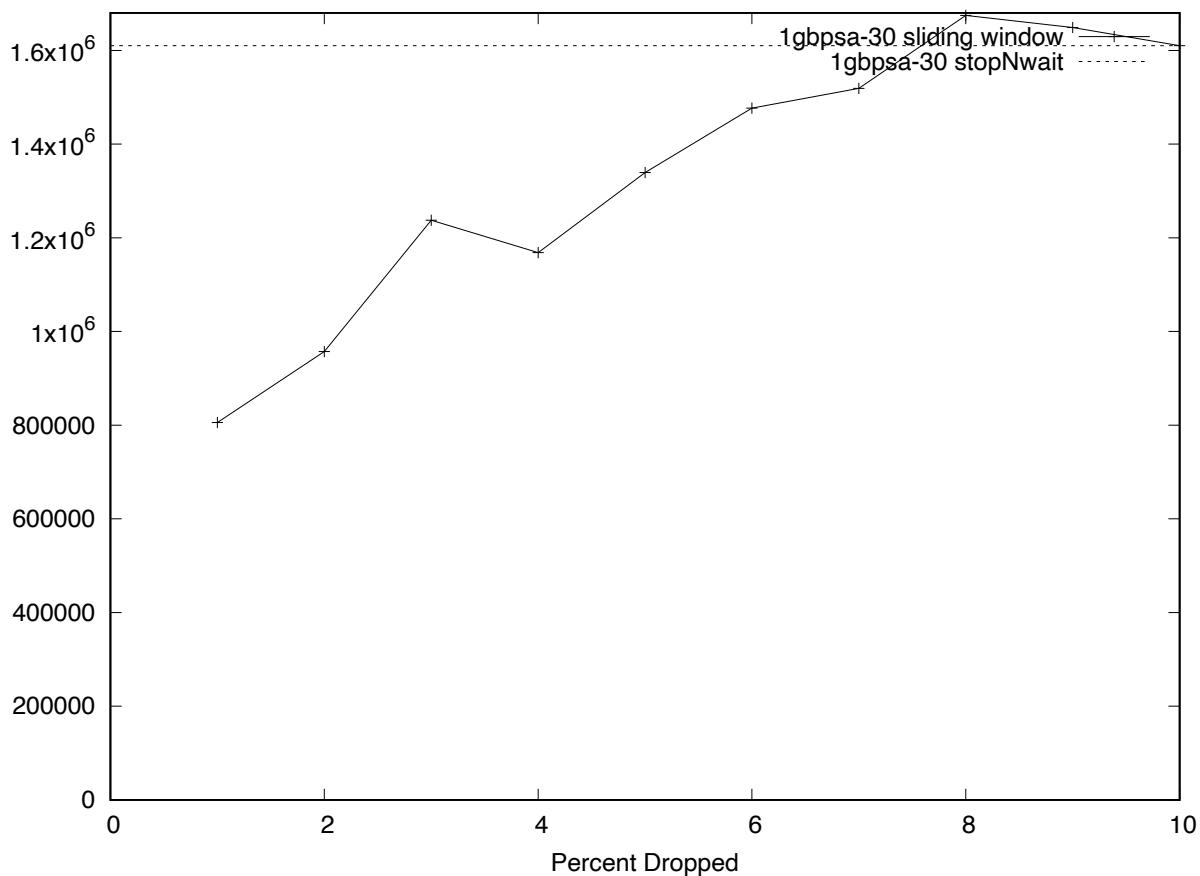
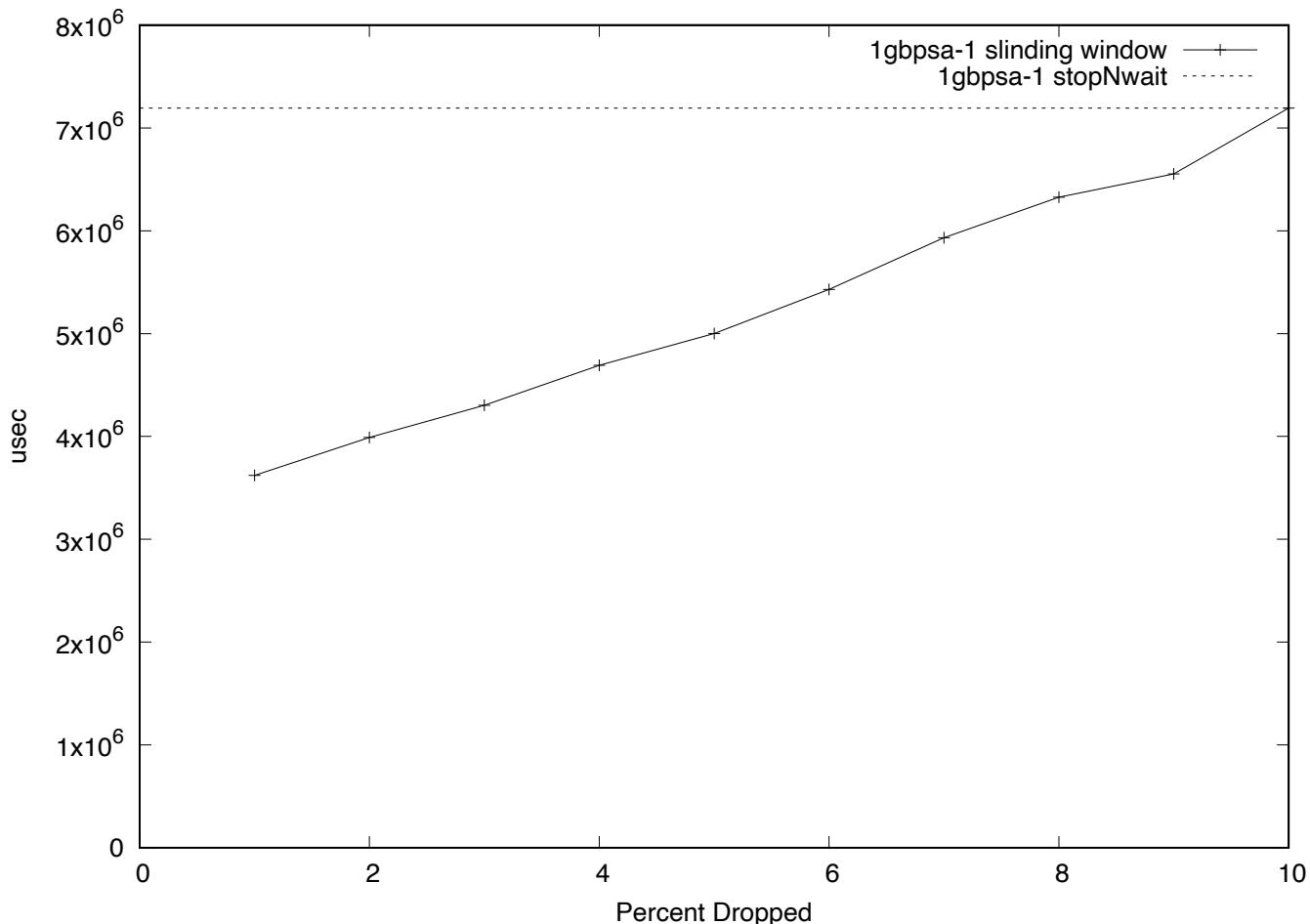


Spread Sheet, Screen Shot:

	A	B	C	D
1	Window size	Time Taken (usec)	Percent Dropped	Retransmits
2	1	3621384	1	420
3	1	3990262	2	617
4	1	4302237	3	840
5	1	4692511	4	1061
6	1	5001322	5	1278
7	1	5429867	6	1501
8	1	5933272	7	1743
9	1	6326245	8	2026
10	1	6553405	9	2166
11	1	7193277	10	2563
12	Window size	Time Taken (usec)	Percent Dropped	Retransmits
13	30	805622	1	7410
14	30	957059	2	10110
15	30	1237647	3	12450
16	30	1168489	4	13230
17	30	1339381	5	14520
18	30	1476621	6	16380
19	30	1518923	7	17130
20	30	1674578	8	17936
21	30	1648671	9	19560
22	30	1610155	10	20239

Plots: (1 gbps stop and wait test case 2, window size 1 test 4, window size 30 test 4)





Output Screen Shots:

```
[18:20:46] alexhvzr@uw1-320-11: ~/hw3.1 $ cd hw3.1  
[18:20:46] alexhvzr@uw1-320-11: ~/hw3.1 $ ./hw3 uw1-320-10  
Choose a testcase  
 1: unreliable test  
 2: stop-and-wait test  
 3: sliding windows  
[--> 3  
Window size = 1 Elapsed time = 2898602  
retransmits = 0  
Window size = 2 Elapsed time = 1326430  
retransmits = 0  
Window size = 3 Elapsed time = 2816368  
retransmits = 12  
Window size = 4 Elapsed time = 4613751  
retransmits = 24  
Window size = 5 Elapsed time = 7126299  
retransmits = 40  
Window size = 6 Elapsed time = 18263085  
retransmits = 42  
Window size = 7 Elapsed time = 32897583  
retransmits = 70  
Window size = 8 Elapsed time = 9497809  
retransmits = 56  
Window size = 9 Elapsed time = 3843930  
retransmits = 54  
Window size = 10 Elapsed time = 4889863  
retransmits = 70  
Window size = 11 Elapsed time = 5990449  
retransmits = 66  
Window size = 12 Elapsed time = 8006211  
retransmits = 60  
Window size = 13 Elapsed time = 7650215  
retransmits = 104  
Window size = 14 Elapsed time = 4597581  
retransmits = 126  
Window size = 15 Elapsed time = 5715296  
retransmits = 105  
Window size = 16 Elapsed time = 6116255  
retransmits = 128  
Window size = 17 Elapsed time = 4826662  
retransmits = 136  
Window size = 18 Elapsed time = 5932328  
retransmits = 144  
Window size = 19 Elapsed time = 4013512  
retransmits = 171  
Window size = 20 Elapsed time = 3616995  
retransmits = 140  
Window size = 21 Elapsed time = 6467439  
retransmits = 147  
Window size = 22 Elapsed time = 3838703  
retransmits = 198  
Window size = 23 Elapsed time = 3949697  
retransmits = 138  
Window size = 24 Elapsed time = 2198838  
retransmits = 120  
Window size = 25 Elapsed time = 3423984  
retransmits = 125  
Window size = 26 Elapsed time = 2373221  
retransmits = 260  
Window size = 27 Elapsed time = 4508140  
retransmits = 189  
Window size = 28 Elapsed time = 4077475  
retransmits = 140  
Window size = 29 Elapsed time = 2971877  
retransmits = 232  
Window size = 30 Elapsed time = 2643052  
retransmits = 210  
finished  
[18:24:21] alexhvzr@uw1-320-10: ~/hw3 $ ]
```

```

message = 19996
message = 19997
message = 19998
message = 19999
Elapsed time = 245398
finished
[20:39:35] alexhvzr@uw1-320-10: ~/hw3 $ ./hw3 uw1-320-11
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 2
client stop-and-wait test
Elapsed time = 3545340
retransmits = 0
finished
[20:40:09] alexhvzr@uw1-320-10: ~/hw3 $ ./hw3 uw1-320-11
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 3
^C
[20:41:08] alexhvzr@uw1-320-10: ~/hw3 $ ./hw3 uw1-320-11
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 3
^C
[20:44:05] alexhvzr@uw1-320-10: ~/hw3 $ ./hw3 uw1-320-11
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 3
Window size = 1 Elapsed time = 3097757
retransmits = 0
Window size = 2 Elapsed time = 1466692
retransmits = 0
Window size = 3 Elapsed time = 990265
retransmits = 0
Window size = 4 Elapsed time = 744918
retransmits = 0
Window size = 5 Elapsed time = 602764
retransmits = 0
Window size = 6 Elapsed time = 497365
retransmits = 0
Window size = 7 Elapsed time = 433494
retransmits = 0
Window size = 8 Elapsed time = 1368988
retransmits = 0
Window size = 9 Elapsed time = 457873
retransmits = 45
Window size = 10 Elapsed time = 830616
retransmits = 70
Window size = 11 Elapsed time = 310377
retransmits = 35
Window size = 12 Elapsed time = 446744
retransmits = 96
Window size = 13 Elapsed time = 456092
retransmits = 52
Window size = 14 Elapsed time = 395362
retransmits = 28
Window size = 15 Elapsed time = 395426
retransmits = 0
Window size = 16 Elapsed time = 449588
retransmits = 48
Window size = 17 Elapsed time = 360539
retransmits = 85
Window size = 18 Elapsed time = 686908
retransmits = 100
Window size = 19 Elapsed time = 551207
retransmits = 95
Window size = 20 Elapsed time = 692101
retransmits = 160
Window size = 21 Elapsed time = 814153
retransmits = 300
Window size = 22 Elapsed time = 902019
retransmits = 176
Window size = 23 Elapsed time = 443247
retransmits = 138
Window size = 24 Elapsed time = 969342
retransmits = 168
Window size = 25 Elapsed time = 774185
retransmits = 25
Window size = 26 Elapsed time = 726393
retransmits = 156
Window size = 27 Elapsed time = 629132
retransmits = 108
Window size = 28 Elapsed time = 389049
retransmits = 124
Window size = 29 Elapsed time = 633365
retransmits = 261
Window size = 30 Elapsed time = 625487
retransmits = 210
finished
[20:44:38] alexhvzr@uw1-320-10: ~/hw3 $ []

```

```

0
0
0
0
^C
[20:39:23] alexhvzr@uw1-320-11: ~/hw3.1 $ ./hw3
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 2
server reliable test
server ending...
finished
[20:40:19] alexhvzr@uw1-320-11: ~/hw3.1 $ ./hw3
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 3
server: early retransmit test:
Ack sent: 0
Message: 0
Ack sent: 1
Message: 1
Ack sent: 2
Message: 2
Ack sent: 3
Message: 3
[20:44:05] alexhvzr@uw1-320-11: ~/hw3.1 $ ./hw3
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 3
Ack sent: 19966
Message: 19966
Ack sent: 19966
Message: 19967
Ack sent: 19968
Message: 19968
Ack sent: 19969
Message: 19969
Ack sent: 19970
Message: 19970
Ack sent: 19971
Message: 19971
Ack sent: 19972
Message: 19972
Ack sent: 19973
Message: 19973
Ack sent: 19974
Message: 19974
Ack sent: 19975
Message: 19975
Ack sent: 19976
Message: 19976
Ack sent: 19977
Message: 19977
Ack sent: 19978
Message: 19978
Ack sent: 19979
Message: 19979
Ack sent: 19980
Message: 19980
Ack sent: 19981
Message: 19981
Ack sent: 19982
Message: 19982
Ack sent: 19983
Message: 19983
Ack sent: 19984
Message: 19984
Ack sent: 19985
Message: 19985
Ack sent: 19986
Message: 19986
Ack sent: 19987
Message: 19987
Ack sent: 19988
Message: 19988
Ack sent: 19989
Message: 19989
Ack sent: 19990
Message: 19990
Ack sent: 19991
Message: 19991
Ack sent: 19992
Message: 19992
Ack sent: 19993
Message: 19993
Ack sent: 19994
Message: 19994
Ack sent: 19995
Message: 19995
Ack sent: 19996
Message: 19996
Ack sent: 19997
Message: 19997
Ack sent: 19998
Message: 19998
Ack sent: 19999
Message: 19999
server ending...
finished
[20:44:48] alexhvzr@uw1-320-11: ~/hw3.1 $ []

```

```
Terminal Shell Edit View Window Help alex — alexhvzr@uv1-320-10: ~ /hw3 — ssh alexhvzr@uv1-320-10.uwb.edu — 119x35
Window size: 21
server early retransmit test:
Percent Dropped: 10
Total ACKS: 39039 Ack
Window size: 22
server early retransmit test:
Percent Dropped: 10
Total ACKS: 38756 Ack
Window size: 23
server early retransmit test:
Percent Dropped: 10
Total ACKS: 38936 Ack
Window size: 24
server early retransmit test:
Percent Dropped: 10
Total ACKS: 38925 Ack
Window size: 25
server early retransmit test:
Percent Dropped: 10
Total ACKS: 39742 Ack
Window size: 26
server early retransmit test:
Percent Dropped: 10
Total ACKS: 40008 Ack
Window size: 27
server early retransmit test:
Percent Dropped: 10
Total ACKS: 39833 Ack
Window size: 28
server early retransmit test:
Percent Dropped: 10
Total ACKS: 40365 Ack
Window size: 29
server early retransmit test:
Percent Dropped: 10
client: sliding window test:
Drop Percentage = 10
Elapsed time = 1731304
retransmits = 18925
client: sliding window test:
Drop Percentage = 10
Elapsed time = 1746445
retransmits = 19734
client: sliding window test:
Drop Percentage = 10
Elapsed time = 1779361
retransmits = 20025
client: sliding window test:
Drop Percentage = 10
Elapsed time = 1660665
retransmits = 19824
client: sliding window test:
Drop Percentage = 10
Elapsed time = 1659892
retransmits = 20358
client: sliding window test:
Drop Percentage = 10
Elapsed time = 1610155
retransmits = 20239
finished
[16:17:28] alexhvzr@uv1-320-11: ~ /hw3.1 $ packet_write_wait: Connection to 172.21.198.91 port 22: Broken pipe
Alex's MacBook-Pro:~ alex$ s
.s: command not found
Alex's MacBook-Pro:~ alex$ ls
```

```
Terminal Shell Edit View Window Help
alex — alexhvzr@uw1-320-10: ~/hw3 — ssh alexhvzr@uw1-320-10.uwb.edu — 119x35

Total ACKS: 26072 Acks
Window size: 22
server early retransmit test:
Percent Dropped: 1
Total ACKS: 26420 Acks
Window size: 23
server early retransmit test:
Percent Dropped: 1
Total ACKS: 26367 Acks
Window size: 24
server early retransmit test:
Percent Dropped: 1
Total ACKS: 26850 Acks
Window size: 25
server early retransmit test:
Percent Dropped: 1
Total ACKS: 27020 Acks
Window size: 26
server early retransmit test:
Percent Dropped: 1
Total ACKS: 27389 Acks
Window size: 27
server early retransmit test:
Percent Dropped: 1
Total ACKS: 27644 Acks
Window size: 28
server early retransmit test:
Percent Dropped: 1
Total ACKS: 27722 Acks
Window size: 29
server early retransmit test:
Percent Dropped: 1
Total ACKS: 27410 Acks
Window size: 30
server ending...
```

alex — alexhvzr@uw1-320-10: ~/hw3 — ssh alexhvzr@uw1-320-10.uwb.edu — 119x35

```
Window size: 1
server ending...
finished
[[15:08:15] alexhvzr@uw1-320-10: ~/hw3 $ ./hw3case4
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 3
server early retransmit test:
Percent Dropped: 1
Total ACKS: 20438 Acks
Window size: 1
server ending...
finished
[[15:09:55] alexhvzr@uw1-320-10: ~/hw3 $ vim udphw3case4.cpp
[[15:12:08] alexhvzr@uw1-320-10: ~/hw3 $ rm hw3case4
[[15:12:36] alexhvzr@uw1-320-10: ~/hw3 $ g++ UdpSocket.cpp Timer.cpp udphw3case4.cpp -o hw3case4
[[15:12:41] alexhvzr@uw1-320-10: ~/hw3 $ ./hw3case4
Choose a testcase
 1: unreliable test
 2: stop-and-wait test
 3: sliding windows
[--> 3
server early retransmit test:
Percent Dropped: 2
Total ACKS: 20617 Acks
Window size: 1
server ending...
finished
[[15:13:09] alexhvzr@uw1-320-10: ~/hw3 $ rm hw3case4
[[15:14:50] alexhvzr@uw1-320-10: ~/hw3 $ g++ UdpSocket.cpp Timer.cpp udphw3case4.cpp -o hw3case4
[[15:14:53] alexhvzr@uw1-320-10: ~/hw3 $ ./hw3case4
Choose a testcase
 1: unreliable test
```