**COMP9331 – Computer Networks & Applications**

**Assignment 1**

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**Lab class: Tuesday 6pm – 8pm**

# Protocol summary

The protocol has been designed and implemented as a reliable transfer protocol over User Datagram Protocol (UDP), otherwise known as STP. The header is designed to include the following packet information:

* Receiver port
* Sequence number
* Acknowledgement number
* SYN bit
* ACK bit
* FIN bit

The following features are included in the STP:

* Three-way handshake
* Single-timer for timeout operations
* Cumulative Acknowledgment
* Sequence and Acknowledgment numbers based on payload size
* Maximum Segment Size
* Maximum Window Size
* Four-segment connection termination
* Sender and Receiver side logs including packet receipt and transmission summary

Key features not included in the STP include:

* Fast retransmit
* Receiver side packet buffering and re-organisation

# Data transmission methodology

## Three-way handshake

Connection between the sender and receiver is initiated by the sender through a three-way handshake. This involves a SYN byte in the packet header being set to 1, packed to binary format and transmitted to the receiver using the receiver IP address and available port number. No payload data is transmitted during the three-way handshake.

If the receiver IP address and port are available the receiver will read the SYN byte, set the header ACK byte to 1 and update the sequence number as the next expected sequence number the receiver expects to see. The header is again packed to binary format and transmitted back to the sender to acknowledge the SYN byte from sender. This is known as a SYNACK segment.

Once the sender receives the SYNACK segment, the sender transmits another segment, acknowledging that connection has been granted. The SYN byte is set to 0 and the sender is now ready to begin transmitting payload data to the receiver.

## Data transmission

1. When initiated, the protocol will first transfer data from the source text files based on the user-defined Maximum Window Size (MWS) which is the maximum window size used by the STP protocol in bytes, and Maximum Segment Size (MSS) which is the maximum number of data in bytes carried in each STP segment. Each packet is iteratively transferred from the text file, converted to bytes and packed into a binary structure before being included in the window.
2. Once the window has reached maximum capacity, that is it can no longer fit anymore STP segments, the protocol will begin continuously transmitting data to the sender based on the user-defined receiver IP address and Port. The window byte capacity is iteratively increased and tracked:  
   *Window\_capacity += len(payload)bytes*
3. When a packet acknowledgement (ACK) is received by the sender, STP will check whether the received acknowledgement number > the largest sequence number in the window. If acknowledgement number > largest sequence number. The sender will iteratively acknowledge all packets in the window where the received acknowledge number > sequence number. The is called **cumulative acknowledgement.** Each time a packet is acknowledged, the window byte capacity is iteratively decreased:

*Window\_capacity -= len(payload)bytes*

1. The window which only counts payload data, not header data. It will continuously slide as data is being acknowledged, with the maximum number of un-acknowledged that the Sender can have at any time being the defined MWS.
2. In the event there is a **timeout**, that is   
   *time since last acknowledged packet > timeout (user-defined input)*  
   the protocol will re-transmit all packets currently in the window
3. The STP has been implemented to allow reliable unidirectional data transfer, meaning the sender may transmit and acknowledge STP segments on a continual basis.

## Four-segment connection termination

Once the total acknowledged STP segments from the Sender is >= length of the text file being transmitted, STP will begin the four-segment connection termination. Logic is as follows:

* Sender transmit header with FIN a byte to initiate the termination with the Receiver
* Receiver will ACK the termination by transmitting ACK byte = 1 to the Sender
* Receiver will send a FIN byte to the Sender
* Sender ACK the FIN byte by sending a ACK byte to the Receiver which in turns acknowledges the terminates the final transfer.

## PLD Module

A PLD module has been designed and implemented between the Sender and Receiver. A random number is generated based on a seed defined by the user. If this random seed number is greater than pdrop then packed is successfully transmitted to the Receiver, else the packet is dropped.

# Detailed STP Header design

Receiver Port

Sequence number

ACK number

SYN

ACK

FIN

Payload

The header includes the following key data:

|  |  |
| --- | --- |
| Data | Description |
| Receiver port | Receiver port number allowing users to keep track of which Ports are and are not available on the Receiver side |
| Sequence number | Identifies how much data has been transmitted to the Receiver. Provides an indication as to where in the stream the packet is |
| Acknowledgement number (ACK) | Signifies the number of bytes that has been received and acknowledged by the Receiver |
| SYN | Initiates three-way handshake between the Sender and Receiver through a SYN byte |
| ACK | Acknowledges the SYN in initialising three-way handshake or FIN in four-segment connection termination through an ACK byte |
| FIN | Initiates the four-segment connection termination through a FIN byte |
| Payload | Payload data at <= Maximum Segment Size |

# Questions

3. a

Timeout value selected is 1000ms. Initial value of 1 second is recommended through RFC6298. As the probability of dropped or lost packets through the local is minimal, it is beneficial to have a lower timeout internal to minimise data transfer delays.

|  |  |
| --- | --- |
| **Pdrop** | **Retransmission** |
| 0.1 | 28 |
| 0.3 | 30 |

As can be seen in the table above as the number drop probability increases, the chances of retransmission also increase. This is due to the number of out of order packets arriving at the receiver due to increase in the number of dropped packets, thus STP must retransmit the most recent acknowledged packet from the Seceiver side.

b.

|  |  |  |
| --- | --- | --- |
| Timeout | Transmitted + Re-transmitted | Overall Transfer Time |
| 1000 | 70 | 7133ms |
| 4\*1000 = 4000 | 70 | 28140ms |
| 1000/4 | 70 | 1876ms |

As can be seen with a decrease in timeout there is a decrease in overall transfer time. There however was no change in transmitted and re-transmitted segments. This may be due to the experiment being run across a local machine, thus there being minimum to low change of there being any packet delay. In real world application, with low timeout values one would typically see pre-mature retransmissions leading to high number of re-transmissions.

# Appendix

## Appendix A – pdrop = 0.1, MWS = 500bytes, MSS = 50bytes, timeout = 1000ms

**Receiver**

rcv 0.038 S 0 0 0

snd 0.828 SA 0 0 1

rcv 3.099 A 0 0 1

rcv 4.209 D 1 50 1

snd 7.024 D 1 0 51

rcv 7.741 D 51 50 1

snd 10.661 D 51 0 101

rcv 3015.183 D 151 50 101

rcv 3015.881 D 201 50 151

rcv 3017.343 D 251 50 201

rcv 3017.895 D 301 50 251

rcv 3021.210 D 351 50 301

rcv 3021.859 D 401 50 351

rcv 3025.803 D 451 50 401

rcv 3029.712 D 501 50 451

rcv 3031.191 D 551 50 501

rcv 6035.953 D 101 50 51

snd 6036.791 D 101 0 151

rcv 6038.512 D 151 50 101

snd 6039.264 D 151 0 201

rcv 6040.104 D 201 50 151

snd 6040.922 D 201 0 251

rcv 6041.431 D 251 50 201

snd 6042.342 D 251 0 301

rcv 6043.151 D 301 50 251

snd 6046.623 D 301 0 351

rcv 6047.235 D 351 50 301

snd 6047.937 D 351 0 401

rcv 6048.343 D 401 50 351

snd 6049.007 D 401 0 451

rcv 6049.386 D 451 50 401

snd 6049.998 D 451 0 501

rcv 6050.355 D 501 50 451

snd 6051.020 D 501 0 551

rcv 6051.417 D 551 50 501

snd 6052.023 D 551 0 601

rcv 9048.708 D 651 50 601

rcv 9051.257 D 701 50 651

rcv 9054.991 D 751 50 701

rcv 9059.411 D 801 50 751

rcv 9063.241 D 851 50 801

rcv 9067.272 D 901 50 851

rcv 9071.461 D 951 50 901

rcv 9075.115 D 1001 50 951

rcv 12083.941 D 1001 50 951

rcv 12084.613 D 601 50 551

snd 12086.794 D 601 0 651

rcv 12087.323 D 651 50 601

snd 12088.089 D 651 0 701

rcv 12088.582 D 701 50 651

snd 12089.454 D 701 0 751

rcv 12090.016 D 751 50 701

snd 12091.014 D 751 0 801

rcv 12091.669 D 801 50 751

snd 12092.378 D 801 0 851

rcv 12092.851 D 851 50 801

snd 12093.481 D 851 0 901

rcv 12094.033 D 901 50 851

snd 12094.750 D 901 0 951

rcv 12095.220 D 951 50 901

snd 12095.746 D 951 0 1001

rcv 12096.061 D 1001 50 951

snd 12096.610 D 1001 0 1051

rcv 12097.457 D 1051 50 1001

snd 12097.963 D 1051 0 1101

rcv 12100.959 D 1101 50 1051

snd 12101.523 D 1101 0 1151

rcv 12101.873 D 1151 50 1101

snd 12102.563 D 1151 0 1201

rcv 15103.965 D 1251 50 1201

rcv 15104.696 D 1301 50 1251

rcv 15106.918 D 1351 50 1301

rcv 15107.249 D 1401 50 1351

rcv 15110.170 D 1451 50 1401

rcv 15110.661 D 1501 50 1451

rcv 15111.376 D 1551 50 1501

rcv 18116.767 D 1201 50 1151

snd 18118.793 D 1201 0 1251

rcv 18119.389 D 1251 50 1201

snd 18120.202 D 1251 0 1301

rcv 18122.939 D 1301 50 1251

snd 18123.886 D 1301 0 1351

rcv 18126.039 D 1351 50 1301

snd 18126.943 D 1351 0 1401

rcv 18127.628 D 1401 50 1351

snd 18128.665 D 1401 0 1451

rcv 18131.387 D 1451 50 1401

snd 18132.260 D 1451 0 1501

rcv 18135.284 D 1501 50 1451

snd 18136.036 D 1501 0 1551

rcv 18136.469 D 1551 50 1501

snd 18137.070 D 1551 0 1601

rcv 18138.769 F 1551 0 1501

snd 18139.078 FA 1551 0 1552

rcv 18142.095 A 1551 0 1501

Amount of (original) Data Received: 1592

Number of Data Segments Received: 32

Number of duplicate segments received: 25

**Sender**

snd 1.205 S 0 0 0

rcv 2.227 SA 0 0 1

snd 4.274 A 1 0 1

snd 5.314 D 1 50 1

snd 8.051 D 51 50 1

drop 8.711 D 101 50 51

snd 3015.050 D 151 50 101

snd 3015.871 D 201 50 151

snd 3018.439 D 251 50 201

snd 3019.017 D 301 50 251

snd 3022.340 D 351 50 301

snd 3023.002 D 401 50 351

snd 3026.791 D 451 50 401

rcv 3027.404 D 1 0 51

snd 3030.815 D 501 50 451

rcv 3031.320 D 51 0 101

snd 3032.266 D 551 50 501

snd 6037.104 D 101 50 51

snd 6037.757 D 151 50 101

snd 6039.744 D 201 50 151

snd 6040.262 D 251 50 201

snd 6041.492 D 301 50 251

snd 6042.005 D 351 50 301

snd 6042.515 D 401 50 351

snd 6042.990 D 451 50 401

snd 6043.655 D 501 50 451

snd 6044.486 D 551 50 501

rcv 6047.584 D 101 0 151

drop 6048.288 D 601 50 551

rcv 9048.890 D 151 0 201

snd 9049.787 D 651 50 601

rcv 9051.604 D 201 0 251

snd 9052.348 D 701 50 651

rcv 9055.326 D 251 0 301

snd 9056.097 D 751 50 701

rcv 9056.528 D 301 0 351

snd 9060.374 D 801 50 751

rcv 9060.904 D 351 0 401

snd 9064.329 D 851 50 801

rcv 9064.911 D 401 0 451

snd 9068.360 D 901 50 851

rcv 9068.831 D 451 0 501

snd 9072.260 D 951 50 901

rcv 9072.879 D 501 0 551

snd 9076.187 D 1001 50 951

rcv 9076.744 D 551 0 601

snd 12085.025 D 1001 50 951

snd 12085.725 D 601 50 551

snd 12087.663 D 651 50 601

snd 12088.129 D 701 50 651

snd 12088.697 D 751 50 701

snd 12089.210 D 801 50 751

snd 12089.618 D 851 50 801

snd 12090.046 D 901 50 851

snd 12090.436 D 951 50 901

snd 12091.011 D 1001 50 951

rcv 12091.550 D 601 0 651

rcv 12092.118 D 651 0 701

rcv 12092.742 D 701 0 751

rcv 12093.446 D 751 0 801

rcv 12094.075 D 801 0 851

rcv 12094.835 D 851 0 901

rcv 12096.148 D 901 0 951

rcv 12097.126 D 951 0 1001

rcv 12097.933 D 1001 0 1051

snd 12098.602 D 1051 50 1001

snd 12098.979 D 1101 50 1051

snd 12102.327 D 1151 50 1101

drop 12103.060 D 1201 50 1151

snd 15105.117 D 1251 50 1201

snd 15105.606 D 1301 50 1251

snd 15107.468 D 1351 50 1301

snd 15107.940 D 1401 50 1351

snd 15111.359 D 1451 50 1401

snd 15111.814 D 1501 50 1451

rcv 15112.125 D 1051 0 1101

snd 15112.548 D 1551 50 1501

rcv 15112.847 D 1101 0 1151

rcv 15113.269 D 1151 0 1201

snd 18117.864 D 1201 50 1151

snd 18119.697 D 1251 50 1201

snd 18120.590 D 1301 50 1251

snd 18121.402 D 1351 50 1301

snd 18124.156 D 1401 50 1351

snd 18124.596 D 1451 50 1401

snd 18127.318 D 1501 50 1451

snd 18127.772 D 1551 50 1501

rcv 18128.292 D 1201 0 1251

rcv 18128.968 D 1251 0 1301

rcv 18129.460 D 1301 0 1351

rcv 18132.748 D 1351 0 1401

rcv 18133.310 D 1401 0 1451

rcv 18136.667 D 1451 0 1501

rcv 18137.401 D 1501 0 1551

rcv 18138.441 D 1551 0 1601

snd 18138.952 F 1551 0 1501

rcv 18140.461 FA 1551 0 1501

snd 18140.760 A 1501 0 1501

Amount of (original) Data Transferred: 1592

Number of Data Segments Sent: 32

Number of (all) Packets Dropped: 3

Number of Retransmitted Segments: 28

Number of Duplicate Acknowledgements received: 1

## Appendix B – pdrop = 0.3, MWS = 500bytes, MSS = 50bytes

**Sender**

snd 1.481 S 0 0 0

rcv 2.412 SA 0 0 1

snd 4.095 A 1 0 1

snd 4.984 D 1 50 1

snd 5.629 D 51 50 1

drop 8.722 D 101 50 51

snd 3011.601 D 151 50 101

snd 3012.396 D 201 50 151

snd 3014.550 D 251 50 201

snd 3015.218 D 301 50 251

drop 3015.921 D 351 50 301

snd 6018.063 D 401 50 351

snd 6018.810 D 451 50 401

rcv 6020.649 D 1 0 51

drop 6021.340 D 501 50 451

rcv 9027.917 D 51 0 101

drop 9028.671 D 551 50 501

snd 15036.800 D 101 50 51

snd 15037.397 D 151 50 101

snd 15039.515 D 201 50 151

snd 15040.011 D 251 50 201

snd 15040.587 D 301 50 251

snd 15041.047 D 351 50 301

snd 15041.585 D 401 50 351

snd 15042.507 D 451 50 401

snd 15042.941 D 501 50 451

snd 15043.621 D 551 50 501

rcv 15044.133 D 101 0 151

drop 15044.997 D 601 50 551

rcv 18049.362 D 151 0 201

snd 18050.146 D 651 50 601

rcv 18052.030 D 201 0 251

snd 18052.878 D 701 50 651

rcv 18055.916 D 251 0 301

snd 18056.827 D 751 50 701

rcv 18057.495 D 301 0 351

snd 18060.945 D 801 50 751

rcv 18061.489 D 351 0 401

snd 18063.121 D 851 50 801

rcv 18063.617 D 401 0 451

drop 18065.509 D 901 50 851

rcv 21067.269 D 451 0 501

snd 21068.073 D 951 50 901

rcv 21070.011 D 501 0 551

snd 21070.831 D 1001 50 951

rcv 21071.353 D 551 0 601

snd 24077.370 D 1001 50 951

snd 24078.135 D 601 50 551

snd 24080.237 D 651 50 601

snd 24080.698 D 701 50 651

snd 24081.224 D 751 50 701

snd 24081.683 D 801 50 751

snd 24082.226 D 851 50 801

snd 24082.660 D 901 50 851

snd 24083.134 D 951 50 901

snd 24083.594 D 1001 50 951

rcv 24084.239 D 601 0 651

rcv 24085.024 D 651 0 701

rcv 24085.625 D 701 0 751

rcv 24086.589 D 751 0 801

rcv 24087.113 D 801 0 851

rcv 24088.176 D 851 0 901

rcv 24089.315 D 901 0 951

rcv 24090.303 D 951 0 1001

rcv 24091.250 D 1001 0 1051

snd 24091.966 D 1051 50 1001

drop 24092.282 D 1101 50 1051

snd 27097.271 D 1151 50 1101

drop 27098.058 D 1201 50 1151

snd 30103.294 D 1251 50 1201

snd 30103.990 D 1301 50 1251

snd 30106.003 D 1351 50 1301

snd 30106.613 D 1401 50 1351

snd 30110.052 D 1451 50 1401

snd 30110.652 D 1501 50 1451

rcv 30113.994 D 1051 0 1101

snd 30114.821 D 1551 50 1501

snd 33120.301 D 1101 50 1051

snd 33120.902 D 1151 50 1101

snd 33122.931 D 1201 50 1151

snd 33123.393 D 1251 50 1201

snd 33123.834 D 1301 50 1251

snd 33124.387 D 1351 50 1301

snd 33124.889 D 1401 50 1351

snd 33125.356 D 1451 50 1401

snd 33126.560 D 1501 50 1451

snd 33127.159 D 1551 50 1501

rcv 33127.911 D 1101 0 1151

rcv 33128.597 D 1151 0 1201

rcv 33129.295 D 1201 0 1251

rcv 33129.880 D 1251 0 1301

rcv 33130.396 D 1301 0 1351

rcv 33130.977 D 1351 0 1401

rcv 33131.406 D 1401 0 1451

rcv 33132.178 D 1451 0 1501

rcv 33133.304 D 1501 0 1551

rcv 33134.258 D 1551 0 1601

snd 33134.643 F 1551 0 1501

rcv 33135.495 FA 1551 0 1501

snd 33135.766 A 1501 0 1501

Amount of (original) Data Transferred: 1592

Number of Data Segments Sent: 32

Number of (all) Packets Dropped: 8

Number of Retransmitted Segments: 30

Number of Duplicate Acknowledgements received: 1

**Receiver**

rcv 0.038 S 0 0 0

snd 0.735 SA 0 0 1

rcv 2.626 A 0 0 1

rcv 3.574 D 1 50 1

snd 4.477 D 1 0 51

rcv 7.121 D 51 50 1

snd 7.995 D 51 0 101

rcv 3010.225 D 151 50 101

rcv 3011.006 D 201 50 151

rcv 3013.168 D 251 50 201

rcv 3013.817 D 301 50 251

rcv 6016.850 D 401 50 351

rcv 6017.534 D 451 50 401

rcv 15035.442 D 101 50 51

snd 15036.403 D 101 0 151

rcv 15037.971 D 151 50 101

snd 15038.841 D 151 0 201

rcv 15039.366 D 201 50 151

snd 15040.368 D 201 0 251

rcv 15040.996 D 251 50 201

snd 15041.930 D 251 0 301

rcv 15042.437 D 301 50 251

snd 15043.291 D 301 0 351

rcv 15043.812 D 351 50 301

snd 15044.588 D 351 0 401

rcv 15045.015 D 401 50 351

snd 15045.648 D 401 0 451

rcv 15046.053 D 451 50 401

snd 15046.730 D 451 0 501

rcv 15047.070 D 501 50 451

snd 15047.757 D 501 0 551

rcv 15048.136 D 551 50 501

snd 15048.762 D 551 0 601

rcv 18048.750 D 651 50 601

rcv 18051.454 D 701 50 651

rcv 18055.450 D 751 50 701

rcv 18059.640 D 801 50 751

rcv 18061.771 D 851 50 801

rcv 21066.740 D 951 50 901

rcv 21069.467 D 1001 50 951

rcv 24076.199 D 1001 50 951

rcv 24076.842 D 601 50 551

snd 24079.175 D 601 0 651

rcv 24079.714 D 651 50 601

snd 24080.540 D 651 0 701

rcv 24081.120 D 701 50 651

snd 24081.895 D 701 0 751

rcv 24082.425 D 751 50 701

snd 24083.420 D 751 0 801

rcv 24084.007 D 801 50 751

snd 24085.253 D 801 0 851

rcv 24085.719 D 851 50 801

snd 24086.570 D 851 0 901

rcv 24087.073 D 901 50 851

snd 24087.699 D 901 0 951

rcv 24088.071 D 951 50 901

snd 24088.681 D 951 0 1001

rcv 24089.056 D 1001 50 951

snd 24089.637 D 1001 0 1051

rcv 24090.530 D 1051 50 1001

snd 24091.113 D 1051 0 1101

rcv 27095.951 D 1151 50 1101

rcv 30101.905 D 1251 50 1201

rcv 30102.585 D 1301 50 1251

rcv 30104.589 D 1351 50 1301

rcv 30105.191 D 1401 50 1351

rcv 30108.667 D 1451 50 1401

rcv 30109.243 D 1501 50 1451

rcv 30113.445 D 1551 50 1501

rcv 33118.941 D 1101 50 1051

snd 33119.949 D 1101 0 1151

rcv 33121.410 D 1151 50 1101

snd 33122.278 D 1151 0 1201

rcv 33122.816 D 1201 50 1151

snd 33123.559 D 1201 0 1251

rcv 33124.008 D 1251 50 1201

snd 33125.684 D 1251 0 1301

rcv 33126.273 D 1301 50 1251

snd 33127.146 D 1301 0 1351

rcv 33127.568 D 1351 50 1301

snd 33128.245 D 1351 0 1401

rcv 33128.695 D 1401 50 1351

snd 33129.362 D 1401 0 1451

rcv 33129.820 D 1451 50 1401

snd 33130.583 D 1451 0 1501

rcv 33131.001 D 1501 50 1451

snd 33131.692 D 1501 0 1551

rcv 33132.057 D 1551 50 1501

snd 33132.671 D 1551 0 1601

rcv 33133.595 F 1551 0 1501

snd 33133.855 FA 1551 0 1552

rcv 33134.257 A 1551 0 1501

Amount of (original) Data Received: 1592

Number of Data Segments Received: 32

Number of duplicate segments received: 22

## Appendix B – pdrop = 0.1, MWS = 500bytes, MSS = 50bytes, timeout = 1000ms

**Sender**

snd 1.291 S 0 0 0

rcv 2.268 SA 0 0 1

snd 4.053 A 1 0 1

snd 5.084 D 1 50 1

snd 7.510 D 51 50 1

drop 10.315 D 101 50 51

snd 1016.166 D 151 50 101

snd 1018.212 D 201 50 151

snd 1019.302 D 251 50 201

snd 1019.985 D 301 50 251

snd 1021.420 D 351 50 301

snd 1022.147 D 401 50 351

snd 1023.239 D 451 50 401

rcv 1023.738 D 1 0 51

snd 1027.438 D 501 50 451

rcv 1027.983 D 51 0 101

snd 1031.230 D 551 50 501

snd 2034.158 D 101 50 51

snd 2034.712 D 151 50 101

snd 2036.836 D 201 50 151

snd 2037.352 D 251 50 201

snd 2040.819 D 301 50 251

snd 2041.317 D 351 50 301

snd 2041.834 D 401 50 351

snd 2042.327 D 451 50 401

snd 2042.902 D 501 50 451

snd 2043.722 D 551 50 501

rcv 2046.662 D 101 0 151

drop 2047.822 D 601 50 551

rcv 3048.567 D 151 0 201

snd 3049.562 D 651 50 601

rcv 3051.258 D 201 0 251

snd 3051.975 D 701 50 651

rcv 3052.523 D 251 0 301

snd 3053.559 D 751 50 701

rcv 3054.032 D 301 0 351

snd 3055.023 D 801 50 751

rcv 3055.503 D 351 0 401

snd 3059.512 D 851 50 801

rcv 3060.081 D 401 0 451

snd 3061.786 D 901 50 851

rcv 3062.351 D 451 0 501

snd 3063.122 D 951 50 901

rcv 3063.585 D 501 0 551

snd 3066.960 D 1001 50 951

rcv 3067.387 D 551 0 601

snd 4071.256 D 1001 50 951

snd 4071.884 D 601 50 551

snd 4073.982 D 651 50 601

snd 4074.640 D 701 50 651

snd 4075.009 D 751 50 701

snd 4075.372 D 801 50 751

snd 4075.790 D 851 50 801

snd 4076.197 D 901 50 851

snd 4076.611 D 951 50 901

snd 4077.063 D 1001 50 951

rcv 4077.594 D 601 0 651

rcv 4080.748 D 651 0 701

rcv 4081.214 D 701 0 751

rcv 4081.547 D 751 0 801

rcv 4082.304 D 801 0 851

rcv 4083.062 D 851 0 901

rcv 4084.077 D 901 0 951

rcv 4085.066 D 951 0 1001

rcv 4086.058 D 1001 0 1051

snd 4086.886 D 1051 50 1001

snd 4087.285 D 1101 50 1051

snd 4090.535 D 1151 50 1101

drop 4090.956 D 1201 50 1151

snd 5094.112 D 1251 50 1201

snd 5094.755 D 1301 50 1251

snd 5096.978 D 1351 50 1301

snd 5097.895 D 1401 50 1351

snd 5098.917 D 1451 50 1401

snd 5099.549 D 1501 50 1451

rcv 5100.991 D 1051 0 1101

snd 5101.756 D 1551 50 1501

rcv 5102.356 D 1101 0 1151

drop 5103.070 D 1601 50 1551

rcv 6105.008 D 1151 0 1201

snd 6105.771 D 1651 50 1601

snd 7108.722 D 1201 50 1151

snd 7109.312 D 1251 50 1201

snd 7111.436 D 1301 50 1251

snd 7111.874 D 1351 50 1301

snd 7112.319 D 1401 50 1351

snd 7112.796 D 1451 50 1401

snd 7113.221 D 1501 50 1451

snd 7113.629 D 1551 50 1501

snd 7114.068 D 1601 50 1551

snd 7114.643 D 1651 50 1601

rcv 7115.038 D 1201 0 1251

snd 7116.446 D 1701 50 1651

rcv 7116.982 D 1251 0 1301

snd 7117.590 D 1751 50 1701

rcv 7118.032 D 1301 0 1351

snd 7118.679 D 1801 50 1751

rcv 7119.380 D 1351 0 1401

snd 7120.374 D 1851 50 1801

rcv 7120.804 D 1401 0 1451

snd 7122.196 D 1901 50 1851

rcv 7122.721 D 1451 0 1501

snd 7123.644 D 1951 50 1901

rcv 7123.979 D 1501 0 1551

rcv 7124.440 D 1551 0 1601

rcv 7125.124 D 1601 0 1651

rcv 7125.568 D 1651 0 1701

rcv 7125.950 D 1701 0 1751

rcv 7126.375 D 1751 0 1801

rcv 7126.760 D 1801 0 1851

rcv 7127.359 D 1851 0 1901

rcv 7128.230 D 1901 0 1951

rcv 7129.088 D 1951 0 2001

snd 7129.653 F 1951 0 1901

rcv 7130.393 FA 1951 0 1901

snd 7133.075 A 1901 0 1901

Amount of (original) Data Transferred: 1953

Number of Data Segments Sent: 40

Number of (all) Packets Dropped: 4

Number of Retransmitted Segments: 30

Number of Duplicate Acknowledgements received: 2

**Receiver**

rcv 0.038 S 0 0 0

snd 0.531 SA 0 0 1

rcv 2.273 A 0 0 1

rcv 3.177 D 1 50 1

snd 3.697 D 1 0 51

rcv 6.552 D 51 50 1

snd 7.119 D 51 0 101

rcv 1009.755 D 151 50 101

rcv 1011.676 D 201 50 151

rcv 1012.348 D 251 50 201

rcv 1012.857 D 301 50 251

rcv 1013.420 D 351 50 301

rcv 1013.945 D 401 50 351

rcv 1014.480 D 451 50 401

rcv 1015.755 D 501 50 451

rcv 1019.091 D 551 50 501

rcv 2021.408 D 101 50 51

snd 2022.221 D 101 0 151

rcv 2026.631 D 151 50 101

snd 2027.483 D 151 0 201

rcv 2028.149 D 201 50 151

snd 2028.996 D 201 0 251

rcv 2029.531 D 251 50 201

snd 2030.476 D 251 0 301

rcv 2030.987 D 301 50 251

snd 2032.044 D 301 0 351

rcv 2032.624 D 351 50 301

snd 2033.477 D 351 0 401

rcv 2033.934 D 401 50 351

snd 2035.143 D 401 0 451

rcv 2035.569 D 451 50 401

snd 2036.284 D 451 0 501

rcv 2036.671 D 501 50 451

snd 2037.307 D 501 0 551

rcv 2037.692 D 551 50 501

snd 2038.296 D 551 0 601

rcv 3038.694 D 651 50 601

rcv 3041.290 D 701 50 651

rcv 3045.031 D 751 50 701

rcv 3049.850 D 801 50 751

rcv 3053.823 D 851 50 801

rcv 3056.901 D 901 50 851

rcv 3061.740 D 951 50 901

rcv 3069.685 D 1001 50 951

rcv 4081.470 D 1001 50 951

rcv 4081.918 D 601 50 551

snd 4083.862 D 601 0 651

rcv 4084.352 D 651 50 601

snd 4084.951 D 651 0 701

rcv 4085.342 D 701 50 651

snd 4085.824 D 701 0 751

rcv 4086.143 D 751 50 701

snd 4086.697 D 751 0 801

rcv 4087.067 D 801 50 751

snd 4087.971 D 801 0 851

rcv 4088.398 D 851 50 801

snd 4089.239 D 851 0 901

rcv 4089.500 D 901 50 851

snd 4090.051 D 901 0 951

rcv 4090.893 D 951 50 901

snd 4091.384 D 951 0 1001

rcv 4091.674 D 1001 50 951

snd 4092.157 D 1001 0 1051

rcv 4093.404 D 1051 50 1001

snd 4094.239 D 1051 0 1101

rcv 4094.513 D 1101 50 1051

snd 4094.889 D 1101 0 1151

rcv 4095.197 D 1151 50 1101

snd 4095.715 D 1151 0 1201

rcv 5100.510 D 1251 50 1201

rcv 5101.158 D 1301 50 1251

rcv 5103.485 D 1351 50 1301

rcv 5104.208 D 1401 50 1351

rcv 5107.498 D 1451 50 1401

rcv 5108.124 D 1501 50 1451

rcv 5112.224 D 1551 50 1501

rcv 6118.240 D 1651 50 1601

rcv 7120.614 D 1201 50 1151

snd 7121.366 D 1201 0 1251

rcv 7123.173 D 1251 50 1201

snd 7123.964 D 1251 0 1301

rcv 7124.752 D 1301 50 1251

snd 7125.508 D 1301 0 1351

rcv 7125.951 D 1351 50 1301

snd 7126.867 D 1351 0 1401

rcv 7127.506 D 1401 50 1351

snd 7128.354 D 1401 0 1451

rcv 7128.840 D 1451 50 1401

snd 7129.751 D 1451 0 1501

rcv 7130.197 D 1501 50 1451

snd 7131.167 D 1501 0 1551

rcv 7131.698 D 1551 50 1501

snd 7132.569 D 1551 0 1601

rcv 7133.076 D 1601 50 1551

snd 7136.281 D 1601 0 1651

rcv 7136.652 D 1651 50 1601

snd 7140.416 D 1651 0 1701

rcv 7140.660 D 1701 50 1651

snd 7141.017 D 1701 0 1751

rcv 7141.767 D 1751 50 1701

snd 7142.261 D 1751 0 1801

rcv 7142.618 D 1801 50 1751

snd 7143.805 D 1801 0 1851

rcv 7144.353 D 1851 50 1801

snd 7145.126 D 1851 0 1901

rcv 7145.433 D 1901 50 1851

snd 7147.031 D 1901 0 1951

rcv 7147.396 D 1951 50 1901

snd 7150.794 D 1951 0 2001

rcv 7152.546 F 1951 0 1901

snd 7153.102 FA 1951 0 1952

rcv 7153.579 A 1951 0 1901

Amount of (original) Data Received: 1953

Number of Data Segments Received: 40

Number of duplicate segments received: 26

## Appendix C – pdrop = 0.1, MWS = 500bytes, MSS = 50bytes, timeout = 4000ms

**Sender**

snd 1.110 S 0 0 0

rcv 2.219 SA 0 0 1

snd 3.755 A 1 0 1

snd 4.729 D 1 50 1

snd 5.348 D 51 50 1

drop 5.855 D 101 50 51

snd 4011.673 D 151 50 101

snd 4012.350 D 201 50 151

snd 4014.424 D 251 50 201

snd 4014.999 D 301 50 251

snd 4018.468 D 351 50 301

snd 4019.157 D 401 50 351

snd 4022.743 D 451 50 401

rcv 4023.276 D 1 0 51

snd 4027.118 D 501 50 451

rcv 4029.883 D 51 0 101

snd 4030.609 D 551 50 501

snd 8033.099 D 101 50 51

snd 8033.680 D 151 50 101

snd 8035.923 D 201 50 151

snd 8036.455 D 251 50 201

snd 8036.854 D 301 50 251

snd 8037.240 D 351 50 301

snd 8037.695 D 401 50 351

snd 8038.137 D 451 50 401

snd 8038.530 D 501 50 451

snd 8038.988 D 551 50 501

rcv 8039.591 D 101 0 151

drop 8040.390 D 601 50 551

rcv 12043.904 D 151 0 201

snd 12044.661 D 651 50 601

rcv 12046.736 D 201 0 251

snd 12047.526 D 701 50 651

rcv 12050.761 D 251 0 301

snd 12051.494 D 751 50 701

rcv 12054.791 D 301 0 351

snd 12055.565 D 801 50 751

rcv 12058.535 D 351 0 401

snd 12059.380 D 851 50 801

rcv 12062.611 D 401 0 451

snd 12063.245 D 901 50 851

rcv 12063.711 D 451 0 501

snd 12067.480 D 951 50 901

rcv 12068.109 D 501 0 551

snd 12071.166 D 1001 50 951

rcv 12071.693 D 551 0 601

snd 16080.040 D 1001 50 951

snd 16080.586 D 601 50 551

snd 16082.678 D 651 50 601

snd 16083.170 D 701 50 651

snd 16083.610 D 751 50 701

snd 16084.044 D 801 50 751

snd 16084.425 D 851 50 801

snd 16084.757 D 901 50 851

snd 16085.212 D 951 50 901

snd 16085.661 D 1001 50 951

rcv 16086.125 D 601 0 651

rcv 16087.444 D 651 0 701

rcv 16088.065 D 701 0 751

rcv 16088.649 D 751 0 801

rcv 16089.270 D 801 0 851

rcv 16090.180 D 851 0 901

rcv 16091.429 D 901 0 951

rcv 16092.525 D 951 0 1001

rcv 16093.500 D 1001 0 1051

snd 16094.371 D 1051 50 1001

snd 16095.016 D 1101 50 1051

snd 16096.006 D 1151 50 1101

drop 16096.571 D 1201 50 1151

snd 20098.714 D 1251 50 1201

snd 20099.483 D 1301 50 1251

snd 20101.758 D 1351 50 1301

snd 20102.394 D 1401 50 1351

snd 20103.802 D 1451 50 1401

snd 20104.429 D 1501 50 1451

rcv 20106.133 D 1051 0 1101

snd 20106.887 D 1551 50 1501

rcv 20107.345 D 1101 0 1151

drop 20109.386 D 1601 50 1551

rcv 24113.735 D 1151 0 1201

snd 24114.269 D 1651 50 1601

snd 28123.025 D 1201 50 1151

snd 28123.444 D 1251 50 1201

snd 28126.680 D 1301 50 1251

snd 28127.168 D 1351 50 1301

snd 28127.612 D 1401 50 1351

snd 28128.065 D 1451 50 1401

snd 28128.421 D 1501 50 1451

snd 28128.861 D 1551 50 1501

snd 28129.149 D 1601 50 1551

snd 28129.618 D 1651 50 1601

rcv 28130.058 D 1201 0 1251

snd 28130.748 D 1701 50 1651

rcv 28131.195 D 1251 0 1301

snd 28131.797 D 1751 50 1701

rcv 28132.136 D 1301 0 1351

snd 28132.803 D 1801 50 1751

rcv 28133.440 D 1351 0 1401

snd 28134.025 D 1851 50 1801

rcv 28134.370 D 1401 0 1451

snd 28134.856 D 1901 50 1851

rcv 28135.152 D 1451 0 1501

snd 28135.596 D 1951 50 1901

rcv 28135.876 D 1501 0 1551

rcv 28136.184 D 1551 0 1601

rcv 28136.700 D 1601 0 1651

rcv 28137.056 D 1651 0 1701

rcv 28137.335 D 1701 0 1751

rcv 28137.566 D 1751 0 1801

rcv 28137.873 D 1801 0 1851

rcv 28138.131 D 1851 0 1901

rcv 28138.401 D 1901 0 1951

rcv 28138.941 D 1951 0 2001

snd 28139.446 F 1951 0 1901

rcv 28140.341 FA 1951 0 1901

snd 28141.728 A 1901 0 1901

Amount of (original) Data Transferred: 1953

Number of Data Segments Sent: 40

Number of (all) Packets Dropped: 4

Number of Retransmitted Segments: 30

Number of Duplicate Acknowledgements received: 2

**Receiver**

rcv 0.068 S 0 0 0

snd 0.820 SA 0 0 1

rcv 2.895 A 0 0 1

rcv 3.583 D 1 50 1

snd 4.475 D 1 0 51

rcv 5.083 D 51 50 1

snd 5.732 D 51 0 101

rcv 4010.610 D 151 50 101

rcv 4011.260 D 201 50 151

rcv 4013.334 D 251 50 201

rcv 4013.904 D 301 50 251

rcv 4017.338 D 351 50 301

rcv 4018.068 D 401 50 351

rcv 4022.233 D 451 50 401

rcv 4026.396 D 501 50 451

rcv 4029.543 D 551 50 501

rcv 8032.037 D 101 50 51

snd 8032.753 D 101 0 151

rcv 8034.709 D 151 50 101

snd 8035.465 D 151 0 201

rcv 8036.071 D 201 50 151

snd 8036.808 D 201 0 251

rcv 8037.355 D 251 50 201

snd 8038.267 D 251 0 301

rcv 8038.793 D 301 50 251

snd 8040.683 D 301 0 351

rcv 8041.269 D 351 50 301

snd 8042.054 D 351 0 401

rcv 8042.599 D 401 50 351

snd 8043.429 D 401 0 451

rcv 8044.951 D 451 50 401

snd 8045.776 D 451 0 501

rcv 8048.094 D 501 50 451

snd 8048.914 D 501 0 551

rcv 8049.387 D 551 50 501

snd 8050.168 D 551 0 601

rcv 12043.603 D 651 50 601

rcv 12046.456 D 701 50 651

rcv 12050.433 D 751 50 701

rcv 12054.457 D 801 50 751

rcv 12058.328 D 851 50 801

rcv 12062.181 D 901 50 851

rcv 12066.506 D 951 50 901

rcv 12070.104 D 1001 50 951

rcv 16078.940 D 1001 50 951

rcv 16079.461 D 601 50 551

snd 16081.769 D 601 0 651

rcv 16082.202 D 651 50 601

snd 16082.931 D 651 0 701

rcv 16083.416 D 701 50 651

snd 16084.750 D 701 0 751

rcv 16085.304 D 751 50 701

snd 16086.485 D 751 0 801

rcv 16086.883 D 801 50 751

snd 16087.681 D 801 0 851

rcv 16088.153 D 851 50 801

snd 16088.864 D 851 0 901

rcv 16089.465 D 901 50 851

snd 16090.076 D 901 0 951

rcv 16090.532 D 951 50 901

snd 16091.164 D 951 0 1001

rcv 16091.547 D 1001 50 951

snd 16092.146 D 1001 0 1051

rcv 16093.319 D 1051 50 1001

snd 16093.974 D 1051 0 1101

rcv 16094.712 D 1101 50 1051

snd 16095.710 D 1101 0 1151

rcv 16096.071 D 1151 50 1101

snd 16096.675 D 1151 0 1201

rcv 20097.673 D 1251 50 1201

rcv 20098.452 D 1301 50 1251

rcv 20100.679 D 1351 50 1301

rcv 20101.280 D 1401 50 1351

rcv 20102.692 D 1451 50 1401

rcv 20103.312 D 1501 50 1451

rcv 20105.796 D 1551 50 1501

rcv 24113.169 D 1651 50 1601

rcv 28121.932 D 1201 50 1151

snd 28122.597 D 1201 0 1251

rcv 28125.489 D 1251 50 1201

snd 28126.305 D 1251 0 1301

rcv 28126.742 D 1301 50 1251

snd 28127.285 D 1301 0 1351

rcv 28127.718 D 1351 50 1301

snd 28128.581 D 1351 0 1401

rcv 28129.087 D 1401 50 1351

snd 28129.798 D 1401 0 1451

rcv 28130.168 D 1451 50 1401

snd 28130.642 D 1451 0 1501

rcv 28130.956 D 1501 50 1451

snd 28131.429 D 1501 0 1551

rcv 28131.792 D 1551 50 1501

snd 28132.607 D 1551 0 1601

rcv 28132.945 D 1601 50 1551

snd 28133.378 D 1601 0 1651

rcv 28133.597 D 1651 50 1601

snd 28134.007 D 1651 0 1701

rcv 28134.237 D 1701 50 1651

snd 28134.571 D 1701 0 1751

rcv 28134.748 D 1751 50 1701

snd 28135.055 D 1751 0 1801

rcv 28135.333 D 1801 50 1751

snd 28135.698 D 1801 0 1851

rcv 28135.993 D 1851 50 1801

snd 28136.391 D 1851 0 1901

rcv 28136.618 D 1901 50 1851

snd 28136.942 D 1901 0 1951

rcv 28137.167 D 1951 50 1901

snd 28137.636 D 1951 0 2001

rcv 28138.754 F 1951 0 1901

snd 28138.984 FA 1951 0 1952

rcv 28140.562 A 1951 0 1901

Amount of (original) Data Received: 1953

Number of Data Segments Received: 40

Number of duplicate segments received: 26

## Appendix C – pdrop = 0.1, MWS = 500bytes, MSS = 50bytes, timeout = 250ms

**Sender**

snd 1.350 S 0 0 0

rcv 2.380 SA 0 0 1

snd 4.250 A 1 0 1

snd 5.125 D 1 50 1

snd 7.984 D 51 50 1

drop 8.497 D 101 50 51

snd 259.146 D 151 50 101

snd 259.613 D 201 50 151

snd 261.489 D 251 50 201

snd 261.816 D 301 50 251

snd 262.099 D 351 50 301

snd 262.454 D 401 50 351

snd 262.895 D 451 50 401

rcv 263.138 D 1 0 51

snd 263.458 D 501 50 451

rcv 263.672 D 51 0 101

snd 264.101 D 551 50 501

snd 515.504 D 101 50 51

snd 516.645 D 151 50 101

snd 518.537 D 201 50 151

snd 519.044 D 251 50 201

snd 520.092 D 301 50 251

snd 520.663 D 351 50 301

snd 521.757 D 401 50 351

snd 522.265 D 451 50 401

snd 523.152 D 501 50 451

snd 523.594 D 551 50 501

rcv 524.563 D 101 0 151

drop 525.297 D 601 50 551

rcv 782.845 D 151 0 201

snd 783.685 D 651 50 601

rcv 785.458 D 201 0 251

snd 786.273 D 701 50 651

rcv 786.883 D 251 0 301

snd 790.308 D 751 50 701

rcv 790.818 D 301 0 351

snd 794.336 D 801 50 751

rcv 794.819 D 351 0 401

snd 798.443 D 851 50 801

rcv 799.173 D 401 0 451

snd 802.374 D 901 50 851

rcv 802.856 D 451 0 501

snd 806.312 D 951 50 901

rcv 806.796 D 501 0 551

snd 810.266 D 1001 50 951

rcv 810.782 D 551 0 601

snd 1068.385 D 1001 50 951

snd 1068.816 D 601 50 551

snd 1070.832 D 651 50 601

snd 1071.296 D 701 50 651

snd 1071.606 D 751 50 701

snd 1071.992 D 801 50 751

snd 1072.367 D 851 50 801

snd 1072.702 D 901 50 851

snd 1073.118 D 951 50 901

snd 1073.491 D 1001 50 951

rcv 1073.710 D 601 0 651

rcv 1074.118 D 651 0 701

rcv 1074.452 D 701 0 751

rcv 1074.856 D 751 0 801

rcv 1075.164 D 801 0 851

rcv 1075.605 D 851 0 901

rcv 1076.403 D 901 0 951

rcv 1077.371 D 951 0 1001

rcv 1078.518 D 1001 0 1051

snd 1079.200 D 1051 50 1001

snd 1079.586 D 1101 50 1051

snd 1080.176 D 1151 50 1101

drop 1080.474 D 1201 50 1151

snd 1333.339 D 1251 50 1201

snd 1334.012 D 1301 50 1251

snd 1335.875 D 1351 50 1301

snd 1336.347 D 1401 50 1351

snd 1337.330 D 1451 50 1401

snd 1337.764 D 1501 50 1451

rcv 1338.194 D 1051 0 1101

snd 1338.661 D 1551 50 1501

rcv 1338.987 D 1101 0 1151

drop 1339.442 D 1601 50 1551

rcv 1594.967 D 1151 0 1201

snd 1595.838 D 1651 50 1601

snd 1853.110 D 1201 50 1151

snd 1855.211 D 1251 50 1201

snd 1858.458 D 1301 50 1251

snd 1858.939 D 1351 50 1301

snd 1859.451 D 1401 50 1351

snd 1859.944 D 1451 50 1401

snd 1860.412 D 1501 50 1451

snd 1860.970 D 1551 50 1501

snd 1861.530 D 1601 50 1551

snd 1862.023 D 1651 50 1601

rcv 1863.164 D 1201 0 1251

snd 1864.101 D 1701 50 1651

rcv 1864.578 D 1251 0 1301

snd 1865.800 D 1751 50 1701

rcv 1866.446 D 1301 0 1351

snd 1867.754 D 1801 50 1751

rcv 1868.220 D 1351 0 1401

snd 1868.781 D 1851 50 1801

rcv 1869.199 D 1401 0 1451

snd 1870.011 D 1901 50 1851

rcv 1870.367 D 1451 0 1501

snd 1870.888 D 1951 50 1901

rcv 1871.215 D 1501 0 1551

rcv 1871.589 D 1551 0 1601

rcv 1872.054 D 1601 0 1651

rcv 1872.424 D 1651 0 1701

rcv 1872.901 D 1701 0 1751

rcv 1873.224 D 1751 0 1801

rcv 1873.520 D 1801 0 1851

rcv 1873.855 D 1851 0 1901

rcv 1874.104 D 1901 0 1951

rcv 1874.474 D 1951 0 2001

snd 1874.865 F 1951 0 1901

rcv 1875.743 FA 1951 0 1901

snd 1876.037 A 1901 0 1901

Amount of (original) Data Transferred: 1953

Number of Data Segments Sent: 40

Number of (all) Packets Dropped: 4

Number of Retransmitted Segments: 30

Number of Duplicate Acknowledgements received: 2

**Receiver**

rcv 0.045 S 0 0 0

snd 0.809 SA 0 0 1

rcv 3.166 A 0 0 1

rcv 6.401 D 1 50 1

snd 7.217 D 1 0 51

rcv 7.780 D 51 50 1

snd 8.364 D 51 0 101

rcv 257.816 D 151 50 101

rcv 258.223 D 201 50 151

rcv 260.110 D 251 50 201

rcv 260.572 D 301 50 251

rcv 260.878 D 351 50 301

rcv 261.118 D 401 50 351

rcv 261.492 D 451 50 401

rcv 262.072 D 501 50 451

rcv 262.810 D 551 50 501

rcv 514.940 D 101 50 51

snd 515.751 D 101 0 151

rcv 517.062 D 151 50 101

snd 517.915 D 151 0 201

rcv 518.780 D 201 50 151

snd 519.702 D 201 0 251

rcv 520.202 D 251 50 201

snd 521.065 D 251 0 301

rcv 521.774 D 301 50 251

snd 522.428 D 301 0 351

rcv 522.795 D 351 50 301

snd 523.430 D 351 0 401

rcv 526.821 D 401 50 351

snd 527.360 D 401 0 451

rcv 527.752 D 451 50 401

snd 528.199 D 451 0 501

rcv 528.584 D 501 50 451

snd 529.046 D 501 0 551

rcv 529.392 D 551 50 501

snd 529.875 D 551 0 601

rcv 782.386 D 651 50 601

rcv 784.953 D 701 50 651

rcv 789.024 D 751 50 701

rcv 793.057 D 801 50 751

rcv 797.215 D 851 50 801

rcv 801.084 D 901 50 851

rcv 805.039 D 951 50 901

rcv 808.977 D 1001 50 951

rcv 1067.029 D 1001 50 951

rcv 1067.429 D 601 50 551

snd 1069.512 D 601 0 651

rcv 1069.785 D 651 50 601

snd 1070.390 D 651 0 701

rcv 1070.776 D 701 50 651

snd 1071.275 D 701 0 751

rcv 1071.667 D 751 50 701

snd 1072.196 D 751 0 801

rcv 1072.608 D 801 50 751

snd 1073.203 D 801 0 851

rcv 1073.595 D 851 50 801

snd 1074.079 D 851 0 901

rcv 1074.414 D 901 50 851

snd 1074.863 D 901 0 951

rcv 1075.404 D 951 50 901

snd 1075.830 D 951 0 1001

rcv 1076.202 D 1001 50 951

snd 1076.741 D 1001 0 1051

rcv 1077.834 D 1051 50 1001

snd 1078.425 D 1051 0 1101

rcv 1078.730 D 1101 50 1051

snd 1079.197 D 1101 0 1151

rcv 1079.415 D 1151 50 1101

snd 1079.896 D 1151 0 1201

rcv 1332.274 D 1251 50 1201

rcv 1332.889 D 1301 50 1251

rcv 1334.563 D 1351 50 1301

rcv 1335.089 D 1401 50 1351

rcv 1335.969 D 1451 50 1401

rcv 1336.346 D 1501 50 1451

rcv 1337.378 D 1551 50 1501

rcv 1594.567 D 1651 50 1601

rcv 1851.835 D 1201 50 1151

snd 1854.081 D 1201 0 1251

rcv 1857.023 D 1251 50 1201

snd 1857.837 D 1251 0 1301

rcv 1858.391 D 1301 50 1251

snd 1859.223 D 1301 0 1351

rcv 1859.713 D 1351 50 1301

snd 1860.807 D 1351 0 1401

rcv 1861.735 D 1401 50 1351

snd 1862.457 D 1401 0 1451

rcv 1862.883 D 1451 50 1401

snd 1863.858 D 1451 0 1501

rcv 1864.358 D 1501 50 1451

snd 1865.096 D 1501 0 1551

rcv 1865.755 D 1551 50 1501

snd 1866.478 D 1551 0 1601

rcv 1866.858 D 1601 50 1551

snd 1867.498 D 1601 0 1651

rcv 1867.841 D 1651 50 1601

snd 1868.484 D 1651 0 1701

rcv 1868.843 D 1701 50 1651

snd 1869.383 D 1701 0 1751

rcv 1869.697 D 1751 50 1701

snd 1870.157 D 1751 0 1801

rcv 1870.410 D 1801 50 1751

snd 1870.832 D 1801 0 1851

rcv 1871.112 D 1851 50 1801

snd 1871.616 D 1851 0 1901

rcv 1871.850 D 1901 50 1851

snd 1872.295 D 1901 0 1951

rcv 1872.552 D 1951 50 1901

snd 1872.963 D 1951 0 2001

rcv 1873.883 F 1951 0 1901

snd 1874.156 FA 1951 0 1952

rcv 1874.616 A 1951 0 1901

Amount of (original) Data Received: 1953

Number of Data Segments Received: 40

Number of duplicate segments received: 26