

7005 Asn4 - Testing and Usage

Make and test all the things!

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Building and Running

Prerequisites:

CMake is installed

C11 compliant compiler is installed

Linux Kernel is at 4.5 or greater

OpenSSL 1.1 is installed

Note to install OpenSSL run `install.sh`

Step 1

Generate makefile by running `cmake .`

Expected outcome

```
18:56:37 master? isaac isaacbox 7005-asn4 cmake ./
-- The C compiler identification is GNU 7.2.0
-- The CXX compiler identification is GNU 7.2.0
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Looking for pthread.h
-- Looking for pthread.h - found
-- Looking for pthread_create
-- Looking for pthread_create - not found
-- Check if compiler accepts -pthread
-- Check if compiler accepts -pthread - yes
-- Found Threads: TRUE
-- Found OpenSSL: /usr/lib/libcrypto.so (found version "1.1.0g")
-- Configuring done
-- Generating done
-- Build files have been written to: /home/isaac/code/7005-asn4
```

Step 2

Build project running `make`

Expected Outcome

```
18:56:59 master@isaac isaacbox 7005-asn4$ make
Scanning dependencies of target 7005-asn4-lossy
[ 8%] Building C object CMakeFiles/7005-asn4-lossy.dir/src/lossy/errors.c.o
[ 16%] Building C object CMakeFiles/7005-asn4-lossy.dir/src/lossy/main.c.o
[ 25%] Building C object CMakeFiles/7005-asn4-lossy.dir/src/lossy/wrapper.c.o
[ 33%] Building CXX object CMakeFiles/7005-asn4-lossy.dir/src/lossy/cpp_wrapper.cpp.o
[ 41%] Linking CXX executable bin/7005-asn4-lossy
[ 41%] Built target 7005-asn4-lossy
Scanning dependencies of target 7005-asn4
[ 50%] Building C object CMakeFiles/7005-asn4.dir/src/client/crypto.c.o
[ 58%] Building C object CMakeFiles/7005-asn4.dir/src/client/epoll.c.o
[ 66%] Building C object CMakeFiles/7005-asn4.dir/src/client/main.c.o
[ 75%] Building C object CMakeFiles/7005-asn4.dir/src/client/network.c.o
[ 83%] Building C object CMakeFiles/7005-asn4.dir/src/client/socket.c.o
[ 91%] Building C object CMakeFiles/7005-asn4.dir/src/client/test.c.o
[100%] Linking C executable bin/7005-asn4
[100%] Built target 7005-asn4
```

Step 3

Verify program built correctly by running `./bin/7005-asn4` and `./bin/7005-asn4-lossy`

Expected Result

```
19:04:19 master@isaac isaacbox 7005-asn4$ ./bin/7005-asn4
usage options:
  [p]ort <1-65535>          - the port to use, default 1337
  [c]lient                  - run as client, exclusive with server
  [s]erver                  - run as server, exclusive with client
  [i]p <url || ip>          - address to connect to
  [f]ile <path/to/file>     - the file to send
  [o]ut <path/to/file>     - the file to write to, default stdout
  [h]elp                   - this message
19:04:21 master@isaac isaacbox 7005-asn4$ ./bin/7005-asn4-lossy
usage options:
  [p]ort <1-65535>          - the port to listen to
  [f]orward <1-65535>      - the port to forward to
  [a]ddress <url || ip>    - the address forward to
  [e]rror <percentage>     - the error rate, default is no errors
  [t]ype <D || B || W[microseconds]> - the type of error to have
    D is to drop packets, default type
    B is BER to corrupt packets in percent such as B5.0
    W is time to wait in microseconds such as W100
  [h]elp                   - this message
```

Test of direct transfer

Purpose:

Show basic function

Step 1

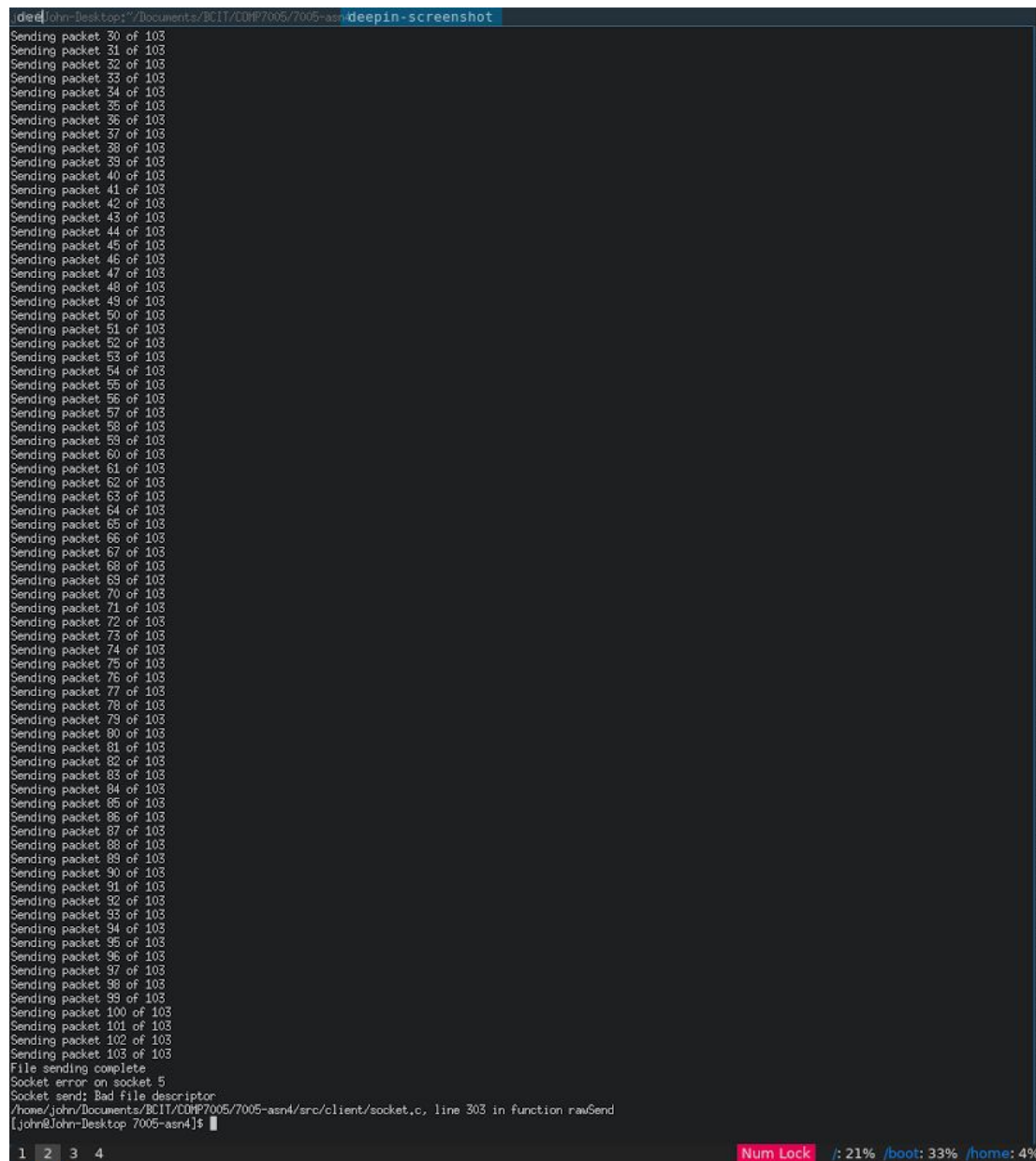
Run server with `./bin/7005-asn-4 -s -p 7001 -f testFile -o testServer`

Step 2

Run client with `./bin/7005-asn-4 -c -i 0.0.0.0 -p 7001 -f testFile -o testServer`

Expected Outcome

The client will connect to the server and transfer the file there as well as the server will transfer its file back as shown below.

A terminal window titled 'deepin-screenshot' showing the output of a file transfer process. The output consists of 74 lines, each starting with 'Sending packet' followed by a number from 30 to 103, and ending with 'of 103'. After the last line, it says 'File sending complete'. The next line is 'Socket error on socket 5', followed by 'Socket send: Bad file descriptor'. The final line is the command prompt '[john@John-Desktop 7005-asn4]\$'. At the bottom of the terminal, there is a status bar with '1 2 3 4' on the left, 'Num Lock' in a red box in the middle, and '/: 21% /boot: 33% /home: 4%' on the right.

```
john@John-Desktop:~/Documents/BCIT/COMP7005/7005-asn4$ ./bin/7005-asn-4 -s -p 7001 -f testFile -o testServer
Sending packet 30 of 103
Sending packet 31 of 103
Sending packet 32 of 103
Sending packet 33 of 103
Sending packet 34 of 103
Sending packet 35 of 103
Sending packet 36 of 103
Sending packet 37 of 103
Sending packet 38 of 103
Sending packet 39 of 103
Sending packet 40 of 103
Sending packet 41 of 103
Sending packet 42 of 103
Sending packet 43 of 103
Sending packet 44 of 103
Sending packet 45 of 103
Sending packet 46 of 103
Sending packet 47 of 103
Sending packet 48 of 103
Sending packet 49 of 103
Sending packet 50 of 103
Sending packet 51 of 103
Sending packet 52 of 103
Sending packet 53 of 103
Sending packet 54 of 103
Sending packet 55 of 103
Sending packet 56 of 103
Sending packet 57 of 103
Sending packet 58 of 103
Sending packet 59 of 103
Sending packet 60 of 103
Sending packet 61 of 103
Sending packet 62 of 103
Sending packet 63 of 103
Sending packet 64 of 103
Sending packet 65 of 103
Sending packet 66 of 103
Sending packet 67 of 103
Sending packet 68 of 103
Sending packet 69 of 103
Sending packet 70 of 103
Sending packet 71 of 103
Sending packet 72 of 103
Sending packet 73 of 103
Sending packet 74 of 103
Sending packet 75 of 103
Sending packet 76 of 103
Sending packet 77 of 103
Sending packet 78 of 103
Sending packet 79 of 103
Sending packet 80 of 103
Sending packet 81 of 103
Sending packet 82 of 103
Sending packet 83 of 103
Sending packet 84 of 103
Sending packet 85 of 103
Sending packet 86 of 103
Sending packet 87 of 103
Sending packet 88 of 103
Sending packet 89 of 103
Sending packet 90 of 103
Sending packet 91 of 103
Sending packet 92 of 103
Sending packet 93 of 103
Sending packet 94 of 103
Sending packet 95 of 103
Sending packet 96 of 103
Sending packet 97 of 103
Sending packet 98 of 103
Sending packet 99 of 103
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Sending packet 103 of 103
File sending complete
Socket error on socket 5
Socket send: Bad file descriptor
[john@John-Desktop 7005-asn4]$
```

```
john@John-Desktop: /Documents/BCIT/COMP7005/7005-asn4$
Sending packet 32 of 103
Sending packet 33 of 103
Sending packet 34 of 103
Sending packet 35 of 103
Sending packet 36 of 103
Sending packet 37 of 103
Sending packet 38 of 103
Sending packet 39 of 103
Sending packet 40 of 103
Sending packet 41 of 103
Sending packet 42 of 103
Sending packet 43 of 103
Sending packet 44 of 103
Sending packet 45 of 103
Sending packet 46 of 103
Sending packet 47 of 103
Sending packet 48 of 103
Sending packet 49 of 103
Sending packet 50 of 103
Sending packet 51 of 103
Sending packet 52 of 103
Sending packet 53 of 103
Sending packet 54 of 103
Sending packet 55 of 103
Sending packet 56 of 103
Sending packet 57 of 103
Sending packet 58 of 103
Sending packet 59 of 103
Sending packet 60 of 103
Sending packet 61 of 103
Sending packet 62 of 103
Sending packet 63 of 103
Sending packet 64 of 103
Sending packet 65 of 103
Sending packet 66 of 103
Sending packet 67 of 103
Sending packet 68 of 103
Sending packet 69 of 103
Sending packet 70 of 103
Sending packet 71 of 103
Sending packet 72 of 103
Sending packet 73 of 103
Sending packet 74 of 103
Sending packet 75 of 103
Sending packet 76 of 103
Sending packet 77 of 103
Sending packet 78 of 103
Sending packet 79 of 103
Sending packet 80 of 103
Sending packet 81 of 103
Sending packet 82 of 103
Sending packet 83 of 103
Sending packet 84 of 103
Sending packet 85 of 103
Sending packet 86 of 103
Sending packet 87 of 103
Sending packet 88 of 103
Sending packet 89 of 103
Sending packet 90 of 103
Sending packet 91 of 103
Sending packet 92 of 103
Sending packet 93 of 103
Sending packet 94 of 103
Sending packet 95 of 103
Sending packet 96 of 103
Sending packet 97 of 103
Sending packet 98 of 103
Sending packet 99 of 103
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Sending packet 103 of 103
File sending complete
Socket read: Socket operation on non-socket
Socket send: Socket operation on non-socket
epoll_wait: Bad file descriptor
/home/john/Documents/BCIT/COMP7005/7005-asn4/src/client/socket.c, line 303 in function rawSend
/home/john/Documents/BCIT/COMP7005/7005-asn4/src/client/epoll.c, line 147 in function waitForEpollEvent
[john@John-Desktop 7005-asn4]$
% VOL | 2.99 GB/15.61 GB 1% 10.0.0.5 0 KB/s 0 KB/s 26°C 2017-12-03 13:39:29 Apps
```

After sending is complete the files can be verified by checking their MD5 checksum as shown below.

```
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Sending packet 103 of 103
File sending complete
Socket error on socket 5
Socket send: Bad file descriptor
/home/john/Documents/BCIT/COMP7005/7005-asn4/src/client/socket.c, line 303 in funct
[john@John-Desktop 7005-asn4]$ md5sum test*
121364332e03c5eaa5e6479b9f28e5c8 testClient
121364332e03c5eaa5e6479b9f28e5c8 testFile
121364332e03c5eaa5e6479b9f28e5c8 testServer
[john@John-Desktop 7005-asn4]$
```

Test with middleman with no errors transfer

Purpose:

Show the middleman functionality

Step 1

Run server with `./bin/7005-asn-4 -s -p 7000 -f testFile -o testServer`

Step 2

Run middleman with `./bin/7005-asn4-lossy -p 7000 -f 7001 -a localhost`

Step 3

Run client with `./bin/7005-asn-4 -c -i 0.0.0.0 -p 7001 -f testFile -o testServer`

Expected Outcome

As shown with the middleman below the packets are all forwarding back and forth

[illegible]

After sending is complete the files can be verified by checking their MD5 checksum as shown below.

```
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Sending packet 103 of 103
File sending complete
Socket error on socket 5
Socket send: Bad file descriptor
/home/john/Documents/BCIT/COMP7005/7005-asn4/src/client/socket.c, line 303 in funct
[john@John-Desktop 7005-asn4]$ md5sum test*
121364332e03c5eaa5e6479b9f28e5c8  testClient
121364332e03c5eaa5e6479b9f28e5c8  testFile
121364332e03c5eaa5e6479b9f28e5c8  testServer
[john@John-Desktop 7005-asn4]$
```

Test with middleman with drop errors

Purpose:

Check that resends and timeouts function correctly

Step 1

Run server with `./bin/7005-asn-4 -s -p 7000 -f testFile -o testServer`

Step 2

Run middleman with `./bin/7005-asn4-lossy -p 7000 -f 7001 -a localhost -t D -e 10`

Step 3

Run client with `./bin/7005-asn-4 -c -i 0.0.0.0 -p 7001 -f testFile -o testServer`

Expected Outcome

As can be seen below the lossy middle man prints the drops that occur when forwarding the traffic.

```
deepin-screenshot | john@John-Desktop:~/Documents/BCIT/COMP7005/7005-asn4$ cat logging.txt | grep dropped | wc -l
14881
john@John-Desktop:~/Documents/BCIT/COMP7005/7005-asn4$ cat logging.txt | wc -l
148810
```

The error rate can be verified by checking the logged number of drops compared to the total packets forwarded.

```
[john@John-Desktop 7005-asn4]$ cat logging.txt | grep dropped | wc -l
14881
[john@John-Desktop 7005-asn4]$ cat logging.txt | wc -l
148810
[john@John-Desktop 7005-asn4]$
```

After sending is complete the files can be verified by checking their MD5 checksum as shown below.

```
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Sending packet 103 of 103
File sending complete
Socket error on socket 5
Socket send: Bad file descriptor
/home/john/Documents/BCIT/COMP7005/7005-asn4/src/client/socket.c, line 303 in funct
[john@John-Desktop 7005-asn4]$ md5sum test*
121364332e03c5eaa5e6479b9f28e5c8 testClient
121364332e03c5eaa5e6479b9f28e5c8 testFile
121364332e03c5eaa5e6479b9f28e5c8 testServer
[john@John-Desktop 7005-asn4]$
```

Test with middleman with corruption errors

Purpose:

Check that HMAC failures result in packet drops

Step 1

Run server with `./bin/7005-asn-4 -s -p 7000 -f testFile -o testServer`

Step 2

Run middleman with `./bin/7005-asn4-lossy -p 7000 -f 7001 -a localhost -t B5 -e 10`

Step 3

Run client with `./bin/7005-asn-4 -c -i 0.0.0.0 -p 7001 -f testFile -o testServer`

Expected Outcome

When bit corruption occurs this will invalidate the HMAC and cause the packet to be dropped as you can see below.

```

C:\Users\Bili\Documents\Bili\DMF7005\7005-ans\keepin-screenshots
Sending packet 47 of 103
Sending packet 48 of 103
Packet MMC failed to verify, dropping...
Sending packet 49 of 103
Sending packet 50 of 103
Sending packet 51 of 103
Packet MMC failed to verify, dropping...
Packet MMC failed to verify, dropping...
Sending packet 52 of 103
Sending packet 53 of 103
Sending packet 54 of 103
Packet MMC failed to verify, dropping...
Sending packet 55 of 103
Sending packet 56 of 103
Sending packet 57 of 103
Packet MMC failed to verify, dropping...
Sending packet 58 of 103
Sending packet 59 of 103
Packet MMC failed to verify, dropping...
Sending packet 60 of 103
Sending packet 61 of 103
Sending packet 62 of 103
Sending packet 63 of 103
Packet MMC failed to verify, dropping...
Packet MMC failed to verify, dropping...
Sending packet 64 of 103
Sending packet 65 of 103
Sending packet 66 of 103
Packet MMC failed to verify, dropping...
Sending packet 67 of 103
Sending packet 68 of 103
Sending packet 69 of 103
Packet MMC failed to verify, dropping...
Sending packet 70 of 103
Sending packet 71 of 103
Sending packet 72 of 103
Packet MMC failed to verify, dropping...
Sending packet 73 of 103
Sending packet 74 of 103
Sending packet 75 of 103
Packet MMC failed to verify, dropping...
Sending packet 76 of 103
Sending packet 77 of 103
Sending packet 78 of 103
Packet MMC failed to verify, dropping...
Sending packet 79 of 103
Packet MMC failed to verify, dropping...
Sending packet 80 of 103
Sending packet 81 of 103
Packet MMC failed to verify, dropping...
Sending packet 82 of 103
Sending packet 83 of 103
Sending packet 84 of 103
Sending packet 85 of 103
Sending packet 86 of 103
Sending packet 87 of 103
Packet MMC failed to verify, dropping...
Sending packet 88 of 103
Sending packet 89 of 103
Packet MMC failed to verify, dropping...
Packet MMC failed to verify, dropping...
Sending packet 91 of 103
Sending packet 92 of 103
Sending packet 93 of 103
Packet MMC failed to verify, dropping...
Sending packet 94 of 103
Packet MMC failed to verify, dropping...
Sending packet 95 of 103
Sending packet 96 of 103
Sending packet 97 of 103
Packet MMC failed to verify, dropping...
Sending packet 98 of 103
Sending packet 99 of 103
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Packet MMC failed to verify, dropping...
Sending packet 103 of 103
File sending complete
packet_send_socket operation on non-socket
C:\Users\Bili\Documents\Bili\DMF7005\7005-ans\src/client/socket.c, line 303 in function ramSend
[C:\John\Desktop\7005-ans\] 1

john@John-Desktop:~/Documents/Bili/DMF7005/7005-ans$
packet sent 66; 5-76
packet sent 66; 5-76
packet sent 67; 5-76
packet sent 68; 5-76
packet sent 69; 5-76
packet sent 70; 5-76
packet corrupted 66; 5-76
packet sent 71; 5-76
packet sent 72; 5-76
packet sent 73; 5-76
packet sent 74; 5-76
packet sent 75; 5-76
packet sent 76; 5-76
packet sent 77; 5-76
packet sent 78; 5-76
packet sent 79; 5-76
packet sent 80; 5-76
packet sent 81; 5-76
packet sent 82; 5-76
packet corrupted 66; 5-76
packet sent 83; 5-76
packet sent 84; 5-76
packet sent 85; 5-76
packet sent 86; 5-76
packet sent 87; 5-76
packet sent 88; 5-76
packet sent 89; 5-76
packet sent 90; 5-76
packet corrupted 66; 5-76
packet sent 91; 5-76
packet sent 92; 5-76
packet sent 93; 5-76
packet sent 94; 5-76
packet sent 95; 5-76
packet sent 96; 5-76
packet sent 97; 5-76
packet sent 98; 5-76
packet sent 99; 5-76
packet sent 100; 5-76
packet sent 101; 5-76
packet sent 102; 5-76
packet corrupted 66; 5-76
packet sent 103; 5-76

john@John-Desktop:~/Documents/Bili/DMF7005/7005-ans$
Packet MMC failed to verify, dropping...
Sending packet 46 of 103
Sending packet 47 of 103
Sending packet 48 of 103
Sending packet 49 of 103
Sending packet 50 of 103
Sending packet 51 of 103
Sending packet 52 of 103
Sending packet 53 of 103
Sending packet 54 of 103
Sending packet 55 of 103
Sending packet 56 of 103
Packet MMC failed to verify, dropping...
Sending packet 58 of 103
Sending packet 59 of 103
Sending packet 60 of 103
Sending packet 61 of 103
Sending packet 62 of 103
Packet MMC failed to verify, dropping...
Packet MMC failed to verify, dropping...
Sending packet 64 of 103
Sending packet 65 of 103
Packet MMC failed to verify, dropping...
Sending packet 67 of 103
Sending packet 68 of 103
Sending packet 69 of 103
Packet MMC failed to verify, dropping...
Packet MMC failed to verify, dropping...
Sending packet 71 of 103
Sending packet 72 of 103
Sending packet 73 of 103
Sending packet 74 of 103
Sending packet 75 of 103
Packet MMC failed to verify, dropping...
Sending packet 76 of 103
Sending packet 77 of 103
Sending packet 78 of 103
Packet MMC failed to verify, dropping...
Sending packet 79 of 103
Sending packet 80 of 103
Sending packet 81 of 103
Packet MMC failed to verify, dropping...
Sending packet 82 of 103
Sending packet 83 of 103
Packet MMC failed to verify, dropping...
Sending packet 85 of 103
Sending packet 86 of 103
Sending packet 87 of 103
Packet MMC failed to verify, dropping...
Sending packet 88 of 103
Sending packet 89 of 103
Packet MMC failed to verify, dropping...
Sending packet 91 of 103
Sending packet 92 of 103
Packet MMC failed to verify, dropping...
Sending packet 94 of 103
Sending packet 95 of 103
Sending packet 96 of 103
Packet MMC failed to verify, dropping...
Packet MMC failed to verify, dropping...
Sending packet 97 of 103
Sending packet 98 of 103
Sending packet 99 of 103
Packet MMC failed to verify, dropping...
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Packet MMC failed to verify, dropping...
Sending packet 103 of 103
File sending complete
Packet MMC failed to verify, dropping...
Packet MMC failed to verify, dropping...

```

The error rate can again be checked by looking at the corrupted prints compared to the total sent to see that the error rate is maintained.

```
490X122
[john@John-Desktop 7005-asn4]$ cat logging.txt | grep corrupted | wc -l
74
[john@John-Desktop 7005-asn4]$ cat logging.txt | wc -l
737
[john@John-Desktop 7005-asn4]$
```

After sending is complete the files can be verified by checking their MD5 checksum as shown below.

```
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Sending packet 103 of 103
File sending complete
Socket error on socket 5
Socket send: Bad file descriptor
/home/john/Documents/BCIT/COMP7005/7005-asn4/src/client/socket.c, line 303 in funct
[john@John-Desktop 7005-asn4]$ md5sum test*
121364332e03c5eaa5e6479b9f28e5c8  testClient
121364332e03c5eaa5e6479b9f28e5c8  testFile
121364332e03c5eaa5e6479b9f28e5c8  testServer
[john@John-Desktop 7005-asn4]$
```

Test with middleman with delayed packet errors

Purpose:

Check resends and timeouts function with delays

Step 1

Run server with `./bin/7005-asn-4 -s -p 7000 -f testFile -o testServer``

Step 2

Run middleman with `./bin/7005-asn4-lossy -p 7000 -f 7001 -a localhost -t W400 -e 10``

Step 3

Run client with `./bin/7005-asn-4 -c -i 0.0.0.0 -p 7001 -f testFile -o testServer``

When delays occur that exceed the timeout the client and server will detect this and will resend the packet in question as can be seen below.

[illegible]

```
john@John-Desktop: /7005-asn4$ cat logging.txt | grep delay | wc -l
56
[john@John-Desktop 7005-asn4]$ cat logging.txt | wc -l
557
[john@John-Desktop 7005-asn4]$
```

After sending is complete the files can be verified by checking their MD5 checksum as shown below.

```
Sending packet 100 of 103
Sending packet 101 of 103
Sending packet 102 of 103
Sending packet 103 of 103
File sending complete
Socket error on socket 5
Socket send: Bad file descriptor
/home/john/Documents/BCIT/COMP7005/7005-asn4/src/client/socket.c, line 303 in funct
[john@John-Desktop 7005-asn4]$ md5sum test*
121364332e03c5eaa5e6479b9f28e5c8  testClient
121364332e03c5eaa5e6479b9f28e5c8  testFile
121364332e03c5eaa5e6479b9f28e5c8  testServer
[john@John-Desktop 7005-asn4]$ █
```