

# CNT 4713 Homework 3

## Go-Back-N Protocol

I have tested my program successfully on mininet with 0 and 10% packet loss. I used a 675 KB TEXT file to test my packet transfers using UDP. I took the following steps to set up my test environment.

For 10% packet loss I set up the following topology

- `sudo mn --topo=single,2 --link=tc,bw=20,loss=10`

I connected to the virtual machine using the ssh protocol

- `ssh -X mininet@192.168.56.101`

I transferred the files from my host machine to the mininet with the following command:

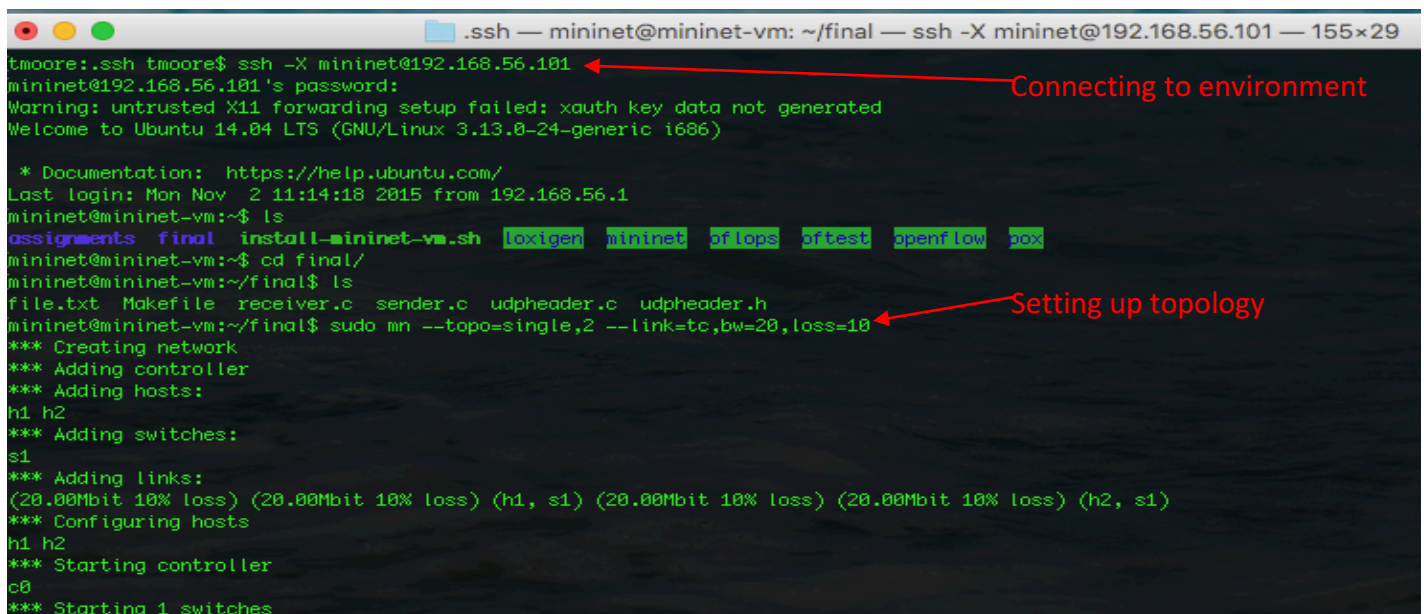
- `scp -r homework3/ mininet@192.168.56.101:/home/mininet/assignments`

With the command `xterm h1 h2` i was able to access the notes in the virtual topology and run the programs in the host.

This allowed me to test my programs in each particular virtual node. By setting up a sender on x1 and the receiver in x2, I noticed a significant delay in transmission time when introducing packet loss to my algorithm. I noticed that since the window size is 100, and a probability of 10%, 10 packets being lost is a pretty high so the receiver could be stuck waiting on a packet indefinitely, because of the high probability of the same packet being lost. With no packet loss, all packets were sent smoothly with no lag in transmission, but when we introduced packet loss, you can see that the sender and receivers progress status updates may pause for a few seconds(because of retransmission) before continuing with status updates.

Below is evidence of my tests:

Step 1: connecting to virtual environment and initializing test environment



```
.ssh — mininet@mininet-vm: ~/final — ssh -X mininet@192.168.56.101 — 155x29
tmoore:ssh tmoore$ ssh -X mininet@192.168.56.101
mininet@192.168.56.101's password:
Warning: untrusted X11 forwarding setup failed: xauth key data not generated
Welcome to Ubuntu 14.04 LTS (GNU/Linux 3.13.0-24-generic i686)

 * Documentation:  https://help.ubuntu.com/
Last login: Mon Nov  2 11:14:18 2015 from 192.168.56.1
mininet@mininet-vm:~$ ls
assignments  final  install-mininet-vm.sh  toxigen  mininet  oflops  oftest  openflow  box
mininet@mininet-vm:~$ cd final/
mininet@mininet-vm:~/final$ ls
file.txt  Makefile  receiver.c  sender.c  udpheader.c  udpheader.h
mininet@mininet-vm:~/final$ sudo mn --topo=single,2 --link=tc,bw=20,loss=10
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2
*** Adding switches:
s1
*** Adding links:
(20.00Mbit 10% loss) (20.00Mbit 10% loss) (h1, s1) (20.00Mbit 10% loss) (20.00Mbit 10% loss) (h2, s1)
*** Configuring hosts
h1 h2
*** Starting controller
c0
*** Starting 1 switches
```

Connecting to environment

Setting up topology

## Step 2: Boot up host nodes and test the program

The screenshot shows two terminal windows side-by-side. The left window, titled "Node: h1", shows the user running 'ifconfig' to check the IP address (10.0.0.1) and broadcast address (10.255.255.255), then listing files (file.txt, Makefile, receiver.c, sender.c, udpheader.c, udpheader.h), compiling the sender and receiver programs with 'gcc', and finally running the sender with './sender 10.0.0.2 5000 file.txt'. The right window, titled "Node: h2", shows the user running 'ifconfig' to check the IP address (10.0.0.2) and broadcast address (10.255.255.255), listing files (file.txt, receiver, receiver.o, sender.c, udpheader.c, udpheader.o), compiling the receiver with 'gcc', and running the receiver with './receiver 5000 output.txt'. Below these windows, a third terminal window shows the user starting a CLI and running 'xterm h1 h2'.

```
tmoores:ssh tmoores$ ssh -X mininet@192.168.56.101
mininet@192.168.56.101's password:
Warning: untrusted X11 forwarding setup failed: xauth key data not generated

"Node: h1"
root@mininet-vm:~/final# ifconfig | grep Bcast
    inet addr:10.0.0.1   Bcast:10.255.255.255  Mask:255.0.0.0
root@mininet-vm:~/final# ls
file.txt  Makefile  receiver.c  sender.c  udpheader.c  udpheader.h
root@mininet-vm:~/final# make
cc -c -o sender.o sender.c
cc -c -o udpheader.o udpheader.c
gcc -Wall -o sender sender.o udpheader.o
cc -c -o receiver.o receiver.c
gcc -Wall -o receiver receiver.o udpheader.o
gcc -Wall -c udpheader.c
root@mininet-vm:~/final# ls
file.txt  output.txt  receiver.c  sender.o  udpheader.h
Makefile  receiver.o  sender.c  udpheader.c  udpheader.o
root@mininet-vm:~/final# ./sender 10.0.0.2 5000 file.txt

"Node: h2"
root@mininet-vm:~/final# ifconfig | grep Bcast
    inet addr:10.0.0.2   Bcast:10.255.255.255  Mask:255.0.0.0
root@mininet-vm:~/final# ls
file.txt  receiver  receiver.o  sender.c  udpheader.c  udpheader.o
Makefile  receiver.c  sender.o  udpheader.h
root@mininet-vm:~/final# ./receiver 5000 output.txt
create socket...
bind socket to port 5000...
Waiting on port 5000...

*** Starting CLI:
mininet> xterm h1 h2
```

You can see on h1 (the left) the program was compiled and sender is ready to execute. On h2 (the right) I executed the receiver.

## Step 3: Run program and compare received files .

The screenshot shows two terminal windows side-by-side. The left window, titled "Node: h1", shows the user running 'xterm h1 h2' to start a CLI. The right window, titled "Node: h2", shows the user running 'xterm h1 h2' to start a CLI. Below these windows, a third terminal window shows the user starting a CLI and running 'xterm h1 h2'.

```
tmoores:ssh tmoores$ ssh -X mininet@192.168.56.101
mininet@192.168.56.101's password:
Warning: untrusted X11 forwarding setup failed: xauth key data not generated

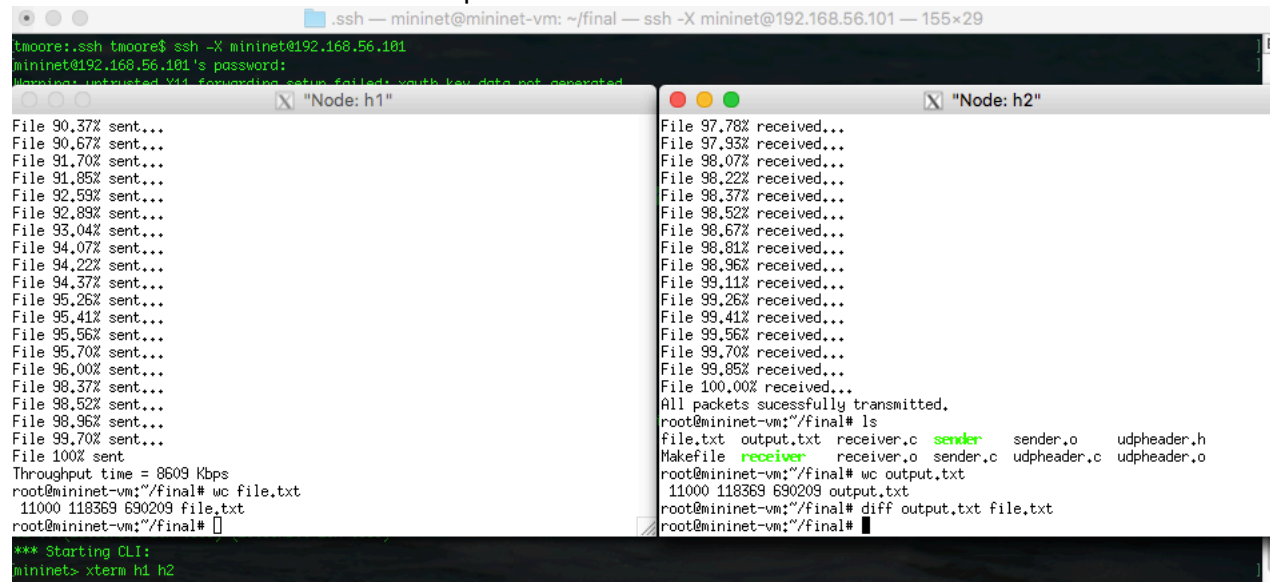
"Node: h1"
File 89.78% sent...
File 90.22% sent...
File 90.37% sent...
File 90.67% sent...
File 91.70% sent...
File 91.85% sent...
File 92.59% sent...
File 92.89% sent...
File 93.04% sent...
File 94.07% sent...
File 94.22% sent...
File 94.37% sent...
File 95.26% sent...
File 95.41% sent...
File 95.56% sent...
File 95.70% sent...
File 96.00% sent...
File 98.37% sent...
File 98.52% sent...
File 98.96% sent...
File 99.70% sent...
File 100% sent
Throughput time = 8609 Kbps
root@mininet-vm:~/final#

"Node: h2"
File 96.89% received...
File 97.04% received...
File 97.19% received...
File 97.33% received...
File 97.48% received...
File 97.63% received...
File 97.78% received...
File 97.93% received...
File 98.07% received...
File 98.22% received...
File 98.37% received...
File 98.52% received...
File 98.67% received...
File 98.81% received...
File 98.96% received...
File 99.11% received...
File 99.26% received...
File 99.41% received...
File 99.56% received...
File 99.70% received...
File 99.85% received...
File 100.00% received...
All packets successfully transmitted.
root@mininet-vm:~/final#

*** Starting CLI:
mininet> xterm h1 h2
```

The receiver pauses for a specific amount of time to handle any sender retransmissions.

The last screenshot shows file comparison and transmission success:



The screenshot shows a terminal window with two panes. The left pane, titled "Node: h1", shows the progress of sending a file. The right pane, titled "Node: h2", shows the progress of receiving the file. Both panes show 100% completion. The left pane also shows the file size (11000 bytes) and the throughput time (8609 Kbps). The right pane shows the file size (11000 bytes) and the throughput time (8609 Kbps). The terminal window title bar indicates the user is logged in as mininet@mininet-vm.

```
.ssh — mininet@mininet-vm: ~/final — ssh -X mininet@192.168.56.101 — 155x29
tmoore:ssh tmoore$ ssh -X mininet@192.168.56.101
mininet@192.168.56.101's password:
Warning: untrusted X11 forwarding setup failed: xauth key data not generated

"Node: h1"
File 90.37% sent...
File 90.67% sent...
File 91.70% sent...
File 91.85% sent...
File 92.53% sent...
File 92.89% sent...
File 93.04% sent...
File 94.07% sent...
File 94.22% sent...
File 94.37% sent...
File 95.26% sent...
File 95.41% sent...
File 95.56% sent...
File 95.70% sent...
File 96.00% sent...
File 98.37% sent...
File 98.52% sent...
File 98.96% sent...
File 99.70% sent...
File 100% sent
Throughput time = 8609 Kbps
root@mininet-vm:~/final# wc file.txt
11000 118369 690209 file.txt
root@mininet-vm:~/final#

"Node: h2"
File 97.78% received...
File 97.93% received...
File 98.07% received...
File 98.22% received...
File 98.37% received...
File 98.52% received...
File 98.67% received...
File 98.81% received...
File 98.96% received...
File 99.11% received...
File 99.26% received...
File 99.41% received...
File 99.56% received...
File 99.70% received...
File 99.85% received...
File 100.00% received...
All packets successfully transmitted.
root@mininet-vm:~/final# ls
file.txt output.txt receiver.c sender.o sender.o udpheader.h
Makefile receiver receiver.o sender.c udpheader.c udpheader.o
root@mininet-vm:~/final# wc output.txt
11000 118369 690209 output.txt
root@mininet-vm:~/final# diff output.txt file.txt
root@mininet-vm:~/final#

*** Starting CLI:
mininet> xterm h1 h2
```

\*\*\*\*NOTE TO INSTRUCTOR\*\*\*\*

File type not specified in instructions- program transfers TEXT FILE ONLY. To send other file types we must change implementation to use memcpy when copying file contents instead of strcpy.