Assignment 4

By: Raghav Sakhuja
2021274

Q1. Custom Topology

Using

```
sudo ./pox/pox.py forwarding.l2_learning
```

I start the pox controller.

The given command runs mininet with the specified topology.

```
sudo mn --custom ~/mininet/custom/topo-2sw-2host.py --topo mytopo --mac
--switch ovsk --controller remote
```

```
mininet> net
h1 h1-eth0:s1-eth1
h2 h2-eth0:s1-eth2
h3 h3-eth0:s2-eth2
h4 h4-eth0:s2-eth3
h5 h5-eth0:s2-eth1
h6 h6-eth0:s3-eth3
h7 h7-eth0:s3-eth1
h8 h8-eth0:s3-eth2
s1 lo:  s1-eth1:h1-eth0 s1-eth2:h2-eth0 s1-eth3:s2-eth4
s2 lo:  s2-eth1:h5-eth0 s2-eth2:h3-eth0 s2-eth3:h4-eth0 s2-eth4:s1-eth3 s2-eth5:s3-eth4
s3 lo:  s3-eth1:h7-eth0 s3-eth2:h8-eth0 s3-eth3:h6-eth0 s3-eth4:s2-eth5
c0
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5 h6 h7 h8
h2 -> h1 h3 h4 h5 h6 h7 h8
h3 -> h1 h2 h4 h5 h6 h7 h8
h4 -> h1 h2 h3 h5 h6 h7 h8
h5 -> h1 h2 h3 h4 h6 h7 h8
h6 -> h1 h2 h3 h4 h5 h7 h8
h7 -> h1 h2 h3 h4 h5 h6 h8
h8 -> h1 h2 h3 h4 h5 h6 h7
*** Results: 0% dropped (56/56 received)
mininet>
```

The net command shows us that the desired topology is activated, and the pingall command shows that all hosts are connected.

Q2. Traffic Control

a) I introduce a specific in h1 host by introducing a delay of 100ms and a bandwidth limit of 1mbit using the following command.

```
sudo tc qdisc add dev h1-eth0 root netem delay 100ms rate 1mbit
```

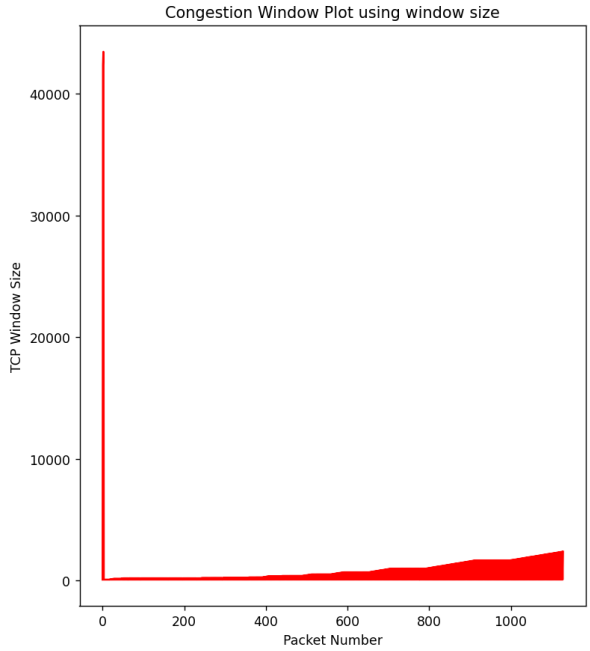
```
root@mininet-vm:/home/mininet# ping 10.0.0.6
PING 10.0.0.6 (10.0.0.6) 56(84) bytes of data.
64 bytes from 10.0.0.6: icmp_seq=1 ttl=64 time=7.61 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=64 time=0.259 ms
64 bytes from 10.0.0.6: icmp_seq=3 ttl=64 time=0.056 ms
^C
--- 10.0.0.6 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2022ms
rtt min/avg/max/mdev = 0.056/2.642/7.612/3.515 ms
root@mininet-vm:/home/mininet# sudo tc qdisc add dev h1-eth0 root netem delay 100ms rate 1mbit
root@mininet-vm:/home/mininet# ping 10.0.0.6
PING 10.0.0.6 (10.0.0.6) 56(84) bytes of data.
64 bytes from 10.0.0.6: icmp_seq=1 ttl=64 time=106 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=64 time=102 ms
64 bytes from 10.0.0.6: icmp_seq=3 ttl=64 time=101 ms
^C
--- 10.0.0.6 ping statistics ---
4 packets transmitted, 3 received, 25% packet loss, time 3005ms
rtt min/avg/max/mdev = 101.116/102.854/105.928/2.179 ms
root@mininet-vm:/home/mininet#
```

Using iperf command I generate traffic between h1 and h6 and generate a pcap file using Wireshark

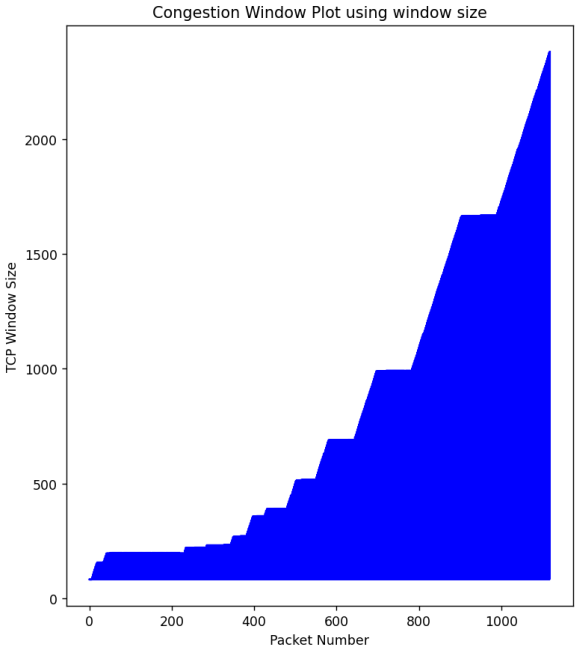
```
root@mininet-vm:/home/mininet# iperf -c 10.0.0.6
------------------------------------------------------------
Client connecting to 10.0.0.6, TCP port 5001
TCP window size: 85.3 KByte (default)
------------------------------------------------------------
[ 29] local 10.0.0.1 port 51978 connected with 10.0.0.6 port 5001
[ ID] Interval       Transfer     Bandwidth
[ 29]  0.0-10.8 sec  2.62 MBytes  2.04 Mbits/sec
root@mininet-vm:/home/mininet#
```

```
root@mininet-vm:/home/mininet# iperf -s
------------------------------------------------------------
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
------------------------------------------------------------
[ 30] local 10.0.0.6 port 5001 connected with 10.0.0.1 port 51978
[ ID] Interval       Transfer     Bandwidth
[ 30]  0.0-23.0 sec  2.62 MBytes   957 Kbits/sec
```

I get the following graphs when I plot the window sizes in the pcap file. We can clearly see that slow start working in these plots, as the window sizes double and then slowly increase after reaching a threshold.



(plot of all the packets)



(plot after removing initial SYNs)