

# Assignment 4

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## 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 10ms using the following command.

```
sudo tc qdisc add dev h1-eth0 root netem delay 10ms rate 1mbit
```

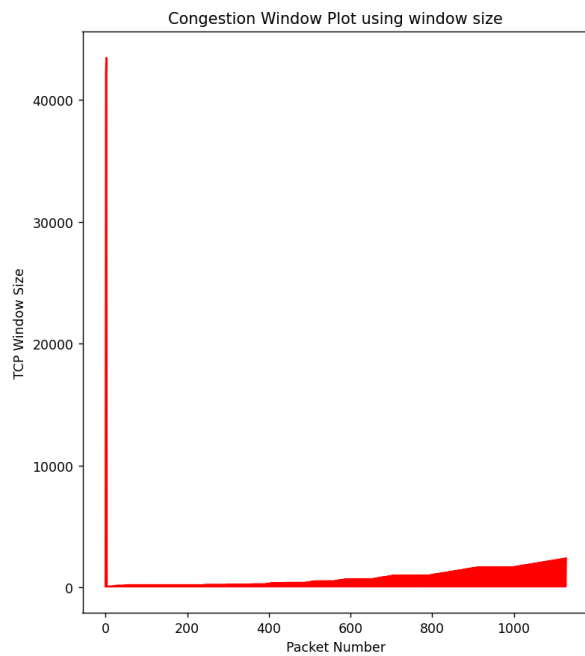
```
root@mininet-vm:/home/mininet# ping 10.0.0.6
PING 10.0.0.6 (10.0.0.6) 56(84) bytes of data.
64 bytes from 10.0.0.6: icmp_seq=1 ttl=64 time=4.33 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=64 time=0.242 ms
64 bytes from 10.0.0.6: icmp_seq=3 ttl=64 time=0.045 ms
^C
--- 10.0.0.6 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2006ms
rtt min/avg/max/mdev = 0.045/1.539/4.332/1.976 ms
root@mininet-vm:/home/mininet# sudo tc qdisc add dev h1-eth0 root netem delay 10ms 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=10.8 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=64 time=10.8 ms
64 bytes from 10.0.0.6: icmp_seq=3 ttl=64 time=11.2 ms
^C
--- 10.0.0.6 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2004ms
rtt min/avg/max/mdev = 10.842/10.956/11.182/0.159 ms
root@mininet-vm:/home/mininet#
```

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

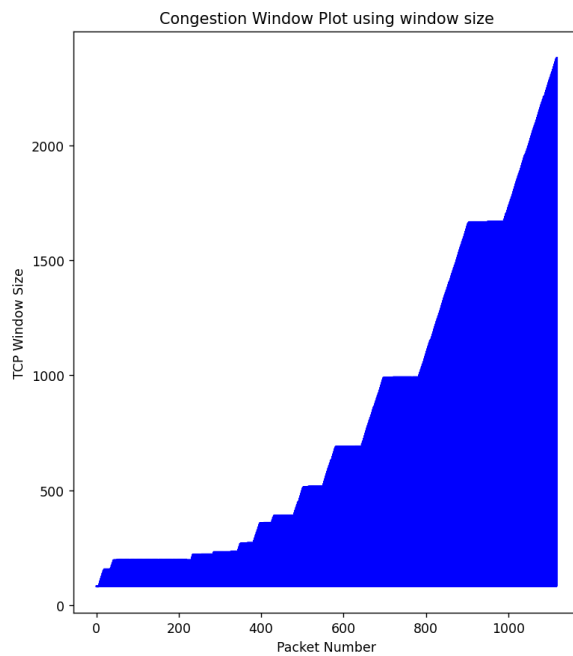
```
"Node: h1"
root@mininet-vm:/home/mininet# iperf -c 10.0.0.6
-----
Client connecting to 10.0.0.6, TCP port 5001
TCP window size: 6.00 MByte (default)
-----
[ 29] local 10.0.0.1 port 35480 connected with 10.0.0.6 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 29] 0.0-10.0 sec  29.0 GBytes  24.9 Gbits/sec
root@mininet-vm:/home/mininet# sudo tc qdisc add dev h1-eth0 root netem delay 10ms rate 1mbit
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 35482 connected with 10.0.0.6 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 29] 0.0-11.3 sec  2.75 MBytes  2.04 Mbits/sec
root@mininet-vm:/home/mininet#
```

```
"Node: h6"
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 35480
[ ID] Interval      Transfer    Bandwidth
[ 30] 0.0-10.0 sec  29.0 GBytes  24.9 Gbits/sec
[ 30] local 10.0.0.6 port 5001 connected with 10.0.0.1 port 35482
[ 30] 0.0-24.1 sec  2.75 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)  
SYNs)



(plot after removing initial