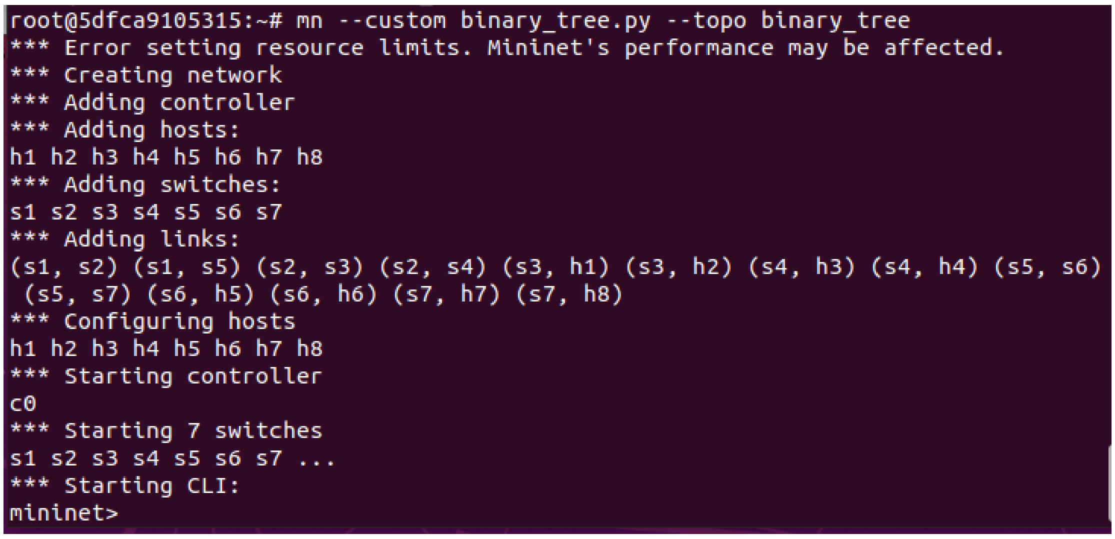
HW3 Tianhao Wu W1651636

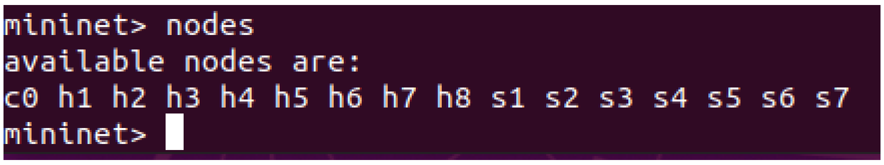
Task 1: Defining custom topologies



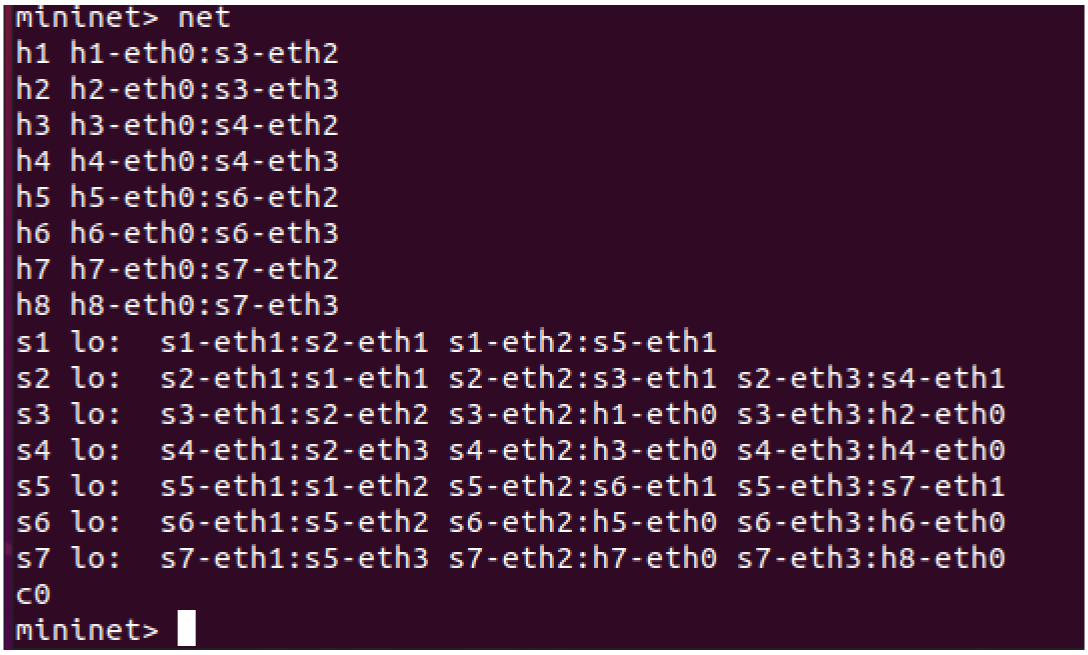
```
root@5dfca9105315:~# mn --custom binary_tree.py --topo binary_tree
*** Error setting resource limits. Mininet's performance may be affected.
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8
*** Adding switches:
s1 s2 s3 s4 s5 s6 s7
*** Adding links:
(s1, s2) (s1, s5) (s2, s3) (s2, s4) (s3, h1) (s3, h2) (s4, h3) (s4, h4) (s5, s6)
 (s5, s7) (s6, h5) (s6, h6) (s7, h7) (s7, h8)
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8
*** Starting controller
c0
*** Starting 7 switches
s1 s2 s3 s4 s5 s6 s7 ...
*** Starting CLI:
mininet>
```

Questions

1. What is the output of “nodes” and “net”

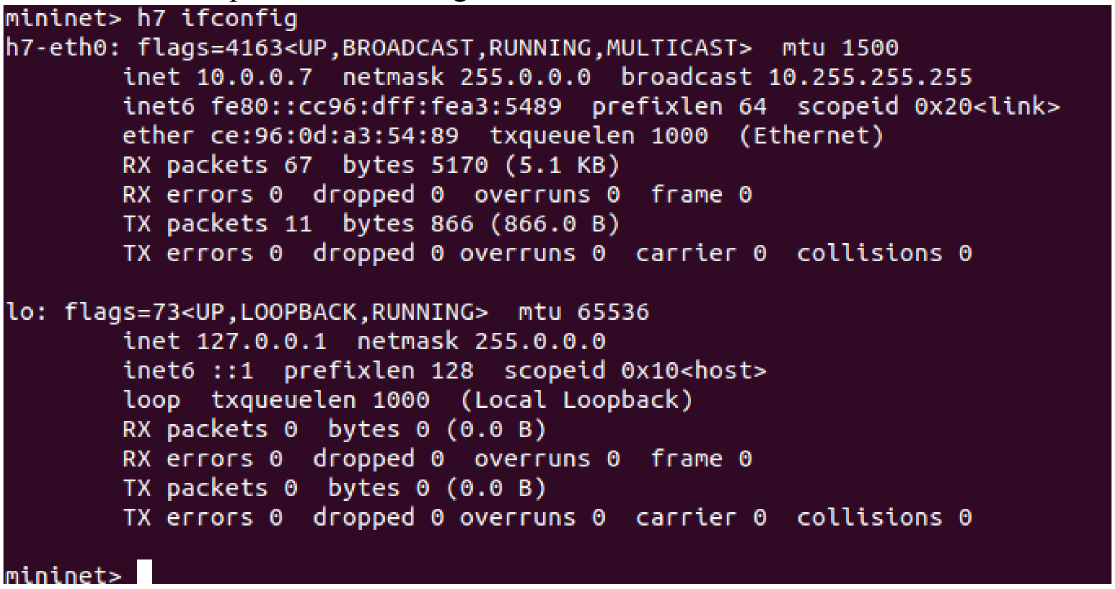


```
mininet> nodes
available nodes are:
c0 h1 h2 h3 h4 h5 h6 h7 h8 s1 s2 s3 s4 s5 s6 s7
mininet>
```



```
mininet> net
h1 h1-eth0:s3-eth2
h2 h2-eth0:s3-eth3
h3 h3-eth0:s4-eth2
h4 h4-eth0:s4-eth3
h5 h5-eth0:s6-eth2
h6 h6-eth0:s6-eth3
h7 h7-eth0:s7-eth2
h8 h8-eth0:s7-eth3
s1 lo:  s1-eth1:s2-eth1 s1-eth2:s5-eth1
s2 lo:  s2-eth1:s1-eth1 s2-eth2:s3-eth1 s2-eth3:s4-eth1
s3 lo:  s3-eth1:s2-eth2 s3-eth2:h1-eth0 s3-eth3:h2-eth0
s4 lo:  s4-eth1:s2-eth3 s4-eth2:h3-eth0 s4-eth3:h4-eth0
s5 lo:  s5-eth1:s1-eth2 s5-eth2:s6-eth1 s5-eth3:s7-eth1
s6 lo:  s6-eth1:s5-eth2 s6-eth2:h5-eth0 s6-eth3:h6-eth0
s7 lo:  s7-eth1:s5-eth3 s7-eth2:h7-eth0 s7-eth3:h8-eth0
c0
mininet>
```

2. What is the output of “h7 ifconfig”

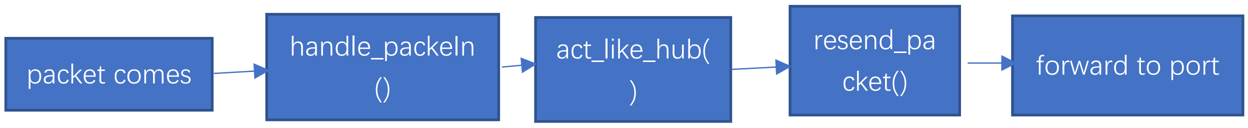


```
mininet> h7 ifconfig
h7-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.0.7  netmask 255.0.0.0  broadcast 10.255.255.255
        inet6 fe80::cc96:dff:fea3:5489  prefixlen 64  scopeid 0x20<link>
        ether ce:96:0d:a3:54:89  txqueuelen 1000  (Ethernet)
        RX packets 67  bytes 5170 (5.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 11  bytes 866 (866.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

mininet> 
```

Task 2: Analyze the “of_tutorial’ controller

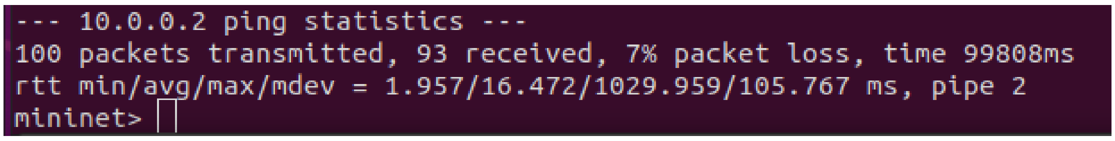
Questions

1. Draw the function call graph of this controller. For example, once a packet comes to the controller, which function is the first to be called, which one is the second, and so forth?



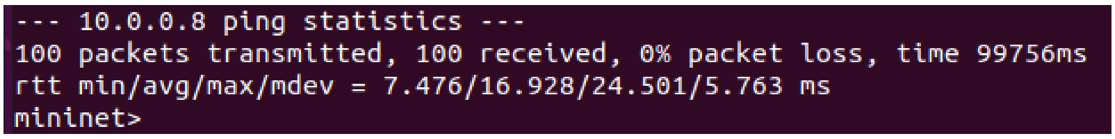
2. Have h1 ping h2, and h1 ping h8 for 100 times (e.g., h1 ping-c100 p2).

h1 ping -c100 h2



```
--- 10.0.0.2 ping statistics ---
100 packets transmitted, 93 received, 7% packet loss, time 99808ms
rtt min/avg/max/mdev = 1.957/16.472/1029.959/105.767 ms, pipe 2
mininet> 
```

h1 ping -c100 h8



```
--- 10.0.0.8 ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99756ms
rtt min/avg/max/mdev = 7.476/16.928/24.501/5.763 ms
mininet>
```

a. Howlong does it take (on average) to ping for each case?

16.472 ms; 16.928ms

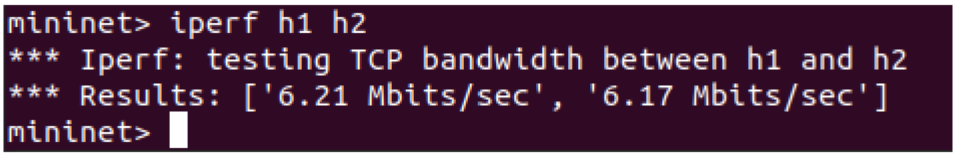
b. What is the minimum and maximum ping you have observed?

1.957ms; 1029.959ms

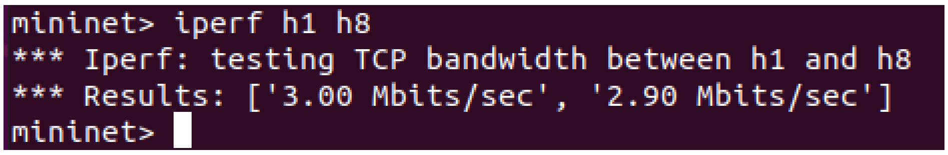
c. What is the difference, and why?

h1 ping h2 is relatively faster because there are fewer connections in between.
h1 ping h2: h1 -> s3 -> h2
h1 ping h8: h1 -> s3 -> s2 -> s1 -> s5 -> s7 -> h8

3. Run"iperf h1 h2" and "iperf h1 h8"



```
mininet> iperf h1 h2
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['6.21 Mbits/sec', '6.17 Mbits/sec']
mininet>
```



```
mininet> iperf h1 h8
*** Iperf: testing TCP bandwidth between h1 and h8
*** Results: ['3.00 Mbits/sec', '2.90 Mbits/sec']
mininet>
```

a. What is "iperf" used for?

to test the TCP bandwidth between any two hosts

b. What is the throughput for each case?

6.21, 6.17; 3.00, 2.90; (Mbits/sec)

c. What is the difference, and explain the reasons for the difference.

Because the distance between hosts are different, the increase in distance increases the chance of network congestion and reduces the throughput.

4. Which of the switches observe traffic? Please describe your way for observing such

traffic on switches (e.g., adding some functions in the “of_tutorial” controller).

s1, s2, s3, s5 and s7. This can be observed from _handle_PacketIn()