

COEN 241
Cloud Computing
HOMEWORK-3
MININET AND OPENFLOW
REPORT
Stuti Jani
ID: W1649923

Task 1 - Defining custom topologies

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

Answer:

mininet> nodes gives all the nodes in the current topology

available nodes are:

c0 h1 h2 h3 h4 h5 h6 h7 h8 s1 s2 s3 s4 s5 s6 s7

The output of "net" is:

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

mininet> net displays all the links in the current topology.

It is seen that the interface eth0 of the host h1 is connected to eth2 of switch s3 and the interface eth0 of host h2 is connected to eth3 of switch s3, and so on.

2. What is the output of "h7 ifconfig"

Answer: This command displays the IP address, broadcast address and MAC address of the host h7.

The output of "h7 ifconfig" is:

```
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::202d:4ff:fe61:ea78 prefixlen 64 scopeid 0x20<link>
    ether 22:2d:04:61:ea:78 txqueuelen 1000 (Ethernet)
    RX packets 237 bytes 36730 (36.7 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 11 bytes 886 (886.0 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
```

Task- 2

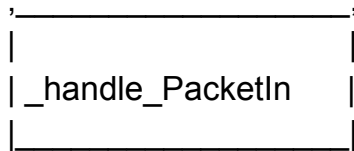
1. Draw the function call graph of this controller. For example, once a packet comes to the controller, which function is the first to be called, which one is the second, and so forth?

Function call graph:

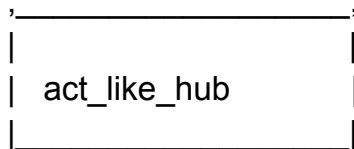
start switch : `_handle_PacketIn()` -> `act_like_hub()` -> `resend_packet()` -> `send(msg)`

packet comes in

|
V

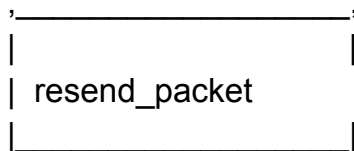


|
V



(or `act_like_switch`, once we implement it)

|
V



|
V

forward message to the port

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, 100 received, 0% packet loss, time 99178ms

rtt min/avg/max/mdev = 1.014/1.552/3.417/0.499 ms

h1 ping -c100 h8

--- 10.0.0.8 ping statistics ---

100 packets transmitted, 100 received, 0% packet loss, time 99155ms

rtt min/avg/max/mdev = 4.507/5.966/12.122/1.603 ms

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

h1 ping h2 : 7.060 ms

h1 ping h8 : 28.943

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

h1 ping h2:

minimum -> 0.778

maximum -> 194.161

h1 ping h8:

minimum -> 9.007

maximum -> 312.170

c. What is the difference, and why?

The ping for h1 ping h8 is clearly greater than h1 ping h2, according to the observation.

The cause of this might be the fact that a packet must pass through more switches from h1 to h8 than it does between h1 and h2, which is simply one switch.

3. Run “iperf h1 h2” and “iperf h1 h8”

a. What is “iperf” used for?

Iperf is an open source tool for helping the administrators measuring the bandwidth for the network performance and quality of a network line. The network link is restricted by two hosts running iperf. It is used to measure the throughput between any two nodes in a network line. iperf does performance evaluation of the network. It

runs regression tests between the specified nodes. Returns a two-element array of [server, client] speeds.

b. What is the throughput for each case?

h2 h2:

Server - 8.00 Mbits/sec

Client - 9.06 Mbits/sec

h1 h8:

Server - 3.46 Mbits/sec

Client - 3.94 Mbits/sec

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

The throughput for h1 ping h8 has been shown to be less than half of that for h1 ping h2. A packet must broadcast every incoming packet to every other node, which adds time to the process of moving a packet through several switches.

The packet transmission rate is faster between h1 and h2 since there is just one switch between them.

4. Which of the switches observe traffic?

We can inspect the information that aids in traffic observation by adding `log.info("Switch observing traffic:%s"% (self.connection) to the line 107 "of tutorial" controller.`

Hence, all switches observe traffic.

Task 3: MAC Learning Controller

1. Describe how the above code works, such as how the "MAC to Port" map is established. You

could use a 'ping' example to describe the establishment process (e.g., h1 ping h2).

Given the operation h1 ping h2, the packet must be routed through switch's3'.

Here, `mac_to_port` is verified to see if `packet.src` is present as the key and the input port when the packet `p` arrives from h1 on one of its input ports.

This means that whenever a packet is being sent to the host provided in the key, the port may be used. The packet is forwarded to the designated port if the pair is present.

If not, the packet is delivered to all ports besides the input port while the switch learns by adding the key,value pair to `mac to port`.

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

h1 ping h2

h1 ping h8

a. How long did it take (on average) to ping for each case?

h1 ping h2 : 11.274 ms

h1 ping h8 : 35.437 ms

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

h1 ping h2:

minimum -> 1.171 ms

maximum -> 102.988 ms

h1 ping h8:

minimum -> 12.062 ms

maximum -> 230.0 ms

c. Any difference from Task 2 and why do you think there is a change if there is?

The lowest and maximum ping values are significantly lower than those seen in task2, despite the average ping being slightly higher than that of task2.

This is because the switch no longer needs to broadcast an incoming packet to every other switch because it has a better understanding of the network owing to the storage of known mac addresses.

Now that it must transfer to a single known address, the entire transmission time and the ping are reduced.

3. Run “iperf h1 h2” and “iperf h1 h8”.

a. What is the throughput for each case?

h2 h2:

Server - 646 Kbits/sec

Client - 824 Kbits/sec

h1 h8:

Server - 148 Kbits/sec

Client - 332 Kbits/sec