

Networks Systems Capstone Lab 1 Report

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1 Part 1

1.1 Flush all switch tables and take screenshots to show the switch tables of all switches.

```
[poncedeleon@ponce]~% sudo ovs-appctl fdb/flush s1
table successfully flushed
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s1
port VLAN MAC Age
[poncedeleon@ponce]~% sudo ovs-appctl fdb/flush s2
table successfully flushed
[poncedeleon@ponce]~% sudo ovs-appctl fdb/flush s3
table successfully flushed
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s1
port VLAN MAC Age
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s2
port VLAN MAC Age
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s3
port VLAN MAC Age
[poncedeleon@ponce]~%
```

Figure 1: Flushing the routing tables for the three switches, then showing their empty tables.

1.2 How does h4 know h1's MAC address? Take screenshot on Wireshark to verify your answers.



The image shows a Wireshark packet capture of an ARP broadcast. The first packet (No. 1) is an ARP request from 10.0.0.0 to 255.255.255. The second packet (No. 2) is an ARP response from 10.0.0.4 to 10.0.0.1. The packets are shown in a list with their respective source and destination IP and MAC addresses.

Figure 2: h1 sending an ARP message to determine the MAC address of h4.

Before the first ping command is sent, h4 will receive an ARP broadcast message with a request from h1, for anybody with that IP address. The sender (h1) determines the IP address of the receiver (h4) since before the first ping request is sent. h4 then responds with its MAC address.

1.3 How does h1 know h4's MAC address? Take screenshot on Wireshark to verify your answers.

At the very beginning, h1 will determine the IP address of the recipient and then send an ARP broadcast message to all the other hosts on the local network. ARP is a link-layer protocol to determine the MAC address of another computer on the local network. The destination will respond with its MAC address to the broadcast message.

1.4 Why does the first ping have a longer delay?

The first ping request-response cycle is slower due to the updating of the routing table within each router.

2 Part 2

2.1 Can h1 ping h4 successfully before enabling STP?

The ping command cannot run effectively before we enable STP. STP is a protocol designed to construct a network topology without any switching loops. These loops result from multiple redundant connections between different switches to improve network resilience. However, before we enable STP on every switch in the network, we cannot know exactly how to send packets in a way that avoids these loops.

2.2 Can h1 ping h4 successfully after STP is enabled?

Yes, once we allow STP to operate on the current network topology, the switches know where to route all the packets.

2.3 Show s1 MAC tables before and after STP is enabled and explain the differences.

```
poncedeleon@ponce]~% sudo ovs-appctl fdb/show s1
port VLAN MAC Age
poncedeleon@ponce]~% sudo ovs-appctl fdb/show s2
port VLAN MAC Age
poncedeleon@ponce]~% sudo ovs-appctl fdb/show s3
port VLAN MAC Age
poncedeleon@ponce]~% sudo ovs-appctl fdb/show s4
port VLAN MAC Age
poncedeleon@ponce]~%
```

Figure 3: Routing tables for all the switches before enabling STP.

Before we run STP, the routing tables in all the switches are empty. Thus when we send information from h1 to h4, our network still cannot avoid switching loops.

```
[poncedeleon@ponce]~% sudo ovs-vsctl set bridge s1 stp-enable=true
[sudo] password for poncedeleon:
sudo: ovs-vsctlset: command not found
[poncedeleon@ponce]~% sudo ovs-vsctl set bridge s1 stp-enable=true
[poncedeleon@ponce]~% sudo ovs-vsctl set bridge s2 stp-enable=true
[poncedeleon@ponce]~% sudo ovs-vsctl set bridge s3 stp-enable=true
[poncedeleon@ponce]~% sudo ovs-vsctl set bridge s4 stp-enable=true
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s1
port VLAN MAC Age
1 0 8e:4e:46:ce:fe:86 17
3 0 da:c7:db:6d:fc:c7 16
3 0 a6:d2:79:fc:a2:a5 13
2 0 5a:8d:89:7d:37:59 13
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s2
port VLAN MAC Age
1 0 9e:7d:9b:7f:ac:a4 1
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s3
port VLAN MAC Age
4 0 9e:7d:9b:7f:ac:a4 3
[poncedeleon@ponce]~% sudo ovs-appctl fdb/show s4
port VLAN MAC Age
2 0 42:c0:2b:c2:cd:74 5
[poncedeleon@ponce]~%
```

Figure 4: Routing tables for all the switches after enabling STP.

After we enable STP, the routing tables can be built normally, and the request made to another host on the same network.

The difference in these two tables can be seen from Figure 4, where after the ping message, where the routing table is filled in with the information of the MAC address for the hosts.

2.4 What have you observed and learned from this lab?

This lab allowed me to refresh on the different protocols active in the Link Layer. It also served as a reminder on mininet and how to create networks with given properties in software. After not having taken a networks course in more than one year, reintroducing even some of the most fundamental ideas in local networks was useful for some of the topics covered later on in the course.