ASSIGNMENT 8

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QUES.

Part A: Hub controller

All traffic arriving on a switch will be forwarded to the controller. The controller then instructs

the switch to forward the packet on all ports except the one it arrived on. This is the default
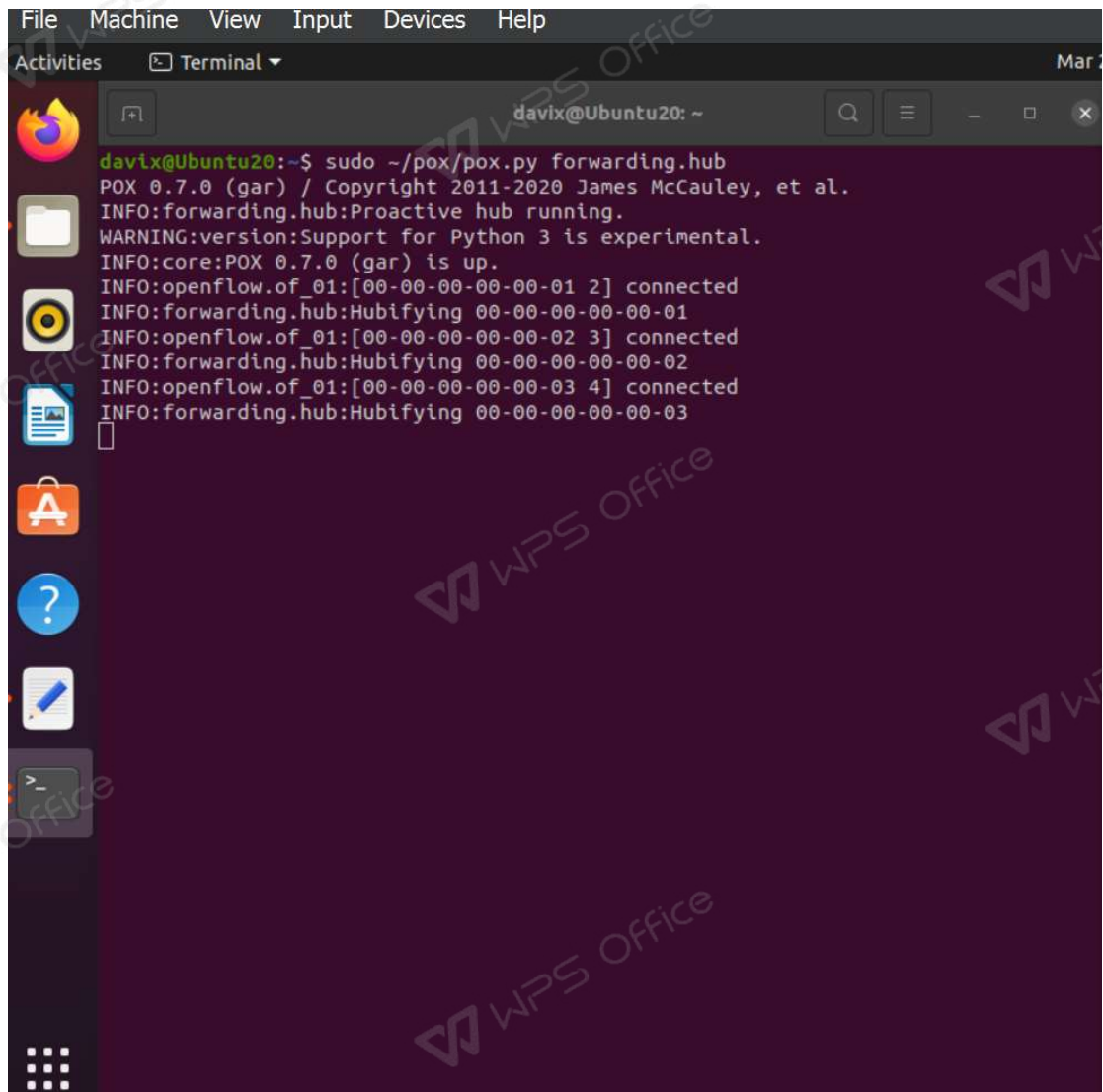
behavior of the of_tutorial.py controller.

1. Have h1 ping h2 and h1 ping h5. How long did it take to ping? What is the

difference? Which of the hosts and switches observe traffic?

2. Run iperf h1 h2 and iperf h1 h5. What is the throughput? What is the

difference?

3. Run pingall to verify connectivity and dump the output.

```
davix@Ubuntu20:~$ sudo ~/pox/pox.py forwarding.hub
POX 0.7.0 (gar) / Copyright 2011-2020 James McCauley, et al.
INFO:forwarding.hub:Proactive hub running.
WARNING:version:Support for Python 3 is experimental.
INFO:core:POX 0.7.0 (gar) is up.
INFO:openflow.of_01:[00-00-00-00-00-01 2] connected
INFO:forwarding.hub:Hubifying 00-00-00-00-00-01
INFO:openflow.of_01:[00-00-00-00-00-02 3] connected
INFO:forwarding.hub:Hubifying 00-00-00-00-00-02
INFO:openflow.of_01:[00-00-00-00-00-03 4] connected
INFO:forwarding.hub:Hubifying 00-00-00-00-00-03
```

```
davix@Ubuntu20:~/mininet$ sudo python3 labb8.py
Unable to contact the remote controller at 127.0.0.1:6653
Connecting to remote controller at 127.0.0.1:6633
*** Adding hosts
*** Adding switch
*** Creating links
*** Starting network
*** Configuring hosts
h1 h2 h3 h4 h5
*** Starting controller
c0
*** Starting 3 switches
s1 s2 s3 ...
*** Running CLI
*** Starting CLI:
mininet> h1 ping h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=0.776 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.222 ms
^C
--- 10.0.0.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1031ms
rtt min/avg/max/mdev = 0.222/0.499/0.776/0.277 ms
mininet> h1 ping h5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=0.950 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=0.180 ms
^C
--- 10.0.0.5 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.180/0.565/0.950/0.385 ms
mininet>
```

SOL:

h1 ping h2 - time - 1031 ms

h1 ping h5 - time - 1003 ms

difference - 28 ms

```
h1 h2 h3 h4 h5
*** Starting controller
c0
*** Starting 3 switches
s1 s2 s3 ...
*** Running CLI
*** Starting CLI:
mininet> h1 ping h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=0.776 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.222 ms
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--- 10.0.0.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1031ms
rtt min/avg/max/mdev = 0.222/0.499/0.776/0.277 ms
mininet> h1 ping h5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=0.950 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=0.180 ms
^C
--- 10.0.0.5 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.180/0.565/0.950/0.385 ms
mininet> iperf h1 h2
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['19.5 Gbits/sec', '19.5 Gbits/sec']
mininet> iperf h1 h5
*** Iperf: testing TCP bandwidth between h1 and h5
*** Results: ['27.0 Gbits/sec', '27.0 Gbits/sec']
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5
h2 -> h1 h3 h4 h5
h3 -> h1 h2 h4 h5
h4 -> h1 h2 h3 h5
h5 -> h1 h2 h3 h4
*** Results: 0% dropped (20/20 received)
mininet>
```

SOL:

iperf h1 h2 - 19.5 Gbits/sec

iperf h1 h5 - 27 Gbits/sec

differnce - 7.5   Gbits/sec

Part B: MAC learning controller

All traffic arriving on a switch will be forwarded to the controller. Modify the default controller

so that, for each switch, it learns the mapping between MAC addresses and ports. It then

instructs the switch which port to forward the packet on.

1. Have h1 ping h2 and h1 ping h5. How long did it take to ping? What is the

difference? Which of the hosts and switches observe traffic? How does this compare to

the hub controller?

2. Run iperf h1 h2 and iperf h1 h5. What is the throughput? What is the

difference? How does this compare to the hub controller?

3. Run pingall to verify connectivity and dump the output.

```
davix@Ubuntu20:~$ sudo ~/pox/pox.py forwarding.hub
POX 0.7.0 (gar) / Copyright 2011-2020 James McCauley, et al.
INFO:forwarding.hub:Proactive hub running.
WARNING:version:Support for Python 3 is experimental.
INFO:core:POX 0.7.0 (gar) is up.
INFO:openflow.of_01:[00-00-00-00-00-01 1] connected
INFO:forwarding.hub:Hubifying 00-00-00-00-00-01
INFO:openflow.of_01:[00-00-00-00-00-03 2] connected
INFO:forwarding.hub:Hubifying 00-00-00-00-00-03
INFO:openflow.of_01:[00-00-00-00-00-02 3] connected
INFO:forwarding.hub:Hubifying 00-00-00-00-00-02
^CINFO:core:Going down...
INFO:openflow.of_01:[00-00-00-00-00-01 1] disconnected
INFO:openflow.of_01:[00-00-00-00-00-03 2] disconnected
INFO:openflow.of_01:[00-00-00-00-00-02 3] disconnected
INFO:core:Down.
davix@Ubuntu20:~$ sudo ~/pox/pox.py forwarding.l2_learning
POX 0.7.0 (gar) / Copyright 2011-2020 James McCauley, et al.
WARNING:version:Support for Python 3 is experimental.
INFO:core:POX 0.7.0 (gar) is up.
INFO:openflow.of_01:[00-00-00-00-00-01 1] connected
INFO:openflow.of_01:[00-00-00-00-00-03 2] connected
INFO:openflow.of_01:[00-00-00-00-00-02 3] connected
```

```
davix@Ubuntu20: ~/mininet                    Q  ≡  _  □  ✕

davix@Ubuntu20:~/mininet$ sudo python3 labb8.py
Unable to contact the remote controller at 127.0.0.1:6653
Connecting to remote controller at 127.0.0.1:6633
*** Adding hosts
*** Adding switch
*** Creating links
*** Starting network
*** Configuring hosts
h1 h2 h3 h4 h5
*** Starting controller
c0
*** Starting 3 switches
s1 s2 s3 ...
*** Running CLI
*** Starting CLI:
mininet>
Interrupt
mininet> h1 ping h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=7.17 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=1.04 ms
^C
--- 10.0.0.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 1.038/4.105/7.173/3.067 ms
mininet> h1 ping h5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=18.8 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=1.32 ms
64 bytes from 10.0.0.5: icmp_seq=3 ttl=64 time=0.158 ms
64 bytes from 10.0.0.5: icmp_seq=4 ttl=64 time=0.235 ms
^C
--- 10.0.0.5 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3028ms
rtt min/avg/max/mdev = 0.158/5.127/18.793/7.903 ms
mininet>
```

SOL:

h1 ping h2 - 1003 ms

h1 ping h5 - 3028 ms

difference - 2025 ms

```
s1 s2 s3 ...
*** Running CLI
*** Starting CLI:
mininet>
Interrupt
mininet> h1 ping h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=7.17 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=1.04 ms
^C
--- 10.0.0.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 1.038/4.105/7.173/3.067 ms
mininet> h1 ping h5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=18.8 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=1.32 ms
64 bytes from 10.0.0.5: icmp_seq=3 ttl=64 time=0.158 ms
64 bytes from 10.0.0.5: icmp_seq=4 ttl=64 time=0.235 ms
^C
--- 10.0.0.5 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3028ms
rtt min/avg/max/mdev = 0.158/5.127/18.793/7.903 ms
mininet> iperf h1 h2
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['33.7 Gbits/sec', '33.7 Gbits/sec']
mininet> iperf h1 h5
*** Iperf: testing TCP bandwidth between h1 and h5
*** Results: ['28.5 Gbits/sec', '28.5 Gbits/sec']
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5
h2 -> h1 h3 h4 h5
h3 -> h1 h2 h4 h5
h4 -> h1 h2 h3 h5
h5 -> h1 h2 h3 h4
*** Results: 0% dropped (20/20 received)
```

SOL:

iperf h1 h2 - 33.7 Gbits/sec

iperf h1 h5 - 28.5 Gbits/sec

Difference - 5.2 Gbits/sec