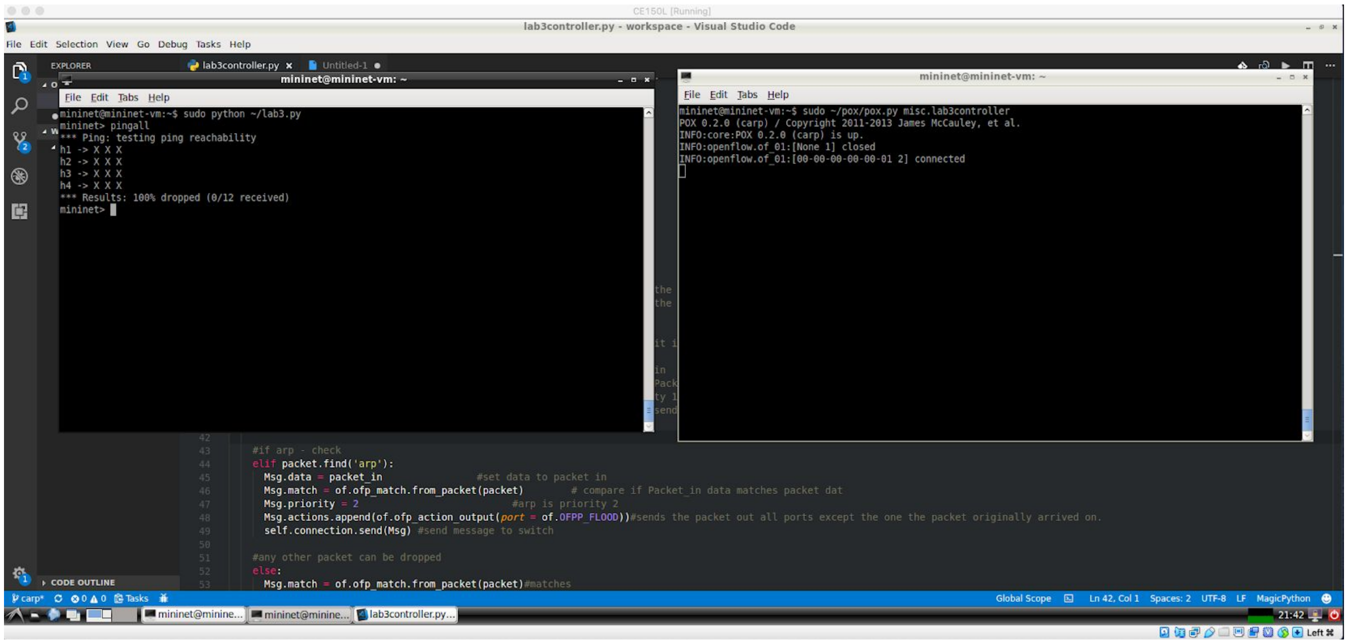
Tyler Soriano
CSE 150
Lab3

1. Running the Pingall command:



```
mininet@mininet-vm:~$ sudo python ~/lab3.py
mininet> pingall
*** Ping: testing ping reachability
h1 -> X X X
h2 -> X X X
h3 -> X X X
h4 -> X X X
*** Results: 100% dropped (0/12 received)
mininet>
```

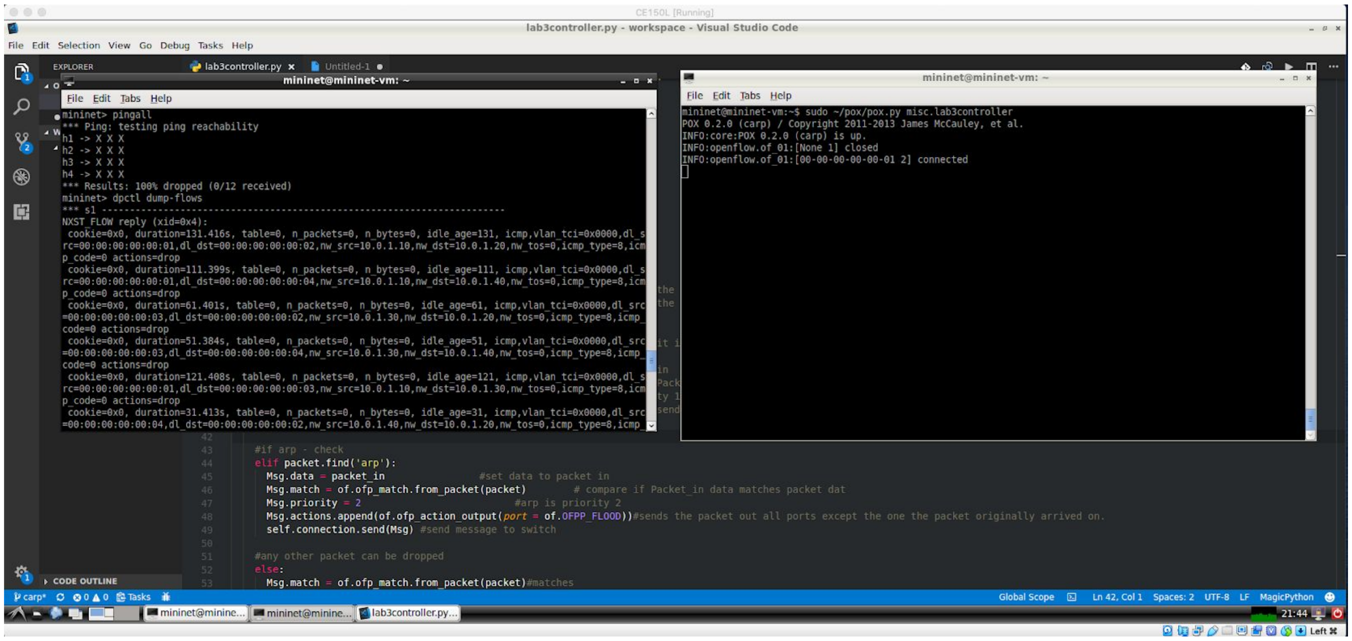
```
mininet@mininet-vm:~$ sudo ~/pox/pox.py misc.lab3controller
POX 0.2.0 (carp) / Copyright 2011-2013 James McCauley, et al.
INFO:core:POX 0.2.0 (carp) is up.
INFO:openflow.of_01:[None 1] closed
INFO:openflow.of_01:[00-00-00-00-00-01 2] connected
```

```
#if arp - check
elif packet.find('arp'):
  Msg.data = packet_in                #set data to packet in
  Msg.match = of.ofp_match.from_packet(packet)        # compare if Packet_in data matches packet dat
  Msg.priority = 2                         #arp is priority 2
  Msg.actions.append(of.ofp_action_output(port = of.OFPP_FLOOD))#sends the packet out all ports except the one the packet originally arrived on.
  self.connection.send(Msg) #send message to switch

#any other packet can be dropped
else:
  Msg.match = of.ofp_match.from_packet(packet)#matches
```

In the figure above you can see that I had configured both lab3.py and lab3controller.py correctly. I created the lab controller from my virtual machine downloading the skeleton code from canvas. The completed controller was saved in the pox/pox/misc folder. I used the commands given in the lab manual to run them.

The left window shows the results from the pingall command. It was said that this test should fail because the ICMP traffic should be blocked. Looking at the results you can see that 100% failed and were dropped. In our code, we block each host from sending ICMP traffic to any of the other 3 hosts. This means that the firewall was not letting hosts receive any messages sent from other hosts, or blocking communications. When we run the ping command, it creates an ARP query which then issues an ICMP ping request. This does not happen because all ICMP traffic is blocked, and therefore those don't occur. Overall, this just lets us know that we have successfully built our firewall, for they do not let any unverified sources access to the different hosts.

2. Running the dpctl dump-flows command

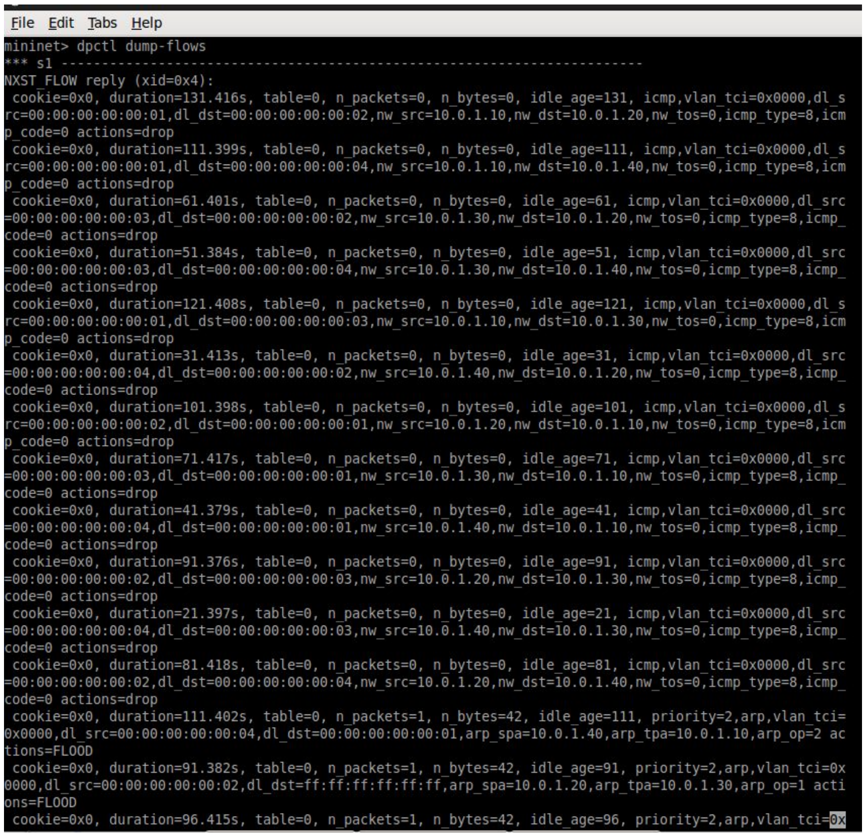


```
mininet> pingall
*** Ping: testing ping reachability
h1 -> X X X
h2 -> X X X
h3 -> X X X
h4 -> X X X
*** Results: 100% dropped (0/12 received)
mininet> dpctl dump-flows
*** s1 -----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=131.416s, table=0, n_packets=0, n_bytes=0, idle_age=131, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:01,dl_dst=00:00:00:00:00:02,nw_src=10.0.1.10,nw_dst=10.0.1.20,nw_tos=0,icmp_type=8,icm
p_code=0 actions=drop
 cookie=0x0, duration=111.399s, table=0, n_packets=0, n_bytes=0, idle_age=111, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,nw_src=10.0.1.10,nw_dst=10.0.1.40,nw_tos=0,icmp_type=8,icm
p_code=0 actions=drop
 cookie=0x0, duration=61.401s, table=0, n_packets=0, n_bytes=0, idle_age=61, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02,nw_src=10.0.1.30,nw_dst=10.0.1.20,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=51.384s, table=0, n_packets=0, n_bytes=0, idle_age=51, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:03,dl_dst=00:00:00:00:00:04,nw_src=10.0.1.30,nw_dst=10.0.1.40,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=121.408s, table=0, n_packets=0, n_bytes=0, idle_age=121, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,nw_src=10.0.1.10,nw_dst=10.0.1.30,nw_tos=0,icmp_type=8,icm
p_code=0 actions=drop
 cookie=0x0, duration=31.413s, table=0, n_packets=0, n_bytes=0, idle_age=31, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:04,dl_dst=00:00:00:00:00:02,nw_src=10.0.1.40,nw_dst=10.0.1.20,nw_tos=0,icmp_type=8,icmp_
```

```
mininet@mininet-vm:~$ sudo ~/pox/pox.py misc.lab3controller
POX 0.2.0 (carp) / Copyright 2011-2013 James McCauley, et al.
INFO:core:POX 0.2.0 (carp) is up.
INFO:openflow.of_01:[None 1] closed
INFO:openflow.of_01:[00-00-00-00-00-01 2] connected
```

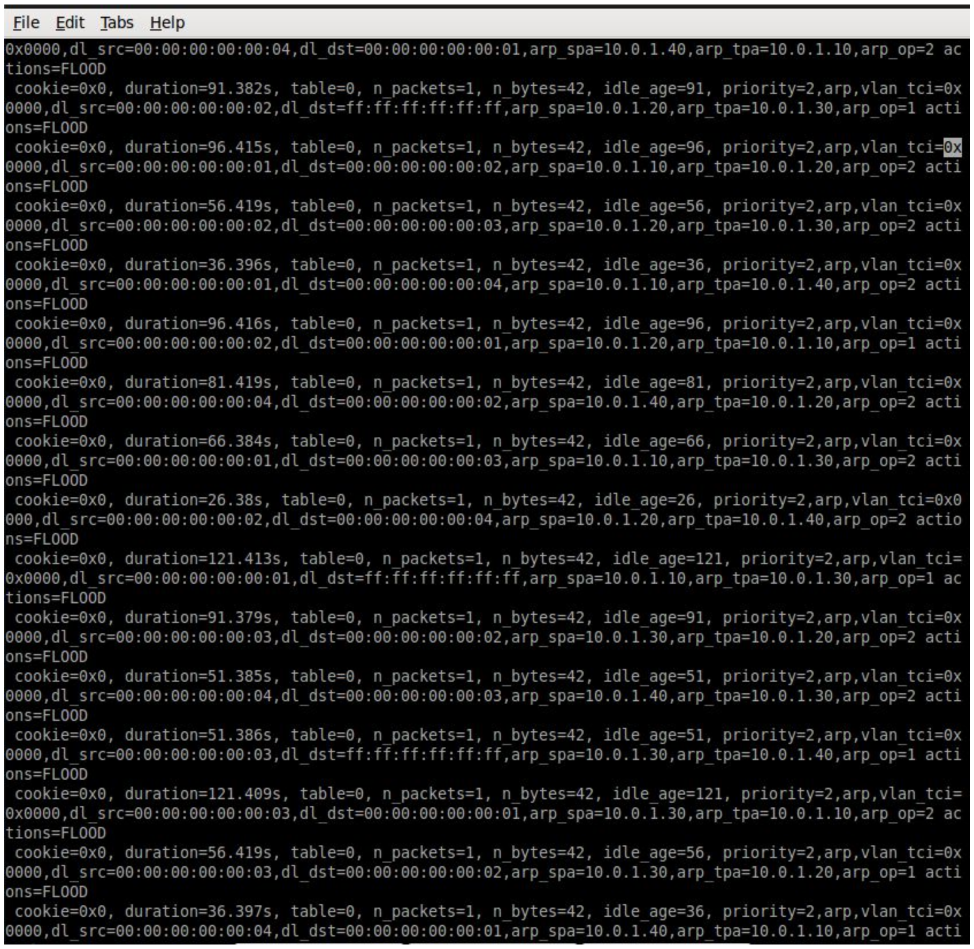
```python

    #if arp - check
    elif packet.find('arp'):
      Msg.data = packet_in                  #set data to packet in
      Msg.match = of.ofp_match.from_packet(packet)        # compare if Packet_in data matches packet dat
      Msg.priority = 2                            #arp is priority 2
      Msg.actions.append(of.ofp_action_output(port = of.OFPP_FLOOD))#sends the packet out all ports except the one the packet originally arrived on.
      self.connection.send(Msg) #send message to switch

    #any other packet can be dropped
    else:
      Msg.match = of.ofp_match.from_packet(packet)#matches
```

Figure 1



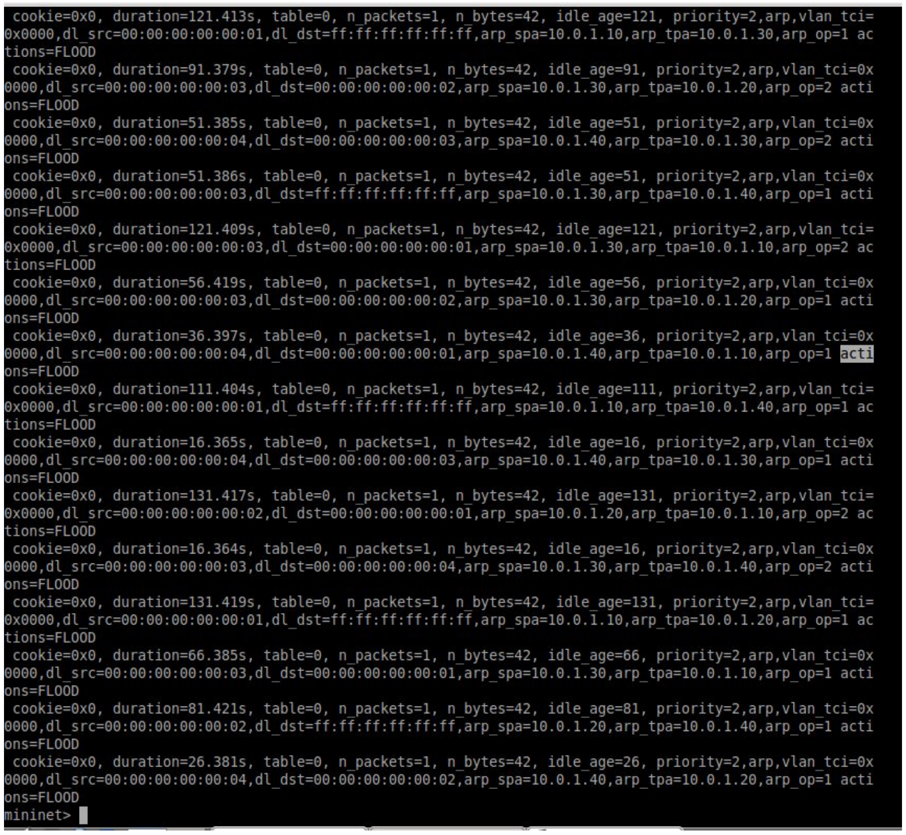
```
mininet> dpctl dump-flows
*** s1 -----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=131.416s, table=0, n_packets=0, n_bytes=0, idle_age=131, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:01,dl_dst=00:00:00:00:00:02,nw_src=10.0.1.10,nw_dst=10.0.1.20,nw_tos=0,icmp_type=8,icm
p_code=0 actions=drop
 cookie=0x0, duration=111.399s, table=0, n_packets=0, n_bytes=0, idle_age=111, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,nw_src=10.0.1.10,nw_dst=10.0.1.40,nw_tos=0,icmp_type=8,icm
p_code=0 actions=drop
 cookie=0x0, duration=61.401s, table=0, n_packets=0, n_bytes=0, idle_age=61, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02,nw_src=10.0.1.30,nw_dst=10.0.1.20,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=51.384s, table=0, n_packets=0, n_bytes=0, idle_age=51, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:03,dl_dst=00:00:00:00:00:04,nw_src=10.0.1.30,nw_dst=10.0.1.40,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=121.408s, table=0, n_packets=0, n_bytes=0, idle_age=121, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,nw_src=10.0.1.10,nw_dst=10.0.1.30,nw_tos=0,icmp_type=8,icm
p_code=0 actions=drop
 cookie=0x0, duration=31.413s, table=0, n_packets=0, n_bytes=0, idle_age=31, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:04,dl_dst=00:00:00:00:00:02,nw_src=10.0.1.40,nw_dst=10.0.1.20,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=101.398s, table=0, n_packets=0, n_bytes=0, idle_age=101, icmp,vlan_tci=0x0000,dl_s
rc=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,nw_src=10.0.1.20,nw_dst=10.0.1.10,nw_tos=0,icmp_type=8,icm
p_code=0 actions=drop
 cookie=0x0, duration=71.417s, table=0, n_packets=0, n_bytes=0, idle_age=71, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,nw_src=10.0.1.30,nw_dst=10.0.1.10,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=41.379s, table=0, n_packets=0, n_bytes=0, idle_age=41, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,nw_src=10.0.1.40,nw_dst=10.0.1.10,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=91.376s, table=0, n_packets=0, n_bytes=0, idle_age=91, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:02,dl_dst=00:00:00:00:00:03,nw_src=10.0.1.20,nw_dst=10.0.1.30,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=21.397s, table=0, n_packets=0, n_bytes=0, idle_age=21, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:04,dl_dst=00:00:00:00:00:03,nw_src=10.0.1.40,nw_dst=10.0.1.30,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=81.418s, table=0, n_packets=0, n_bytes=0, idle_age=81, icmp,vlan_tci=0x0000,dl_src
=00:00:00:00:00:02,dl_dst=00:00:00:00:00:04,nw_src=10.0.1.20,nw_dst=10.0.1.40,nw_tos=0,icmp_type=8,icmp_
code=0 actions=drop
 cookie=0x0, duration=111.402s, table=0, n_packets=1, n_bytes=42, idle_age=111, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.40,arp_tpa=10.0.1.10,arp_op=2 ac
tions=FLOOD
 cookie=0x0, duration=91.382s, table=0, n_packets=1, n_bytes=42, idle_age=91, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:02,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.20,arp_tpa=10.0.1.30,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=96.415s, table=0, n_packets=1, n_bytes=42, idle_age=96, priority=2,arp,vlan_tci=0x
```

Figure 2



```
0x0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.40,arp_tpa=10.0.1.10,arp_op=2 ac
tions=FLOOD
 cookie=0x0, duration=91.382s, table=0, n_packets=1, n_bytes=42, idle_age=91, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:02,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.20,arp_tpa=10.0.1.30,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=96.415s, table=0, n_packets=1, n_bytes=42, idle_age=96, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.10,arp_tpa=10.0.1.20,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=56.419s, table=0, n_packets=1, n_bytes=42, idle_age=56, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.20,arp_tpa=10.0.1.30,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=36.396s, table=0, n_packets=1, n_bytes=42, idle_age=36, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,arp_spa=10.0.1.10,arp_tpa=10.0.1.40,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=96.416s, table=0, n_packets=1, n_bytes=42, idle_age=96, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.20,arp_tpa=10.0.1.10,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=81.419s, table=0, n_packets=1, n_bytes=42, idle_age=81, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.40,arp_tpa=10.0.1.20,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=66.384s, table=0, n_packets=1, n_bytes=42, idle_age=66, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.10,arp_tpa=10.0.1.30,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=26.38s, table=0, n_packets=1, n_bytes=42, idle_age=26, priority=2,arp,vlan_tci=0x0
000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:04,arp_spa=10.0.1.20,arp_tpa=10.0.1.40,arp_op=2 actio
ns=FLOOD
 cookie=0x0, duration=121.413s, table=0, n_packets=1, n_bytes=42, idle_age=121, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:01,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.10,arp_tpa=10.0.1.30,arp_op=1 ac
tions=FLOOD
 cookie=0x0, duration=91.379s, table=0, n_packets=1, n_bytes=42, idle_age=91, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.30,arp_tpa=10.0.1.20,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=51.385s, table=0, n_packets=1, n_bytes=42, idle_age=51, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.40,arp_tpa=10.0.1.30,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=51.386s, table=0, n_packets=1, n_bytes=42, idle_age=51, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.30,arp_tpa=10.0.1.40,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=121.409s, table=0, n_packets=1, n_bytes=42, idle_age=121, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.30,arp_tpa=10.0.1.10,arp_op=2 ac
tions=FLOOD
 cookie=0x0, duration=56.419s, table=0, n_packets=1, n_bytes=42, idle_age=56, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.30,arp_tpa=10.0.1.20,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=36.397s, table=0, n_packets=1, n_bytes=42, idle_age=36, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.40,arp_tpa=10.0.1.10,arp_op=1 acti
```

Figure 3



```
 cookie=0x0, duration=121.413s, table=0, n_packets=1, n_bytes=42, idle_age=121, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:01,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.10,arp_tpa=10.0.1.30,arp_op=1 ac
tions=FLOOD
 cookie=0x0, duration=91.379s, table=0, n_packets=1, n_bytes=42, idle_age=91, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.30,arp_tpa=10.0.1.20,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=51.385s, table=0, n_packets=1, n_bytes=42, idle_age=51, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.40,arp_tpa=10.0.1.30,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=51.386s, table=0, n_packets=1, n_bytes=42, idle_age=51, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.30,arp_tpa=10.0.1.40,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=121.409s, table=0, n_packets=1, n_bytes=42, idle_age=121, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.30,arp_tpa=10.0.1.10,arp_op=2 ac
tions=FLOOD
 cookie=0x0, duration=56.419s, table=0, n_packets=1, n_bytes=42, idle_age=56, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.30,arp_tpa=10.0.1.20,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=36.397s, table=0, n_packets=1, n_bytes=42, idle_age=36, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.40,arp_tpa=10.0.1.10,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=111.404s, table=0, n_packets=1, n_bytes=42, idle_age=111, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:01,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.10,arp_tpa=10.0.1.40,arp_op=1 ac
tions=FLOOD
 cookie=0x0, duration=16.365s, table=0, n_packets=1, n_bytes=42, idle_age=16, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.40,arp_tpa=10.0.1.30,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=131.417s, table=0, n_packets=1, n_bytes=42, idle_age=131, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.20,arp_tpa=10.0.1.10,arp_op=2 ac
tions=FLOOD
 cookie=0x0, duration=16.364s, table=0, n_packets=1, n_bytes=42, idle_age=16, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:04,arp_spa=10.0.1.30,arp_tpa=10.0.1.40,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=131.419s, table=0, n_packets=1, n_bytes=42, idle_age=131, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:01,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.10,arp_tpa=10.0.1.20,arp_op=1 ac
tions=FLOOD
 cookie=0x0, duration=66.385s, table=0, n_packets=1, n_bytes=42, idle_age=66, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.30,arp_tpa=10.0.1.10,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=81.421s, table=0, n_packets=1, n_bytes=42, idle_age=81, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:02,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.20,arp_tpa=10.0.1.40,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=26.381s, table=0, n_packets=1, n_bytes=42, idle_age=26, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.40,arp_tpa=10.0.1.20,arp_op=1 acti
ons=FLOOD
mininet> 
```

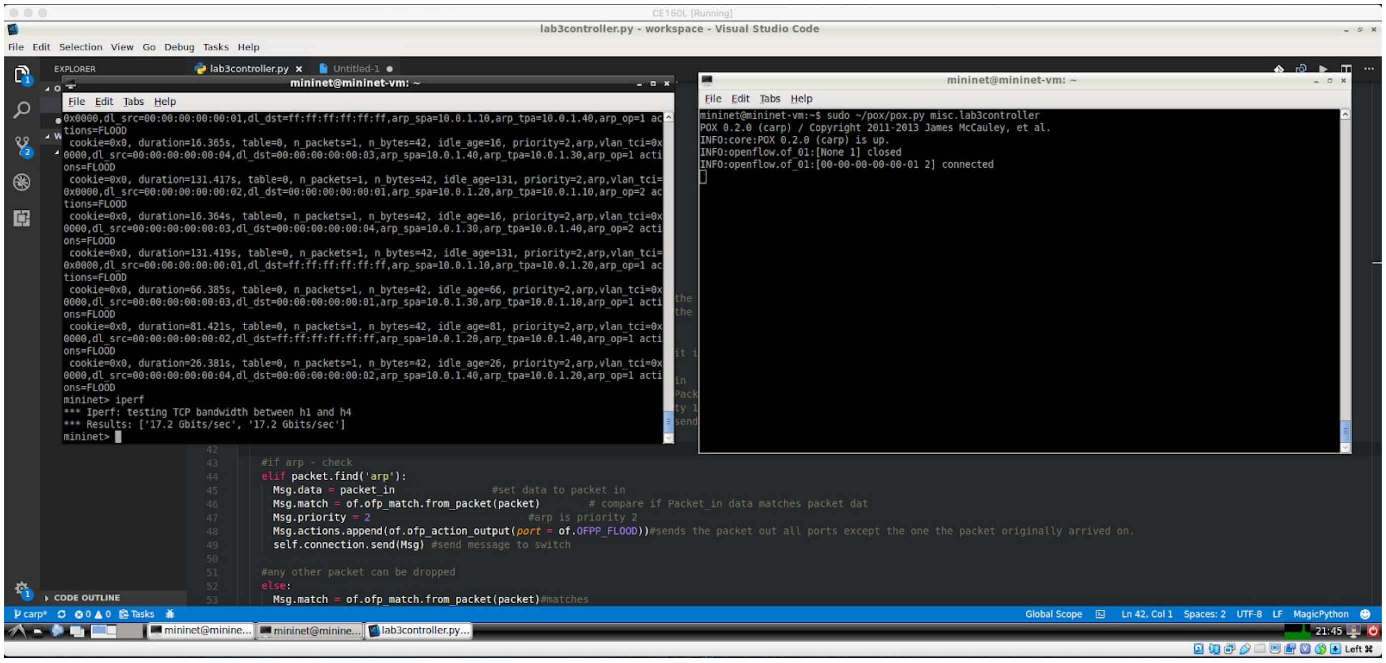
Figure 4

After doing a bit of research I was able to figure out what the dpctl dump-flows command is supposed to accomplish. The command displays all of the current flows that we installed into the switch with of_flow_mod. Both sources tell me that this command is a debugging tool and does not display openFlow table entries. They display much simpler flows maintained by the kernel switch module but are exact copies of all the packets that have passed through the system in a given time frame. We are only working with one switch, so all the flows shown are from this one switch.

We run this command immediately after the pingall so we can see all of the flows from the pingall command. In this case you see all of the flows that the pingall command created. First you see all of the dropped flows. These dropped flows are all of the ivp4 src ip or dst ips that did not have tcp protocols or anything else with tcp protocols. The floods show the successful ivp4 src ips and dst ips with tcp protocol or all of the src ips and dst ips with arp protocol.

Sources I used:
https://discuss.openvswitch.narkive.com/tW0CYfRw/ovs-discuss-ovs-dpctl-dump-flows-vs-ovs-ofctl-dump-flows
https://mail.openvswitch.org/pipermail/ovs-discuss/2010-August/024253.html

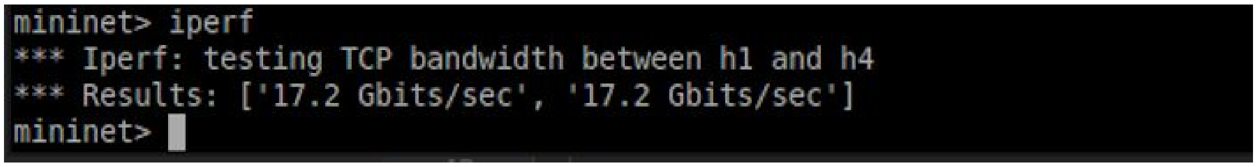
3. Running the iperf command



```
0x0000,dl_src=00:00:00:00:00:01,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.10,arp_tpa=10.0.1.40,arp_op=1 ac
tions=FLOOD
 cookie=0x0, duration=16.365s, table=0, n_packets=1, n_bytes=42, idle_age=16, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:03,arp_spa=10.0.1.40,arp_tpa=10.0.1.30,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=131.417s, table=0, n_packets=1, n_bytes=42, idle_age=131, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.20,arp_tpa=10.0.1.10,arp_op=2 ac
tions=FLOOD
 cookie=0x0, duration=16.364s, table=0, n_packets=1, n_bytes=42, idle_age=16, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:04,arp_spa=10.0.1.30,arp_tpa=10.0.1.40,arp_op=2 acti
ons=FLOOD
 cookie=0x0, duration=131.419s, table=0, n_packets=1, n_bytes=42, idle_age=131, priority=2,arp,vlan_tci=
0x0000,dl_src=00:00:00:00:00:01,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.10,arp_tpa=10.0.1.20,arp_op=1 ac
tions=FLOOD
 cookie=0x0, duration=66.385s, table=0, n_packets=1, n_bytes=42, idle_age=66, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10.0.1.30,arp_tpa=10.0.1.10,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=81.421s, table=0, n_packets=1, n_bytes=42, idle_age=81, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:02,dl_dst=ff:ff:ff:ff:ff:ff,arp_spa=10.0.1.20,arp_tpa=10.0.1.40,arp_op=1 acti
ons=FLOOD
 cookie=0x0, duration=26.381s, table=0, n_packets=1, n_bytes=42, idle_age=26, priority=2,arp,vlan_tci=0x
0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:02,arp_spa=10.0.1.40,arp_tpa=10.0.1.20,arp_op=1 acti
ons=FLOOD
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h4
*** Results: ['17.2 Gbits/sec', '17.2 Gbits/sec']
mininet>
```

```
mininet@mininet-vm:~$ sudo ~/pox/pox.py misc.lab3controller
POX 0.2.0 (carp) / Copyright 2011-2013 James McCauley, et al.
INFO:core:POX 0.2.0 (carp) is up.
INFO:openflow.of_01:[None 1] closed
INFO:openflow.of_01:[00-00-00-00-00-01 2] connected
```

```python

    #if arp - check
    elif packet.find('arp'):
      Msg.data = packet_in                #set data to packet in
      Msg.match = of.ofp_match.from_packet(packet)        # compare if Packet_in data matches packet dat
      Msg.priority = 2                        #arp is priority 2
      Msg.actions.append(of.ofp_action_output(port = of.OFPP_FLOOD))#sends the packet out all ports except the one the packet originally arrived on.
      self.connection.send(Msg) #send message to switch

    #any other packet can be dropped
    else:
      Msg.match = of.ofp_match.from_packet(packet)#matches
```



```
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h4
*** Results: ['17.2 Gbits/sec', '17.2 Gbits/sec']
mininet>
```

As you can see we have successfully run the iperf command yielding a result of 17.2 Gbits/sec. The iperf command tests TCP bandwidth which means it tested the traffic that has passed through. In this case, the TCP packets

Resources used for this lab/ code:
http://intronetworks.cs.luc.edu/auxiliary_files/mininet/poxwiki.pdf
https://github.com/CPqD/RouteFlow/blob/master/pox/pox/forwarding/l2_learning.py
150 Piazza
TA Melanie Wong