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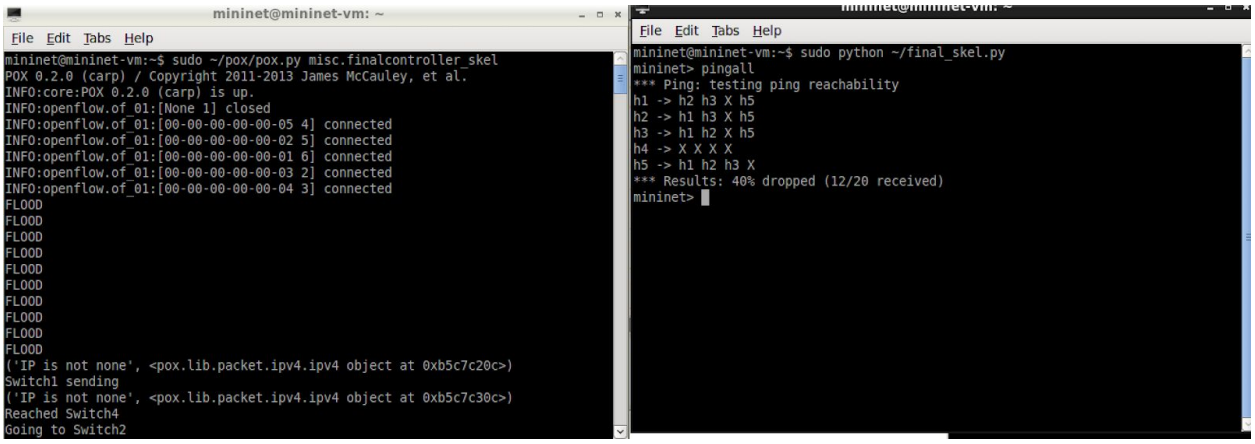
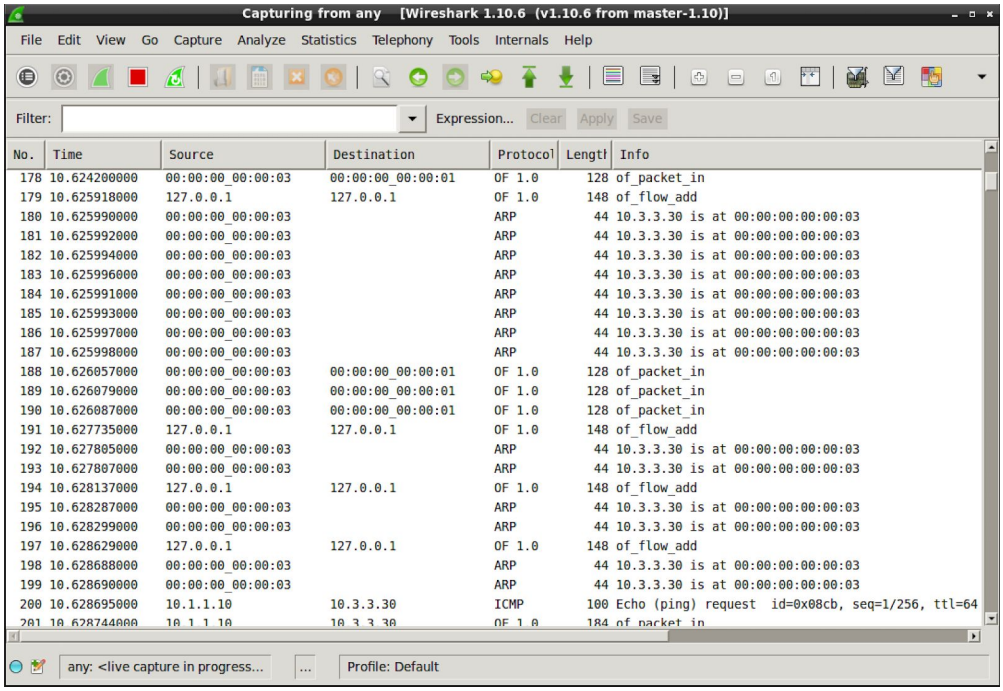
Final Project - 12/06/19

Presentation:

Listening on the “any” interface on wireshark, I were able to capture all the packets that were being sent to the different hosts. To do that, I used the command “pingall” which involves transfers/pings between all host pairs. Because pings involve ICMP packets, the ones from host 4 (or the “hacker”) are dropped to any other host and pings fail because this host is an untrusted host. Also in wireshark, is shown where there is a request but no reply as well as the print statement coded in the controller.





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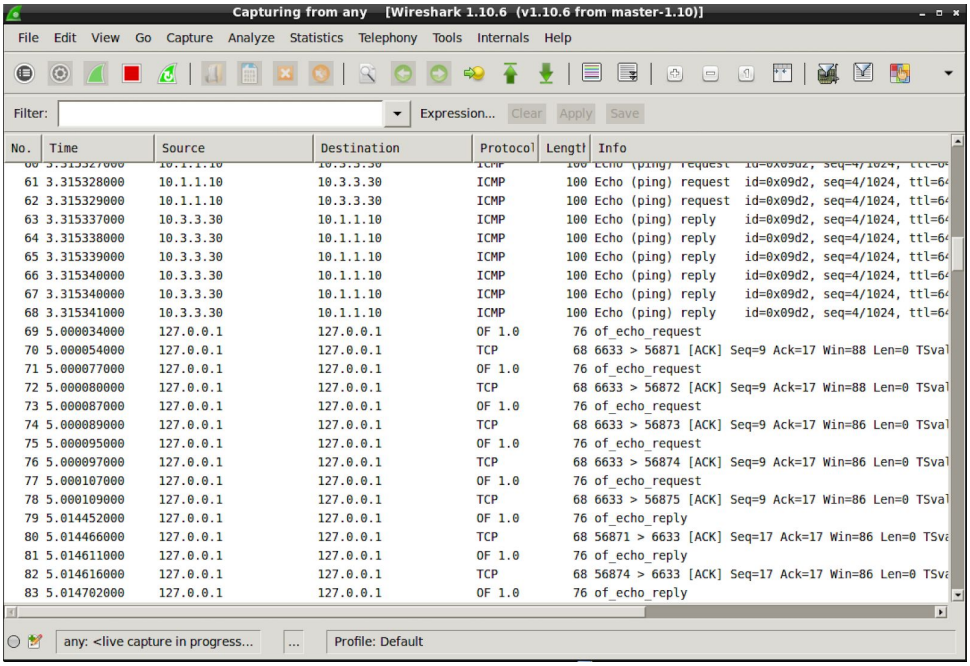
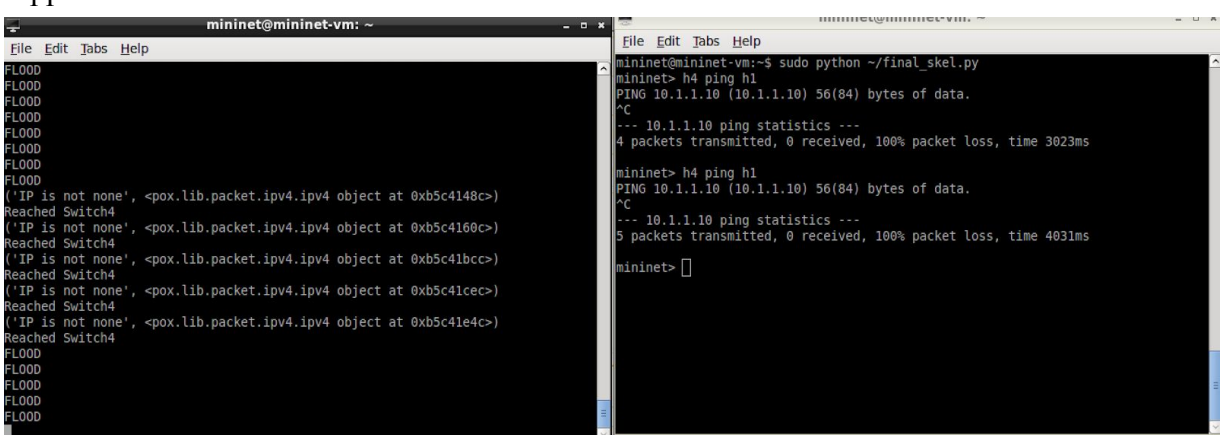
Using the command “h1 ping h3” I was able to get a successful ping between two trusted hosts (h1 and h3), which involve requests and replies. Which can be seen below in the pictures

```
mininet> h1 ping h3
PING 10.3.3.30 (10.3.3.30) 56(84) bytes of data.
64 bytes from 10.3.3.30: icmp_seq=1 ttl=64 time=0.213 ms
64 bytes from 10.3.3.30: icmp_seq=2 ttl=64 time=0.039 ms
64 bytes from 10.3.3.30: icmp_seq=3 ttl=64 time=0.040 ms
64 bytes from 10.3.3.30: icmp_seq=4 ttl=64 time=0.041 ms
^C
--- 10.3.3.30 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 2998ms
rtt min/avg/max/mdev = 0.039/0.083/0.213/0.075 ms
```



The pictures below show ping involving the untrusted host h4 (the hacker), in which there are ICMP echo requests but no replies because the packets are identified as a threat and therefore dropped at switch 4.



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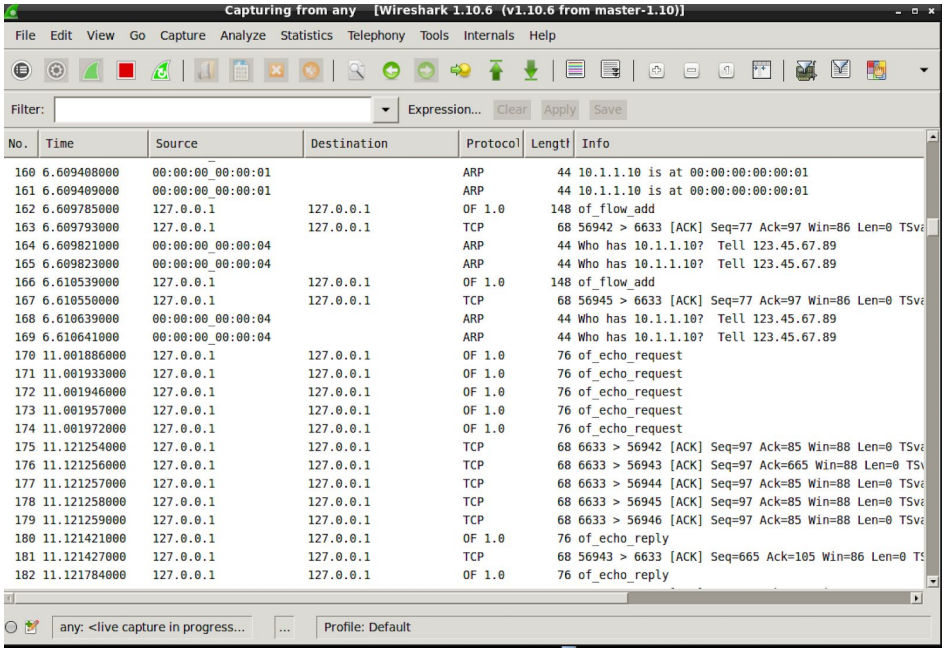
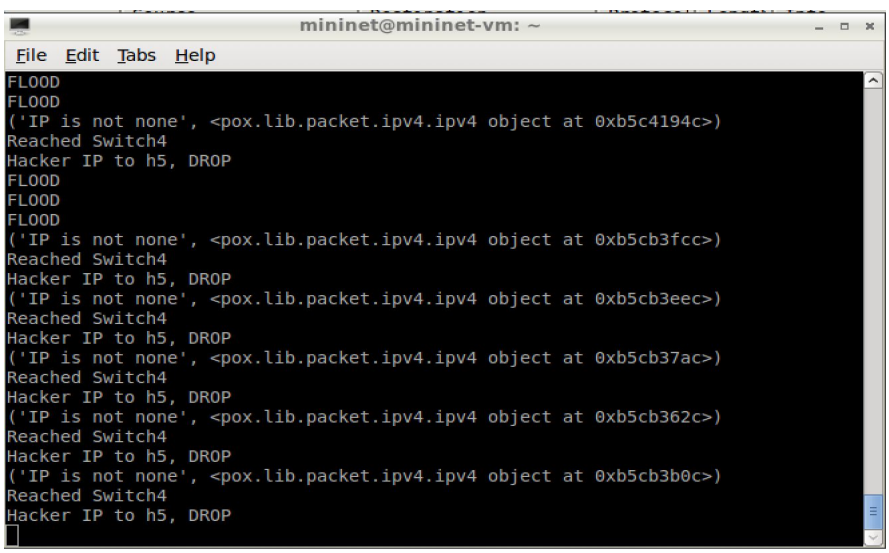
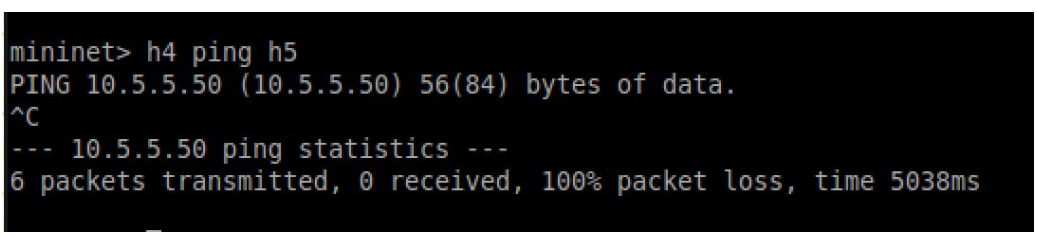


The below picture shows a similar situation with ping between an untrusted host (hacker) and the server h5. Here, ICMP echo requests are identified and dropped. Some of these print statements occur and alternate after the “IP is not None”, which means that IP packets are dropped and won't reach the server h5.





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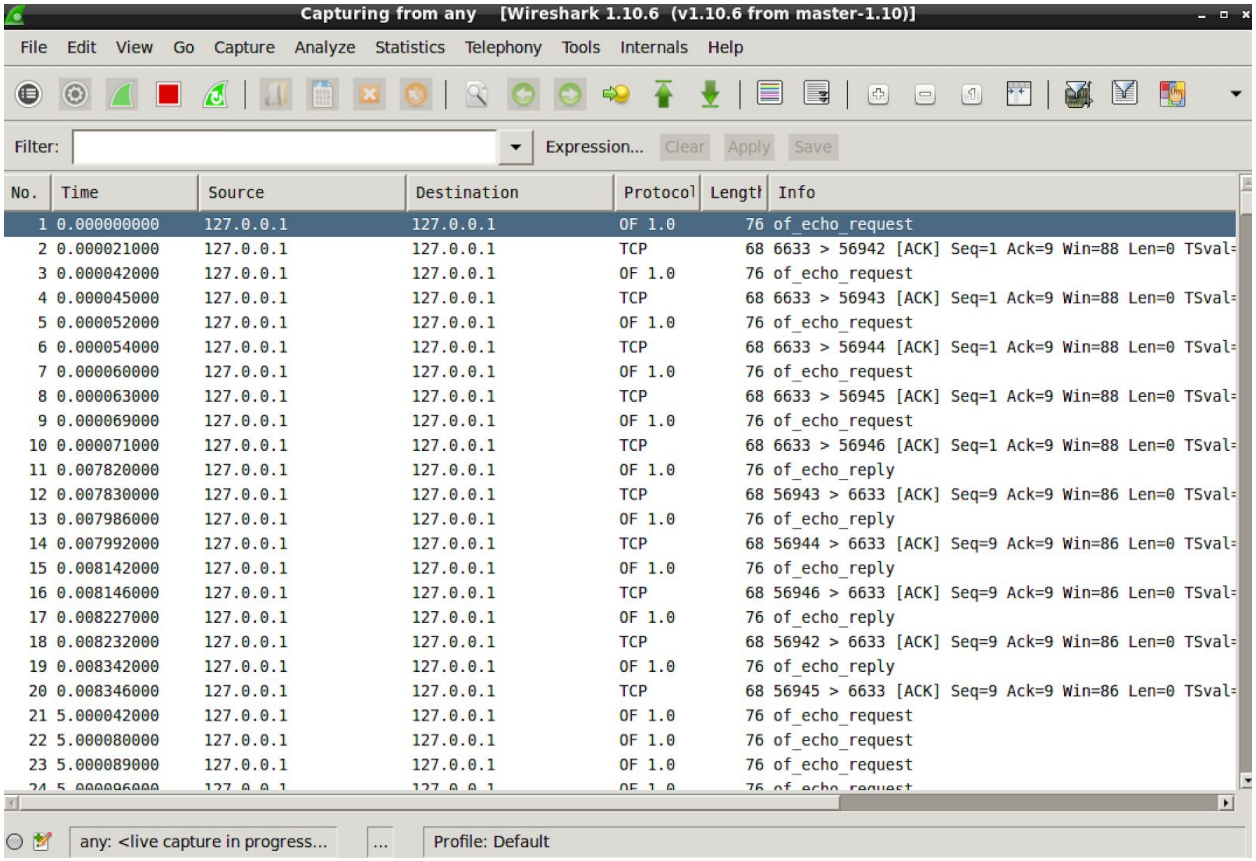

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
2	0.000021000	127.0.0.1	127.0.0.1	TCP	68	6633 > 56942 [ACK] Seq=1 Ack=9 Win=88 Len=0 TSval=
3	0.000042000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
4	0.000045000	127.0.0.1	127.0.0.1	TCP	68	6633 > 56943 [ACK] Seq=1 Ack=9 Win=88 Len=0 TSval=
5	0.000052000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
6	0.000054000	127.0.0.1	127.0.0.1	TCP	68	6633 > 56944 [ACK] Seq=1 Ack=9 Win=88 Len=0 TSval=
7	0.000060000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
8	0.000063000	127.0.0.1	127.0.0.1	TCP	68	6633 > 56945 [ACK] Seq=1 Ack=9 Win=88 Len=0 TSval=
9	0.000069000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
10	0.000071000	127.0.0.1	127.0.0.1	TCP	68	6633 > 56946 [ACK] Seq=1 Ack=9 Win=88 Len=0 TSval=
11	0.007820000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_reply
12	0.007830000	127.0.0.1	127.0.0.1	TCP	68	56943 > 6633 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=
13	0.007986000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_reply
14	0.007992000	127.0.0.1	127.0.0.1	TCP	68	56944 > 6633 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=
15	0.008142000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_reply
16	0.008146000	127.0.0.1	127.0.0.1	TCP	68	56946 > 6633 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=
17	0.008227000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_reply
18	0.008232000	127.0.0.1	127.0.0.1	TCP	68	56942 > 6633 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=
19	0.008342000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_reply
20	0.008346000	127.0.0.1	127.0.0.1	TCP	68	56945 > 6633 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=
21	5.000042000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
22	5.000080000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
23	5.000089000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request
24	5.000096000	127.0.0.1	127.0.0.1	OF 1.0	76	of_echo_request

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Now I will test the hosts using the “iperf” command. The below picture shows successful transmissions between the trusted hosts h1, h2, h3, and h5, as well as the first two iperf commands, as well as the print statements that are generated when the packets are sent from one host and received by another. The third command does not automatically resolve and requires interruption because of the IP packets not being able to reach the server h5 from the untrusted host h4 after they are dropped by the controller.

```
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5cb3e4c>)
Switch1 sending
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5cb366c>)
Reached Switch4
Going to Switch5
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5cb324c>)
Switch5 receiving
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5cb354c>)
Switch5 is sending
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5cb350c>)
Reached Switch4
Going to Switch1
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5cb390c>)
Switch1 receiving
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5cb3f2c>)
Switch1 sending
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5c416cc>)
Reached Switch4
Going to Switch5
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5c4112c>)
Switch5 receiving
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5c4186c>)
Reached Switch4
Hacker IP to h5, DROP
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5c4160c>)
Reached Switch4
Hacker IP to h5, DROP
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5c419ac>)
Reached Switch4
Hacker IP to h5, DROP
FLOOD
FLOOD
FLOOD
FLOOD
FLOOD
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5c40f6c>)
Reached Switch4
Hacker IP to h5, DROP
('IP is not none', <pox.lib.packet.ipv4.ipv4 object at 0xb5c40c8c>)
Reached Switch4
Hacker IP to h5, DROP
```

```
mininet> iperf h1 h3
*** Iperf: testing TCP bandwidth between h1 and h3
*** Results: ['25.9 Gbits/sec', '25.9 Gbits/sec']
mininet> iperf h5 h1
*** Iperf: testing TCP bandwidth between h5 and h1
*** Results: ['26.1 Gbits/sec', '26.1 Gbits/sec']
mininet> iperf h4 h5
*** Iperf: testing TCP bandwidth between h4 and h5
^C
Interrupt
mininet> iperf h1 h2
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['30.9 Gbits/sec', '30.9 Gbits/sec']
```

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Finally, using the command “dpctl dump-flows” i was able to get entries for each switch that I created using the “of_flow_mod.” I played around with the timeout settings and found out that if I didn't include a specific time, I would still receive entries.

```
*** s1 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=415.347s, table=0, n_packets=147440, n_bytes=9731048, idle
_age=410, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,
nw_src=10.2.2.20,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=51882 actions=outp
ut:8
 cookie=0x0, duration=649.429s, table=0, n_packets=140321, n_bytes=9270098, idle
_age=644, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,
nw_src=10.1.1.10,nw_dst=10.5.5.50,nw_tos=0,tp_src=5001,tp_dst=57611 actions=outp
ut:1
 cookie=0x0, duration=1735.384s, table=0, n_packets=9, n_bytes=882, idle_age=168
0, icmp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:04,nw_src
=10.1.1.10,nw_dst=123.45.67.89,nw_tos=0,icmp_type=0,icmp_code=0 actions=output:1
 cookie=0x0, duration=706.714s, table=0, n_packets=4, n_bytes=272, idle_age=706,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,nw_src=10
.1.1.10,nw_dst=10.3.3.30,nw_tos=16,tp_src=42723,tp_dst=5001 actions=output:1
 cookie=0x0, duration=706.708s, table=0, n_packets=2, n_bytes=140, idle_age=706,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,nw_src=10
.3.3.30,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=42723 actions=output:8
 cookie=0x0, duration=415.405s, table=0, n_packets=3, n_bytes=206, idle_age=415,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,nw_src=10
.2.2.20,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=51881 actions=output:8
 cookie=0x0, duration=649.445s, table=0, n_packets=4, n_bytes=272, idle_age=649,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:01,nw_src=10
.5.5.50,nw_dst=10.1.1.10,nw_tos=16,tp_src=57610,tp_dst=5001 actions=output:8
 cookie=0x0, duration=415.397s, table=0, n_packets=513366, n_bytes=19326763084,
idle_age=410, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00
:02,nw_src=10.1.1.10,nw_dst=10.2.2.20,nw_tos=0,tp_src=51882,tp_dst=5001 actions=
output:1
```

```
*** s2 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=415.354s, table=0, n_packets=513394, n_bytes=19326764932,
idle_age=410, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00
:02,nw_src=10.1.1.10,nw_dst=10.2.2.20,nw_tos=0,tp_src=51882,tp_dst=5001 actions=
output:8
 cookie=0x0, duration=415.415s, table=0, n_packets=4, n_bytes=272, idle_age=415,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:02,nw_src=10
.1.1.10,nw_dst=10.2.2.20,nw_tos=16,tp_src=51881,tp_dst=5001 actions=output:8
 cookie=0x0, duration=415.353s, table=0, n_packets=147389, n_bytes=9727682, idle
_age=410, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,
nw_src=10.2.2.20,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=51882 actions=outp
ut:1
 cookie=0x0, duration=415.413s, table=0, n_packets=3, n_bytes=206, idle_age=415,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,nw_src=10
.2.2.20,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=51881 actions=output:1
 cookie=0x0, duration=615.837s, table=0, n_packets=1, n_bytes=42, idle_age=615,
arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:05,arp_spa=12
3.45.67.89,arp_tpa=10.5.5.50,arp_op=1 actions=FLOOD
 cookie=0x0, duration=706.719s, table=0, n_packets=1, n_bytes=42, idle_age=706,
arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10
.3.3.30,arp_tpa=10.1.1.10,arp_op=2 actions=FLOOD
 cookie=0x0, duration=1169.235s, table=0, n_packets=2, n_bytes=84, idle_age=615,
 arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:04,arp_spa=1
0.5.5.50,arp_tpa=123.45.67.89,arp_op=2 actions=FLOOD
 cookie=0x0, duration=649.453s, table=0, n_packets=1, n_bytes=42, idle_age=649,
arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,arp_spa=10
.1.1.10,arp_tpa=10.5.5.50,arp_op=2 actions=FLOOD
```

```
*** s3 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=706.678s, table=0, n_packets=277139, n_bytes=18291182, idl
e_age=701, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01
,nw_src=10.3.3.30,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=42724 actions=out
put:1
 cookie=0x0, duration=706.68s, table=0, n_packets=345657, n_bytes=16215317202, i
dle_age=701, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:
03,nw_src=10.1.1.10,nw_dst=10.3.3.30,nw_tos=0,tp_src=42724,tp_dst=5001 actions=o
utput:8
 cookie=0x0, duration=706.723s, table=0, n_packets=4, n_bytes=272, idle_age=706,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,nw_src=10
.1.1.10,nw_dst=10.3.3.30,nw_tos=16,tp_src=42723,tp_dst=5001 actions=output:8
 cookie=0x0, duration=706.722s, table=0, n_packets=2, n_bytes=140, idle_age=706,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,nw_src=10
.3.3.30,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=42723 actions=output:1
 cookie=0x0, duration=615.844s, table=0, n_packets=1, n_bytes=42, idle_age=615,
arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:05,arp_spa=12
3.45.67.89,arp_tpa=10.5.5.50,arp_op=1 actions=FLOOD
 cookie=0x0, duration=706.73s, table=0, n_packets=1, n_bytes=42, idle_age=706, a
rp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10.
3.3.30,arp_tpa=10.1.1.10,arp_op=2 actions=FLOOD
 cookie=0x0, duration=1169.242s, table=0, n_packets=2, n_bytes=84, idle_age=615,
 arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:04,arp_spa=1
0.5.5.50,arp_tpa=123.45.67.89,arp_op=2 actions=FLOOD
 cookie=0x0, duration=649.459s, table=0, n_packets=1, n_bytes=42, idle_age=649,
arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,arp_spa=10
.1.1.10,arp_tpa=10.5.5.50,arp_op=2 actions=FLOOD
```

```
*** s4 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=415.361s, table=0, n_packets=147389, n_bytes=9727682, idle
_age=410, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,
nw_src=10.2.2.20,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=51882 actions=outp
ut:1
 cookie=0x0, duration=649.44s, table=0, n_packets=140321, n_bytes=9270098, idle
age=644, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,n
w_src=10.1.1.10,nw_dst=10.5.5.50,nw_tos=0,tp_src=5001,tp_dst=57611 actions=outpu
t:4
 cookie=0x0, duration=706.727s, table=0, n_packets=4, n_bytes=272, idle_age=706,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:03,nw_src=10
.1.1.10,nw_dst=10.3.3.30,nw_tos=16,tp_src=42723,tp_dst=5001 actions=output:3
 cookie=0x0, duration=706.723s, table=0, n_packets=2, n_bytes=140, idle_age=706,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,nw_src=10
.3.3.30,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=42723 actions=output:1
 cookie=0x0, duration=415.42s, table=0, n_packets=3, n_bytes=206, idle_age=415,
tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:01,nw_src=10.
2.2.20,nw_dst=10.1.1.10,nw_tos=0,tp_src=5001,tp_dst=51881 actions=output:1
 cookie=0x0, duration=649.459s, table=0, n_packets=4, n_bytes=272, idle_age=649,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:01,nw_src=10
.5.5.50,nw_dst=10.1.1.10,nw_tos=16,tp_src=57610,tp_dst=5001 actions=output:1
 cookie=0x0, duration=415.369s, table=0, n_packets=513366, n_bytes=19326763084,
idle_age=410, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00
:02,nw_src=10.1.1.10,nw_dst=10.2.2.20,nw_tos=0,tp_src=51882,tp_dst=5001 actions=
output:2
```

```
*** s5 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=649.444s, table=0, n_packets=140372, n_bytes=9273464, idle
_age=644, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,
nw_src=10.1.1.10,nw_dst=10.5.5.50,nw_tos=0,tp_src=5001,tp_dst=57611 actions=outp
ut:8
 cookie=0x0, duration=649.457s, table=0, n_packets=627459, n_bytes=16359931550,
idle_age=644, tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00
:01,nw_src=10.5.5.50,nw_dst=10.1.1.10,nw_tos=0,tp_src=57611,tp_dst=5001 actions=
output:1
 cookie=0x0, duration=649.468s, table=0, n_packets=4, n_bytes=272, idle_age=649,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:01,nw_src=10
.5.5.50,nw_dst=10.1.1.10,nw_tos=16,tp_src=57610,tp_dst=5001 actions=output:1
 cookie=0x0, duration=649.463s, table=0, n_packets=3, n_bytes=206, idle_age=649,
 tcp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,nw_src=10
.1.1.10,nw_dst=10.5.5.50,nw_tos=0,tp_src=5001,tp_dst=57610 actions=output:8
 cookie=0x0, duration=615.855s, table=0, n_packets=1, n_bytes=42, idle_age=615,
arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:04,dl_dst=00:00:00:00:00:05,arp_spa=12
3.45.67.89,arp_tpa=10.5.5.50,arp_op=1 actions=FLOOD
 cookie=0x0, duration=706.736s, table=0, n_packets=1, n_bytes=42, idle_age=706,
arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:01,arp_spa=10
.3.3.30,arp_tpa=10.1.1.10,arp_op=2 actions=FLOOD
 cookie=0x0, duration=1169.257s, table=0, n_packets=2, n_bytes=84, idle_age=615,
 arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:05,dl_dst=00:00:00:00:00:04,arp_spa=1
0.5.5.50,arp_tpa=123.45.67.89,arp_op=2 actions=FLOOD
 cookie=0x0, duration=649.47s, table=0, n_packets=1, n_bytes=42, idle_age=649, a
rp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_dst=00:00:00:00:00:05,arp_spa=10.
1.1.10,arp_tpa=10.5.5.50,arp_op=2 actions=FLOOD
```