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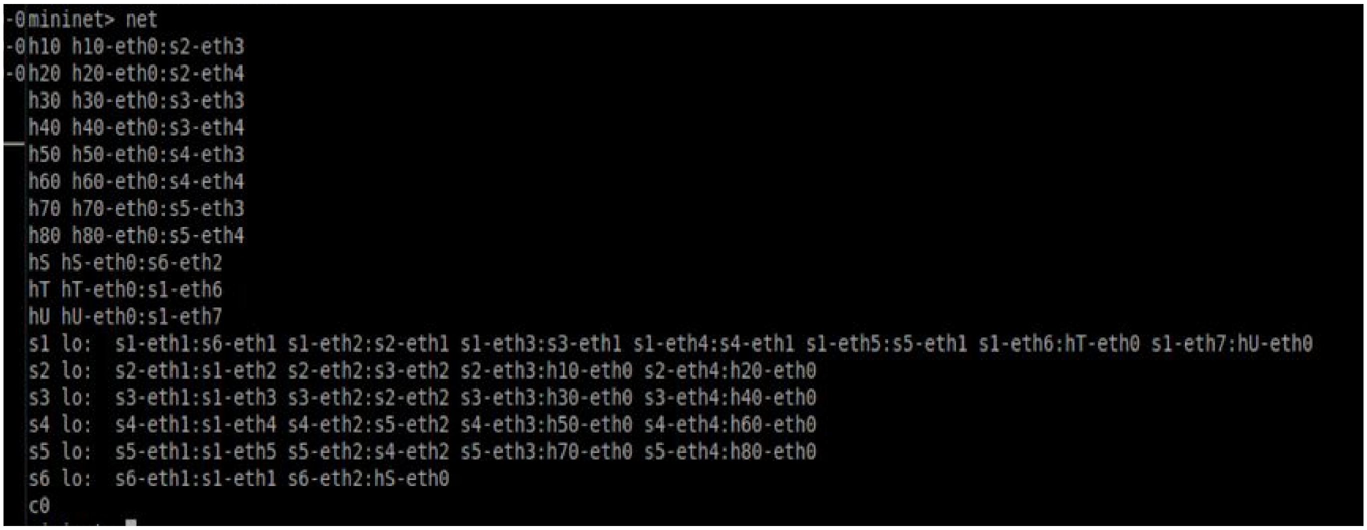
CSE 150
Final Project

Topology and link connection:

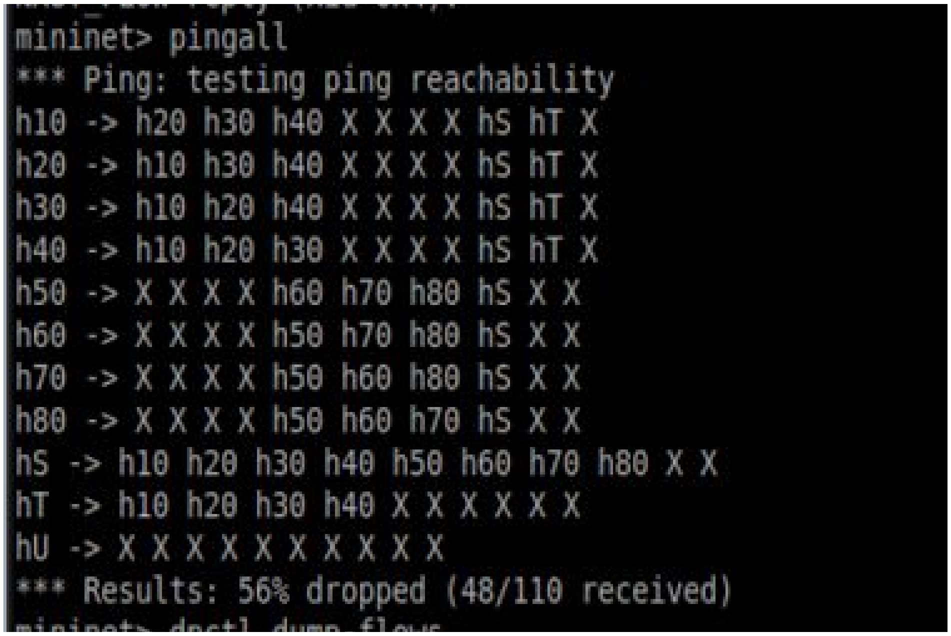
Each switch is connected properly on different ports to each other and other Hosts



```
mininet> net
h10 h10-eth0:s2-eth3
h20 h20-eth0:s2-eth4
h30 h30-eth0:s3-eth3
h40 h40-eth0:s3-eth4
h50 h50-eth0:s4-eth3
h60 h60-eth0:s4-eth4
h70 h70-eth0:s5-eth3
h80 h80-eth0:s5-eth4
hS hS-eth0:s6-eth2
hT hT-eth0:s1-eth6
hU hU-eth0:s1-eth7
s1 lo:  s1-eth1:s6-eth1 s1-eth2:s2-eth1 s1-eth3:s3-eth1 s1-eth4:s4-eth1 s1-eth5:s5-eth1 s1-eth6:hT-eth0 s1-eth7:hU-eth0
s2 lo:  s2-eth1:s1-eth2 s2-eth2:s3-eth2 s2-eth3:h10-eth0 s2-eth4:h20-eth0
s3 lo:  s3-eth1:s1-eth3 s3-eth2:s2-eth2 s3-eth3:h30-eth0 s3-eth4:h40-eth0
s4 lo:  s4-eth1:s1-eth4 s4-eth2:s5-eth2 s4-eth3:h50-eth0 s4-eth4:h60-eth0
s5 lo:  s5-eth1:s1-eth5 s5-eth2:s4-eth2 s5-eth3:h70-eth0 s5-eth4:h80-eth0
s6 lo:  s6-eth1:s1-eth1 s6-eth2:hS-eth0
c0
```

ICMP Protocols:

Using the Pingall command, we can test ICMP and along with ARP packets between every host, which will be considered non-ip protocol, where successful pings equates to a reliable connection via ICMP.

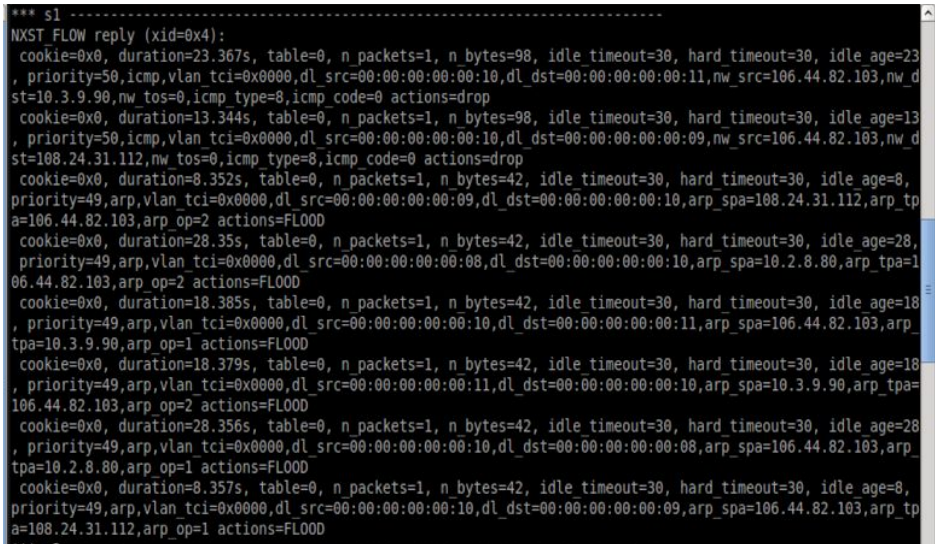


```
mininet> pingall
*** Ping: testing ping reachability
h10 -> h20 h30 h40 X X X X hS hT X
h20 -> h10 h30 h40 X X X X hS hT X
h30 -> h10 h20 h40 X X X X hS hT X
h40 -> h10 h20 h30 X X X X hS hT X
h50 -> X X X X h60 h70 h80 hS X X
h60 -> X X X X h50 h70 h80 hS X X
h70 -> X X X X h50 h60 h80 hS X X
h80 -> X X X X h50 h60 h70 hS X X
hS -> h10 h20 h30 h40 h50 h60 h70 h80 X X
hT -> h10 h20 h30 h40 X X X X X X
hU -> X X X X X X X X X X
*** Results: 56% dropped (48/110 received)
mininet> dpctl dump-flows
```

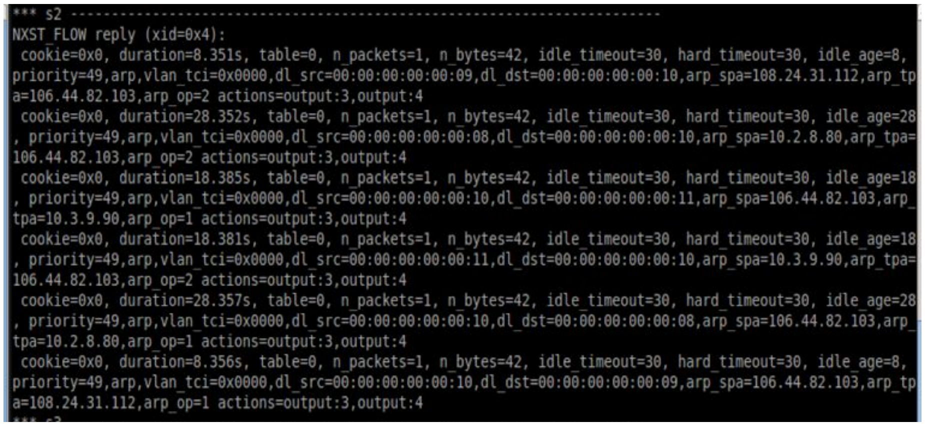
Department A can’t send ICMP messages to Department B and vice versa, as well as the trusted host can only send ICMP messages to Department A. The untrusted host won’t be able to send anything because it can’t send IP or ICMP to anywhere. Neither external host won’t be able to get a successful ping because of blocked IP traffic.

Flow Table:

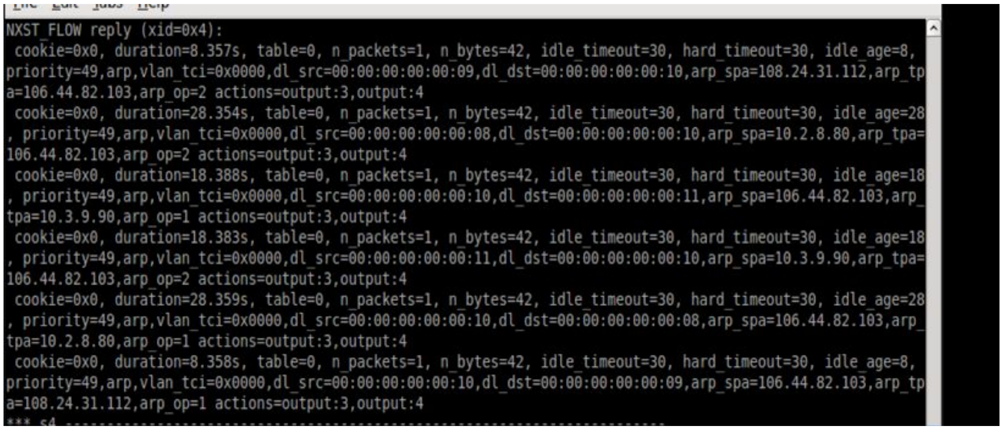
From the Pingall command, flow mods are installed on the table of each switch, based off of the rulings from above.



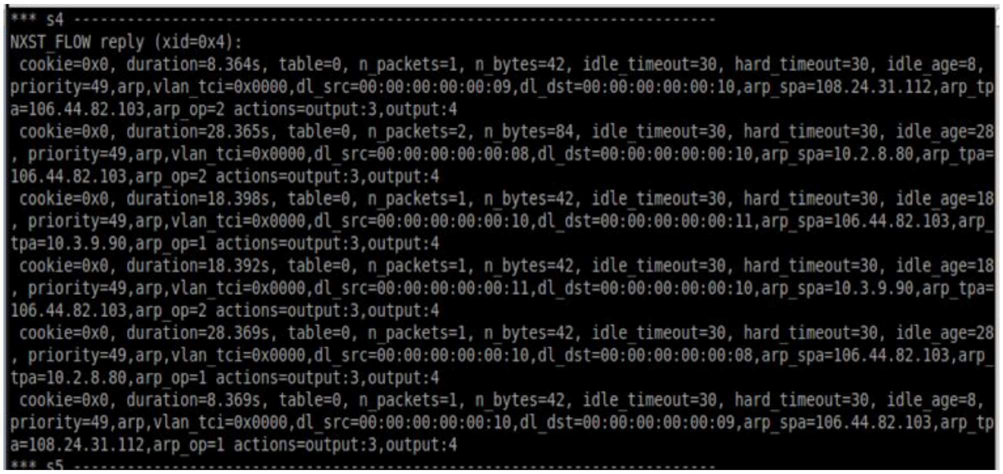
```
*** s1 -----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=23.367s, table=0, n_packets=1, n_bytes=98, idle_timeout=30, hard_timeout=30, idle_age=23
, priority=50,icmp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:11,nw_src=106.44.82.103,nw_d
st=10.3.9.90,nw_tos=0,icmp_type=8,icmp_code=0 actions=drop
 cookie=0x0, duration=13.344s, table=0, n_packets=1, n_bytes=98, idle_timeout=30, hard_timeout=30, idle_age=13
, priority=50,icmp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:09,nw_src=106.44.82.103,nw_d
st=108.24.31.112,nw_tos=0,icmp_type=8,icmp_code=0 actions=drop
 cookie=0x0, duration=8.352s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:09,dl_dst=00:00:00:00:00:10,arp_spa=108.24.31.112,arp_tp
a=106.44.82.103,arp_op=2 actions=FLOOD
 cookie=0x0, duration=28.35s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28,
 priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:08,dl_dst=00:00:00:00:00:10,arp_spa=10.2.8.80,arp_tpa=1
06.44.82.103,arp_op=2 actions=FLOOD
 cookie=0x0, duration=18.385s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:11,arp_spa=106.44.82.103,arp_
tpa=10.3.9.90,arp_op=1 actions=FLOOD
 cookie=0x0, duration=18.379s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:11,dl_dst=00:00:00:00:00:10,arp_spa=10.3.9.90,arp_tpa=
106.44.82.103,arp_op=2 actions=FLOOD
 cookie=0x0, duration=28.356s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:08,arp_spa=106.44.82.103,arp_
tpa=10.2.8.80,arp_op=1 actions=FLOOD
 cookie=0x0, duration=8.357s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:09,arp_spa=106.44.82.103,arp_tp
a=108.24.31.112,arp_op=1 actions=FLOOD
```



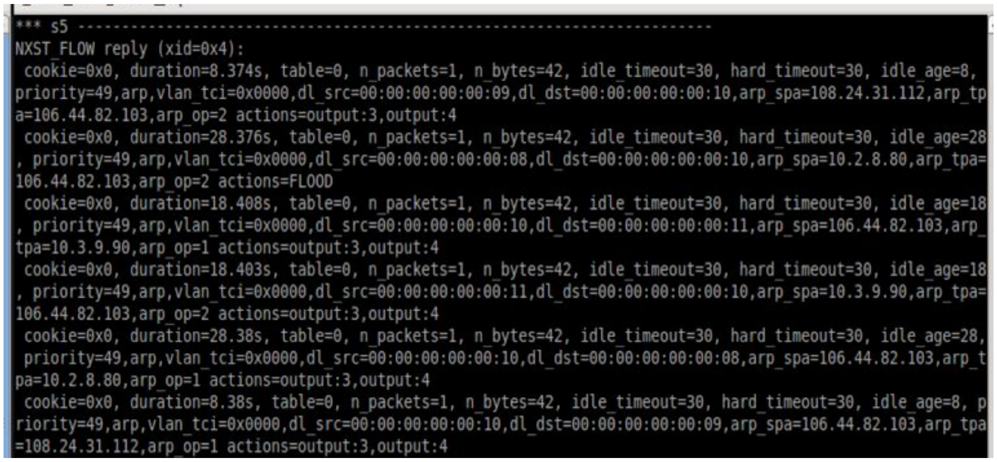
```
*** s2 -----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=8.351s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:09,dl_dst=00:00:00:00:00:10,arp_spa=108.24.31.112,arp_tp
a=106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.352s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:08,dl_dst=00:00:00:00:00:10,arp_spa=10.2.8.80,arp_tpa=
106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=18.385s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:11,arp_spa=106.44.82.103,arp_
tpa=10.3.9.90,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=18.381s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:11,dl_dst=00:00:00:00:00:10,arp_spa=10.3.9.90,arp_tpa=
106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.357s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:08,arp_spa=106.44.82.103,arp_
tpa=10.2.8.80,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=8.356s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:09,arp_spa=106.44.82.103,arp_tp
a=108.24.31.112,arp_op=1 actions=output:3,output:4
```



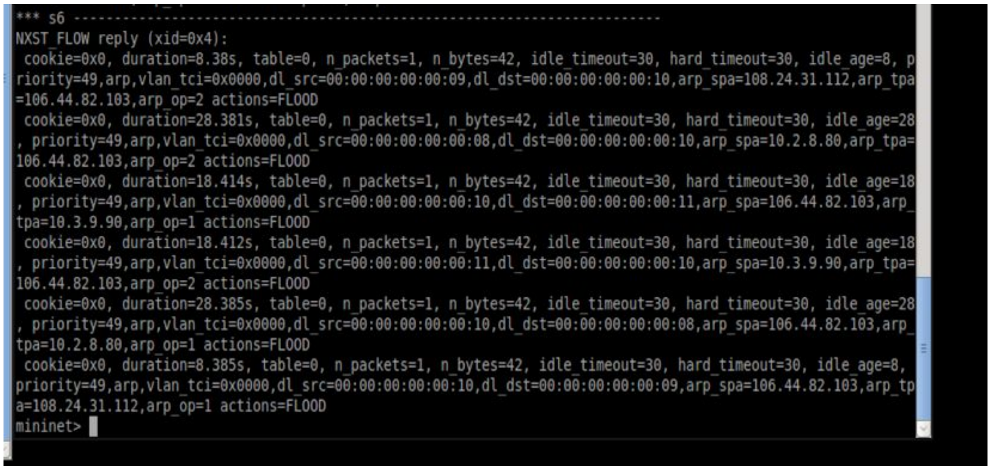
```
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=8.357s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:09,dl_dst=00:00:00:00:00:10,arp_spa=108.24.31.112,arp_tp
a=106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.354s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:08,dl_dst=00:00:00:00:00:10,arp_spa=10.2.8.80,arp_tpa=
106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=18.388s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:11,arp_spa=106.44.82.103,arp_
tpa=10.3.9.90,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=18.383s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:11,dl_dst=00:00:00:00:00:10,arp_spa=10.3.9.90,arp_tpa=
106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.359s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:08,arp_spa=106.44.82.103,arp_
tpa=10.2.8.80,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=8.358s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:09,arp_spa=106.44.82.103,arp_tp
a=108.24.31.112,arp_op=1 actions=output:3,output:4
*** s4 -----------------------------------------------------------------------
```



```
*** s4 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=8.364s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:09,dl_dst=00:00:00:00:00:10,arp_spa=108.24.31.112,arp_tp
a=106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.365s, table=0, n_packets=2, n_bytes=84, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:08,dl_dst=00:00:00:00:00:10,arp_spa=10.2.8.80,arp_tpa=
106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=18.398s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:11,arp_spa=106.44.82.103,arp_
tpa=10.3.9.90,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=18.392s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:11,dl_dst=00:00:00:00:00:10,arp_spa=10.3.9.90,arp_tpa=
106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.369s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:08,arp_spa=106.44.82.103,arp_
tpa=10.2.8.80,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=8.369s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:09,arp_spa=106.44.82.103,arp_tp
a=108.24.31.112,arp_op=1 actions=output:3,output:4
*** s5 ----------------------------------------------------------------------
```



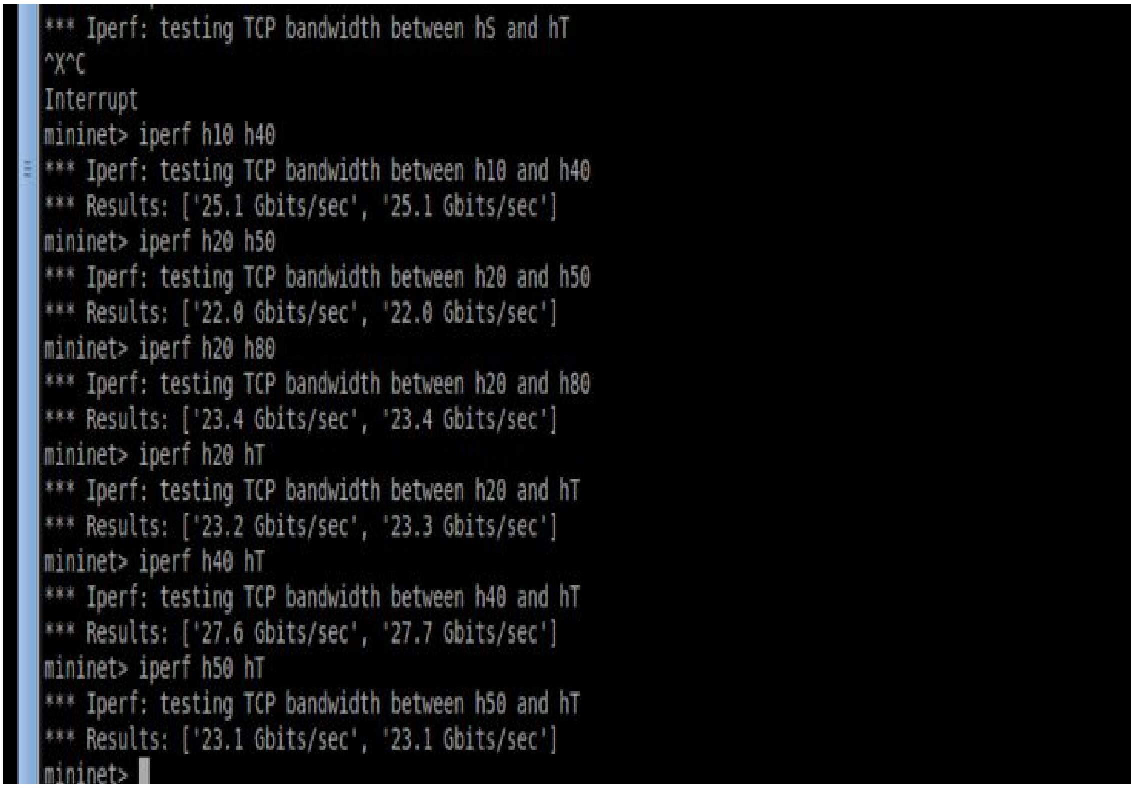
```
*** s5 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=8.374s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:09,dl_dst=00:00:00:00:00:10,arp_spa=108.24.31.112,arp_tp
a=106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.376s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:08,dl_dst=00:00:00:00:00:10,arp_spa=10.2.8.80,arp_tpa=
106.44.82.103,arp_op=2 actions=FLOOD
 cookie=0x0, duration=18.408s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:11,arp_spa=106.44.82.103,arp_
tpa=10.3.9.90,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=18.403s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:11,dl_dst=00:00:00:00:00:10,arp_spa=10.3.9.90,arp_tpa=
106.44.82.103,arp_op=2 actions=output:3,output:4
 cookie=0x0, duration=28.38s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28,
 priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:08,arp_spa=106.44.82.103,arp_t
pa=10.2.8.80,arp_op=1 actions=output:3,output:4
 cookie=0x0, duration=8.38s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8, p
riority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:09,arp_spa=106.44.82.103,arp_tpa
=108.24.31.112,arp_op=1 actions=output:3,output:4
```



```
*** s6 ----------------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=8.38s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8, p
riority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:09,dl_dst=00:00:00:00:00:10,arp_spa=108.24.31.112,arp_tpa
=106.44.82.103,arp_op=2 actions=FLOOD
 cookie=0x0, duration=28.381s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:08,dl_dst=00:00:00:00:00:10,arp_spa=10.2.8.80,arp_tpa=
106.44.82.103,arp_op=2 actions=FLOOD
 cookie=0x0, duration=18.414s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:11,arp_spa=106.44.82.103,arp_
tpa=10.3.9.90,arp_op=1 actions=FLOOD
 cookie=0x0, duration=18.412s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=18
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:11,dl_dst=00:00:00:00:00:10,arp_spa=10.3.9.90,arp_tpa=
106.44.82.103,arp_op=2 actions=FLOOD
 cookie=0x0, duration=28.385s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=28
, priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:08,arp_spa=106.44.82.103,arp_
tpa=10.2.8.80,arp_op=1 actions=FLOOD
 cookie=0x0, duration=8.385s, table=0, n_packets=1, n_bytes=42, idle_timeout=30, hard_timeout=30, idle_age=8,
priority=49,arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:10,dl_dst=00:00:00:00:00:09,arp_spa=106.44.82.103,arp_tp
a=108.24.31.112,arp_op=1 actions=FLOOD
mininet> 
```

Ip Other:

Using Iperf, we can test the other IP protocol access that was denied by the ping command via ICMP traffic control.



```
*** Iperf: testing TCP bandwidth between hS and hT
^X^C
Interrupt
mininet> iperf h10 h40
*** Iperf: testing TCP bandwidth between h10 and h40
*** Results: ['25.1 Gbits/sec', '25.1 Gbits/sec']
mininet> iperf h20 h50
*** Iperf: testing TCP bandwidth between h20 and h50
*** Results: ['22.0 Gbits/sec', '22.0 Gbits/sec']
mininet> iperf h20 h80
*** Iperf: testing TCP bandwidth between h20 and h80
*** Results: ['23.4 Gbits/sec', '23.4 Gbits/sec']
mininet> iperf h20 hT
*** Iperf: testing TCP bandwidth between h20 and hT
*** Results: ['23.2 Gbits/sec', '23.3 Gbits/sec']
mininet> iperf h40 hT
*** Iperf: testing TCP bandwidth between h40 and hT
*** Results: ['27.6 Gbits/sec', '27.7 Gbits/sec']
mininet> iperf h50 hT
*** Iperf: testing TCP bandwidth between h50 and hT
*** Results: ['23.1 Gbits/sec', '23.1 Gbits/sec']
mininet>
```

Here, we are able to create a connection between department A and department B computers. The trusted host is now able to send tcp packets to both departments instead of just department A.