```
mininet@mininet-vm: ~

File  Edit  Tabs  Help

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>
```

SS1: `pingall` dropping all the packets, which is what it is supposed to do because the firewall is active and will drop any non TCP/ARP/IPv4 packets

```
mininet> dpctl dump-flows
*** s1 ------------------------------------------------------------
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=53.939s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=53, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=43.915s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=43, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=23.932s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=23, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=63.949s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=63, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=33.948s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=33, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=83.965s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=83, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=13.946s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=13, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=73.933s, table=0, n_packets=1, n_bytes=98, idle_timeout=90
, hard_timeout=90, idle_age=73, 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,ic
mp_code=0 actions=drop
 cookie=0x0, duration=83.969s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=83, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=88.92s, table=0, n_packets=1, n_bytes=42, idle_timeout=90,
 hard_timeout=90, idle_age=88, arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:01,dl_d
st=00:00:00:00:00:02,arp_spa=10.0.1.10,arp_tpa=10.0.1.20,arp_op=2 actions=FLOOD
 cookie=0x0, duration=48.926s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=48, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=28.934s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=28, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=88.922s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=88, 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=1 actions=FLOOD
 cookie=0x0, duration=73.935s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=73, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=58.943s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=58, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=18.919s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=18, arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:02,dl_
```

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 cookie=0x0, duration=83.967s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=83, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=43.918s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=43, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=43.921s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=43, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=48.927s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=48, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=28.936s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=28, 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=1 actions=FLOOD
 cookie=0x0, duration=8.901s, table=0, n_packets=1, n_bytes=42, idle_timeout=90,
 hard_timeout=90, idle_age=8, arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:04,dl_ds
t=00:00:00:00:00:03,arp_spa=10.0.1.40,arp_tpa=10.0.1.30,arp_op=1 actions=FLOOD
 cookie=0x0, duration=8.899s, table=0, n_packets=1, n_bytes=42, idle_timeout=90,
 hard_timeout=90, idle_age=8, arp,vlan_tci=0x0000,dl_src=00:00:00:00:00:03,dl_ds
t=00:00:00:00:00:04,arp_spa=10.0.1.30,arp_tpa=10.0.1.40,arp_op=2 actions=FLOOD
 cookie=0x0, duration=58.946s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=58, 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=1 actions=FLOOD
 cookie=0x0, duration=73.937s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=73, arp,vlan_tci=0x0000,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 actions=FLOOD
 cookie=0x0, duration=18.923s, table=0, n_packets=1, n_bytes=42, idle_timeout=90
, hard_timeout=90, idle_age=18, arp,vlan_tci=0x0000,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 actions=FLOOD
mininet>
```

SS2, SS3: `dpctl dump-flows` is used to list all the flow entries currently installed on a switch, allowing for verifying the rules applied by the controller and ensures they match the proper configurations

```
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h4
*** Results: ['18.9 Gbits/sec', '18.9 Gbits/sec']
mininet>
```

SS4: `iperf` helps analyze how the firewall rules affect network performance