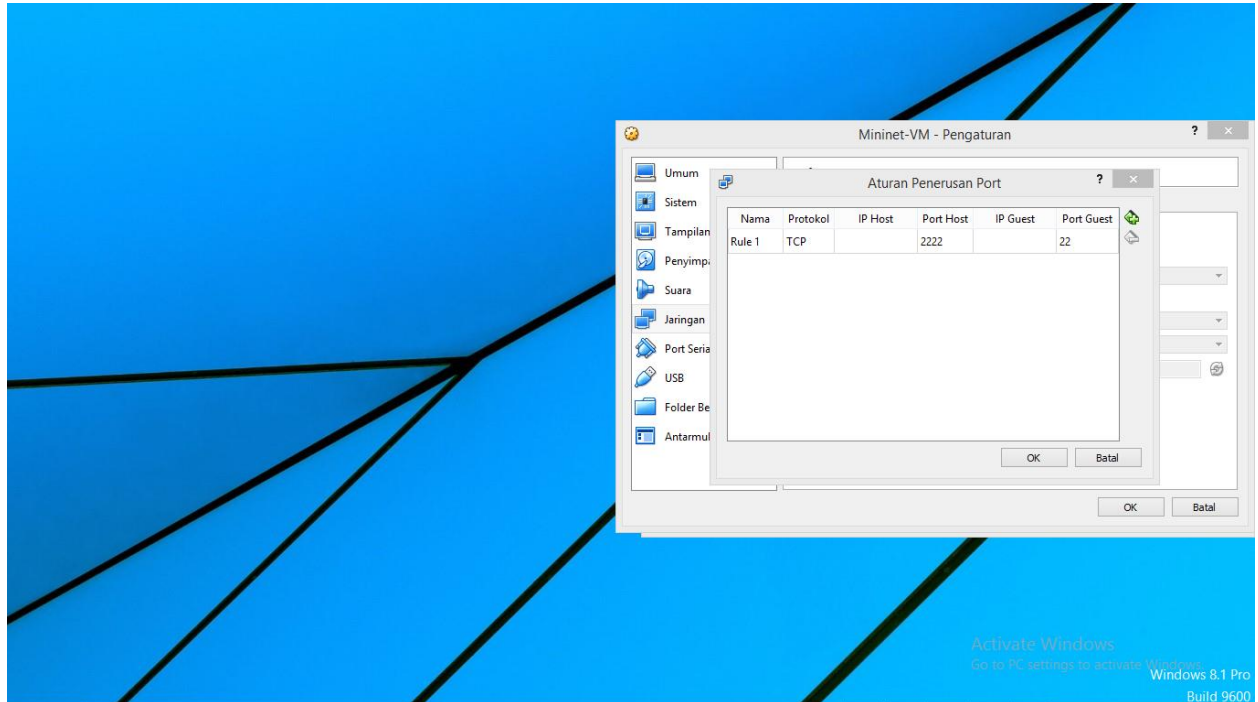
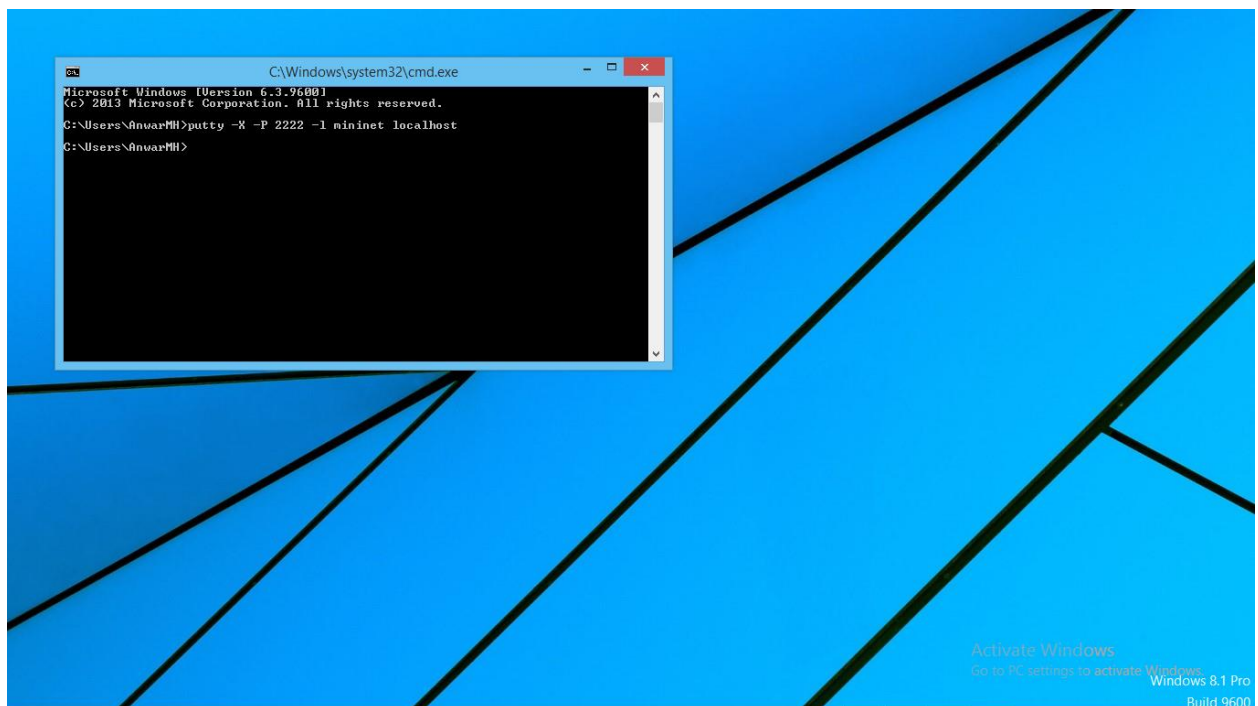


Mininet

Configure Access



Access via SSH



```
mininet@mininet-vm: ~  
Using username "mininet".  
mininet@localhost's password:  
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)  
  
 * Documentation:  https://help.ubuntu.com/  
Last login: Mon Apr  9 01:49:03 2018 from 10.0.2.2  
mininet@mininet-vm:~$ sudo mn  
*** Creating network  
*** Adding controller  
*** Adding hosts:  
h1 h2  
*** Adding switches:  
s1  
*** Adding links:  
(h1, s1) (h2, s1)  
*** Configuring hosts  
h1 h2  
*** Starting controller  
c0  
*** Starting 1 switches  
s1 ...  
*** Starting CLI:  
mininet>
```

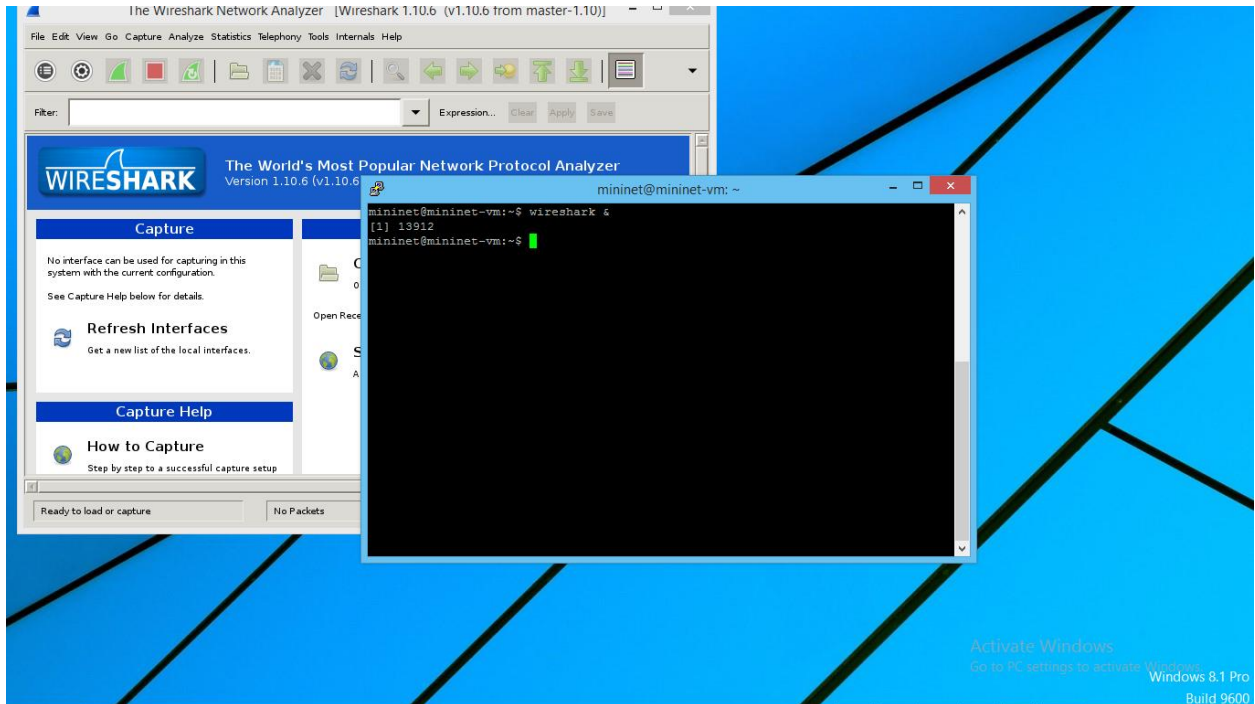
Activate Windows
Go to PC settings to activate Windows.
Windows 8.1 Pro
Build 9600

```
mininet@mininet-vm: ~  
Using username "mininet".  
mininet@localhost's password:  
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)  
  
 * Documentation:  https://help.ubuntu.com/  
Last login: Mon Apr  9 01:49:03 2018 from 10.0.2.2  
mininet@mininet-vm:~$ sudo mn  
*** Creating network  
*** Adding controller  
*** Adding hosts:  
h1 h2  
*** Adding switches:  
s1  
*** Adding links:  
(h1, s1) (h2, s1)  
*** Configuring hosts  
h1 h2  
*** Starting controller  
c0  
*** Starting 1 switches  
s1 ...  
*** Starting CLI:  
mininet>
```

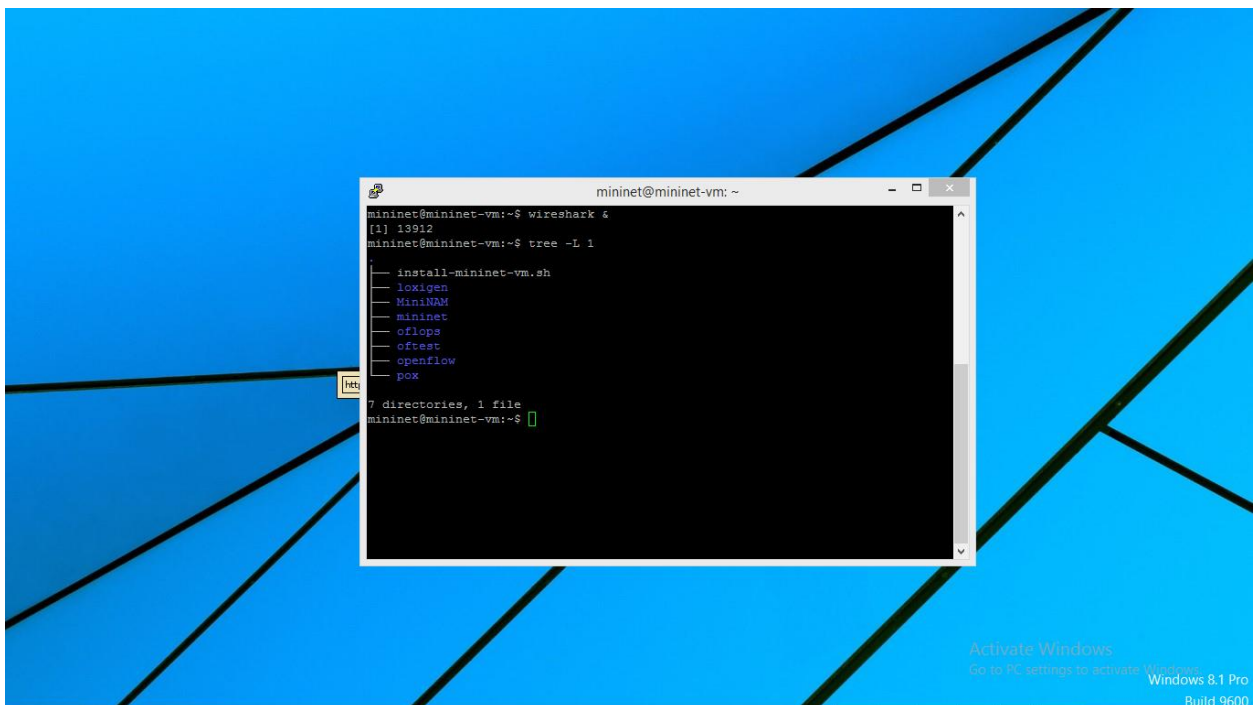
```
mininet@mininet-vm: ~  
Using username "mininet".  
mininet@localhost's password:  
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)  
  
 * Documentation:  https://help.ubuntu.com/  
Last login: Mon Apr  9 01:53:48 2018 from 10.0.2.2  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flow s1  
ovs-ofctl: unknown command 'dump-flow'; use --help for help  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST_FLOW reply (xid=0x4):  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST_FLOW reply (xid=0x4):  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST_FLOW reply (xid=0x4):  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST_FLOW reply (xid=0x4):  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST_FLOW reply (xid=0x4):  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST_FLOW reply (xid=0x4):  
mininet@mininet-vm:~$
```

Activate Windows
Go to PC settings to activate Windows.
Windows 8.1 Pro
Build 9600

Test Wireshark



Check



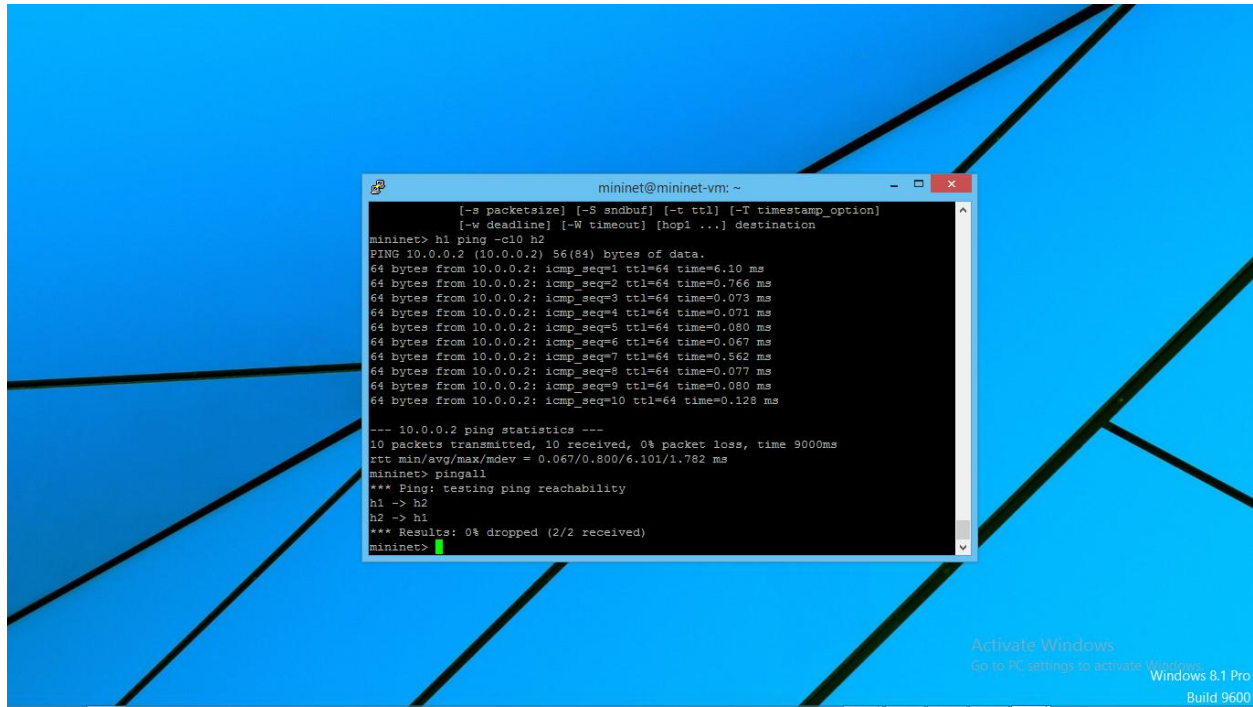
```
mininet@mininet-vm: ~/mininet
mininet@mininet-vm:~/mininet$ tree -L 2 -d
.
├── bin
├── build
│   ├── bdist.linux-x86_64
│   ├── lib.linux-x86_64-2.7
│   └── scripts-2.7
├── custom
├── debian
│   └── source
├── dist
├── doc
├── examples
│   └── test
├── mininet
│   └── examples -> ../examples
├── mininet.egg-info
├── util
│   ├── kbuild
│   ├── nox-patches
│   ├── openflow-patches
│   ├── sch_hsb-ofbuf
│   └── vm
```

Activate Windows
Go to PC settings to activate Windows.
Windows 8.1 Pro
Build 9600

```
mininet@mininet-vm: ~/mininet/examples
mininet@mininet-vm:~/mininet/examples$ ll
total 364
drwxrwxr-x 3 mininet mininet 4096 Mar 21 2017 ./
drwxrwxr-x 13 mininet mininet 4096 Mar 21 2017 ../
-rwxrwxr-x 1 mininet mininet 1074 Mar 21 2017 baresshd.py*
-rwxrwxr-x 1 mininet mininet 2310 Mar 21 2017 bind.py*
-rw-rw-r-- 1 mininet mininet 3875 Mar 21 2017 clustercli.py
-rwxrwxr-x 1 mininet mininet 639 Mar 21 2017 clusterdemo.py*
-rwxrwxr-x 1 mininet mininet 33427 Mar 21 2017 cluster.py*
-rwxrwxr-x 1 mininet mininet 501 Mar 21 2017 clusterSanity.py*
-rwxrwxr-x 1 mininet mininet 15612 Mar 21 2017 consoles.py*
-rwxrwxr-x 1 mininet mininet 1612 Mar 21 2017 controllers2.py*
-rwxrwxr-x 1 mininet mininet 1061 Mar 21 2017 controllers.py*
-rwxrwxr-x 1 mininet mininet 4967 Mar 21 2017 controlnet.py*
-rwxrwxr-x 1 mininet mininet 3725 Mar 21 2017 cpu.py*
-rwxrwxr-x 1 mininet mininet 960 Mar 21 2017 emptynet.py*
-rwxrwxr-x 1 mininet mininet 1549 Mar 21 2017 hwintf.py*
-rw-rw-r-- 1 mininet mininet 48 Mar 21 2017 _init_.py
-rwxrwxr-x 1 mininet mininet 1320 Mar 21 2017 infoptions.py*
-rwxrwxr-x 1 mininet mininet 2034 Mar 21 2017 limit.py*
-rwxrwxr-x 1 mininet mininet 4062 Mar 21 2017 linearbandwidth.py*
-rwxrwxr-x 1 mininet mininet 2826 Mar 21 2017 linuxrouter.py*
-rwxrwxr-x 1 mininet mininet 154479 Mar 21 2017 miredit.py*
-rwxrwxr-x 1 mininet mininet 4198 Mar 21 2017 mobility.py*
```

Activate Windows
Go to PC settings to activate Windows.
Windows 8.1 Pro
Build 9600

Notes – Mininet Walkthrough



The screenshot shows a terminal window titled "mininet@mininet-vm: ~". The terminal displays the output of a ping command and a pingall command. The ping command shows 10 successful pings to 10.0.0.2 with 0% packet loss. The pingall command shows that both h1 and h2 are reachable.

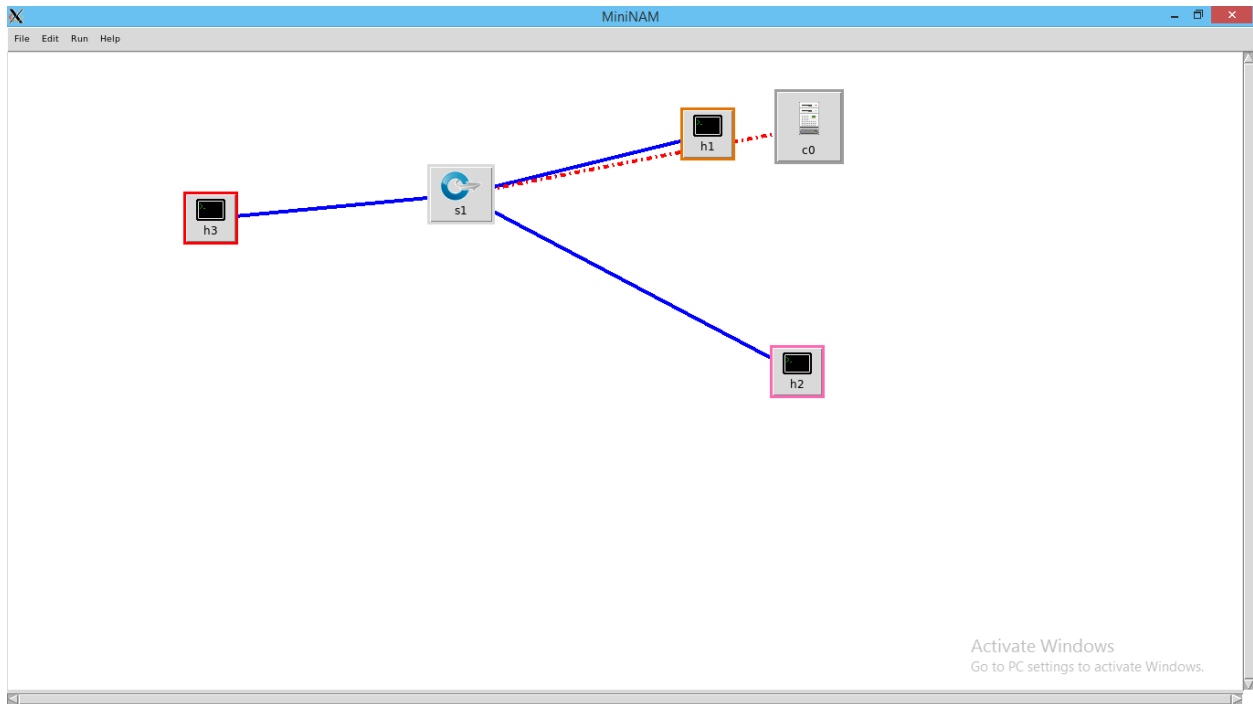
```
mininet@mininet-vm: ~  
[--s packetsize] [--s sndbuf] [--t ttl] [--T timestamp_option]  
[--w deadline] [--W timeout] [hop1 ...] destination  
mininet> h1 ping -c10 h2  
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data:  
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=6.10 ms  
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.766 ms  
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.073 ms  
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.071 ms  
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.080 ms  
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.067 ms  
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=0.582 ms  
64 bytes from 10.0.0.2: icmp_seq=8 ttl=64 time=0.077 ms  
64 bytes from 10.0.0.2: icmp_seq=9 ttl=64 time=0.080 ms  
64 bytes from 10.0.0.2: icmp_seq=10 ttl=64 time=0.128 ms  
--- 10.0.0.2 ping statistics ---  
10 packets transmitted, 10 received, 0% packet loss, time 9000ms  
rtt min/avg/max/mdev = 0.067/0.800/6.101/1.782 ms  
mininet> pingall  
*** Ping: testing ping reachability  
h1 -> h2  
h2 -> h1  
*** Results: 0% dropped (2/2 received)  
mininet>
```

Activate Windows
Go to PC settings to activate Windows.
Windows 8.1 Pro
Build 9600

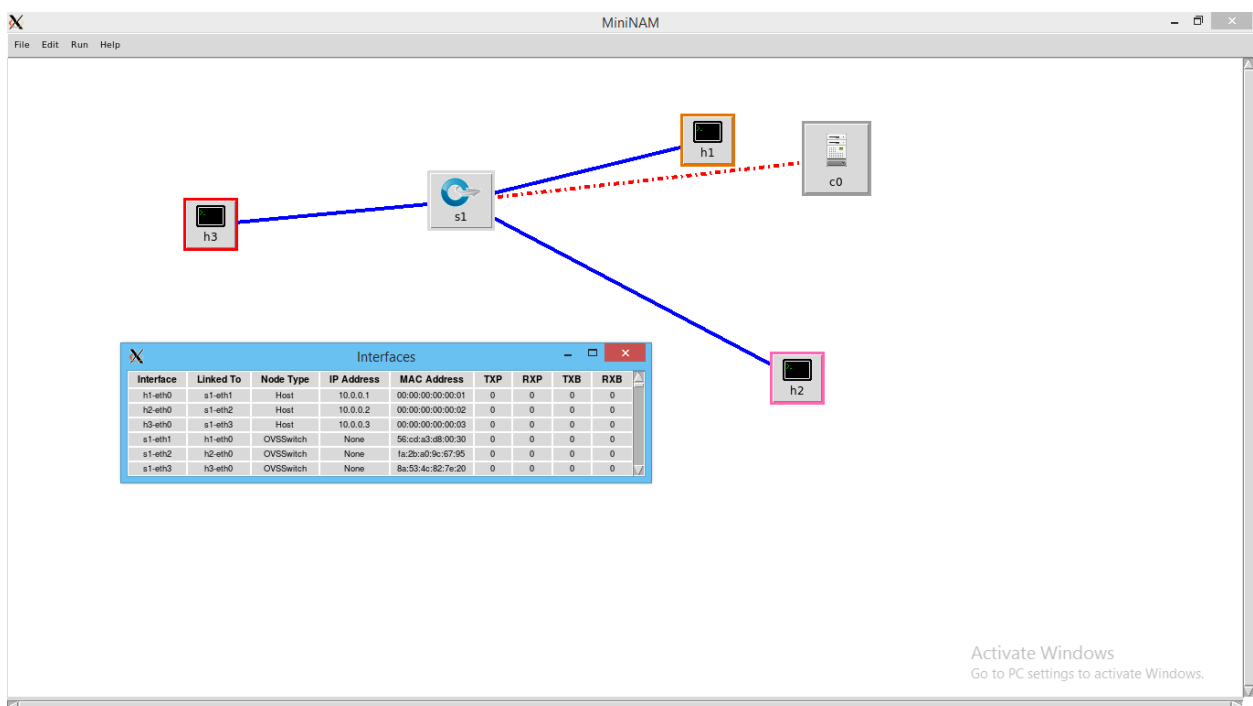
MiniNAM

Setup

```
mininet@mininet-vm: ~/MiniNAM$ sudo python MiniNAM.py
```

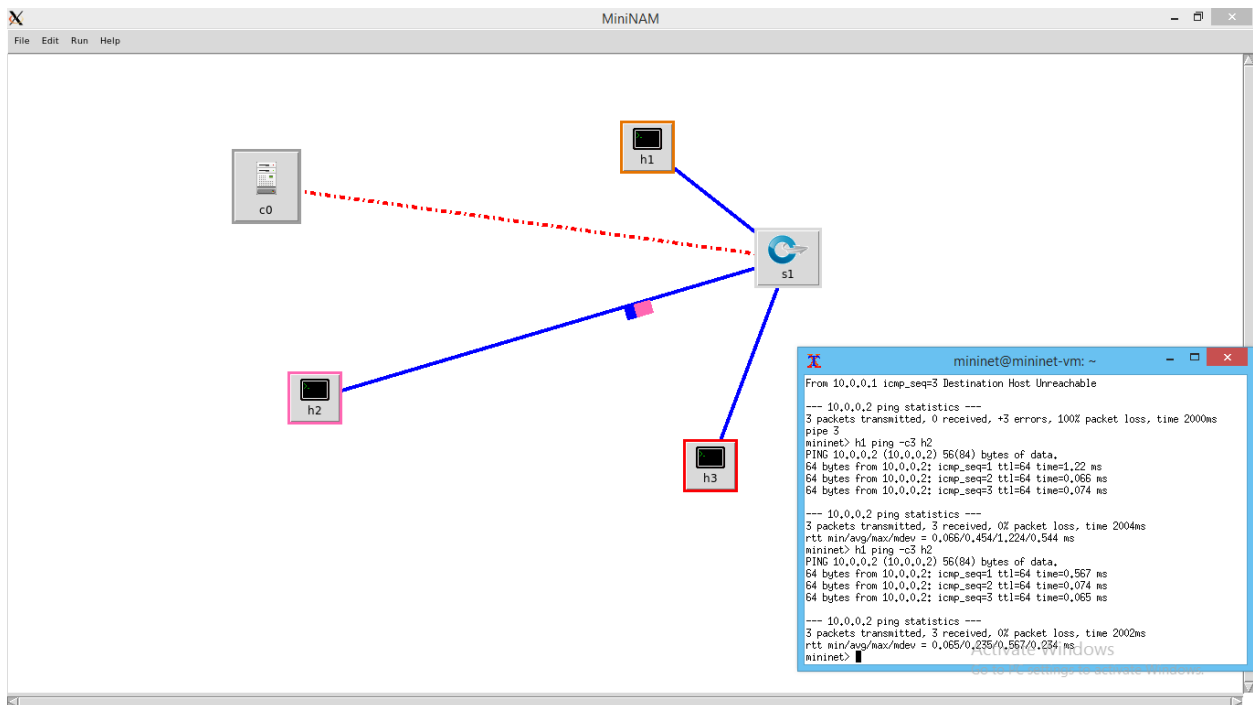
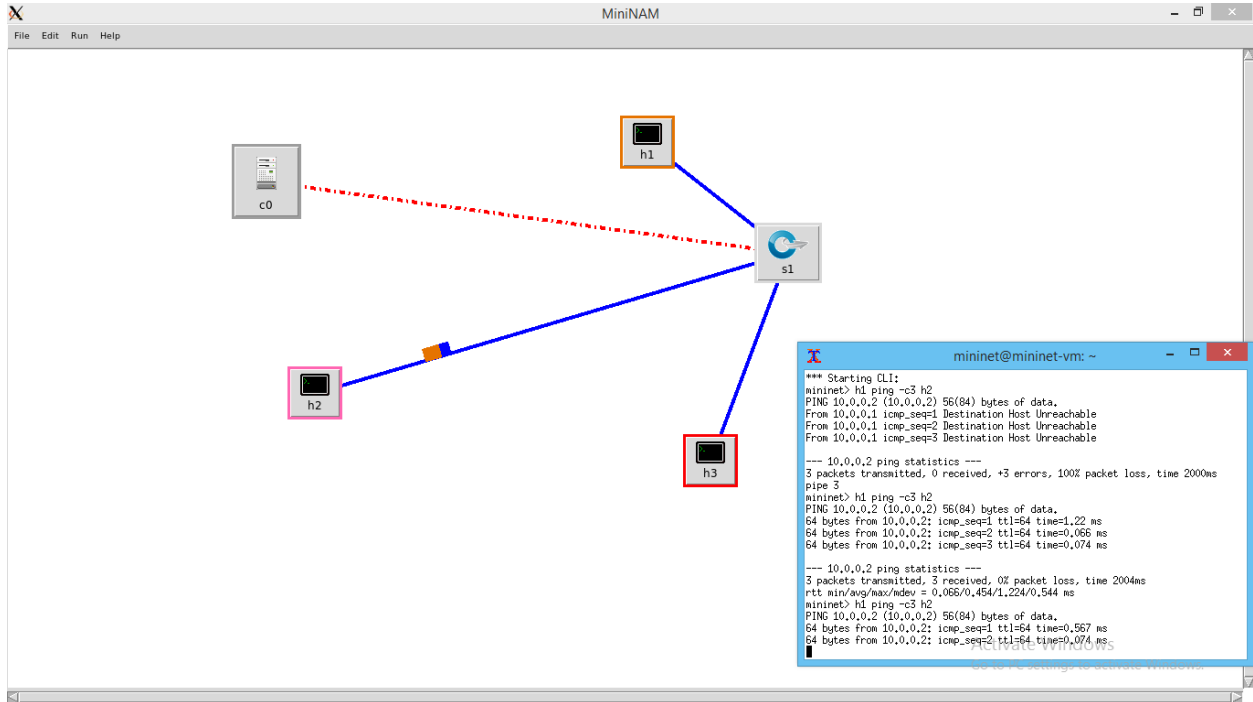


h1 ping -c2 h2



OpenFlow

Manual Flow Entry



Filter - of

[illegible]

Of and not (of10.echo_request.type or of10.echo_reply.type)

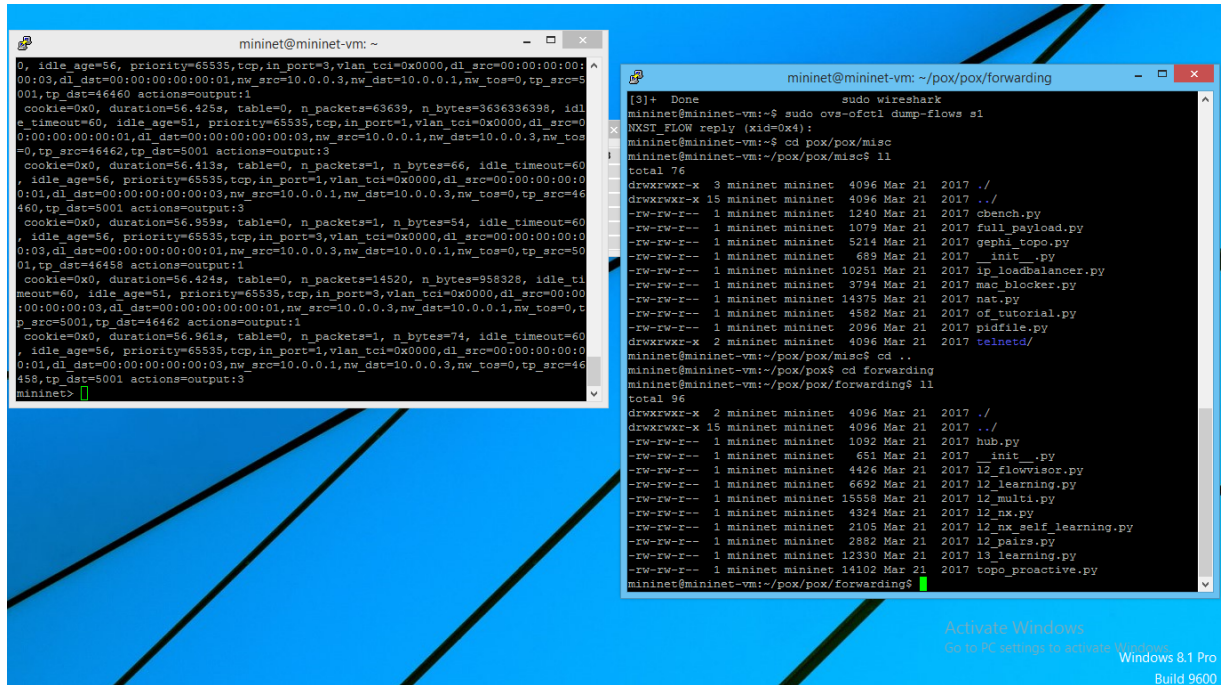
The screenshot displays the Wireshark network protocol analyzer interface. At the top, the title bar reads "Capturing on [v1.10.6 from master-1.10]". The menu bar includes File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Tools, Internals, and Help. Below the menu is a toolbar with icons for various functions like opening files, saving, and filtering. A filter box contains the expression "oF10.echo_request_type or oF10.echo_reply_type". The main packet list pane shows several captured packets, with packet 64248 selected. This packet is an Echo Reply (74) from 127.0.0.1 to 127.0.0.1. The packet details pane below shows the layers: Ethernet II, Internet Protocol Version 4, Transmission Control Protocol, and OpenFlow (LOX1). The packet bytes pane at the bottom shows the raw hex and ASCII data. On the right side of the screen, a terminal window titled "mininet@mininet-vm: ~" displays log output from Mininet, showing messages related to gRPC tree model assertions and children assertions. The background of the laptop screen features a blue and white geometric pattern.

Flow Entries

```
mininet@mininet-vm: ~  
0, idle_age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46460 actions=output:1  
cookie=0x0, duration=56.425s, table=0, n_packets=63639, n_bytes=3636336398, idle_timeout=60, idle_age=51, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46462, tp_dst=5001 actions=output:3  
cookie=0x0, duration=56.413s, table=0, n_packets=1, n_bytes=66, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46460, tp_dst=5001 actions=output:3  
cookie=0x0, duration=56.999s, table=0, n_packets=1, n_bytes=54, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46458 actions=output:1  
cookie=0x0, duration=56.424s, table=0, n_packets=14520, n_bytes=958328, idle_timeout=60, idle_age=51, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46462 actions=output:1  
cookie=0x0, duration=56.961s, table=0, n_packets=1, n_bytes=74, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46458, tp_dst=5001 actions=output:3  
mininet> |  
  
mininet@mininet-vm: ~/pox/pox/misc  
K_IS_TREE_MODEL (tree_model)' failed  
(wireshark:4568): dconf-WARNING **: failed to commit changes to dconf: Failed to execute child process "dbus-launch" (No such file or directory)  
[3]+ Done sudo wireshark  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST FLOW reply (xid=0x4):  
mininet@mininet-vm:~$ cd pox/pox/misc  
mininet@mininet-vm:~/pox/pox/misc$ ll  
total 76  
drwxrwxr-x 3 mininet mininet 4096 Mar 21 2017 ./  
drwxrwxr-x 15 mininet mininet 4096 Mar 21 2017 ../  
-rw-rw-r-- 1 mininet mininet 1240 Mar 21 2017 cbench.py  
-rw-rw-r-- 1 mininet mininet 1079 Mar 21 2017 full_payload.py  
-rw-rw-r-- 1 mininet mininet 5214 Mar 21 2017 gephi_topo.py  
-rw-rw-r-- 1 mininet mininet 689 Mar 21 2017 _init_.py  
-rw-rw-r-- 1 mininet mininet 10251 Mar 21 2017 ip_loadbalancer.py  
-rw-rw-r-- 1 mininet mininet 3794 Mar 21 2017 mac_blocker.py  
-rw-rw-r-- 1 mininet mininet 14375 Mar 21 2017 nat.py  
-rw-rw-r-- 1 mininet mininet 4582 Mar 21 2017 of_tutorial.py  
-rw-rw-r-- 1 mininet mininet 2096 Mar 21 2017 pidfile.py  
drwxrwxr-x 2 mininet mininet 4096 Mar 21 2017 telnetd/  
mininet@mininet-vm:~/pox/pox/misc$
```

POX Controller

Files

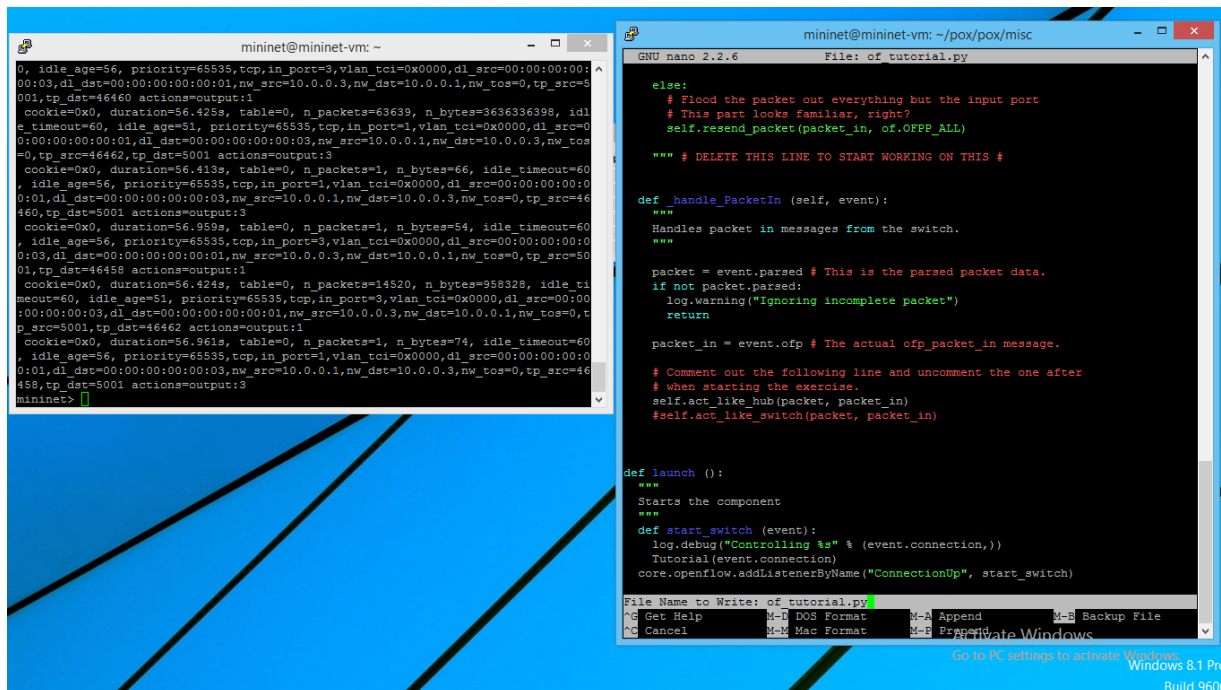


The image shows two terminal windows from a mininet VM. The left window displays a list of network packets with details like source/destination IP, port, and protocol. The right window shows the output of the 'ls' command in the '/pox/pox/misc' directory, listing various Python scripts like 'cbench.py', 'full_payload.py', 'geph1_topo.py', etc.

```
mininet@mininet-vm: ~  
0, idle_age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46460 actions=output:1  
cookie=0x0, duration=56.4258, table=0, n_packets=63639, n_bytes=3636336398, idle_timeout=60, idle_age=51, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46462, tp_dst=5001 actions=output:3  
cookie=0x0, duration=56.4138, table=0, n_packets=1, n_bytes=66, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46460, tp_dst=5001 actions=output:3  
cookie=0x0, duration=56.9598, table=0, n_packets=1, n_bytes=54, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46458 actions=output:1  
cookie=0x0, duration=56.4248, table=0, n_packets=14520, n_bytes=958328, idle_timeout=60, idle_age=51, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46462 actions=output:1  
cookie=0x0, duration=56.9618, table=0, n_packets=1, n_bytes=74, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46458, tp_dst=5001 actions=output:3  
mininet>
```

```
mininet@mininet-vm: ~/pox/pox/forwarding  
[3]+ Done sudo wireshark  
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1  
NXST FLOW reply (xid=0x4):  
mininet@mininet-vm:~$ cd pox/pox/misc  
mininet@mininet-vm:~/pox/pox/misc$ ll  
total 76  
drwxrwxr-x 3 mininet mininet 4096 Mar 21 2017 ./  
drwxrwxr-x 15 mininet mininet 4096 Mar 21 2017 ../  
-rw-rw-r-- 1 mininet mininet 1240 Mar 21 2017 cbench.py  
-rw-rw-r-- 1 mininet mininet 1079 Mar 21 2017 full_payload.py  
-rw-rw-r-- 1 mininet mininet 5214 Mar 21 2017 gephi_topo.py  
-rw-rw-r-- 1 mininet mininet 689 Mar 21 2017 init.py  
-rw-rw-r-- 1 mininet mininet 10251 Mar 21 2017 ip_loadbalancer.py  
-rw-rw-r-- 1 mininet mininet 3794 Mar 21 2017 mac_blocker.py  
-rw-rw-r-- 1 mininet mininet 14375 Mar 21 2017 nat.py  
-rw-rw-r-- 1 mininet mininet 4582 Mar 21 2017 of_tutorial.py  
-rw-rw-r-- 1 mininet mininet 2096 Mar 21 2017 pdfdiff.py  
drwxrwxr-x 2 mininet mininet 4096 Mar 21 2017 telnetd/  
mininet@mininet-vm:~/pox/pox/misc$ cd ..  
mininet@mininet-vm:~/pox/pox$ cd forwarding  
mininet@mininet-vm:~/pox/pox/forwarding$ ll  
total 96  
drwxrwxr-x 2 mininet mininet 4096 Mar 21 2017 ./  
drwxrwxr-x 15 mininet mininet 4096 Mar 21 2017 ../  
-rw-rw-r-- 1 mininet mininet 1092 Mar 21 2017 hub.py  
-rw-rw-r-- 1 mininet mininet 651 Mar 21 2017 init.py  
-rw-rw-r-- 1 mininet mininet 4426 Mar 21 2017 l2_flowvisor.py  
-rw-rw-r-- 1 mininet mininet 6692 Mar 21 2017 l2_learning.py  
-rw-rw-r-- 1 mininet mininet 15558 Mar 21 2017 l2_multi.py  
-rw-rw-r-- 1 mininet mininet 4324 Mar 21 2017 l2_nx.py  
-rw-rw-r-- 1 mininet mininet 2105 Mar 21 2017 l2_nx_self_learning.py  
-rw-rw-r-- 1 mininet mininet 2882 Mar 21 2017 l2_pairs.py  
-rw-rw-r-- 1 mininet mininet 12330 Mar 21 2017 l3_learning.py  
-rw-rw-r-- 1 mininet mininet 14102 Mar 21 2017 topo_proactive.py  
mininet@mininet-vm:~/pox/pox/forwarding$
```

mininet@mininet-vm:~/pox/pox/misc nano of_tutorial.py



The image shows a terminal window with the nano text editor open, editing the file 'of_tutorial.py'. The code defines a packet handler and a launch function. The nano editor's status bar at the bottom shows 'File Name to Write: of_tutorial.py' and various keyboard shortcuts.

```
mininet@mininet-vm: ~  
0, idle_age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46460 actions=output:1  
cookie=0x0, duration=56.4258, table=0, n_packets=63639, n_bytes=3636336398, idle_timeout=60, idle_age=51, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46462, tp_dst=5001 actions=output:3  
cookie=0x0, duration=56.4138, table=0, n_packets=1, n_bytes=66, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46460, tp_dst=5001 actions=output:3  
cookie=0x0, duration=56.9598, table=0, n_packets=1, n_bytes=54, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46458 actions=output:1  
cookie=0x0, duration=56.4248, table=0, n_packets=14520, n_bytes=958328, idle_timeout=60, idle_age=51, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:03, dl_dst=00:00:00:00:00:01, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, tp_src=5001, tp_dst=46462 actions=output:1  
cookie=0x0, duration=56.9618, table=0, n_packets=1, n_bytes=74, idle_timeout=60, idle_age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:01, dl_dst=00:00:00:00:00:03, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, tp_src=46458, tp_dst=5001 actions=output:3  
mininet>
```

```
mininet@mininet-vm: ~/pox/pox/misc  
GNU nano 2.2.6 File: of_tutorial.py  
  
else:  
    # Flood the packet out everything but the input port  
    # This part looks familiar, right?  
    self.resend_packet(packet_in, of.OFPP_ALL)  
  
    """ # DELETE THIS LINE TO START WORKING ON THIS #  
  
def _handle_PacketIn (self, event):  
    """  
    Handles packet in messages from the switch.  
    """  
  
    packet = event.parsed # This is the parsed packet data.  
    if not packet.parsed:  
        log.warning("Ignoring incomplete packet")  
        return  
  
    packet_in = event.ofp # The actual ofp_packet_in message.  
  
    # Comment out the following line and uncomment the one after  
    # when starting the exercise.  
    self.act_like_hub(packet, packet_in)  
    #self.act_like_switch(packet, packet_in)  
  
def launch ():  
    """  
    Starts the component  
    """  
    def start_switch (event):  
        log.debug("Controlling %s" % (event.connection,))  
        Tutorial(event.connection)  
        core.openflow.addListenerByName("ConnectionUp", start_switch)  
  
File Name to Write: of_tutorial.py  
^G Get Help      ^M-D DOS Format  ^M-A Append      ^M-B Backup File  
^C Cancel        ^M-M Mac Format  ^M-F Private Windows
```

Hub Behavior

```

mininet@mininet-vm: ~
0, idle age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:00, dl_dst=00:00:00:00:00:00, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0,
001, up, dt=46460 actions=output:1
cookie=0x0, duration=56.4254, table=0, n_packets=63639, n_bytes=3636336
e timeout=60, idle age=51, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:00, dl_dst=00:00:00:00:00:00, nw_src=10.0.0.1, nw_dst=10.0.0.3,
0, up, dt=46462, dt_dst=5001 actions=output:3
cookie=0x0, duration=56.4134, table=0, n_packets=1, n_bytes=66, idle ti
, idle age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:00, dl_dst=00:00:00:00:00:00, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, t
460, up, dt=5001 actions=output:3
cookie=0x0, duration=56.9594, table=0, n_packets=1, n_bytes=54, idle ti
, idle age=56, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:00, dl_dst=00:00:00:00:00:00, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw_tos=0, t
0, up, dt=46458 actions=output:1
cookie=0x0, duration=56.4244, table=0, n_packets=14520, n_bytes=958328,
meout=60, idle age=51, priority=65535, tcp, in_port=3, vlan_tci=0x0000, dl_src=00:00:00:00:00:00, dl_dst=00:00:00:00:00:00, nw_src=10.0.0.3, nw_dst=10.0.0.1, nw
src=5001, up, dt=46462 actions=output:1
cookie=0x0, duration=56.9612, table=0, n_packets=1, n_bytes=74, idle ti
, idle age=56, priority=65535, tcp, in_port=1, vlan_tci=0x0000, dl_src=00:00:00:00:00:00, dl_dst=00:00:00:00:00:00, nw_src=10.0.0.1, nw_dst=10.0.0.3, nw_tos=0, t
458, up, dt=5001 actions=output:3
mininet>

```

Activate Windows
Go to PC settings to activate Windows.
Windows 8.1 Pro
Build 9600

The image displays three terminal windows from a Kali Linux virtual machine, showing network setup and package management tasks.

Top-Left Window: "Node: h1"

```

001, tp_dst=46460 actions=output:1
cookie=
a_timeout=
07:00:00:
root@mininet-vm:~# tcpdump -XX -n -i h1-eth0 > h1.txt &
[1] 5509
root@mininet-vm:~# tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
0:01, d1_
460, tp_d
cookie=
, idle_a
0:03, d1_
01, tp_d
cookie=
meout=60
:00:00:0
p_src=50
Cookie=
, idle_a
0:01, d1_
458, tp_d
mininet>
mininet>
mininet>

```

Top-Right Window: mininet@mininet-vm: ~/pox

```

1 mininet mininet 689 Mar 21 2017 __init__.py
1 mininet mininet 250 Apr 9 04:59 __init__.pyc
1 mininet mininet 10251 Mar 21 2017 ip_loadbalancer.py
1 mininet mininet 3794 Mar 21 2017 mac_blocker.py
1 mininet mininet 14375 Mar 21 2017 nat.py
1 mininet mininet 4586 Apr 9 04:59 of_substant

```

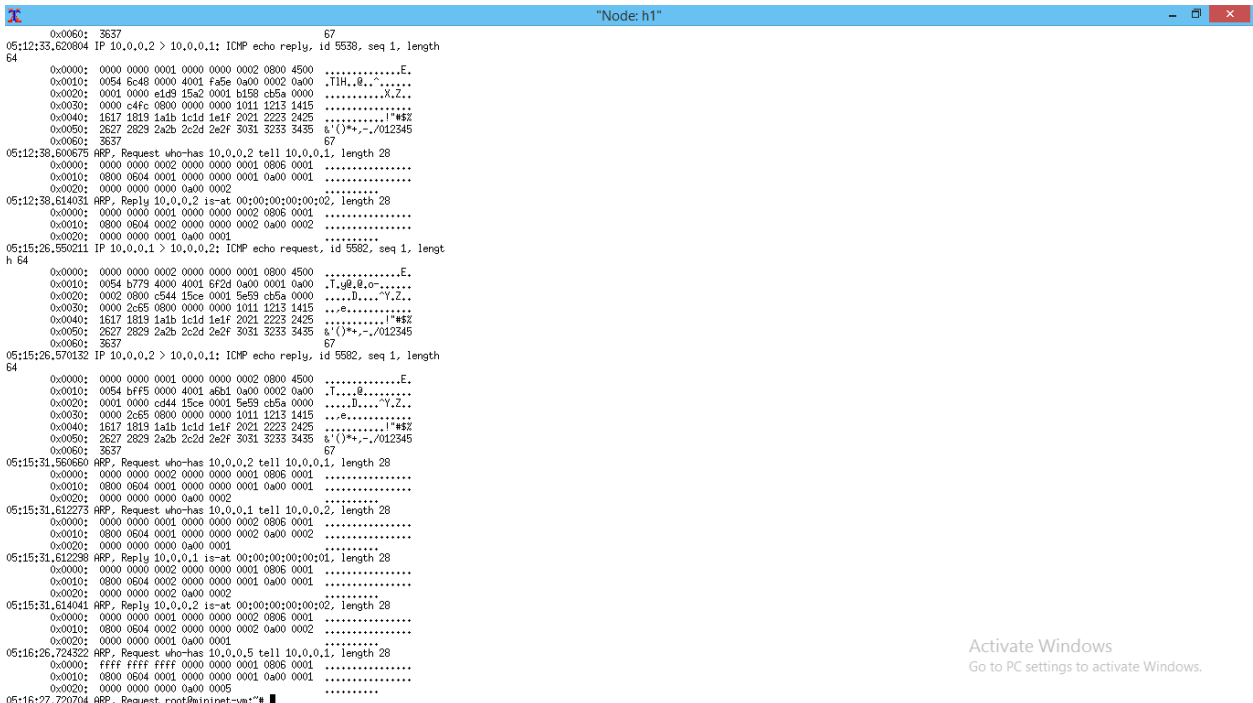
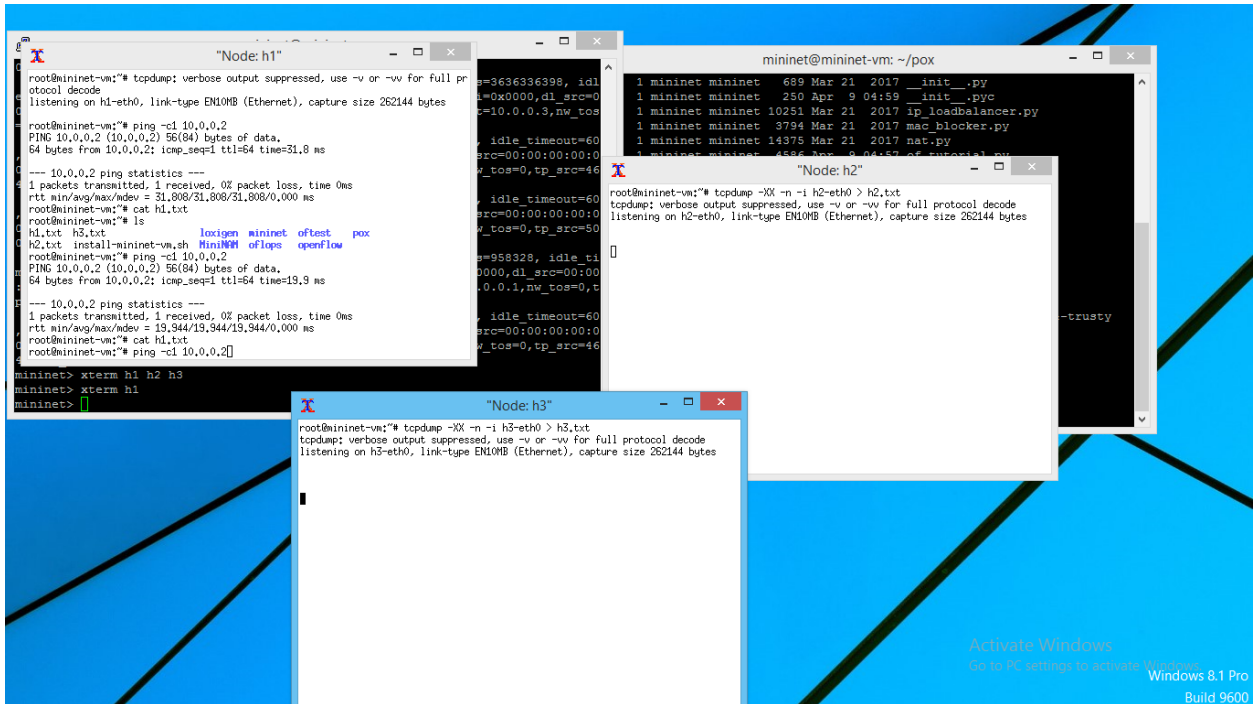
Bottom Window: "Node: h3"

```

root@mininet-vm:~# tcpdump -XX -n -i h3-eth0 > h3.txt
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h3-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
mininet>
mininet>
mininet>

```

Activate Windows
Go to PC settings to activate Windows.
Windows 8.1 Pro
Build 9600



MiniNAM

File Edit Run Help

h1

h2

h3

h1

h2

h3

h1

h2

h3

Interfaces

Interface	Linked To	Node Type	IP Address	MAC Address	TXP	RXP	TXB	RXB
h1-eth0	s1-eth1	Host	10.0.0.1	00:00:00:00:00:01	0	0	0	0
h2-eth0	s1-eth2	Host	10.0.0.2	00:00:00:00:00:02	0	0	0	0
h3-eth0	s1-eth3	Host	10.0.0.3	00:00:00:00:00:03	0	0	0	0
s1-eth1	h1-eth0	OVSwitch	None	d2:b3:d4:ee:14:e1	0	0	0	0
s1-eth2	h2-eth0	OVSwitch	None	7e:54:61:6f:59:51	0	0	0	0
s1-eth3	h3-eth0	OVSwitch	None	9a:3b:88:01:2a:68	0	0	0	0

mininet@mininet-vm: ~

```
rtt min/avg/max/mdev = 7.862/7.862/7.862/0.000 ms
mininet> h1 ping -c1 10.0.0.5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
From 10.0.0.1 icmp_seq=1 Destination Host Unreachable

--- 10.0.0.5 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms

mininet> sh ovs-ofctl dump-flows s1
NXST_FLOW reply (xid=0x4):
mininet> pingpair
h1 -> h2
h2 -> h1
*** Results: 0% dropped (2/2 received)
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3
h2 -> h1 h3
h3 -> h1 h2
*** Results: 0% dropped (6/6 received)
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h3
*** Results: ['8.23 Mbits/sec', '9.99 Mbits/sec']
mininet>
```

Activate Windows
Go to PC settings to activate Windows.