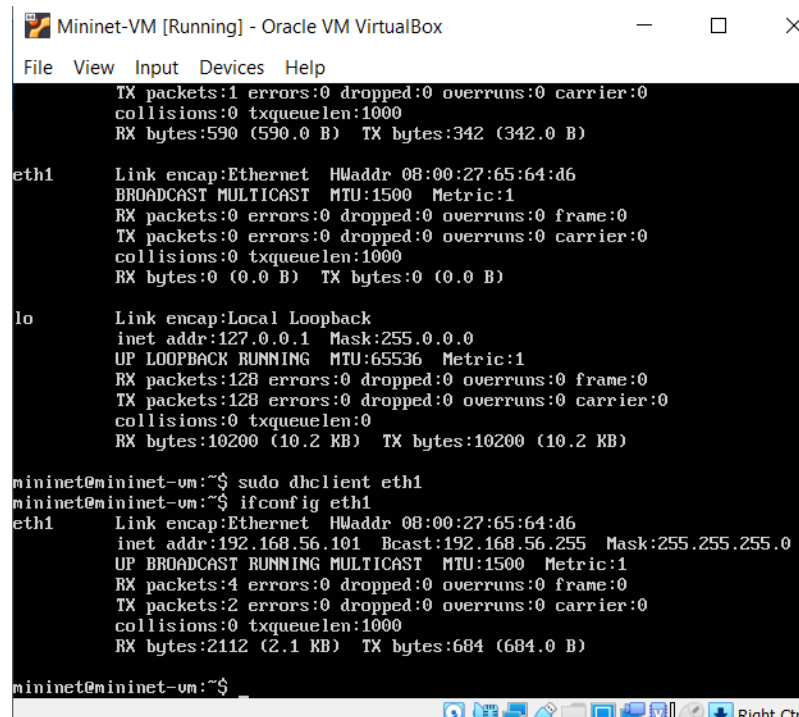


Practical 8 - Building an example application and invoking services and network commands in Openflow

→ We check out the ip address at host interface eth1.



```

TX packets:1 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:590 (590.0 B) TX bytes:342 (342.0 B)

eth1      Link encap:Ethernet  HWaddr 08:00:27:65:64:d6
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:128 errors:0 dropped:0 overruns:0 frame:0
          TX packets:128 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:10200 (10.2 KB) TX bytes:10200 (10.2 KB)

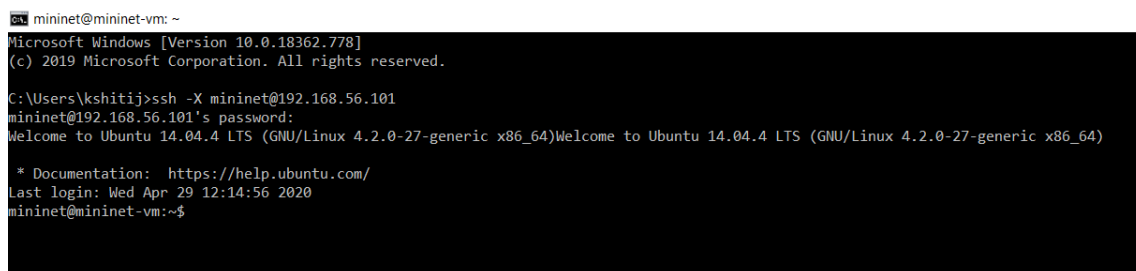
mininet@mininet-vm:~$ sudo dhclient eth1
mininet@mininet-vm:~$ ifconfig eth1
eth1      Link encap:Ethernet  HWaddr 08:00:27:65:64:d6
          inet addr:192.168.56.101  Bcast:192.168.56.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2112 (2.1 KB) TX bytes:684 (684.0 B)

mininet@mininet-vm:~$

```

Figure 1: eth1 interface

→ In order to remote login in mininet through Windows OS, we have to enable X11 forwarding. This is done by installing Xming on Windows. We type the command as shown in figure 2 to securely login to mininet vm. We make use of the ip address provided in figure in 1 for eth1 network adapter.



```

mininet@mininet-vm: ~
Microsoft Windows [Version 10.0.18362.778]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\kshitij>ssh -X mininet@192.168.56.101
mininet@192.168.56.101'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: Wed Apr 29 12:14:56 2020
mininet@mininet-vm:~$

```

Figure 2: SSH login to mininet VM

→ We create a simple topology where we make use of 3 hosts, 1 openflow switch connected to a remote controller. The command is used as shown in figure 3.

```
Microsoft Windows [Version 10.0.18362.778]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\kshiti>ssh -X mininet@192.168.56.101
mininet@192.168.56.101's password:
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)

 * Documentation:  https://help.ubuntu.com/
Last login: Wed Apr 29 12:14:56 2020
mininet@mininet-vm:~$ sudo mn --topo single,3 --mac --switch ovsk --controller remote
*** Creating network
*** Adding controller
Unable to contact the remote controller at 127.0.0.1:6653
Unable to contact the remote controller at 127.0.0.1:6633
Setting remote controller to 127.0.0.1:6653
*** Adding hosts:
h1 h2 h3
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1) (h3, s1)
*** Configuring hosts
h1 h2 h3
*** Starting controller
c0
*** Starting 1 switches
s1 ...
*** Starting CLI:
mininet>
```

Figure 3: Creating a topology

→ ovs-ofctl is a utility that comes with Open vSwitch and enables visibility and control over a single switch's flow table. We open another SSH window and look into flow table entries which are empty initially .

```
mininet@mininet-vm: ~
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)

 * Documentation:  https://help.ubuntu.com/
Last login: Wed Apr 29 16:49:38 2020 from 192.168.56.1
mininet@mininet-vm:~$ sudo ovs-ofctl show s1
DPPT_FEATURES_REPLY (xid=0x2): dpid:0000000000000001
n_tables:254, n_buffers:256
capabilities: FLOW_STATS TABLE_STATS PORT_STATS QUEUE_STATS ARP_MATCH_IP
actions: OUTPUT SET_VLAN_VID SET_VLAN_PCP STRIP_VLAN SET_DL_SRC SET_DL_DST SET_NW_SRC SET_NW_DST SET_NW_TOS SET_TP_SRC SET_TP_DST ENQUEUE
1(s1-eth1): addr:e2:cd:98:c0:9c:e5
  config:
  state:
  current: 10GB-FD COPPER
  speed: 10000 Mbps now, 0 Mbps max
2(s1-eth2): addr:42:1a:6d:bb:08:2a
  config:
  state:
  current: 10GB-FD COPPER
  speed: 10000 Mbps now, 0 Mbps max
3(s1-eth3): addr:fa:2f:89:a6:e1:6a
  config:
  state:
  current: 10GB-FD COPPER
  speed: 10000 Mbps now, 0 Mbps max
LOCAL(s1): addr:6e:b7:4b:6f:ad:4d
  config:
  state:
  speed: 0 Mbps now, 0 Mbps max
DPPT_GET_CONFIG_REPLY (xid=0x4): frags=normal miss_send_len=0
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1
NXST_FLOW reply (xid=0x4):
mininet@mininet-vm:~$
```

Figure 4: New SSH window to view switch's flow entries

→ We now try to ping host 2 from h1. This results in "Host unreachable" response. This is because we did not configure the switch what to do with incoming packets. So, we add the entries in in the flow table by issuing the

commands as mentioned in figure 5. Then we again try to ping host 2 and now we get the replies back as shown in figure 6.

```
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1
NXST_FLOW reply (xid=0x4):
mininet@mininet-vm:~$ sudo ovs-ofctl add-flow s1 in_port=1,actions=output:2
mininet@mininet-vm:~$ sudo ovs-ofctl add-flow s1 in_port=2,actions=output:1
mininet@mininet-vm:~$ ovs-ofctl dump-flows s1
ovs-ofctl: /var/run/openvswitch/s1.mgmt: failed to open socket (Permission denied)
mininet@mininet-vm:~$ sudo ovs-ofctl dump-flows s1
NXST_FLOW reply (xid=0x4):
 cookie=0x0, duration=182.528s, table=0, n_packets=5, n_bytes=378, idle_age=164, in_port=1 actions=output:2
 cookie=0x0, duration=174.032s, table=0, n_packets=5, n_bytes=378, idle_age=164, in_port=2 actions=output:1
mininet@mininet-vm:~$
```

Figure 5: Adding flow entries in open vswitch

```
mininet> h1 ping -c3 h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
From 10.0.0.1 icmp_seq=1 Destination Host Unreachable
From 10.0.0.1 icmp_seq=2 Destination Host Unreachable
From 10.0.0.1 icmp_seq=3 Destination Host Unreachable

--- 10.0.0.2 ping statistics ---
3 packets transmitted, 0 received, +3 errors, 100% packet loss, time 2000ms
pipe 3
mininet> sudo ovs-ofctl add-flow s1 in_port=1,actions=output:2
*** Unknown command: sudo ovs-ofctl add-flow s1 in_port=1,actions=output:2
mininet> h1 ping -c3 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=0.360 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.022 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.024 ms

--- 10.0.0.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 1998ms
rtt min/avg/max/mdev = 0.022/0.135/0.360/0.159 ms
mininet>
```

Figure 6: Ping before adding the flow table entries and after adding