

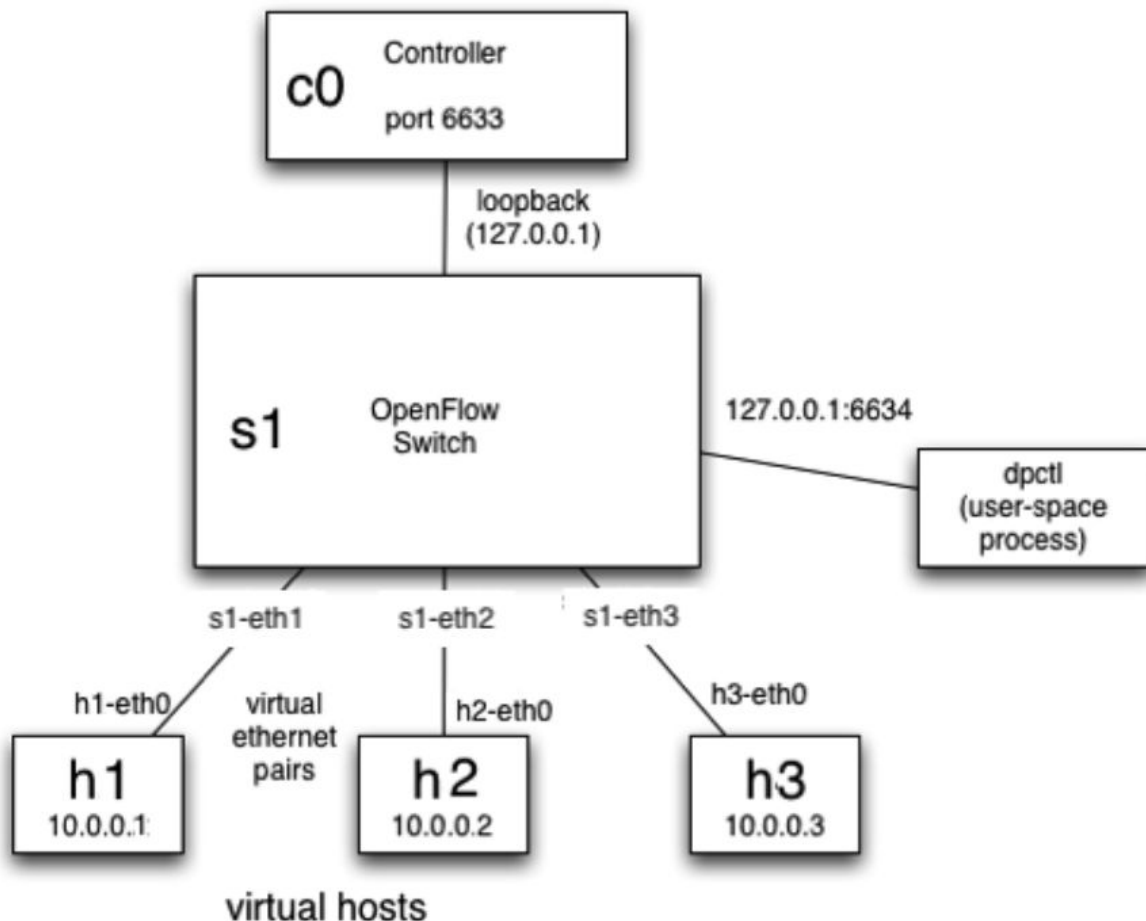
Computer Network Design - Lab 3

Network topology

The topology has three hosts named h1, h2 and h3 respectively. Each host has an Ethernet interface called h1-eth0, h2-eth0 and h3-eth0 respectively. The three hosts are connected through a switch named s1.

The switch s1 has three ports named s1-eth1, s1-eth2 and s1-eth3. The controller is connected on the loopback interface (in real life this may or may not be the case, it means the switch and controller are built in a single box).

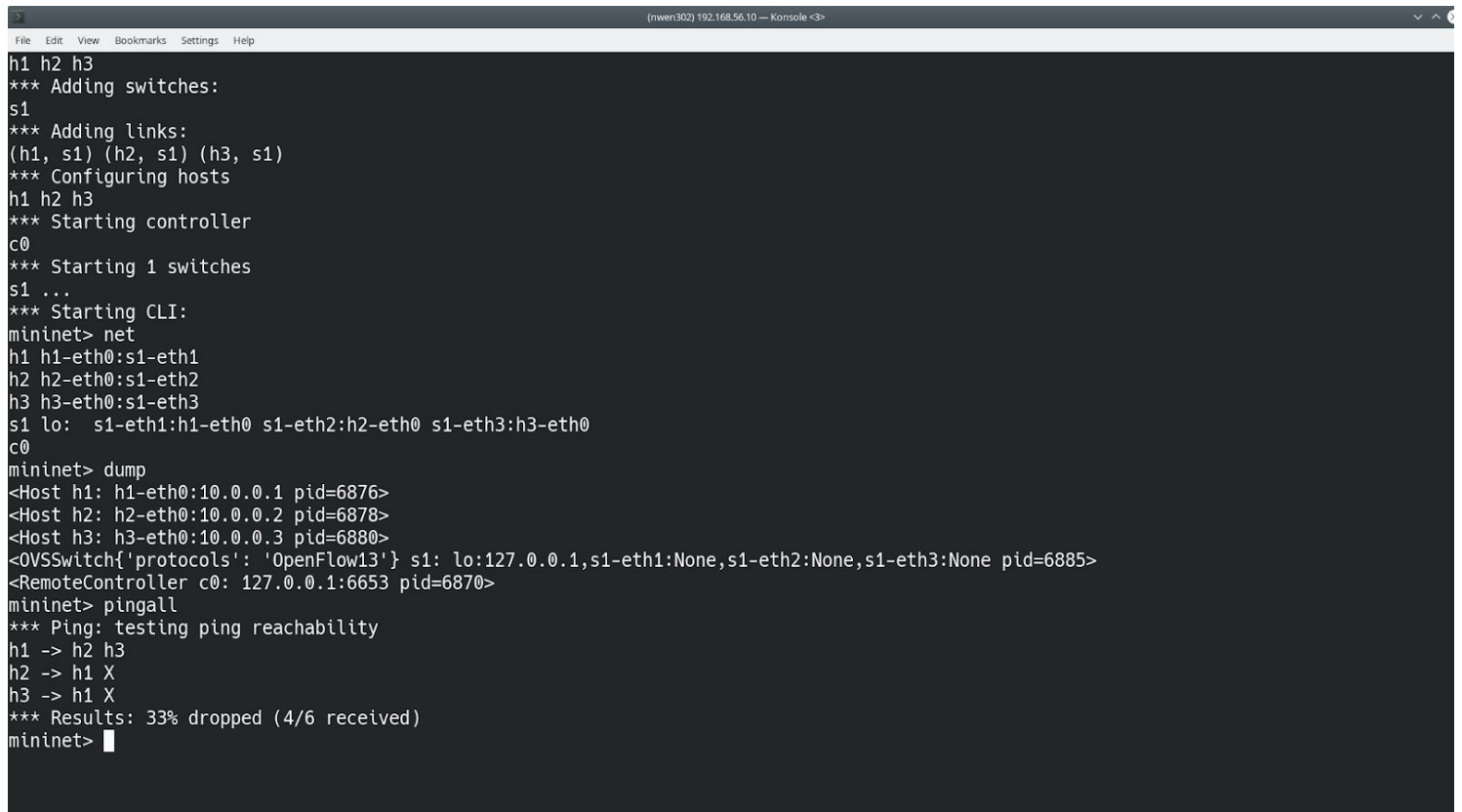
The controller is identified as c0 and connected through port 6653.



Key Task 1:

To block traffic between host 2 and host 3. I added the following code to the Simple_Switch_13.py:

```
-----
actions = []
match = parser.OFPMatch(eth_src = "00:00:00:00:00:02" ,
eth_dst = "00:00:00:00:00:03")
self.add_flow(datapath, 1, match, actions)
match = parser.OFPMatch(eth_src = "00:00:00:00:00:03" ,
eth_dst = "00:00:00:00:00:02")
self.add_flow(datapath, 1, match, actions)
-----
```



```
(nwen302) 192.168.56.10 — Konsole <3>
File Edit View Bookmarks Settings Help
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> net
h1 h1-eth0:s1-eth1
h2 h2-eth0:s1-eth2
h3 h3-eth0:s1-eth3
s1 lo: s1-eth1:h1-eth0 s1-eth2:h2-eth0 s1-eth3:h3-eth0
c0
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=6876>
<Host h2: h2-eth0:10.0.0.2 pid=6878>
<Host h3: h3-eth0:10.0.0.3 pid=6880>
<OVSSwitch{'protocols': 'OpenFlow13'} s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None,s1-eth3:None pid=6885>
<RemoteController c0: 127.0.0.1:6653 pid=6870>
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3
h2 -> h1 X
h3 -> h1 X
*** Results: 33% dropped (4/6 received)
mininet> 
```

Then ,I run the ryu-manager as shown in the figure below just to see what is actually happening.

To have a clear idea. I start a ping from h1 to h2. The number of packets will keep increasing because I used a continuous ping.

From the source (dl_src=52:6f:95:34:9b:39) we have a packet of 42.

From the source (dl_src=32:59:14:c4:4e:8f) we have a packet of 41.

```
nwen302@nwen302-core:~$ sudo ovs-ofctl -O OpenFlow13 dump-flws s1
[sudo] password for nwen302:
ovs-ofctl: unknown command 'dump-flws'; use --help for help
nwen302@nwen302-core:~$ sudo ovs-ofctl -O OpenFlow13 dump-flows s1
cookie=0x0, duration=470.668s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:03 actions=d
rop
cookie=0x0, duration=470.667s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02 actions=d
rop
cookie=0x0, duration=470.667s, table=0, n_packets=55, n_bytes=4098, priority=0 actions=CONTROLLER:65535
nwen302@nwen302-core:~$ sudo ovs-ofctl -O OpenFlow13 dump-flows s1
[sudo] password for nwen302:
cookie=0x0, duration=263.982s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:03 actions=d
rop
cookie=0x0, duration=263.981s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02 actions=d
rop
cookie=0x0, duration=40.818s, table=0, n_packets=42, n_bytes=4004, priority=1,in_port="s1-eth2",dl_src=52:6f:95:34:9b:39,dl_dst=32:59:
14:c4:4e:8f actions=output:"s1-eth1"
cookie=0x0, duration=40.817s, table=0, n_packets=41, n_bytes=3906, priority=1,in_port="s1-eth1",dl_src=32:59:14:c4:4e:8f,dl_dst=52:6f:
95:34:9b:39 actions=output:"s1-eth2"
cookie=0x0, duration=263.980s, table=0, n_packets=86, n_bytes=6488, priority=0 actions=CONTROLLER:65535
nwen302@nwen302-core:~$
```

If I start a ping from h1 to h3 I start a ping from h1 to h2. The number of packets will get aggregated. The number of packets will keep increasing(added).

Now, let us generate a lot of packets to see what is happening here. To do that I used the command below in Mininet:

```
-----
mininet> iperf h1 h2
-----
```

```
nwen302@nwen302-core:~$ sudo mn --topo=single,3 --mac
*** No default OpenFlow controller found for default switch!
*** Falling back to OVS Bridge
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1) (h3, s1)
*** Configuring hosts
h1 h2 h3
*** Starting controller
*** Starting 1 switches
s1 ...
*** Starting CLI:
mininet> iperf h1 h2
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['42.0 Gbits/sec', '42.2 Gbits/sec']
mininet>
```


If we look closely at the highlighted line, it shows that 'packet_count' number goes above the threshold(1000).

```
packet in 1 02:95:70:84:72:46 82:d3:ae:94:ae:5a 1
packet in 1 02:95:70:84:72:46 82:d3:ae:94:ae:5a 1
{'00:00:00:00:00:03': 0, '00:00:00:00:00:02': 0, '02:95:70:84:72:46': 46950, '82:d3:ae:94:ae:5a': 10367}
('src_host', '02:95:70:84:72:46', 'packet_count', 46950, 'is above threshold', 1000)
('blocking the mac', '02:95:70:84:72:46')
('src_host', '82:d3:ae:94:ae:5a', 'packet_count', 10367, 'is above threshold', 1000)
('blocking the mac', '82:d3:ae:94:ae:5a')
{'00:00:00:00:00:03': 0, '00:00:00:00:00:02': 0, '82:d3:ae:94:ae:5a': 18686, '02:95:70:84:72:46': 83509}
('src_host', '82:d3:ae:94:ae:5a', 'packet_count', 18686, 'is above threshold', 1000)
('blocking the mac', '82:d3:ae:94:ae:5a')
('src_host', '02:95:70:84:72:46', 'packet_count', 83509, 'is above threshold', 1000)
('blocking the mac', '02:95:70:84:72:46')
packet in 1 22:2f:01:5c:a4:ae 33:33:00:00:00:02 3
^Cnwen302@nwen302-core:~/lab3/ryu/app$
```

Now, let us check the Flows again. We need to look at these two arguments, `hard_timeout=65535` and `priority=100`. These two arguments help to block the sources only. I set the `priority = 100` to block the source. If I set the `priority = 1` we will not be able to see which flow gets executed. In task 3, we need to block all the traffic originating from this host for 24 hours. 24 hours will be equal to 86400 seconds, but we can not block the traffic for one day(24h). Therefore, I had to set the `hard_timeout` to the maximum. For the `hard_timeout=65535`, the '65535' basically represents the number of seconds, The hard and idle timeout range is from 0 through 65535. Traffic will be blocked for 65535 sec, after that, the flow will be removed automatically. In other words, the flow will be persistent during the `hard_timeout=65535` and exactly after 65535 sec the flow will be removed.

```
(nwen302) 192.168.56.10 - Konsole <2>
File Edit View Bookmarks Settings Help
nwen302@nwen302-core:~$ sudo ovs-ofctl -O OpenFlow13 dump-flows s1
[sudo] password for nwen302:
cookie=0x0, duration=762.870s, table=0, n_packets=11, n_bytes=670, hard_timeout=65535, priority=100,dl_src=82:d3:ae:94:ae:5a actions=drop
cookie=0x0, duration=762.867s, table=0, n_packets=36568, n_bytes=2090201208, hard_timeout=65535, priority=100,dl_src=02:95:70:84:72:46 actions=drop
cookie=0x0, duration=811.922s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:03 actions=drop
cookie=0x0, duration=811.919s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02 actions=drop
cookie=0x0, duration=773.780s, table=0, n_packets=18679, n_bytes=1233034, priority=1,in_port="s1-eth2",dl_src=82:d3:ae:94:ae:5a,dl_dst=02:95:70:84:72:46 actions=output:"s1-eth1"
cookie=0x0, duration=773.756s, table=0, n_packets=46950, n_bytes=2687081956, priority=1,in_port="s1-eth1",dl_src=02:95:70:84:72:46,dl_dst=82:d3:ae:94:ae:5a actions=output:"s1-eth2"
cookie=0x0, duration=811.919s, table=0, n_packets=13, n_bytes=858, priority=0 actions=CONTROLLER:65535
nwen302@nwen302-core:~$
```

All the Tasks Have been achieved. However, task 3 is a bit difficult.

Task 1:

```

mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3
h2 -> h1 X
h3 -> h1 X
*** Results: 33% dropped (4/6 received)
mininet> █

```

Task 2:

```

nwen302@nwen302-core:~/lab3/ryu/app$ sudo /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
loading app simple_switch_13.py
loading app ryu.controller.ofp_handler
instantiating app simple_switch_13.py of SimpleSwitch13
instantiating app ryu.controller.ofp_handler of OFPHandler
packet in 1 02:95:70:84:72:46 33:33:00:00:00:02 1
packet in 1 22:2f:01:5c:a4:ae 33:33:00:00:00:02 3
packet in 1 82:d3:ae:94:ae:5a 33:33:00:00:00:02 2
{'00:00:00:00:00:03': 0, '00:00:00:00:00:02': 0}
packet in 1 02:95:70:84:72:46 33:33:00:00:00:02 1
packet in 1 22:2f:01:5c:a4:ae 33:33:00:00:00:02 3
{'00:00:00:00:00:03': 0, '00:00:00:00:00:02': 0}
packet in 1 82:d3:ae:94:ae:5a 33:33:00:00:00:02 2
{'00:00:00:00:00:03': 0, '00:00:00:00:00:02': 0}
packet in 1 02:95:70:84:72:46 ff:ff:ff:ff:ff:ff 1
packet in 1 82:d3:ae:94:ae:5a 02:95:70:84:72:46 2
packet in 1 02:95:70:84:72:46 82:d3:ae:94:ae:5a 1
packet in 1 02:95:70:84:72:46 82:d3:ae:94:ae:5a 1
{'00:00:00:00:00:03': 0, '00:00:00:00:00:02': 0, '02:95:70:84:72:46': 46950, '82:d3:ae:94:ae:5a': 10367}
('src_host', '02:95:70:84:72:46', 'packet_count', 46950, 'is above threshold', 1000)
('blocking the mac', '02:95:70:84:72:46')
('src_host', '82:d3:ae:94:ae:5a', 'packet_count', 10367, 'is above threshold', 1000)
('blocking the mac', '82:d3:ae:94:ae:5a')
{'00:00:00:00:00:03': 0, '00:00:00:00:00:02': 0, '82:d3:ae:94:ae:5a': 18686, '02:95:70:84:72:46': 83509}
('src_host', '82:d3:ae:94:ae:5a', 'packet_count', 18686, 'is above threshold', 1000)
('blocking the mac', '82:d3:ae:94:ae:5a')
('src_host', '02:95:70:84:72:46', 'packet_count', 83509, 'is above threshold', 1000)
('blocking the mac', '02:95:70:84:72:46')
packet in 1 22:2f:01:5c:a4:ae 33:33:00:00:00:02 3
^Cnwen302@nwen302-core:~/lab3/ryu/app$ █

```

Task 3:

```

nwen302@nwen302-core:~$ sudo ovs-ofctl -O OpenFlow13 dump-flows s1
[sudo] password for nwen302:
cookie=0x0, duration=762.870s, table=0, n_packets=11, n_bytes=670, hard_timeout=65535, priority=100,dl_src=82:d3:ae:94:ae:5a actions=drop
cookie=0x0, duration=762.867s, table=0, n_packets=36568, n_bytes=2090201208, hard_timeout=65535, priority=100,dl_src=02:95:70:84:72:46 actions=drop
cookie=0x0, duration=811.922s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:02,dl_dst=00:00:00:00:00:03 actions=drop
cookie=0x0, duration=811.919s, table=0, n_packets=0, n_bytes=0, priority=1,dl_src=00:00:00:00:00:03,dl_dst=00:00:00:00:00:02 actions=drop
cookie=0x0, duration=773.780s, table=0, n_packets=18679, n_bytes=1233034, priority=1,in_port="s1-eth2",dl_src=82:d3:ae:94:ae:5a,dl_dst=02:95:70:84:72:46 actions=output:"s1-eth1"
cookie=0x0, duration=773.756s, table=0, n_packets=46950, n_bytes=2687081956, priority=1,in_port="s1-eth1",dl_src=02:95:70:84:72:46,dl_dst=82:d3:ae:94:ae:5a actions=output:"s1-eth2"
cookie=0x0, duration=811.919s, table=0, n_packets=13, n_bytes=858, priority=0 actions=CONTROLLER:65535
nwen302@nwen302-core:~$ █

```


Things That I spend very long time to fix are so many but here are the toughest ones:
The first I faced I could not fix for while was this error below.

```
nwen302@nwen302-core:~/lab3/ryu/app$ sudo /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
loading app simple_switch_13.py
loading app ryu.controller.ofp_handler
instantiating app simple_switch_13.py of SimpleSwitch13
instantiating app ryu.controller.ofp_handler of OFPHandler
hub: uncaught exception: Traceback (most recent call last):
  File "/home/nwen302/.local/lib/python2.7/site-packages/ryu/lib/hub.py", line 60, in _launch
    return func(*args, **kwargs)
  File "/home/nwen302/lab3/ryu/app/simple_switch_13.py", line 33, in _monitor
    self.request_flow_metrics(self.datapath_obj)
  File "/home/nwen302/lab3/ryu/app/simple_switch_13.py", line 37, in request_flow_metrics
    ofp = datapath.ofproto
AttributeError: 'NoneType' object has no attribute 'ofproto'
```

I tried many different ways to fix it, but each method I used did not work. It actually makes it harder or it will cause more error. After searching and looking for a solution to this error, I found this website. This website explains this command below in detail.

```
-----
$ ps -ef | grep python
-----
```

<https://explainshell.com/explain?cmd=ps+-ef+%7C+grep+python>

Basically, I had many processes running at the same time.

```
File Edit View Bookmarks Settings Help
https://ubuntu.com/livepatch
0 packages can be updated.
0 updates are security updates.

New release '20.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Sun Oct 18 09:34:23 2020 from 192.168.56.1
nwen302@nwen302-core:~$ ps -ef | grep python
root      895      1   0 Oct14 ?        00:00:00 /usr/bin/python3 /usr/bin/networkd-dispatcher --run-startup-triggers
root     1199      1   0 Oct14 ?        00:00:00 /usr/bin/python3 /usr/share/unattended-upgrades/unattended-upgrade-shutdown --wait-for-
signal
root     1200      1   0 Oct14 ?        00:01:16 /usr/bin/python3 /usr/bin/core-daemon
root     1772    1771   0 Oct14 pts/0    00:00:00 /usr/bin/python /usr/bin/mn --topo=single,3 --mac
root     1885    1884   0 Oct14 pts/0    00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_monitor_13.py
root     2159    2158   0 Oct14 pts/0    00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_monitor_13.py
root     2434    2433   0 Oct14 pts/0    00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_monitor_13.py
root     5136    5135   0 00:50 pts/5    00:00:00 /usr/bin/python /usr/bin/mn --topo=single,3 --mac
root     5412    5411   0 00:56 ?        00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
root     5420    5419   0 00:58 pts/5    00:00:00 /usr/bin/python /usr/bin/mn --controller=remote --topo=single,3 --switch=ovsk,protocols
=OpenFlow13 --mac
root     5429    5428   0 00:59 ?        00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
root     5515    5514   0 01:00 pts/5    00:00:00 /usr/bin/python /usr/bin/mn --topo=single,3 --mac
root     5607    5606   0 01:01 ?        00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
root     5665    5664   0 01:09 ?        00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
root     5760    5759   0 01:10 ?        00:00:00 /usr/bin/python /usr/bin/mn --controller=remote --topo=single,3 --mac
root     5769    5768   0 01:11 ?        00:00:00 /usr/bin/python /usr/bin/mn --controller=remote --topo=single,3 --switch=ovsk,protocols
=OpenFlow13 --mac
root     5802    5801   0 01:15 pts/5    00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
root     5806    5805   0 01:15 ?        00:00:00 /usr/bin/python /usr/bin/mn --topo=single,3 --mac
root     5909    5908   0 01:22 pts/5    00:00:00 /usr/bin/python /home/nwen302/.local/bin/ryu-manager simple_switch_13.py
11:23 PM
```

Therefore, I had to kill each process individually using this command below.

```
-----  
% sudo kill -9 <pid-number>  
-----
```