

ĐẠI HỌC QUỐC GIA THÀNH PHỐ HỒ CHÍ MINH

TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN

KHOA CÔNG NGHỆ THÔNG TIN

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Báo cáo đồ án 2

# Link and Network with SDN

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Môn học: Mạng máy tính nâng cao

CSC11004 \_22MMT

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Lê Ngọc Sơn

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Ngày 14 tháng 12 năm 2024



## Mục lục

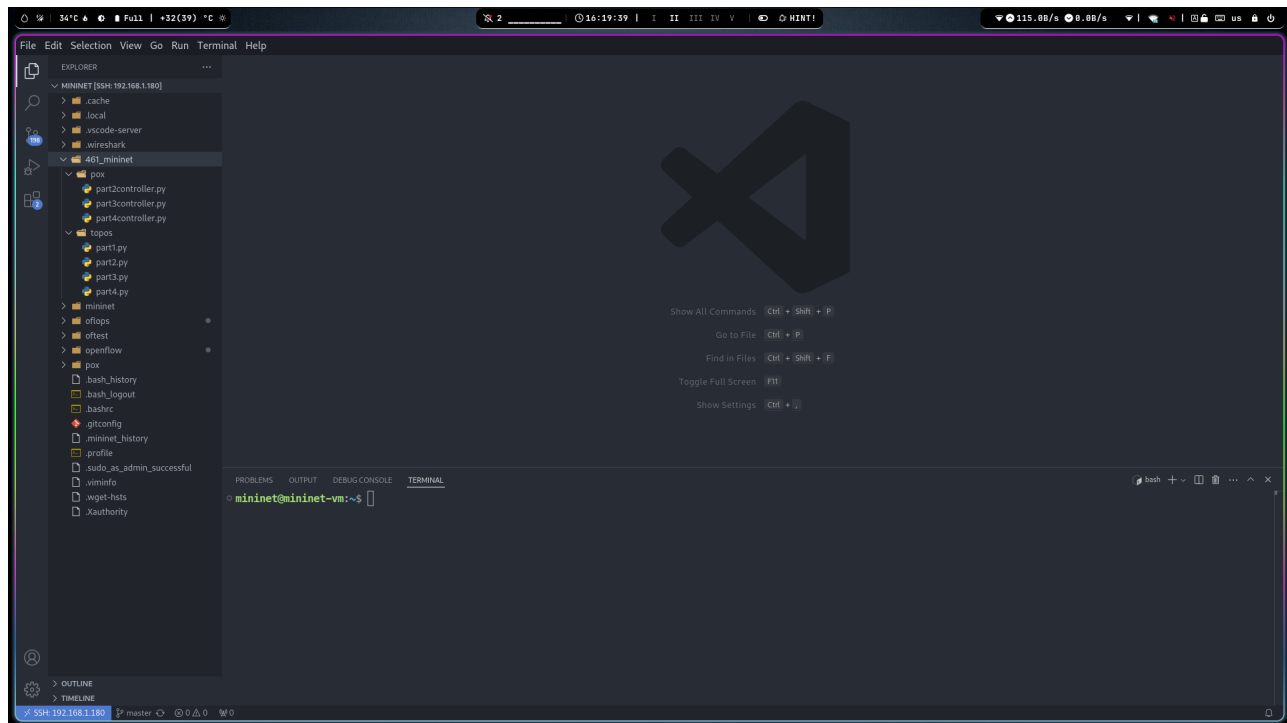
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# 1 Thông tin sinh viên

Nhóm gồm có 2 thành viên:

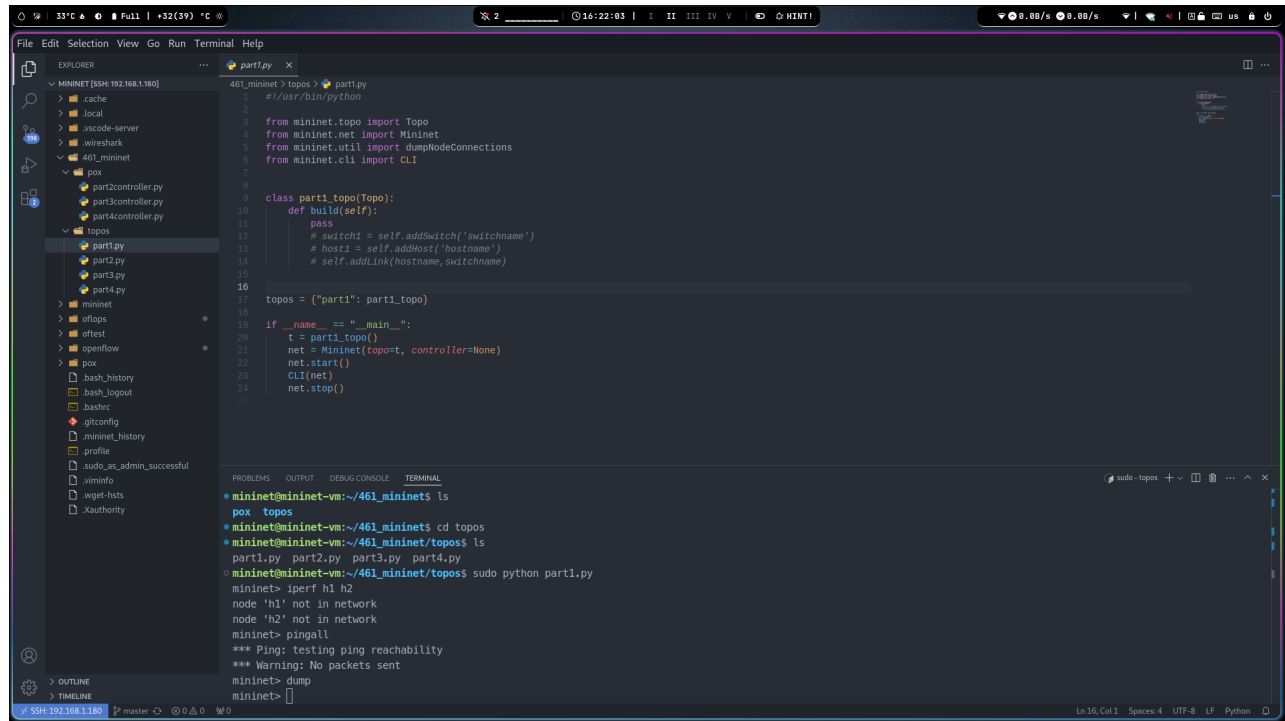
- Lê Hoàng Đạt - 22127060.
- Nguyễn Hồ Đăng Duy - 22127085.

# 2 Chuẩn bị các kết nối

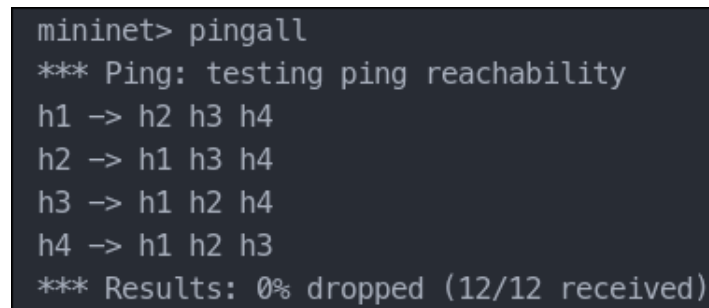


Hình 1: Kết nối ssh vào máy mininet

### 3 Part 1: Mininet Primer



Hình 2: Kết quả của file `part1.py` ban đầu sau khi chạy



Hình 3: Kết quả sau khi chạy `pingall`

```

mininet@mininet-vm:~/461_mininet/topos$ sudo python part1.py
mininet> iperf h1 h2
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['28.4 Gbits/sec', '28.5 Gbits/sec']
mininet> iperf h1 h3
*** Iperf: testing TCP bandwidth between h1 and h3
*** Results: ['29.4 Gbits/sec', '29.6 Gbits/sec']
mininet> iperf h1 h4
*** Iperf: testing TCP bandwidth between h1 and h4
*** Results: ['25.2 Gbits/sec', '25.4 Gbits/sec']
mininet> iperf h2 h4
*** Iperf: testing TCP bandwidth between h2 and h4
*** Results: ['26.9 Gbits/sec', '27.1 Gbits/sec']
mininet> 

```

Hình 4: Kết quả sau khi chạy iperf

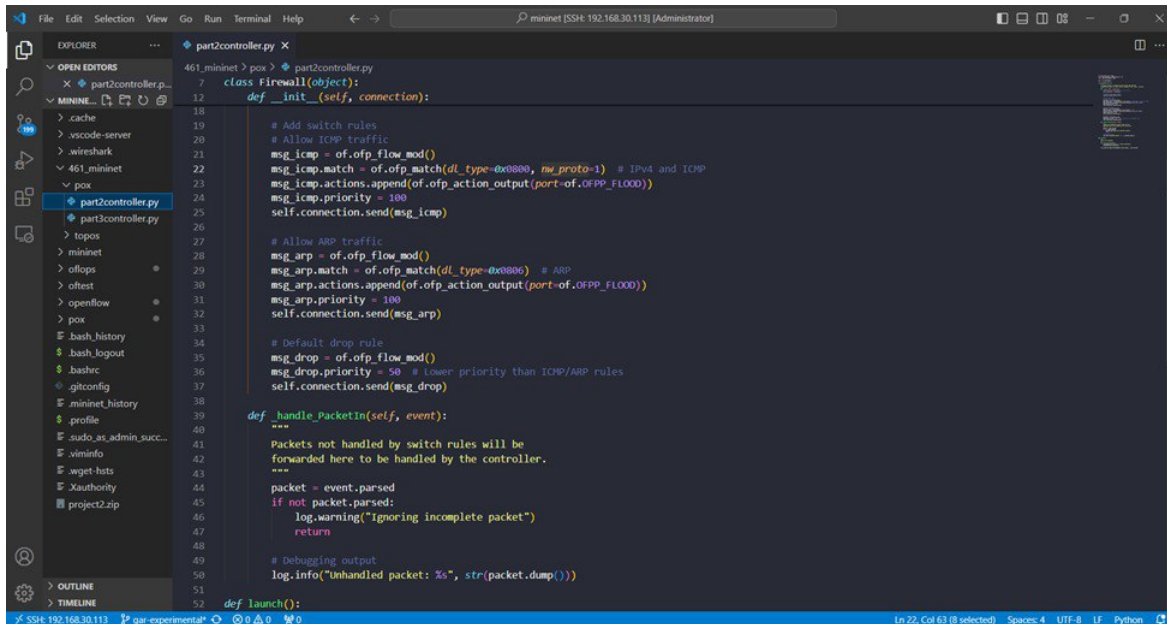
```

mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=1778>
<Host h2: h2-eth0:10.0.0.2 pid=1780>
<Host h3: h3-eth0:10.0.0.3 pid=1784>
<Host h4: h4-eth0:10.0.0.4 pid=1786>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None,s1-eth3:None,s1-eth4:None pid=1791>
<Controller c0: 127.0.0.1:6653 pid=1771>

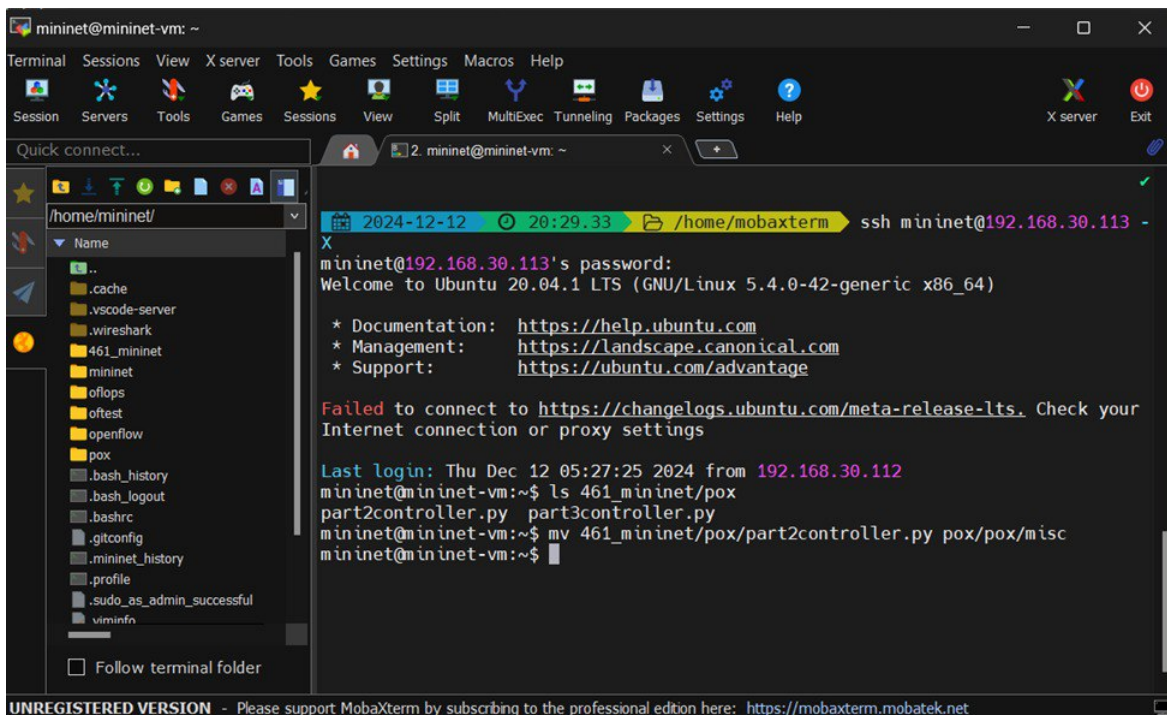
```

Hình 5: Kết quả sau khi chạy dump

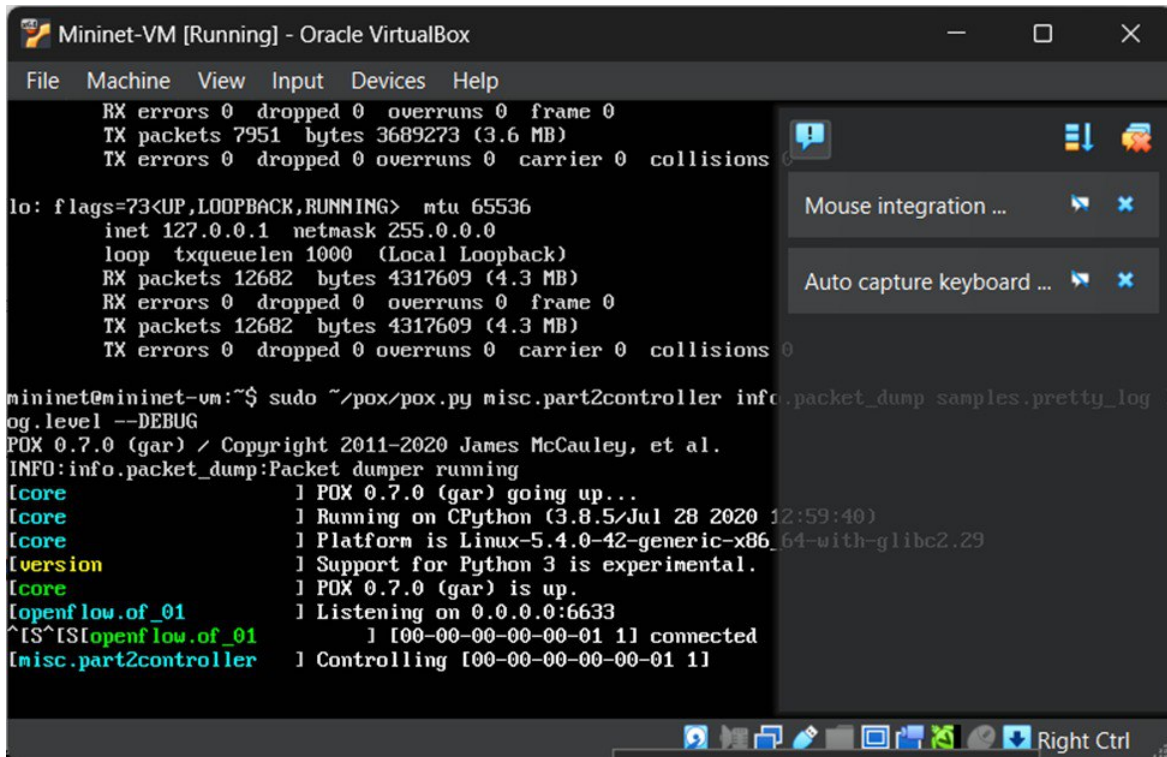
## 4 Part 2: SDN Controllers using POX



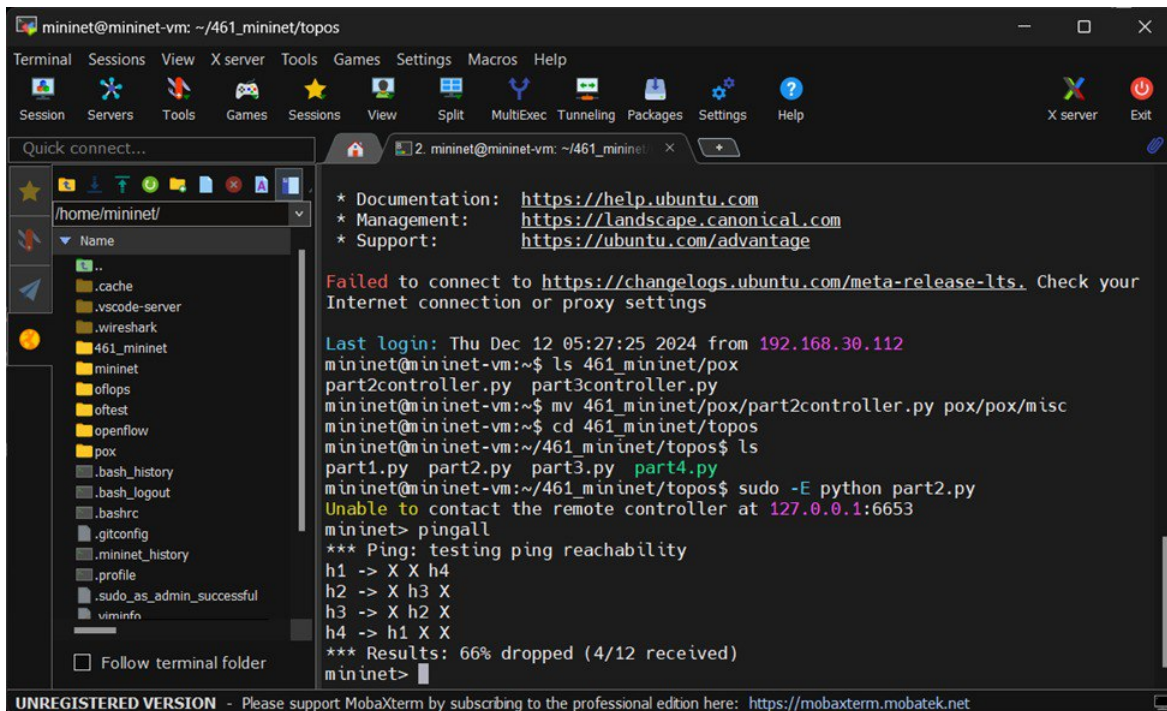
Hình 6: Chỉnh code của part2controller.py



Hình 7: Chuyển code từ thư mục 461\_mininet/pox sang pox/pox/misc



Hình 8: Trên máy ảo mininet khởi chạy thuật toán vừa tạo



Hình 9: Khởi chạy topology và thực hiện lệnh pingall



```

mininet@mininet-vm: ~/461_mininet/topos
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
/home/mininet/
Name
..
.cache
.vscode-server
.wireshark
461_mininet
mininet
oflops
oftest
openflow
pox
.bash_history
.bash_logout
.bashrc
.gitconfig
.mininet_history
.profile
.sudo_as_admin_successful
viminfo
Follow terminal folder

* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your
Internet connection or proxy settings

Last login: Thu Dec 12 05:27:25 2024 from 192.168.30.112
mininet@mininet-vm:~$ ls 461_mininet/pox
part2controller.py part3controller.py
mininet@mininet-vm:~$ mv 461_mininet/pox/part2controller.py pox/pox/misc
mininet@mininet-vm:~$ cd 461_mininet/topos
mininet@mininet-vm:~/461_mininet/topos$ ls
part1.py part2.py part3.py part4.py
mininet@mininet-vm:~/461_mininet/topos$ sudo -E python part2.py
Unable to contact the remote controller at 127.0.0.1:6653
mininet> pingall
*** Ping: testing ping reachability
h1 -> X X h4
h2 -> X h3 X
h3 -> X h2 X
h4 -> h1 X X
*** Results: 66% dropped (4/12 received)
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h4

```

Hình 10: Lệnh iperf không trả về kết quả vì đã bị block

```

mininet@mininet-vm: ~/461_mininet/topos
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
/home/mininet/
Name
..
.cache
.vscode-server
.wireshark
461_mininet
mininet
oflops
oftest
openflow
pox
.bash_history
.bash_logout
.bashrc
.gitconfig
.mininet_history
.profile
.sudo_as_admin_successful
viminfo
Follow terminal folder

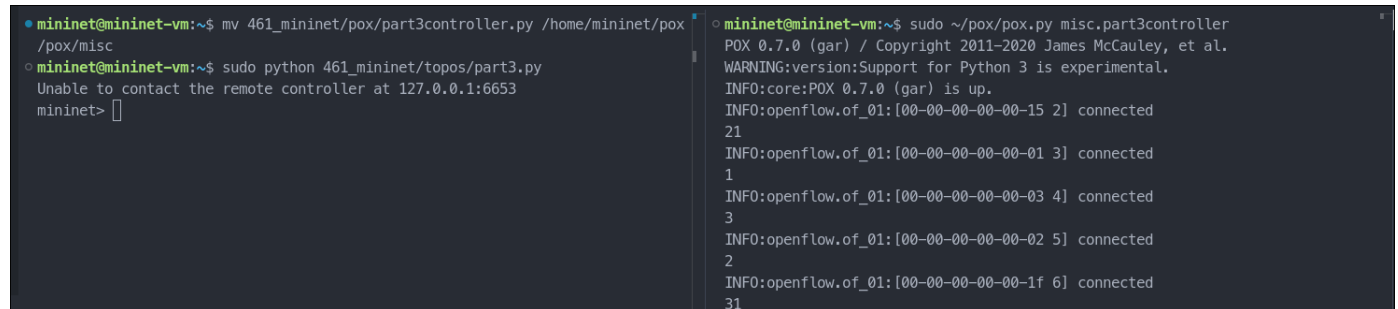
mininet@mininet-vm:~$ cd 461_mininet/topos
mininet@mininet-vm:~/461_mininet/topos$ ls
part1.py part2.py part3.py part4.py
mininet@mininet-vm:~/461_mininet/topos$ sudo -E python part2.py
Unable to contact the remote controller at 127.0.0.1:6653
mininet> pingall
*** Ping: testing ping reachability
h1 -> X X h4
h2 -> X h3 X
h3 -> X h2 X
h4 -> h1 X X
*** Results: 66% dropped (4/12 received)
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h4
^C
Interrupt
mininet> dpctl dump-flows
*** s1 -----
cookie=0x0, duration=183.949s, table=0, n_packets=8, n_bytes=784, priority=100,
icmp actions=FL00D
cookie=0x0, duration=183.949s, table=0, n_packets=10, n_bytes=420, priority=100
,arp actions=FL00D
cookie=0x0, duration=183.949s, table=0, n_packets=6, n_bytes=444, priority=50 a
ctions=drop
mininet>

```

Hình 11: Lệnh dpctl dump-flows kiểm tra lại hoạt động của s1



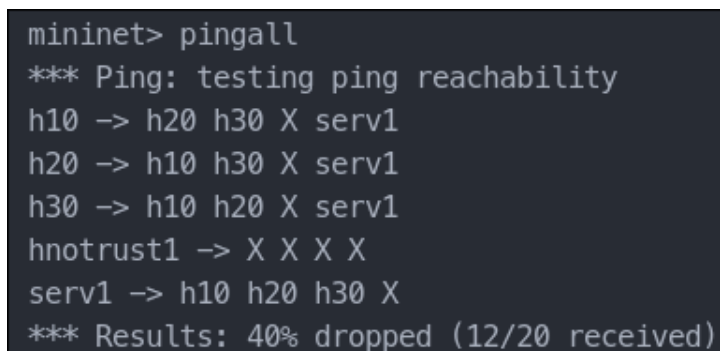
## 5 Part 3: A more complex network



```
mininet@mininet-vm:~$ mv 461_mininet/pox/part3controller.py /home/mininet/pox/
/pox/misc
mininet@mininet-vm:~$ sudo python 461_mininet/topos/part3.py
Unable to contact the remote controller at 127.0.0.1:6653
mininet>

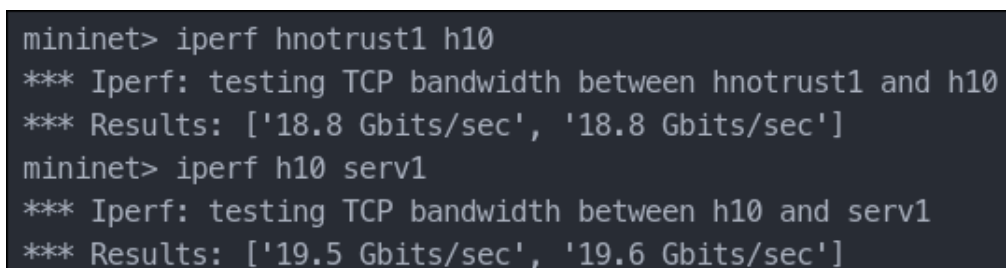
mininet@mininet-vm:~$ sudo ~/pox/pox.py misc.part3controller
POX 0.7.0 (gar) / Copyright 2011-2020 James McCauley, et al.
WARNING:version:Support for Python 3 is experimental.
INFO:core:POX 0.7.0 (gar) is up.
INFO:openflow.of_01:[00-00-00-00-00-15 2] connected
21
INFO:openflow.of_01:[00-00-00-00-00-01 3] connected
1
INFO:openflow.of_01:[00-00-00-00-00-03 4] connected
3
INFO:openflow.of_01:[00-00-00-00-00-02 5] connected
2
INFO:openflow.of_01:[00-00-00-00-00-1f 6] connected
31
```

Hình 12: Chuyển file sang misc rồi chạy pox và topo



```
mininet> pingall
*** Ping: testing ping reachability
h10 -> h20 h30 X serv1
h20 -> h10 h30 X serv1
h30 -> h10 h20 X serv1
hnotrust1 -> X X X X
serv1 -> h10 h20 h30 X
*** Results: 40% dropped (12/20 received)
```

Hình 13: Kết quả chạy pingall (chặn hnotrust1)



```
mininet> iperf hnotrust1 h10
*** Iperf: testing TCP bandwidth between hnotrust1 and h10
*** Results: ['18.8 Gbits/sec', '18.8 Gbits/sec']
mininet> iperf h10 serv1
*** Iperf: testing TCP bandwidth between h10 and serv1
*** Results: ['19.5 Gbits/sec', '19.6 Gbits/sec']
```

Hình 14: Kết quả khi chạy iperf theo yêu cầu đề bài

```
mininet> dpctl dump-flows
*** cores21 -----
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=20,icmp,nw_src=172.16.10.100,nw_dst=10.0.1.10 actions=drop
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=20,icmp,nw_src=172.16.10.100,nw_dst=10.0.2.20 actions=drop
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=20,icmp,nw_src=172.16.10.100,nw_dst=10.0.3.30 actions=drop
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=20,icmp,nw_src=172.16.10.100,nw_dst=10.0.4.10 actions=drop
cookie=0x0, duration=253.723s, table=0, n_packets=0, n_bytes=0, priority=19,ip,nw_src=172.16.10.100,nw_dst=10.0.4.10 actions=drop
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.1.10,nw_dst=10.0.2.20 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.1.10,nw_dst=10.0.3.30 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=229159, n_bytes=12284883046, priority=10,ip,nw_src=10.0.1.10,nw_dst=10.0.4.10 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=73531, n_bytes=4854438, priority=10,ip,nw_src=10.0.1.10,nw_dst=172.16.10.100 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.2.20,nw_dst=10.0.1.10 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.2.20,nw_dst=10.0.3.30 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.2.20,nw_dst=10.0.4.10 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=1, n_bytes=98, priority=10,ip,nw_src=10.0.2.20,nw_dst=172.16.10.100 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.3.30,nw_dst=10.0.1.10 actions=NORMAL
cookie=0x0, duration=253.723s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.3.30,nw_dst=10.0.2.20 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.3.30,nw_dst=10.0.4.10 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=1, n_bytes=98, priority=10,ip,nw_src=10.0.3.30,nw_dst=172.16.10.100 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=72962, n_bytes=4816916, priority=10,ip,nw_src=10.0.4.10,nw_dst=10.0.1.10 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.4.10,nw_dst=10.0.2.20 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=2, n_bytes=196, priority=10,ip,nw_src=10.0.4.10,nw_dst=10.0.3.30 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=1, n_bytes=98, priority=10,ip,nw_src=10.0.4.10,nw_dst=172.16.10.100 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=229627, n_bytes=11781731982, priority=10,ip,nw_src=172.16.10.100,nw_dst=10.0.1.10 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=0, n_bytes=0, priority=10,ip,nw_src=172.16.10.100,nw_dst=10.0.2.20 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=0, n_bytes=0, priority=10,ip,nw_src=172.16.10.100,nw_dst=10.0.3.30 actions=NORMAL
cookie=0x0, duration=253.722s, table=0, n_packets=0, n_bytes=0, priority=10,ip,nw_src=172.16.10.100,nw_dst=172.16.10.100 actions=NORMAL
*** dcs31 -----
cookie=0x0, duration=253.724s, table=0, n_packets=302135, n_bytes=12289701334, priority=2 actions=FL00D
cookie=0x0, duration=253.723s, table=0, n_packets=0, n_bytes=0, priority=1 actions=drop
*** s1 -----
cookie=0x0, duration=253.756s, table=0, n_packets=605290, n_bytes=24076287460, priority=2 actions=FL00D
cookie=0x0, duration=253.756s, table=0, n_packets=0, n_bytes=0, priority=1 actions=drop
*** s2 -----
cookie=0x0, duration=253.772s, table=0, n_packets=18, n_bytes=1764, priority=2 actions=FL00D
cookie=0x0, duration=253.771s, table=0, n_packets=0, n_bytes=0, priority=1 actions=drop
*** s3 -----
cookie=0x0, duration=253.788s, table=0, n_packets=18, n_bytes=1764, priority=2 actions=FL00D
cookie=0x0, duration=253.788s, table=0, n_packets=0, n_bytes=0, priority=1 actions=drop
```

Hình 15: Tất cả rules đã cài đặt trên switches

## 6 Part 4: A learning router

```
mininet@mininet-vm:~$ mv 461_mininet/pox/part4controller.py /home/mininet/
pox/pox/misc
mininet@mininet-vm:~$ 
mininet@mininet-vm:~$ sudo ~/pox/pox.py misc.part4controller
POX 0.7.0 (gar) / Copyright 2011-2020 James McCauley, et al.
WARNING:version:Support for Python 3 is experimental.
INFO:core:POX 0.7.0 (gar) is up.
```

Hình 16: Chuyển file sang misc rồi chạy pox và topo

```
mininet> pingall
*** Ping: testing ping reachability
h10 -> X X X X
h20 -> h10 X X X
h30 -> h10 h20 X X
hnotrust1 -> X X X X
serv1 -> h10 h20 h30 X
*** Results: 70% dropped (6/20 received)
mininet> pingall
*** Ping: testing ping reachability
h10 -> h20 h30 X serv1
h20 -> h10 h30 X serv1
h30 -> h10 h20 X serv1
hnotrust1 -> X X X X
serv1 -> h10 h20 h30 X
*** Results: 40% dropped (12/20 received)
```

Hình 17: Kết quả chạy pingall (chặn hnotrust1)

```
mininet> iperf hnotrust1 h10
*** Iperf: testing TCP bandwidth between hnotrust1 and h10
*** Results: ['19.5 Gbits/sec', '19.5 Gbits/sec']
mininet> iperf h10 serv1
*** Iperf: testing TCP bandwidth between h10 and serv1
*** Results: ['17.1 Gbits/sec', '17.2 Gbits/sec']
```

Hình 18: Kết quả khi chạy iperf theo yêu cầu đề bài

```
mininet> dpctl dump-flows
*** cores21 -----
cookie=0x0, duration=410.411s, table=0, n_packets=4, n_bytes=392, priority=1,ip,nw_src=172.16.10.100,nw_dst=10.0.4.10 actions=drop
cookie=0x0, duration=410.411s, table=0, n_packets=9, n_bytes=882, priority=1,icmp,nw_src=172.16.10.100 actions=drop
cookie=0x0, duration=225.499s, table=0, n_packets=1, n_bytes=98, priority=0,ip,nw_dst=10.0.3.30 actions=mod_dl_dst:00:00:00:00:00:03,output:"cores21-eth3"
cookie=0x0, duration=215.515s, table=0, n_packets=43274, n_bytes=2856840, priority=0,ip,nw_dst=172.16.10.100 actions=mod_dl_dst:00:00:00:00:00:05,output:"cores21-eth5"
cookie=0x0, duration=185.563s, table=0, n_packets=0, n_bytes=0, priority=0,ip,nw_dst=10.0.2.20 actions=mod_dl_dst:00:00:00:00:00:02,output:"cores21-eth2"
cookie=0x0, duration=52.189s, table=0, n_packets=264518, n_bytes=1070600044, priority=0,ip,nw_dst=10.0.1.10 actions=mod_dl_dst:00:00:00:00:00:01,output:"cores21-eth1"
cookie=0x0, duration=41.693s, table=0, n_packets=15712, n_bytes=687395896, priority=0,ip,nw_dst=10.0.4.10 actions=mod_dl_dst:00:00:00:00:00:04,output:"cores21-eth4"
*** dcs31 -----
cookie=0x0, duration=410.403s, table=0, n_packets=493277, n_bytes=10815719130, actions=FL00D
*** s1 -----
cookie=0x0, duration=410.418s, table=0, n_packets=745928, n_bytes=23046651644, actions=FL00D
*** s2 -----
cookie=0x0, duration=410.411s, table=0, n_packets=28, n_bytes=2408, actions=FL00D
*** s3 -----
cookie=0x0, duration=410.426s, table=0, n_packets=27, n_bytes=2310, actions=FL00D
```

Hình 19: Tất cả rules đã cài đặt trên switches

## Tài liệu

- [1] Slide bài giảng môn Mạng máy tính nâng cao
- [2] Báo cáo project 2: SDN (Trần Nam Tuấn, Nguyễn Thiện Khánh)