

BÁO CÁO THỰC HÀNH

Môn học: Công nghệ mạng khả lập trình

Buổi báo cáo: Lab 01

Tên chủ đề: Xây dựng mô mạng phẳng mạng SDN bằng Mininet

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THÔNG TIN CHUNG:

Lớp: NT541.Q11.2

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1. ĐÁNH GIÁ KHÁC:

Nội dung	Kết quả
Tổng thời gian thực hiện bài thực hành trung bình	1 ngày
Link Video thực hiện (nếu có)	
Ý kiến (nếu có) + Khó khăn + Đề xuất ...	
Điểm tự đánh giá	10

Phần bên dưới của báo cáo này là báo cáo chi tiết của nhóm thực hiện.

BÁO CÁO CHI TIẾT

1. Cài đặt Mininet

- Tải mã nguồn Mininet từ GitHub

```
khanhle@ubuntu:~$ git clone https://github.com/mininet/mininet.git
Cloning into 'mininet'...
remote: Enumerating objects: 10388, done.
remote: Counting objects: 100% (128/128), done.
remote: Compressing objects: 100% (59/59), done.
remote: Total 10388 (delta 102), reused 69 (delta 69), pack-reused 10260 (from 3)
Receiving objects: 100% (10388/10388), 3.36 MiB | 4.81 MiB/s, done.
Resolving deltas: 100% (6906/6906), done.
khanhle@ubuntu:~$
```

- Chạy script cài đặt Mininet. Lúc này mininet đã cài đặt thành công

```
khanhle@ubuntu:~$ mininet/util/install.sh -a
Detected Linux distribution: Ubuntu 20.04 focal amd64
sys.version_info(major=2, minor=7, micro=18, releaselevel='final', serial=0)
Detected Python (python) version 2
Installing all packages except for -eix (doxypy, ivs, nox-classic)...
Install Mininet-compatible kernel if necessary
[sudo] password for khanhle:
Get:1 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]
Get:3 http://ppa.launchpad.net/sumo/stable/ubuntu focal InRelease [18.3 kB]
Hit:4 http://download.opensuse.org/repositories/devel:/kubic:/libcontainers:/stable:/cri-o:/1.28/xUbuntu_20.04 InRelease
Hit:5 http://us.archive.ubuntu.com/ubuntu focal InRelease
Get:6 http://security.ubuntu.com/ubuntu focal-security InRelease [128 kB]
Ign:2 https://packages.cloud.google.com/apt kubernetes-xenial InRelease
Get:7 http://us.archive.ubuntu.com/ubuntu focal-updates InRelease [128 kB]
Err:8 https://packages.cloud.google.com/apt kubernetes-xenial Release
404 Not Found [IP: 142.250.71.238 443]
Hit:9 https://repo.zabbix.com/zabbix/7.2/release/ubuntu focal InRelease
Get:10 https://download.opensuse.org/repositories/devel:/kubic:/libcontainers:/stable/xUbuntu_20.04 InRelease [1,642 B]
Get:11 http://ppa.launchpad.net/sumo/stable/ubuntu focal/main amd64 Packages [952 B]
Get:12 https://repo.zabbix.com/zabbix-tools/debian-ubuntu focal InRelease [2,476 B]
```

```
khanh@ubuntu:~$ sudo mn
[sudo] password for khanh:
*** 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>
```

2. Tạo mạng OpenFlow bằng Mininet

- Tạo file topo.py để định nghĩa topology

```
1  from mininet.topo import Topo
2  class MyTopo(Topo):
3      def build(self):
4          # Add hosts and switches
5          h1 = self.addHost('h1')
6          h2 = self.addHost('h2')
7          h3 = self.addHost('h3')
8          h4 = self.addHost('h4')
9
10         s1 = self.addSwitch('s1')
11         s2 = self.addSwitch('s2')
12         s3 = self.addSwitch('s3')
13         s4 = self.addSwitch('s4')
14
15         # Add links
16         self.addLink(h1, s1)
17         self.addLink(h2, s2)
18         self.addLink(h3, s3)
19         self.addLink(h4, s4)
20
21         self.addLink(s1, s2)
22         self.addLink(s1, s3)
23         self.addLink(s1, s4)
24  topos = {'mytopo': (lambda: MyTopo())}
```



- Mở terminal và chạy lệnh “*sudo mn --custom topo.py --topo mytopo --controller=ovsc*” tại thư mục đang lưu file trên. Lúc này thành công tạo topo với Mininet

```
khanh@ubuntu:~/nt541/lab1$ sudo mn --custom topo.py --topo mytopo --controller=ovsc
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4
*** Adding switches:
s1 s2 s3 s4
*** Adding links:
(h1, s1) (h2, s2) (h3, s3) (h4, s4) (s1, s2) (s1, s3) (s1, s4)
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
c0
*** Starting 4 switches
s1 s2 s3 s4 ...
*** Starting CLI:
mininet>
```

3. Kiểm tra mạng tạo ra

3.1. Kiểm tra kết nối

- Dùng các lệnh kiểm tra kết nối mạng.

```
mininet> net
h1 h1-eth0:s1-eth1
h2 h2-eth0:s2-eth1
h3 h3-eth0:s3-eth1
h4 h4-eth0:s4-eth1
s1 lo: s1-eth1:h1-eth0 s1-eth2:s2-eth2
s2 lo: s2-eth1:h2-eth0 s2-eth2:s1-eth2 s2-eth3:s3-eth2
s3 lo: s3-eth1:h3-eth0 s3-eth2:s2-eth3 s3-eth3:s4-eth2
s4 lo: s4-eth1:h4-eth0 s4-eth2:s3-eth3
c0
```

```
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=28104>
<Host h2: h2-eth0:10.0.0.2 pid=28106>
<Host h3: h3-eth0:10.0.0.3 pid=28108>
<Host h4: h4-eth0:10.0.0.4 pid=28110>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=28115>
<OVSSwitch s2: lo:127.0.0.1,s2-eth1:None,s2-eth2:None,s2-eth3:None pid=28118>
<OVSSwitch s3: lo:127.0.0.1,s3-eth1:None,s3-eth2:None,s3-eth3:None pid=28121>
<OVSSwitch s4: lo:127.0.0.1,s4-eth1:None,s4-eth2:None pid=28124>
<RemoteController c0: 127.0.0.1:6653 pid=28098>
```

- Kiểm tra kết nối với ping.
 - o h1 ping h2

```
mininet> h1 ping 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=5.38 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.667 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.140 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.106 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.145 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.064 ms
^C
--- 10.0.0.2 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5089ms
rtt min/avg/max/mdev = 0.064/1.083/5.380/1.932 ms
```

- h3 ping h4

```
mininet> h3 ping h4
PING 10.0.0.4 (10.0.0.4) 56(84) bytes of data.
64 bytes from 10.0.0.4: icmp_seq=1 ttl=64 time=6.26 ms
64 bytes from 10.0.0.4: icmp_seq=2 ttl=64 time=0.437 ms
64 bytes from 10.0.0.4: icmp_seq=3 ttl=64 time=0.087 ms
64 bytes from 10.0.0.4: icmp_seq=4 ttl=64 time=0.080 ms
64 bytes from 10.0.0.4: icmp_seq=5 ttl=64 time=0.080 ms
64 bytes from 10.0.0.4: icmp_seq=6 ttl=64 time=0.085 ms
^C
--- 10.0.0.4 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5079ms
rtt min/avg/max/mdev = 0.080/1.171/6.258/2.278 ms
```

- Kiểm tra kết nối với iperf với h1 làm server và h2, h3, h4 là các client. Thấy rằng kết nối thành công.

```
mininet> h1 iperf -s &
mininet> h2 iperf -c h1
-----
Client connecting to 10.0.0.1, TCP port 5001
TCP window size: 1.96 MByte (default)
-----
[ 3] local 10.0.0.2 port 41176 connected with 10.0.0.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 3] 0.0-10.0 sec  28.2 GBytes 24.3 Gbits/sec
mininet> h3 iperf -c h1
-----
Client connecting to 10.0.0.1, TCP port 5001
TCP window size: 3.54 MByte (default)
-----
[ 3] local 10.0.0.3 port 36406 connected with 10.0.0.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 3] 0.0-10.0 sec  25.6 GBytes 21.9 Gbits/sec
mininet> h4 iperf -c h1
-----
Client connecting to 10.0.0.1, TCP port 5001
TCP window size: 4.27 MByte (default)
-----
[ 3] local 10.0.0.4 port 39654 connected with 10.0.0.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 3] 0.0-10.0 sec  28.8 GBytes 24.7 Gbits/sec
mininet>
```

3.2. Dùng Wireshark tiến hành bắt các gói tin OpenFlow

3.2.1. Các gói tin bắt được

- OFPT_ECHO_REQUEST và OFPT_ECHO_REPLY: Kiểm tra kết nối giữa controller và switch

1 0.00000000	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
2 0.0009620	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
3 0.0009929	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
4 0.0010168	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
5 0.0011744	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
6 0.0011815	127.0.0.1	127.0.0.1	TCP	68 42470 -- 6653 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=3379093212 TSecr=3379093212
7 0.0013268	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
8 0.0013315	127.0.0.1	127.0.0.1	TCP	68 42510 -- 6653 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=3379093213 TSecr=3379093213
9 0.0013499	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
10 0.0013549	127.0.0.1	127.0.0.1	TCP	68 42502 -- 6653 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=3379093213 TSecr=3379093213
11 0.0013707	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
12 0.0013748	127.0.0.1	127.0.0.1	TCP	68 42486 -- 6653 [ACK] Seq=9 Ack=9 Win=86 Len=0 TSval=3379093213 TSecr=3379093213
13 0.0013282	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
14 0.0020577	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
15 0.0020652	127.0.0.1	127.0.0.1	TCP	68 42470 -- 6653 [ACK] Seq=17 Win=86 Len=0 TSval=3379098213 TSecr=3379098213
16 0.0021405	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
17 0.0021622	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
18 0.0021826	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
19 0.0023651	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
20 0.0023705	127.0.0.1	127.0.0.1	TCP	68 42502 -- 6653 [ACK] Seq=17 Win=86 Len=0 TSval=3379098214 TSecr=3379098214

- OFPT_PACKET_IN và OFPT_PACKET_OUT: Gửi dữ liệu từ switch lên controller khi switch không biết cách xử lý và ngược lại.

684 29.135585...	fe80::dc28:dfff...	ff02::2	OpenFlow	156 Type: OFPT_PACKET_IN
685 29.135976...	fe80::dc28:dfff...	ff02::2	OpenFlow	162 Type: OFPT_PACKET_OUT

- OFPT_HELLO: Thiết lập kết nối ban đầu giữa switch và controller.

162 27.515049	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
264 29.684509...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
270 29.688991...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
275 29.690374...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
280 29.691386...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO

- OFPT_FEATURES_REQUEST và OFPT_FEATURES_REPLY: Cho phép controller lấy thông tin về switch.

284 29.693279...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
287 29.693663...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
290 29.694258...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
293 29.694714...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
296 29.711596...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
297 29.714959...	127.0.0.1	127.0.0.1	OpenFlow	244 Type: OFPT_FEATURES_REPLY
299 29.715938...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
300 29.717625...	127.0.0.1	127.0.0.1	OpenFlow	244 Type: OFPT_FEATURES_REPLY
302 29.718864...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
303 29.720870...	127.0.0.1	127.0.0.1	OpenFlow	292 Type: OFPT_FEATURES_REPLY
305 29.721739...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
306 29.722074...	127.0.0.1	127.0.0.1	OpenFlow	292 Type: OFPT_FEATURES_REPLY

- OFPT_PORT_STATUS: Switch gửi thông điệp này tới Controller khi có thay đổi trạng thái cổng (port).

299 29.715938...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
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3.2.2. Thông tin các gói tin

- OFPT_HELLO, OFPT_FEATURES_REQUEST, OFPT_ECHO_REQUEST, OFPT_ECHO_REPLY, OFPT_PORT_STATUS:
 - o Version: Phiên bản của giao thức OpenFlow (1.0)
 - o Type: Loại thông điệp
 - o Length: Độ dài của thông điệp (8), riêng gói tin OFPT_PORT_STATUS có độ dài 64.
 - o Transaction ID: Mã để theo dõi yêu cầu và phản hồi



162	27.515049...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
264	29.684509...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
270	29.688991...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
275	29.690374...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
280	29.691386...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_HELLO
284	29.693279...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
287	29.693663...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
290	29.694250...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
293	29.694714...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
296	29.711596...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
297	29.714959...	127.0.0.1	127.0.0.1	OpenFlow	244 Type: OFPT_FEATURES_REPLY
299	29.715938...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
300	29.717625...	127.0.0.1	127.0.0.1	OpenFlow	244 Type: OFPT_FEATURES_REPLY
302	29.718864...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
303	29.720870...	127.0.0.1	127.0.0.1	OpenFlow	292 Type: OFPT_FEATURES_REPLY
305	29.721739...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS

▶ Frame 162: 76 bytes on wire (608 bits), 76 bytes captured (608 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 6653, Dst Port: 58492, Seq: 1, Ack: 1, Len: 8
 - OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_HELLO (0)
 Length: 8
 Transaction ID: 777930874

284	29.693279...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
287	29.693663...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
290	29.694250...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
293	29.694714...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_FEATURES_REQUEST
296	29.711596...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
297	29.714959...	127.0.0.1	127.0.0.1	OpenFlow	244 Type: OFPT_FEATURES_REPLY
299	29.715938...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
300	29.717625...	127.0.0.1	127.0.0.1	OpenFlow	244 Type: OFPT_FEATURES_REPLY
302	29.718864...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
303	29.720870...	127.0.0.1	127.0.0.1	OpenFlow	292 Type: OFPT_FEATURES_REPLY
305	29.721739...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS

▶ Frame 284: 76 bytes on wire (608 bits), 76 bytes captured (608 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 6653, Dst Port: 58498, Seq: 9, Ack: 9, Len: 8
 - OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_FEATURES_REQUEST (5)
 Length: 8
 Transaction ID: 389645511

2384	77.030180...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
2385	77.030292...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
2386	77.030982...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2388	77.031085...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2390	77.350204...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
2391	77.350722...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2394	77.857508...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
2395	77.857932...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2401	82.032658...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST

▶ Frame 2384: 76 bytes on wire (608 bits), 76 bytes captured (608 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 58522, Dst Port: 6653, Seq: 11323, Ack: 11529, Len: 8
 - OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_ECHO_REQUEST (2)
 Length: 8
 Transaction ID: 0

2386	77.030982...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2388	77.031085...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2390	77.350204...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
2391	77.350722...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2394	77.857508...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST
2395	77.857932...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REPLY
2401	82.032658...	127.0.0.1	127.0.0.1	OpenFlow	76 Type: OFPT_ECHO_REQUEST

▶ Frame 2386: 76 bytes on wire (608 bits), 76 bytes captured (608 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 6653, Dst Port: 58524, Seq: 11529, Ack: 11331, Len: 8
 - OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_ECHO_REPLY (3)
 Length: 8
 Transaction ID: 0

305 29.721739...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
306 29.722074...	127.0.0.1	127.0.0.1	OpenFlow	292 Type: OFPT_FEATURES_REPLY
312 29.889174...	::	ff02::1:ff5b:b6...	OpenFlow	172 Type: OFPT_PACKET_IN
313 29.890174...	::	ff02::1:ff5b:b6...	OpenFlow	178 Type: OFPT_PACKET_OUT
317 29.890438...	::	ff02::1:ff5b:b6...	OpenFlow	172 Type: OFPT_PACKET_IN
318 29.890961...	::	ff02::1:ff5b:b6...	OpenFlow	178 Type: OFPT_PACKET_OUT
322 29.891208...	::	ff02::1:ff5b:b6...	OpenFlow	172 Type: OFPT_PACKET_IN

▶ Frame 305: 132 bytes on wire (1056 bits), 132 bytes captured (1056 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 58524, Dst Port: 6653, Seq: 9, Ack: 17, Len: 64
 ▶ OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 ▶ Type: OFPT_PORT_STATUS (12)
 Length: 64
 Transaction ID: 0

- OFPT_FEATURES_REPLY: Có các trường thông tin về switch
 - N_tables: Số flow table mà switch hỗ trợ
 - Capabilities: Các khả năng mà switch hỗ trợ
 - Actions: Các hành động mà switch hỗ trợ
 - Port: Thông tin các port của switch

303 29.720870...	127.0.0.1	127.0.0.1	OpenFlow	292 Type: OFPT_FEATURES_REPLY
305 29.721739...	127.0.0.1	127.0.0.1	OpenFlow	132 Type: OFPT_PORT_STATUS
306 29.722074...	127.0.0.1	127.0.0.1	OpenFlow	292 Type: OFPT_FEATURES_REPLY
312 29.889174...	::	ff02::1:ff5b:b6...	OpenFlow	172 Type: OFPT_PACKET_IN
313 29.890174...	::	ff02::1:ff5b:b6...	OpenFlow	178 Type: OFPT_PACKET_OUT
317 29.890438...	::	ff02::1:ff5b:b6...	OpenFlow	172 Type: OFPT_PACKET_IN
318 29.890961...	::	ff02::1:ff5b:b6...	OpenFlow	178 Type: OFPT_PACKET_OUT
322 29.891208...	::	ff02::1:ff5b:b6...	OpenFlow	172 Type: OFPT_PACKET_IN
323 29.891497...	::	ff02::1:ff5b:b6...	OpenFlow	178 Type: OFPT_PACKET_OUT
331 29.953532...	fe80::7486:baff...	ff02::16	OpenFlow	176 Type: OFPT_PACKET_IN
332 29.954410...	fe80::7486:baff...	ff02::16	OpenFlow	182 Type: OFPT_PACKET_OUT
338 29.954797...	fe80::7486:baff...	ff02::16	OpenFlow	176 Type: OFPT_PACKET_IN
339 29.954822...	fe80::7486:baff...	ff02::16	OpenFlow	176 Type: OFPT_PACKET_IN
340 29.955271...	fe80::7486:baff...	ff02::16	OpenFlow	182 Type: OFPT_PACKET_OUT
342 29.955297...	fe80::7486:baff...	ff02::16	OpenFlow	182 Type: OFPT_PACKET_OUT
348 29.955562...	fe80::7486:baff...	ff02::16	OpenFlow	176 Type: OFPT_PACKET_IN
349 29.955913...	fe80::7486:baff...	ff02::16	OpenFlow	182 Type: OFPT_PACKET_OUT
356 30.049566...	::	ff02::16	OpenFlow	176 Type: OFPT_PACKET_IN
357 30.050503...	::	ff02::16	OpenFlow	182 Type: OFPT_PACKET_OUT
373 30.208921...	::	ff02::1:ff43:12...	OpenFlow	172 Type: OFPT_PACKET_IN

▶ Frame 303: 292 bytes on wire (2336 bits), 292 bytes captured (2336 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 58522, Dst Port: 6653, Seq: 73, Ack: 17, Len: 224
 ▶ OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_FEATURES_REPLY (6)
 Length: 224
 Transaction ID: 3199340078
 ▶ Datapath unique ID: 0x0000000000000003
 n_buffers: 0
 n_tables: 254
 Pad: 000000
 ▶ capabilities: 0x000000c7
 1 = Flow statistics: True
 1 = Table statistics: True
 1 = Port statistics: True
 0... = Group statistics: False
 0... = Can reassemble IP fragments: False
 1... = Queue statistics: True
 0... = Switch will block looping ports: False
 ▶ actions: 0x00000fff
 1 = Output to switch port: True
 1 = Set the 802.1q VLAN id: True
 1... = Set the 802.1q priority: True
 1... = Strip the 802.1q header: True
 1... = Ethernet source address: True
 1... = Ethernet destination address: True
 1... = IP source address: True
 1... = IP destination address: True
 1... = IP ToS (DSCP field, 6 bits): True
 1... = TCP/UDP source port: True
 1... = TCP/UDP destination port: True
 1... = Output to queue: True
 ▶ Port data 1
 ▶ Port data 2

- OFPT_PACKET_IN:
 - In port: Cổng mà switch nhận gói tin.
 - Reason: Lý do gói tin không được xử lý bởi flow rule trong flow table của switch.

322	29.891208...	::	ff02::1:ff5b:b6...	OpenFlow	172	Type: OFPT_PACKET_IN
323	29.891497...	::	ff02::1:ff5b:b6...	OpenFlow	178	Type: OFPT_PACKET_OUT
331	29.953532...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
332	29.954410...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
338	29.954797...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
339	29.954822...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
340	29.955271...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
342	29.955297...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
348	29.955562...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
349	29.955913...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
356	30.049566...	::	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
357	30.050503...	::	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
373	30.208921...	::	ff02::1:ff43:12...	OpenFlow	172	Type: OFPT_PACKET_IN

▶ Frame 322: 172 bytes on wire (1376 bits), 172 bytes captured (1376 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 58510, Dst Port: 6653, Seq: 249, Ack: 17, Len: 104
 ▶ OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_PACKET_IN (10)
 Length: 104
 Transaction ID: 0
 Buffer Id: 0xffffffff
 Total length: 86
 In port: 2
 Reason: No matching flow (table-miss flow entry) (0)
 Pad: 00
 ▶ Ethernet II, Src: 96:4b:71:5b:b6:bc (96:4b:71:5b:b6:bc), Dst: IPv6mcast_ff:5b:b6:bc (33:33:ff:5b:b6:bc)
 ▶ Internet Protocol Version 6, Src: ::, Dst: ff02::1:ff5b:b6bc
 ▶ Internet Control Message Protocol v6

- OFPT_PACKET_OUT:
 - Action type: Hành động thực hiện với gói tin
 - Output port: Cổng mà switch sẽ gửi gói tin đến
 - Max length: Độ dài tối đa

323	29.891497...	::	ff02::1:ff5b:b6...	OpenFlow	178	Type: OFPT_PACKET_OUT
331	29.953532...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
332	29.954410...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
338	29.954797...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
339	29.954822...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
340	29.955271...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
342	29.955297...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
348	29.955562...	fe80::7486:baff...	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
349	29.955913...	fe80::7486:baff...	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
356	30.049566...	::	ff02::16	OpenFlow	176	Type: OFPT_PACKET_IN
357	30.050503...	::	ff02::16	OpenFlow	182	Type: OFPT_PACKET_OUT
373	30.208921...	::	ff02::1:ff43:12...	OpenFlow	172	Type: OFPT_PACKET_IN

▶ Frame 323: 178 bytes on wire (1424 bits), 178 bytes captured (1424 bits) on interface any, id 0
 ▶ Linux cooked capture
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 6653, Dst Port: 58510, Seq: 17, Ack: 353, Len: 110
 ▶ OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_PACKET_OUT (13)
 Length: 110
 Transaction ID: 2876622058
 Buffer Id: 0xffffffff
 In port: 2
 Actions length: 8
 Actions type: Output to switch port (0)
 Action length: 8
 Output port: 65531
 Max length: 65509
 ▶ Ethernet II, Src: 96:4b:71:5b:b6:bc (96:4b:71:5b:b6:bc), Dst: IPv6mcast_ff:5b:b6:bc (33:33:ff:5b:b6:bc)
 ▶ Internet Protocol Version 6, Src: ::, Dst: ff02::1:ff5b:b6bc
 ▶ Internet Control Message Protocol v6

YÊU CẦU CHUNG

1) Đánh giá

- Chuẩn bị tốt các yêu cầu đặt ra trong bài thực hành.
- Sinh viên hiểu và tự thực hiện được bài thực hành, trả lời đầy đủ các yêu cầu đặt ra.
- Nộp báo cáo kết quả chi tiết những đã thực hiện, quan sát thấy và kèm ảnh chụp màn hình kết quả (nếu có); giải thích cho quan sát (nếu có).
- Sinh viên báo cáo kết quả thực hiện và nộp bài.

2) Báo cáo

- File **.PDF** hoặc **.docx**. Tập trung vào nội dung, giải thích.
 - Nội dung trình bày bằng Font chữ **Times New Romans/ hoặc font chữ của mẫu báo cáo này (UTM Avo)– cỡ chữ 13. Canh đều (Justify) cho văn bản. Canh giữa (Center) cho ảnh chụp.**
 - Đặt tên theo định dạng: LabX_MSSV1_MSSV2. (trong đó X là Thứ tự buổi Thực hành).
- Ví dụ: Lab01_21520001_21520002
- Nộp file báo cáo trên theo thời gian đã thống nhất tại courses.uit.edu.vn.

Bài sao chép, trễ, ... sẽ được xử lý tùy mức độ vi phạm.

HẾT