

**LAB 2**  
**CONSTRUCT A SIMPLE NETWORK**



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Group: **M02**

*Submission: an **ID\_NAME\_Lab02.pdf** file describes clearly how did you solve the problem*

**Exercise 0:** change the directory to your home directory

Answer: \$cd

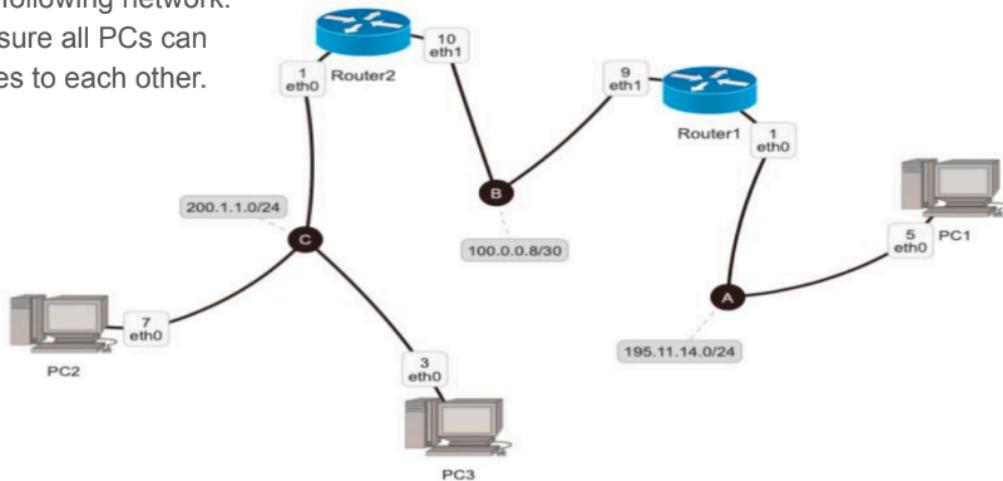
A screenshot of a terminal window titled "Ubuntu20043 [Running] - Oracle VM VirtualBox". The window shows a terminal session with the prompt "lnk@lnk: ~". The user has typed the command "\$ cd" and pressed Enter. The terminal window has a dark theme with a red header bar. To the left of the terminal, there is a dock with icons for the Dash, Home, and Task View, and a desktop environment icon. The desktop background is a purple gradient.

## Exercise 6: Construct the following network

### Exercise 6

Construct the following network.

Please make sure all PCs can send messages to each other.



Answer:

*Creating exercises6 directory*

```
$ mkdir -p ~/CT106H/lab2/exercises6
```

```
$ cd ~/CT106H/lab2/exercises6
```

```
TuongB2206021 [Running] - Oracle VM VirtualBox
Activities Terminal
b2206021@TuongB2206021: ~/CT106H/lab2/exercises6
b2206021@TuongB2206021:~$ mkdir -p ~/CT106H/lab2/exercises6
b2206021@TuongB2206021:~$ cd ~/CT106H/lab2/exercises6
```

*Prepare the lab*

```
$ mkdir pc1 pc2 pc3 r1 r2 shared
```

*// If I want to use wireshark to track*

*the traffic between devices, I have to create an extra **shared** file because if i try to sniff packets and store it into ~/hosthome/\_pcap it will never work somehow (It's an extra file that i want to create for every exercises even if it is used or not)*

```
$ gedit lab.conf
```

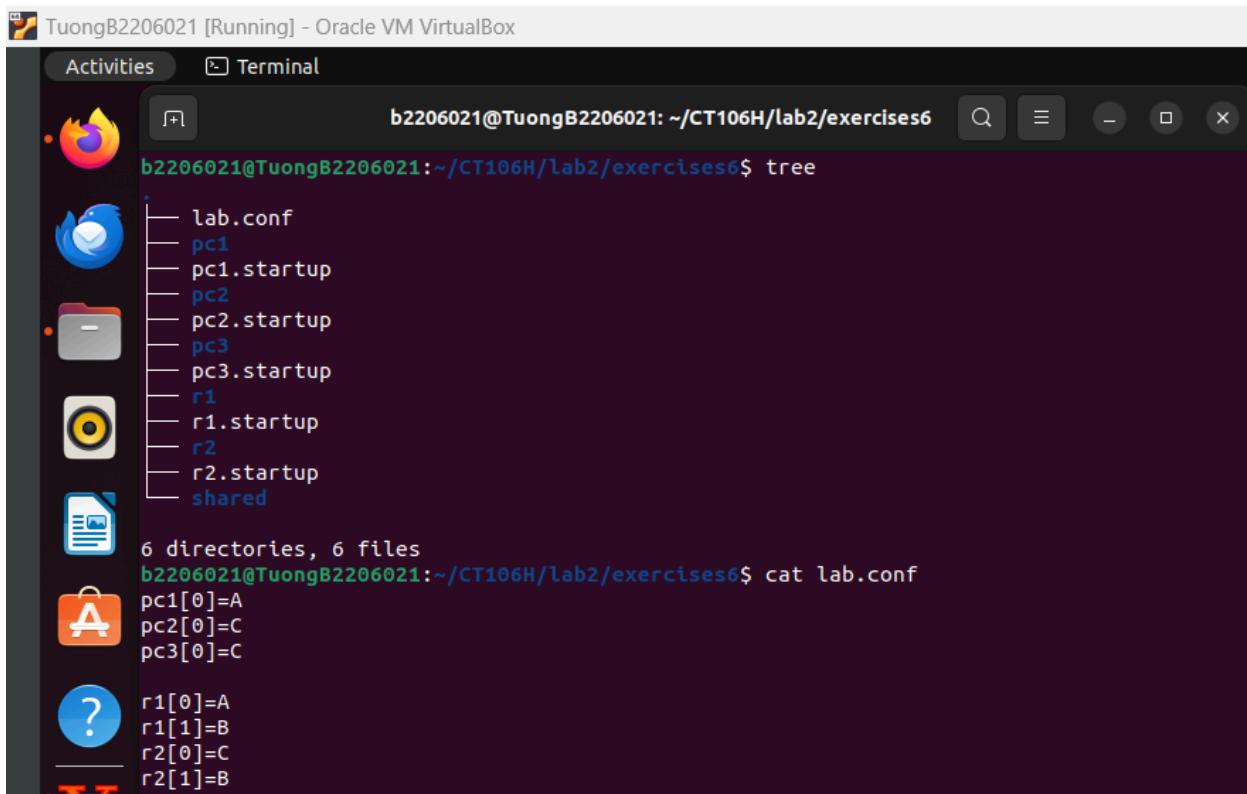
```
$ gedit pc1.startup
```

```
$ gedit pc2.startup
```

```
$ gedit pc3.startup
```

```
$ gedit r1.startup
```

```
$ gedit r2.startup
```



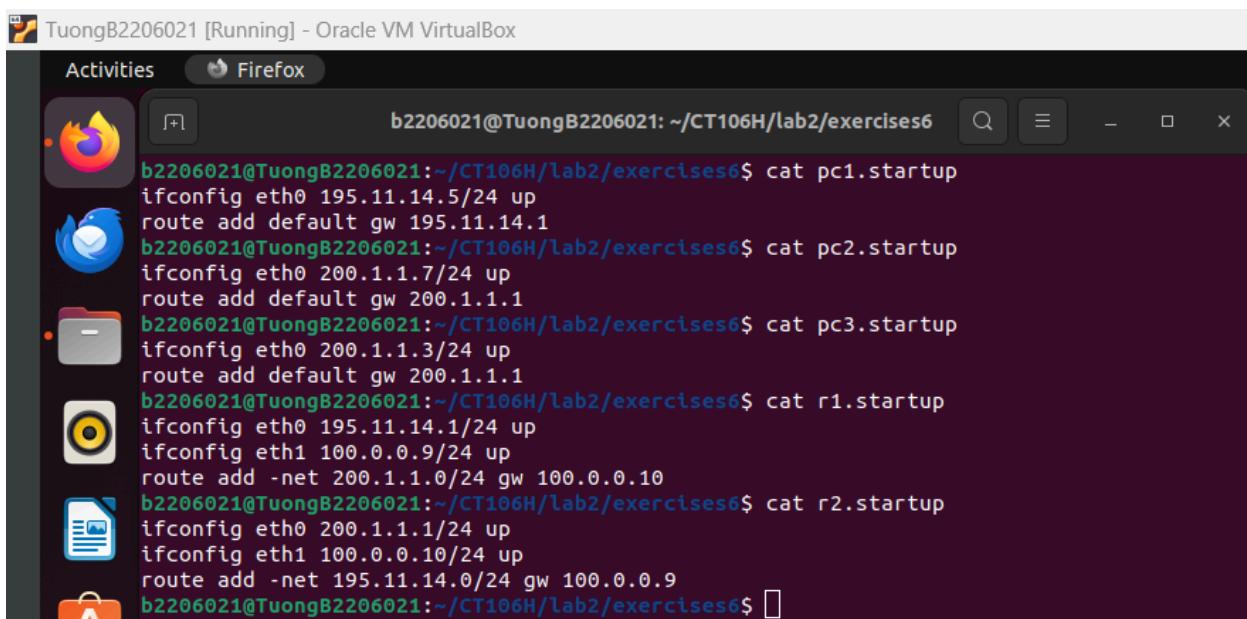
TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── r1
├── r1.startup
├── r2
└── r2.startup
└── shared

6 directories, 6 files
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ cat lab.conf
pc1[0]=A
pc2[0]=C
pc3[0]=C

r1[0]=A
r1[1]=B
r2[0]=C
r2[1]=B
```



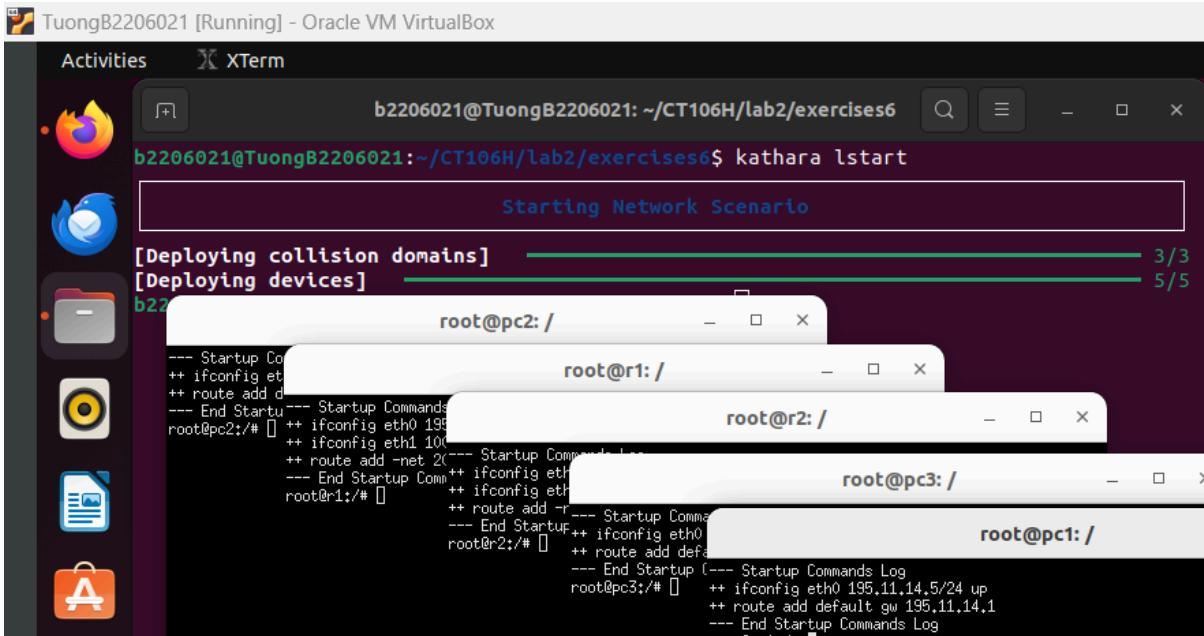
TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Firefox

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ cat pc1.startup
ifconfig eth0 195.11.14.5/24 up
route add default gw 195.11.14.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ cat pc2.startup
ifconfig eth0 200.1.1.7/24 up
route add default gw 200.1.1.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ cat pc3.startup
ifconfig eth0 200.1.1.3/24 up
route add default gw 200.1.1.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ cat r1.startup
ifconfig eth0 195.11.14.1/24 up
ifconfig eth1 100.0.0.9/24 up
route add -net 200.1.1.0/24 gw 100.0.0.10
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ cat r2.startup
ifconfig eth0 200.1.1.1/24 up
ifconfig eth1 100.0.0.10/24 up
route add -net 195.11.14.0/24 gw 100.0.0.9
b2206021@TuongB2206021:~/CT106H/lab2/exercises6$ 
```

## *Start the lab*

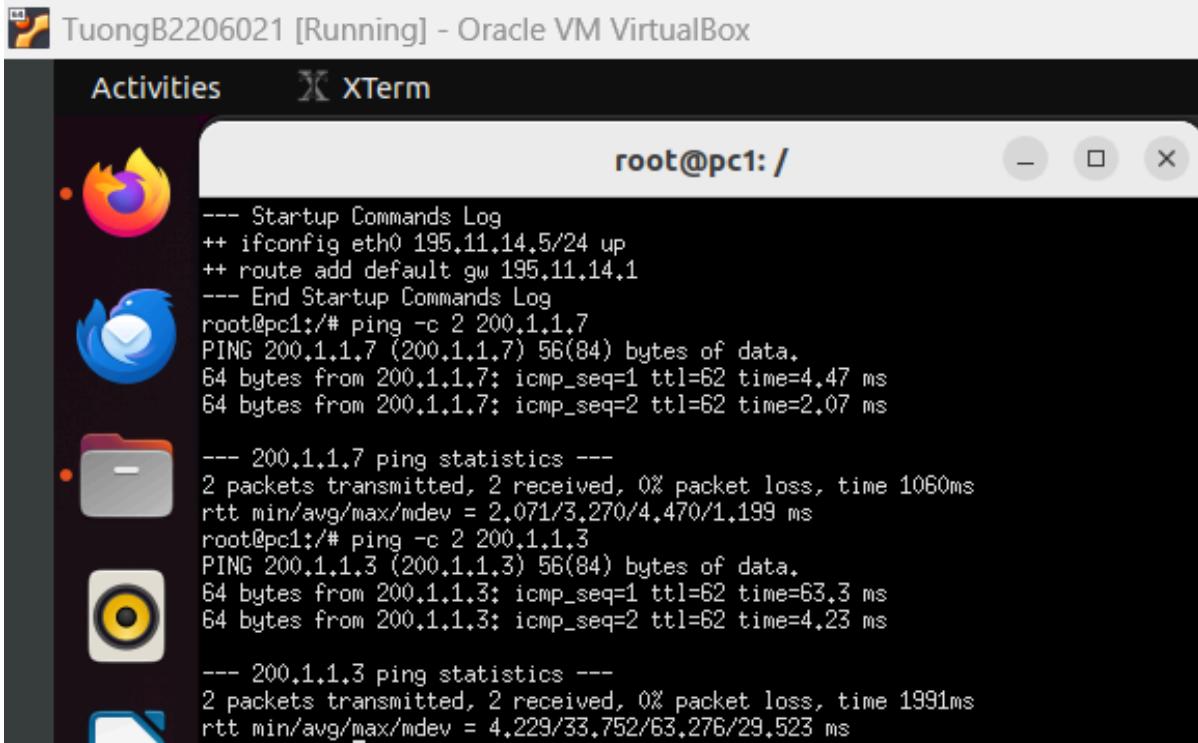
\$ kathara lstart



## *Testing connectivity*

On pc1:

```
# ping -c 2 200.1.1.7 (pc1 ping pc2)
# ping -c 2 200.1.1.3 (pc1 ping pc3)
```



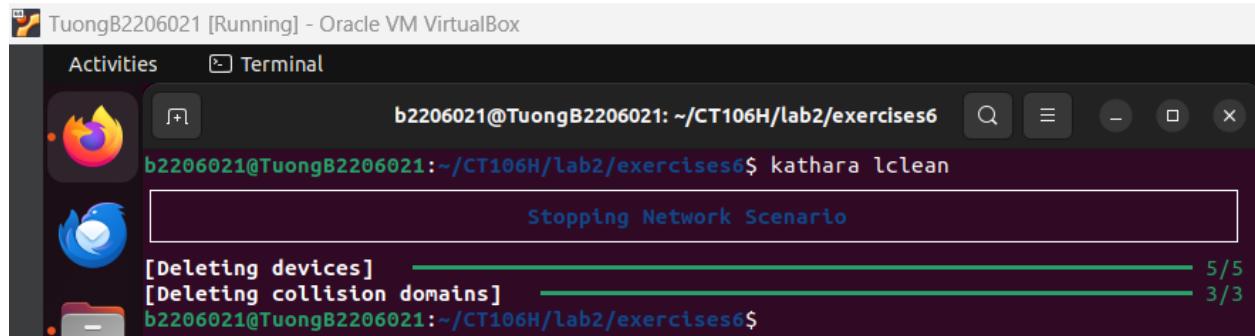
# route -n (On r1 and r2)

```
--- Startup Commands Log
++ ifconfig eth0 195.11.14.1/24 up
++ ifconfig eth1 100.0.0.9/24 up
++ route add -net 200.1.1.0/24 gw 100.0.0.10
--- End Startup Commands Log
root@r1:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref    Use Iface
100.0.0.0       0.0.0.0        255.255.255.0 U     0      0        0 eth1
195.11.14.0     0.0.0.0        255.255.255.0 U     0      0        0 eth0
200.1.1.0       100.0.0.10    255.255.255.0 UG    0      0        0 eth1
root@r1:/# 
```

```
--- Startup Commands Log
++ ifconfig eth0 200.1.1.1/24 up
++ ifconfig eth1 100.0.0.10/24 up
++ route add -net 195.11.14.0/24 gw 100.0.0.9
--- End Startup Commands Log
root@r2:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref    Use Iface
100.0.0.0       0.0.0.0        255.255.255.0 U     0      0        0 eth1
195.11.14.0     100.0.0.9     255.255.255.0 UG    0      0        0 eth1
200.1.1.0       0.0.0.0        255.255.255.0 U     0      0        0 eth0
root@r2:/# 
```

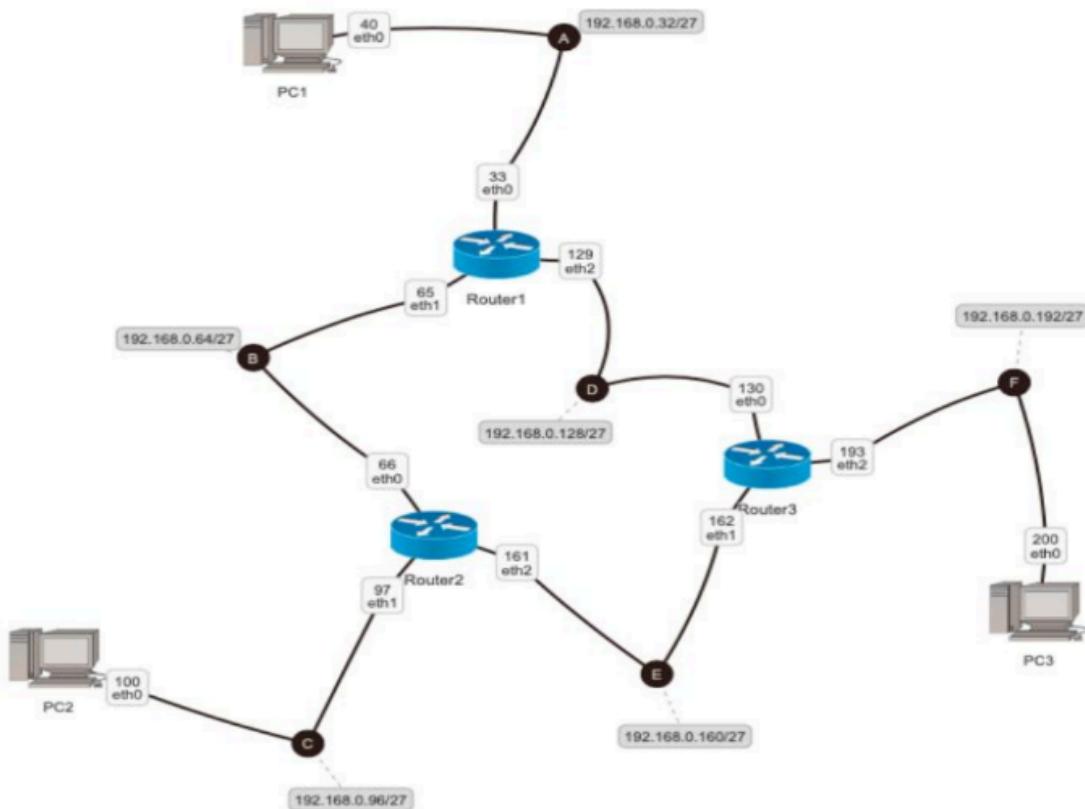
### Clean the lab

\$ kathara lclean



```
TuongB2206021 [Running] - Oracle VM VirtualBox
Activities Terminal
b2206021@TuongB2206021: ~/CT106H/lab2/exercises6$ kathara lclean
Stopping Network Scenario
[Deleting devices] 5/5
[Deleting collision domains] 3/3
b2206021@TuongB2206021: ~/CT106H/lab2/exercises6$
```

### Exercise 7: Construct the following network

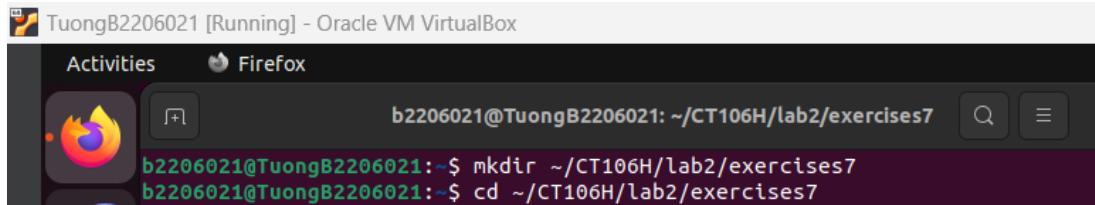


Answer:

*Create exercises7 directory*

```
$ mkdir -p ~/CT106H/lab2/exercises7
```

```
$ cd ~/CT106H/lab2/exercises7
```



```
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ mkdir -p ~/CT106H/lab2/exercises7
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cd ~/CT106H/lab2/exercises7
```

*Prepare the lab*

```
$ mkdir pc1 pc2 pc3 r1 r2 r3 shared
```

```
$ gedit lab.conf
```

```
$ gedit pc1.startup
```

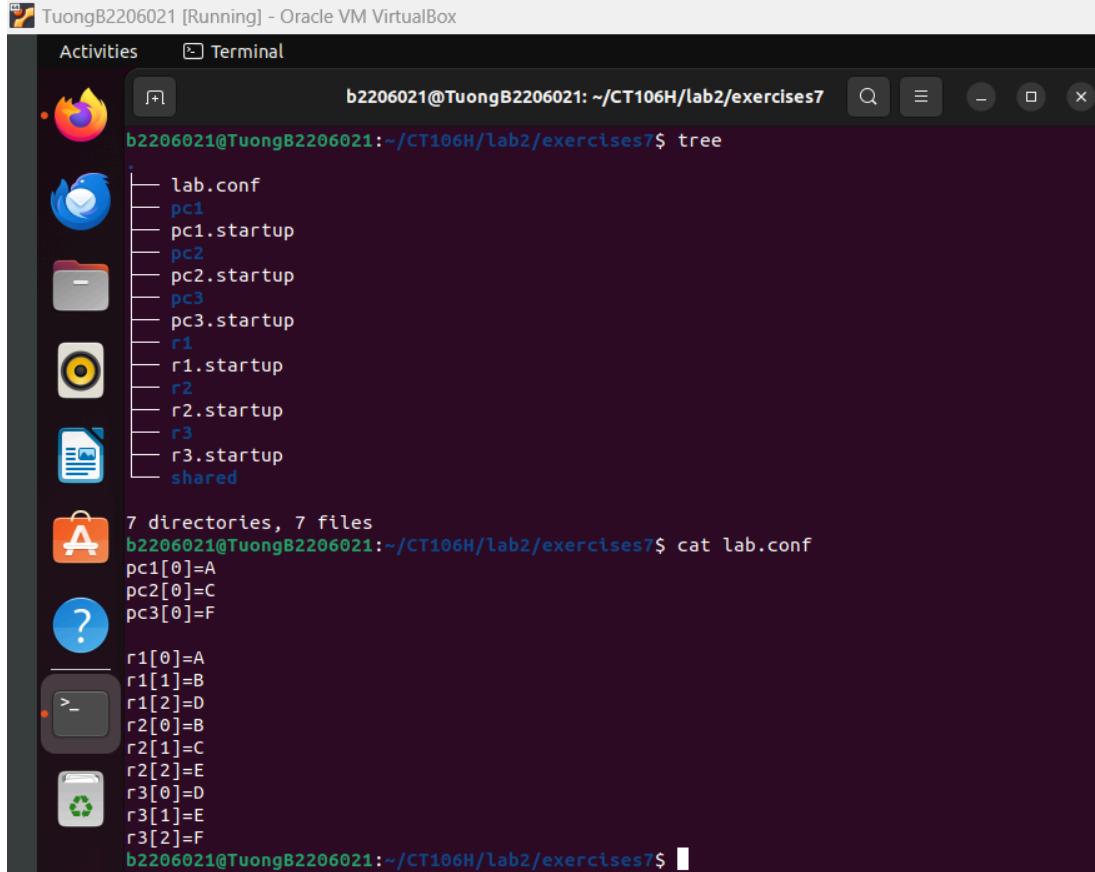
```
$ gedit pc2.startup
```

```
$ gedit pc3.startup
```

```
$ gedit r1.startup
```

```
$ gedit r2.startup
```

```
$ gedit r3.startup
```



```
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ tree
.
├── lab.conf
├── pc1
│   └── pc1.startup
├── pc2
│   └── pc2.startup
├── pc3
│   └── pc3.startup
└── r1
    ├── r1.startup
    ├── r2
    │   └── r2.startup
    └── r3
        └── r3.startup
└── shared

7 directories, 7 files
```

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cat lab.conf
pc1[0]=A
pc2[0]=C
pc3[0]=F
r1[0]=A
r1[1]=B
r1[2]=D
r2[0]=B
r2[1]=C
r2[2]=E
r3[0]=D
r3[1]=E
r3[2]=F
```

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$
```

```

Activities Terminal
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cat pc1.startup
ifconfig eth0 192.168.0.40/27 up
route add default gw 192.168.0.33
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cat pc2.startup
ifconfig eth0 192.168.0.100/27 up
route add default gw 192.168.0.97
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cat pc3.startup
ifconfig eth0 192.168.0.200/27 up
route add default gw 192.168.0.193
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cat r1.startup
ifconfig eth0 192.168.0.33/27 up
ifconfig eth1 192.168.0.65/27 up
ifconfig eth2 192.168.0.129/27 up
route add -net 192.168.0.96/27 gw 192.168.0.66
route add -net 192.168.0.160/27 gw 192.168.0.66
route add -net 192.168.0.192/27 gw 192.168.0.130
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cat r2.startup
ifconfig eth0 192.168.0.66/27 up
ifconfig eth1 192.168.0.97/27 up
ifconfig eth2 192.168.0.161/27 up
route add -net 192.168.0.32/27 gw 192.168.0.65
route add -net 192.168.0.128/27 gw 192.168.0.162
route add -net 192.168.0.192/27 gw 192.168.0.162
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ cat r3.startup
ifconfig eth0 192.168.0.130/27 up
ifconfig eth1 192.168.0.162/27 up
ifconfig eth2 192.168.0.193/27 up
route add -net 192.168.0.32/27 gw 192.168.0.129
route add -net 192.168.0.64/27 gw 192.168.0.129
route add -net 192.168.0.96/27 gw 192.168.0.161
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ 

```

### *Start the lab*

\$ kathara lstart

```

Activities XTerm
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ kathara lstart
Starting Network Scenario
[Deploying collision domains] 6/6
[Deploying devices] 6/6
b2206021@TuongB2206021:~/CT106H/lab2/exercises7$ 
root@pc1: / 
root@pc2: / 
root@pc3: / 
root@r1: / 
root@r2: / 
root@r3: / 

--- Start --- Startup Commands Log
++ ifconfig
++ route add
--- End Start --- Startup Commands Log
root@pc1:# ++ ifconfig
++ route add
--- End Start --- Startup Commands Log
root@pc2:# ++ ifconfig
++ route add
--- End Start --- Startup Commands Log
root@pc3:# ++ ifconfig
++ route add
--- End Start --- Startup Commands Log
root@r1:# ++ ifconfig
++ route add
--- End Start --- Startup Commands Log
root@r2:# ++ ifconfig
++ route add
--- End Start --- Startup Commands Log
root@r3:# ++ ifconfig
++ route add
--- End Start --- Startup Commands Log
root@r3:/# 

```

### Testing connectivity

*On pc1:*

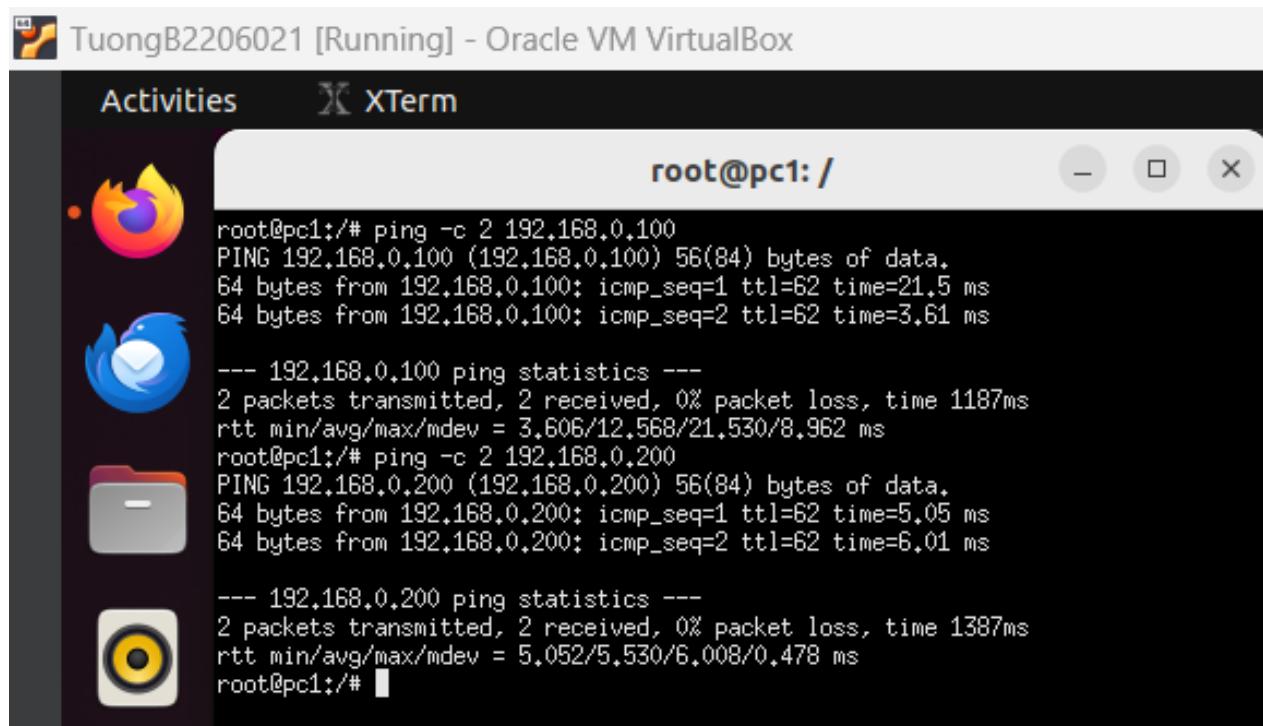
```
# ping -c 2 192.168.0.100 (ping to pc2)
# ping -c 2 192.168.0.200 (ping to pc3)
```

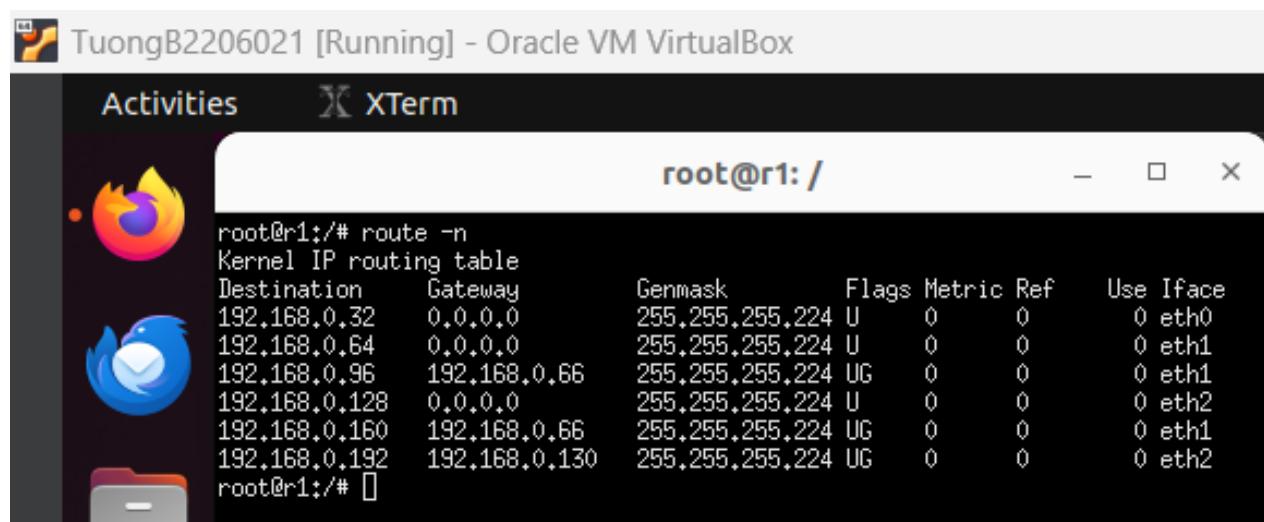
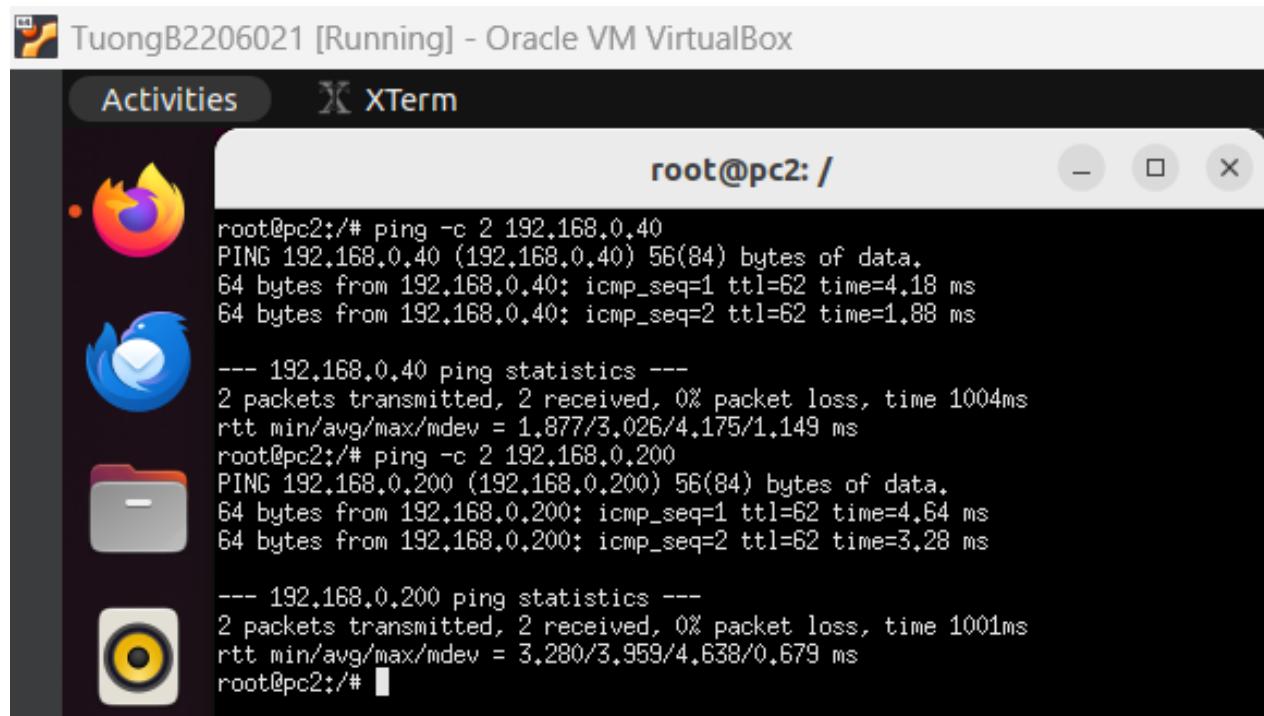
*On pc2:*

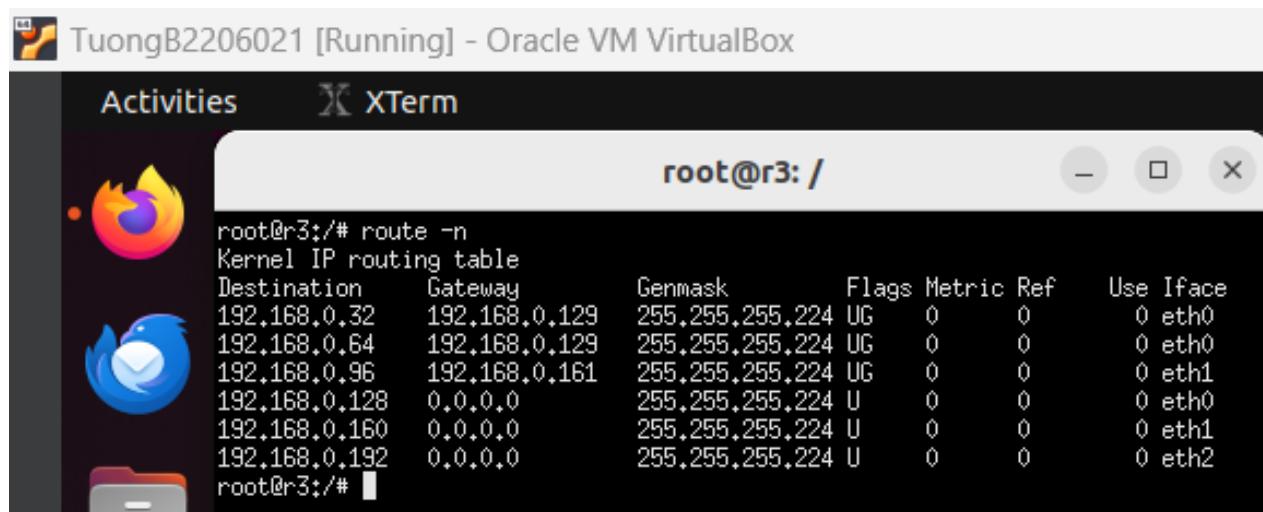
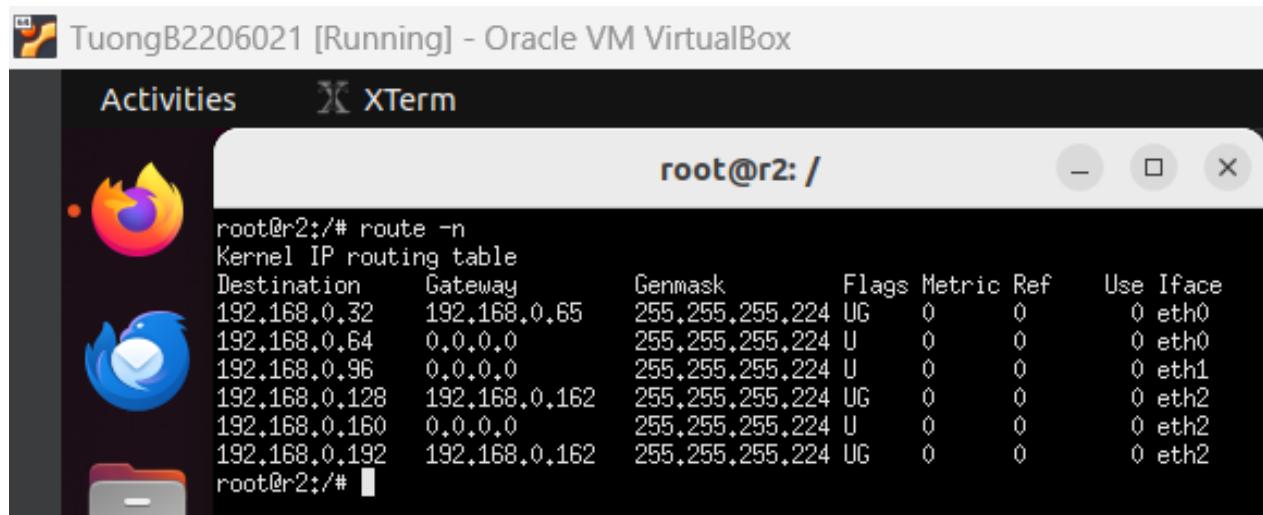
```
# ping -c 2 192.168.0.40 (ping to pc1)
# ping -c 2 192.168.0.200 (ping to pc3)
```

*On router1,2,3: # route -n*

⇒ The network worked successfully

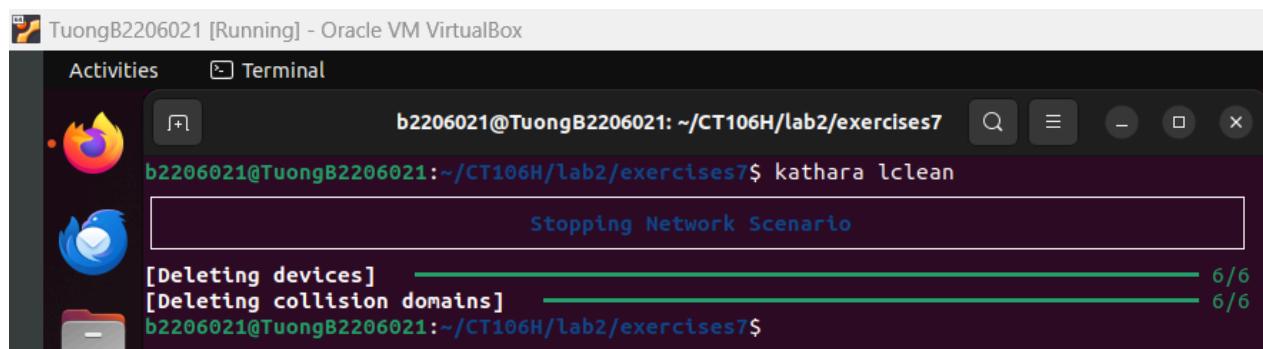




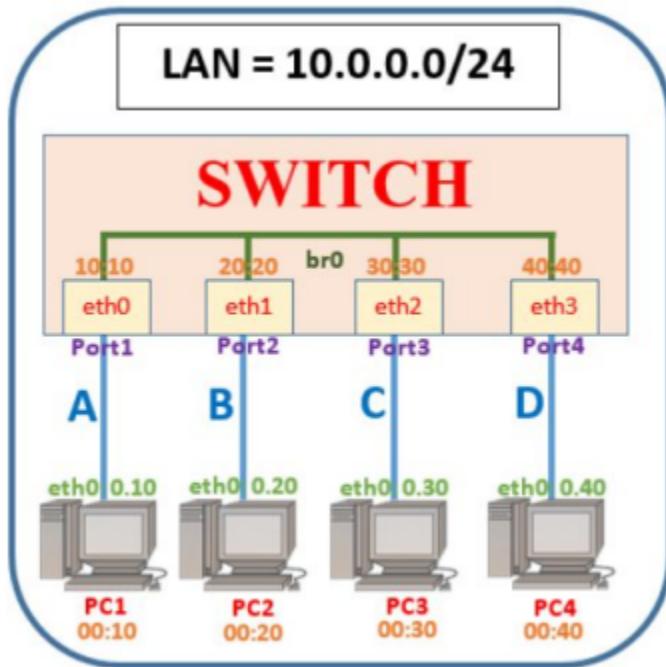


### Clean the lab

\$ kathara lclean



## Exercise 8: Construct the following LAN using a switch



Answer:

*Create exercises8 directory*

```
$ mkdir -p ~/CT106H/lab2/exercises8
```

```
$ cd ~/CT106H/lab2/exercises8
```

A screenshot of a Linux desktop environment showing a terminal window. The title bar says "TuongB2206021 [Running] - Oracle VM VirtualBox". The terminal window shows the command line:

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises8$ mkdir -p ~/CT106H/lab2/exercises8
b2206021@TuongB2206021: ~$ cd ~/CT106H/lab2/exercises8
b2206021@TuongB2206021: ~/CT106H/lab2/exercises8$
```

*Prepare the lab*

```
$ mkdir pc1 pc2 pc3 pc4 sw shared
```

```
$ gedit lab.conf
```

```
$ gedit pc1.startup
```

```
$ gedit pc2.startup
```

```
$ gedit pc3.startup
```

```
$ gedit pc4.startup
```

```
$ gedit sw.startup
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises8$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
└── shared
    └── sw
        └── sw.startup

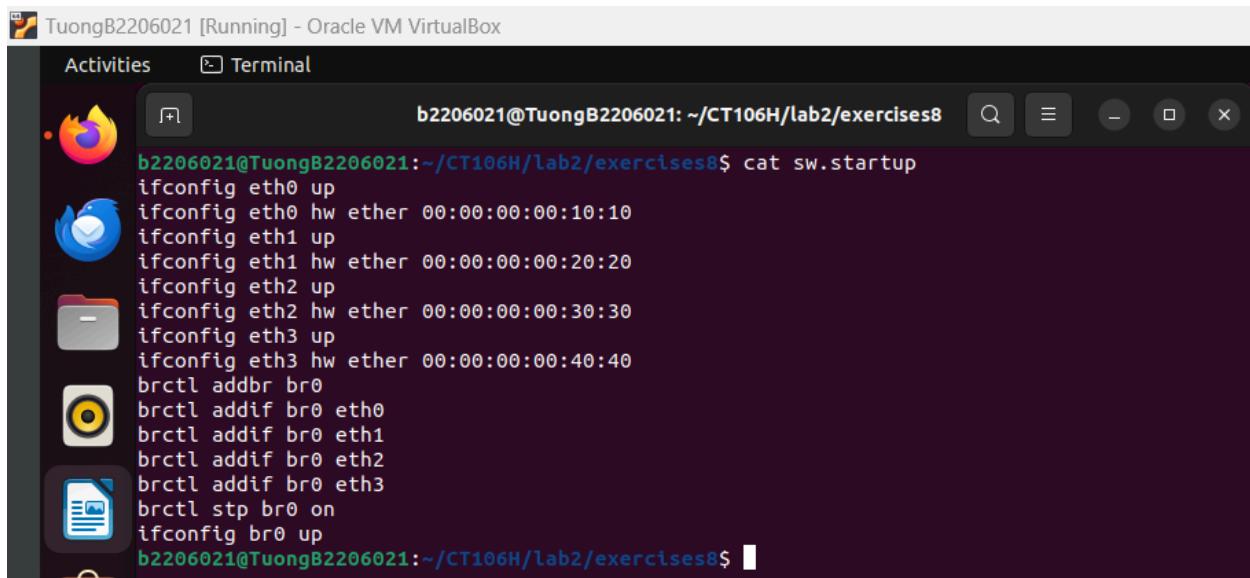
6 directories, 6 files
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$ cat lab.conf
pc1[0]=A
pc2[0]=B
pc3[0]=C
pc4[0]=D

sw[0]=A
sw[1]=B
sw[2]=C
sw[3]=D
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$ cat pc1.startup
ifconfig eth0 10.0.0.10/24 up
ifconfig eth0 hw ether 00:00:00:00:00:10
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$ cat pc2.startup
ifconfig eth0 10.0.0.20/24 up
ifconfig eth0 hw ether 00:00:00:00:00:20
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$ cat pc3.startup
ifconfig eth0 10.0.0.30/24 up
ifconfig eth0 hw ether 00:00:00:00:00:30
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$ cat pc4.startup
ifconfig eth0 10.0.0.40/24 up
ifconfig eth0 hw ether 00:00:00:00:00:40
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$
```

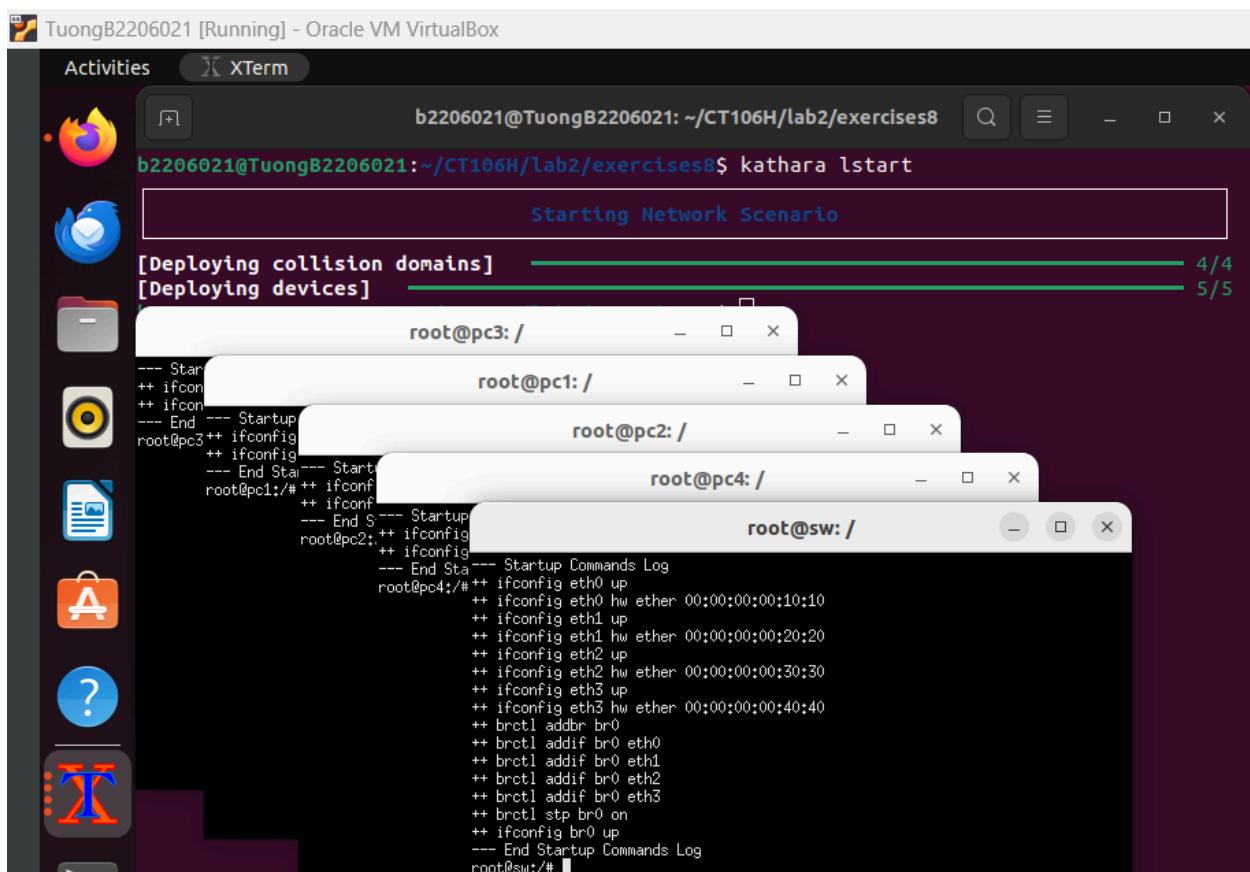


A screenshot of a Linux desktop environment in Oracle VM VirtualBox. The terminal window shows the command `cat sw.startup` being run, displaying a series of networking commands:

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$ cat sw.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:00:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:00:20:20
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:00:30:30
ifconfig eth3 up
ifconfig eth3 hw ether 00:00:00:00:40:40
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl addif br0 eth3
brctl stp br0 on
ifconfig br0 up
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$
```

### Start the lab

\$ kathara lstart

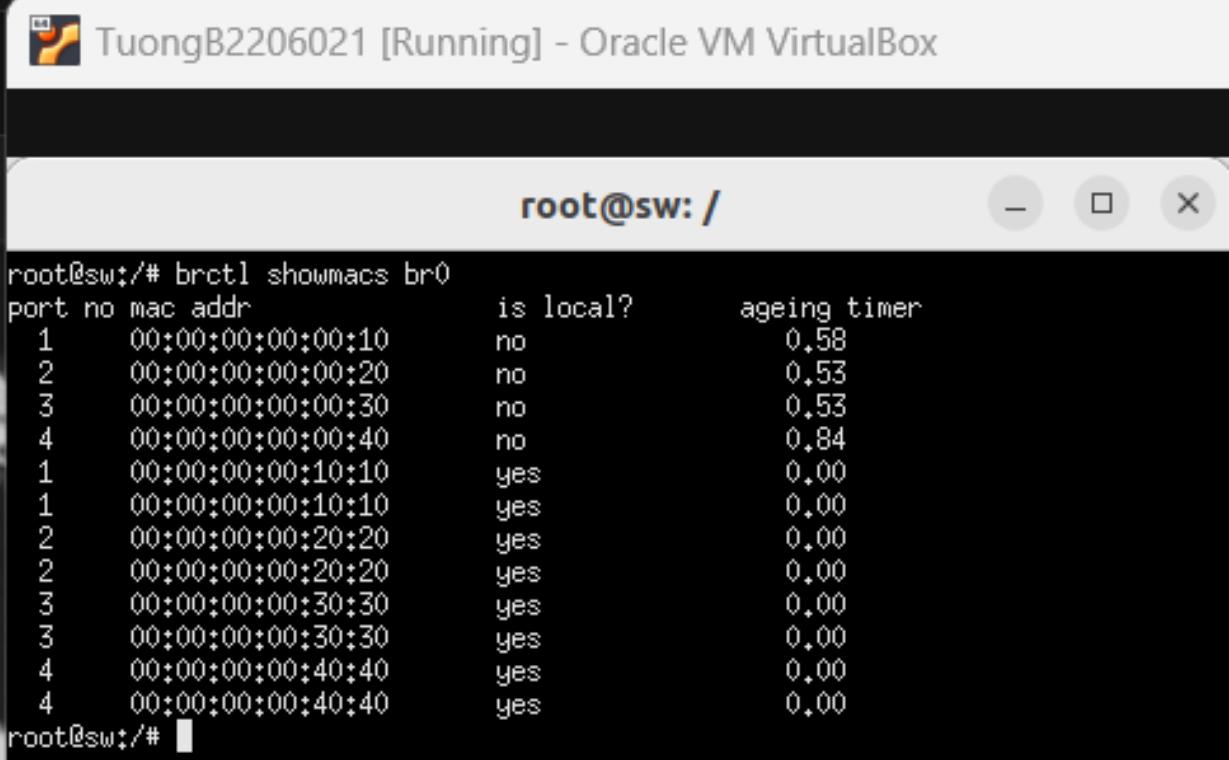


A screenshot of a Linux desktop environment in Oracle VM VirtualBox. Multiple terminal windows are running the command `kathara lstart`. One window shows the progress of the deployment:

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises8$ kathara lstart
Starting Network Scenario
[Deploying collision domains] 4/4
[Deploying devices] 5/5
```

Other windows show the output of the `sw.startup` file being executed on different hosts:

- `root@pc3: /`:  
--- Start ---  
++ ifcon  
++ ifcon  
--- End --- Startup  
root@pc3:++ ifconfig  
++ ifconfig  
--- End S--- Startup  
root@pc1:/#++ ifconfig  
++ ifconfig  
--- End S--- Startup  
root@pc2:/#++ ifconfig  
++ ifconfig  
--- End S--- Startup  
root@pc4:/#++ ifconfig  
++ ifconfig  
--- End Sta--- Startup Commands Log  
root@pc4:/#++ ifconfig eth0 up  
++ ifconfig eth0 hw ether 00:00:00:00:10:10  
++ ifconfig eth1 up  
++ ifconfig eth1 hw ether 00:00:00:00:20:20  
++ ifconfig eth2 up  
++ ifconfig eth2 hw ether 00:00:00:00:30:30  
++ ifconfig eth3 up  
++ ifconfig eth3 hw ether 00:00:00:00:40:40  
++ brctl addbr br0  
++ brctl addif br0 eth0  
++ brctl addif br0 eth1  
++ brctl addif br0 eth2  
++ brctl addif br0 eth3  
++ brctl stp br0 on  
++ ifconfig br0 up  
--- End Startup Commands Log
- `root@sw: /`:  
root@sw:/#



The screenshot shows a terminal window titled "TuongB2206021 [Running] - Oracle VM VirtualBox". The window title bar includes the icon for the virtual machine, the name "TuongB2206021", the status "Running", and the application "Oracle VM VirtualBox". The terminal prompt is "root@sw: /". The command "brctl showmacs br0" is run, and the output is displayed in a table:

port no	mac addr	is local?	ageing timer
1	00:00:00:00:00:10	no	0.58
2	00:00:00:00:00:20	no	0.53
3	00:00:00:00:00:30	no	0.53
4	00:00:00:00:00:40	no	0.84
1	00:00:00:00:10:10	yes	0.00
1	00:00:00:00:10:10	yes	0.00
2	00:00:00:00:20:20	yes	0.00
2	00:00:00:00:20:20	yes	0.00
3	00:00:00:00:30:30	yes	0.00
3	00:00:00:00:30:30	yes	0.00
4	00:00:00:00:40:40	yes	0.00
4	00:00:00:00:40:40	yes	0.00

root@sw:/#

The command **brctl showmacs br0** displays MAC address information for a bridge interface **br0**

- **port no:** This indicates the port number in the bridge interface to which the MAC address is associated. The bridge ports (1 to 4) where devices are connected.
- **mac addr:** This column lists the MAC addresses associated with the bridge interface **br0**. Each MAC address is tied to a specific port
- **is local?:** This indicates whether the MAC address is local to the bridge. "Yes" means that the MAC address belongs to the bridge device itself, while "No" indicates that it is a remote MAC address
- **ageing timer:** This shows the amount of time (in seconds) since the last activity was seen on that MAC address. After the connection test, the ageing timer for each non-local MAC address starts counting down from when the address was last seen

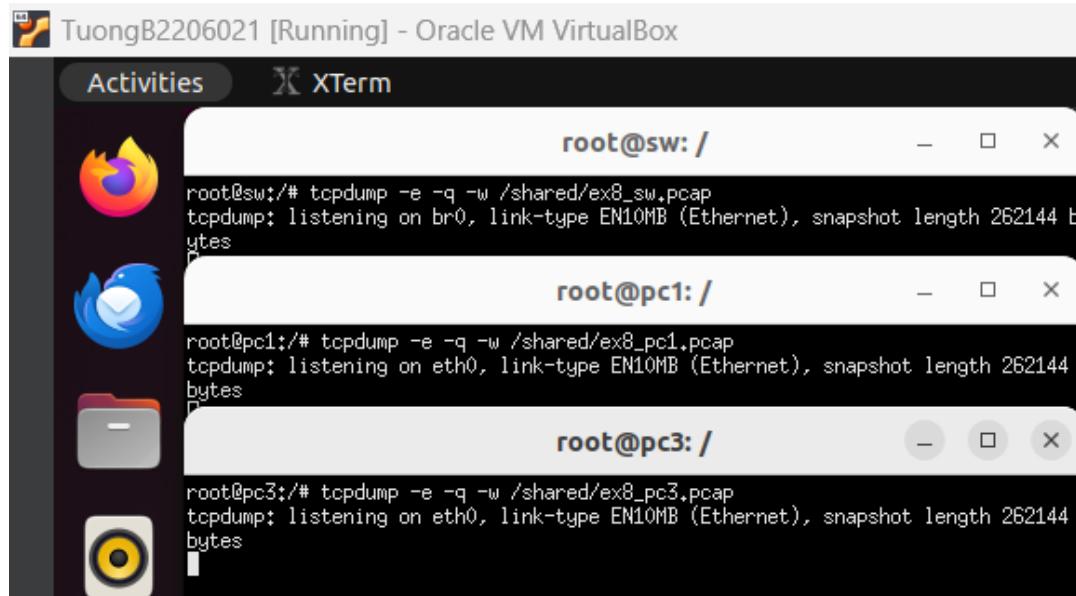
## Exercise 8 (cont.)

*On the switch, pc1 and pc3, run the command*

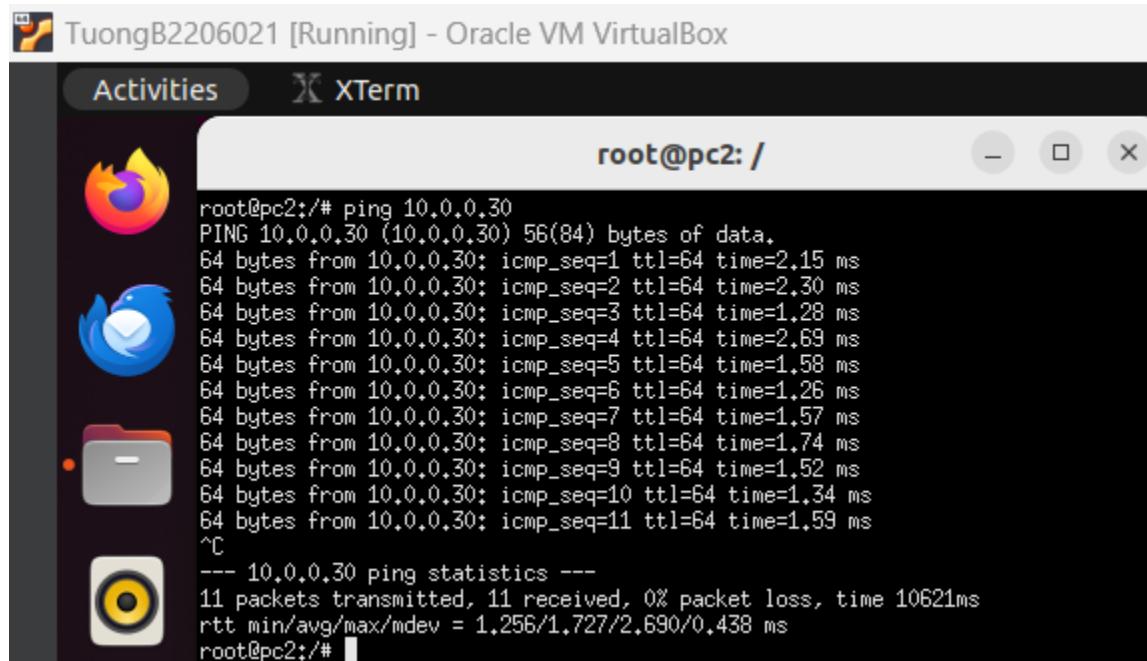
```
$ tcpdump -e -q -w /shared/ex8_switch.pcap
```

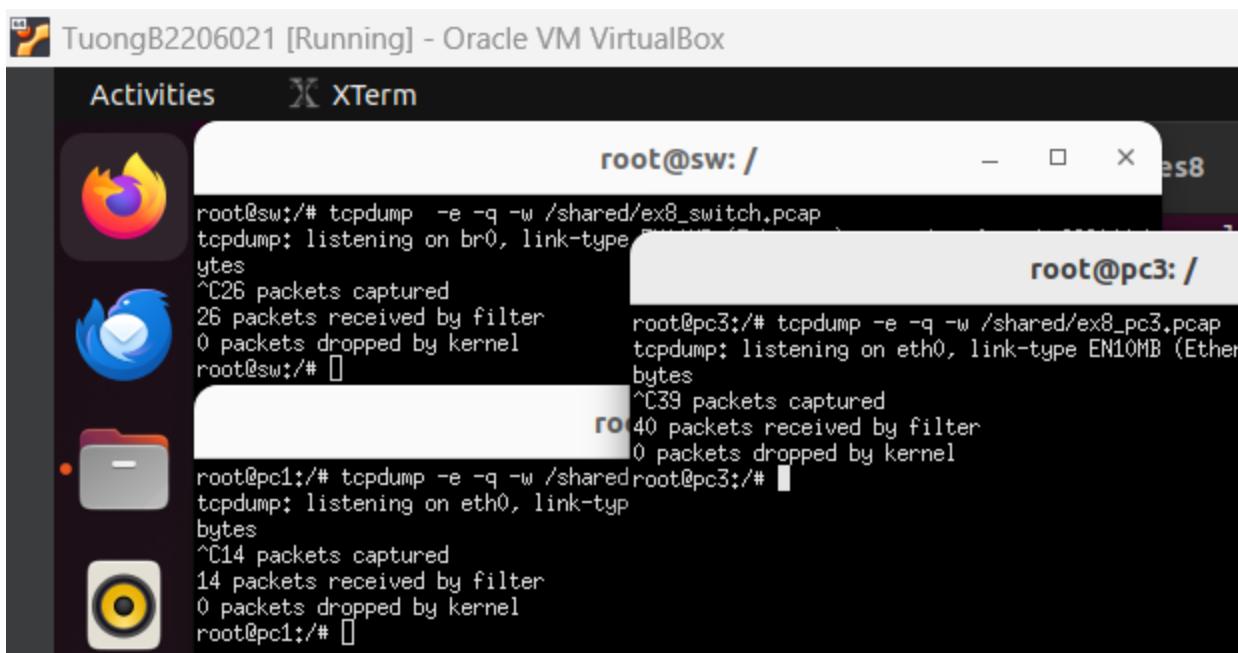
```
$ tcpdump -e -q -w /shared/ex8_pc1.pcap
```

```
$ tcpdump -e -q -w /shared/ex8_pc3.pcap
```



*On pc2, send the message to pc3 using the command ping 10.0.0.30 , then wait for about 10 seconds, and stop all the the ping command on pc2, and stop tcpdump commands on other devices.*





*On the switch check the contain of the Mac Lookup Table again using the command brctl showmacs br0, and explain the information lists in the Table*

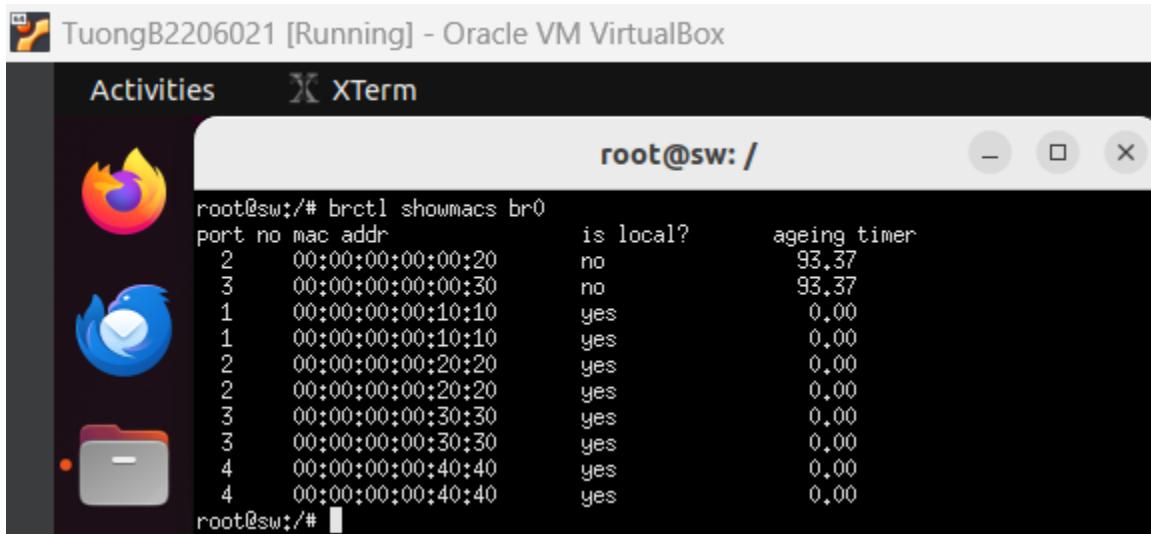
# brctl showmacs br0 (on sw)

The switch learns the MAC address of the device (MAC address 00:00:00:00:00:20) and associates it with the port that it is connected to.

The MAC address of the device (MAC address 00:00:00:00:00:30) is either learned from the reply ping or already present from previous traffic.

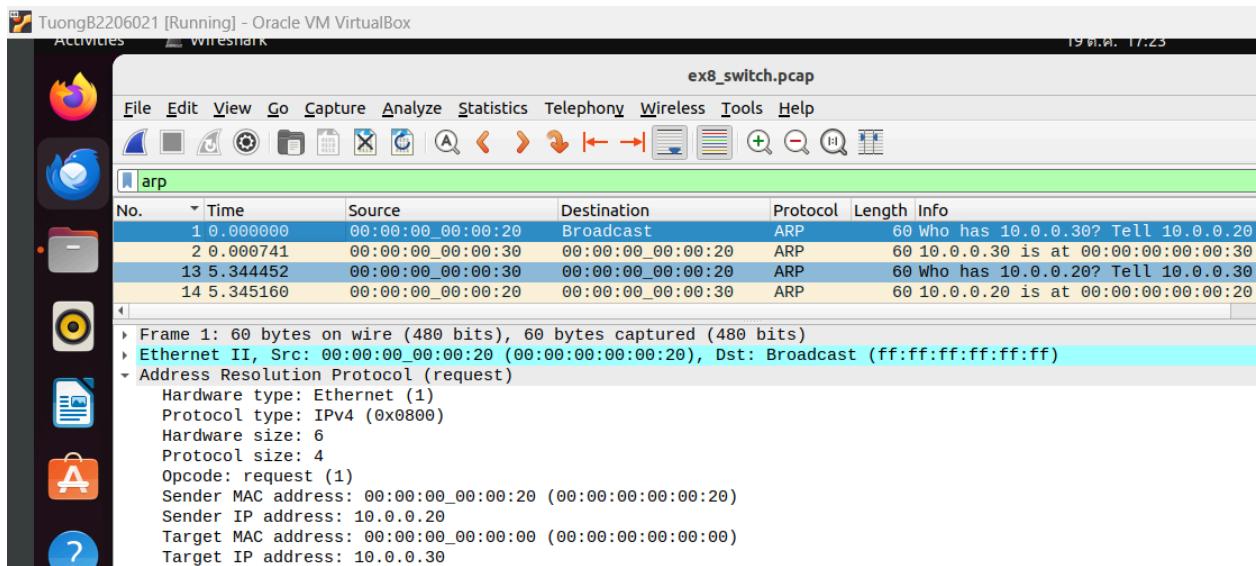
The ageing timer for both devices will reset, indicating recent activity.

If no frames are received from these MAC addresses within the 93.37 seconds, the switch will remove these entries from its MAC address table.

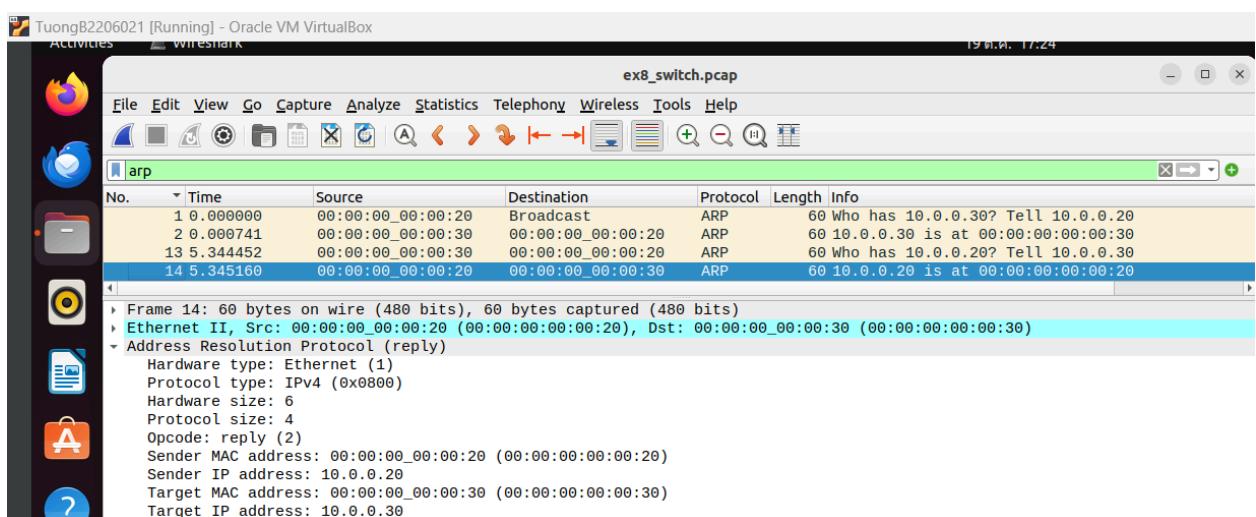


*Use Wireshark to open ex8\_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:20, explain the contain in the frame*

**Frame 1** captured is **60 bytes** in length. This frame is an ARP request from the device with the IP **10.0.0.20** and MAC address **00:00:00:00:00:20**. The request is broadcasted to all devices on the local network (destination MAC is **ff:ff:ff:ff:ff:ff**). The goal is to discover the MAC address of the device with the IP address **10.0.0.30**

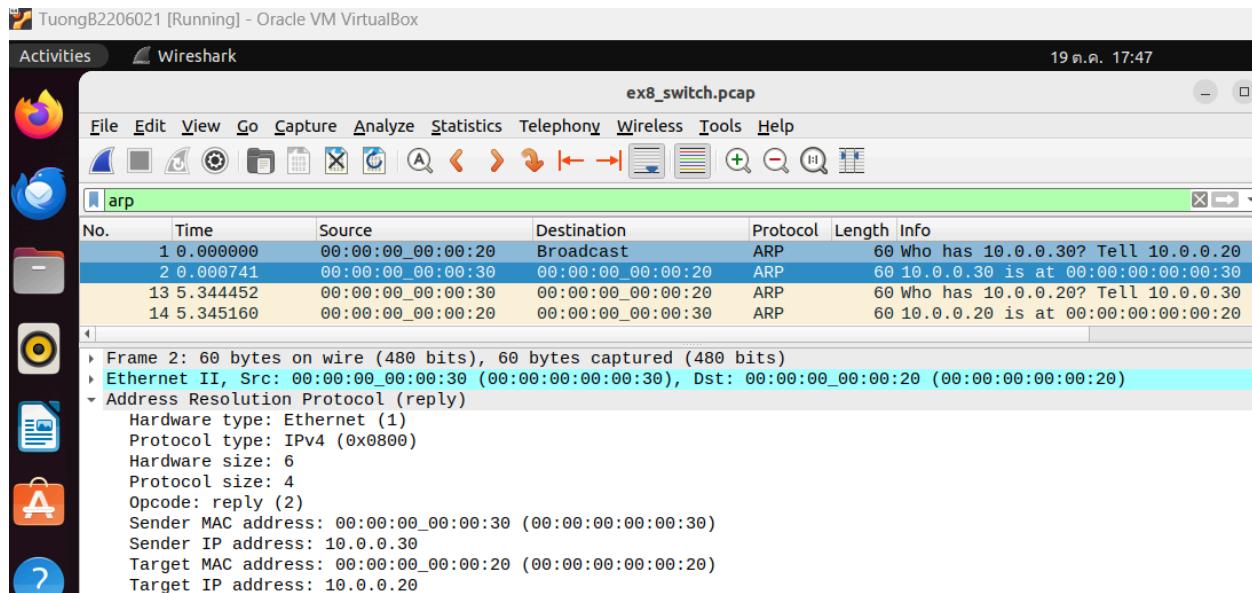


And on **frame 14 (60 bytes)**, it received an ARP request from the device (MAC address **00:00:00:00:00:30**) after a few seconds. It replies directly to the sender. The goal is to announce the MAC address of itself for the sender

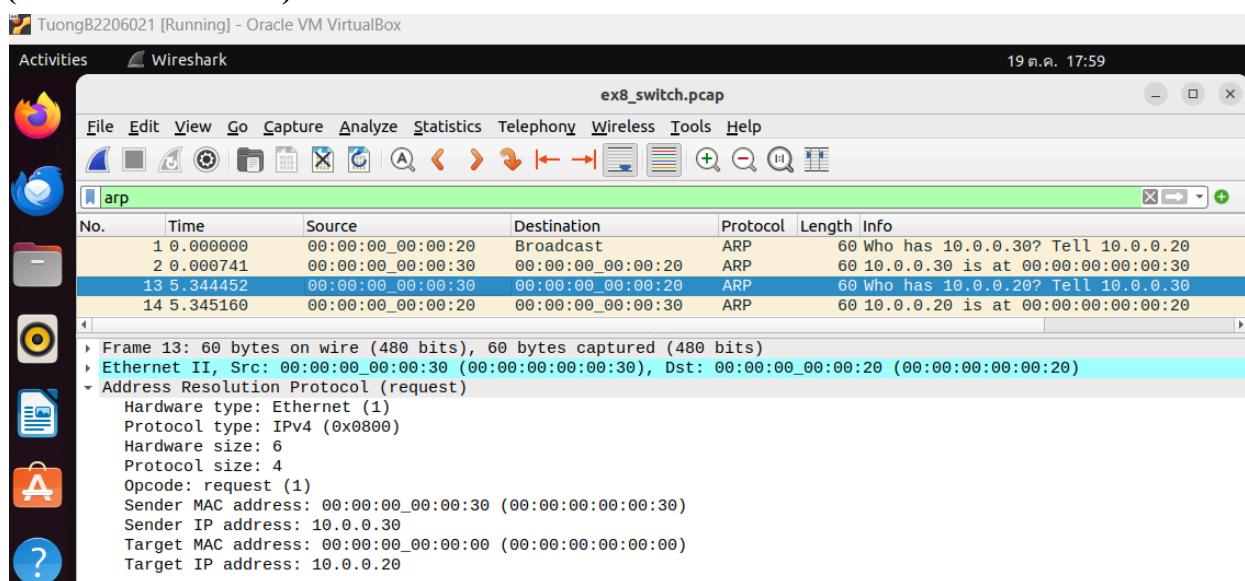


*Use Wireshark to open ex8\_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame*

**Frame 2 captured is 60 bytes in length. This frame is an ARP reply from the device with the IP 10.0.0.30 and MAC address 00:00:00:00:00:30. The reply is sent directly to the sender (destination MAC is 00:00:00:00:00:20). The goal is to announce the sender where the MAC address of it is located**

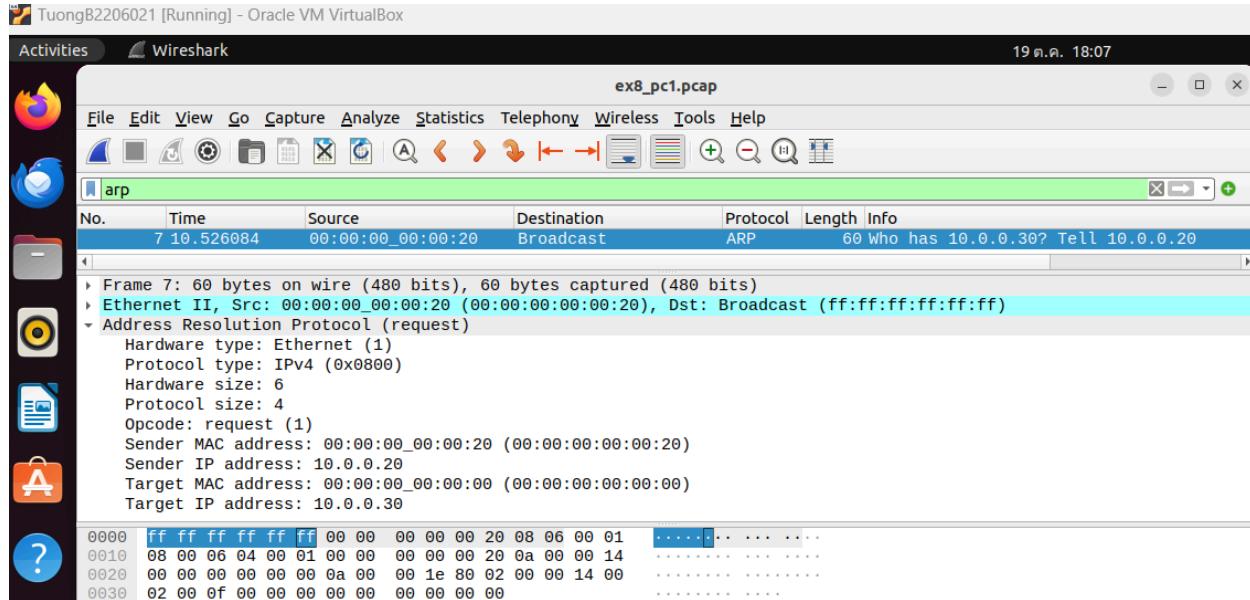


*And on frame 13 (60 bytes), it also sends a broadcast ARP request (Target MAC address: 00:00:00:00:00:00) in order to find out where the MAC address (00:00:00:00:00:20) of the device with the IP address 10.0.0.20 is located*



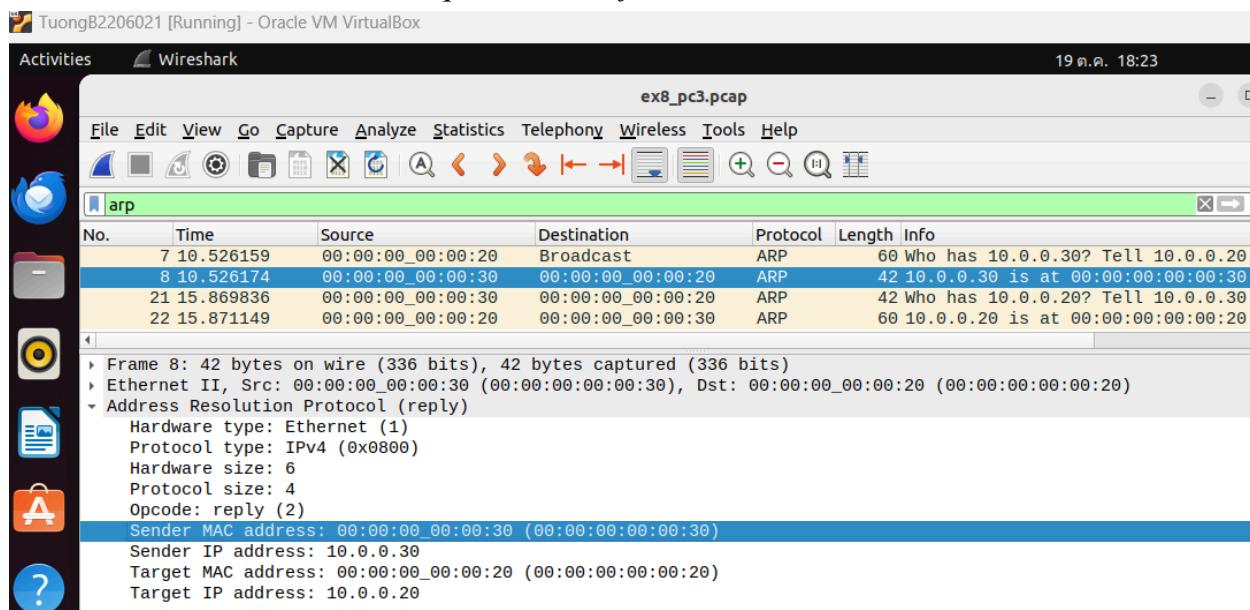
*Use Wireshark to open pc1\_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame*

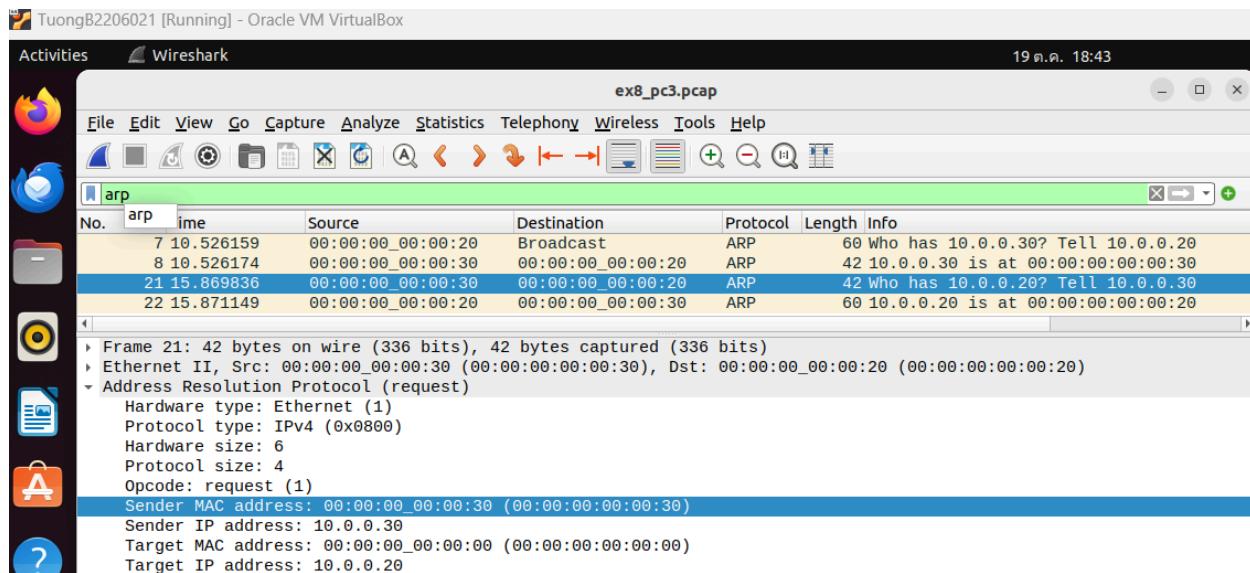
*There is no frame with the source address 00:00:00:00:00:30 because pc1 does not communicate with pc3.*



*Use Wireshark to open pc3\_switch.pcap, open the frame using ARP protocol with the source MAC address of 00:00:00:00:00:30, explain the contain in the frame*

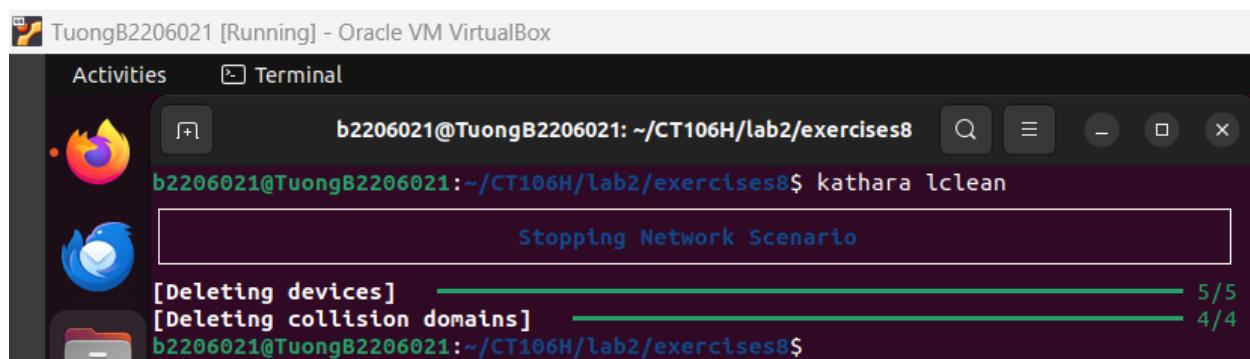
*The frame 8 and frame 21 with 42 bytes in length captured the ARP reply and request are sent. On the first image, it replies with the MAC address of pc3. And on the second one, it also send a broadcast request to look for the sender's MAC address*



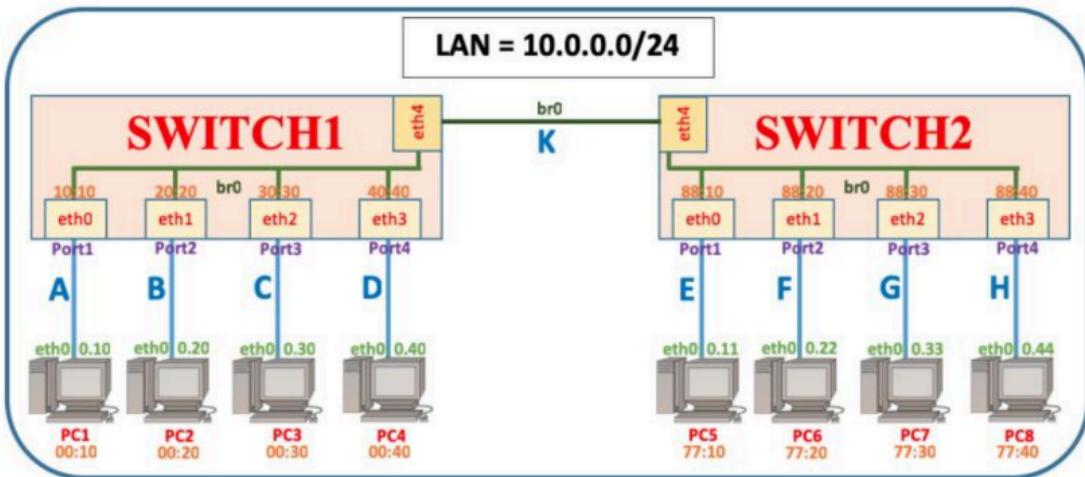


### Clean the lab

\$ kathara lc



## Exercise 9: Construct the following network

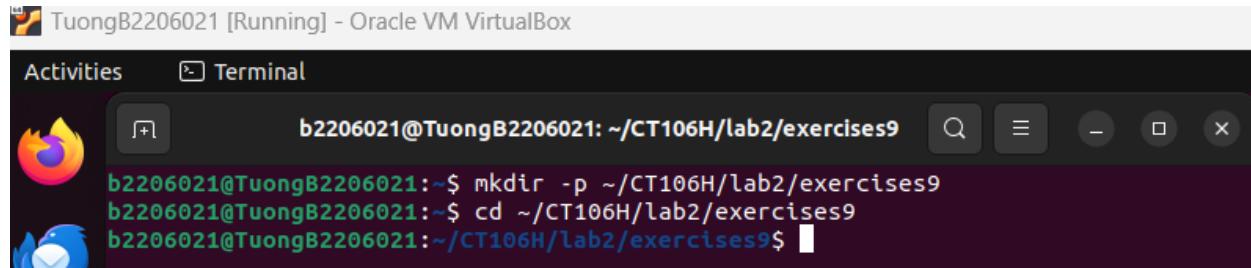


Answer:

*Create exercises9 directory*

```
$ mkdir -p ~/CT106H/lab2/exercises9
```

```
$ cd ~/CT106H/lab2/exercises9
```



*Prepare the lab*

```
$ mkdir pc1 pc2 pc3 pc4 pc5 pc6 pc7 pc8 sw1 sw2 shared
```

```
$ gedit lab.conf
```

```
$ gedit pc1.startup
```

```
$ gedit pc2.startup
```

```
$ gedit pc3.startup
```

```
$ gedit pc4.startup
```

```
$ gedit pc5.startup
```

```
$ gedit pc6.startup
```

```
$ gedit pc7.startup
```

```
$ gedit pc8.startup
```

```
$ gedit sw1.startup
```

```
$ gedit sw2.startup
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises9$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
├── pc5
├── pc5.startup
├── pc6
├── pc6.startup
├── pc7
├── pc7.startup
├── pc8
├── pc8.startup
└── shared
    ├── sw1
    └── sw2
        └── sw2.startup

11 directories, 11 files
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises9$ cat lab.conf
pc1[0]=A
pc2[0]=B
pc3[0]=C
pc4[0]=D
pc5[0]=E
pc6[0]=F
pc7[0]=G
pc8[0]=H

sw1[0]=A
sw1[1]=B
sw1[2]=C
sw1[3]=D
sw1[4]=K

sw2[0]=E
sw2[1]=F
sw2[2]=G
sw2[3]=H
sw2[4]=K
```

TuongB2206021 [Running] - Oracle VM VirtualBox

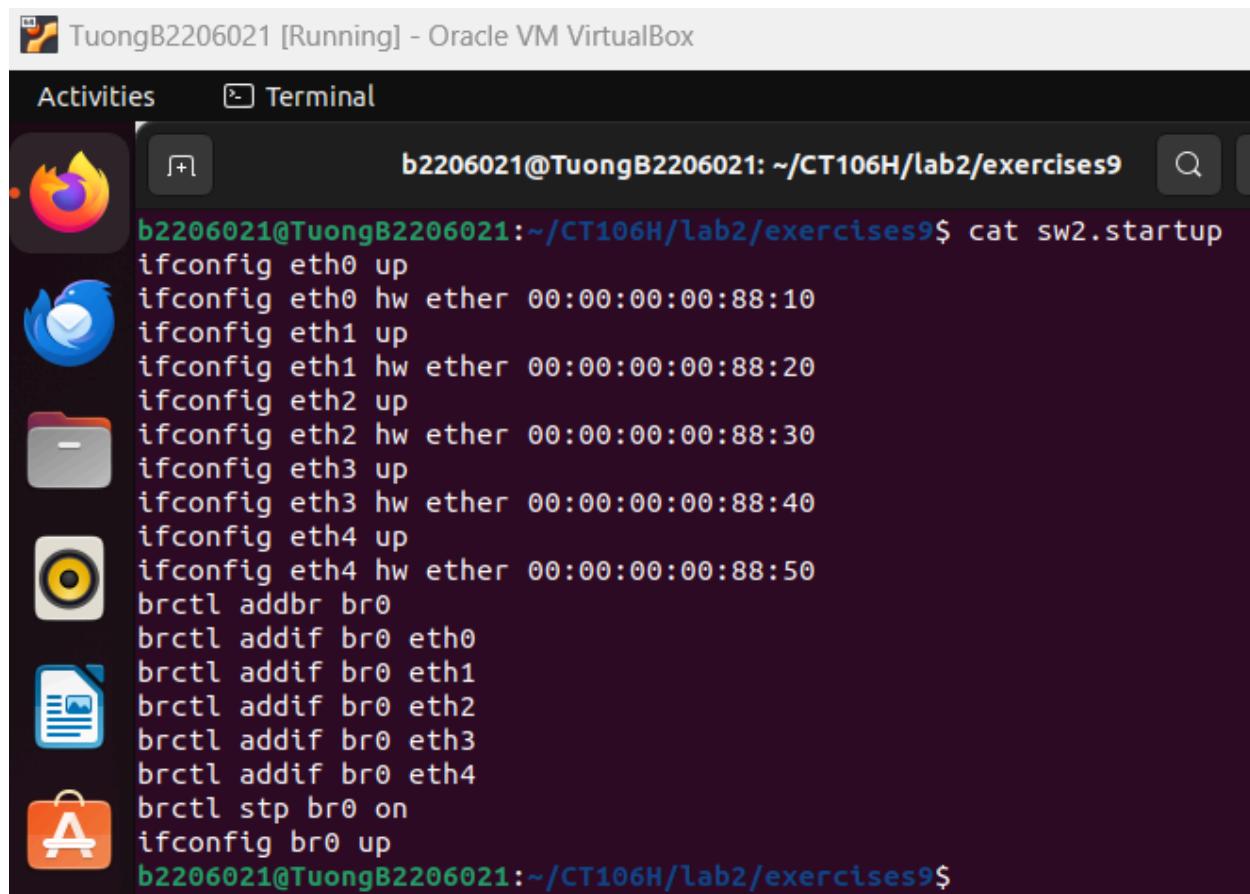
Activities Terminal

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc1.startup
ifconfig eth0 10.0.0.10/24 up
ifconfig eth0 hw ether 00:00:00:00:00:10
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc2.startup
ifconfig eth0 10.0.0.20/24 up
ifconfig eth0 hw ether 00:00:00:00:00:20
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc3.startup
ifconfig eth0 10.0.0.30/24 up
ifconfig eth0 hw ether 00:00:00:00:00:30
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc4.startup
ifconfig eth0 10.0.0.40/24 up
ifconfig eth0 hw ether 00:00:00:00:00:40
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc5.startup
ifconfig eth0 10.0.0.11/24 up
ifconfig eth0 hw ether 00:00:00:00:77:10
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc6.startup
ifconfig eth0 10.0.0.22/24 up
ifconfig eth0 hw ether 00:00:00:00:77:20
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc7.startup
ifconfig eth0 10.0.0.33/24 up
ifconfig eth0 hw ether 00:00:00:00:77:30
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat pc8.startup
ifconfig eth0 10.0.0.44/24 up
ifconfig eth0 hw ether 00:00:00:00:77:40
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

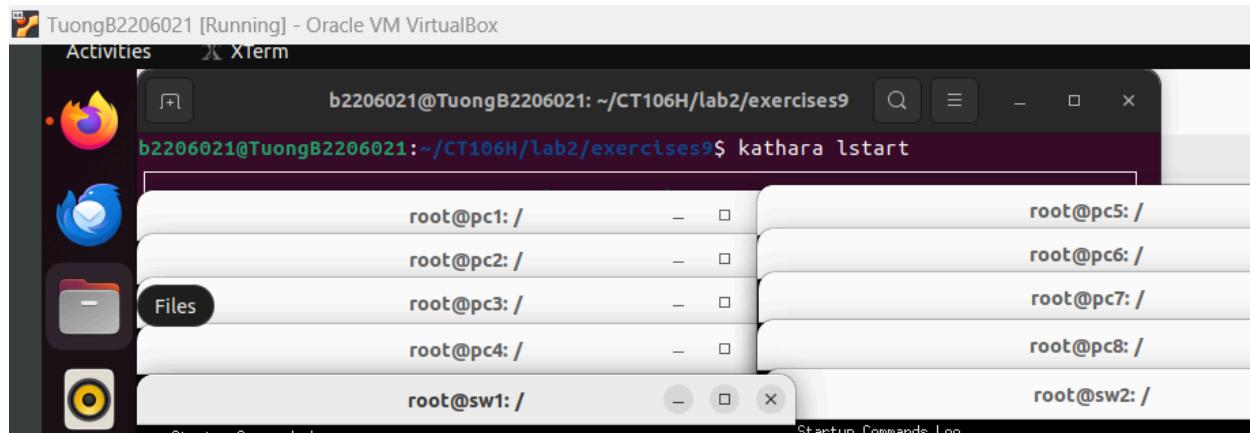
```
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat sw1.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:00:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:00:20:20
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:00:30:30
ifconfig eth3 up
ifconfig eth3 hw ether 00:00:00:00:40:40
ifconfig eth4 up
ifconfig eth4 hw ether 00:00:00:00:50:50
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl addif br0 eth3
brctl addif br0 eth4
brctl stp br0 on
ifconfig br0 up
```



```
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ cat sw2.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:00:88:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:00:88:20
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:00:88:30
ifconfig eth3 up
ifconfig eth3 hw ether 00:00:00:00:88:40
ifconfig eth4 up
ifconfig eth4 hw ether 00:00:00:00:88:50
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl addif br0 eth3
brctl addif br0 eth4
brctl stp br0 on
ifconfig br0 up
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$
```

### *Start the lab*

**\$ kathara lstart**



```
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ kathara lstart
root@pc1: /
root@pc2: /
root@pc3: /
root@pc4: /
root@sw1: /
```

Host	Root Login	Root Path
pc5	root@pc5:	/
pc6	root@pc6:	/
pc7	root@pc7:	/
pc8	root@pc8:	/
sw2	root@sw2:	/

Startup Commands Log

## Testing connectivity

*On pc1:*

```
# ping -c 2 10.0.0.40
```

```
# ping -c 2 10.0.0.11
```

*On pc5:*

```
# ping -c 2 10.0.0.44
```

```
# ping -c 2 10.0.0.30
```

```
root@pc1: / --- Startup Commands Log
++ ifconfig eth0 10.0.0.10/24 up
++ ifconfig eth0 hw ether 00:00:00:00:00:10
--- End Startup Commands Log
root@pc1:/# ping -c 2 10.0.0.40
PING 10.0.0.40 (10.0.0.40) 56(84) bytes of data.
64 bytes from 10.0.0.40: icmp_seq=1 ttl=64 time=3.68 ms
64 bytes from 10.0.0.40: icmp_seq=2 ttl=64 time=3.88 ms
--- 10.0.0.40 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1347ms
rtt min/avg/max/mdev = 3.681/3.780/3.879/0.099 ms
root@pc1:/# ping -c 2 10.0.0.11
PING 10.0.0.11 (10.0.0.11) 56(84) bytes of data.
64 bytes from 10.0.0.11: icmp_seq=1 ttl=64 time=3.11 ms
64 bytes from 10.0.0.11: icmp_seq=2 ttl=64 time=0.525 ms
--- 10.0.0.11 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.525/1.818/3.111/1.293 ms

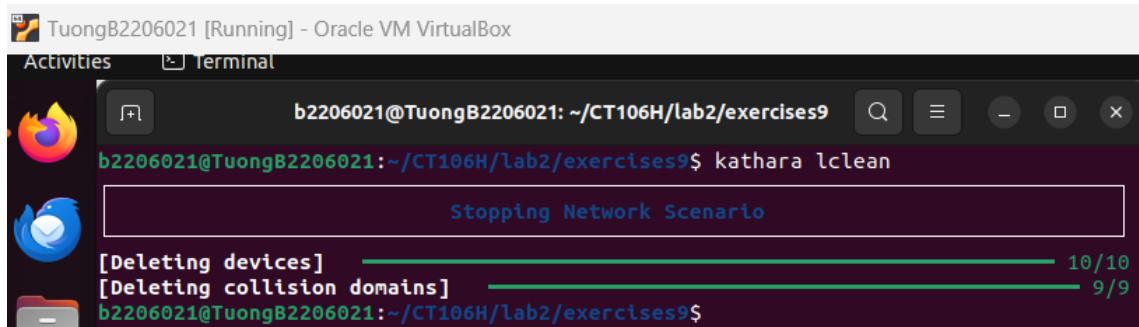
root@pc5: / --- Startup Commands Log
++ ifconfig eth0 10.0.0.11/24 up
++ ifconfig eth0 hw ether 00:00:00:00:00:11
--- End Startup Commands Log
root@pc5:/# ping -c 2 10.0.0.44
PING 10.0.0.44 (10.0.0.44) 56(84) bytes of data.
64 bytes from 10.0.0.44: icmp_seq=1 ttl=64 time=44.9 ms
64 bytes from 10.0.0.44: icmp_seq=2 ttl=64 time=1.00 ms
--- 10.0.0.44 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1781ms
rtt min/avg/max/mdev = 1.000/22.954/44.909/21.954 ms
root@pc5:/# ping -c 2 10.0.0.30
PING 10.0.0.30 (10.0.0.30) 56(84) bytes of data.
64 bytes from 10.0.0.30: icmp_seq=1 ttl=64 time=4.36 ms
64 bytes from 10.0.0.30: icmp_seq=2 ttl=64 time=1.23 ms
--- 10.0.0.30 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.230/2.795/4.360/1.565 ms
```

**# brctl showmacs br0 (On sw1 and sw2)**

Port	MAC Address	is local?	ageing timer	Port	MAC Address	is local?	ageing timer
1	00:00:00:00:10:10	no	18.07	5	00:00:00:00:10:10	no	233.19
3	00:00:00:00:00:30	no	37.55	5	00:00:00:00:00:30	no	46.44
4	00:00:00:00:00:40	no	18.05	5	00:00:00:00:00:40	no	83.30
1	00:00:00:00:10:10	yes	0.00	5	00:00:00:00:50:50	no	0.09
1	00:00:00:00:10:10	yes	0.00	1	00:00:00:00:77:10	no	96.61
2	00:00:00:00:20:20	yes	0.00	2	00:00:00:00:77:20	no	83.30
2	00:00:00:00:20:20	yes	0.00	3	00:00:00:00:77:30	no	46.44
3	00:00:00:00:30:30	yes	0.00	4	00:00:00:00:77:40	no	60.76
3	00:00:00:00:30:30	yes	0.00	1	00:00:00:00:88:10	yes	0.00
4	00:00:00:00:40:40	yes	0.00	1	00:00:00:00:88:10	yes	0.00
4	00:00:00:00:40:40	yes	0.00	2	00:00:00:00:88:20	yes	0.00
5	00:00:00:00:50:50	yes	0.00	2	00:00:00:00:88:20	yes	0.00
5	00:00:00:00:50:50	yes	0.00	3	00:00:00:00:88:30	yes	0.00
5	00:00:00:00:77:10	no	181.39	3	00:00:00:00:88:30	yes	0.00
5	00:00:00:00:77:20	no	74.41	4	00:00:00:00:88:40	yes	0.00
5	00:00:00:00:77:30	no	37.55	4	00:00:00:00:88:40	yes	0.00
5	00:00:00:00:77:40	no	57.38	5	00:00:00:00:88:50	yes	0.00
5	00:00:00:00:88:50	no	116.06	5	00:00:00:00:88:50	yes	0.00

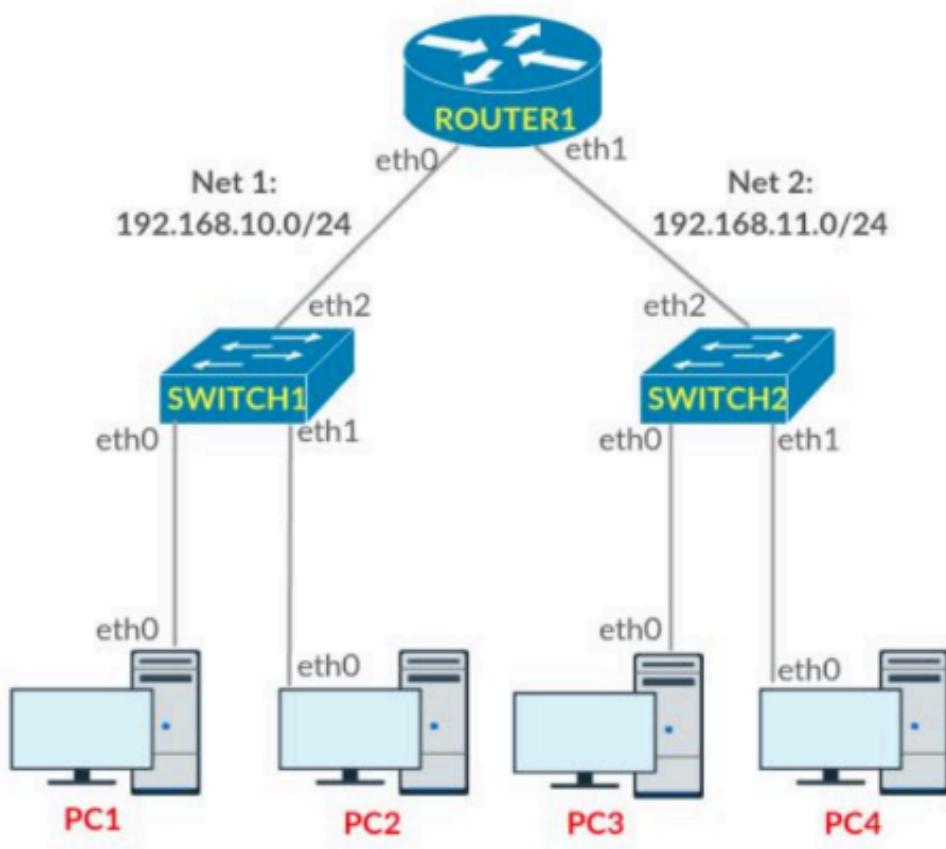
### Clean the lab

\$ kathara lclean



```
TuongB2206021 [Running] - Oracle VM VirtualBox
Activities Terminal
b2206021@TuongB2206021: ~/CT106H/lab2/exercises9
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$ kathara lclean
Stopping Network Scenario
[Deleting devices] 10/10
[Deleting collision domains] 9/9
b2206021@TuongB2206021:~/CT106H/lab2/exercises9$
```

### Exercise 10: Construct the following network

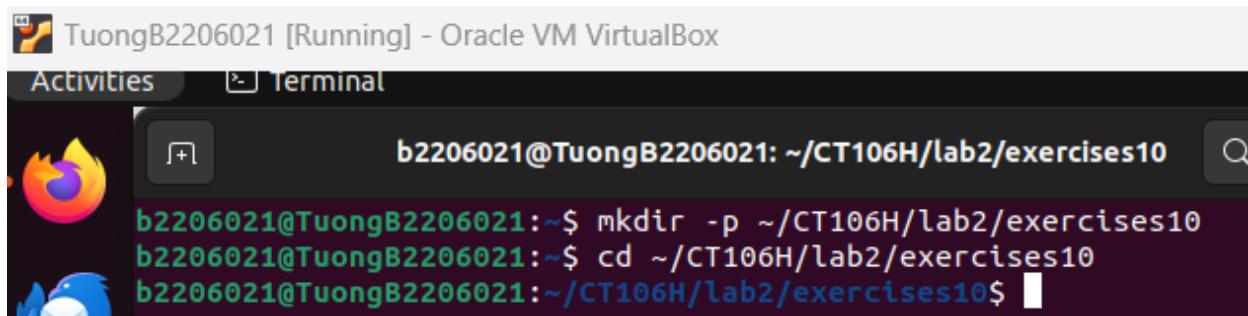


Answer:

*Create exercises10 directory*

\$ mkdir -p ~/CT106H/lab2/exercises10

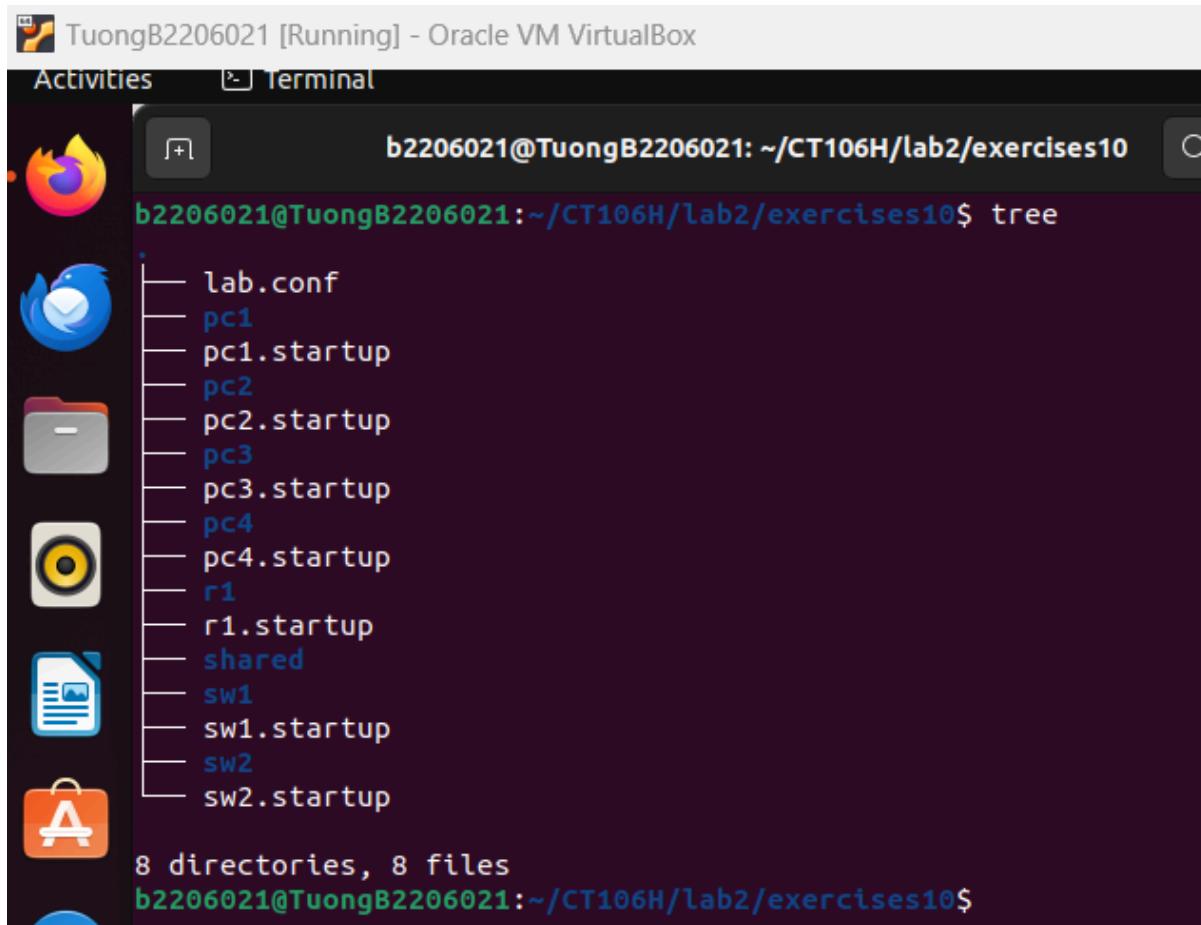
\$ cd ~/CT106H/lab2/exercises10



```
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ mkdir -p ~/CT106H/lab2/exercises10
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ cd ~/CT106H/lab2/exercises10
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$
```

*Prepare the lab*

```
$ mkdir pc1 pc2 pc3 pc4 r1 sw1 sw2 shared
$ gedit lab.conf
$ gedit pc1.startup
$ gedit pc2.startup
$ gedit pc3.startup
$ gedit pc4.startup
$ gedit r1.startup
$ gedit sw1.startup
$ gedit sw2.startup
```



```
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── pc4
├── pc4.startup
├── r1
├── r1.startup
├── shared
├── sw1
├── sw1.startup
├── sw2
└── sw2.startup

8 directories, 8 files
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises10$ cat lab.conf
pc1[0]=C
pc2[0]=D
pc3[0]=E
pc4[0]=F

sw1[0]=C
sw1[1]=D
sw1[2]=A

sw2[0]=E
sw2[1]=F
sw2[2]=B

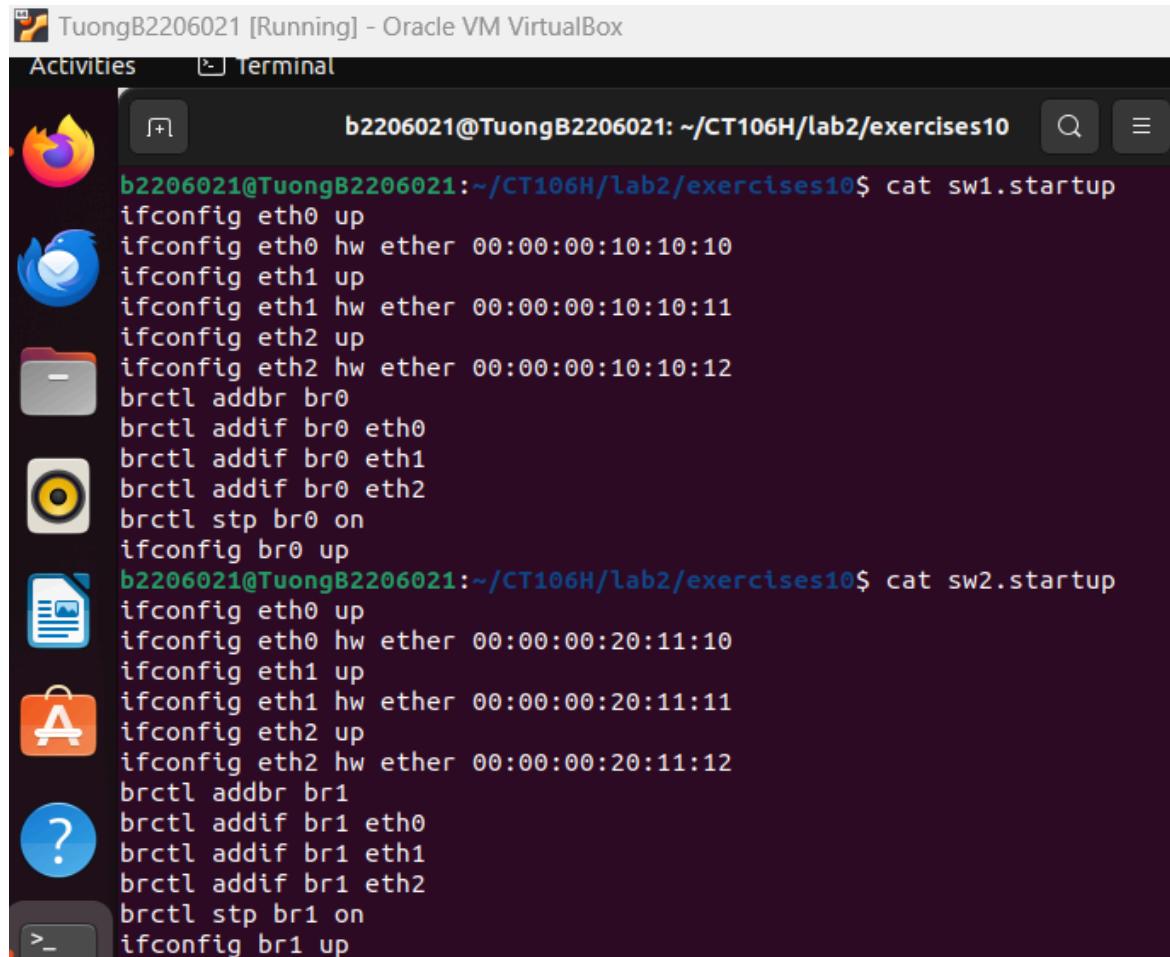
r1[0]=A
r1[1]=B
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ cat r1.startup
ifconfig eth0 192.168.10.1/24 up
ifconfig eth0 hw ether 00:00:00:50:10:10
ifconfig eth1 192.168.11.1/24 up
ifconfig eth1 hw ether 00:00:00:50:11:10

b2206021@TuongB2206021:~/CT106H/lab2/exercises10$
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises10$ cat pc1.startup
ifconfig eth0 192.168.10.10/24 up
ifconfig eth0 hw ether 00:00:00:00:10:10
route add default gw 192.168.10.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ cat pc2.startup
ifconfig eth0 192.168.10.11/24 up
ifconfig eth0 hw ether 00:00:00:00:10:11
route add default gw 192.168.10.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ cat pc3.startup
ifconfig eth0 192.168.11.10/24 up
ifconfig eth0 hw ether 00:00:00:00:11:10
route add default gw 192.168.11.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ cat pc4.startup
ifconfig eth0 192.168.11.11/24 up
ifconfig eth0 hw ether 00:00:00:00:11:11
route add default gw 192.168.11.1
```



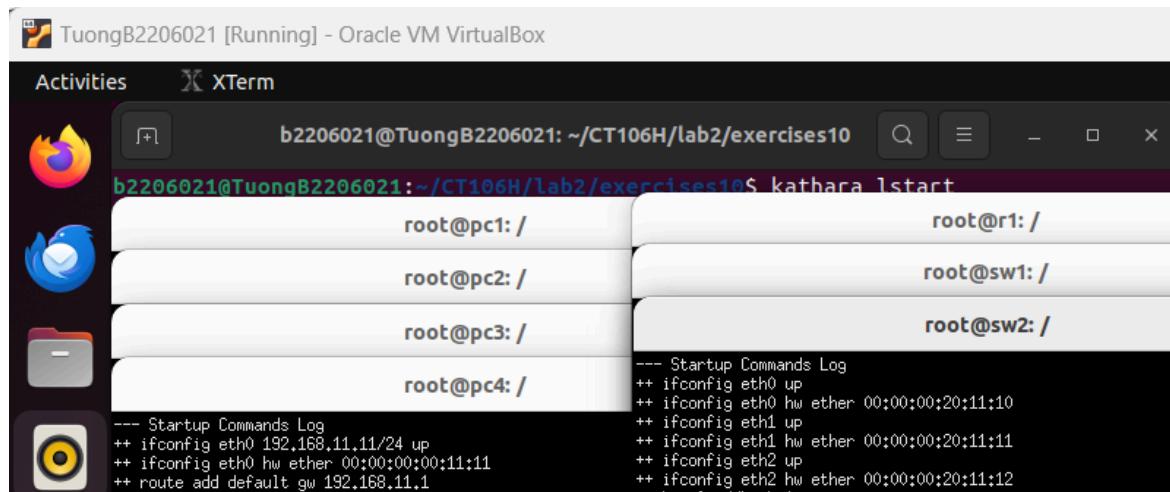
TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises10$ cat sw1.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:10:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:10:10:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:10:10:12
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl stp br0 on
ifconfig br0 up
b2206021@TuongB2206021: ~/CT106H/lab2/exercises10$ cat sw2.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:20:11:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:20:11:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:20:11:12
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2
brctl stp br1 on
ifconfig br1 up
```

*Start the lab*

\$ kathara lstart



TuongB2206021 [Running] - Oracle VM VirtualBox

Activities XTerm

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises10$ kathara lstart
root@pc1: /
root@pc2: /
root@pc3: /
root@pc4: /
root@r1: /
root@sw1: /
root@sw2: /
--- Startup Commands Log
++ ifconfig eth0 up
++ ifconfig eth0 hw ether 00:00:00:20:11:10
++ ifconfig eth1 up
++ ifconfig eth1 hw ether 00:00:00:20:11:11
++ ifconfig eth2 up
++ ifconfig eth2 hw ether 00:00:00:20:11:12
++ route add default gw 192.168.11.1
++ brctl addbr br1
++ brctl addif br1 eth0
++ brctl addif br1 eth1
++ brctl addif br1 eth2
++ brctl stp br1 on
++ ifconfig br1 up
```

### Testing connectivity

On pc1: # ping -c 2 192.168.11.11 (pc1 ping pc4)

On r1: # route -n

```
root@pc1:/# ping -c 2 192.168.11.11
PING 192.168.11.11 (192.168.11.11) 56(84) bytes of data.
64 bytes from 192.168.11.11: icmp_seq=1 ttl=63 time=4.10 ms
64 bytes from 192.168.11.11: icmp_seq=2 ttl=63 time=2.91 ms

--- 192.168.11.11 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 2.914/3.506/4.099/0.592 ms

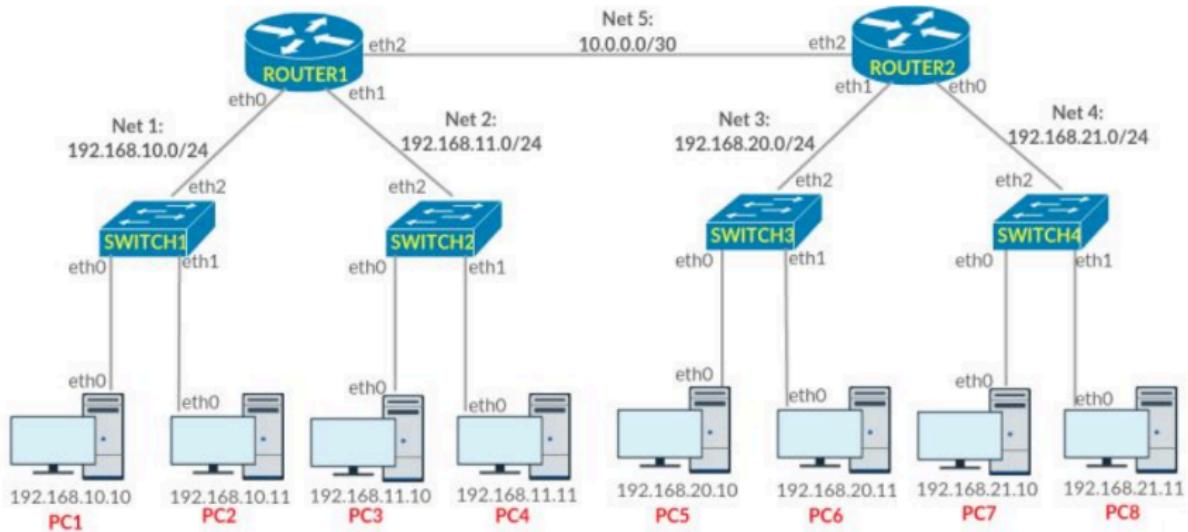
root@r1:/#
root@r1:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref  Use Iface
192.168.10.0   0.0.0.0        255.255.255.0 U     0      0      0 eth0
192.168.11.0   0.0.0.0        255.255.255.0 U     0      0      0 eth1
```

### Clean the lab

\$ kathara lclean

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$ kathara lclean
Stopping Network Scenario
[Deleting devices] 7/7
[Deleting collision domains] 6/6
b2206021@TuongB2206021:~/CT106H/lab2/exercises10$
```

## Exercise 11: Construct the following network

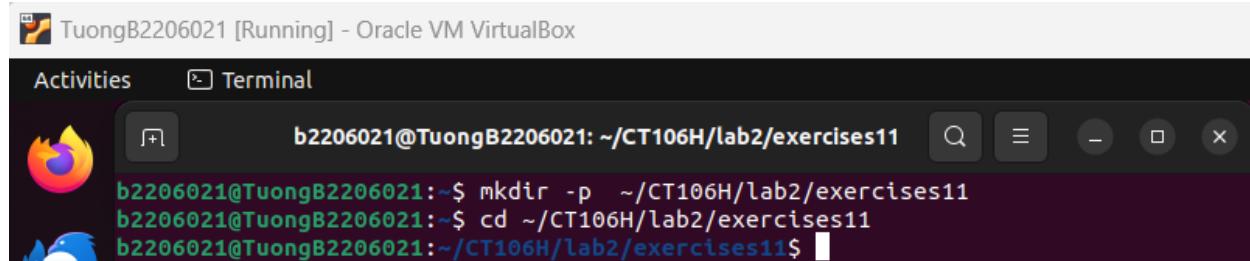


Answer:

*Create exercises11 directory*

```
$ mkdir -p ~/CT106H/lab2/exercises11
```

```
$ cd ~/CT106H/lab2/exercises11
```



*Prepare the lab*

```
$ mkdir pc1 pc2 pc3 pc4 pc5 pc6 pc7 pc8 r1 r2 sw1 sw2 sw3 sw4 shared
```

```
$ gedit lab.conf
```

```
$ gedit pc1.startup
```

```
$ gedit pc2.startup
```

```
$ gedit pc3.startup
```

```
$ gedit pc4.startup
```

```
$ gedit pc5.startup
```

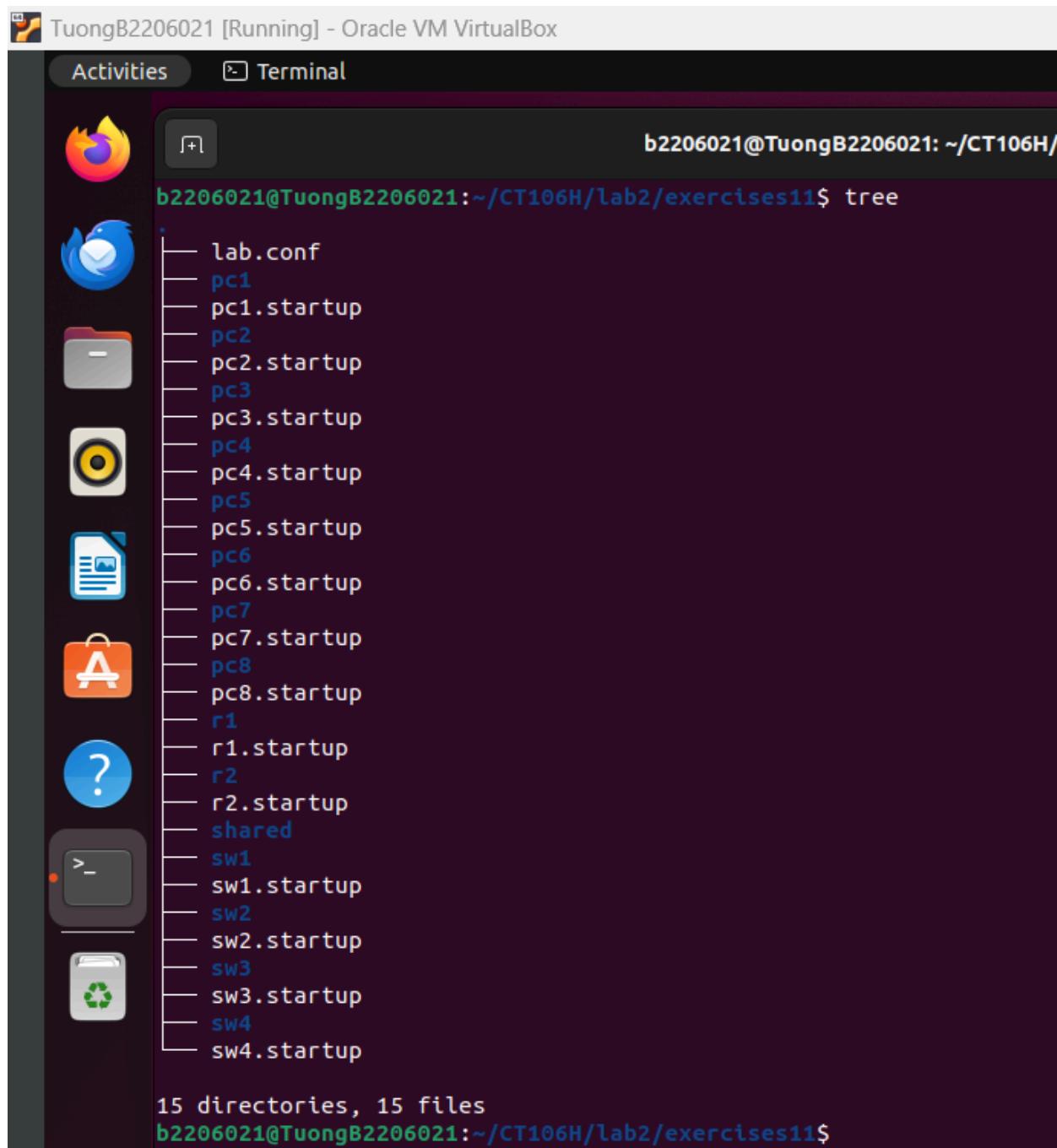
```
$ gedit pc6.startup
```

```
$ gedit pc7.startup
```

```
$ gedit pc8.startup
```

```
$ gedit r1.startup
```

```
$ gedit r2.startup  
$ gedit sw1.startup  
$ gedit sw2.startup  
$ gedit sw3.startup  
$ gedit sw4.startup
```



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "TuongB2206021 [Running] - Oracle VM VirtualBox". The terminal content displays the output of the "tree" command, showing a directory structure:

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ tree  
.  
├── lab.conf  
├── pc1  
├── pc1.startup  
├── pc2  
├── pc2.startup  
├── pc3  
├── pc3.startup  
├── pc4  
├── pc4.startup  
├── pc5  
├── pc5.startup  
├── pc6  
├── pc6.startup  
├── pc7  
├── pc7.startup  
├── pc8  
├── pc8.startup  
└── r1  
    ├── r1.startup  
    └── r2.startup  
        ├── r2.startup  
        └── shared  
            ├── sw1  
            ├── sw1.startup  
            ├── sw2  
            ├── sw2.startup  
            ├── sw3  
            ├── sw3.startup  
            ├── sw4  
            ├── sw4.startup  
            └── sw4.startup  
  
15 directories, 15 files  
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$
```

The screenshot shows a Linux desktop environment with a dark theme. A terminal window is open in the top right corner, displaying the command `cat lab.conf` and its output. The output lists various nodes and their corresponding values:

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat lab.conf
pc1[0]=A
pc2[0]=B
pc3[0]=C
pc4[0]=D
pc5[0]=E
pc6[0]=F
pc7[0]=G
pc8[0]=H
sw1[0]=A
sw1[1]=B
sw1[2]=I
sw2[0]=C
sw2[1]=D
sw2[2]=J
sw3[0]=E
sw3[1]=F
sw3[2]=K
sw4[0]=G
sw4[1]=H
sw4[2]=L
r1[0]=I
r1[1]=J
r1[2]=M
r2[0]=L
r2[1]=K
r2[2]=M
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$
```

To the left of the terminal, there is a docked application menu with several icons:

- Firefox icon
- Nautilus file manager icon
- Terminal icon
- GNOME Help icon
- GNOME Control Center icon
- GNOME Dash icon
- Recycle bin icon

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc1.startup
ifconfig eth0 192.168.10.10/24 up
ifconfig eth0 hw ether 00:00:00:00:10:10
route add default gw 192.168.10.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc2.startup
ifconfig eth0 192.168.10.11/24 up
ifconfig eth0 hw ether 00:00:00:00:10:11
route add default gw 192.168.10.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc3.startup
ifconfig eth0 192.168.11.10/24 up
ifconfig eth0 hw ether 00:00:00:00:11:10
route add default gw 192.168.11.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc4.startup
ifconfig eth0 192.168.11.11/24 up
ifconfig eth0 hw ether 00:00:00:00:11:11
route add default gw 192.168.11.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc5.startup
ifconfig eth0 192.168.20.10/24 up
ifconfig eth0 hw ether 00:00:00:00:20:10
route add default gw 192.168.20.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc6.startup
ifconfig eth0 192.168.20.11/24 up
ifconfig eth0 hw ether 00:00:00:00:20:11
route add default gw 192.168.20.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc7.startup
ifconfig eth0 192.168.21.10/24 up
ifconfig eth0 hw ether 00:00:00:00:21:10
route add default gw 192.168.21.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat pc8.startup
ifconfig eth0 192.168.21.11/24 up
ifconfig eth0 hw ether 00:00:00:00:21:11
route add default gw 192.168.21.1
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat r1.startup
ifconfig eth0 192.168.10.1/24 up
ifconfig eth0 hw ether 00:00:00:50:10:10
ifconfig eth1 192.168.11.1/24 up
ifconfig eth1 hw ether 00:00:00:50:11:10
ifconfig eth2 10.0.0.1/30 up
route add default gw 10.0.0.2
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat r2.startup
ifconfig eth0 192.168.21.1/24 up
ifconfig eth0 hw ether 00:00:00:51:21:10
ifconfig eth1 192.168.20.1/24 up
ifconfig eth1 hw ether 00:00:00:51:20:10
ifconfig eth2 10.0.0.2/30 up
route add default gw 10.0.0.1
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ █
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat sw1.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:10:10:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:10:10:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:10:10:12
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl stp br0 on
ifconfig br0 up
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat sw2.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:20:11:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:20:11:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:20:11:12
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2
brctl stp br1 on
ifconfig br1 up
```

TuongB2206021 [Running] - Oracle VM VirtualBox

Activities Terminal

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat sw3.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:30:20:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:30:20:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:30:20:12
brctl addbr br2
brctl addif br2 eth0
brctl addif br2 eth1
brctl addif br2 eth2
brctl stp br2 on
ifconfig br2 up
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ cat sw4.startup
ifconfig eth0 up
ifconfig eth0 hw ether 00:00:00:40:21:10
ifconfig eth1 up
ifconfig eth1 hw ether 00:00:00:40:21:11
ifconfig eth2 up
ifconfig eth2 hw ether 00:00:00:40:21:12
brctl addbr br3
brctl addif br3 eth0
brctl addif br3 eth1
brctl addif br3 eth2
brctl stp br3 on
ifconfig br3 up
```

## *Start the lab*

\$ kathara lstart

```
b2206021@TuongB2206021:~/CT106H/lab2/exercises11$ kathara lstart
root@pc1: / - □ × root@sw1: /
root@pc2: / - □ × root@sw2: /
root@pc3: / - □ × root@sw3: /
root@pc4: / - □ × root@sw4: /
root@pc5: / - □ × root@r1: /
root@pc6: / - □ ×
root@pc7: / - □ ×
root@pc8: / - □ ×
--- Startup Commands Log
++ ifconfig eth0 192.168.21.11/24 up
++ ifconfig eth0 hw ether 00:00:00:51:21:10
++ ifconfig eth1 192.168.20.1/24 up
++ ifconfig eth1 hw ether 00:00:00:51:20:10
++ ifconfig eth2 10.0.0.2/30 up
++ route add default gw 10.0.0.1
--- End Startup Commands Log
root@r2: #
```

## *Testing connectivity*

On pc3:

```
# ping -c 1 192.168.10.10 (pc3 ping pc1)
# ping -c 1 192.168.20.11 (pc3 ping pc6)
# ping -c 1 192.168.21.10 (pc3 ping pc7)
```

On pc8:

```
# ping -c 1 192.168.10.10 (pc8 ping pc1)
# ping -c 1 192.168.11.10 (pc8 ping pc3)
# ping -c 1 192.168.20.10 (pc8 ping pc5)
```

```
root@pc3: # ping -c 1 192.168.10.10
PING 192.168.10.10 (192.168.10.10) 56(84) bytes of data.
64 bytes from 192.168.10.10: icmp_seq=1 ttl=63 time=34.0 ms
--- 192.168.10.10 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 34.019/34.019/34.019/0.000 ms
root@pc3: # ping -c 1 192.168.20.11
PING 192.168.20.11 (192.168.20.11) 56(84) bytes of data.
64 bytes from 192.168.20.11: icmp_seq=1 ttl=62 time=57.5 ms
--- 192.168.20.11 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 57.512/57.512/57.512/0.000 ms
root@pc3: # ping -c 1 192.168.21.10
PING 192.168.21.10 (192.168.21.10) 56(84) bytes of data.
64 bytes from 192.168.21.10: icmp_seq=1 ttl=62 time=41.5 ms
--- 192.168.21.10 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 41.481/41.481/41.481/0.000 ms
root@pc8: # ping -c 1 192.168.10.10
PING 192.168.10.10 (192.168.10.10) 56(84) bytes of data.
64 bytes from 192.168.10.10: icmp_seq=1 ttl=62 time=39.6 ms
--- 192.168.10.10 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 39.607/39.607/39.607/0.000 ms
root@pc8: # ping -c 1 192.168.11.10
PING 192.168.11.10 (192.168.11.10) 56(84) bytes of data.
64 bytes from 192.168.11.10: icmp_seq=1 ttl=62 time=50.8 ms
--- 192.168.11.10 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 50.838/50.838/50.838/0.000 ms
root@pc8: # ping -c 1 192.168.20.10
PING 192.168.20.10 (192.168.20.10) 56(84) bytes of data.
64 bytes from 192.168.20.10: icmp_seq=1 ttl=63 time=4.57 ms
--- 192.168.20.10 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 4.571/4.571/4.571/0.000 ms
```

# route -n (On r1 and r2)

```
root@r1:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref    Use Iface
0.0.0.0         10.0.0.2      0.0.0.0       UG    0      0        0 eth2
10.0.0.0        0.0.0.0       255.255.255.252 U     0      0        0 eth2
192.168.10.0   0.0.0.0       255.255.255.0  U     0      0        0 eth0
192.168.11.0   0.0.0.0       255.255.255.0  U     0      0        0 eth1
root@r1:/# 

root@r2:/# route -n
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref    Use Iface
0.0.0.0         10.0.0.1      0.0.0.0       UG    0      0        0 eth2
10.0.0.0        0.0.0.0       255.255.255.252 U     0      0        0 eth2
192.168.20.0   0.0.0.0       255.255.255.0  U     0      0        0 eth1
192.168.21.0   0.0.0.0       255.255.255.0  U     0      0        0 eth0
root@r2:/# 
```

Clean the lab

\$ kathara clean

```
b2206021@TuongB2206021: ~/CT106H/lab2/exercises11$ kathara lclean
Stopping Network Scenario
[Deleting devices] 14/14
[Deleting collision domains] 13/13
b2206021@TuongB2206021: ~/CT106H/lab2/exercises11$ 
```