

LAB 5

CONSTRUCT A SIMPLE NETWORK



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Group: M01

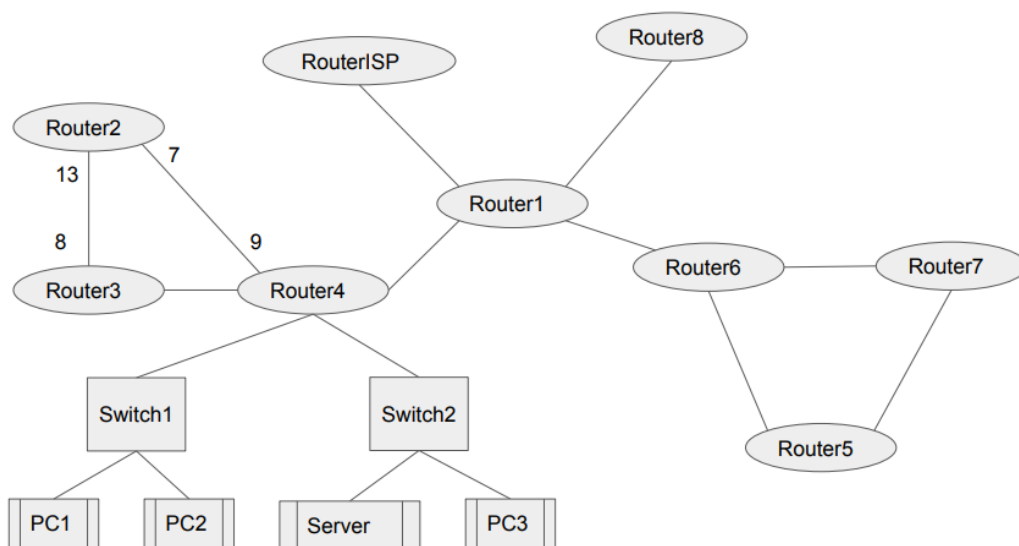
*Submission: an **ID_NAME_Lab05.pdf** file describes clearly how did you solve the problem*

Exercise 0: change the directory to your home directory

Answer: \$cd

```
thienng@thienng-VirtualBox: ~$ cd
thienng@thienng-VirtualBox: ~$
```

Exercise: Construct the network



Original network 142.12.128.0/20

→Netmask: 255.255.240.0

→Broadcast: 142.12.143.255

➔ The network has 6 LAN, in order to store it we need to use 3 bits for subnetting and 9 bits for representing hosts

# LAN	Subnet	Netmask	Broadcast	IP Range
1	142.12.128.0/23	255.255.254.0	142.12.129.255	142.12.128.1 - 142.12.129.254
2	142.12.130.0/23	255.255.254.0	142.12.131.255	142.12.130.1 - 142.12.131.254
3	142.12.132.0/23	255.255.254.0	142.12.133.255	142.12.132.1 - 142.12.133.254
4	142.12.134.0/23	255.255.254.0	142.12.135.255	142.12.134.1 - 142.12.135.254
5	142.12.136.0/23	255.255.254.0	142.12.137.255	142.12.136.1 - 142.12.137.254
6	142.12.138.0/23	255.255.254.0	142.12.139.255	142.12.138.1 - 142.12.139.254

Original network 190.190.190.0/25

→Netmask: 255.255.255.128

→Broadcast: 190.190.190.127

➔ The network has 5 Lan, in order to store it we need to use 3 bits for subnetting and 4 bits for representing hosts

# LAN	Subnet	Netmask	Broadcast	IP Range
1	190.190.190.0/28	255.255.255.240	190.190.190.15	190.190.190.1 - 190.190.190.14
2	190.190.190.16/28	255.255.255.240	190.190.190.31	190.190.190.17 - 190.190.190.30
3	190.190.190.32/28	255.255.255.240	190.190.190.47	190.190.190.33 - 190.190.190.46
4	190.190.190.48/28	255.255.255.240	190.190.190.63	190.190.190.49 - 190.190.190.62
5	190.190.190.64/28	255.255.255.240	190.190.190.79	190.190.190.65 - 190.190.190.78

1. Files and Folders

UbuntuB2005893 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal

```
thienng@thienng-VirtualBox:~/LAB5$ tree
.
├── lab.conf
├── pc1
├── pc1.startup
├── pc2
├── pc2.startup
├── pc3
├── pc3.startup
├── r1
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ospfd.conf
│   │       ├── ripd.conf
│   │       └── zebra.conf
├── r1.startup
├── r2
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       └── ospfd.conf
├── r2.startup
├── r3
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       └── ospfd.conf
├── r3.startup
├── r4
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       └── ospfd.conf
├── r4.startup
├── r5
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
├── r5.startup
├── r6
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
├── r6.startup
├── r7
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
├── r7.startup
├── r8
├── risp
├── risp.startup
├── server
│   ├── var
│   │   └── www
│   │       └── html
│   │           └── index.html
├── server.startup
├── shared
├── sw1.startup
├── sw2.startup
```

31 directories, 36 files

thienng@thienng-VirtualBox:~/LAB5\$

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File Machine View Input Devices Help

Activities Terminal

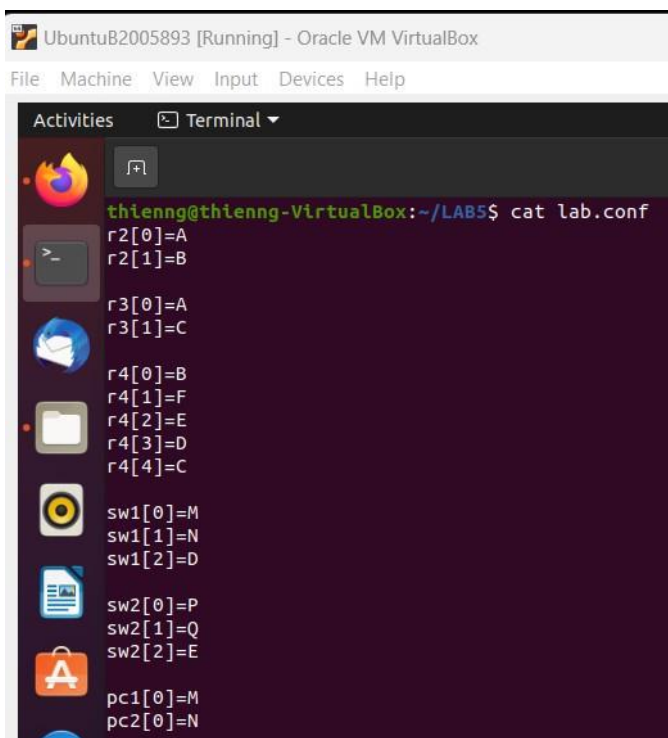
```
thienng@thienng-VirtualBox:~/LAB5$ tree
.
├── r4.startup
├── r5
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
├── r5.startup
├── r6
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
├── r6.startup
├── r7
│   ├── etc
│   │   └── quagga
│   │       ├── daemons
│   │       ├── ripd.conf
│   │       └── zebra.conf
├── r7.startup
├── r8
├── risp
├── risp.startup
├── server
│   ├── var
│   │   └── www
│   │       └── html
│   │           └── index.html
├── server.startup
├── shared
├── sw1.startup
├── sw2.startup
```

31 directories, 36 files

thienng@thienng-VirtualBox:~/LAB5\$

2. Files configurations

➔ \$ cat lab.conf



UbuntuB2005893 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal

```
thienng@thienng-VirtualBox:~/LAB5$ cat lab.conf
r2[0]=A
r2[1]=B

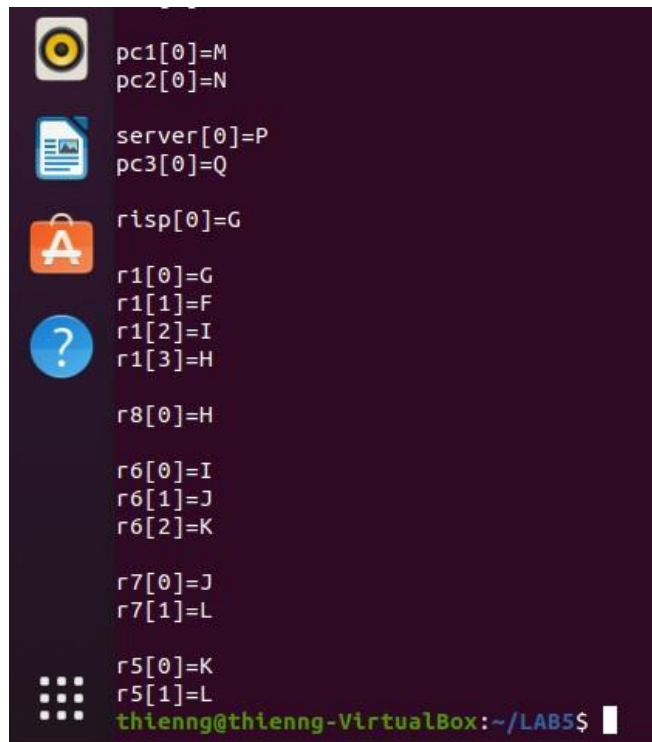
r3[0]=A
r3[1]=C

r4[0]=B
r4[1]=F
r4[2]=E
r4[3]=D
r4[4]=C

sw1[0]=M
sw1[1]=N
sw1[2]=D

sw2[0]=P
sw2[1]=Q
sw2[2]=E

pc1[0]=M
pc2[0]=N
```



```
pc1[0]=M
pc2[0]=N

server[0]=P
pc3[0]=Q

r1sp[0]=G

r1[0]=G
r1[1]=F
r1[2]=I
r1[3]=H

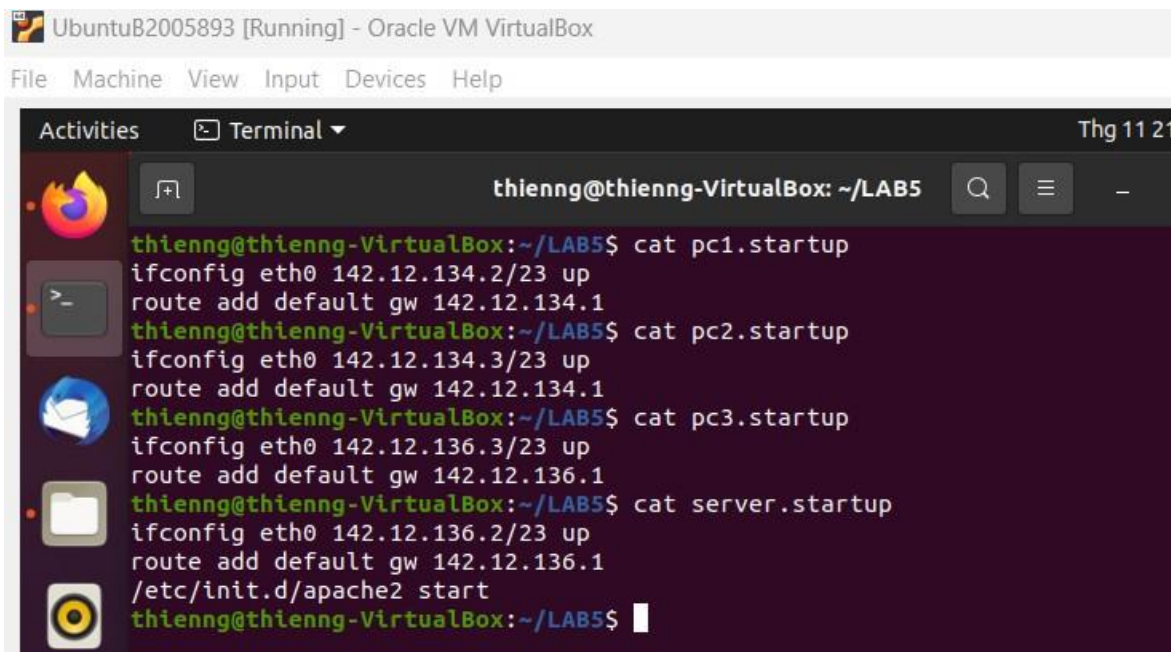
r8[0]=H

r6[0]=I
r6[1]=J
r6[2]=K

r7[0]=J
r7[1]=L

r5[0]=K
r5[1]=L
thienng@thienng-VirtualBox:~/LAB5$
```

➔ Cat the PCs and the server



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File Machine View Input Devices Help

Activities Terminal Thg 11 21

```
thienng@thienng-VirtualBox: ~/LAB5
thienng@thienng-VirtualBox:~/LAB5$ cat pc1.startup
ifconfig eth0 142.12.134.2/23 up
route add default gw 142.12.134.1
thienng@thienng-VirtualBox:~/LAB5$ cat pc2.startup
ifconfig eth0 142.12.134.3/23 up
route add default gw 142.12.134.1
thienng@thienng-VirtualBox:~/LAB5$ cat pc3.startup
ifconfig eth0 142.12.136.3/23 up
route add default gw 142.12.136.1
thienng@thienng-VirtualBox:~/LAB5$ cat server.startup
ifconfig eth0 142.12.136.2/23 up
route add default gw 142.12.136.1
/etc/init.d/apache2 start
thienng@thienng-VirtualBox:~/LAB5$
```

➔ Cat the routers

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File Machine View Input Devices Help

```
Activities Terminal Thg 11 21 18:13
thienng@thienng-VirtualBox: ~/LAB5

thienng@thienng-VirtualBox:~/LAB5$ cat r1.startup
ifconfig eth0 161.10.20.225/28 up
ifconfig eth1 142.12.138.1/23 up
ifconfig eth2 190.190.190.17/28 up
ifconfig eth3 190.190.190.1/28 up
/etc/init.d/quagga start
thienng@thienng-VirtualBox:~/LAB5$ cat r2.startup
ifconfig eth0 142.12.128.1/23 up
ifconfig eth1 142.12.130.1/23 up
/etc/init.d/quagga start
thienng@thienng-VirtualBox:~/LAB5$ cat r3.startup
ifconfig eth0 142.12.128.2/23 up
ifconfig eth1 142.12.132.1/23 up
/etc/init.d/quagga start
thienng@thienng-VirtualBox:~/LAB5$ cat r4.startup
ifconfig eth0 142.12.130.2/23 up
ifconfig eth1 142.12.138.2/23 up
ifconfig eth2 142.12.136.1/23 up
ifconfig eth3 142.12.134.1/23 up
ifconfig eth4 142.12.132.2/23 up
/etc/init.d/quagga start
```

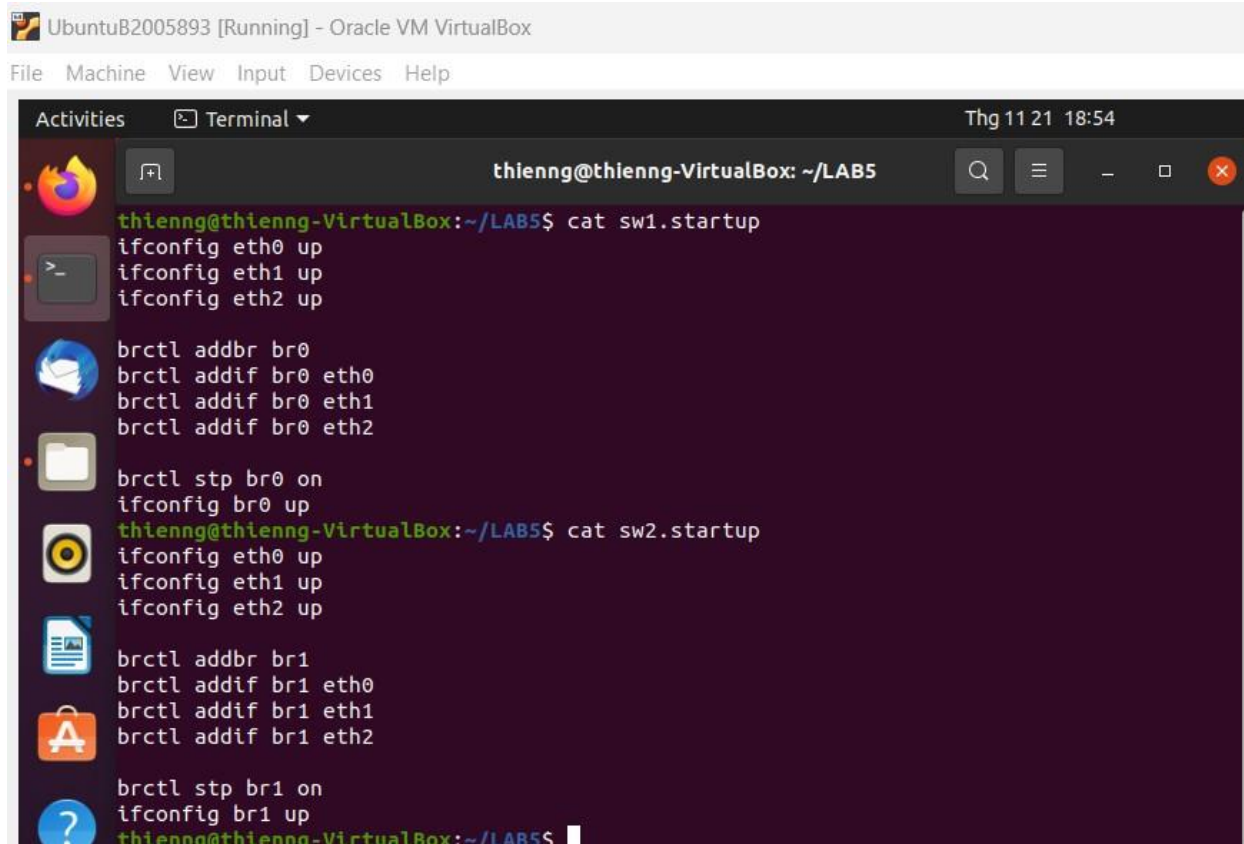
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File Machine View Input Devices Help

```
Activities Terminal Thg 11 21 18:15
thienng@thienng-VirtualBox: ~/LAB5

thienng@thienng-VirtualBox:~/LAB5$ cat r5.startup
ifconfig eth0 190.190.190.49/28 up
ifconfig eth1 190.190.190.65/28 up
/etc/init.d/quagga start
thienng@thienng-VirtualBox:~/LAB5$ cat r6.startup
ifconfig eth0 190.190.190.18/28 up
ifconfig eth1 190.190.190.34/28 up
ifconfig eth2 190.190.190.50/28 up
/etc/init.d/quagga start
thienng@thienng-VirtualBox:~/LAB5$ cat r7.startup
ifconfig eth0 190.190.190.33/28 up
ifconfig eth1 190.190.190.66/28 up
/etc/init.d/quagga start
thienng@thienng-VirtualBox:~/LAB5$ cat r8.startup
ifconfig eth0 190.190.190.2/28 up
route add default gw 190.190.190.1
thienng@thienng-VirtualBox:~/LAB5$ cat risp.startup
ifconfig eth0 161.10.20.226/28 up
route add default gw 161.10.20.225thienng@thienng-VirtualBox:~/LAB5$
```


➔ Cat the switches



The screenshot shows a terminal window titled "thienng@thienng-VirtualBox: ~/LAB5". The terminal displays the output of two "cat" commands. The first command, "cat sw1.startup", shows configuration for a bridge named br0, including bringing up interfaces eth0, eth1, and eth2, adding them to the bridge, and enabling STP. The second command, "cat sw2.startup", shows similar configuration for a bridge named br1.

```
thienng@thienng-VirtualBox: ~/LAB5$ cat sw1.startup
ifconfig eth0 up
ifconfig eth1 up
ifconfig eth2 up

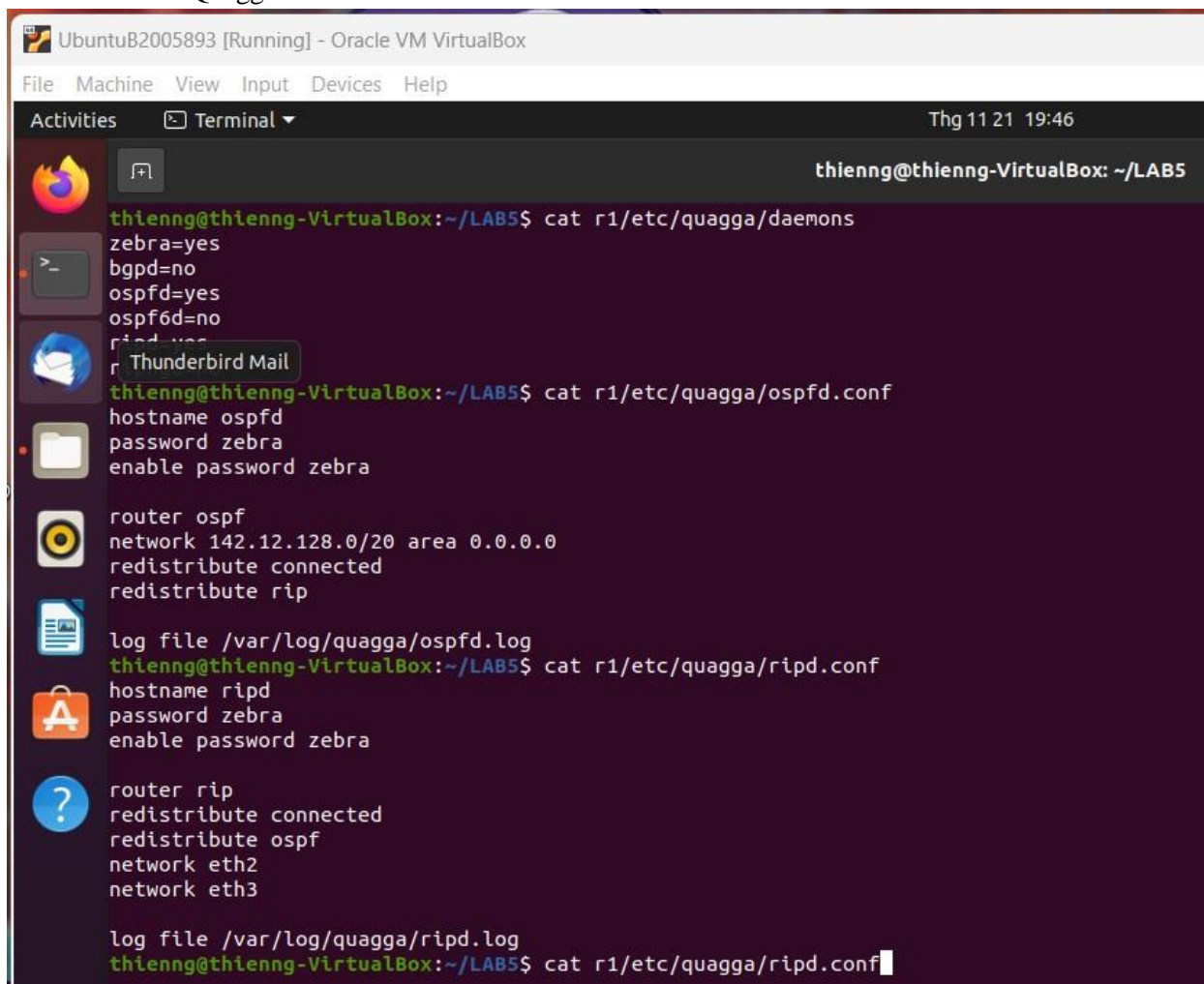
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2

brctl stp br0 on
ifconfig br0 up
thienng@thienng-VirtualBox:~/LAB5$ cat sw2.startup
ifconfig eth0 up
ifconfig eth1 up
ifconfig eth2 up

brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2

brctl stp br1 on
ifconfig br1 up
thienng@thienng-VirtualBox:~/LAB5$
```

3. Cat the Quagga in each router



The screenshot shows a terminal window titled "UbuntuB2005893 [Running] - Oracle VM VirtualBox". The terminal is running on a host named "thienng@thienng-VirtualBox" in the directory "~/LAB5". The user has executed the command `cat r1/etc/quagga/daemons`, which displays the following configuration:

```
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=yes
```

Next, the user runs `cat r1/etc/quagga/ospfd.conf`, showing the OSPF daemon configuration:

```
hostname ospfd
password zebra
enable password zebra

router ospf
network 142.12.128.0/20 area 0.0.0.0
redistribute connected
redistribute rip

log file /var/log/quagga/ospfd.log
```

Finally, the user runs `cat r1/etc/quagga/ripd.conf`, displaying the RIP daemon configuration:

```
hostname ripd
password zebra
enable password zebra

router rip
redistribute connected
redistribute ospf
network eth2
network eth3

log file /var/log/quagga/ripd.log
```

The terminal prompt is `thienng@thienng-VirtualBox:~/LAB5$` and the command `cat r1/etc/quagga/ripd.conf` is being entered.

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File Machine View Input Devices Help

Activities Terminal Thg 11 21 19:48

thienng@thienng-VirtualBox: ~/LAB5

```
thienng@thienng-VirtualBox:~/LAB5$ cat r2/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=no
ripngd=no

thienng@thienng-VirtualBox:~/LAB5$ cat r2/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra

#Default is 10
interface eth0
ospf cost 13
interface eth1
ospf cost 7

router ospf
network 142.12.128.0/20 area 0.0.0.0
redistribute connected

log file /var/log/quagga/ospfd.log
thienng@thienng-VirtualBox:~/LAB5$
```

UbuntuB2005893 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 11 21 19:48

thienng@thienng-VirtualBox: ~/LAB5

```
thienng@thienng-VirtualBox:~/LAB5$ cat r3/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=no
ripngd=no

thienng@thienng-VirtualBox:~/LAB5$ cat r3/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra

#Default is 10
interface eth0
ospf cost 8

router ospf
network 142.12.128.0/20 area 0.0.0.0
redistribute connected

log file /var/log/quagga/ospfd.log
thienng@thienng-VirtualBox:~/LAB5$
```

UbuntuB2005893 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 11 21 19:51

thienng@thienng-VirtualBox: ~/LAB5

```
thienng@thienng-VirtualBox:~/LAB5$ cat r4/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra

#Default is 10
interface eth0
ospf cost 9

router ospf
network 142.12.128.0/20 area 0.0.0.0
redistribute connected

log file /var/log/quagga/ospfd.log
thienng@thienng-VirtualBox:~/LAB5$
```

UbuntuB2005893 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 11 21 19:52

thienng@thienng-VirtualBox: ~/LAB5

```
thienng@thienng-VirtualBox:~/LAB5$ cat r5/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=no
ospf6d=no
ripd=yes
ripngd=no
thienng@thienng-VirtualBox:~/LAB5$ cat r5/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra

router rip
redistribute connected
network eth0
network eth1

log file /var/log/quagga/ripd.log
thienng@thienng-VirtualBox:~/LAB5$
```

UbuntuB2005893 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 11 21 19:53

thienng@thienng-VirtualBox: ~/LAB5

```
thienng@thienng-VirtualBox:~/LAB5$ cat r6/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra

router rip
 redistribute connected
 network eth0
 network eth1
 network eth2

log file /var/log/quagga/ripd.log
thienng@thienng-VirtualBox:~/LAB5$ cat r7/etc/quagga/ripd.conf
h Rhythmbox pd
password zebra
enable password zebra

router rip
 redistribute connected
 network eth0
 network eth1

log file /var/log/quagga/ripd.log
thienng@thienng-VirtualBox:~/LAB5$
```

UbuntuB2005893 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Thg 11 21 19:54

thienng@thienng-VirtualBox: ~/LAB5/server/var/www/html

```
thienng@thienng-VirtualBox:~/LAB5/server/var/www/html$ cat index.html
<html>
<body>

Hello!

<pre>
My name is Nguyen Vo Thuan Thien, B2005893!
</pre>

</body>
</html>
thienng@thienng-VirtualBox:~/LAB5/server/var/www/html$
```


File Machine View Input Devices Help

The screenshot displays a virtual machine environment with four terminal windows. The top bar indicates the system is 'UbuntuB2005893 [Running] - Oracle VM VirtualBox'. The menu bar includes 'File', 'Machine', 'View', 'Input', 'Devices', and 'Help'. The clock shows 'Thu 11:21 20:13'.

The terminal windows are as follows:

- root@pc1:/**: Shows startup commands log, a successful ping to 142.12.134.2, and a kernel IP routing table.
- root@pc3:/**: Shows startup commands log, a successful ping to 142.12.136.2, and a kernel IP routing table.
- root@pc2:/**: Shows startup commands log, a successful ping to 142.12.134.2, and a kernel IP routing table.
- root@server:/**: Shows startup commands log, successful pings to 142.12.136.2 and 161.10.20.225, and a kernel IP routing table.

The routing tables for each host are:

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	142.12.134.1	0.0.0.0	UG	0	0	0	eth0
142.12.134.0	0.0.0.0	255.255.254.0	U	0	0	0	eth0

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	142.12.136.1	0.0.0.0	UG	0	0	0	eth0
142.12.136.0	0.0.0.0	255.255.254.0	U	0	0	0	eth0

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	142.12.134.1	0.0.0.0	UG	0	0	0	eth0
142.12.134.0	0.0.0.0	255.255.254.0	U	0	0	0	eth0

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	142.12.136.1	0.0.0.0	UG	0	0	0	eth0
142.12.136.0	0.0.0.0	255.255.254.0	U	0	0	0	eth0

6. Testing connectivity

The image shows two side-by-side screenshots of an Ubuntu VM terminal window titled "UbuntuB2005893 [Running] - Oracle VM VirtualBox". The terminal is running as root on a host named pc1. The left screenshot shows ping tests to 142.12.138.2, 190.190.190.18, 190.190.190.17, and 190.190.190.33. The right screenshot shows ping tests to 142.12.128.1, 142.12.132.2, 142.12.130.2, and 190.190.190.34. All tests show 0% packet loss.

```

root@pc1: /
root@pc1:~# ping 142.12.138.2
PING 142.12.138.2 (142.12.138.2) 56(84) bytes of data.
64 bytes from 142.12.138.2: icmp_seq=1 ttl=64 time=0.342 ms
64 bytes from 142.12.138.2: icmp_seq=2 ttl=64 time=0.168 ms
^C
--- 142.12.138.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 11ms
rtt min/avg/max/mdev = 0.168/0.255/0.342/0.087 ms
root@pc1:~# ping 190.190.190.18
PING 190.190.190.18 (190.190.190.18) 56(84) bytes of data.
64 bytes from 190.190.190.18: icmp_seq=1 ttl=62 time=0.146 ms
64 bytes from 190.190.190.18: icmp_seq=2 ttl=62 time=0.235 ms
^C
--- 190.190.190.18 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 13ms
rtt min/avg/max/mdev = 0.146/0.190/0.235/0.046 ms
root@pc1:~# ping 190.190.190.17
PING 190.190.190.17 (190.190.190.17) 56(84) bytes of data.
64 bytes from 190.190.190.17: icmp_seq=1 ttl=63 time=0.126 ms
64 bytes from 190.190.190.17: icmp_seq=2 ttl=63 time=0.269 ms
^C
--- 190.190.190.17 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 18ms
rtt min/avg/max/mdev = 0.126/0.197/0.269/0.072 ms
root@pc1:~# ping 190.190.190.33
PING 190.190.190.33 (190.190.190.33) 56(84) bytes of data.
64 bytes from 190.190.190.33: icmp_seq=1 ttl=61 time=0.128 ms
64 bytes from 190.190.190.33: icmp_seq=2 ttl=61 time=0.244 ms
^C
--- 190.190.190.33 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 16ms
rtt min/avg/max/mdev = 0.128/0.186/0.244/0.058 ms
root@pc1:~#

root@pc1: /
root@pc1:~# ping 142.12.128.1
PING 142.12.128.1 (142.12.128.1) 56(84) bytes of data.
64 bytes from 142.12.128.1: icmp_seq=1 ttl=63 time=0.190 ms
64 bytes from 142.12.128.1: icmp_seq=2 ttl=63 time=0.209 ms
^C
--- 142.12.128.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 16ms
rtt min/avg/max/mdev = 0.190/0.199/0.209/0.017 ms
root@pc1:~# ping 142.12.132.2
PING 142.12.132.2 (142.12.132.2) 56(84) bytes of data.
64 bytes from 142.12.132.2: icmp_seq=1 ttl=64 time=0.108 ms
64 bytes from 142.12.132.2: icmp_seq=2 ttl=64 time=0.142 ms
^C
--- 142.12.132.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 3ms
rtt min/avg/max/mdev = 0.108/0.125/0.142/0.017 ms
root@pc1:~# ping 142.12.130.2
PING 142.12.130.2 (142.12.130.2) 56(84) bytes of data.
64 bytes from 142.12.130.2: icmp_seq=1 ttl=64 time=0.106 ms
64 bytes from 142.12.130.2: icmp_seq=2 ttl=64 time=0.169 ms
^C
--- 142.12.130.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 11ms
rtt min/avg/max/mdev = 0.106/0.137/0.169/0.033 ms
root@pc1:~# ping 190.190.190.34
PING 190.190.190.34 (190.190.190.34) 56(84) bytes of data.
64 bytes from 190.190.190.34: icmp_seq=1 ttl=62 time=0.119 ms
64 bytes from 190.190.190.34: icmp_seq=2 ttl=62 time=0.282 ms
^C
--- 190.190.190.34 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 32ms
rtt min/avg/max/mdev = 0.119/0.200/0.282/0.082 ms
root@pc1:~#

```

7. Ready to connect to server

The image shows a screenshot of an Ubuntu VM terminal window titled "UbuntuB2005893 [Running] - Oracle VM VirtualBox". The terminal is running as root on a host named pc1. The terminal is divided into four panes. The top-left pane shows a "Go to URL" dialog box with the URL "142.12.136.2" entered. The top-right pane shows a "Go to URL" dialog box with the URL "142.12.136.2" entered. The bottom-left pane shows a "Go to URL" dialog box with the URL "142.12.136.2" entered. The bottom-right pane shows a terminal window titled "root@server: /" with the following content:

```

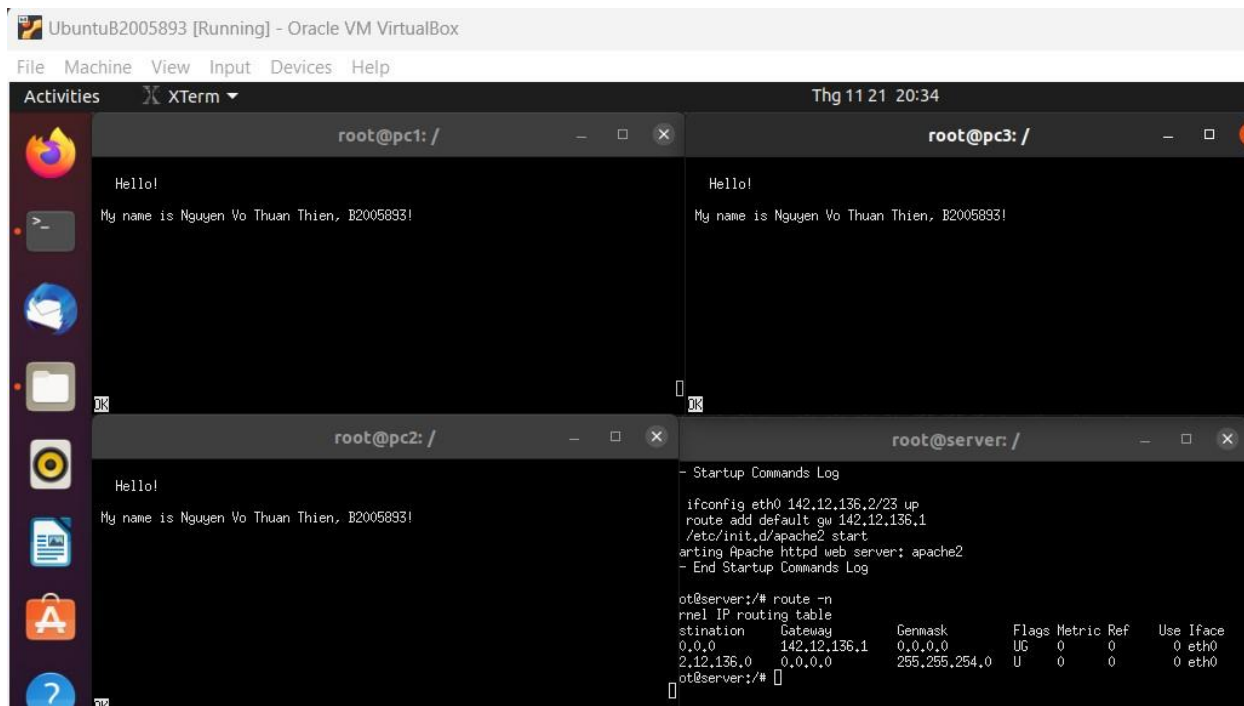
- Startup Commands Log
ifconfig eth0 142.12.136.2/23 up
route add default gw 142.12.136.1
/etc/init.d/apache2 start
Starting Apache httpd web server: apache2
- End Startup Commands Log

ot@server:~# route -n
rnel IP routing table
stination      Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0        142.12.136.1    0.0.0.0         UG  0      0      0 eth0
2.12.136.0     0.0.0.0         255.255.254.0   U   0      0      0 eth0
ot@server:~#

```


8. Result

- ➔ The Server provides a web service which shows “My name is Nguyen Vo Thuan Thien, B2005893!”



9. Delete all VMs

