

LAB 2

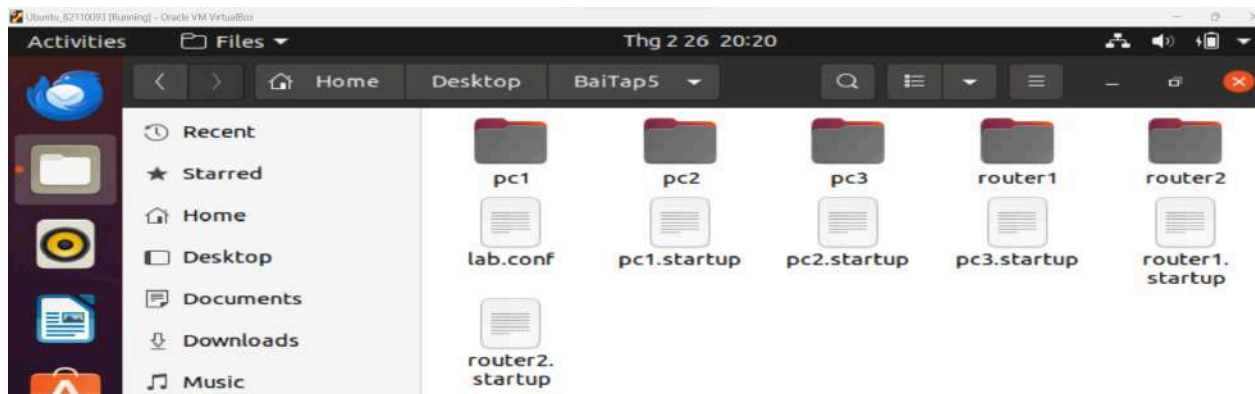


Họ tên và MSSV: Ha La Phin B2110093

Nhóm học phần: 11

Bài 5:

```
halaphin@laphin: ~/Desktop/BaiTap5
halaphin@laphin:~$ mkdir ~/Desktop/BaiTap5
halaphin@laphin:~$ cd ~/Desktop/BaiTap5
halaphin@laphin:~/Desktop/BaiTap5$ mkdir pc1 pc2 pc3 router1 router2
halaphin@laphin:~/Desktop/BaiTap5$ touch lab.conf pc1.startup pc2.startup pc3.startup router1.startup router2.startup
halaphin@laphin:~/Desktop/BaiTap5$ ls
lab.conf      pc2          pc3.startup  router2
pc1           pc2.startup  router1      router2.startup
pc1.startup  pc3         router1.startup
halaphin@laphin:~/Desktop/BaiTap5$
```



Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Text Editor Thg 2 26 20:29

lab.conf
~/Desktop/BaiTap5

```
1 pc1[0]=A
2 pc2[0]=B
3 pc3[0]=C
4 router1[0]=A
5 router1[1]=B
6 router2[0]=A
7 router2[1]=C
```

Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Text Editor Thg 2 26 20:30

pc1.startup
~/Desktop/BaiTap5 Save

```
1 ifconfig eth0 10.0.0.101/24 up
2 route add -net 10.0.1.0/24 gw 10.0.0.1
3 route add -net 10.0.2.0/24 gw 10.0.0.2
```

Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Text Editor Thg 2 26 22:07

pc2.startup
~/Desktop/BaiTap5

```
1 ifconfig eth0 10.0.1.101/24 up
2 route add default gw 10.0.1.1
3
```

Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Text Editor Thg 2 26 22:09

pc3.startup
~/Desktop/BaiTap5

pc2.startup

```
1 ifconfig eth0 10.0.2.101/24 up
2 route add default gw 10.0.2.1
3
```

Ubuntu [B2110093] [Running] - Oracle VM VirtualBox

Activities

Text Editor

Thg 2 26 20:46

router1.startup
~/Desktop/BaiTap5

Save

1 ifconfig eth0 10.0.0.1/24 up
2 ifconfig eth1 10.0.1.1/24 up
3 route add -net 10.0.2.0/24 gw 10.0.0.2

Ubuntu [B2110093] [Running] - Oracle VM VirtualBox

Activities

Text Editor

Thg 2 26 21:57

router2.startup
~/Desktop/BaiTap5

Save

1 ifconfig eth0 10.0.0.2/24 up
2 ifconfig eth1 10.0.2.1/24 up
3 route add -net 10.0.1.0/24 gw 10.0.0.1

Ubuntu [B2110093] [Running] - Oracle VM VirtualBox

Activities

XTerm

Thg 2 26 20:49

halaphin@laphin: ~/Desktop/BaiTap5

root@router1: /

root@pc2: /

root@pc3: /

root@pc1: /

root@router2: /

--- Startup Commands Log
++ ifconfig eth0 10.0.0.2/24 up
++ ifconfig eth1 10.0.2.1/24 up
++ route add -net 10.0.1.0/24 gw 10.0.0.1
--- End Startup Commands Log
root@router2:/#

Ubuntu [B2110093] [Running] - Oracle VM VirtualBox

Activities

XTerm

Thg 2 26 21:48

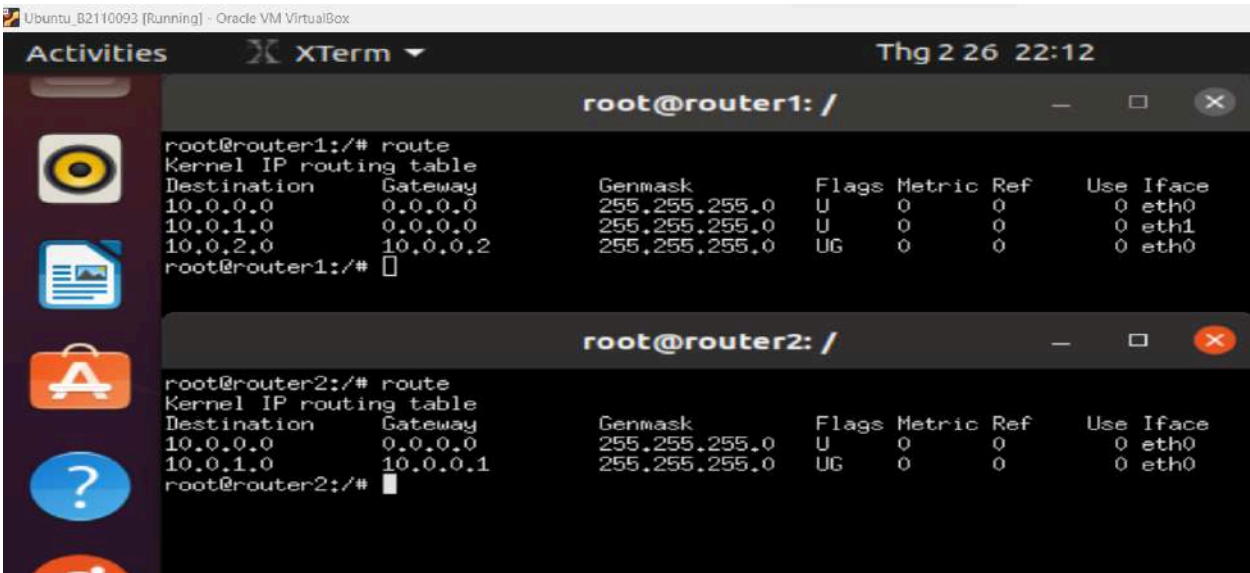
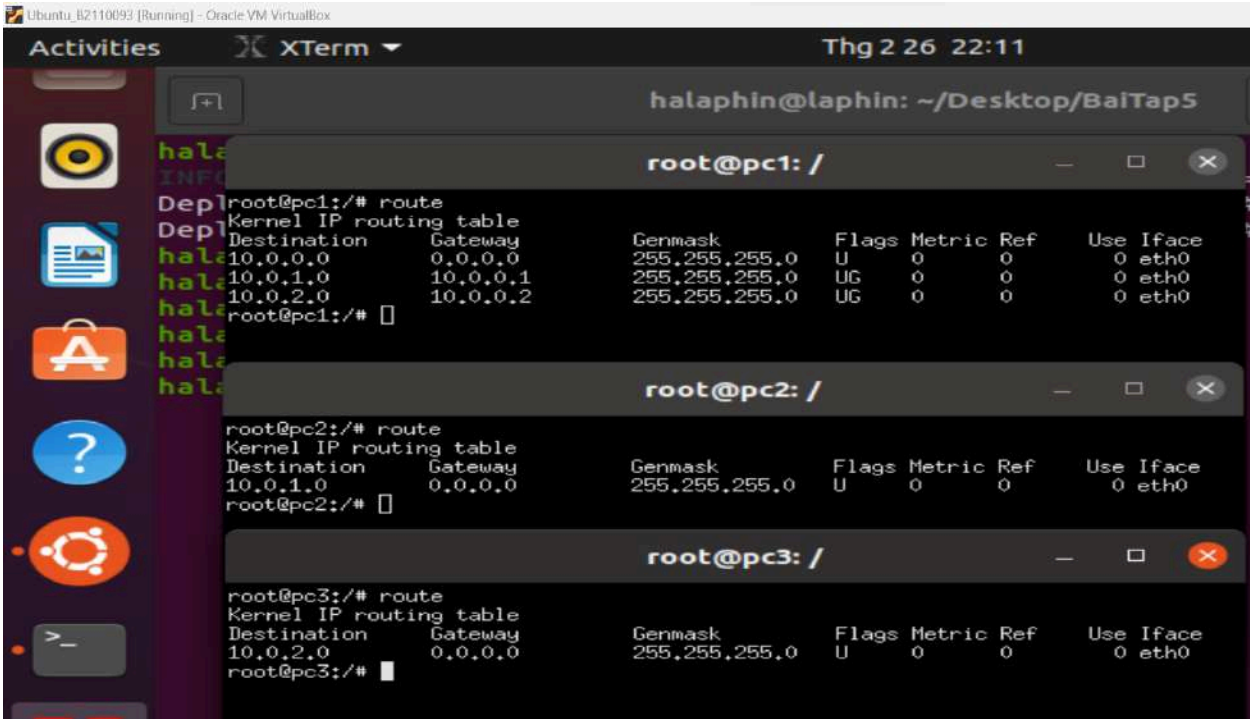
root@pc1: /

root@pc1:/# route

Kernel IP routing table

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
10.0.0.0	0.0.0.0	255.255.255.0	U	0	0	0	eth0
10.0.1.0	10.0.0.1	255.255.255.0	UG	0	0	0	eth0
10.0.2.0	10.0.0.2	255.255.255.0	UG	0	0	0	eth0

root@pc1:/#




```
Ubuntu_B2110093 [Running] - Oracle VM VirtualBox
Activities XTerm Thg 2 26 22:14
root@pc1: /
--- Startup Commands Log
++ ifconfig eth0 10.0.0.101/24 up
++ route add -net 10.0.1.0/24 gw 10.0.0.1
++ route add -net 10.0.2.0/24 gw 10.0.0.2
--- End Startup Commands Log
root@pc1:~# ping 10.0.1.101 -c 3
PING 10.0.1.101 (10.0.1.101) 56(84) bytes of data.
64 bytes from 10.0.1.101: icmp_seq=1 ttl=63 time=0.913 ms
64 bytes from 10.0.1.101: icmp_seq=2 ttl=63 time=0.819 ms
64 bytes from 10.0.1.101: icmp_seq=3 ttl=63 time=0.997 ms

--- 10.0.1.101 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2053ms
rtt min/avg/max/mdev = 0.819/0.909/0.997/0.072 ms
root@pc1:~# ping 10.0.2.101 -c 3
PING 10.0.2.101 (10.0.2.101) 56(84) bytes of data.
64 bytes from 10.0.2.101: icmp_seq=1 ttl=63 time=0.669 ms
64 bytes from 10.0.2.101: icmp_seq=2 ttl=63 time=0.889 ms
64 bytes from 10.0.2.101: icmp_seq=3 ttl=63 time=1.19 ms

--- 10.0.2.101 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2022ms
rtt min/avg/max/mdev = 0.669/0.916/1.191/0.213 ms
root@pc1:~#
```

Kiểm tra và không thấy lỗi !

```
Ubuntu_B2110093 [Running] - Oracle VM VirtualBox
Activities XTerm Thg 2 26 22:20
root@pc2: /
--- Startup Commands Log
++ ifconfig eth0 10.0.1.101/24 up
++ route add default gw 10.0.1.1
--- End Startup Commands Log
root@pc2:~# tcpdump -s 1536 -w /hostlab/BT5_pc2.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 bytes
root@pc2:~#

root@router1: /
root@router1:~# tcpdump -s 1536 -w /hostlab/BT5_router1.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 bytes
root@router1:~#

root@router2: /
root@router2:~# tcpdump -s 1536 -w /hostlab/BT5_router2.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 bytes
root@router2:~#
```

```
Activities XTerm Thg 2 26 22:22
root@pc3: /
64 bytes from 10.0.1.101: icmp_seq=47 ttl=62 time=1.07 ms
64 bytes from 10.0.1.101: icmp_seq=48 ttl=62 time=0.841 ms
64 bytes from 10.0.1.101: icmp_seq=49 ttl=62 time=1.03 ms
64 bytes from 10.0.1.101: icmp_seq=50 ttl=62 time=0.742 ms
64 bytes from 10.0.1.101: icmp_seq=51 ttl=62 time=1.09 ms
64 bytes from 10.0.1.101: icmp_seq=52 ttl=62 time=0.723 ms
64 bytes from 10.0.1.101: icmp_seq=53 ttl=62 time=0.682 ms
64 bytes from 10.0.1.101: icmp_seq=54 ttl=62 time=1.28 ms
64 bytes from 10.0.1.101: icmp_seq=55 ttl=62 time=0.817 ms
64 bytes from 10.0.1.101: icmp_seq=56 ttl=62 time=1.31 ms
64 bytes from 10.0.1.101: icmp_seq=57 ttl=62 time=1.41 ms
64 bytes from 10.0.1.101: icmp_seq=58 ttl=62 time=1.50 ms
64 bytes from 10.0.1.101: icmp_seq=59 ttl=62 time=1.23 ms
64 bytes from 10.0.1.101: icmp_seq=60 ttl=62 time=0.774 ms
64 bytes from 10.0.1.101: icmp_seq=61 ttl=62 time=0.968 ms
64 bytes from 10.0.1.101: icmp_seq=62 ttl=62 time=1.45 ms
64 bytes from 10.0.1.101: icmp_seq=63 ttl=62 time=0.691 ms
64 bytes from 10.0.1.101: icmp_seq=64 ttl=62 time=1.30 ms
64 bytes from 10.0.1.101: icmp_seq=65 ttl=62 time=0.807 ms
^C
--- 10.0.1.101 ping statistics ---
65 packets transmitted, 65 received, 0% packet loss, time 64608ms
rtt min/avg/max/mdev = 0.538/1.221/5.421/0.668 ms
root@pc3:/#
```

```
Ubuntu, 62110993 (Running) - Oracle VM VirtualBox
Activities XTerm Thg 2 26 22:29
root@pc2: /
--- Startup Commands Log
++ ifconfig eth0 10.0.1.101/24 up
++ route add default gw 10.0.1.1
--- End Startup Commands Log
root@pc2:/# tcpdump -s 1536 -w /hostlab/BT5_pc2.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot size 1536
^C140 packets captured
140 packets received by filter
0 packets dropped by kernel
root@pc2:/# tcpdump -s 1536 -w /shared/BT5_pc2.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot size 1536
^C

root@router1: /
root@router1:/# tcpdump -s 1536 -w /shared/BT5_router1.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot size 1536
^C

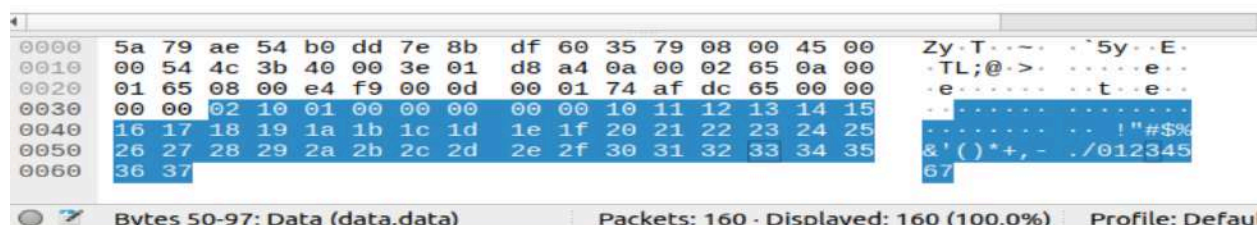
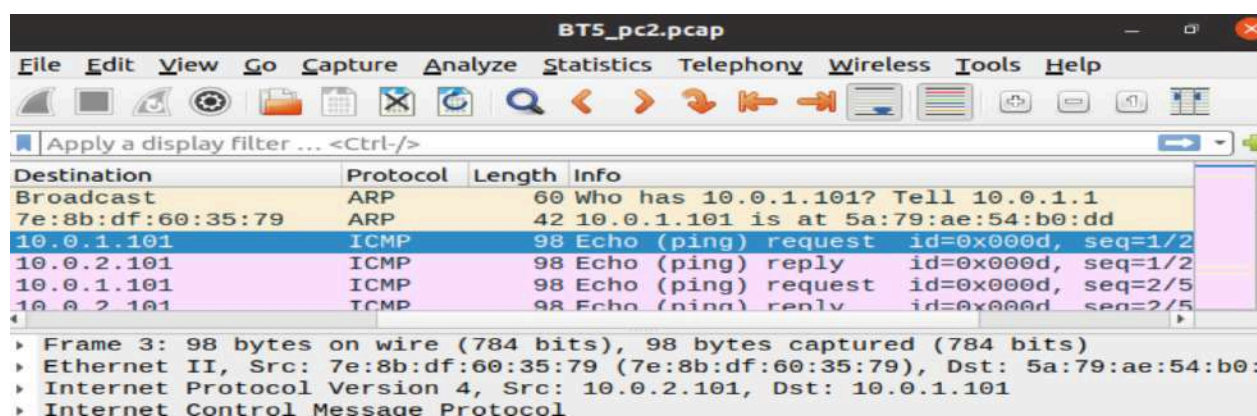
root@router2: /
root@router2:/# tcpdump -s 1536 -w /shared/BT5_router2.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot size 1536
^C
```

Download Wireshark

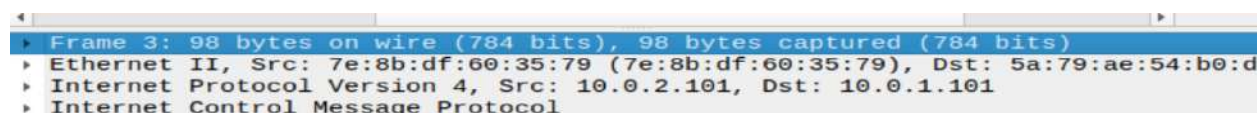
```

halaphin@laphin: ~/Desktop/BaiTap5
halaphin@laphin:~/Desktop/BaiTap5$ sudo apt-get install wireshark
[sudo] password for halaphin:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libbc-ares2 libdouble-conversion3 liblua5.2-0 libpcre2-16-0 libqt5core5a
  libqt5dbus5 libqt5gui5 libqt5multimedia5 libqt5multimedia5-plugins
  libqt5multimediagsttools5 libqt5multimediawidgets5 libqt5network5
  libqt5opengl5 libqt5printsupport5 libqt5svg5 libqt5widgets5 libsmi2ldbl
  libsnappy1v5 libspandsp2 libssh-gcrypt-4 libwireshark-data libwireshark13
  libwiretap10 libwsutil11 libxcb-xinerama0 libxcb-xinput0
  qt5-gtk-platformtheme qttranslations5-l10n wireshark-common wireshark-qt
Suggested packages:
  qt5-image-formats-plugins qtwayland5 snmp-mibs-downloader geotipupdate
  geotip-database geotip-database-extra libjs-leaflet
  libjs-leaflet-markerscluster wireshark-doc

```



Toàn bộ khung số 3 có kích thước là 98 Bytes



- Header Internet Control Message Protocol:
 - Gói tin sử dụng giao thức ICMP
 - Giao thức này hoạt động trên Network Layer của mô hình OSI
 - Thông điệp có độ dài 48 bytes, nội dung thông điệp là:

The image shows a Wireshark packet capture analysis. The top pane displays the packet details for an Internet Control Message Protocol (ICMP) Echo (ping) request. The packet is 64 bytes long, with a source IP of 10.0.2.101 and a destination IP of 10.0.1.101. The packet is captured on the interface eth0.

The middle pane shows a list of captured packets. The selected packet is packet 3, which is an ICMP Echo (ping) request. The packet is 64 bytes long, with a source IP of 10.0.2.101 and a destination IP of 10.0.1.101.

The bottom pane shows the packet bytes and their corresponding ASCII values. The packet is 64 bytes long, with a source IP of 10.0.2.101 and a destination IP of 10.0.1.101.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	7e:8b:df:60:35:79	Broadcast	ARP	60	Who has 10.0.1.101? Tell 10.0.1.1
2	0.000009	5a:79:ae:54:b0:dd	7e:8b:df:60:35:79	ARP	42	10.0.1.101 is at 5a:79:ae:54:b0:dd
3	0.000097	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=1/256, ttl=62 (reply in 4)
4	0.000116	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=1/256, ttl=64 (request in 3)
5	1.140661	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=2/512, ttl=62 (reply in 6)
6	1.140668	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=2/512, ttl=64 (request in 5)
7	2.145849	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=3/768, ttl=62 (reply in 8)
8	2.145876	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=3/768, ttl=64 (request in 7)
9	3.369586	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=4/1024, ttl=62 (reply in 9)
10	3.369612	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=4/1024, ttl=64 (request in 9)
11	4.624449	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=5/1280, ttl=62 (reply in 11)
12	4.624463	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=5/1280, ttl=64 (request in 11)
13	5.103851	5a:79:ae:54:b0:dd	7e:8b:df:60:35:79	ARP	42	Who has 10.0.1.1? Tell 10.0.1.1
14	5.104161	7e:8b:df:60:35:79	5a:79:ae:54:b0:dd	ARP	60	10.0.1.1 is at 7e:8b:df:60:35:79
15	5.936761	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=6/1536, ttl=62 (reply in 15)
16	5.936782	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=6/1536, ttl=64 (request in 15)
17	7.016091	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=7/1792, ttl=62 (reply in 17)
18	7.016112	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=7/1792, ttl=64 (request in 17)
19	8.050824	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=8/2048, ttl=62 (reply in 19)

The image shows a Wireshark packet capture analysis. The top pane displays the packet details for an Internet Control Message Protocol (ICMP) Echo (ping) request. The packet is 64 bytes long, with a source IP of 10.0.2.101 and a destination IP of 10.0.1.101. The packet is captured on the interface eth0.

The middle pane shows a list of captured packets. The selected packet is packet 3, which is an ICMP Echo (ping) request. The packet is 64 bytes long, with a source IP of 10.0.2.101 and a destination IP of 10.0.1.101.

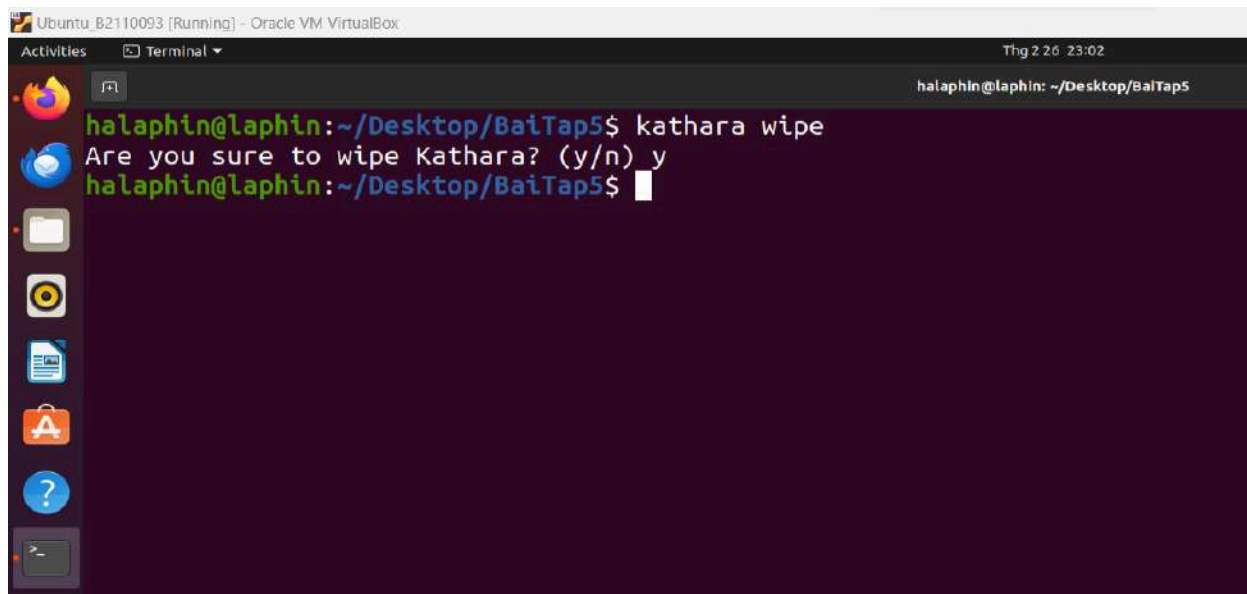
The bottom pane shows the packet bytes and their corresponding ASCII values. The packet is 64 bytes long, with a source IP of 10.0.2.101 and a destination IP of 10.0.1.101.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	7e:8b:df:60:35:79	Broadcast	ARP	60	Who has 10.0.1.101? Tell 10.0.1.1
2	0.000009	5a:79:ae:54:b0:dd	7e:8b:df:60:35:79	ARP	42	10.0.1.101 is at 5a:79:ae:54:b0:dd
3	0.000097	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=1/256, ttl=62 (reply in 4)
4	0.000116	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=1/256, ttl=64 (request in 3)
5	1.140661	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=2/512, ttl=62 (reply in 6)
6	1.140668	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=2/512, ttl=64 (request in 5)
7	2.145849	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=3/768, ttl=62 (reply in 8)
8	2.145876	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=3/768, ttl=64 (request in 7)
9	3.369586	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=4/1024, ttl=62 (reply in 9)
10	3.369612	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=4/1024, ttl=64 (request in 9)
11	4.624449	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=5/1280, ttl=62 (reply in 11)
12	4.624463	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=5/1280, ttl=64 (request in 11)
13	5.103851	5a:79:ae:54:b0:dd	7e:8b:df:60:35:79	ARP	42	Who has 10.0.1.1? Tell 10.0.1.1
14	5.104161	7e:8b:df:60:35:79	5a:79:ae:54:b0:dd	ARP	60	10.0.1.1 is at 7e:8b:df:60:35:79
15	5.936761	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=6/1536, ttl=62 (reply in 15)
16	5.936782	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=6/1536, ttl=64 (request in 15)
17	7.016091	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=7/1792, ttl=62 (reply in 17)
18	7.016112	10.0.1.101	10.0.2.101	ICMP	98	Echo (ping) reply id=0x0000, seq=7/1792, ttl=64 (request in 17)
19	8.050824	10.0.2.101	10.0.1.101	ICMP	98	Echo (ping) request id=0x0000, seq=8/2048, ttl=62 (reply in 19)

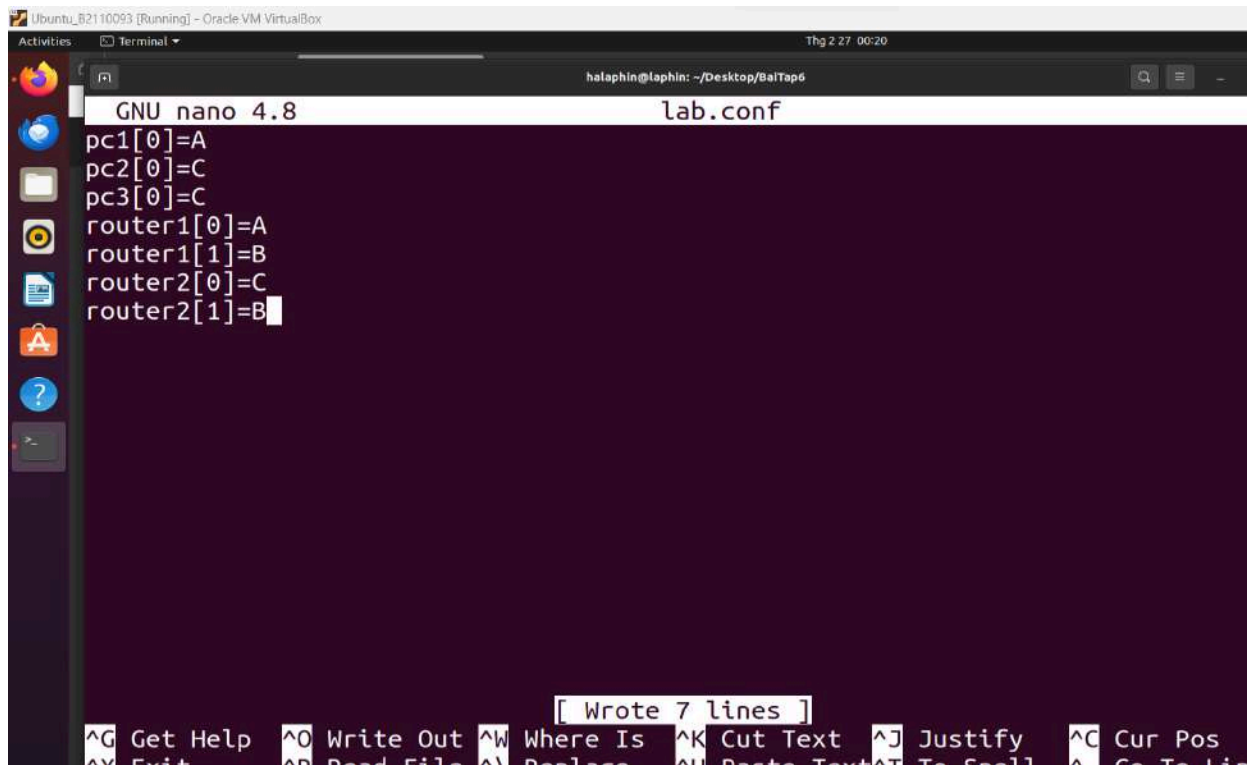

```
Frame 3: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
Ethernet II, Src: 7e:8b:df:60:35:79 (7e:8b:df:60:35:79), Dst: 5a:79:ae:54:b0:dd (5a:79:ae:54:b0:dd)
  Destination: 5a:79:ae:54:b0:dd (5a:79:ae:54:b0:dd)
  Source: 7e:8b:df:60:35:79 (7e:8b:df:60:35:79)
  Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 10.0.2.101, Dst: 10.0.1.101
Internet Control Message Protocol
```

- Header Ethernet II:

- Địa chỉ MAC của máy gửi dữ liệu là 7e:8b:df:60:35:79, đây là địa chỉ của router1. Vì trong quá trình truyền tải dữ liệu, địa chỉ MAC của tập nguồn tin luôn thay đổi, do mỗi khi qua một router thì sẽ mở gói và đóng gói. Do vậy, địa chỉ MAC nguồn của gói sẽ là địa chỉ MAC cuối cùng mà nó đi qua
- Địa chỉ MAC của máy nhận dữ liệu là 5a:79:aeb0:dd, đây là địa chỉ của pc2
- Trường type mang giá trị là 0x0800. Thông tin thể hiện là IPv4
- Payload có chiều dài là 28 bytes



Bài 6 :



Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Terminal Thg 2/27 00:20

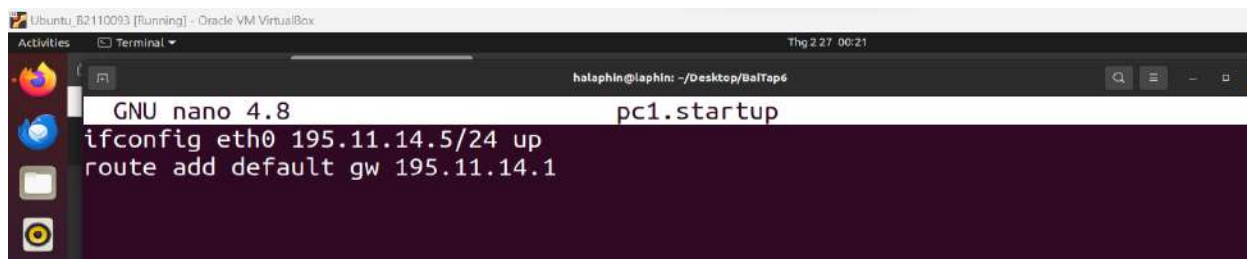
halaphin@laphin: ~/Desktop/BaiTap6

GNU nano 4.8 lab.conf

```
pc1[0]=A
pc2[0]=C
pc3[0]=C
router1[0]=A
router1[1]=B
router2[0]=C
router2[1]=B
```

[Wrote 7 lines]

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^Y Exit ^R Read File ^X Replace ^U Paste Text ^T To Spell ^_ Go To Line



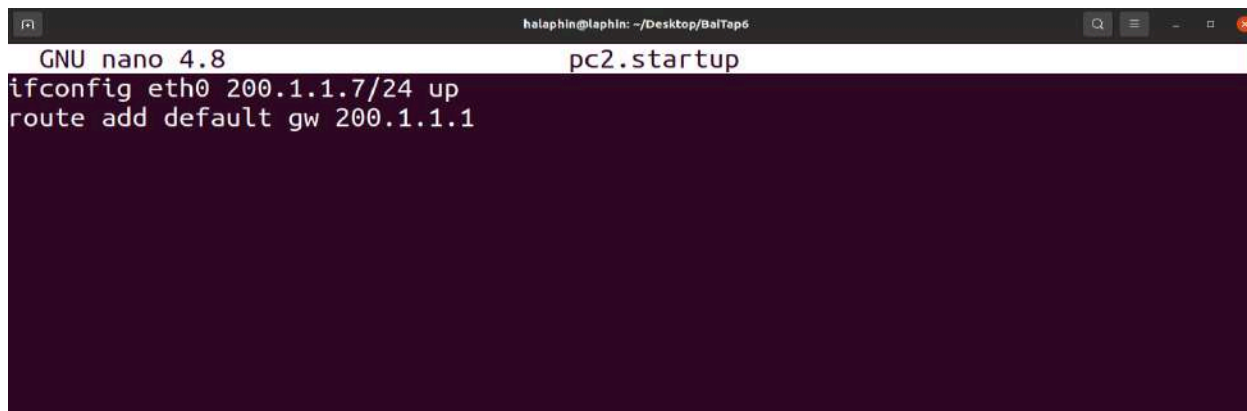
Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Terminal Thg 2/27 00:21

halaphin@laphin: ~/Desktop/BaiTap6

GNU nano 4.8 pc1.startup

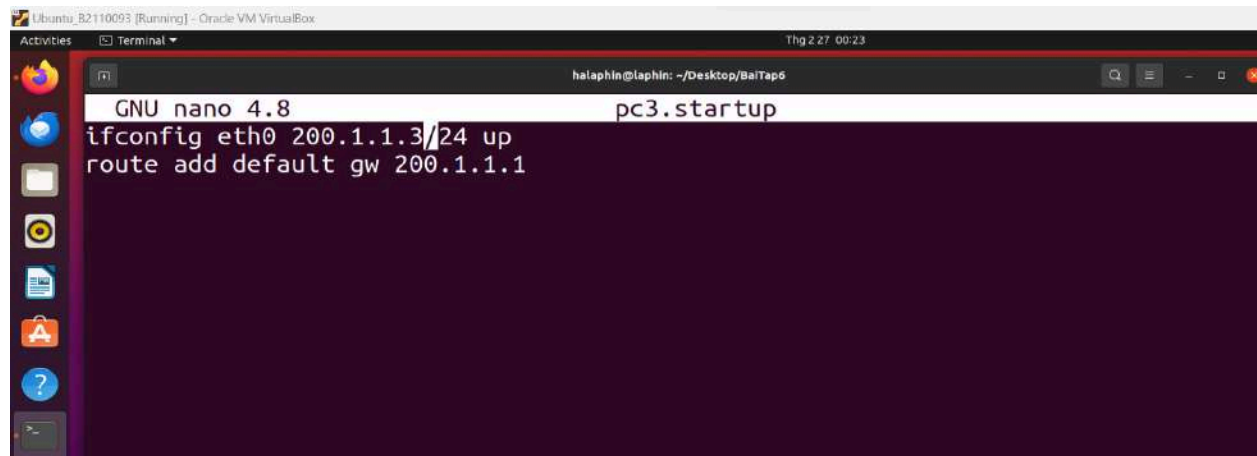
```
ifconfig eth0 195.11.14.5/24 up
route add default gw 195.11.14.1
```



halaphin@laphin: ~/Desktop/BaiTap6

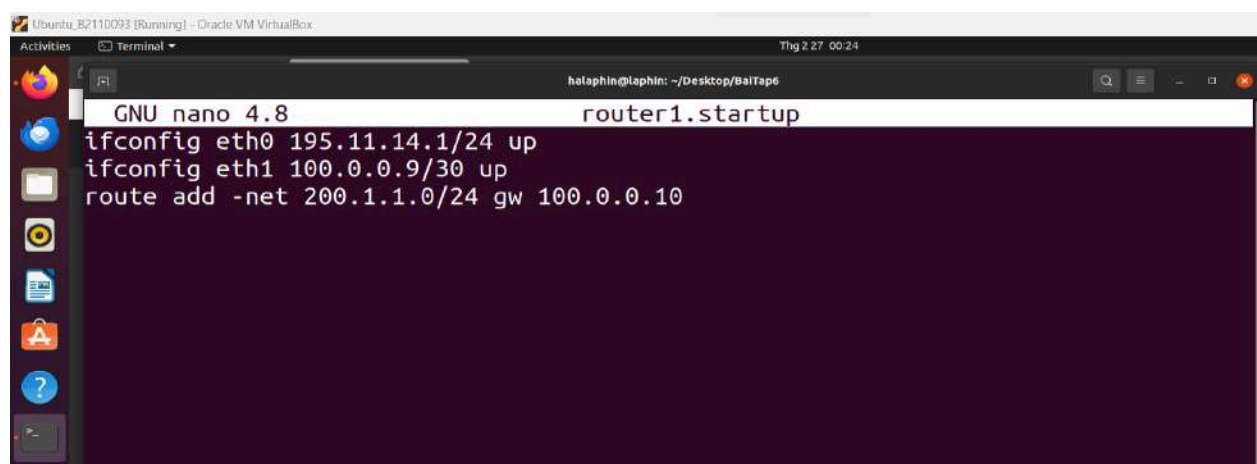
GNU nano 4.8 pc2.startup

```
ifconfig eth0 200.1.1.7/24 up
route add default gw 200.1.1.1
```

The screenshot shows a terminal window titled "Ubuntu_B2110093 [Running] - Oracle VM VirtualBox" with a timestamp of "Thg 2 27 00:23". The user is logged in as "halaphin@laphin" and is in the directory "~/Desktop/BaiTap6". The terminal is running GNU nano 4.8, editing a file named "pc3.startup". The content of the file is:

```
ifconfig eth0 200.1.1.3/24 up
route add default gw 200.1.1.1
```



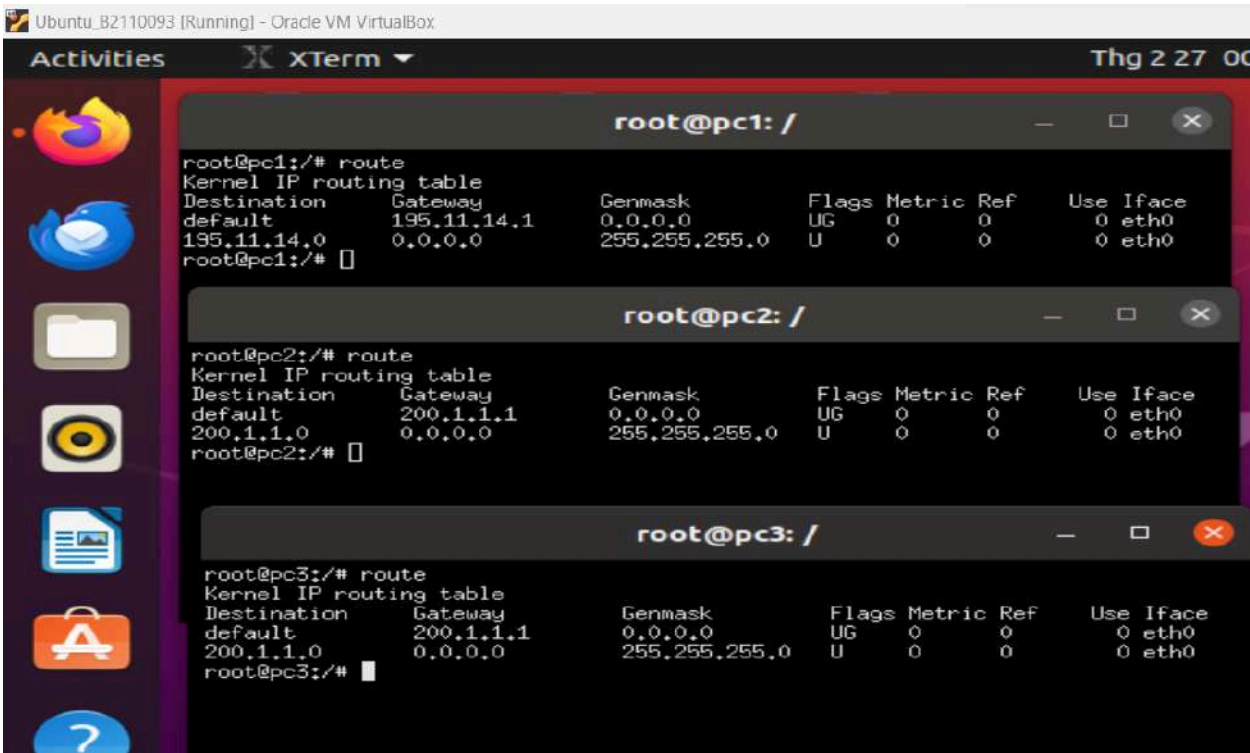
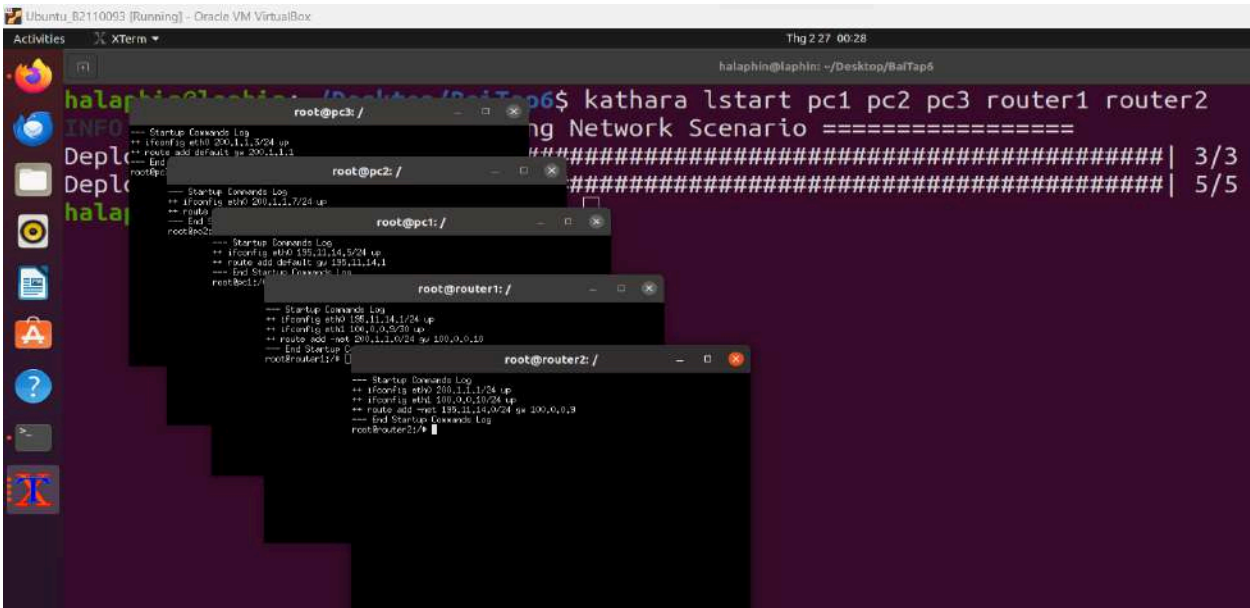
The screenshot shows a terminal window titled "Ubuntu_B2110093 [Running] - Oracle VM VirtualBox" with a timestamp of "Thg 2 27 00:24". The user is logged in as "halaphin@laphin" and is in the directory "~/Desktop/BaiTap6". The terminal is running GNU nano 4.8, editing a file named "router1.startup". The content of the file is:

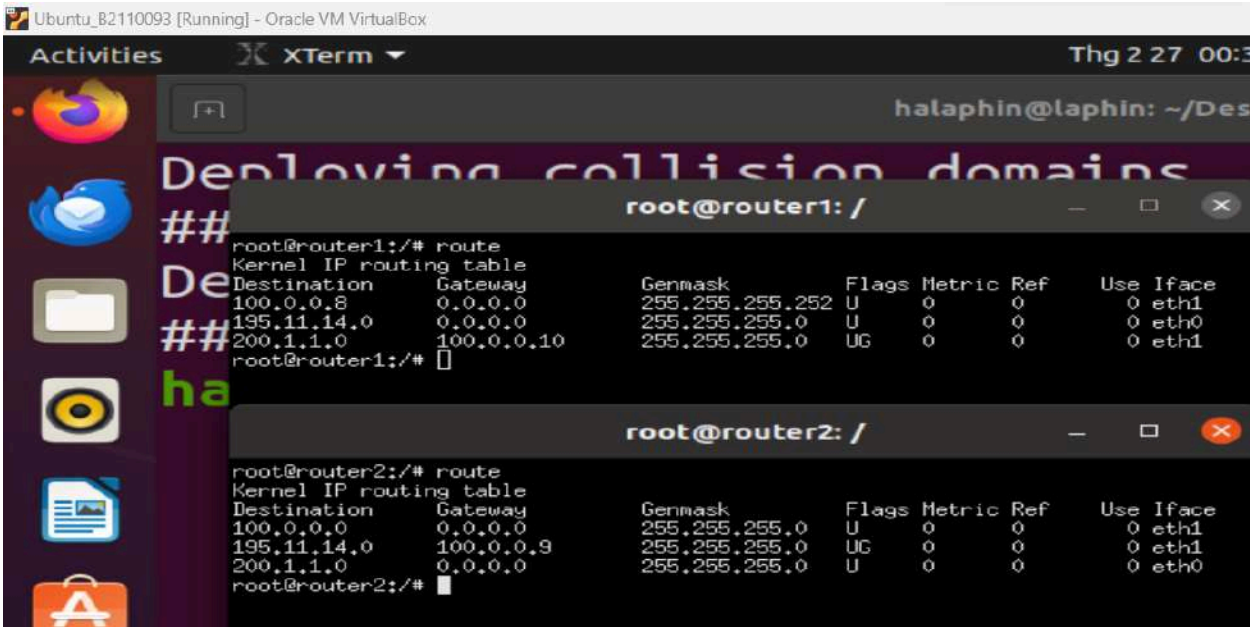
```
ifconfig eth0 195.11.14.1/24 up
ifconfig eth1 100.0.0.9/30 up
route add -net 200.1.1.0/24 gw 100.0.0.10
```



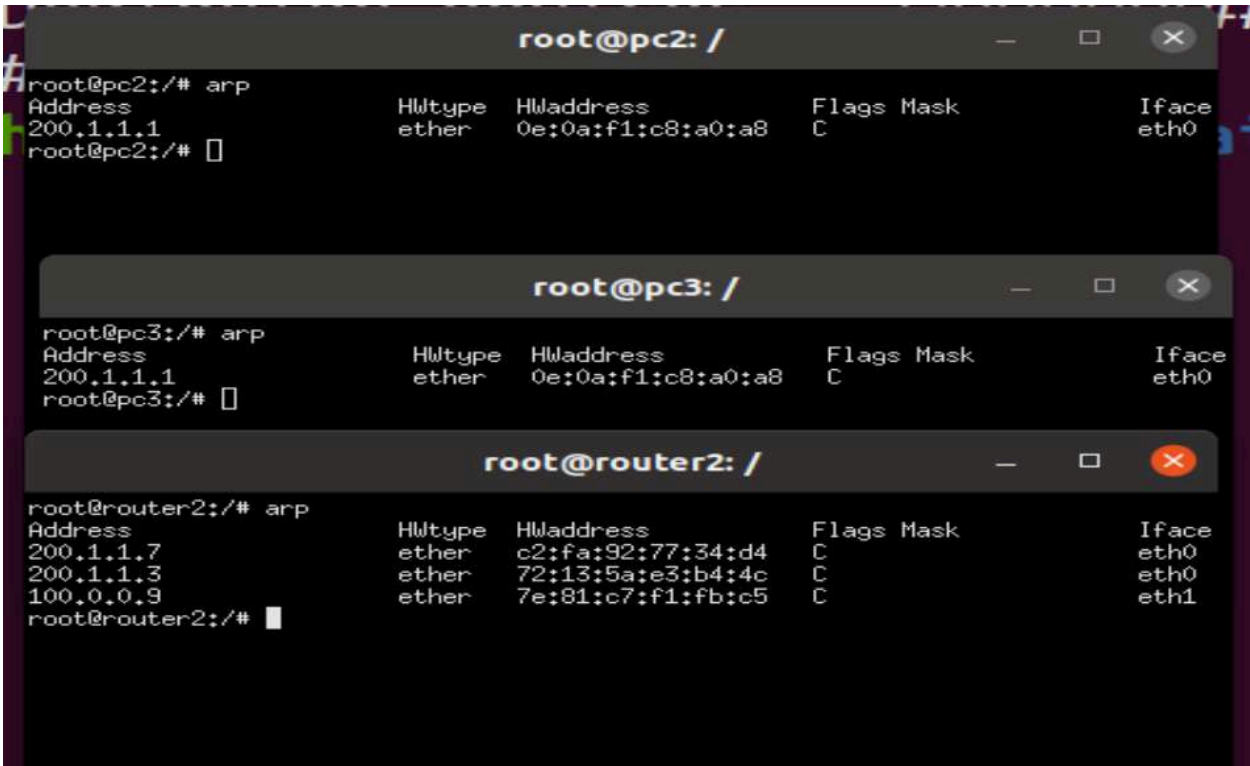
The screenshot shows a terminal window titled "Ubuntu_B2110093 [Running] - Oracle VM VirtualBox" with a timestamp of "Thg 2 27 00:26". The user is logged in as "halaphin@laphin" and is in the directory "~/Desktop/BaiTap6". The terminal is running GNU nano 4.8, editing a file named "router2.startup". The content of the file is:

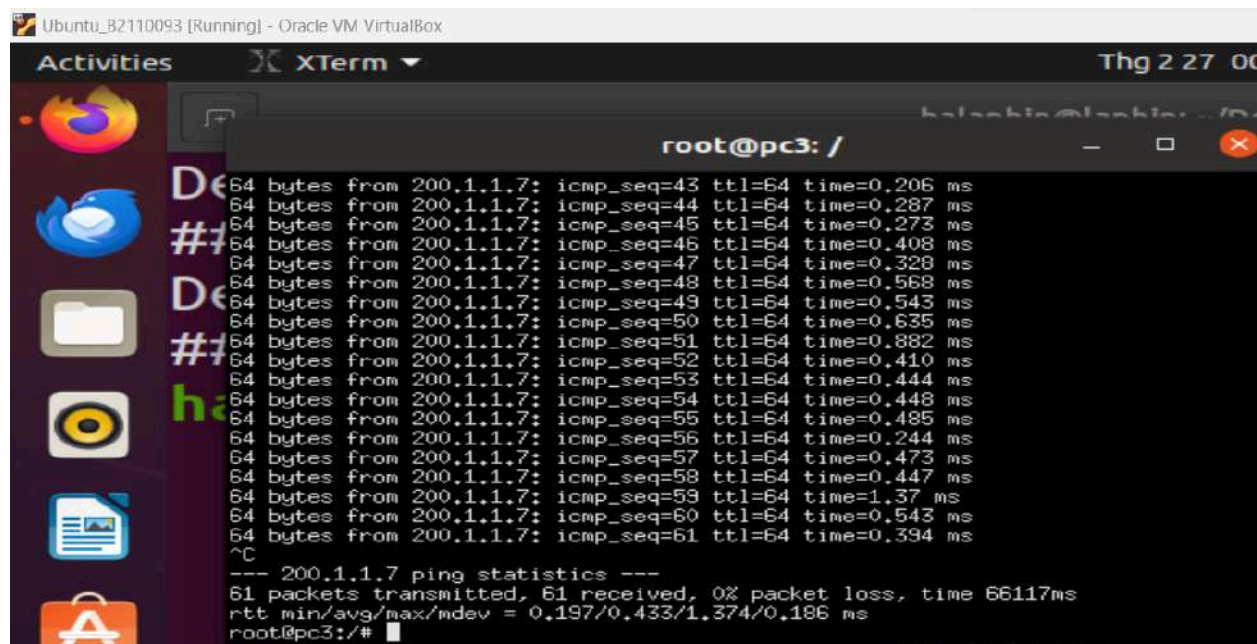
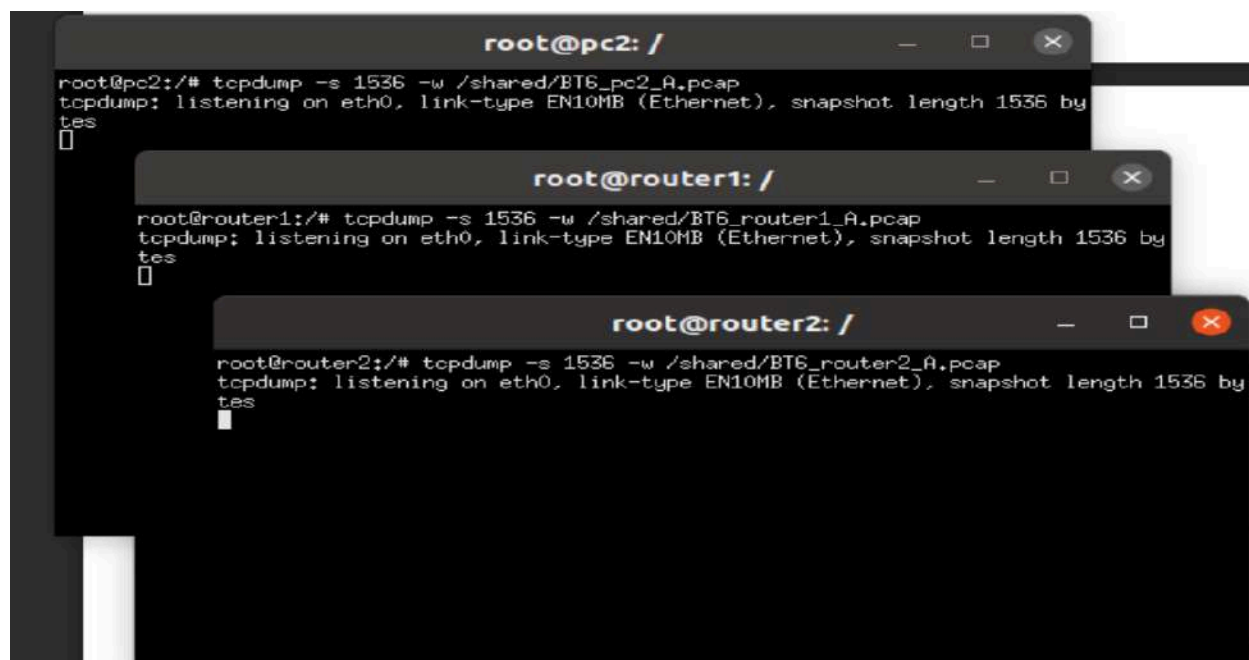
```
ifconfig eth0 200.1.1.1/24 up
ifconfig eth1 100.0.0.10/24 up
route add -net 195.11.14.0/24 gw 100.0.0.9
```





Giao thức ARP giữa 2 thiết bị trong cùng nhánh mạng LAN C:





The screenshot shows a virtual machine environment with three terminal windows. The background terminal shows the deployment of collision domains and devices. The three foreground terminal windows show the execution of tcpdump on the eth0 interface of each host.

```
root@pc2: /
root@pc2:~# tcpdump -s 1536 -w /shared/BT6_pc2_A.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 bytes
^C132 packets captured
0 packets received by filter
0 packets dropped by kernel
root@pc2:~#
```

```
root@router1: /
root@router1:~# tcpdump -s 1536 -w /shared/BT6_router1_A.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 bytes
^C0 packets captured
0 packets received by filter
0 packets dropped by kernel
root@router1:~#
```

```
root@router2: /
root@router2:~# tcpdump -s 1536 -w /shared/BT6_router2_A.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 bytes
^C132 packets captured
132 packets received by filter
0 packets dropped by kernel
root@router2:~#
```

The screenshot shows three terminal windows displaying the output of the 'arp' command on three different hosts. Each window shows a table of IP addresses, hardware types, hardware addresses, flags, masks, and interfaces.

```
root@pc3: /
root@pc3:~# arp
Address      HWtype  HWaddress  Flags Mask  Iface
200.1.1.7    ether   c2:fa:92:77:34:d4  C          eth0
200.1.1.1    ether   0e:0a:f1:c8:a0:a8  C          eth0
root@pc3:~#
```

```
root@pc2: /
root@pc2:~# arp
Address      HWtype  HWaddress  Flags Mask  Iface
200.1.1.1    ether   0e:0a:f1:c8:a0:a8  C          eth0
200.1.1.3    ether   72:13:5a:e3:b4:4c  C          eth0
root@pc2:~#
```

```
root@router2: /
root@router2:~# arp
Address      HWtype  HWaddress  Flags Mask  Iface
200.1.1.7    ether   c2:fa:92:77:34:d4  C          eth0
200.1.1.3    ether   72:13:5a:e3:b4:4c  C          eth0
100.0.0.9     ether   7e:81:c7:f1:fb:c5  C          eth1
root@router2:~#
```

- pc3 có thông tin địa chỉ mạng của pc2 và pc2 có thông tin địa chỉ mạng của pc3, router2 thì không thay đổi

Wireshark packet capture analysis of BT6_pc2_A.pcap. The main packet list shows 15 frames. Frame 1 is an ARP request from 72:13:5a:e3:b4:4c to Broadcast. The packet details pane for Frame 1 shows Ethernet II and ARP protocol layers. The packet bytes pane shows the raw hex data.

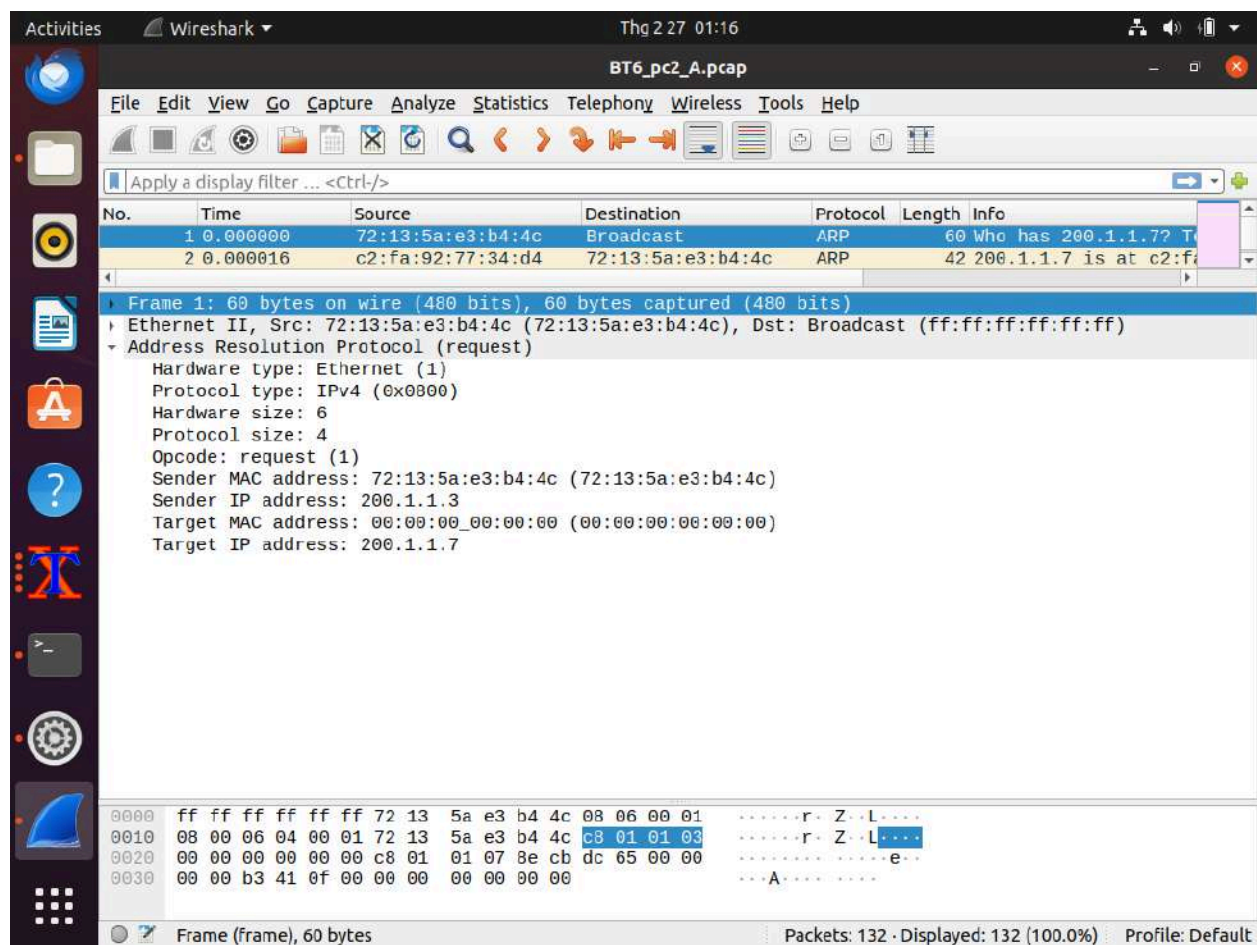
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	72:13:5a:e3:b4:4c	Broadcast	ARP	60	Who has 200.1.1.7? T
2	0.000016	c2:fa:92:77:34:d4	72:13:5a:e3:b4:4c	ARP	42	200.1.1.7 is at c2:fa
3	0.000139	200.1.1.3	200.1.1.7	ICMP	98	Echo (ping) request
4	0.000166	200.1.1.7	200.1.1.3	ICMP	98	Echo (ping) reply
5	1.379473	200.1.1.3	200.1.1.7	ICMP	98	Echo (ping) request
6	1.379499	200.1.1.7	200.1.1.3	ICMP	98	Echo (ping) reply
7	2.389696	200.1.1.3	200.1.1.7	ICMP	98	Echo (ping) request
8	2.389744	200.1.1.7	200.1.1.3	ICMP	98	Echo (ping) reply
9	3.419284	200.1.1.3	200.1.1.7	ICMP	98	Echo (ping) request
10	3.419317	200.1.1.7	200.1.1.3	ICMP	98	Echo (ping) reply
11	4.612273	200.1.1.3	200.1.1.7	ICMP	98	Echo (ping) request
12	4.612292	200.1.1.7	200.1.1.3	ICMP	98	Echo (ping) reply
13	5.258686	c2:fa:92:77:34:d4	72:13:5a:e3:b4:4c	ARP	42	Who has 200.1.1.3? T
14	5.258963	72:13:5a:e3:b4:4c	c2:fa:92:77:34:d4	ARP	60	200.1.1.3 is at 72:13
15	5.615220	200.1.1.3	200.1.1.7	ICMP	98	Echo (ping) request

Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
Ethernet II, Src: 72:13:5a:e3:b4:4c (72:13:5a:e3:b4:4c), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Address Resolution Protocol (request)

0000 ff ff ff ff ff ff 72 13 5a e3 b4 4c 08 06 00 01r.Z..L....
0010 08 00 06 04 00 01 72 13 5a e3 b4 4c c8 01 01 03r.Z..L....
0020 00 00 00 00 00 00 c8 01 01 07 8e cb dc 65 00 00e.....
0030 00 00 b3 41 0f 00 00 00 00 00 00 00A.....

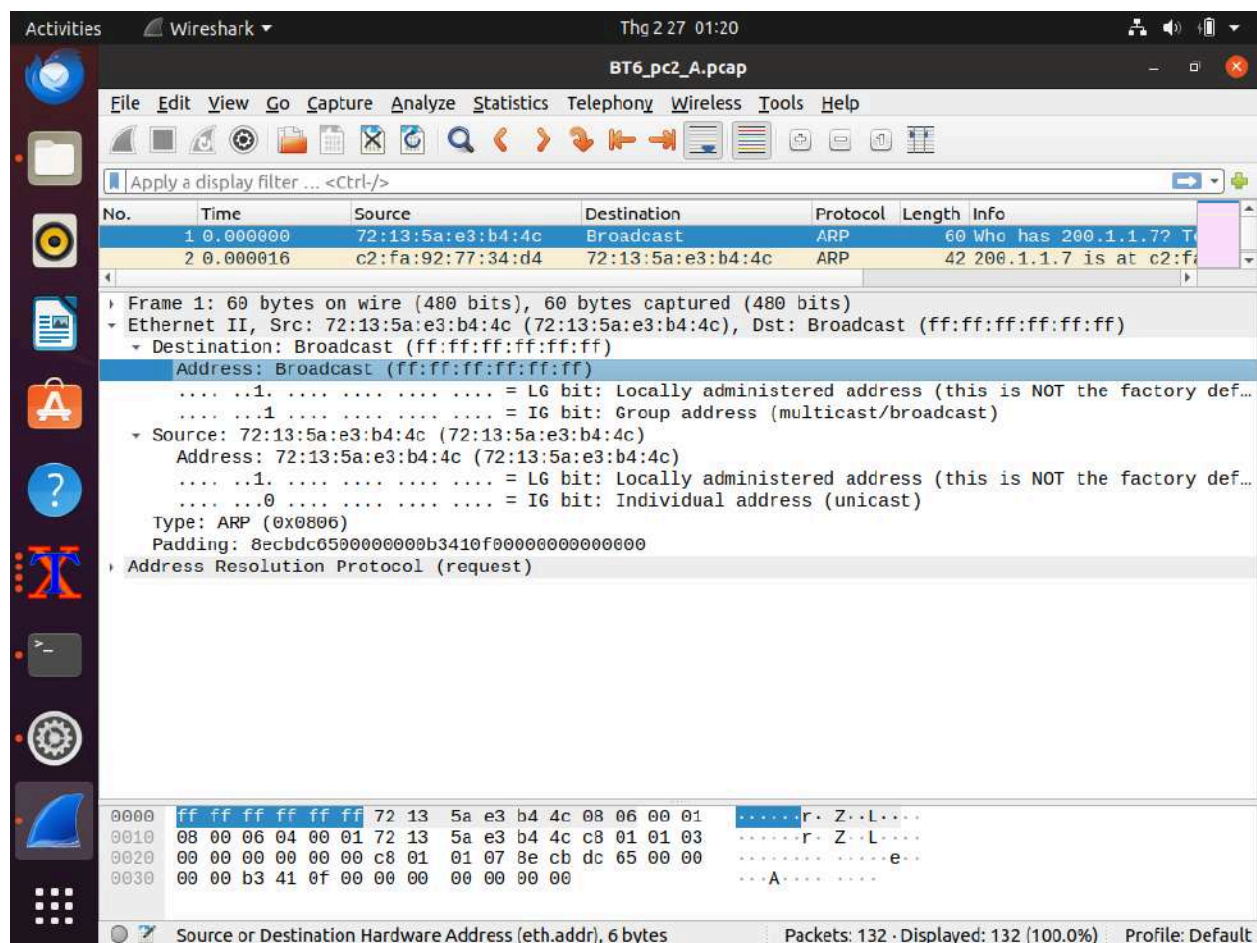
Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
Encapsulation type: Ethernet (1)
Arrival Time: Feb 27, 2024 00:39:50.712945000 +07
[Time shift for this packet: 0.000000000 seconds]
Epoch Time: 1708969190.712945000 seconds
[Time delta from previous captured frame: 0.000000000 seconds]
[Time delta from previous displayed frame: 0.000000000 seconds]
[Time since reference or first frame: 0.000000000 seconds]
Frame Number: 1
Frame Length: 60 bytes (480 bits)
Capture Length: 60 bytes (480 bits)
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:arp]
[Coloring Rule Name: ARP]
[Coloring Rule String: arp]
Ethernet II, Src: 72:13:5a:e3:b4:4c (72:13:5a:e3:b4:4c), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Address Resolution Protocol (request)

- Frame 1 có kích thước 60 bytes



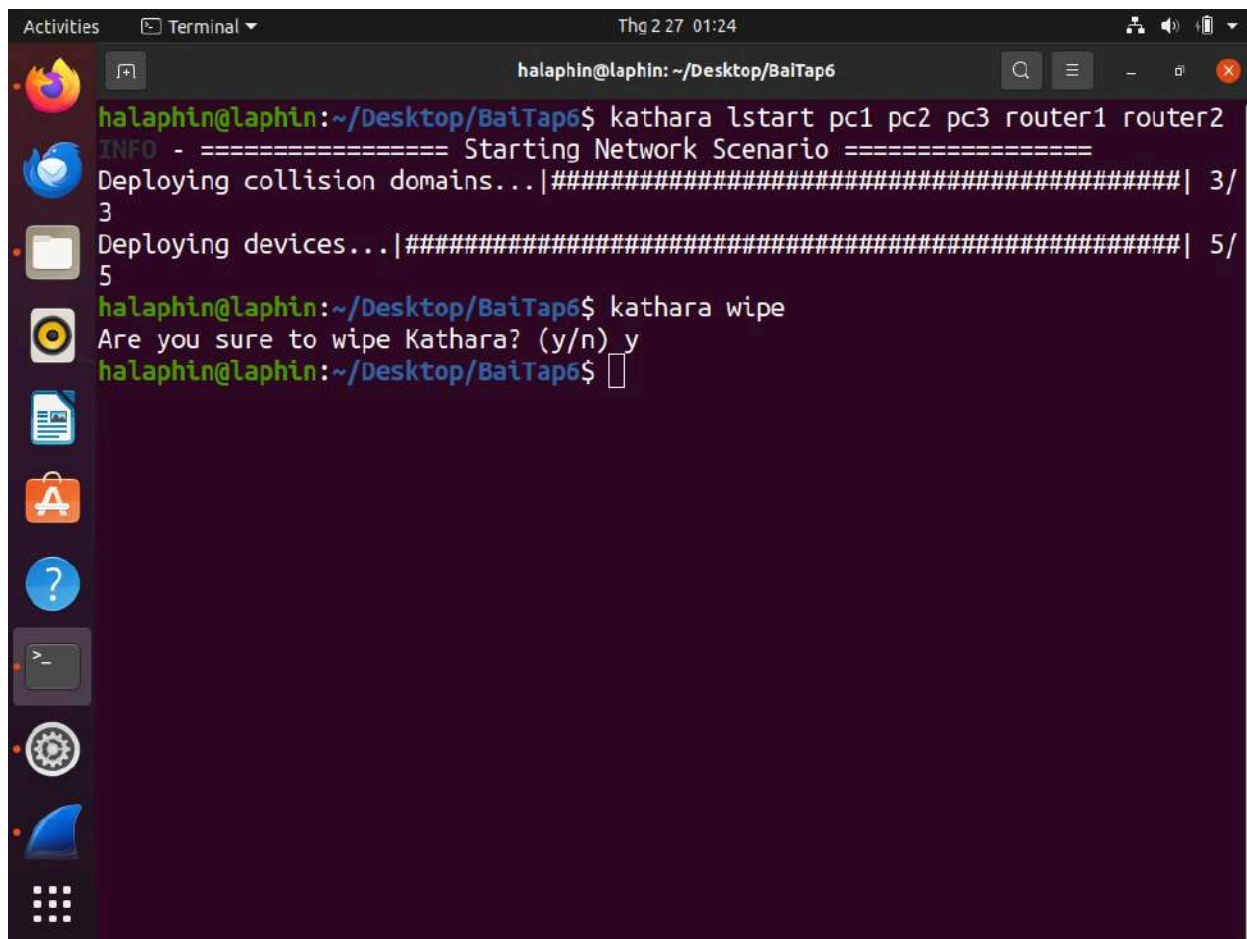
1. Trường Opcode có giá trị là 0x0001 thể hiện thông tin request, và còn có giá trị là 0x0002 thể hiện thông tin reply
2. Địa chỉ IP của máy gửi dữ liệu là 200.1.1.3 và địa chỉ MAC là 72:13:5a:e3:b4:4c
3. Địa chỉ IP của máy gửi dữ liệu là 200.1.1.7 và không có địa chỉ MAC

Chọn khung Ethenet II :



1. Địa chỉ MAC của máy gửi dữ liệu là 72:13:5a:e3:b4:4c, đây là địa chỉ của pc3
2. Địa chỉ MAC của máy nhận dữ liệu là ff:ff:ff:ff:ff:ff, địa chỉ MAC không ở thiết bị nào
3. Trường Type có giá trị là 0x8606, thể hiện là giao thức là ARP

Hủy mạng ảo bằng lệnh `lwiipe` sau khi đã thực hiện xong phần 2.3.2.1



```
halaphin@laphin: ~/Desktop/BaiTap6
halaphin@laphin:~/Desktop/BaiTap6$ kathara lstart pc1 pc2 pc3 router1 router2
INFO - ===== Starting Network Scenario =====
Deploying collision domains...|#####| 3/3
Deploying devices...|#####| 5/5
halaphin@laphin:~/Desktop/BaiTap6$ kathara wipe
Are you sure to wipe Kathara? (y/n)_y
halaphin@laphin:~/Desktop/BaiTap6$
```

2.3.2.2. Giao thức ARP giữa 2 thiết bị khác nhánh mạng LAN

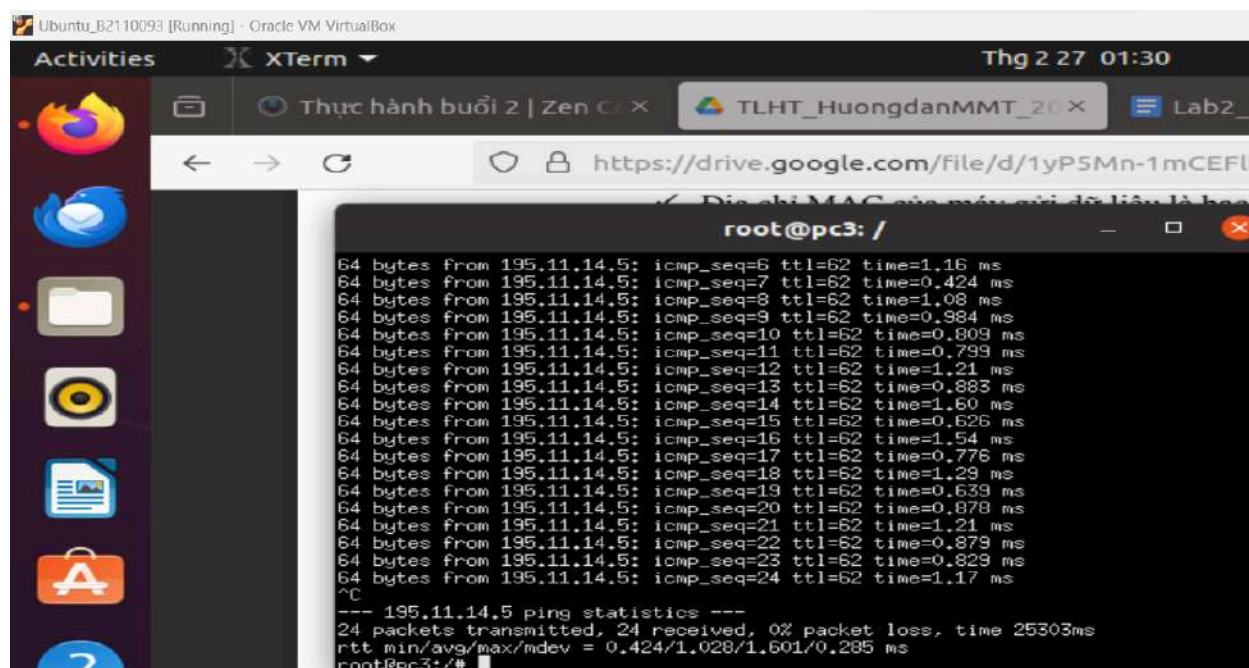
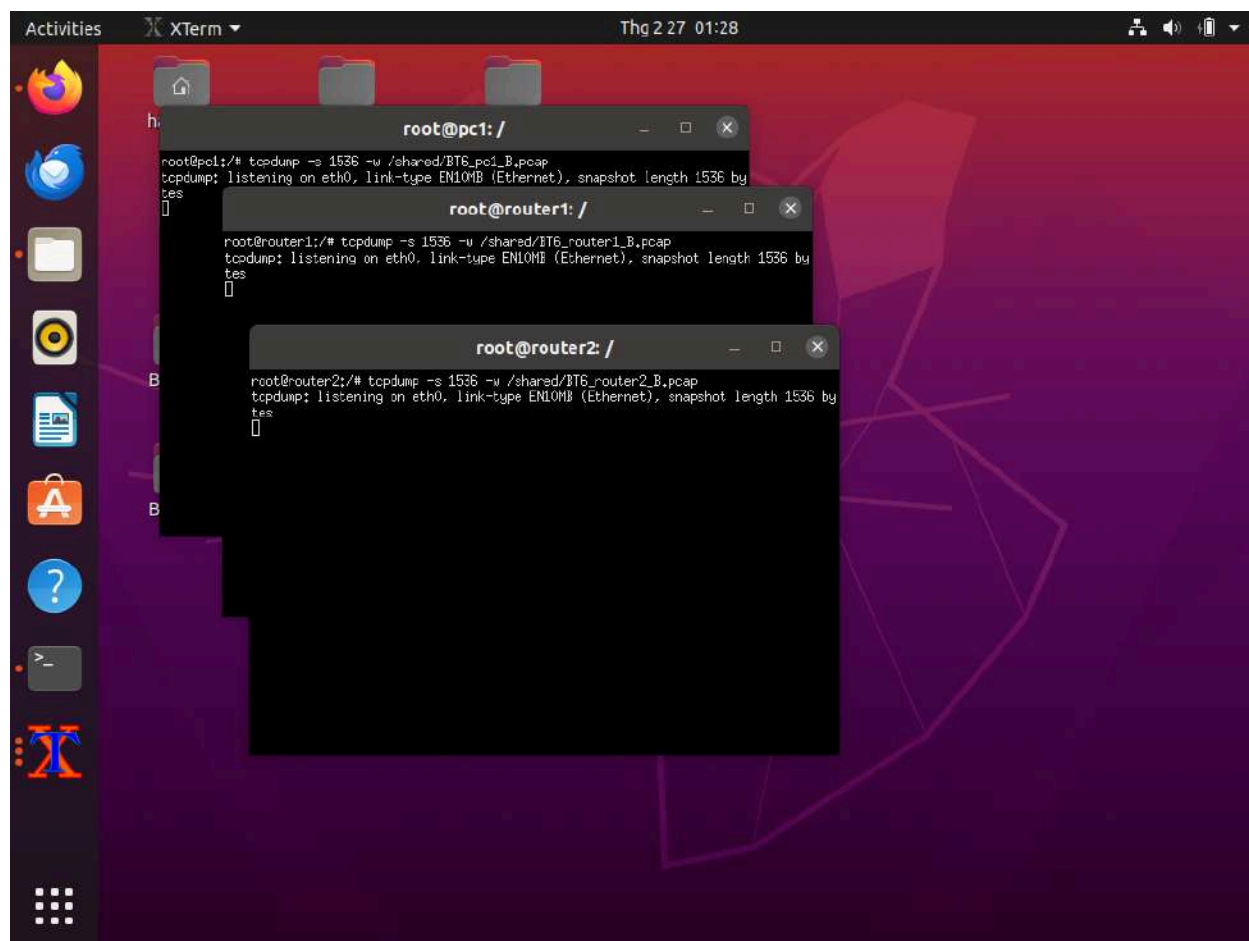
The screenshot shows a Linux desktop with a dark theme. The top bar indicates the date and time as 'Thứ 2 27 01:25'. The desktop has a sidebar with application icons including Firefox, Telegram, a file manager, a media player, a document editor, a terminal, a help icon, and system settings. Three terminal windows are open, each with a title bar from 'XTerm'. The top window, titled 'halaphin@laphin: ~/Desktop/BaiTap6', shows a command 'start pc1 router1 router2' and a progress indicator '3/3'. The middle window, titled 'root@router2: /', shows a 'Startup Commands Log' with commands for interface configuration and routing. The bottom window, titled 'root@router1: /', also shows a 'Startup Commands Log' with similar configuration commands.

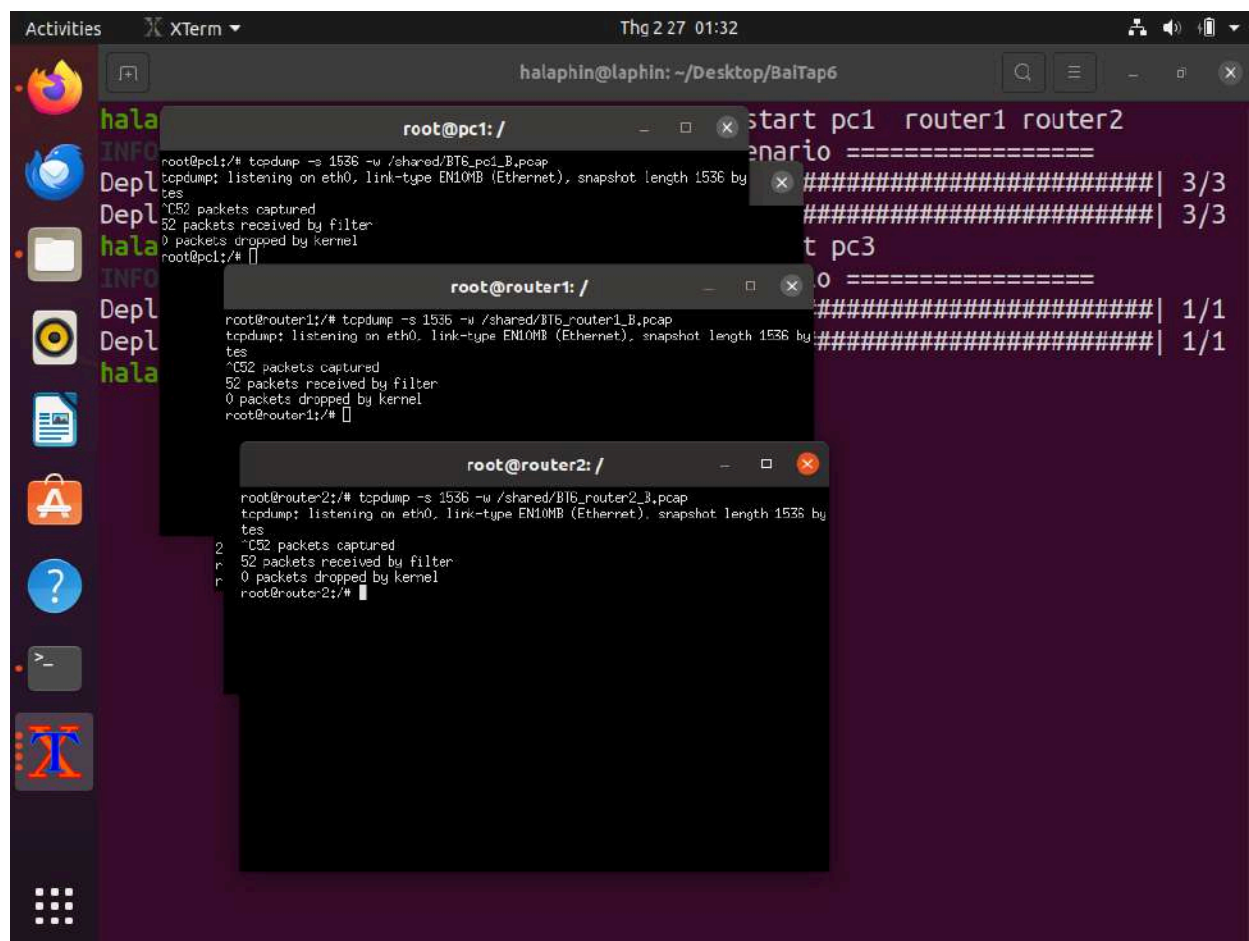
```
halaphin@laphin: ~/Desktop/BaiTap6
root@pc1: /
root@router2: /
root@router1: /
```

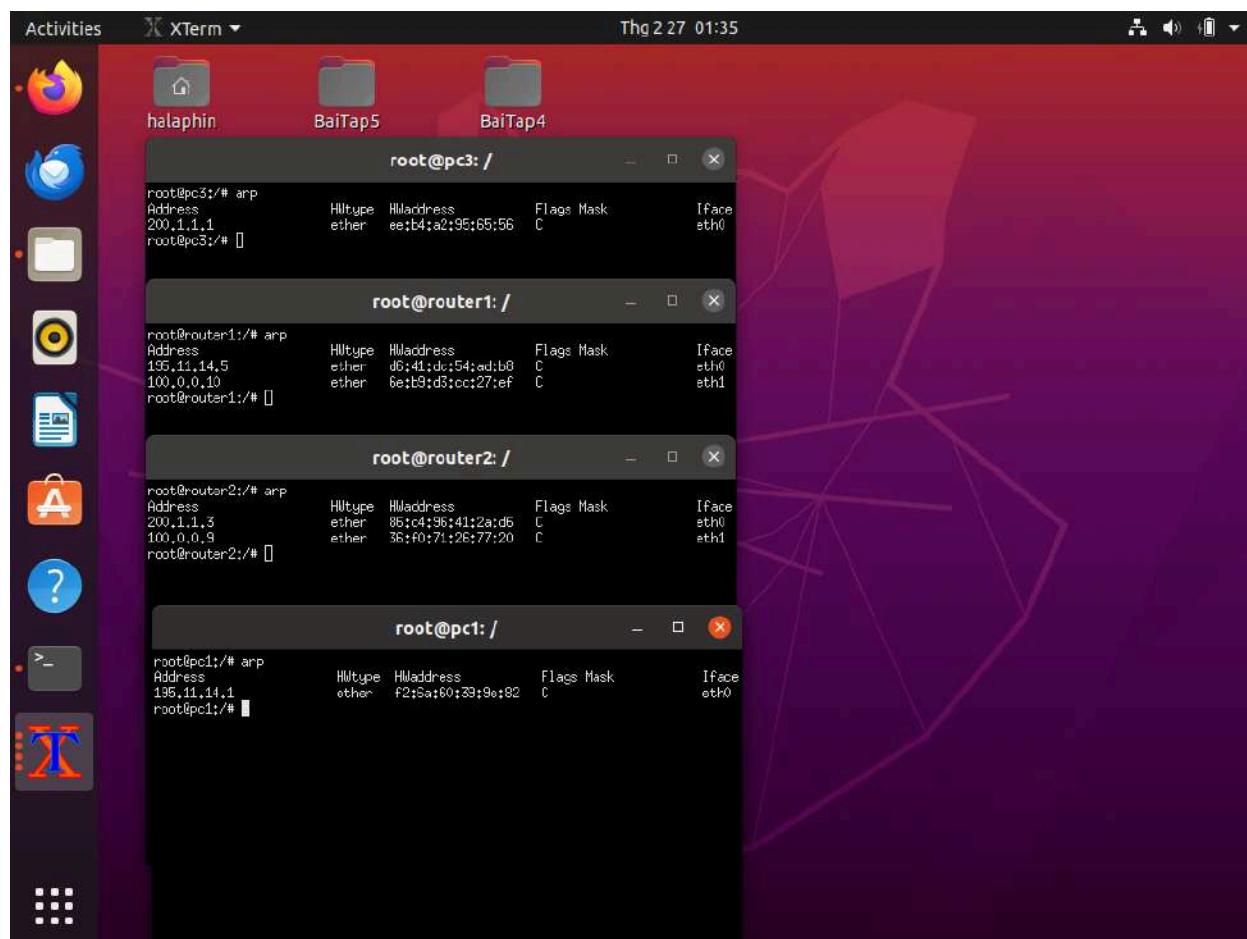
start pc1 router1 router2
scenario =====
#####| 3/3
#####| 3/3

--- Startup Commands Log
++ ifconfig eth0 195.11.14.1/24 up
--- End
root@router2: /#

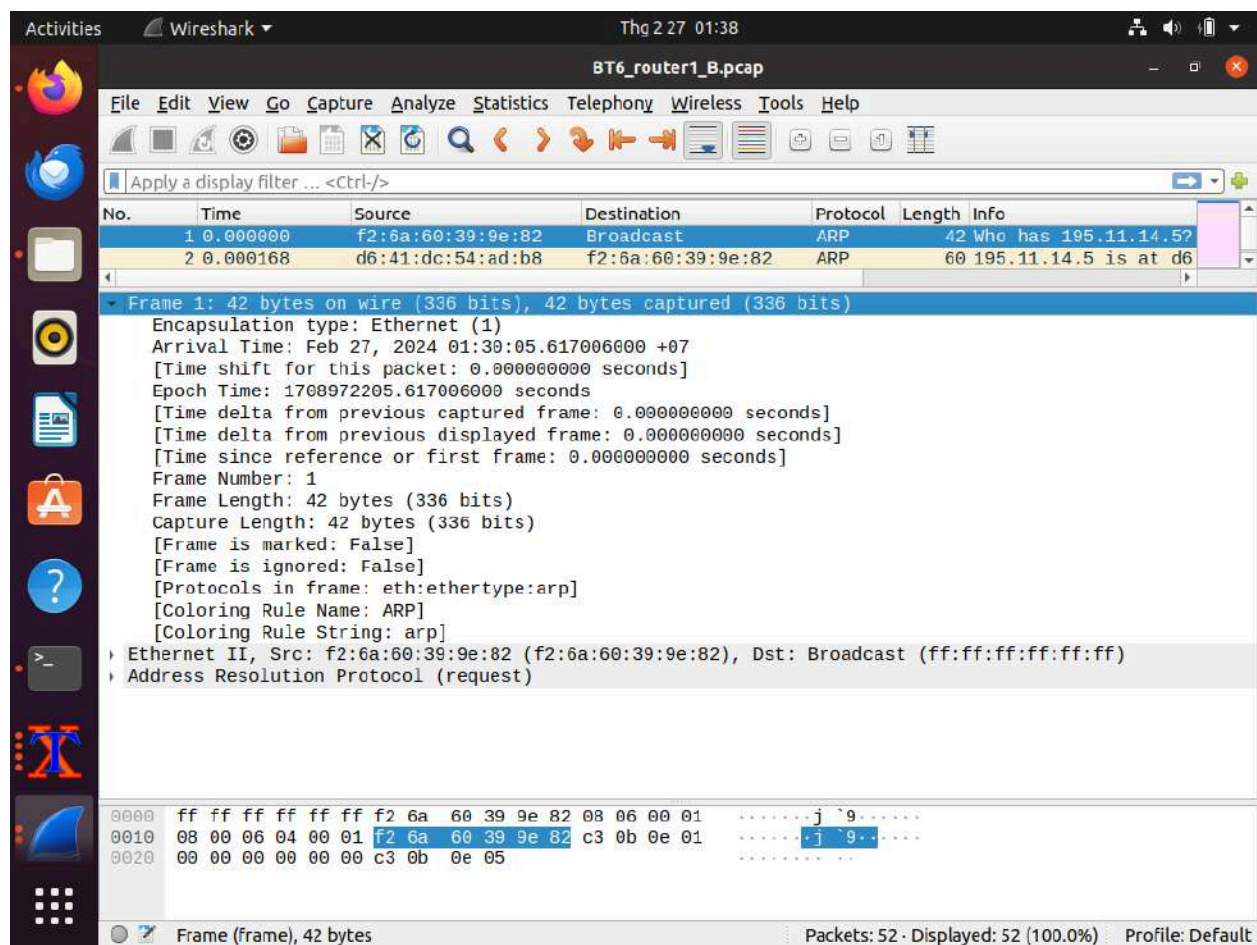
--- Startup Commands Log
++ ifconfig eth0 195.11.14.1/24 up
++ ifconfig eth1 100.0.0.9/30 up
++ route add -net 200.1.1.0/24 gw 100.0.0.10
--- End Startup Commands Log
root@router1: /#



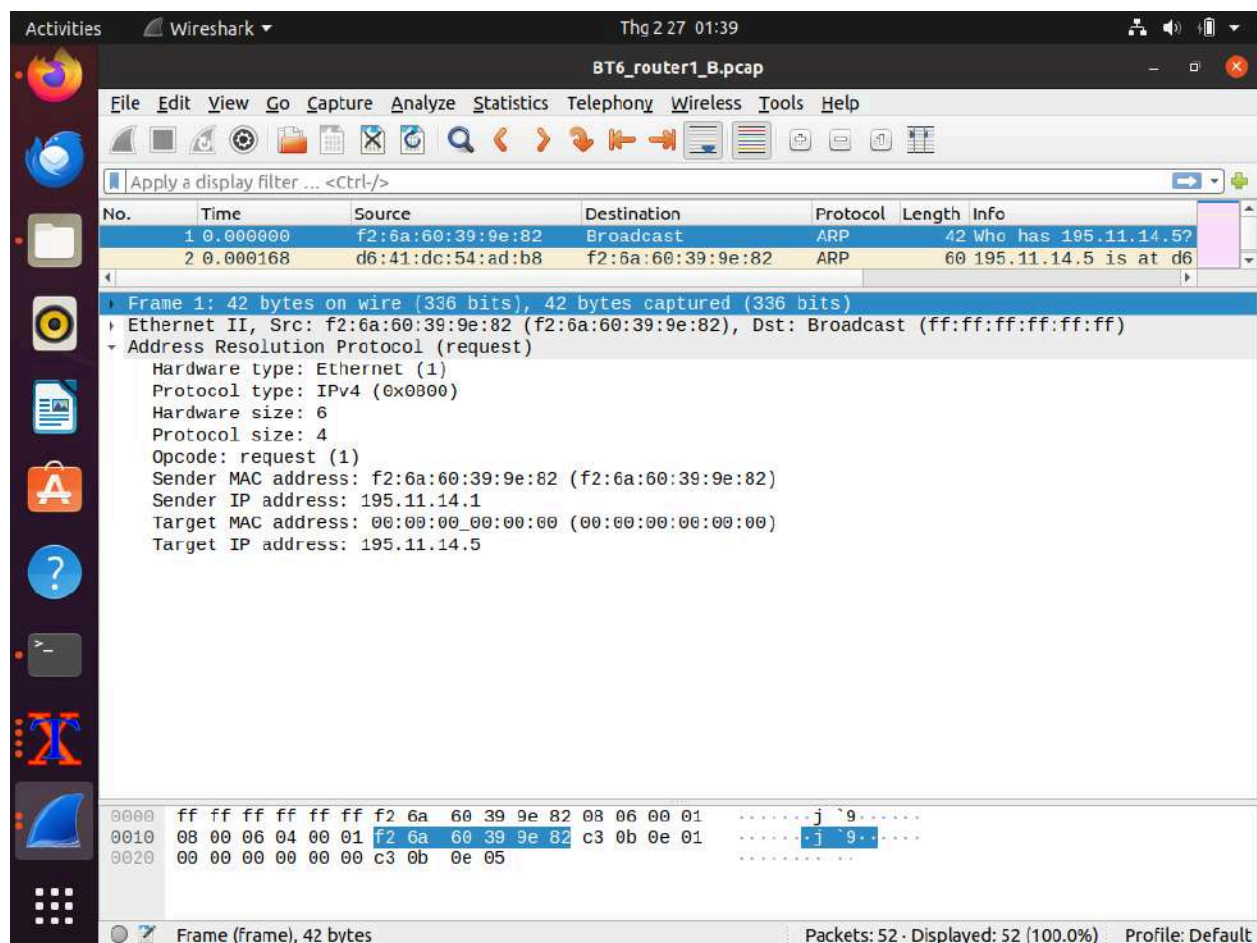




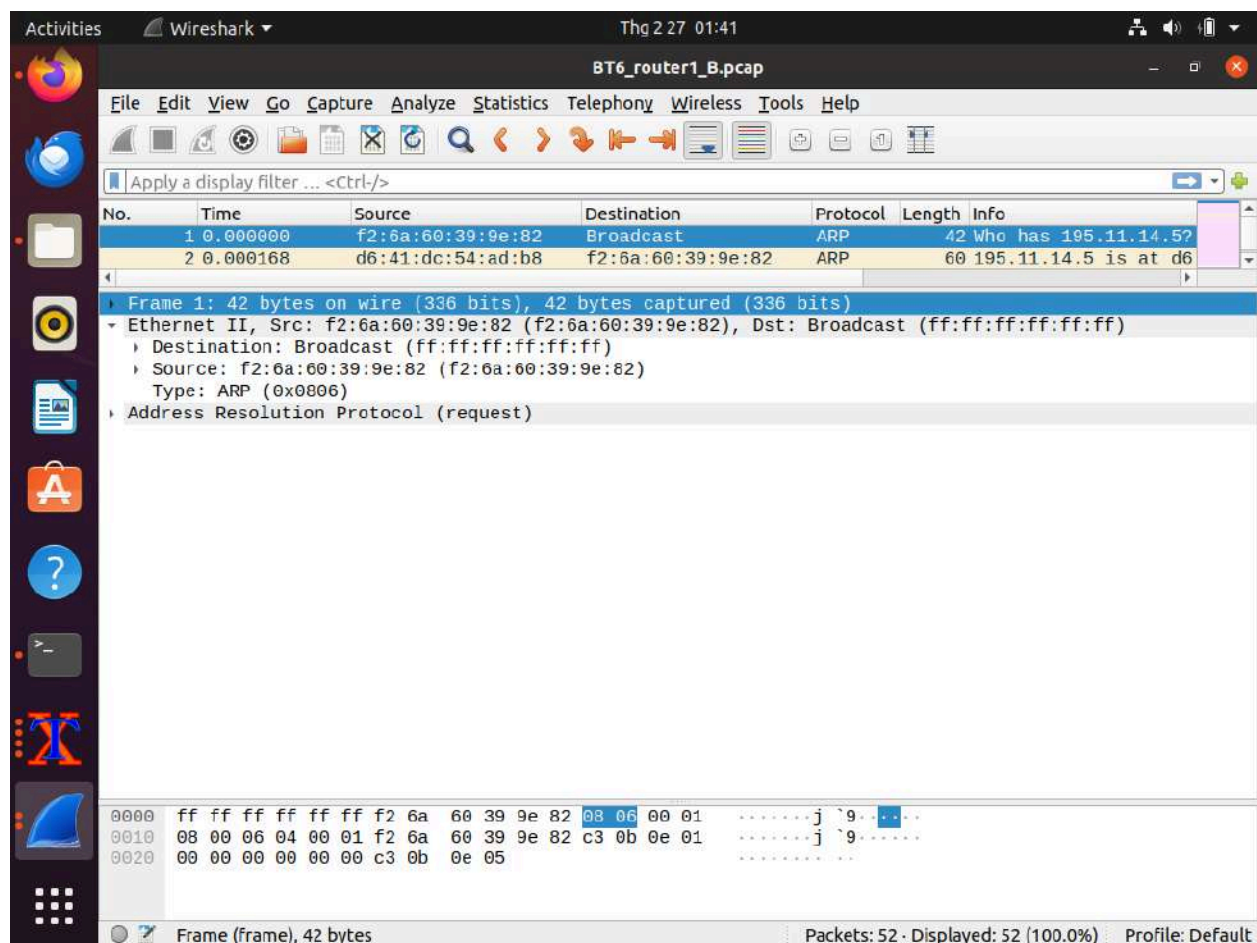
- pc3 có thông tin địa chỉ mạng của router2 vì cần đi qua router2 để đến pc1, pc3 trong phần 2.3.2.1 thì có thông tin địa chỉ mạng của pc2
- router2 có thông tin địa chỉ mạng của pc3 và router1, router2 trong phần 2.3.2.1 thì không có thông tin gì
- router1 có thông tin địa chỉ mạng của pc1 và router2
- pc1 thì có thông tin địa chỉ mạng của router1



- Frame 1 có kích thước 42 bytes



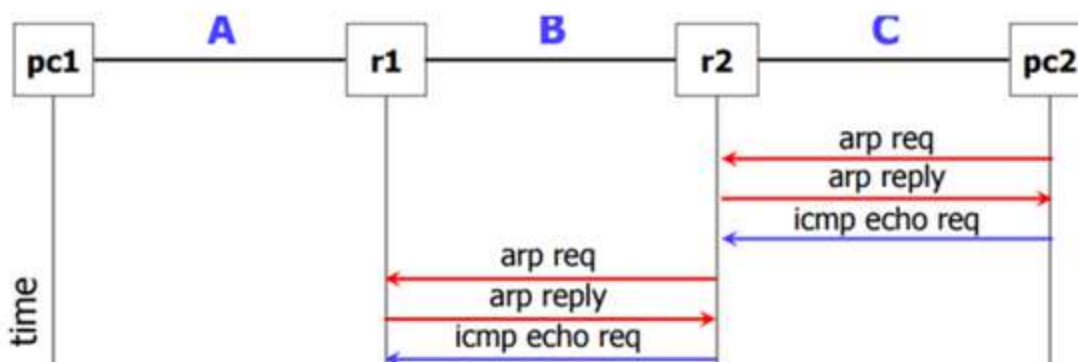
- Header Address Resolution Protocol:
 - Trường Opcode có giá trị là 0x0001 thể hiện thông tin request; Nó còn có thể có giá trị 0x0002 thể hiện thông tin reply
 - Địa chỉ IP của máy gửi dữ liệu là 195.11.14.1 và địa chỉ MAC là f2:6a:60:39:9e:82
 - Địa chỉ IP của máy nhận dữ liệu là 195.11.14.5 và không có địa chỉ MAC



- Header Ethernet II:

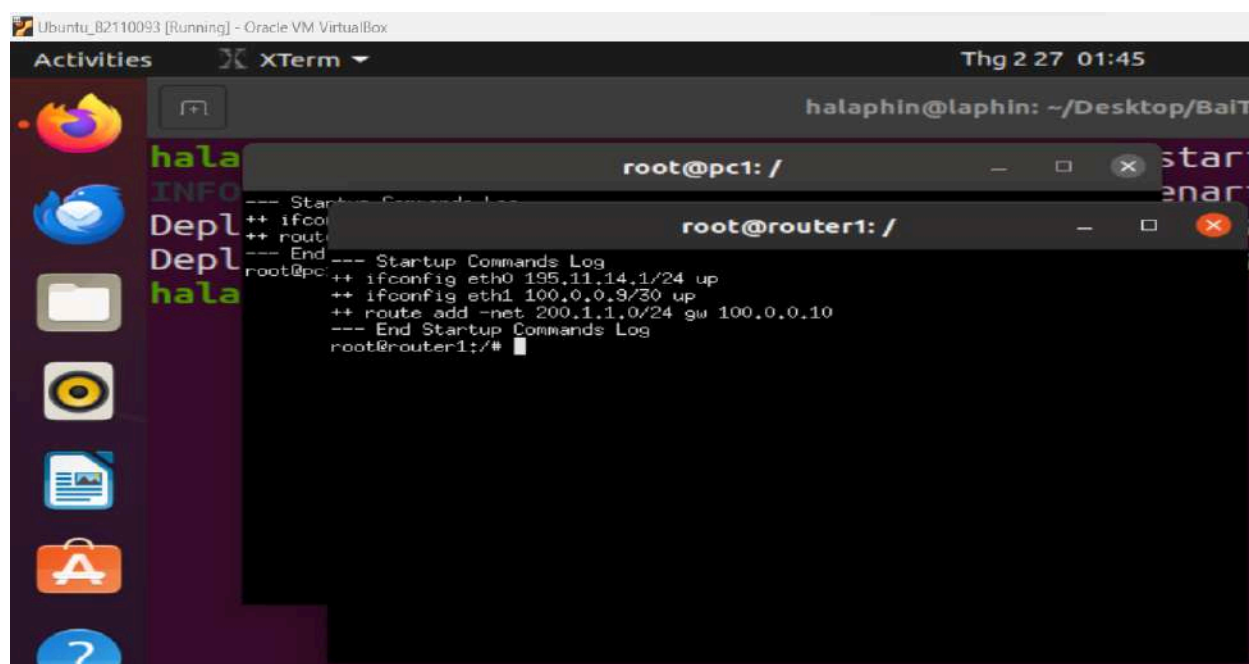
- Địa chỉ MAC của máy gửi dữ liệu là fa:6a:60:39:9e:82:, đây là địa chỉ của router1
- Địa chỉ MAC của máy nhận dữ liệu là ff:ff:ff:ff:ff:ff, địa chỉ MAC không là của máy nào; Nó là địa chỉ Broadcast, có nghĩa là tất cả thiết bị trong mạng đó sẽ đều nhận được gói tin
- Trường Type có giá trị là 0x0806, thể hiện giao thức ARP

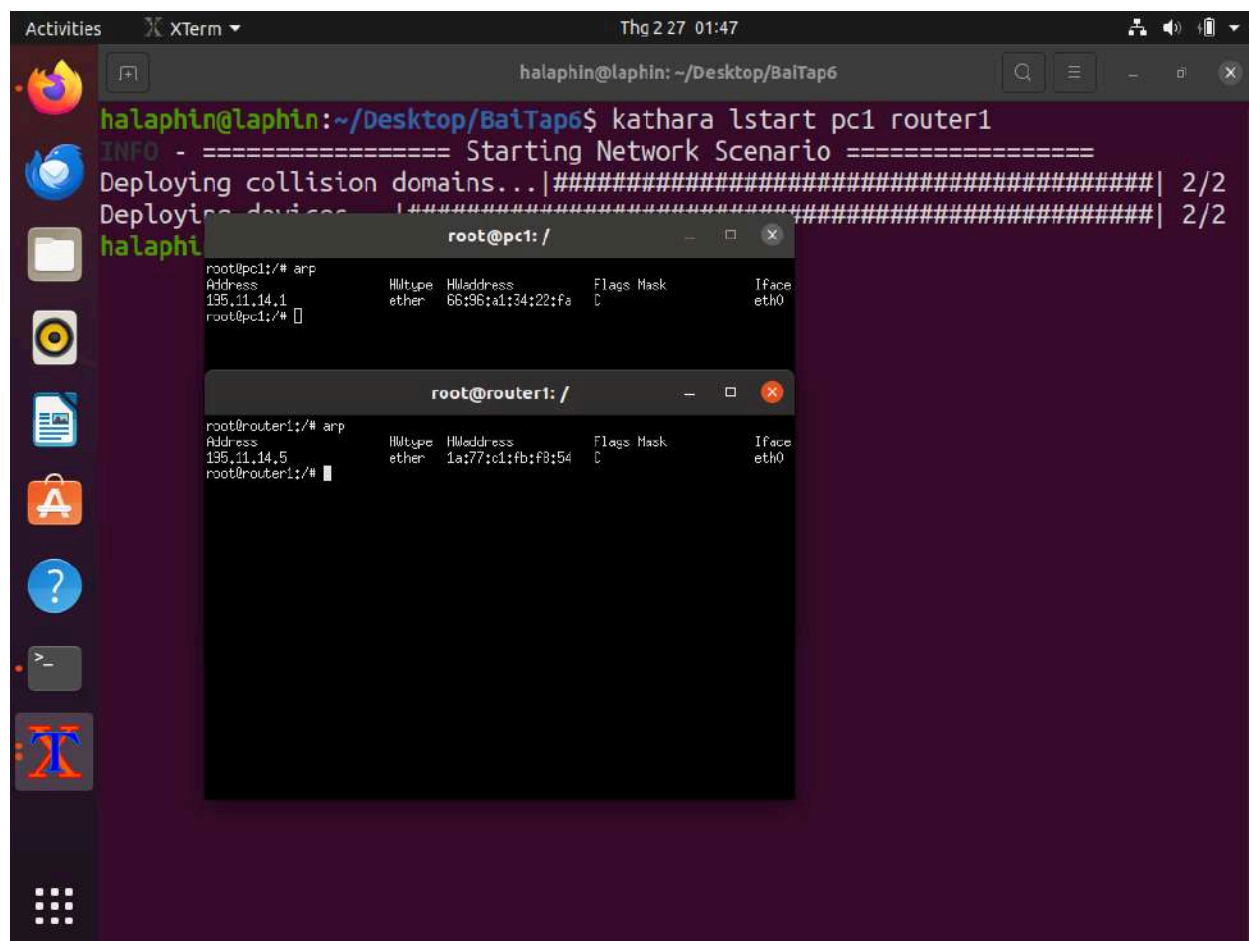
Vẽ sơ đồ tuần tự (sequence diagram) thể hiện vai trò của giao thức ARP



trong việc truyền tải dữ liệu từ pc3 đến pc1 bằng lệnh ping

15) Hủy mạng ảo bằng lệnh lswipe sau khi đã thực hiện xong 2.3.2.2



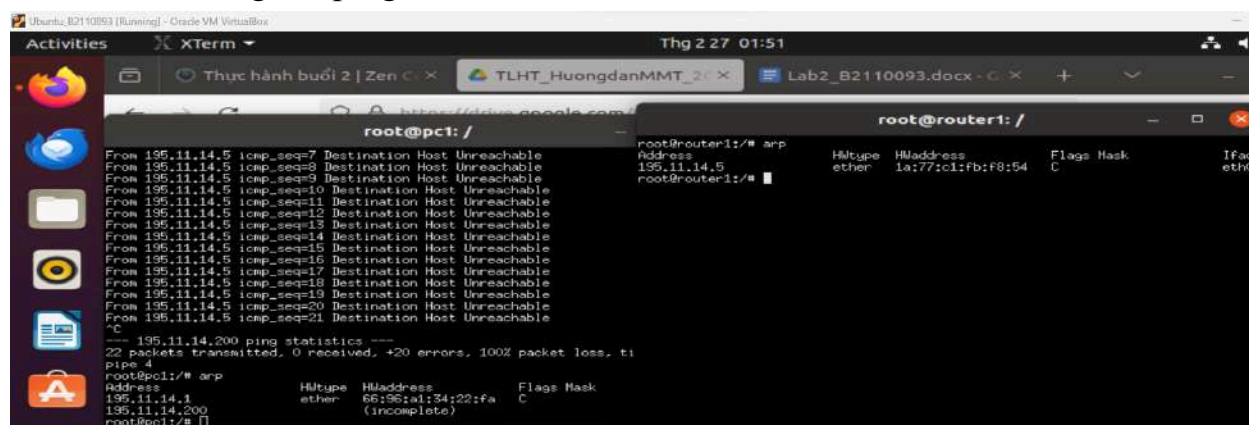


```
halaphin@laphin: ~/Desktop/BaiTap6
halaphin@laphin:~/Desktop/BaiTap6$ kathara lstart pc1 router1
INFO - ===== Starting Network Scenario =====
Deploying collision domains...|#####| 2/2
Deploying devices...|#####| 2/2
halaphin@laphin:~/Desktop/BaiTap6$
```

```
root@pc1: /
root@pc1:/# arp
Address          Hwtype  Hwaddress    Flags Mask    Iface
195.11.14.1      ether    66:96:a1:34:22:fa  C          eth0
root@pc1:/#
```

```
root@router1: /
root@router1:/# arp
Address          Hwtype  Hwaddress    Flags Mask    Iface
195.11.14.5      ether    1a:77:c1:fb:f8:54  C          eth0
root@router1:/#
```

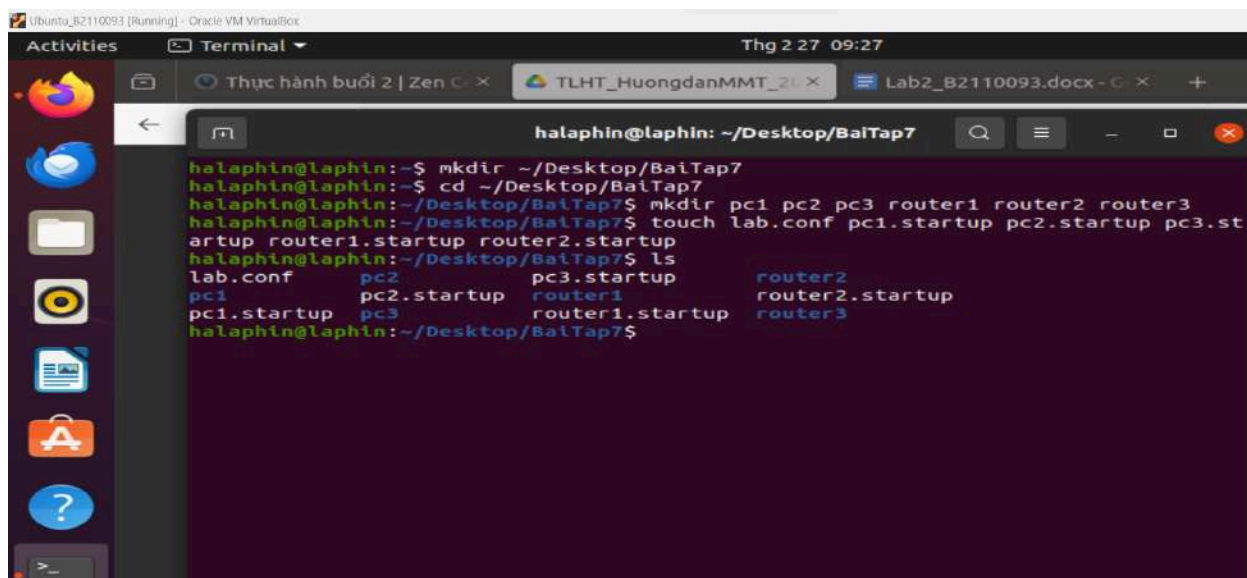
- Pc1 Không thể ping đến đại chỉ 8.8.8.8



```
root@pc1: /
From 195.11.14.5 icmp_seq=7 Destination Host Unreachable
From 195.11.14.5 icmp_seq=8 Destination Host Unreachable
From 195.11.14.5 icmp_seq=9 Destination Host Unreachable
From 195.11.14.5 icmp_seq=10 Destination Host Unreachable
From 195.11.14.5 icmp_seq=11 Destination Host Unreachable
From 195.11.14.5 icmp_seq=12 Destination Host Unreachable
From 195.11.14.5 icmp_seq=13 Destination Host Unreachable
From 195.11.14.5 icmp_seq=14 Destination Host Unreachable
From 195.11.14.5 icmp_seq=15 Destination Host Unreachable
From 195.11.14.5 icmp_seq=16 Destination Host Unreachable
From 195.11.14.5 icmp_seq=17 Destination Host Unreachable
From 195.11.14.5 icmp_seq=18 Destination Host Unreachable
From 195.11.14.5 icmp_seq=19 Destination Host Unreachable
From 195.11.14.5 icmp_seq=20 Destination Host Unreachable
From 195.11.14.5 icmp_seq=21 Destination Host Unreachable
--- 195.11.14.200 ping statistics ---
22 packets transmitted, 0 received, 100% packet loss, 0.000 ms RTT
root@pc1:/# arp
Address          Hwtype  Hwaddress    Flags Mask    Iface
195.11.14.1      ether    66:96:a1:34:22:fa  C          eth0
195.11.14.200    ether    (incomplete)      C          eth0
root@pc1:/#
```

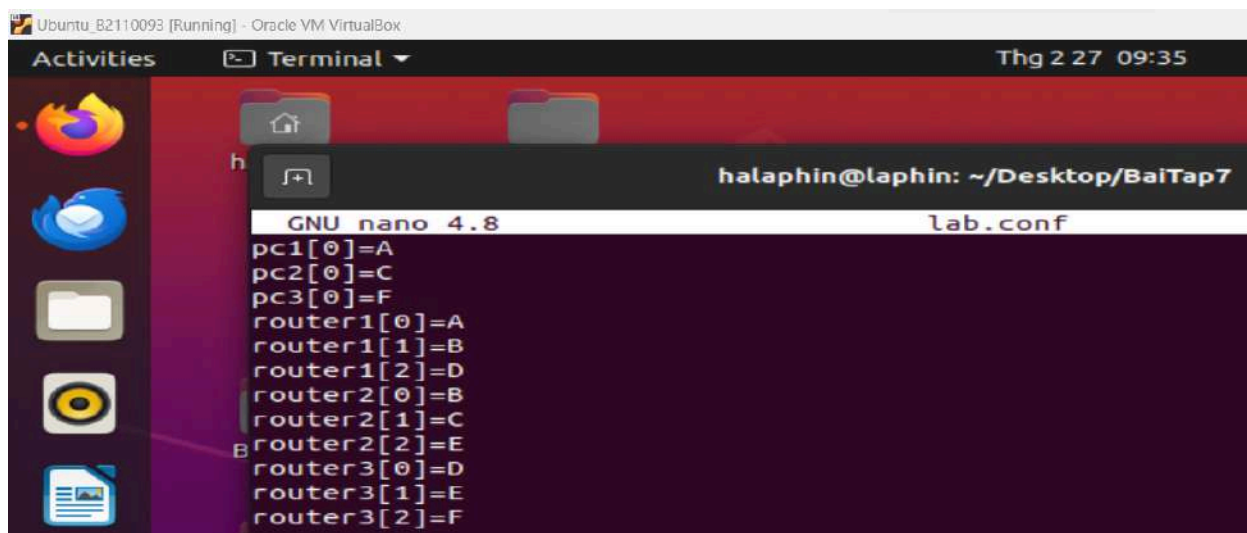
- pc1 không ping được 195.11.14.200 nhưng bảng ARP vẫn hiện 195.11.14.200 (không hoàn thiện)
- router1 không thay đổi

Bài 7:



The terminal window shows the user 'halaphin' at host 'laphin' in the directory '~/Desktop/BaiTap7'. The user has created a directory and then created subdirectories for three PCs and three routers. They have also created startup configuration files for each. The 'ls' command shows the files in the current directory.

```
halaphin@laphin:~$ mkdir ~/Desktop/BaiTap7
halaphin@laphin:~$ cd ~/Desktop/BaiTap7
halaphin@laphin:~/Desktop/BaiTap7$ mkdir pc1 pc2 pc3 router1 router2 router3
halaphin@laphin:~/Desktop/BaiTap7$ touch lab.conf pc1.startup pc2.startup pc3.startup
halaphin@laphin:~/Desktop/BaiTap7$ ls
lab.conf      pc2      pc3.startup  router2
pc1           pc2.startup  router1      router2.startup
pc1.startup  pc3         router1.startup  router3
pc3          router3
```



The terminal window shows the user 'halaphin' at host 'laphin' in the directory '~/Desktop/BaiTap7'. They have opened the 'lab.conf' file in nano 4.8. The file contains configuration for three PCs and three routers, each with three interfaces.

```
GNU nano 4.8 lab.conf
pc1[0]=A
pc2[0]=C
pc3[0]=F
router1[0]=A
router1[1]=B
router1[2]=D
router2[0]=B
router2[1]=C
router2[2]=E
router3[0]=D
router3[1]=E
router3[2]=F
```



The terminal window shows the user 'halaphin' at host 'laphin' in the directory '~/Desktop/BaiTap7'. They have opened the 'pc1.startup' file in nano 4.8. The file contains configuration for the PC1 interface eth0, including IP address, netmask, and default gateway.

```
GNU nano 4.8 pc1.startup
ifconfig eth0 192.168.0.40/27 up
route add default gw 192.168.0.33
```

Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Terminal Thg 2 27 09:34

halaphin@laphin: ~/Desktop/BaiTap7

```
GNU nano 4.8 pc2.startup
ifconfig eth0 192.168.0.100/27 up
route add default gw 192.168.0.97
```

Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Terminal Thg 2 27 09:34

halaphin@laphin: ~/Desktop/BaiTap7

```
GNU nano 4.8 pc3.startup
ifconfig eth0 192.168.0.200/27 up
route add default gw 192.168.0.193
```

Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Terminal Thg 2 27 09:33

halaphin@laphin: ~/Desktop/BaiTap7

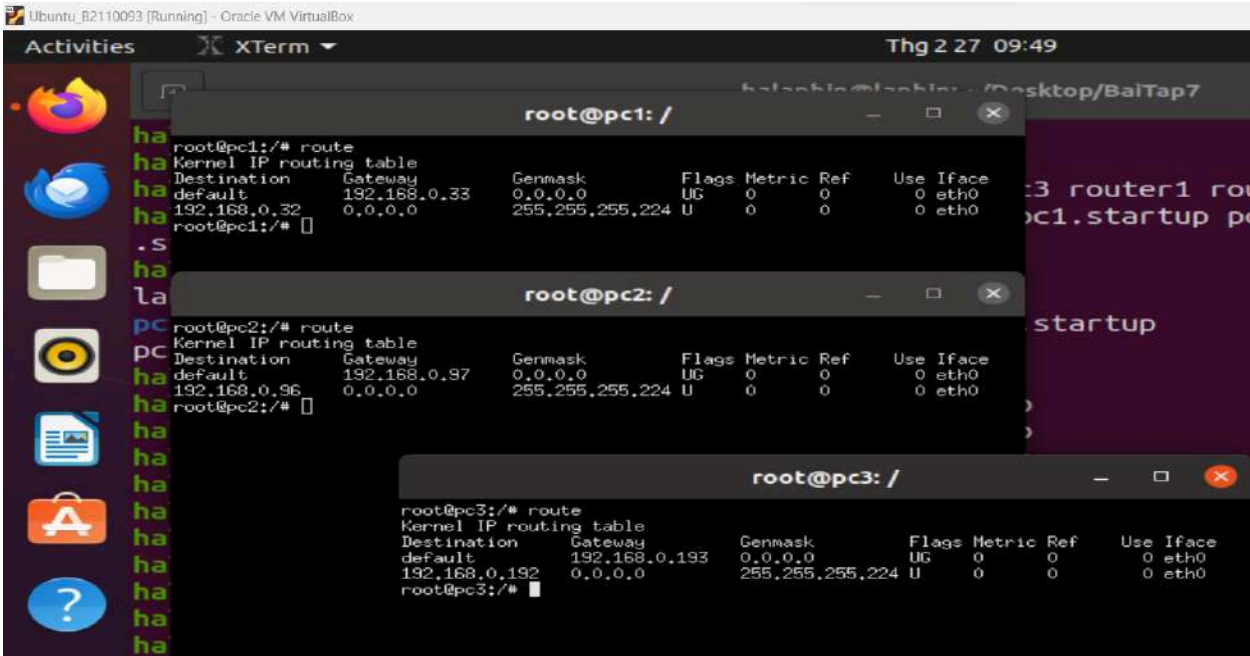
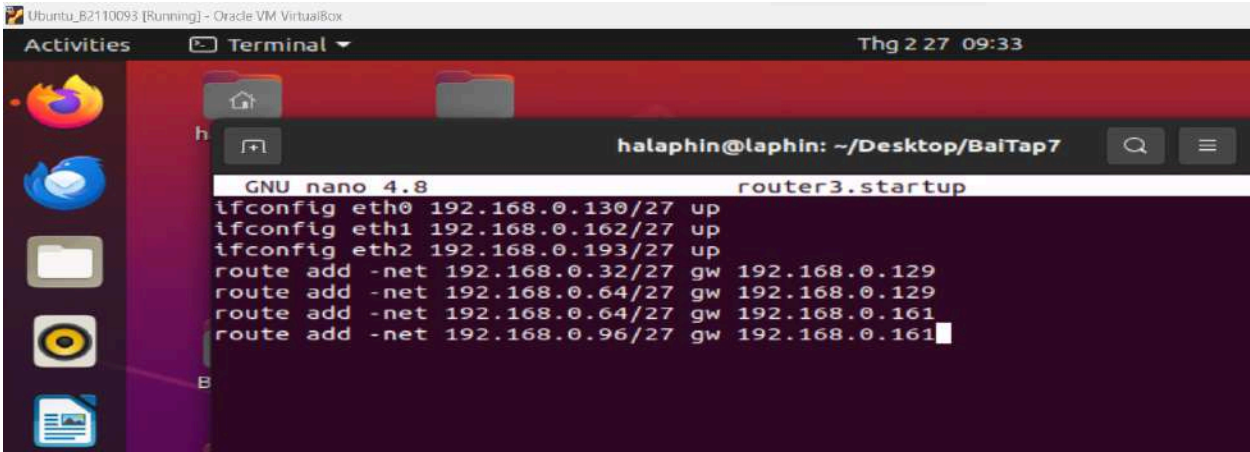
```
GNU nano 4.8 router1.startup
ifconfig eth0 192.168.0.33/27 up
ifconfig eth1 192.168.0.65/27 up
ifconfig eth2 192.168.0.129/27 up
route add -net 192.168.0.96/27 gw 192.168.0.66
route add -net 192.168.0.160/27 gw 192.168.0.130
route add -net 192.168.0.160/27 gw 192.168.0.66
route add -net 192.168.0.192/27 gw 192.168.0.130
```

Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities Terminal Thg 2 27 09:32

halaphin@laphin: ~/Desktop/BaiTap7

```
GNU nano 4.8 router2.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 192.160.0.128/27 gw 192.168.0.65
route add -net 192.168.0.192/27 gw 192.168.0.162
```

```
Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities XTerm Thg 2 27 0

root@router1: /

root@router1:/# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
192.168.0.32 0.0.0.0 255.255.255.224 U 0 0 0 eth0
192.168.0.64 0.0.0.0 255.255.255.224 U 0 0 0 eth1
192.168.0.96 192.168.0.66 255.255.255.224 UG 0 0 0 eth1
192.168.0.128 0.0.0.0 255.255.255.224 U 0 0 0 eth2
192.168.0.160 192.168.0.66 255.255.255.224 UG 0 0 0 eth1
192.168.0.160 192.168.0.130 255.255.255.224 UG 0 0 0 eth2
192.168.0.192 192.168.0.130 255.255.255.224 UG 0 0 0 eth2
root@router1:/#

root@router2: /

root@router2:/# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
192.160.0.128 192.168.0.65 255.255.255.224 UG 0 0 0 eth0
192.168.0.32 192.168.0.65 255.255.255.224 UG 0 0 0 eth0
192.168.0.64 0.0.0.0 255.255.255.224 U 0 0 0 eth0
192.168.0.96 0.0.0.0 255.255.255.224 U 0 0 0 eth1
192.168.0.128 192.168.0.162 255.255.255.224 UG 0 0 0 eth2
192.168.0.160 0.0.0.0 255.255.255.224 U 0 0 0 eth2
192.168.0.192 192.168.0.162 255.255.255.224 UG 0 0 0 eth2
root@router2:/#

root@router3: /

root@router3:/# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
192.168.0.32 192.168.0.129 255.255.255.224 UG 0 0 0 eth0
192.168.0.64 192.168.0.161 255.255.255.224 UG 0 0 0 eth1
192.168.0.64 192.168.0.129 255.255.255.224 UG 0 0 0 eth0
192.168.0.96 192.168.0.161 255.255.255.224 UG 0 0 0 eth1
192.168.0.128 0.0.0.0 255.255.255.224 U 0 0 0 eth0
192.168.0.160 0.0.0.0 255.255.255.224 U 0 0 0 eth1
192.168.0.192 0.0.0.0 255.255.255.224 U 0 0 0 eth2
root@router3:/#
```

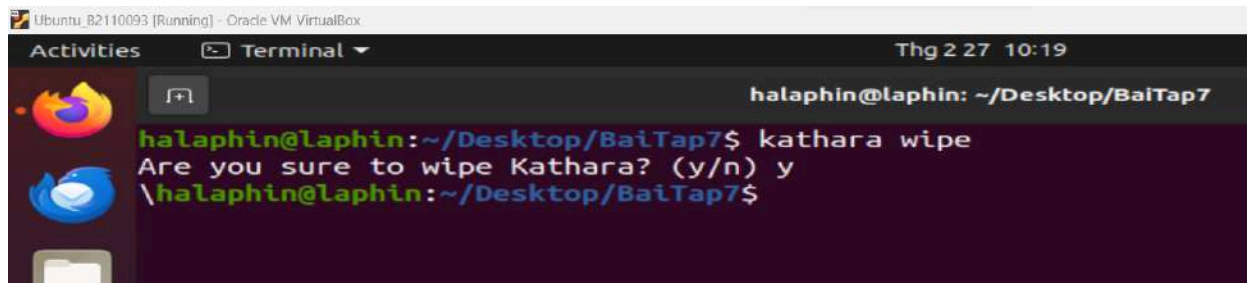
```
Ubuntu_B2110093 [Running] - Oracle VM VirtualBox

Activities XTerm Thg 2 27 09:53

root@pc1: /

root@pc1:/# ping 192.168.0.100 -c 3
PING 192.168.0.100 (192.168.0.100) 56(84) bytes of data:
64 bytes from 192.168.0.100: icmp_seq=1 ttl=62 time=1.19 ms
64 bytes from 192.168.0.100: icmp_seq=2 ttl=62 time=1.19 ms
64 bytes from 192.168.0.100: icmp_seq=3 ttl=62 time=1.19 ms
--- 192.168.0.100 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 3049ms
rtt min/avg/max/mdev = 1.188/1.190/1.191/0.001 ms
root@pc1:/# ping 192.168.0.200 -c 3
PING 192.168.0.200 (192.168.0.200) 56(84) bytes of data:
64 bytes from 192.168.0.200: icmp_seq=1 ttl=62 time=0.907 ms
64 bytes from 192.168.0.200: icmp_seq=2 ttl=62 time=1.20 ms
64 bytes from 192.168.0.200: icmp_seq=3 ttl=62 time=1.51 ms
--- 192.168.0.200 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2697ms
rtt min/avg/max/mdev = 0.907/1.204/1.507/0.244 ms
root@pc1:/#
```

Pc1 ping thành công đến pc2 và pc3



The image shows a terminal window within a virtual machine. The title bar at the top reads "Ubuntu_B2110093 [Running] - Oracle VM VirtualBox". The terminal interface has a dark background with a sidebar on the left containing icons for "Activities", a terminal icon, and a file manager icon. The top of the terminal window displays the username and host as "halaphin@laphin:" and the current directory as "~/Desktop/BaiTap7". The time "Thg 2 27 10:19" is shown in the top right corner. The terminal history shows the command "kathara wipe" being entered, followed by a confirmation prompt "Are you sure to wipe Kathara? (y/n)" which was answered with "y". The prompt then returns to the shell "halaphin@laphin:~/Desktop/BaiTap7\$".

```
halaphin@laphin:~/Desktop/BaiTap7$ kathara wipe
Are you sure to wipe Kathara? (y/n) y
halaphin@laphin:~/Desktop/BaiTap7$
```