

## LAB 2



Họ tên và MSSV: Quách Minh Hớn - B2110078

Nhóm học phần: 11

- Các sinh viên bị phát hiện sao chép bài của nhau sẽ nhận 0đ cho tất cả bài thực hành của môn này.
- Bài nộp phải ở dạng PDF. Tên file PDF đặt theo cấu trúc “CT112\_MSSV\_Lab2\_HoTen”. Ví dụ, SV có MSSV là B1234 và Họ tên là “Nguyễn Văn A”; tên file sẽ đặt như sau “CT112\_B1234\_Lab2\_NguyenVanA”.
- File nộp cần cung cấp đầy đủ các bước giải quyết bài toán.

### Bài 5: chuyển về thư mục home

UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal
b2110078@UbuntuB2110078: ~/CT112/BaiTap5
b2110078@UbuntuB2110078:~/CT112/BaiTap5$ mkdir pc1 pc2 pc3
b2110078@UbuntuB2110078:~/CT112/BaiTap5$ mkdir router1 router2
b2110078@UbuntuB2110078:~/CT112/BaiTap5$
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 23 23:01
b2110078@UbuntuB2110078: ~/CT112/BaiTap5
GNU nano 6.2 pc1.startup
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
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^_ Replace ^U Paste ^J Justify ^_/ Go To Line
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 24 16:23
b2110078@UbuntuB2110078: ~/CT112/BaiTap5
GNU nano 6.2 pc2.startup
ifconfig eth0 10.0.1.101/24 up
route add default gw 10.0.1.1
Wrote 2 lines
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line
```

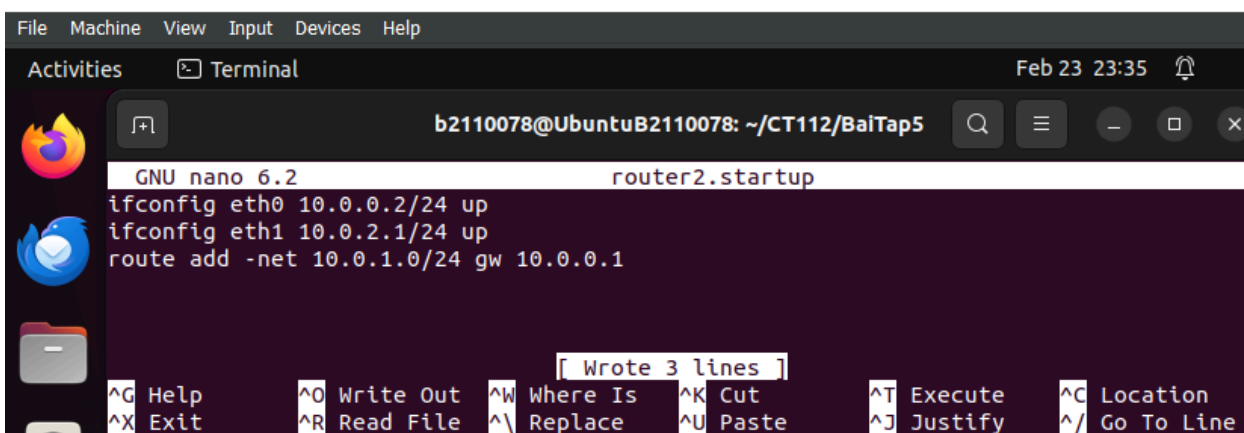
UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 24 16:24
b2110078@UbuntuB2110078: ~/CT112/BaiTap5
GNU nano 6.2 pc3.startup
ifconfig eth0 10.0.2.101/24 up
route add default gw 10.0.2.1
Wrote 2 lines
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 23 23:27
b2110078@UbuntuB2110078: ~/CT112/BaiTap5
GNU nano 6.2 router1.startup
ifconfig eth0 10.0.0.1/24 up
ifconfig eth1 10.0.1.1/24 up
route add -net 10.0.2.0/24 gw 10.0.0.2
Wrote 3 lines
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

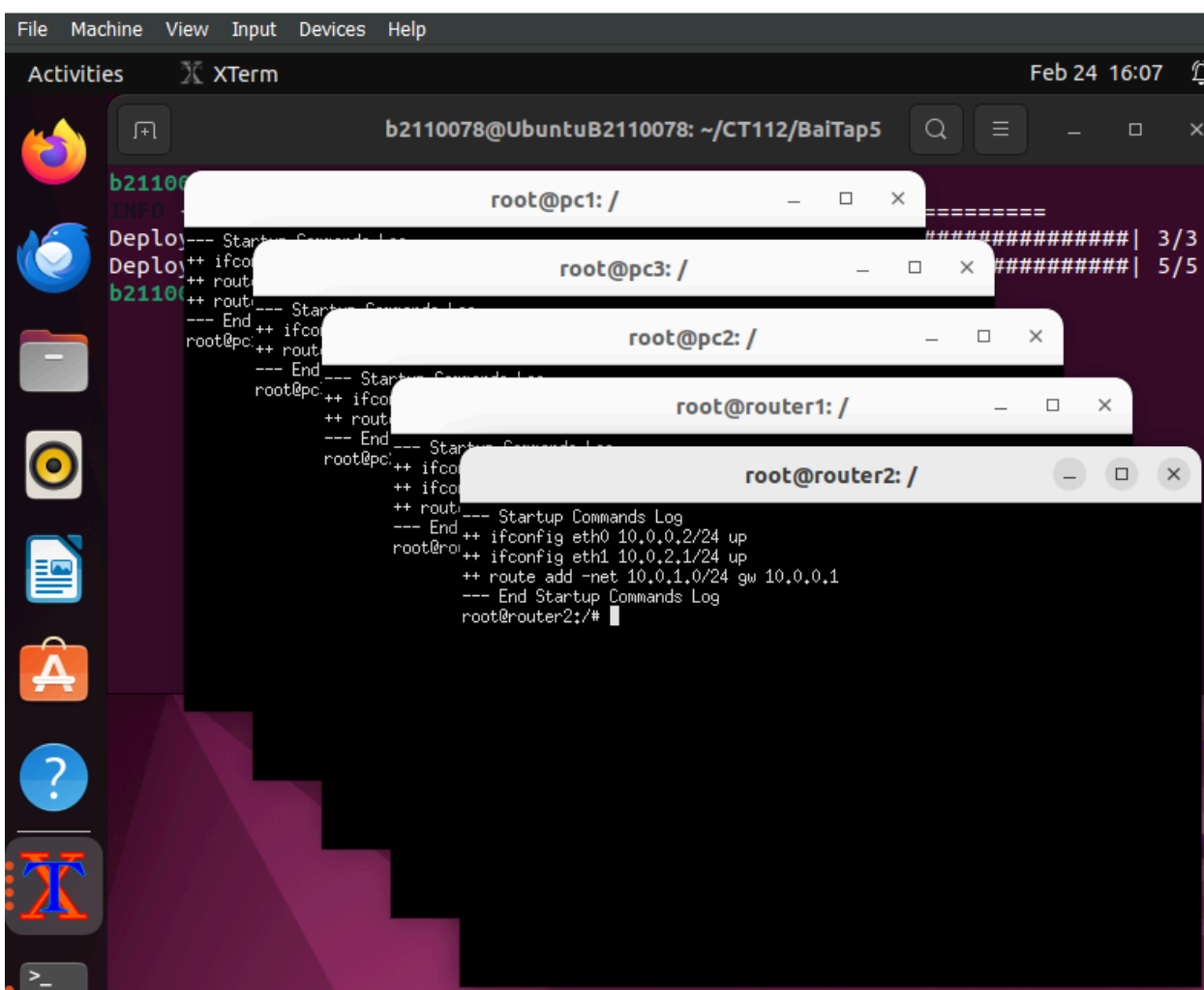


The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap5". The terminal is running GNU nano 6.2 to edit a file named "router2.startup". The content of the file is as follows:

```
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
```

At the bottom of the terminal, there is a status bar with various keyboard shortcuts: ^G Help, ^O Write Out, ^W Where Is, ^K Cut, ^T Execute, ^C Location, ^X Exit, ^R Read File, ^\_ Replace, ^U Paste, ^J Justify, and ^\_/ Go To Line. A notification "Wrote 3 lines" is also visible.

UbuntuB2110078 [Running] - Oracle VM VirtualBox



The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap5". The terminal is running XTerm. The output of the deployment process is as follows:

```
root@pc1: /
root@pc3: /
root@pc2: /
root@router1: /
root@router2: /
```

The terminal also shows the following output:

```
--- Startup Commands Log
--- End
++ 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:/#
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

```

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:/#

```

```

root@pc2: /
root@pc2:/# route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
default        10.0.1.1        0.0.0.0         UG     0      0      0 eth0
10.0.1.0        0.0.0.0         255.255.255.0   U      0      0      0 eth0
root@pc2:/#

```

```

root@pc3: /
root@pc3:/# route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
default        10.0.2.1        0.0.0.0         UG     0      0      0 eth0
10.0.2.0        0.0.0.0         255.255.255.0   U      0      0      0 eth0
root@pc3:/#

```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

```

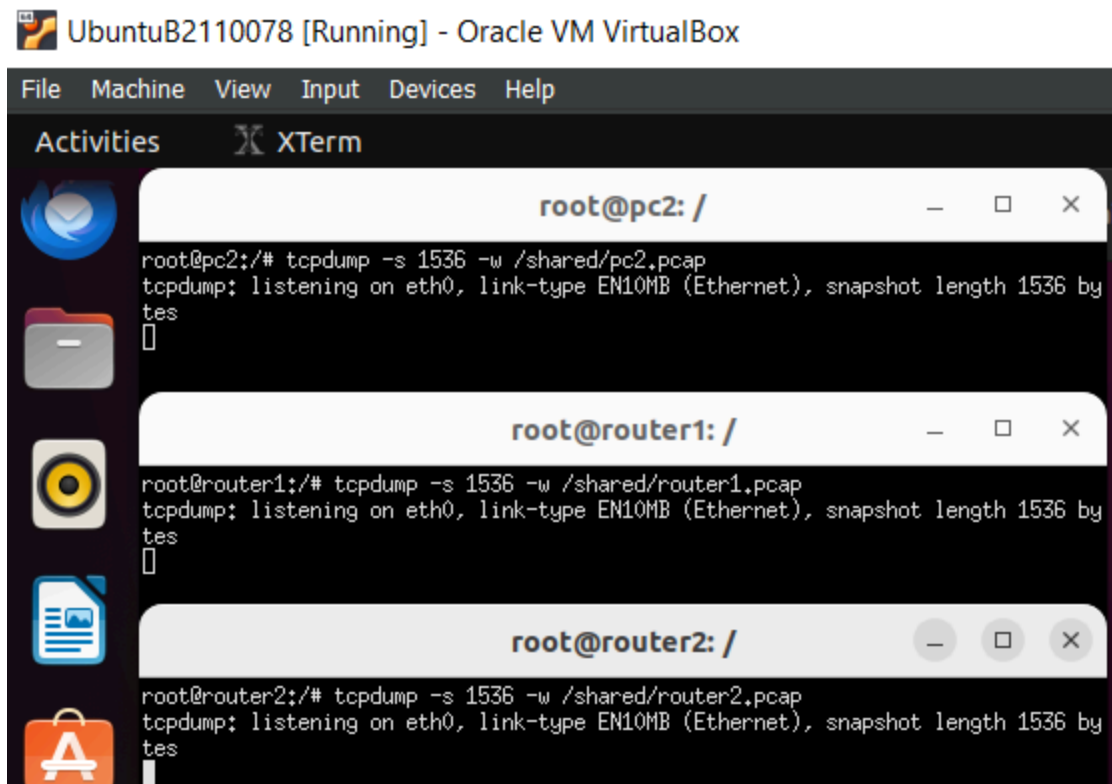
root@router1: /
root@router1:/# route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.0.0        0.0.0.0         255.255.255.0   U      0      0      0 eth0
10.0.1.0        0.0.0.0         255.255.255.0   U      0      0      0 eth1
10.0.2.0        10.0.0.2        255.255.255.0   UG     0      0      0 eth0
root@router1:/#

```

```

root@router2: /
root@router2:/# 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        0.0.0.0         255.255.255.0   U      0      0      0 eth1
root@router2:/#

```



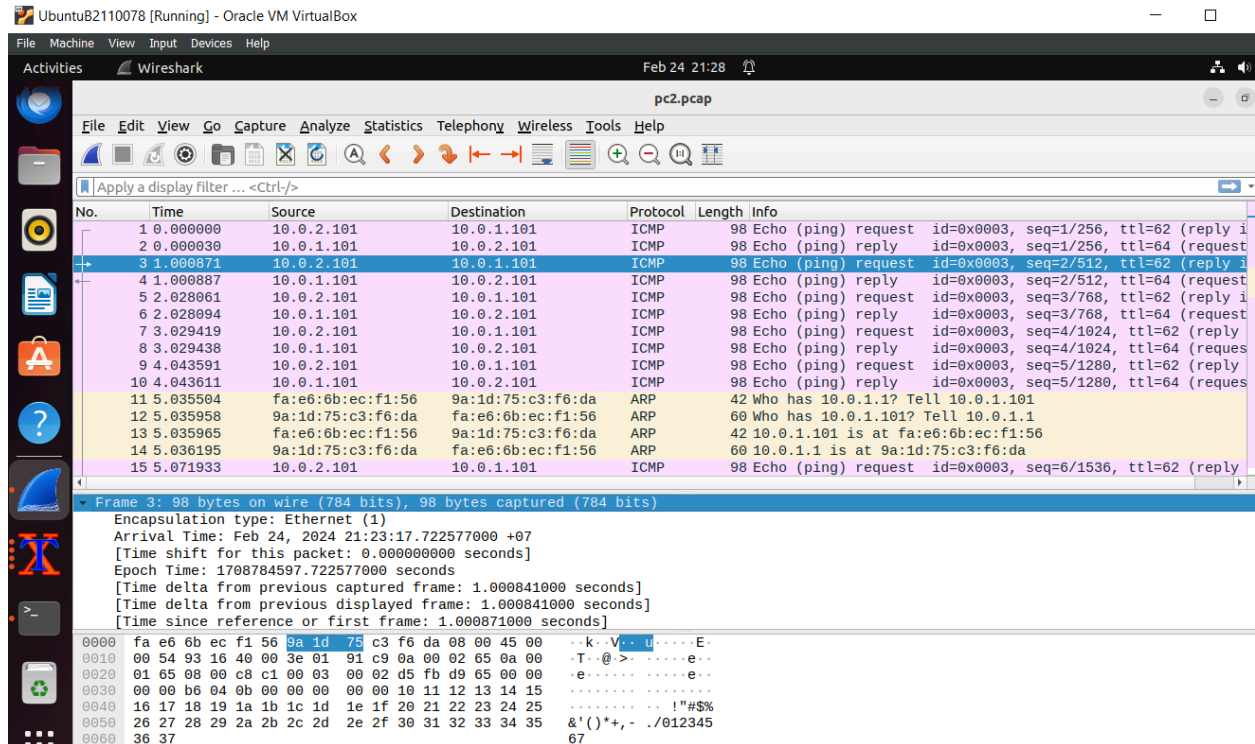
UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

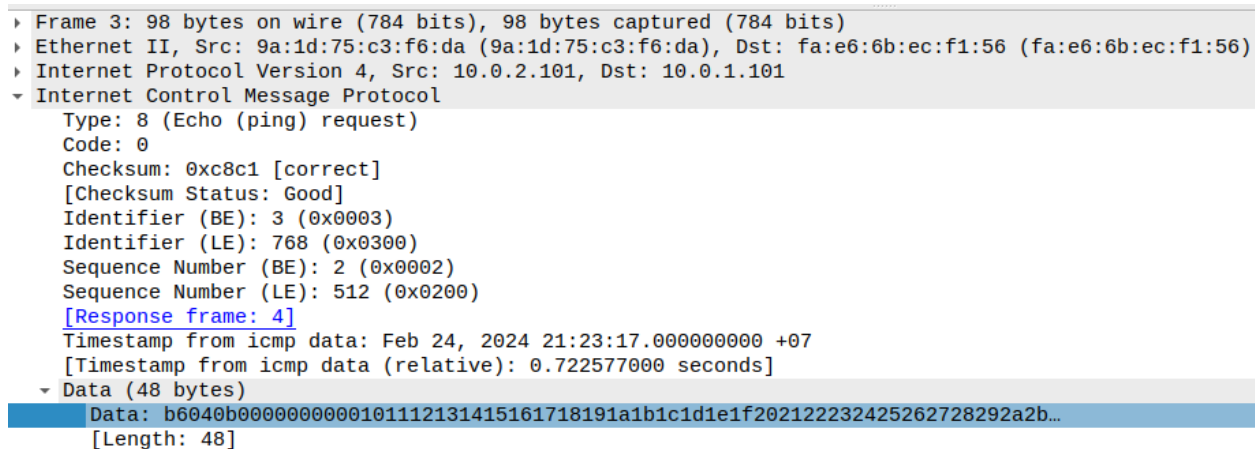
Activities XTerm

root@pc3: /

```
64 bytes from 10.0.1.101: icmp_seq=26 ttl=62 time=1.16 ms
64 bytes from 10.0.1.101: icmp_seq=27 ttl=62 time=1.33 ms
64 bytes from 10.0.1.101: icmp_seq=28 ttl=62 time=1.19 ms
64 bytes from 10.0.1.101: icmp_seq=29 ttl=62 time=2.37 ms
64 bytes from 10.0.1.101: icmp_seq=30 ttl=62 time=1.30 ms
64 bytes from 10.0.1.101: icmp_seq=31 ttl=62 time=1.28 ms
64 bytes from 10.0.1.101: icmp_seq=32 ttl=62 time=1.01 ms
64 bytes from 10.0.1.101: icmp_seq=33 ttl=62 time=1.11 ms
64 bytes from 10.0.1.101: icmp_seq=34 ttl=62 time=1.57 ms
64 bytes from 10.0.1.101: icmp_seq=35 ttl=62 time=1.10 ms
64 bytes from 10.0.1.101: icmp_seq=36 ttl=62 time=1.04 ms
64 bytes from 10.0.1.101: icmp_seq=37 ttl=62 time=1.47 ms
64 bytes from 10.0.1.101: icmp_seq=38 ttl=62 time=1.25 ms
64 bytes from 10.0.1.101: icmp_seq=39 ttl=62 time=0.836 ms
64 bytes from 10.0.1.101: icmp_seq=40 ttl=62 time=2.07 ms
64 bytes from 10.0.1.101: icmp_seq=41 ttl=62 time=1.48 ms
64 bytes from 10.0.1.101: icmp_seq=42 ttl=62 time=1.54 ms
64 bytes from 10.0.1.101: icmp_seq=43 ttl=62 time=0.792 ms
64 bytes from 10.0.1.101: icmp_seq=44 ttl=62 time=2.11 ms
64 bytes from 10.0.1.101: icmp_seq=45 ttl=62 time=0.951 ms
64 bytes from 10.0.1.101: icmp_seq=46 ttl=62 time=0.642 ms
64 bytes from 10.0.1.101: icmp_seq=47 ttl=62 time=0.686 ms
64 bytes from 10.0.1.101: icmp_seq=48 ttl=62 time=1.69 ms
64 bytes from 10.0.1.101: icmp_seq=49 ttl=62 time=1.66 ms
64 bytes from 10.0.1.101: icmp_seq=50 ttl=62 time=0.750 ms
64 bytes from 10.0.1.101: icmp_seq=51 ttl=62 time=1.17 ms
64 bytes from 10.0.1.101: icmp_seq=52 ttl=62 time=1.16 ms
64 bytes from 10.0.1.101: icmp_seq=53 ttl=62 time=0.897 ms
64 bytes from 10.0.1.101: icmp_seq=54 ttl=62 time=0.828 ms
64 bytes from 10.0.1.101: icmp_seq=55 ttl=62 time=1.28 ms
64 bytes from 10.0.1.101: icmp_seq=56 ttl=62 time=1.15 ms
64 bytes from 10.0.1.101: icmp_seq=57 ttl=62 time=1.09 ms
64 bytes from 10.0.1.101: icmp_seq=58 ttl=62 time=0.948 ms
64 bytes from 10.0.1.101: icmp_seq=59 ttl=62 time=1.23 ms
^C
--- 10.0.1.101 ping statistics ---
59 packets transmitted, 59 received, 0% packet loss, time 58179ms
rtt min/avg/max/mdev = 0.642/1.296/2.369/0.384 ms
root@pc3:/#
```



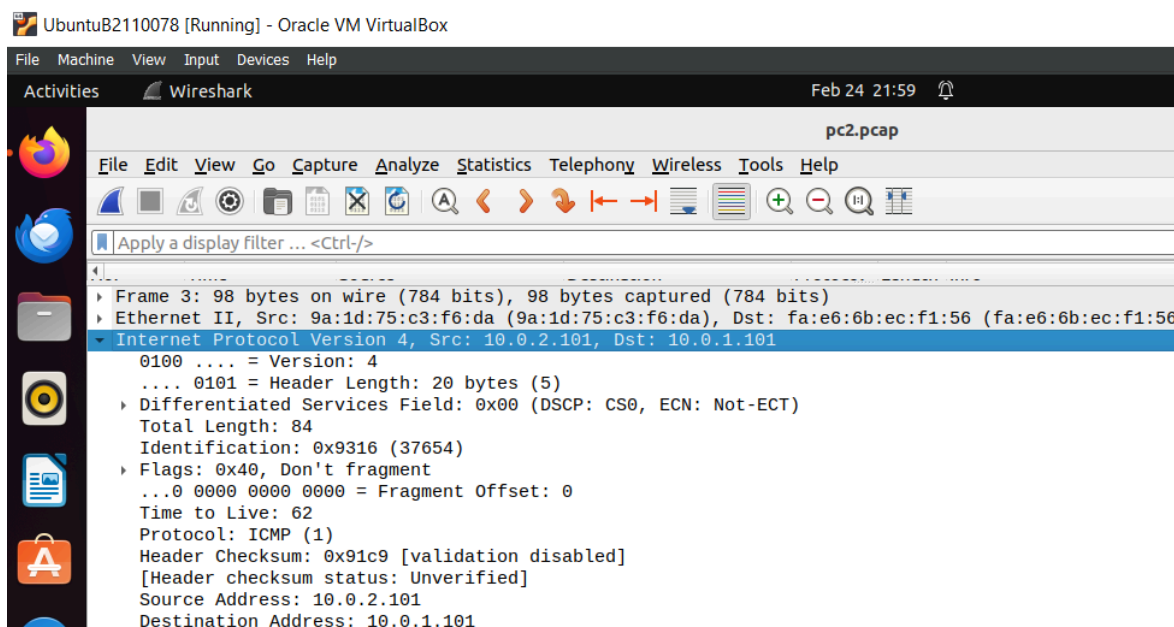
## - Frame 3 có kích thước là 98 bytes



## - 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:

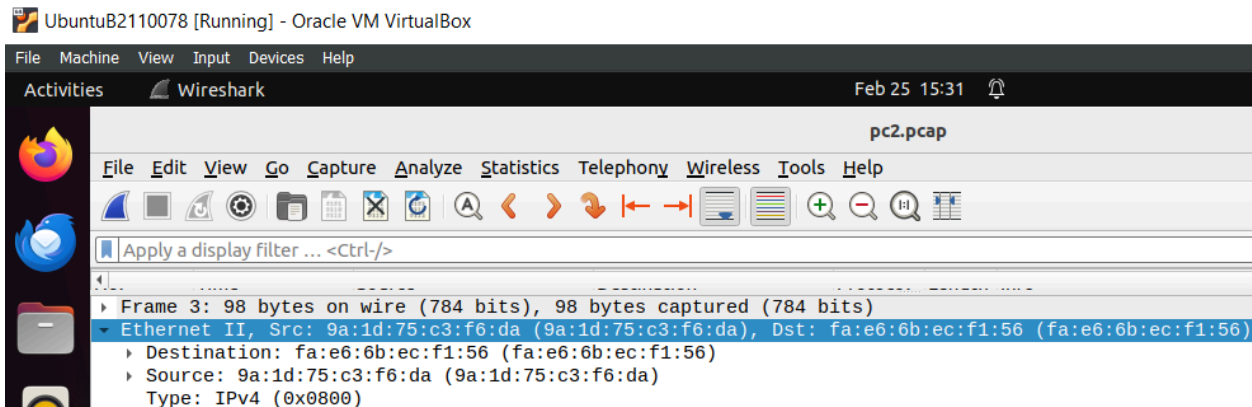
0000	fa	e6	6b	ec	f1	56	9a	1d	75	c3	f6	da	08	00	45	00	..k..V..u.....E..
0010	00	54	93	16	40	00	3e	01	91	c9	0a	00	02	65	0a	00	..T..@.>.....e..
0020	01	65	08	00	c8	c1	00	03	00	02	d5	fb	d9	65	00	00	..e.....e..
0030	00	00	b6	04	0b	00	00	00	00	00	10	11	12	13	14	15	..[.....
0040	16	17	18	19	1a	1b	1c	1d	1e	1f	20	21	22	23	24	25	.....!"\$%&
0050	26	27	28	29	2a	2b	2c	2d	2e	2f	30	31	32	33	34	35	..&'()*+,-./012345
0060	36	37															67



- Header Internet Protocol Version 4:
  - IP của máy gửi dữ liệu là 10.0.2.101 của PC3
  - IP của máy nhận dữ liệu là 10.0.1.101 của PC2
  - Định danh ID của gói tin IP này là 0x9316. Định danh của 1 gói tin giúp máy nhận dữ liệu có thể xác định từng gói riêng biệt, để ghép chúng lại sau khi tác ra trong quá trình truyền trong mạng
  - Độ dài Header là 20 bytes. Phần Header bao gồm những trường sau:
    - Version (4 bits)
    - Header Length (4 bits)
    - Differentiated Services Field (6 bits)
    - Total Length (16 bits)
    - Identification (16 bits)
    - Flags (3 bits)
    - Time to Live (8 bits)
    - Header Checksum (16 bits)
    - Source Address (32 bits)

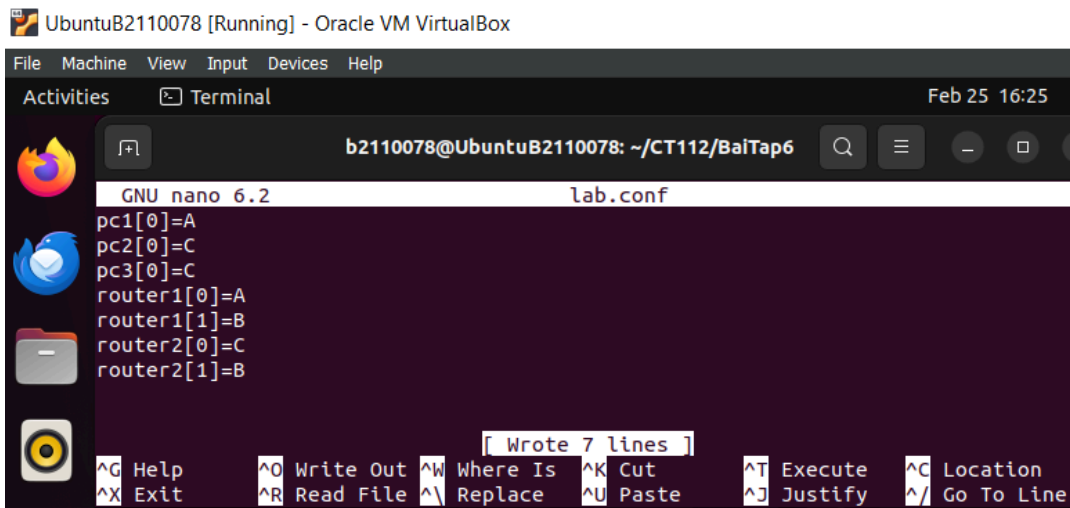


- Destination Address (32 bits)
- Trường Total Length có độ dài là 84 bytes. Message + Header = 64 + 20 = 84



- Header Ethernet II:
  - Địa chỉ MAC của máy gửi dữ liệu là *9a:1d:75:c3:f6:da*, 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 *fa:e6:6b:ec:f1:56*, đây là địa chỉ của pc2
  - Trường type mang giá trị là 0x0800. Thông tin thể hiện là IPv4
  - Payload có chiều dài là 64 bytes

## Bài 6:



UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 25 16:29
b2110078@UbuntuB2110078: ~/CT112/BaiTap6
GNU nano 6.2 pc1.startup
ifconfig eth0 195.11.14.5/24 up
route add default gw 195.11.14.1
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line
```

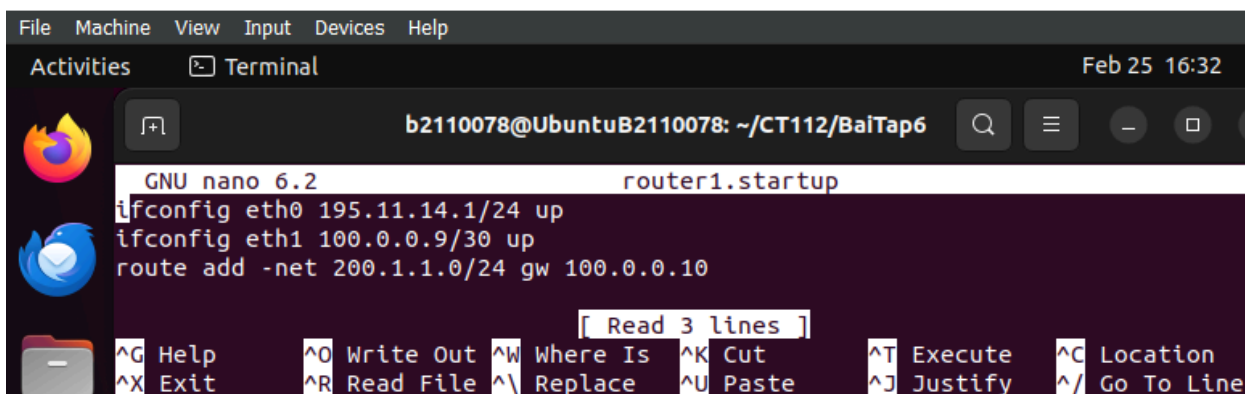
UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 25 16:30
b2110078@UbuntuB2110078: ~/CT112/BaiTap6
GNU nano 6.2 pc2.startup
ifconfig eth0 200.1.1.7/24 up
route add default gw 200.1.1.1
[ Read 2 lines ]
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 25 16:31
b2110078@UbuntuB2110078: ~/CT112/BaiTap6
GNU nano 6.2 pc3.startup
ifconfig eth0 200.1.1.3/24 up
route add default gw 200.1.1.1
[ Read 2 lines ]
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

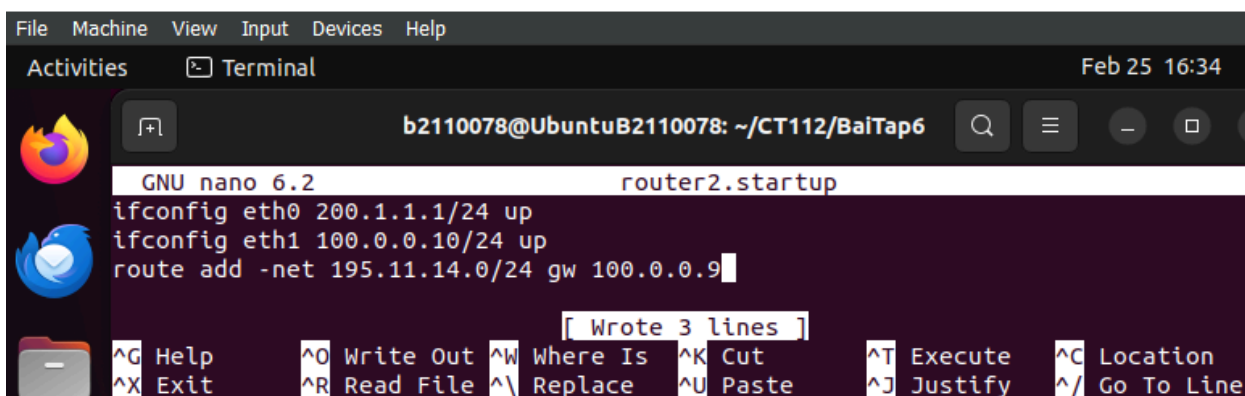


The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap6". The terminal is running the nano 6.2 editor, editing a file named "router1.startup". The content of the file is as follows:

```
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 bottom of the terminal shows the nano editor's help menu with various shortcuts like ^G for Help, ^O for Write Out, etc.

UbuntuB2110078 [Running] - Oracle VM VirtualBox

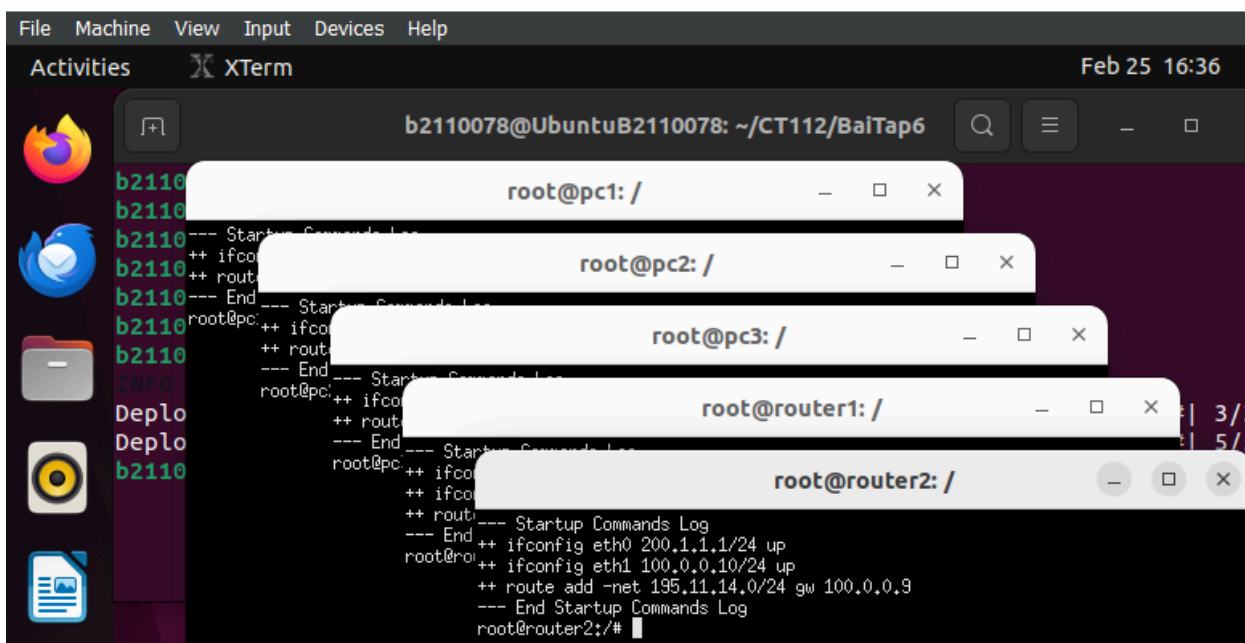


The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap6". The terminal is running the nano 6.2 editor, editing a file named "router2.startup". The content of the file is as follows:

```
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
```

The bottom of the terminal shows the nano editor's help menu with various shortcuts like ^G for Help, ^O for Write Out, etc.

UbuntuB2110078 [Running] - Oracle VM VirtualBox



The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap6". The terminal is running the nano 6.2 editor, editing a file named "router1.startup". The content of the file is as follows:

```
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
```

The bottom of the terminal shows the nano editor's help menu with various shortcuts like ^G for Help, ^O for Write Out, etc.

UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

root@pc1: /

```
root@pc1:~# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
default 195.11.14.1 0.0.0.0 UG 0 0 0 eth0
195.11.14.0 0.0.0.0 255.255.255.0 U 0 0 0 eth0
root@pc1:~#
```

root@pc2: /

```
root@pc2:~# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
default 200.1.1.1 0.0.0.0 UG 0 0 0 eth0
200.1.1.0 0.0.0.0 255.255.255.0 U 0 0 0 eth0
root@pc2:~#
```

root@pc3: /

```
root@pc3:~# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
default 200.1.1.1 0.0.0.0 UG 0 0 0 eth0
200.1.1.0 0.0.0.0 255.255.255.0 U 0 0 0 eth0
root@pc3:~#
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

root@router1: /

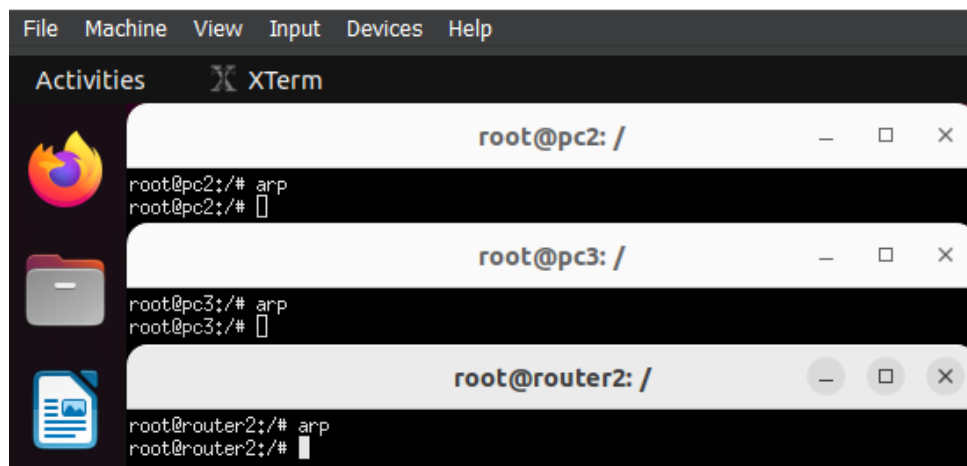
```
root@router1:~# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
100.0.0.8 0.0.0.0 255.255.255.252 U 0 0 0 eth1
195.11.14.0 0.0.0.0 255.255.255.0 U 0 0 0 eth0
200.1.1.0 100.0.0.10 255.255.255.0 UG 0 0 0 eth1
root@router1:~#
```

root@router2: /

```
root@router2:~# route
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@router2:~#
```

### □ 2.3.2.1/ Giao thức ARP giữa 2 thiết bị trong cùng nhánh mạng LAN C:

UbuntuB2110078 [Running] - Oracle VM VirtualBox



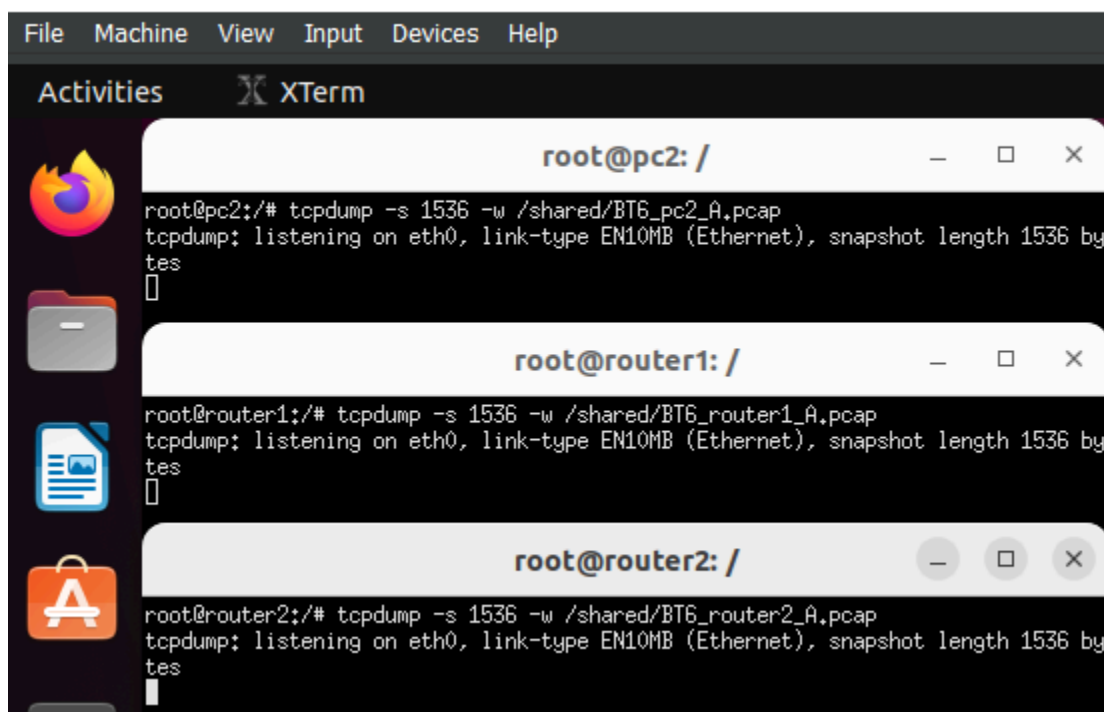
```
File Machine View Input Devices Help
Activities XTerm

root@pc2: /
root@pc2:/# arp
root@pc2:/#

root@pc3: /
root@pc3:/# arp
root@pc3:/#

root@router2: /
root@router2:/# arp
root@router2:/#
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox



```
File Machine View Input Devices Help
Activities XTerm

root@pc2: /
root@pc2:/# tcpdump -s 1536 -w /shared/BT6_pc2_A.pcap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 1536 by tes
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 by tes
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 by tes
root@router2:/#
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities XTerm
root@pc3: /
root@pc3:/# ping 200.1.1.7
PING 200.1.1.7 (200.1.1.7) 56(84) bytes of data.
64 bytes from 200.1.1.7: icmp_seq=1 ttl=64 time=0.626 ms
64 bytes from 200.1.1.7: icmp_seq=2 ttl=64 time=0.335 ms
64 bytes from 200.1.1.7: icmp_seq=3 ttl=64 time=0.278 ms
64 bytes from 200.1.1.7: icmp_seq=4 ttl=64 time=0.399 ms
64 bytes from 200.1.1.7: icmp_seq=5 ttl=64 time=0.308 ms
64 bytes from 200.1.1.7: icmp_seq=6 ttl=64 time=0.226 ms
64 bytes from 200.1.1.7: icmp_seq=7 ttl=64 time=0.188 ms
64 bytes from 200.1.1.7: icmp_seq=8 ttl=64 time=0.237 ms
64 bytes from 200.1.1.7: icmp_seq=9 ttl=64 time=0.237 ms
64 bytes from 200.1.1.7: icmp_seq=10 ttl=64 time=0.250 ms
64 bytes from 200.1.1.7: icmp_seq=11 ttl=64 time=0.347 ms
64 bytes from 200.1.1.7: icmp_seq=12 ttl=64 time=0.246 ms
64 bytes from 200.1.1.7: icmp_seq=13 ttl=64 time=0.370 ms
64 bytes from 200.1.1.7: icmp_seq=14 ttl=64 time=0.373 ms
64 bytes from 200.1.1.7: icmp_seq=15 ttl=64 time=0.399 ms
64 bytes from 200.1.1.7: icmp_seq=16 ttl=64 time=0.320 ms
64 bytes from 200.1.1.7: icmp_seq=17 ttl=64 time=0.325 ms
64 bytes from 200.1.1.7: icmp_seq=18 ttl=64 time=0.300 ms
64 bytes from 200.1.1.7: icmp_seq=19 ttl=64 time=0.265 ms
64 bytes from 200.1.1.7: icmp_seq=20 ttl=64 time=0.298 ms
64 bytes from 200.1.1.7: icmp_seq=21 ttl=64 time=0.533 ms
64 bytes from 200.1.1.7: icmp_seq=22 ttl=64 time=0.327 ms
```

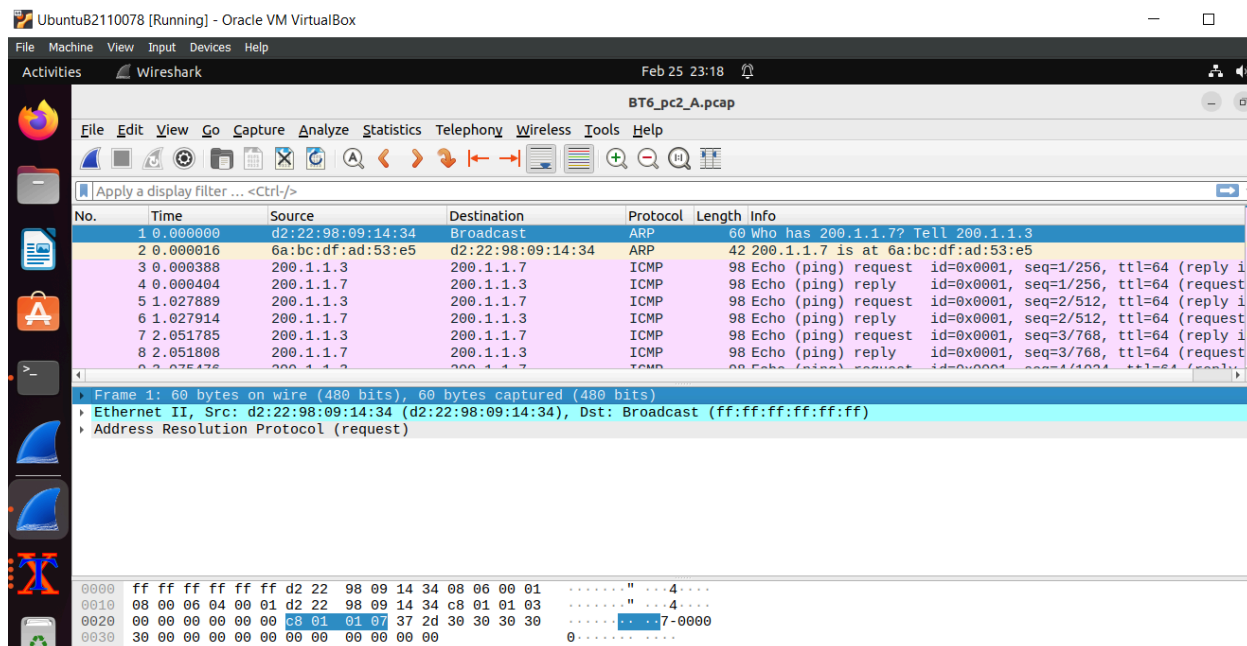
UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities XTerm
root@pc3: /
root@pc3:/# arp
Address          HWtype  HWaddress      Flags Mask    Iface
200.1.1.7        ether    6a:bc:df:ad:53:e5  C             eth0
root@pc3:/#

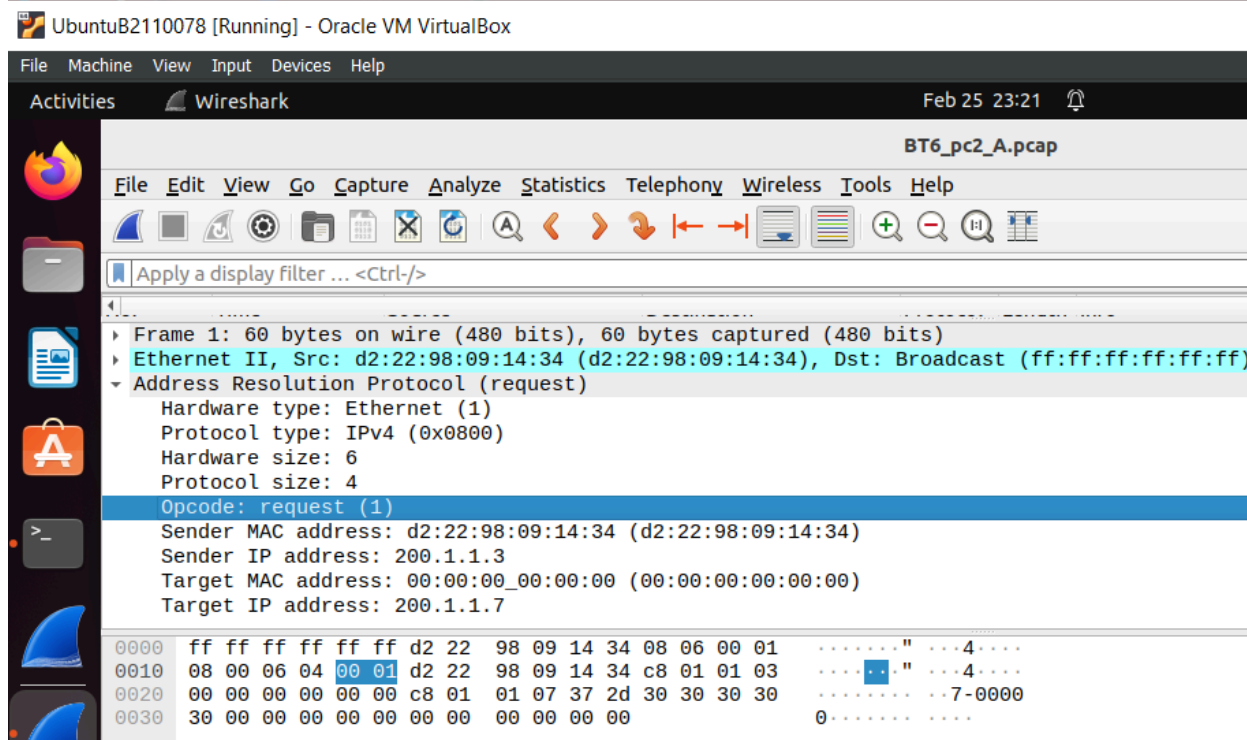
root@pc2: /
root@pc2:/# arp
Address          HWtype  HWaddress      Flags Mask    Iface
200.1.1.3        ether    d2:22:98:09:14:34  C             eth0
root@pc2:/#

root@router2: /
root@router2:/# arp
root@router2:/#
```

- pc3 có thông tin địa chỉ mạng của pc2 và pc2 có thông tin địa chỉ mạng của pc3, router2 thì không nhận được gì cả

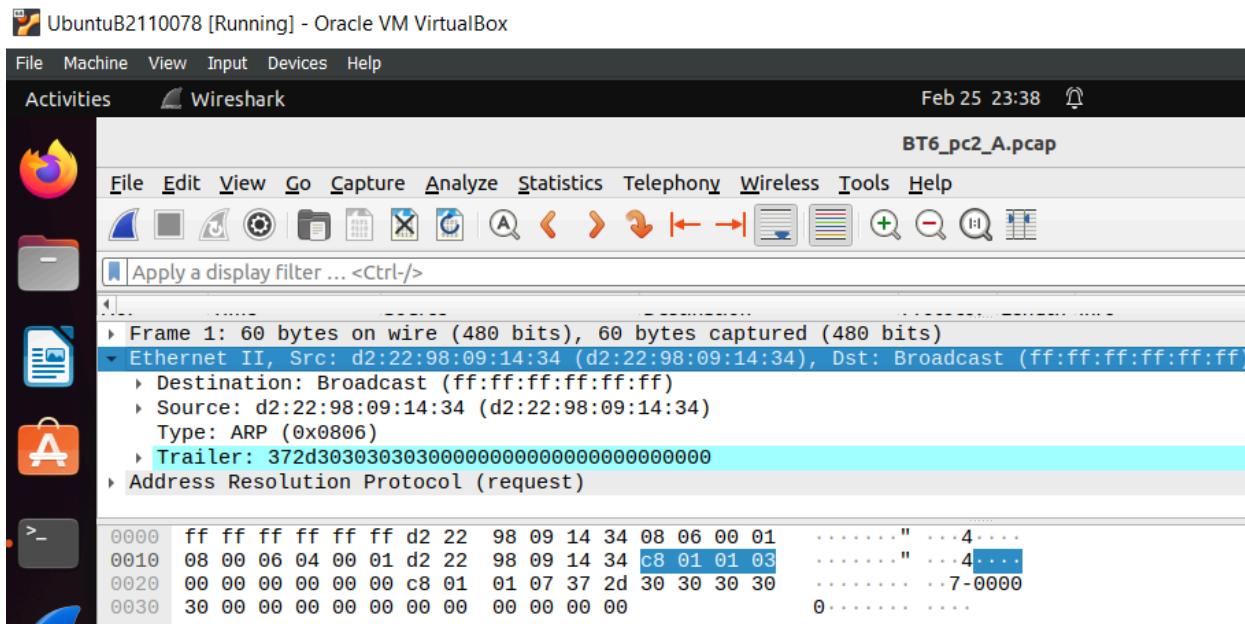


- Frame 1 có kích thước 60 bytes



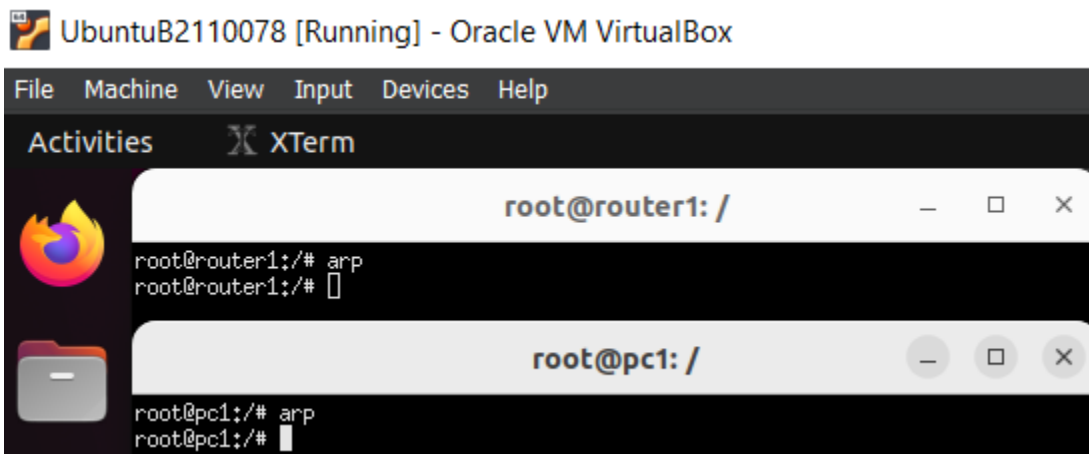
- Header Address Resolution Protocol:
  - Trường Opcode có giá trị là 0x0001 thể hiện thông tin request; Nó còn có thể có giá trị 0x0002 thể hiện thông tin reply
  - Địa chỉ IP của máy gửi dữ liệu là 200.1.1.3 và địa chỉ MAC là d2:22:98:09:14:34

- Địa chỉ IP của máy nhận dữ liệu là 200.1.1.7 và không có địa chỉ MAC



- Header Ethernet II:
  - Địa chỉ MAC của máy gửi dữ liệu là d2:22:98:09:14:34, đây là địa chỉ của pc3
  - 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

#### □ 2.3.2.2/ Giao thức ARP giữa 2 thiết bị khác nhánh mạng LAN:







UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

root@pc3: /

```
root@pc3:/# ping 195.11.14.5
PING 195.11.14.5 (195.11.14.5) 56(84) bytes of data.
64 bytes from 195.11.14.5: icmp_seq=1 ttl=62 time=4.24 ms
64 bytes from 195.11.14.5: icmp_seq=2 ttl=62 time=0.787 ms
64 bytes from 195.11.14.5: icmp_seq=3 ttl=62 time=0.750 ms
64 bytes from 195.11.14.5: icmp_seq=4 ttl=62 time=0.751 ms
64 bytes from 195.11.14.5: icmp_seq=5 ttl=62 time=1.58 ms
64 bytes from 195.11.14.5: icmp_seq=6 ttl=62 time=1.47 ms
64 bytes from 195.11.14.5: icmp_seq=7 ttl=62 time=0.652 ms
64 bytes from 195.11.14.5: icmp_seq=8 ttl=62 time=1.01 ms
64 bytes from 195.11.14.5: icmp_seq=9 ttl=62 time=0.842 ms
64 bytes from 195.11.14.5: icmp_seq=10 ttl=62 time=0.645 ms
64 bytes from 195.11.14.5: icmp_seq=11 ttl=62 time=0.799 ms
64 bytes from 195.11.14.5: icmp_seq=12 ttl=62 time=0.746 ms
64 bytes from 195.11.14.5: icmp_seq=13 ttl=62 time=0.585 ms
64 bytes from 195.11.14.5: icmp_seq=14 ttl=62 time=0.741 ms
64 bytes from 195.11.14.5: icmp_seq=15 ttl=62 time=0.988 ms
64 bytes from 195.11.14.5: icmp_seq=16 ttl=62 time=1.21 ms
64 bytes from 195.11.14.5: icmp_seq=17 ttl=62 time=2.79 ms
64 bytes from 195.11.14.5: icmp_seq=18 ttl=62 time=0.909 ms
64 bytes from 195.11.14.5: icmp_seq=19 ttl=62 time=0.872 ms
64 bytes from 195.11.14.5: icmp_seq=20 ttl=62 time=1.32 ms
64 bytes from 195.11.14.5: icmp_seq=21 ttl=62 time=0.680 ms
64 bytes from 195.11.14.5: icmp_seq=22 ttl=62 time=0.674 ms
64 bytes from 195.11.14.5: icmp_seq=23 ttl=62 time=0.763 ms
64 bytes from 195.11.14.5: icmp_seq=24 ttl=62 time=1.00 ms
64 bytes from 195.11.14.5: icmp_seq=25 ttl=62 time=0.837 ms
64 bytes from 195.11.14.5: icmp_seq=26 ttl=62 time=0.750 ms
64 bytes from 195.11.14.5: icmp_seq=27 ttl=62 time=0.818 ms
64 bytes from 195.11.14.5: icmp_seq=28 ttl=62 time=1.43 ms
^C
--- 195.11.14.5 ping statistics ---
28 packets transmitted, 28 received, 0% packet loss, time 27615ms
rtt min/avg/max/mdev = 0.585/1.094/4.238/0.744 ms
root@pc3:/#
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

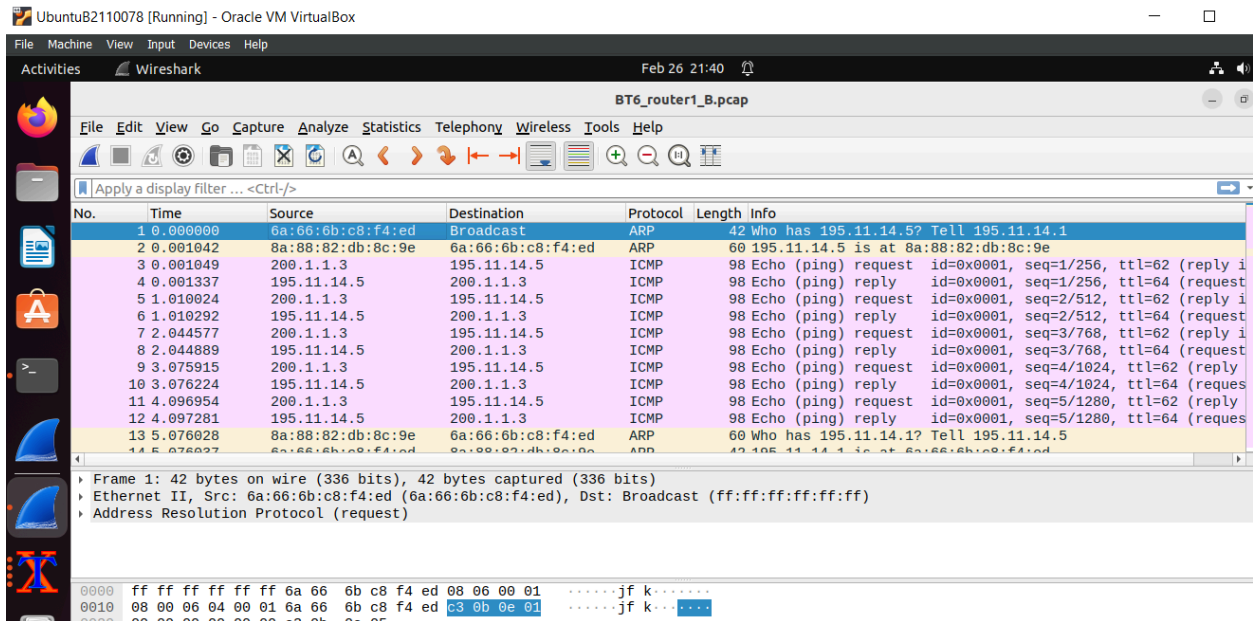
```
root@pc3: /
root@pc3:/# arp
Address          Hwtype  Hwaddress      Flags Mask      Iface
200.1.1.1        ether   fe:55:fe:6f:8d:dd  C              eth0
root@pc3:/#
```

```
root@router2: /
root@router2:/# arp
Address          Hwtype  Hwaddress      Flags Mask      Iface
200.1.1.3        ether   1a:f9:11:c6:03:2b  C              eth0
100.0.0.9        ether   ba:c9:3e:13:3b:77  C              eth1
root@router2:/#
```

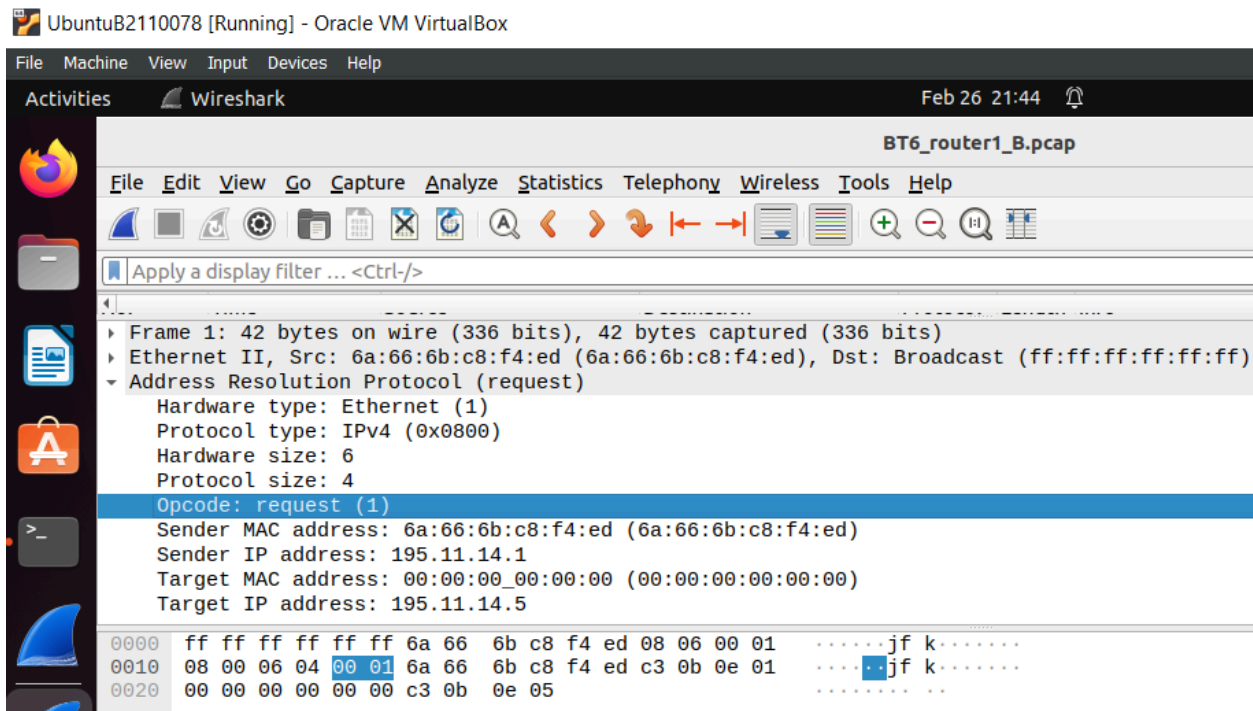
```
root@router1: /
root@router1:/# arp
Address          Hwtype  Hwaddress      Flags Mask      Iface
195.11.14.5      ether   8a:88:82:db:8c:9e  C              eth0
100.0.0.10       ether   82:1a:7e:39:8f:9c  C              eth1
root@router1:/#
```

```
root@pc1: /
root@pc1:/# arp
Address          Hwtype  Hwaddress      Flags Mask      Iface
195.11.14.1      ether   6a:66:6b:c8:f4:ed  C              eth0
root@pc1:/#
```

- 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

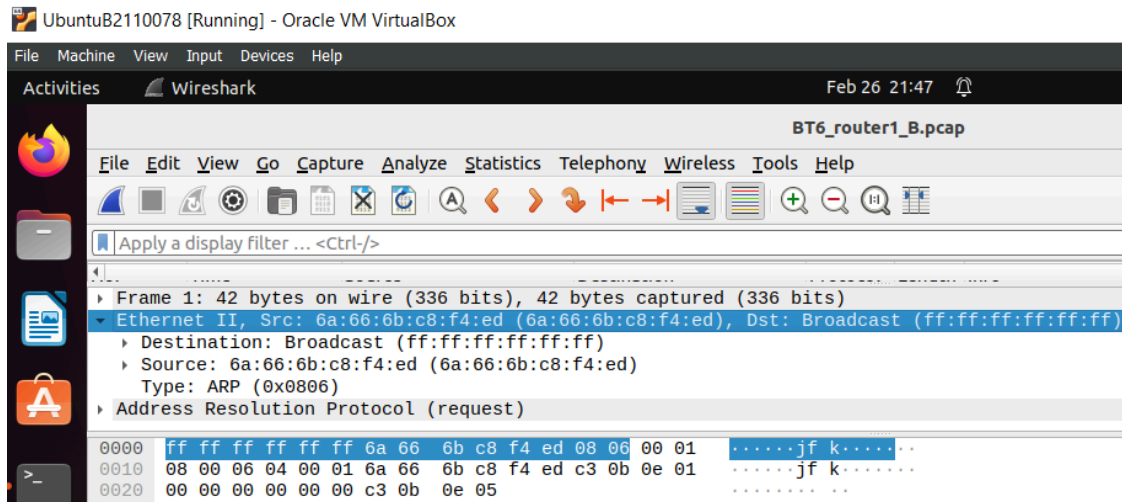


- Frame 1 có kích thước 42 bytes

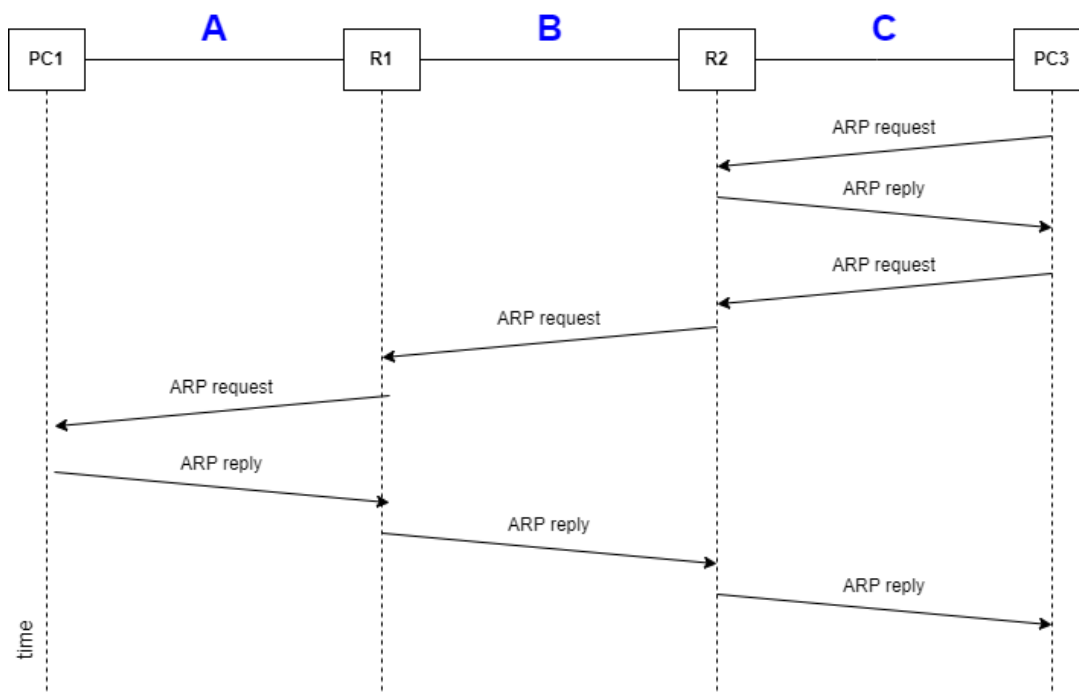


- Header Address Resolution Protocol:
  - Trường Opcode có giá trị là 0x0001 thể hiện thông tin request; Nó còn có thể có giá trị 0x0002 thể hiện thông tin reply
  - Địa chỉ IP của máy gửi dữ liệu là 195.11.14.1 và địa chỉ MAC là 6a:66:6b:c8:f4:ed

- 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 6a:66:6b:c8:f4:ed, 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



UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

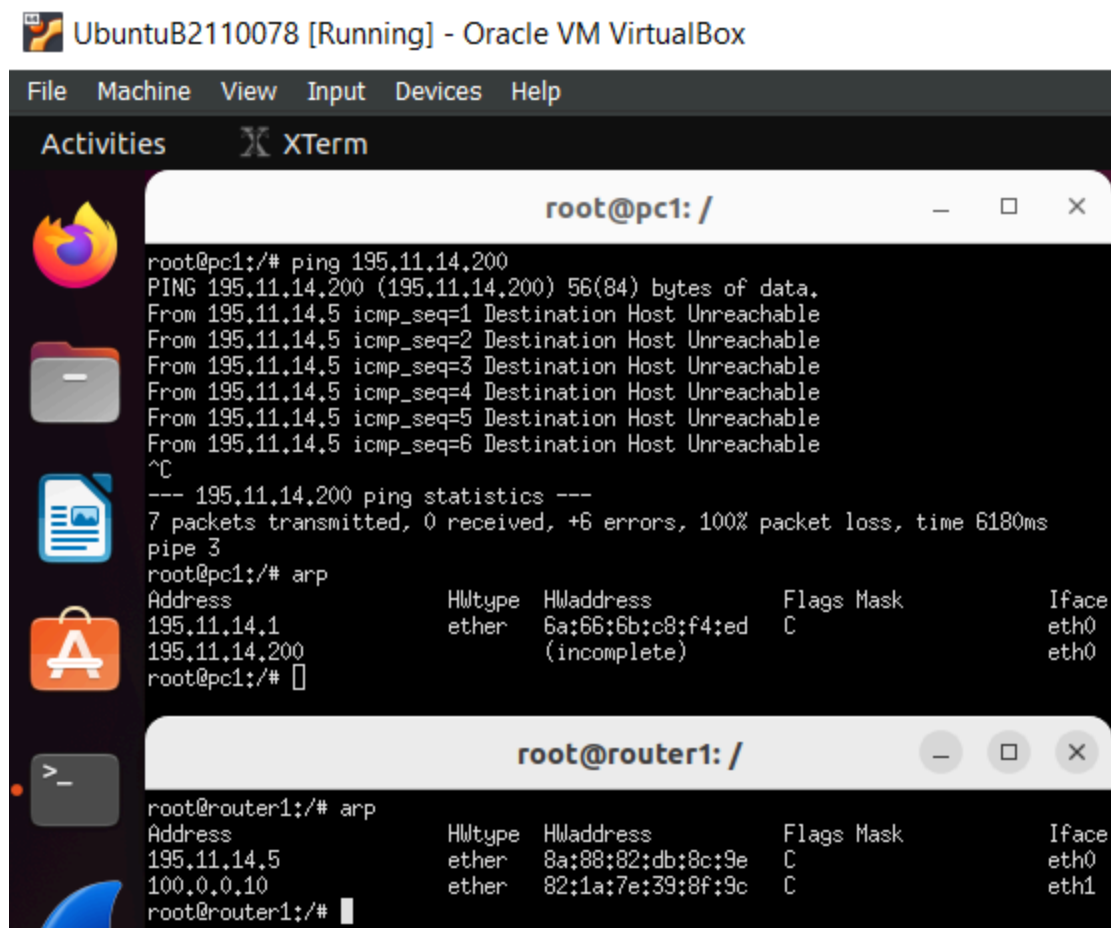
Activities XTerm

```
root@pc1: /
root@pc1:~# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
From 195.11.14.1 icmp_seq=1 Destination Net Unreachable
From 195.11.14.1 icmp_seq=2 Destination Net Unreachable
From 195.11.14.1 icmp_seq=3 Destination Net Unreachable
From 195.11.14.1 icmp_seq=4 Destination Net Unreachable
From 195.11.14.1 icmp_seq=5 Destination Net Unreachable
From 195.11.14.1 icmp_seq=6 Destination Net Unreachable
From 195.11.14.1 icmp_seq=7 Destination Net Unreachable
From 195.11.14.1 icmp_seq=8 Destination Net Unreachable
From 195.11.14.1 icmp_seq=9 Destination Net Unreachable
^C
--- 8.8.8.8 ping statistics ---
9 packets transmitted, 0 received, +9 errors, 100% packet loss, time 8193ms

root@pc1:~# arp
Address                  Hwtype  Hwaddress      Flags Mask          Iface
195.11.14.1              ether   6a:66:6b:c8:f4:ed  C                   eth0
root@pc1:~#
```

```
root@router1: /
root@router1:~# arp
Address                  Hwtype  Hwaddress      Flags Mask          Iface
195.11.14.5              ether   8a:88:82:db:8c:9e  C                   eth0
100.0.0.10               ether   82:1a:7e:39:8f:9c  C                   eth1
root@router1:~#
```

- pc1 không ping được 8.8.8.8

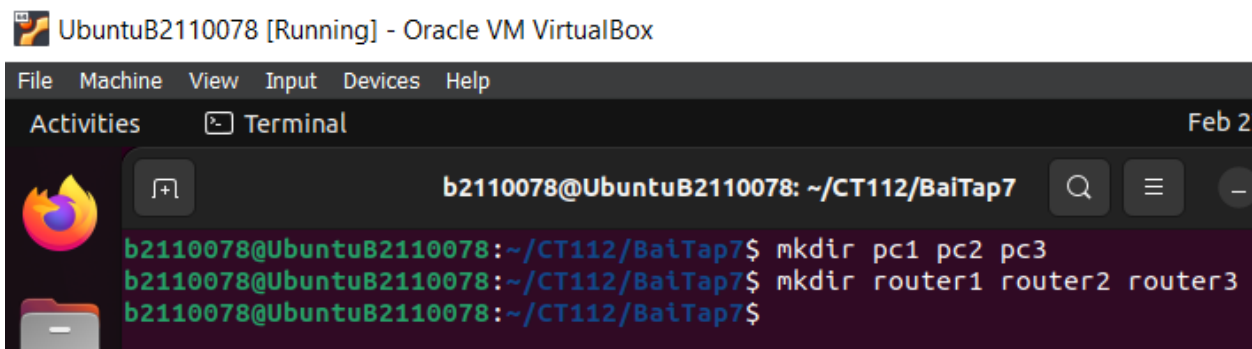


```
root@pc1: /
root@pc1:/# ping 195.11.14.200
PING 195.11.14.200 (195.11.14.200) 56(84) bytes of data.
From 195.11.14.5 icmp_seq=1 Destination Host Unreachable
From 195.11.14.5 icmp_seq=2 Destination Host Unreachable
From 195.11.14.5 icmp_seq=3 Destination Host Unreachable
From 195.11.14.5 icmp_seq=4 Destination Host Unreachable
From 195.11.14.5 icmp_seq=5 Destination Host Unreachable
From 195.11.14.5 icmp_seq=6 Destination Host Unreachable
^C
--- 195.11.14.200 ping statistics ---
7 packets transmitted, 0 received, +6 errors, 100% packet loss, time 6180ms
pipe 3
root@pc1:/# arp
Address                  Hwtype  Hwaddress      Flags Mask        Iface
195.11.14.1              ether   6a:66:6b:c8:f4:ed  C                 eth0
195.11.14.200            (incomplete)
root@pc1:/#

root@router1: /
root@router1:/# arp
Address                  Hwtype  Hwaddress      Flags Mask        Iface
195.11.14.5              ether   8a:88:82:db:8c:9e  C                 eth0
100.0.0.10               ether   82:1a:7e:39:8f:9c  C                 eth1
root@router1:/#
```

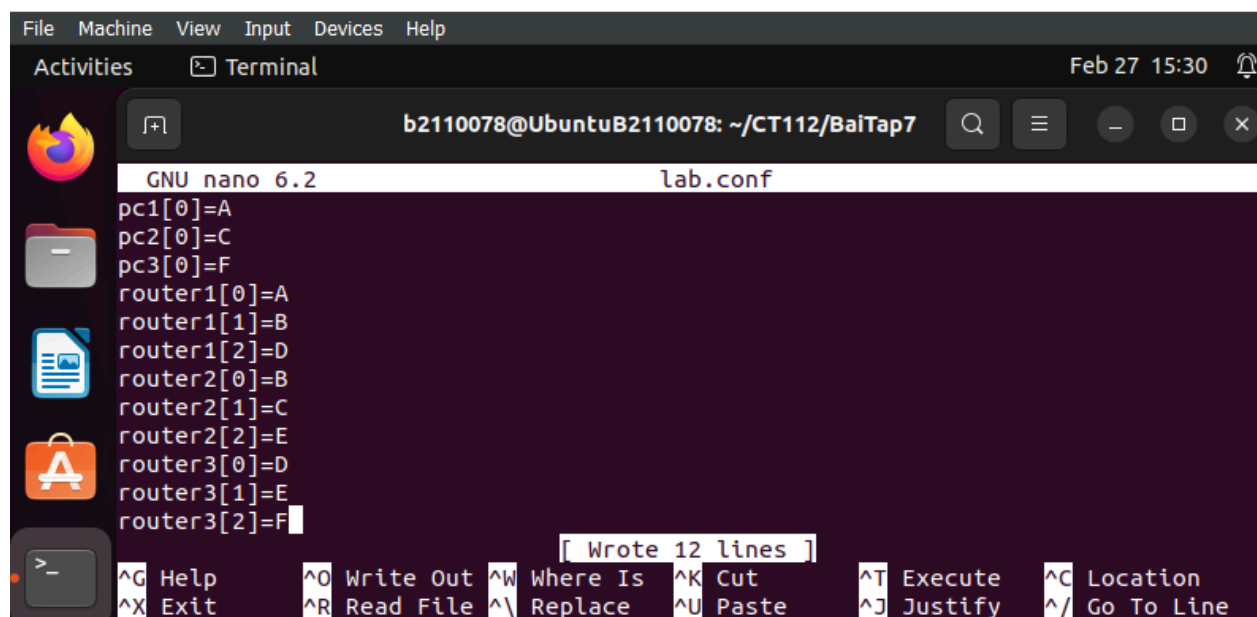
- pc1 không ping được 195.11.14.200 nhưng bảng ARP vẫn hiện 195.11.14.200 (không hoàn thiện)
- router1 không thay đổi

## Bài 7:



```
b2110078@UbuntuB2110078: ~/CT112/BaiTap7
b2110078@UbuntuB2110078:~/CT112/BaiTap7$ mkdir pc1 pc2 pc3
b2110078@UbuntuB2110078:~/CT112/BaiTap7$ mkdir router1 router2 router3
b2110078@UbuntuB2110078:~/CT112/BaiTap7$
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox

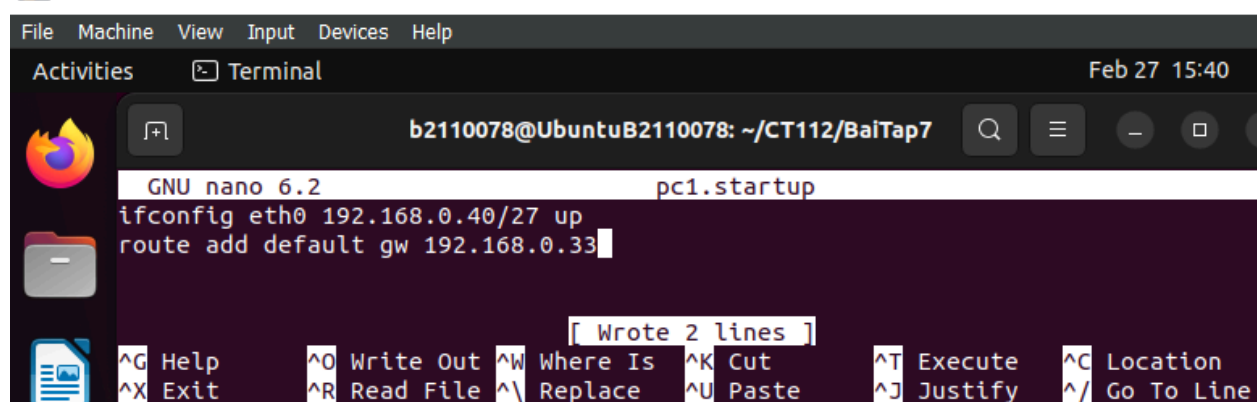


The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap7". The terminal is running the GNU nano 6.2 editor, editing a file named "lab.conf". The file contains the following configuration:

```
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 status bar at the bottom indicates "Wrote 12 lines". The terminal also shows a menu with various shortcuts: ^G Help, ^O Write Out, ^W Where Is, ^K Cut, ^T Execute, ^C Location, ^X Exit, ^R Read File, ^\_ Replace, ^U Paste, ^J Justify, and ^\_/ Go To Line.

UbuntuB2110078 [Running] - Oracle VM VirtualBox

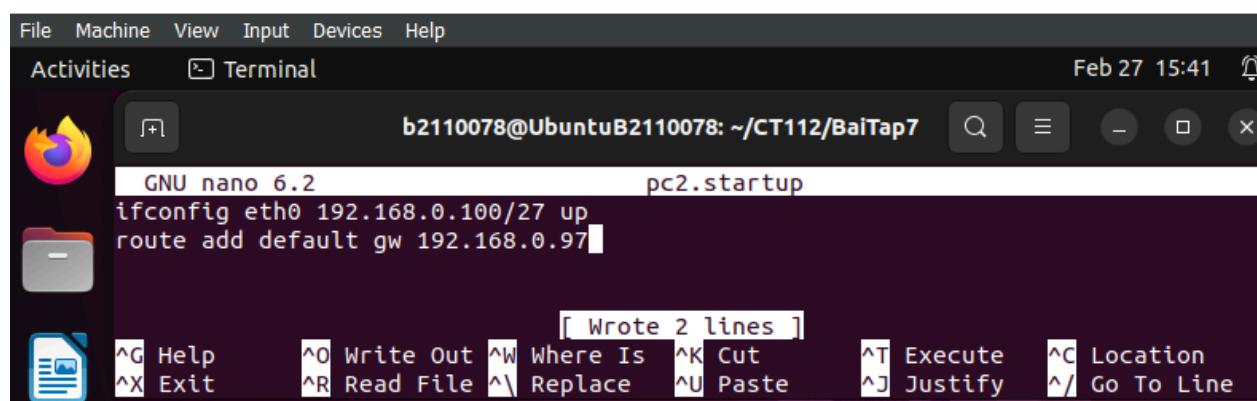


The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap7". The terminal is running the GNU nano 6.2 editor, editing a file named "pc1.startup". The file contains the following configuration:

```
ifconfig eth0 192.168.0.40/27 up
route add default gw 192.168.0.33
```

The status bar at the bottom indicates "Wrote 2 lines". The terminal also shows a menu with various shortcuts: ^G Help, ^O Write Out, ^W Where Is, ^K Cut, ^T Execute, ^C Location, ^X Exit, ^R Read File, ^\_ Replace, ^U Paste, ^J Justify, and ^\_/ Go To Line.

UbuntuB2110078 [Running] - Oracle VM VirtualBox



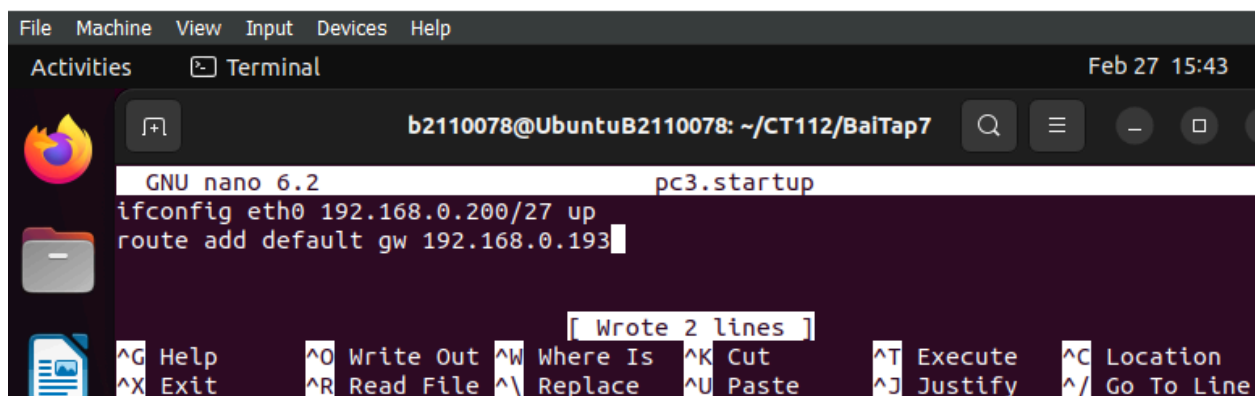
The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap7". The terminal is running the GNU nano 6.2 editor, editing a file named "pc2.startup". The file contains the following configuration:

```
ifconfig eth0 192.168.0.100/27 up
route add default gw 192.168.0.97
```

The status bar at the bottom indicates "Wrote 2 lines". The terminal also shows a menu with various shortcuts: ^G Help, ^O Write Out, ^W Where Is, ^K Cut, ^T Execute, ^C Location, ^X Exit, ^R Read File, ^\_ Replace, ^U Paste, ^J Justify, and ^\_/ Go To Line.



UbuntuB2110078 [Running] - Oracle VM VirtualBox

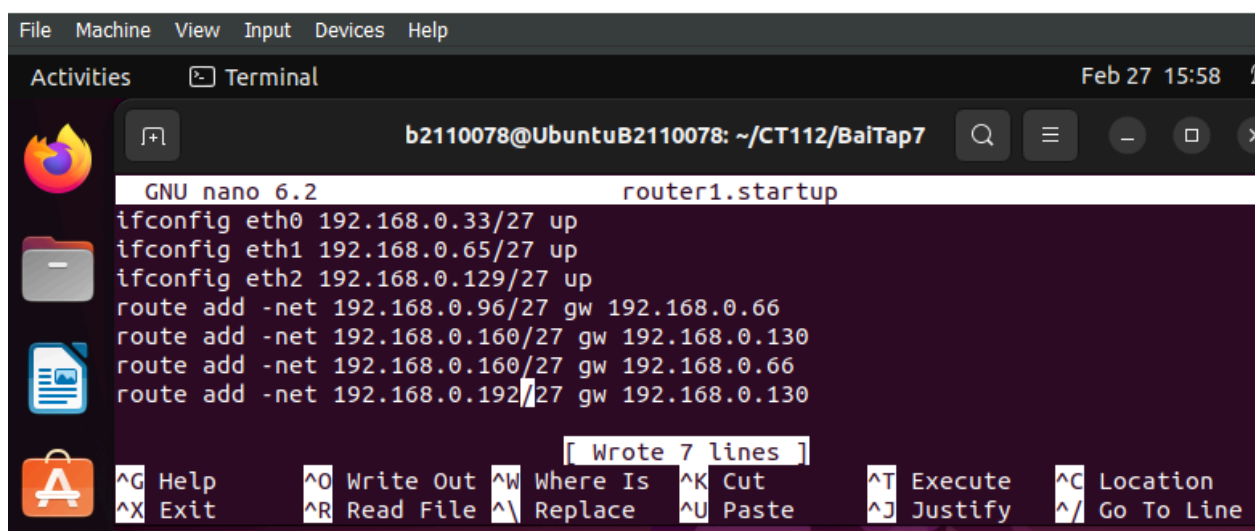


The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap7". The terminal is running GNU nano 6.2, editing a file named "pc3.startup". The content of the file is:

```
ifconfig eth0 192.168.0.200/27 up
route add default gw 192.168.0.193
```

The status bar at the bottom indicates "Wrote 2 lines".

UbuntuB2110078 [Running] - Oracle VM VirtualBox

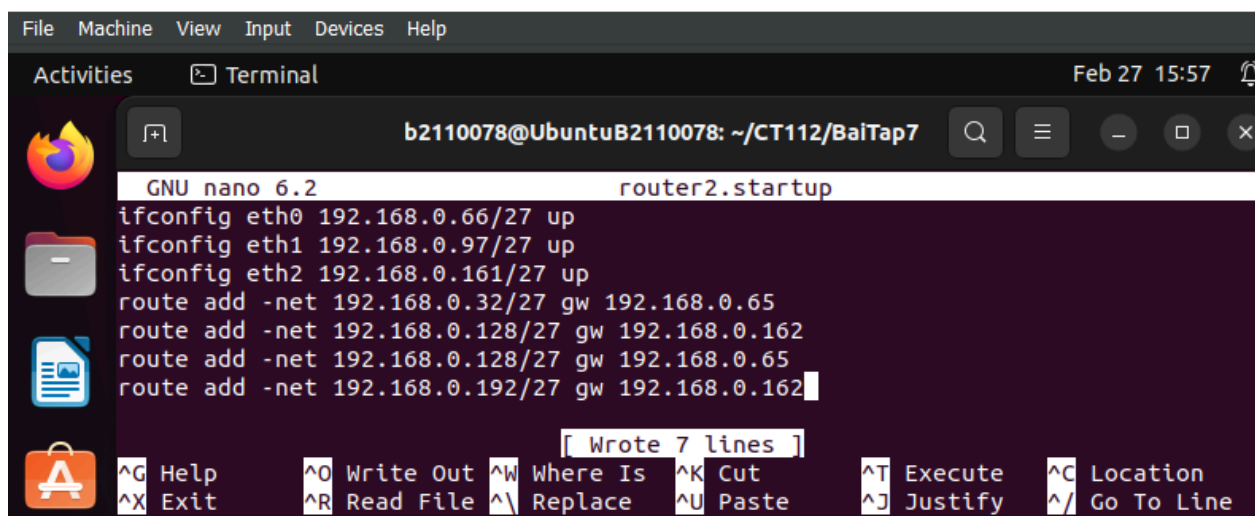


The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap7". The terminal is running GNU nano 6.2, editing a file named "router1.startup". The content of the file is:

```
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
```

The status bar at the bottom indicates "Wrote 7 lines".

UbuntuB2110078 [Running] - Oracle VM VirtualBox



The screenshot shows a terminal window titled "b2110078@UbuntuB2110078: ~/CT112/BaiTap7". The terminal is running GNU nano 6.2, editing a file named "router2.startup". The content of the file is:

```
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 192.168.0.128/27 gw 192.168.0.65
route add -net 192.168.0.192/27 gw 192.168.0.162
```

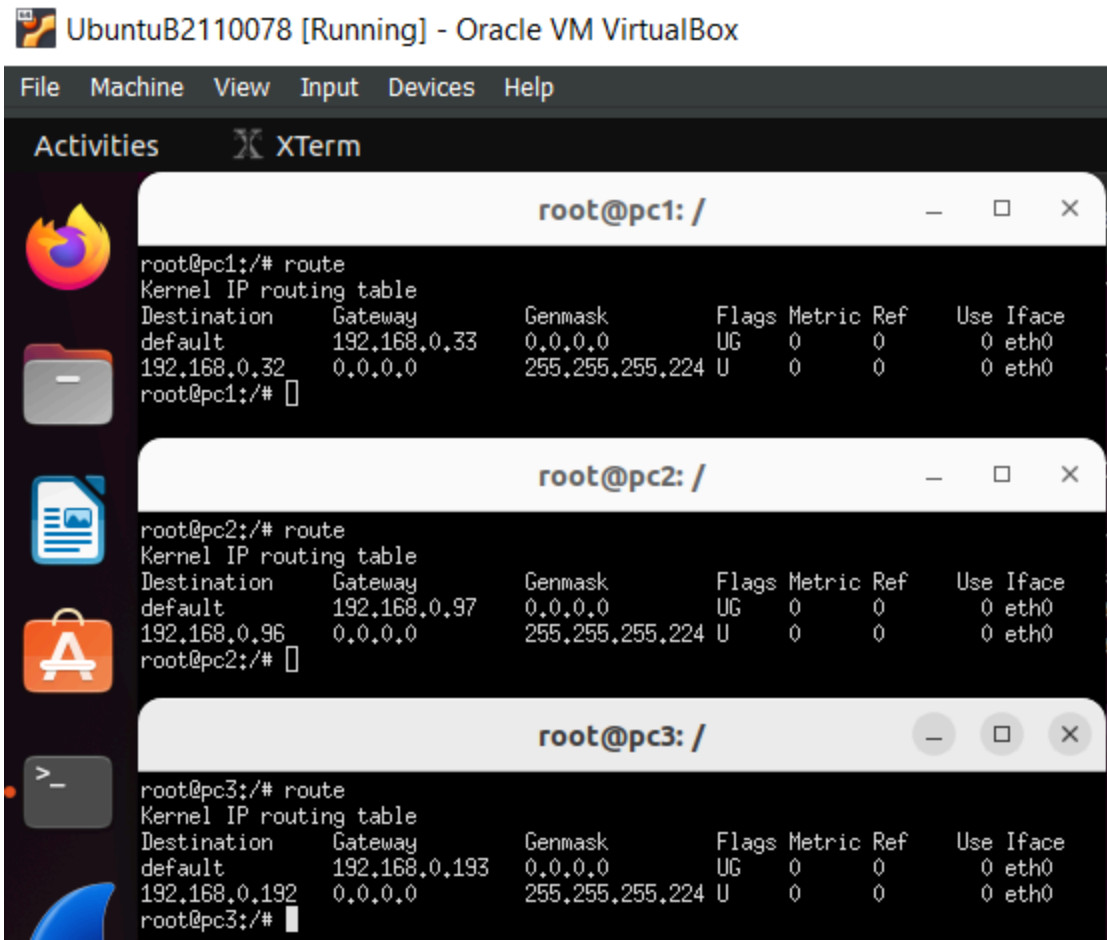
The status bar at the bottom indicates "Wrote 7 lines".

UbuntuB2110078 [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal Feb 27 16:00
b2110078@UbuntuB2110078: ~/CT112/BaiTap7
GNU nano 6.2 router3.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 192.168.0.64/27 gw 192.168.0.161
route add -net 192.168.0.96/27 gw 192.168.0.161
[Wrote 7 lines]
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line
```

UbuntuB2110078 [Running] - Oracle VM VirtualBox









```
File Machine View Input Devices Help
Activities XTerm Feb 27 16:50
b2110078@UbuntuB2110078: ~/CT112/BaiTap7
root@pc3: /
root@router1: /
root@pc1: /
root@pc2: /
root@router3: /
root@router2: /
--- Startup Commands Log
++ 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 192.168.0.128/27 gw 192.168.0.65
++ route add -net 192.168.0.192/27 gw 192.168.0.162
--- End Startup Commands Log
root@router2:/#
```



UbuntuB2110078 [Running] - Oracle VM VirtualBox

FileMachineViewInputDevicesHelp

ActivitiesXTerm



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
192.168.0.32	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	192.168.0.65	255.255.255.224	UG	0	0	0	eth0
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:/#

- Ping pc2 và pc3 bằng pc1:

UbuntuB2110078 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities XTerm

```
root@pc1: /
root@pc1:/# ping 192.168.0.100
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=1.24 ms
64 bytes from 192.168.0.100: icmp_seq=2 ttl=62 time=0.813 ms
64 bytes from 192.168.0.100: icmp_seq=3 ttl=62 time=1.47 ms
64 bytes from 192.168.0.100: icmp_seq=4 ttl=62 time=0.669 ms
64 bytes from 192.168.0.100: icmp_seq=5 ttl=62 time=0.607 ms
^C
--- 192.168.0.100 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4051ms
rtt min/avg/max/mdev = 0.607/0.959/1.470/0.337 ms
root@pc1:/# ping 192.168.0.200
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=1.78 ms
64 bytes from 192.168.0.200: icmp_seq=2 ttl=62 time=1.02 ms
64 bytes from 192.168.0.200: icmp_seq=3 ttl=62 time=0.783 ms
64 bytes from 192.168.0.200: icmp_seq=4 ttl=62 time=0.882 ms
^C
--- 192.168.0.200 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3092ms
rtt min/avg/max/mdev = 0.783/1.116/1.783/0.393 ms
root@pc1:/#
```