

Relatório TP2

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Parte I

Captura e análise de Tramas Ethernet

1. Endereço MAC da interface ativa do meu computador é 3c:6a:a7:07:88:a2

```
Trama 201: 000 bytes on wire (捕获数据), 000 bytes captured (捕获数据) on interface 00:00:00:00:00:00 (Ethernet II), Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
```

2. O endereço do destino da trama é 00:d0:03:ff:94:00

Dst: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)

Isto não corresponde ao endereço Ethernet do servidor HTTP para <http://www.portugalglobal.pt/PT/Paginas/Index.aspx>. A trama é destinada ao router da rede LAN que é o link usado para sair da *subnet*.

3. Valor hexadecimal do campo *Type*

```
▼ Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)  
> Destination: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)  
> Source: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)  
Type: IPv4 (0x0800)
```

O valor *Type* é 0x0800 e representa o endereço IPv4.

- 4.

```
▼ Hypertext Transfer Protocol  
  ▼ GET /PT/inovcontacto/Paginas/InovContacto.aspx HTTP/1.1\r\n  
    > [Expert Info (Chat/Sequence): GET /PT/inovcontacto/Paginas/InovContacto.aspx HTTP/1.1\r\n      Request Method: GET  
      Request URI: /PT/inovcontacto/Paginas/InovContacto.aspx  
      Request Version: HTTP/1.1
```

```
0000  00 d0 03 ff 94 00 3c 6a a7 07 88 a2 08 00 45 00  .....<j .....E-  
0010  02 52 f0 3e 40 00 80 06 e4 bf ac 1a 01 41 d5 3a  -R->@... ..A.:  
0020  a1 11 c4 5b 00 50 85 d8 e6 53 a3 cd 54 e2 50 18  ...[.P...S..T.P-  
0030  02 00 3b 21 00 00 47 45 54 20 2f 50 54 2f 69 6e  ..;!..GET /PT/in
```

Foram usados 54 bytes para o carácter ASCII “G” desde o início da trama. São encontrados 14 bytes que correspondem à trama da Ethernet, seguidos de 20 bytes do IP e mais 20 bytes do TCP que corresponde ao nível antes do HTTP ser encontrado.

a) $54/517 = 0.10$, ou seja, 10%

$$54 \div 517 = 0,10444874274661508704061895551257$$

b) Este overhead é justificado pelos mesmos fatores apontados na 4.

5. Endereço Ethernet na fonte

```
> Frame 28: 608 bytes on wire (4864 bits), 608 bytes captured (4864 bits) on interface \Device\NPF_{4
v Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
  > Destination: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
  v Source: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
    Address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
      ....0. .... = LG bit: Globally unique address (factory default)
      ....0. .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
  > Internet Protocol Version 4, Src: 172.26.1.65, Dst: 213.58.161.17
```

Endereço Ethernet na fonte não corresponde ao endereço Ethernet do site <http://www.portugalglobal.pt/PT/Paginas/Index.aspx> ou do endereço da minha máquina, mas sim ao endereço do router IntelCor, que é o *link* usado para aceder à minha subnet.

6. O endereço destino é 00:d0:03:ff:94:00 e corresponde à minha máquina.

```
v Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
  v Destination: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
    Address: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
      ....0. .... = LG bit: Globally unique address (factory default)
      ....0. .... = IG bit: Individual address (unicast)
  > Source: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
    Type: IPv4 (0x0800)
  > Internet Protocol Version 4, Src: 172.26.1.65, Dst: 213.58.161.17
```

7.

```
v Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
  > Destination: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
  > Source: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
    Type: IPv4 (0x0800)
  > Internet Protocol Version 4, Src: 172.26.1.65, Dst: 213.58.161.17
  > Transmission Control Protocol, Src Port: 50267, Dst Port: 80, Seq: 1, Ack: 1, Len: 554
  > Hypertext Transfer Protocol
```

O valor hexadecimal do campo *Type* é 0x0800 e este valor corresponde ao IP do protocolo que já foi mencionado na pergunta 3.

8. Resposta enviada pelo servidor foi HTTP/1.1 200 OK\r\n

132	0.712149	213.58.161.17	172.26.1.65	HTTP	173	HTTP/1.1 200 OK (text/html)
139	0.967294	172.26.1.65	213.58.161.17	HTTP	497	GET /Style%20Library/datePick
142	0.968790	172.26.1.65	213.58.161.17	HTTP	551	GET /_layouts/2070/styles/Htm
154	0.978880	172.26.1.65	213.58.161.17	HTTP	547	GET /_layouts/2070/styles/Htm
155	0.979165	172.26.1.65	213.58.161.17	HTTP	493	GET /Style%20Library/styles.c
156	0.979343	172.26.1.65	213.58.161.17	HTTP	496	GET /Style%20Library/styles_t
159	0.979691	172.26.1.65	213.58.161.17	HTTP	531	GET /_layouts/2070/styles/cor
160	0.980771	213.58.161.17	172.26.1.65	HTTP	1199	HTTP/1.1 200 OK (text/css)
161	0.983237	172.26.1.65	213.58.161.17	HTTP	487	GET /Style%20Library/jquery-1
167	0.985546	213.58.161.17	172.26.1.65	HTTP	1150	HTTP/1.1 200 OK (text/css)
169	0.987071	172.26.1.65	213.58.161.17	HTTP	489	GET /Style%20Library/jquery.t
171	0.993101	213.58.161.17	172.26.1.65	HTTP	580	HTTP/1.1 200 OK (text/css)
179	0.996125	172.26.1.65	213.58.161.17	HTTP	495	GET /Style%20Library/jquery.t
206	1.005354	213.58.161.17	172.26.1.65	HTTP	920	HTTP/1.1 200 OK (applicator
213	1.005882	213.58.161.17	172.26.1.65	HTTP	1065	HTTP/1.1 200 OK (text/css)

Type: IPv4 (0x0800)

- > Internet Protocol Version 4, Src: 213.58.161.17, Dst: 172.26.1.65
- > Transmission Control Protocol, Src Port: 80, Dst Port: 50267, Seq: 90001, Ack: 555, Len: 119
- > [73 Reassembled TCP Segments (90119 bytes): #31(1250), #32(1250), #34(1250), #35(1250), #37(1250)]
- > Hypertext Transfer Protocol
 - > HTTP/1.1 200 OK\r\n
 - > [Expert Info (Chat/Sequence): HTTP/1.1 200 OK\r\n]
 - Response Version: HTTP/1.1

```

00000000 48 54 54 50 2f 31 2e 31 20 32 30 30 20 4f 4b 0d HTTP/1.1 200 OK.
00000010 0a 43 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 -Cache-Control:
  
```

Protocolo ARP

9. A coluna do endereço *Ethernet* contém o endereço IP, a coluna do endereço MAC contém o endereço físico e a coluna do endereço *type* indica o protocolo tipo, que neste caso é dinâmico.

```

C:\Users\ivomi>arp -a

Interface: 172.26.1.65 --- 0x9
Internet Address      Physical Address      Type
172.26.254.254       00-d0-03-ff-94-00    dynamic
172.26.255.255       ff-ff-ff-ff-ff-ff    static
224.0.0.22           01-00-5e-00-00-16    static
224.0.0.251         01-00-5e-00-00-fb    static
239.255.255.250     01-00-5e-7f-ff-fa    static
255.255.255.255     ff-ff-ff-ff-ff-ff    static

Interface: 192.168.56.1 --- 0x17
Internet Address      Physical Address      Type
192.168.56.255       ff-ff-ff-ff-ff-ff    static
224.0.0.22           01-00-5e-00-00-16    static
224.0.0.251         01-00-5e-00-00-fb    static
224.0.0.252         01-00-5e-00-00-fc    static
239.255.255.250     01-00-5e-7f-ff-fa    static
  
```

10. O valor hexadecimal do endereço da fonte é 3c:6a:a7:07:88:a2. O valor hexadecimal do endereço do destino é ff:ff:ff:ff:ff:ff. Isto pois a comunicação da minha máquina com o router que providencia a rede eduoam que a mensagem de ARP Request já estava guardada em cache.

```

144 98.272... IntelCor_07:88:a2 ComdaEnt_ff: ARP 42 Who has 172.26.254.254? Tell 172.26.1.65
145 98.275... ComdaEnt_ff:94:00 IntelCor_07: ARP 60 172.26.254.254 is at 00:00:03:ff:94:00
20_ 906.27... IntelCor_07:88:a2 Broadcast ARP 42 Who has 172.26.1.65? (ARP Probe)
20_ 906.92... IntelCor_07:88:a2 Broadcast ARP 42 Who has 172.26.254.254? Tell 172.26.1.65
20_ 906.92... ComdaEnt_ff:94:00 IntelCor_07: ARP 60 172.26.254.254 is at 00:00:03:ff:94:00
20_ 907.27... IntelCor_07:88:a2 Broadcast ARP 42 Who has 172.26.1.65? (ARP Probe)
20_ 908.27... IntelCor_07:88:a2 Broadcast ARP 42 Who has 172.26.1.65? (ARP Probe)
20_ 909.27... IntelCor_07:88:a2 Broadcast ARP 42 ARP Announcement for 172.26.1.65
35_ 2774.6... IntelCor_07:88:a2 Broadcast ARP 42 Who has 172.26.254.254? Tell 172.26.1.65
35_ 2774.6... ComdaEnt_ff:94:00 IntelCor_07: ARP 60 172.26.254.254 is at 00:00:03:ff:94:00
> Frame 20115: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{462EEEDE-6083-4B18-A701-8B6D4719F7B4}, id 0
> Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
    Sender IP address: 172.26.1.65
    Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
    Target IP address: 172.26.254.254
  
```

```

0000 ff ff ff ff ff ff 3c 6a a7 07 88 a2 08 06 00 01 .....<j .....
0010 08 00 06 04 00 01 3c 6a a7 07 88 a2 ac 1a 01 41 .....<j .....A
0020 00 00 00 00 00 00 ac 1a fe fe .....
  
```

▼ Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

11. O valor hexadecimal do *Type* da trama *Ethernet* corresponde a 0x0806, indicando um *ARP Request*.

```

> Frame 20115: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{462EEEDE-6083-4B18-A701-8B6D4719F7B4}, id 0
> Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  Destination: Broadcast (ff:ff:ff:ff:ff:ff)
    Address: Broadcast (ff:ff:ff:ff:ff:ff)
      ....01 ..... = LG bit: Locally administered address (this is NOT the factory default)
      ....01 ..... = IG bit: Group address (multicast/broadcast)
  Source: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
    Address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
      ....00 ..... = LG bit: Globally unique address (factory default)
      ....00 ..... = IG bit: Individual address (unicast)
  Type: ARP (0x0806)
  Address Resolution Protocol (request)
  
```

```

0000 ff ff ff ff ff ff 3c 6a a7 07 88 a2 08 06 00 01 .....<j .....
0010 08 00 06 04 00 01 3c 6a a7 07 88 a2 ac 1a 01 41 .....<j .....A
0020 00 00 00 00 00 00 ac 1a fe fe .....
  
```

Type: ARP (0x0806)

12. O campo *ARP opcode* conta 20 bits desde o início da trama da *Ethernet*, tendo o valor igual a 1 o que significa que a minha máquina está a tentar fazer um *ARP Request*.

```

v Address Resolution Protocol (request)
  Hardware type: Ethernet (1)
  Protocol type: IPv4 (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: request (1)
  Sender MAC address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
  Sender IP address: 172.26.1.65
  Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
-----
0000  ff ff ff ff ff ff 3c 6a a7 07 88 a2 08 06 00 01  ....<j .....
0010  08 00 06 04 00 01 3c 6a a7 07 88 a2 ac 1a 01 41  ....<j .....A
0020  00 00 00 00 00 00 ac 1a fe fe  .... ..

```

13. Sim, contém o endereço de origem e a pergunta é um pedido de endereço MAC onde a resposta para o ARP address contendo o endereço Ethernet 3c:6a:a7:07:88:a2 para o remetente com o endereço de IP 172.26.1.65

```

v Source: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
  Address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
  .... 0. .... = LG bit: Globally unique address (factory default)
  .... 0 .... = IG bit: Individual address (unicast)
Type: ARP (0x0806)

```

Sender MAC address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
 Sender IP address: 172.26.1.65
 Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
 Target IP address: 172.26.254.254

14.

No.	Time	Source	Destination	Protocol	Length	Info
144	98.272...	IntelCor_07:88:a2	ComdaEnt_ff:...	ARP	42	Who has 172.26.254.254? Tell 172.26.1.65
145	98.275...	ComdaEnt_ff:94:00	IntelCor_07:...	ARP	60	172.26.254.254 is at 00:d0:03:ff:94:00
20...	906.27...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.1.65? (ARP Probe)
20...	906.92...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.254.254? Tell 172.26.1.65
20...	906.92...	ComdaEnt_ff:94:00	IntelCor_07:...	ARP	60	172.26.254.254 is at 00:d0:03:ff:94:00
20...	907.27...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.1.65? (ARP Probe)
20...	908.27...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.1.65? (ARP Probe)
20...	909.27...	IntelCor_07:88:a2	Broadcast	ARP	42	ARP Announcement for 172.26.1.65
35...	2774.6...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.254.254? Tell 172.26.1.65

```

Address: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
  .... 0. .... = LG bit: Globally unique address (factory default)
  .... 0 .... = IG bit: Individual address (unicast)
Type: ARP (0x0806)
Padding: 0000000000000000000000000000000000000000000000000000000000000000
v Address Resolution Protocol (reply)
  Hardware type: Ethernet (1)
  Protocol type: IPv4 (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: reply (2)
  Sender MAC address: ComdaEnt_ff:94:00 (00:d0:03:ff:94:00)
  Sender IP address: 172.26.254.254
  Target MAC address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
  Target IP address: 172.26.1.65
-----
0000  3c 6a a7 07 88 a2 00 d0 03 ff 94 00 08 06 00 01  <j.....
0010  08 00 06 04 00 02 00 d0 03 ff 94 00 ac 1a fe fe  ....<j .....
0020  3c 6a a7 07 88 a2 ac 1a 01 41 00 00 00 00 00 00  <j.....A
0030  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....

```


16.

```
Terminal - core@XubunCORE: -
File Edit View Terminal Go Help
inet6 addr: fe80::500a:7cff:fee9:e805/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:12 errors:0 dropped:0 overruns:0 frame:0
TX packets:52 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1064 (1.0 KB) TX bytes:9778 (9.7 KB)

n2.eth1.212 Link encap:Ethernet Hwaddr a6:70:80:b8:80:b5
inet6 addr: fe80::a470:80ff:feb8:80b5/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:12 errors:0 dropped:0 overruns:0 frame:0
TX packets:53 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1064 (1.0 KB) TX bytes:9888 (9.8 KB)

n3.eth0.212 Link encap:Ethernet Hwaddr 7e:d3:3e:78:e4:16
inet6 addr: fe80::7cd3:3eff:fe78:e416/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:12 errors:0 dropped:0 overruns:0 frame:0
TX packets:51 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1068 (1.0 KB) TX bytes:9696 (9.6 KB)

core@XubunCORE:~$
```

```
Terminal - core@XubunCORE: -
File Edit View Terminal Go Help
RX bytes:160261 (160.2 KB) TX bytes:98135 (98.1 KB)

lo
Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING MTU:65536
Metric:1
RX bytes:0 overruns:0 frame:0
TX bytes:0 overruns:0 carrier:0

Terminal - core@XubunCORE: -
File Edit View Terminal Go Help
inet6 addr: fe80::500a:7cff:fee9:e805/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:12 errors:0 dropped:0 overruns:0 frame:0
TX packets:52 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1064 (1.0 KB) TX bytes:9778 (9.7 KB)

n2.eth1.212 Link encap:Ethernet Hwaddr a6:70:80:b8:80:b5
inet6 addr: fe80::a470:80ff:feb8:80b5/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:12 errors:0 dropped:0 overruns:0 frame:0
TX packets:53 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1064 (1.0 KB) TX bytes:9888 (9.8 KB)

n3.eth0.212 Link encap:Ethernet Hwaddr 7e:d3:3e:78:e4:16
inet6 addr: fe80::7cd3:3eff:fe78:e416/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:12 errors:0 dropped:0 overruns:0 frame:0
TX packets:51 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1068 (1.0 KB) TX bytes:9696 (9.6 KB)

core@XubunCORE:~$
```

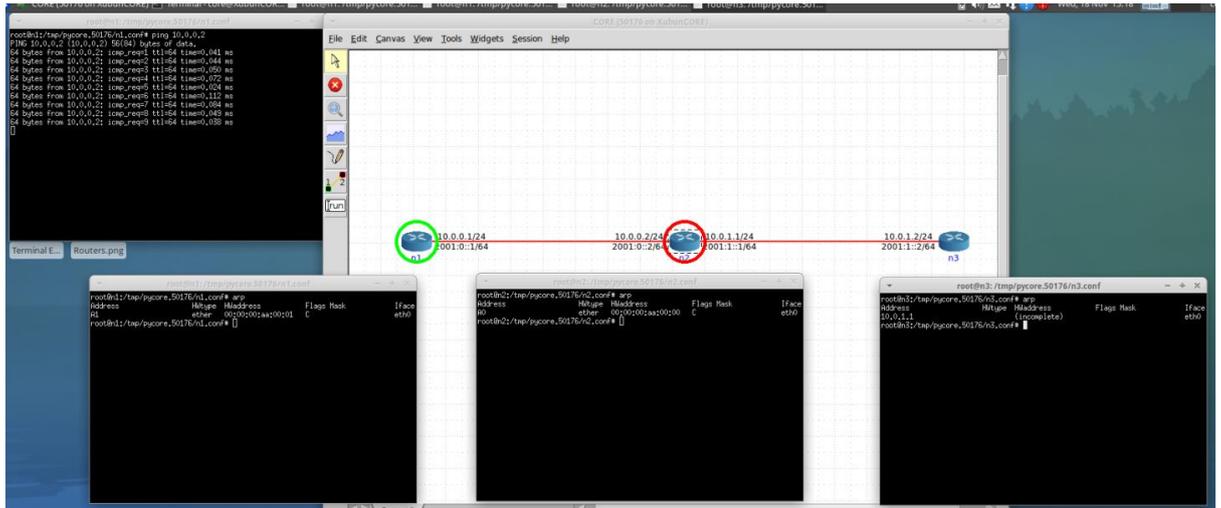
17.

```
root@n1: /tmp/pycore.50171/n1.conf
root@n1:/tmp/pycore.50171/n1.conf# arp
Address          Hwtype Hwaddress      Flags Mask      Iface
A1               ether  00:00:00:aa:00:01 C                eth0
root@n1:/tmp/pycore.50171/n1.conf#
```

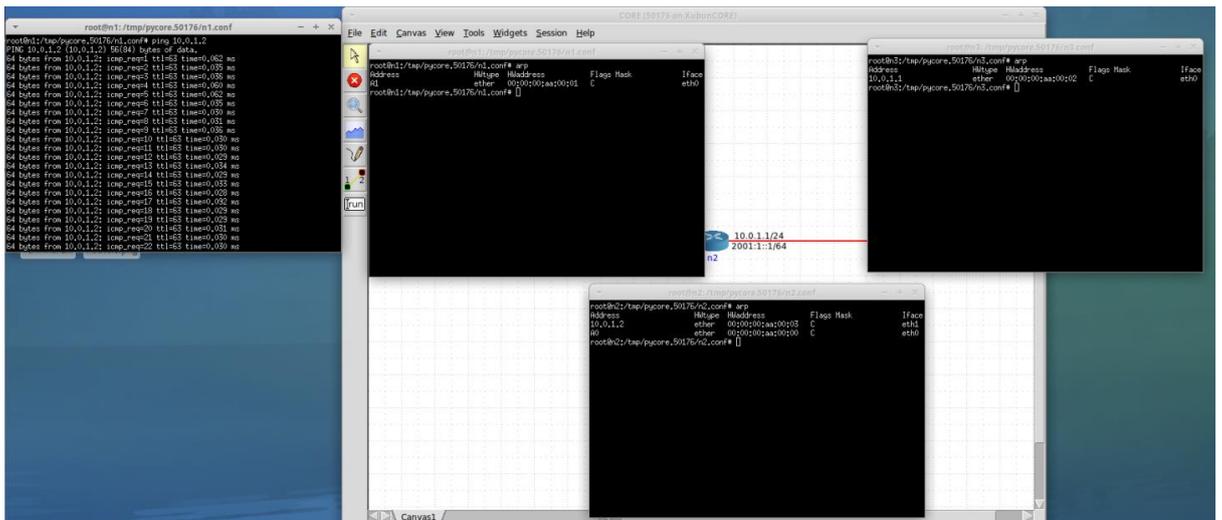
```
root@n2: /tmp/pycore.50171/n2.conf
root@n2:/tmp/pycore.50171/n2.conf# arp
Address          Hwtype Hwaddress      Flags Mask      Iface
10.0.1.2         ether  00:00:00:aa:00:03 C                eth1
A0               ether  00:00:00:aa:00:00 C                eth0
root@n2:/tmp/pycore.50171/n2.conf#
```

```
root@n3: /tmp/pycore.50171/n3.conf
root@n3:/tmp/pycore.50171/n3.conf# arp
Address          Hwtype Hwaddress      Flags Mask      Iface
10.0.1.1         ether  00:00:00:aa:00:02 C                eth0
root@n3:/tmp/pycore.50171/n3.conf#
```

18.



Após dar *ping* entre o router n1 e n2 verificamos que o router n1 guarda na sua cache o endereço do router n2, e como o router n3 não foi chamado, não possui nada na sua cache.

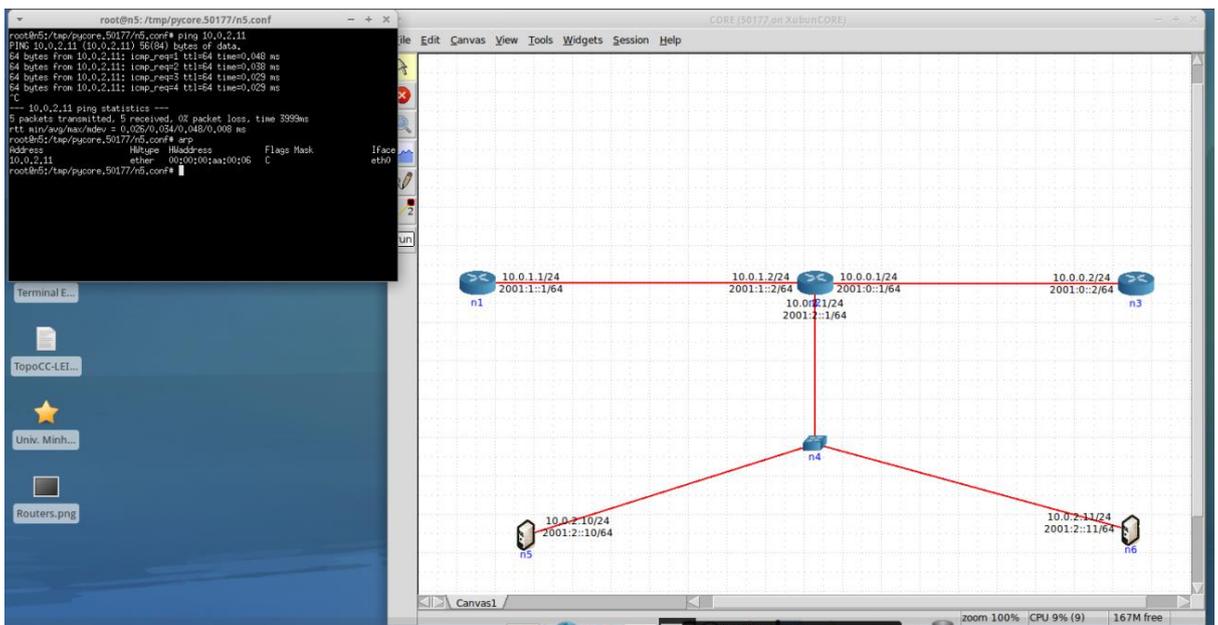


Por contrapartida no segundo *ping* de n1 para n3, o n1 continua com o endereço de n2, este (n2) contém o endereço do router n1 e n3, e este último (n3) fica com endereço do router n2.

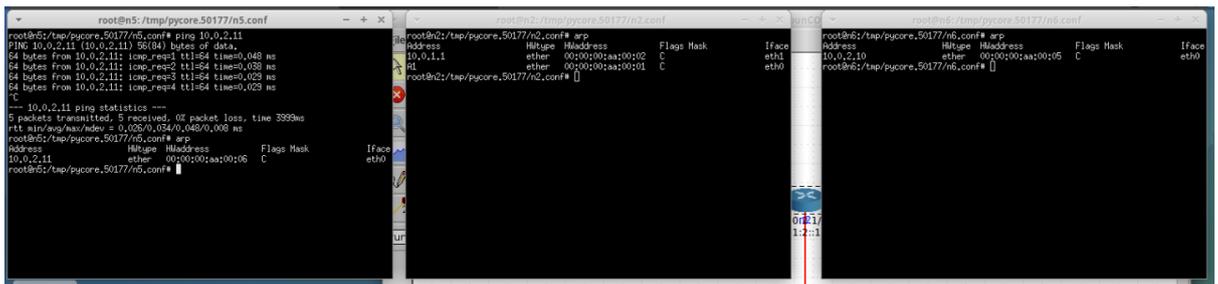
19. Ao remover-mos a ligação entre n1 e n2 e ao tentarmos fazer *ping* verificamos que não obtemos resposta, uma vez que o endereço destino é inexistente.

```
root@n1:/tmp/pycore.43195/n1.conf# arp -s 10.0.1.2 00:00:00:aa:00:12
root@n1:/tmp/pycore.43195/n1.conf# arp
Address          Hwtype Hwaddress      Flags Mask      Iface
10.0.1.2         ether  00:00:00:aa:00:12  CM              eth0
root@n1:/tmp/pycore.43195/n1.conf# ping 10.0.1.2
PING 10.0.1.2 (10.0.1.2) 56(84) bytes of data.
^C
--- 10.0.1.2 ping statistics ---
10 packets transmitted, 0 received, 100% packet loss, time 9063ms
root@n1:/tmp/pycore.43195/n1.conf#
```

20. A nossa hipótese é que na tabela ARP de n5 apenas será adicionado o IP de n6, uma vez que ambos os *host* estão ligados ao mesmo *switch*, não há necessidade de comunicar com o mesmo router n2.



Como podemos ver pela *screenshot* em baixo, concluímos que a nossa hipótese estava correta e que apenas foram adicionados os endereços de n6 a n5 e n5 a n6, continuando n2 apenas a conter os endereços de n1 e n3.



Parte II

1.

No.	Time	Source	Destination	Protocol	Length	Info
21	16.231...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.254.254? Tell 172.26.1.65
22	16.236...	ComdaEnt_ff:94:00	IntelCor_07:...	ARP	60	172.26.254.254 is at 00:d0:03:ff:94:00
34	16.330...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.1.65? (ARP Probe)
39	16.466...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.254.254? Tell 172.26.1.65
40	16.471...	ComdaEnt_ff:94:00	IntelCor_07:...	ARP	60	172.26.254.254 is at 00:d0:03:ff:94:00
43	16.549...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.254.254? Tell 172.26.1.65
44	16.553...	ComdaEnt_ff:94:00	IntelCor_07:...	ARP	60	172.26.254.254 is at 00:d0:03:ff:94:00
61	17.331...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.1.65? (ARP Probe)
119	18.333...	IntelCor_07:88:a2	Broadcast	ARP	42	Who has 172.26.1.65? (ARP Probe)
358	19.334...	IntelCor_07:88:a2	Broadcast	ARP	42	ARP Announcement for 172.26.1.65

<

> Frame 358: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{462EEED-6D83-4B18-A701-8B6D4719F7B4}, id 0
> Ethernet II, Src: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
v Address Resolution Protocol (ARP Announcement)
 Hardware type: Ethernet (1)
 Protocol type: IPv4 (0x0800)
 Hardware size: 6
 Protocol size: 4
 Opcode: request (1)
 [Is gratuitous: True]
 [Is announcement: True]
 Sender MAC address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)
 Sender IP address: 172.26.1.65
 Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
 Target IP address: 172.26.1.65

0000	ff ff ff ff ff ff 3c 6a a7 07 88 a2 08 06 00 01<j
0010	08 00 06 04 00 01 3c 6a a7 07 88 a2 ac 1a 01 41<jA
0020	00 00 00 00 00 00 ac 1a 01 41- -A

2. Neste caso, o IP do Sender coincide com o IP do Target. Ou seja, é enviado um pedido de ARP gratuito cuja função é descobrir o endereço MAC do IP da nossa máquina nativa, de forma a verificar que o endereço IP que nos foi atribuído é único.

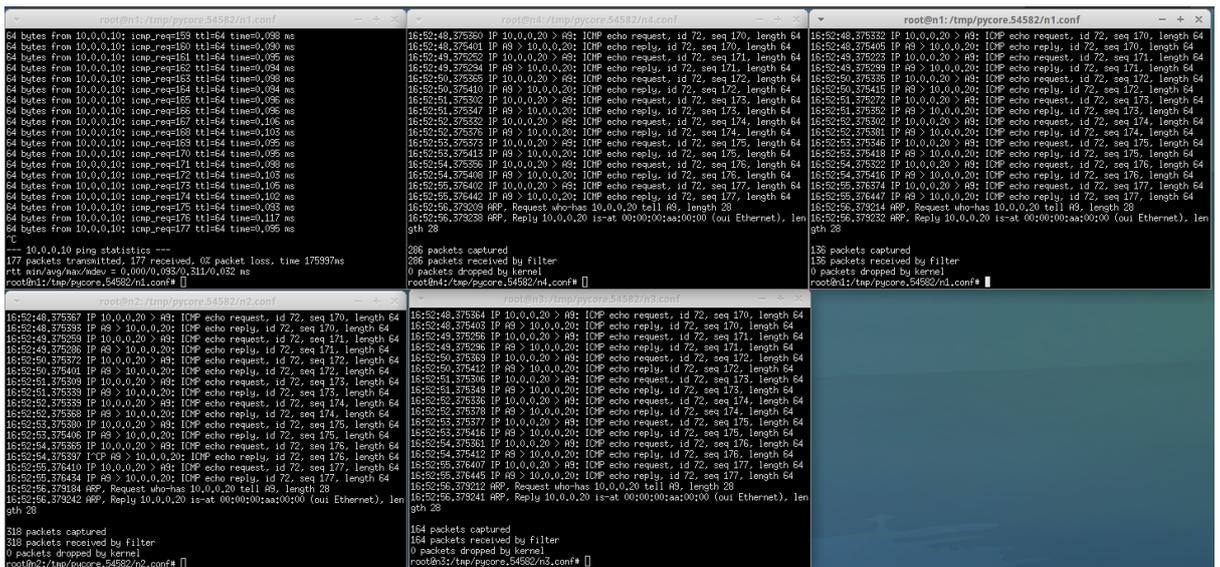
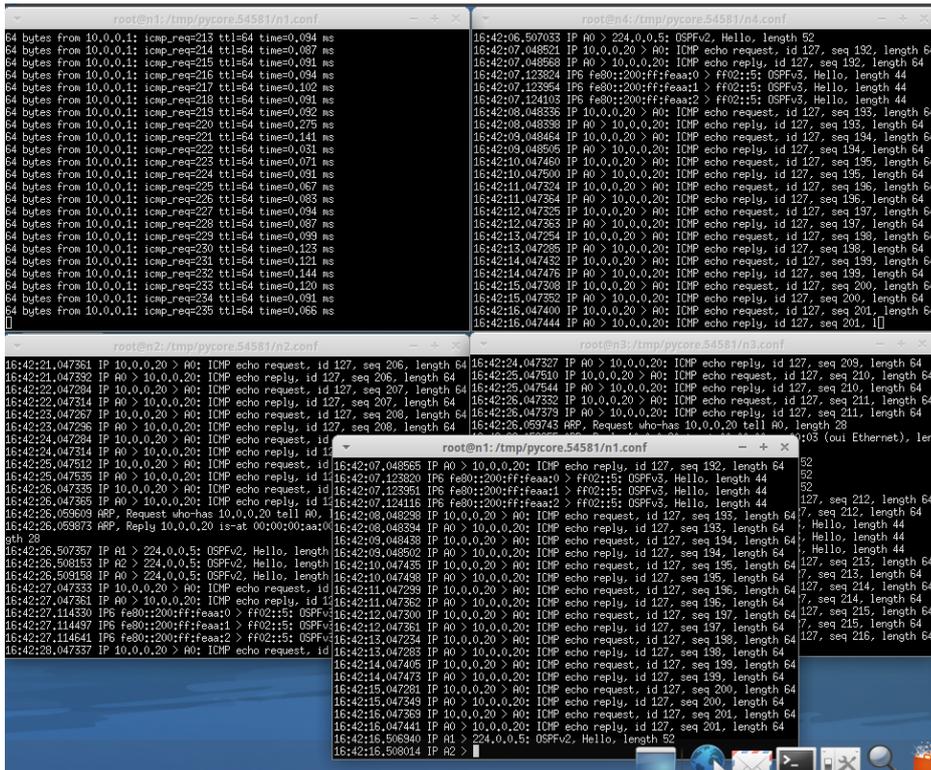
Sender MAC address: IntelCor_07:88:a2 (3c:6a:a7:07:88:a2)

Sender IP address: 172.26.1.65

Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)

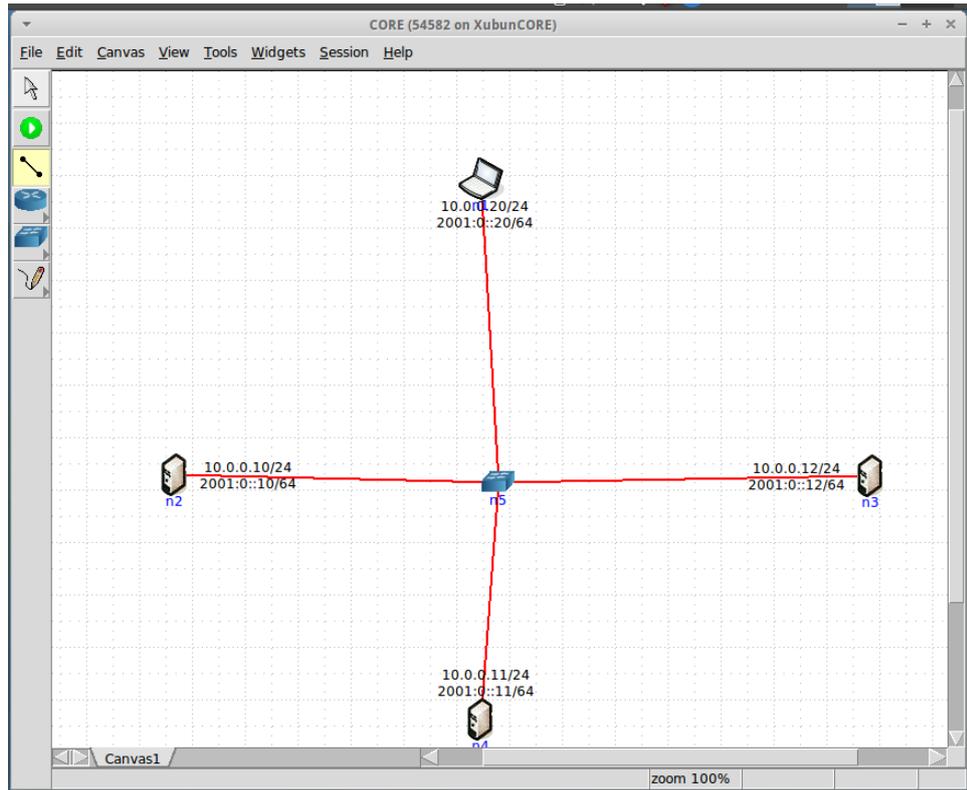
Target IP address: 172.26.1.65

3. 1.



Através das *screenshots* podemos observar que através do *ping* do n1 para n2 verificamos que existe tráfego entre todos os dispositivos à exceção do n5, sendo que este *hub*, como não é do nível 2, não fará endereçamento MAC fazendo apenas *Broadcast*.

2.



```
root@n1:/tmp/pycore.54582/n1.conf#
64 bytes from 10.0.0.10: icmp_req=109 ttl=64 time=0.077 ns
64 bytes from 10.0.0.10: icmp_req=110 ttl=64 time=0.078 ns
64 bytes from 10.0.0.10: icmp_req=111 ttl=64 time=0.076 ns
64 bytes from 10.0.0.10: icmp_req=112 ttl=64 time=0.078 ns
64 bytes from 10.0.0.10: icmp_req=113 ttl=64 time=0.075 ns
64 bytes from 10.0.0.10: icmp_req=114 ttl=64 time=0.073 ns
64 bytes from 10.0.0.10: icmp_req=115 ttl=64 time=0.090 ns
64 bytes from 10.0.0.10: icmp_req=116 ttl=64 time=0.122 ns
64 bytes from 10.0.0.10: icmp_req=117 ttl=64 time=0.078 ns
64 bytes from 10.0.0.10: icmp_req=118 ttl=64 time=0.078 ns
64 bytes from 10.0.0.10: icmp_req=119 ttl=64 time=0.078 ns
64 bytes from 10.0.0.10: icmp_req=120 ttl=64 time=0.082 ns
64 bytes from 10.0.0.10: icmp_req=121 ttl=64 time=0.351 ns
64 bytes from 10.0.0.10: icmp_req=122 ttl=64 time=0.096 ns
64 bytes from 10.0.0.10: icmp_req=123 ttl=64 time=0.076 ns
64 bytes from 10.0.0.10: icmp_req=124 ttl=64 time=0.075 ns
64 bytes from 10.0.0.10: icmp_req=125 ttl=64 time=0.078 ns
64 bytes from 10.0.0.10: icmp_req=126 ttl=64 time=0.073 ns
64 bytes from 10.0.0.10: icmp_req=127 ttl=64 time=0.077 ns
^C
- - - 10.0.0.10 ping statistics - - -
122 packets transmitted, 122 received, 0% packet loss, time 126396ms
rtt min/avg/max/ndev = 0.000/0.077/0.351/0.041 ms
root@n1:/tmp/pycore.54582/n1.conf#

root@n2:/tmp/pycore.54582/n2.conf#
17:01:44.895332 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 119, length 64
17:01:45.895341 IP n5 > 10.0.0.20 > n8: ICMP echo request, id 72, seq 120, length 64
17:01:46.895351 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 120, length 64
17:01:46.895361 IP n5 > 10.0.0.20 > n8: ICMP echo request, id 72, seq 121, length 64
17:01:47.895371 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 121, length 64
17:01:47.895381 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 122, length 64
17:01:48.895391 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 122, length 64
17:01:48.895401 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 123, length 64
17:01:49.895411 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 123, length 64
17:01:49.895421 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 124, length 64
17:01:50.895431 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 124, length 64
17:01:50.895441 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 125, length 64
17:01:51.895451 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 125, length 64
17:01:51.895461 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 126, length 64
17:01:52.895471 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 126, length 64
17:01:52.895481 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 127, length 64
17:01:53.895491 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 127, length 64
17:01:53.895501 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 128, length 64
17:01:53.895511 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 128, length 64
^C
88 packets captured
88 packets received by filter
0 packets dropped by kernel
root@n1:/tmp/pycore.54582/n1.conf#

root@n3:/tmp/pycore.54582/n3.conf#
17:01:45.895331 IP n5 > 10.0.0.20 > n8: ICMP echo request, id 72, seq 120, length 64
17:01:46.895341 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 120, length 64
17:01:46.895351 IP n5 > 10.0.0.20 > n8: ICMP echo request, id 72, seq 121, length 64
17:01:47.895361 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 121, length 64
17:01:47.895371 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 122, length 64
17:01:48.895381 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 122, length 64
17:01:48.895391 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 123, length 64
17:01:49.895401 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 123, length 64
17:01:49.895411 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 124, length 64
17:01:50.895421 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 124, length 64
17:01:50.895431 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 125, length 64
17:01:51.895441 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 125, length 64
17:01:51.895451 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 126, length 64
17:01:52.895461 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 126, length 64
17:01:52.895471 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 127, length 64
17:01:53.895481 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 127, length 64
17:01:53.895491 IP n5 > 10.0.0.20: ICMP echo request, id 72, seq 128, length 64
17:01:53.895501 IP n5 > 10.0.0.20: ICMP echo reply, id 72, seq 128, length 64
^C
206 packets captured
206 packets received by filter
0 packets dropped by kernel
root@n2:/tmp/pycore.54582/n2.conf#

root@n4:/tmp/pycore.54582/n4.conf# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 65535 bytes
-vv
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
root@n4:/tmp/pycore.54582/n4.conf#
```

Com o ping de n1 e n2 os únicos que apresentam tráfego são o n1 e n2 respetivamente, como o n4 e o n3 não apresentam nada, devido ao facto de existir uma switch que também de nível 2 que faz o endereçamento do MAC. Assim qualquer pedido é enviado diretamente para o endereço estipulado, uma vez que o switch elimina colisões e conecta cada a uma porta do computador.

Conclusão

Este relatório teve como foco o estudo da ligação lógica, em destaque a *Ethernet* e o protocolo ARP. Precedendo a este trabalho, o nosso conhecimento sobre esta matéria era inexistente. Com o auxílio do *Wireshark* e do Core, estudámos os diferentes tipos de protocolo ARP, incluindo o *ARP Request* (pedido ARP) e o ARP gratuito. Ainda alcançamos uma maior compreensão das origens e destinos dos endereços *Ethernet* e das suas respectivas mensagens e funções. Dito isto, de forma sucinta, posteriormente ao estudo destes tópicos, adquirimos capacidade de interpretar e analisar este tema, proporcionando uma aprendizagem interativa e abrangente ao nosso grupo.