

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

```
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...}
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)
    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.

```
> 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)
    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.

```
> 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: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

> Frame 20115: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{462EEDE-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)
  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_{462EEDE-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)
    Destination: Broadcast (ff:ff:ff:ff:ff:ff)
      Address: Broadcast (ff:ff:ff:ff:ff:ff)
        ....1. .... = LG bit: Locally administered address (this is NOT the factory default)
        ....1. .... = 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)
        ....0. .... = LG bit: Globally unique address (factory default)
        ....0. .... = 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*.

```

  ▾ 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  ..... ..

```

```

▼ 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)

```

14.

- ```

 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
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
```

- [illegible]



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 errors:0 dropped:0 overruns:0 frame:0
TX bytes:0 errors:0 dropped: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.

```

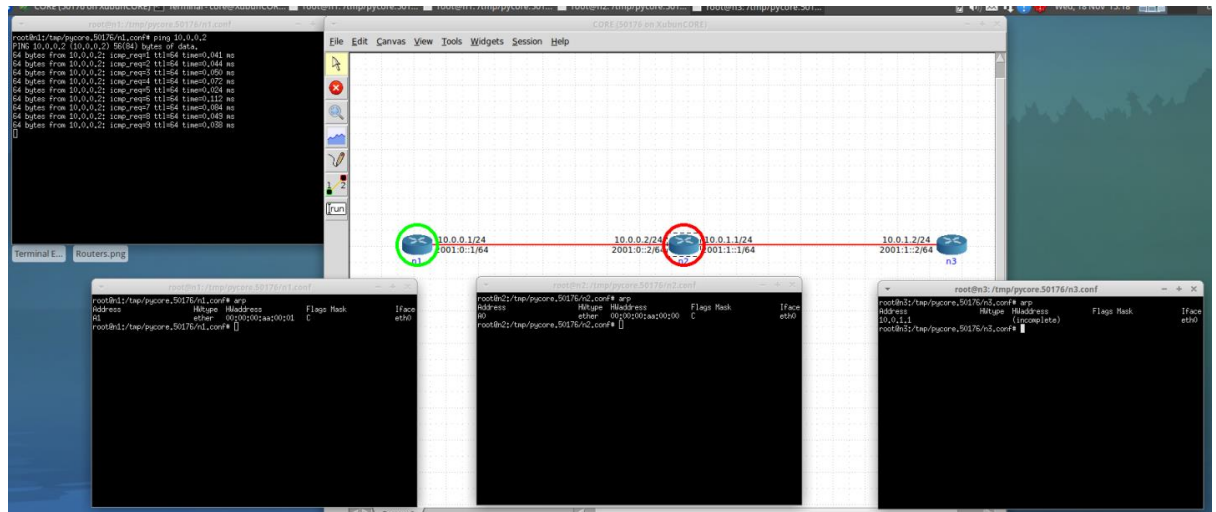
root@n1:/tmp/pycore.50171/n1.conf# arp
Address Hwtype Hwaddress Flags Mask Iface
A1 ether 00:00:00:aa:00:01 C eth0
root@n1:/tmp/pycore.50171/n1.conf#

root@n2:/tmp/pycore.50171/n2.conf# 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#

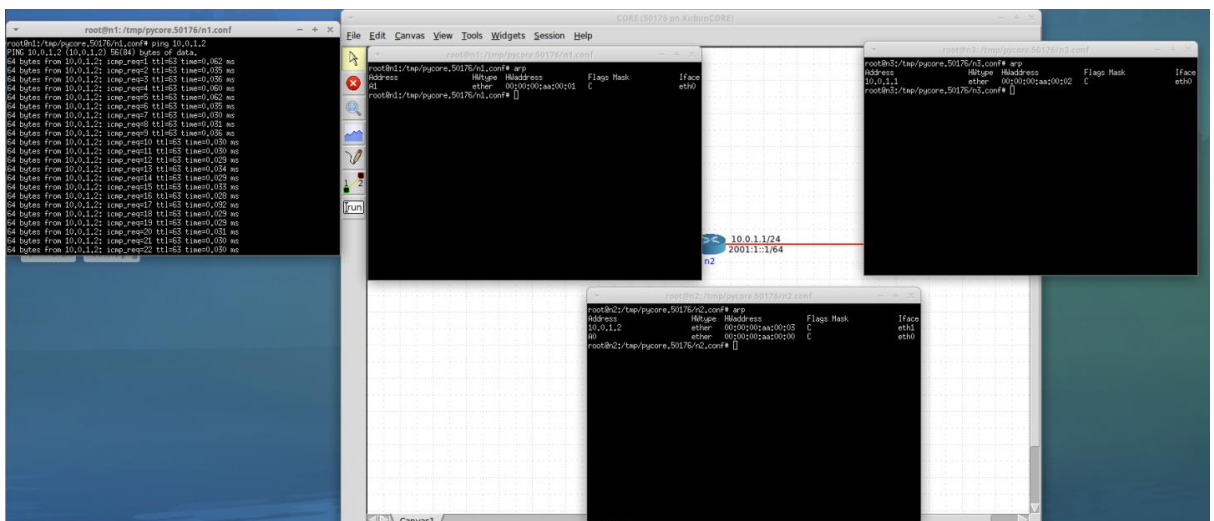
root@n3:/tmp/pycore.50171/n3.conf# arp
Address Hwtype Hwaddress Flags Mask Iface
10.0.1.1 ether 00:00:00:aa:00:02 C eth0
root@n3:/tmp/pycore.50171/n3.conf#

```

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.

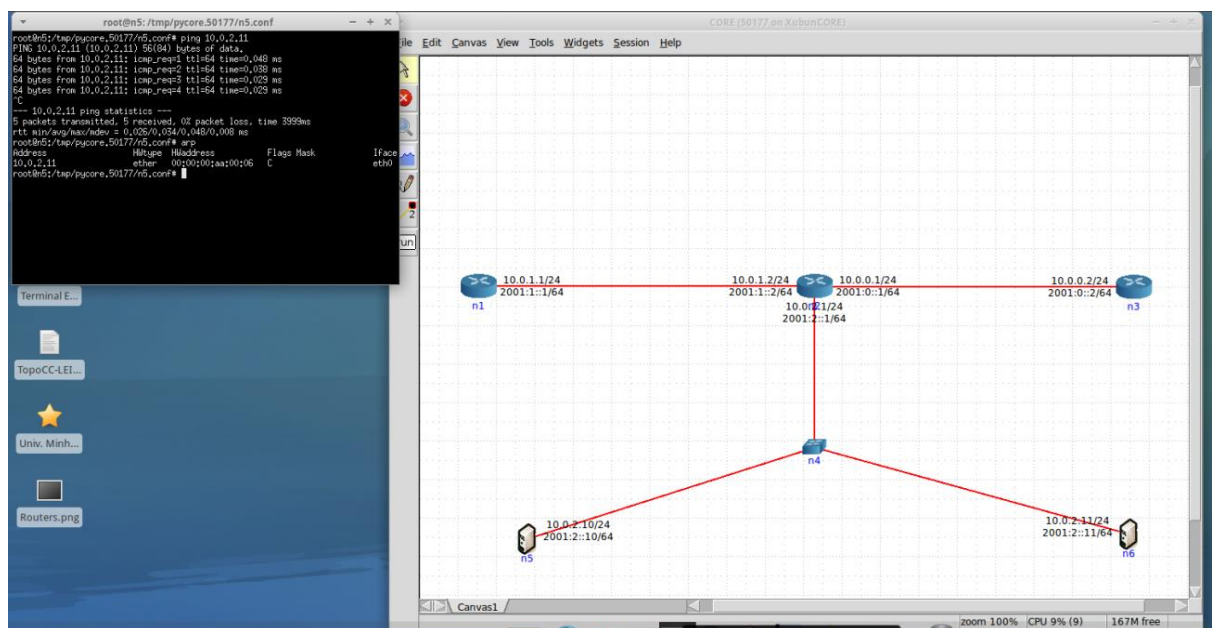


19. Ao remover-mos a ligação entre n1 e n2 e ao tentarmos fazer *ping* verificamos que não obtemos resposta, uma vez que o endereço destino é inexistente.

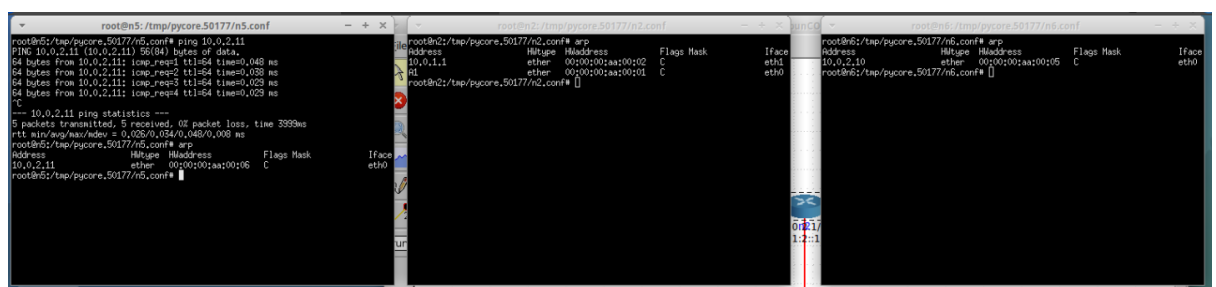
```
root@n1:/tmp/pycore.43195/n1.conf# arp -s 10.0.1.2 00:00:00:aa:00:12
root@n1:/tmp/pycore.43195/n1.conf# arp
Address Hwtype Hwaddress Flags Mask Iface
10.0.1.2 ether 00:00:00:aa:00:12 CM eth0
root@n1:/tmp/pycore.43195/n1.conf# ping 10.0.1.2
PING 10.0.1.2 (10.0.1.2) 56(84) bytes of data.
^C
--- 10.0.1.2 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 | .....<j .....A |
| 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.

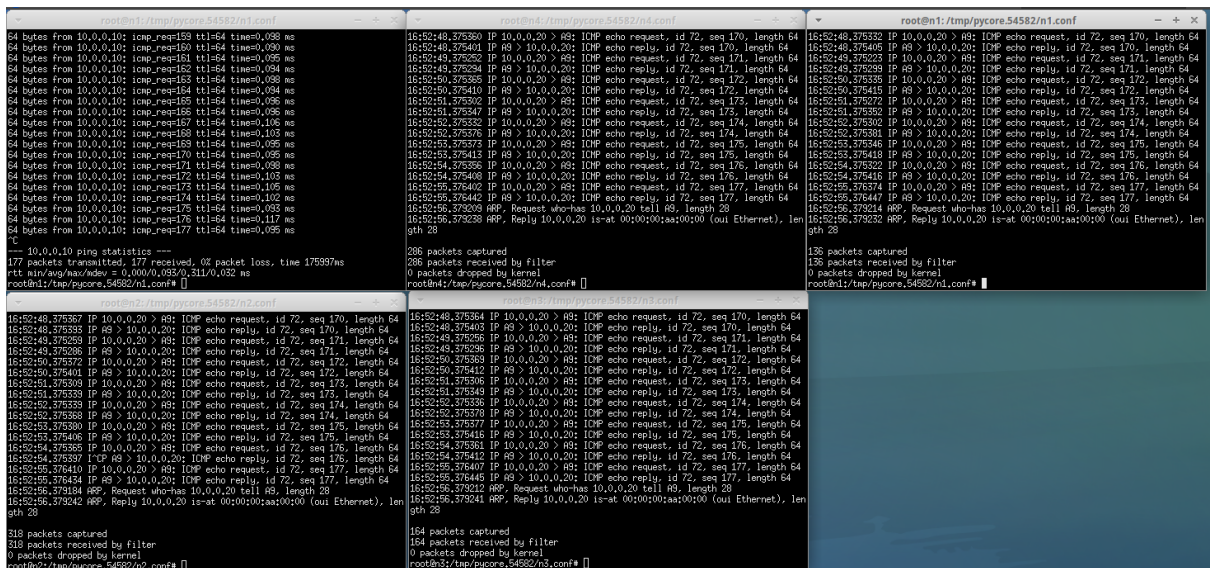
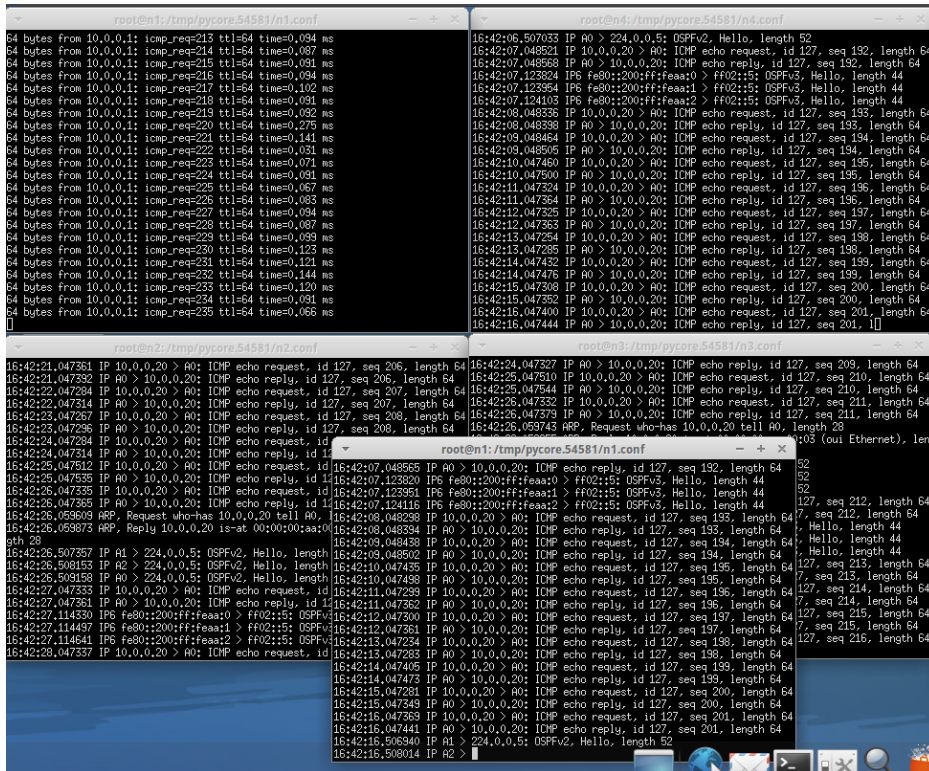
Sender MAC address: IntelCor\_07:88:a2 (3c:6a:a7:07:88:a2)

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.

The screenshot displays the XubunCORE network simulation software. The main window shows a network diagram on a grid background. A central blue router icon labeled 'n5' is connected by red lines to four host icons (labeled n2, n3, n4, and n1) arranged around it. Each host icon is accompanied by its IP address and MAC address: n2 (10.0.0.10/24, 2001:0::10/64), n3 (10.0.0.12/24, 2001:0::12/64), n4 (10.0.0.11/24, 2001:0::11/64), and n1 (10.0.0.20/24, 2001:0::20/64). The interface includes a menu bar at the top with options: File, Edit, Canvas, View, Tools, Widgets, Session, and Help. A toolbar on the left contains icons for selection, execution, and various network components. The status bar at the bottom indicates 'Canvas1' and 'zoom 100%'.

```

root@n1:/tmp/pycore.54582/n1.conf#
64 bytes from 10.0.0.10: icmp_seq=109 ttl=64 time=0.077 ms
64 bytes from 10.0.0.10: icmp_seq=110 ttl=64 time=0.076 ms
64 bytes from 10.0.0.10: icmp_seq=111 ttl=64 time=0.076 ms
64 bytes from 10.0.0.10: icmp_seq=112 ttl=64 time=0.078 ms
64 bytes from 10.0.0.10: icmp_seq=113 ttl=64 time=0.076 ms
64 bytes from 10.0.0.10: icmp_seq=114 ttl=64 time=0.073 ms
64 bytes from 10.0.0.10: icmp_seq=115 ttl=64 time=0.090 ms
64 bytes from 10.0.0.10: icmp_seq=116 ttl=64 time=0.122 ms
64 bytes from 10.0.0.10: icmp_seq=117 ttl=64 time=0.078 ms
64 bytes from 10.0.0.10: icmp_seq=118 ttl=64 time=0.078 ms
64 bytes from 10.0.0.10: icmp_seq=119 ttl=64 time=0.082 ms
64 bytes from 10.0.0.10: icmp_seq=120 ttl=64 time=0.083 ms
64 bytes from 10.0.0.10: icmp_seq=121 ttl=64 time=0.095 ms
64 bytes from 10.0.0.10: icmp_seq=122 ttl=64 time=0.080 ms
64 bytes from 10.0.0.10: icmp_seq=123 ttl=64 time=0.080 ms
64 bytes from 10.0.0.10: icmp_seq=124 ttl=64 time=0.075 ms
64 bytes from 10.0.0.10: icmp_seq=125 ttl=64 time=0.078 ms
64 bytes from 10.0.0.10: icmp_seq=126 ttl=64 time=0.073 ms
64 bytes from 10.0.0.10: icmp_seq=127 ttl=64 time=0.077 ms

10.0.0.10 ping statistics ---
128 packets transmitted, 128 received, 0% packet loss, time 126399ms
rtt min/avg/max/mdev = 0.000/0.077/0.351/0.041 ms
root@n1:/tmp/pycore.54582/n1.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
0 packets captured
0 packets received by filter
0 packets dropped by kernel
root@n4:/tmp/pycore.54582/n4.conf# C
root@n4:/tmp/pycore.54582/n4.conf#

root@n3:/tmp/pycore.54582/n3.conf#
17:01:44.895332 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 119, length 64
17:01:44.895351 IP 68 > 10.0.0.20: ICMP echo request, id 72, seq 120, length 64
17:01:44.895361 IP 10.0.0.20 > 68: ICMP echo request, id 72, seq 121, length 64
17:01:44.895382 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 121, length 64
17:01:47.895333 IP 10.0.0.20 > 68: ICMP echo request, id 72, seq 122, length 64
17:01:47.895358 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 122, length 64
17:01:48.895363 IP 10.0.0.20 > 68: ICMP echo request, id 72, seq 123, length 64
17:01:48.895376 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 123, length 64
17:01:49.895276 IP 10.0.0.20 > 68: ICMP echo request, id 72, seq 124, length 64
17:01:49.895291 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 124, length 64
17:01:50.895375 IP 10.0.0.20 > 68: ICMP echo request, id 72, seq 125, length 64
17:01:50.895392 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 125, length 64
17:01:51.895222 IP 68 > 10.0.0.20: ICMP echo request, id 72, seq 126, length 64
17:01:52.895358 IP 10.0.0.20 > 68: ICMP echo request, id 72, seq 127, length 64
17:01:52.895370 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 127, length 64
17:01:53.895293 IP 10.0.0.20 > 68: ICMP echo request, id 72, seq 128, length 64
17:01:53.895308 IP 68 > 10.0.0.20: ICMP echo reply, id 72, seq 128, length 64

206 packets captured
206 packets received by filter
0 packets dropped by kernel
root@n3:/tmp/pycore.54582/n3.conf#

root@n3:/tmp/pycore.54582/n3.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
0 packets captured
0 packets received by filter
0 packets dropped by kernel
root@n3:/tmp/pycore.54582/n3.conf#

```

## **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.