



**UNIVERSIDADE FEDERAL DA PARAÍBA**

**CENTRO DE INFORMÁTICA**

**ENGENHARIA DE COMPUTAÇÃO**

**Relatório – Laboratório de Redes  
Ethernet & ARP**

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João Pessoa – 13 de março de 2019

178	1.247319	Shenzhen_c3:3e:e9	ArrisGro_d2:21:75	0x0800	54	IPv4
179	1.270817	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	0x0800	147	IPv4
180	1.283000	2804:14c:da10:672:1...	2804:14c:da80:82bc:...	DNS	131	Standard query response 0x428b A use
181	1.283669	2804:14c:da80:82bc:...	2804:14c:da10:672:1...	DNS	95	Standard query 0x3da1 A userweb.wpi.
182	1.288410	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	0x0800	60	IPv4
183	1.288411	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	0x0800	105	IPv4
184	1.292164	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	0x0800	66	IPv4
185	1.292212	Shenzhen_c3:3e:e9	ArrisGro_d2:21:75	0x0800	54	IPv4
186	1.293640	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	0x0800	309	IPv4
187	1.293712	Shenzhen_c3:3e:e9	ArrisGro_d2:21:75	0x0800	54	IPv4
188	1.300120	2804:14c:da10:672:1...	2804:14c:da80:82bc:...	DNS	111	Standard query response 0x3da1 A use
189	1.300795	2804:14c:da80:82bc:...	2804:14c:da10:672:1...	DNS	95	Standard query 0x2707 AAAA userweb.w
190	1.309417	2804:14c:da10:672:1...	2804:14c:da80:82bc:...	DNS	131	Standard query response 0x428b A use

```

> Frame 179: 147 bytes on wire (1176 bits), 147 bytes captured (1176 bits) on interface 0
▼ Ethernet II, Src: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75), Dst: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)
  > Destination: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)
  > Source: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)
  Type: IPv4 (0x0800)
▼ Data (133 bytes)
  Data: 45000085185b4000fc116b7fb5d58402c0a8000d0035e532...
  [Length: 133]

```

0000	bc ec 23 c3 3e e9 bc 2e 48 d2 21 75 08 00 45 00	..#.>... H!u..E
0010	00 85 18 5b 40 00 fc 11 6b 7f b5 d5 84 02 c0 a8	...[@... k.....
0020	00 0d 00 35 e5 32 00 71 87 e4 79 d1 81 80 00 01	...5.2.q ..y.....
0030	00 01 00 00 00 00 02 37 36 02 37 38 03 31 31 32	.....7 6.78.112
0040	02 35 30 07 69 6e 2d 61 64 64 72 04 61 72 70 61	.50.in-a ddr.arpa
0050	00 00 0c 00 01 c0 0c 00 0c 00 01 00 00 01 2c 00	.....,.
0060	32 10 65 63 32 2d 35 30 2d 31 31 32 2d 37 38 2d	2.ec2-50 -112-78-
0070	37 36 09 75 73 2d 77 65 73 74 2d 32 07 63 6f 6d	76.us-we st-2.com

- 1) Qual é o endereço Ethernet de 48 bits do seu computador?  
R: **bc:2e:48:d2:21:75**
- 2) Qual é o endereço de destino de 48 bits no quadro Ethernet? Este é o endereço Ethernet de *gaia.css.umass.edu*? Qual dispositivo tem esse endereço como seu endereço Ethernet?  
R: **O endereço de destino é bc:ec:23:c3:e3:e9 e não é o endereço Ethernet de gaia.cs.umass.edu. É o endereço do hostlink do meu roteador da Arris, que é o link usado para sair da subnet.**
- 3) Você consegue ver o campo CRC (Checksum)? Qual é o valor hexadecimal do campo CRC neste quadro Ethernet?  
R: **O valor hexadecimal é 0x0800. Que corresponde ao protocolo IP.**

38 0.51895/	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	0x0800	1514	IPv4
▼ Ethernet II, Src: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9), Dst: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)					
▼ Destination: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)					
Address: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)					
.... ..0. .... = LG bit: Globally unique address (factory default)					
.... ...0 .... = IG bit: Individual address (unicast)					
▼ Source: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)					
Address: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)					
.... ..0. .... = LG bit: Globally unique address (factory default)					
.... ...0 .... = IG bit: Individual address (unicast)					
Type: IPv4 (0x0800)					
▼ Data (819 bytes)					
Data: 45000333781140008006233fc0a8000d341a67a51ba501bb...					
[Length: 819]					
0000	bc 2e 48 d2 21 75	bc ec 23 c3 3e e9	08 00 45 00	.H.!u..#>..E.	
0010	03 33 78 11 40 00	80 06 23 3f c0 a8	00 0d 34 1a	3x.@...#?....4.	
0020	67 a5 1b a5 01 bb	24 9c 43 c3 90 9b	5c 16 50 18	g.....\$.C...P.	
0030	44 70 7a e3 00 00	17 03 03 03 06 00	00 00 00 00	Dpz.....	
0040	00 00 01 74 51 d7	2f 22 9f 6f 0f 60	c9 9b 2c 9a	...tQ./" o`....	
0050	20 7f 71 92 67 9d	9d 4b 8c 1b 9a 5c	05 a0 07 d2	.q.g.K ...\....	
0060	cb dd b4 73 19 66	fc 7e 3e ed 54 83	75 55 35 26	...s.f~>T.uU5&	
0070	ec 72 50 b5 f6 4d	be 1c 8c 42 c5 91	6a 4f 2a 78	rP..M..B..j0*x	

- 4) Qual é o valor do campo “source address” no quadro Ethernet? Esse é o endereço do seu computador ou do servidor em *gaia.sc.umass.edu*? De quem é este endereço MAC?  
R: **bc:ec:23:c3:3e:e9. Este é endereço do hostlink do meu roteador da Arris, que é usado para entrar na minha subnet.**
- 5) Qual é o valor do campo “destination address” no quadro Ethernet? Esse é o MAC do seu computador?  
R: **O endereço de destino é bc:2e:48:d2:21:75, que é o MAC do meu computador.**
- 6) Você consegue ver o campo CRC (Checksum)? Qual é o valor hexadecimal do campo CRC neste quadro Ethernet?  
R: **O valor hexadecimal é 0x0800. Que corresponde ao protocolo IP.**

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17134.648]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>arp -d

C:\WINDOWS\system32>arp -a

Interface: 169.254.90.48 --- 0x11
  Internet Address      Physical Address      Type
  224.0.0.22            01-00-5e-00-00-16    static

Interface: 192.168.0.13 --- 0x13
  Internet Address      Physical Address      Type
  192.168.0.1           bc-2e-48-d2-21-75    dynamic
  192.168.0.255         ff-ff-ff-ff-ff-ff    static
  224.0.0.22            01-00-5e-00-00-16    static

Interface: 169.254.117.38 --- 0x1b
  Internet Address      Physical Address      Type
  169.254.255.255       ff-ff-ff-ff-ff-ff    static
  224.0.0.22            01-00-5e-00-00-16    static
```

7) Anote o conteúdo do cache ARP do seu computador. Qual é o significado dos valores de cada coluna?

R: A coluna *Internet Address* contém os endereços IP, a coluna *Physical Address* contém os endereços MAC, e a coluna *Type* indica o tipo de protocolo.

1077	8.685260	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	ARP	56	Who has 192.168.0.13? Tell 192.168.0.1
1078	8.685269	Shenzhen_c3:3e:e9	ArrisGro_d2:21:75	ARP	42	192.168.0.13 is at bc:ec:23:c3:3e:e9
5	0.042349	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	93	Standard query 0x8d36 AAAA discordapp.io
6	0.058946	2804:14c:da10:672:1::	2804:14c:da80:82bc::	DNS	155	Standard query response 0x8d36 AAAA discordapp.io SOA gabe.ns
33	1.061696	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	93	Standard query 0x85d4 AAAA discordapp.io
34	1.075800	2804:14c:da10:672:1::	2804:14c:da80:82bc::	DNS	155	Standard query response 0x85d4 AAAA discordapp.io SOA gabe.ns
53	1.293690	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	94	Standard query 0x23fb A www.google.com
54	1.293870	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	94	Standard query 0x1760 AAAA www.google.com
55	1.303785	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	95	Standard query 0xb090 A ssl.gstatic.com
56	1.304000	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	95	Standard query 0xb090 A ssl.gstatic.com
> Frame 1077: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface 0						
▼ Ethernet II, Src: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75), Dst: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)						
▼ Destination: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)						
Address: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)						
.... ..0. .... = LG bit: Globally unique address (factory default)						
.... ..0. .... = IG bit: Individual address (unicast)						
▼ Source: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)						
Address: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)						
.... ..0. .... = LG bit: Globally unique address (factory default)						
.... ..0. .... = IG bit: Individual address (unicast)						
Type: ARP (0x0806)						
Trailer: 7a2938250000000000000000000000						
▼ Address Resolution Protocol (request)						
Hardware type: Ethernet (1)						
Protocol type: IPv4 (0x0800)						
Hardware size: 6						
Protocol size: 4						
Opcode: request (1)						
Sender MAC address: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)						
Sender IP address: 192.168.0.1 (192.168.0.1)						
Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)						
Target IP address: 192.168.0.13 (192.168.0.13)						

0000	bc ec 23 c3 3e e9 bc 2e 48 d2 21 75 08 06 00 01	..#.>...H+!u... ..
0010	08 00 06 04 00 01 bc 2e 48 d2 21 75 c0 a8 00 01	.....H+!u... ..
0020	00 00 00 00 00 00 c0 a8 00 0d 7a 29 38 25 00 00	.....z)8%... ..
0030	00 00 00 00 00 00 00 00	.....

## ARP Request

1077	8.685260	ArrisGro_d2:21:75	Shenzhen_c3:3e:e9	ARP	56	Who has 192.168.0.13? Tell 192.168.0.1
1078	8.685269	Shenzhen_c3:3e:e9	ArrisGro_d2:21:75	ARP	42	192.168.0.13 is at bc:ec:23:c3:3e:e9
5	0.042349	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	93	Standard query 0x8d36 AAAA discordapp.io
6	0.058946	2804:14c:da10:672:1::	2804:14c:da80:82bc::	DNS	155	Standard query response 0x8d36 AAAA discordapp.io SOA gabe.ns
33	1.061696	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	93	Standard query 0x85d4 AAAA discordapp.io
34	1.075800	2804:14c:da10:672:1::	2804:14c:da80:82bc::	DNS	155	Standard query response 0x85d4 AAAA discordapp.io SOA gabe.ns
53	1.293690	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	94	Standard query 0x23fb A www.google.com
54	1.293870	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	94	Standard query 0x1760 AAAA www.google.com
55	1.303785	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	95	Standard query 0xb090 A ssl.gstatic.com
56	1.304000	2804:14c:da80:82bc::	2804:14c:da10:672:1::	DNS	95	Standard query 0xb090 A ssl.gstatic.com

> Frame 1078: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0

▼ Ethernet II, Src: Shenzhen\_c3:3e:e9 (bc:ec:23:c3:3e:e9), Dst: ArrisGro\_d2:21:75 (bc:2e:48:d2:21:75)

▼ Destination: ArrisGro\_d2:21:75 (bc:2e:48:d2:21:75)

Address: ArrisGro\_d2:21:75 (bc:2e:48:d2:21:75)

.... ..0. .... = LG bit: Globally unique address (factory default)

.... ..0. .... = IG bit: Individual address (unicast)

▼ Source: Shenzhen\_c3:3e:e9 (bc:ec:23:c3:3e:e9)

Address: Shenzhen\_c3:3e:e9 (bc:ec:23:c3:3e:e9)

.... ..0. .... = LG bit: Globally unique address (factory default)

.... ..0. .... = IG bit: Individual address (unicast)

Type: ARP (0x0806)

▼ Address Resolution Protocol (reply)

Hardware type: Ethernet (1)

Protocol type: IPv4 (0x0800)

Hardware size: 6

Protocol size: 4

Opcode: reply (2)

Sender MAC address: Shenzhen\_c3:3e:e9 (bc:ec:23:c3:3e:e9)

Sender IP address: 192.168.0.13 (192.168.0.13)

Target MAC address: ArrisGro\_d2:21:75 (bc:2e:48:d2:21:75)

Target IP address: 192.168.0.1 (192.168.0.1)

0000	bc 2e 48 d2 21 75 bc ec 23 c3 3e e9 08 06 00 01	..H+!u...#.>... ..
0010	08 00 06 04 00 02 bc ec 23 c3 3e e9 c0 a8 00 0d	.....#.>.....
0020	bc 2e 48 d2 21 75 c0 a8 00 01	..H+!u... ..

## ARP Reply

13) Observe o painel central o quadro Ethernet II. O que significa o campo Destination Address? Qual o valor dele? Por que este valor?

R: Significa que o host em questão está solicitando o endereço MAC desse destino, por via de Broadcast, através do seu IP. Seu valor é bc:ec:23:c3:3e:e9. Esse é o endereço MAC do destino do request.

14) No painel central selecione Address Resolution Protocol. O que significam os campos: Sender MAC Address, Sender IP Address, Target MAC Address e Target IP Address?

R: O host que está solicitando o endereço MAC possui os atributos do *sender* (MAC bc:2e:48:d2:21:75 e IP 192.168.0.1), enquanto o destino da solicitação possui os atributos de *target* (MAC bc:ec:23:c3:3e:e9 e IP 192.168.0.13).

15) Há dois tipos de pacote ARP, um é de uma requisição (request) mandada em broadcast e outro a resposta (reply) mandada em unicast. Identifique em sua captura os dois tipos de pacote, quais campos são diferentes nos campos do ARP?

R: Vide captura acima. A diferença nos dois pacotes, além de terem *sender* e *target* diferentes, é que o pacote do *request* possui um campo chamado "*trailer*", que é uma imposição de 60 bytes (no mínimo) do Ethernet no tamanho dos pacotes. O *trailer* é o preenchimento adicionado aos pacotes curtos pra satisfazer esse requisito. Ainda como diferença, o *opcode* do request é (1) e do reply é (2).

Trailer: 7a293825000000000000000000000000

▼ Address Resolution Protocol (request)

Hardware type: Ethernet (1)

Protocol type: IPv4 (0x0800)

Hardware size: 6

Protocol size: 4

Opcode: request (1)

Sender MAC address: ArrisGro\_d2:21:75 (bc:2e:48:d2:21:75)

Sender IP address: 192.168.0.1 (192.168.0.1)

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

Target IP address: 192.168.0.13 (192.168.0.13)

0000 bc ec 23 c3 3e e9 bc 2e 48 d2 21 75 08 06 00 01 ..#>...H!u...

0010 08 00 06 04 00 01 bc 2e 48 d2 21 75 c0 a8 00 01 .....H!u...

0020 00 00 00 00 00 00 c0 a8 00 0d 7a 29 38 25 00 00 .....z)8%

0030 00 00 00 00 00 00 00 00 .....

Type: ARP (0x0806)

▼ Address Resolution Protocol (reply)

Hardware type: Ethernet (1)

Protocol type: IPv4 (0x0800)

Hardware size: 6

Protocol size: 4

Opcode: reply (2)

Sender MAC address: Shenzhen\_c3:3e:e9 (bc:ec:23:c3:3e:e9)

Sender IP address: 192.168.0.13 (192.168.0.13)

Target MAC address: ArrisGro\_d2:21:75 (bc:2e:48:d2:21:75)

Target IP address: 192.168.0.1 (192.168.0.1)

0000 bc 2e 48 d2 21 75 bc ec 23 c3 3e e9 08 06 00 01 ..H!u..#>.....

0010 08 00 06 04 00 02 bc ec 23 c3 3e e9 c0 a8 00 0d .....#>.....

0020 bc 2e 48 d2 21 75 c0 a8 00 01 ..H!u... ..