

CS-315 COMPUTER NETWORKS LAB – 11

PART-1

1. The 48-bit Ethernet address of my computer = c4:41:1e:75:b1:52

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✓ Ethernet II, Src: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52), Dst: 3ComEurope_7e:d9:01 (00:1e:c1:7e:d9:01)
  > Destination: 3ComEurope_7e:d9:01 (00:1e:c1:7e:d9:01)
  > Source: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52)
  Type: IPv4 (0x0800)
  > Internet Protocol Version 4, Src: 128.119.247.66, Dst: 128.119.245.12
```

2. The 48-bit destination address in the ethernet frame is 00:1e:c1:7e:d9:01 .No, this is not the ethernet address of gaia.cs.umass.edu. This is the address of the router (gateway to the internet) to which my computer is connected. The device that has this ethernet address is 3ComEurope_7e:d9:01.
3. The hexadecimal value for the two-byte Frame type field in the Ethernet frame carrying the HTTP GET request is 0x0800. The upper layer protocol is IPv4.
4. The ASCII “G” in “GET” appears after $4 \times 16 + 2 = 66$ bytes from the very start of the Ethernet frame. It starts from the 67th byte.

0020	f5 0c d3 1a 00 50 df c1 db 19 56 32 7b c7 80 18P...V2{..
0030	08 0a 98 99 00 00 01 01 08 0a 08 e7 51 ba f7 d2Q..
0040	96 a8 47 45 54 20 2f 77 69 72 65 73 68 61 72 6b	..GET /w ireshar
0050	2d 6c 61 62 73 2f 48 54 54 50 2d 77 69 72 65 73	-labs/HT TP-wire
0060	68 61 72 6b 2d 6c 61 62 2d 66 69 6c 65 33 2e 68	hark-lab -file3.
0070	74 64 6c 20 48 54 54 50 2f 31 2a 31 0d 0a 48 6f	+ml HTTP /1 1..H

$0x0400 = 64(\text{decimal}) + 2 \text{ bytes (4 hexadecimal digits)}$

$= 66 \text{ bytes.}$

5. The Ethernet source address is 00:1e:c1:7e:d9:01. No, this is neither the Ethernet address of my computer nor that of gaia.cs.umass.edu. This is the address of the router to which my computer is connected. The device that has this ethernet address is 3ComEurope_7e:d9:01.

```
✓ Frame 154: 303 bytes on wire (4004 bits), 303 bytes captured (4004 bits) on interface eth0, id 0
✓ Ethernet II, Src: 3ComEurope_7e:d9:01 (00:1e:c1:7e:d9:01), Dst: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52)
  > Destination: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52)
  > Source: 3ComEurope_7e:d9:01 (00:1e:c1:7e:d9:01)
  Type: IPv4 (0x0800)
  > Internet Protocol Version 4, Src: 128.119.245.12, Dst: 128.119.247.66
```

6. The destination address in the Ethernet frame is c4:41:1e:75:b1:52. Yes, this is the Ethernet address of my computer.
7. The hexadecimal value for the two-byte Frame type field is 0x0800. The upper layer protocol is IPv4.
8. The ASCII “O” in “OK” appears after 79 bytes (0x0040 = 64 + 15) from the very start of the Ethernet frame. The ASCII “O” in “OK” appears after 13 bytes (0x0000 = 0 + 13) in the HTTP.

0030	00 ec e4 36 00 00 01 01 08 0a f7 d2 96 ad 08 e7	...6....
0040	51 ba 48 54 54 50 2f 31 2e 31 20 32 30 30 20 4f	HTTP/1 .1 200 O
0050	4b 0d 0a 44 61 74 65 3a 20 54 75 65 2c 20 30 32	K·Date: Tue, 02
0060	20 4e 6f 76 20 32 30 32 31 20 31 37 3a 33 37 3a	Nov 202 1 17:37:
0070	34 33 20 47 4d 54 0d 0a 53 65 72 76 65 72 3a 20	13 GMT... Server:

0000	48 54 54 50 2f 31 2e 31 20 32 30 30 20 4f 4b 0d	HTTP/1.1 200 OK
0010	0a 44 61 74 65 3a 20 54 75 65 2c 20 30 32 20 4e	Date: Tue, 02 N

9. Four Ethernet frames (each containing an IP datagram, each containing a TCP segment) carry data that is part of the complete HTTP “OK 200 ...” reply message since there are 4 reassembled TCP segments.

PART-2

1. There are 9 entries stored in the ARP cache.

```
PS C:\Users\pavan> arp -a

Interface: 192.168.0.194 --- 0x12
Internet Address      Physical Address      Type
192.168.0.1           e0-1c-fc-ed-68-1e    dynamic
192.168.0.255         ff-ff-ff-ff-ff-ff    static
224.0.0.2             01-00-5e-00-00-02    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
228.8.8.8             01-00-5e-08-08-08    static
239.255.255.250       01-00-5e-7f-ff-fa    static
255.255.255.255       ff-ff-ff-ff-ff-ff    static
PS C:\Users\pavan> |
```

2. ARP cache contains mappings of IP addresses to MAC addresses. In each displayed entry, there is an Internet address (IP address), Physical address (MAC address) and Type (static/dynamic).

3. The hexadecimal value of the source address in the Ethernet frame containing the first ARP request message is c4:41:1e:75:b1:52.
4. The hexadecimal value of the destination address in the Ethernet frame containing the first ARP request message is ff:ff:ff:ff:ff:ff. This is a broadcast message sent to all devices within the local network segment. This is the address of the router to which my computer is connected.

108	6.344929	BelkinIntern_75:b1:52	Broadcast	ARP	42 Who has 128.119.247.1? Tell 128.119.247.66
109	6.347010	3ComEurope_7e:d9:01	BelkinIntern_75:b1:52	ARP	60 128.119.247.1 is at 00:1e:c1:7e:d9:01
110	6.347145	128.119.247.66	128.119.104.12	TCP	85 54032 → 8190 [PSH, ACK] Seq=1 Ack=1 Win=4096 Len=31
111	6.347167	128.119.247.66	128.119.104.12	TCP	54 54032 → 8190 [FIN, ACK] Seq=32 Ack=1 Win=4096 Len=0
112	6.348565	128.119.104.12	128.119.247.66	TCP	60 8190 → 54032 [ACK] Seq=1 Ack=33 Win=2047 Len=0

> Frame 108: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface en9, id 0000

▼ Ethernet II, Src: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

> Destination: Broadcast (ff:ff:ff:ff:ff:ff)

> Source: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52)

Type: ARP (0x0806)

▼ Address Resolution Protocol (request)

Hardware type: Ethernet (1)

Protocol type: IPv4 (0x0800)

Hardware size: 6

Protocol size: 4

Opcode: request (1)

Sender MAC address: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52)

Sender IP address: 128.119.247.66

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

Target IP address: 128.119.247.1

0000 ff ff ff ff ff ff c4 41 1e 75 b1 52 08 06 00 01

0010 08 00 06 04 00 01 c4 41 1e 75 b1 52 80 77 f7 42

0020 00 00 00 00 00 00 00 77 f7 01

5. The hexadecimal value for the two-byte Ethernet Frame type field is 0x0806. The upper layer protocol is ARP.
6. The ARP opcode field begins after 20 bytes from the very beginning of the Ethernet frame. $0x0010 = 16 + 4$ (8 hexadecimal digits) = 20, i.e, it begins from 21st byte.
7. The value of the opcode field within the ARP request message is request (1).
8. Yes, as we can see in the screenshot above. The value is 128.119.247.66.
9. The IP address of the device whose corresponding Ethernet address is being requested in the ARP request message is 128.119.247.1, which is the Target IP address as we can see in the screenshot above.

109	6.347010	3ComEurope_7e:d9:01	BelkinIntern_75:b1:52	ARP	60	128.119.247.1 is at 00:1e:c1:7e:d9:01
110	6.347145	128.119.247.66	128.119.104.12	TCP	85	54032 → 8190 [PSH, ACK] Seq=1 Ack=1 Win=4096 Len=31
111	6.347167	128.119.247.66	128.119.104.12	TCP	54	54032 → 8190 [FIN, ACK] Seq=32 Ack=1 Win=4096 Len=0
112	6.348565	128.119.104.12	128.119.247.66	TCP	60	8190 → 54032 [ACK] Seq=1 Ack=33 Win=2047 Len=0

> Frame 109: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface en9, id 0000	c4 41 1e 75 b1 52 00 1e c1 7e d9 01 08 06 00 01	·A·u·R······
> Ethernet II, Src: 3ComEurope_7e:d9:01 (00:1e:c1:7e:d9:01), Dst: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52), id 0010	08 00 06 04 00 02 00 1e c1 7e d9 01 08 77 f7 01	·····B·····W··
Address Resolution Protocol (reply)	0020 c4 41 1e 75 b1 52 80 77 f7 42 00 00 00 00 00	·A·u·R·w·B······
Hardware type: Ethernet (1)	0030 00 00 00 00 00 00 00 00 00 00 00	·····
Protocol type: IPv4 (0x0800)		
Hardware size: 6		
Protocol size: 4		
Opcode: reply (2)		
Sender MAC address: 3ComEurope_7e:d9:01 (00:1e:c1:7e:d9:01)		
Sender IP address: 128.119.247.1		
Target MAC address: BelkinIntern_75:b1:52 (c4:41:1e:75:b1:52)		
Target IP address: 128.119.247.66		

10. The value of the opcode field within the ARP reply message received is reply (2).
11. The Ethernet address corresponding to the IP address (128.119.247.1) that was specified in the ARP request message is 00:1e:c1:7e:d9:01.
12. There are no ARP replies in this trace, because we are not at all the machines that sent the request. The ARP request is broadcast, which is sent to all devices within the local network segment, but the ARP reply is sent back directly to the sender's Ethernet address.