Lab 4 - Ethernet & ARP
Computer Networks

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1 What is the 48-bit Ethernet address of your computer?

Answers: The 48-bit Ethernet address of my computer is 94:e9:79:0f:f2:dc

2 What is the 48-bit destination address in the Ethernet frame? Is this the Ethernet address of gaia.cs.umass.edu? What device has this as its Ethernet address?

Answers: The 48-bit destination address in the Ethernet frame is 03:fa:bd:15:43:69. This Ethernet address is not Ethernet address of gaia.cs.umass.edu. This Ethernet address is Ethernet address of first-hop router from my computer to gaia.cs.umass.edu.

3 Give the hexadecimal value for the two-byte Frame type field. What upper layer protocol does this correspond to?

Answers: Type: IPv4 (0x0800)

4 How many bytes from the very start of the Ethernet frame does the ASCII "G" in "GET" appear in the Ethernet frame?

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	Routerbo_e6:74:81	Broadcast	ARP	56	Who has 172.16.13.248? Tell 172.16.0.1
2	0.204990242	Routerbo_e6:74:81	Broadcast	ARP	56	Who has 172.16.13.154? Tell 172.16.0.1
3	0.222916191	0e:fa:bd:15:43:69	LiteonTe_0f:f2:dc	0x0800	591	IPv4
4	0.234273681	LiteonTe_0f:f2:dc	0e:fa:bd:15:43:69	0x0800	1494	IPv4
5	0.234305851	LiteonTe_0f:f2:dc	0e:fa:bd:15:43:69	0x0800	1233	IPv4
6	0.269023295	0e:fa:bd:15:43:69	LiteonTe_0f:f2:dc	0x0800	66	IPv4
7	0.316628085	LiteonTe_0f:f2:dc	0e:fa:bd:15:43:69	0x0800	66	IPv4
8	0.353398010	0e:fa:bd:15:43:69	LiteonTe_0f:f2:dc	0x0800	66	IPv4
9	0.614613328	Routerbo_9d:41:e0	Broadcast	0x9003	64	Ethernet II
10	1.023420331	Routerbo_9d:41:e0	Spanning-tree-(for-...	STP	60	Conf. Root = 8192/0/0e:fa:bd:15:43:69 (
11	1.133801738	LiteonTe_0f:f2:dc	0e:fa:bd:15:43:69	0x0800	77	IPv4
12	1.145823431	LiteonTe_0f:f2:dc	0e:fa:bd:15:43:69	0x0800	66	IPv4

```
    Address: LiteonTe_0f:f2:dc (94:e9:79:0f:f2:dc)
    .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
    .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
  ▾ Source: 0e:fa:bd:15:43:69 (0e:fa:bd:15:43:69)
    Address: 0e:fa:bd:15:43:69 (0e:fa:bd:15:43:69)
    .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
    .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
  Type: IPv4 (0x0800)
▾ Data (52 bytes)
    Data: 45200034498a4000740694b314bd4e25ac11197301bbbad2...
    [Length: 52]

0000  94 e9 79 0f f2 dc 0e fa  bd 15 43 69 08 00 45 20   ··y····· ··Ci··E
0010  00 34 49 8a 40 00 74 06  94 b3 14 bd 4e 25 ac 11   ·4I·@·t· ····N%··
0020  19 73 01 bb ba d2 12 28  c6 30 46 2a ac d3 80 10   ·s·····( ·0F*····
0030  04 02 a9 b6 00 00 01 01  08 0a 72 25 13 e7 c1 e3   ········ ··r%····
0040  d0 c9                                              ··
```

Answers: The ASCII "G" appears 52 bytes from the start of the Ethernet frame. There are 14 B Ethernet frame, and then 20 bytes of IP header followed by 20 bytes of TCP header before the HTTP data is encountered.

5 What is the value of the Ethernet source address? Is this the address of your computer, or of gaia.cs.umass.edu (Hint: the answer is no). What device has this as its Ethernet address?


```
  ▾ Source: 0e:fa:bd:15:43:69 (0e:fa:bd:15:43:69)
      Address: 0e:fa:bd:15:43:69 (0e:fa:bd:15:43:69)
      .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
      .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
```

```
thang@thang:~$ arping -f -I $(ip route show match 0/0 | awk '{print $5, $3}')
ARPING 172.17.0.1 from 172.17.25.115 wlp3s0
Unicast reply from 172.17.0.1 [0E:FA:BD:15:43:69]  3.955ms
Sent 1 probes (1 broadcast(s))
Received 1 response(s)
```

Answers: The value of the Ethernet source address is 0e:fa:bd:15:43:69. This is neither the Ethernet address of gaia.cs.umass.edu nor the address of my computer. It is MAC address of first-hop router from my computer to gaia.cs.umass.edu.

6   What is the destination address in the Ethernet frame? Is this the Ethernet address of your computer?

```
Destination: LiteonTe_0f:f2:dc (94:e9:79:0f:f2:dc)
  Address: LiteonTe_0f:f2:dc (94:e9:79:0f:f2:dc)
  .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
  .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
```

Answers: The destination address in the Ethernet frame is LiteonTe_0f:f2:dc. It is not Ethernet address of my computer. It is Ethernet address of first-hop router from gaia.cs.umass.edu.

7   Give the hexadecimal value for the two-byte Frame type field. What upper layer protocol does this correspond to?

Answers: Type: IPv4(0x0800)

8   How many bytes from the very start of the Ethernet frame does the ASCII "O" in "OK" (i.e., the HTTP response code) appear in the Ethernet frame?

Answers: Similarly, The ASCII "O" appears 52 bytes from the start of the Ethernet frame.

9   Write down the contents of your computer's ARP cache. What is the meaning of each column value?

```
thang@thang:~$ arp
Address                 HWtype  HWaddress           Flags Mask         Iface
_gateway                ether   0e:fa:bd:15:43:69   C                  wlp3s0
```

Answers: The Address column contains IP address. The HWtype column indicates protocol type. The HWaddress contains MAC address. The Flags Mask indicateS if the MAC address has been learned, manually set, published or is incomplete. The Iface indicates name of interface.

10   What are the hexadecimal values for the source and destination addresses in the Ethernet frame containing the ARP request message?

```
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: 0e:fa:bd:15:43:69 (0e:fa:bd:15:43:69)
  Address: 0e:fa:bd:15:43:69 (0e:fa:bd:15:43:69)
  .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
  .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
```

Answers: The hexadecimal values for the source and destination addresses in the Ethernet frame containing the ARP request message are 0e:fa:bd:15:43:69 and ff:ff:ff:ff:ff:ff, respectively.

11 Give the hexadecimal value for the two-byte Ethernet Frame type field. What upper layer protocol does this correspond to?

Answers: Type: ARP(0x0806)

12

a) How many bytes from the very beginning of the Ethernet frame does the ARP opcode field begin? *The ARP opcode field begins 20 bytes from the very beginning of the Ethernet frame.*

b) What is the value of the opcode field within the ARP-payload part of the Ethernet frame in which an ARP request is made? *The hex value for opcode field withing the ARP-payload of the request is 0x0001, for request.*

c) Does the ARP message contain the IP address of the sender? *Yes, the ARP message containing the IP address 192.168.1.105 for the sender.*

d) Where in the ARP request does the "question" appear – the Ethernet address of the machine whose corresponding IP address is being queried? *The field "Target MAC address" is set to 00:00:00:00:00:00 to question the machine whose corresponding IP address (192.168.1.1) is being queried.*

13 Now find the ARP reply that was sent in response to the ARP request.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	AmbitMic_a9:3d:68	Broadcast	ARP	42	Who has 192.168.1.1? Tell 192.168.1.105
2	0.001018	LinksysG_da:af:73	AmbitMic_a9:3d:68	ARP	60	192.168.1.1 is at 00:06:25:da:af:73
3	0.001028	192.168.1.105	199.2.53.206	TCP	62	1057 → 631 [SYN] Seq=0 Win=64240 Len=0 MSS
4	2.962850	192.168.1.105	199.2.53.206	TCP	62	[TCP Retransmission] 1057 → 631 [SYN] Seq=
5	8.971488	192.168.1.105	199.2.53.206	TCP	62	[TCP Retransmission] 1057 → 631 [SYN] Seq=
6	13.542974	CnetTech_73:8d:ce	Broadcast	ARP	60	Who has 192.168.1.117? Tell 192.168.1.104
7	17.444423	192.168.1.105	128.119.245.12	TCP	62	1058 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=
8	17.465902	128.119.245.12	192.168.1.105	TCP	62	80 → 1058 [SYN, ACK] Seq=0 Ack=1 Win=5840
9	17.465927	192.168.1.105	128.119.245.12	TCP	54	1058 → 80 [ACK] Seq=1 Ack=1 Win=64240 Len=
10	17.466468	192.168.1.105	128.119.245.12	HTTP	686	GET /ethereal-labs/HTTP-ethereal-lab-file3
11	17.494766	128.119.245.12	192.168.1.105	TCP	60	80 → 1058 [ACK] Seq=1 Ack=633 Win=6952 Len
12	17.498935	128.119.245.12	192.168.1.105	TCP	1514	80 → 1058 [ACK] Seq=1 Ack=633 Win=6952 Len
13	17.500025	128.119.245.12	192.168.1.105	TCP	1514	80 → 1058 [ACK] Seq=1461 Ack=633 Win=6952
14	17.500069	192.168.1.105	128.119.245.12	TCP	54	1058 → 80 [ACK] Seq=633 Ack=2921 Win=64240
15	17.527057	128.119.245.12	192.168.1.105	TCP	1514	80 → 1058 [ACK] Seq=2921 Ack=633 Win=6952

```
  Type: ARP (0x0806)
  Padding: 000000000000000000000000000000000000
▼ Address Resolution Protocol (reply)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (2)
    Sender MAC address: LinksysG_da:af:73 (00:06:25:da:af:73)
    Sender IP address: 192.168.1.1
    Target MAC address: AmbitMic_a9:3d:68 (00:d0:59:a9:3d:68)
    Target IP address: 192.168.1.105
```

a) How many bytes from the very beginning of the Ethernet frame does the ARP opcode field begin? *The ARP opcode field begins 20 bytes from the very beginning of the Ethernet frame*

b) What is the value of the opcode field within the ARP-payload part of the Ethernet frame in which an ARP response is made? *The hex value for opcode field withing the ARP-payload of the request is 0x0002, for reply.*

c) Where in the ARP message does the "answer" to the earlier ARP request appear – the IP address of the machine having the Ethernet address whose corresponding IP address is being queried? *The answer to the earlier ARP request appears in the"Sender MAC address" field, which contains the Ethernet address 00:06:25:da:af:73 for the sender with IP address 192.168.1.1.*

14 What are the hexadecimal values for the source and destination addresses in the Ethernet frame containing the ARP reply message?

Answers: The hex value for the source address is 00:06:25:da:af:73 and for the destination is 00:d0:59:a9:3d:68.

15 Why is there no ARP reply (sent in response to the ARP request in packet 6) in the packet trace?

Answers: There is no reply in this trace, because we are not at the machine that sent the request. The ARP request is broadcast, but the ARP reply is sent back directly to the sender's Ethernet address.