

Assignment 6

Name – Harshavardhan Bamane

PRN – 22510112

S7

```
→ ~ arp
```

Address	HWtype	HWaddress	Flags	Mask	Iface
10.40.10.32	ether	5c:ba:ef:61:27:2d	C		wlp0s20f3
10.40.16.251	ether	b4:8c:9d:be:8f:7d	C		wlp0s20f3
10.40.2.48	ether	c4:75:ab:06:b6:7f	C		wlp0s20f3
10.40.8.59	ether	e8:fb:1c:47:44:8b	C		wlp0s20f3
10.40.14.65	ether	d0:c5:d3:3d:1e:27	C		wlp0s20f3
10.40.5.49	ether	e4:0d:36:fc:fb:4d	C		wlp0s20f3
10.40.1.195	ether	a4:4e:31:a2:de:50	C		wlp0s20f3
10.40.10.77	ether	00:e9:3a:08:82:eb	C		wlp0s20f3
10.40.10.201	ether	00:e9:3a:99:6b:77	C		wlp0s20f3
10.40.6.205	ether	ec:63:d7:db:63:ed	C		wlp0s20f3
10.40.9.189	ether	b8:bc:5b:df:1b:b8	C		wlp0s20f3
10.40.18.77	ether	00:45:e2:d6:6a:4d	C		wlp0s20f3
10.40.16.112	ether	20:2b:20:d2:fa:95	C		wlp0s20f3
10.40.11.11	ether	00:e9:3a:21:bb:65	C		wlp0s20f3
10.40.3.101	ether	84:a6:c8:25:4b:62	C		wlp0s20f3
10.40.11.92	ether	d8:c0:a6:58:9b:d9	C		wlp0s20f3
10.40.4.238	ether	a8:93:4a:12:fd:b1	C		wlp0s20f3
10.40.10.156	ether	ac:74:b1:a5:cd:32	C		wlp0s20f3
169.254.169.254		(incomplete)			wlp0s20f3
10.40.15.102	ether	20:1e:88:00:f3:11	C		wlp0s20f3
10.40.6.94	ether	f0:a6:54:1f:ea:4b	C		wlp0s20f3
_gateway	ether	00:04:96:a1:fb:0b	C		wlp0s20f3
10.40.10.148	ether	bc:f4:d4:4f:62:25	C		wlp0s20f3
10.40.21.159	ether	bc:f4:d4:5c:a6:75	C		wlp0s20f3

```
→ ~
```

Internet address are ip addresses

Physical address are MAC / Ethernet addresses

Type column shows that ip address is static or dynamic.

1.

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=1460 SACK_PERM
4	2.962850	192.168.1.105	199.2.53.206	TCP	62	[TCP Retransmission] 1057 → 631 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM
5	8.971488	192.168.1.105	199.2.53.206	TCP	62	[TCP Retransmission] 1057 → 631 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM
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=1460 SACK_PERM
8	17.465902	128.119.245.12	192.168.1.105	TCP	62	80 → 1058 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM
9	17.465927	192.168.1.105	128.119.245.12	TCP	54	1058 → 80 [ACK] Seq=1 Ack=1 Win=64240 Len=0
10	17.466468	192.168.1.105	128.119.245.12	HTTP	686	GET /ethereal-labs/HTTP-ethereal-lab-file3.html HTTP/1.1
11	17.494766	128.119.245.12	192.168.1.105	TCP	60	80 → 1058 [ACK] Seq=1 Ack=633 Win=6952 Len=0
12	17.498935	128.119.245.12	192.168.1.105	TCP	1514	80 → 1058 [ACK] Seq=1 Ack=633 Win=6952 Len=1460 [TCP segment of a reassembled PDU]
13	17.500025	128.119.245.12	192.168.1.105	TCP	1514	80 → 1058 [ACK] Seq=1461 Ack=633 Win=6952 Len=1460 [TCP segment of a reassembled PDU]
14	17.500069	192.168.1.105	128.119.245.12	TCP	54	1058 → 80 [ACK] Seq=633 Ack=2921 Win=64240 Len=0
15	17.527057	128.119.245.12	192.168.1.105	TCP	1514	80 → 1058 [ACK] Seq=2921 Ack=633 Win=6952 Len=1460 [TCP segment of a reassembled PDU]
16	17.527422	128.119.245.12	192.168.1.105	HTTP	489	HTTP/1.1 200 OK (text/html)
17	17.527457	192.168.1.105	128.119.245.12	TCP	54	1058 → 80 [ACK] Seq=633 Ack=4816 Win=64240 Len=0

> Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits)	0000	ff ff ff ff ff 00 d0	59 a9 3d 68 08 06 00 01	..... Y=h....
> Ethernet II, Src: AmbitMic_a9:3d:68 (00:d0:59:a9:3d:68), Dst: Broadcast (ff:ff:ff:ff:ff:ff)	0010	08 00 06 04 00 01 00 d0	59 a9 3d 68 c0 a8 01 69	..... Y=h...i
▼ Address Resolution Protocol (request)	0020	00 00 00 00 00 c0 a8	01 01	..... ..
Hardware type: Ethernet (1)				
Protocol type: IPv4 (0x0800)				
Hardware size: 6				
Protocol size: 4				
Opcode: request (1)				
Sender MAC address: AmbitMic_a9:3d:68 (00:d0:59:a9:3d:68)				
Sender IP address: 192.168.1.105				
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)				
Target IP address: 192.168.1.1				

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

ANS: Source MAC address: 00:d0:59:a9:3d:68

Destination MAC address: ff:ff:ff:ff:ff:ff

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

ANS: Type: ARP (0x0806)

Type: ARP (0x0806)

ARP protocol correspond to this upper layer protocol.

4.

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

Ans: 20 bytes

Address: AmbitMic_a9:3d:68 (00:d0:59:a9:3d:68)	0000	ff ff ff ff ff 00 d0 59 a9 3d 68 08 06 00 01	..... Y.=h....
.... .. = IG bit: Globally unique address (factory default)	0010	08 00 06 04 00 01 00 d0 59 a9 3d 68 c0 a8 01 69	.... Y.=h....i
.... .. = IG bit: Individual address (unicast)	0020	00 00 00 00 00 00 c0 a8 01 01	.....
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: AmbitMic_a9:3d:68 (00:d0:59:a9:3d:68)			
Sender IP address: 192.168.1.105			
Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)			
Target IP address: 192.168.1.1			

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?

Ans: value of a opcode field : 00 01

ff ff ff ff ff ff 00 d0 59 a9 3d 68 08 06 00 01	..... Y.=h....
08 00 06 04 00 01 00 d0 59 a9 3d 68 c0 a8 01 69	.... Y.=h....i
00 00 00 00 00 00 c0 a8 01 01	.....

c) Does the ARP message contain the IP address of the sender?

Ans: Yes, ARP message contain the IP address of the sender.

Address Resolution Protocol (request)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: request (1)
Sender MAC address: AmbitMic_a9:3d:68 (00:d0:59:a9:3d:68)
Sender IP address: 192.168.1.105
Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
Target IP address: 192.168.1.1

d) Where in the ARP request does the “question” appear – the Ethernet address of the machine whose corresponding IP address is being queried?

Ans: 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.

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

The screenshot shows a Wireshark packet capture of an Ethernet network. The packet list on the left shows a sequence of packets, including an ARP request (packet 60) and an ARP reply (packet 61). The packet details pane for packet 61 shows the ARP reply structure, including the sender's IP address (192.168.1.1) and the target's IP address (192.168.1.105). The packet bytes pane shows the raw data of the ARP reply, with the opcode field (00 02) highlighted in blue.

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

Ans: 20 bytes.

The screenshot shows the packet details pane for the ARP reply (packet 61). The opcode field is highlighted in blue, showing the value 00 02. The packet bytes pane shows the raw data of the ARP reply, with the opcode field (00 02) highlighted in blue.

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?

Ans: opcode field = 00 02

The screenshot shows the packet bytes pane for the ARP reply (packet 61). The opcode field (00 02) is highlighted in blue. The packet bytes pane shows the raw data of the ARP reply, with the opcode field (00 02) highlighted in blue.

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?

Ans: 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.

```

  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

```

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

Ans: 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 .

```

  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

```

7. Open the ethernet-ethereal-trace-1 trace file in <http://gaia.cs.umass.edu/wireshark-labs/wireshark-traces.zip>. The first and second ARP packets in this trace correspond to an ARP request sent by the computer running Wireshark, and the ARP reply sent to the computer running Wireshark by the computer with the ARP-requested Ethernet address. But

there is yet another computer on this network, as indicated by packet 6 – another ARP request. Why is there no ARP reply (sent in response to the ARP request in packet 6) in the packet trace?

Ans: The ARP request is broadcast, but the ARP reply is sent back directly to the sender's Ethernet address.

Captured packet.

The image shows a Wireshark packet capture window titled '*Wi-Fi'. The packet list on the left shows a series of ARP requests (protocol 60) from various sources to the broadcast destination (ff:ff:ff:ff:ff:ff). Packet 1871 is selected, showing it is an ARP request from AzureWav_47:44:8b to the broadcast address.

No.	Time	Source	Destination	Protocol	Length	Info
1847	14.747043	AzureWav_e5:14:bd	Broadcast	ARP	60	who has 10.40.7.75? (ARP Probe)
1850	14.847350	ExtremeN_a1:fb:0b	Broadcast	ARP	60	who has 10.40.14.66? Tell 10.40.0.2
1851	14.847414	ExtremeN_a1:fb:0b	Broadcast	ARP	60	who has 10.40.22.208? Tell 10.40.0.2
1852	14.847656	ExtremeN_a1:fb:0b	Broadcast	ARP	60	who has 10.40.7.53? Tell 10.40.0.2
1858	14.950811	ExtremeN_a1:fb:0b	Broadcast	ARP	60	who has 10.40.10.82? Tell 10.40.0.2
1859	14.950899	ExtremeN_a1:fb:0b	Broadcast	ARP	60	who has 10.40.1.61? Tell 10.40.0.2
1865	14.954253	ExtremeN_a1:fb:0b	Broadcast	ARP	60	who has 10.40.12.131? Tell 10.40.0.2
1871	15.019179	AzureWav_47:44:8b	Broadcast	ARP	42	who has 10.40.7.253? Tell 10.40.8.59
1873	15.031378	IntelCor_27:14:6a	AzureWav_47:44:8b	ARP	60	10.40.7.253 is at 14:85:7f:27:14:6a
1878	15.052878	CloudNet_5c:a6:75	Broadcast	ARP	60	who has 10.40.11.38? Tell 10.40.21.159
1881	15.054398	IntelCor_01:a6:18	Broadcast	ARP	60	who has 10.40.7.253? Tell 10.40.24.155
1882	15.054491	IntelCor_63:fd:6c	Broadcast	ARP	60	who has 10.40.7.253? Tell 10.40.6.199
1883	15.054512	AzureWav_e3:78:6b	Broadcast	ARP	60	who has 10.40.7.253? Tell 10.40.1.20
1884	15.054526	CloudNet_8e:15:4b	Broadcast	ARP	60	who has 10.40.7.253? Tell 10.40.11.213
1885	15.055147	IntelCor_42:45:1e	Broadcast	ARP	60	who has 10.40.7.253? Tell 10.40.7.242
1886	15.055175	LiteonTe_71:8f:f5	Broadcast	ARP	60	who has 10.40.7.253? Tell 10.40.13.89
1887	15.055903	CloudNet_03:a1:f9	Broadcast	ARP	60	who has 10.40.7.253? Tell 10.40.11.34
1895	15.156070	ExtremeN_a1:fb:0b	Broadcast	ARP	60	who has 10.40.14.154? Tell 10.40.0.2
1899	15.157223	a6:9d:b7:2a:c3:c1	Broadcast	ARP	42	who has 10.40.2.211? Tell 10.40.13.235

Packet 1871 details:

- Frame 1871: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF...
- Ethernet II, Src: AzureWav_47:44:8b (e8:fb:1c:47:44:8b), 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: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)
 - Sender IP address: 10.40.8.59
 - Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
 - Target IP address: 10.40.7.253

Packet bytes (hex):

```
0000 ff ff ff ff ff e8 fb 1c 47 44 8b 08 06 00 01 .....GD....
0010 08 00 06 04 00 01 e8 fb 1c 47 44 8b 0a 28 08 3b .....GD...(;
0020 00 00 00 00 00 00 0a 28 07 fd .....( ..
```


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

ANS: Source MAC address: e8:fb:1c:47:44:8b

Destination MAC address: 00:00:00:00:00:00

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

ANS: Type: ARP (0x0806)

Type: ARP (0x0806)

ARP protocol correspond to this upper layer protocol.

4.

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

Ans: 20 bytes

> Frame 1871: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF		0000	ff ff ff ff ff ff e8 fb 1c 47 44 8b 08 06 00 01	.....GD....
> Ethernet II, Src: AzureWav_47:44:8b (e8:fb:1c:47:44:8b), Dst: Broadcast (ff:ff:ff:ff:ff:ff)		0010	08 00 06 04 00 01 e8 fb 1c 47 44 8b 0a 28 08 3b	....GD..(.;
▼ Address Resolution Protocol (request)		0020	00 00 00 00 00 00 0a 28 07 fd(..
Hardware type: Ethernet (1)				
Protocol type: IPv4 (0x0800)				
Hardware size: 6				
Protocol size: 4				
Opcode: request (1)				
Sender MAC address: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)				
Sender IP address: 10.40.8.59				
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)				
Target IP address: 10.40.7.253				

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?

Ans: value of a opcode field : 00 01

ff ff ff ff ff ff e8 fb 1c 47 44 8b 08 06 00 01	.....GD....
08 00 06 04 00 01 e8 fb 1c 47 44 8b 0a 28 08 3b	....GD..(.;
00 00 00 00 00 00 0a 28 07 fd(..

c) Does the ARP message contain the IP address of the sender?

Ans: Yes, ARP message contain the IP address of the sender.

```

  Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)
    Sender IP address: 10.40.8.59
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 10.40.7.253

```

d) Where in the ARP request does the “question” appear – the Ethernet address of the machine whose corresponding IP address is being queried?

Ans: The field “Target MAC address” is set to 00:00:00:00:00:00 to question the machine whose corresponding IP address 10.40.7.253 is being queried.

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

The image shows a Wireshark packet capture window titled 'arp2.pcapng'. The packet list pane shows several ARP requests. Packet 1873 is selected, showing an ARP request from IntelCor_27:14:6a to AzureWav_47:44:8b. The packet details pane shows the structure of the ARP request, including hardware type, protocol type, hardware size, protocol size, opcode, sender MAC and IP addresses, and target MAC and IP addresses. The packet bytes pane shows the raw data of the packet, with the target MAC address field highlighted in blue.

No.	Time	Source	Destination	Protocol	Length	Info
1851	14.847414	ExtremetN_a1:fb:0b	Broadcast	ARP	60	Who has 10.40.22.208? Tell 10.40.0.2
1852	14.847656	ExtremetN_a1:fb:0b	Broadcast	ARP	60	Who has 10.40.7.53? Tell 10.40.0.2
1858	14.950811	ExtremetN_a1:fb:0b	Broadcast	ARP	60	Who has 10.40.10.82? Tell 10.40.0.2
1859	14.950899	ExtremetN_a1:fb:0b	Broadcast	ARP	60	Who has 10.40.1.61? Tell 10.40.0.2
1865	14.954253	ExtremetN_a1:fb:0b	Broadcast	ARP	60	Who has 10.40.12.131? Tell 10.40.0.2
1871	15.019179	AzureWav_47:44:8b	Broadcast	ARP	42	Who has 10.40.7.253? Tell 10.40.8.59
1873	15.031378	IntelCor_27:14:6a	AzureWav_47:44:8b	ARP	60	10.40.7.253 is at 14:85:7f:27:14:6a
1878	15.052878	CloudNet_5c:a6:75	Broadcast	ARP	60	Who has 10.40.11.38? Tell 10.40.21.159
1881	15.054398	IntelCor_01:6e:18	Broadcast	ARP	60	Who has 10.40.7.253? Tell 10.40.24.155
1882	15.054491	IntelCor_63:fd:6c	Broadcast	ARP	60	Who has 10.40.7.253? Tell 10.40.6.199
1883	15.054512	AzureWav_e3:78:6b	Broadcast	ARP	60	Who has 10.40.7.253? Tell 10.40.1.20
1884	15.054526	CloudNet_8e:15:4b	Broadcast	ARP	60	Who has 10.40.7.253? Tell 10.40.11.213
1885	15.055147	IntelCor_42:45:1e	Broadcast	ARP	60	Who has 10.40.7.253? Tell 10.40.7.242
1886	15.055175	LiteonTe_71:8f:f5	Broadcast	ARP	60	Who has 10.40.7.253? Tell 10.40.13.89
1887	15.055903	CloudNet_03:a1:f9	Broadcast	ARP	60	Who has 10.40.7.253? Tell 10.40.11.34
1895	15.156070	ExtremetN_a1:fb:0b	Broadcast	ARP	60	Who has 10.40.14.154? Tell 10.40.0.2
1899	15.157223	a6:9d:b7:24:c3:c1	Broadcast	ARP	42	Who has 10.40.2.211? Tell 10.40.13.235
1902	15.256641	ExtremetN_a1:fb:0b	Broadcast	ARP	60	Who has 10.40.19.57? Tell 10.40.0.2
1930	15.266949	CloudNet_b1:56:e5	Broadcast	ARP	60	Who has 10.40.14.79? Tell 10.40.0.74

> Frame 1873: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface \DeviceNPF...
> Ethernet II, Src: IntelCor_27:14:6a (14:85:7f:27:14:6a), Dst: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)
 Address Resolution Protocol (reply)
 Hardware type: Ethernet (1)
 Protocol type: IPv4 (0x0800)
 Hardware size: 6
 Protocol size: 4
 Opcode: reply (2)
 Sender MAC address: IntelCor_27:14:6a (14:85:7f:27:14:6a)
 Sender IP address: 10.40.7.253
 Target MAC address: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)
 Target IP address: 10.40.8.59

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

Ans: 20 bytes.

> Frame 1873: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface \Device\NPF	0000	e8 fb 1c 47 44 8b 14 85 7f 27 14 6a 08 06 00 01	...GD...'.j...
> Ethernet II, Src: IntelCor_27:14:6a (14:85:7f:27:14:6a), Dst: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)	0010	08 00 06 04 00 02 14 85 7f 27 14 6a 0a 28 07 fd	....j.(...
> Address Resolution Protocol (reply)	0020	e8 fb 1c 47 44 8b 0a 28 08 3b 00 00 00 00 00 00	...GD..(;
Hardware type: Ethernet (1)	0030	00 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: IntelCor_27:14:6a (14:85:7f:27:14:6a)			
Sender IP address: 10.40.7.253			
Target MAC address: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)			
Target IP address: 10.40.8.59			

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?

Ans: opcode field = 00 02

e8 fb 1c 47 44 8b 14 85 7f 27 14 6a 08 06 00 01	...GD...'.j...
08 00 06 04 00 02 14 85 7f 27 14 6a 0a 28 07 fd	....j.(...
e8 fb 1c 47 44 8b 0a 28 08 3b 00 00 00 00 00 00	...GD..(;
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....

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?

Ans: The answer to the earlier ARP request appears in the Sender MAC address field, which contains the Ethernet address 14:85:7f:27:14:6a for the sender with IP address 10.40.7.253.

> Address Resolution Protocol (reply)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: reply (2)
Sender MAC address: IntelCor_27:14:6a (14:85:7f:27:14:6a)
Sender IP address: 10.40.7.253
Target MAC address: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)
Target IP address: 10.40.8.59

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

Ans: The hex value for the source address is 14:85:7f:27:14:6a and for the destination is e8:fb:1c:47:44:8b.

```

  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: IntelCor_27:14:6a (14:85:7f:27:14:6a)
    Sender IP address: 10.40.7.253
    Target MAC address: AzureWav_47:44:8b (e8:fb:1c:47:44:8b)
    Target IP address: 10.40.8.59

```

7. Open the ethernet-ethereal-trace-1 trace file in <http://gaia.cs.umass.edu/wireshark-labs/wireshark-traces.zip>. The first and second ARP packets in this trace correspond to an ARP request sent by the computer running Wireshark, and the ARP reply sent to the computer running Wireshark by the computer with the ARP-requested Ethernet address. But there is yet another computer on this network, as indicated by packet 6 – another ARP request. Why is there no ARP reply (sent in response to the ARP request in packet 6) in the packet trace?

Ans: The ARP request is broadcast, but the ARP reply is sent back directly to the sender's Ethernet address.