

HO CHI MINH UNIVERSITY OF TECHNOLOGY
Faculty of Computer Science and Engineering



Computer Networks

Report for lab 6

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

Answer: The 48-bit Ethernet address of my computer is 70:66:55:5b:72:7f

No.	Time	Source	Destination	Protocol	Length	Info
33	07:20:21.694818	fe80::b4cb:9880:5fd...	ff02::1:3	LLMNR	84	Standard query 0xc
34	07:20:21.695080	AzureWav_5b:72:7f	IPv4mcast_fc	0x0800	64	IPv4
35	07:20:21.806523	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	55	IPv4
36	07:20:21.806524	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	55	IPv4
37	07:20:21.867107	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
38	07:20:21.867107	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
39	07:20:21.870996	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	66	IPv4
40	07:20:22.001471	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
41	07:20:22.001636	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	54	IPv4
42	07:20:22.002329	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	541	IPv4
43	07:20:22.106769	fe80::b4cb:9880:5fd...	ff02::1:3	LLMNR	84	Standard query 0xc
44	07:20:22.106938	AzureWav_5b:72:7f	IPv4mcast_fc	0x0800	64	IPv4
45	07:20:22.128154	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4

> Frame 42: 541 bytes on wire (4328 bits), 541 bytes captured (4328 bits) on interface \Device\NPF_{3219B7}

Ethernet II, Src: AzureWav_5b:72:7f (70:66:55:5b:72:7f), Dst: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

Destination: HewlettP_4d:44:ac (00:26:55:4d:44:ac)
Address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)
.....0. = LG bit: Globally unique address (factory default)
.....0. = IG bit: Individual address (unicast)

Source: AzureWav_5b:72:7f (70:66:55:5b:72:7f)
Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)
.....0. = LG bit: Globally unique address (factory default)
.....0. = IG bit: Individual address (unicast)

Type: IPv4 (0x0800)

> Data (527 bytes)

0000 00 26 55 4d 44 ac 70 66 55 5b 72 7f 08 00 45 00 -&UMD-pf U[r...E-
0010 02 0f 72 a8 40 00 80 06 73 c3 0a 80 92 79 80 77 --r-@---s---y-w
0020 f5 0c ee b0 00 50 9d df a1 0d 23 cc d8 76 50 18P-..#...vP.
0030 02 00 78 ca 00 00 47 45 54 20 2f 77 69 72 65 73 --x...GE T /wires
0040 68 61 72 6b 2d 6c 61 62 73 2f 48 54 54 50 2d 65 hark-lab s/HTTP-e
0050 74 68 65 72 65 61 6c 2d 6c 61 62 2d 66 69 6c 65 thereal- lab-file
0060 33 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d 3.html H TTP/1.1
0070 0a 48 6f 73 74 3a 20 67 61 69 61 2e 63 73 2e 75 -Host: g aia.cs.u
0080 6d 61 73 73 2e 65 64 75 0d 0a 43 6f 6e 6e 65 63 mass.edu --Connec
0090 74 69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 tion: ke ep-alive
00a0 0d 0a 44 4e 54 3a 20 31 0d 0a 55 70 67 72 61 64 --DNT: 1 --Upgrad

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?

Answer: The 48-bit destination address in the Ethernet frame is 00:26:55:4d:44:ac. This is not the address of gaia.cs.umass.edu. This is the address of the router that my computer has to go through in order to reach the destination.

No.	Time	Source	Destination	Protocol	Length	Info
33	07:20:21.694818	fe80::b4cb:9880:5fd...	ff02::1:3	LLMNR	84	Standard query 0xc
34	07:20:21.695080	AzureWav_5b:72:7f	IPv4mcast_fc	0x0800	64	IPv4
35	07:20:21.806523	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	55	IPv4
36	07:20:21.806524	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	55	IPv4
37	07:20:21.867107	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
38	07:20:21.867107	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
39	07:20:21.870996	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	66	IPv4
40	07:20:22.001471	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
41	07:20:22.001636	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	54	IPv4
42	07:20:22.002329	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	541	IPv4
43	07:20:22.106769	fe80::b4cb:9880:5fd...	ff02::1:3	LLMNR	84	Standard query 0xc
44	07:20:22.106938	AzureWav_5b:72:7f	IPv4mcast_fc	0x0800	64	IPv4
45	07:20:22.128154	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4

> Frame 42: 541 bytes on wire (4328 bits), 541 bytes captured (4328 bits) on interface \Device\NPF_{3219B71}

▼ Ethernet II, Src: AzureWav_5b:72:7f (70:66:55:5b:72:7f), Dst: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

Destination: HewlettP_4d:44:ac (00:26:55:4d:44:ac)
Address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)
.... ..0. = LG bit: Globally unique address (factory default)
.... ..0. = IG bit: Individual address (unicast)

Source: AzureWav_5b:72:7f (70:66:55:5b:72:7f)
Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)
.... ..0. = LG bit: Globally unique address (factory default)
.... ..0. = IG bit: Individual address (unicast)

Type: IPv4 (0x0800)

> Data (527 bytes)

0000	00 26 55 4d 44 ac 70 66 55 5b 72 7f 08 00 45 00	..&UMD.pf U[r...E.
0010	02 0f 72 a8 40 00 80 06 73 c3 0a 80 92 79 80 77	..r.@... s...y.w
0020	f5 0c ee b0 00 50 9d df a1 0d 23 cc d8 76 50 18	....P... ..#..vP.
0030	02 00 78 ca 00 00 47 45 54 20 2f 77 69 72 65 73	..x...GE T /wires
0040	68 61 72 6b 2d 6c 61 62 73 2f 48 54 54 50 2d 65	hark-lab s/HTTP-e
0050	74 68 65 72 65 61 6c 2d 6c 61 62 2d 66 69 6c 65	thereal- lab-file
0060	33 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d	3.html H TTP/1.1.
0070	0a 48 6f 73 74 3a 20 67 61 69 61 2e 63 73 2e 75	..Host: g aia.cs.u
0080	6d 61 73 73 2e 65 64 75 0d 0a 43 6f 6e 6e 65 63	mass.edu ..Connec
0090	74 69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65	tion: ke ep-alive
00a0	0d 0a 44 4e 54 3a 20 31 0d 0a 55 70 67 72 61 64	..DNT: 1 ..Upgrad

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

Answer: The hexadecimal value for the two-byte frame type field is 0x0800. This corresponds to the IP protocol (the frame type field indicates that the next layer above IP – the layer to which the payload of the Ethernet frame will connect to IP.

No.	Time	Source	Destination	Protocol	Length	Info
33	07:20:21.694818	fe80::b4cb:9880:5fd...	ff02::1:3	LLMNR	84	Standard query 0xc
34	07:20:21.695080	AzureWav_5b:72:7f	IPv4mcast_fc	0x0800	64	IPv4
35	07:20:21.806523	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	55	IPv4
36	07:20:21.806524	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	55	IPv4
37	07:20:21.867107	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
38	07:20:21.867107	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
39	07:20:21.870996	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	66	IPv4
40	07:20:22.001471	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
41	07:20:22.001636	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	54	IPv4
42	07:20:22.002329	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	541	IPv4
43	07:20:22.106769	fe80::b4cb:9880:5fd...	ff02::1:3	LLMNR	84	Standard query 0xc
44	07:20:22.106938	AzureWav_5b:72:7f	IPv4mcast_fc	0x0800	64	IPv4
45	07:20:22.128154	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4

> Frame 42: 541 bytes on wire (4328 bits), 541 bytes captured (4328 bits) on interface \Device\NPF_{3219B7}

Ethernet II, Src: AzureWav_5b:72:7f (70:66:55:5b:72:7f), Dst: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

Destination: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

Address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

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

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

Source: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

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

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

Type: IPv4 (0x0800)

> Data (527 bytes)

0000	00 26 55 4d 44 ac 70 66 55 5b 72 7f 08 00 45 00	..&UMD.pf U[r...E-
0010	02 0f 72 a8 40 00 80 06 73 c3 0a 80 92 79 80 77	..r.@... s...y.w
0020	f5 0c ee b0 00 50 9d df a1 0d 23 cc d8 76 50 18	....P... ..#..vP.
0030	02 00 78 ca 00 00 47 45 54 20 2f 77 69 72 65 73	..x...GE T /wires
0040	68 61 72 6b 2d 6c 61 62 73 2f 48 54 54 50 2d 65	hark-lab s/HTTP-e
0050	74 68 65 72 65 61 6c 2d 6c 61 62 2d 66 69 6c 65	thereal- lab-file
0060	33 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d	3.html H TTP/1.1.
0070	0a 48 6f 73 74 3a 20 67 61 69 61 2e 63 73 2e 75	..Host: g aia.cs.u
0080	6d 61 73 73 2e 65 64 75 0d 0a 43 6f 6e 6e 65 63	mass.edu ..Connec
0090	74 69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65	tion: ke ep-alive
00a0	0d 0a 44 4e 54 3a 20 31 0d 0a 55 70 67 72 61 64	..DNT: 1 ..Upgrad

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

Answer: The ASCII “G” appears 54 bytes from the start of the Ethernet frame.

- The ethernet frame (first 14 bytes containing destination address, source address, and frame type)
- The IP header (20 bytes)
- The TCP header (20 bytes)

0000	00	26	55	4d	44	ac	70	66	55	5b	72	7f	08	00	45	00	..&UMD..pf U[r...E..
0010	02	0f	72	a8	40	00	80	06	73	c3	0a	80	92	79	80	77	..r.@... s....y.w
0020	f5	0c	ee	b0	00	50	9d	df	a1	0d	23	cc	d8	76	50	18	.....P... ..#...vP.
0030	02	00	78	ca	00	00	47	45	54	20	2f	77	69	72	65	73	..x...GE T /wires
0040	68	61	72	6b	2d	6c	61	62	73	2f	48	54	54	50	2d	65	hark-lab s/HTTP-e
0050	74	68	65	72	65	61	6c	2d	6c	61	62	2d	66	69	6c	65	thereal- lab-file
0060	33	2e	68	74	6d	6c	20	48	54	54	50	2f	31	2e	31	0d	3.html H TTP/1.1.
0070	0a	48	6f	73	74	3a	20	67	61	69	61	2e	63	73	2e	75	..Host: g aia.cs.u
0080	6d	61	73	73	2e	65	64	75	0d	0a	43	6f	6e	6e	65	63	mass.edu ..Connec
0090	74	69	6f	6e	3a	20	6b	65	65	70	2d	61	6c	69	76	65	tion: ke ep-alive
00a0	0d	0a	44	4e	54	3a	20	31	0d	0a	55	70	67	72	61	64	..DNT: 1 ..Upgrad
00b0	65	2d	49	6e	73	65	63	75	72	65	2d	52	65	71	75	65	e-Insecu re-Reque
00c0	73	74	73	3a	20	31	0d	0a	55	73	65	72	2d	41	67	65	sts: 1.. User-Age
00d0	6e	74	3a	20	4d	6f	7a	69	6c	6c	61	2f	35	2e	30	20	nt: Mozi lla/5.0
00e0	28	57	69	6e	64	6f	77	73	20	4e	54	20	31	30	2e	30	(Windows NT 10.0
00f0	3b	20	57	69	6e	36	34	3b	20	78	36	34	29	20	41	70	; Win64; x64) Ap
0100	70	6c	65	57	65	62	4b	69	74	2f	35	33	37	2e	33	36	pleWebKi t/537.36
0110	20	28	4b	48	54	4d	4c	2c	20	6c	69	6b	65	20	47	65	(KHTML, like Ge
0120	63	6b	6f	29	20	43	68	72	6f	6d	65	2f	38	36	2e	30	cko) Chr ome/86.0
0130	2e	34	32	34	30	2e	31	39	38	20	53	61	66	61	72	69	.4240.19 8 Safari

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?

Answer: The value of the Ethernet source address is 00:26:55:4d:44:ac, this is not the address of my computer or gaia.cs.umass.edu. This is once again the address of the router that has recieved the ok message and forwarded it to my computer.

No.	Time	Source	Destination	Protocol	Length	Info
40	07:20:22.001471	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
41	07:20:22.001636	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	54	IPv4
42	07:20:22.002329	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	541	IPv4
43	07:20:22.106769	fe80::b4cb:9880:5fd...	ff02::1:3	LLMNR	84	Standard
44	07:20:22.106938	AzureWav_5b:72:7f	IPv4mcast_fc	0x0800	64	IPv4
45	07:20:22.128154	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	68	IPv4
46	07:20:22.128316	AzureWav_5b:72:7f	HewlettP_4d:44:ac	0x0800	54	IPv4
47	07:20:22.305045	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	56	IPv4
48	07:20:22.312376	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	1466	IPv4
49	07:20:22.312711	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	1466	IPv4

> Frame 48: 1466 bytes on wire (11728 bits), 1466 bytes captured (11728 bits) on interface \Device\NPF...

Ethernet II, Src: HewlettP_4d:44:ac (00:26:55:4d:44:ac), Dst: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

Destination: AzureWav_5b:72:7f (70:66:55:5b:72:7f)
 Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)
0. = LG bit: Globally unique address (factory default)
0. = IG bit: Individual address (unicast)

Source: HewlettP_4d:44:ac (00:26:55:4d:44:ac)
 Address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)
0. = LG bit: Globally unique address (factory default)
0. = IG bit: Individual address (unicast)

Type: IPv4 (0x0800)

0000	70 66 55 5b 72 7f 00 26 55 4d 44 ac 08 00 45 20	pfU[r...& UMD...E
0010	05 ac 9e 08 40 00 2b 06 99 a6 80 77 f5 0c 0a 80	....@.+...w....
0020	92 79 00 50 ee b0 23 cc d8 76 9d df a2 f4 50 10	..y.P...#...v....P.
0030	00 ed 0b f2 00 00 48 54 54 50 2f 31 2e 31 20 32	.....HT TP/1.1 2
0040	30 30 20 4f 4b 0d 0a 44 61 74 65 3a 20 4d 6f 6e	00 OK...D ate: Mon
0050	2c 20 32 33 20 4e 6f 76 20 32 30 32 30 20 30 30	, 23 Nov 2020 00
0060	3a 32 30 3a 32 31 20 47 4d 54 0d 0a 53 65 72 76	:20:21 G MT...Serv
0070	65 72 3a 20 41 70 61 63 68 65 2f 32 2e 34 2e 36	er: Apac he/2.4.6
0080	20 28 43 65 6e 74 4f 53 29 20 4f 70 65 6e 53 53	(CentOS) OpenSS
0090	4c 2f 31 2e 30 2e 32 6b 2d 66 69 70 73 20 50 48	L/1.0.2k -fips PH
00a0	50 2f 37 2e 34 2e 31 32 20 6d 6f 64 5f 70 65 72	P/7.4.12 mod_per
00b0	6c 2f 32 2e 30 2e 31 31 20 50 65 72 6c 2f 76 35	l/2.0.11 Perl/v5

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

Answer: The destination address is 70:66:55:5b:72:7f. This is the address This is the address of my computer.

47	07:20:22.305045	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	56 IPv4
48	07:20:22.312376	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	1466 IPv4
49	07:20:22.312711	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	1466 IPv4

> Frame 48: 1466 bytes on wire (11728 bits), 1466 bytes captured (11728 bits) on interface \Device\NPF_{32...}

▼ Ethernet II, Src: HewlettP_4d:44:ac (00:26:55:4d:44:ac), Dst: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

 ▼ Destination: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

 Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

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

 0. = IG bit: Individual address (unicast)

 ▼ Source: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

 Address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

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

 0. = IG bit: Individual address (unicast)

 Type: IPv4 (0x0800)

0000	70 66 55 5b 72 7f 00 26	55 4d 44 ac 08 00 45 20	pfU[r...& UMD...E
0010	05 ac 9e 08 40 00 2b 06	99 a6 80 77 f5 0c 0a 80	...@...w...
0020	92 79 00 50 ee b0 23 cc	d8 76 9d df a2 f4 50 10	.y.P...#...v...P.
0030	00 ed 0b f2 00 00 48 54	54 50 2f 31 2e 31 20 32	.....HT TP/1.1 2
0040	30 30 20 4f 4b 0d 0a 44	61 74 65 3a 20 4d 6f 6e	00 OK..D ate: Mon
0050	2c 20 32 33 20 4e 6f 76	20 32 30 32 30 20 30 30	, 23 Nov 2020 00
0060	3a 32 30 3a 32 31 20 47	4d 54 0d 0a 53 65 72 76	:20:21 G MT..Serv
0070	65 72 3a 20 41 70 61 63	68 65 2f 32 2e 34 2e 36	er: Apac he/2.4.6
0080	20 28 43 65 6e 74 4f 53	29 20 4f 70 65 6e 53 53	(CentOS) OpenSS
0090	4c 2f 31 2e 30 2e 32 6b	2d 66 69 70 73 20 50 48	L/1.0.2k -fips PH
00a0	50 2f 37 2e 34 2e 31 32	20 6d 6f 64 5f 70 65 72	P/7.4.12 mod_per
00b0	6c 2f 32 2e 30 2e 31 31	20 50 65 72 6c 2f 76 35	l/2.0.11 Perl/v5
00c0	2e 31 36 2e 33 0d 0a 4c	61 73 74 2d 4d 6f 64 69	.16.3..L ast-Modi

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

Answer: The hex value of this field is 0x0800. This corresponds to the IP protocol.

47	07:20:22.305045	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	56 IPv4
48	07:20:22.312376	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	1466 IPv4
49	07:20:22.312711	HewlettP_4d:44:ac	AzureWav_5b:72:7f	0x0800	1466 IPv4

> Frame 48: 1466 bytes on wire (11728 bits), 1466 bytes captured (11728 bits) on interface \Device\NPF_{32...}

▼ Ethernet II, Src: HewlettP_4d:44:ac (00:26:55:4d:44:ac), Dst: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

 ▼ Destination: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

 Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

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

 0. = IG bit: Individual address (unicast)

 ▼ Source: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

 Address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)

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

 0. = IG bit: Individual address (unicast)

 Type: IPv4 (0x0800)

0000	70 66 55 5b 72 7f 00 26	55 4d 44 ac 08 00 45 20	pfU[r...& UMD...E
0010	05 ac 9e 08 40 00 2b 06	99 a6 80 77 f5 0c 0a 80	...@...w...
0020	92 79 00 50 ee b0 23 cc	d8 76 9d df a2 f4 50 10	.y.P...#...v...P.
0030	00 ed 0b f2 00 00 48 54	54 50 2f 31 2e 31 20 32	.....HT TP/1.1 2
0040	30 30 20 4f 4b 0d 0a 44	61 74 65 3a 20 4d 6f 6e	00 OK..D ate: Mon
0050	2c 20 32 33 20 4e 6f 76	20 32 30 32 30 20 30 30	, 23 Nov 2020 00
0060	3a 32 30 3a 32 31 20 47	4d 54 0d 0a 53 65 72 76	:20:21 G MT..Serv
0070	65 72 3a 20 41 70 61 63	68 65 2f 32 2e 34 2e 36	er: Apac he/2.4.6
0080	20 28 43 65 6e 74 4f 53	29 20 4f 70 65 6e 53 53	(CentOS) OpenSS
0090	4c 2f 31 2e 30 2e 32 6b	2d 66 69 70 73 20 50 48	L/1.0.2k -fips PH
00a0	50 2f 37 2e 34 2e 31 32	20 6d 6f 64 5f 70 65 72	P/7.4.12 mod_per
00b0	6c 2f 32 2e 30 2e 31 31	20 50 65 72 6c 2f 76 35	l/2.0.11 Perl/v5
00c0	2e 31 36 2e 33 0d 0a 4c	61 73 74 2d 4d 6f 64 69	.16.3..L ast-Modi

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?

Answer: There are 67 bytes before the “O” (or “O” appears as the 68th byte). These bytes include the ethernet frame, the IP header, the TCP header, and some HTTP preamble text.

0000	70 66 55 5b 72 7f 00 26 55 4d 44 ac 08 00 45 20	pfU[r- & UMD- -E
0010	05 ac 9e 08 40 00 2b 06 99 a6 80 77 f5 0c 0a 80	....@+. .w....
0020	92 79 00 50 ee b0 23 cc d8 76 9d df a2 f4 50 10	.y.P..#. .v....P.
0030	00 ed 0b f2 00 00 48 54 54 50 2f 31 2e 31 20 32	.....HT TP/1.1 2
0040	30 30 20 4f 4b 0d 0a 44 61 74 65 3a 20 4d 6f 6e	00 OK.D ate: Mon
0050	2c 20 32 33 20 4e 6f 76 20 32 30 32 30 20 30 30	, 23 Nov 2020 00
0060	3a 32 30 3a 32 31 20 47 4d 54 0d 0a 53 65 72 76	:20:21 G MT..Serv
0070	65 72 3a 20 41 70 61 63 68 65 2f 32 2e 34 2e 36	er: Apac he/2.4.6
0080	20 28 43 65 6e 74 4f 53 29 20 4f 70 65 6e 53 53	(CentOS) OpenSS
0090	4c 2f 31 2e 30 2e 32 6b 2d 66 69 70 73 20 50 48	L/1.0.2k -fips PH
00a0	50 2f 37 2e 34 2e 31 32 20 6d 6f 64 5f 70 65 72	P/7.4.12 mod_per
00b0	6c 2f 32 2e 30 2e 31 31 20 50 65 72 6c 2f 76 35	l/2.0.11 Perl/v5
00c0	2e 31 36 2e 33 0d 0a 4c 61 73 74 2d 4d 6f 64 69	.16.3..L ast-Modi
00d0	66 69 65 64 3a 20 53 75 6e 2c 20 32 32 20 4e 6f	fied: Su n, 22 No
00e0	76 20 32 30 32 30 20 30 36 3a 35 39 3a 30 31 20	v 2020 0 6:59:01
00f0	47 4d 54 0d 0a 45 54 61 67 3a 20 22 31 31 39 34	GMT..ETa g: "1194
0100	2d 35 62 34 61 63 39 63 63 35 66 63 37 39 22 0d	-5b4ac9c c5fc79".
0110	0a 41 63 63 65 70 74 2d 52 61 6e 67 65 73 3a 20	-Accept- Ranges:
0120	62 79 74 65 73 0d 0a 43 6f 6e 74 65 6e 74 2d 4c	bytes..C ontent-L

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

Answer: The columns show the internet address (IPv4) and the physical address (Ethernet). The last column shows whether the IPv4 address is dynamic or static.


```
C:\Users\Admin>arp -a

Interface: 10.128.146.121 --- 0x5
    Internet Address      Physical Address      Type
    10.128.0.1            00-26-55-4d-44-ac    dynamic
    10.128.255.255        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
    224.0.0.252           01-00-5e-00-00-fc    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 --- 0x8
    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

Interface: 169.254.168.189 --- 0xe
    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
    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
    255.255.255.255       ff-ff-ff-ff-ff-ff    static
```

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

Answer: The source address is (70:66:55:5b:72:7f), the destination address is (ff:ff:ff:ff:ff:ff). The source address is the Ethernet address of my computer and the destination address is broadcast.

No.	Time	Source	Destination	Protocol	Length	Info
2	08:29:18.226436	AzureWav_5b:72:7f	Broadcast	ARP	42	Who has 10.128.0.1? Tell 10.128.146.121
3	08:29:18.237767	HewlettP_4d:44:ac	AzureWav_5b:72:7f	ARP	56	10.128.0.1 is at 00:26:55:4d:44:ac

<

> Frame 2: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{3219B7F4-C797-4F0F-9E1A-7D5DFE741F02}

> Ethernet II, Src: AzureWav_5b:72:7f (70:66:55:5b:72:7f), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

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

> Source: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

Type: ARP (0x0806)

> Address Resolution Protocol (request)

0000	ff ff ff ff ff ff 70 66 55 5b 72 7f 08 06 00 01	.....pf U[r.....
0010	08 00 06 04 00 01 70 66 55 5b 72 7f 0a 80 92 79	.....pf U[r.....y
0020	00 00 00 00 00 00 0a 80 00 01	.....

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

Answer: The type value is 0x0806 which corresponds to ARP.

No.	Time	Source	Destination	Protocol	Length	Info
2	08:29:18.226436	AzureWav_5b:72:7f	Broadcast	ARP	42	Who has 10.128.0.1? Tell 10.128.146.121
3	08:29:18.237767	HewlettP_4d:44:ac	AzureWav_5b:72:7f	ARP	56	10.128.0.1 is at 00:26:55:4d:44:ac

<

> Frame 2: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{3219B7F4-C797-4F0F-9E1A-7D5DFE741F02}

> Ethernet II, Src: AzureWav_5b:72:7f (70:66:55:5b:72:7f), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

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

> Source: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

Type: ARP (0x0806)

> Address Resolution Protocol (request)

0000	ff ff ff ff ff ff 70 66 55 5b 72 7f 08 06 00 01	.....pf U[r.....
0010	08 00 06 04 00 01 70 66 55 5b 72 7f 0a 80 92 79pf U[r.....y
0020	00 00 00 00 00 00 0a 80 00 01

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12/

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

Answer: The opcode field starts 20 bytes from the beginning of the 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?

Answer: The opcode has a hex value of 0x0001, which is for request.

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

Answer: The ARP message contains the IP address 10.128.0.1

No.	Time	Source	Destination	Protocol	Length	Info
2	08:29:18.226436	AzureWav_5b:72:7f	Broadcast	ARP	42	Who has 10.128.0.1? Tell 10.128.146.121
3	08:29:18.237767	HewlettP_4d:44:ac	AzureWav_5b:72:7f	ARP	56	10.128.0.1 is at 00:26:55:4d:44:ac

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

Answer: The "question" is in the field Target MAC address, which is set to :00:00:00:00:00

No.	Time	Source	Destination	Protocol	Length	Info
2	08:29:18.226436	AzureWav_5b:72:7f	Broadcast	ARP	42	Who has 10.128.0.1? Tell 10.128.146.121
3	08:29:18.237767	HewlettP_4d:44:ac	AzureWav_5b:72:7f	ARP	56	10.128.0.1 is at 00:26:55:4d:44:ac

<p>> Frame 2: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{3219B7F4-C797-4F0F-9E1A-7D5DFE741F02}.</p> <p>▼ Ethernet II, Src: AzureWav_5b:72:7f (70:66:55:5b:72:7f), Dst: Broadcast (ff:ff:ff:ff:ff:ff)</p> <p> ▼ Destination: Broadcast (ff:ff:ff:ff:ff:ff)</p> <p> Address: Broadcast (ff:ff:ff:ff:ff:ff)</p> <p> ...1. = LG bit: Locally administered address (this is NOT the factory default)</p> <p> ...1. = IG bit: Group address (multicast/broadcast)</p> <p> ▼ Source: AzureWav_5b:72:7f (70:66:55:5b:72:7f)</p> <p> Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)</p> <p> ...0. = LG bit: Globally unique address (factory default)</p> <p> ...0. = IG bit: Individual address (unicast)</p> <p> Type: ARP (0x0806)</p> <p>▼ Address Resolution Protocol (request)</p> <p> Hardware type: Ethernet (1)</p> <p> Protocol type: IPv4 (0x0800)</p> <p> Hardware size: 6</p> <p> Protocol size: 4</p> <p> Opcode: request (1)</p> <p> Sender MAC address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)</p> <p> Sender IP address: 10.128.146.121</p> <p> Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)</p> <p> Target IP address: 10.128.0.1</p>						
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13/

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

Answer: The opcode field begins 20 bytes from the beginning of the 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?

Answer: The hex value for opcode field withing the ARP-payload of the request is 0x0002, for reply message.

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?

Answer: The answer to the earlier ARP request appears in the “Sender MAC address” field, which contains the Ethernet address 00:26:55:4d:dd:ac for the sender with IP address 10.128.0.1

arp						
No.	Time	Source	Destination	Protocol	Length	Info
2	08:29:18.226436	AzureWav_5b:72:7f	Broadcast	ARP	42	Who has 10.128.0.1? Tell 10.128.146.121
3	08:29:18.237767	HewlettP_4d:44:ac	AzureWav_5b:72:7f	ARP	56	10.128.0.1 is at 00:26:55:4d:44:ac

<p>> Frame 3: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface \Device\NPF_{3219B7F4-C797-4F0F-9E1A-7D5DFE741F0}</p> <p>✓ Ethernet II, Src: HewlettP_4d:44:ac (00:26:55:4d:44:ac), Dst: AzureWav_5b:72:7f (70:66:55:5b:72:7f)</p> <p> ✓ Destination: AzureWav_5b:72:7f (70:66:55:5b:72:7f)</p> <p> Address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)</p> <p> ...0... = LG bit: Globally unique address (factory default)</p> <p> ...0... = IG bit: Individual address (unicast)</p> <p> ✓ Source: HewlettP_4d:44:ac (00:26:55:4d:44:ac)</p> <p> Address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)</p> <p> ...0... = LG bit: Globally unique address (factory default)</p> <p> ...0... = IG bit: Individual address (unicast)</p> <p> Type: ARP (0x0806)</p> <p> Trailer: 00000000000000000000000000000000</p> <p>✓ Address Resolution Protocol (reply)</p> <p> Hardware type: Ethernet (1)</p> <p> Protocol type: IPv4 (0x0800)</p> <p> Hardware size: 6</p> <p> Protocol size: 4</p> <p> Opcode: reply (2)</p> <p> Sender MAC address: HewlettP_4d:44:ac (00:26:55:4d:44:ac)</p> <p> Sender IP address: 10.128.0.1</p> <p> Target MAC address: AzureWav_5b:72:7f (70:66:55:5b:72:7f)</p> <p> Target IP address: 10.128.146.121</p>						
---	--	--	--	--	--	--

0000	70 66 55 5b 72 7f 00 26 55 4d 44 ac 08 06 00 01	pfU[r...& UMD....
0010	08 00 06 04 00 02 00 26 55 4d 44 ac 0a 80 00 01	.....& UMD....
0020	70 66 55 5b 72 7f 0a 80 92 79 00 00 00 00 00 00	pfU[r...y.....

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

Answer: The source is (00:26:55:4d:44:ac), Destination (70:66:55:5b:72:7f)

arp						
No.	Time	Source	Destination	Protocol	Length	Info
2	08:29:18.226436	AzureWav_5b:72:7f	Broadcast	ARP	42	Who has 10.128.0.1? Tell 10.128.146.121
3	08:29:18.237767	HewlettP_4d:44:ac	AzureWav_5b:72:7f	ARP	56	10.128.0.1 is at 00:26:55:4d:44:ac

> Frame 3: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface \Device\NPF_{321987F4-C797-4F0F-9E1A-7D5DFE741F}

▼ Ethernet II, Src: HewlettP_4d:44:ac (00:26:55:4d:44:ac), Dst: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

Destination: AzureWav_5b:72:7f (70:66:55:5b:72:7f)

15/

Answer: 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.