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CSC323-A
17 October 2017

ARP

1) The 48-bit Ethernet address of my computer is 44:37:e6:1e:0f:b1.
2) The 48-bit destination address of the Ethernet frame is 08:95:2a:2b:1c:6c. This is the Ethernet address of my router.
3) The hex value for my two-byte frame is 0x0800. The upper layer protocol this correspond to is IPv4.
4) In the Ethernet frame, the "G" in GET is 47 bytes.
5) The value of the Ethernet source address is 08:95:2a:1b:1c:6c. The device that has this address is my router.
6) The destination address in the Ethernet frame is 44:37:e6:1e:0f:b1. 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 this corresponds to is IPv4.
8) In the Ethernet frame, the "O" in OK is 44 bytes.
9) The contents of my computer's ARP cache is IP, PA, and Type. IP stands for internet address, PA stands for physical address, and Type stands for protocol type.
10) In the Ethernet frame with the ARP request message, the hexadecimal value for the source address is ec:9b:f3:f9:50:0a, and the hexadecimal value for the destination address is ff:ff:ff:ff:ff:ff.
11) The hexadecimal value for the two-byte Ethernet Frame type field is 0x0806. The upper layer protocol this corresponds to is ARP.
12) From the very beginning of the Ethernet frame, the ARP opcode fields begins at 20 bytes. The value of the opcode within the ARP-payload part of the Ethernet frame is 0x0001. Yes, the ARP contain the IP address of the sender which is 192.168.0.16. In the ARP request, the "question" appears at 00:00:00:00:00:00.
13) In the ARP reply, the opcode field begins at 20 bytes. The value of the opcode field is 2. The "answer" to the earlier ARP request is 08:95:2a:1b:2c:6c.
14) In the ARP reply message, the destination address in hexadecimal value is 08:95:2a:1b:2c:6c, and the source address is the exact same value.
15) There is no reply because my machine is not the one that sent the request. Therefore, I did not receive the reply.

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      216 32.988420       HonHaiPr_1e:0f:b1      Technico_1b:1c:6c       0x0800    423    IPv4
Frame 216: 423 bytes on wire (3384 bits), 423 bytes captured (3384 bits) on interface 0
    Interface id: 0 (\Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB})
        Interface name: \Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB}
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 14, 2017 13:17:16.250492000 Eastern Daylight Time
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1508001436.250492000 seconds
    [Time delta from previous captured frame: 0.000939000 seconds]
    [Time delta from previous displayed frame: 0.000939000 seconds]
    [Time since reference or first frame: 32.988420000 seconds]
    Frame Number: 216
    Frame Length: 423 bytes (3384 bits)
    Capture Length: 423 bytes (3384 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:data]
Ethernet II, Src: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1), Dst: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
    Destination: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
        Address: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
        Address: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Data (409 bytes)
0000  45 00 01 99 62 c7 40 00 80 06 00 00 c0 a8 00 09   E...b.@.........
0010  80 77 f5 0c c7 ae 00 50 2d 90 81 23 c1 f6 61 f4   .w.....P-..#..a.
0020  50 18 40 29 37 c1 00 00 47 45 54 20 2f 77 69 72   P.@)7...GET /wir
0030  65 73 68 61 72 6b 2d 6c 61 62 73 2f 48 54 54 50   eshark-labs/HTTP
0040  2d 65 74 68 65 72 65 61 6c 2d 6c 61 62 2d 66 69   -ethereal-lab-fi
0050  6c 65 33 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e   le3.html HTTP/1.
0060  31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e 63 73   1..Host: gaia.cs
0070  2e 75 6d 61 73 73 2e 65 64 75 0d 0a 55 73 65 72   .umass.edu..User
0080  2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61 2f   -Agent: Mozilla/
0090  35 2e 30 20 28 57 69 6e 64 6f 77 73 20 4e 54 20   5.0 (Windows NT
00a0  36 2e 31 3b 20 57 69 6e 36 34 3b 20 78 36 34 3b   6.1; Win64; x64;
00b0  20 72 76 3a 35 36 2e 30 29 20 47 65 63 6b 6f 2f    rv:56.0) Gecko/
00c0  32 30 31 30 30 31 30 31 20 46 69 72 65 66 6f 78   20100101 Firefox
00d0  2f 35 36 2e 30 0d 0a 41 63 63 65 70 74 3a 20 74   /56.0..Accept: t
00e0  65 78 74 2f 68 74 6d 6c 2c 61 70 70 6c 69 63 61   ext/html,applica
00f0  74 69 6f 6e 2f 78 68 74 6d 6c 2b 78 6d 6c 2c 61   tion/xhtml+xml,a
0100  70 70 6c 69 63 61 74 69 6f 6e 2f 78 6d 6c 3b 71   pplication/xml;q
0110  3d 30 2e 39 2c 2a 2f 2a 3b 71 3d 30 2e 38 0d 0a   =0.9,*/*;q=0.8..
0120  41 63 63 65 70 74 2d 4c 61 6e 67 75 61 67 65 3a   Accept-Language:
0130  20 65 6e 2d 55 53 2c 65 6e 3b 71 3d 30 2e 35 0d    en-US,en;q=0.5.
0140  0a 41 63 63 65 70 74 2d 45 6e 63 6f 64 69 6e 67   .Accept-Encoding
0150  3a 20 67 7a 69 70 2c 20 64 65 66 6c 61 74 65 0d   : gzip, deflate.
0160  0a 43 6f 6e 6e 65 63 74 69 6f 6e 3a 20 6b 65 65   .Connection: kee
0170  70 2d 61 6c 69 76 65 0d 0a 55 70 67 72 61 64 65   p-alive..Upgrade
0180  2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75 65 73   -Insecure-Reques
0190  74 73 3a 20 31 0d 0a 0d 0a                        ts: 1....
    Data: 4500019962c7400080060000c0a800098077f50cc7ae0050...
    [Length: 409]
```

```
   250 34.490497      Technico_1b:1c:6c      HonHaiPr_1e:0f:b1      0x0800   842    IPv4
Frame 250: 842 bytes on wire (6736 bits), 842 bytes captured (6736 bits) on interface 0
    Interface id: 0 (\Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB})
        Interface name: \Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB}
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 14, 2017 13:17:17.752569000 Eastern Daylight Time
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1508001437.752569000 seconds
    [Time delta from previous captured frame: 0.011034000 seconds]
    [Time delta from previous displayed frame: 0.011034000 seconds]
    [Time since reference or first frame: 34.490497000 seconds]
    Frame Number: 250
    Frame Length: 842 bytes (6736 bits)
    Capture Length: 842 bytes (6736 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:data]
Ethernet II, Src: Technico_1b:1c:6c (08:95:2a:1b:1c:6c), Dst: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
    Destination: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
        Address: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
        Address: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Data (828 bytes)
0000  45 00 03 3c 0d 5f 40 00 39 06 cd 79 48 15 5b 1d   E..<._@.9..yH.[.
0010  c0 a8 00 09 00 50 c7 6c f7 9f 51 90 54 7a 28 bf   .....P.l..Q.Tz(.
0020  50 18 01 22 de 40 00 00 48 54 54 50 2f 31 2e 31   P..".@..HTTP/1.1
0030  20 32 30 30 20 4f 4b 0d 0a 41 63 63 65 70 74 2d    200 OK..Accept-
0040  52 61 6e 67 65 73 3a 20 62 79 74 65 73 0d 0a 43   Ranges: bytes..C
0050  61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 6d 61   ache-Control: ma
0060  78 2d 61 67 65 3d 31 37 32 38 30 30 0d 0a 43 6f   x-age=172800..Co
0070  6e 74 65 6e 74 2d 54 79 70 65 3a 20 61 70 70 6c   ntent-Type: appl
0080  69 63 61 74 69 6f 6e 2f 6f 63 73 70 2d 72 65 73   ication/ocsp-res
0090  70 6f 6e 73 65 0d 0a 44 61 74 65 3a 20 53 61 74   ponse..Date: Sat
00a0  2c 20 31 34 20 4f 63 74 20 32 30 31 37 20 31 37   , 14 Oct 2017 17
00b0  3a 31 37 3a 32 34 20 47 4d 54 0d 0a 45 74 61 67   :17:24 GMT..Etag
00c0  3a 20 22 35 39 65 32 30 39 32 39 2d 31 64 37 22   : "59e20929-1d7"
00d0  0d 0a 45 78 70 69 72 65 73 3a 20 4d 6f 6e 2c 20   ..Expires: Mon,
00e0  31 36 20 4f 63 74 20 32 30 31 37 20 31 37 3a 31   16 Oct 2017 17:1
00f0  37 3a 32 34 20 47 4d 54 0d 0a 4c 61 73 74 2d 4d   7:24 GMT..Last-M
0100  6f 64 69 66 69 65 64 3a 20 53 61 74 2c 20 31 34   odified: Sat, 14
0110  20 4f 63 74 20 32 30 31 37 20 31 32 3a 35 35 3a    Oct 2017 12:55:
0120  30 35 20 47 4d 54 0d 0a 53 65 72 76 65 72 3a 20   05 GMT..Server:
0130  45 43 53 20 28 6c 67 61 2f 31 33 41 32 29 0d 0a   ECS (lga/13A2)..
0140  58 2d 43 61 63 68 65 3a 20 48 49 54 0d 0a 43 6f   X-Cache: HIT..Co
0150  6e 74 65 6e 74 2d 4c 65 6e 67 74 68 3a 20 34 37   ntent-Length: 47
0160  31 0d 0a 0d 0a 30 82 01 d3 0a 01 00 a0 82 01 cc   1....0..........
0170  30 82 01 c8 06 09 2b 06 01 05 05 07 30 01 01 04   0.....+.....0...
0180  82 01 b9 30 82 01 b5 30 81 9e a2 16 04 14 0f 80   ...0...0........
0190  61 1c 82 31 61 d5 2f 28 e7 8d 46 38 b4 2c e1 c6   a..1a./(..F8.,..
01a0  d9 e2 18 0f 32 30 31 37 31 30 31 34 31 32 30 39   ....201710141209
01b0  34 33 5a 30 73 30 71 30 49 30 09 06 05 2b 0e 03   43Z0s0q0I0...+..
01c0  02 1a 05 00 04 14 10 5f a6 7a 80 08 9d b5 27 9f   ......._.z....'.
01d0  35 ce 83 0b 43 88 9e a3 c7 0d 04 14 0f 80 61 1c   5...C.........a.
01e0  82 31 61 d5 2f 28 e7 8d 46 38 b4 2c e1 c6 d9 e2   .1a./(..F8.,....
01f0  02 10 07 10 8b 20 9e d3 45 6c ee 88 94 91 44 c4   ..... ..El....D.
0200  56 0c 80 00 18 0f 32 30 31 37 31 30 31 34 31 32   V.....2017101412
0210  30 39 34 33 5a a0 11 18 0f 32 30 31 37 31 30 32   0943Z....2017102
0220  31 31 31 32 34 34 33 5a 30 0d 06 09 2a 86 48 86   1112443Z0...*.H.
0230  f7 0d 01 01 0b 05 00 03 82 01 01 00 ca df 03 9c   ................
0240  3d a0 a2 e7 e0 21 85 9a dc 61 85 6e d6 a6 ef 92   =....!...a.n....
0250  5e 5f 57 27 01 7e 78 24 51 cf e5 57 2c be 9c 93   ^_W'.~x$Q..W,...
0260  00 9a ce 71 ea 74 4d 92 5a ff 65 22 32 cc f9 33   ...q.tM.Z.e"2..3
0270  04 71 ac b7 94 74 11 fc 02 c2 cb 17 0a c7 fe 4d   .q...t.........M
0280  44 ad eb e6 bf f6 64 6a 43 b0 13 03 83 63 8d b8   D.....djC....c..
0290  b5 2a 09 55 16 cc e9 5b b6 f0 a3 2a c9 6c 11 9e   .*.U...[...*.l..
02a0  60 f2 e1 18 77 aa da 04 2c b8 4d 94 33 72 4a c0   `...w...,.M.3rJ.
02b0  f5 0c ce 85 f8 0c 21 94 95 a5 14 bd c2 a6 be a5   ......!.........
02c0  76 d4 3c 18 9c 3d 0f 09 b2 63 9a 99 34 09 7e a7   v.<..=...c..4.~.
02d0  cd 66 5f fc 85 d9 8c 55 aa 5e 07 a7 e5 7c 6b f9   .f_....U.^...|k.
02e0  6a 5b c4 d0 13 2b 87 81 e8 e4 45 a2 b4 41 70 15   j[...+....E..Ap.
02f0  28 2f ea 60 7c 9e fa 40 4d 2a ed cb 6a 6b 11 01   (/.`|..@M*..jk..
0300  20 c0 65 2f c9 d8 0b e7 09 e4 c3 87 da 46 e1 24    .e/.........F.$
0310  e3 b7 4d 59 dd 1f b7 9d 2e 33 dd 5b a5 b4 fa e5   ..MY.....3.[....
0320  67 9e d4 26 80 bb df c2 9a 64 11 64 05 37 98 73   g..&.....d.d.7.s
0330  8a db 65 95 1b 29 eb 4a b5 97 d4 d0               ..e..).J....
```

Data: 4500033c0d5f40003906cd7948155b1dc0a800090050c76c...
[Length: 828]

```
    2 0.651884        SamsungE_f9:50:0a      Broadcast            ARP      60       Who has 192.168.0.1? Tell 192.168.0.16
Frame 2: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
    Interface id: 0 (\Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB})
        Interface name: \Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB}
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 14, 2017 13:42:46.979626000 Eastern Daylight Time
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1508002966.979626000 seconds
    [Time delta from previous captured frame: 0.651884000 seconds]
    [Time delta from previous displayed frame: 0.651884000 seconds]
    [Time since reference or first frame: 0.651884000 seconds]
    Frame Number: 2
    Frame Length: 60 bytes (480 bits)
    Capture Length: 60 bytes (480 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:arp]
    [Coloring Rule Name: ARP]
    [Coloring Rule String: arp]
Ethernet II, Src: SamsungE_f9:50:0a (ec:9b:f3:f9:50:0a), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
    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: SamsungE_f9:50:0a (ec:9b:f3:f9:50:0a)
        Address: SamsungE_f9:50:0a (ec:9b:f3:f9:50:0a)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: ARP (0x0806)
    Padding: 55feb3de3f386c78cb66e323bede00012200
Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: SamsungE_f9:50:0a (ec:9b:f3:f9:50:0a)
    Sender IP address: 192.168.0.16
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.0.1
```

```
     55 17.231092        Technico_1b:1c:6c        HonHaiPr_1e:0f:b1        ARP        60        192.168.0.1 is at 08:95:2a:1b:1c:6c
Frame 55: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
    Interface id: 0 (\Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB})
        Interface name: \Device\NPF_{EF36F6C3-AE01-49E0-85ED-01DCD29009AB}
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 14, 2017 13:43:03.558834000 Eastern Daylight Time
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1508002983.558834000 seconds
    [Time delta from previous captured frame: 0.000587000 seconds]
    [Time delta from previous displayed frame: 0.000587000 seconds]
    [Time since reference or first frame: 17.231092000 seconds]
    Frame Number: 55
    Frame Length: 60 bytes (480 bits)
    Capture Length: 60 bytes (480 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:arp]
    [Coloring Rule Name: ARP]
    [Coloring Rule String: arp]
Ethernet II, Src: Technico_1b:1c:6c (08:95:2a:1b:1c:6c), Dst: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
    Destination: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
        Address: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
        Address: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    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: Technico_1b:1c:6c (08:95:2a:1b:1c:6c)
    Sender IP address: 192.168.0.1
    Target MAC address: HonHaiPr_1e:0f:b1 (44:37:e6:1e:0f:b1)
    Target IP address: 192.168.0.9
```

	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	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	62	IPv4
4	2.962850	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	62	IPv4
5	8.971488	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	62	IPv4
6	13.542…	Telebit_73:8d:ce	Broadcast	ARP	60	Who has 192.168.1.117? Tell 192.168.1.104
7	17.444…	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	62	IPv4
8	17.465…	LinksysG_da:af:73	AmbitMic_a9:3d:68	0x0800	62	IPv4
9	17.465…	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	54	IPv4
10	17.466…	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	686	IPv4
11	17.494…	LinksysG_da:af:73	AmbitMic_a9:3d:68	0x0800	60	IPv4
12	17.498…	LinksysG_da:af:73	AmbitMic_a9:3d:68	0x0800	1514	IPv4
13	17.500…	LinksysG_da:af:73	AmbitMic_a9:3d:68	0x0800	1514	IPv4
14	17.500…	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	54	IPv4
15	17.527…	LinksysG_da:af:73	AmbitMic_a9:3d:68	0x0800	1514	IPv4
16	17.527…	LinksysG_da:af:73	AmbitMic_a9:3d:68	0x0800	489	IPv4
17	17.527…	AmbitMic_a9:3d:68	LinksysG_da:af:73	0x0800	54	IPv4

me 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits)
ernet II, Src: AmbitMic_a9:3d:68 (00:d0:59:a9:3d:68), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
ress Resolution Protocol (request)