VILNIUS UNIVERSITY
SIAULIAI ACADEMY

PROGRAMŲ SISTEMOS BACHELOR STUDY PROGRAMME

Software engineering

ANNA KUTOVA

Computer Networks

Laboratory work No.7

ARP

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Laboratory Work Report

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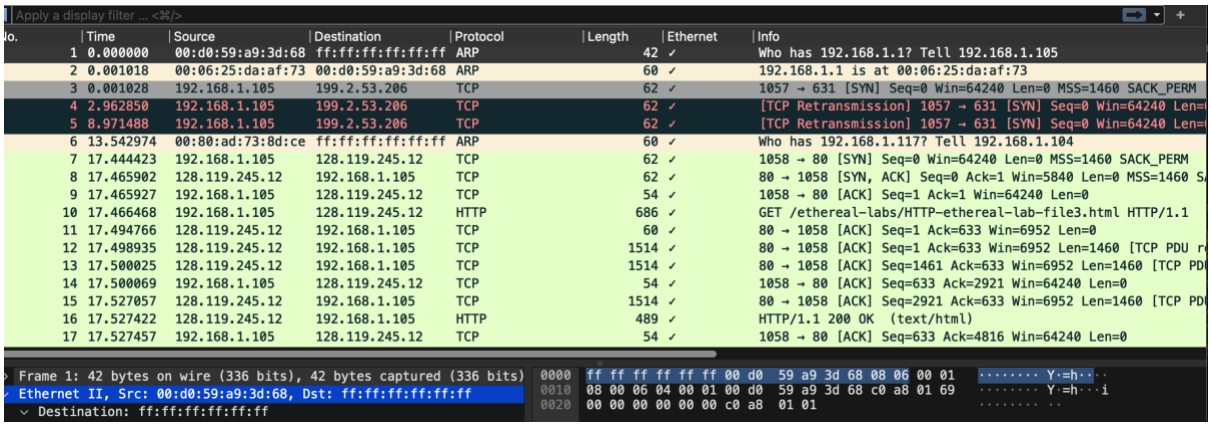
Capturing and analyzing Ethernet frames

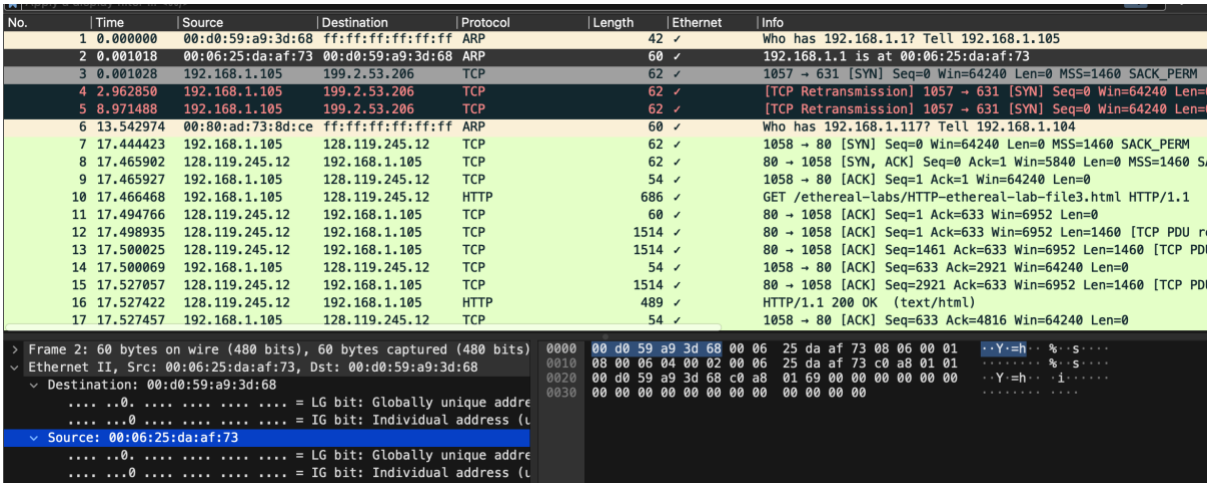
Since I used the file *ethernet--ethereal-trace-1* for this lab, for convenience I will refer to the sender's machine and MAC address in the trace as my machine and my MAC address - even though the trace was originally captured on the authors' computer.

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



Answer: the 48-bit Ethernet address of my computer is **00:d0:59:a9:3d:68**

2. *What is the 48-bit destination address in the Ethernet frame?*
   Is this the Ethernet address of gaia.cs.umass.edu? (Hint: the answer is no).
   What device has this as its Ethernet address?



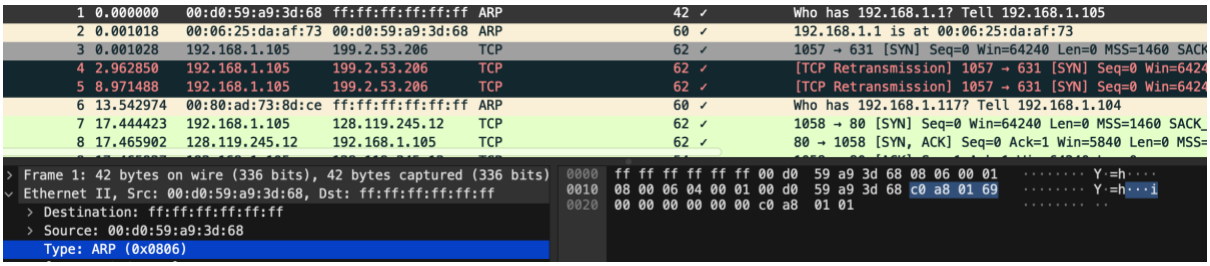
Answer:

a. The 48-bit destination address in the Ethernet frame is **00:06:25:da:af:73**

b. This address is not the Ethernet address of gaia.cs.umass.edu - it belongs to my TP-Link router, which serves as the gateway to the Internet.

3. *Give the hexadecimal value for the two-byte Frame type field.*

What upper layer protocol does this correspond to?

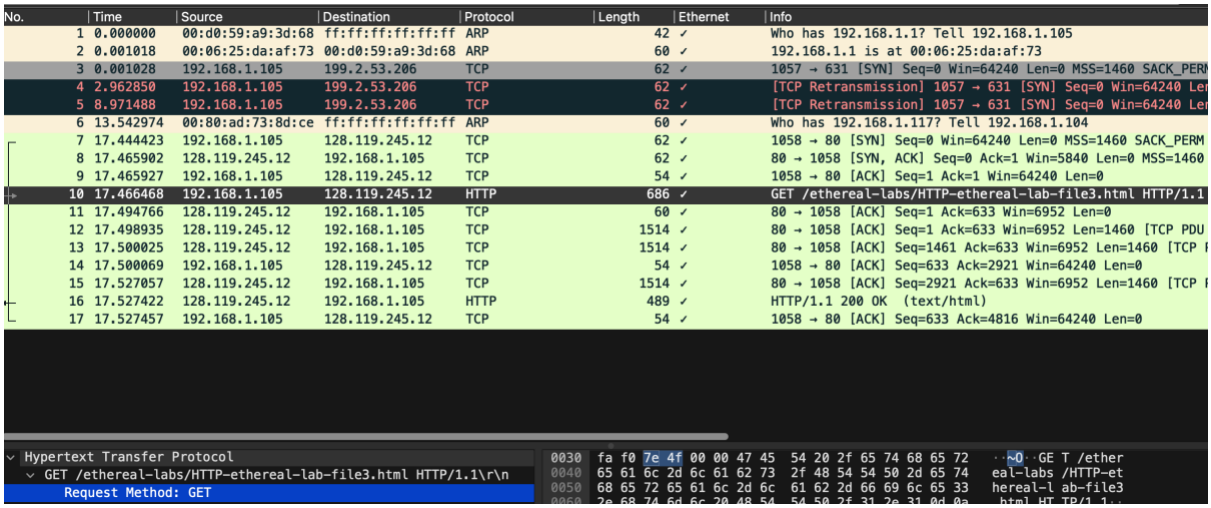


Answer:

a. The hexadecimal value for the two-byte Frame type field is **0x0806**

b. This corresponds to the **ARP** (Address Resolution Protocol), which is used to map IP addresses to MAC (Ethernet) addresses on a local network.

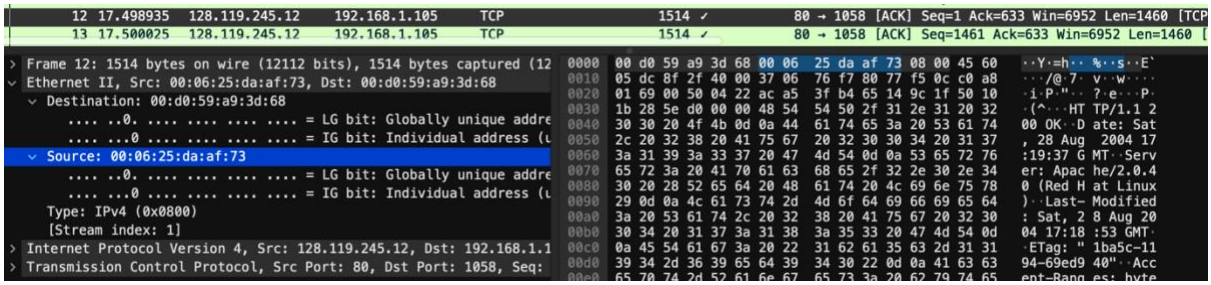
4. *How many bytes from the very start of the Ethernet frame does the ASCII "G" in "GET" appear in the Ethernet frame?*



Answer: The ASCII "G" in "GET" appears at **byte 54** in the Ethernet frame:

Ethernet header: 14 bytes
IP header: 20 bytes (standard size without options)
TCP header: 20 bytes (also standard size without options)

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?



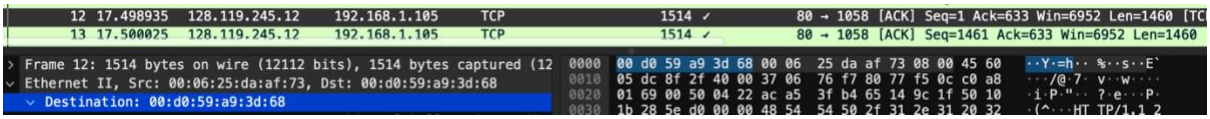
Answer:

a. The Ethernet source address is **00:06:25:da:af:73**

b. No, this is not the MAC address of gaia.cs.umass.edu, nor is it my computer's MAC address. It is the MAC address of the home router or gateway that forwarded the packet from my computer to the internet.

6. *What is the destination address in the Ethernet frame?*

Is this the Ethernet address of your computer?

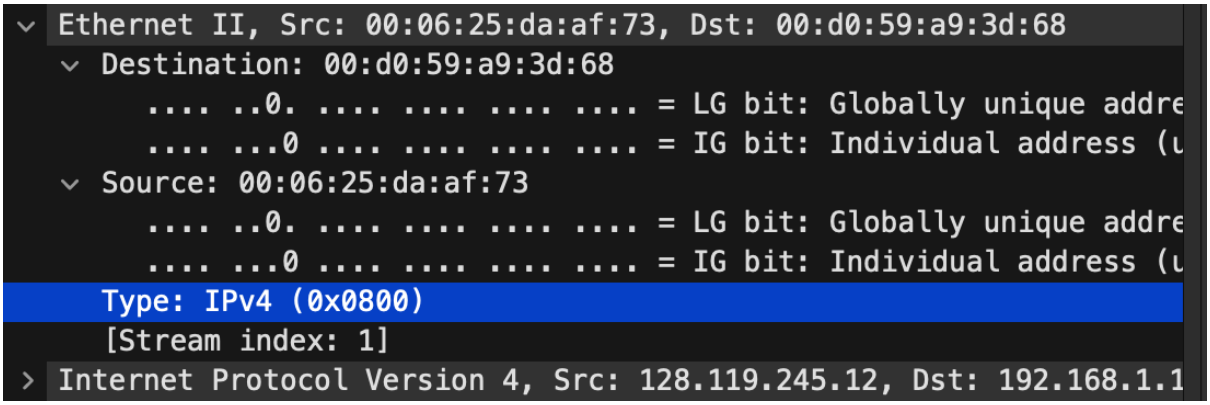


Answer:

a. The destination address in the Ethernet frame is **00:d0:59:a9:3d:68**

b. Yes, this is the Ethernet address of my computer

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

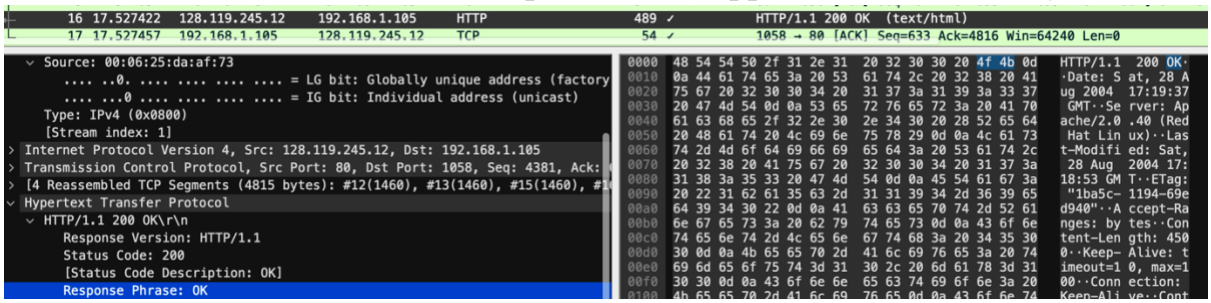


Answer:

a. The hexadecimal value for the two-byte Frame type field is **0x0800**

b. This correspond to **Internet Protocol Version 4 (IPv4)**

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?*

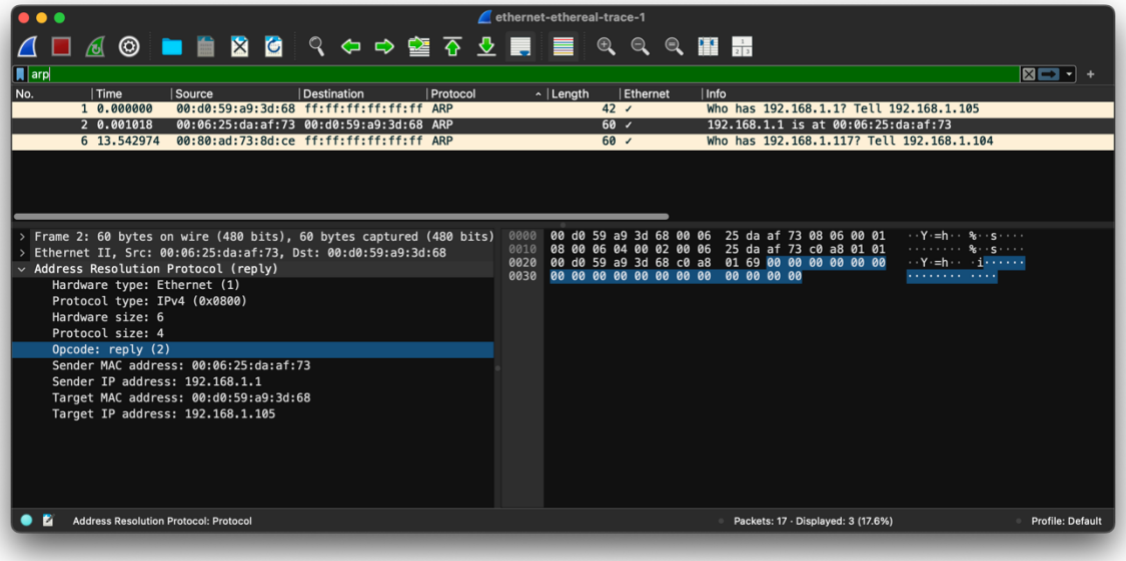


Answer: The ASCII "O" in "OK" appears 54 bytes from the very start of the Ethernet frame.

The Address Resolution Protocol

ARP Caching

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



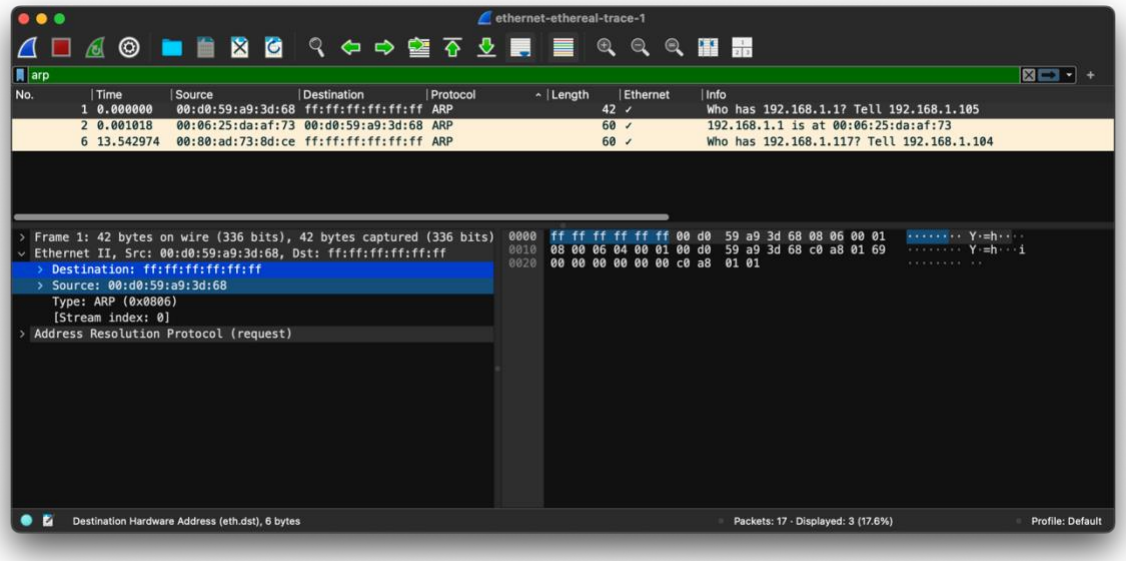
Answer: Based on the captured file, the ARP cache on the Mac would include entries from ARP reply packets.
For example:

IP Address: **192.168.1.1**
MAC Address: **00:06:25:da:af:73**

This information is taken from an ARP reply, where the sender informs the target of its MAC address. The target device can then store this mapping in its ARP cache.

Observing ARP in action

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



Answer:

Source MAC: **00:d0:59:a9:3d:68**
Destination MAC: **ff:ff:ff:ff:ff:ff**

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

Answer:

a. The hexadecimal value for the two-byte Ethernet Frame type field is **(0x0806)**
b. This correspond to **ARP (Address Resolution Protocol)**

12. *Download the ARP specification from ftp://ftp.rfc-editor.org/in-notes/std/std37.txt.*
A readable, detailed discussion of ARP is also at *http://www.erg.abdn.ac.uk/users/gorry/course/inet-pages/arp.html*.

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

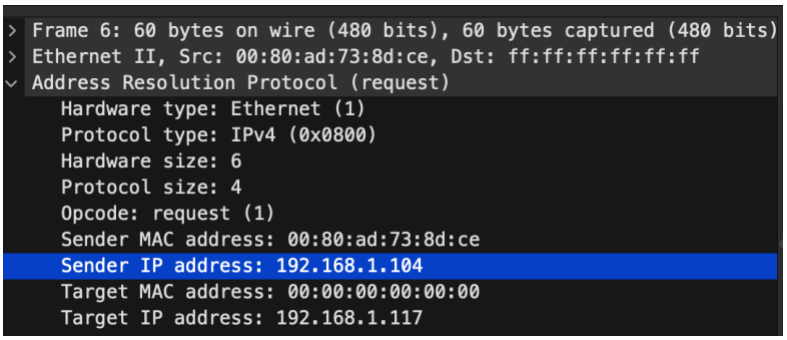
b) *What is the value of the opcode field within the ARP-payload part of the Ethernet frame in which an ARP request is made?*

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

Answer:

a. The ARP opcode field begins 20 bytes from the very beginning of the Ethernet frame.
b. The value of the opcode field in an ARP request is 1.
c. Yes, the ARP message contains the IP address of the sender.



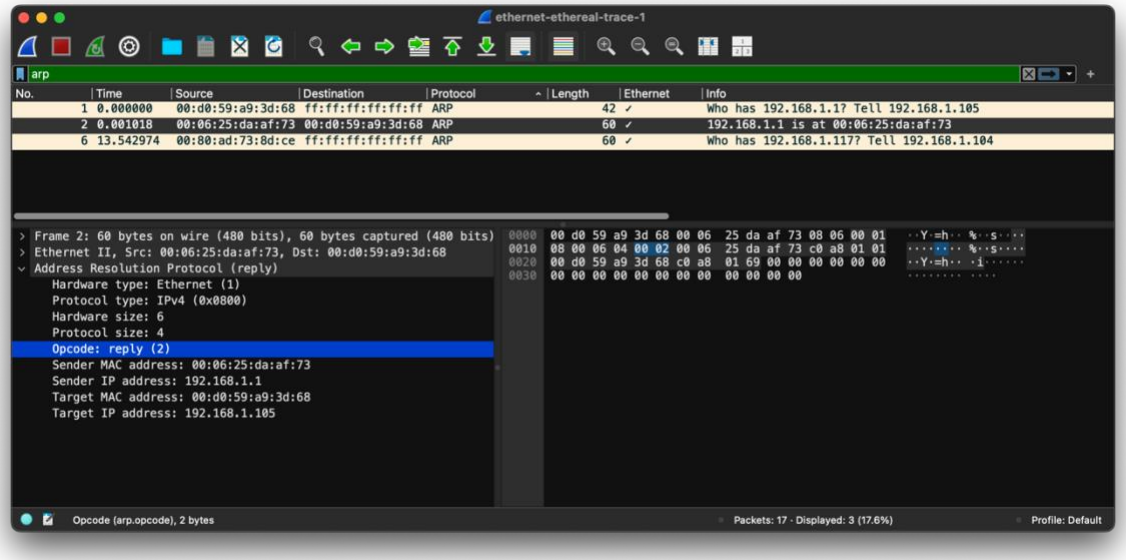
d. The "question" - the Ethernet address being queried - appears in the target hardware address field of the ARP request, which is typically empty (all zeros) because the sender is requesting that address.

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

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

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?*

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:

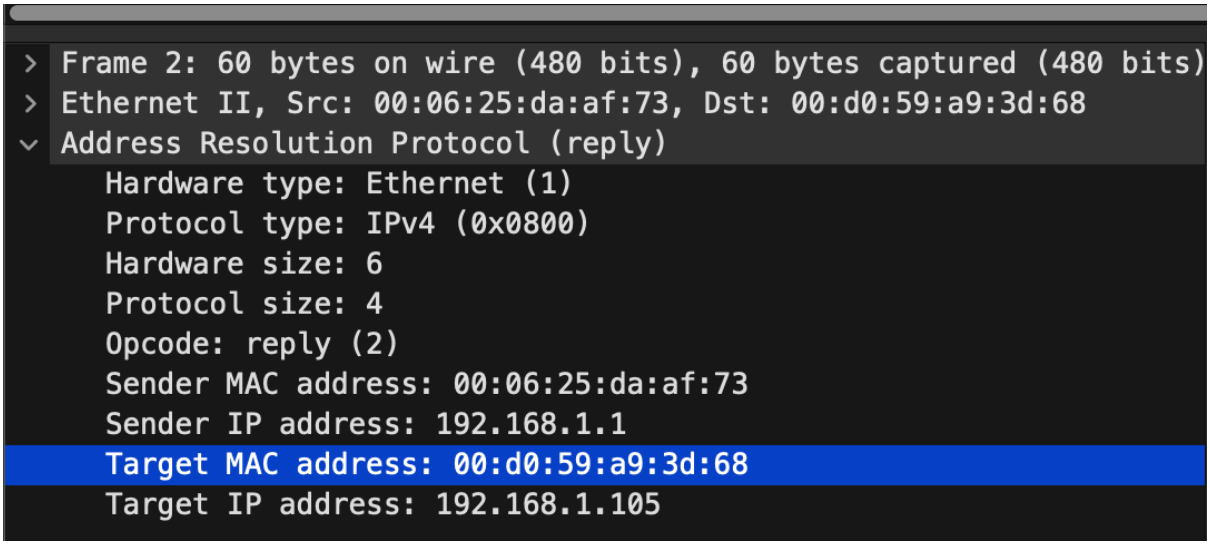
a. The ARP opcode field begins 20 bytes from the very beginning of the Ethernet frame.

b. The value of the opcode field in an ARP reply is 2.

c. The "answer" appears in the sender protocol address field of the ARP reply message. This field contains the IP address corresponding to the Ethernet (MAC) address being provided:

Sender IP address: 192.168.1.1
Sender MAC address: 00:06:25:da:af:73

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

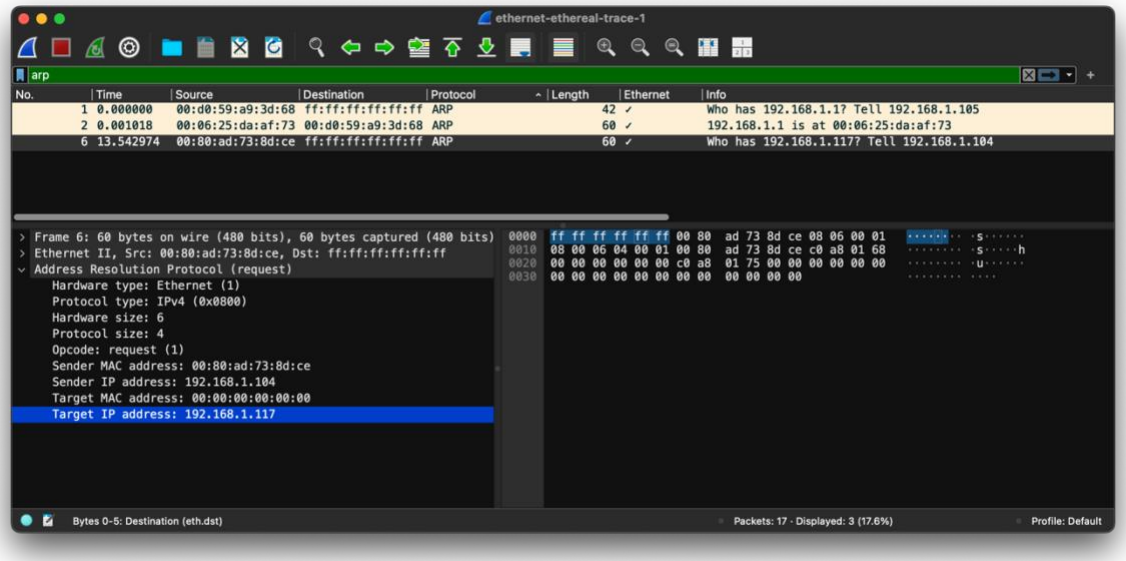


Answer: The hexadecimal values for the source and destination addresses in the Ethernet frame containing the ARP reply message are:

Sender MAC address: 00:06:25:da:af:73 (source)

Target MAC address: 00:d0:59:a9:3d:68 (destination)

15. *Open the ethernet-ethereal-trace-1 trace file in* [*http://gaia.cs.umass.edu/wireshark-labs/wireshark-traces.zip*](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?



Answer: There is no ARP reply in the trace for packet 6 because the ARP request is broadcast to all devices, but the ARP reply is sent only directly to the requester.

If the device with IP 192.168.1.117 did not respond (for example: it is offline or unreachable), no reply packet will appear in the trace.