Computer Networks

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Homework - 2

P1:- T or f :-

a) A user requests a webpage that consists of some text and 3 images. for this page, the client will send one request message and receive 4 responses message

Sol:- This has to be 'false', the client has to send 4 messages and will receive 4 response messages in return.

b). Two distinct web pages can be sent over the same persistent connection?

Sol:- This will be 'true', http persistent connection will be open until the it is explicitly closed by either Client / server.

c). With non-persistent connections between browser & origin server, it is possible for a single TCP segment to carry 2 distinct http request messages.

Sol:- false. with non-persistent connections it has the capability to carry only one request by each TCP segment.

d). The date header in the http response message indicates when the object in the response was last modified.

Sol:- false. Date in the header indicates the req. generation time

e). Http response message never have an empty message body.

Sol:- False. Response Message 204 : No content indicates an empty message body in the Http response message.

Pg:-

a) find the total average response time.

Sol:.

→ Average time to transmit = $\left(\frac{L}{R}\right)$

→ Average object size is 8,50,000 bits.

→ Average request rate from institution browsers → Origin Servers ⇒ 16 requests/second.

Average Access delay ⇒ $\left(\frac{\Delta}{1-\Delta\beta}\right)$

$\Delta \Rightarrow \frac{8,50,000 \text{ bits}}{15,000,000 \text{ bits/sec}}$

$\Delta \Rightarrow \left(\frac{85}{1500}\right) \Rightarrow 0.0567 \text{ sec}$ #

→ Traffic Intensity $\beta\Delta \Rightarrow \{16 \text{ req/sec}\} \cdot \{0.0567 \text{ sec/req}\}$

$\beta\Delta = 0.907$ #

Average Access delay $\Rightarrow \left\{\frac{0.0567}{1-0.907}\right\} \approx 0.6$ sec #

$\therefore$ Total average response time $\Rightarrow 0.6 + 3$

$\Rightarrow 3.6$ sec #.

b). Suppose, Cache is installed in the institutional LAN Suppose the miss rate is 0.4. find the total response time.

Sol:-

we have reduced the traffic intensity on the access link by 60% for requests within institutional network.

Average access delay $\Rightarrow \frac{0.0567 \text{ sec}}{1-(0.4)(0.907)}$

$\Rightarrow 0.089$ sec #

Average response time $\Rightarrow (0.6).0 + (0.4)(3.089)$

$\Rightarrow 1.24$ sec #.

P3:- Consider an Http client that wants to retreive a web document at a given URL. The Ip Address of the Http Server is initially unknown. what transport and application-layer protocols besides Http are needed in this scenario?

Sol:- for the given Scenario:

⇒ Application Layer Protocols — DNS, HTTP

⇒ Transport Layer Protocols — { UDP for DNS
TCP for HTTP

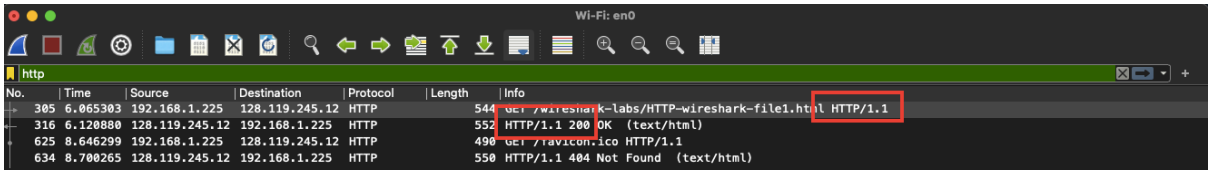
→ The above mentioned protocols are basically req. for making up the scenario we wanted.

Wireshark Lab: HTTP v7.0

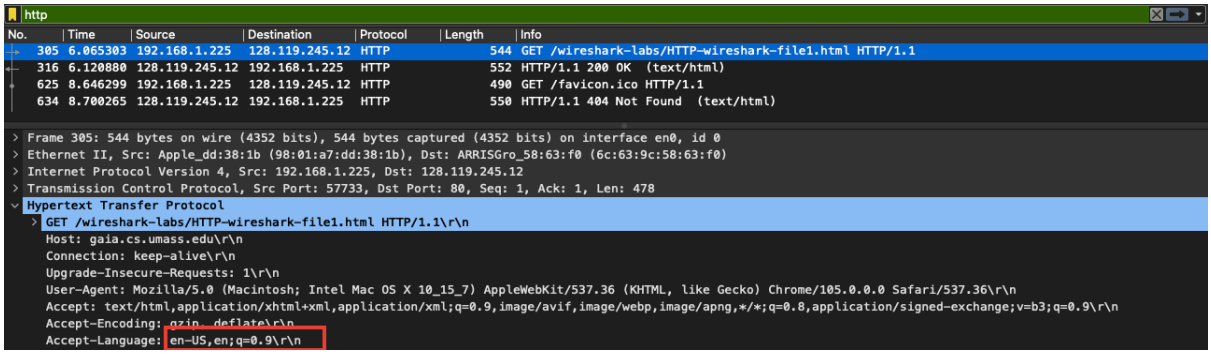
1. **The basic HTTP GET/response interaction.**

Questions:

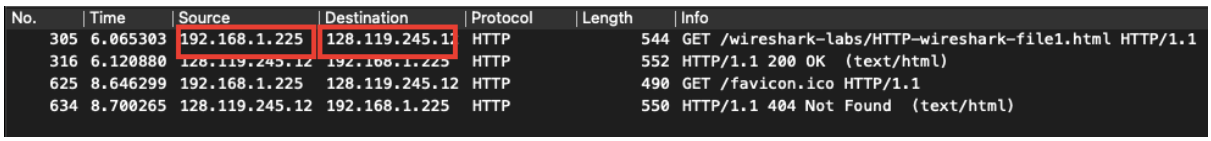
1. Is your browser running HTTP version 1.0 or 1.1? What version of HTTP is the server running?
Ans: Both the browser and the server are running on HTTP version 1.1



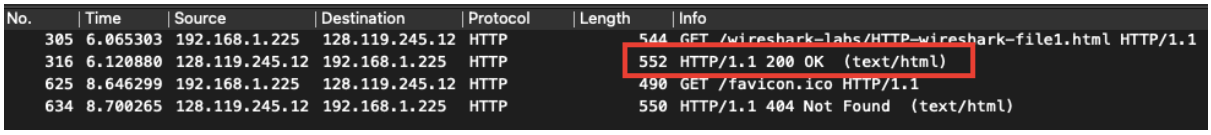
2. What languages (if any) does your browser indicate that it can accept to the server?
Ans: Browser indicates that it accepts en-US; English – United States for the server.



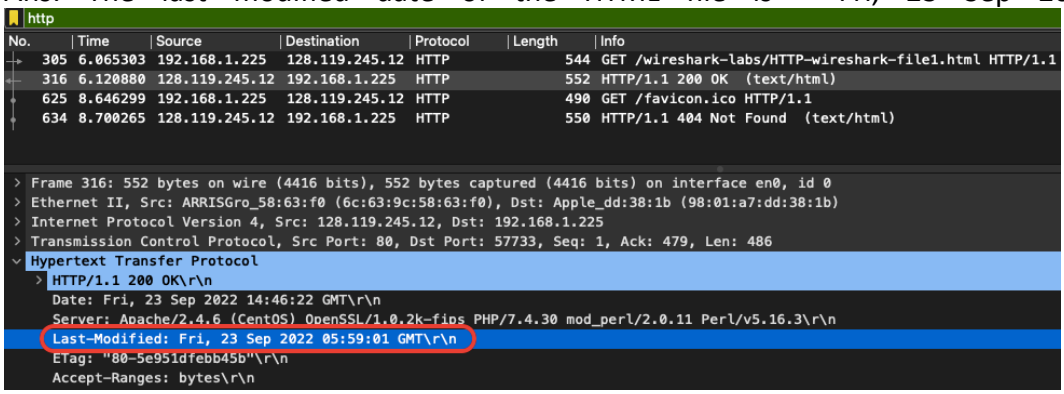
3. What is the IP address of your computer? Of the 'gaia.cs.umass.edu.server'?
Ans: My computer Address is 192.168.1.225 and the server's address is 128.119.245.12



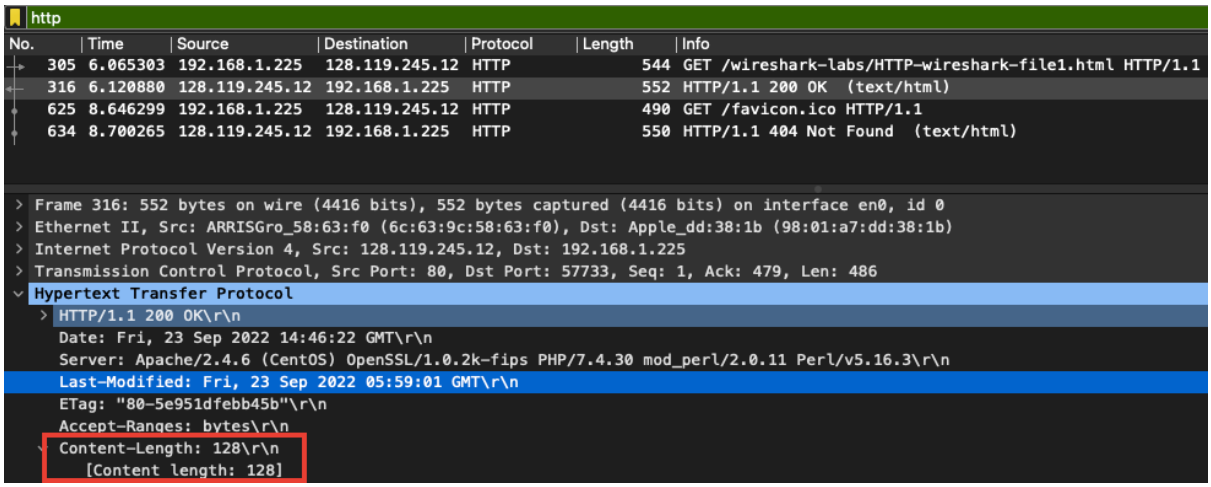
4. What is the status code returned from the server to your browser?
Ans: Status code returned is "200 OK"



5. When was the HTML file that you are retrieving last modified at the server?
Ans: The last modified date of the HTML file is "Fri, 23 Sep 2022 05:59:01 GMT"



6. How many bytes of content are being returned to your browser?
   Ans: Response from the server is about 128 bytes to the browser.

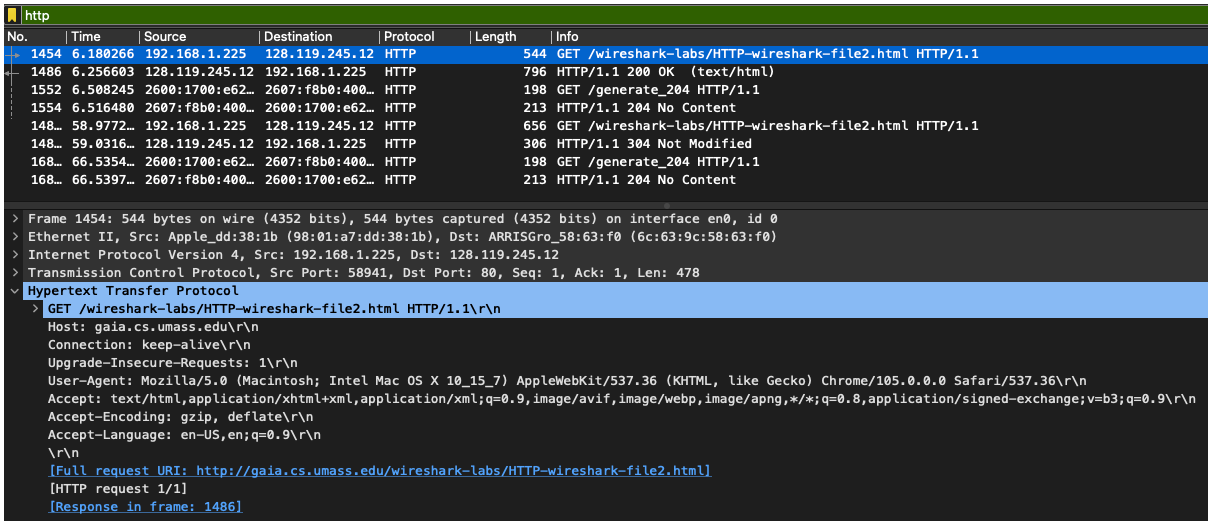


7. By inspecting the raw data in the packet content window, do you see any headers within the data that are not displayed in the packet-listing window? If so, name one.
   Ans: After the inspection of the raw data packet content window, we cannot find any headers within the data.

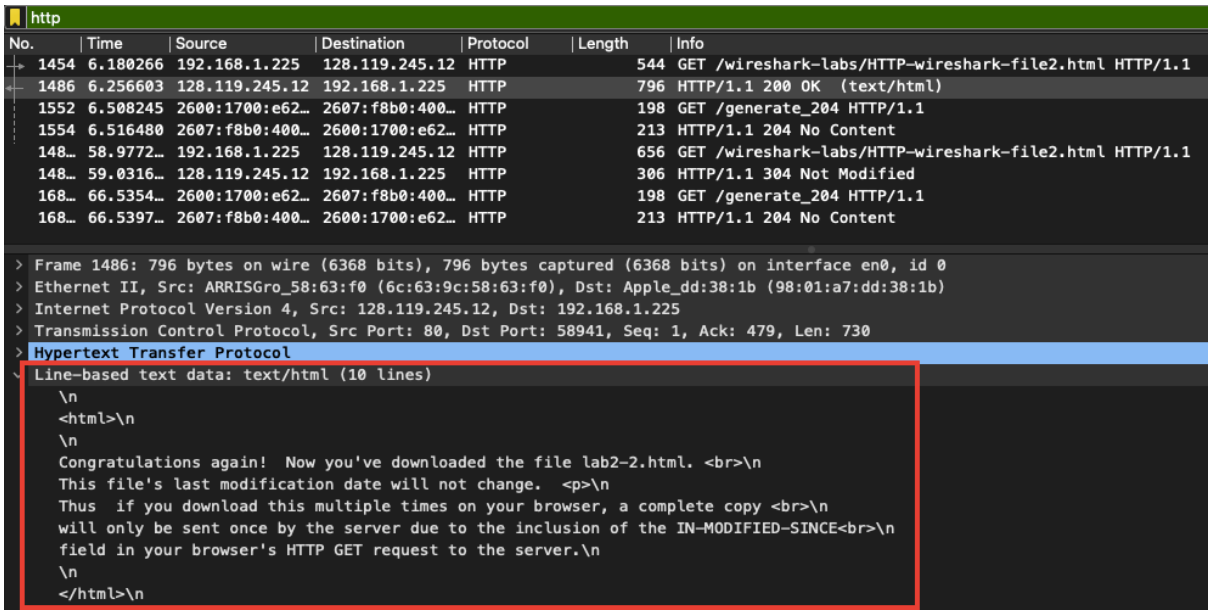
2. The HTTP CONDITIONAL GET/response interaction

Questions:

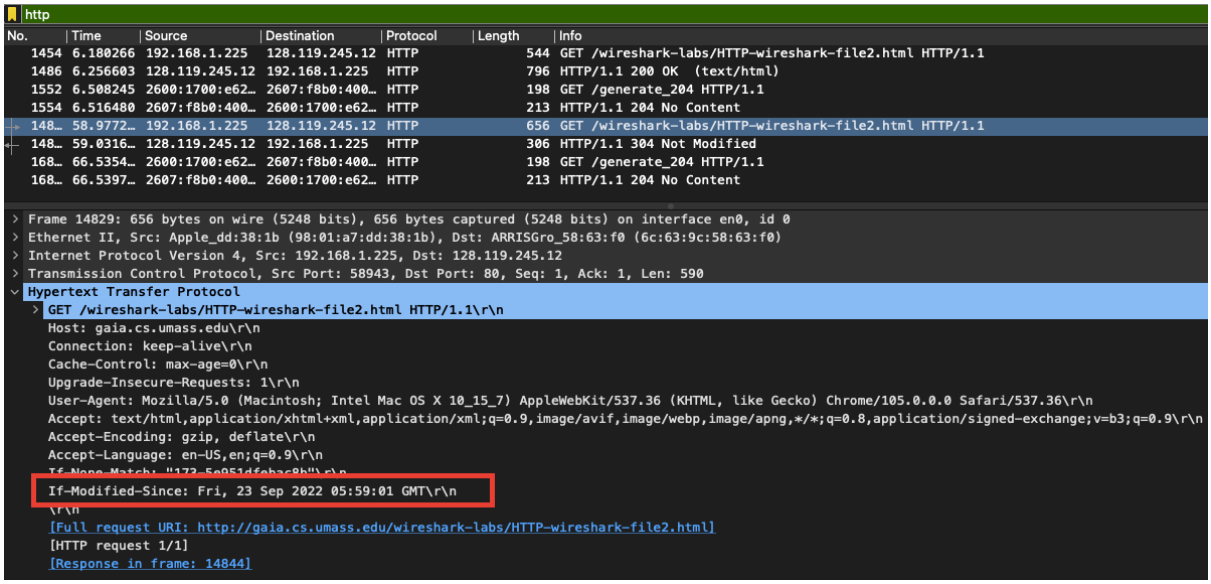
8. Inspect the contents of the first HTTP GET request from your browser to the server. Do you see an "IF-MODIFIEDSINCE line in the HTTP GET?
   Ans: For the first HTTP GET request from my browser to the server, there is no "IF-MODIFIED-SINCE".



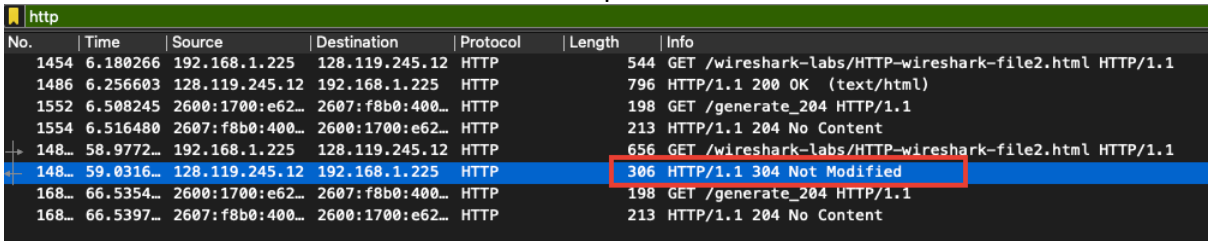
9. Inspect the contents of the server response. Did the server explicitly return the contents of the file? How can you tell?
   Ans: "Line-based text data" field is used for returning the contents of the file to the browser.



10. Now inspect the contents of the second HTTP GET request from your browser to the server. DO you see an “IFMODIFIED- SINCE” line in the HTTP GET? If so, what information follows the “IF-MODIFIED-SINCE” header?
    Ans: We observed to have “IF-MODIFIED-SINCE” header representing the last time at which the file was downloaded from the server.



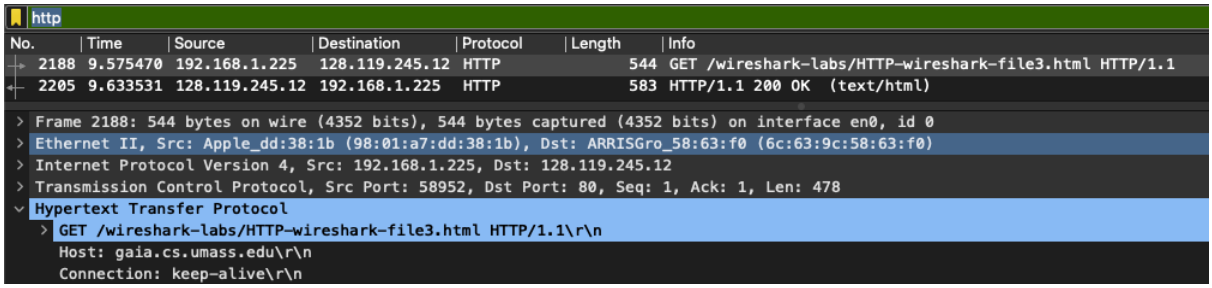
11. What is the HTTP status code and phrase returned from the server in response to this second HTTP GET? Did the server explicitly return the contents of the file? Explain
    Ans: For the second http get request, status code obtained is “304 Not Modified” as the browser is fetching the content which got stored in the cache after the first request being made, as it involves no modification and it results in Not Modified response.



3. Retrieving Long Documents
Questions:

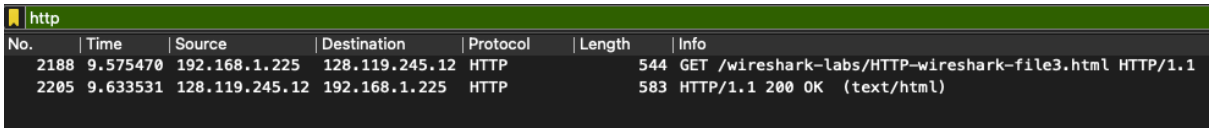
12. How many HTTP GET request messages did your browser send? Which packet number in the trace contains the GET message for the Bill or Rights?

Ans: Browser has sent one HTTP GET request and received GET message for the Bill or Rights at packet number 2188.



13. Which packet number in the trace contains the status code and phrase associated with the response to the HTTP GET request?

Ans: We got status code along with a phrase as “200 OK” associated with the response to the HTTP GET request at packet number 2205.

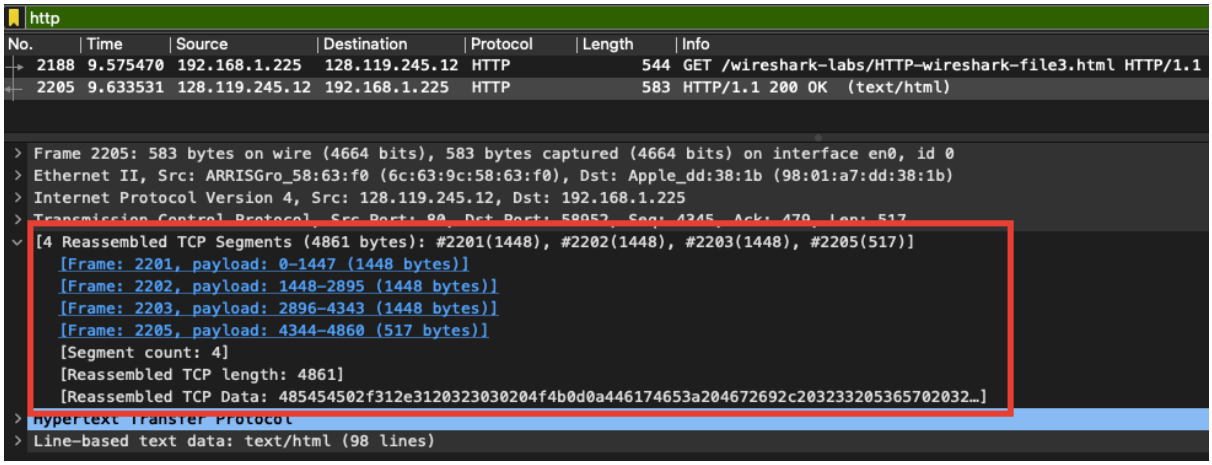


14. What is the status code and phrase in the response?

Ans: It produces “200 Ok” as the status code and the phrase as a part of the response.

15. How many data-containing TCP segments were needed to carry the single HTTP response and the text of the Bill of Rights?

Ans: 4 data-containing TCP segments to carry HTTP response.

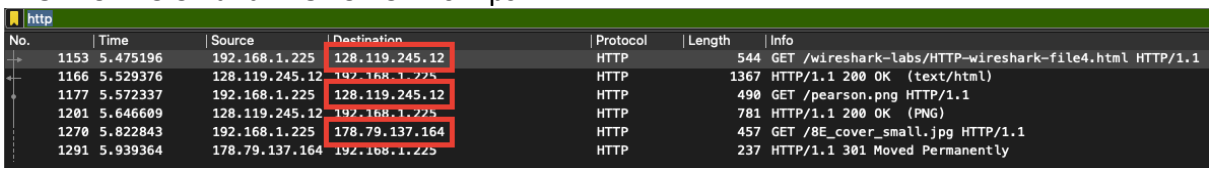


4. HTML Document with Embedded Objects

Questions:

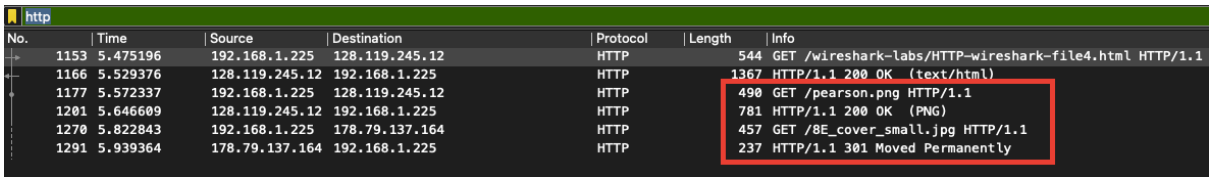
16. How many HTTP GET request messages did your browser send? To which Internet addresses were these GET requests sent?

Ans: There are 3 HTTP GET request messages that are sent by the browser, and they were sent to the 128.119.245.32 and 178.79.137.164 Ips.



17. Can you tell whether your browser downloaded the two images serially, or whether they were downloaded from two web sites in parallel? Explain.

Ans: The two images were downloaded serially as the GET request for the second image is published after receiving the response for the first GET request for image. The same is said to be downloaded parallelly when we have both the GET requests side by side/ immediately.

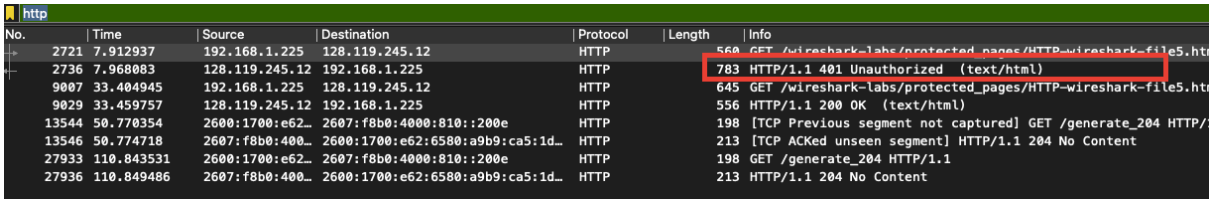


5. HTTP Authentication

Questions:

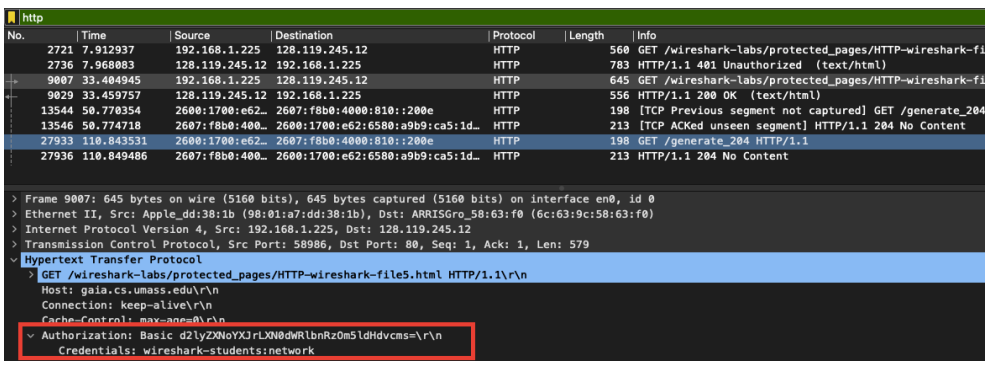
18. What is the server's response (status code and phrase) in response to the initial HTTP GET message from your browser?

Ans: Server response is "401 Unauthorized" as the status code and phrase in the initial HTTP GET request.



19. When your browser's sends the HTTP GET message for the second time, what new field is included in the HTTP GET message?

Ans: Field called as "Authorization" was added to the GET message during the second time, representing username and password (credentials) used to authorize for the site.

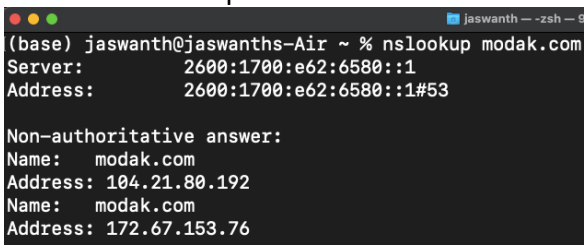


Wireshark Lab: DNS v7.0 1. Nslookup

Questions:

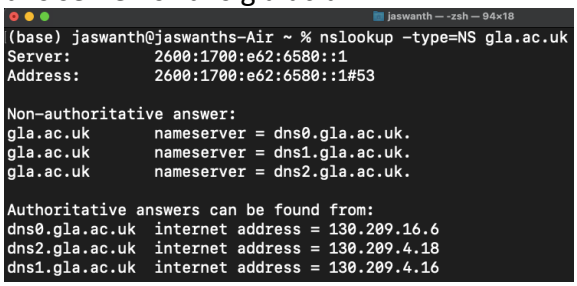
1. Run nslookup to obtain the IP address of a Web server in Asia. What is the IP address of the server?

Ans: The nslookup for “www.modak.com” resulted in the IP address 172.67.153.76



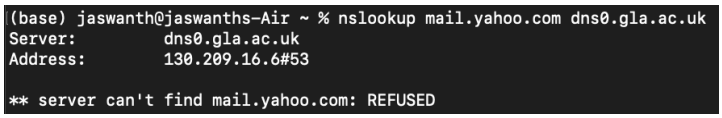
2. Run nslookup to determine the authoritative DNS servers for a university in Europe.

Ans: The nslookup for authoritative DNS servers is “nslookup -type=NS gla.ac.uk” and the authoritative dns server is “dns.gla.ac.uk”



3. Run nslookup so that one of the DNS servers obtained in Question 2 is queried for the mail servers for Yahoo mail. What is the IP address?

Ans: The IP address of the DNS server “dns.gla.ac.uk” obtained from the query to mail.yahoo.com is “130.209.16.6#53”



2. Ipconfig
   ipconfig /all

```
C:\Users\MANISH>ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-3T0PPCI
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Mixed
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek PCIe FE Family Controller
   Physical Address. . . . . . . . . : 18-60-24-16-C3-95
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek RTL8723BE 802.11 bgn Wi-Fi Adapter
   Physical Address. . . . . . . . . : F8-28-19-88-DE-67
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : FA-28-19-88-DE-67
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
   Physical Address. . . . . . . . . : F8-28-19-88-DE-67
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes



   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Bluetooth Device (Personal Area Network)
   Physical Address. . . . . . . . . : F8-28-19-88-DE-68
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

C:\Users\MANISH>
```

ipconfig /displaydns

```
C:\Users\MANISH>ipconfig /displaydns

Windows IP Configuration

    mssplus.mcafee.com
    ----------------------------------------
    Record data for type AAAA could not be displayed.


    mssplus.mcafee.com
    ----------------------------------------
    Record Name . . . . . : mssplus.mcafee.com
    Record Type . . . . . : 1
    Time To Live  . . . . : 604363
    Data Length . . . . . : 4
    Section . . . . . . . : Answer
    A (Host) Record . . . : 0.0.0.1


    1.0.0.0.in-addr.arpa
    ----------------------------------------
    Record Name . . . . . : 1.0.0.0.in-addr.arpa.
    Record Type . . . . . : 12
    Time To Live  . . . . : 604363
    Data Length . . . . . : 8
    Section . . . . . . . : Answer
    PTR Record  . . . . . : mssplus.mcafee.com
```

ipconfig /flushdns

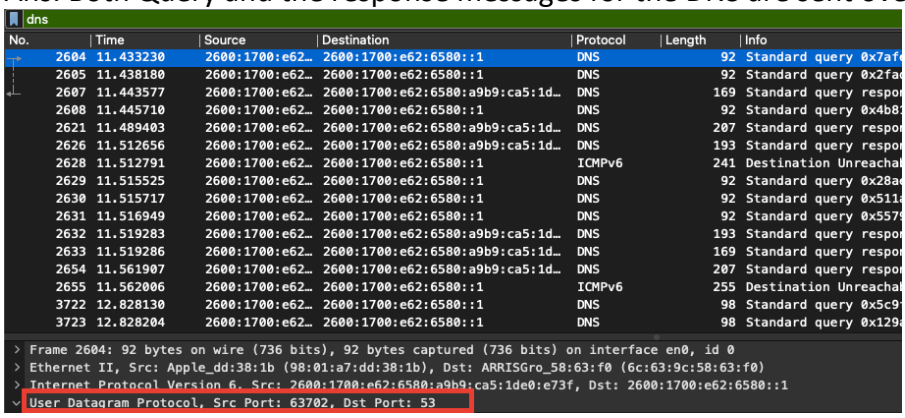
```
C:\Users\MANISH>ipconfig /flushdns

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.

C:\Users\MANISH>
```

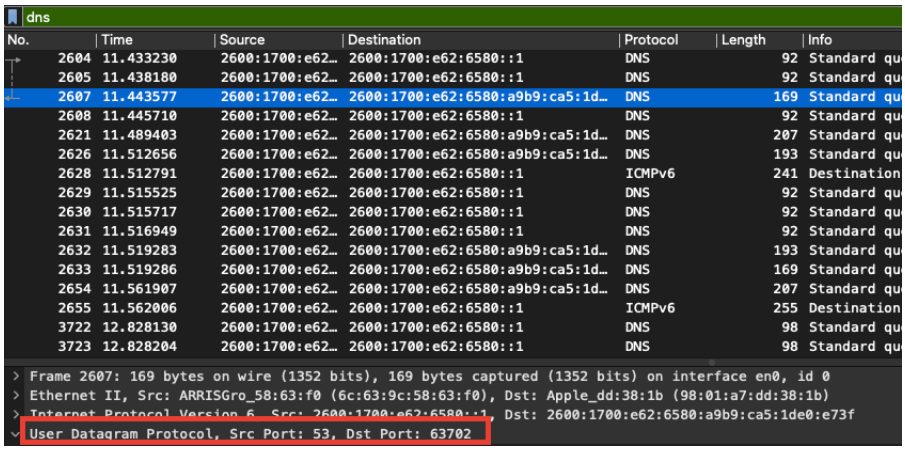
3. Tracing DNS with Wireshark

Questions:

4. Locate the DNS query and response messages. Are then sent over UDP or TCP?

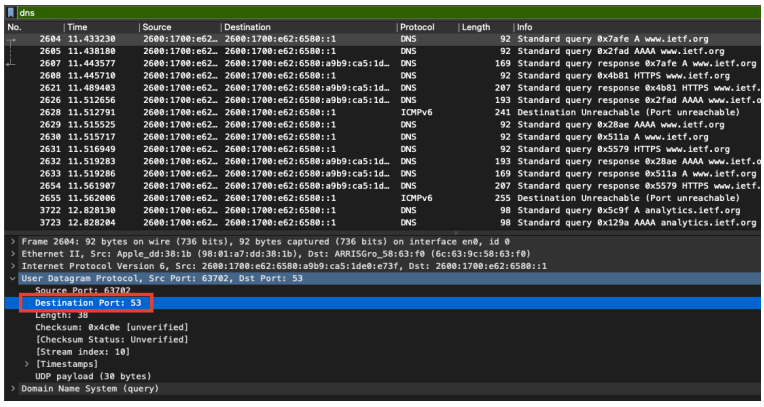
Ans: Both Query and the response messages for the DNS are sent over User Datagram Protocol (UDP).

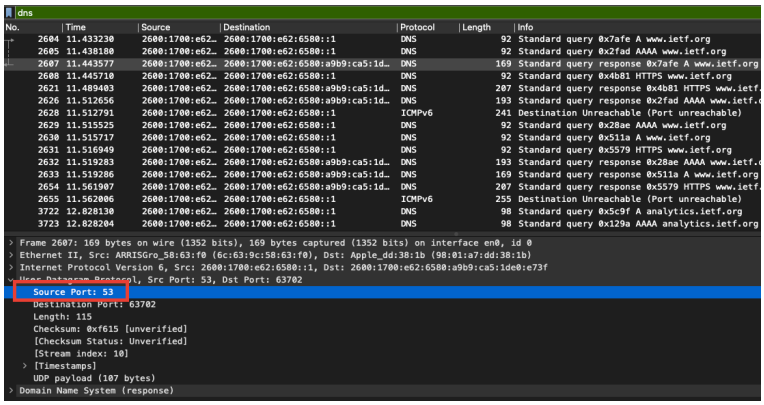




5. What is the destination port for the DNS query message? What is the source port of DNS response message?

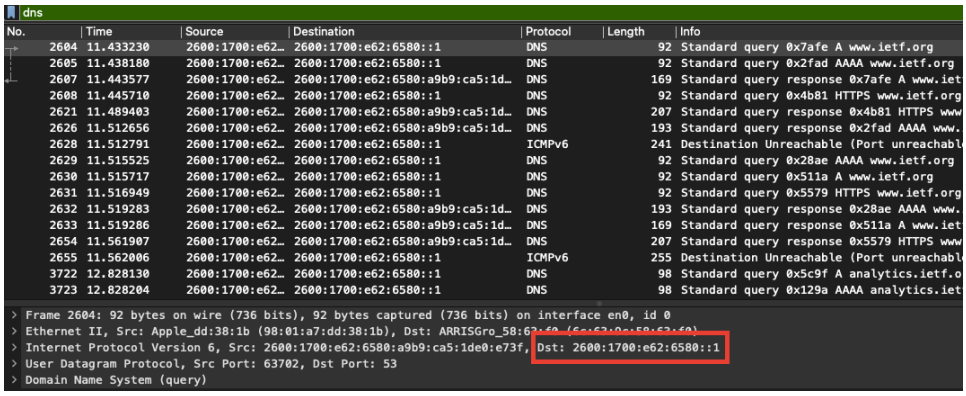
Ans: Destination port DNS and response message DNS port is “53”.

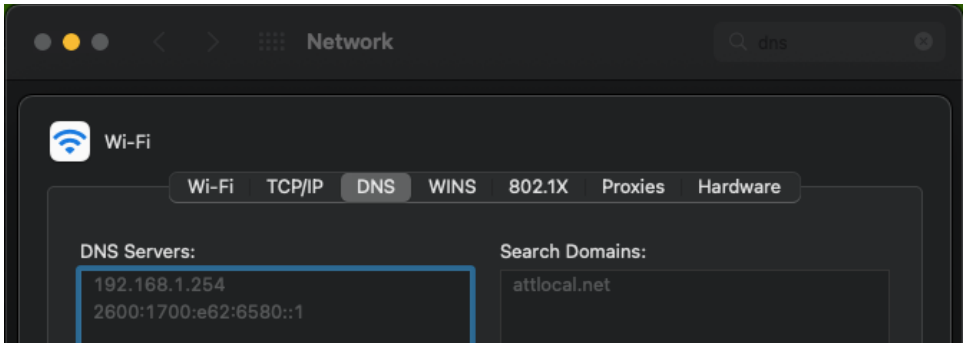




6. To what IP address is the DNS query message sent? Use ipconfig to determine the IP address of your local DNS server. Are these two IP addresses the same?

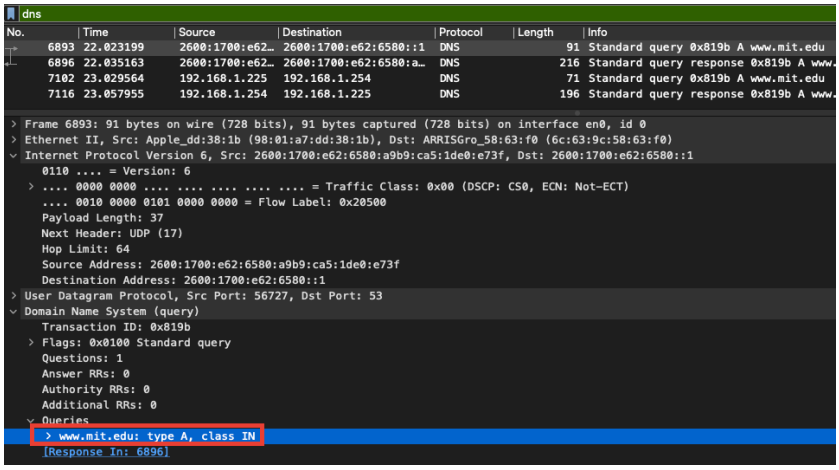
Ans: DNS query message is sent to the same IPv6 address as my local DNS server i.e. “2600:1700:62:6580::1”





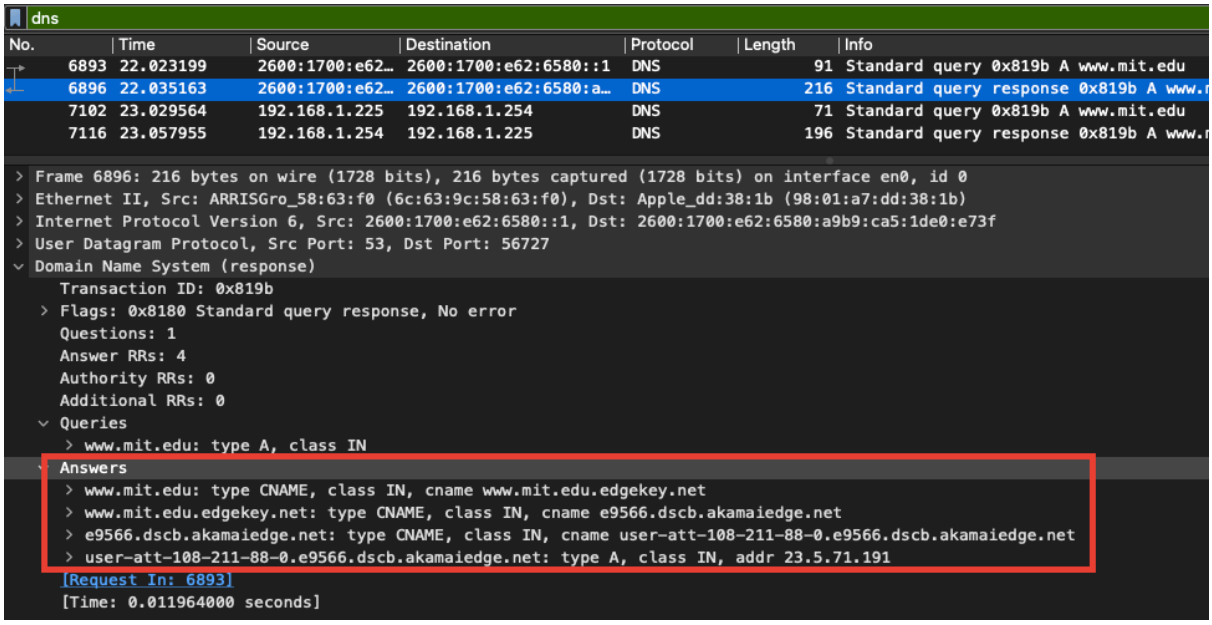
7. Examine the DNS query message. What “Type” of DNS query is it? Does the query message contain any “answers”?

Ans: DNS query message is of Type ‘A’ DNS Query and does not contain any answers.



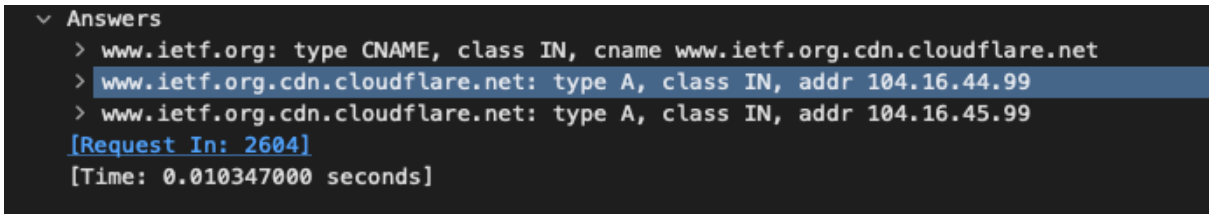
8. Examine the DNS response message. How many “answers” are provided? What do each of these answers contain?

Ans: DNS response message has 3 answers each of which contains the Name, Type, TTL, Data Length and Server IP Address.



9. Consider the subsequent TCP SYN packet sent by your host. Does the destination IP address of the SYN packet correspond to any of the IP addresses provided in the DNS response message?

Ans: IP address of the destination of TCP SYN packet corresponds to the IP address in the type A response received i.e., “104.16.44.99”

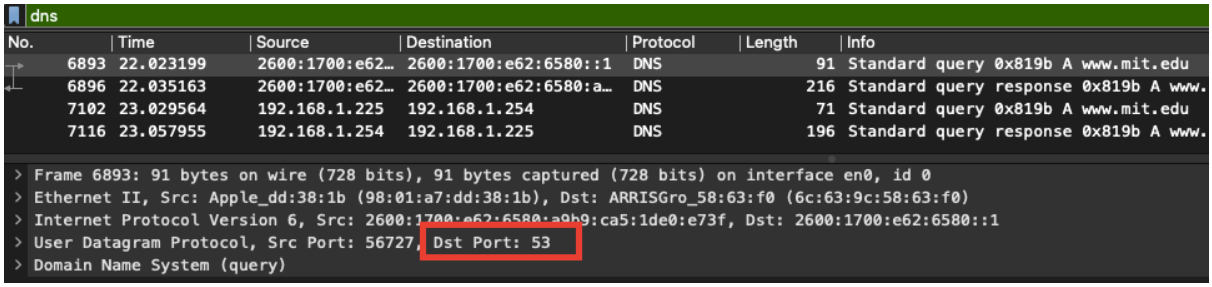


10. This web page contains images. Before retrieving each image, does your host issue new DNS queries?

Ans: Host does not issue any new DNS queries for retrieval of every image.

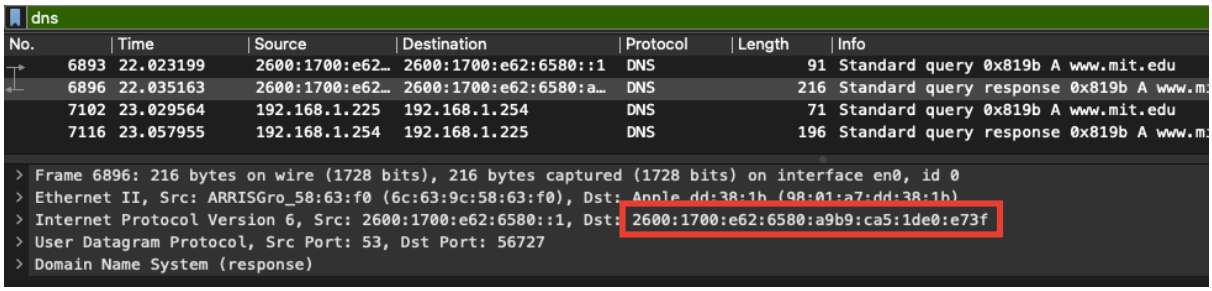
11. What is the destination port for the DNS query message? What is the source port of DNS response message?

Ans: Destination port of the DNS query message and the source port of DNS response message are the same and the port number is 53.



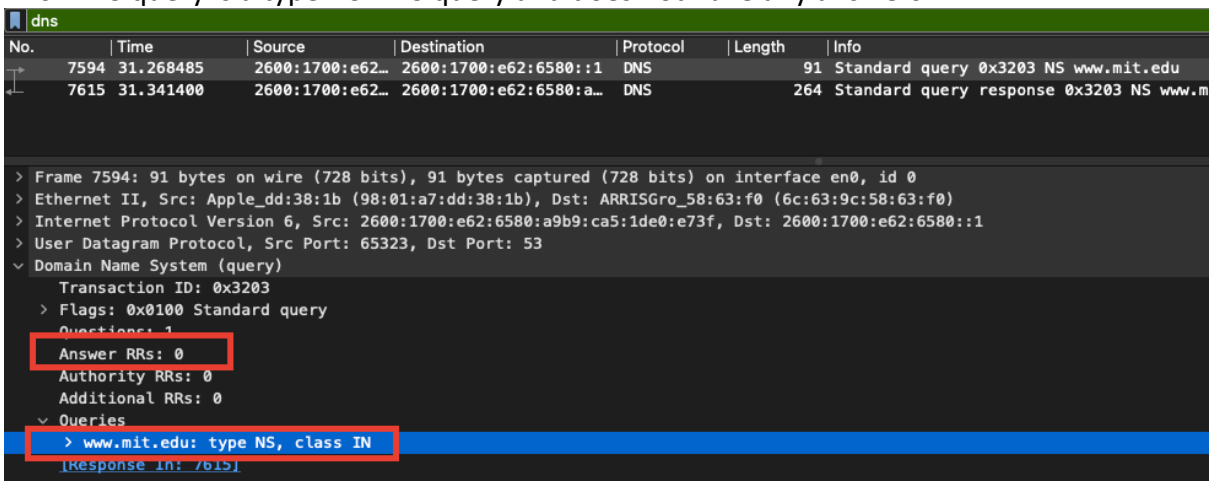
12. To what IP address is the DNS query message sent? Is this the IP address of your default local DNS server?

Ans: DNS query message is sent to the same IP address as my local DNS server which is “2600:1700:e62:6580:a9b9:ca5:1de0:e73f”



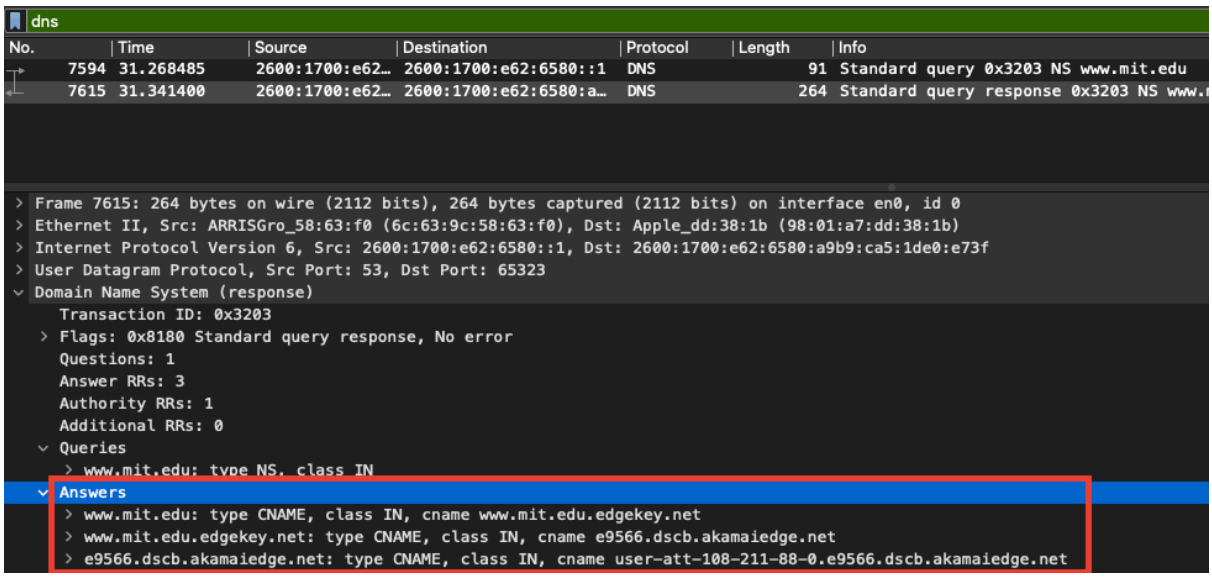
13. Examine the DNS query message. What “Type” of DNS query is it? Does the query message contain any “answers”?

Ans: DNS query is a type NS DNS query and does not have any answers.

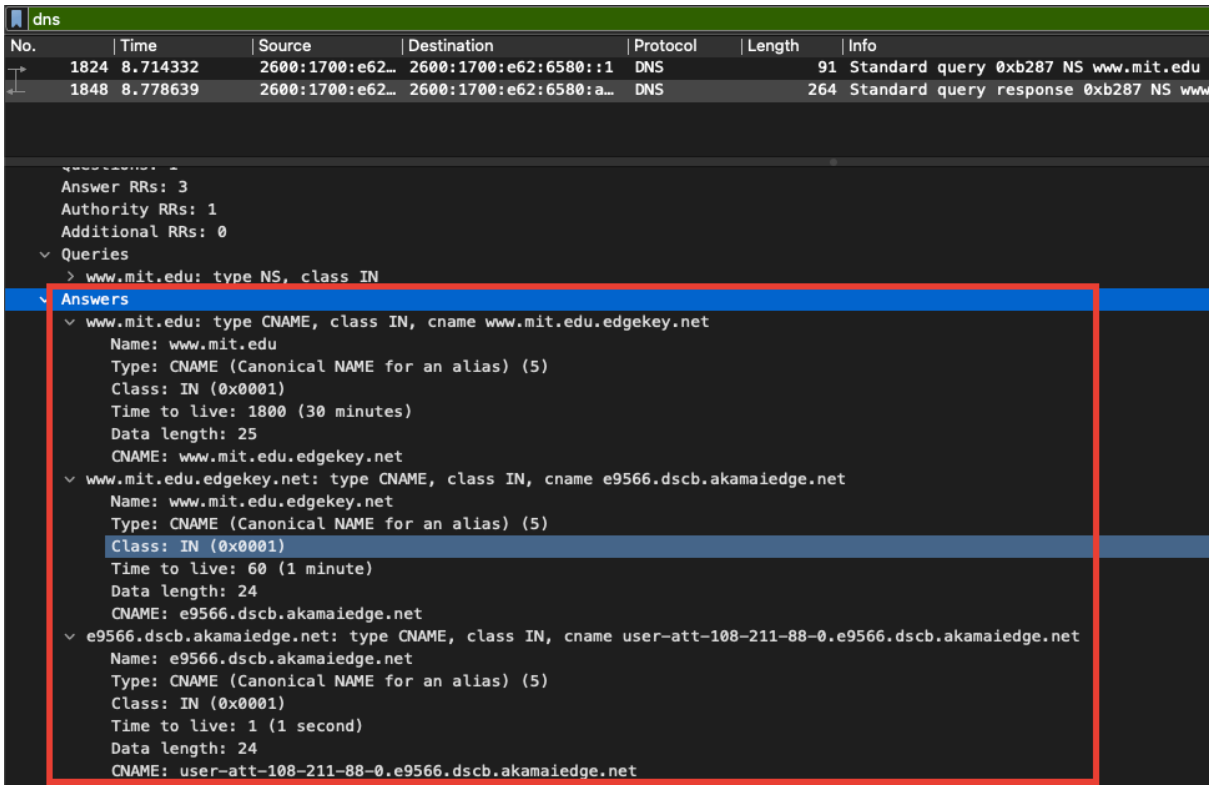


14. Examine the DNS response message. How many “answers” are provided? What do each of these answers contain?

Ans: DNS response message has three answers and each of them has Name, Type, TTL, Data Length and Server IP Address as fields.

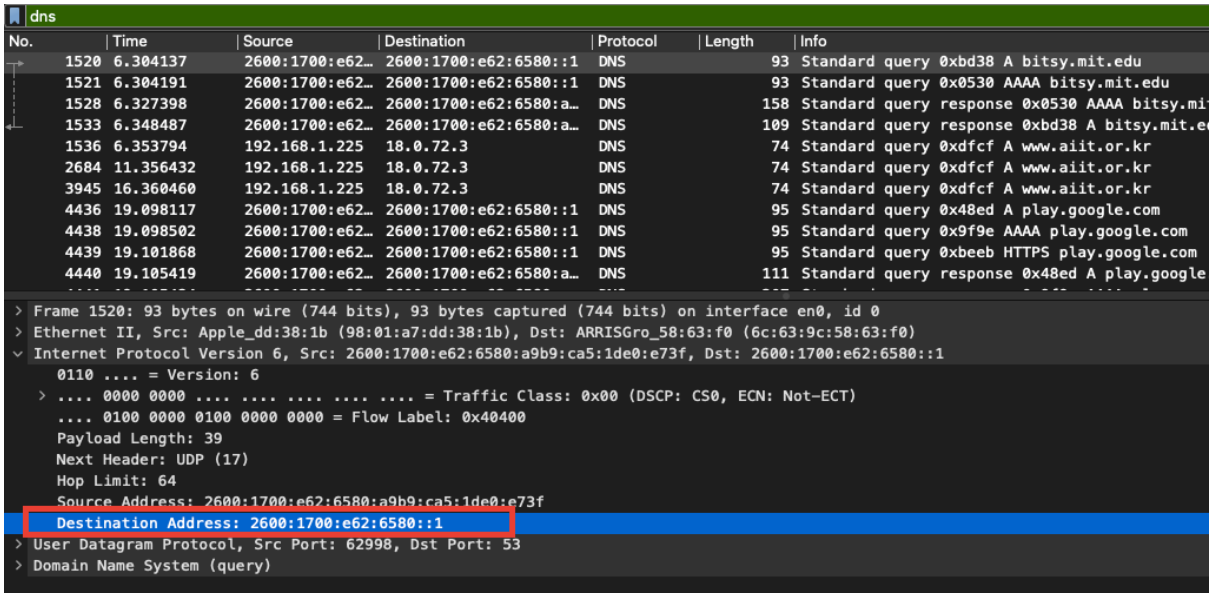


15. Provide a screenshot.



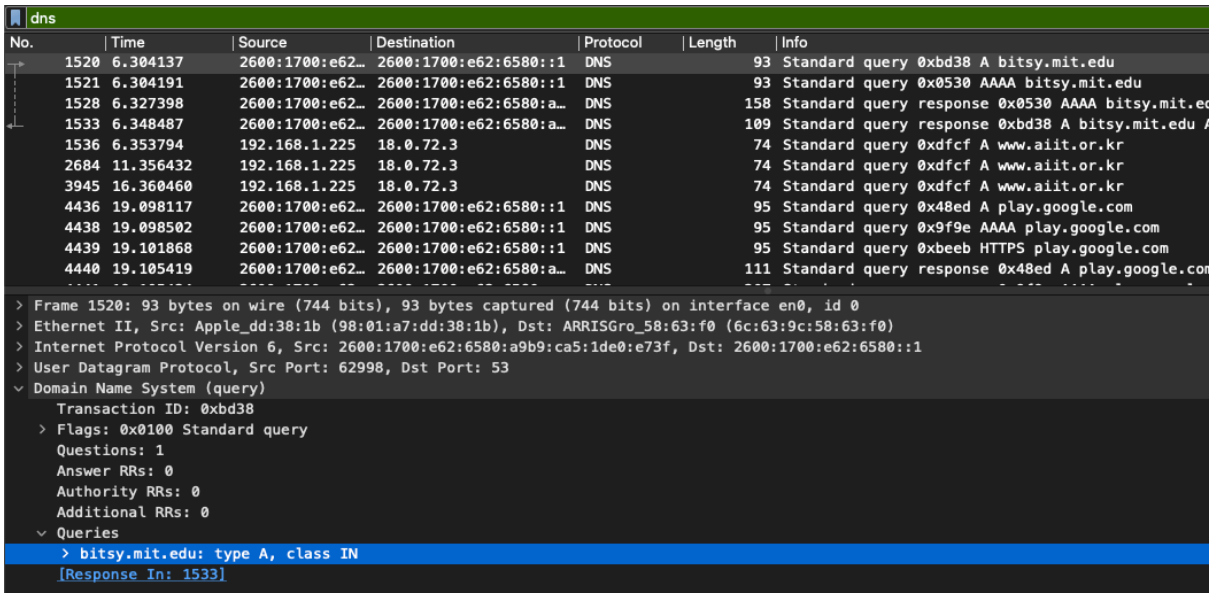
16. To what IP address is the DNS query message sent? Is this the IP address of your default local DNS server?

Ans: DNS query message was sent to same IP address that of the local DNS server which is “2600:1700:62:6580::1”



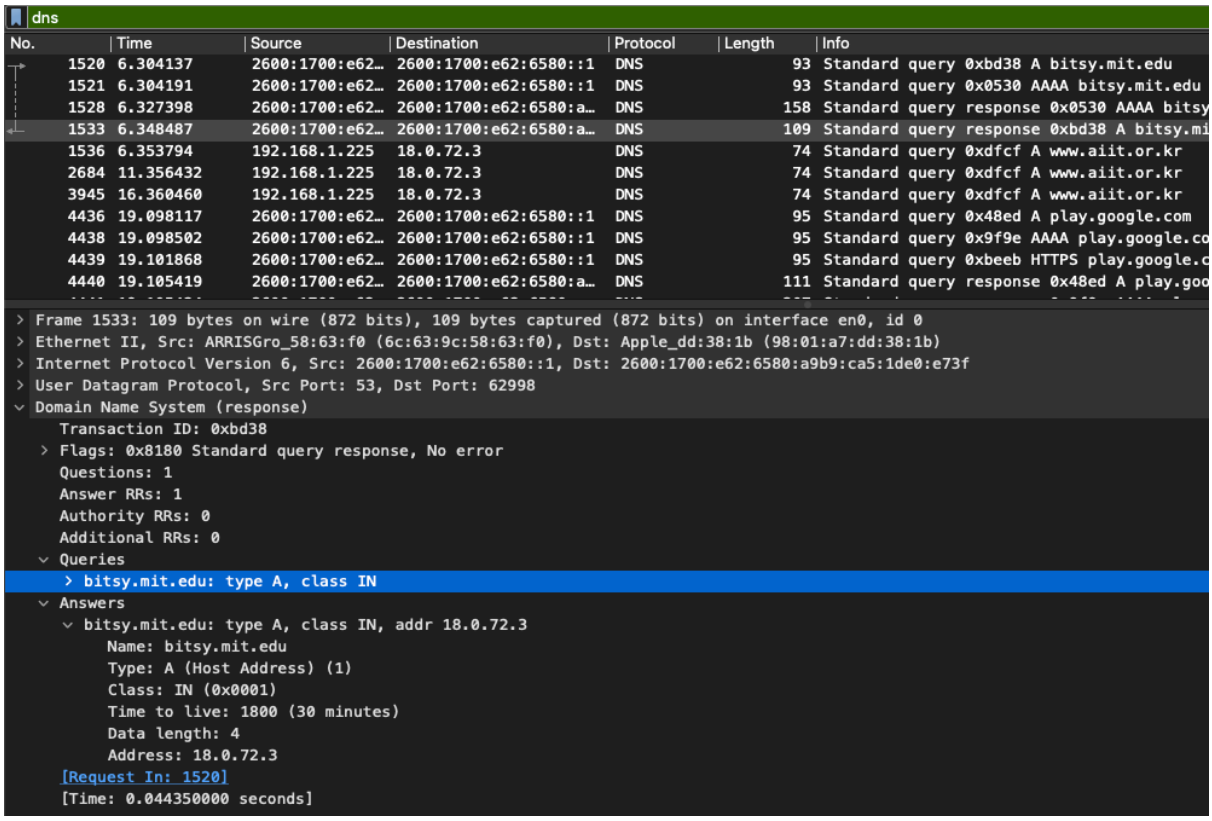
17. Examine the DNS query message. What “Type” of DNS query is it? Does the query message contain any “answers”?

Ans: DNS query is of type A and the query message does not have any answers.

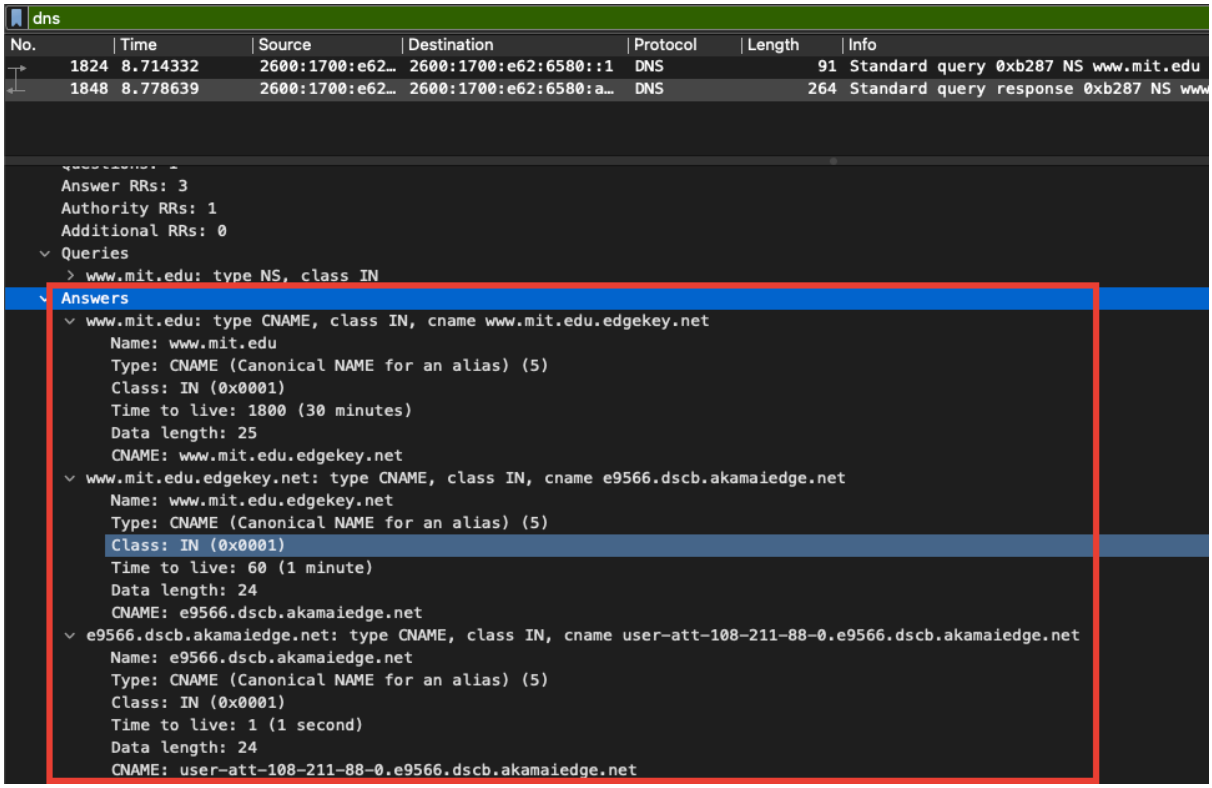


18. Examine the DNS response message. What MIT nameservers does the response message provide? Does this response message also provide the IP addresses of the MIT nameservers?

Ans: DNS response message contains 8 MIT nameservers along with the IP addresses which are highlighted in the screenshot.

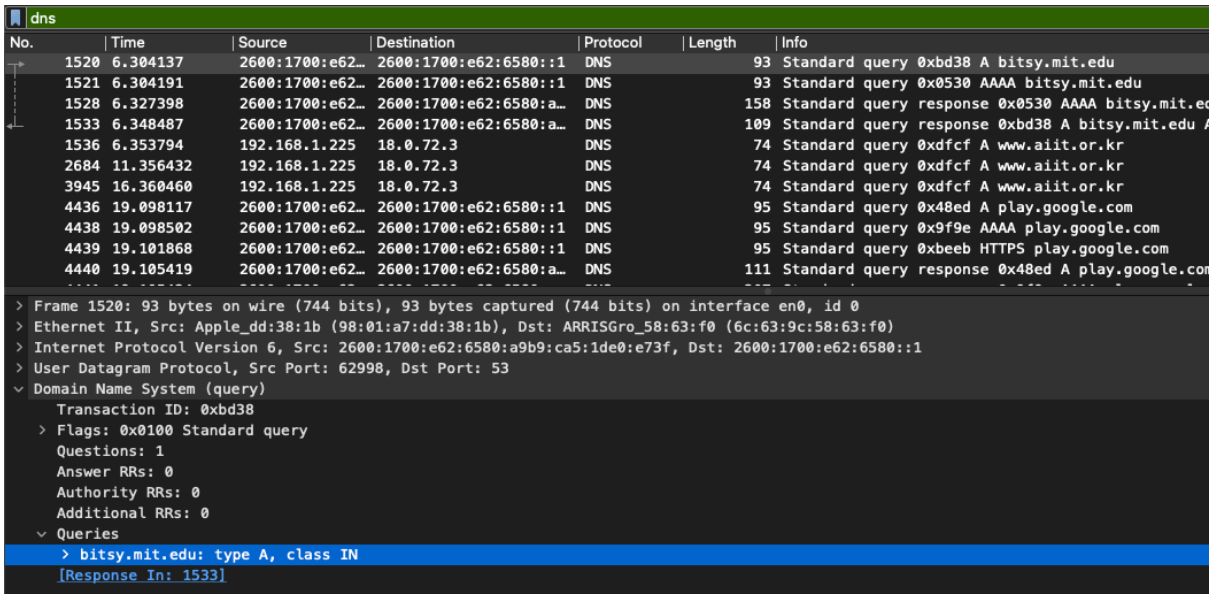


19. Please provide screenshots.



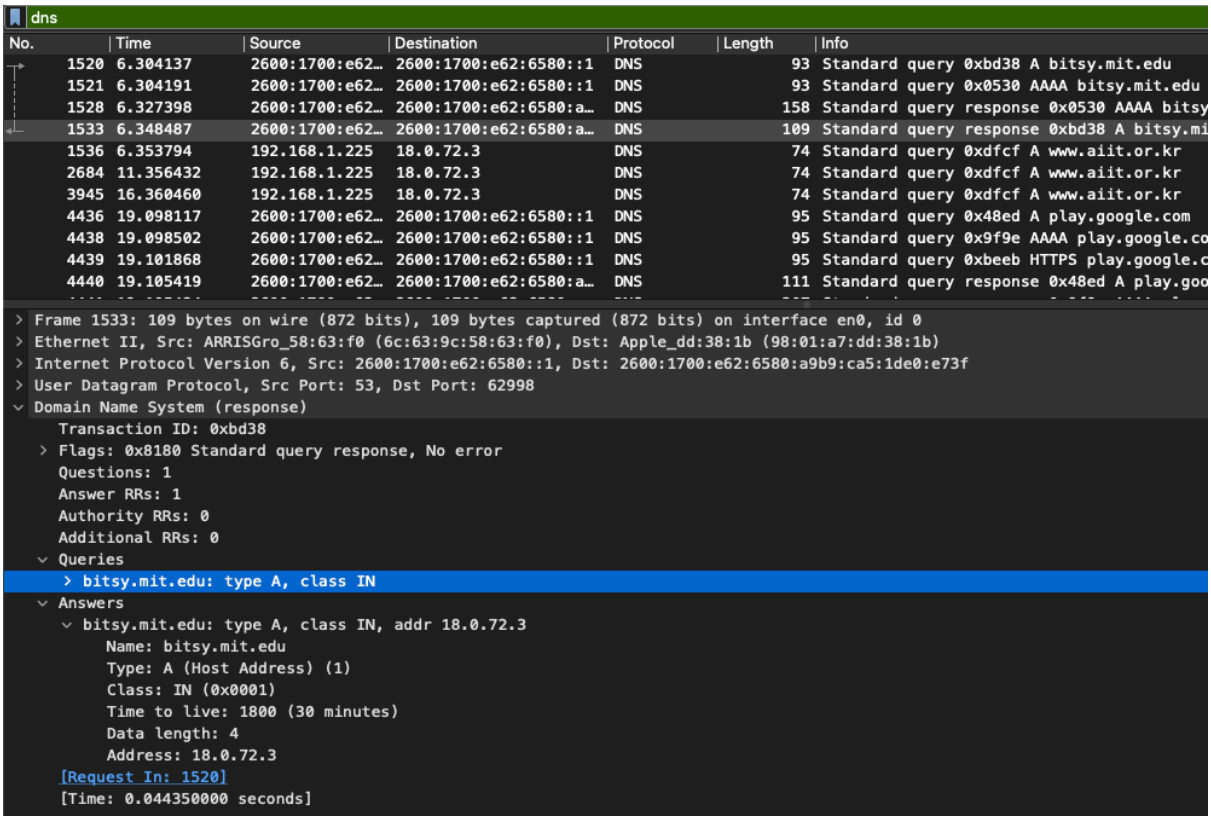
20. To what IP address is the DNS query message sent? Is this the IP address of your default local DNS server? If not, what does the IP address correspond to?

Ans: DNS query message is sent to the IP address “2600:1700:62:6580:a9b9:ca5:1de0:e73f” which is the IP address of bitsy.mit DNS response server.



21. Examine the DNS query message. What “Type” of DNS query is it? Does the query message contain any “answers”?

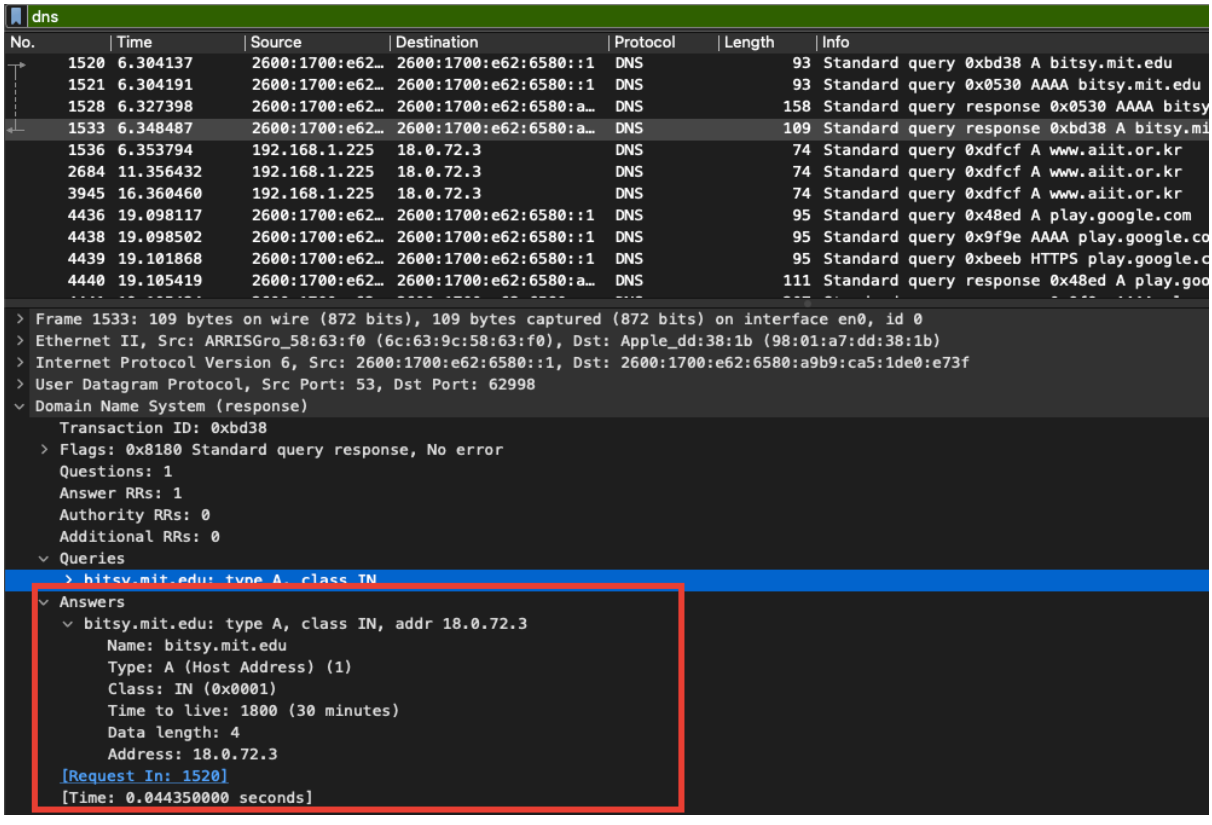
Ans: DNS query message is type A and does not contain any “answers.”



22. Examine the DNS response message. How many “answers” are provided? What does each of these answers contain?

Ans: Only one answer provided in the DNS response message and the answer contains fields like Name, Type, TTL, Data Length and Servers IP addresses.

23. Provide Screenshot.



Problem 19:

a. Starting with a root DNS Server (for one of the root-servers[a-m].root-servers.net), initiate a sequence of queries for the IP Address for your department's web server by using dig. Show the list of the names of DNS servers in the delegation chain in answering your query.

Solution: I have initiated a sequence of queries using dig on the department's website (cise.ufl.edu)

```
(base) jaswanth@jaswanths-Air ~ % dig @j.root-servers.net cise.ufl.edu

; <<>> DiG 9.10.6 <<>> @j.root-servers.net cise.ufl.edu
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 6839
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 27
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;cise.ufl.edu.                  IN      A

;; AUTHORITY SECTION:
edu.                    172800  IN      NS      b.edu-servers.net.
edu.                    172800  IN      NS      f.edu-servers.net.
edu.                    172800  IN      NS      i.edu-servers.net.
edu.                    172800  IN      NS      a.edu-servers.net.
edu.                    172800  IN      NS      g.edu-servers.net.
edu.                    172800  IN      NS      j.edu-servers.net.
edu.                    172800  IN      NS      k.edu-servers.net.
edu.                    172800  IN      NS      m.edu-servers.net.
edu.                    172800  IN      NS      l.edu-servers.net.
edu.                    172800  IN      NS      h.edu-servers.net.
edu.                    172800  IN      NS      c.edu-servers.net.
edu.                    172800  IN      NS      e.edu-servers.net.
edu.                    172800  IN      NS      d.edu-servers.net.

;; ADDITIONAL SECTION:
b.edu-servers.net.      172800  IN      A       192.33.14.30
b.edu-servers.net.      172800  IN      AAAA    2001:503:231d::2:30
f.edu-servers.net.      172800  IN      A       192.35.51.30
f.edu-servers.net.      172800  IN      AAAA    2001:503:d414::30
i.edu-servers.net.      172800  IN      A       192.43.172.30
i.edu-servers.net.      172800  IN      AAAA    2001:503:39c1::30
a.edu-servers.net.      172800  IN      A       192.5.6.30
a.edu-servers.net.      172800  IN      AAAA    2001:503:a83e::2:30
g.edu-servers.net.      172800  IN      A       192.42.93.30
g.edu-servers.net.      172800  IN      AAAA    2001:503:eea3::30
j.edu-servers.net.      172800  IN      A       192.48.79.30
j.edu-servers.net.      172800  IN      AAAA    2001:502:7094::30
k.edu-servers.net.      172800  IN      A       192.52.178.30
k.edu-servers.net.      172800  IN      AAAA    2001:503:d2d::30
m.edu-servers.net.      172800  IN      A       192.55.83.30
m.edu-servers.net.      172800  IN      AAAA    2001:501:b1f9::30
l.edu-servers.net.      172800  IN      A       192.41.162.30
l.edu-servers.net.      172800  IN      AAAA    2001:500:d937::30
h.edu-servers.net.      172800  IN      A       192.54.112.30
h.edu-servers.net.      172800  IN      AAAA    2001:502:8cc::30
c.edu-servers.net.      172800  IN      A       192.26.92.30
c.edu-servers.net.      172800  IN      AAAA    2001:503:83eb::30
e.edu-servers.net.      172800  IN      A       192.12.94.30
e.edu-servers.net.      172800  IN      AAAA    2001:502:1ca1::30
d.edu-servers.net.      172800  IN      A       192.31.80.30
d.edu-servers.net.      172800  IN      AAAA    2001:500:856e::30

;; Query time: 11 msec
;; SERVER: 2001:503:c27::2:30#53(2001:503:c27::2:30)
;; WHEN: Fri Sep 23 14:48:14 CDT 2022
;; MSG SIZE  rcvd: 836
```

```
(base) jaswanth@jaswanths-Air ~ % dig @j.edu-servers.net cise.ufl.edu

; <<>> DiG 9.10.6 <<>> @j.edu-servers.net cise.ufl.edu
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 15665
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 5
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;cise.ufl.edu.                  IN      A

;; AUTHORITY SECTION:
ufl.edu.                172800  IN      NS      ns.name.ufl.edu.
ufl.edu.                172800  IN      NS      rns.name.ufl.edu.
ufl.edu.                172800  IN      NS      ens.name.ufl.edu.

;; ADDITIONAL SECTION:
ns.name.ufl.edu.        172800  IN      A       128.227.30.254
rns.name.ufl.edu.       172800  IN      A       128.6.224.66
ens.name.ufl.edu.       172800  IN      A       128.227.30.252
ens.name.ufl.edu.       172800  IN      A       128.227.30.253

;; Query time: 77 msec
;; SERVER: 2001:502:7094::30#53(2001:502:7094::30)
;; WHEN: Fri Sep 23 14:49:22 CDT 2022
;; MSG SIZE  rcvd: 163
```

Now we fetch the list of names of name servers / DNS servers in the chain

```
(base) jaswanth@jaswanths-Air ~ % dig @ns.name.ufl.edu cise.ufl.edu

; <<>> DiG 9.10.6 <<>> @ns.name.ufl.edu cise.ufl.edu
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 58773
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 6
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1220
;; QUESTION SECTION:
;cise.ufl.edu.                  IN      A

;; ANSWER SECTION:
cise.ufl.edu.           3600    IN      A       128.227.36.46

;; AUTHORITY SECTION:
cise.ufl.edu.           3600    IN      NS      ns.name.ufl.edu.
cise.ufl.edu.           3600    IN      NS      ns1.cise.ufl.edu.
cise.ufl.edu.           3600    IN      NS      ns2.cise.ufl.edu.
cise.ufl.edu.           3600    IN      NS      ns3.cise.ufl.edu.

;; ADDITIONAL SECTION:
ns.name.ufl.edu.        900     IN      A       8.6.245.30
ns.name.ufl.edu.        900     IN      A       128.227.30.254
ns1.cise.ufl.edu.       3600    IN      A       128.227.205.194
ns2.cise.ufl.edu.       3600    IN      A       128.227.205.195
ns3.cise.ufl.edu.       3600    IN      A       128.227.205.196

;; Query time: 215 msec
;; SERVER: 8.6.245.30#53(8.6.245.30)
;; WHEN: Fri Sep 23 14:50:34 CDT 2022
;; MSG SIZE  rcvd: 213
```

b. Repeat part (a) for a popular website

Solution: I have initiated a sequence of queries using dig on popular website – Apple (apple.com)

```
(base) jaswanth@jaswanths-Air ~ % dig @j.gtld-servers.net apple.com

; <<>> DiG 9.10.6 <<>> @j.gtld-servers.net apple.com
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 15679
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 9
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;apple.com.                     IN      A

;; AUTHORITY SECTION:
apple.com.              172800  IN      NS      a.ns.apple.com.
apple.com.              172800  IN      NS      b.ns.apple.com.
apple.com.              172800  IN      NS      c.ns.apple.com.
apple.com.              172800  IN      NS      d.ns.apple.com.

;; ADDITIONAL SECTION:
a.ns.apple.com.         172800  IN      A       17.253.200.1
a.ns.apple.com.         172800  IN      AAAA    2620:149:ae0::53
b.ns.apple.com.         172800  IN      A       17.253.207.1
b.ns.apple.com.         172800  IN      AAAA    2620:149:ae7::53
c.ns.apple.com.         172800  IN      A       204.19.119.1
c.ns.apple.com.         172800  IN      AAAA    2620:171:800:714::1
d.ns.apple.com.         172800  IN      A       204.26.57.1
d.ns.apple.com.         172800  IN      AAAA    2620:171:801:714::1

;; Query time: 75 msec
;; SERVER: 2001:502:7094::30#53(2001:502:7094::30)
;; WHEN: Fri Sep 23 14:52:23 CDT 2022
;; MSG SIZE  rcvd: 281
```

```
(base) jaswanth@jaswanths-Air ~ % dig @j.root-servers.net apple.com

; <<>> DiG 9.10.6 <<>> @j.root-servers.net apple.com
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 17427
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 27
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;apple.com.                     IN      A

;; AUTHORITY SECTION:
com.                    172800  IN      NS      e.gtld-servers.net.
com.                    172800  IN      NS      b.gtld-servers.net.
com.                    172800  IN      NS      j.gtld-servers.net.
com.                    172800  IN      NS      m.gtld-servers.net.
com.                    172800  IN      NS      i.gtld-servers.net.
com.                    172800  IN      NS      f.gtld-servers.net.
com.                    172800  IN      NS      a.gtld-servers.net.
com.                    172800  IN      NS      g.gtld-servers.net.
com.                    172800  IN      NS      h.gtld-servers.net.
com.                    172800  IN      NS      l.gtld-servers.net.
com.                    172800  IN      NS      k.gtld-servers.net.
com.                    172800  IN      NS      c.gtld-servers.net.
com.                    172800  IN      NS      d.gtld-servers.net.

;; ADDITIONAL SECTION:
e.gtld-servers.net.     172800  IN      A       192.12.94.30
e.gtld-servers.net.     172800  IN      AAAA    2001:502:1ca1::30
b.gtld-servers.net.     172800  IN      A       192.33.14.30
b.gtld-servers.net.     172800  IN      AAAA    2001:503:231d::2:30
j.gtld-servers.net.     172800  IN      A       192.48.79.30
j.gtld-servers.net.     172800  IN      AAAA    2001:502:7094::30
m.gtld-servers.net.     172800  IN      A       192.55.83.30
m.gtld-servers.net.     172800  IN      AAAA    2001:501:b1f9::30
i.gtld-servers.net.     172800  IN      A       192.43.172.30
i.gtld-servers.net.     172800  IN      AAAA    2001:503:39c1::30
f.gtld-servers.net.     172800  IN      A       192.35.51.30
f.gtld-servers.net.     172800  IN      AAAA    2001:503:d414::30
a.gtld-servers.net.     172800  IN      A       192.5.6.30
a.gtld-servers.net.     172800  IN      AAAA    2001:503:a83e::2:30
g.gtld-servers.net.     172800  IN      A       192.42.93.30
g.gtld-servers.net.     172800  IN      AAAA    2001:503:eea3::30
h.gtld-servers.net.     172800  IN      A       192.54.112.30
h.gtld-servers.net.     172800  IN      AAAA    2001:502:8cc::30
l.gtld-servers.net.     172800  IN      A       192.41.162.30
l.gtld-servers.net.     172800  IN      AAAA    2001:500:d937::30
k.gtld-servers.net.     172800  IN      A       192.52.178.30
k.gtld-servers.net.     172800  IN      AAAA    2001:503:d2d::30
c.gtld-servers.net.     172800  IN      A       192.26.92.30
c.gtld-servers.net.     172800  IN      AAAA    2001:503:83eb::30
d.gtld-servers.net.     172800  IN      A       192.31.80.30
d.gtld-servers.net.     172800  IN      AAAA    2001:500:856e::30

;; Query time: 17 msec
;; SERVER: 192.58.128.30#53(192.58.128.30)
;; WHEN: Fri Sep 23 14:51:30 CDT 2022
;; MSG SIZE  rcvd: 834
```

```
(base) jaswanth@jaswanths-Air ~ % dig @a.ns.apple.com apple.com

; <<>> DiG 9.10.6 <<>> @a.ns.apple.com apple.com
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 35132
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 9
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;apple.com.                     IN      A

;; ANSWER SECTION:
apple.com.              900     IN      A       17.253.144.10

;; AUTHORITY SECTION:
apple.com.              43200   IN      NS      b.ns.apple.com.
apple.com.              43200   IN      NS      a.ns.apple.com.
apple.com.              43200   IN      NS      c.ns.apple.com.
apple.com.              43200   IN      NS      d.ns.apple.com.

;; ADDITIONAL SECTION:
b.ns.apple.com.         43200   IN      AAAA    2620:149:ae7::53
a.ns.apple.com.         43200   IN      AAAA    2620:149:ae0::53
c.ns.apple.com.         43200   IN      AAAA    2620:171:800:714::1
d.ns.apple.com.         43200   IN      AAAA    2620:171:801:714::1
b.ns.apple.com.         43200   IN      A       17.253.207.1
a.ns.apple.com.         43200   IN      A       17.253.200.1
c.ns.apple.com.         43200   IN      A       204.19.119.1
d.ns.apple.com.         43200   IN      A       204.26.57.1

;; Query time: 132 msec
;; SERVER: 2620:149:ae0::53#53(2620:149:ae0::53)
;; WHEN: Fri Sep 23 14:52:53 CDT 2022
;; MSG SIZE  rcvd: 297
```