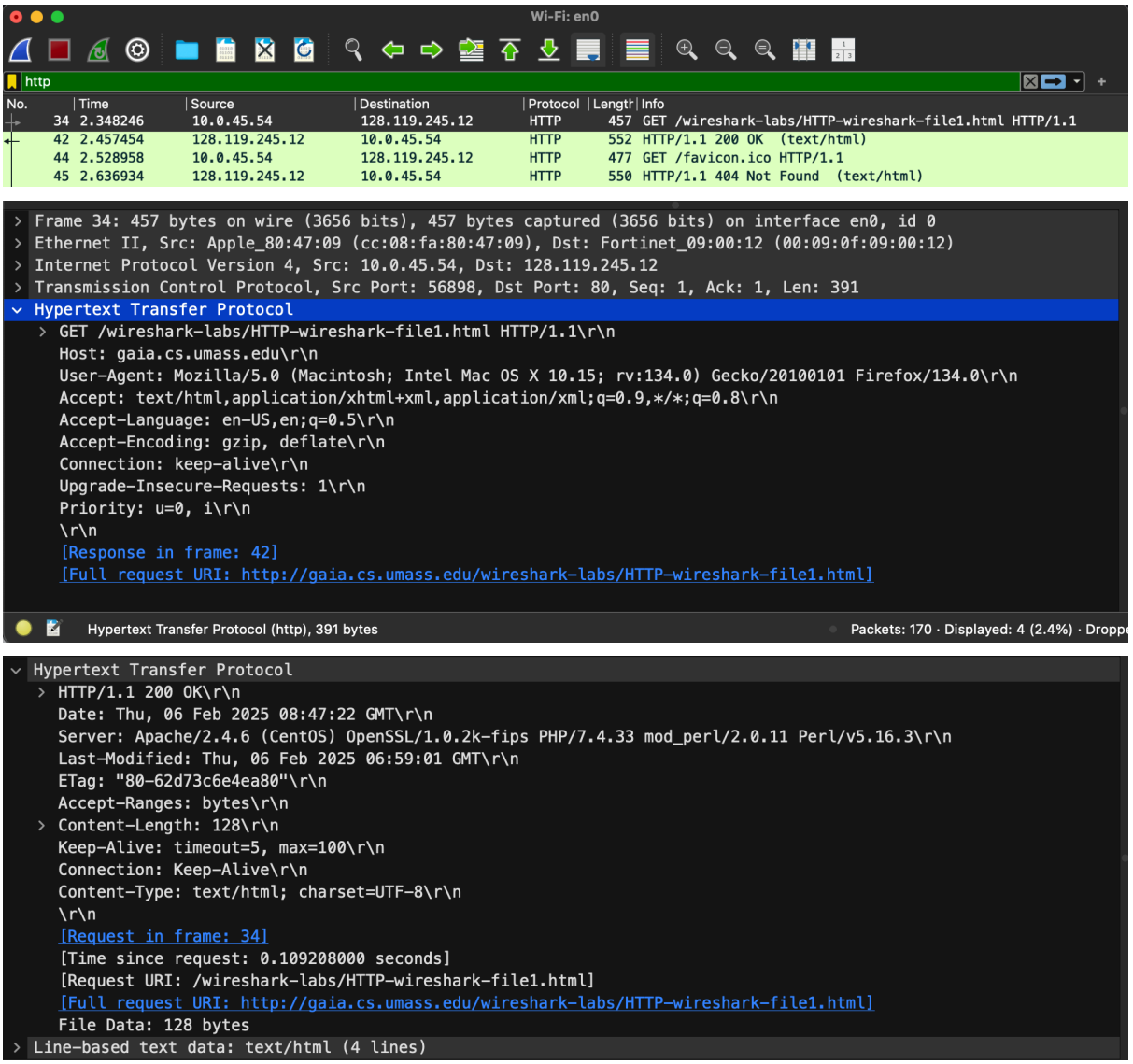
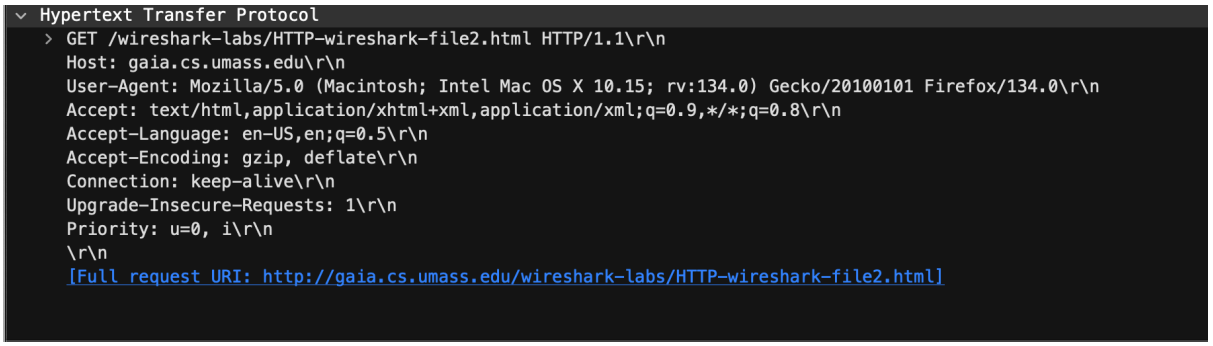
Task 1.

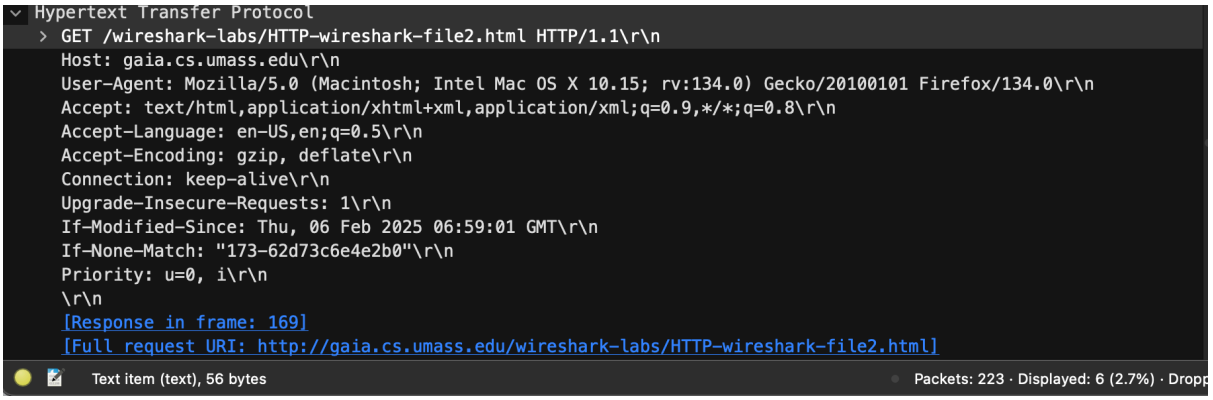


a) My IP: 10.0.45.54, gaia.cs.umass.edu IP: 128.119.245.12
b) Version: HTTP/1.1. Code: 200. Phrase: OK.
c)
   i) Language accepted: English-US.
   ii) Modified: 06/2-25, 06:59:01 GTM
   iii) 128 bytes

Task 2.

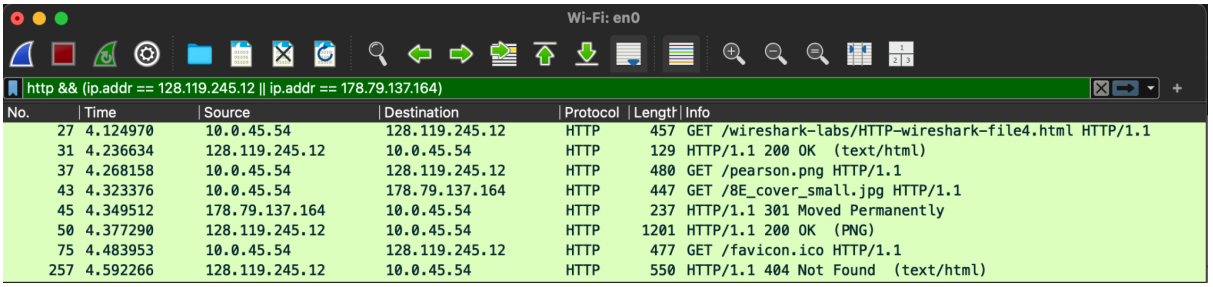


a) There is no Of-Modified-Since, because it's the first time the browser requests that page, and therefore has no cached version of it.
b) HTTP/1.1 200 OK means that the server has explicitly accepted our request.



c) There is an If-Modified-Since line, stating the information of the last time the cached file was modified, Thu, 06 Feb 2025 06:59:01 GMT.
d) Since the file has not been modified, the response from the server is HTTP/1.1 304 Not Modified.

Task 3.



a) Ignoring the favicon request, we have 3 GET requests in total, to 2 different IPs, 128.119.245.12 and 178.79.137.164. The reason why we have 3 GET but 2 IPs, is because one of the images is hosted at the same place as the HTML file.
b) In this case, the requests have been sent in parallel, We can tell from that both GET for the images, are sent after each other and not waiting for the server response.

2.1

(a)

```
cstl@cstls-Air ~ % nslookup governo.gov.ao

Server:         2001:6b0:2:1::53
Address:        2001:6b0:2:1::53#53

Non-authoritative answer:
Name: governo.gov.ao
Address: 197.216.107.12
```

(b)

```
cstl@cstls-Air ~ % nslookup -type=MX unmsm.edu.pe

Server:         2001:6b0:2:1::53
Address:        2001:6b0:2:1::53#53

Non-authoritative answer:
unmsm.edu.pe        mail exchanger = 10 alt4.aspmx.l.google.com.
unmsm.edu.pe        mail exchanger = 1 aspmx.l.google.com.
unmsm.edu.pe        mail exchanger = 5 alt1.aspmx.l.google.com.
unmsm.edu.pe        mail exchanger = 5 alt2.aspmx.l.google.com.
unmsm.edu.pe        mail exchanger = 10 aspmx3.googlemail.com.
unmsm.edu.pe        mail exchanger = 10 aspmx2.googlemail.com.

Authoritative answers can be found from:

cstl@cstls-Air ~ %
```

(c)

```
cstl@cstls-Air ~ % nslookup -type=NS svt.se
Server:         2001:6b0:2:1::53
Address:        2001:6b0:2:1::53#53

Non-authoritative answer:
svt.se  nameserver = a14-64.akam.net.
svt.se  nameserver = nsa.dnsnode.net.
svt.se  nameserver = nsp.dnsnode.net.
svt.se  nameserver = nsu.dnsnode.net.
svt.se  nameserver = a1-8.akam.net.
svt.se  nameserver = a2-65.akam.net.
svt.se  nameserver = a3-67.akam.net.

Authoritative answers can be found from:
nsp.dnsnode.net         has AAAA address 2a01:3f1:3032::53
a1-8.akam.net has AAAA address 2600:1401:2::8
a2-65.akam.net          has AAAA address 2600:1480:7000::41
a3-67.akam.net          has AAAA address 2600:1408:1c::43
a14-64.akam.net         has AAAA address 2600:1480:1800::40
nsp.dnsnode.net         internet address = 194.58.198.32
a1-8.akam.net internet address = 193.108.91.8
a2-65.akam.net          internet address = 95.100.174.65
a3-67.akam.net          internet address = 96.7.49.67
a14-64.akam.net         internet address = 184.26.161.64
```

We see that, for example:

svt.se nameserver = a14-64.akam.net.

which means that a server named a14-64.akam.net is responsible for svt.se.

Furthermore, we can also see that:

a14-64.akam.net has AAAA address 2600:1480:1800::40

a14-64.akam.net internet address = 184.26.161.64

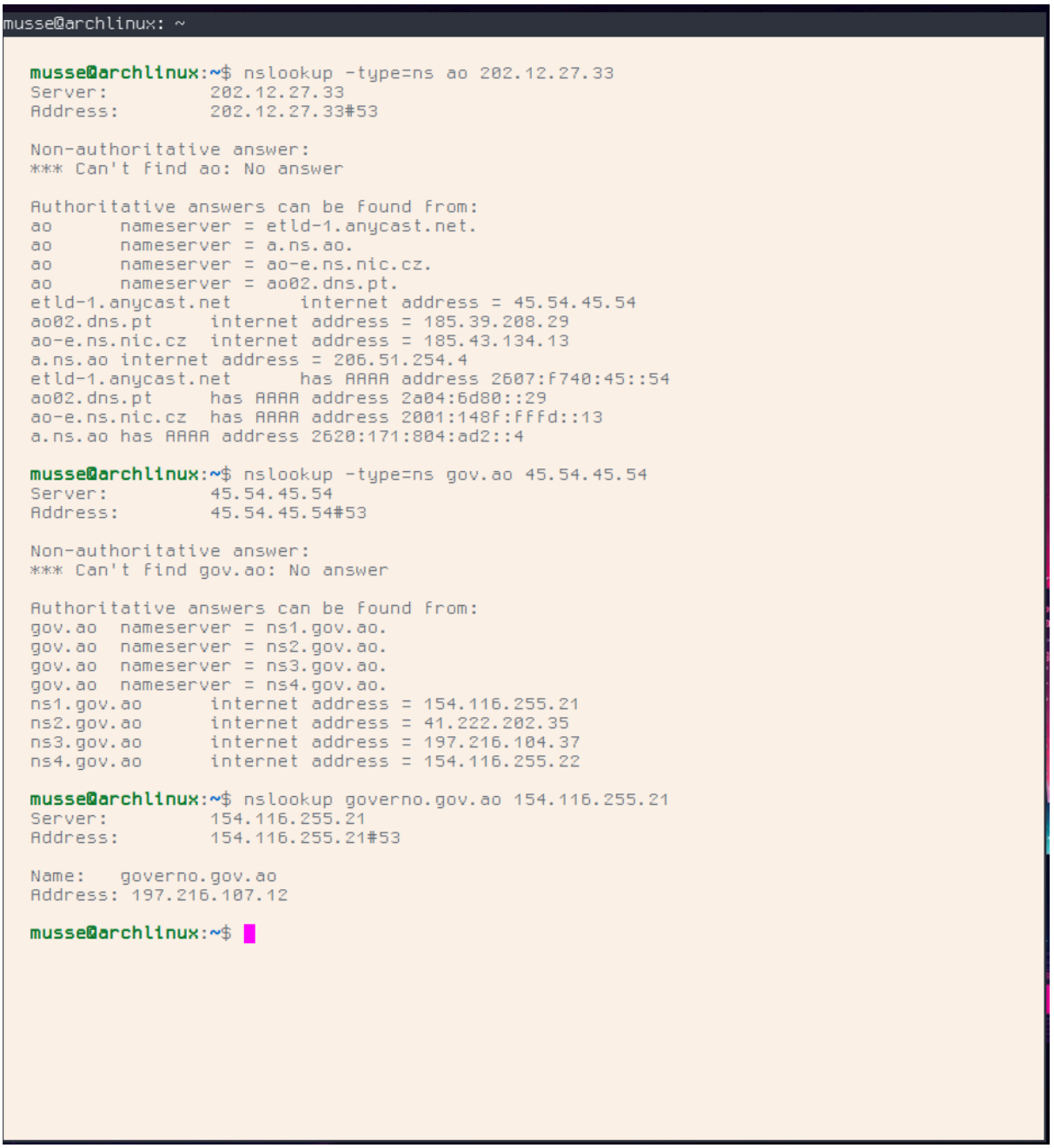
which means that a14-64.akam.net has both an IPv6 and an IPv4 address.

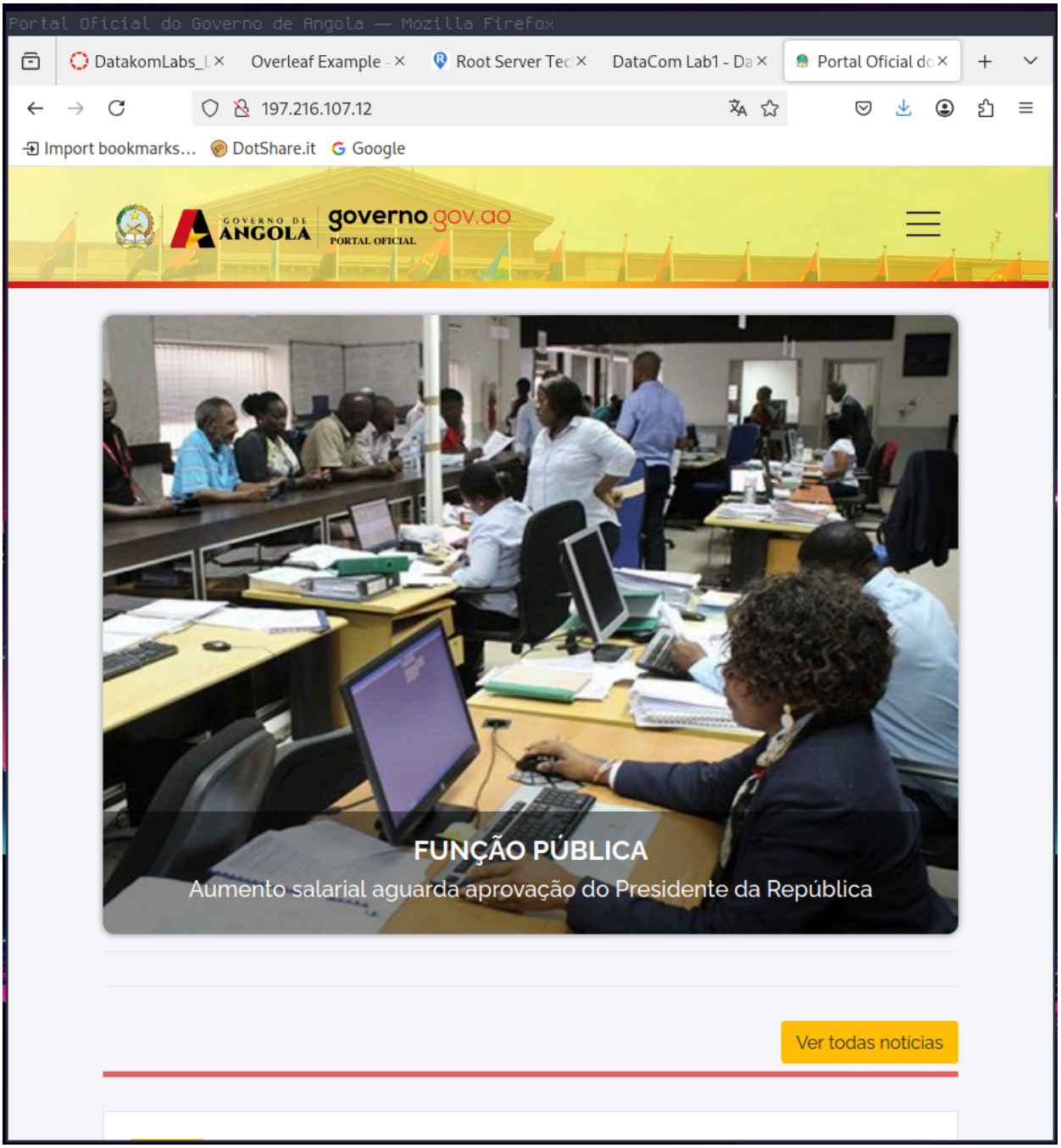
(d)

```
cstl@cstls-Air ~ % nslookup amazon.com a14-64.akam.net.
Server:         a14-64.akam.net.
Address:        2600:1480:1800::40#53

** server can't find amazon.com: REFUSED

cstl@cstls-Air ~ %
```

The answer I get is refused, since a14-64.akam.net. has no authority over amazon.com, and therefore can’t give us its IP.

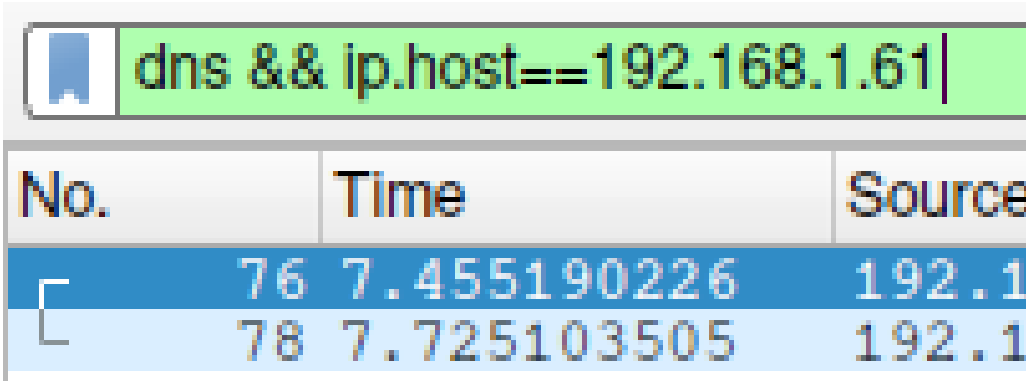
5


musse@archlinux: ~
musse@archlinux:~$ nslookup -type=ns ao 202.12.27.33
Server: 202.12.27.33
Address: 202.12.27.33#53
Non-authoritative answer:
*** Can't find ao: No answer
Authoritative answers can be found from:
ao nameserver = etld-1.anycast.net.
ao nameserver = a.ns.ao.
ao nameserver = ao-e.ns.nic.cz.
ao nameserver = ao02.dns.pt.
etld-1.anycast.net internet address = 45.54.45.54
ao02.dns.pt internet address = 185.39.208.29
ao-e.ns.nic.cz internet address = 185.43.134.13
a.ns.ao internet address = 206.51.254.4
etld-1.anycast.net has AAAA address 2607:f740:45::54
ao02.dns.pt has AAAA address 2a04:6d80::29
ao-e.ns.nic.cz has AAAA address 2001:148f:fffd::13
a.ns.ao has AAAA address 2620:171:804:ad2::4
musse@archlinux:~$ nslookup -type=ns gov.ao 45.54.45.54
Server: 45.54.45.54
Address: 45.54.45.54#53
Non-authoritative answer:
*** Can't find gov.ao: No answer
Authoritative answers can be found from:
gov.ao nameserver = ns1.gov.ao.
gov.ao nameserver = ns2.gov.ao.
gov.ao nameserver = ns3.gov.ao.
gov.ao nameserver = ns4.gov.ao.
ns1.gov.ao internet address = 154.116.255.21
ns2.gov.ao internet address = 41.222.202.35
ns3.gov.ao internet address = 197.216.104.37
ns4.gov.ao internet address = 154.116.255.22
musse@archlinux:~$ nslookup governo.gov.ao 154.116.255.21
Server: 154.116.255.21
Address: 154.116.255.21#53
Name: governo.gov.ao
Address: 197.216.107.12
musse@archlinux:~$


Portal Oficial do Governo de Angola — Mozilla Firefox
DatakomLabs_L
Overleaf Example -
Root Server Tec
DataCom Lab1 - Da
Portal Oficial do
197.216.107.12
Import bookmarks...
DotShare.it
Google
GOVERNO DE ANGOLA
governo.gov.ao
PORTAL OFICIAL
FUNÇÃO PÚBLICA
Aumento salarial aguarda aprovação do Presidente da República
Ver todas noticias

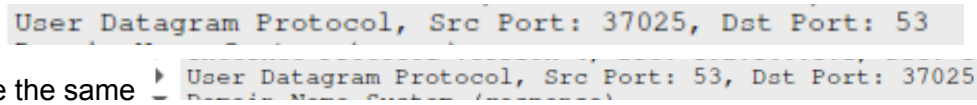
6.

a)



b)

1. UDP
2. They are the same
3. It is sent to my router



Query:

```
▸ Frame 76: 88 bytes on wire (704 bits), 88 bytes captured (704 bits) on interface wlan0, id 0
▸ Ethernet II, Src: LiteonTechno_6a:dd:87 (3c:95:09:6a:dd:87), Dst: ASUSTekCOMPU_68:4b:18 (3c:7c:3f:68:4b:18)
▸ Internet Protocol Version 4, Src: 192.168.1.61, Dst: 192.168.1.1
▸ User Datagram Protocol, Src Port: 37025, Dst Port: 53
▾ Domain Name System (query)
    Transaction ID: 0x5120
  ▾ Flags: 0x0100 Standard query
      0... .... .... .... = Response: Message is a query
      .000 0... .... .... = Opcode: Standard query (0)
      .... ..0. .... .... = Truncated: Message is not truncated
      .... ...1 .... .... = Recursion desired: Do query recursively
      .... .... .0.. .... = Z: reserved (0)
      .... .... ...0 .... = Non-authenticated data: Unacceptable
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 1
  ▾ Queries
    ▾ gaia.cs.umass.edu: type A, class IN
        Name: gaia.cs.umass.edu
        [Name Length: 17]
        [Label Count: 4]
        Type: A (1) (Host Address)
        Class: IN (0x0001)
  ▾ Additional records
    ▾ <Root>: type OPT
        Name: <Root>
        Type: OPT (41)
        UDP payload size: 1472
        Higher bits in extended RCODE: 0x00
        EDNS0 version: 0
      ▾ Z: 0x0000
          0... .... .... .... = DO bit: Cannot handle DNSSEC security RRs
          .000 0000 0000 0000 = Reserved: 0x0000
        Data length: 0
    [Response In: 78]
```

c) Response:

```
▸ Frame 78: 104 bytes on wire (832 bits), 104 bytes captured (832 bits) on interface wlan0, id 0
▸ Ethernet II, Src: ASUSTekCOMPU_68:4b:18 (3c:7c:3f:68:4b:18), Dst: LiteonTechno_6a:dd:87 (3c:95:09:6a:dd:87)
▸ Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.1.61
▸ User Datagram Protocol, Src Port: 53, Dst Port: 37025
▾ Domain Name System (response)
    Transaction ID: 0x5120
  ▾ Flags: 0x8180 Standard query response, No error
      1... .... .... .... = Response: Message is a response
      .000 0... .... .... = Opcode: Standard query (0)
      .... .0.. .... .... = Authoritative: Server is not an authority for domain
      .... ..0. .... .... = Truncated: Message is not truncated
      .... ...1 .... .... = Recursion desired: Do query recursively
      .... .... 1... .... = Recursion available: Server can do recursive queries
      .... .... .0.. .... = Z: reserved (0)
      .... .... ..0. .... = Answer authenticated: Answer/authority portion was not authenticated by the server
      .... .... ...0 .... = Non-authenticated data: Unacceptable
      .... .... .... 0000 = Reply code: No error (0)
    Questions: 1
    Answer RRs: 1
    Authority RRs: 0
    Additional RRs: 1
  ▾ Queries
    ▾ gaia.cs.umass.edu: type A, class IN
        Name: gaia.cs.umass.edu
        [Name Length: 17]
        [Label Count: 4]
        Type: A (1) (Host Address)
        Class: IN (0x0001)
  ▾ Answers
    ▾ gaia.cs.umass.edu: type A, class IN, addr 128.119.245.12
        Name: gaia.cs.umass.edu
        Type: A (1) (Host Address)
        Class: IN (0x0001)
        Time to live: 3600 (1 hour)
        Data length: 4
        Address: 128.119.245.12
  ▾ Additional records
    ▾ <Root>: type OPT
        Name: <Root>
        Type: OPT (41)
        UDP payload size: 1232
        Higher bits in extended RCODE: 0x00
        EDNS0 version: 0
      ▾ Z: 0x0000
          0... .... .... .... = DO bit: Cannot handle DNSSEC security RRs
          .000 0000 0000 0000 = Reserved: 0x0000
        Data length: 0
    [Request In: 76]
    [Time: 0.269913279 seconds]
```

It's a standard query

d)

No new queries since all info about the paths are in the html which the web server provides for

```
<p align="left">
  <img src="http://kurose.cslash.net/8E_cover_small.jpg" width="168" height="220"> == $0
</p>
" And while we have your attention, you might want to take time to check out the available open resources for this book at "
<a href="http://gaia.cs.umass.edu/kurose_ross">http://gaia.cs.umass.edu/kurose_ross</a>
```

e) no the browser cached the ip-adress connected to the domain in it's DNS cache

7.

a)

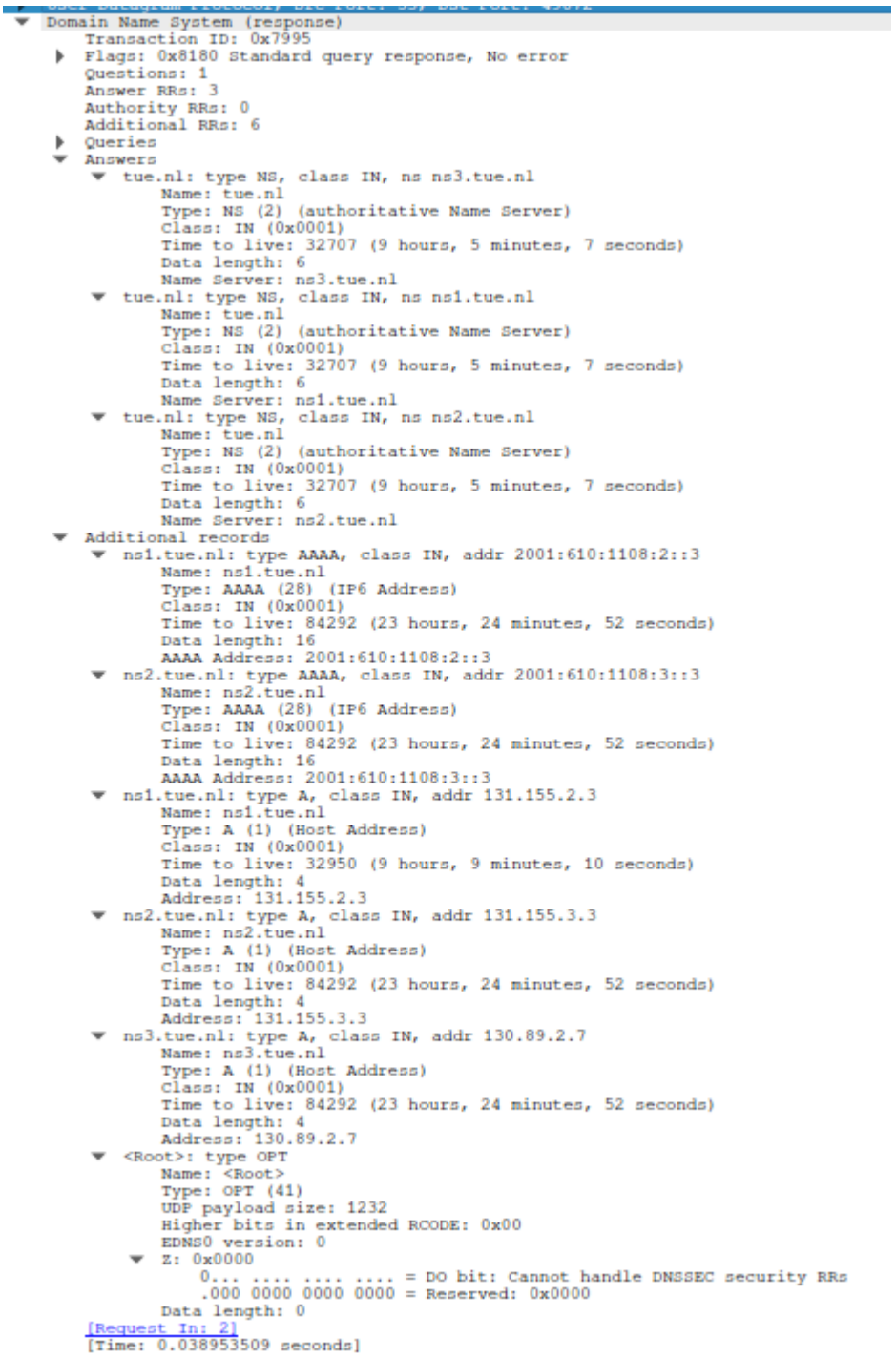
```
musse@archlinux:~$ nslookup -type=A www.tue.nl
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
www.tue.nl      canonical name = web.w3.tue.nl.
Name:   web.w3.tue.nl
Address: 167.235.218.203
```

nslookup gave CNAME web.w3.tue.nl and Ipv4 adress 167.235.218.203.

```
▾ Domain Name System (response)
    Transaction ID: 0x3662
  ▸ Flags: 0x8180 Standard query response, No error
    Questions: 1
    Answer RRs: 2
    Authority RRs: 0
    Additional RRs: 1
  ▸ Queries
  ▾ Answers
    ▾ www.tue.nl: type CNAME, class IN, cname web.w3.tue.nl
        Name: www.tue.nl
        Type: CNAME (5) (Canonical NAME for an alias)
        Class: IN (0x0001)
        Time to live: 27050 (7 hours, 30 minutes, 50 seconds)
        Data length: 9
        CNAME: web.w3.tue.nl
    ▾ web.w3.tue.nl: type A, class IN, addr 167.235.218.203
        Name: web.w3.tue.nl
        Type: A (1) (Host Address)
        Class: IN (0x0001)
        Time to live: 300 (5 minutes)
        Data length: 4
        Address: 167.235.218.203
  ▾ Additional records
    ▾ <Root>: type OPT
        Name: <Root>
        Type: OPT (41)
        UDP payload size: 1232
        Higher bits in extended RCODE: 0x00
        EDNS0 version: 0
      ▾ Z: 0x0000
          0... .... .... .... = DO bit: Cannot handle DNSSEC security RRs
          .000 0000 0000 0000 = Reserved: 0x0000
        Data length: 0
    [Request In: 61]
    [Time: 0.066181994 seconds]
```

It's a standard query response
It contains the query for the IPv4 address (A) of www.tue.nl
It contains the answer for the canonical name (CNAME) web.w3.tue.nl
It contains the DNS resolve for its CNAME the address 167.235.218.203
It contains additional records you didnt ask for but received anyways like how large the UDP payload was
b)

```
musse@archlinux:~$ nslookup -type=ns tue.nl
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
tue.nl  nameserver = ns3.tue.nl.
tue.nl  nameserver = ns1.tue.nl.
tue.nl  nameserver = ns2.tue.nl.

Authoritative answers can be found from:
ns1.tue.nl      has AAAA address 2001:610:1108:2::3
ns2.tue.nl      has AAAA address 2001:610:1108:3::3
ns1.tue.nl      internet address = 131.155.2.3
ns2.tue.nl      internet address = 131.155.3.3
ns3.tue.nl      internet address = 130.89.2.7
```



We asked for name servers and got 3 answers. We didn't specifically ask for their IPv4 and IPv6 addresses but got them anyways through the glue record. We didnt receive an IPv6 address for nameserver 3.

c)

```
musse@archlinux:~$ nslookup -type=A www.tue.nl ns1.tue.nl
Server:         ns1.tue.nl
Address:        131.155.2.3#53

www.tue.nl      canonical name = web.w3.tue.nl.
```

```
▼ Domain Name System (response)
    Transaction ID: 0x1f73
  ▶ Flags: 0x8500 Standard query response, No error
    Questions: 1
    Answer RRs: 1
    Authority RRs: 4
    Additional RRs: 0
  ▶ Queries
  ▼ Answers
    ▼ www.tue.nl: type CNAME, class IN, cname web.w3.tue.nl
        Name: www.tue.nl
        Type: CNAME (5) (Canonical NAME for an alias)
        Class: IN (0x0001)
        Time to live: 86400 (1 day)
        Data length: 15
        CNAME: web.w3.tue.nl
  ▼ Authoritative nameservers
    ▼ w3.tue.nl: type NS, class IN, ns ns-1853.awsdns-39.co.uk
        Name: w3.tue.nl
        Type: NS (2) (authoritative Name Server)
        Class: IN (0x0001)
        Time to live: 86400 (1 day)
        Data length: 25
        Name Server: ns-1853.awsdns-39.co.uk
    ▼ w3.tue.nl: type NS, class IN, ns ns-1464.awsdns-55.org
        Name: w3.tue.nl
        Type: NS (2) (authoritative Name Server)
        Class: IN (0x0001)
        Time to live: 86400 (1 day)
        Data length: 23
        Name Server: ns-1464.awsdns-55.org
    ▼ w3.tue.nl: type NS, class IN, ns ns-424.awsdns-53.com
        Name: w3.tue.nl
        Type: NS (2) (authoritative Name Server)
        Class: IN (0x0001)
        Time to live: 86400 (1 day)
        Data length: 22
        Name Server: ns-424.awsdns-53.com
    ▼ w3.tue.nl: type NS, class IN, ns ns-550.awsdns-04.net
        Name: w3.tue.nl
        Type: NS (2) (authoritative Name Server)
        Class: IN (0x0001)
        Time to live: 86400 (1 day)
        Data length: 22
        Name Server: ns-550.awsdns-04.net
    [Request In: 7]
    [Time: 0.029493687 seconds]
```

d)

4 name servers in 4 different TLDs

e)

```
musse@archlinux:~$ nslookup web.w3.tue.nl ns-550.awsdns-04.net
Server:         ns-550.awsdns-04.net
Address:        205.251.194.38#53

Name:   web.w3.tue.nl
Address: 167.235.218.203
Name:   web.w3.tue.nl
Address: 2a01:4f8:c011:eec::1
```