TABLE OF CONTENTS

1. TCP #1: Sockets

- Take a screenshot of the prompt and the command that ChatGPT generates

You

find a single command and its command-line flags that, when executed, lists all TCP sockets in a LISTEN state on an IPv4 address, showing the program that is using it

ChatGPT

To list all TCP sockets in a LISTEN state on an IPv4 address, t is using each socket, you can use the following command with specific flags in a Unix-like operating system (like Linux):

bash Copy code

```
sudo ss -tlnp4
```

- Run the command using sudo and take a screenshot of the output to include in your lab notebook.

```
raghuram@course-vm:~$ sudo ss -tlnp4
State    Recv-Q   Send-Q     Local Address:Port      Peer Address:Port  Process
LISTEN   0        4096           127.0.0.1:38091          0.0.0.0:*      users:(("containerd",pid=477,fd=8))
LISTEN   0        128              0.0.0.0:22             0.0.0.0:*      users:(("sshd",pid=807,fd=3))
LISTEN   0        4096       127.0.0.53%lo:53             0.0.0.0:*      users:(("systemd-resolve",pid=390,fd=1
4))
```

- List a service that can be contacted from any interface on the machine. List a service that can only be contacted by local processes.

1) Service Contactable from Any Interface on the Machine:

SSH (Secure Shell)

- IP Address: 0.0.0.0

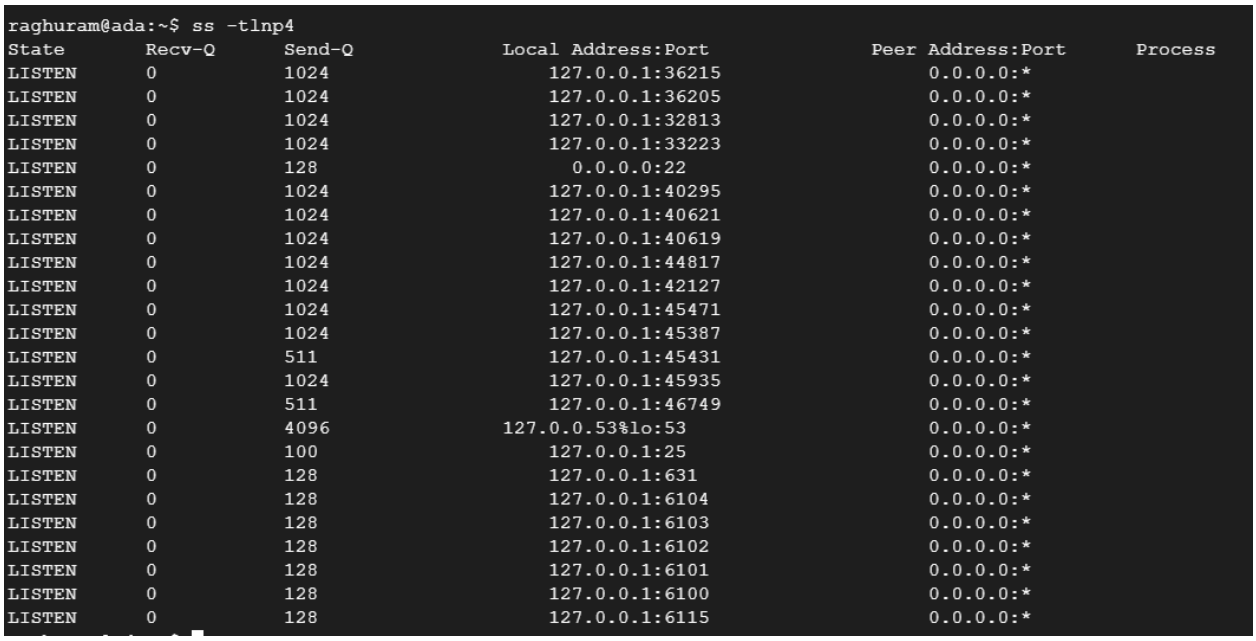
- Port: 22

2) **Service Contactable Only by Local Processes:**

System DNS Resolver (systemd-resolve)

- IP Address: 127.0.0.53
- Port: 53

- Run the command again, but do not use sudo as this is a machine managed by CAT. Include a screenshot of the output.



```
raghuram@ada:~$ ss -tlnp4
State       Recv-Q      Send-Q            Local Address:Port             Peer Address:Port      Process
LISTEN      0           1024                  127.0.0.1:36215                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:36205                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:32813                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:33223                 0.0.0.0:*
LISTEN      0           128                     0.0.0.0:22                    0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:40295                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:40621                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:40619                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:44817                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:42127                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:45471                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:45387                 0.0.0.0:*
LISTEN      0           511                   127.0.0.1:45431                 0.0.0.0:*
LISTEN      0           1024                  127.0.0.1:45935                 0.0.0.0:*
LISTEN      0           511                   127.0.0.1:46749                 0.0.0.0:*
LISTEN      0           4096              127.0.0.53%lo:53                    0.0.0.0:*
LISTEN      0           100                   127.0.0.1:25                    0.0.0.0:*
LISTEN      0           128                   127.0.0.1:631                   0.0.0.0:*
LISTEN      0           128                   127.0.0.1:6104                  0.0.0.0:*
LISTEN      0           128                   127.0.0.1:6103                  0.0.0.0:*
LISTEN      0           128                   127.0.0.1:6102                  0.0.0.0:*
LISTEN      0           128                   127.0.0.1:6101                  0.0.0.0:*
LISTEN      0           128                   127.0.0.1:6100                  0.0.0.0:*
LISTEN      0           128                   127.0.0.1:6115                  0.0.0.0:*
```

:

- List the services that this machine provides for external access

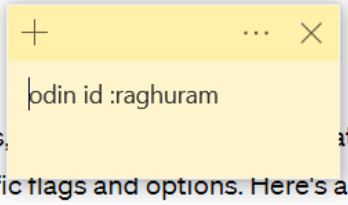
  Ans : SSH (Secure Shell) Local Address:Port: 0.0.0.0:22

2. -

- Take a screenshot of the prompt and the command that ChatGPT generates

You

find a single lsof command and its command-line flags that, when executed, lists all TCP sockets in a LISTEN state on an IPv4 address, showing the program that is using it



ChatGPT

To list all TCP sockets in a LISTEN state on an IPv4 address, t is using each socket, you can use the `lsof` command with specific flags and options. Here's a suitable command:

bash Copy code

```
lsof -iTCP -sTCP:LISTEN -nP -P
```

- Run the command using sudo and take a screenshot of the output to include in your lab notebook.

```
raghuram@course-vm:~$ sudo lsof -iTCP -sTCP:LISTEN -nP -P
COMMAND    PID            USER   FD   TYPE DEVICE SIZE/OFF NODE NAME
systemd-r 390 systemd-resolve   14u  IPv4  17451      0t0  TCP 127.0.0.53:53 (LISTEN)
container 477            root    8u  IPv4  18424      0t0  TCP 127.0.0.1:38091 (LISTEN)
xrdp-sesm 525            root    7u  IPv6  18027      0t0  TCP [::1]:3350 (LISTEN)
xrdp      656            xrdp   11u  IPv6  18180      0t0  TCP *:3389 (LISTEN)
sshd      807            root    3u  IPv4  19007      0t0  TCP *:22 (LISTEN)
sshd      807            root    4u  IPv6  19009      0t0  TCP *:22 (LISTEN)
raghuram@course-vm:~$
```

4. -

- Show a screenshot of the measured bandwidth available between your us-west1-b VM and each of the other Compute Engine VMs. Explain the relative differences (or lack thereof) in your results.

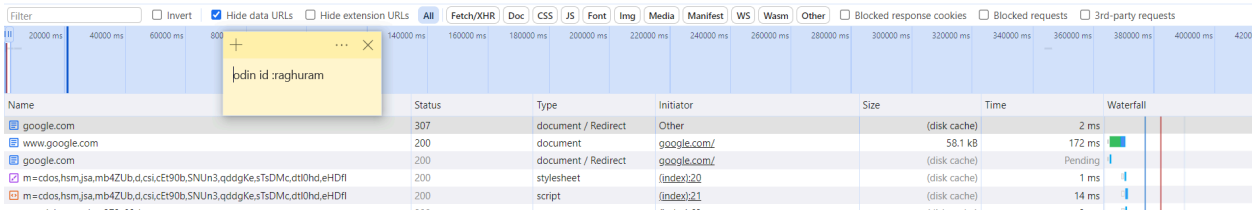
```
raghuram@vm-us-west1-b:~$ iperf -c 10.152.0.2 -p 80
------------------------------------------------------------
Client connecting to 10.152.0.2, TCP port 80
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  1] local 10.138.0.11 port 37786 connected with 10.152.0.2 port 80
[ ID] Interval       Transfer     Bandwidth
[  1] 0.0000-10.1636 sec   189 MBytes   156 Mbits/sec
raghuram@vm-us-west1-b:~$ iperf -c 10.132.0.2 -p 80
------------------------------------------------------------
Client connecting to 10.132.0.2, TCP port 80
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  1] local 10.138.0.11 port 55338 connected with 10.132.0.2 port 80
[ ID] Interval       Transfer     Bandwidth
[  1] 0.0000-10.2053 sec   194 MBytes   159 Mbits/sec
raghuram@vm-us-west1-b:~$ iperf -c 10.142.0.2 -p 80
------------------------------------------------------------
Client connecting to 10.142.0.2, TCP port 80
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  1] local 10.138.0.11 port 46802 connected with 10.142.0.2 port 80
[ ID] Interval       Transfer     Bandwidth
[  1] 0.0000-10.1015 sec   433 MBytes   359 Mbits/sec
```

The difference is

- The physical proximity of the VMs to each other.
- The quality and capacity of the network connections between the VMs.

5. HTTP #3: Requests

- Take a screenshot of the initial requests for your lab notebook.



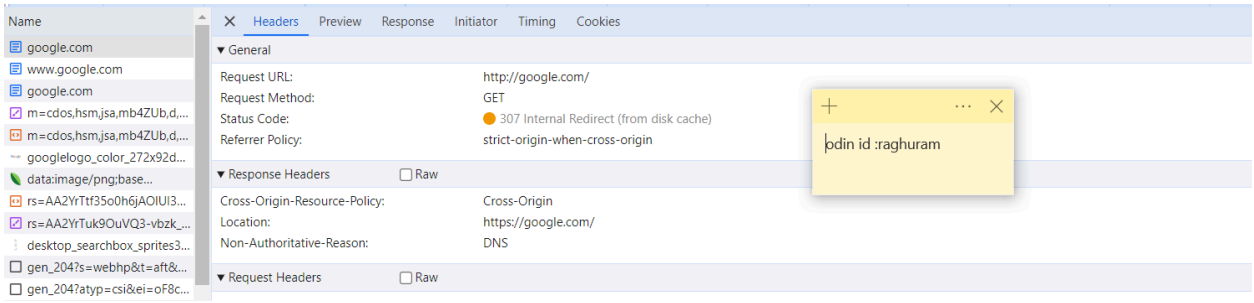
- What is the URL being requested?

http://google.com/

- Explain the HTTP status code that is returned and what the code indicates

  307 Internal Redirect (from disk cache) which means temporary redirection that won't modify the original request method or body.

- Take a screenshot indicating the version of the HTTP protocol that is used for each request. (Hint: look at the response status line and alt-svc: HTTP response headers indicating HTTP/2 or HTTP/3).



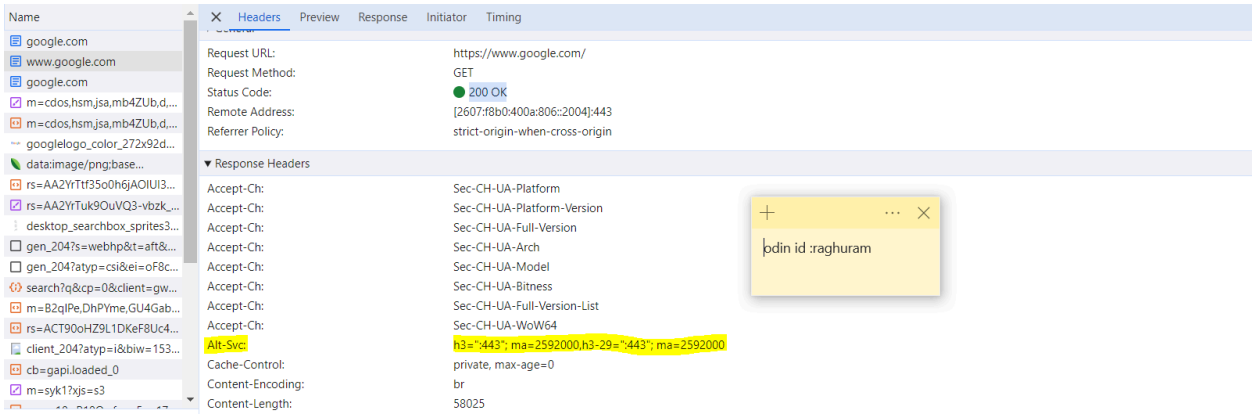
- What is the URL being requested?

  https://www.google.com/

- Explain the HTTP status code that is returned and what the code indicates

  200 OK code means that the request was successful, but the meaning of success depends on the request method

- Take a screenshot indicating the version of the HTTP protocol that is used for each request. (Hint: look at the response status line and alt-svc: HTTP response headers indicating HTTP/2 or HTTP/3).



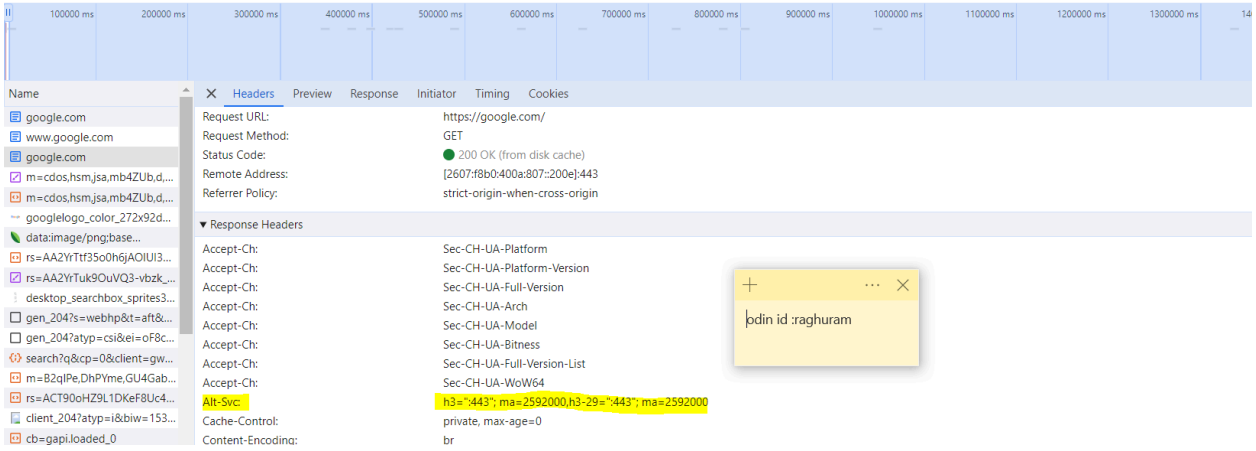
- What is the URL being requested?

  https://google.com/

- Explain the HTTP status code that is returned and what the code indicates

  200 OK (from disk cache) that the response was indeed served from cache. Browser will serve this response from cache until the response expires

- Take a screenshot indicating the version of the HTTP protocol that is used for each request. (Hint: look at the response status line and alt-svc: HTTP response headers indicating HTTP/2 or HTTP/3).

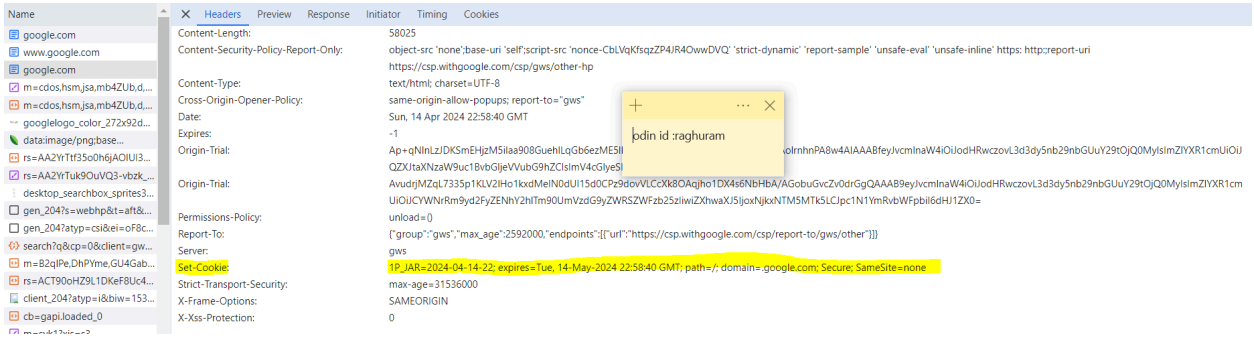


- Show the URLs the browser is redirected to via this header.

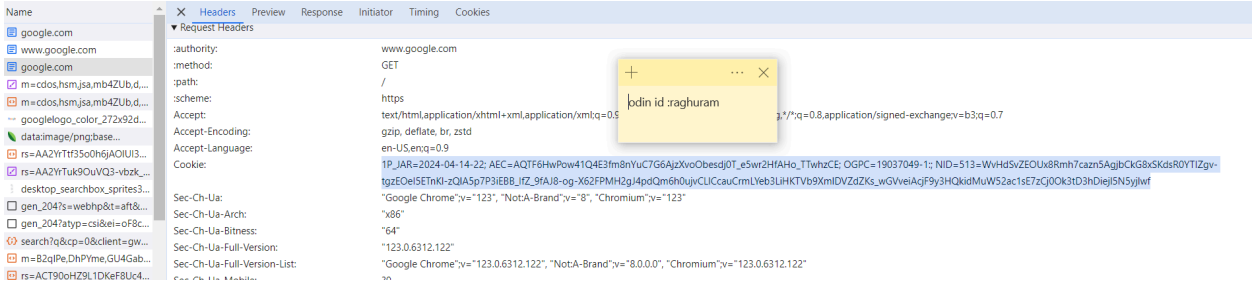
  https://www.google.com/

  https://google.com/

- Take a screenshot of when cookies are set via Set-Cookie:

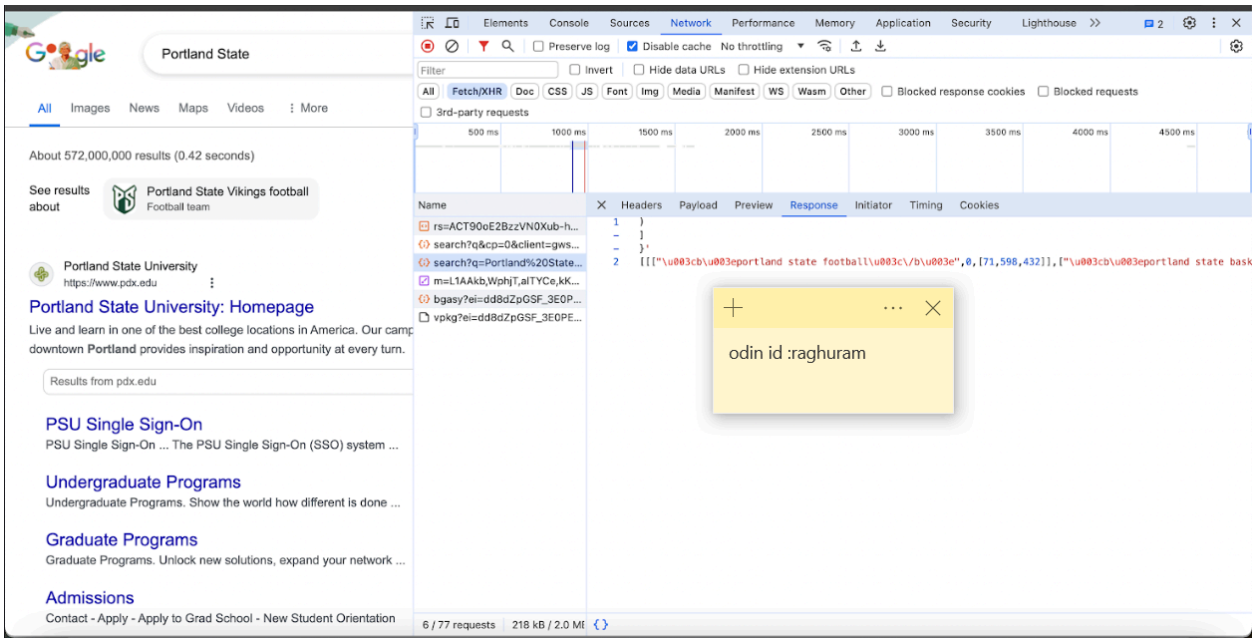


- Take a screenshot of when cookies are attached via Cookie:



6. -

- Show the requests and responses in the listing. Click on the last request sent, then click on the response to see that its payload has returned the data that is then rendered on the search page similar to what is shown below for "rabbid"



02.2: DNS, Recap

1. DNS reconnaissance #1 (dig)

- Take a screenshot of the prompt and the dig command produced.

```
raghuram@ada:~$ dig @131.252.208.53 www.pdx.edu A +tcp

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> @131.252.208.53 www.pdx.edu A +tcp
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 8248
;; flags: qr rd ra; QUERY: 1, ANSWER: 4, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: d1e2c429f9a78f0301000000661c756823a0b4b8f69e7650 (good)
;; QUESTION SECTION:
;www.pdx.edu.                   IN      A

;; ANSWER SECTION:
www.pdx.edu.            60      IN      A       18.161.6.84
www.pdx.edu.            60      IN      A       18.161.6.96
www.pdx.edu.            60      IN      A       18.161.6.112
www.pdx.edu.            60      IN      A       18.161.6.120

;; Query time: 75 msec
;; SERVER: 131.252.208.53#53(131.252.208.53) (TCP)
;; WHEN: Sun Apr 14 17:31:36 PDT 2024
;; MSG SIZE  rcvd: 132
```

- Take a screenshot of the records returned for your lab notebook.

```
raghuram@ada:~$ dig @131.252.208.53 pdx.edu MX +tcp

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> @131.252.208.53 pdx.edu MX +tcp
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 12869
;; flags: qr rd ra; QUERY: 1, ANSWER: 5, AUTHORITY: 0, ADDITIONAL: 2

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: 8f13d65d8c0cfe7e01000000661c85327a1bfe6a66fbf42b (good)
;; QUESTION SECTION:
;pdx.edu.                       IN      MX

;; ANSWER SECTION:
pdx.edu.                76866   IN      MX      10 alt3.aspmx.l.google.com.
pdx.edu.                76866   IN      MX      10 alt4.aspmx.l.google.com.
pdx.edu.                76866   IN      MX      1 aspmx.l.google.com.
pdx.edu.                76866   IN      MX      5 alt1.aspmx.l.google.com.
pdx.edu.                76866   IN      MX      5 alt2.aspmx.l.google.com.

;; ADDITIONAL SECTION:
aspmx.l.google.com.     233     IN      A       142.250.107.27

;; Query time: 3 msec
;; SERVER: 131.252.208.53#53(131.252.208.53) (TCP)
;; WHEN: Sun Apr 14 18:38:58 PDT 2024
;; MSG SIZE  rcvd: 198
```

- What cloud provider hosts the web site for www.pdx.edu?

  Amazon Web services (AWS)

- What cloud provider handles mail for pdx.edu?

  Google's mail servers like alt3.aspmx.l.google.com

- Take a screenshot of the results for both records for your lab notebook.

```
raghuram@ada:~$ dig mashimaro.cs.pdx.edu NS

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> mashimaro.cs.pdx.edu NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 46577
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;mashimaro.cs.pdx.edu.          IN      NS

;; AUTHORITY SECTION:
cs.pdx.edu.             300     IN      SOA     walt.ee.pdx.edu. support.cat.pdx.edu. 2024040800 600 300 1209600 300

;; Query time: 7 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Sun Apr 14 19:01:09 PDT 2024
;; MSG SIZE  rcvd: 105
```

```
raghuram@ada:~$ dig mashimaro.cs.pdx.edu A

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> mashimaro.cs.pdx.edu A
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 27850
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;mashimaro.cs.pdx.edu.          IN      A

;; ANSWER SECTION:
mashimaro.cs.pdx.edu.   2224    IN      A       131.252.220.66

;; Query time: 0 msec
```

2. Iterative DNS lookups

- List all of the iterative dig commands performed for the lookup

  dig
  dig f.root-servers.net console.cloud.google.com NS +tcp
  dig a.root-servers.net console.cloud.google.com. A +tcp

- Take a screenshot of the results of the final query for your lab notebook.

```
raghuram@course-vm:~$ dig a.root-servers.net  console.cloud.google.com. A +tcp

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> a.root-servers.net console.cloud.google.com. A +tcp
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 33675
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;a.root-servers.net.            IN      A

;; ANSWER SECTION:
a.root-servers.net.     259200  IN      A       198.41.0.4

;; Query time: 4 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Mon Apr 15 06:04:35 UTC 2024
;; MSG SIZE  rcvd: 63

;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26211
;; flags: qr rd ra; QUERY: 1, ANSWER: 7, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;console.cloud.google.com.      IN      A

;; ANSWER SECTION:
console.cloud.google.com. 300   IN      CNAME   www3.l.google.com.
www3.l.google.com.      300     IN      A       142.250.107.101
www3.l.google.com.      300     IN      A       142.250.107.139
www3.l.google.com.      300     IN      A       142.250.107.102
www3.l.google.com.      300     IN      A       142.250.107.113
www3.l.google.com.      300     IN      A       142.250.107.138
www3.l.google.com.      300     IN      A       142.250.107.100

;; Query time: 4 msec
```

3. Reverse DNS lookups

- Take a screenshot of the prompt and the command produced

produce a single command line with commands dig, egrep, and awk, to list all IPv4 addresses that espn.go.com points to.

ChatGPT

To produce a list of all IPv4 addresses that `espn.go.com` points to using `dig`, `egrep`, and `awk`, you can use the following single command line:

bash Copy code

```
dig espn.go.com A +short | egrep -o "([0-9]{1,3}[\.]){3}[0-9]{1,3}" | awk '{print $1}
```

Here's what each part of this pipeline does:

1. `dig espn.go.com A +short`: Performs a DNS loo iated with `espn.go.com`, which are the IPv4 addresses. The `+short` option simplifies the output to just the

odin id :raghuram

- Take a screenshot of its results for your lab notebook

```
raghuram@course-vm:~$ dig espn.go.com A +short | egrep -o "([0-9]{1,3}[\.]){3}[0-9]{1,3}" | awk '{print $1}'
18.65.229.14
18.65.229.26
18.65.229.61
18.65.229.93
```

- Take a screenshot of the command and its results for your lab notebook

```
raghuram@course-vm:~$ for ip in $(dig espn.go.com A +short | egrep -o "([0-9]{1,3}[\.]){3}[0-9]{1,3}"); do
    dig -x $ip +short | awk '{print $1}'
done
server-18-65-229-26.sea73.r.cloudfront.net.
server-18-65-229-14.sea73.r.cloudfront.net.
server-18-65-229-93.sea73.r.cloudfront.net.
server-18-65-229-61.sea73.r.cloudfront.net.
```

4. Host enumeration

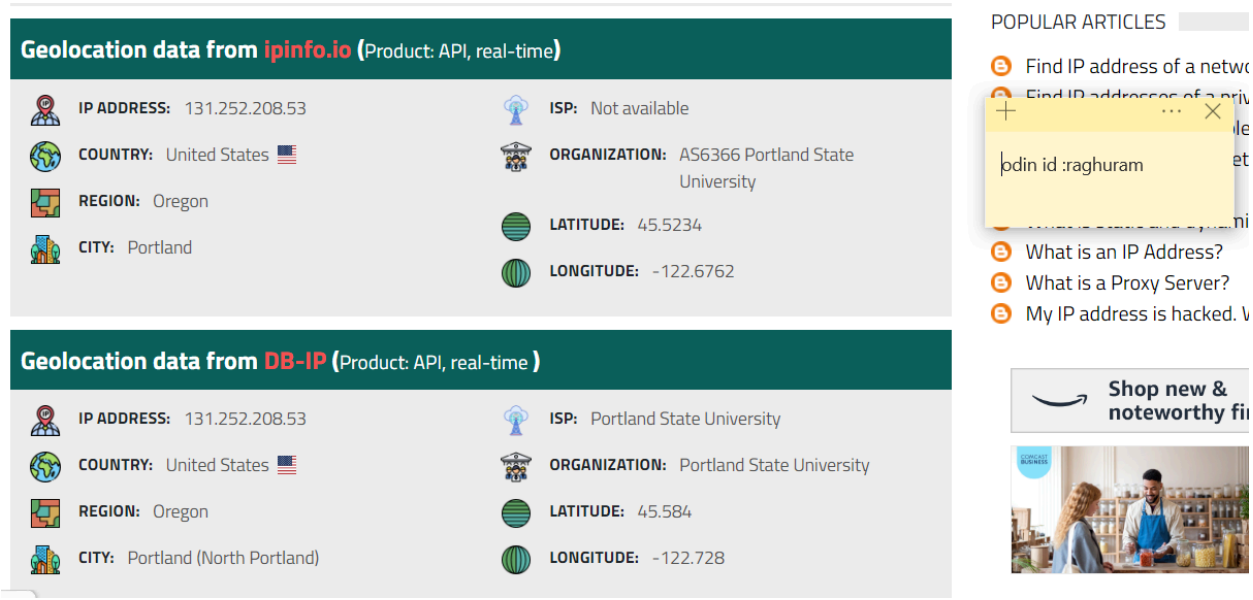
- Take a screenshot of the results in your lab notebook

```
raghuram@course-vm:~$ cat 220hosts.txt | head -185 | tail -30
acura.cs.pdx
astonmartin.cs.pdx
audi.cs.pdx
bentley.cs.pdx
bmw.cs.pdx
cadillac.cs.pdx
ferrari.cs.pdx
fiat.cs.pdx
ford.cs.pdx
honda.cs.pdx
hummer.cs.pdx
jaguar.cs.pdx
jeep.cs.pdx
lamborghini.cs.pdx
landrover.cs.pdx
lexus.cs.pdx
lotus.cs.pdx
maserati.cs.pdx
mazda.cs.pdx
mclaren.cs.pdx
mercedes.cs.pdx
nissan.cs.pdx
panoz.cs.pdx
porsche.cs.pdx
subaru.cs.pdx
toyota.cs.pdx
tvr.cs.pdx
ultima.cs.pdx
volvo.cs.pdx
vw.cs.pdx
```

5. Geographic DNS #2

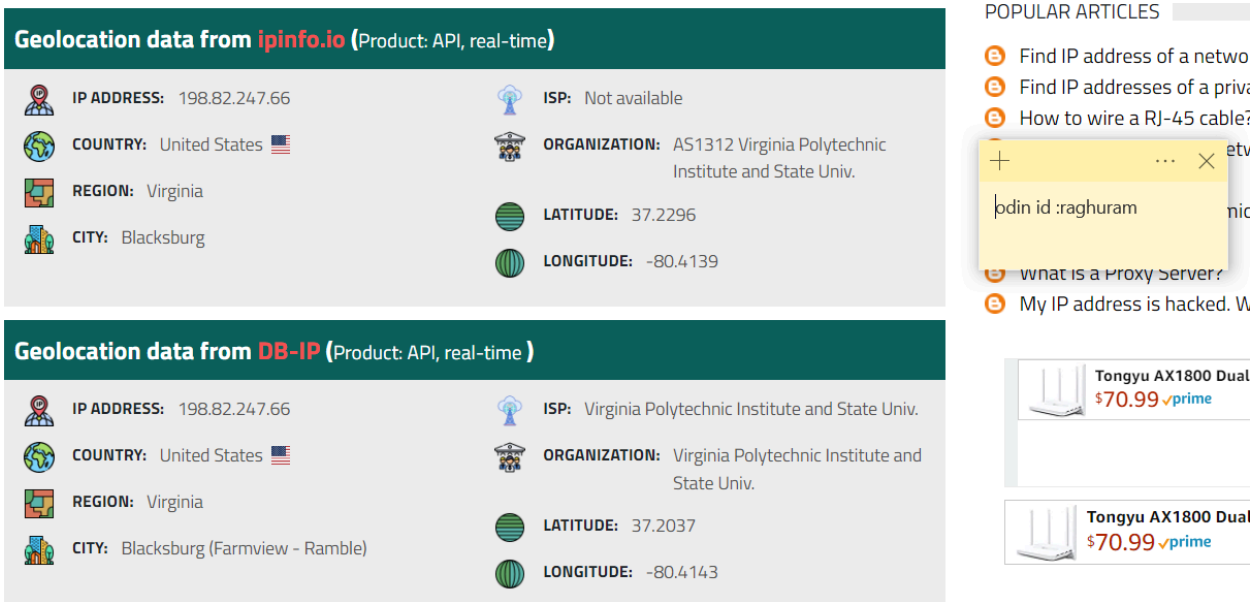
- What geographic locations do ipinfo.io and DB-IP return?

  131.252.208.53



- What geographic locations do ipinfo.io and DB-IP return?

  198.82.247.66.



- Record one address for www.google.com from each result for your lab notebook.

For 131.252.208.208.53

```
raghuram@ada:~$ dig @131.252.208.53 www.google.com

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> @131.252.208.53 www.google.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 57207
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: d6e9e54353ccebc001000000661cd59bd9ba9135e28e60b5 (good)
;; QUESTION SECTION:
;www.google.com.                        IN      A

;; ANSWER SECTION:
www.google.com.         50      IN      A       142.250.217.100

;; Query time: 0 msec
;; SERVER: 131.252.208.53#53(131.252.208.53) (UDP)
;; WHEN: Mon Apr 15 00:22:03 PDT 2024
;; MSG SIZE  rcvd: 87
```

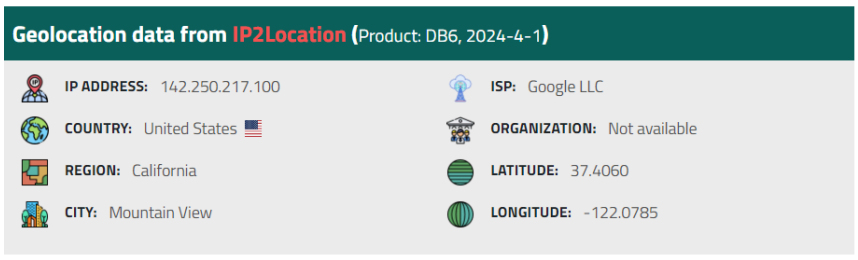
- Record one address for www.google.com from each result for your lab notebook.

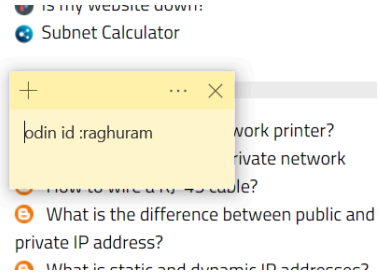
For 198.82.247.66.

```
raghuram@ada:~$ dig @198.82.247.66  www.google.com

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> @198.82.247.66 www.google.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 53283
;; flags: qr rd ra; QUERY: 1, ANSWER: 6, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: 3611a04105e24998fd23e157661cd5f9db45981359284997 (good)
;; QUESTION SECTION:
;www.google.com.                        IN      A

;; ANSWER SECTION:
www.google.com.         145     IN      A       142.251.16.99
www.google.com.         145     IN      A       142.251.16.103
www.google.com.         145     IN      A       142.251.16.147
www.google.com.         145     IN      A       142.251.16.104
www.google.com.         145     IN      A       142.251.16.105
www.google.com.         145     IN      A       142.251.16.106

;; Query time: 63 msec
;; SERVER: 198.82.247.66#53(198.82.247.66) (UDP)
;; WHEN: Mon Apr 15 00:23:37 PDT 2024
;; MSG SIZE  rcvd: 167
```

- What are the geographic coordinates of each DNS server and the IP address it resolves for www.google.com?

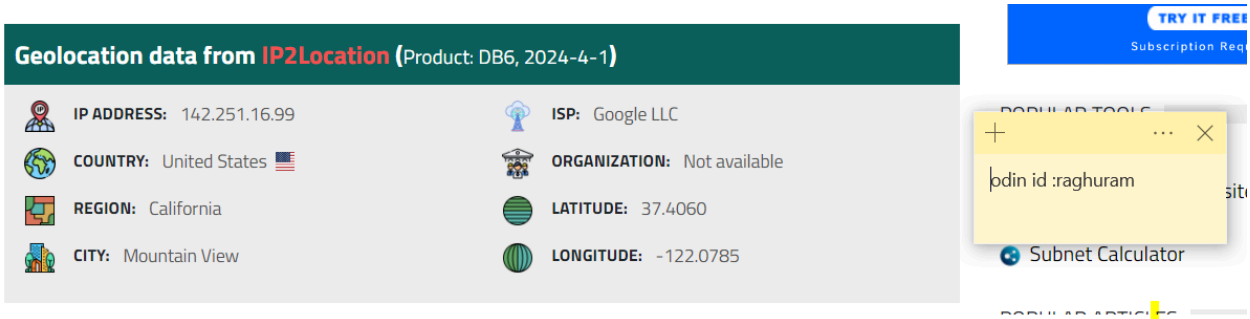
For ip address 142.250.217.100





- What are the geographic coordinates of each DNS server and the IP address it resolves for www.google.com?

For ip address 142.251.16.99



- Take a screenshot of the results for your lab notebook.

```
raghuram@ada:~$ traceroute 131.252.208.53
traceroute to 131.252.208.53 (131.252.208.53), 30 hops max, 60 byte packets
 1  rdns.cat.pdx.edu (131.252.208.53)  0.602 ms  0.453 ms  0.347 ms
```

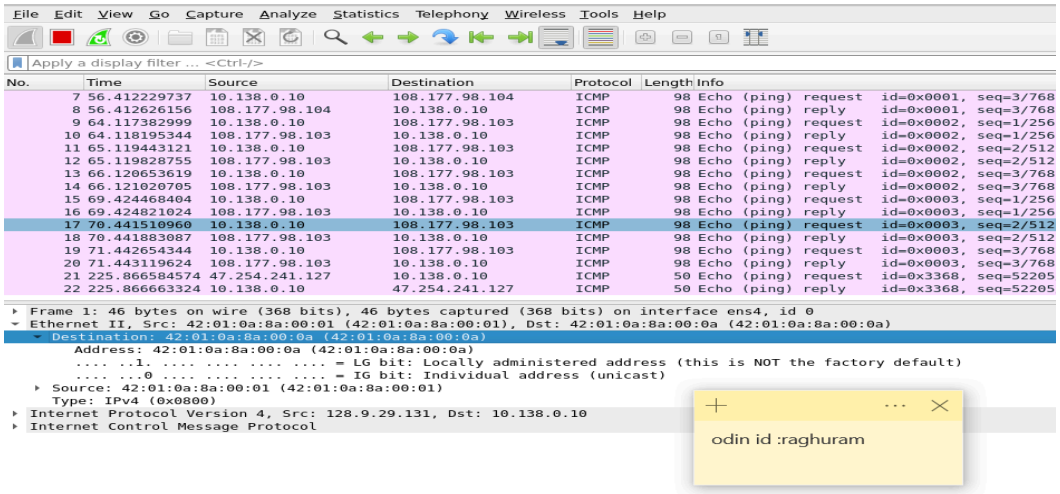
```
raghuram@ada:~$ traceroute 198.82.247.66
traceroute to 198.82.247.66 (198.82.247.66), 30 hops max, 60 byte packets
 1  glados.cat.pdx.edu (131.252.208.21)  4.428 ms  4.224 ms  4.108 ms
 2  0015-opnsense.cat.pdx.edu (10.208.91.1)  0.114 ms  0.087 ms  0.092 ms
 3  CORE1.net.pdx.edu (131.252.5.142)  1.456 ms  1.372 ms  1.269 ms
 4  131.252.5.213 (131.252.5.213)  0.473 ms  0.366 ms  0.461 ms
 5  e0-28.switch4.pdx1.he.net (216.218.230.89)  27.169 ms *  26.930 ms
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  eqix-ash.vt.edu (206.126.236.139)  57.584 ms  57.484 ms  57.370 ms
11  192.70.187.20 (192.70.187.20)  64.827 ms  64.796 ms  64.573 ms
12  isb-core.xe-7-0-0.0.cns.vt.edu (128.173.0.202)  65.234 ms  65.226 ms  65.347 ms
13  cas-core.lo0.2000.cns.vt.edu (198.82.1.143)  64.686 ms  64.330 ms  64.595 ms
14  jeru.cns.vt.edu (198.82.247.66)  64.456 ms  64.264 ms  64.172 ms
```

```
raghuram@ada:~$ traceroute 142.251.16.99
traceroute to 142.251.16.99 (142.251.16.99), 30 hops max, 60 byte packets
 1  glados.cat.pdx.edu (131.252.208.21)  5.688 ms  5.559 ms  5.438 ms
 2  0015-opnsense.cat.pdx.edu (10.208.91.1)  1.406 ms  1.325 ms  1.232 ms
 3  CORE1.net.pdx.edu (131.252.5.142)  1.865 ms  1.771 ms  1.680 ms
 4  131.252.5.213 (131.252.5.213)  0.807 ms  0.710 ms  0.617 ms
 5  google.nwax.net (198.32.195.34)  3.882 ms  3.955 ms  4.184 ms
 6  108.170.255.175 (108.170.255.175)  5.171 ms 192.178.105.35 (192.178.105.35)  4.270 ms 192.178.105.129 (192.178.105.129)  4.265 ms
 7  108.170.255.196 (108.170.255.196)  4.433 ms  5.328 ms 192.178.105.148 (192.178.105.148)  16.268 ms
 8  * 216.239.50.20 (216.239.50.20)  11.683 ms *
 9  142.250.213.63 (142.250.213.63)  52.507 ms * *
10  192.178.81.226 (192.178.81.226)  67.872 ms  67.750 ms *
11  172.253.51.73 (172.253.51.73)  64.305 ms 142.250.209.59 (142.250.209.59)  66.552 ms 172.253.51.73 (172.253.51.73)  76.949 ms
12  142.251.68.15 (142.251.68.15)  64.899 ms 142.251.227.157 (142.251.227.157)  63.741 ms  64.816 ms
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * bl-in-f99.1e100.net (142.251.16.99)  65.357 ms
```

```
raghuram@ada:~$ traceroute 142.250.217.100
traceroute to 142.250.217.100 (142.250.217.100), 30 hops max, 60 byte packets
 1  glados.cat.pdx.edu (131.252.208.21)  1.244 ms  1.093 ms  0.976 ms
 2  0015-opnsense.cat.pdx.edu (10.208.91.1)  0.200 ms  0.150 ms  0.094 ms
 3  CORE1.net.pdx.edu (131.252.5.142)  8.107 ms  8.038 ms  7.927 ms
 4  131.252.5.213 (131.252.5.213)  0.492 ms  0.399 ms  0.400 ms
 5  google.nwax.net (198.32.195.34)  4.211 ms  4.237 ms  4.226 ms
 6  192.178.105.35 (192.178.105.35)  4.621 ms  4.982 ms 108.170.255.123 (108.170.255.123)  4.848 ms
 7  142.251.55.201 (142.251.55.201)  4.835 ms 142.251.55.203 (142.251.55.203)  4.578 ms  4.752 ms
 8  sea09s30-in-f4.1e100.net (142.250.217.100)  4.300 ms  4.188 ms  4.115 ms
```

6. Wireshark Lab #3

- Take a screenshot of the bytes in the packet dump window as shown below



- Does the destination MAC address correspond to an interface on the VM, an interface on the default router or an interface on Google's web site?

  destination MAC address correspond an interface on the default router

- Does the destination MAC address correspond to an interface on the VM, an interface on the default router or an interface on Google's web site?

  destination MAC address correspond to an interface on the VM

8. Network Recap Lab #4

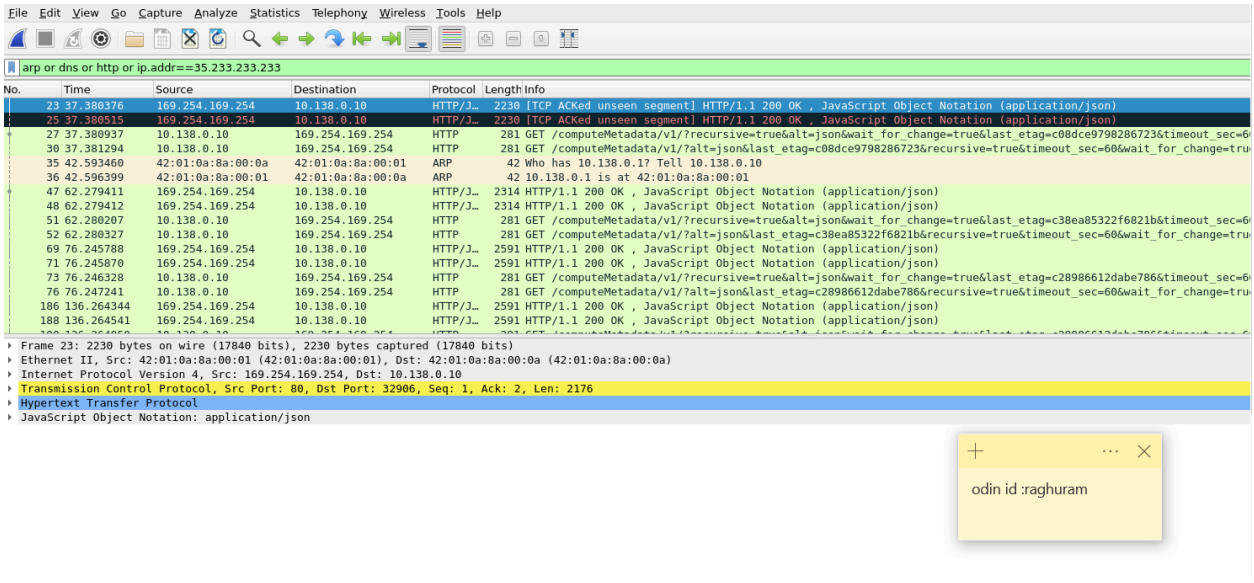
- Find the IP address of <OdinId>.oregonctf.org, replacing <OdinId> with your OdinId

```
raghuram@course-vm:~$ dig raghuram.oregonctf.org

; <<>> DiG 9.18.18-0ubuntu0.22.04.2-Ubuntu <<>> raghuram.oregonctf.org
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 51634
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;raghuram.oregonctf.org.                IN      A

;; ANSWER SECTION:
raghuram.oregonctf.org. 3600    IN      A       35.233.233.233

;; Query time: 72 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Tue Apr 16 02:09:24 UTC 2024
;; MSG SIZE  rcvd: 67
```

9. Collect trace

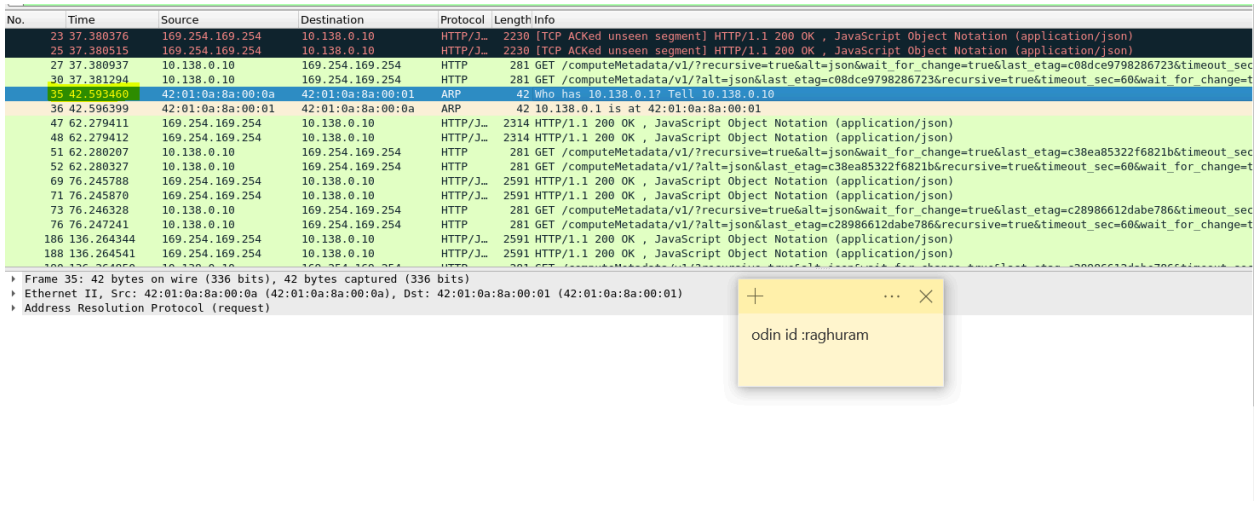
10. Analyze trace

- Take a screenshot of the all of the packets returned within Wireshark that includes their packet numbers



ARP

- **What packet numbers in the trace are the result of the VM attempting to get the hardware address of the default router?**

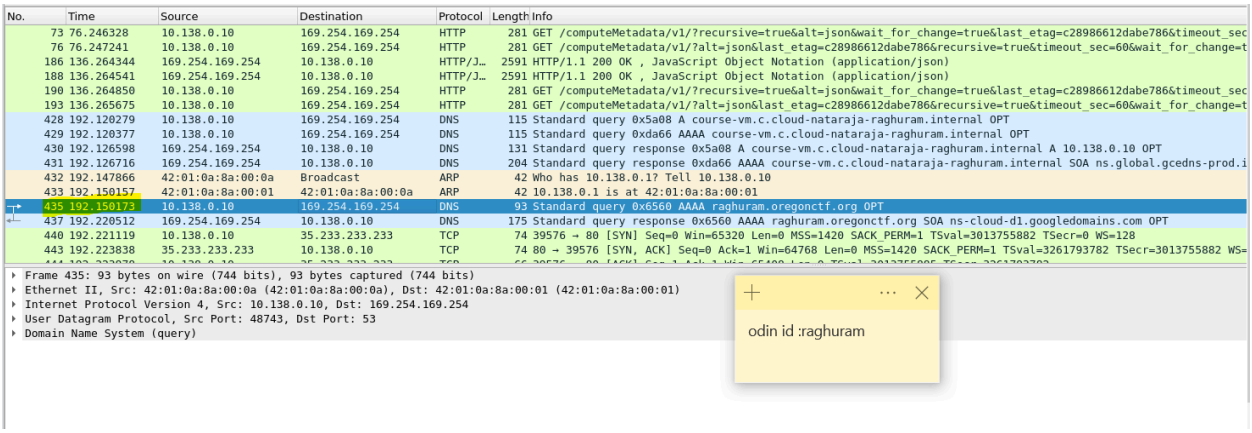


- **What is this hardware address?**

  42:01:0a:8a:00:0a

DNS

- **What packet numbers in the trace correspond to the DNS request for the web site?**

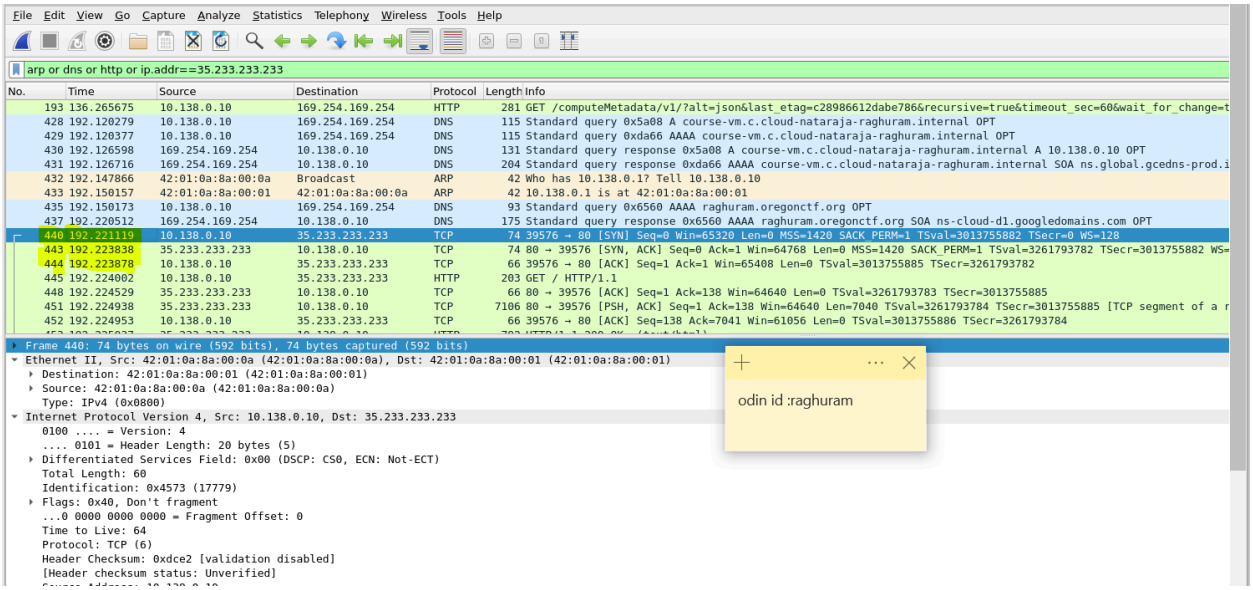


- What is the IP address of the local DNS server being queried?

  169.254.169.254

TCP

- **What packet numbers in the trace correspond to the initial TCP handshake for the web request?**

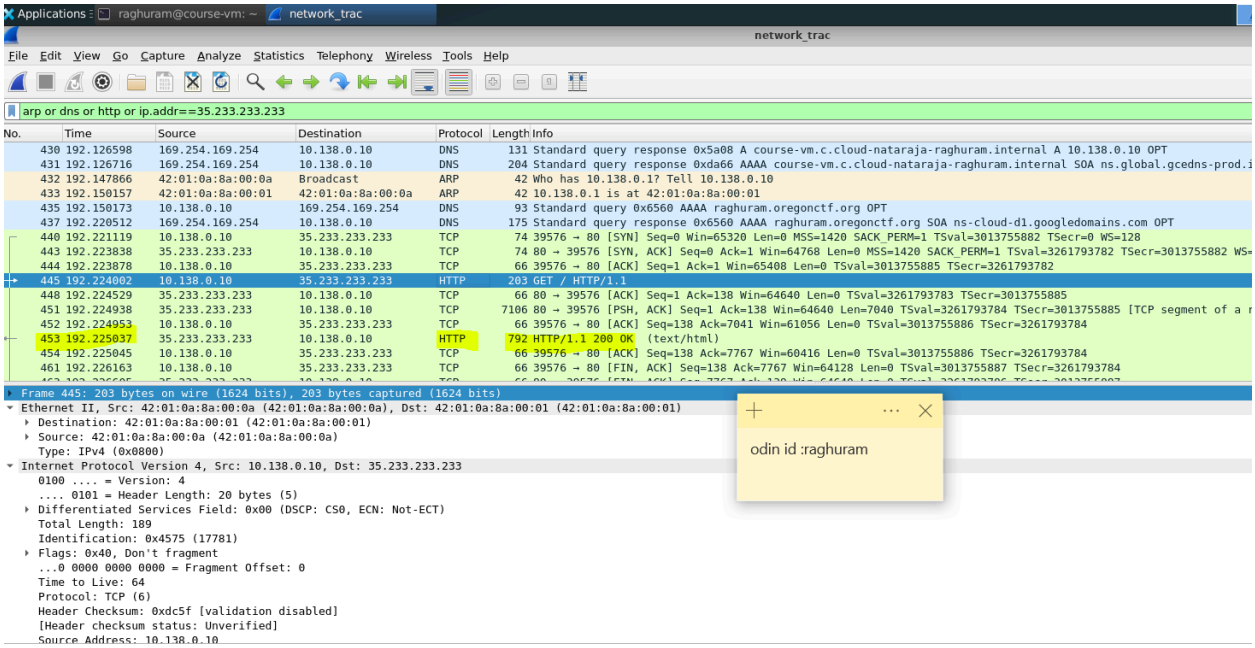


- **How long does it take to perform the initial TCP handshake?**

  0.002661 seconds

HTTP

- **What packet numbers in the trace correspond to the actual HTTP request and response?**



- **How long does it take to process the HTTP request after the handshake?**

  0.001035 seconds