Assignment 1
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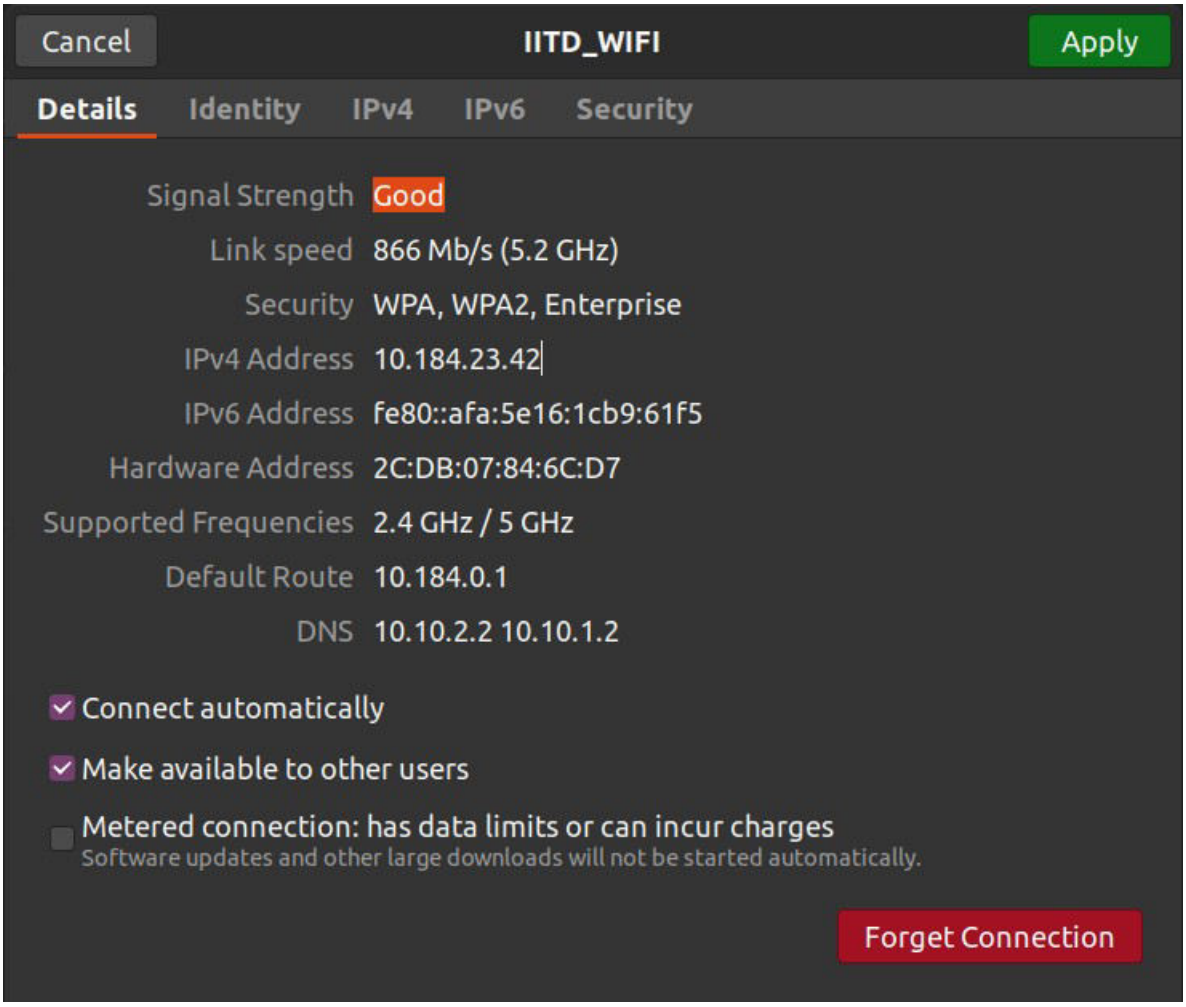
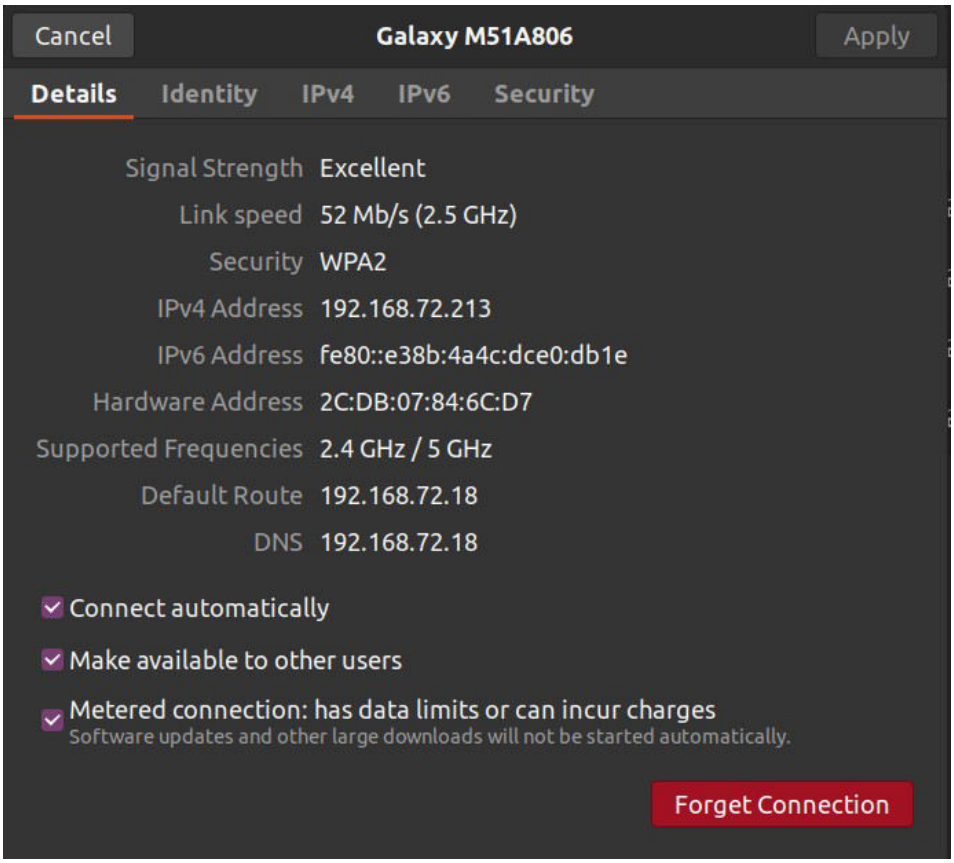
2020CS10385

Networking Tools

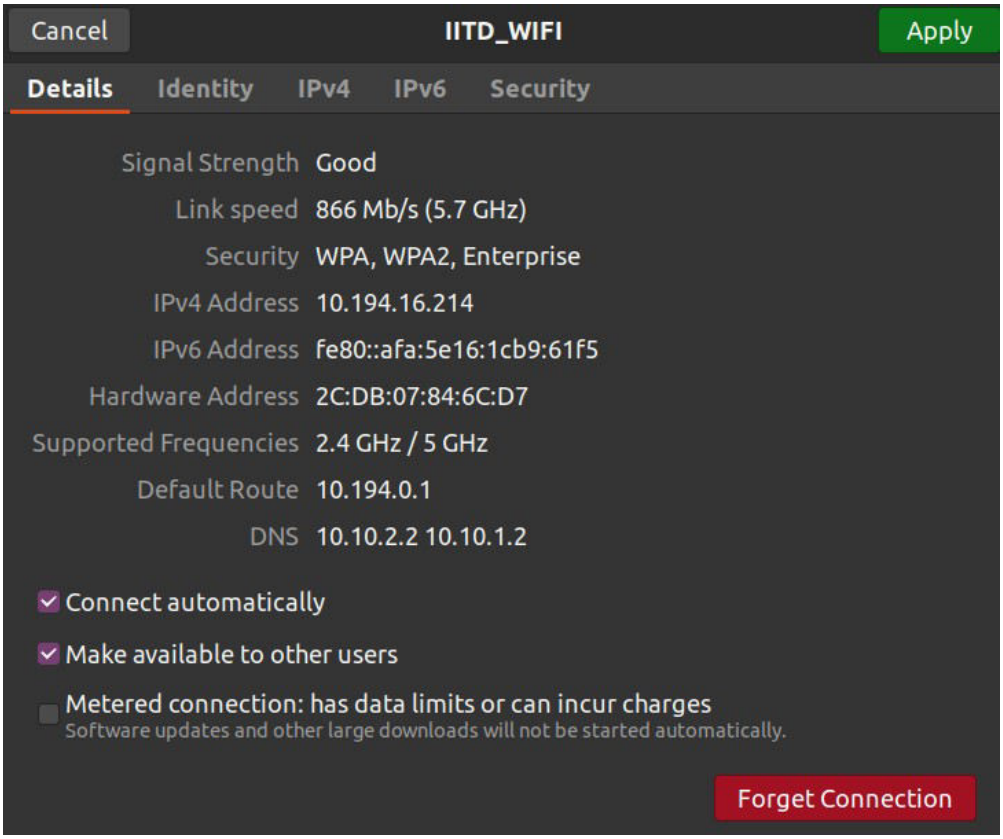
1. a) IP address of IITD Hostel Wifi : 10.184.23.42 (IPv4)



b) IP address of mobile network : 192.168.72.213 (IPv4)



c) IP address of IITD Library Wifi : 10.194.16.214 (IPv4)



2. a) IP address associated with google.com and facebook.com

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ nslookup www.google.com
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
Name:   www.google.com
Address: 142.250.183.164
Name:   www.google.com
Address: 2404:6800:4002:82b::2004

shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ nslookup www.facebook.com
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
www.facebook.com        canonical name = star-mini.c10r.facebook.com.
Name:   star-mini.c10r.facebook.com
Address: 157.240.16.35
Name:   star-mini.c10r.facebook.com
Address: 2a03:2880:f12f:183:face:b00c:0:25de
```

b) IP address associated with google.com and facebook.com using different DNS server. As a result of different DNS server the IP address of both of them changes.

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ nslookup www.google.com 149.112.112.112
Server:         149.112.112.112
Address:        149.112.112.112#53

Non-authoritative answer:
Name:   www.google.com
Address: 172.217.16.132
Name:   www.google.com
Address: 2a00:1450:4001:806::2004

shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ nslookup www.facebook.com 149.112.112.112
Server:         149.112.112.112
Address:        149.112.112.112#53

Non-authoritative answer:
www.facebook.com        canonical name = star-mini.c10r.facebook.com.
Name:   star-mini.c10r.facebook.com
Address: 157.240.195.35
Name:   star-mini.c10r.facebook.com
Address: 2a03:2880:f11c:8083:face:b00c:0:25de
```

3. a) Ping of google.com

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ ping google.com
PING google.com (142.250.193.206) 56(84) bytes of data.
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=1 ttl=118 time=6.86 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=2 ttl=118 time=8.14 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=3 ttl=118 time=41.2 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=4 ttl=118 time=20.9 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=5 ttl=118 time=7.69 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=6 ttl=118 time=25.0 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=7 ttl=118 time=26.2 ms
^C
--- google.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6009ms
rtt min/avg/max/mdev = 6.862/19.431/41.183/11.807 ms
```

b) Ping after increasing ping time interval. As a result the time taken increases but ping remains nearly same.

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ ping -i 5 google.com
PING google.com (142.250.193.206) 56(84) bytes of data.
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=1 ttl=117 time=4.71 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=2 ttl=117 time=68.4 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=3 ttl=117 time=6.45 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=4 ttl=117 time=6.24 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=5 ttl=117 time=141 ms
^C
--- google.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 20022ms
rtt min/avg/max/mdev = 4.714/45.315/140.785/53.540 ms
```

c) Ping after changing TTL.

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ ping -t 90 google.com
PING google.com (142.250.193.206) 56(84) bytes of data.
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=1 ttl=117 time=76.1 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=2 ttl=117 time=241 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=3 ttl=117 time=63.7 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=4 ttl=117 time=11.0 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=5 ttl=117 time=6.31 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=6 ttl=117 time=8.31 ms
64 bytes from del11s17-in-f14.1e100.net (142.250.193.206): icmp_seq=7 ttl=117 time=7.27 ms
^C
--- google.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6009ms
rtt min/avg/max/mdev = 6.307/59.112/241.067/79.093 ms
```

d) Ping after decreasing ping packet size, this causes to reduce the ping value.

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ ping -s 24 -w 7 google.com
PING google.com (142.250.67.238) 24(52) bytes of data.
32 bytes from bom07s24-in-f14.1e100.net (142.250.67.238): icmp_seq=1 ttl=117 time=23.8 ms
32 bytes from bom07s24-in-f14.1e100.net (142.250.67.238): icmp_seq=2 ttl=117 time=29.0 ms
32 bytes from bom07s24-in-f14.1e100.net (142.250.67.238): icmp_seq=3 ttl=117 time=24.7 ms
32 bytes from bom07s24-in-f14.1e100.net (142.250.67.238): icmp_seq=4 ttl=117 time=29.5 ms
32 bytes from bom07s24-in-f14.1e100.net (142.250.67.238): icmp_seq=5 ttl=117 time=28.1 ms
32 bytes from bom07s24-in-f14.1e100.net (142.250.67.238): icmp_seq=6 ttl=117 time=28.9 ms
32 bytes from bom07s24-in-f14.1e100.net (142.250.67.238): icmp_seq=7 ttl=117 time=29.8 ms

--- google.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6007ms
rtt min/avg/max/mdev = 23.816/27.671/29.802/2.233 ms
```

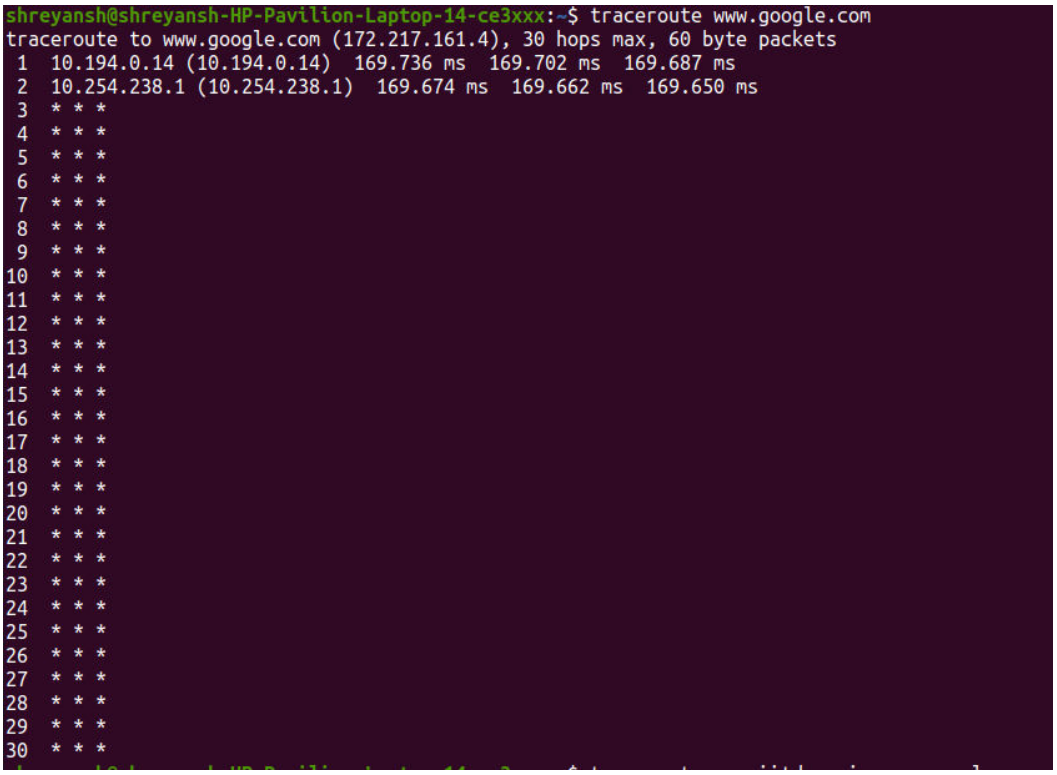
4. Traceroute

**** Using IITD WiFi**

a) iitd.ac.in. Traceroute is done successfully with no request timeout.

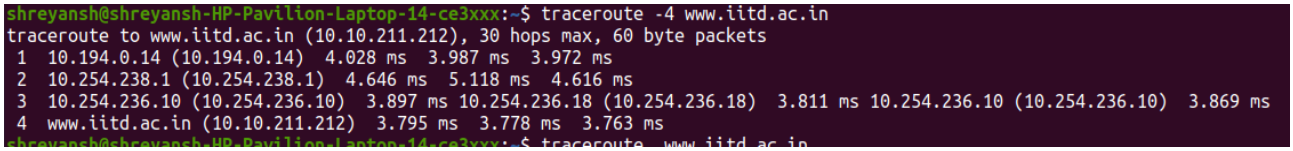
```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ traceroute www.iitd.ac.in
traceroute to www.iitd.ac.in (10.10.211.212), 30 hops max, 60 byte packets
 1  10.194.0.14 (10.194.0.14)  2.516 ms  2.473 ms  2.456 ms
 2  10.254.238.1 (10.254.238.1)  2.475 ms  2.458 ms  2.442 ms
 3  10.254.236.18 (10.254.236.18)  2.439 ms  2.424 ms 10.254.236.10 (10.254.236.10)  2.360 ms
 4  www.iitd.ac.in (10.10.211.212)  2.407 ms  2.392 ms  2.377 ms
```

b) google.com. Except first two requests all the rest are timed out.

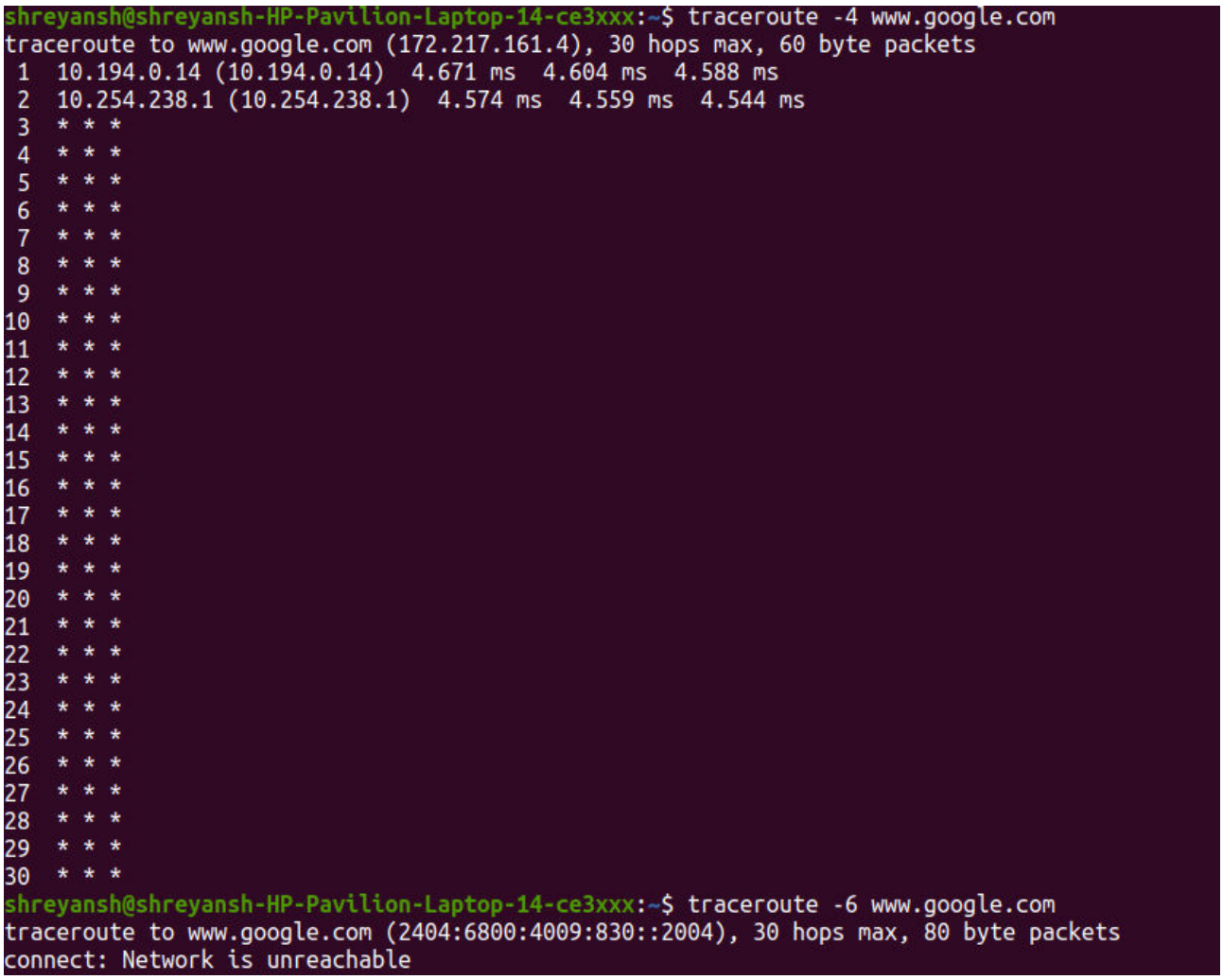


c) facebook.com. Same result as with google.com

d) Forcing IPv4 on iitd.ac.in. Traceroute is done successfully with no request timeout.



e) Forcing IPv4 and IPv6 on google.com. No difference when Ipv4 in enforced and on enforcing IPv6 it is not able to connect.



** Using mobile network

a) facebook.com

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ traceroute www.facebook.com
traceroute to www.facebook.com (157.240.239.35), 30 hops max, 60 byte packets
 1  _gateway (192.168.67.212)  11.165 ms  11.587 ms  11.708 ms
 2  * * *
 3  56.14.87.5 (56.14.87.5)  157.407 ms 56.8.178.105 (56.8.178.105)  157.428 ms 56.14.86.245 (56.14.86.245)  157.380 ms
 4  192.168.44.236 (192.168.44.236)  157.400 ms 192.168.44.234 (192.168.44.234)  157.349 ms 192.168.44.238 (192.168.44.238)  157.334 ms
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  ae4.pr02.del1.tfbnw.net (157.240.73.118)  198.974 ms * *
14  173.252.67.213 (173.252.67.213)  721.451 ms ae4.pr02.del1.tfbnw.net (157.240.73.118)  721.433 ms po102.psw01.del1.tfbnw.net (31.13.24.7)  522.271 ms
15  edge-star-mini-shv-02-del1.facebook.com (157.240.239.35)  522.219 ms po102.psw01.del1.tfbnw.net (31.13.24.7)  522.203 ms po102.psw02.del1.tfbnw.net (74.119.78.33)  522.186 ms
```

b) forcing IPv6 on google.com works using mobile network but not with IITD WiFi

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ traceroute -6 www.google.com
traceroute to www.google.com (2404:6800:4002:80c::2004), 30 hops max, 80 byte packets
 1  2409:4050:2d18:a688::7 (2409:4050:2d18:a688::7)  16.119 ms  16.045 ms  16.013 ms
 2  * * *
 3  2405:200:331:eeee:20::1292 (2405:200:331:eeee:20::1292)  109.425 ms  115.906 ms  124.469 ms
 4  2405:200:801:300::e72 (2405:200:801:300::e72)  127.919 ms 2405:200:801:300::e76 (2405:200:801:300::e76)  129.672 ms 2405:200:801:300::e72 (2405:200:801:300::e72)  156.380 ms
 5  * * *
 6  * * *
 7  * * *
 8  2001:4860:1:1::1ef4 (2001:4860:1:1::1ef4)  118.464 ms  118.411 ms 2001:4860:1:1::15b4 (2001:4860:1:1::15b4)  118.499 ms
 9  2404:6800:812a::1 (2404:6800:812a::1)  125.446 ms 2404:6800:812f::1 (2404:6800:812f::1)  48.622 ms  63.523 ms
10  2001:4860:0:1::54e6 (2001:4860:0:1::54e6)  63.477 ms 2001:4860:0:1::5396 (2001:4860:0:1::5396)  65.441 ms 2001:4860:0:1::53a0 (2001:4860:0:1::53a0)  79.549 ms
11  * 2001:4860:0:1::1687 (2001:4860:0:1::1687)  80.858 ms  71.947 ms
12  del03s17-in-x04.1e100.net (2404:6800:4002:80c::2004)  55.610 ms 2001:4860::1c:4000:eaf6 (2001:4860::1c:4000:eaf6)  47.434 ms del03s17-in-x04.1e100.net (2404:6800:4002:80c::2004)  50.057 ms
```

c) iitd.ac.in Most of requests are timed out only few are successful

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ traceroute  www.iitd.ac.in
traceroute to www.iitd.ac.in (103.27.9.24), 30 hops max, 60 byte packets
 1  _gateway (192.168.67.212)  123.916 ms  123.876 ms  131.463 ms
 2  * * *
 3  56.8.178.93 (56.8.178.93)  193.589 ms 56.14.86.249 (56.14.86.249)  193.575 ms 56.14.87.5 (56.14.87.5)  193.559 ms
 4  192.168.44.234 (192.168.44.234)  208.784 ms 192.168.44.236 (192.168.44.236)  208.773 ms  208.761 ms
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * 136.232.148.254.static.jio.com (136.232.148.254)  97.950 ms *
12  * * 136.232.148.254.static.jio.com (136.232.148.254)  107.251 ms
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

d) Forcing IPv4 on iitd.ac.in

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ traceroute -4 www.iitd.ac.in
traceroute to www.iitd.ac.in (103.27.9.24), 30 hops max, 60 byte packets
 1  _gateway (192.168.67.212)  9.832 ms  9.790 ms  13.066 ms
 2  * * *
 3  56.14.86.237 (56.14.86.237)  68.172 ms 56.14.87.9 (56.14.87.9)  68.154 ms  71.208 ms
 4  192.168.44.234 (192.168.44.234)  71.307 ms 192.168.44.238 (192.168.44.238)  127.250 ms  127.238 ms
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  136.232.148.254.static.jio.com (136.232.148.254)  367.192 ms * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

e) Forcing IP 192.168.43.45 on google.com. All requests are not shown.

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ traceroute -g 192.168.43.45 www.iitd.ac.in
traceroute to www.iitd.ac.in (10.10.211.212), 30 hops max, 72 byte packets
 1  * * *
 2  * * *
 3  * * *
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

Packet Analysis

1. DNS Task

Source	Destination	Protocol	Length	Info
2409:4050:2e38:ddd8:a72e:80d1:a006:cdb9	2409:4050:2e38:ddd8::3d	DNS	98	Standard query 0xb0c6 A www.cse.iitd.ac.in
2409:4050:2e38:ddd8:a72e:80d1:a006:cdb9	2409:4050:2e38:ddd8::3d	DNS	98	Standard query 0xe332 AAAA www.cse.iitd.ac.in
2409:4050:2e38:ddd8:a72e:80d1:a006:cdb9	2409:4050:2e38:ddd8::3d	DNS	98	Standard query 0xe332 AAAA www.cse.iitd.ac.in
192.168.190.213	192.168.190.244	DNS	78	Standard query 0xb0c6 A www.cse.iitd.ac.in
2409:4050:2e38:ddd8::3d	2409:4050:2e38:ddd8:a72e:80d1:a006:cdb9	DNS	149	Standard query response 0xe332 AAAA www.cse.iitd.ac.in SOA dns8.iitd.ac.in
192.168.190.244	192.168.190.213	DNS	94	Standard query response 0xb0c6 A www.cse.iitd.ac.in A 103.27.9.152

Fig. Image of all queries and responses.

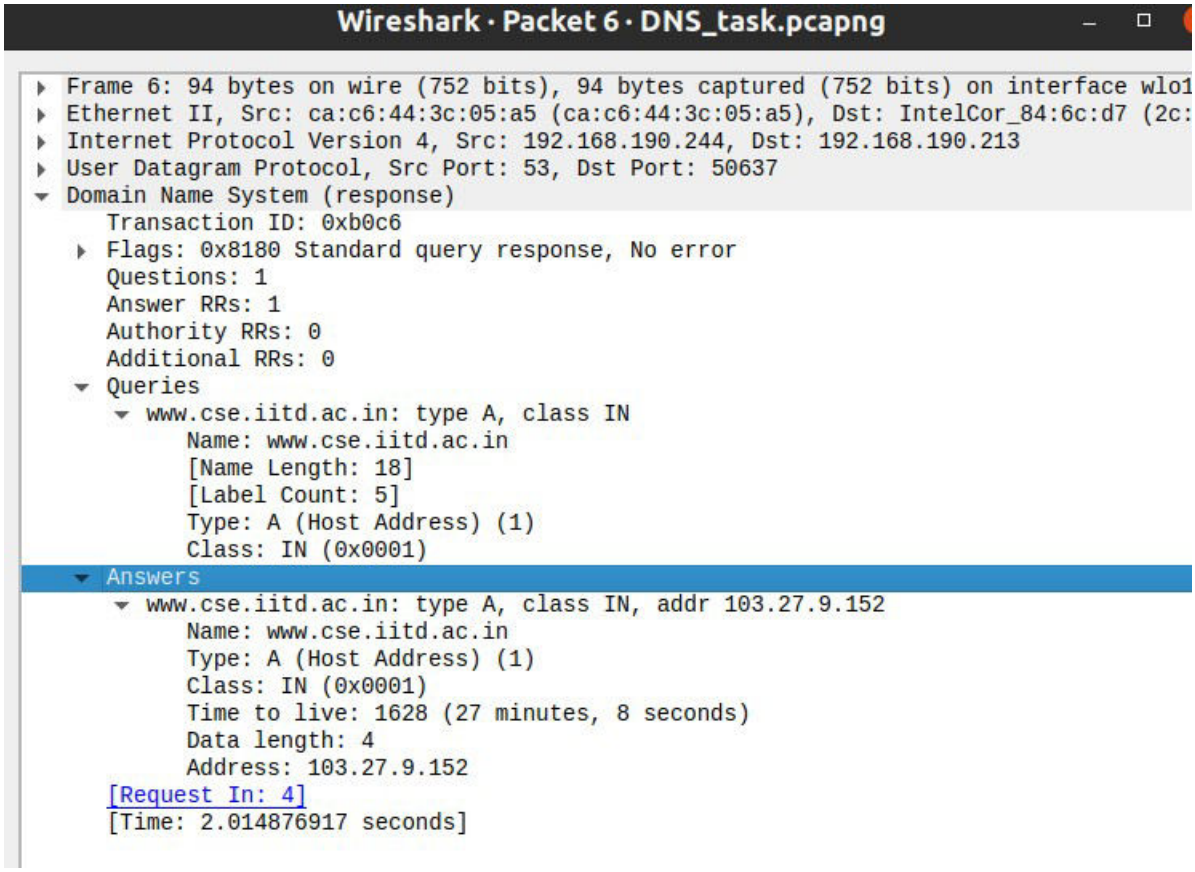


Fig. Query response in which answer is returned

1. They are sent over UDP.
2. 4 queries are send in total, out of which 2 are of type “A” and rest 2 are of type “AAAA”.
3. 2 DNS servers are involved.
4. DNS server with IP address 192.168.190.244

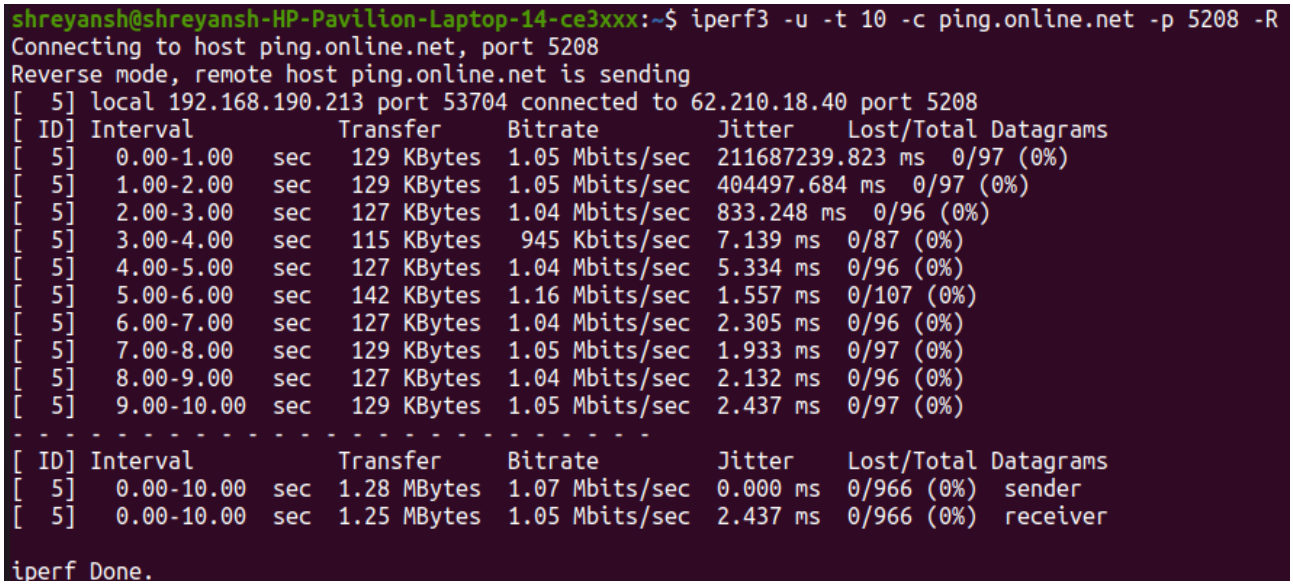
5. One DNS server responds to query of type “A” which has the IP address of the site and One DNS server responds to query of type “AAAA” which has no answer.

6.

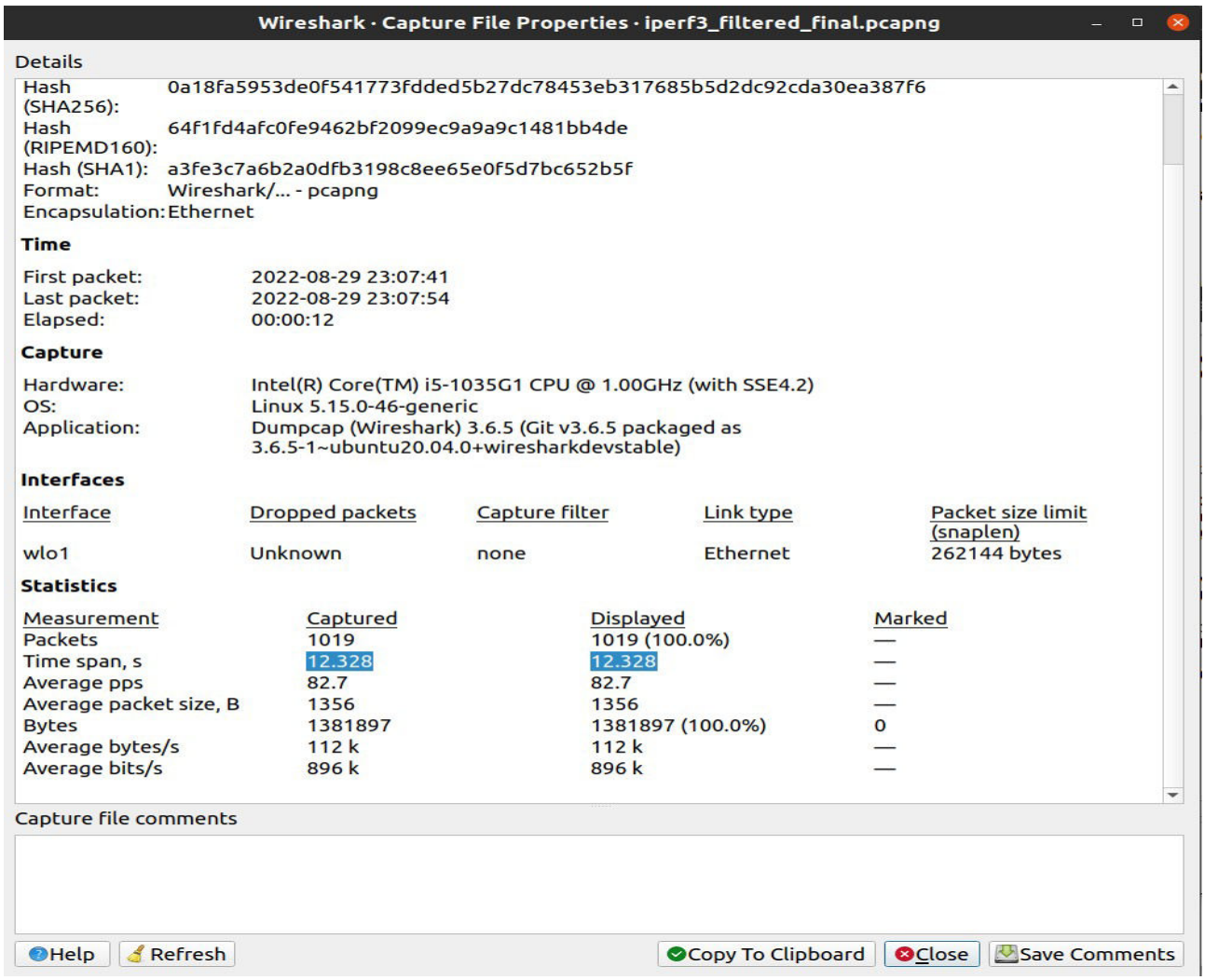
	IP type	Name	Value	Type	TTL (in sec)
Query	IP6	www.cse.iitd.ac.in	-	A	-
Query	IP6	www.cse.iitd.ac.in	-	AAAA	-
Query	IP6	www.cse.iitd.ac.in	-	AAAA	-
Query	IP4	www.cse.iitd.ac.in	-	A	-
Response	IP6	www.cse.iitd.ac.in	-	AAAA	3418
Response	IP4	www.cse.iitd.ac.in	103.27.9.152	A	1628

2. **Iperf Task**

1. 977 packets.
2. Bulk data is send from server to client and average size of packet is 1356.
3. Throughput from terminal is 1.07 Mbits/s i.e. 0.13375 Mb/s.
   In wireshark the time taken for all packets is
   12.328 – 0.244 = 12.084 s.
   UDP length (packet size) = 1400 bytes.
   Throughput is (no. of packets * packet size) / Total time
   i.e 977*1400/12.084 = 0.1131 Mb/s.
   Both the values are nearly same.



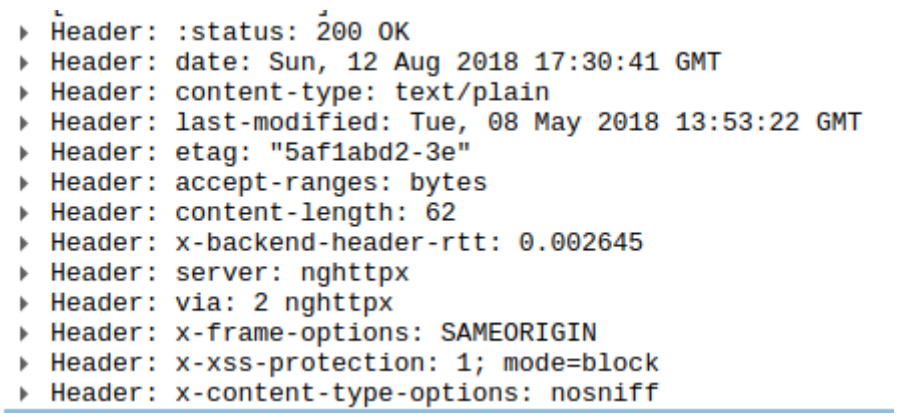
```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ iperf3 -u -t 10 -c ping.online.net -p 5208 -R
Connecting to host ping.online.net, port 5208
Reverse mode, remote host ping.online.net is sending
[  5] local 192.168.190.213 port 53704 connected to 62.210.18.40 port 5208
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-1.00   sec   129 KBytes  1.05 Mbits/sec  211687239.823 ms  0/97 (0%)
[  5]   1.00-2.00   sec   129 KBytes  1.05 Mbits/sec  404497.684 ms  0/97 (0%)
[  5]   2.00-3.00   sec   127 KBytes  1.04 Mbits/sec  833.248 ms  0/96 (0%)
[  5]   3.00-4.00   sec   115 KBytes   945 Kbits/sec  7.139 ms  0/87 (0%)
[  5]   4.00-5.00   sec   127 KBytes  1.04 Mbits/sec  5.334 ms  0/96 (0%)
[  5]   5.00-6.00   sec   142 KBytes  1.16 Mbits/sec  1.557 ms  0/107 (0%)
[  5]   6.00-7.00   sec   127 KBytes  1.04 Mbits/sec  2.305 ms  0/96 (0%)
[  5]   7.00-8.00   sec   129 KBytes  1.05 Mbits/sec  1.933 ms  0/97 (0%)
[  5]   8.00-9.00   sec   127 KBytes  1.04 Mbits/sec  2.132 ms  0/96 (0%)
[  5]   9.00-10.00  sec   129 KBytes  1.05 Mbits/sec  2.437 ms  0/97 (0%)
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-10.00  sec  1.28 MBytes  1.07 Mbits/sec  0.000 ms  0/966 (0%)  sender
[  5]   0.00-10.00  sec  1.25 MBytes  1.05 Mbits/sec  2.437 ms  0/966 (0%)  receiver

iperf Done.
```



File Properties

3. **HTTP Task**

1. 9 packets of HTTP/2 and 2 of HTTP/1.1
2. 4 packets are exchanged.
3. HTTP/2 has all the header lines of HTTP/1.1 along with some other lines. These are : x-backend-header-rtt, via, x-frame-options, x-xss-protection, x-content-type-options.



Header of HTTP/2

4. **Ping Task**

** I have used 1000 as packet size because for larger sizes there was 100% packet loss.

1. Total 12 IP packets are shared of which 2 are DNS packets 5 are ping request packets and 5 are ping reply packets (no packets were lost.)
2. Total size of packet is 1008 bytes of which 992 bytes data is there.
3.

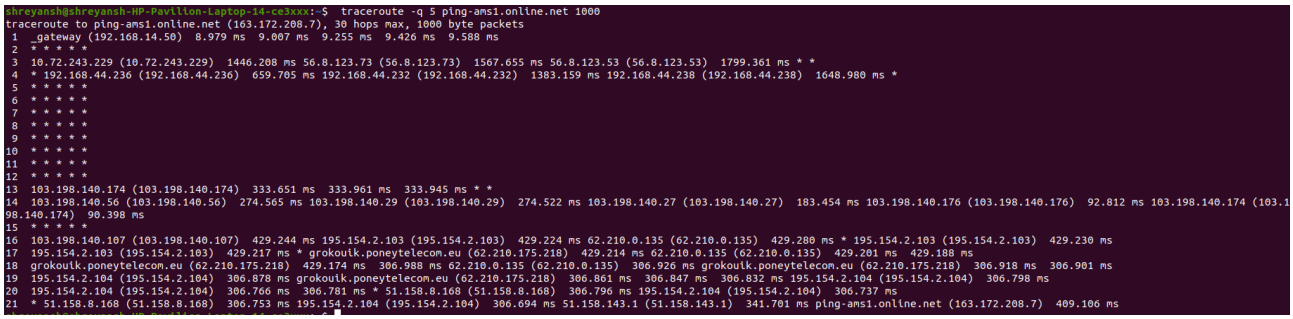
	Fragmented	Length of packet (bytes)	Time of sending	Time of recieving	Actual length of data (bytes)
Query	No	1008	16:48:15.0197	-	992
Response	No	1008	-	16:48:15.7568	992
Query	No	1008	16:48:16.0210	-	992
Response	No	1008	-	16:48:17.0231	992
Query	No	1008	16:48:17.0257	-	992
Response	No	1008	-	16:48:18.0250	992
Query	No	1008	16:48:18.1576	-	992
Response	No	1008	-	16:48:18.8910	992
Query	No	1008	16:48:19.0254	-	992
Response	No	1008	-	16:48:20.0173	992

```
shreyansh@shreyansh-HP-Pavilion-Laptop-14-ce3xxx:~$ ping -s 1000 ping-ams1.online.net -c 5
PING ping-ams1.online.net (163.172.208.7) 1000(1028) bytes of data.
1008 bytes from ping-ams1.online.net (163.172.208.7): icmp_seq=1 ttl=49 time=737 ms
1008 bytes from ping-ams1.online.net (163.172.208.7): icmp_seq=2 ttl=49 time=1005 ms
1008 bytes from ping-ams1.online.net (163.172.208.7): icmp_seq=3 ttl=49 time=1135 ms
1008 bytes from ping-ams1.online.net (163.172.208.7): icmp_seq=4 ttl=49 time=866 ms
1008 bytes from ping-ams1.online.net (163.172.208.7): icmp_seq=5 ttl=49 time=992 ms

--- ping-ams1.online.net ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 737.110/946.855/1134.526/135.007 ms, pipe 2
```

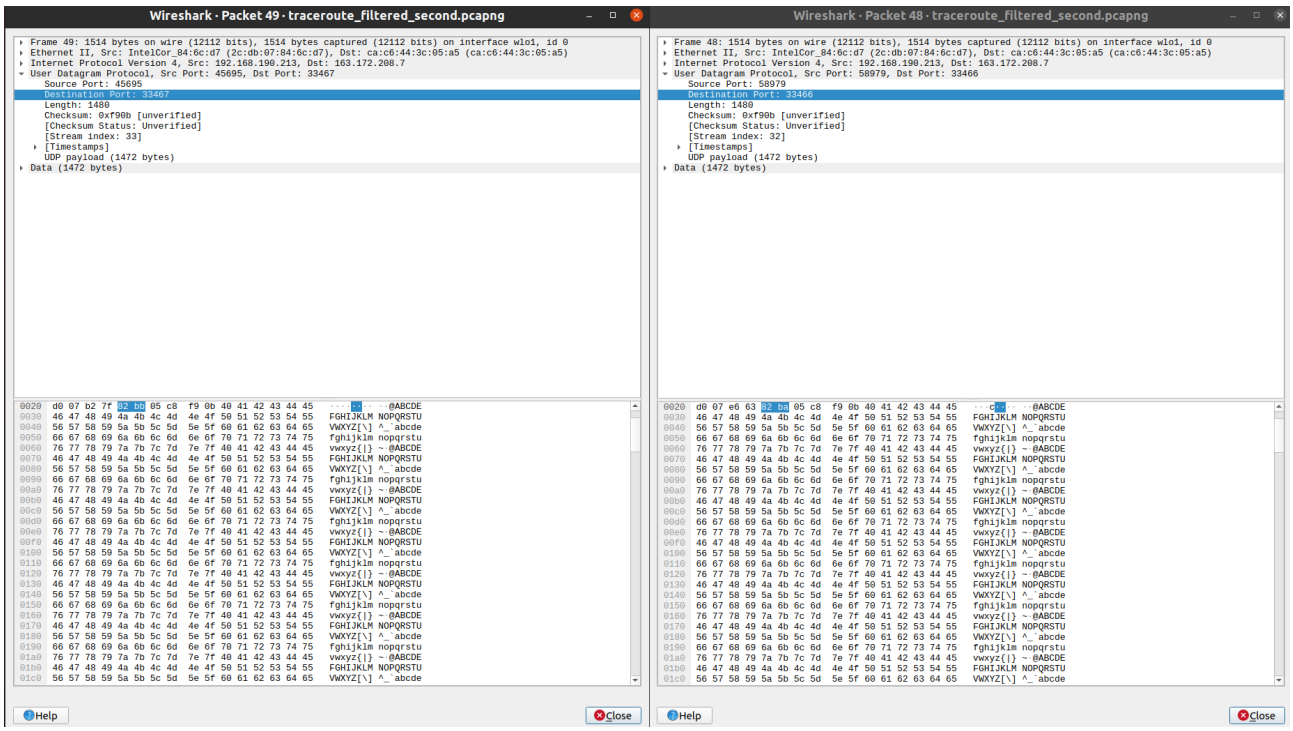
5. **Traceroute Task**

** I have used 1000 as packet size because for larger sizes I was getting only * after 2 lines.

1. 21 hops
2. Total 122 packets are exchanged, of which 116 are sent from client to remote machine and 6 are sent from remote machine to the client.
3. Destination port increases by one and source port changes arbitirarily. Length, check sum, UDP payload remains same.
   Checksum and IP should remain same since IP of destination must be same and checksum to verify that message is intact.
   The source port and destination port must change because UDP is used and it sends packets one after the other and waits for replies to distuinguish between different responses, so it changes the port number.



Output on terminal



Datagram of two consecutive packets