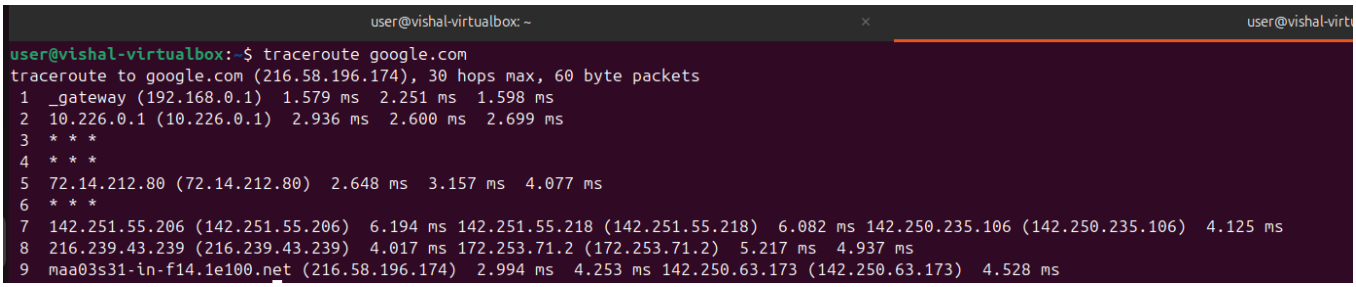
Q3) Explore traceroute/tracert for different websites eg google.com and analyse the parameters in the output and explore different options for traceroute command

What is Traceroute?

- `traceroute` is a **network diagnostic tool** used to trace the path packets take from your device to a destination (e.g., `google.com`).
- It helps identify network latency, hops, and routing issues.



Explanation of Traceroute Output

The **hop number** (each router the packet passes through).

1) Hop Count: The traceroute to `google.com` took 9 hops, indicating the number of network devices (routers) between your system and Google's server.

2) Router Information: Each responding hop represents a router along the path. Notable ones include:

- Hop 1 (`192.168.0.1`): Your home router (default gateway).
- Hop 2 (`10.226.0.1`): ISP's internal router.
- Hop 5 (`72.14.212.80`): Google's backbone network.
- Hop 9 (`216.58.196.174`): Google's final server.

3) Round Trip Time (RTT): The RTT values (in milliseconds) show how long it takes for packets to reach each router and return. Low RTT (~2-6ms) indicates a fast and efficient connection.

4) Missing Hops: Hops 3, 4, and 6 did not respond (* * *), likely due to firewalls or security policies blocking ICMP/UDP traceroute packets.

5) Final Hop: Hop 9 successfully reached `google.com`, confirming that the network route is working correctly with minimal delay (~3-5ms).

Different Options in `traceroute`

1: Limit the number of hops

- By default, traceroute allows **30 hops** before stopping.
- To **limit** the maximum hops, use -m

```
user@vishal-virtualbox:~$ traceroute -m 15 google.com
traceroute to google.com (216.58.196.174), 15 hops max, 60 byte packets
 1  _gateway (192.168.0.1)  20.863 ms  2.091 ms  1.431 ms
 2  10.226.0.1 (10.226.0.1)  2.735 ms  3.485 ms  3.058 ms
 3  * * *
 4  * * *
 5  72.14.212.80 (72.14.212.80)  3.041 ms  3.557 ms  2.878 ms
 6  * * *
 7  142.251.55.88 (142.251.55.88)  3.989 ms 142.251.55.90 (142.251.55.90)  3.716 ms 142.250.228.82 (142.250.228.82)  5.068 ms
 8  172.253.70.166 (172.253.70.166)  4.081 ms 216.239.43.235 (216.239.43.235)  3.648 ms maa03s31-in-f14.1e100.net (216.58.196.174)  3.267 ms
user@vishal-virtualbox:~$
```

2: Use ICMP instead of UDP

By default, **traceroute** uses **UDP packets**, but some networks block UDP.

3: Change packet size

Default **packet size**: 60 bytes.

```
user@vishal-virtualbox:~$ traceroute google.com 120
traceroute to google.com (216.58.196.174), 30 hops max, 120 byte packets
 1  _gateway (192.168.0.1)  2.988 ms  3.016 ms  2.707 ms
 2  10.226.0.1 (10.226.0.1)  3.947 ms  3.694 ms  3.512 ms
 3  * * *
 4  * * *
 5  72.14.212.80 (72.14.212.80)  10.049 ms  9.906 ms  9.741 ms
 6  * * *
 7  142.250.228.82 (142.250.228.82)  4.733 ms 142.251.55.204 (142.251.55.204)  3.306 ms 142.251.49.218 (142.251.49.218)  4.178 ms
 8  216.239.43.235 (216.239.43.235)  4.060 ms 142.251.230.90 (142.251.230.90)  39.489 ms 172.253.75.14 (172.253.75.14)  4.646 ms
 9  maa03s31-in-f14.1e100.net (216.58.196.174)  3.033 ms  4.029 ms  3.064 ms
```

4: Change timeout value

- Default **timeout** per hop: **5 seconds**.
- To reduce **waiting time**, use -w:

```
user@vishal-virtualbox:~$ traceroute -w 2 google.com
traceroute to google.com (216.58.196.174), 30 hops max, 60 byte packets
 1  _gateway (192.168.0.1)  4.278 ms  4.042 ms  3.930 ms
 2  * * *
 3  * * *
 4  * * *
 5  72.14.212.80 (72.14.212.80)  2.254 ms  2.773 ms  2.674 ms
 6  * * *
 7  142.251.60.186 (142.251.60.186)  5.219 ms 142.251.60.184 (142.251.60.184)  2.929 ms 142.251.49.218 (142.251.49.218)  3.956 ms
 8  216.239.43.239 (216.239.43.239)  3.581 ms 172.253.71.132 (172.253.71.132)  3.703 ms 216.239.43.235 (216.239.43.235)  3.448 ms
 9  142.251.51.119 (142.251.51.119)  3.262 ms 142.250.208.153 (142.250.208.153)  3.698 ms  6.301 ms
10  216.239.43.239 (216.239.43.239)  4.560 ms maa03s31-in-f14.1e100.net (216.58.196.174)  4.237 ms  4.065 ms
user@vishal-virtualbox:~$
```