

Networking Training Program 2025

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Question-3:

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

Output:

In Ubuntu,

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute googel.com  
traceroute to googel.com (142.250.192.132), 30 hops max, 60 byte packets  
 1  reliance.reliance (192.168.29.1)  6.104 ms  5.940 ms  5.904 ms  
 2  10.50.208.1 (10.50.208.1)  5.950 ms  5.744 ms  5.704 ms  
 3  172.31.3.94 (172.31.3.94)  12.546 ms  12.535 ms  12.524 ms  
 4  192.168.115.208 (192.168.115.208)  12.350 ms  192.168.115.204 (192.168.115.204)  10.031 ms  192.168.115.208 (192.168.115.208)  12.421 ms  
 5  192.168.232.132 (192.168.232.132)  10.338 ms  10.262 ms  10.215 ms  
 6  192.168.232.162 (192.168.232.162)  12.212 ms  192.168.232.163 (192.168.232.163)  12.047 ms  192.168.232.162 (192.168.232.162)  11.986 ms  
 7  192.168.115.170 (192.168.115.170)  9.304 ms  192.168.115.176 (192.168.115.176)  9.283 ms  9.181 ms  
 8  * * *  
 9  * * *  
10  74.125.51.4 (74.125.51.4)  18.936 ms  72.14.217.254 (72.14.217.254)  20.789 ms  18.648 ms  
11  * * *  
12  142.251.60.186 (142.251.60.186)  22.571 ms  74.125.253.16 (74.125.253.16)  20.703 ms  142.250.228.244 (142.250.228.244)  20.734 ms  
13  142.250.208.152 (142.250.208.152)  18.523 ms  172.253.70.166 (172.253.70.166)  17.818 ms  172.253.75.14 (172.253.75.14)  20.690 ms  
14  142.251.49.232 (142.251.49.232)  74.754 ms  72.14.232.50 (72.14.232.50)  32.432 ms  32.188 ms  
15  192.178.110.199 (192.178.110.199)  39.775 ms  72.14.232.34 (72.14.232.34)  37.067 ms  30.223 ms  
16  142.250.238.81 (142.250.238.81)  34.118 ms  192.178.110.105 (192.178.110.105)  33.680 ms  142.250.238.81 (142.250.238.81)  32.454 ms  
17  bom12s18-in-f4.1e100.net (142.250.192.132)  29.521 ms  36.155 ms  142.250.238.81 (142.250.238.81)  28.964 ms
```

traceroute to google.com (142.250.192.132), 30 hops max, 60 byte packets means the IPv4 address of Google Server and 30 hops till stopping and 60 byte is the packet size for probing.

Hop 1: Local Network (ISP Gateway) : reliance 192.168.29.1 the ms is the latency of the response.

Hop 2: ISP Infrastructure: 10.50.208.1 is the A private IP inside the ISP's network.

We have different options for traceroute command,

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -4 googel.com  
traceroute to googel.com (172.217.160.132), 30 hops max, 60 byte packets  
 1  reliance.reliance (192.168.29.1)  2.534 ms  7.657 ms  7.646 ms  
 2  10.50.208.1 (10.50.208.1)  8.086 ms  8.057 ms  8.044 ms  
 3  172.31.3.94 (172.31.3.94)  14.101 ms  14.089 ms  14.057 ms  
 4  192.168.115.204 (192.168.115.204)  9.827 ms  192.168.115.202 (192.168.115.202)  16.133 ms  192.168.115.206 (192.168.115.206)  11.920 ms  
 5  192.168.232.132 (192.168.232.132)  13.936 ms  13.885 ms  13.870 ms  
 6  192.168.232.163 (192.168.232.163)  16.012 ms  10.382 ms  22.799 ms  
 7  192.168.115.170 (192.168.115.170)  22.706 ms  22.670 ms  192.168.115.172 (192.168.115.172)  22.653 ms  
 8  * * *  
 9  * * *  
10  74.125.51.4 (74.125.51.4)  17.953 ms  * 72.14.217.254 (72.14.217.254)  18.596 ms  
11  * * *  
12  74.125.252.214 (74.125.252.214)  18.850 ms  108.170.231.128 (108.170.231.128)  18.835 ms  209.85.247.250 (209.85.247.250)  27.552 ms  
13  172.253.75.14 (172.253.75.14)  27.536 ms  216.239.59.171 (216.239.59.171)  27.456 ms  172.253.70.166 (172.253.70.166)  27.403 ms  
14  maa03s29-in-f4.1e100.net (172.217.160.132)  20.018 ms  142.250.239.229 (142.250.239.229)  21.242 ms  maa03s29-in-f4.1e100.net (172.217.160.132)  19.835 ms
```

By using the `-4` option, traceroute exclusively employs IPv4 addresses to trace the route to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -6 google.com  
traceroute to google.com (2404:6800:4009:806::2004), 30 hops max, 80 byte packets  
 1  2405:201:e022:10ed:b6a7:c6ff:fee7:67e4 (2405:201:e022:10ed:b6a7:c6ff:fee7:67e4)  2.677 ms  4.778 ms  12.143 ms  
 2  * * *  
 3  2405:203:400:100:172:31:3:94 (2405:203:400:100:172:31:3:94)  15.147 ms  15.135 ms  15.883 ms  
 4  * * *  
 5  2405:200:87f:3168:61::5 (2405:200:87f:3168:61::5)  15.753 ms  15.742 ms  15.731 ms  
 6  * * *  
 7  2405:200:801:4f00::13a (2405:200:801:4f00::13a)  8.284 ms  2405:200:801:4f00::13e (2405:200:801:4f00::13e)  15.448 ms  
 8  * * *  
 9  * * *  
10  * * *  
11  2001:4860:0:1::34c8 (2001:4860:0:1::34c8)  14.195 ms  2404:6800:8131::1 (2404:6800:8131::1)  15.541 ms *  
12  2001:4860:0:1::1842 (2001:4860:0:1::1842)  23.564 ms * *  
13  2001:4860::9:4001:7733 (2001:4860::9:4001:7733)  31.914 ms  2001:4860:0:1::40bc (2001:4860:0:1::40bc)  14.892 ms  2001:4860:0:1::882a (2001:4860:0:1::882a)  22.968 ms  
14  2001:4860::9:4001:b922 (2001:4860::9:4001:b922)  22.954 ms  2001:4860::9:4000:d773 (2001:4860::9:4000:d773)  34.779 ms  
15  2001:4860::9:4001:b923 (2001:4860::9:4001:b923)  33.713 ms  
16  * 2001:4860:0:1::879f (2001:4860:0:1::879f)  34.366 ms  2001:4860:0:1::3fe5 (2001:4860:0:1::3fe5)  34.797 ms  
17  bom07s01-in-x04.1e100.net (2404:6800:4009:806::2004)  37.848 ms  2001:4860:0:1::7ba7 (2001:4860:0:1::7ba7)  30.006 ms  
2001:4860:0:1::7ba9 (2001:4860:0:1::7ba9)  35.805 ms
```

By specifying the `-6` option, traceroute utilizes IPv6 addresses to trace the route to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -F google.com  
traceroute to google.com (142.250.193.68), 30 hops max, 60 byte packets  
 1  reliance.reliance (192.168.29.1)  2.328 ms  10.221 ms  10.207 ms  
 2  10.50.208.1 (10.50.208.1)  11.031 ms  11.016 ms  11.004 ms  
 3  172.31.3.94 (172.31.3.94)  20.062 ms  20.048 ms  20.034 ms  
 4  192.168.115.208 (192.168.115.208)  20.016 ms  20.004 ms  192.168.115.206 (192.168.115.206)  19.989 ms  
 5  192.168.232.132 (192.168.232.132)  20.048 ms  20.033 ms  20.019 ms  
 6  192.168.232.162 (192.168.232.162)  19.898 ms  9.095 ms  11.677 ms  
 7  192.168.115.174 (192.168.115.174)  11.624 ms  11.591 ms  192.168.115.176 (192.168.115.176)  8.836 ms  
 8  * * *  
 9  * * *  
10  72.14.217.254 (72.14.217.254)  22.565 ms * 74.125.50.202 (74.125.50.202)  24.034 ms  
11  * * *  
12  142.251.55.238 (142.251.55.238)  28.599 ms  142.250.233.142 (142.250.233.142)  20.654 ms  142.251.55.204 (142.251.55.204)  20.630 ms  
13  142.250.239.56 (142.250.239.56)  25.412 ms  172.253.71.2 (172.253.71.2)  19.319 ms  142.250.208.152 (142.250.208.152)  19.672 ms  
14  172.253.72.136 (172.253.72.136)  21.679 ms  142.251.246.202 (142.251.246.202)  47.708 ms  47.693 ms  
15  209.85.250.57 (209.85.250.57)  45.241 ms  60.005 ms  192.178.82.233 (192.178.82.233)  50.348 ms  
16  142.251.54.85 (142.251.54.85)  49.718 ms  142.251.54.83 (142.251.54.83)  50.945 ms  52.696 ms  
17  142.251.54.83 (142.251.54.83)  51.761 ms  del11s16-in-f4.1e100.net (142.250.193.68)  51.552 ms  49.765 ms
```

By using the `-F` option, traceroute ensures that packets are not fragmented during the traceroute process to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -f 10 google.com  
traceroute to google.com (216.58.200.164), 30 hops max, 60 byte packets  
10 * 72.14.196.126 (72.14.196.126)  17.036 ms *  
11 * * *  
12 209.85.253.84 (209.85.253.84)  24.711 ms  142.250.228.244 (142.250.228.244)  24.683 ms  209.85.247.228 (209.85.247.228)  20.510 ms  
13 172.253.71.132 (172.253.71.132)  17.407 ms  172.253.71.2 (172.253.71.2)  20.482 ms  142.250.208.152 (142.250.208.152)  20.472 ms  
14 172.253.72.136 (172.253.72.136)  24.520 ms  142.250.224.150 (142.250.224.150)  51.041 ms  142.250.224.156 (142.250.224.156)  54.733 ms  
15 192.178.82.233 (192.178.82.233)  56.282 ms  142.251.246.202 (142.251.246.202)  45.315 ms  142.251.255.57 (142.251.255.57)  48.532 ms  
16 192.178.82.237 (192.178.82.237)  47.853 ms  172.253.67.87 (172.253.67.87)  51.730 ms  142.250.63.53 (142.250.63.53)  48.745 ms  
17 nrt12s11-in-f164.1e100.net (216.58.200.164)  52.169 ms  172.253.67.87 (172.253.67.87)  50.156 ms  172.253.67.85 (172.253.67.85)  48.124 ms
```

By providing the `-f` option followed by the TTL value (e.g., 10), traceroute initiates the traceroute operation from the specified hop to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -g 192.168.10.5 googel.com  
traceroute to googel.com (142.251.42.4), 30 hops max, 72 byte packets  
1 * * *  
2 * * *  
3 * * *  
4 * * *  
5 * * *  
6 * * *  
7 * * *  
8 * * *  
9 * * *  
10 * * *  
11 * ^C
```

By using the `-g` option followed by the gateway IP address, traceroute routes the packet through the specified gateway to reach the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -m 5 googel.com  
traceroute to googel.com (142.251.42.4), 5 hops max, 60 byte packets  
1 reliance.reliance (192.168.29.1) 7.128 ms 7.064 ms 7.034 ms  
2 10.50.208.1 (10.50.208.1) 7.786 ms 8.655 ms 8.642 ms  
3 172.31.3.94 (172.31.3.94) 13.682 ms 13.627 ms 13.594 ms  
4 192.168.115.206 (192.168.115.206) 9.185 ms 192.168.115.204 (192.168.115.204) 11.455 ms 11.692 ms  
5 192.168.232.132 (192.168.232.132) 15.600 ms 15.539 ms 15.524 ms
```

By specifying the `-m` option followed by the desired TTL value (e.g., 5), traceroute limits the traceroute operation to a maximum of 5 hops to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -n googel.com  
traceroute to googel.com (142.251.42.4), 30 hops max, 60 byte packets  
1 192.168.29.1 2.395 ms * *  
2 10.50.208.1 11.509 ms 11.491 ms 11.476 ms  
3 172.31.3.94 15.956 ms 15.773 ms 15.732 ms  
4 192.168.115.206 13.984 ms 13.961 ms 192.168.115.204 13.916 ms  
5 192.168.232.132 14.169 ms 14.315 ms 16.204 ms  
6 192.168.232.163 16.193 ms 192.168.232.162 18.722 ms 192.168.232.163 12.862 ms  
7 192.168.115.170 9.455 ms 9.912 ms 192.168.115.174 12.419 ms  
8 * * *  
9 * * *  
10 72.14.217.254 22.768 ms * *  
11 * * *  
12 142.250.233.142 21.040 ms 142.251.55.88 19.353 ms 216.239.59.230 18.255 ms  
13 142.250.62.66 25.694 ms 142.250.208.230 21.185 ms 22.150 ms  
14 72.14.232.34 32.016 ms 142.250.238.206 34.657 ms 142.250.212.0 30.162 ms  
15 192.178.110.109 39.080 ms 72.14.232.34 31.301 ms 192.178.110.207 31.515 ms  
16 192.178.110.109 33.419 ms 209.85.248.61 31.697 ms 192.178.110.109 35.102 ms  
17 142.251.42.4 31.400 ms 31.534 ms 209.85.250.139 34.257 ms
```

By using the `-n` option, traceroute displays IP addresses instead of resolving them to domain names during the traceroute operation to the destination `google.com`.


```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -p 20292 googel.com  
traceroute to googel.com (142.251.42.4), 30 hops max, 60 byte packets  
1  reliance.reliance (192.168.29.1)  7.081 ms  7.030 ms  7.012 ms  
2  10.50.208.1 (10.50.208.1)  6.997 ms  6.979 ms  6.961 ms  
3  172.31.3.94 (172.31.3.94)  11.017 ms  11.002 ms  13.136 ms  
4  192.168.115.206 (192.168.115.206)  10.971 ms  192.168.115.208 (192.168.115.208)  13.102 ms  13.082 ms  
5  192.168.232.132 (192.168.232.132)  10.202 ms  10.152 ms  10.120 ms  
6  192.168.232.163 (192.168.232.163)  13.828 ms  192.168.232.162 (192.168.232.162)  11.067 ms  10.990 ms  
7  192.168.115.170 (192.168.115.170)  8.055 ms  8.012 ms  192.168.115.174 (192.168.115.174)  11.834 ms  
8  * * *  
9  * * *  
10 72.14.217.254 (72.14.217.254)  19.128 ms  74.125.51.4 (74.125.51.4)  20.463 ms  20.430 ms  
11 * * *  
12 * * *  
13 * * *  
14 * * *  
15 * * *  
16 * * *  
17 * * *  
18 * * *  
19 * * *  
20 * * *  
21 * * *  
22 * * *  
23 * * *  
24 * * *  
25 * * *  
26 * * *^C
```

By providing the `-p` option followed by the desired port number (e.g., 20292), traceroute uses the specified port for the traceroute operation to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute -q 1 googel.com  
traceroute to googel.com (142.251.42.4), 30 hops max, 60 byte packets  
1  reliance.reliance (192.168.29.1)  2.312 ms  
2  10.50.208.1 (10.50.208.1)  2.899 ms  
3  172.31.3.94 (172.31.3.94)  14.180 ms  
4  192.168.115.202 (192.168.115.202)  14.138 ms  
5  192.168.232.132 (192.168.232.132)  7.748 ms  
6  192.168.232.162 (192.168.232.162)  14.099 ms  
7  192.168.115.170 (192.168.115.170)  7.955 ms  
8  *  
9  *  
10 74.125.50.202 (74.125.50.202)  21.758 ms  
11 *  
12 142.250.233.144 (142.250.233.144)  21.685 ms  
13 142.251.229.250 (142.251.229.250)  21.671 ms  
14 142.250.238.182 (142.250.238.182)  39.527 ms  
15 142.250.238.182 (142.250.238.182)  37.923 ms  
16 192.178.110.107 (192.178.110.107)  34.432 ms  
17 bom12s19-in-f4.1e100.net (142.251.42.4)  31.486 ms
```

By using the `-q` option followed by the desired number of probes (e.g., 1), traceroute sends the specified number of probes per hop during the traceroute operation to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute googel.com 100  
traceroute to googel.com (142.251.42.4), 30 hops max, 100 byte packets  
 1  reliance.reliance (192.168.29.1)  5.992 ms  5.927 ms  6.102 ms  
 2  10.50.208.1 (10.50.208.1)  7.169 ms  7.157 ms  7.144 ms  
 3  172.31.3.94 (172.31.3.94)  18.509 ms  18.498 ms  18.486 ms  
 4  192.168.115.202 (192.168.115.202)  18.473 ms  192.168.115.208 (192.168.115.208)  18.461 ms  192.168.115.206 (192.168.115.206)  8.872 ms  
 5  192.168.232.132 (192.168.232.132)  18.557 ms  18.420 ms  18.518 ms  
 6  192.168.232.163 (192.168.232.163)  18.388 ms  192.168.232.162 (192.168.232.162)  12.800 ms  12.771 ms  
 7  192.168.115.174 (192.168.115.174)  19.093 ms  192.168.115.170 (192.168.115.170)  7.298 ms  192.168.115.174 (192.168.115.174)  19.020 ms  
 8  * * *  
 9  * * *  
10  72.14.217.254 (72.14.217.254)  20.120 ms  74.125.50.202 (74.125.50.202)  20.106 ms  72.14.217.254 (72.14.217.254)  20.093 ms  
11  * * *  
12  142.251.55.242 (142.251.55.242)  20.427 ms  142.251.49.216 (142.251.49.216)  22.065 ms  142.250.233.142 (142.250.233.142)  21.108 ms  
13  142.251.230.52 (142.251.230.52)  20.002 ms  172.253.71.132 (172.253.71.132)  18.497 ms  172.253.71.2 (172.253.71.2)  20.481 ms  
14  142.251.49.232 (142.251.49.232)  36.063 ms  72.14.232.50 (72.14.232.50)  31.322 ms  72.14.232.34 (72.14.232.34)  36.579 ms  
15  142.250.238.206 (142.250.238.206)  33.507 ms  192.178.110.209 (192.178.110.209)  35.119 ms  192.178.110.207 (192.178.110.207)  34.723 ms  
16  192.178.110.105 (192.178.110.105)  32.768 ms  209.85.248.61 (209.85.248.61)  30.289 ms  192.178.110.105 (192.178.110.105)  33.578 ms  
17  209.85.250.139 (209.85.250.139)  29.606 ms  31.014 ms  30.994 ms  
18  bom12s19-in-f4.1e100.net (142.251.42.4)  31.375 ms  31.629 ms  31.508 ms  
aswath@aswath-VirtualBox:~$
```

By providing the packet length value (e.g., 100), traceroute utilizes packets with the specified length during the traceroute operation to the destination `google.com`.

```
aswath@aswath-VirtualBox: ~  
aswath@aswath-VirtualBox:~$ traceroute --help  
Usage:  
  traceroute [ -46dFITnreAUDV ] [ -f first_ttl ] [ -g gate,... ] [ -i device ] [ -m max_ttl ] [ -N squeries ] [ -p port ] [ -t tos ] [ -l flow_label ] [ -w MAX,HERE,NEAR ] [ -q nqueries ] [ -s src_addr ] [ -z sendwait ] [ --fwmark=num ] host  
  t [ packetlen ]  
Options:  
  -4                  Use IPv4  
  -6                  Use IPv6  
  -d --debug          Enable socket level debugging  
  -F --dont-fragment  Do not fragment packets  
  -f first_ttl        --first=first_ttl  
                      Start from the first_ttl hop (instead from 1)  
  -g gate,...        --gateway=gate,...  
                      Route packets through the specified gateway  
                      (maximum 8 for IPv4 and 127 for IPv6)  
  -I --icmp           Use ICMP ECHO for tracerouting  
  -T --tcp           Use TCP SYN for tracerouting (default port is 80)  
  -i device          --interface=device  
                      Specify a network interface to operate with  
  -m max_ttl         --max-hops=max_ttl  
                      Set the max number of hops (max TTL to be reached). Default is 30  
  -N squeries        --sim-queries=squeries  
                      Set the number of probes to be tried simultaneously (default is 16)  
  -n                 Do not resolve IP addresses to their domain names  
  -p port            --port=port  
                      Set the destination port to use. It is either  
                      initial udp port value for "default" method  
                      (incremented by each probe, default is 33434), or  
                      initial seq for "icmp" (incremented as well,  
                      default from 1), or some constant destination  
                      port for other methods (with default of 80 for  
                      "tcp", 53 for "udp", etc.)
```

By executing the `traceroute --help` command, traceroute displays help messages that detail the usage and available options of the traceroute command.