
ASSIGNMENT REPORT

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Q1.

a)

```
[chupacabra@archlinux ~]$ ifconfig
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 19723 bytes 3061608 (2.9 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 19723 bytes 3061608 (2.9 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.38 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::c5b8:f10e:46d:2285 prefixlen 64 scopeid 0x20<link>
    ether 58:84:92:79:70:0c txqueuelen 1000 (Ethernet)
    RX packets 7329755 bytes 10273465468 (9.5 GiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 639499 bytes 111934651 (106.7 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

“wlan0” shows the broadcast network.

The inet and inet6 shows my ipv4 and ipv6 address respectively.

b)

What Is My IP?

My Public IPv4: [103.72.9.243](#) 🌐

My Public IPv6: Not Detected

My IP Location: Gurgaon, HR IN 🌐

My ISP: DDC Broadband Pvt. Ltd. 🌐

The IP addresses on ifconfig and on whatismyip are different because they both are showing IPs of different networks.

‘ifconfig’ is showing the IP address in my LAN which is the private/local address, unique only in my local network, meanwhile ‘whatismyip’ is showing my public IP address unique over the entire internet.

Q2.

a)

```
[chupacabra@archlinux ~]$ sudo ip addr add 192.168.1.69/24 dev wlan0
[sudo] password for chupacabra:
[chupacabra@archlinux ~]$ sudo ip addr del 192.168.1.38/24 dev wlan0
```

ip addr with “add” flag adds the given address on the specified interface. After adding the new address, we delete the old one.

```
[chupacabra@archlinux ~]$ ifconfig
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 21695 bytes 3181064 (3.0 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 21695 bytes 3181064 (3.0 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.69 netmask 255.255.255.0 broadcast 0.0.0.0
    inet6 fe80::c5b8:f10e:46d:2285 prefixlen 64 scopeid 0x20<link>
    ether 50:84:92:79:70:0c txqueuelen 1000 (Ethernet)
    RX packets 7357485 bytes 10301506597 (9.5 GiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 651090 bytes 117221929 (111.7 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

After adding the new address and deleting the old one, we can confirm the changes by ifconfig.

Following the same set of procedures allows us to revert back all the changes.

```
[chupacabra@archlinux ~]$ sudo ip addr add 192.168.1.38/24 dev wlan0
[chupacabra@archlinux ~]$ sudo ip addr del 192.168.1.69/24 dev wlan0
[chupacabra@archlinux ~]$ ifconfig
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 23046 bytes 3263056 (3.1 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 23046 bytes 3263056 (3.1 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.38 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::c5b8:f10e:46d:2285 prefixlen 64 scopeid 0x20<link>
    ether 50:84:92:79:70:0c txqueuelen 1000 (Ethernet)
    RX packets 7388570 bytes 10336220572 (9.6 GiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 661797 bytes 121372016 (115.7 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Q3.

- a) First we need to open a server port on localhost, for this assignment I'm using port 65469.

```
[chupacabra@archlinux ~]$ nc -l -p 65469
```

Then we need to open a client and connect it to the server port.

```
[chupacabra@archlinux ~]$ nc localhost 65469
```

As we can see below, the connection is working correctly.

```
[chupacabra@archlinux ~]$ nc -l -p 65469
whoami
hello
checking
[]
```

```
[chupacabra@archlinux ~]$ nc localhost 65469
whoami
hello
checking
[]
```

- b) There are two ways to check the state of the tcp connection, below are both:

```
[chupacabra@archlinux ~]$ netstat -tnp | grep :65469
(Not all processes could be identified, non-owned process info
will not be shown, you would have to be root to see it all.)
tcp        0      0 127.0.0.1:47596    127.0.0.1:65469    ESTABLISHED 3922/nc
tcp        0      0 127.0.0.1:65469    127.0.0.1:47596    ESTABLISHED 3875/nc
[chupacabra@archlinux ~]$ ss -tnp | grep :65469
ESTAB 0      0      127.0.0.1:47596    127.0.0.1:65469  users:(("nc",pid=3922,fd=3))
ESTAB 0      0      127.0.0.1:65469    127.0.0.1:47596  users:(("nc",pid=3875,fd=4))
```

Q4.

- a) We can use nslookup with type “soa” which gives information about the zone, including the primary authoritative name server and contact details and various timers.

```
[chupacabra@archlinux ~]$ nslookup -type=soa google.in
Server:      8.8.8.8
Address:     8.8.8.8#53

Non-authoritative answer:
google.in
    origin = ns1.google.com
    mail addr = dns-admin.google.com
    serial = 666720642
    refresh = 900
    retry = 900
    expire = 1800
    minimum = 60

Authoritative answers can be found from:
```

We have the origin which we can query to get an authoritative response.

```
[chupacabra@archlinux ~]$ nslookup google.in ns1.google.com
Server:      ns1.google.com
Address:     216.239.32.10#53

Name:   google.in
Address: 142.250.194.132
Name:   google.in
Address: 2404:6800:4002:822::2004
```

- b) In the image below, we can see the TTL for IPv4 address is 14 seconds and for IPv6 address is 2 seconds, which means that after 14 seconds IPv4 address and after 2 seconds IPv6 address would need refreshing and expire from the local DNS server.

```
[chupacabra@archlinux ~]$ nslookup -debug google.com
Server:      8.8.8.8
Address:     8.8.8.8#53

-----
QUESTIONS:
    google.com, type = A, class = IN
ANSWERS:
    → google.com
       internet address = 172.217.167.46
       ttl = 14
AUTHORITY RECORDS:
ADDITIONAL RECORDS:
-----
Non-authoritative answer:
Name:   google.com
Address: 172.217.167.46
-----
QUESTIONS:
    google.com, type = AAAA, class = IN
ANSWERS:
    → google.com
       has AAAA address 2404:6800:4002:819::200e
       ttl = 2
AUTHORITY RECORDS:
ADDITIONAL RECORDS:
-----
Name:   google.com
Address: 2404:6800:4002:819::200e
```

Q5.

a)

```
PS C:\Users\sirChupacabra> tracert google.in

Tracing route to google.in [142.250.194.196]
over a maximum of 30 hops:

  1  124 ms    3 ms    2 ms  192.168.1.1
  2   30 ms    2 ms   23 ms  10.90.96.1
  3   4 ms     2 ms    4 ms  157.10.248.37.swiftify.in [157.10.248.37]
  4   3 ms     3 ms    3 ms  157.10.248.1.swiftify.in [157.10.248.1]
  5  11 ms     3 ms    2 ms  45.120.248.31
  6  36 ms    78 ms   20 ms  192.178.83.231
  7   5 ms     4 ms    3 ms  142.251.52.207
  8  44 ms     3 ms    4 ms  del12s07-in-f4.1e100.net [142.250.194.196]

Trace complete.
```

We have 7 intermediate hosts with the 8th being our destination.

Addr.		Avg. latency
192.168.1.1	(124ms + 3ms + 2ms)/3	43 ms
10.90.96.1	(30ms + 2ms + 23ms)/3	18.33 ms
157.10.248.37	(4ms + 2ms + 4ms)/3	3.33 ms
157.10.248.1	(3ms + 3ms + 2ms)/3	2.67 ms
45.120.248.31	(3ms + 4ms + 3ms)/3	3.33 ms
192.178.83.231	(36ms + 78ms + 20ms)/3	44.67 ms
142.251.52.207	(5ms + 3ms + 3ms)/3	3.67 ms
142.250.194.196	(44ms + 3ms + 4ms)/3	17 ms

- b) Below are the 50 pings. It has also calculated the avg of the 50 pings for us at the bottom i.e. 18.767 ms.

```
[chupacabra@archlinux ~]$ ping -c 50 google.in
PING google.in (142.250.194.196) 56(84) bytes of data.
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=1 ttl=118 time=4.25 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=3 ttl=118 time=5.34 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=4 ttl=118 time=5.39 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=5 ttl=118 time=6.30 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=6 ttl=118 time=6.69 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=7 ttl=118 time=5.89 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=8 ttl=118 time=5.98 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=9 ttl=118 time=74.9 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=10 ttl=118 time=97.0 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=11 ttl=118 time=17.3 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=12 ttl=118 time=5.24 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=13 ttl=118 time=64.9 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=14 ttl=118 time=84.9 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=15 ttl=118 time=5.77 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=16 ttl=118 time=5.23 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=17 ttl=118 time=5.48 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=18 ttl=118 time=5.21 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=19 ttl=118 time=3.62 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=20 ttl=118 time=5.14 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=21 ttl=118 time=5.44 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=22 ttl=118 time=5.60 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=23 ttl=118 time=6.37 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=24 ttl=118 time=5.36 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=25 ttl=118 time=5.68 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=26 ttl=118 time=5.89 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=27 ttl=118 time=6.22 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=28 ttl=118 time=6.19 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=29 ttl=118 time=4.25 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=30 ttl=118 time=34.3 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=31 ttl=118 time=55.9 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=32 ttl=118 time=78.9 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=33 ttl=118 time=13.1 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=34 ttl=118 time=22.9 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=35 ttl=118 time=4.90 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=36 ttl=118 time=4.97 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=37 ttl=118 time=5.19 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=38 ttl=118 time=5.29 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=39 ttl=118 time=3.53 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=40 ttl=118 time=5.25 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=41 ttl=118 time=5.50 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=42 ttl=118 time=4.86 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=43 ttl=118 time=5.46 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=44 ttl=118 time=5.61 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=45 ttl=118 time=30.7 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=47 ttl=118 time=96.7 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=48 ttl=118 time=8.68 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=49 ttl=118 time=39.6 ms
64 bytes from dell2s07-in-f4.1e100.net (142.250.194.196): icmp_seq=50 ttl=118 time=4.06 ms

--- google.in ping statistics ---
50 packets transmitted, 48 received, 4% packet loss, time 49097ms
rtt min/avg/max/mdev = 3.525/18.767/96.964/26.597 ms
```

- c) The sum of all the avg latencies of all intermediate hosts with the destination is 136.0 ms while the avg of 50 pings to same address is significantly lower of only 18.767 ms.

This discrepancy is expected because traceroute accumulates latency across all hops, while ping only measures the direct round-trip time to the final destination.

- d) The maximum latency from traceroute (44.67 ms) is higher than the average ping latency (18.767 ms). This could be because while one hop (possibly due to distance or network congestion) takes longer, the overall network path to the destination is quicker, as seen from average ping time. This is a typical scenario where the average ping hides the variability in hop-by-hop latency.

- e) There are two entries for a single hop specifically hops 3 and 4 both show IPs belonging to “swiftify.in” (my ISP), but with different IP addresses 157.10.248.37 and 157.10.248.1.

This shows that the network uses multiple paths to the same destination to optimize resource usage and prevent bottlenecks.

- f) Below are the 50 pings to “stanford.edu”. It has also calculated the avg of the 50 pings for us at the bottom i.e. 338.687 ms.

```
[chupacabra@archlinux ~]$ ping -c 50 stanford.edu
PING stanford.edu (171.67.215.200) 56(84) bytes of data.
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=1 ttl=237 time=304 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=237 time=328 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=237 time=352 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=237 time=373 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=237 time=282 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=237 time=315 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=237 time=338 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=237 time=362 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=237 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=237 time=306 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=237 time=327 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=237 time=555 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=237 time=271 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=237 time=395 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=237 time=316 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=237 time=339 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=237 time=364 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=237 time=285 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=237 time=305 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=237 time=327 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=237 time=350 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=237 time=271 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=237 time=292 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=237 time=315 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=237 time=340 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=237 time=452 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=237 time=281 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=237 time=303 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=237 time=326 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=237 time=348 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=237 time=371 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=237 time=292 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=237 time=315 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=237 time=338 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=237 time=360 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=237 time=281 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=237 time=303 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=237 time=532 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=237 time=348 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=237 time=372 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=237 time=294 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=237 time=316 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=237 time=335 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=237 time=358 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=237 time=483 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=237 time=301 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=237 time=324 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=237 time=347 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=237 time=370 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=237 time=291 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49063ms
rtt min/avg/max/mdev = 270.670/338.687/554.673/58.732 ms
```

- g) Below are both, the previously done traceroute on google.in and recently done traceroute on stanford.edu. We can see that stanford took lot more hops to reach its destination compared to google with stanford taking 21 hops while google taking only 8 hops.

```
PS C:\Users\sirChupacabra> tracert google.in

Tracing route to google.in [142.250.194.196]
over a maximum of 30 hops:

  1  124 ms    3 ms     2 ms  192.168.1.1
  2   30 ms    2 ms    23 ms  10.90.96.1
  3   4 ms     2 ms     4 ms  157.10.248.37.swiftify.in [157.10.248.37]
  4   3 ms     3 ms     3 ms  157.10.248.1.swiftify.in [157.10.248.1]
  5  11 ms     3 ms     2 ms  45.120.248.31
  6  36 ms    78 ms    20 ms  192.178.83.231
  7   5 ms     4 ms     3 ms  142.251.52.207
  8  44 ms     3 ms     4 ms  del12s07-in-f4.1e100.net [142.250.194.196]

Trace complete.
PS C:\Users\sirChupacabra> tracert stanford.edu

Tracing route to stanford.edu [171.67.215.200]
over a maximum of 30 hops:

  1   1 ms     1 ms     1 ms  192.168.1.1
  2   3 ms     4 ms     2 ms  10.90.96.1
  3   4 ms     2 ms     2 ms  157.10.248.37.swiftify.in [157.10.248.37]
  4  35 ms     6 ms     3 ms  157.10.248.1.swiftify.in [157.10.248.1]
  5  61 ms    61 ms    37 ms  1.6.52.90
  6   4 ms     3 ms     3 ms  100.70.142.4
  7   3 ms     2 ms     2 ms  100.70.136.182
  8  173 ms   203 ms   202 ms  115.245.181.189
  9   *        *        *    Request timed out.
 10   *        *        *    Request timed out.
 11  150 ms   244 ms   151 ms  103.198.140.176
 12  227 ms   203 ms   202 ms  49.45.4.64
 13   *        *        *    Request timed out.
 14   *        *        *    Request timed out.
 15   *       247 ms   358 ms  port-channel21.core3.nyc4.he.net [184.105.213.138]
 16   *        *       274 ms  port-channel13.core3.sjc2.he.net [184.104.198.253]
 17  385 ms    *        *    100ge0-16.core2.pao1.he.net [184.104.188.34]
 18  308 ms   305 ms   305 ms  stanford-university.e0-62.core2.pao1.he.net [184.105.177.238]
 19  318 ms   272 ms   337 ms  campus-nw-rtr-vl1102.SUNet [171.66.255.196]
 20   *        *        *    Request timed out.
 21  355 ms   324 ms   304 ms  web.stanford.edu [171.67.215.200]

Trace complete.
```

- h) The latency difference between google.in and stanford.edu is primarily due to differences in geographical distance, network infrastructure, the number of hops, and potential network congestion. Google's extensive and optimized global network infrastructure typically provides lower latency compared to a university network. Since google is a globally heavily used, it likely has servers in almost every major country to reduce latency and congestion while stanford is a university in United States, it likely hosted only on the Stanford University campus.

Q6.

```
chupacabra@:/home$ ping -c 5 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
64 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.031 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.028 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.036 ms
64 bytes from 127.0.0.1: icmp_seq=4 ttl=64 time=0.026 ms
64 bytes from 127.0.0.1: icmp_seq=5 ttl=64 time=0.030 ms

--- 127.0.0.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4171ms
rtt min/avg/max/mdev = 0.026/0.030/0.036/0.003 ms
chupacabra@:/home$ sudo ifconfig lo down
chupacabra@:/home$ ping -c 5 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.

--- 127.0.0.1 ping statistics ---
5 packets transmitted, 0 received, 100% packet loss, time 4151ms
```

Using ifconfig, we can disable the loopback interface which successfully results in 100% packet loss.