
Computer Networks

Assignment 1

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Q1)

a) 172.20.245.104

```
parth@LAPTOP-M0BPOTJN:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.20.245.104 netmask 255.255.240.0 broadcast 172.20.255.255
    inet6 fe80::215:5dff:fe90:36ea prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:90:36:ea txqueuelen 1000 (Ethernet)
    RX packets 294978 bytes 371776975 (371.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 46866 bytes 3415579 (3.4 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

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 1454 bytes 151369 (151.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1454 bytes 151369 (151.3 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

b) 103.25.231.125

The IP address 172.20.245.104 is a private/local IP address that I see in my terminal, which is assigned to devices within my internal network for internal communication. On the other hand, the IP address 103.25.231.125 is a public/global IP address assigned by my ISP, which is visible to external networks and used for internet communication. When I check my IP address from my terminal, I see the private IP assigned within my local network, while websites showing my IP address display the public IP that identifies my network on the internet.



The screenshot shows the homepage of WhatIsMyIP.com. The navigation bar includes links for 'What Is My IP?', 'IP Address Lookup', 'IP WHOIS Lookup', 'DNS Lookup', 'Internet Speed Test', and 'Tools'. The main content area features a video player on the left and a green box on the right titled 'What Is My IP?'. The green box displays the following information: 'My Public IPv4: 103.25.231.125', 'My Public IPv6: Not Detected', 'My IP Location: Noida, UP IN', and 'My ISP: Indraprastha Institute of Information Technology Delhi'. Below the green box is a blue search bar with the text 'What is an IP address?' and a dropdown arrow.

Q2)

a) initial ip 172.20.245.104 which I changed to 192.168.0.1

When I change the IP address of a network interface, I also need to set a netmask to define the network range for that address. For instance, with the command:-

sudo ifconfig eth0 192.168.0.1 netmask 255.255.255.0, I assign the IP address 192.168.0.1 to eth0 and use the netmask 255.255.255.0 to specify that the first part of the address is used to identify the network, and the remaining part is used for individual devices.

```
parth@LAPTOP-M0BPOTJN:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.20.245.104 netmask 255.255.240.0 broadcast 172.20.255.255
    inet6 fe80::215:5dff:fe90:3f0c prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:90:3f:0c txqueuelen 1000 (Ethernet)
    RX packets 53605 bytes 49999924 (49.9 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 10690 bytes 850946 (850.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

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 803 bytes 80826 (80.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 803 bytes 80826 (80.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

parth@LAPTOP-M0BPOTJN:~$ sudo ifconfig eth0 192.168.0.1 netmask 255.255.255.0
[sudo] password for parth:
parth@LAPTOP-M0BPOTJN:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.1 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::215:5dff:fe90:3f0c prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:90:3f:0c txqueuelen 1000 (Ethernet)
    RX packets 53712 bytes 50016557 (50.0 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 10690 bytes 850946 (850.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

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 803 bytes 80826 (80.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 803 bytes 80826 (80.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

parth@LAPTOP-M0BPOTJN:~$ sudo ifconfig eth0 172.20.245.104 netmask 255.255.240.0
parth@LAPTOP-M0BPOTJN:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.20.245.104 netmask 255.255.240.0 broadcast 172.20.255.255
    inet6 fe80::215:5dff:fe90:3f0c prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:90:3f:0c txqueuelen 1000 (Ethernet)
    RX packets 53799 bytes 50029496 (50.0 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 10690 bytes 850946 (850.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

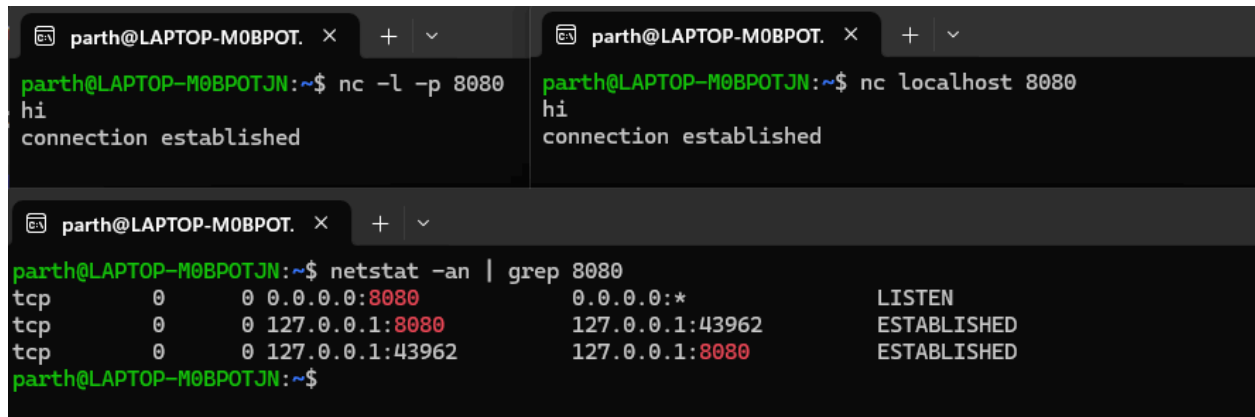
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 803 bytes 80826 (80.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 803 bytes 80826 (80.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Q3)

a) I have Set up connection with localhost at port 8080

Commands i used

- nc -l -p 8080
- nc localhost 8080



The screenshot shows three terminal windows from a user named 'parth' on a machine named 'LAPTOP-M0BPOT'. The first window shows the command 'nc -l -p 8080' being executed, followed by 'hi' being received and 'connection established' being printed. The second window shows the command 'nc localhost 8080' being executed, followed by 'hi' being sent and 'connection established' being printed. The third window shows the command 'netstat -an | grep 8080' being executed, resulting in a table of network connections.

| Protocol | Recv-Q | Send-Q | Local Address | Foreign Address | State |
|----------|--------|--------|-----------------|-----------------|-------------|
| tcp | 0 | 0 | 0.0.0.0:8080 | 0.0.0.0:* | LISTEN |
| tcp | 0 | 0 | 127.0.0.1:8080 | 127.0.0.1:43962 | ESTABLISHED |
| tcp | 0 | 0 | 127.0.0.1:43962 | 127.0.0.1:8080 | ESTABLISHED |

b) I used the command `netstat -an | grep 8080` to check the status of connections on port 8080. This command lists all network connections and filters the results to show only those involving port 8080. From the output, I can see that the connection to localhost on port 8080 is in an ESTABLISHED state, indicating that the port is actively being used for communication

Q4)

a) To obtain an authoritative answer for "google.in," I followed a two-step process using nslookup.

First, I used `nslookup querytype=soa google.in` to find the Start of Authority record. This step provided me with the authoritative name server for google.in, which turned out to be ns1.google.com in my case

Next, I queried the domain directly using this authoritative server by running `nslookup google.in ns1.google.com`. This ensured that the answer I received was authoritative, coming straight from the server responsible for managing google.in domain.

```

parth@LAPTOP-M0BPOTJN:~$ nslookup
> set querytype=soa
> google.in
Server:          10.255.255.254
Address:         10.255.255.254#53

Non-authoritative answer:
google.in
      origin = ns1.google.com
      mail addr = dns-admin.google.com
      serial = 667090956
      refresh = 900
      retry = 900
      expire = 1800
      minimum = 60

Authoritative answers can be found from:
ns1.google.com  internet address = 216.239.32.10

```

```

parth@LAPTOP-M0BPOTJN:~$ nslookup google.in ns1.google.com
Server:          ns1.google.com
Address:         216.239.32.10#53

Name:   google.in
Address: 142.250.77.228
Name:   google.in
Address: 2404:6800:4002:814::2004

```

- b) TTL is 222s which can be found in the ans section using dig command on google.in
TTL is time that an entry would be saved in local dns cache and it is 222 s

```

parth@LAPTOP-M0BPOTJN:~$ dig google.in

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> google.in
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 18816
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;google.in.                IN      A

;; ANSWER SECTION:
google.in.                222     IN      A      142.250.192.228

;; Query time: 20 msec
;; SERVER: 10.255.255.254#53(10.255.255.254) (UDP)
;; WHEN: Wed Aug 21 13:24:51 IST 2024
;; MSG SIZE rcvd: 54

```

Q5)

a) - There are 10 host except the one hidden in intermediate which is shown using * * *

- if we exclude start and the end there are only 8 hosts

- here is list of ip in the order

- 1 172.20.240.1
- 2 192.168.210.91
- 3 192.168.64.254
- 4 192.168.1.99
- 5 103.25.231.1
- 6 10.119.234.162
- 7 72.14.195.56
- 8 192.178.80.159 ,142.251.54.111
- 9 142.251.54.83
- 10 142.250.193.67

- average latency :-

- 1 172.20.240.1 - 0.39 ms
- 2 192.168.210.91 - 12.086 ms
- 3 192.168.64.254 - 101.554 ms
- 4 192.168.1.99 - 49.964 ms
- 5 103.25.231.1 - 50.743 ms
- 6 10.119.234.162 - 83.934 ms
- 7 72.14.195.56 - 101.178 ms
- 8 192.178.80.159-155.586 ms , 142.251.54.111-154.602 ms overall avg at this hop 154.930 ms
- 9 142.251.54.83 -137.063 ms
- 10 142.250.193.67 - 101.574 ms

```
parth@LAPTOP-M0BPOTJN:~$ traceroute www.google.in
traceroute to www.google.in (142.250.193.67), 30 hops max, 60 byte packets
 1 LAPTOP-M0BPOTJN.mshome.net (172.20.240.1) 0.299 ms 0.443 ms 0.428 ms
 2 192.168.210.91 (192.168.210.91) 12.096 ms 12.085 ms 12.076 ms
 3 192.168.64.254 (192.168.64.254) 101.563 ms 101.554 ms 101.545 ms
 4 vpn.iiitd.edu.in (192.168.1.99) 49.973 ms 49.964 ms 49.954 ms
 5 103.25.231.1 (103.25.231.1) 50.752 ms 50.744 ms 50.734 ms
 6 * * *
 7 10.119.234.162 (10.119.234.162) 49.457 ms 101.182 ms 101.164 ms
 8 72.14.195.56 (72.14.195.56) 101.233 ms 101.154 ms 101.148 ms
 9 192.178.80.159 (192.178.80.159) 155.586 ms 142.251.54.111 (142.251.54.111) 154.612 ms 154.593 ms
10 142.251.54.83 (142.251.54.83) 153.812 ms 153.793 ms 103.584 ms
11 del11s16-in-f3.1e100.net (142.250.193.67) 101.602 ms 101.611 ms 101.510 ms
```

b)

Command used :- ping -c 50 google.in
average latency is 163.740 ms

```
parth@LAPTOP-M8BPOTJN:~$ ping -c 50 google.in
PING google.in (142.250.192.228) 56(84) bytes of data:
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=1 ttl=110 time=114 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=2 ttl=110 time=127 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=3 ttl=110 time=474 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=4 ttl=110 time=428 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=5 ttl=110 time=354 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=6 ttl=110 time=129 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=7 ttl=110 time=140 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=8 ttl=110 time=191 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=9 ttl=110 time=85.6 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=10 ttl=110 time=139 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=11 ttl=110 time=137 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=12 ttl=110 time=170 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=13 ttl=110 time=130 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=14 ttl=110 time=113 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=15 ttl=110 time=240 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=16 ttl=110 time=374 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=17 ttl=110 time=121 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=18 ttl=110 time=105 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=19 ttl=110 time=436 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=20 ttl=110 time=141 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=21 ttl=110 time=112 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=22 ttl=110 time=87.5 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=23 ttl=110 time=219 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=24 ttl=110 time=144 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=25 ttl=110 time=106 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=26 ttl=110 time=128 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=27 ttl=110 time=100 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=28 ttl=110 time=123 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=29 ttl=110 time=95.1 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=30 ttl=110 time=183 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=31 ttl=110 time=89.4 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=32 ttl=110 time=127 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=33 ttl=110 time=157 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=34 ttl=110 time=110 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=35 ttl=110 time=135 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=36 ttl=110 time=107 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=37 ttl=110 time=144 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=38 ttl=110 time=101 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=39 ttl=110 time=143 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=40 ttl=110 time=102 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=41 ttl=110 time=355 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=42 ttl=110 time=95.0 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=43 ttl=110 time=123 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=44 ttl=110 time=142 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=45 ttl=110 time=128 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=46 ttl=110 time=138 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=47 ttl=110 time=110 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=48 ttl=110 time=186 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=49 ttl=110 time=105 ms
64 bytes from dell1s13-in-f4.1e100.net (142.250.192.228): icmp_seq=50 ttl=110 time=143 ms

--- google.in ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49023ms
rtt min/avg/max/mdev = 85.623/163.740/473.735/95.089 ms
```

- c) from a) summing latency of the averages of each hop gives 709.313 ms
From b) it is coming 163.740 ms(from the screenshot)

Reason :-

Traceroute operates by sending data packets with a limited lifespan, known as Time to Live (TTL), which determines how many hops the packet can survive before being returned. When a packet fails to reach its final destination and expires at an intermediate step, that node sends the packet back, revealing its identity. By gradually increasing the TTL, Traceroute is able to map out each intermediate host along the path. This process, however, takes more time compared to a simple ping, which directly sends a packet to the destination without tracking the intermediate hosts.

- d) from a) maximum latency of the averages of each hop is 154.93 ms
From b) latency is 163.74 ms

These two are pretty close .I think this could be because one of the hops in traceroute has particularly high latency, acting as a bottleneck for the packets. Essentially, most of the time is spent at that specific hop, so it sets the pace for the rest of the journey. As a result, the overall ping time ends up being close to the time spent at this slow hop, which also shows up as the maximum time in traceroute. This makes sense because if one hop is particularly slow, it would dominate the total time it takes for the packets to travel the entire route, which would reflect similarly in both traceroute and ping.

e)When I did a traceroute to google.in, I noticed something interesting at the 9th hop—there were two different IP addresses, 192.178.80.159 and 142.251.54.111. I found out that this happens because the network is using some sort of mechanism to balance a load on a router , which is a way to spread out traffic across different routes to keep things running smoothly. So, at that particular hop, my data was sent through multiple paths, which is why I saw more than one IP address. It's actually pretty normal, especially for big networks like Google

f) average latency is 293.704 ms after pinging stanford.edu 50 times

```
parth@LAPTOP-M0BPOTJN:~$ 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=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=241 time=378 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=241 time=312 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=241 time=292 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=241 time=293 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=241 time=296 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=241 time=353 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=241 time=294 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=241 time=323 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=241 time=290 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49012ms
rtt min/avg/max/mdev = 286.550/293.704/377.612/15.902 ms
```

g) Number of Hops for Stanford.edu is 26 vs 11 in google.in this is high because of location as well as that for stanford packet must go to tier 1 isp but for google it wont have to

```
parth@LAPTOP-M0BPOTJN:~$ traceroute stanford.edu
traceroute to stanford.edu (171.67.215.200), 30 hops max, 60 byte packets
 1 172.20.240.1 (172.20.240.1) 0.377 ms 0.355 ms 0.345 ms
 2 192.168.32.254 (192.168.32.254) 31.474 ms 31.443 ms 31.432 ms
 3 192.168.1.99 (192.168.1.99) 5.581 ms 5.552 ms 5.515 ms
 4 103.25.231.1 (103.25.231.1) 4.562 ms 4.527 ms 4.484 ms
 5 10.1.209.201 (10.1.209.201) 28.192 ms 28.181 ms 28.150 ms
 6 10.1.200.137 (10.1.200.137) 33.815 ms 33.791 ms 33.770 ms
 7 10.255.238.254 (10.255.238.254) 28.495 ms 10.255.238.122 (10.255.238.122) 48.616 ms 48.596 ms
 8 180.149.48.18 (180.149.48.18) 27.458 ms 27.442 ms 41.629 ms
 9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 campus-nw-rtr-vl1004.SUNet (171.64.255.200) 288.165 ms * campus-ial-nets-b-vl1120.SUNet (171.66.255.232) 300.881 ms
25 campus-east-rtr-vl1020.SUNet (171.64.255.232) 300.403 ms campus-nw-rtr-vl1004.SUNet (171.64.255.200) 301.676 ms 290.622 ms
26 * web.stanford.edu (171.67.215.200) 300.998 ms 301.743 ms
```

h) as my device is in India, accessing google.in typically results in lower latency because Google's infrastructure services direct you to a nearby data center in India or a nearby region, avoiding the need for traffic to go through a Tier 1 ISP. In contrast, accessing stanford.edu usually involves longer routing paths and more network hops, as it is based in the U.S., leading to higher latency.

Q6) I used IPTABLES which basically help in adding firewall rules for ip. This command configures iptables to append a rule to the output chain that blocks any outgoing packets destined for the localhost address. This means any attempt by applications on the local system to send data to 127.0.0.1 will be discarded and result in no response being received.

```
parth@LAPTOP-M0BPOTJN:~$ sudo iptables -A OUTPUT -d 127.0.0.1 -j DROP
parth@LAPTOP-M0BPOTJN:~$ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
^C
--- 127.0.0.1 ping statistics ---
5 packets transmitted, 0 received, 100% packet loss, time 4172ms

parth@LAPTOP-M0BPOTJN:~$ sudo iptables -D OUTPUT -d 127.0.0.1 -j DROP
parth@LAPTOP-M0BPOTJN:~$ ping 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=0.058 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.029 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.042 ms
64 bytes from 127.0.0.1: icmp_seq=4 ttl=64 time=0.033 ms
^C
--- 127.0.0.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3113ms
rtt min/avg/max/mdev = 0.029/0.040/0.058/0.011 ms
```

References :-

[ifconfig\(8\) - Linux manual page \(man7.org\)](#)

[netstat\(8\) - Linux manual page \(man7.org\)](#)

[traceroute\(8\) - Linux manual page \(man7.org\)](#)

[ping\(8\) - Linux manual page \(man7.org\)](#)

[iptables\(8\) - Linux manual page \(man7.org\)](#)

[dns - How do I find the authoritative name-server for a domain name? - Stack Overflow](#)

[Difference between Ping and Traceroute - GeeksforGeeks](#)