

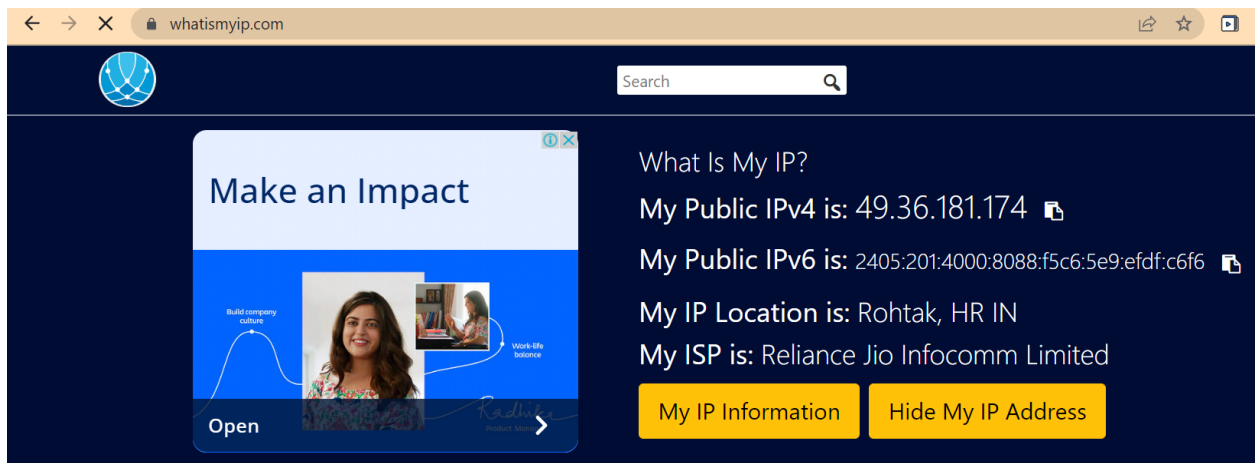
CN Assignment 1

1. a) IP address is 192.168.64.128

```
abhishek@abhishek-virtual-machine:~$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.64.128 netmask 255.255.255.0 broadcast 192.168.64.255
    inet6 fe80::352b:e921:3d3f:d2b7 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:14:bf:ff txqueuelen 1000 (Ethernet)
    RX packets 561469 bytes 821373096 (821.3 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 98559 bytes 11153250 (11.1 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 7036 bytes 678401 (678.4 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 7036 bytes 678401 (678.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

b)



The screenshot shows the website 'whatismyip.com' in a web browser. The page has a dark blue header with a search bar. Below the header, there is a large blue banner with the text 'Make an Impact' and a woman's photo. To the right of the banner, the following information is displayed:

- What Is My IP?
- My Public IPv4 is: 49.36.181.174
- My Public IPv6 is: 2405:201:4000:8088:f5c6:5e9:efdf:c6f6
- My IP Location is: Rohtak, HR IN
- My ISP is: Reliance Jio Infocomm Limited

At the bottom of the information section, there are two yellow buttons: 'My IP Information' and 'Hide My IP Address'.

No they are not the same. Ipconfig gives the private IP address of the machine whereas whatismyip.com shows the public IP address of the machine. Public IP address is assigned by your ISP.

2. a)

An authoritative answer is a response we get directly from the primary DNS server holding the master copy of the zone file. To find the authoritative name-server for a domain name, we first need to access the corresponding SOA record. To get the authoritative answer from the nslookup command, we need the name server of the

domain. To get the name server we use the -type=soa flag with the nslookup command we can find the primary name server for iiitd.ac.in as ns1.iiitd.edu.in.

```
abhishek@abhishek-virtual-machine:~$ nslookup -type=soa iiitd.ac.in
Server:          127.0.0.53
Address:         127.0.0.53#53

Non-authoritative answer:
iiitd.ac.in
    origin = ns1.iiitd.edu.in
    mail addr = admin-it.iiitd.ac.in
    serial = 2014013320
    refresh = 86400
    retry = 7200
    expire = 3600000
    minimum = 86400
```

To find the authoritative answer for iiitd.ac.in, we execute a new nslookup query in which we specify the primary name server as ns1.iiitd.edu.in.

```
abhishek@abhishek-virtual-machine:~$ nslookup iiitd.ac.in ns1.iiitd.edu.in
Server:          ns1.iiitd.edu.in
Address:         103.25.231.10#53

Name:   iiitd.ac.in
Address: 103.25.231.30
```

b)

```
abhishek@abhishek-virtual-machine:~$ dig A iiitd.ac.in

; <<>> DiG 9.18.1-1ubuntu1.1-Ubuntu <<>> A iiitd.ac.in
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 7891
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;iiitd.ac.in.                IN      A

;; ANSWER SECTION:
iiitd.ac.in.                 5       IN      A      103.25.231.30

;; Query time: 12 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Thu Sep 22 17:14:35 IST 2022
;; MSG SIZE rcvd: 56
```

TTL is 5. The unit of TTL is in seconds. TTL denotes the time for which a cached dns record on a nameserver is valid. After it expires, the local name server needs to request dns entry from the authoritative server again.

3. a)

Using tracertr because tracerout is not working -

```
abhishek@abhishek-virtual-machine:~$ sudo traceroute google.in
traceroute to google.in (142.250.67.164), 30 hops max, 60 byte packets
 1  _gateway (192.168.64.2)  0.780 ms  0.281 ms  0.386 ms
 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  * * *
```

```
C:\Users\Nirmata>tracert google.in

Tracing route to google.in [2404:6800:4009:82f::2004]
over a maximum of 30 hops:

  1      3 ms      1 ms      1 ms    2405:201:4000:8088:1a82:8cff:fef0:cd5b
  2      *          *          *      Request timed out.
  3      8 ms      23 ms     4 ms    2405:200:801:300::64b
  4      8 ms      10 ms     7 ms    2001:4860:1:1::15b4
  5      9 ms       7 ms     7 ms    2404:6800:8068::1
  6      7 ms       4 ms     4 ms    2001:4860:0:1::36
  7      8 ms       8 ms     5 ms    2001:4860:0:11dd::2
  8     38 ms      29 ms    27 ms    2001:4860::9:4000:d773
```

Average Ping latency for 1: $(3+1+1)/3 = 1.67$ ms

Average Ping latency for 3: $(8+23+4)/3 = 11.67$ ms

Average Ping latency for 4: $(8+10+7)/3 = 8.33$ ms

Average Ping latency for 5: $(9+7+7)/3 = 7.67$ ms

Average Ping latency for 6: $(7+4+4)/3 = 5$ ms

Average Ping latency for 7: $(8+8+5)/3 = 7$ ms

Average Ping latency for 8: $(38+29+27)/3 = 31.33$ ms

b) Average latency = 34.707 ms

```
abhishek@abhishek-virtual-machine:~$ ping -c 100 google.in
PING google.in (142.250.192.132) 56(84) bytes of data:
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=1 ttl=128 time=28.9 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=2 ttl=128 time=34.2 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=3 ttl=128 time=28.6 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=4 ttl=128 time=101 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=5 ttl=128 time=32.6 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=6 ttl=128 time=32.1 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=7 ttl=128 time=29.6 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=8 ttl=128 time=38.6 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=9 ttl=128 time=31.0 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=10 ttl=128 time=33.7 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=11 ttl=128 time=31.1 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=12 ttl=128 time=30.0 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=13 ttl=128 time=29.0 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=14 ttl=128 time=61.7 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=15 ttl=128 time=60.2 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=16 ttl=128 time=32.3 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=17 ttl=128 time=32.0 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=18 ttl=128 time=29.4 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=19 ttl=128 time=42.6 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=20 ttl=128 time=31.1 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=21 ttl=128 time=30.6 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=22 ttl=128 time=29.9 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=23 ttl=128 time=31.2 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=24 ttl=128 time=33.5 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=25 ttl=128 time=36.0 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=26 ttl=128 time=30.2 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=27 ttl=128 time=30.0 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=28 ttl=128 time=32.3 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=29 ttl=128 time=36.4 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=30 ttl=128 time=35.4 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=31 ttl=128 time=30.2 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=32 ttl=128 time=31.4 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=33 ttl=128 time=30.9 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=34 ttl=128 time=32.2 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=35 ttl=128 time=32.5 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=36 ttl=128 time=30.8 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=37 ttl=128 time=48.3 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=38 ttl=128 time=34.0 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=39 ttl=128 time=33.5 ms
64 bytes from bom12s18-in-f4.1e100.net (142.250.192.132): icmp_seq=40 ttl=128 time=31.4 ms
```

```
--- google.in ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99228ms
rtt min/avg/max/mdev = 28.551/34.707/100.568/8.927 ms
```

c) Average latency = 316.652

```
64 bytes from columbiauniversity.us (128.59.105.24): icmp_seq=85 ttl=128 time=353 ms
64 bytes from columbiauniversity.info (128.59.105.24): icmp_seq=86 ttl=128 time=314 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=87 ttl=128 time=294 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=88 ttl=128 time=284 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=89 ttl=128 time=337 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=90 ttl=128 time=361 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=91 ttl=128 time=355 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=92 ttl=128 time=300 ms
64 bytes from gutenberge.org (128.59.105.24): icmp_seq=93 ttl=128 time=322 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=94 ttl=128 time=280 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=95 ttl=128 time=365 ms
64 bytes from columbiauniversity.us (128.59.105.24): icmp_seq=96 ttl=128 time=385 ms
64 bytes from gutenberge.org (128.59.105.24): icmp_seq=97 ttl=128 time=283 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=98 ttl=128 time=284 ms
64 bytes from columbiauniversity.us (128.59.105.24): icmp_seq=99 ttl=128 time=280 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=100 ttl=128 time=372 ms
```

```
--- columbia.edu ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99466ms
rtt min/avg/max/mdev = 279.762/316.652/398.467/36.771 ms
```

d)

```
C:\Users\Nirmata>ping 2405:201:4000:8088:1a82:8cff:fe0:cd5b
```

```
Pinging 2405:201:4000:8088:1a82:8cff:fe0:cd5b with 32 bytes of data:
```

```
Reply from 2405:201:4000:8088:1a82:8cff:fe0:cd5b: time=2ms
```

```
Reply from 2405:201:4000:8088:1a82:8cff:fe0:cd5b: time=4ms
```

```
Reply from 2405:201:4000:8088:1a82:8cff:fe0:cd5b: time=6ms
```

```
Reply from 2405:201:4000:8088:1a82:8cff:fe0:cd5b: time=6ms
```

```
Ping statistics for 2405:201:4000:8088:1a82:8cff:fe0:cd5b:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 2ms, Maximum = 6ms, Average = 4ms
```

```
C:\Users\Nirmata>ping 2405:200:801:300::64b
```

```
Pinging 2405:200:801:300::64b with 32 bytes of data:
```

```
Request timed out.
```

```
Request timed out.
```

```
Request timed out.
```

```
Request timed out.
```

```
Ping statistics for 2405:200:801:300::64b:
```

```
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

```
C:\Users\Nirmata>ping 2001:4860:1:1::15b4
```

```
Pinging 2001:4860:1:1::15b4 with 32 bytes of data:
```

```
Reply from 2001:4860:1:1::15b4: time=6ms
```

```
Reply from 2001:4860:1:1::15b4: time=5ms
```

```
Reply from 2001:4860:1:1::15b4: time=6ms
```

```
Reply from 2001:4860:1:1::15b4: time=7ms
```

```
Ping statistics for 2001:4860:1:1::15b4:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 5ms, Maximum = 7ms, Average = 6ms
```



```
C:\Users\Nirmata>ping 2404:6800:8068::1
```

```
Pinging 2404:6800:8068::1 with 32 bytes of data:
```

```
Request timed out.
```

```
Request timed out.
```

```
Request timed out.
```

```
Request timed out.
```

```
Ping statistics for 2404:6800:8068::1:
```

```
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

```
C:\Users\Nirmata>ping 2001:4860:0:1::36
```

```
Pinging 2001:4860:0:1::36 with 32 bytes of data:
```

```
Reply from 2001:4860:0:1::36: time=6ms
```

```
Reply from 2001:4860:0:1::36: time=8ms
```

```
Reply from 2001:4860:0:1::36: time=8ms
```

```
Reply from 2001:4860:0:1::36: time=5ms
```

```
Ping statistics for 2001:4860:0:1::36:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 5ms, Maximum = 8ms, Average = 6ms
```

```

C:\Users\Nirmata>ping 2001:4860:0:11dd::2

Pinging 2001:4860:0:11dd::2 with 32 bytes of data:
Reply from 2001:4860:0:11dd::2: time=7ms
Reply from 2001:4860:0:11dd::2: time=6ms
Reply from 2001:4860:0:11dd::2: time=5ms
Reply from 2001:4860:0:11dd::2: time=10ms

Ping statistics for 2001:4860:0:11dd::2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 5ms, Maximum = 10ms, Average = 7ms

```

```

C:\Users\Nirmata>ping 2001:4860::9:4000:d773

Pinging 2001:4860::9:4000:d773 with 32 bytes of data:
Reply from 2001:4860::9:4000:d773: time=27ms
Reply from 2001:4860::9:4000:d773: time=26ms
Reply from 2001:4860::9:4000:d773: time=24ms
Reply from 2001:4860::9:4000:d773: time=24ms

Ping statistics for 2001:4860::9:4000:d773:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 24ms, Maximum = 27ms, Average = 25ms

```

Please note that intermediate hosts - 2404:6800:8068::1 and 2405:200:801:300::64b are not reachable as observed by tracert command.

```

C:\Users\Nirmata>tracert 2404:6800:8068::1

Tracing route to 2404:6800:8068::1 over a maximum of 30 hops

 1      2 ms      2 ms      2 ms    2405:201:4000:8088:1a82:8cff:fef0:cd5b
 2      *          *          *        Request timed out.
 3      8 ms      7 ms      *        2405:200:801:300::64b
 4      *          *          *        Request timed out.
 5      *          *          *        Request timed out.
 6      *          *          *        Request timed out.
 7      *          *          *        Request timed out.
 8      *          *          *        Request timed out.
 9      *          *          *        Request timed out.
10     *          *          *        Request timed out.
11     *          *          *        Destination net unreachable.

Trace complete.

```

```

C:\Users\Nirmata>tracert 2405:200:801:300::64b

Tracing route to 2405:200:801:300::64b over a maximum of 30 hops

  1      6 ms      1 ms      2 ms      2405:201:4000:8088:1a82:8cff:fef0:cd5b
  2      *          *          *          Request timed out.
  3      *          *          *          Request timed out.
  4      *          *          *          Request timed out.
  5      *          *          *          Request timed out.
  6      *          *          *          Request timed out.
  7      *          *          *          Request timed out.
  8      *          *          *          Request timed out.
  9      *          *          *          Request timed out.
 10     *          *          *          Request timed out.
 11     *          *          *          Request timed out.
 12     *          *          *          Request timed out.
 13     *          *          *          Request timed out.
 14     *          *          *          Request timed out.
 15     *          *          *          Request timed out.
 16     *          *          *          Request timed out.
 17     *          *          *          Request timed out.
 18     *          *          *          Request timed out.
 19     *          *          *          Request timed out.
 20     *          *          *          Request timed out.
 21     *          *          *          Request timed out.
 22     *          *          *          Request timed out.
 23     *          *          *          Request timed out.
 24     *          *          *          Request timed out.
 25     *          *          *          Request timed out.
 26     *          *          *          Request timed out.
 27     *          *          *          Request timed out.
 28     *          *          *          Request timed out.
 29     *          *          *          Request timed out.
 30     *          *          *          Request timed out.

Trace complete.

```

Total ping latency: $4+6+6+7+25=46$ ms. Here, the ping latency comes out to be 46 ms but it would be more than that because pinging 2 IP address had 'request timed out' so no ping latency could be derived because the host is not responding to pings. Assuming they did not have 'request timed out' they would have had ping latency >0 and the total ping latency would come out to be more than 46 ms.

The value is different from the average latency by direct ping command to the google.in. This is expected since the ping is the time taken for the packet to reach its destination and return back. So when we are adding ping latency to each intermediate host, we are adding some latencies multiple times. For example ping a to c and a to d path has intermediate hosts b and c.

When we add all

Average latency fo a to b : Time from a to b + Time to b to a

Average latency for a to c: Average latency to b+ Time from b to c + Time from c to b

Whereas average latency

A to d: Time from a to b+ Time from b to c + Time from c to d+ Time from d to c+ Time from c to b+ Time from b to a.

As a result,when we sum the average latency of intermediate nodes, delays for packets to intermediate hosts are counted multiple times and hence it is not the same.

e)

Maximum ping latency of intermediate host = 25 ms. Actual latency=34.707 ms. They are approximately the same. Since the maximum latency is the measure of the bottleneck latency of the intermediate host.

f)

```
C:\Windows\system32>tracert -h 100 columbia.edu

Tracing route to columbia.edu [128.59.105.24]
over a maximum of 100 hops:

  0  0 ms  0 ms  0 ms  10.0.0.1
  1  1 ms  5 ms  2 ms  reliance.reliance [192.168.29.1]
  2  4 ms  3 ms  5 ms  10.0.64.1
  3  5 ms  5 ms  4 ms  172.16.18.29
  4  4 ms  3 ms  5 ms  192.168.96.234
  5  5 ms  11 ms  8 ms  172.26.111.117
  6  4 ms  4 ms  3 ms  172.26.111.131
  7  29 ms  25 ms  16 ms  192.168.44.44
  8  *      *      *      Request timed out.
  9  *      *      *      Request timed out.
 10  *      *      *      Request timed out.
 11  *      *      *      Request timed out.
 12  43 ms  42 ms  43 ms  103.198.140.170
 13  248 ms  271 ms  256 ms  103.198.140.17
 14  *      *      *      Request timed out.
 15  247 ms  247 ms  244 ms  be3359.ccr42.lax01.atlas.cogentco.com [154.54.3.69]
 16  256 ms  255 ms  255 ms  be2932.ccr32.phx01.atlas.cogentco.com [154.54.45.161]
 17  271 ms  270 ms  270 ms  be2930.ccr21.elp01.atlas.cogentco.com [154.54.42.78]
 18  278 ms  278 ms  279 ms  be2928.ccr42.iah01.atlas.cogentco.com [154.54.30.161]
 19  265 ms  265 ms  267 ms  be2690.ccr42.atl01.atlas.cogentco.com [154.54.28.129]
 20  261 ms  305 ms  261 ms  be2113.ccr42.dca01.atlas.cogentco.com [154.54.24.221]
 21  272 ms  272 ms  269 ms  be2807.ccr42.jfk02.atlas.cogentco.com [154.54.40.109]
 22  285 ms  284 ms  285 ms  be2897.rcr24.jfk01.atlas.cogentco.com [154.54.84.214]
 23  264 ms  267 ms  263 ms  38.122.8.210
 24  266 ms  265 ms  266 ms  cc-core-1-x-nyser32-gw-1.net.columbia.edu [128.59.255.5]
 25  267 ms  266 ms  266 ms  cc-conc-1-x-cc-core-1.net.columbia.edu [128.59.255.21]
 26  276 ms  278 ms  276 ms  vii.org [128.59.105.24]

Trace complete.
```

The difference between the number of hops in tracert command of google.in and columbia.edu is Because of the distance in server of google.in and columbia.in. The server of columbia.edu is at a greater distance than that of columbia.edu.

4. 127.0.0.1 is the localhost server which runs on the loopback network interface allowing it to process the request locally bypassing the network interface card. So by turning off the loopback network interface, we can make the ping command fail to 127.0.0.1. Loopback network interface can be turned off by writing the following command: Sudo ifconfig lo down.

```
abhishek@abhishek-virtual-machine:~$ sudo ifconfig lo down
abhishek@abhishek-virtual-machine:~$ ping -c 3 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.

--- 127.0.0.1 ping statistics ---
3 packets transmitted, 0 received, 100% packet loss, time 2030ms
```

5. A. HTTP request packet
- i) Request type: Get
 - ii) User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/105.0.0.0 Safari/537.36\r\n
 - iii) HTTP request packet's URL: http://info.cern.ch/favicon.ico/

User agent Type breakup: Mozilla/5.0: Browser is mozilla compatible Linux x86_64: Platform browser is running on AppleWebKit/537.36 : Web renderer is AppleWebKit version 537.36 Chrome/93.0.4577.82: Browser is chrome and version is 93.0.4577.82 Safari/537.36: Client is based on Safari version 537.36

B. For HTTP response packets

- i) HTTP response code: 200
 - ii) HTTP response description: OK
 - iii) Name and version of the web server: Apache HTTP/ 1.1
- It is a get http request to apache web server using http 1.1

Response code 200 indicates the request was success and the required response is attached

C. 2 web objects got downloaded from from different TCP connections.

D. HTTP is persistent.

Getting the IP address of http://info.cern.ch

```
C:\Users\Nirmata>ping info.cern.ch

Pinging webafs706.cern.ch [2001:1458:d00:34::100:125] with 32 bytes of data:
Reply from 2001:1458:d00:34::100:125: time=280ms
Reply from 2001:1458:d00:34::100:125: time=505ms
Reply from 2001:1458:d00:34::100:125: time=286ms
Reply from 2001:1458:d00:34::100:125: time=205ms

Ping statistics for 2001:1458:d00:34::100:125:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 205ms, Maximum = 505ms, Average = 319ms
```

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|-------------------------|---|----------|--------|---------------------------------------|
| 1170 | 98.294933 | 2405:201:4000:8034::... | 2001:1458:d00:34::100:125 | TCP | 74 | 61351 → 80 [ACK] Seq=1 Ack=1 Win=6604 |
| 1171 | 98.295417 | 2405:201:4000:8034::... | 2001:1458:d00:34::100:125 | HTTP | 556 | GET / HTTP/1.1 |
| 1172 | 98.298892 | 2001:1458:d00:34::1 | 2405:201:4000:8034::e87b:2d98:f23c:6... | TCP | 86 | 80 → 61352 [SYN] Seq=0 Ack=1 Win=0 |

Hypertext Transfer Protocol

```
> GET / HTTP/1.1\r\n
Host: info.cern.ch\r\n
Connection: keep-alive\r\n
Pragma: no-cache\r\n
Cache-Control: no-cache\r\n
Upgrade-Insecure-Requests: 1\r\n
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/105.0.0.0 Safari/537.36\r\n
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange\r\n
Accept-Encoding: gzip, deflate\r\n
Accept-Language: en-GB,en-US;q=0.9,en;q=0.8\r\n
\r\n
[Full request URI: http://info.cern.ch/]
[HTTP request 1/1]
[Response in frame: 1175]
```

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|------------------------|---|----------|--------|---------------------------------------|
| 1174 | 98.606013 | 2001:1458:d00:34::1... | 2405:201:4000:8034::e87b:2d98:f23c:6... | TCP | 74 | 80 → 61351 [ACK] Seq=1 Ack=483 Win=29 |
| 1175 | 98.606181 | 2001:1458:d00:34::1... | 2405:201:4000:8034::e87b:2d98:f23c:6... | HTTP | 952 | HTTP/1.1 200 OK (text/html) |
| 1176 | 98.606313 | 2001:1458:d00:34::1 | 2405:201:4000:8034::e87b:2d98:f23c:6... | TCP | 74 | 80 → 61351 [FIN] Seq=870 Ack=483 |

Hypertext Transfer Protocol

```
> HTTP/1.1 200 OK\r\n
Date: Fri, 23 Sep 2022 11:50:15 GMT\r\n
Server: Apache\r\n
Last-Modified: Wed, 05 Feb 2014 16:00:31 GMT\r\n
ETag: "286-4f1aadb3105c0"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 646\r\n
Connection: close\r\n
Content-Type: text/html\r\n
\r\n
[HTTP response 1/1]
[Time since request: 0.310764000 seconds]
[Request in frame: 1171]
[Request URI: http://info.cern.ch/]
```

ipv6.addr == 2001:1458:d00:34::100:125

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|-------------------------|--|----------|--------|---------------------------------------|
| 1178 | 98.609264 | 2405:201:4000:8034::... | 2001:1458:d00:34::100:125 | TCP | 74 | 61351 → 80 [FIN, ACK] Seq=483 Ack=880 |
| 1186 | 98.747255 | 2405:201:4000:8034::... | 2001:1458:d00:34::100:125 | HTTP | 497 | GET /favicon.ico HTTP/1.1 |
| 1191 | 98.821711 | 2001:1458:d00:34::1... | 2405:201:4000:8034:e87b:2d98:f23c:6... | TCP | 74 | 80 → 61351 [ACK] Seq=880 Ack=484 Win= |

> Transmission Control Protocol, Src Port: 61352, Dst Port: 80, Seq: 1, Ack: 1, Len: 423

▼ Hypertext Transfer Protocol

> GET /favicon.ico HTTP/1.1\r\n

Host: info.cern.ch\r\n

Connection: keep-alive\r\n

Pragma: no-cache\r\n

Cache-Control: no-cache\r\n

User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/105.0.0.0 Safari/537.36\r\n

Accept: image/avif,image/webp,image/apng,image/svg+xml,image/*,*/*;q=0.8\r\n

Referer: http://info.cern.ch/\r\n

Accept-Encoding: gzip, deflate\r\n

Accept-Language: en-GB,en-US;q=0.9,en;q=0.8\r\n

\r\n

[Full request URI: <http://info.cern.ch/favicon.ico>]

[HTTP request 1/1]

ipv6.addr == 2001:1458:d00:34::100:125

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|------------------------|--|----------|--------|---------------------------------------|
| 1196 | 98.958105 | 2001:1458:d00:34::1... | 2405:201:4000:8034:e87b:2d98:f23c:6... | TCP | 1514 | 80 → 61352 [ACK] Seq=1 Ack=424 Win=29 |
| 1197 | 98.958531 | 2001:1458:d00:34::1... | 2405:201:4000:8034:e87b:2d98:f23c:6... | HTTP | 288 | HTTP/1.1 200 OK (image/vnd.microsoft |
| 1198 | 98.958531 | 2001:1458:d00:34::1... | 2405:201:4000:8034:e87b:2d98:f23c:6... | TCP | 74 | 80 → 61352 [FIN, ACK] Seq=1655 Ack=42 |

▼ Hypertext Transfer Protocol

> HTTP/1.1 200 OK\r\n

Date: Fri, 23 Sep 2022 11:50:15 GMT\r\n

Server: Apache\r\n

Last-Modified: Fri, 18 Jan 2008 15:26:11 GMT\r\n

ETag: "57e-44400c31d2ac0"\r\n

Accept-Ranges: bytes\r\n

> Content-Length: 1406\r\n

Connection: close\r\n

Content-Type: image/vnd.microsoft.icon\r\n

\r\n

[HTTP response 1/1]

[Time since request: 0.211276000 seconds]

[Request in frame: 1186]

[Request URI: <http://info.cern.ch/favicon.ico>]

6. a)

```
C:\Windows\system32>netstat -ano -p tcp
```

Active Connections

| Proto | Local Address | Foreign Address | State | PID |
|-------|----------------------|---------------------|-------------|-------|
| TCP | 0.0.0.0:135 | 0.0.0.0:0 | LISTENING | 1240 |
| TCP | 0.0.0.0:445 | 0.0.0.0:0 | LISTENING | 4 |
| TCP | 0.0.0.0:902 | 0.0.0.0:0 | LISTENING | 7624 |
| TCP | 0.0.0.0:912 | 0.0.0.0:0 | LISTENING | 7624 |
| TCP | 0.0.0.0:5040 | 0.0.0.0:0 | LISTENING | 5880 |
| TCP | 0.0.0.0:6646 | 0.0.0.0:0 | LISTENING | 4368 |
| TCP | 0.0.0.0:7680 | 0.0.0.0:0 | LISTENING | 2508 |
| TCP | 0.0.0.0:49664 | 0.0.0.0:0 | LISTENING | 900 |
| TCP | 0.0.0.0:49665 | 0.0.0.0:0 | LISTENING | 480 |
| TCP | 0.0.0.0:49666 | 0.0.0.0:0 | LISTENING | 1812 |
| TCP | 0.0.0.0:49667 | 0.0.0.0:0 | LISTENING | 2800 |
| TCP | 0.0.0.0:49668 | 0.0.0.0:0 | LISTENING | 6592 |
| TCP | 0.0.0.0:49672 | 0.0.0.0:0 | LISTENING | 860 |
| TCP | 0.0.0.0:53507 | 0.0.0.0:0 | LISTENING | 32404 |
| TCP | 0.0.0.0:53529 | 0.0.0.0:0 | LISTENING | 35776 |
| TCP | 0.0.0.0:63889 | 0.0.0.0:0 | LISTENING | 49528 |
| TCP | 127.0.0.1:8884 | 0.0.0.0:0 | LISTENING | 4 |
| TCP | 127.0.0.1:18313 | 0.0.0.0:0 | LISTENING | 10540 |
| TCP | 127.0.0.1:49669 | 127.0.0.1:55552 | ESTABLISHED | 6780 |
| TCP | 127.0.0.1:49670 | 127.0.0.1:55552 | ESTABLISHED | 8016 |
| TCP | 127.0.0.1:51204 | 127.0.0.1:51205 | ESTABLISHED | 3356 |
| TCP | 127.0.0.1:51205 | 127.0.0.1:51204 | ESTABLISHED | 3356 |
| TCP | 127.0.0.1:53529 | 127.0.0.1:53530 | ESTABLISHED | 35776 |
| TCP | 127.0.0.1:53530 | 127.0.0.1:53529 | ESTABLISHED | 6432 |
| TCP | 127.0.0.1:55053 | 0.0.0.0:0 | LISTENING | 6780 |
| TCP | 127.0.0.1:55296 | 0.0.0.0:0 | LISTENING | 6780 |
| TCP | 127.0.0.1:55552 | 0.0.0.0:0 | LISTENING | 6804 |
| TCP | 127.0.0.1:55552 | 127.0.0.1:49669 | ESTABLISHED | 6804 |
| TCP | 127.0.0.1:55552 | 127.0.0.1:49670 | ESTABLISHED | 6804 |
| TCP | 127.0.0.1:59056 | 127.0.0.1:59057 | ESTABLISHED | 74296 |
| TCP | 127.0.0.1:59057 | 127.0.0.1:59056 | ESTABLISHED | 74296 |
| TCP | 127.0.0.1:59064 | 127.0.0.1:59065 | ESTABLISHED | 74296 |
| TCP | 127.0.0.1:59065 | 127.0.0.1:59064 | ESTABLISHED | 74296 |
| TCP | 127.0.0.1:59463 | 127.0.0.1:59464 | ESTABLISHED | 75236 |
| TCP | 127.0.0.1:59464 | 127.0.0.1:59463 | ESTABLISHED | 75236 |
| TCP | 127.0.0.1:59465 | 127.0.0.1:59466 | ESTABLISHED | 75236 |
| TCP | 127.0.0.1:59466 | 127.0.0.1:59465 | ESTABLISHED | 75236 |
| TCP | 127.0.0.1:59467 | 127.0.0.1:59468 | ESTABLISHED | 75236 |
| TCP | 127.0.0.1:59468 | 127.0.0.1:59467 | ESTABLISHED | 75236 |
| TCP | 127.0.0.1:59473 | 127.0.0.1:59474 | ESTABLISHED | 7624 |
| TCP | 127.0.0.1:59474 | 127.0.0.1:59473 | ESTABLISHED | 7624 |
| TCP | 127.0.0.1:64120 | 0.0.0.0:0 | LISTENING | 6432 |
| TCP | 172.18.32.1:139 | 0.0.0.0:0 | LISTENING | 4 |
| TCP | 192.168.29.215:139 | 0.0.0.0:0 | LISTENING | 4 |
| TCP | 192.168.29.215:49448 | 20.198.119.143:443 | ESTABLISHED | 7424 |
| TCP | 192.168.29.215:51247 | 170.114.10.28:443 | CLOSE_WAIT | 3356 |
| TCP | 192.168.29.215:54180 | 157.240.239.60:443 | ESTABLISHED | 26308 |
| TCP | 192.168.29.215:54218 | 13.235.226.255:443 | ESTABLISHED | 17092 |
| TCP | 192.168.29.215:54227 | 204.79.197.203:443 | TIME_WAIT | 0 |
| TCP | 192.168.29.215:54228 | 204.79.197.203:443 | TIME_WAIT | 0 |
| TCP | 192.168.29.215:54236 | 65.2.117.88:443 | ESTABLISHED | 17092 |
| TCP | 192.168.29.215:58953 | 170.114.0.2:443 | ESTABLISHED | 3356 |
| TCP | 192.168.29.215:58959 | 142.250.199.170:443 | ESTABLISHED | 12680 |
| TCP | 192.168.29.215:58984 | 13.73.252.129:8883 | ESTABLISHED | 16124 |
| TCP | 192.168.29.215:59030 | 170.114.14.71:443 | ESTABLISHED | 3356 |
| TCP | 192.168.29.215:59715 | 3.114.202.64:443 | ESTABLISHED | 17092 |
| TCP | 192.168.29.215:59721 | 3.108.35.59:443 | ESTABLISHED | 17092 |
| TCP | 192.168.29.215:59729 | 3.108.35.59:443 | ESTABLISHED | 17092 |
| TCP | 192.168.64.1:139 | 0.0.0.0:0 | LISTENING | 4 |
| TCP | 192.168.75.1:139 | 0.0.0.0:0 | LISTENING | 4 |

b)

```
abhishek@abhishek-virtual-machine:~$ sudo netstat -at info.cern.ch
[sudo] password for abhishek:
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 localhost:ipp           0.0.0.0:*               LISTEN
tcp        0      0 localhost:domain        0.0.0.0:*               LISTEN
tcp        0      0 abhishek-virtual-:34420 76.237.120.34.bc.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:58936 bom12s20-in-f1.1e:https TIME_WAIT
tcp        0      0 abhishek-virtual-:53068 102.115.120.34.bc:https ESTABLISHED
tcp        0      0 abhishek-virtual-:34120 123.208.120.34.bc:https ESTABLISHED
tcp        0      0 abhishek-virtual-:52030 117.18.237.29:http      TIME_WAIT
tcp        0      0 abhishek-virtual-:44636 82.221.107.34.bc.g:http TIME_WAIT
tcp        0      0 abhishek-virtual-:35898 server-18-66-63-1:https ESTABLISHED
tcp        0      0 abhishek-virtual-:34412 76.237.120.34.bc.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:34446 76.237.120.34.bc.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:45554 239.237.117.34.bc:https TIME_WAIT
tcp        0      0 abhishek-virtual-:40502 bom07s15-in-f10.1:https TIME_WAIT
tcp        0      0 abhishek-virtual-:35884 server-18-66-63-1:https TIME_WAIT
tcp        0      0 abhishek-virtual-:35892 server-18-66-63-1:https TIME_WAIT
tcp        0      0 abhishek-virtual-:34114 123.208.120.34.bc:https TIME_WAIT
tcp        0      0 abhishek-virtual-:43390 bom07s18-in-f10.1:https TIME_WAIT
tcp        0      0 abhishek-virtual-:44624 82.221.107.34.bc.g:http TIME_WAIT
tcp        0      0 abhishek-virtual-:54148 ec2-54-184-13-11.:https ESTABLISHED
tcp        0      0 abhishek-virtual-:34458 76.237.120.34.bc.:https ESTABLISHED
tcp        0      0 abhishek-virtual-:49332 117.18.237.29:http      ESTABLISHED
tcp        0      0 abhishek-virtual-:50118 191.144.160.34.bc:https ESTABLISHED
tcp        0      0 abhishek-virtual-:58082 ec2-52-39-175-179:https ESTABLISHED
tcp        0      0 abhishek-virtual-:53278 del11s20-in-f10.1:https TIME_WAIT
tcp        0      0 abhishek-virtual-:50894 server-13-35-191-:https TIME_WAIT
tcp        0      0 abhishek-virtual-:50128 191.144.160.34.bc:https ESTABLISHED
tcp        0      0 abhishek-virtual-:34440 76.237.120.34.bc.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:50112 191.144.160.34.bc:https TIME_WAIT
tcp        0      0 abhishek-virtual-:34424 76.237.120.34.bc.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:55762 117.18.237.29:http      ESTABLISHED
tcp        0      0 abhishek-virtual-:33048 bom12s10-in-f3.1e1:http TIME_WAIT
tcp        0      0 abhishek-virtual-:53066 102.115.120.34.bc:https TIME_WAIT
tcp        0      0 abhishek-virtual-:47110 221.5.120.34.bc.g:https TIME_WAIT
tcp        0      0 abhishek-virtual-:49142 ec2-52-11-213-12.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:50102 191.144.160.34.bc:https TIME_WAIT
tcp        0      0 abhishek-virtual-:42928 201.181.244.35.bc:https ESTABLISHED
tcp        0      0 abhishek-virtual-:41722 49.44.117.112:http      TIME_WAIT
tcp        0      0 abhishek-virtual-:43776 36.75.98.34.bc.go:https TIME_WAIT
tcp        0      0 abhishek-virtual-:34424 76.237.120.34.bc.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:55762 117.18.237.29:http      ESTABLISHED
tcp        0      0 abhishek-virtual-:33048 bom12s10-in-f3.1e1:http TIME_WAIT
tcp        0      0 abhishek-virtual-:53066 102.115.120.34.bc:https TIME_WAIT
tcp        0      0 abhishek-virtual-:47110 221.5.120.34.bc.g:https TIME_WAIT
tcp        0      0 abhishek-virtual-:49142 ec2-52-11-213-12.:https TIME_WAIT
tcp        0      0 abhishek-virtual-:50102 191.144.160.34.bc:https TIME_WAIT
tcp        0      0 abhishek-virtual-:42928 201.181.244.35.bc:https ESTABLISHED
tcp        0      0 abhishek-virtual-:41722 49.44.117.112:http      TIME_WAIT
tcp        0      0 abhishek-virtual-:43776 36.75.98.34.bc.go:https TIME_WAIT
tcp        0      0 abhishek-virtual-:34432 76.237.120.34.bc.:https TIME_WAIT
tcp6       0      0 ip6-localhost:ipp      [::]:*                 LISTEN
```