Computer Networks Assignment-1
Vishnu Vardhan 2020480

Q1)

a)

Ifconfig:- Interface configuration. It is used to view and change the configuration of the network interface in the system.

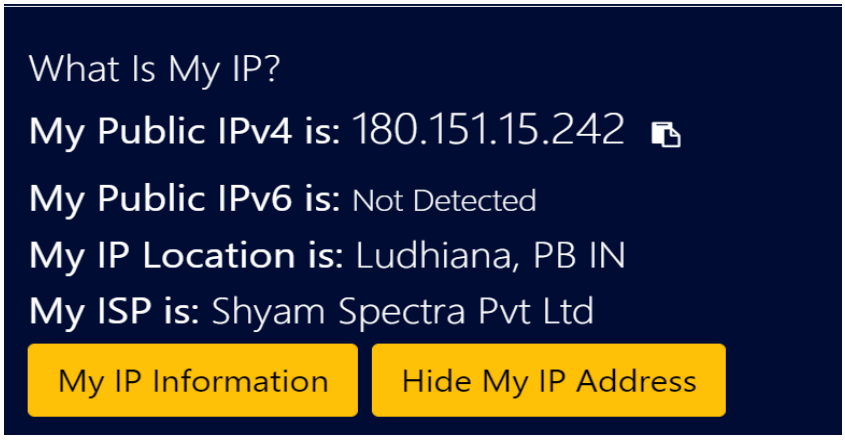
IP address = 192.168.168.129

```
vishnu@vishnu-virtual-machine:~$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.168.129  netmask 255.255.255.0  broadcast 192.168.168.255
        inet6 fe80::8ff4:9668:f75:5b9f  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:02:2b:9a  txqueuelen 1000  (Ethernet)
        RX packets 186109  bytes 269547497 (269.5 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 26604  bytes 4756312 (4.7 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 2788  bytes 283908 (283.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 2788  bytes 283908 (283.9 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

b)

IP address shown on the website https://www.whatismyip.com is **180.151.15.242**

Both IPs are different. In the first case, it is the network interface IP address and in the second case, it is the Ip address of the internet(ISP). In the first case the IP that DHCP (Dynamic host configuration protocol) is provided to us and in the second case the IP which the ISP Provides us, the world recognizes us with this IP.



Q2)

```
vishnu@vishnu-virtual-machine:~$ nslookup google.in
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
Name:   google.in
Address: 142.250.192.36
Name:   google.in
Address: 2404:6800:4009:80d::2004
```

To find the authoritative name-server for a domain name. We first need to access the Start of Authority to access the authoritative server.

```
vishnu@vishnu-virtual-machine:~$ nslookup -type=soa google.in
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
google.in
        origin = ns1.google.com
        mail addr = dns-admin.google.com
        serial = 475782946
        refresh = 900
        retry = 900
        expire = 1800
        minimum = 60

Authoritative answers can be found from:
ns1.google.com  internet address = 216.239.32.10
ns1.google.com  has AAAA address 2001:4860:4802:32::a
```

To get the primary server IP address of google.in we can lookup for ns1.google.com For authoritative results, we have to specify the name of the server the nslookup command

```
vishnu@vishnu-virtual-machine:~$ nslookup google.in ns1.google.com
Server:         ns1.google.com
Address:        216.239.32.10#53

Name:   google.in
Address: 142.250.194.164
Name:   google.in
Address: 2404:6800:4002:823::2004
```

b)

```
vishnu@vishnu-virtual-machine:~$ dig +noedns google.com

; <<>> DiG 9.18.1-1ubuntu1.2-Ubuntu <<>> +noedns google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 47968
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;google.com.                    IN      A

;; ANSWER SECTION:
google.com.             5       IN      A       142.250.194.206

;; Query time: 8 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Fri Sep 23 18:58:27 IST 2022
;; MSG SIZE  rcvd: 44

vishnu@vishnu-virtual-machine:~$ dig +nocmd +noall +answer +ttlid +noedns google.com
google.com.             5       IN      A       142.250.194.206
vishnu@vishnu-virtual-machine:~$
```

It would expire in 5 seconds.

3)

a)

```
 1    10 ms    18 ms    40 ms  192.168.48.254
 2    29 ms    62 ms    84 ms  auth.iiitd.edu.in [192.168.1.99]
 3     5 ms     7 ms    28 ms  180.151.15.241.reverse.spectranet.in [180.151.15.241]
 4     6 ms     9 ms     8 ms  72.14.194.202
 5   124 ms    37 ms     8 ms  74.125.243.99
 6    26 ms    41 ms    26 ms  172.253.69.58
 7    47 ms    51 ms    86 ms  216.239.48.65
 8    25 ms    24 ms    39 ms  108.170.248.209
 9    31 ms    26 ms    37 ms  142.251.70.57
10    31 ms    31 ms    39 ms  bom07s35-in-f4.1e100.net [142.250.66.4]
```

Average latency:-

1. (10 + 18 + 40)/3 = 22.66/2 = 11.33
2. (29+62+84)/3 = 58.333/2 = 29.1665
3. (5+7+28)/3 = 13.33/2 = 6.665
4. (6+9+8)/3 = 7.66/2 = 3.83
5. (124+37+8)/3 = 56.33/2 = 28.165
6. (26+41+26)/3 = 31/2 = 15.5
7. (47+51+86)/3 = 61.3333/2 = 30.7775
8. (25+24+39)/3 = 29.3333/2 = 14.6665
9. (31+26+37)/3 = 31.333/2 = 15.665
10. (31+31+39)/3= 33.666/2 = 16.833

b)

```
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=72 ttl=128 time=3.68 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=73 ttl=128 time=3.42 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=74 ttl=128 time=3.40 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=75 ttl=128 time=3.26 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=76 ttl=128 time=3.64 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=77 ttl=128 time=3.70 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=78 ttl=128 time=3.47 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=79 ttl=128 time=3.24 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=80 ttl=128 time=3.46 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=81 ttl=128 time=3.08 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=82 ttl=128 time=3.35 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=83 ttl=128 time=3.53 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=84 ttl=128 time=3.45 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=85 ttl=128 time=3.33 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=86 ttl=128 time=3.43 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=87 ttl=128 time=3.18 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=88 ttl=128 time=3.26 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=89 ttl=128 time=3.48 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=90 ttl=128 time=3.62 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=91 ttl=128 time=3.43 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=92 ttl=128 time=3.46 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=93 ttl=128 time=3.42 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=94 ttl=128 time=3.36 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=95 ttl=128 time=3.77 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=96 ttl=128 time=3.31 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=97 ttl=128 time=3.28 ms
64 bytes from kul01s10-in-f36.1e100.net (216.58.221.36): icmp_seq=98 ttl=128 time=3.77 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=99 ttl=128 time=3.39 ms
64 bytes from del03s07-in-f4.1e100.net (216.58.221.36): icmp_seq=100 ttl=128 time=3.43 ms

--- google.in ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99172ms
rtt min/avg/max/mdev = 2.617/3.607/5.790/0.484 ms
```

The average latency is **1.8ms**

C)

```
64 bytes from www-ltm.cc.columbia.edu (128.59.105.24): icmp_seq=72 ttl=128 time=245 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=73 ttl=128 time=246 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=74 ttl=128 time=245 ms
64 bytes from columbiauniversity.org (128.59.105.24): icmp_seq=75 ttl=128 time=245 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=76 ttl=128 time=245 ms
64 bytes from columbiauniversity.us (128.59.105.24): icmp_seq=77 ttl=128 time=245 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=78 ttl=128 time=245 ms
64 bytes from columbiauniversity.info (128.59.105.24): icmp_seq=79 ttl=128 time=245 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=80 ttl=128 time=245 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=81 ttl=128 time=245 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=82 ttl=128 time=248 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=83 ttl=128 time=246 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=84 ttl=128 time=246 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=85 ttl=128 time=245 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=86 ttl=128 time=245 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=87 ttl=128 time=245 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=88 ttl=128 time=245 ms
64 bytes from columbiauniversity.info (128.59.105.24): icmp_seq=89 ttl=128 time=246 ms
64 bytes from www-ltm.cc.columbia.edu (128.59.105.24): icmp_seq=90 ttl=128 time=245 ms
64 bytes from columbiauniversity.info (128.59.105.24): icmp_seq=91 ttl=128 time=246 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=92 ttl=128 time=245 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=93 ttl=128 time=245 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=94 ttl=128 time=245 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=95 ttl=128 time=245 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=96 ttl=128 time=245 ms
64 bytes from columbiauniversity.org (128.59.105.24): icmp_seq=97 ttl=128 time=245 ms
64 bytes from www-ltm.cc.columbia.edu (128.59.105.24): icmp_seq=98 ttl=128 time=245 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=99 ttl=128 time=246 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=100 ttl=128 time=245 ms

--- columbia.edu ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99154ms
rtt min/avg/max/mdev = 244.790/245.532/252.839/0.869 ms
```

The average latency is **122.766ms**

d)

Sum of the values of the latencies = 172.483ms and the average latency in (b) is 1.8ms. The difference is because when we fetch the path using traceroute it the nodes send the acknowledgement duw to which the delay accors in tracteroute case.

e)

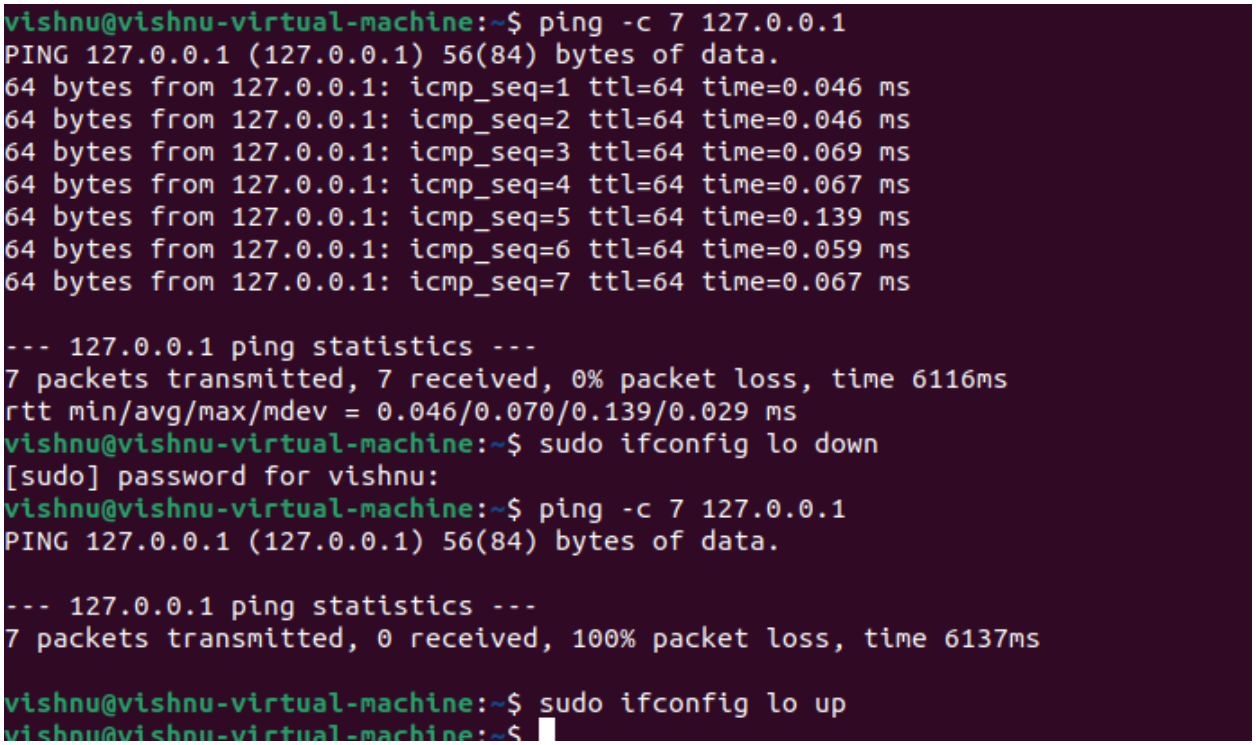
The maximum values of the latencies are 30.665ms and the maximum latency in (b) is 1.8 ms.The difference is because when we fetch the path using traceroute it the nodes send the acknowledgement duw to which the delay accors in tracteroute case.

f)

```
Tracing route to google.in [142.250.66.4]
over a maximum of 30 hops:

  1    10 ms    18 ms    40 ms  192.168.48.254
  2    29 ms    62 ms    84 ms  auth.iiitd.edu.in [192.168.1.99]
  3     5 ms     7 ms    28 ms  180.151.15.241.reverse.spectranet.in [180.151.15.241]
  4     6 ms     9 ms     8 ms  72.14.194.202
  5   124 ms    37 ms     8 ms  74.125.243.99
  6    26 ms    41 ms    26 ms  172.253.69.58
  7    47 ms    51 ms    86 ms  216.239.48.65
  8    25 ms    24 ms    39 ms  108.170.248.209
  9    31 ms    26 ms    37 ms  142.251.70.57
 10    31 ms    31 ms    39 ms  bom07s35-in-f4.1e100.net [142.250.66.4]

Trace complete.

C:\Users\799vi>tracert columbia.edu

Tracing route to columbia.edu [128.59.105.24]
over a maximum of 30 hops:

  1    45 ms    20 ms     2 ms  192.168.64.254
  2     1 ms     1 ms     1 ms  vpn.iiitd.edu.in [192.168.1.99]
  3     2 ms     2 ms     3 ms  180.151.15.241.reverse.spectranet.in [180.151.15.241]
  4     3 ms     3 ms     3 ms  219.65.112.205.static-delhi.vsnl.net.in [219.65.112.205]
  5    24 ms    24 ms    26 ms  172.28.176.253
  6    26 ms    41 ms    26 ms  ix-ae-0-100.tcore1.mlv-mumbai.as6453.net [180.87.38.5]
  7   147 ms     *        *     if-be-6-2.ecore1.emrs2-marseille.as6453.net [195.219.174.16]
  8     *      146 ms   146 ms  if-ae-7-2.tcore1.pye-paris.as6453.net [195.219.174.9]
  9   146 ms   145 ms   146 ms  if-ae-55-4.tcore1.pvu-paris.as6453.net [80.231.153.168]
 10   141 ms   141 ms   142 ms  be6453.agr21.par04.atlas.cogentco.com [130.117.15.69]
 11   148 ms   147 ms   148 ms  be2151.ccr32.par04.atlas.cogentco.com [154.54.61.33]
 12   147 ms   148 ms   149 ms  be2103.ccr42.par01.atlas.cogentco.com [154.54.61.21]
 13   252 ms   238 ms   238 ms  be3628.ccr42.jfk02.atlas.cogentco.com [154.54.27.169]
 14   239 ms   239 ms   239 ms  be2897.rcr24.jfk01.atlas.cogentco.com [154.54.84.214]
 15   237 ms   238 ms   237 ms  38.122.8.210
 16   240 ms   240 ms   240 ms  cc-core-1-x-nyser32-gw-1.net.columbia.edu [128.59.255.5]
 17   239 ms   239 ms   239 ms  cc-conc-1-x-cc-core-1.net.columbia.edu [128.59.255.21]
 18   244 ms   244 ms   244 ms  columbiauniversity.info [128.59.105.24]
```

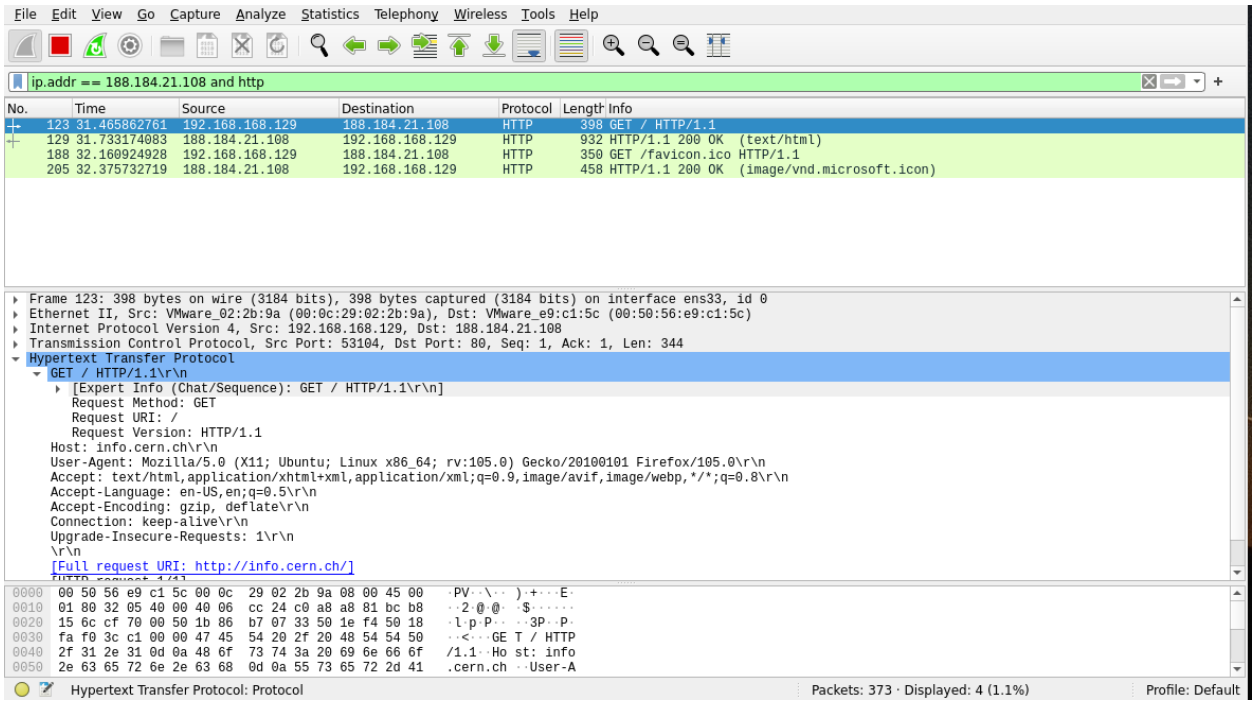
It is clearly evident from the above image of traceroutes of google.in and columbia.edu that the latencies to reach google.in is less compared to the latencies of columbia.edu. The number of hops to reach the destination in case of google is 9, whereas in case of columbia.edu is 17 hops. The physical location of the sever columbia.edu is with IP 128.59.105.24 is far from the server of google.in with IP 142.250.66.4. Therefore the latency to reach columbia.edu is higher than the latency to reach google.in

4)



127.0.0.1 is the IP address. With the command **sudo ifconfig lo down** the command will temporarily disable the loopback interference thus ping comammnd fails with the IP 127.0.0.1. Here 7packets are transmitted and 0 received and hence the packet loss is 100%. This command will check the connectivity of the loopback interface by sending packets to it and receiving the same. We can bring down the IP and then with the command **sudo ifconfig lo up** command we can take the IP address 127.0.0.1 up and running.

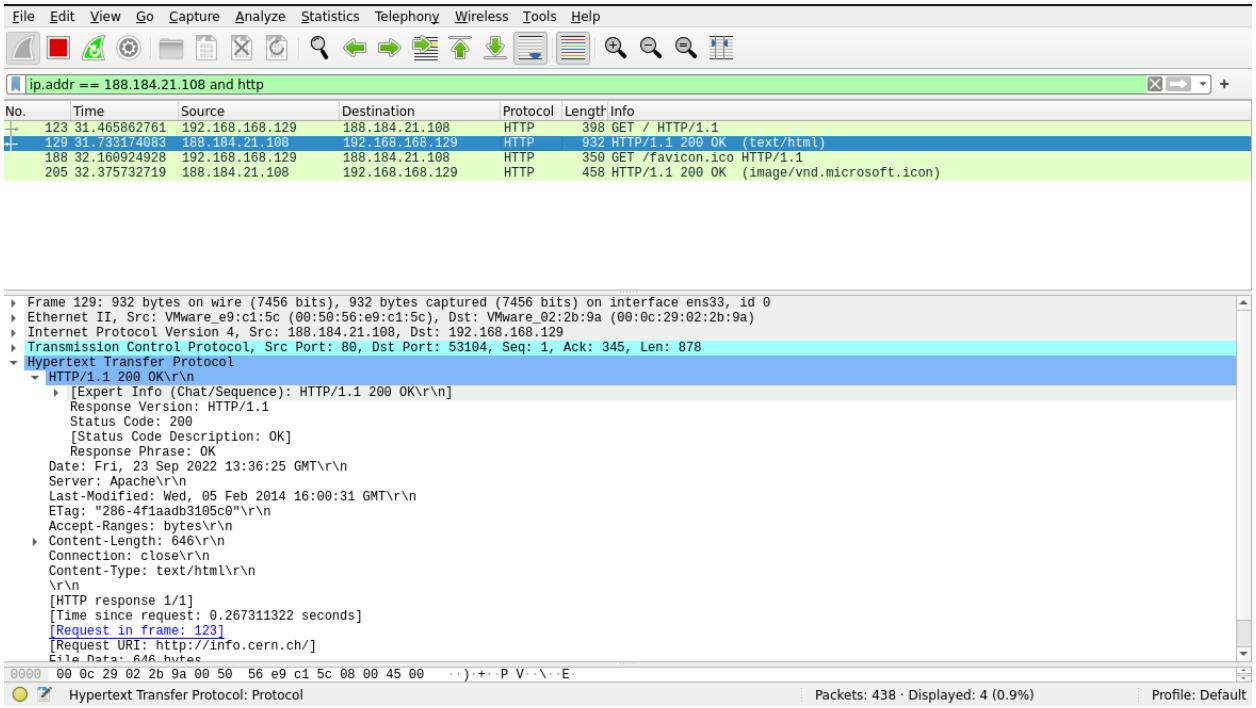
5)



Http request type = GET

User agent type = Mozilla/5.0

HTTP request packet's URL = http://info.cern.ch/



HTTP response code = 200
HTTP response description = OK
Name and version of the web server = Apache 1.1

4 packets have been downloaded. They were on the same TCP connections.

Persistent. As the versions of the requests and responses are not the same.

6)

a) netstat -ano -t tcp 188.184.21.108(IP address)

```
vishnu@vishnu-virtual-machine:~$ nslookup info.cern.ch
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
info.cern.ch    canonical name = webafs706.cern.ch.
Name:   webafs706.cern.ch
Address: 188.184.21.108
Name:   webafs706.cern.ch
Address: 2001:1458:d00:34::100:125

vishnu@vishnu-virtual-machine:~$ netstat -ano -t tcp 188.184.21.108
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       Timer
tcp        0      0 127.0.0.1:631           0.0.0.0:*               LISTEN      off (0.00/0/0)
tcp        0      0 127.0.0.53:53           0.0.0.0:*               LISTEN      off (0.00/0/0)
tcp        0      0 192.168.168.129:59344   13.227.138.17:443       ESTABLISHED keepalive (9.44/0/0)
tcp        0      0 192.168.168.129:59192   13.35.191.54:443        ESTABLISHED keepalive (7.29/0/0)
tcp        0      0 192.168.168.129:59354   13.227.138.17:443       ESTABLISHED keepalive (9.44/0/0)
tcp     1562      0 192.168.168.129:59356   13.227.138.17:443       ESTABLISHED keepalive (9.44/0/0)
tcp        0      0 192.168.168.129:59268   18.66.78.9:443          ESTABLISHED off (0.00/0/0)
tcp        0      0 192.168.168.129:58334   34.117.237.239:443      TIME_WAIT   timewait (18.96/0/0)
tcp        0      0 192.168.168.129:42680   13.35.191.54:443        ESTABLISHED keepalive (4.15/0/0)
tcp        0      0 192.168.168.129:59210   13.35.191.54:443        ESTABLISHED keepalive (7.30/0/0)
tcp        0      0 192.168.168.129:59370   13.227.138.17:443       ESTABLISHED keepalive (9.43/0/0)
tcp     2613      0 192.168.168.129:59332   13.227.138.17:443       ESTABLISHED keepalive (9.44/0/0)
tcp        0      0 192.168.168.129:59196   13.35.191.54:443        ESTABLISHED keepalive (7.29/0/0)
tcp        0      0 192.168.168.129:59178   13.35.191.54:443        ESTABLISHED keepalive (7.29/0/0)
tcp        0      0 192.168.168.129:59334   13.227.138.17:443       ESTABLISHED keepalive (9.43/0/0)
tcp        0      0 192.168.168.129:59212   13.35.191.54:443        ESTABLISHED keepalive (7.30/0/0)
tcp        0      0 192.168.168.129:60398   34.210.107.213:443      ESTABLISHED keepalive (93.68/0/0)
tcp6       0      0 ::1:631                 :::*                    LISTEN      off (0.00/0/0)
```

b)

```
vishnu@vishnu-virtual-machine:~$ netstat -t http://info.cern.ch
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 vishnu-virtual-ma:58700 _gateway:domain         TIME_WAIT
tcp        0      0 vishnu-virtual-ma:53628 ec2-52-42-74-230.:https ESTABLISHED
tcp        0      0 vishnu-virtual-ma:36644 _gateway:domain         ESTABLISHED
```

Status:- Established