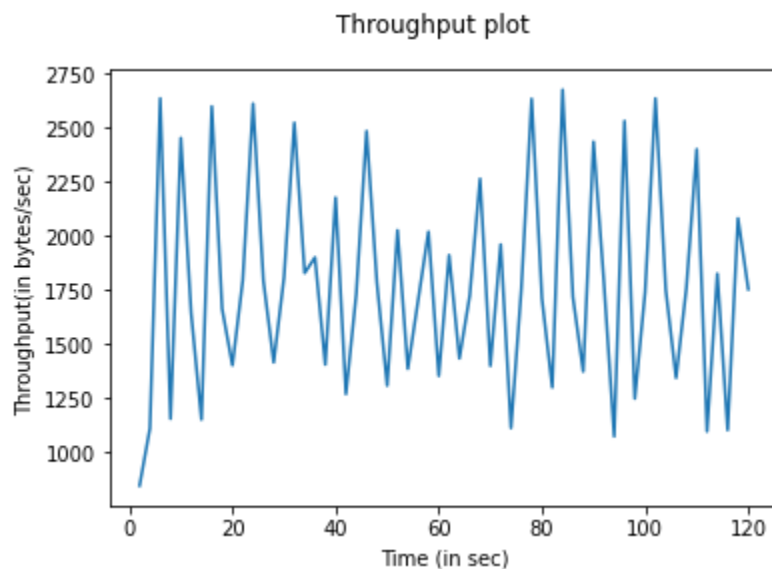


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**CSE 232 - Computer Networks**  
**Assignment - 2**

---

**Q1)**



Analysis of the packet capture: We run the client and server program (which infinitely exchange data until stopped) for two minutes and capture the packets using wireshark. We then filter the packers with TCP port same as that of our client-server program. We then filter the packets with source port equal to the server port and export the data as a csv file.

Computing aggregate throughput: Python script is written to compute aggregate throughput every two seconds ( $\#length\_data/time\_taken$ ).

Plotting: The graph is plotted with 2 second time intervals on the x-axis and throughput (bytes/sec) on the y-axis.

**Q2)**

Wireshark interface showing a packet capture of HTTP traffic. The packet list shows four packets, with the first packet (No. 4) selected. The packet details pane shows the frame information and the Hypertext Transfer Protocol section. The packet bytes pane shows the raw data in hexadecimal and ASCII.

No.	Time	Source	Destination	Protocol	Length	Info
4	0.152067195	172.16.53.2	188.184.21.108	HTTP	397	GET / HTTP/1.1
6	0.306297404	188.184.21.108	172.16.53.2	HTTP	944	HTTP/1.1 200 OK (text/html)
14	0.983826386	172.16.53.2	188.184.21.108	HTTP	349	GET /favicon.ico HTTP/1.1
16	1.137984432	188.184.21.108	172.16.53.2	HTTP	1720	HTTP/1.1 200 OK (image/vnd.microsoft.icon)

Frame 4: 397 bytes on wire (3176 bits), 397 bytes captured (3176 bits) on interface 0  
 Ethernet II, Src: Vmware\_8b:f7:a9 (00:0c:29:8b:f7:a9), Dst: 66:c7:53:dd:33:64 (66:c7:53:dd:33:64)  
 Internet Protocol Version 4, Src: 172.16.53.2, Dst: 188.184.21.108  
 Transmission Control Protocol, Src Port: 53778, Dst Port: 80, Seq: 1, Ack: 1, Len: 331  
 Hypertext Transfer Protocol

```

0000 66 c7 53 dd 33 64 00 0c 29 8b f7 a9 08 00 45 00 f 5 3 d . . . . . E
0010 01 7f 91 3c 40 00 40 06 f5 05 ac 10 35 02 bc b8 . . . < @ . . . . 5 . .
0020 15 6c d2 12 00 50 29 2e f2 e8 75 e3 20 cb 80 18 . 1 . . P . . . u . . .
0030 01 fd b4 a8 00 00 01 01 08 0a 90 f1 eb c6 58 cc . . . . . X . . . . .
0040 f7 b7 47 45 54 20 2f 20 48 54 54 50 2f 31 2e 31 . . GET / HTTP/1.1
0050 0d 0a 48 6f 73 74 3a 20 69 6e 66 6f 2e 63 65 72 . . Host: info.cer
0060 6e 2e 63 68 0d 0a 55 73 65 72 2d 41 67 65 6e 74 n.ch : Us er-Agent
0070 3a 20 4d 6f 7a 69 6c 6c 61 2f 35 2e 30 20 28 58 : Mozilla/5.0 (X
0080 31 31 3b 20 55 62 75 6e 74 75 3b 20 4c 69 6e 75 11; Ubuntu; Linu
0090 78 20 78 38 36 5f 36 34 3b 20 72 76 3a 39 32 2e x x86_64 ; rv:92.
00a0 30 29 20 47 65 63 6b 6f 2f 32 30 31 30 30 31 30 0) Gecko/20100101
00b0 31 20 46 69 72 65 66 6f 78 2f 39 32 2e 30 0d 0a 1 Firefo x/92.0
00c0 41 63 63 65 70 74 3a 20 74 65 78 74 2f 68 74 6d Accept: text/htm
00d0 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 68 l,applic ation/xh
00e0 74 6d 6c 2b 78 6d 6c 2c 61 70 70 6c 69 63 61 74 tml+xml, applicat
  
```

wireshark\_ens33\_20211005021303\_jkOxt5.pcapng Packets: 21 · Displayed: 4 (19.0%) Profile: Default

1) (No. 4)

Hypertext Transfer Protocol

GET / HTTP/1.1\r\n

[Expert Info (Chat/Sequence): GET / HTTP/1.1\r\n]

Request Method: GET

Request URI: /

Request Version: HTTP/1.1

Host: info.cern.ch\r\n

User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86\_64; rv:92.0) Gecko/20100101 Firefox/92.0\r\n

Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,\*/\*;q=0.8\r\n

Accept-Language: en-US,en;q=0.5\r\n

Accept-Encoding: gzip, deflate\r\n

Connection: keep-alive\r\n

Upgrade-Insecure-Requests: 1\r\n

\r\n

[Full request URI: http://info.cern.ch/]

[HTTP request 1/1]

[Response in frame: 6]

HTTP packet type : request

HTTP request type : GET

User agent type :Mozilla/5.0 (X11; Ubuntu; Linux x86\_64; rv:92.0) Gecko/20100101 Firefox/92.0

HTTP request packet's URL: <http://info.cern.ch/> (Full request URI)

2) (No. 6)

```
▼ Hypertext Transfer Protocol
  ▼ HTTP/1.1 200 OK\r\n
    ▶ [Expert Info (Chat/Sequence): HTTP/1.1 200 OK\r\n]
      Response Version: HTTP/1.1
      Status Code: 200
      [Status Code Description: OK]
      Response Phrase: OK
      Date: Tue, 05 Oct 2021 09:13:06 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: 0.154140209 seconds]
      [Request in frame: 4]
      [Request URI: http://info.cern.ch/]
      File Data: 646 bytes
    ▶ Line-based text data: text/html (13 lines)
```

HTTP packet type : response

HTTP response code : 200

HTTP response description: OK

Name and version of the web server: Apache

3) (No. 14)

```
▼ Hypertext Transfer Protocol
  ▼ GET /favicon.ico HTTP/1.1\r\n
    ▶ [Expert Info (Chat/Sequence): GET /favicon.ico HTTP/1.1\r\n]
      Request Method: GET
      Request URI: /favicon.ico
      Request Version: HTTP/1.1
      Host: info.cern.ch\r\n
      User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:92.0) Gecko/20100101 Firefox/92.0\r\n
      Accept: image/webp,*/*\r\n
      Accept-Language: en-US,en;q=0.5\r\n
      Accept-Encoding: gzip, deflate\r\n
      Connection: keep-alive\r\n
      Referer: http://info.cern.ch/\r\n
      \r\n
      [Full request URI: http://info.cern.ch/favicon.ico]
      [HTTP request 1/1]
      [Response in frame: 16]
```

HTTP packet type : request

HTTP request type : GET

User agent type: Mozilla/5.0 (X11; Ubuntu; Linux x86\_64; rv:92.0) Gecko/20100101  
Firefox/92.0

HTTP request packet's URL: http://info.cern.ch/favicon.ico (Full request URI)

4) (No. 16)

```
▼ Hypertext Transfer Protocol
  ▼ HTTP/1.1 200 OK\r\n
    ▶ [Expert Info (Chat/Sequence): HTTP/1.1 200 OK\r\n]
      Response Version: HTTP/1.1
      Status Code: 200
      [Status Code Description: OK]
      Response Phrase: OK
      Date: Tue, 05 Oct 2021 09:13:06 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: 0.154158046 seconds]
      [Request in frame: 14]
      [Request URI: http://info.cern.ch/favicon.ico]
      File Data: 1406 bytes
```

HTTP packet type : response

HTTP response code : 200

HTTP response description: OK

Name and version of the web server: Apache

**Q3)**

```

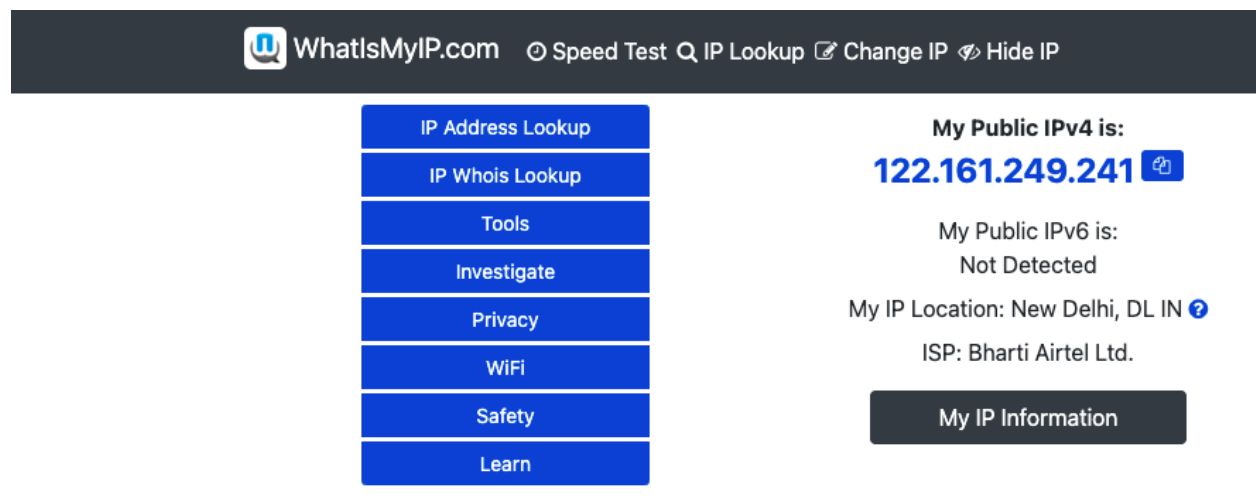
harmansingh@ubuntu:~$ ifconfig -a
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 3000
    inet 172.16.53.2 netmask 255.255.255.0 broadcast 172.16.53.255
    inet6 fe80::a32e:f2d9:7e78:6123 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:8b:f7:a9 txqueuelen 1000 (Ethernet)
    RX packets 1695551 bytes 2296733136 (2.2 GB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 210905 bytes 37960835 (37.9 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 42089 bytes 4436056 (4.4 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 42089 bytes 4436056 (4.4 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

```

The IP address of our network (for the ens33 interface) is : **172.16.53.2**

b)



The screenshot shows the homepage of WhatIsMyIP.com. At the top, there is a navigation bar with links: WhatIsMyIP.com, Speed Test, IP Lookup, Change IP, and Hide IP. Below the navigation bar, there is a vertical menu on the left with buttons: IP Address Lookup, IP Whois Lookup, Tools, Investigate, Privacy, WiFi, Safety, and Learn. On the right side, the main content area displays the following information:

- My Public IPv4 is:** **122.161.249.241** (with a copy icon)
- My Public IPv6 is:** Not Detected
- My IP Location:** New Delhi, DL IN (with a help icon)
- ISP:** Bharti Airtel Ltd.
- A button labeled **My IP Information**.

IP address shown on the website: **122.161.249.241**

The IP address shown on the website is the public IP address (external IP address) which is a part of the WAN (Wide Area Network). It is generally assigned to a modem or a router and not to a computer directly in residential settings.

The IP address shown on the terminal (using ifconfig) is the private IP address. The modem/router acts as a DHCP server and assigns private IP addresses to all the devices connected in the LAN (Local Area Network). All the devices in the LAN share

the common public IP address (but are assigned different internal or private IP addresses) to connect to the world (IP address assigned to the modem/router; found using a website).

#### Q4)

a)

Command : **ping -c 1 [www.google.com](http://www.google.com) -M do -s 3000**

```
harmansingh@ubuntu:~$ ping -c 1 www.google.com -M do -s 3000
PING www.google.com (216.58.196.196) 3000(3028) bytes of data.
ping: local error: Message too long, mtu=1500

--- www.google.com ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms
```

The c flag denotes the number of packets to be sent. We send 1 packet of size 3000 bytes (specified by the s flag). The M flag with do option prohibits fragmentation of the packet.

The test failed since the mtu of the interface is 1500 bytes but we are sending a packet of size 3000 bytes, which exceeds the maximum transmission unit.

b) Command to display all active tcp connections with pids: **sudo netstat -atp**

```
harmansingh@ubuntu:~$ sudo netstat -atp
[sudo] password for harmansingh:
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       PID/Program name
tcp        0      0 localhost:domain        0.0.0.0:*               LISTEN      121230/systemd-reso
tcp        0      0 localhost:ipp           0.0.0.0:*               LISTEN      42342/cupsd
tcp        0      0 ubuntu:52028            ec2-44-240-216-68:https ESTABLISHED 41446/firefox
tcp        0      0 ubuntu:55172            maa05s15-in-f14.1:https ESTABLISHED 41446/firefox
tcp        0      0 ubuntu:38086            45.55.41.223:http       CLOSE_WAIT 44006/plugin_host-3
tcp        0      0 ubuntu:45594            maa05s14-in-f3.1e:https ESTABLISHED 41446/firefox
tcp        0      0 ubuntu:33114            maa03s34-in-f14.1:https ESTABLISHED 41446/firefox
tcp        0      0 ubuntu:40674            239.237.117.34.bc:https ESTABLISHED 41446/firefox
tcp6       0      0 ip6-localhost:ipp      [::]:*                 LISTEN      42342/cupsd
```

Q5)a)

```
harmansingh@ubuntu:~$ nslookup -type=soa google.com
Server:          127.0.0.53
Address:         127.0.0.53#53

Non-authoritative answer:
google.com
    origin = ns1.google.com
    mail addr = dns-admin.google.com
    serial = 400672185
    refresh = 900
    retry = 900
    expire = 1800
    minimum = 60

Authoritative answers can be found from:

harmansingh@ubuntu:~$ nslookup google.com ns1.google.com
Server:          ns1.google.com
Address:         216.239.32.10#53

Name:   google.com
Address: 142.250.195.14
Name:   google.com
Address: 2404:6800:4002:826::200e
```

Nslookup responses are generally non-authoritative (response is not from the primary DNS server but from a cached copy in a 3rd party DNS server).

For getting the authoritative response, we first need to find the authoritative name server. We find the same for google.com using nslookup -type=soa google.com and find the origin.

In the next query, we specify the authoritative name server found above in our nslookup query to get an authoritative response.

b)

```

harmansingh@ubuntu:~$ dig A +ttlunits www.google.com

; <<>> DiG 9.11.3-1ubuntu1.15-Ubuntu <<>> A +ttlunits www.google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 15304
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;www.google.com.                IN      A

;; ANSWER SECTION:
www.google.com.                5m58s   IN      A      142.250.71.4

;; Query time: 9 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Oct 05 08:18:56 PDT 2021
;; MSG SIZE rcvd: 59

```

A DNS record's time to live (TTL) is a DNS server setting that specifies a cache how long to keep DNS records before refreshing the search to acquire a new response again from a nameserver. TTL is commonly used to lessen the strain on authoritative name servers and to speed up client DNS queries.

For [www.google.com](http://www.google.com), the time-to-live is 5 minutes 58 seconds. That is, after 5 minutes 58 seconds, this entry in the local DNS would expire.

## Q6)

a)

```

C:\Users\new user>tracert www.iiith.ac.in

Tracing route to www.iiit.ac.in [196.12.53.50]
over a maximum of 30 hops:

  1    1 ms    1 ms    1 ms  dsldevice.lan [192.168.1.1]
  2   19 ms   24 ms   4 ms  abts-north-dynamic-255.47.161.122.airtelbroadband.in [122.161.47.255]
  3   11 ms   10 ms   18 ms  125.18.73.17
  4   55 ms   49 ms   54 ms  116.119.68.248
  5   43 ms   44 ms   43 ms  49.44.220.188
  6    *      *      *      Request timed out.
  7   45 ms   44 ms   44 ms  115.242.184.26.static.jio.com [115.242.184.26]
  8   55 ms   56 ms   60 ms  196.12.34.76
  9   64 ms   64 ms   63 ms  196.12.53.50

Trace complete.

```

I can see 9 intermediate hosts (including the ones not reachable).

If we ignore the intermediate host that is not reachable (request timed out)- 6th number, the total intermediate hosts are 8.



Intermediate host IP	Average latency (in ms)
192.168.1.1	1
122.161.47.255	15.667
125.18.73.17	13
116.119.68.248	52.667
49.44.220.188	43.333
***	Request timed out
115.242.184.26	44.333
196.12.34.76	57
196.12.53.50	63.667

b)

```
C:\Users\new user>ping -n 100 www.iiith.ac.in

Pinging www.iiit.ac.in [196.12.53.50] with 32 bytes of data:
Reply from 196.12.53.50: bytes=32 time=65ms TTL=58
Reply from 196.12.53.50: bytes=32 time=63ms TTL=58
Reply from 196.12.53.50: bytes=32 time=67ms TTL=58
Reply from 196.12.53.50: bytes=32 time=63ms TTL=58
Reply from 196.12.53.50: bytes=32 time=69ms TTL=58
Reply from 196.12.53.50: bytes=32 time=65ms TTL=58
Reply from 196.12.53.50: bytes=32 time=63ms TTL=58
```

```
Reply from 196.12.53.50: bytes=32 time=62ms TTL=58
Reply from 196.12.53.50: bytes=32 time=188ms TTL=58
Reply from 196.12.53.50: bytes=32 time=64ms TTL=58

Ping statistics for 196.12.53.50:
    Packets: Sent = 100, Received = 99, Lost = 1 (1% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 62ms, Maximum = 188ms, Average = 69ms
```

Average latency : **69 ms**

c)

For 192.168.1.1:

```
C:\Users\new user>ping -n 10 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time=3ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=2ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=2ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=2ms TTL=64
Reply from 192.168.1.1: bytes=32 time=2ms TTL=64

Ping statistics for 192.168.1.1:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 1ms
```

For 122.161.47.255:

```
C:\Users\new user>ping -n 10 122.161.47.255

Pinging 122.161.47.255 with 32 bytes of data:
Reply from 122.161.47.255: bytes=32 time=18ms TTL=254
Reply from 122.161.47.255: bytes=32 time=10ms TTL=254
Reply from 122.161.47.255: bytes=32 time=7ms TTL=254
Reply from 122.161.47.255: bytes=32 time=8ms TTL=254
Reply from 122.161.47.255: bytes=32 time=4ms TTL=254
Reply from 122.161.47.255: bytes=32 time=7ms TTL=254
Reply from 122.161.47.255: bytes=32 time=7ms TTL=254
Reply from 122.161.47.255: bytes=32 time=4ms TTL=254
Reply from 122.161.47.255: bytes=32 time=9ms TTL=254
Reply from 122.161.47.255: bytes=32 time=4ms TTL=254

Ping statistics for 122.161.47.255:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 18ms, Average = 7ms
```

For 125.18.73.17:

```
C:\Users\new user>ping -n 10 125.18.73.17

Pinging 125.18.73.17 with 32 bytes of data:
Reply from 125.18.73.17: bytes=32 time=77ms TTL=61
Reply from 125.18.73.17: bytes=32 time=5ms TTL=61
Reply from 125.18.73.17: bytes=32 time=4ms TTL=61
Reply from 125.18.73.17: bytes=32 time=4ms TTL=61
Reply from 125.18.73.17: bytes=32 time=4ms TTL=61
Reply from 125.18.73.17: bytes=32 time=4ms TTL=61
Reply from 125.18.73.17: bytes=32 time=134ms TTL=61
Reply from 125.18.73.17: bytes=32 time=4ms TTL=61
Reply from 125.18.73.17: bytes=32 time=4ms TTL=61
Reply from 125.18.73.17: bytes=32 time=5ms TTL=61

Ping statistics for 125.18.73.17:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 134ms, Average = 24ms
```

For 116.119.68.248:

```
C:\Users\new user>ping -n 10 116.119.68.248

Pinging 116.119.68.248 with 32 bytes of data:
Reply from 116.119.68.248: bytes=32 time=54ms TTL=61
Reply from 116.119.68.248: bytes=32 time=42ms TTL=61
Reply from 116.119.68.248: bytes=32 time=42ms TTL=61
Reply from 116.119.68.248: bytes=32 time=41ms TTL=61
Reply from 116.119.68.248: bytes=32 time=44ms TTL=61
Reply from 116.119.68.248: bytes=32 time=44ms TTL=61
Reply from 116.119.68.248: bytes=32 time=47ms TTL=61
Reply from 116.119.68.248: bytes=32 time=55ms TTL=61
Reply from 116.119.68.248: bytes=32 time=48ms TTL=61
Reply from 116.119.68.248: bytes=32 time=59ms TTL=61

Ping statistics for 116.119.68.248:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 41ms, Maximum = 59ms, Average = 47ms
```

For 49.44.220.188:

```
C:\Users\new user>ping -n 10 49.44.220.188

Pinging 49.44.220.188 with 32 bytes of data:
Reply from 49.44.220.188: bytes=32 time=39ms TTL=250
Reply from 49.44.220.188: bytes=32 time=37ms TTL=250
Reply from 49.44.220.188: bytes=32 time=47ms TTL=250
Reply from 49.44.220.188: bytes=32 time=50ms TTL=250
Reply from 49.44.220.188: bytes=32 time=38ms TTL=250
Reply from 49.44.220.188: bytes=32 time=38ms TTL=250
Reply from 49.44.220.188: bytes=32 time=38ms TTL=250
Reply from 49.44.220.188: bytes=32 time=42ms TTL=250
Reply from 49.44.220.188: bytes=32 time=88ms TTL=250
Reply from 49.44.220.188: bytes=32 time=49ms TTL=250

Ping statistics for 49.44.220.188:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 37ms, Maximum = 88ms, Average = 46ms
```

For 115.242.184.26:

```
C:\Users\new user>ping -n 10 115.242.184.26

Pinging 115.242.184.26 with 32 bytes of data:
Reply from 115.242.184.26: bytes=32 time=39ms TTL=58
Reply from 115.242.184.26: bytes=32 time=39ms TTL=58
Reply from 115.242.184.26: bytes=32 time=40ms TTL=58
Reply from 115.242.184.26: bytes=32 time=74ms TTL=58
Reply from 115.242.184.26: bytes=32 time=39ms TTL=58
Reply from 115.242.184.26: bytes=32 time=41ms TTL=58
Reply from 115.242.184.26: bytes=32 time=39ms TTL=58
Reply from 115.242.184.26: bytes=32 time=40ms TTL=58
Reply from 115.242.184.26: bytes=32 time=43ms TTL=58
Reply from 115.242.184.26: bytes=32 time=181ms TTL=58

Ping statistics for 115.242.184.26:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 39ms, Maximum = 181ms, Average = 57ms
```

For 196.12.34.76:

```
C:\Users\new user>ping -n 10 196.12.34.76

Pinging 196.12.34.76 with 32 bytes of data:
Reply from 196.12.34.76: bytes=32 time=125ms TTL=249
Reply from 196.12.34.76: bytes=32 time=48ms TTL=249
Reply from 196.12.34.76: bytes=32 time=47ms TTL=249
Reply from 196.12.34.76: bytes=32 time=45ms TTL=249
Reply from 196.12.34.76: bytes=32 time=46ms TTL=249
Reply from 196.12.34.76: bytes=32 time=48ms TTL=249
Reply from 196.12.34.76: bytes=32 time=55ms TTL=249
Reply from 196.12.34.76: bytes=32 time=47ms TTL=249
Reply from 196.12.34.76: bytes=32 time=54ms TTL=249
Reply from 196.12.34.76: bytes=32 time=45ms TTL=249

Ping statistics for 196.12.34.76:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 45ms, Maximum = 125ms, Average = 56ms
```

For 196.12.53.50:

```
C:\Users\new user>ping -n 10 196.12.53.50

Pinging 196.12.53.50 with 32 bytes of data:
Reply from 196.12.53.50: bytes=32 time=62ms TTL=58
Reply from 196.12.53.50: bytes=32 time=63ms TTL=58
Reply from 196.12.53.50: bytes=32 time=64ms TTL=58
Reply from 196.12.53.50: bytes=32 time=125ms TTL=58
Reply from 196.12.53.50: bytes=32 time=62ms TTL=58
Reply from 196.12.53.50: bytes=32 time=62ms TTL=58
Reply from 196.12.53.50: bytes=32 time=63ms TTL=58
Reply from 196.12.53.50: bytes=32 time=63ms TTL=58
Reply from 196.12.53.50: bytes=32 time=65ms TTL=58
Reply from 196.12.53.50: bytes=32 time=68ms TTL=58

Ping statistics for 196.12.53.50:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 62ms, Maximum = 125ms, Average = 69ms
```

Addition of average ping latencies of all the intermediate hosts: **307ms**

In (b), average ping latency is **69ms**.

They are not matching. In (b), the ping average latency is of the destination IP which constitutes going through all the intermediate hosts once and reaching the destination. However, the average latency of any intermediate host is more or less the sum of average latencies of all the previous intermediate hosts. Thus, the average latencies get added again and again while summing all the average latencies. Thus, the sum of ping latencies of the intermediate hosts is more than that of the average ping latency of the destination only where all the intermediate hosts are more or less visited once only.

d)

They are matching. Maximum ping latency among the intermediate hosts: **69ms**  
**[196.12.53.50]**

Average ping latency from (b): **69ms**

The average latencies increase as we reach near the destination. We are not adding the times again and again here. The average latency from (b) constitutes visiting all the intermediate hosts once and giving us the overall average latency. The maximum latency we found in (b) is also for the destination IP (or can be near the destination IP in some cases) since this also constitutes visiting more or less similar intermediate hosts. Thus, they are matching.

e)

```
harmansingh@ubuntu:~$ dig +noall +answer -x 192.168.1.1
1.1.168.192.in-addr.arpa. 15 IN PTR dsldevice.lan.
harmansingh@ubuntu:~$ dig +noall +answer -x 122.161.47.255
255.47.161.122.in-addr.arpa. 4502 IN PTR abts-north-dynamic-255.47.161.122.airtelbroadband.in.
harmansingh@ubuntu:~$ ^C
harmansingh@ubuntu:~$ dig +noall +answer -x 125.18.73.17
harmansingh@ubuntu:~$ dig +noall +answer -x 116.119.68.248
harmansingh@ubuntu:~$ dig +noall +answer -x 49.44.220.188
harmansingh@ubuntu:~$ dig +noall +answer -x 115.242.184.26
26.184.242.115.in-addr.arpa. 4502 IN PTR 115.242.184.26.static.jio.com.
harmansingh@ubuntu:~$ dig +noall +answer -x 196.12.34.76
harmansingh@ubuntu:~$ dig +noall +answer -x 196.12.53.50
harmansingh@ubuntu:~$ $
```

Intermediate host IP	Host name
192.168.1.1	dsldevice.lan
122.161.47.255	

	abts-north-dynamic-255.47.161.122.airtel broadband.in
125.18.73.17	-
116.119.68.248	-
49.44.220.188	-
***	-
115.242.184.26	115.242.184.26.static.jio.com
196.12.34.76	-
196.12.53.50	-

## Q7)

a)

In order to fail the ping for the loopback interface, we first disable the local host so that the ping doesn't work.

As it can be seen in the image below, ping to 127.0.0.1 fails. This happens because the loopback interface is disabled with the command **sudo ifconfig lo down**

```
harmansingh@ubuntu:~$ sudo ifconfig lo down
harmansingh@ubuntu:~$ 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 4088ms
```

If we enable the interface again (**sudo ifconfig lo up**), the ping to 127.0.0.1(loopback interface, localhost) works fine.

```
harmansingh@ubuntu:~$ sudo ifconfig lo up
harmansingh@ubuntu:~$ 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=0.032 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.044 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.038 ms
64 bytes from 127.0.0.1: icmp_seq=4 ttl=64 time=0.042 ms
64 bytes from 127.0.0.1: icmp_seq=5 ttl=64 time=0.035 ms

--- 127.0.0.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4078ms
rtt min/avg/max/mdev = 0.032/0.038/0.044/0.005 ms
```