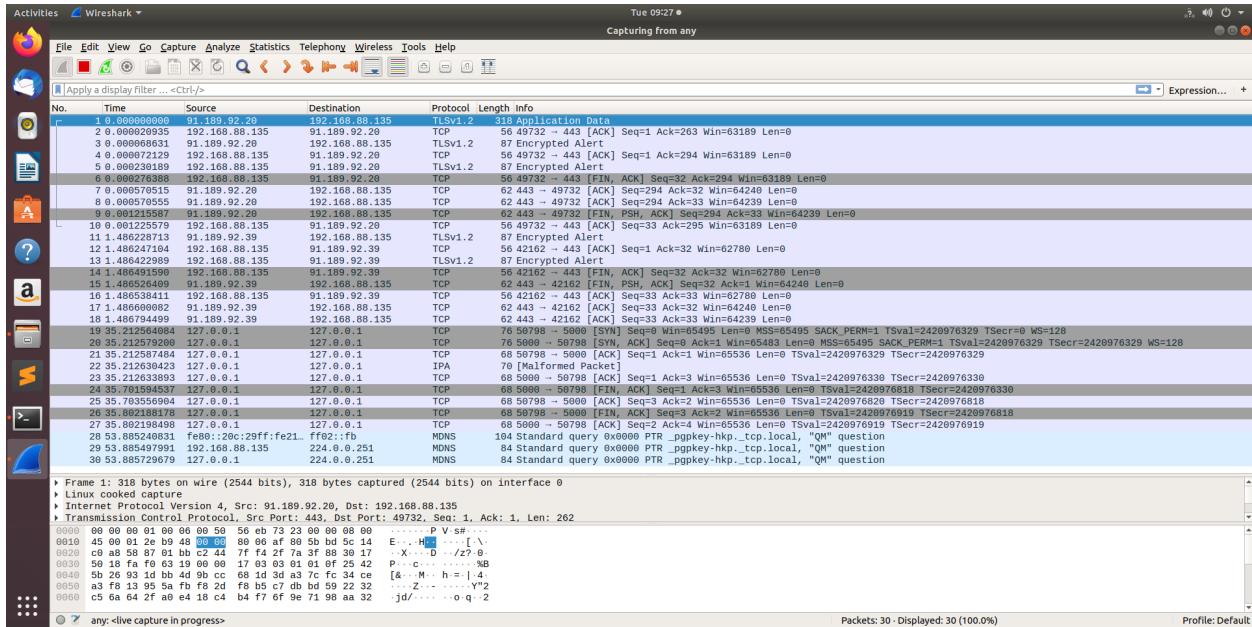
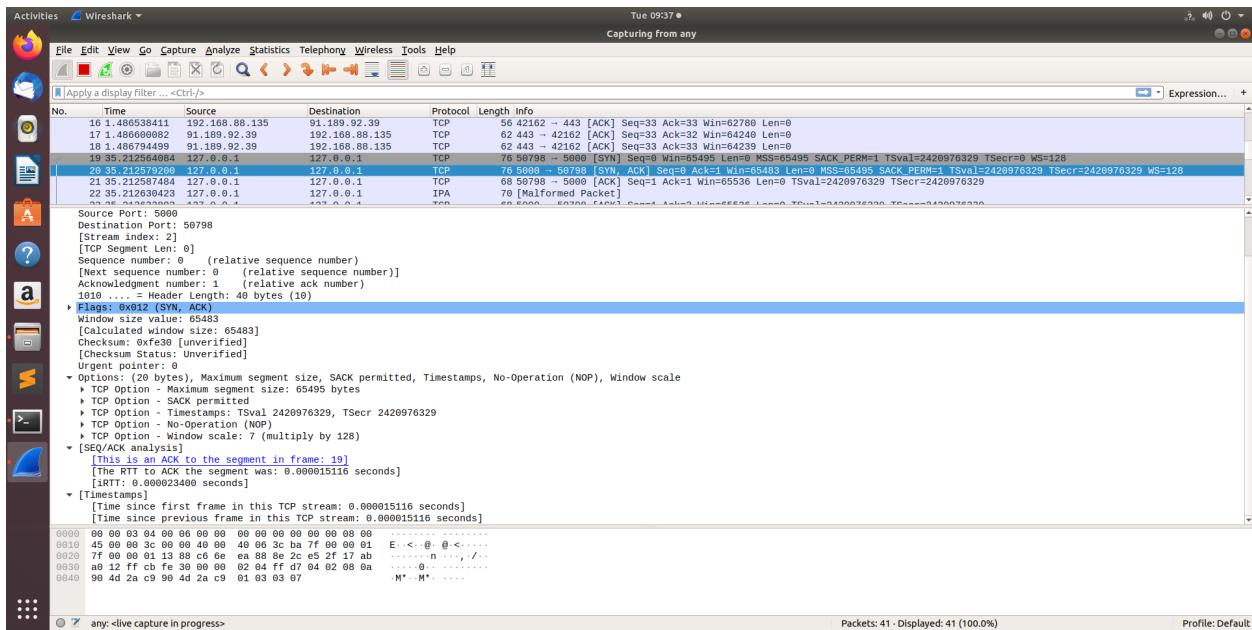


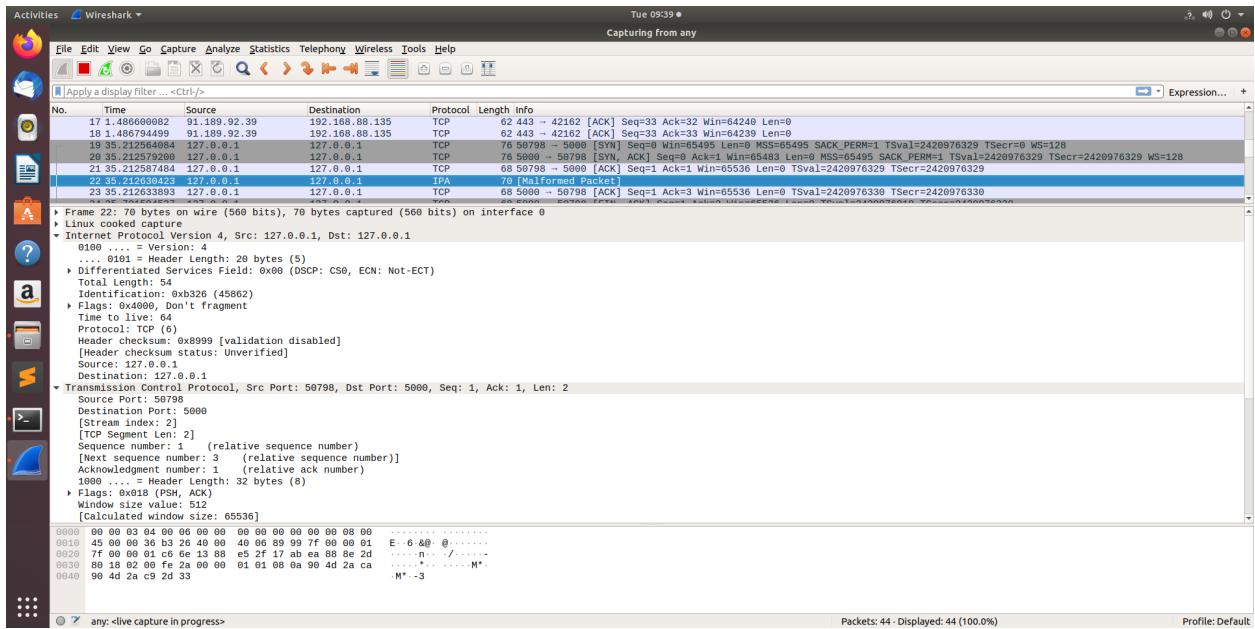
Solution 1- We will run the code for a timestamp of 2 minutes and analyze the packets we receive from server and client programs in Wireshark.



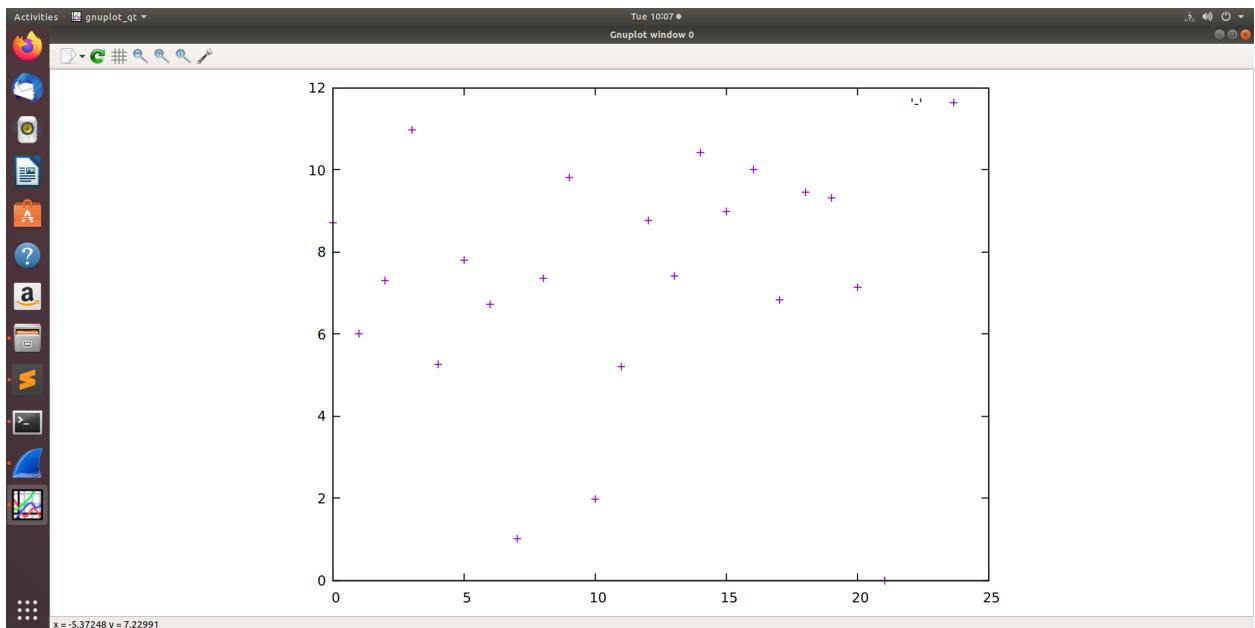
Now we will look into TCP,IPA packets of the local host to get a better understanding of the packets.



We see port number, destination port, ack no., checksum in the TCP .



This is an IPA packet. We see that somehow the packet has malfunctioned. This can be because of the fact that the checksum is wrong or the ack is wrong or the port is not free. The plot for aggregate throughput is as follows-

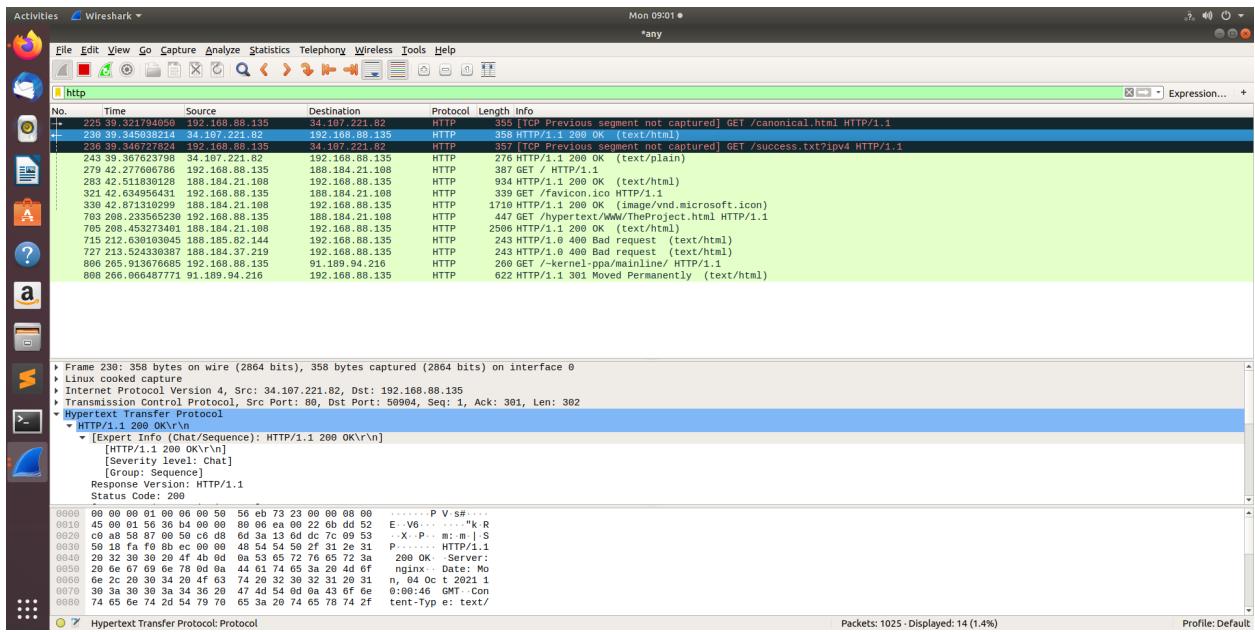


Solution 2- For each of the captured packets we got from Wireshark. We would be required to discuss the following from the packet details we obtained -

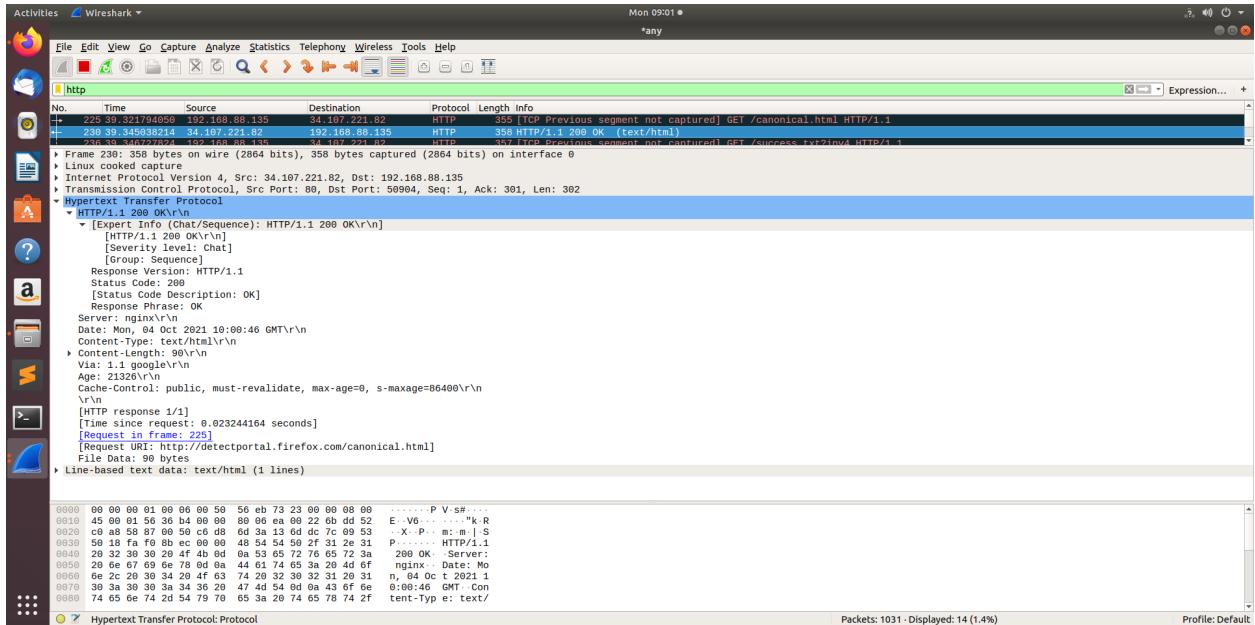
- HTTP packet type
- For HTTP request packets

- HTTP request type
- User-agent type
- HTTP request packet's URL
- Name and version of the webserver
- For HTTP response packets
- HTTP response code
- HTTP response description

The very first picture shows the http filtered packets which the system received . After this we will look into each type of packet and list the details that we were required to list from above.



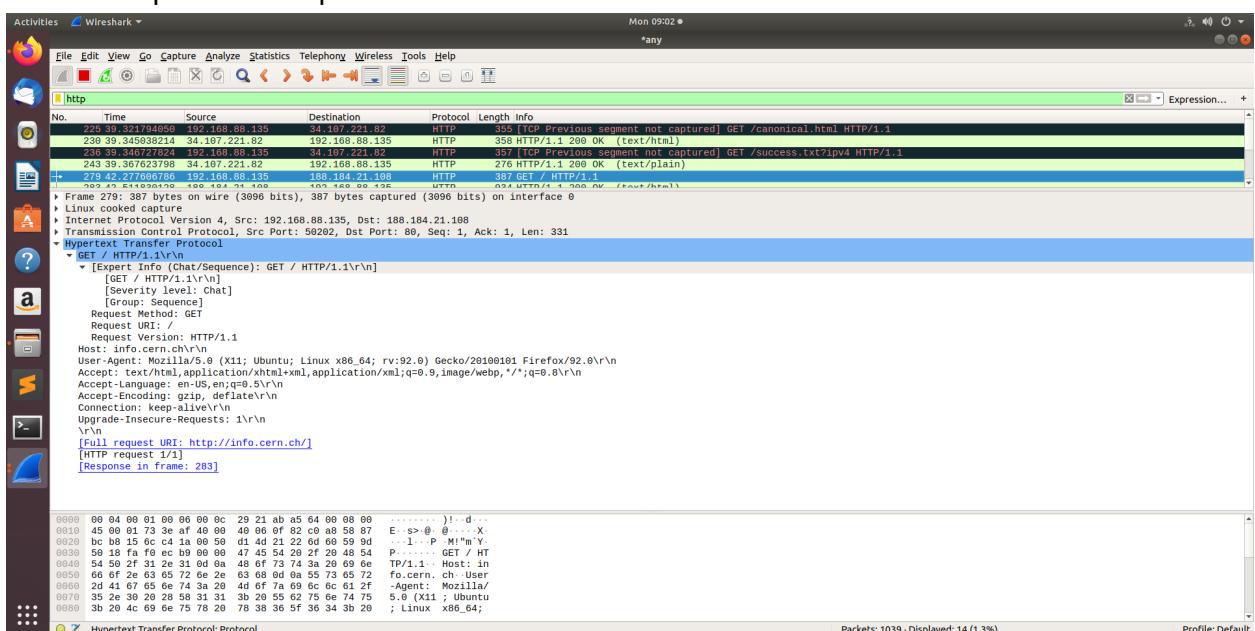
Now we see that there are certain type of http packets. We will go into the details of the packets that are not duplicates.



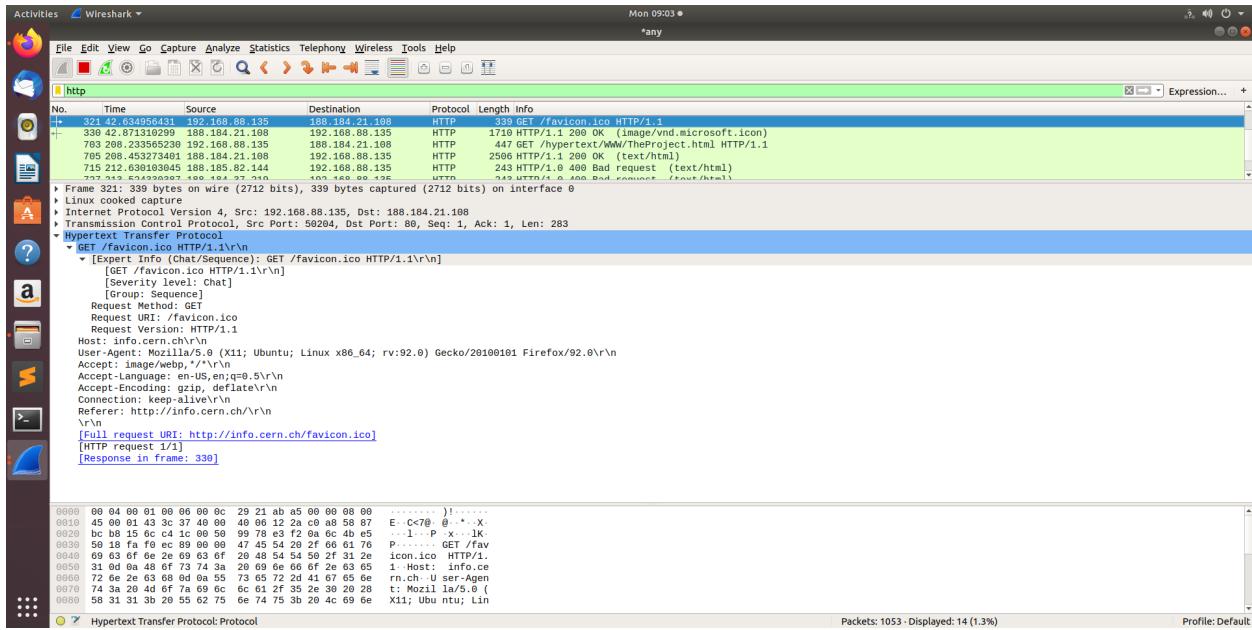
•HTTP packet type- RESPONSE

• For HTTP request packets

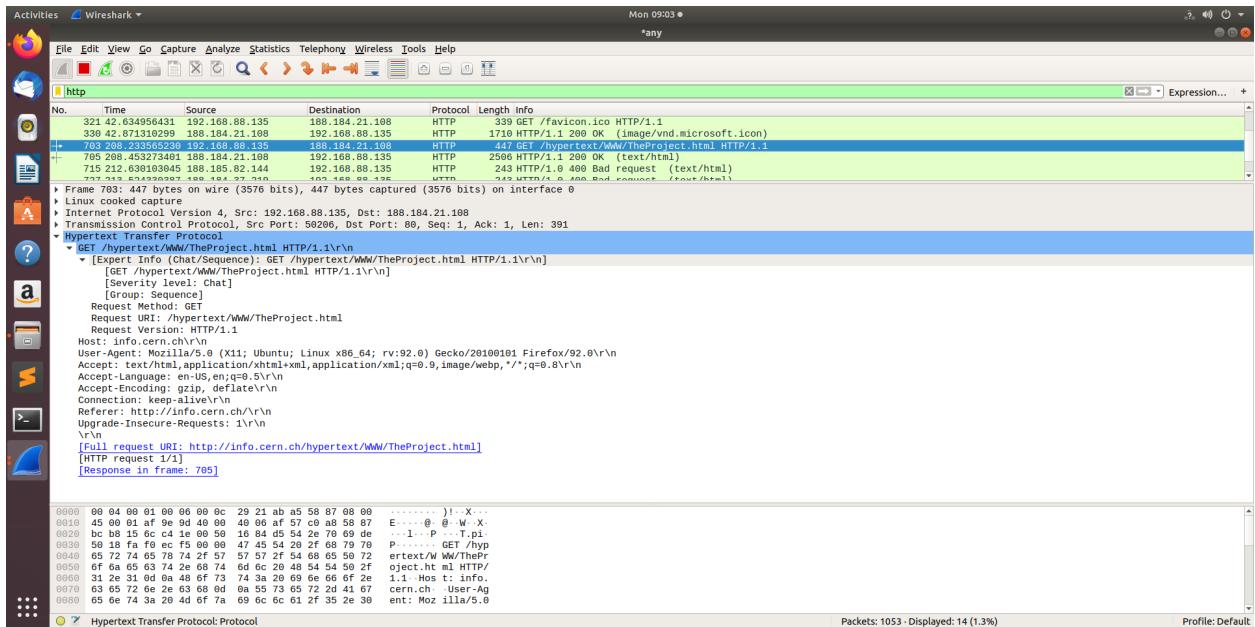
- HTTP request type-NA
- User-agent type-NA
- HTTP request packet's URL-<http://detectportal.firefox.com/canonical.html>
- Name and version of the webserver-nginx , version-NA
- For HTTP response packets
- HTTP response code-200
- HTTP response description-OK



- HTTP packet type- REQUEST
- For HTTP request packets
 - HTTP request type-GET
 - User-agent type-User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:92.0) Gecko/20100101 Firefox/92.0\r\n
 - HTTP request packet's URL-<http://info.cern.ch/>
 - Name and version of the webserver-NA
- For HTTP response packets
 - HTTP response code-NA
 - HTTP response description-NA



- HTTP packet type- REQUEST
- For HTTP request packets
 - HTTP request type-GET
 - User-agent type-User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:92.0) Gecko/20100101 Firefox/92.0\r\n
 - HTTP request packet's URL-<http://info.cern.ch/favicon.ico>
 - Name and version of the webserver-NA
- For HTTP response packets
 - HTTP response code-NA
 - HTTP response description-NA



•HTTP packet type- REQUEST

• For HTTP request packets

○ HTTP request type-GET

○ User-agent type-User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:92.0)

Gecko/20100101 Firefox/92.0\r\n

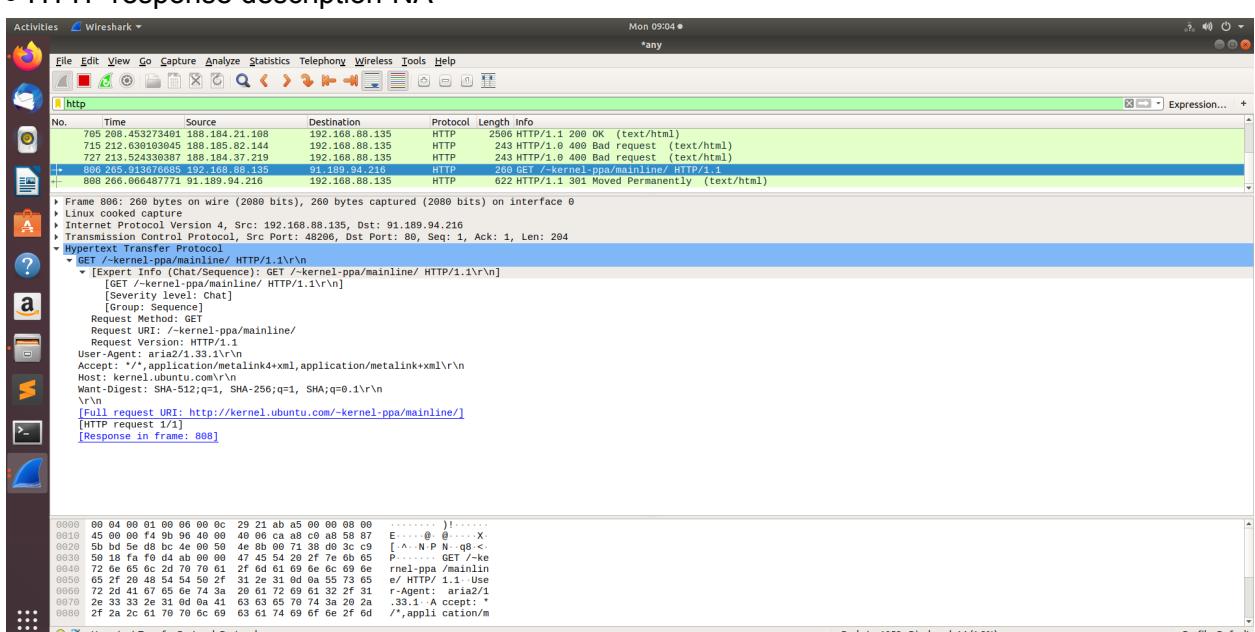
○ HTTP request packet's URL-<http://info.cern.ch/hypertext/WWW/The Project.html>

○ Name and version of the webserver-NA

• For HTTP response packets

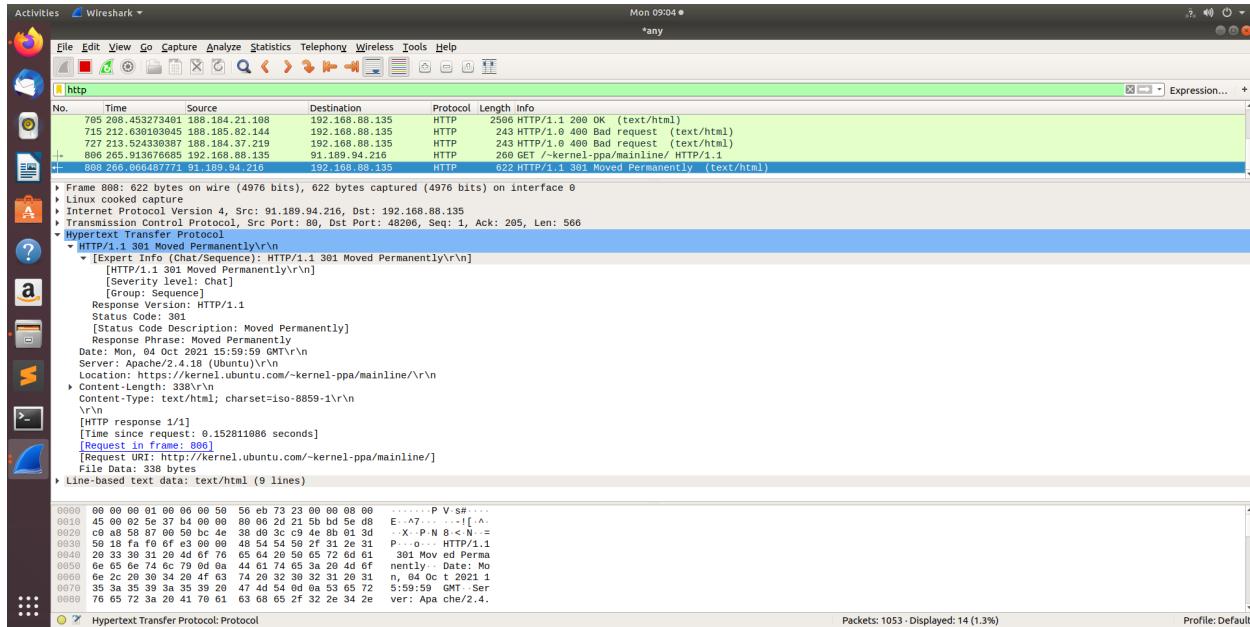
○ HTTP response code-NA

○ HTTP response description-NA



•HTTP packet type- REQUEST

- For HTTP request packets
 - HTTP request type-GET
 - User-agent type-User-Agent: aria2/1.33.1\r\n
 - HTTP request packet's URL-<http://kernel.ubuntu.com/~kernel-ppa/mainline/>
 - Name and version of the webserver-NA
- For HTTP response packets
 - HTTP response code-NA
 - HTTP response description-NA



- HTTP packet type- RESPONSE
- For HTTP request packets
 - HTTP request type-NA
 - User-agent type-User-Agent:NA
 - HTTP request packet's URL-NA
 - Name and version of the webserver-Apache/2.4.18(Ubuntu)\r\n
- For HTTP response packets
 - HTTP response code-301
 - HTTP response description-Moved Permanently

Solution 3- The ip addresses which I obtained from the whatismyip.com and from ifconfig are not the same. They are different from each other because of the following reason- THE site SHOWS the public ip of our network interface and the ifconfig command is showing us the private ip of our system.

WhatIsMyIP.com

- Speed Test
- IP Lookup
- Change IP
- Hide IP

Search ...

Sign Up

Login

IP Address Lookup

IP Whois Lookup

Tools

Investigate

Privacy

WiFi

Safety

Learn

My Public IPv4 is:
103.66.227.227

My Public IPv6 is:
Not Detected

My IP Location: New Delhi, DL IN

ISP: Daksh Broadband Services Pvt Ltd

My IP Information

```
snehubuntu@ubuntu:~$ ifconfig -a
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.88.135 netmask 255.255.255.0 broadcast 192.168.88.255
              inet6 fe80::2c:29ff:fe21:ab83 prefixlen 64 scoped_id 0x20<link>
        ether 00:0c:29:21:ab:83 txqueuelen 1000 (Ethernet)
          RX packets 252066 bytes 1624608 (1.5 MiB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 1678 bytes 214223 (214.2 kB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 5536
      inet 127.0.0.1 netmask 255.255.255.0
            inet6 ::1 prefixlen 128 scoped_id 0x0<host>
        loop txqueuelen 1000 (Local Loopback)
          RX packets 1005 bytes 81654 (81.6 kB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 1005 bytes 81654 (81.6 kB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

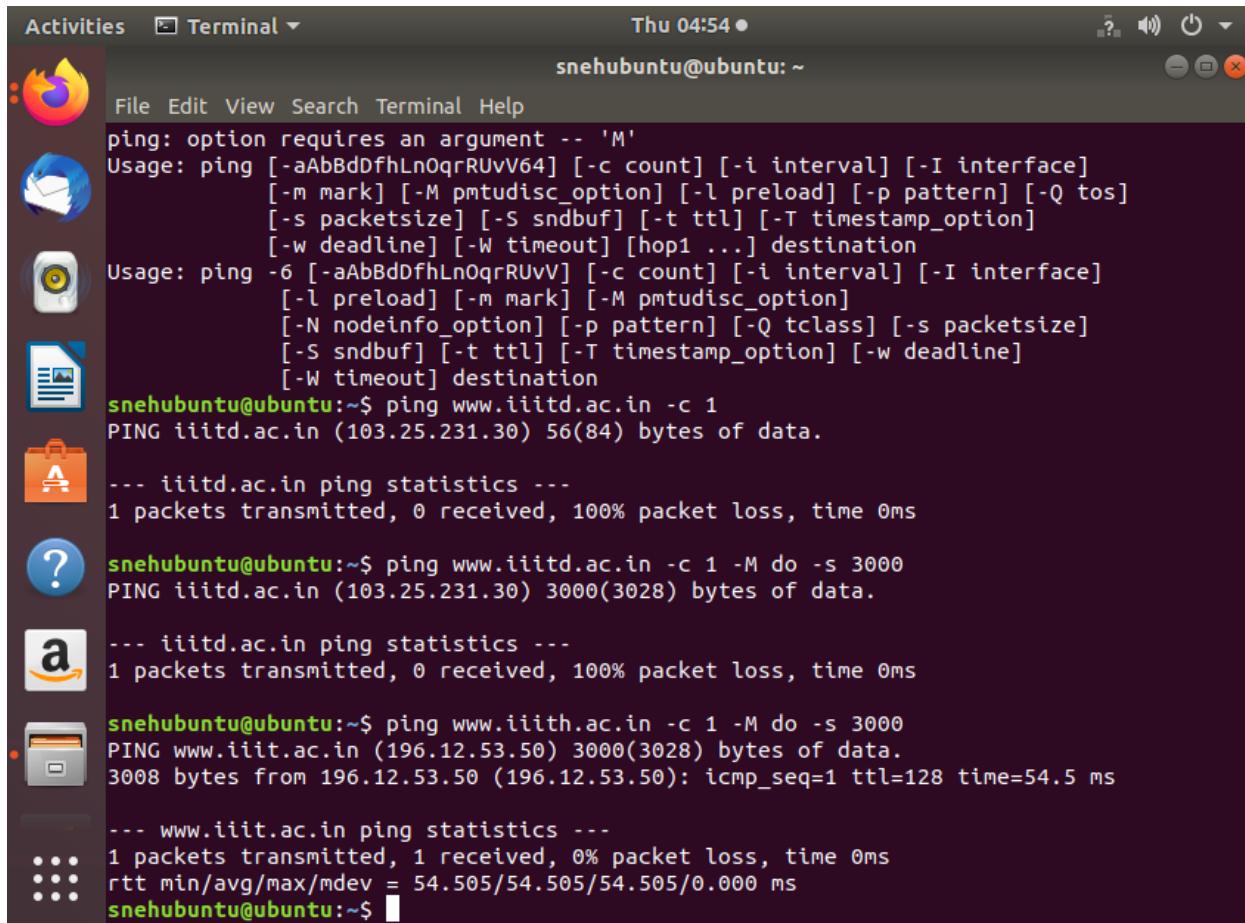
snehubuntu@ubuntu:~$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.88.135 netmask 255.255.255.0 broadcast 192.168.88.255
              inet6 fe80::2c:29ff:fe21:ab83 prefixlen 64 scoped_id 0x20<link>
        ether 00:0c:29:21:ab:83 txqueuelen 1000 (Ethernet)
          RX packets 2643 bytes 163583 (1.0 kB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 1699 bytes 216992 (216.9 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 scoped_id 0x0<host>
        loop txqueuelen 1000 (Local Loopback)
          RX packets 1011 bytes 82152 (82.1 kB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 1011 bytes 82152 (82.1 kB)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

```

Solution 4(a)- We can simply change the upper limit of mtu from 1500 which is the default value to 3000(3500 for any approximations).

```
snehubuntu@ubuntu:~$ ifconfig | grep mtu
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
snehubuntu@ubuntu:~$ ifconfig ens33 mtu 1000 up
SIOCSIFFLAGS: Operation not permitted
SIOCSIFFLAGS: Operation not permitted
snehubuntu@ubuntu:~$ sudo ifconfig ens33 mtu 1000 up
[sudo] password for snehubuntu:
snehubuntu@ubuntu:~$ ifconfig ens33 mtu 1000 up
SIOCSIFFLAGS: Operation not permitted
SIOCSIFFLAGS: Operation not permitted
snehubuntu@ubuntu:~$ ifconfig | grep mtu
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1000
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
snehubuntu@ubuntu:~$ sudo ifconfig ens33 mtu 3500 up
snehubuntu@ubuntu:~$ ping www.liitd.ac.in -c 1 -M do -s 3000
PING liitd.ac.in (103.25.231.30) 3000(3028) bytes of data.
```



A screenshot of a Ubuntu desktop environment. In the top bar, there is an 'Activities' button, a 'Terminal' button, the date and time 'Thu 04:54', and a user icon 'snehubuntu@ubuntu: ~'. Below the top bar is a dock with several icons: a browser, a file manager, a terminal, a system settings gear, a dash, and a user profile. The main area shows a terminal window with the following content:

```
File Edit View Search Terminal Help
ping: option requires an argument -- 'M'
Usage: ping [-aAbBdDfhLn0qrRUvV64] [-c count] [-i interval] [-I interface]
            [-m mark] [-M pmtdisc_option] [-l preload] [-p pattern] [-Q tos]
            [-s packetsize] [-S sndbuf] [-t ttl] [-T timestamp_option]
            [-w deadline] [-W timeout] [hop1 ...] destination
Usage: ping -6 [-aAbBdDfhLn0qrRUvV] [-c count] [-i interval] [-I interface]
            [-l preload] [-m mark] [-M pmtdisc_option]
            [-N nodeinfo_option] [-p pattern] [-Q tcclass] [-s packetsize]
            [-S sndbuf] [-t ttl] [-T timestamp_option] [-w deadline]
            [-W timeout] destination
snehubuntu@ubuntu:~$ ping www.iiitd.ac.in -c 1
PING iiitd.ac.in (103.25.231.30) 56(84) bytes of data.
--- iiitd.ac.in ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
snehubuntu@ubuntu:~$ ping www.iiitd.ac.in -c 1 -M do -s 3000
PING iiitd.ac.in (103.25.231.30) 3000(3028) bytes of data.
--- iiitd.ac.in ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
snehubuntu@ubuntu:~$ ping www.iiith.ac.in -c 1 -M do -s 3000
PING www.iiith.ac.in (196.12.53.50) 3000(3028) bytes of data.
3008 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=1 ttl=128 time=54.5 ms
--- www.iiith.ac.in ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 54.505/54.505/54.505/0.000 ms
snehubuntu@ubuntu:~$
```

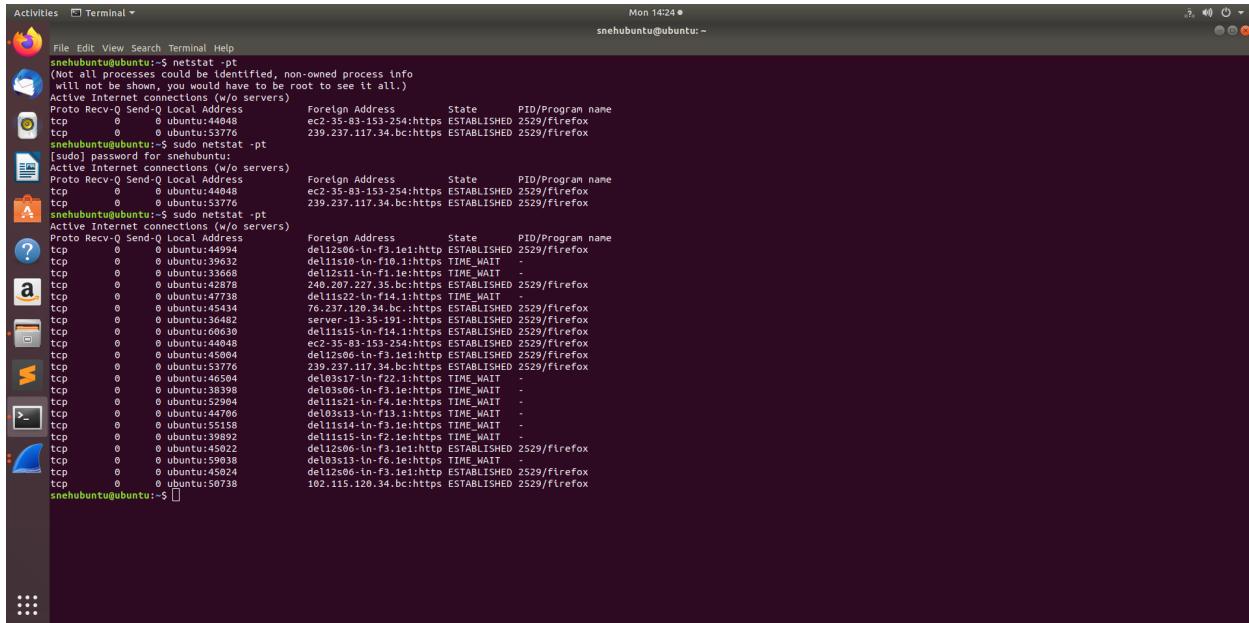
Command- sudo ifconfig ens33 mtu 3300 up

This changes the value of mtu to 3500. From this command we have simply increased the default size of mtu .

Command- ping www.iiith.ac.in -c 1 -M do -s 3000

This command helps us to send the packet of size 3000(-s) and in a single packet as we use (-c 1)

Solution 4(b)- For finding all the active tcp connections along with pid we will use command netstat with flag -pt



```
Mon 14:24 ●
snehubuntu@ubuntu:~$ netstat -pt
(Not all processes could be identified, non-owned process info
will not be shown, you would have to be root to see it all.)
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address          Foreign Address        State      PID/Program name
tcp     0      0  ubuntu:44994              ec2-35-81-153-254:https ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:44948              239.237.117.34.bc:https ESTABLISHED 2529/firefox
snehubuntu@ubuntu:~$ sudo netstat -pt
[sudo] password for snehubuntu:
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address          Foreign Address        State      PID/Program name
tcp     0      0  ubuntu:44994              delis206-in-f3.1.e1:http ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:44948              delis151-in-f1.1e:https TIME-WAIT -
tcp     0      0  ubuntu:33668              delis11-in-f1.1e:https TIME-WAIT -
tcp     0      0  ubuntu:42878              240.207.227.35.bc:https ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:47738              delis22-in-f14.1http TIME-WAIT -
tcp     0      0  ubuntu:45434              76.237.120.34.bc:.https ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:36482              server:13-35-191:.https ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:44940              delis13-in-f1.1e:https TIME-WAIT -
tcp     0      0  ubuntu:44848              ec2-35-81-153-254:https ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:45064              delis206-in-f3.1.e1:http ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:53776              239.237.117.34.bc:https ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:46504              del03s17-in-f22.1:https TIME-WAIT -
tcp     0      0  ubuntu:38398              del03s06-in-f3.1.e:https TIME-WAIT -
tcp     0      0  ubuntu:44944              delis15-in-f1.1e:https TIME-WAIT -
tcp     0      0  ubuntu:44766              del03s13-in-f13.1http TIME-WAIT -
tcp     0      0  ubuntu:55158              delis14-in-f3.1.e:https TIME-WAIT -
tcp     0      0  ubuntu:39892              delis15-in-f2.1e:https TIME-WAIT -
tcp     0      0  ubuntu:45022              del12s06-in-f3.1.e1:http ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:59038              del03s13-in-f6.1e:https TIME-WAIT -
tcp     0      0  ubuntu:44942              del12s08-in-f3.1.e1:http ESTABLISHED 2529/firefox
tcp     0      0  ubuntu:58738              102.115.120.34.bc:https ESTABLISHED 2529/firefox
snehubuntu@ubuntu:~$
```

Solution 5(a)- The following way can help us in getting an authoritative answer from nslookup . Setting query type as soa we get the name of an authoritative server. Now we will use nslookup with classroom along with the authoritative name of the server of the server to get authoritative answer from nslookup. We had to do all this because from nslookup we get a lot of answer from the cache and other information. Hence, to get an authoritative result we were required to do all this.

```

Activities Terminal Mon 11:34 ●
snehubuntu@ubuntu:~●

Non-authoritative answer:
google.com      nameserver = ns4.google.com.
google.com      nameserver = ns1.google.com.
google.com      nameserver = ns3.google.com.
google.com      nameserver = ns2.google.com.

Authoritative answers can be found from:
snehubuntu@ubuntu:~$ nslookup -q=ns example.com
Server:      127.0.0.53
Address:    127.0.0.53#53

Non-authoritative answer:
example.com    nameserver = a.lana-servers.net.
example.com    nameserver = b.lana-servers.net.

Authoritative answers can be found from:
snehubuntu@ubuntu:~$ nslookup
> set querytype=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 = 68521490
                refresh = 900
                retry = 900
                expire = 1800
                minimum = 60

Authoritative answers can be found from:
> MCnchubuntu@ubuntu:~$ nslookup classroom.google.com ns1.googleServer
nslookup: couldn't get address for 'ns1.googleServer': not found
snehubuntu@ubuntu:~$ nslookup classroom.google.com ns1.google.com
Server:      ns1.google.com
Address:    216.239.32.10#53

Name:   classroom.google.com
Address: 142.250.194.46
Name:   classroom.google.com
Address: 2404:6800:4002:81ff:200e

snehubuntu@ubuntu:~$ 

```

Solution 5(b)- We will get the TTL on local dns through dns. To get authoritative result we will use the -soa tag. The TTL shows 300 seconds . That means after 50 minutes the entry will expire.

```

Activities Terminal Mon 12:05 ●
snehubuntu@ubuntu:~●

;; ANSWER SECTION:
google.com.      5     IN      A       172.217.27.174
;; Query time: 10 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 12:01:36 PDT 2021
;; MSG SIZE rcvd: 55

snehubuntu@ubuntu:~$ dig mx classroom.google.com @ns1.google.com

; <>> DIG 9.11.3-ubuntui.15-Ubuntu <>> mx classroom.google.com @ns1.google.com
;; global options: +cd
;; Got answer:
;; ->HEADER<-: opcode: QUERY, status: NOERROR, id: 2449
;; flags: qr aa rd; QUERY: 1, ANSWER: 5, AUTHORITY: 0, ADDITIONAL: 11
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags: udp: 512
;; QUESTION SECTION:
;classroom.google.com.      IN      MX

;; ANSWER SECTION:
classroom.google.com. 600  IN      MX      5 gmr-smtp-in.l.google.com.
classroom.google.com. 600  IN      MX      30 alt3.gmr-smtp-in.l.google.com.
classroom.google.com. 600  IN      MX      10 alt1.gmr-smtp-in.l.google.com.
classroom.google.com. 600  IN      MX      20 alt2.gmr-smtp-in.l.google.com.
classroom.google.com. 600  IN      MX      40 alt4.gmr-smtp-in.l.google.com.

;; ADDITIONAL SECTION:
gmr-smtp-in.l.google.com. 380  IN      A       172.217.194.14
gmr-smtp-in.l.google.com. 380  IN      AAAA     2403:190:4001:c04::e
alt3.gmr-smtp-in.l.google.com. 380  IN      A       64.233.171.14
alt3.gmr-smtp-in.l.google.com. 380  IN      AAAA     2607:f8b0:4003:c15::e
alt1.gmr-smtp-in.l.google.com. 380  IN      A       173.194.202.14
alt1.gmr-smtp-in.l.google.com. 380  IN      AAAA     2607:f8b0:400e:c00::e
alt2.gmr-smtp-in.l.google.com. 380  IN      A       142.250.141.14
alt2.gmr-smtp-in.l.google.com. 380  IN      AAAA     2607:f8b0:4023:c0b::e
alt4.gmr-smtp-in.l.google.com. 380  IN      A       142.250.152.14
alt4.gmr-smtp-in.l.google.com. 380  IN      AAAA     2607:f8b0:4001:c56::e

;; Query time: 73 msec
;; SERVER: 216.239.32.10#53(216.239.32.10)
;; WHEN: Mon Oct 04 12:03:50 PDT 2021
;; MSG SIZE rcvd: 383

snehubuntu@ubuntu:~$ 

```

Solution 6(a)- In the first part we will try to see all the intermediate hosts to iiith.ac.in.

Total number of intermediate hosts including the * host is **10**

1. Average Latency 344.33 ms
2. Average Latency 3.33 ms
3. * host
4. Average Latency 10.66 ms

5. Average Latency 34.66 ms
6. Average Latency 15 ms
7. Average Latency 384 ms
8. Average Latency 31.66 ms
9. Average latency 48 ms
10. Average latency 54.33 ms

```
Windows PowerShell [Version 10.0.19043.1237]
(c) Microsoft Corporation. All rights reserved.

C:\Users\SNEH SUMAN>tracert www.iiith.ac.in

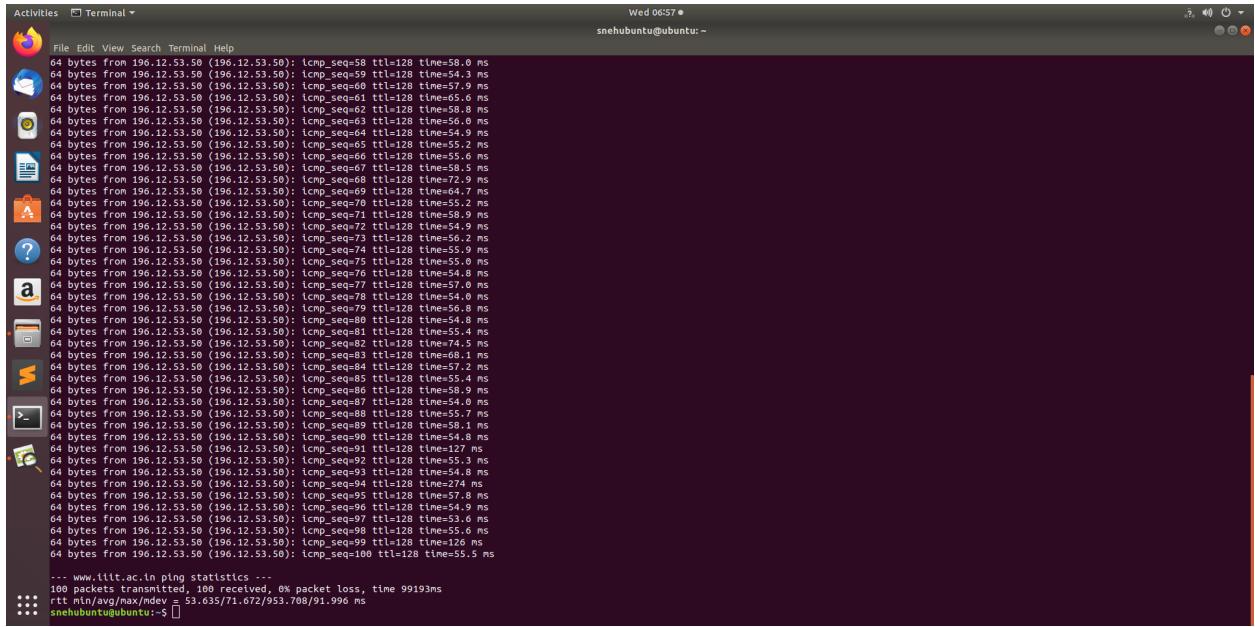
Tracing route to www.iiith.ac.in [196.12.53.50]
over a maximum of 30 hops:
  1  1029 ms    2 ms    2 ms  192.168.0.1
  2  *          4 ms    3 ms  10.255.255.39
  3  *          9 ms   12 ms  24 ms  103.66.224.17
  4  *          *       *       Request timed out.
  5  6 ms    6 ms  20 ms  136.232.16.77.static.jio.com [136.232.16.77]
  6  32 ms   38 ms  34 ms  172.16.22.117
  7  64 ms   1034 ms  103 ms  172.16.2.231
  8  30 ms   31 ms  27 ms  172.16.2.42
  9  40 ms   66 ms  38 ms  172.16.2.26
 10  54 ms   54 ms  55 ms  196.12.53.50

Trace complete.

C:\Users\SNEH SUMAN>
```

Solution 6(b)- Here we will calculate average latency after 100 pings to the iiith server.

```
File Edit View Search Terminal Help
snehubuntu@ubuntu:~$ ping -l 600 -n 100 www.iiith.ac.in
ping: cannot set value > 3
snehubuntu@ubuntu:~$ ping -c 100 www.iiith.ac.in
PING www.iiith.ac.in (196.12.53.50) 56(84) bytes of data.
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=1 ttl=128 time=55.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=2 ttl=128 time=54.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=3 ttl=128 time=55.5 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=4 ttl=128 time=57.7 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=5 ttl=128 time=55.7 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=6 ttl=128 time=54.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=7 ttl=128 time=54.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=8 ttl=128 time=55.5 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=9 ttl=128 time=55.5 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=10 ttl=128 time=55.4 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=11 ttl=128 time=56.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=12 ttl=128 time=60.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=13 ttl=128 time=55.2 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=14 ttl=128 time=55.3 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=15 ttl=128 time=55.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=16 ttl=128 time=79.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=17 ttl=128 time=54.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=18 ttl=128 time=55.5 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=19 ttl=128 time=57.1 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=20 ttl=128 time=55.3 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=21 ttl=128 time=55.5 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=22 ttl=128 time=65.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=23 ttl=128 time=78.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=24 ttl=128 time=55.1 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=25 ttl=128 time=57.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=26 ttl=128 time=55.7 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=27 ttl=128 time=55.7 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=28 ttl=128 time=55.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=29 ttl=128 time=57.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=30 ttl=128 time=54.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=31 ttl=128 time=54.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=32 ttl=128 time=55.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=33 ttl=128 time=58.4 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=34 ttl=128 time=95.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=35 ttl=128 time=107 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=36 ttl=128 time=55.4 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=37 ttl=128 time=57.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=38 ttl=128 time=55.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=39 ttl=128 time=70.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=40 ttl=128 time=67.4 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=41 ttl=128 time=55.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=42 ttl=128 time=54.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=43 ttl=128 time=54.2 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=44 ttl=128 time=55.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=45 ttl=128 time=55.1 ms
```



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "Terminal" and it displays the command "ping www.iitt.ac.in". The output of the ping command is shown, detailing 100 packets transmitted, 100 received, 0% packet loss, and an average round-trip time (rtt) of 53.635 ms. The terminal window is located at the bottom of the screen, and the desktop background is visible above it.

```
File Edit View Search Terminal Help
Activities Terminal *
Wed 06:57 *
snehubuntu@ubuntu: ~
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=58 ttl=128 time=50.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=59 ttl=128 time=54.3 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=60 ttl=128 time=57.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=61 ttl=128 time=65.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=62 ttl=128 time=58.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=63 ttl=128 time=56.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=64 ttl=128 time=55.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=65 ttl=128 time=55.2 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=66 ttl=128 time=55.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=67 ttl=128 time=58.5 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=68 ttl=128 time=72.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=69 ttl=128 time=55.2 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=70 ttl=128 time=58.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=71 ttl=128 time=58.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=72 ttl=128 time=54.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=73 ttl=128 time=56.2 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=74 ttl=128 time=55.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=75 ttl=128 time=54.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=76 ttl=128 time=57.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=77 ttl=128 time=57.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=78 ttl=128 time=54.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=79 ttl=128 time=56.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=80 ttl=128 time=54.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=81 ttl=128 time=55.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=82 ttl=128 time=74.5 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=83 ttl=128 time=60.1 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=84 ttl=128 time=57.2 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=85 ttl=128 time=55.4 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=86 ttl=128 time=58.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=87 ttl=128 time=54.7 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=88 ttl=128 time=55.7 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=89 ttl=128 time=58.1 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=90 ttl=128 time=54.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=91 ttl=128 time=127 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=92 ttl=128 time=55.3 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=93 ttl=128 time=54.0 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=94 ttl=128 time=57.4 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=95 ttl=128 time=57.8 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=96 ttl=128 time=54.9 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=97 ttl=128 time=53.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=98 ttl=128 time=55.6 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=99 ttl=128 time=126 ms
64 bytes from 196.12.53.50 (196.12.53.50): icmp_seq=100 ttl=128 time=55.5 ms
...
... www.iitt.ac.in ping statistics ...
100 packets transmitted, 100 received, 0% packet loss, time 99193ms
rtt min/avg/max/mdev = 53.635/71.672/953.708/91.996 ms
snehubuntu@ubuntu: ~
```

The average latency will be equal to = Sum total of all the timings we have got from the 100 ping commands from our side/100=71.672 ms

Solution 6(c)- NO, Average Latency from part a) is 92.597 ms. This is not the same with b). This is because latency is the measurement of RTT while ping (ICMP services) is a one-way command .Also the fact that in part a) we have 10 different hosts from which the system needs to establish the connections. This will take more time as new connections are to be established each time. On the other hand when we establish a connection from a single host even 100 times. The connection is easier as the system has already established it in the first go. Hence, less time. Hence, they are not equal

Solution 6(d)-NO, Max average latency is not the same as part b.This is because latency is the measurement of RTT while ping (ICMP services) is a one-way command. Hence, they can't be similar.

Solution 6(e)- The reverse dns lookup are as follows

```
Activities Terminal Mon 14:33 ●
snehubuntu@ubuntu:~$ dig -x 192.168.0.1
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 192.168.0.1
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 33491
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;1.0.168.192.in-addr.arpa. IN PTR
;;
;; Query time: 9 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:29:18 PDT 2021
;; MSG SIZE rcvd: 53
snehubuntu@ubuntu:~$ dig -x 10.255.255.39
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 10.255.255.39
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 50835
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;39.255.255.10.in-addr.arpa. IN PTR
;;
;; Query time: 6 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:30:51 PDT 2021
;; MSG SIZE rcvd: 55
snehubuntu@ubuntu:~$ dig -x 103.66.224.17
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 103.66.224.17
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 33882
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;17.224.66.103.in-addr.arpa. IN PTR
;;
;; Query time: 9 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:30:51 PDT 2021
;; MSG SIZE rcvd: 55
snehubuntu@ubuntu:~$ dig -x 136.232.16.77
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 136.232.16.77
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NOERROR, id: 3047
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;77.16.232.136.in-addr.arpa. IN PTR
;;
;; ANSWER SECTION:
;77.16.232.136.in-addr.arpa. 5 IN PTR 136.232.16.77.static.jlo.com.
;;
;; Query time: 7 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:31:33 PDT 2021
;; MSG SIZE rcvd: 97
snehubuntu@ubuntu:~$ dig -x 172.16.22.117
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 172.16.22.117
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 32773
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;117.22.16.172.in-addr.arpa. IN PTR
;;
;; Query time: 8 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:31:52 PDT 2021
;; MSG SIZE rcvd: 55
snehubuntu@ubuntu:~$ dig -x 172.25.115.31
```

```
Activities Terminal Mon 14:33 ●
snehubuntu@ubuntu:~$ dig -x 103.66.224.17
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 103.66.224.17
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 33882
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;17.224.66.103.in-addr.arpa. IN PTR
;;
;; Query time: 8 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:31:33 PDT 2021
;; MSG SIZE rcvd: 55
snehubuntu@ubuntu:~$ dig -x 136.232.16.77
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 136.232.16.77
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NOERROR, id: 3047
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;77.16.232.136.in-addr.arpa. IN PTR
;;
;; ANSWER SECTION:
;77.16.232.136.in-addr.arpa. 5 IN PTR 136.232.16.77.static.jlo.com.
;;
;; Query time: 7 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:31:33 PDT 2021
;; MSG SIZE rcvd: 97
snehubuntu@ubuntu:~$ dig -x 172.16.22.117
; <>> DIG 9.11.3-1ubuntu1.15-Ubuntu <>> -x 172.16.22.117
;; global options: +cmd
;; Got answer:
;; -->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 32773
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;;
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;117.22.16.172.in-addr.arpa. IN PTR
;;
;; Query time: 8 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:31:52 PDT 2021
;; MSG SIZE rcvd: 55
snehubuntu@ubuntu:~$ dig -x 172.25.115.31
```

```

Activities Terminal Mon 14:34
snehubuntu@ubuntu:~$ dig -x 172.25.115.31
;; WHEN: Mon Oct 04 14:31:52 PDT 2021
;; MSG SIZE rcvd: 55
snehubuntu@ubuntu:~$ dig -x 172.16.2.42
;; global options: <ndn>
;; Got answer:
;; ->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 1888
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;31.115.25.172.in-addr.arpa. IN PTR
;; Query time: 6 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:32:03 PDT 2021
;; MSG SIZE rcvd: 55
snehubuntu@ubuntu:~$ dig -x 172.16.2.26
;; global options: <ndn>
;; Got answer:
;; ->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 30984
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;42.2.16.172.in-addr.arpa. IN PTR
;; Query time: 8 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:32:13 PDT 2021
;; MSG SIZE rcvd: 53
snehubuntu@ubuntu:~$ dig -x 172.16.2.26
;; global options: <ndn>
;; Got answer:
;; ->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 34689
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
Activities Terminal Mon 14:35
snehubuntu@ubuntu:~$ dig -x 172.16.2.26
;; global options: <ndn>
;; Got answer:
;; ->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 34689
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;42.2.16.172.in-addr.arpa. IN PTR
;; Query time: 8 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:32:13 PDT 2021
;; MSG SIZE rcvd: 53
snehubuntu@ubuntu:~$ dig -x 196.12.53.50
;; global options: <ndn>
;; Got answer:
;; ->HEADER<> opcode: QUERY, status: NXDOMAIN, id: 21546
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, Flags: udp: 65494
;; QUESTION SECTION:
;50.53.12.196.in-addr.arpa. IN PTR
;; Query time: 486 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 04 14:32:26 PDT 2021
;; MSG SIZE rcvd: 54
snehubuntu@ubuntu:~$ 

```

Solution 7- We can get 100% packet loss from loopback addr.(127.0.0.1) if we simply disable the ping (ICMP ECHO).

```

snehubuntu@ubuntu:~$ sudo sysctl -w net.ipv4.icmp_echo_ignore_all=1
net.ipv4.icmp_echo_ignore_all = 1
snehubuntu@ubuntu:~$ 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 ...
16 packets transmitted, 0 received, 100% packet loss, time 15359ms
snehubuntu@ubuntu:~$ ping -c 50 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
... 127.0.0.1 ping statistics ...
50 packets transmitted, 0 received, 100% packet loss, time 50174ms
snehubuntu@ubuntu:~$ 

```

Command- `sudo systemctl -w net.ipv4.icmp_echo_ignore_all= wehn` set to 1 disables the ping(ICMP ECHO) and when set to 0 enables the ping.