COL-334/672 (COMPUTER NETWORKS)

ASSIGNMENT 1

1 NETWORKING TOOLS

a. IP address of the machine (basically the IP address of the interface connected to WiFi or Ethernet) can be found directly by using **ipconfig** command in windows.
On connecting to different Internet service providers (ISPs) or even different devices the IP address of the interface is changed as this IP address is not of our pc but is the IP address of the network we are connected to.

IP address using Airtel Broadband: 169.254.48.17

```
Connection-specific DNS Suffix  . :
IPv6 Address. . . . . . . . . . . : 2401:4900:5d15:acf4:ec0e:67cd:ee2d:3011
Temporary IPv6 Address. . . . . . : 2401:4900:5d15:acf4:4dfb:f323:5a57:72e7
Link-local IPv6 Address . . . . . : fe80::ec0e:67cd:ee2d:3011%14
Autoconfiguration IPv4 Address. . : 169.254.48.17
Subnet Mask . . . . . . . . . . . : 255.255.0.0
Default Gateway . . . . . . . . . : fe80::5877:9aff:fecf:45b9%14
```

Ip address using Airtel Mobile Hotspot: 169.254.185.83

```
Connection-specific DNS Suffix  . :
IPv6 Address. . . . . . . . . . . : 2402:3a80:1bd4:9b81:d8e6:68f:adf9:b953
Temporary IPv6 Address. . . . . . : 2402:3a80:1bd4:9b81:fd82:6696:13d9:fe59
Link-local IPv6 Address . . . . . : fe80::d8e6:68f:adf9:b953%14
Autoconfiguration IPv4 Address. . : 169.254.185.83
Subnet Mask . . . . . . . . . . . : 255.255.0.0
Default Gateway . . . . . . . . . : fe80::60af:9fff:fee9:6e0c%14
```

b. IP address associated with www.google.com and www.facebook.com can be found using **nslookup** command in windows.

IP address of www.google.com using Default server: 172.217.161.4
IP address of www.facebook.com using Default server: 157.240.16.35

```
C:\Users\HARIKESH>nslookup
Default Server:  UnKnown
Address:  2401:4900:5d15:acf4::dc

> www.google.com
Server:  UnKnown
Address:  2401:4900:5d15:acf4::dc

Non-authoritative answer:
Name:    www.google.com
Addresses:  2404:6800:4002:807::2004
          172.217.161.4

> www.facebook.com
Server:  UnKnown
Address:  2401:4900:5d15:acf4::dc

Non-authoritative answer:
Name:    star-mini.c10r.facebook.com
Addresses:  2a03:2880:f12f:83:face:b00c:0:25de
          157.240.16.35
Aliases:  www.facebook.com
```

Now on using some Open DNS servers from the web the IP address of both of these domain names changes. One important thing to note is that we get response from these open servers only i.e. if we try to obtain IP address of these sites using any private server we will not get any response.

IP address of www.google.com using dns.google.com server: 142.250.182.164

IP address of www.facebook.com using dns.opendns.com server: 157.240.198.35

IP address of www.facebook.com if we try it using some private server: No response

```
C:\Users\HARIKESH>nslookup www.google.com 8.8.8.8
Server:  dns.google
Address:  8.8.8.8

Non-authoritative answer:
Name:    www.google.com
Addresses:  2404:6800:4002:81e::2004
          142.250.182.164


C:\Users\HARIKESH>nslookup www.facebook.com 253.112.112.112
Server:  UnKnown
Address:  253.112.112.112

*** UnKnown can't find www.facebook.com: No response from server

C:\Users\HARIKESH>nslookup www.facebook.com 208.67.220.220
Server:  dns.opendns.com
Address:  208.67.220.220

Non-authoritative answer:
Name:    star-mini.c10r.facebook.com
Addresses:  2a03:2880:f144:82:face:b00c:0:25de
          157.240.198.35
Aliases:  www.facebook.com
```

c. For pinging the IP address of www.iitd.ac.in we can directly use the **ping** command in windows. Directly using **>>ping www.iitd.ac.in** gives us the required results.
Using the command with -l flag **>>ping -l 230 www.iitd.ac.in** chances the packet size to 230 bytes and the default size is 32 bytes.
Using the command with -i flag **>>ping -i 150 www.iitd.ac.in** changes the TTL values and one important thing to note is that the TTL value shown after executing the command is the TTL value of the packets received and is thus not controlled by us but is defined by server while the TTL value we are setting is the TTL values of packets sent.

For finding the maximum size of the ping packet that we can send on www.iitd.ac.in we just start increasing the size of packets using -l flag and then narrow down the range and try to find the exact ping packet size in bytes that we are able to send and it is nearly 35000 bytes and it varies every time but is closely near 35000 bytes. (One of these results is shown in the figure below).
Does this packet size same for all other domains? Simply no, because as we try to increase size of ping packets of www.google.com and www.facebook.com we see that the max size of ping packet that we can send on www.goole.com and www.facebook.com is very much less than that of www.iitd.ac.in. One of the reasons why the maximum ping packet size changes with different domains is that these are the ethernet protocols and can depend on the domains itself like what maximum data flow they are allowing.

Pinging the IP address of www.iitd.ac.in with different packet sizes, TTL values

```
C:\Users\HARIKESH>ping www.iitd.ac.in

Pinging www.iitd.ac.in [103.27.9.24] with 32 bytes of data:
Reply from 103.27.9.24: bytes=32 time=50ms TTL=50
Reply from 103.27.9.24: bytes=32 time=219ms TTL=50
Reply from 103.27.9.24: bytes=32 time=278ms TTL=50
Reply from 103.27.9.24: bytes=32 time=62ms TTL=50

Ping statistics for 103.27.9.24:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 50ms, Maximum = 278ms, Average = 152ms

C:\Users\HARIKESH>ping -l 230 www.iitd.ac.in

Pinging www.iitd.ac.in [103.27.9.24] with 230 bytes of data:
Reply from 103.27.9.24: bytes=230 time=63ms TTL=50
Reply from 103.27.9.24: bytes=230 time=494ms TTL=50
Reply from 103.27.9.24: bytes=230 time=35ms TTL=50
Reply from 103.27.9.24: bytes=230 time=79ms TTL=50

Ping statistics for 103.27.9.24:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 35ms, Maximum = 494ms, Average = 167ms

C:\Users\HARIKESH>ping -i 150 www.iitd.ac.in

Pinging www.iitd.ac.in [103.27.9.24] with 32 bytes of data:
Reply from 103.27.9.24: bytes=32 time=879ms TTL=50
Reply from 103.27.9.24: bytes=32 time=947ms TTL=50
Reply from 103.27.9.24: bytes=32 time=439ms TTL=50
Reply from 103.27.9.24: bytes=32 time=43ms TTL=50

Ping statistics for 103.27.9.24:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 43ms, Maximum = 947ms, Average = 577ms
```

I Finding the maximum ping packet size that can be sent on www.iitd.ac.in (actually range)

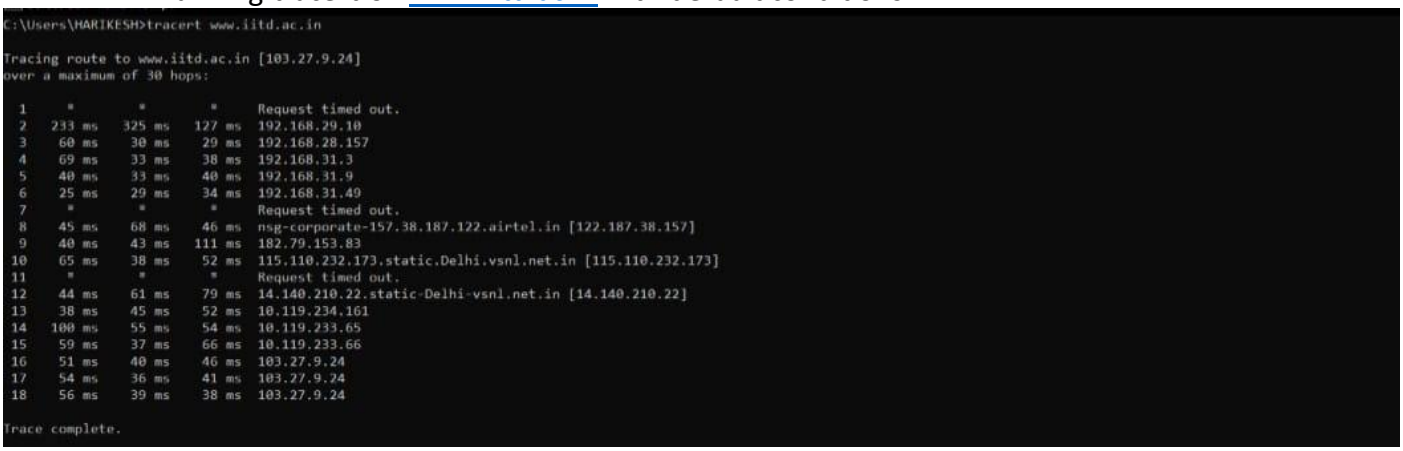
II Comparing the maximum packet size with different other domains like www.google.com

```
C:\Users\HARIKESH>ping 35500 www.iitd.ac.in
Bad parameter www.iitd.ac.in.

C:\Users\HARIKESH>ping -l 35500 www.iitd.ac.in

Pinging www.iitd.ac.in [103.27.9.24] with 35500 bytes of data:
Reply from 103.27.9.24: bytes=35500 time=205ms TTL=50
Reply from 103.27.9.24: bytes=35500 time=154ms TTL=50
Reply from 103.27.9.24: bytes=35500 time=168ms TTL=50
Reply from 103.27.9.24: bytes=35500 time=724ms TTL=50

Ping statistics for 103.27.9.24:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 154ms, Maximum = 724ms, Average = 312ms

C:\Users\HARIKESH>ping -l 36000 www.iitd.ac.in

Pinging www.iitd.ac.in [103.27.9.24] with 36000 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 103.27.9.24:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

```
C:\Users\HARIKESH>ping -l 2000 www.google.com

Pinging www.google.com [2404:6800:4002:81e::2004] with 2000 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 2404:6800:4002:81e::2004:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

d. Tracerouting of www.iitd.ac.in can be done in windows using **tracert** command.
One of my ISP was blocking packets on the path to www.iitd.ac.in hence i have tracerouted www.iitd.ac.in using only 1 ISP provider while ran traceroute on www.google.com using other both ISP providers.
If some paths default to IPV6 we can force tracerout to use IPV4 using -4 flag in the command and vice-verca. In case of www.iitd.ac.in it was by default all IPV4 hence I used this in www.google.com

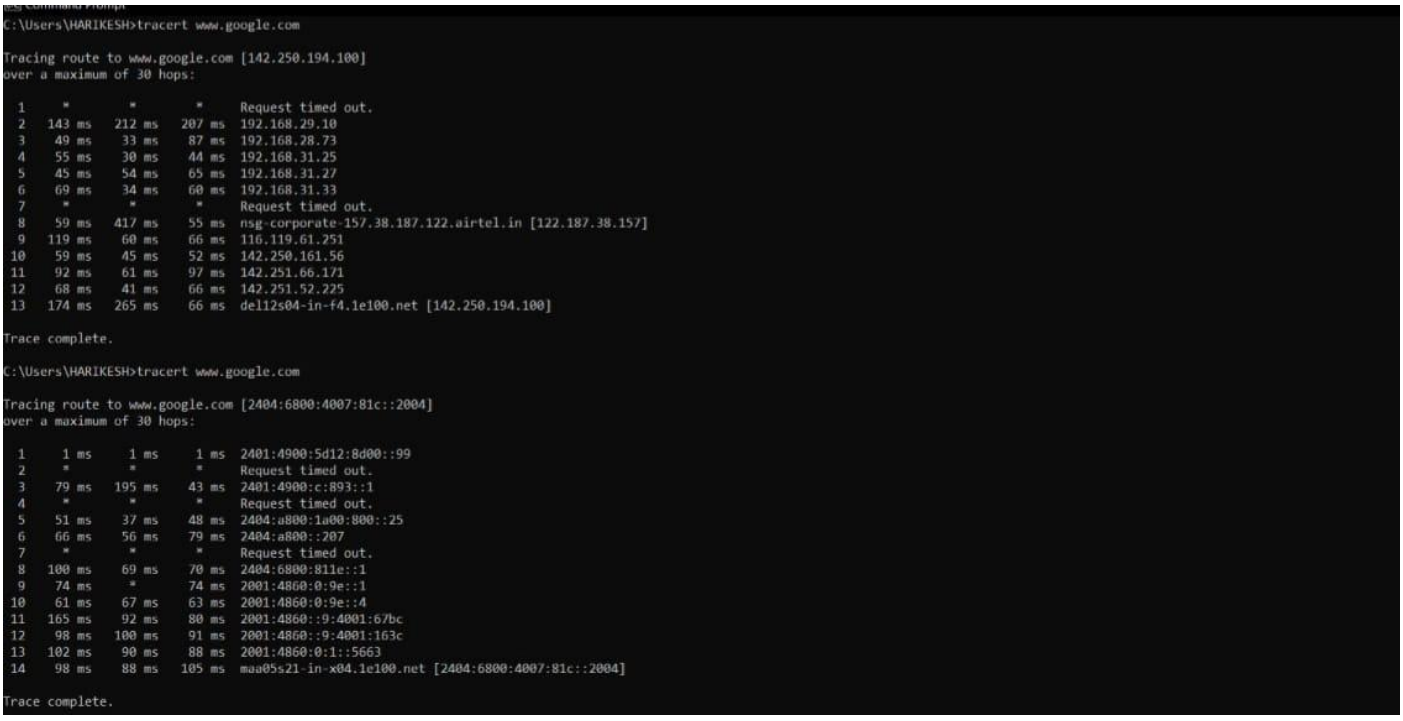
Running tracert on www.iitd.ac.in with default conditions



```
C:\Users\HARIKESH>tracert www.iitd.ac.in

Tracing route to www.iitd.ac.in [103.27.9.24]
over a maximum of 30 hops:

  1     *        *        *     Request timed out.
  2   233 ms   325 ms   127 ms  192.168.29.10
  3    60 ms    30 ms    29 ms  192.168.28.157
  4    69 ms    33 ms    38 ms  192.168.31.3
  5    40 ms    33 ms    40 ms  192.168.31.9
  6    25 ms    29 ms    34 ms  192.168.31.49
  7     *        *        *     Request timed out.
  8    45 ms    68 ms    46 ms  nsg-corporate-157.38.187.122.airtel.in [122.187.38.157]
  9    40 ms    43 ms   111 ms  182.79.153.83
 10    65 ms    38 ms    52 ms  115.110.232.173.static.Delhi.vsnl.net.in [115.110.232.173]
 11     *        *        *     Request timed out.
 12    44 ms    61 ms    79 ms  14.140.210.22.static-Delhi-vsnl.net.in [14.140.210.22]
 13    38 ms    45 ms    52 ms  10.119.234.161
 14   100 ms    55 ms    54 ms  10.119.233.65
 15    59 ms    37 ms    66 ms  10.119.233.66
 16    51 ms    40 ms    46 ms  103.27.9.24
 17    54 ms    36 ms    41 ms  103.27.9.24
 18    56 ms    39 ms    38 ms  103.27.9.24

Trace complete.
```

I Running tracert on www.google.com using Airtel(ISP) Broadband

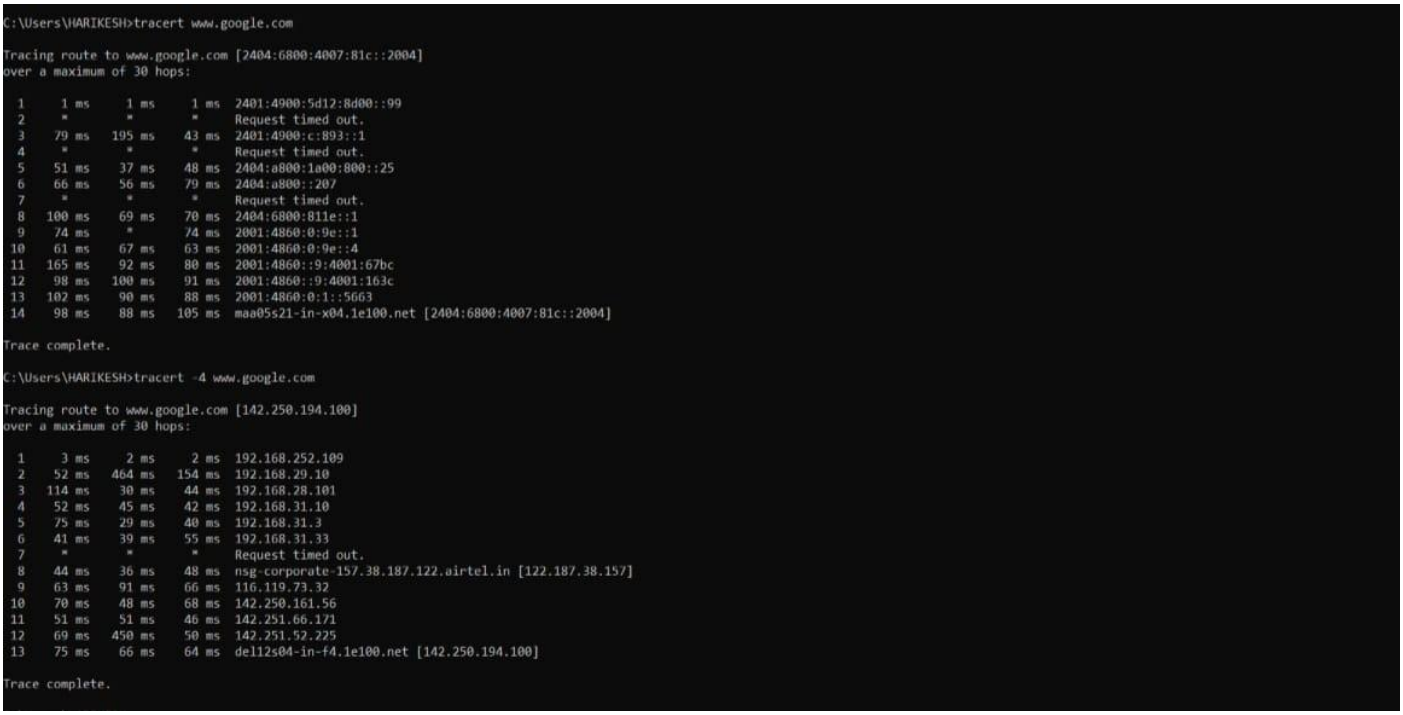
II Running tracert on www.google.com using Airtel Mobile hotspot



```
C:\Users\HARIKESH>tracert www.google.com

Tracing route to www.google.com [142.250.194.100]
over a maximum of 30 hops:

  1     *        *        *     Request timed out.
  2   143 ms   212 ms   207 ms  192.168.29.10
  3    49 ms    33 ms    87 ms  192.168.28.73
  4    55 ms    30 ms    44 ms  192.168.31.25
  5    45 ms    54 ms    65 ms  192.168.31.27
  6    69 ms    34 ms    60 ms  192.168.31.33
  7     *        *        *     Request timed out.
  8    59 ms   417 ms    55 ms  nsg-corporate-157.38.187.122.airtel.in [122.187.38.157]
  9   119 ms    60 ms    66 ms  116.119.61.251
 10    59 ms    45 ms    52 ms  142.250.161.56
 11    92 ms    61 ms    97 ms  142.251.66.171
 12    68 ms    41 ms    66 ms  142.251.52.225
 13   174 ms   265 ms    66 ms  del12s04-in-f4.1e100.net [142.250.194.100]

Trace complete.

C:\Users\HARIKESH>tracert www.google.com

Tracing route to www.google.com [2404:6800:4007:81c::2004]
over a maximum of 30 hops:

  1     1 ms     1 ms     1 ms  2401:4900:5d12:8d00::99
  2     *        *        *     Request timed out.
  3    79 ms   195 ms    43 ms  2401:4900:c:893::1
  4     *        *        *     Request timed out.
  5    51 ms    37 ms    48 ms  2404:a800:1a00:800::25
  6    66 ms    56 ms    79 ms  2404:a800::207
  7     *        *        *     Request timed out.
  8   100 ms    69 ms    70 ms  2404:6800:811e::1
  9    74 ms     *       74 ms  2001:4860:0:9e::1
 10    61 ms    67 ms    63 ms  2001:4860:0:9e::4
 11   165 ms    92 ms    80 ms  2001:4860::9:4001:67bc
 12    98 ms   100 ms    91 ms  2001:4860::9:4001:163c
 13   102 ms    90 ms    88 ms  2001:4860:0:1::5663
 14    98 ms    88 ms   105 ms  maa05s21-in-x04.1e100.net [2404:6800:4007:81c::2004]

Trace complete.
```

Running tracert on www.google.com by forcing it to use IPV4 only

Command Used: **tracert -4 www.google.com**

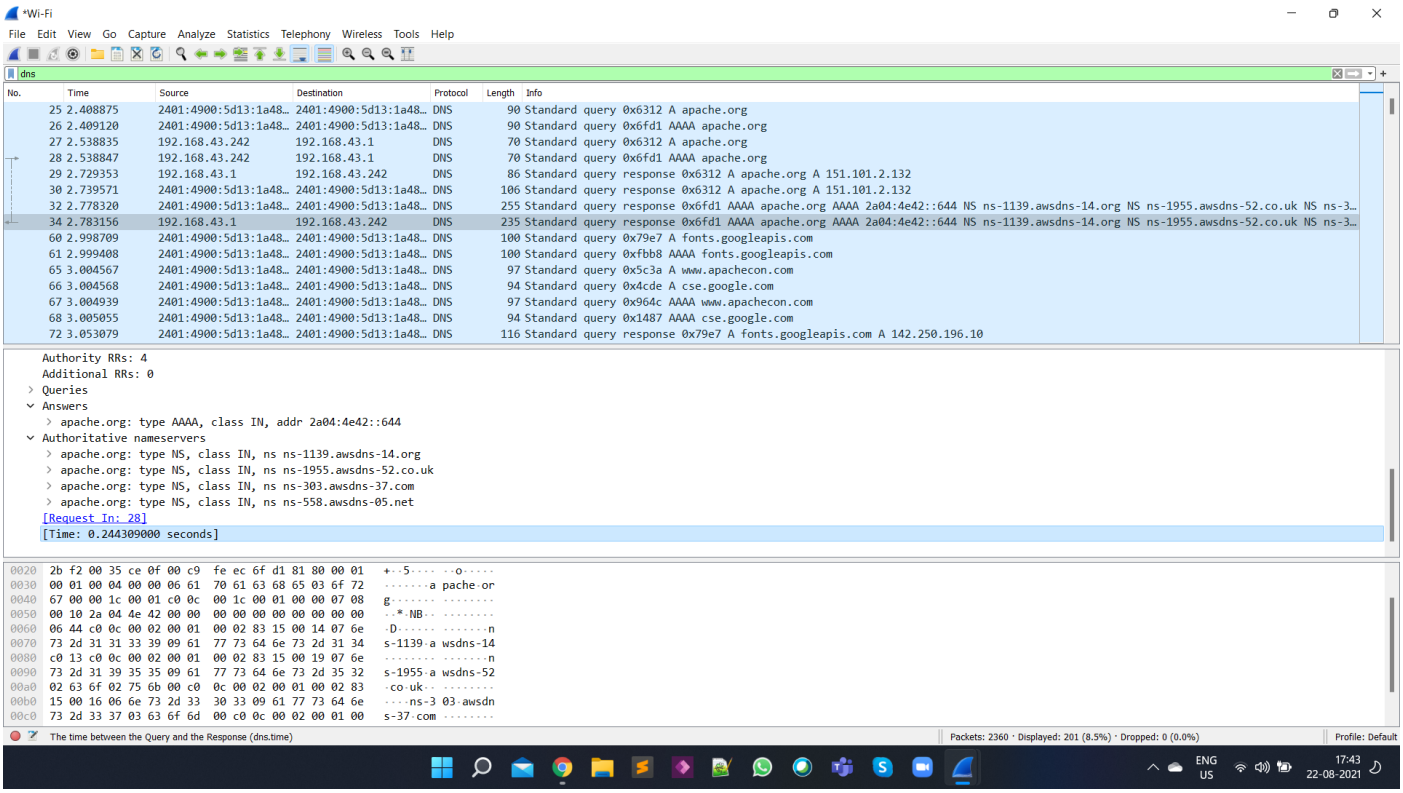


2 PACKET ANALYSIS

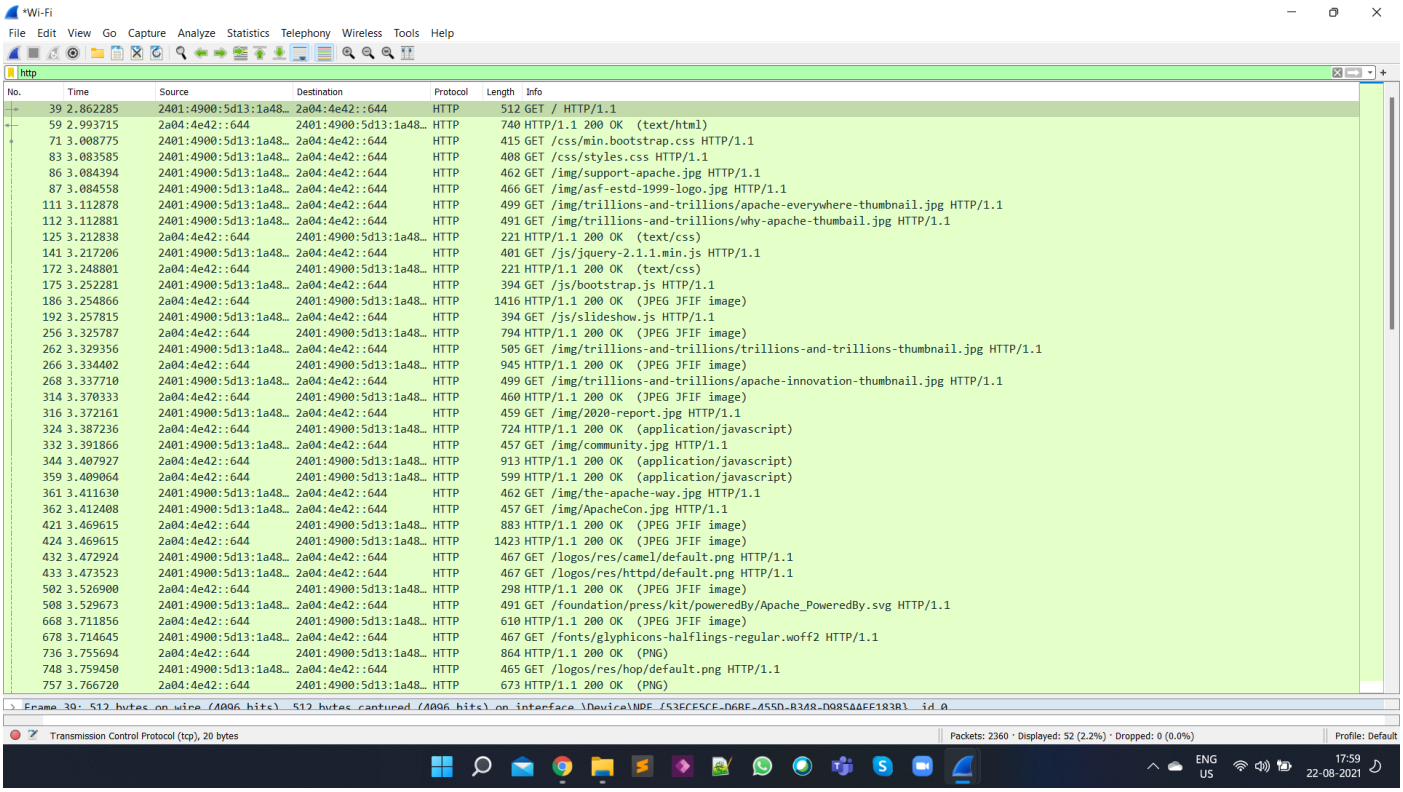
Installed wireshark and analyed protocols being used along with flushing the local DNS cache and clearing the Browser cache.

Captured packets while visiting http://apache.org using wireshark

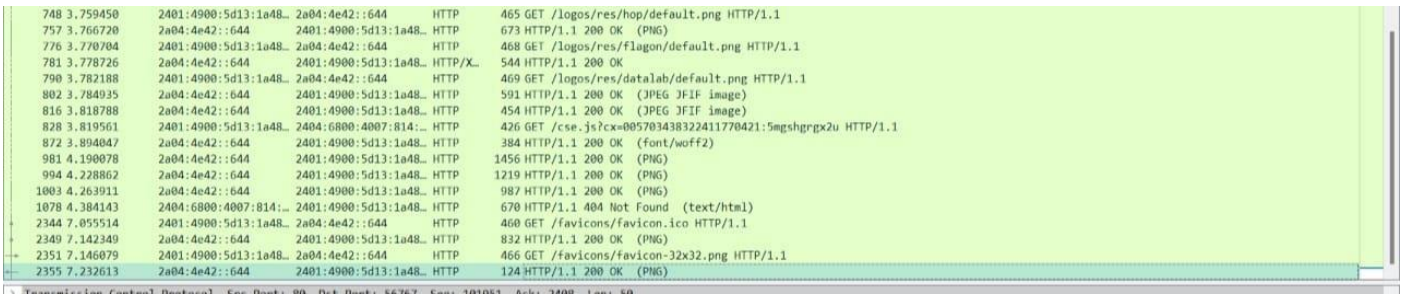
a. Applied a dns filter on the packet trace and DNS request response time is the time to get response from the main domain i.e. apache.org and in total there are 4 such authoritative name servers and on an average all will take approx. same time to get responded. So, time taken for responding dns request response i.e. dns.time == 0.244309000 seconds.

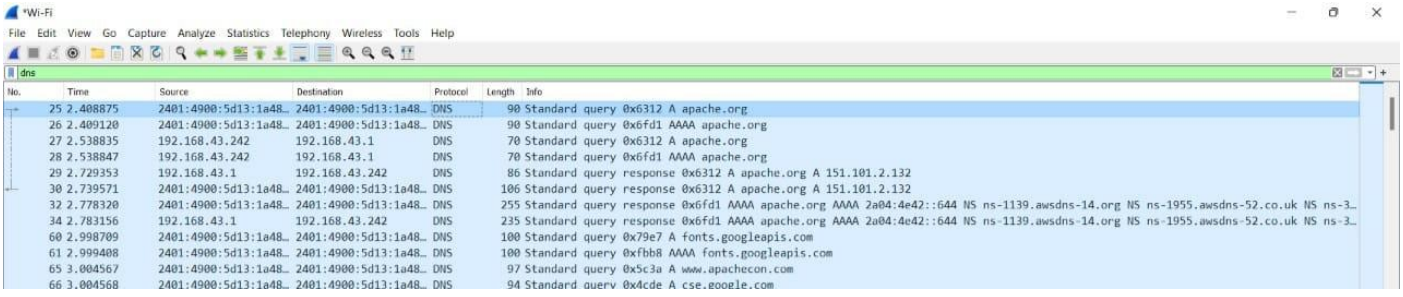


b. Applied an http filter and total number of http requests made while visiting http://apache.org are approximately 52.
Any webpage consist of a lot of files, images, and for accessing each and every file browser asserts a query which is bacially an http request to get the data. All these images, adds, videos and chunks of data are retrieved when the web brower is accessed through http requests and then the response of original query is sent back along with the data obtained here.



c. Now, we have to find the total time taken to download the entire webpage . This is actually the time between the first dns request made and last content object received i.e. last image, objets were approached which are basically http requests. So, time taken is 7.232613 – 2.408875 = 4.8237 seconds.





d. Now, we will be running packet trace for http://www.cse.iitd.ac.in and then will be filtering it for http.
Total http requests obtained are 2 and there is no other http traffic.
In case of http://apache.org we were getting more http traffic as compared to http://www.cse.iitd.ac.in this tells us that the former webpage is more structured i.e. contains more files, images and is complex compared to the latter.