

Computer Networks - Assignment 1

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1 Networking Tools

1. IP address using ipconfig

The IP address of my was not static. It was different with different service providers.

- IP address obtained with RELIANCE JIO - 192.168.43.85
- IP address obtained with AIRTEL - 192.168.43.173

```
Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix  . : 
Link-local IPv6 Address . . . . . : fe80::48f7:be2e:40f7:d94c%2
IPv4 Address. . . . . : 192.168.43.173
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.43.1
```

Figure 1: IP address with Airtel

```
Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix  . : 
IPv6 Address. . . . . : 2409:4063:220d:80c0:48f7:be2e:40f7:d94c
Temporary IPv6 Address. . . . . : 2409:4063:220d:80c0:d4cb:7004:34cb:5b1e
Link-local IPv6 Address . . . . . : fe80::48f7:be2e:40f7:d94c%2
IPv4 Address. . . . . : 192.168.43.85
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : fe80::acd2:3bff:feb9:575b%2
                          192.168.43.1
```

Figure 2: IP address with Reliance Jio

Reason for varying IP addresses:

The IP address keeps changing because the ISP generally provides "Dynamic IP address" instead of "Static IP address". One of the main reasons for this is that if one decides to move across town, he/she can still keep the previous ISP and there would be no need to go through the hassle of rerouting the "Static IP address".

2. nslookup

IP address of www.google.com -

- IPv4 Address - 142.250.193.36
- IPv6 Address - 2404:6800:4002:81a::2004

IP address of www.facebook.com -

- IPv4 Address - 157.240.198.35
- IPv6 Address - 2a03:2880:f144:82:face:b00c:0:25de

```
PS C:\Users\gupta> nslookup www.google.com ns1.google.com
Server: ns1.google.com
Address: 216.239.32.10

Name:    www.google.com
Addresses: 2404:6800:4002:81a::2004
          142.250.193.36

PS C:\Users\gupta> nslookup www.facebook.com
Server:    Unknown
Address:   192.168.43.1

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
```

On changing the DNS server, the IP address of the above domains were also changing.

IP address of www.google.com on changing DNS servers:

- (a) DNS server used - dns9.quad9.net (9.9.9.9)
 - IPv4 Address - 172.217.24.68
 - IPv6 Address - 2404:6800:4005:804::2004
- (b) DNS server used - one.one.one.one (1.1.1.1)
 - IPv4 Address - 142.250.196.36
 - IPv6 Address - 2404:6800:4007:82a::2004

<pre>PS C:\Users\gupta> nslookup www.google.com 9.9.9.9 Server: dns9.quad9.net Address: 9.9.9.9 Non-authoritative answer: Name: www.google.com Addresses: 2404:6800:4005:804::2004 172.217.24.68</pre>	<pre>PS C:\Users\gupta> nslookup www.google.com 1.1.1.1 Server: one.one.one.one Address: 1.1.1.1 Non-authoritative answer: Name: www.google.com Addresses: 2404:6800:4007:82a::2004 142.250.196.36</pre>
--	--

IP address of www.facebook.com on changing DNS servers:

- (a) DNS server used - dns9.quad9.net (9.9.9.9)
 - IPv4 Address - 157.240.13.35
 - IPv6 Address - 2a03:2880:f10c:283:face:b00c:0:25de
- (b) DNS server used - one.one.one.one (1.1.1.1)
 - IPv4 Address - 157.240.16.35
 - IPv6 Address - 2a03:2880:f12f:183:face:b00c:0:25de

<pre>PS C:\Users\gupta> nslookup www.facebook.com 9.9.9.9 Server: dns9.quad9.net Address: 9.9.9.9 Non-authoritative answer: Name: star-mini.c10r.facebook.com Addresses: 2a03:2880:f10c:283:face:b00c:0:25de 157.240.13.35 Aliases: www.facebook.com</pre>	<pre>PS C:\Users\gupta> nslookup www.facebook.com 1.1.1.1 Server: one.one.one.one Address: 1.1.1.1 Non-authoritative answer: Name: star-mini.c10r.facebook.com Addresses: 2a03:2880:f12f:183:face:b00c:0:25de 157.240.16.35 Aliases: www.facebook.com</pre>
--	---

3. ping

Pinging www.iitd.ac.in with different packet sizes:

<pre>PS C:\Users\gupta> ping -l 64 www.iitd.ac.in Pinging www.iitd.ac.in [103.27.9.24] with 64 bytes of data: Reply from 103.27.9.24: bytes=64 time=57ms TTL=49 Reply from 103.27.9.24: bytes=64 time=64ms TTL=49 Reply from 103.27.9.24: bytes=64 time=100ms TTL=49 Reply from 103.27.9.24: bytes=64 time=100ms TTL=49 Ping statistics for 103.27.9.24: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 57ms, Maximum = 100ms, Average = 80ms</pre>	<pre>PS C:\Users\gupta> ping -l 128 www.iitd.ac.in Pinging www.iitd.ac.in [103.27.9.24] with 128 bytes of data: Reply from 103.27.9.24: bytes=128 time=87ms TTL=49 Reply from 103.27.9.24: bytes=128 time=91ms TTL=49 Reply from 103.27.9.24: bytes=128 time=63ms TTL=49 Reply from 103.27.9.24: bytes=128 time=66ms TTL=49 Ping statistics for 103.27.9.24: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 63ms, Maximum = 91ms, Average = 76ms</pre>
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Figure 3: Pinging www.iitd.ac.in with packet sizes of 64 and 128 bytes

Pinging www.iitd.ac.in with different TTL values:

<pre>PS C:\Users\gupta> ping -i 10 www.iitd.ac.in Pinging www.iitd.ac.in [103.27.9.24] with 32 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),</pre>	<pre>PS C:\Users\gupta> ping -i 30 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=66ms TTL=49 Reply from 103.27.9.24: bytes=32 time=61ms TTL=49 Reply from 103.27.9.24: bytes=32 time=68ms TTL=49 Reply from 103.27.9.24: bytes=32 time=218ms TTL=49 Ping statistics for 103.27.9.24: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 61ms, Maximum = 218ms, Average = 103ms</pre>
--	---

Figure 4: Pinging www.iitd.ac.in with packet TTL values of 10 and 30

Maximum packet size that could be sent to www.iitd.ac.in:

```

PS C:\Users\gupta> ping -l 1472 -n 1 www.iitd.ac.in

Pinging www.iitd.ac.in [103.27.9.24] with 1472 bytes of data:
Reply from 103.27.9.24: bytes=1472 time=87ms TTL=46

Ping statistics for 103.27.9.24:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 87ms, Maximum = 87ms, Average = 87ms
PS C:\Users\gupta> ping -l 1473 -n 1 www.iitd.ac.in

Pinging www.iitd.ac.in [103.27.9.24] with 1473 bytes of data:
Request timed out.

Ping statistics for 103.27.9.24:
    Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),

```

Figure 5: Maximum packet size that could be sent to www.iitd.ac.in

<pre> PS C:\Users\gupta> ping -l 1472 -n 1 www.google.com Pinging www.google.com [172.217.160.228] with 1472 bytes of data: Reply from 172.217.160.228: bytes=68 (sent 1472) time=92ms TTL=110 Ping statistics for 172.217.160.228: Packets: Sent = 1, Received = 1, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 92ms, Maximum = 92ms, Average = 92ms PS C:\Users\gupta> ping -l 1473 -n 1 www.google.com Pinging www.google.com [172.217.160.228] with 1473 bytes of data: Request timed out. Ping statistics for 172.217.160.228: Packets: Sent = 1, Received = 0, Lost = 1 (100% loss), </pre>	<pre> PS C:\Users\gupta> ping -l 1472 -n 1 www.facebook.com Pinging star-mini.c10r.facebook.com [157.240.198.35] with 1472 bytes of data: Reply from 157.240.198.35: bytes=1472 time=96ms TTL=50 Ping statistics for 157.240.198.35: Packets: Sent = 1, Received = 1, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 96ms, Maximum = 96ms, Average = 96ms PS C:\Users\gupta> ping -l 1473 -n 1 www.facebook.com Pinging star-mini.c10r.facebook.com [157.240.198.35] with 1473 bytes of data: Request timed out. Ping statistics for 157.240.198.35: Packets: Sent = 1, Received = 0, Lost = 1 (100% loss), </pre>
--	--

Figure 6: Maximum packet size that could be sent to www.google.com and www.facebook.com

Observation: Note that in Figure 5 and Figure 6, I am able to ping with packet size of 1472 bytes but not with 1473 bytes for all the three domains. For all the three domains, the maximum size of ping packet that I am able to send is 1472 bytes.

The maximum amount of data that can be placed in a single segment without fragmentation is limited by Maximum Transmission Unit (MTU). Most link-layer protocols have an MTU of 1500 bytes. The maximum amount of data that can be put in one segment (Maximum Segment Size) can be obtained by subtracting the size of header from MTU. The header size in this case appears to be of around 28 bytes.

4. tracert

tracert for www.iitd.ac.in with multiple ISPs

```

PS C:\Users\gupta> tracert www.iitd.ac.in

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

  0  1 ms    1 ms    4 ms   192.168.43.1
  1  *      *      *      Request timed out.
  2  53 ms   51 ms   80 ms   10.72.171.166
  3  264 ms  60 ms  52 ms   172.25.119.184
  4  70 ms   38 ms  48 ms   172.25.119.185
  5  112 ms  81 ms  95 ms   172.16.8.70
  6  *      *      *      Request timed out.
  7  *      *      *      Request timed out.
  8  *      *      *      Request timed out.
  9  *      *      *      Request timed out.
 10  *      *      *      Request timed out.
 11  164 ms  85 ms  53 ms   115.255.253.18
 12  59 ms  62 ms  117 ms  115.249.198.97
 13  *      *      *      Request timed out.
 14  *      *      *      Request timed out.
 15  *      *      *      Request timed out.
 16  *      *      *      Request timed out.
 17  *      *      *      Request timed out.
 18  *      *      *      Request timed out.
 19  157 ms  347 ms 319 ms  103.27.9.24
 20  63 ms   74 ms  117 ms  103.27.9.24
 21  153 ms  163 ms 461 ms  103.27.9.24

Trace complete.

```

Figure 7: tracert for www.iitd.ac.in using Reliance Jio ISP

```

PS C:\Users\gupta> tracert www.iitd.ac.in

Tracing route to www.iitd.ac.in [103.27.9.24]
over a maximum of 30 hops:
  1    4 ms    3 ms    3 ms  192.168.43.1
  2   179 ms   20 ms   38 ms  192.168.59.1
  3   104 ms   26 ms   38 ms  nsg-corporate-70.39.185.122.airtel.in [122.185.39.70]
  4    70 ms   39 ms   51 ms  nsg-corporate-69.39.185.122.airtel.in [122.185.39.69]
  5   148 ms   45 ms   37 ms  182.79.149.6
  6    *      *      *      Request timed out.
  7    *      *      *      Request timed out.
  8    51 ms   63 ms   53 ms  14.140.210.22.static-Delhi-vsnl.net.in [14.140.210.22]
  9    85 ms   71 ms   63 ms  10.119.234.161
 10    83 ms   75 ms   79 ms  10.119.233.65
 11   183 ms   50 ms   77 ms  10.119.233.66
 12    77 ms   63 ms   52 ms  103.27.9.24
 13   124 ms   67 ms   88 ms  103.27.9.24
 14    82 ms   77 ms   77 ms  103.27.9.24

Trace complete.

```

Figure 8: tracert for www.iitd.ac.in using Airtel ISP

Observations:

- The route taken to reach **www.iitd.ac.in** is different for the two ISPs.
- Many routers in the path were not responding on using the Reliance Jio ISP. When I switched to Airtel, no. of hops in the route decreased and more no. of routers started responding.

```

PS C:\Users\gupta> tracert www.facebook.com

Tracing route to star-mini.c10r.facebook.com [2a03:2880:f144:82:face:b00c:0:25de]
over a maximum of 30 hops:
  1    3 ms    5 ms    1 ms  2409:4063:220d:80c0::43
  2    *      *      *      Request timed out.
  3   90 ms   49 ms   38 ms  2405:200:341:a168:4::fff04
  4   44 ms   40 ms   118 ms  2405:200:801:e00::94e
  5    *      *      *      Request timed out.
  6   57 ms   114 ms   68 ms  2405:200:1602:1739::3
  7   44 ms   68 ms   92 ms  ae4.pr02.dell1.tfbnw.net [2620:0:1cff:dead:beee::e7c]
  8   63 ms   74 ms   66 ms  ae4.pr02.dell1.tfbnw.net [2620:0:1cff:dead:beee::e7c]
  9   59 ms   47 ms   61 ms  po102.psw02.dell1.tfbnw.net [2620:0:1cff:dead:bef0::45d]
 10   47 ms   58 ms   61 ms  po2.msw1am.01.dell1.tfbnw.net [2a03:2880:f044:ffff::4d]
 11   66 ms    *    55 ms  edge-star-mini6-shv-01-dell1.facebook.com [2a03:2880:f144:82:face:b00c:0:25de]

Trace complete.

```

Figure 9: www.facebook.com is using IPv6 addresses by default with Reliance Jio ISP

```

PS C:\Users\gupta> tracert -4 www.facebook.com

Tracing route to star-mini.c10r.facebook.com [157.240.198.35]
over a maximum of 30 hops:
  1    1 ms    1 ms    1 ms  192.168.43.1
  2    *      *      *      Request timed out.
  3   32 ms   52 ms   64 ms  10.72.171.134
  4   53 ms   55 ms   33 ms  172.25.119.180
  5   54 ms   47 ms   51 ms  172.25.119.181
  6   48 ms   39 ms   39 ms  172.16.8.70
  7    *      *      *      Request timed out.
  8    *      *      *      Request timed out.
  9    *      *      *      Request timed out.
 10    *      *      *      Request timed out.
 11    *      *      *      Request timed out.
 12   67 ms   49 ms   68 ms  ae4.pr02.dell1.tfbnw.net [157.240.73.118]
 13   56 ms   58 ms   60 ms  po102.psw01.dell1.tfbnw.net [31.13.24.7]
 14   61 ms   70 ms   55 ms  157.240.38.91
 15   66 ms   62 ms   72 ms  edge-star-mini-shv-01-dell1.facebook.com [157.240.198.35]

Trace complete.

```

Figure 10: Using tracert -4 www.facebook.com forces tracert to use IPv4 addresses

Observations:

- With Reliance Jio ISP, **www.facebook.com** was using IPv6 addresses by default. To force it to use IPv4, I used the command **tracert -4 www.facebook.com**
- None of the IP addresses observed on the routes to different hosts were private.
- Some of the routers on the path were not replying.

Changes in the tracert for some of the missing routers:

- In case of Windows 10 OS, the only change that I could do to get reply from more routers is to change the ISP (see Figure 6 and Figure 7 above). But, in this case, the route taken itself changes.

- Increasing the wait time (by using -w flag) made some of the routers, that were not replying earlier, to respond.
- When I tried traceroute on Linux, few routers were replying on sending the default UDP packets. Sending ICMP packets (using -I flag) increased the number of routers that were replying.

```
aniket@aniket-VirtualBox:~$ traceroute www.google.com
traceroute to www.google.com (142.250.192.196), 30 hops max, 60 byte packets
 1 _gateway (10.0.2.2)  1.759 ms  1.702 ms  1.672 ms
 2 * * *
 3 * * *
 4 * * *
 5 * * *
 6 * * *
 7 * * *
 8 * * *
 9 * * *
10 * * *
11 * * *
12 * ^C
```

Figure 11: On LINUX system - traceroute www.google.com (sending default UDP packets)

```
aniket@aniket-VirtualBox:~$ traceroute -I www.google.com
traceroute to www.google.com (142.250.192.196), 30 hops max, 60 byte packets
 1 _gateway (10.0.2.2)  0.419 ms  0.388 ms  0.377 ms
 2 192.168.43.1 (192.168.43.1)  4.551 ms  5.327 ms  10.565 ms
 3 192.168.59.1 (192.168.59.1)  48.237 ms  48.990 ms  48.978 ms
 4 * * *
 5 nsg-corporate-65.39.185.122.airtel.in (122.185.39.65)  50.109 ms * *
 6 116.119.42.214 (116.119.42.214)  73.980 ms * *
 7 * * *
 8 * 172.253.68.91 (172.253.68.91)  71.946 ms *
 9 142.250.236.55 (142.250.236.55)  84.638 ms * *
10 del11s12-in-f4.1e100.net (142.250.192.196)  80.407 ms  71.064 ms  77.901 ms
```

Figure 12: On LINUX system - traceroute -I www.google.com (sending ICMP packets)

2 Packet Analysis

1. **dns** filter for packets grabbed while visiting **http://apache.org/**
 - (a) There were multiple DNS requests and response.
 - (b) There were 2 DNS queries of type A to get the IPv4 address and 1 DNS query of type AAAA to get the IPv6 address of the host (apache.org).
 - (c) There were many other subsequent DNS queries for the different websites mentioned/used in the webpage.
 - Time taken in the first type A request-response for apache.org host: 0.187694000 sec

```

  ~ Queries
    ~ apache.org: type A, class IN
      Name: apache.org
      [Name Length: 10]
      [Label Count: 2]
      Type: A (Host Address) (1)
      Class: IN (0x0001)
    ~ Answers
      ~ apache.org: type A, class IN, addr 151.101.2.132
        Name: apache.org
        Type: A (Host Address) (1)
        Class: IN (0x0001)
        Time to live: 1800 (30 minutes)
        Data length: 4
        Address: 151.101.2.132
      > Authoritative nameservers
        [Request In: 101]
        [Time: 0.187694000 seconds]
```

- Time taken in the second type A request-response for apache.org host: 0.004123000 sec

```

  ▾ Queries
    ▾ apache.org: type A, class IN
      Name: apache.org
      [Name Length: 10]
      [Label Count: 2]
      Type: A (Host Address) (1)
      Class: IN (0x0001)
    ▾ Answers
      ▾ apache.org: type A, class IN, addr 151.101.2.132
        Name: apache.org
        Type: A (Host Address) (1)
        Class: IN (0x0001)
        Time to live: 1800 (30 minutes)
        Data length: 4
        Address: 151.101.2.132
        [Request In: 107]
        [Time: 0.004123000 seconds]

```

- Time taken in the type AAAA request-response for apache.org host: 0.098022000 sec

```

  ▾ Queries
    ▾ apache.org: type AAAA, class IN
      Name: apache.org
      [Name Length: 10]
      [Label Count: 2]
      Type: AAAA (IPv6 Address) (28)
      Class: IN (0x0001)
    ▾ Answers
      ▾ apache.org: type AAAA, class IN, addr 2a04:4e42::644
        Name: apache.org
        Type: AAAA (IPv6 Address) (28)
        Class: IN (0x0001)
        Time to live: 1800 (30 minutes)
        Data length: 16
        AAAA Address: 2a04:4e42::644
      > Authoritative nameservers
        [Request In: 111]
        [Time: 0.098022000 seconds]

```

2. **http** filter for packets grabbed while visiting **http://apache.org/**

- Total number of http packets grabbed = 64
- Number of http request packets = 32
- Number of http response packets = 32

Structure of web-pages (based on observation on the packets grabbed)

- It consists of a base HTML file which has multiple HTML elements.
- The website, when visited, contains several images, link to several other websites, UI components etc.
- The base HTML file generally has the relative paths to the CSS files, Javascript files, image files and other files if they are stored on the same server.
- If the files required are not on the same server, then the HTML file contains the URLs that can be used to get to the server that contains the required file.

Rendering of the web-page (based on observation on the packets grabbed)

- The browser first made a DNS request (to any DNS server) to get the IP address of the server.
- It then sent HTTP GET request to the server.
- It received the base HTML file in response from the server.
- It then sent multiple other HTTP GET request to the same server to get the files and images for whose the relative paths were mentioned in the base HTML page.
- For the files that were not on the same server, browser first found the IP addresses of the servers (by making another DNS requests) that contain the files by using the URLs mentioned.
- It then requested those servers for the required files and render those files after getting response.

3. Total time taken to download entire website (**http://apache.org/**)

```
<title>Welcome to The Apache Software Foundation!</title>\n
<link href="https://fonts.googleapis.com/css?family=Montserrat:300,600" rel="stylesheet">\n
<link href="/css/min.bootstrap.css" rel="stylesheet">\n
<link href="/css/styles.css" rel="stylesheet">\n
<style>\n
```

NOTE: To get the total time to download the entire website, we need the time when first DNS request is sent and when last content packet is received. Note that in this case, the base HTML file has reference to other hosts as well that use https protocol (see the figure above. It is a snap from the HTML file received in one of the HTTP responses. It contains reference to a host using HTTPS). The browser requests file/data from those hosts as well. The last content packet may or may not be an HTTP packet.

- Time at which first DNS request was sent - 7.728428 sec
- Approximate time at which the grabbing of packets stopped - 20.264863 sec
- Total time taken to download the website = 20.264863 - 7.728428 sec = 12.536435 sec

4. Packet trace for **http://www.cse.iitd.ac.in**

- There was almost no http traffic for http://www.cse.iitd.ac.in.

```

Hypertext Transfer Protocol
  HTTP/1.1 301 Moved Permanently\r\n
    > [Expert Info (Chat/Sequence): HTTP/1.1 301 Moved Permanently\r\n]
      Response Version: HTTP/1.1
      Status Code: 301
      [Status Code Description: Moved Permanently]
      Response Phrase: Moved Permanently
      Date: Fri, 20 Aug 2021 06:55:22 GMT\r\n
      Server: Apache/2.4.7 (Ubuntu) mod_auth_kerb/5.4 PHP/5.5.9-1ubuntu4.20 OpenSSL/1.0.1f mod_wsgi/3.4 Python/3.4.3\r\n
      Location: https://www.cse.iitd.ac.in/\r\n

```

- It is because the host sent an http response stating that the website has been moved to https://www.cse.iitd.ac.in/. Thus, we are redirected to https://www.cse.iitd.ac.in/ which uses https and therefore it sends data packets encrypted with SSL which are not captured using http filter.
- In case of http://apache.org/, the host was using http protocol and was not encrypting the packets. Thus, it was easier in that case to grab the packets using http filter.

3 Traceroute Implementation using Ping

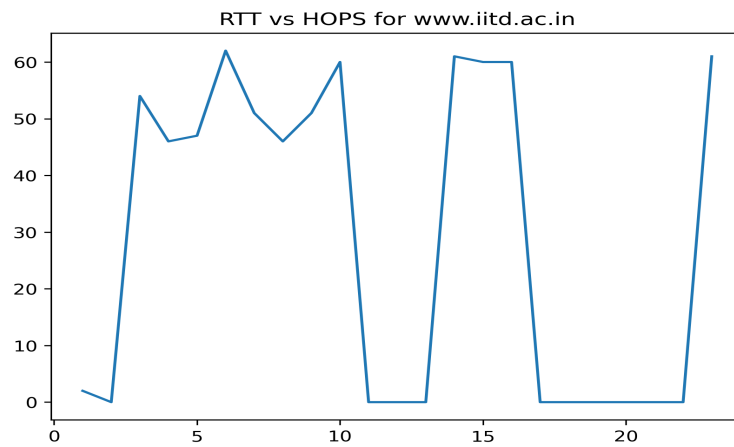
NOTE: I pinged each of the routers 3 times and took the minimum of the 3 rtt values for plotting, if the router replied and zero otherwise.

- Route tracing for www.iitd.ac.in

```

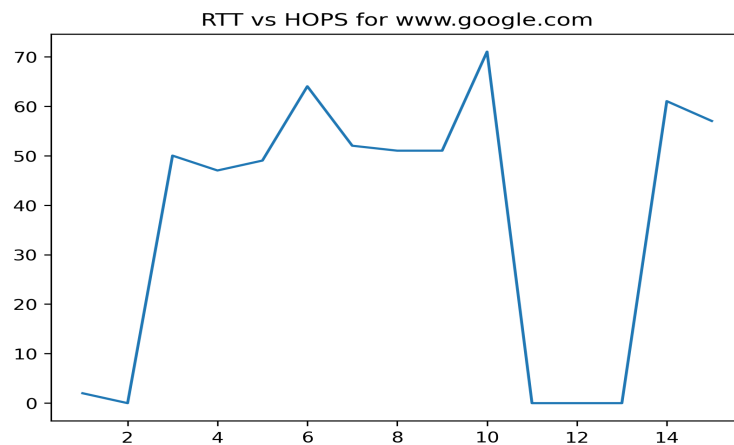
PS C:\Users\gupta\Sem5\C0L334\Assignment> python traceroute.py www.iitd.ac.in
Tracing route to www.iitd.ac.in with maximum of 30 hops
 1  2ms    5ms    4ms    192.168.43.1
 2  *      *      *      *
 3  54ms   59ms   61ms   10.72.223.69
 4  46ms   64ms   56ms   192.168.30.53
 5  47ms   63ms   48ms   192.168.30.46
 6  66ms   62ms   64ms   172.26.101.134
 7  51ms   60ms   64ms   172.26.101.147
 8  71ms   46ms   67ms   192.168.30.58
 9  51ms   56ms   56ms   192.168.30.61
10  60ms   76ms   101ms  172.25.115.24
11  *      *      *      *
12  *      *      *      *
13  *      *      *      *
14  61ms   76ms   64ms   115.249.187.169
15  60ms   63ms   61ms   115.255.253.18
16  60ms   69ms   69ms   115.249.198.97
17  *      *      *      *
18  *      *      *      *
19  *      *      *      *
20  *      *      *      *
21  *      *      *      *
22  *      *      *      *
23  61ms   65ms   70ms   103.27.9.24
Trace completed

```



- Route tracing for www.google.com

```
PS C:\Users\gupta\Sem5\COL334\Assignment> python traceroute.py www.google.com
Tracing route to www.google.com with maximum of 30 hops
 1 2ms 4ms 4ms 192.168.43.1
 2 * * * *
 3 50ms 56ms 53ms 10.72.223.45
 4 47ms 56ms 53ms 192.168.30.49
 5 51ms 49ms 59ms 192.168.30.46
 6 64ms 80ms 72ms 172.26.101.134
 7 52ms 56ms 55ms 172.26.101.146
 8 51ms 62ms 53ms 192.168.30.58
 9 51ms 58ms 64ms 192.168.30.59
10 71ms 72ms 71ms 172.25.115.24
11 * * * *
12 * * * *
13 * * * *
14 61ms 63ms 69ms 142.251.52.225
15 60ms 57ms 75ms 142.250.194.100
Trace completed
```



- Route tracing for www.facebook.com

```
PS C:\Users\gupta\Sem5\COL334\Assignment> python traceroute.py -h 30 -w 5000 www.facebook.com
Tracing route to www.facebook.com with maximum of 30 hops
 1 2ms 4ms 4ms 192.168.43.1
 2 * * * *
 3 56ms 60ms 68ms 10.72.223.45
 4 56ms 67ms 72ms 192.168.30.53
 5 54ms 63ms 57ms 192.168.30.48
 6 75ms 76ms 74ms 172.26.101.134
 7 46ms 62ms 56ms 172.26.101.146
 8 48ms 54ms 50ms 192.168.30.54
 9 50ms 59ms 54ms 192.168.30.55
10 56ms 83ms 70ms 172.25.115.24
11 * * * *
12 * * * *
13 * * * *
14 62ms 76ms 64ms 173.252.67.147
15 63ms 75ms 73ms 157.240.198.35
Trace completed
```