# COL334: Assignment 1

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## Contents



# 1 Networking Tools

## 1.a Local IP Address

To obtain the *IP address* of a device, running `ifconfig` gives the detailed information about the same.

### 1.a.i Router

The following output is obtained on running the command when connected to Wi-Fi router:

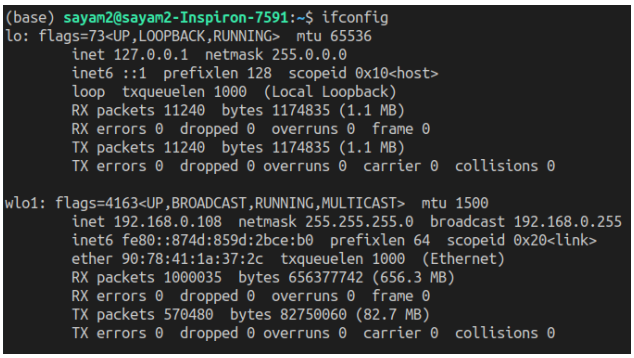



Figure 1: `ifconfig` on router

The first entry in the output, i.e., `lo`, is the **loopback connection** which is used to connect to ports on the same device.

The second entry, `wlo1`, is the relevant one and it contains information about the **Wi-Fi connection**. The *IP address* is the `inet` address: 192.168.0.108.

### 1.a.ii Mobile Hotspot

On connecting to mobile hotspot, following is the output of `ifconfig`:

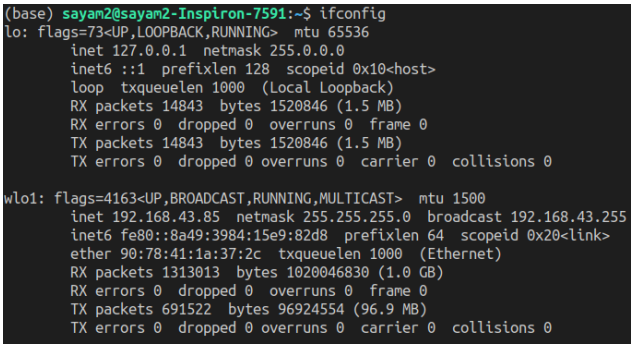



Figure 2: `ifconfig` on mobile hotspot

The *IP address* which is the `inet` address now has changed to: 192.168.43.85.

## 1.b IP Address of Different Servers

To obtain the *IP address* of servers, the `nslookup` command is used. This *IP address* depends on the **DNS server** being used.

### 1.b.i Google

```
(base) sayam2@sayam2-Inspiron-7591:~$ nslookup www.google.com 1.1.1.1
Server:         1.1.1.1
Address:        1.1.1.1#53

Non-authoritative answer:
Name:   www.google.com
Address: 142.250.182.132
Name:   www.google.com
Address: 2404:6800:4007:82c::2004

(base) sayam2@sayam2-Inspiron-7591:~$ nslookup www.google.com 8.8.8.8
Server:         8.8.8.8
Address:        8.8.8.8#53

Non-authoritative answer:
Name:   www.google.com
Address: 142.250.76.36
Name:   www.google.com
Address: 2404:6800:4007:817::2004
```

Figure 3: `nslookup` for Google using 2 different DNS servers

Using **Cloudfare 1.1.1.1 DNS** server gave the *IP address* as 142.250.182.132, while using **Google Public DNS** server resulted in an *IP address* of 142.250.76.36.

### 1.b.ii Facebook

```
(base) sayam2@sayam2-Inspiron-7591:~$ nslookup www.facebook.com 1.1.1.1
Server:         1.1.1.1
Address:        1.1.1.1#53

Non-authoritative answer:
www.facebook.com        canonical name = star-mini.c10r.facebook.com.
Name:   star-mini.c10r.facebook.com
Address: 157.240.192.35
Name:   star-mini.c10r.facebook.com
Address: 2a03:2880:f137:182:face:b00c:0:25de

(base) sayam2@sayam2-Inspiron-7591:~$ nslookup www.facebook.com 8.8.8.8
Server:         8.8.8.8
Address:        8.8.8.8#53

Non-authoritative answer:
www.facebook.com        canonical name = star-mini.c10r.facebook.com.
Name:   star-mini.c10r.facebook.com
Address: 157.240.228.35
Name:   star-mini.c10r.facebook.com
Address: 2a03:2880:f168:81:face:b00c:0:25de
```

Figure 4: `nslookup` for Facebook using 2 different DNS servers

Using **Cloudfare 1.1.1.1 DNS** server gave the *IP address* as 157.240.192.35, while using **Google Public DNS** server resulted in an *IP address* of 157.240.228.35.

## 1.c Ping (Pong)

To analyse the ping values, a script was written to **binary search** on different values of *packet size* and *TTL value*.

The size of the transmitted packet is always 28 bytes larger than the size set using the `-s` command. This is the header data which has the same structure for all packets.

#### 1.c.i Packet Size

**IITD** The maximum packet size that can be pinged is 29116 (+28) bytes.

**Google** The maximum pingable packet size is only 68 (+28) bytes.

**Facebook** The maximum packet size that is pinged is 1452 (+28) bytes.

#### 1.c.ii Time To Live (TTL) Value

**IITD** The smallest TTL value achieved is 12 hops.

**Google** The least number of hops taken to ping Google is 8 hops.

**Facebook** Facebook is reached within atleast 10 hops.

### 1.d `traceroute`

#### 1.d.i IITD

**Router** Running `traceroute` to IITD using router gave no response:

```
traceroute to www.iitd.ac.in (103.27.9.24), 64 hops max
  1   192.168.0.1  0.897ms  0.707ms  0.738ms
  2   *  *  *
  3   *  *  *
  4   14.142.71.205  6.728ms  3.405ms  7.705ms
  5   *  *  *
  6   14.140.210.22  31.739ms  59.348ms  43.518ms
  7   *  *  *
  8   *  *  *
  9   *  *  *
 10   *  *  *
 11   *  *  *
 12   *  *  *
 13   *  *  *
 14   *  *  *
 15   *  *  *
 16   *  *  *
 17   *  *  *
 18   *  *  *
 19   *  *  *
 20   *  *  *
 21   *  *  *
 22   *  *  *
 23   *  *  *
 24   *  *  *
 25   *  *  *
```

```
 26   *  *  *
 27   *  *  *
 28   *  *  *
 29   *  *  *
 30   *  *  *
 31   *  *  *
 32   *  *  *
 33   *  *  *
 34   *  *  *
 35   *  *  *
 36   *  *  *
 37   *  *  *
 38   *  *  *
 39   *  *  *
```

**Router + VPN** Running `traceroute` using *IITD VPN* was successful and gave the following trace:

```
traceroute to www.iitd.ac.in (10.10.211.212), 64 hops max
  1   10.54.16.1  33.066ms  31.264ms  38.566ms
  2   10.7.1.24  43.527ms  31.737ms  33.720ms
  3   10.10.211.212  31.988ms  31.566ms  32.533ms
```

### 1.d.ii Google

**Router** The trace obtained was:

```
traceroute to www.google.com (142.250.195.68), 64 hops max
  1   192.168.0.1  0.917ms  1.146ms  0.765ms
  2   *  *  *
  3   183.83.248.26  2.044ms  3.249ms  2.161ms
  4   *  *  *
  5   183.82.12.70  3.566ms  2.411ms  2.189ms
  6   108.170.253.97  18.613ms  22.689ms  20.718ms
  7   142.251.55.73  16.569ms  15.059ms  16.694ms
  8   108.170.253.97  24.064ms  53.537ms  18.354ms
  9   142.251.55.75  16.038ms  14.557ms  38.061ms
 10   142.250.195.68  16.217ms  17.874ms  15.328ms
```

**Mobile Hotspot** The trace now obtained was:

```
traceroute to www.google.com (142.250.77.100), 64 hops max
  1   192.168.43.1  79.318ms  0.976ms  0.871ms
  2   *  *  *
  3   10.50.108.129  46.436ms  28.415ms  35.397ms
  4   10.51.185.237  19.708ms  23.982ms  34.774ms
  5   125.18.109.37  30.757ms  62.044ms  23.968ms
  6   182.79.239.197  38.869ms  33.425ms  50.627ms
  7   72.14.208.234  64.566ms  44.386ms  38.511ms
  8   *  *  *
  9   142.251.55.222  49.079ms  35.311ms  58.332ms
 10   108.170.253.103  41.313ms  34.322ms  39.976ms
 11   74.125.242.129  35.876ms  57.069ms  41.281ms
 12   142.250.77.100  37.079ms  39.846ms  38.868ms
```

#### 1.d.iii Observations

The following observations were made when running `traceroute`:

1. Three packets are pinged for each hop value to *display consistency, or a lack thereof, in the route*
2. The router at the second hop value doesn't ping when using the default (no additional options) `traceroute` command
3. Different routes are followed when using different networks to access the same URL

#### 1.d.iv Changes to Improve Tracing

1. Traceroute by default uses **UDP** which is unreliable and hence many servers do not respond to it. To avoid this issue, `-I` flag can be used, which uses **ICPM echo** as the packet instead.

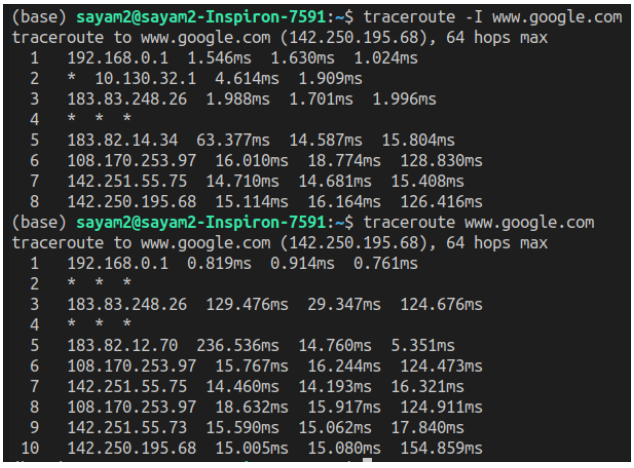



Figure 5: `traceroute` with and without `-I` flag (for Google)

2. Using the `-I` flag also permits finding the route for some websites (such as IITD) which is impossible without the flag.

```
(base) sayam2@sayam2-Inspiron-7591:~$ traceroute -I www.iitd.ac.in
traceroute to www.iitd.ac.in (103.27.9.24), 64 hops max
  1   192.168.0.1  1.309ms  1.422ms  1.131ms
  2   10.130.32.1  1.971ms  4.176ms  4.310ms
  3   *  *  *
  4   14.142.71.205  7.806ms  1.898ms  1.781ms
  5   *  *  *
  6   14.140.210.22  28.884ms  28.104ms  125.913ms
  7   *  *  *
  8   *  *  *
  9   *  *  *
 10   103.27.9.24  27.160ms  135.094ms  28.671ms
```

Figure 6: `traceroute` for IITD with `-I` flag

3. To find the best value of the $RTT$, the number of iterations can be increased to establish a stable communication with each router and have a larger success rate of pinging.

# 2 Packet Analysis

## 2.a DNS Filter for Apache

After the actual DNS query for `http://apache.org`, a few DNS queries are made to various Google services (such as YouTube, ad services, etc). These are (mostly) because of the YouTube embeds and other browser/website services. The DNS query for `http://apache.org` looks like:

```
▸ Frame 22: 81 bytes on wire (648 bits), 81 bytes captured (648 bits) on interface wlo1, id 0
▸ Ethernet II, Src: IntelCor_1a:37:2c (90:78:41:1a:37:2c), Dst: 84:d8:1b:13:0f:e8 (84:d8:1b:13:0f:e8)
▸ Internet Protocol Version 4, Src: 192.168.0.108, Dst: 192.168.0.1
▸ User Datagram Protocol, Src Port: 46824, Dst Port: 53
▾ Domain Name System (query)
    Transaction ID: 0x7e31
  ▸ Flags: 0x0100 Standard query
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 1
  ▾ Queries
    ▸ apache.org: type A, class IN
  ▾ Additional records
    ▸ <Root>: type OPT
    [Response In: 23]
```

Figure 7: DNS query for Apache

The response is received in 68.7 milliseconds:

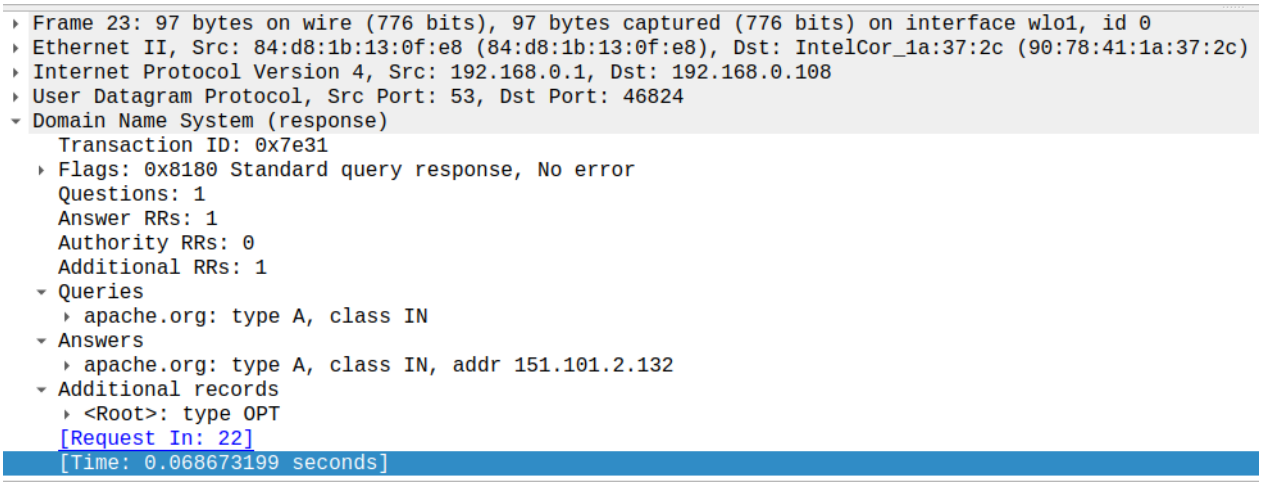


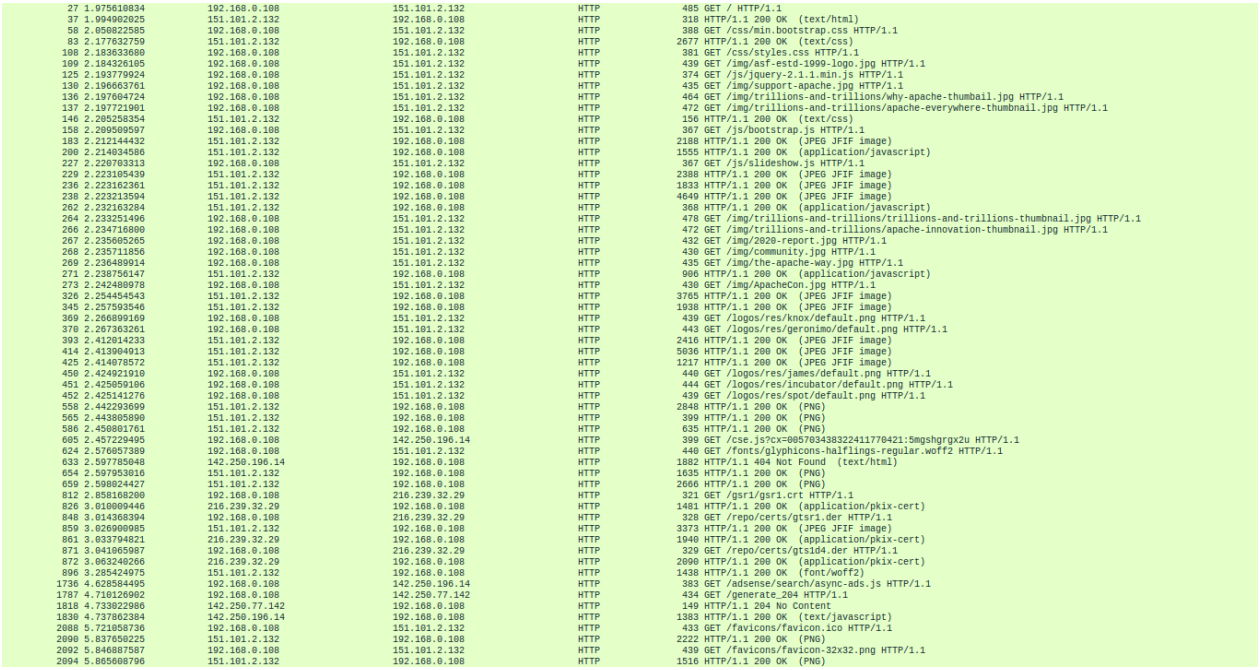

Figure 8: DNS response for Apache

## 2.b HTTP Filter for Apache

24 requests were made for the loading of the webpage to the IP address. 6 additional requests were made to two separate Google IP addresses (3 each). The requests were such that each response yielded a single *file* such as:

- text/html
- text/css
- text/javascript (requested from Google)
- application/javascript
- application/pkix-cert (requested from Google)
- font/woff2
- PNG
- JPEG JFIF image

All of the responses yielded a status code of 200 (except for two responses which were both to Google and they yielded status codes of 204 and 404).



| | | | | | |
|---|---|---|---|---|---|
| 27 | 1.975610834 | 192.168.0.108 | 151.101.2.132 | HTTP | 485 GET / HTTP/1.1 |
| 37 | 1.994902025 | 151.101.2.132 | 192.168.0.108 | HTTP | 318 HTTP/1.1 200 OK (text/html) |
| 58 | 2.050822585 | 192.168.0.108 | 151.101.2.132 | HTTP | 388 GET /css/min.bootstrap.css HTTP/1.1 |
| 83 | 2.177632759 | 151.101.2.132 | 192.168.0.108 | HTTP | 2677 HTTP/1.1 200 OK (text/css) |
| 108 | 2.183633680 | 192.168.0.108 | 151.101.2.132 | HTTP | 381 GET /css/styles.css HTTP/1.1 |
| 109 | 2.184326105 | 192.168.0.108 | 151.101.2.132 | HTTP | 439 GET /img/asf-estd-1999-logo.jpg HTTP/1.1 |
| 125 | 2.193779924 | 192.168.0.108 | 151.101.2.132 | HTTP | 374 GET /js/jquery-2.1.1.min.js HTTP/1.1 |
| 130 | 2.196663761 | 192.168.0.108 | 151.101.2.132 | HTTP | 435 GET /img/support-apache.jpg HTTP/1.1 |
| 136 | 2.197604724 | 192.168.0.108 | 151.101.2.132 | HTTP | 464 GET /img/trillions-and-trillions/why-apache-thumbail.jpg HTTP/1.1 |
| 137 | 2.197721901 | 192.168.0.108 | 151.101.2.132 | HTTP | 472 GET /img/trillions-and-trillions/apache-everywhere-thumbnail.jpg HTTP/1.1 |
| 146 | 2.205258354 | 151.101.2.132 | 192.168.0.108 | HTTP | 156 HTTP/1.1 200 OK (text/css) |
| 158 | 2.209509597 | 192.168.0.108 | 151.101.2.132 | HTTP | 367 GET /js/bootstrap.js HTTP/1.1 |
| 183 | 2.212144432 | 151.101.2.132 | 192.168.0.108 | HTTP | 2188 HTTP/1.1 200 OK (JPEG JFIF image) |
| 200 | 2.214034586 | 151.101.2.132 | 192.168.0.108 | HTTP | 1555 HTTP/1.1 200 OK (application/javascript) |
| 227 | 2.220703313 | 192.168.0.108 | 151.101.2.132 | HTTP | 367 GET /js/slideshow.js HTTP/1.1 |
| 229 | 2.223105439 | 151.101.2.132 | 192.168.0.108 | HTTP | 2388 HTTP/1.1 200 OK (JPEG JFIF image) |
| 236 | 2.223162361 | 151.101.2.132 | 192.168.0.108 | HTTP | 1833 HTTP/1.1 200 OK (JPEG JFIF image) |
| 238 | 2.223213594 | 151.101.2.132 | 192.168.0.108 | HTTP | 4649 HTTP/1.1 200 OK (JPEG JFIF image) |
| 262 | 2.232163284 | 151.101.2.132 | 192.168.0.108 | HTTP | 360 HTTP/1.1 200 OK (application/javascript) |
| 264 | 2.233251496 | 192.168.0.108 | 151.101.2.132 | HTTP | 478 GET /img/trillions-and-trillions/trillions-and-trillions-thumbnail.jpg HTTP/1.1 |
| 266 | 2.234716800 | 192.168.0.108 | 151.101.2.132 | HTTP | 472 GET /img/trillions-and-trillions/apache-innovation-thumbnail.jpg HTTP/1.1 |
| 267 | 2.235605265 | 192.168.0.108 | 151.101.2.132 | HTTP | 432 GET /img/2020-report.jpg HTTP/1.1 |
| 268 | 2.235711856 | 192.168.0.108 | 151.101.2.132 | HTTP | 430 GET /img/community.jpg HTTP/1.1 |
| 269 | 2.236489914 | 192.168.0.108 | 151.101.2.132 | HTTP | 435 GET /img/the-apache-way.jpg HTTP/1.1 |
| 271 | 2.238756147 | 151.101.2.132 | 192.168.0.108 | HTTP | 906 HTTP/1.1 200 OK (application/javascript) |
| 273 | 2.242480978 | 192.168.0.108 | 151.101.2.132 | HTTP | 430 GET /img/ApacheCon.jpg HTTP/1.1 |
| 326 | 2.254454543 | 151.101.2.132 | 192.168.0.108 | HTTP | 3765 HTTP/1.1 200 OK (JPEG JFIF image) |
| 345 | 2.257593546 | 151.101.2.132 | 192.168.0.108 | HTTP | 1938 HTTP/1.1 200 OK (JPEG JFIF image) |
| 360 | 2.266899169 | 192.168.0.108 | 151.101.2.132 | HTTP | 439 GET /logos/res/knox/default.png HTTP/1.1 |
| 370 | 2.267363261 | 192.168.0.108 | 151.101.2.132 | HTTP | 443 GET /logos/res/geronimo/default.png HTTP/1.1 |
| 393 | 2.412014233 | 151.101.2.132 | 192.168.0.108 | HTTP | 2416 HTTP/1.1 200 OK (JPEG JFIF image) |
| 414 | 2.413904913 | 151.101.2.132 | 192.168.0.108 | HTTP | 5036 HTTP/1.1 200 OK (JPEG JFIF image) |
| 425 | 2.414078572 | 151.101.2.132 | 192.168.0.108 | HTTP | 1217 HTTP/1.1 200 OK (JPEG JFIF image) |
| 450 | 2.424921910 | 192.168.0.108 | 151.101.2.132 | HTTP | 440 GET /logos/res/james/default.png HTTP/1.1 |
| 451 | 2.425059106 | 192.168.0.108 | 151.101.2.132 | HTTP | 444 GET /logos/res/incubator/default.png HTTP/1.1 |
| 452 | 2.425141276 | 192.168.0.108 | 151.101.2.132 | HTTP | 439 GET /logos/res/spot/default.png HTTP/1.1 |
| 558 | 2.442293699 | 151.101.2.132 | 192.168.0.108 | HTTP | 2848 HTTP/1.1 200 OK (PNG) |
| 565 | 2.443805890 | 151.101.2.132 | 192.168.0.108 | HTTP | 399 HTTP/1.1 200 OK (PNG) |
| 586 | 2.450801761 | 151.101.2.132 | 192.168.0.108 | HTTP | 635 HTTP/1.1 200 OK (PNG) |
| 605 | 2.457229495 | 192.168.0.108 | 142.250.196.14 | HTTP | 399 GET /cse.js?cx=005703438322411770421:5mgshgrgx2u HTTP/1.1 |
| 624 | 2.576057389 | 192.168.0.108 | 151.101.2.132 | HTTP | 440 GET /fonts/glyphicons-halflings-regular.woff2 HTTP/1.1 |
| 633 | 2.597785048 | 142.250.196.14 | 192.168.0.108 | HTTP | 1882 HTTP/1.1 404 Not Found (text/html) |
| 654 | 2.597953016 | 151.101.2.132 | 192.168.0.108 | HTTP | 1635 HTTP/1.1 200 OK (PNG) |
| 659 | 2.598024427 | 151.101.2.132 | 192.168.0.108 | HTTP | 2666 HTTP/1.1 200 OK (PNG) |
| 812 | 2.858168200 | 192.168.0.108 | 216.239.32.29 | HTTP | 321 GET /gsr1/gsr1.crt HTTP/1.1 |
| 826 | 3.010009446 | 216.239.32.29 | 192.168.0.108 | HTTP | 1481 HTTP/1.1 200 OK (application/pkix-cert) |
| 848 | 3.014368394 | 192.168.0.108 | 216.239.32.29 | HTTP | 328 GET /repo/certs/gtsr1.der HTTP/1.1 |
| 859 | 3.026900985 | 151.101.2.132 | 192.168.0.108 | HTTP | 3373 HTTP/1.1 200 OK (JPEG JFIF image) |
| 861 | 3.033794821 | 216.239.32.29 | 192.168.0.108 | HTTP | 1040 HTTP/1.1 200 OK (application/pkix-cert) |
| 871 | 3.041065987 | 192.168.0.108 | 216.239.32.29 | HTTP | 329 GET /repo/certs/gts1d4.der HTTP/1.1 |
| 872 | 3.063240266 | 216.239.32.29 | 192.168.0.108 | HTTP | 2090 HTTP/1.1 200 OK (application/pkix-cert) |
| 896 | 3.285424975 | 151.101.2.132 | 192.168.0.108 | HTTP | 1438 HTTP/1.1 200 OK (font/woff2) |
| 1736 | 4.628584495 | 192.168.0.108 | 142.250.196.14 | HTTP | 383 GET /adsense/search/async-ads.js HTTP/1.1 |
| 1787 | 4.710126902 | 192.168.0.108 | 142.250.77.142 | HTTP | 434 GET /generate_204 HTTP/1.1 |
| 1818 | 4.733022986 | 142.250.77.142 | 192.168.0.108 | HTTP | 149 HTTP/1.1 204 No Content |
| 1830 | 4.737862384 | 142.250.196.14 | 192.168.0.108 | HTTP | 1383 HTTP/1.1 200 OK (text/javascript) |
| 2088 | 5.721058736 | 192.168.0.108 | 151.101.2.132 | HTTP | 433 GET /favicons/favicon.ico HTTP/1.1 |
| 2090 | 5.837650225 | 151.101.2.132 | 192.168.0.108 | HTTP | 2222 HTTP/1.1 200 OK (PNG) |
| 2092 | 5.846887587 | 192.168.0.108 | 151.101.2.132 | HTTP | 439 GET /favicons/favicon-32x32.png HTTP/1.1 |
| 2094 | 5.865608796 | 151.101.2.132 | 192.168.0.108 | HTTP | 1516 HTTP/1.1 200 OK (PNG) |

Figure 9: Entire list of HTTP requests and responses for Apache

## 2.c Time to Download the Webpage

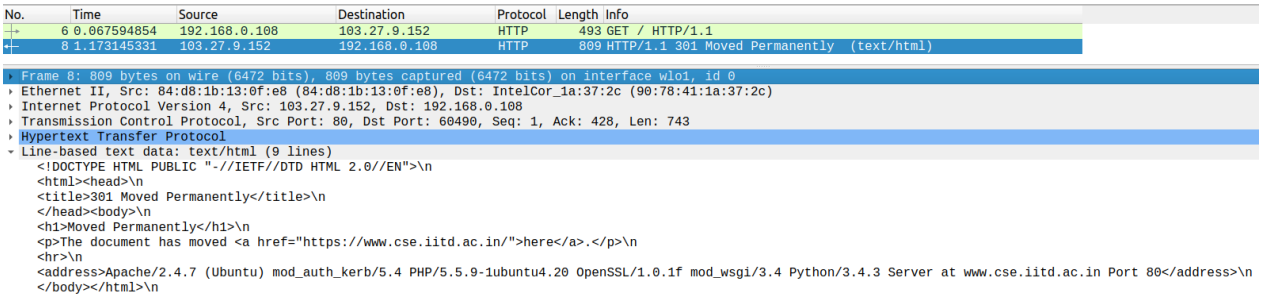
The total time taken is defined as:

$$time(last\ HTTP\ response) - time(first\ DNS\ query)$$

On evaluating, the time is obtained to be $(5.865 - 1.888)s = \mathbf{3.977s}$

## 2.d HTTP Filter for CSE IITD

On applying the *HTTP* filter for `http://www.cse.iitd.ac.in`, there is a single response with error code 301, which means that the webpage has been **Moved Permanently**. The response contains a webpage which *redirects* to https://www.cse.iitd.ac.in. The communications over *HTTPS* are done over **TLS** which first includes initiating connection, encryption handshake and then sharing of information securely.



| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 6 | 0.067594854 | 192.168.0.108 | 103.27.9.152 | HTTP | 493 | GET / HTTP/1.1 |
| 8 | 1.173145331 | 103.27.9.152 | 192.168.0.108 | HTTP | 809 | HTTP/1.1 301 Moved Permanently (text/html) |

```
▸ Frame 8: 809 bytes on wire (6472 bits), 809 bytes captured (6472 bits) on interface wlo1, id 0
▸ Ethernet II, Src: 84:d8:1b:13:0f:e8 (84:d8:1b:13:0f:e8), Dst: IntelCor_1a:37:2c (90:78:41:1a:37:2c)
▸ Internet Protocol Version 4, Src: 103.27.9.152, Dst: 192.168.0.108
▸ Transmission Control Protocol, Src Port: 80, Dst Port: 60490, Seq: 1, Ack: 428, Len: 743
▸ Hypertext Transfer Protocol
▾ Line-based text data: text/html (9 lines)
    <!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">\n
    <html><head>\n
    <title>301 Moved Permanently</title>\n
    </head><body>\n
    <h1>Moved Permanently</h1>\n
    <p>The document has moved <a href="https://www.cse.iitd.ac.in/">here</a>.</p>\n
    <hr>\n
    <address>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 Server at www.cse.iitd.ac.in Port 80</address>\n
    </body></html>\n
```

Figure 10: HTTP request and response for `http://www.cse.iitd.ac.in`

# 3 Implementing Traceroute

## 3.a Explanation of the Code

To implement `traceroute`, socket programming was used to send an *ICMP* echo request (type = 8) and receive the response from the server setting different hop values. Breaking down the main part of the `ping` function:

```
80              t = time.time()
81              sock.sendto(packet, (DEST, 1))
82              response, (addr, _) = sock.recvfrom(1024)
83              t = (time.time() - t) * 1000
```

The above code sends the packet and receives it, computing the *RTT* too.

```
84              if checksum(response) != 0:
85                  raise socket.timeout
86              code = struct.unpack("B", response[20:21])[0]
87              rtt[ttl].append([t, addr, code])
88              reached |= code == 0
```

The checksum is verified to be 0 and then the first byte of the **header** is analysed. This contains the type of the packet, which equals 0 on a successful echo and 11 on TTL exceeded.

The remaining code inside the `ping` function involves setting the *TTL value* and printing relevant information.

## 3.b Working of the Code

### 3.b.i GitHub

GitHub is used since it has considerable number of hops with routers on the way both responding and not responding. The output and plot of the traceroute looks like:

```
Traceroute starting for www.github.com (13.234.176.102)
1        (192.168.0.1) 1.19        18.62        2.60
2        (10.130.32.1) 9.21        1.74        1.59
3        (183.83.248.26) 10.68        2.39        6.32
4        (183.82.14.78) 19.69        120.93        17.46
5        (99.83.69.114) 23.17        17.28        19.87
6        (150.222.219.128) 126.26        18.12        15.96
7        (150.222.219.137) 15.89        15.50        137.79
8        *        *        *
9        (54.239.45.102) 27.68        25.22        26.25
10        *        *        *
11        (52.95.67.164) 78.17        39.11        136.33
12        (52.95.64.222) 25.50        27.56        149.62
13        (52.95.64.223) 29.82        29.91        142.83
14        (52.95.67.171) 30.80        30.49        139.91
15        (52.95.67.182) 29.70        30.19        144.63
```

```
16        *         *         *
17        *         *         *
18        *         *         *
19        *         *         *
20        *         *         *
21        (13.234.176.102) 30.12        29.57        29.40
```

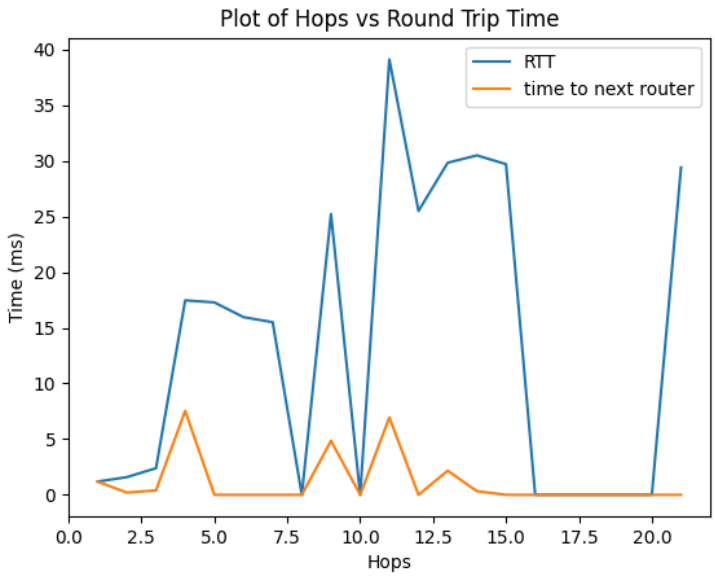



Figure 11: Plot for GitHub

### 3.b.ii IITD

The output for IITD is also added to the report to show the proper handling of the termination condition, i.e., when the *header type* does not equal `ICMP echo` even if the returned *IP address* matches (reference to this Piazza post). The output and plot are as follows:

```
Traceroute starting for www.iitd.ac.in (103.27.9.24)
1         (192.168.0.1) 5.37        5.96        2.40
2         (10.130.32.1) 2.41        2.74        1.53
3         *         *         *
4         (14.142.71.205) 3.80        1.65        2.10
5         *         *         *
6         (14.140.210.22) 99.03        26.99        26.11
7         *         *         *
8         *         *         *
9         *         *         *
10         (103.27.9.24) 28.21        27.72        27.85
11         (103.27.9.24) 27.87        27.85        87.41
```

```
12          (103.27.9.24) 27.69          29.59          27.74
```

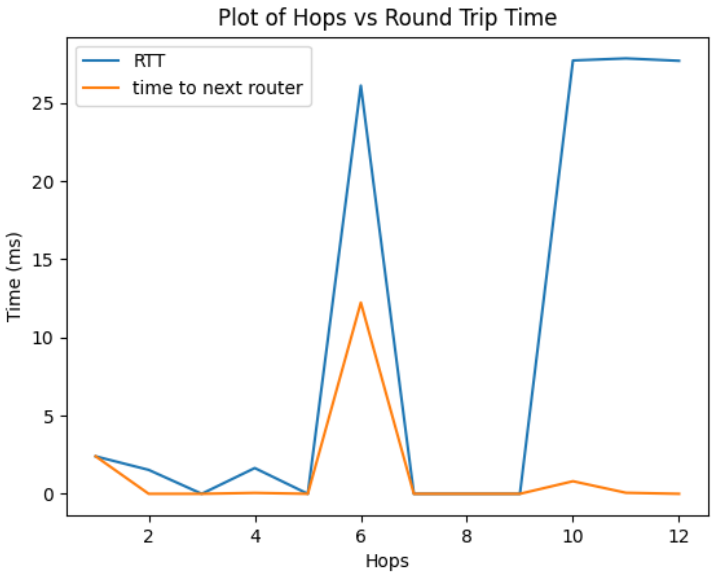



Figure 12: Plot for IITD