

# Computer Networks Assignment 1

This is my report for the first assignment of the Computer Networks course. The report is written in markdown and can be viewed in any markdown viewer. Each individual question has its own folder with a report and any images used in the report.

## Problem 1

### Part a

```
root@ur-mum-virtual-machine:/home/ur-mum/Documents/CN# ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.232.129 netmask 255.255.255.0 broadcast 192.168.232.255
    inet6 fe80::1eaf:8055:f765:2a0b prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:cd:f6:82 txqueuelen 1000 (Ethernet)
    RX packets 296954 bytes 327149471 (327.1 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 108355 bytes 23366001 (23.3 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 97843 bytes 11792754 (11.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 97843 bytes 11792754 (11.7 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Using ifconfig:  
*local/private ip address*

### Part b

My IP Address is:

IPv4: 103.25.231.102

IPv6: Not detected

My IP Information:

ISP: Indraprastha Institute of Information Technology Delhi

Services: Network Sharing

Device: [redacted]

City: Noida

Region: Uttar Pradesh

Country: India

Your location may be exposed!

[Show Complete IP Details](#)

[HIDE MY IP ADDRESS NOW](#)

Location not accurate? [Update My IP Location](#)

Using What is my ip address:  
*global/public ip address*

Both the IP addresses are different.

The difference between the two is that the local ip address is the ip address of the device on the local network, while the global ip address is the ip address of the device on the internet. The local ip address is assigned by the router, while the

global ip address is assigned by the ISP company that provides internet service to the user. This is done to reduce the number of IP addresses and abstract the IP addresses for security.

## Problem 2

### Part a

An authoritative answer is a response we get directly from the primary DNS server holding the master copy of the zone file.

To receive an authoritative answer we first must find the primary DNS server for the domain we are looking for. We can do this by using the `nslookup` command. For example, if we want to find the primary DNS server for `google.com` we can run the command `nslookup -type=soa google.com` which will return the primary DNS server for `google.com` which is `ns1.google.com`.

Now that we have the primary DNS server for `google.com` we can run the command `nslookup google.com ns1.google.com` which will return an authoritative answer for `google.com` which is in the image below:

```
root@urum-virtual-machine:/home/ur-mum/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1/Q2# nslookup -type=soa google.in
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
google.in
  origin = ns1.google.com
  mail addr = dns-admin.google.com
  serial = 556730683
  refresh = 900
  retry = 900
  expire = 1800
  minimum = 60

Authoritative answers can be found from:
ns1.google.com internet address = 216.239.32.10
ns1.google.com has AAAA address 2001:4860:4802:32::a

root@urum-virtual-machine:/home/ur-mum/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1/Q2# nslookup google.in ns1.google.com
Server:      ns1.google.com
Address:     216.239.32.10#53

Name:   google.in
Address: 172.217.167.228
Name:   google.in
Address: 2404:6800:4002:80f::2004

root@urum-virtual-machine:/home/ur-mum/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1/Q2#
```

Figure 1: plot

for part (b):

Time to live of google.com DNS is 5 seconds. It will then be

## Problem 3

### Part a

The total hops are 10. One intermediary router is `_gateway(192.168.232.2)`. The average latency was is 0.506ms. The other is `del1s22-in-f14.1e100.net(142.250.206.174)`.

```

root@urmum-virtual-machine:/home/ur-mum/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1/Q2# nslookup -debug google.in
Server:      127.0.0.53
Address:     127.0.0.53#53

-----
QUESTIONS:
  google.in, type = A, class = IN
ANSWERS:
-> google.in
  internet address = 142.250.192.196
  ttl = 5
AUTHORITY RECORDS:
ADDITIONAL RECORDS:
-----
Non-authoritative answer:
Name:   google.in
Address: 142.250.192.196
-----
QUESTIONS:
  google.in, type = AAAA, class = IN
ANSWERS:
-> google.in
  has AAAA address 2404:6800:4002:817::2004
  ttl = 5
AUTHORITY RECORDS:
ADDITIONAL RECORDS:
-----
Name:   google.in
Address: 2404:6800:4002:817::2004

```

Figure 2: plot

The average latency was 5.802ms. Rest of the routers are not shown in the output of the command `tracert www.google.com -I`.

The output of the command `tracert www.google.com -I` is shown below:

```

root@urmum-virtual-machine:/home/ur-mum/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1# tracert -I google.com
tracert to google.com (142.250.206.174), 30 hops max, 60 byte packets
 1 _gateway (192.168.232.2) 0.564 ms 0.495 ms 0.415 ms
 2 * * *
 3 * * *
 4 * * *
 5 * * *
 6 * * *
 7 * * *
 8 * * *
 9 * * *
10 dell1s22-in-f14.1e100.net (142.250.206.174) 5.876 ms 5.821 ms 5.765 ms

```

Figure 3: plot

The below result on windows is given by the command `tracert www.google.com`:

### Part b

After pinging the URL “www.google.com” 50 times, I got an average of 9.009 ms. The exact output is shown below:

### Part c

Adding up all intermediate router latencies, we get  $0.506\text{ms} + 5.802\text{ms} = 6.308\text{ms}$ . This is less than the average latency of pinging the URL “www.google.com” 50 times which is 9.009 ms. They are different as both traceroute and ping use different methods to calculate the latency. Traceroute uses ICMP packets to calculate the latency, while ping uses ICMP echo packets to calculate the latency.

```

C:\WINDOWS\system32>tracert google.com

Tracing route to google.com [142.250.206.174]
over a maximum of 30 hops:

  0  59 ms  14 ms  18 ms  192.168.32.254
  1   5 ms   2 ms   2 ms  vpn.iiitd.edu.in [192.168.1.99]
  2   4 ms   2 ms   2 ms  103.25.231.1
  3   *      *      *      Request timed out.
  4   3 ms   4 ms   6 ms  10.119.234.162
  5   5 ms  11 ms   3 ms  72.14.194.160
  6   7 ms   4 ms   5 ms  74.125.243.97
  7   7 ms   4 ms   4 ms  142.251.76.203
  8   5 ms   4 ms   3 ms  del11s22-in-f14.1e100.net [142.250.206.174]

Trace complete.

```

Figure 4: plot

```

--- google.in ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49099ms
rtt min/avg/max/mdev = 5.516/9.009/64.666/8.123 ms

```

Figure 5: plot

#### Part d

Maximum of all intermediate router latencies is 5.802ms. This is less than the average latency of pinging the URL “www.google.com” 50 times which is 9.009 ms. This is because the latency of any one intermediate router will be less than all the intermediate routers.

#### Part e

The multiple entries in the traceroute output are due to the fact that the packets are being routed through different paths. This is because the routers are using different routing algorithms to route the packets. The routers are using different routing algorithms because they are different routers and they are using different routing algorithms to route the packets.

#### Part f

The average latency is 329.266 ms. The output of the command `ping stanford.edu -c 50` is shown below:

#### Part g

The number of hops to stanford.edu is 27. This is much lower than google.com’s 10 hops. The output of the command `traceroute stanford.edu -I` is shown below:

```

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49084ms
rtt min/avg/max/mdev = 326.331/329.266/344.812/2.648 ms

```

Figure 6: plot

```

root@urmun-virtual-machine:/home/ur-num/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1# traceroute -I stanford.edu
traceroute to stanford.edu (171.67.215.200), 30 hops max, 60 byte packets
 1 _gateway (192.168.232.2)  0.189 ms  0.108 ms  0.079 ms
 2 * * *
 3 * * *
 4 * * *
 5 * * *
 6 * * *
 7 * * *
 8 * * *
 9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 web.stanford.edu (171.67.215.200)  382.297 ms  382.253 ms  374.441 ms

```

Figure 7: plot

Below is the output of the command `tracert stanford.edu` on windows:

## Part h

The latency difference between stanford.edu and google.com is 329.266 ms - 9.009 ms = 320.257 ms. This is due to stanford.edu being farther away from my location than google.com. This is because the packets have to travel a longer distance to reach stanford.edu than google.com. This is also leads to the higher number of hops to stanford.edu than google.com.

## Problem 4

To fail the localhost (127.0.0.1) with 100% packetloss, I made the firewall reject any input connection to the localhost. This can be done by running the command `sudo iptables -A INPUT -p icmp --icmp-type echo-request -s 127.0.0.1 -j DROP`. This will reject any input connection to the localhost. To test this I ran the command `ping 127.0.0.1` which returned the below image:

To restore the localhost I ran the command `sudo iptables -D INPUT -p icmp --icmp-type echo-request -s 127.0.0.1 -j DROP` which will remove the rule that rejects any input connection to the localhost. To test this I ran

```
C:\WINDOWS\system32>tracert stanford.edu

Tracing route to stanford.edu [171.67.215.200]
over a maximum of 30 hops:

  0  8 ms  37 ms  44 ms  192.168.32.254
  1  5 ms  3 ms  4 ms  vpn.iiitd.edu.in [192.168.1.99]
  2  6 ms  2 ms  4 ms  103.25.231.1
  3  27 ms  29 ms  27 ms  10.1.209.201
  4  30 ms  30 ms  30 ms  10.1.200.137
  5  33 ms  31 ms  32 ms  10.255.238.254
  6  28 ms  28 ms  27 ms  180.149.48.18
  7  179 ms  178 ms  181 ms  180.149.48.6
  8  195 ms  215 ms  211 ms  180.149.48.20
  9  253 ms  254 ms  323 ms  180.149.48.13
 10  364 ms  390 ms  322 ms  fourhundredge-0-0-0-2.4079.core1.ashb.net.internet2.edu [163.253.1.116]
 11  410 ms  317 ms  494 ms  fourhundredge-0-0-0-1.4079.core1.clev.net.internet2.edu [163.253.1.123]
 12  317 ms  383 ms  318 ms  fourhundredge-0-0-0-2.4079.core1.eqch.net.internet2.edu [163.253.1.211]
 13  321 ms  322 ms  321 ms  fourhundredge-0-0-0-1.4079.core1.chic.net.internet2.edu [163.253.1.206]
 14  326 ms  327 ms  327 ms  fourhundredge-0-0-0-1.4079.core2.kans.net.internet2.edu [163.253.2.29]
 15  350 ms  321 ms  320 ms  fourhundredge-0-0-0-1.4079.core2.denv.net.internet2.edu [163.253.1.250]
 16  334 ms  336 ms  336 ms  fourhundredge-0-0-0-3.4079.core2.salt.net.internet2.edu [163.253.1.169]
 17  323 ms  323 ms  322 ms  fourhundredge-0-0-0-2.4079.core2.sacr.net.internet2.edu [163.253.1.186]
 18  314 ms  316 ms  314 ms  fourhundredge-0-0-0-21.4079.core1.sacr.net.internet2.edu [163.253.1.34]
 19  322 ms  390 ms  381 ms  fourhundredge-0-0-0-4079.core1.sunn.net.internet2.edu [163.253.1.193]
 20  334 ms  335 ms  335 ms  hpr-svl-agg10--internet2r&e-100ge.cenic.net [137.164.26.126]
 21  315 ms  314 ms  317 ms  hpr-oak-agg8--svl-hpr3-100g.cenic.net [137.164.25.95]
 22  328 ms  354 ms  326 ms  137.164.26.241
 23  323 ms  323 ms  322 ms  woa-west-rtr-v13.SUNet [171.66.255.132]
 24  *      *      *      Request timed out.
 25  321 ms  319 ms  321 ms  web.stanford.edu [171.67.215.200]
```

Figure 8: plot

```
root@urmun-virtual-machine:/home/ur-mum/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1/Q4# 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 ---
5 packets transmitted, 0 received, 100% packet loss, time 4089ms
```

Figure 9: plot

the command `ping 127.0.0.1` which returned the below image:

```
root@urmun-virtual-machine:/home/ur-mum/Documents/CN/CSE232-ComputerNetworks-Assignments/Assignment-1/Q4# ping 127.0.0.1 -c 5
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data:
64 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.039 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.051 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.087 ms
64 bytes from 127.0.0.1: icmp_seq=4 ttl=64 time=0.060 ms
64 bytes from 127.0.0.1: icmp_seq=5 ttl=64 time=0.059 ms

--- 127.0.0.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4083ms
rtt min/avg/max/mdev = 0.039/0.060/0.087/0.016 ms
```

Figure 10: plot

## Problem 5

## Problem 6

## Sources:

<https://www.linode.com/docs/guides/how-to-use-nslookup-command/>

<https://www.baeldung.com/cs/dns-authoritative-server-ip#:~:text=An%20authoritative%20answer%20is%20a,c>

<https://www.howtouselinux.com/post/dns-ttl#:~:text=The%20best%20way%20to%20check,is%20available%20c>

<https://superuser.com/questions/1137399/why-iptables-rules-are-impacting->

```
root@urmum-virtual-machine:/home/ur-mum# telnet 192.168.24.12 9900
Trying 192.168.24.12...
Connected to 192.168.24.12.
Escape character is '^]'.
GET /secret
Host:192.168.24:9900

HTTP/1.1 200 OK
Content-Type: text/plain
ip: 192.168.1.99
X-secret: U2FsdGVkX1/FRtU+minEV2D1U125PKOCWrnuR16vSrB4bvMAkMgOXThQKNT+1P8Q
Date: Fri, 18 Aug 2023 15:09:05 GMT
Connection: close

Success
Connection closed by foreign host.
```

Figure 11: plot

```
root@urmum-virtual-machine:/home/ur-mum# telnet 192.168.24.12 smtp
Trying 192.168.24.12...
Connected to 192.168.24.12.
Escape character is '^]'.
220 Welcome to CSE232 Mail Server
helo cse232.com
250 xeon01-rs-iiitd.iiitd.edu.in
MAIL FROM: 21038@cse232.com
250 2.1.0 Ok
RCPT TO: 21038@cse232.com
250 2.1.5 Ok
DATA
354 End data with <CR><LF>.<CR><LF>
testing.
.
250 2.0.0 Ok: queued as 344B76F6457B
```

Figure 12: plot

ping-localhost

<https://www.cloudservus.com/blog/using-telnet-to-send-mail>

<https://www.novell.com/documentation/extend5/Docs/help/Composer/books/TelnetAppendixB.html>

<https://www.wikihow.com/Send-Email-Using-Telnet>

<https://www.cloudservus.com/blog/using-telnet-to-send-mail>