

LAB ASSIGNMENT - 1

Computer Networks

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Section I : Computer Networks Utilities

1. **Ping** : Sends ICMP echo_request to network host. It tells how much time it takes for packets to reach the host. It checks if a host is alive or not.

icmp_seq : indicates number request in icmp request(Internet Control Message Protocol)

i. ping hostname/ip

```
$ ping iitrpr.ac.in
64 bytes from ip6-localhost (::1): icmp_seq=1 ttl=128 time=0.159 ms
64 bytes from ip6-localhost (::1): icmp_seq=2 ttl=128 time=0.177 ms
64 bytes from ip6-localhost (::1): icmp_seq=3 ttl=128 time=0.214 ms
64 bytes from ip6-localhost (::1): icmp_seq=4 ttl=128 time=0.216 ms
```

ii. ping -a hostname/ip : beep sound when the peer is reachable.

```
$ ping -a iitrpr.ac.in
PING iitrpr.ac.in(ip6-localhost (::1)) 56 data bytes
64 bytes from ip6-localhost (::1): icmp_seq=1 ttl=128 time=0.166 ms
64 bytes from ip6-localhost (::1): icmp_seq=2 ttl=128 time=0.206 ms
64 bytes from ip6-localhost (::1): icmp_seq=3 ttl=128 time=0.203 ms
64 bytes from ip6-localhost (::1): icmp_seq=4 ttl=128 time=0.273 ms
```

iii. ping -c(count) hostname/ip : set the number of times to send the ping request.

```
$ ping -c 4 iitrpr.ac.in
64 bytes from ip6-localhost (::1): icmp_seq=1 ttl=128 time=0.156 ms
64 bytes from ip6-localhost (::1): icmp_seq=2 ttl=128 time=0.222 ms
64 bytes from ip6-localhost (::1): icmp_seq=3 ttl=128 time=0.281 ms
64 bytes from ip6-localhost (::1): icmp_seq=4 ttl=128 time=0.145 ms
```

```
--- iitrpr.ac.in ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 0.145/0.201/0.281/0.054 ms
```

iv. ping -f hostname/ip : flood the network by sending a hundred or more packets per second. Need to be super-user.

```
$ sudo ping -f -c 10 iitrpr.ac.in
PING iitrpr.ac.in(::1) 56 data bytes

--- iitrpr.ac.in ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 112ms
rtt min/avg/max/mdev = 0.082/0.377/1.439/0.477 ms, pipe 3, ipg/ewma 12.465/0.371 ms
```

v. ping -i (time-interval) hostname/ip : change the time interval between two pings.

Default time interval is one second for the linux system.

```
$ ping -i 2 iitrpr.ac.in
PING iitrpr.ac.in(ip6-localhost (::1)) 56 data bytes
64 bytes from ip6-localhost (::1): icmp_seq=1 ttl=128 time=0.209 ms
64 bytes from ip6-localhost (::1): icmp_seq=2 ttl=128 time=0.188 ms
64 bytes from ip6-localhost (::1): icmp_seq=3 ttl=128 time=0.158 ms
```

Note : If we want to set time less than 0.2 sec, then we need super user access(sudo).

vi. ping -s (packetsize) hostname/IP : The default ping packet size is 56 bytes. It changes the packet size.

```
$ ping -s 128 iitrpr.ac.in
PING iitrpr.ac.in(ip6-localhost (::1)) 128 data bytes
136 bytes from ip6-localhost (::1): icmp_seq=1 ttl=128 time=0.209 ms
136 bytes from ip6-localhost (::1): icmp_seq=2 ttl=128 time=0.229 ms
136 bytes from ip6-localhost (::1): icmp_seq=3 ttl=128 time=0.252 ms
136 bytes from ip6-localhost (::1): icmp_seq=4 ttl=128 time=0.160 ms
```

vii. ping -w (time-in-seconds) hostname/ip : set a time limit after which ping will exit; no matter how many ping packets are sent or received.

```
$ ping -w 3 iitrpr.ac.in
PING iitrpr.ac.in(ip6-localhost (::1)) 56 data bytes
64 bytes from ip6-localhost (::1): icmp_seq=1 ttl=128 time=0.164 ms
64 bytes from ip6-localhost (::1): icmp_seq=2 ttl=128 time=0.181 ms
64 bytes from ip6-localhost (::1): icmp_seq=3 ttl=128 time=0.172 ms

--- iitrpr.ac.in ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.164/0.172/0.181/0.012 ms
```

viii. Ping -T(time-to-live) : set the Time To Live.

- 2. Traceroute** : prints the route that a packet takes to reach the host. The first column corresponds to the hop count. The second column represents the address of that hop and after that, three space-separated times in milliseconds. traceroute command sends three packets to the hop and each of the time refers to the time taken by the packet to reach the hop.

i. traceroute [options] host_Address [pathlength]

```
$ tracert iitrpr.ac.in
Tracing route to iitrpr.ac.in [172.30.4.14]
over a maximum of 30 hops:
```

```
  1   2 ms   2 ms   1 ms 172.21.4.2
  2   1 ms   1 ms   2 ms 172.30.4.14
```

Trace complete.

ii. traceroute -4/-6 host_address : Use ip version 4/6 i.e. use IPv4/6

```
$ tracert -4 iitrpr.ac.in
Tracing route to iitrpr.ac.in [117.252.3.35]
over a maximum of 30 hops:
```

```
  1   2 ms   3 ms   2 ms 172.21.4.3
  2   4 ms   4 ms   4 ms 103.118.50.3
  3   4 ms   4 ms   4 ms 117.242.132.26
  4   *      *      *    Request timed out.
  5   *      *      *    Request timed out.
  6  49 ms  49 ms  60 ms 172.24.175.218
  7  48 ms  48 ms  48 ms 172.24.175.213
  8  53 ms  52 ms  53 ms 117.252.3.35
  9   *      *      *    Request timed out.
```

iii. traceroute -F host_address : It is used if we do not want to fragment packets.

iv. traceroute -n host_address : Not to resolve IP address to their domain name.

- 3. NSlookup :** “It is used for getting information from the DNS server. It is a network administration tool for querying the Domain Name System (DNS) to obtain domain name or IP address mapping or any other specific DNS record. It is also used to troubleshoot DNS related problems.” - Geeksforgeeks

Note that some IP addresses will not return a domain name because there may be records indicating multiple domain names for a given IP address.

- i. nslookup destination :** to find the address record for a domain.

```
$ nslookup iitrpr.ac.in
Server:      172.30.4.14
Address:     172.30.4.14#53
```

```
Name: iitrpr.ac.in
Address: 172.30.4.14
Name: iitrpr.ac.in
Address: ::1
```

Reverse DNS : By entering the IP address into the Reverse DNS Lookup Tool, we are able to find the domain name associated with the corresponding IP.

```
$ nslookup 209.132.183.105
105.183.132.209.in-addr.arpa  name = redirect.redhat.com.
```

Authoritative answers can be found from:

```
183.132.209.in-addr.arpa    nameserver = ns1.redhat.com.
183.132.209.in-addr.arpa    nameserver = ns2.redhat.com.
ns1.redhat.com internet address = 209.132.186.218
ns2.redhat.com internet address = 209.132.183.2
```

- ii. nslookup -type=any destination :** To view all the available DNS records.

```
$ nslookup -type=any iitrpr.ac.in
Server:      172.30.4.14
Address:     172.30.4.14#53

iitrpr.ac.in
  origin = ns.iitrpr.ac.in
  mail addr = root.ns.iitrpr.ac.in
  serial = 9
  refresh = 604800
  retry = 86400
  expire = 2419200
  minimum = 604800
iitrpr.ac.in  nameserver = ns.iitrpr.ac.in.
Name: iitrpr.ac.in
Address: 172.30.4.14
Name: iitrpr.ac.in
Address: ::1
```

iii. nslookup -type=soa destination : tells the start of authority record, provides the authoritative information about the domain, the e-mail address of the domain admin, the domain serial number etc.

```
$ nslookup -type=soa iitrpr.ac.in
Server:      172.30.4.14
Address:     172.30.4.14#53

iitrpr.ac.in
origin = ns.iitrpr.ac.in
mail addr = root.ns.iitrpr.ac.in
serial = 9
refresh = 604800
retry = 86400
expire = 2419200
minimum = 604800
```

iii. nslookup -type=ns destination : record maps a domain name to a list of DNS servers authoritative for that domain. It outputs the name serves which are associated with the given domain.

```
$ nslookup -type=ns iitrpr.ac.in
Server:      172.30.4.14
Address:     172.30.4.14#53

iitrpr.ac.in  nameserver = ns.iitrpr.ac.in.
```

iv. nslookup -type=a destination : Lookup for an a record.

```
$ nslookup -type=a iitrpr.ac.in
Server:      172.30.4.14
Address:     172.30.4.14#53

Name:  iitrpr.ac.in
Address: 172.30.4.14
```

v. nslookup -type=mx destination : Look for mail-exchange record.

```
$ nslookup -type=mx google.com
Server:      172.30.4.14
Address:     172.30.4.14#53

Non-authoritative answer:
google.com  mail exchanger = 10 aspmx.l.google.com.
google.com  mail exchanger = 40 alt3.aspmx.l.google.com.
google.com  mail exchanger = 20 alt1.aspmx.l.google.com.
google.com  mail exchanger = 30 alt2.aspmx.l.google.com.
google.com  mail exchanger = 50 alt4.aspmx.l.google.com.
```

Authoritative answers can be found from:

```
google.com  nameserver = ns4.google.com.
google.com  nameserver = ns3.google.com.
google.com  nameserver = ns2.google.com.
google.com  nameserver = ns1.google.com.
ns1.google.com internet address = 216.239.32.10
(...)
```

vi. nslookup -type=txt destination : Look for text record.

```
$ nslookup -type=txt google.com
Server:      172.30.4.14
Address:     172.30.4.14#53
```

Non-authoritative answer:

```
google.com    text = "globalsign-smime-dv=CDYX+XFHUw2wml6/Gb8+59BsH31KzUr6c1l2BPvqKX8="
google.com    text = "v=spf1 include:_spf.google.com ~all"
google.com    text = "facebook-domain-verification=22rm551cu4k0ab0bxsw536tlds4h95"
google.com    text = "docuSign=1b0a6754-49b1-4db5-8540-d2c12664b289"
google.com    text = "docuSign=05958488-4752-4ef2-95eb-aa7ba8a3bd0e"
```

Authoritative answers can be found from:

```
google.com    nameserver = ns3.google.com.
google.com    nameserver = ns1.google.com.
google.com    nameserver = ns4.google.com.
google.com    nameserver = ns2.google.com.
ns1.google.com internet address = 216.239.32.10
ns1.google.com has AAAA address 2001:4860:4802:32::a
ns2.google.com internet address = 216.239.34.10
ns2.google.com has AAAA address 2001:4860:4802:34::a
```

4. **NetStat** : “Netstat command displays various network related information such as network connections, routing tables, interface statistics, masquerade connections, multicast memberships etc.” - Geeksforgeeks

i. netstat :

```
$ netstat
Active Connections

Proto Local Address      Foreign Address    State
TCP   127.0.0.1:50242     StarkHUB:50243     ESTABLISHED
TCP   127.0.0.1:50243     StarkHUB:50242     ESTABLISHED
TCP   172.21.5.133:7680   172.23.4.236:64906 TIME_WAIT
(...)
```

ii. netstat -a : display both listening & non- listening sockets.

```
$ netstat -a
Active Connections

Proto Local Address      Foreign Address    State
TCP   0.0.0.0:135        StarkHUB:0         LISTENING
TCP   0.0.0.0:445        StarkHUB:0         LISTENING
TCP   0.0.0.0:1500       StarkHUB:0         LISTENING
(...)
UDP   0.0.0.0:500        *.*
UDP   0.0.0.0:1500       *.*
UDP   0.0.0.0:3702       *.*
(...)
```

iii. netstat -tp : list all TCP ports.

iv. netstat -au : list all UDP ports.

v. netstat -l : list all listening ports.

vi. netstat -lt : list all listening TCP ports.

vii. netstat -lu : list all listening UDP ports

viii. netstat -s : list statistics of all ports.

```
$ netstat -s
IPv4 Statistics

Packets Received          = 3595775
Received Header Errors    = 0
Received Address Errors   = 19
Datagrams Forwarded       = 0
Unknown Protocols Received = 2
Received Packets Discarded = 27346
```



```
Received Packets Delivered    = 3857273
Output Requests               = 2357469
Routing Discards              = 0
Discarded Output Packets      = 4723
Output Packet No Route        = 276
Reassembly Required           = 0
Reassembly Successful         = 0
Reassembly Failures           = 0
Datagrams Successfully Fragmented = 0
Datagrams Failing Fragmentation = 0
Fragments Created             = 0
```

IPv6 Statistics

(...)

ICMPv4 Statistics

(...)

ICMPv6 Statistics

(...)

TCP Statistics for IPv4

(...)

TCP Statistics for IPv6

(...)

UDP Statistics for IPv4

(...)

UDP Statistics for IPv6

(...)

ix. netstat -pt : display PID and program name.

x. netstat -r : to get kernel routing information.

5. Ifconfig : It is used to configure the kernel-resident network interfaces.

i. ifconfig :

```
$ ifconfig
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.56.1 netmask 255.255.255.0 broadcast 192.168.56.255
    inet6 fe80::c195:d688:280:f9e6 prefixlen 64 scopeid 0xfd<compat,link,site,host>
    ether 0a:00:27:00:00:11 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 1500
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0xfe<compat,link,site,host>
    loop (Local Loopback)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wifi0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.21.5.133 netmask 255.255.252.0 broadcast 172.21.7.255
    inet6 fe80::f1a2:649b:5fb6:db6f prefixlen 64 scopeid 0xfd<compat,link,site,host>
    ether 00:21:6b:fc:c9:8e (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

ii. ifconfig -a : display all interfaces available, even if they are down.

iii. ifconfig -s : display short list instead of details.

```
$ ifconfig -s
Iface  MTU  RX-OK RX-ERR RX-DRP RX-OVR  TX-OK TX-ERR TX-DRP TX-OVR Flg
eth1   1500    0    0    0 0      0    0    0 0 BMRU
lo     1500    0    0    0 0      0    0    0 0 LRU
wifi0  1500    0    0    0 0      0    0    0 0 BMRU
```

iv. ifconfig -v : display in verbose mode.

- 6. Hostname :** “to obtain the DNS(Domain Name System) name and set the system’s hostname or NIS(Network Information System) domain name. A hostname is a name which is given to a computer and it is attached to the network.” - Geeksforgeeks

i. hostname

```
$ hostname  
StarkHUB
```

ii. hostname -a : to get alias name of the host system(if any).

iii. hostname -A : to get all FQDNs(Fully Qualified Domain Name) of the host system.

iv. sudo hostname -F filename : to set the hostname specified in a file. Can be performed by the superuser(root) only

v. hostname -i : to get the IP(network) addresses.

```
$ hostname -i  
127.0.1.1
```

vi. hostname -I : to get all IP(network) addresses.

```
$ hostname -I  
192.168.56.1 172.21.5.133
```

vii. hostname -V : gives version number as output.

```
$ hostname -V  
hostname 3.20
```

viii. sudo hostname <new_hostname> : set new hostname

```
$ sudo hostname StarkCenter  
$ hostname  
StarkCenter
```

TEST FOR EACH WEBSITE - Ping, TraceRoute, NSLookup :

1. iitrpr.ac.in

i. ping :

```
PING iitrpr.ac.in(ip6-localhost (::1)) 56 data bytes
64 bytes from ip6-localhost (::1): icmp_seq=1 ttl=128 time=0.483 ms
64 bytes from ip6-localhost (::1): icmp_seq=2 ttl=128 time=0.460 ms
64 bytes from ip6-localhost (::1): icmp_seq=3 ttl=128 time=0.462 ms
64 bytes from ip6-localhost (::1): icmp_seq=4 ttl=128 time=0.459 ms
--- iitrpr.ac.in ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3002ms
rtt min/avg/max/mdev = 0.459/0.466/0.483/0.009 ms
```

ii. traceroute :

```
1  4 ms  3 ms  5 ms 172.21.4.2
2  2 ms  2 ms  3 ms 172.30.4.14
```

iii. nslookup:

```
Name: iitrpr.ac.in
Address: 172.30.4.14
Name: iitrpr.ac.in
Address: ::1
```

2. google.com

i. ping :

```
PING google.com (172.217.174.238) 56(84) bytes of data.
64 bytes from bom12s03-in-f14.1e100.net (172.217.174.238): icmp_seq=1 ttl=55 time=39.7 ms
64 bytes from bom12s03-in-f14.1e100.net (172.217.174.238): icmp_seq=2 ttl=55 time=49.0 ms
64 bytes from bom12s03-in-f14.1e100.net (172.217.174.238): icmp_seq=3 ttl=55 time=39.1 ms
64 bytes from bom12s03-in-f14.1e100.net (172.217.174.238): icmp_seq=4 ttl=55 time=38.6 ms
--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 2999ms
rtt min/avg/max/mdev = 38.638/41.659/49.070/4.300 ms
```

ii. traceroute :

```
1  3 ms  2 ms  2 ms 172.21.4.2
2  4 ms  3 ms  4 ms 103.118.50.3
3  4 ms  3 ms  4 ms 117.242.132.26
4  *    *    *   Request timed out.
5 202 ms 35 ms 138 ms 74.125.48.138
6 42 ms 41 ms 44 ms 209.85.246.51
7 38 ms 38 ms 37 ms 216.239.50.167
8 42 ms 49 ms 50 ms bom12s03-in-f14.1e100.net [172.217.174.238]
```

iii. nslookup :

```
Non-authoritative answer:
Name: google.com
Address: 172.217.174.238
Name: google.com
Address: 2404:6800:4009:801::200e
```

3. google.co.in

i. ping :

```
PING google.co.in (172.217.166.163) 56(84) bytes of data.  
64 bytes from bom07s20-in-f3.1e100.net (172.217.166.163): icmp_seq=1 ttl=55 time=34.8 ms  
64 bytes from bom07s20-in-f3.1e100.net (172.217.166.163): icmp_seq=2 ttl=55 time=61.0 ms  
64 bytes from bom07s20-in-f3.1e100.net (172.217.166.163): icmp_seq=3 ttl=55 time=36.0 ms  
64 bytes from bom07s20-in-f3.1e100.net (172.217.166.163): icmp_seq=4 ttl=55 time=35.6 ms  
--- google.co.in ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 2999ms  
rtt min/avg/max/mdev = 34.843/41.899/61.021/11.049 ms
```

ii. traceroute :

```
1  2 ms  3 ms  3 ms  172.21.4.3  
2  6 ms  7 ms  4 ms  103.118.50.3  
3 14 ms 11 ms  6 ms 117.242.132.26  
4 37 ms  *    *    218.248.181.22  
5 39 ms 37 ms 37 ms 74.125.48.138  
6 47 ms 46 ms 40 ms 209.85.247.65  
7 36 ms 37 ms 37 ms 74.125.253.107  
8 39 ms 40 ms 39 ms bom07s20-in-f3.1e100.net [172.217.166.163]
```

iii. nslookup :

```
Non-authoritative answer:  
Name: google.co.in  
Address: 172.217.166.163  
Name: google.co.in  
Address: 2404:6800:4009:80e::2003
```

4. Gmail.com

i. ping :

```
PING gmail.com (216.58.203.37) 56(84) bytes of data.  
64 bytes from hkg12s10-in-f5.1e100.net (216.58.203.37): icmp_seq=1 ttl=55 time=39.2 ms  
64 bytes from hkg12s10-in-f5.1e100.net (216.58.203.37): icmp_seq=2 ttl=55 time=37.7 ms  
64 bytes from hkg12s10-in-f5.1e100.net (216.58.203.37): icmp_seq=3 ttl=55 time=37.0 ms  
64 bytes from hkg12s10-in-f5.1e100.net (216.58.203.37): icmp_seq=4 ttl=55 time=37.8 ms  
--- gmail.com ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 3000ms  
rtt min/avg/max/mdev = 37.090/37.982/39.298/0.844 ms
```

ii. traceroute :

```
1  3 ms  3 ms  4 ms  172.21.4.3  
2  3 ms  3 ms  2 ms  103.118.50.3  
3 74 ms  3 ms  3 ms 117.242.132.26  
4 *    *    *    Request timed out.  
5 49 ms 38 ms 40 ms 74.125.48.138  
6 42 ms 41 ms 49 ms 209.85.246.51  
7 41 ms 39 ms 41 ms 108.170.232.205  
8 41 ms 40 ms 149 ms bom12s01-in-f5.1e100.net [172.217.167.165]
```

iii. nslookup :

```
Non-authoritative answer:  
Name: gmail.com  
Address: 216.58.203.37  
Name: gmail.com  
Address: 2404:6800:4009:80f::2005
```

5. facebook.com

i. ping :

```
PING facebook.com (31.13.79.35) 56(84) bytes of data.
64 bytes from edge-star-mini-shv-02-bom1.facebook.com (31.13.79.35): icmp_seq=1 ttl=57 time=40.3 ms
64 bytes from edge-star-mini-shv-02-bom1.facebook.com (31.13.79.35): icmp_seq=2 ttl=57 time=39.6 ms
64 bytes from edge-star-mini-shv-02-bom1.facebook.com (31.13.79.35): icmp_seq=3 ttl=57 time=41.1 ms
64 bytes from edge-star-mini-shv-02-bom1.facebook.com (31.13.79.35): icmp_seq=4 ttl=57 time=39.9 ms

--- facebook.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3001ms
rtt min/avg/max/mdev = 39.605/40.254/41.117/0.606 ms
```

ii. traceroute :

```
1  2 ms  3 ms  3 ms 172.21.4.3
2  3 ms  3 ms  2 ms 103.118.50.3
3 17 ms  7 ms  8 ms 117.242.132.26
4  *    *    37 ms 218.248.181.22
5 39 ms 39 ms 39 ms ae35.pr02.bom1.tfbnw.net [157.240.67.136]
6 36 ms 36 ms 43 ms po102.psw01.bom1.tfbnw.net [157.240.32.185]
7 38 ms 37 ms 42 ms 157.240.39.45
8 40 ms 39 ms 81 ms edge-star-mini-shv-02-bom1.facebook.com [31.13.79.35]
```

iii. nslookup :

```
Non-authoritative answer:
Name:   facebook.com
Address: 31.13.79.35
Name:   facebook.com
Address: 2a03:2880:f12f:183:face:b00c:0:25de
```

6. india.gov.in

i. ping :

```
PING india.gov.in (164.100.61.151) 56(84) bytes of data.
--- india.gov.in ping statistics ---
4 packets transmitted, 0 received, 100% packet loss, time 3000ms
```

ii. traceroute :

```
1  4 ms  3 ms  3 ms 172.21.4.3
2  3 ms  4 ms  5 ms 103.118.50.3
3  4 ms  9 ms  4 ms 117.242.132.26
4 186 ms 161 ms 142 ms 218.248.181.22
5  *    *    *    Request timed out.
(Timed out till 25. Force closed after that)
```

iii. nslookup :

```
Non-authoritative answer:
Name:   india.gov.in
Address: 164.100.61.151
```

7. wikipedia.org

i. ping :

```
PING wikipedia.com (103.102.166.226) 56(84) bytes of data:
64 bytes from ncredir-lb.eqsin.wikimedia.org (103.102.166.226): icmp_seq=1 ttl=54 time=102 ms
64 bytes from ncredir-lb.eqsin.wikimedia.org (103.102.166.226): icmp_seq=2 ttl=54 time=102 ms
64 bytes from ncredir-lb.eqsin.wikimedia.org (103.102.166.226): icmp_seq=3 ttl=54 time=102 ms
64 bytes from ncredir-lb.eqsin.wikimedia.org (103.102.166.226): icmp_seq=4 ttl=54 time=102 ms
--- wikipedia.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3000ms
rtt min/avg/max/mdev = 102.087/102.291/102.615/0.376 ms
```

ii. traceroute :

```
1  2 ms  4 ms  4 ms 172.21.4.2
2  4 ms  3 ms  3 ms 103.118.50.3
3  3 ms  3 ms  4 ms 117.242.132.26
4 38 ms 37 ms  * 218.248.181.22
5 53 ms 38 ms 36 ms 115.113.165.93.static-mumbai.vsnl.net.in [115.113.165.93]
6 40 ms 40 ms 40 ms 172.23.78.233
7 54 ms 54 ms 56 ms 172.29.209.114
8 163 ms 72 ms 101 ms 115.114.85.222
9 51 ms 53 ms 55 ms 115.114.85.241
10 98 ms 102 ms 97 ms if-ae-34-2.tcore1.svq-singapore.as6453.net [180.87.36.41]
11 94 ms 94 ms 94 ms if-ae-6-2.thar1.40b-singapore.as6453.net [120.29.215.34]
12 105 ms 95 ms 97 ms 180.87.164.62
13 98 ms 97 ms 100 ms text-lb.eqsin.wikimedia.org [103.102.166.224]
```

iii. nslookup :

```
Non-authoritative answer:
Name:  wikipedia.org
Address: 208.73.210.217
Name:  wikipedia.org
Address: 208.73.211.177
Name:  wikipedia.org
Address: 208.73.211.165
Name:  wikipedia.org
Address: 208.73.210.202
```

8. nationalgeographic.com

i. ping :

```
PING nationalgeogrphic.com (192.161.187.200) 56(84) bytes of data.  
64 bytes from 192.161.187.200.static.quadranet.com (192.161.187.200): icmp_seq=1 ttl=48 time=292 ms  
64 bytes from 192.161.187.200.static.quadranet.com (192.161.187.200): icmp_seq=2 ttl=48 time=288 ms  
64 bytes from 192.161.187.200.static.quadranet.com (192.161.187.200): icmp_seq=3 ttl=48 time=287 ms  
64 bytes from 192.161.187.200.static.quadranet.com (192.161.187.200): icmp_seq=4 ttl=48 time=288 ms  
--- nationalgeogrphic.com ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 3001ms  
rtt min/avg/max/mdev = 287.264/289.192/292.367/2.029 ms
```

ii. traceroute :

```
1  5 ms  2 ms  6 ms 172.21.4.3  
2  4 ms  8 ms  3 ms 103.118.50.3  
3  4 ms  6 ms  8 ms 117.242.132.26  
4  *    *    *   Request timed out.  
5 47 ms 45 ms 44 ms 61.246.195.185  
6 41 ms 41 ms 42 ms 182.79.211.35  
7 46 ms 41 ms 41 ms a23-57-12-105.deploy.static.akamaitechnologies.com [23.57.12.105]
```

iii. nslookup :

```
Non-authoritative answer:  
Name:   nationalgeographic.com  
Address: 23.57.12.105
```

9. nkn.gov.in

i. ping :

```
PING nkn.gov.in (180.149.57.82) 56(84) bytes of data.  
--- nkn.gov.in ping statistics ---  
4 packets transmitted, 0 received, 100% packet loss, time 3008ms
```

ii. traceroute :

```
1  2 ms  2 ms  3 ms 172.21.4.2  
2 139 ms  3 ms  4 ms 103.118.50.3  
3 11 ms  9 ms  3 ms 117.242.132.26  
4 38 ms 263 ms  *  218.248.181.22  
5  *    *    *   Request timed out.  
6 41 ms 38 ms 60 ms static.ill.210.212.64.182/24.bsnl.in [210.212.64.182]  
7 43 ms 40 ms 53 ms 10.255.223.229  
8  *    *    *   Request timed out.  
(Timed out till 25. Force closed after that)
```

iii. nslookup :

```
Non-authoritative answer:  
Name:   nkn.gov.in  
Address: 180.149.57.82  
Name:   nkn.gov.in  
Address: 2001:4408:5200::b495:3952
```


10. irctc.co.in

i. ping :

```
PING irctc.co.in (103.252.142.19) 56(84) bytes of data:  
--- irctc.co.in ping statistics ---  
4 packets transmitted, 0 received, 100% packet loss, time 2999ms
```

ii. traceroute :

```
1  3 ms  3 ms  3 ms 172.21.4.2  
2 12 ms 16 ms 12 ms 103.118.50.3  
3  6 ms  5 ms  3 ms 117.242.132.26  
4 38 ms 40 ms 37 ms 218.248.181.22  
5  *    *    *    Request timed out.  
(Timed out till 25. Force closed after that)
```

iii. nslookup :

```
Non-authoritative answer:  
Name:  irctc.co.in  
Address: 103.252.142.18  
Name:  irctc.co.in  
Address: 103.252.142.19  
Name:  irctc.co.in  
Address: 103.252.142.21
```

Part a & b of Section 1 :

Website	max-RTT	min-RTT	avg-RTT	Loss
iitrpr.ac.in	0.483	0.459	0.466	0
google.com	49.070	38.638	49.070	0
google.co.in	61.021	34.843	41.899	0
gmail.com	39.398	37.090	37.982	0
facebook.com	41.117	39.605	40.254	0
wikipedia.org	102.615	102.087	102.291	0
india.gov.in	-	-	-	100
nationalgeographic.com	292.367	287.264	289.192	0
nkn.gov.in	-	-	-	100
irctc.gov.in	-	-	-	100

Note : 1. Total four packets and 56 data bytes are sent in all cases.
2. All time is in mili-seconds.
3. Loss is in percentage.

Part c of Section 1 :

Default ping packet size is 56 bytes.

It is 64 bytes if we consider the Internet Protocol header.

Packet size received for 56 byte ping packet size was 64 bytes.

If we change ping packet size to 100 bytes then following are the result :

Website	data-packet Received	max-RTT	min-RTT	avg-RTT	Loss
iitrpr.ac.in	108	0.231	0.145	0.184	0
google.com	76	40.750	37.376	39.035	25
google.co.in	76	41.435	38.271	39.459	0
gmail.com	76	40.461	36.783	38.085	0
facebook.com	108	51.716	36.938	43.339	0
wikipedia.org	108	109.274	102.401	104.705	0
india.gov.in	-	-	-	-	100
nationalgeographic.com	108	233.196	232.080	232.632	0
nkn.gov.in	-	-	-	-	100
irctc.gov.in	-	-	-	-	100

Note : 1. Total four packets and 100 data bytes are sent in all cases.

2. All time is in mili-seconds.

3. Loss is in percentage.

4. Data-Packet received is in bytes.

Part d of Section 1 :

Trace route IP is the same for level three for all the ten websites (except for iitrpr.ac.in : as it has only two levels and it is consistent with others only till level one).

Trace Route IP is the same upto level four six websites (not for nationgeographic.com, google.com, gmail.com, iitrpr.ac.in).

Level 1 : 172.21.4.3

Level 2 : 103.118.50.3

Level 3 : 117.242.132.26

Level 4 : 218.248.181.22

Level 1 : 172.21.4.3 is the private IP denoting default gateway. (Default gateway is the node in a computer network using the internet protocol suite that serves as the forwarding host (router) to other networks when no other route specification matches the destination IP address of a packet. In most cases, the default gateway IP address is the private IP address assigned to the router. This is the IP address that the router uses to communicate with a local home network.) This can be seen in the last line of screenshot.

```
C:\Windows\system32\cmd.exe

C:\Users\Amit Srivastava\Desktop>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Ethernet adapter VirtualBox Host-Only Network:

    Connection-specific DNS Suffix  . :
    Link-local IPv6 Address . . . . . : fe80::c195:d688:280:f9e6%17
    IPv4 Address. . . . . : 192.168.56.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . :

Wireless LAN adapter Local Area Connection* 1:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

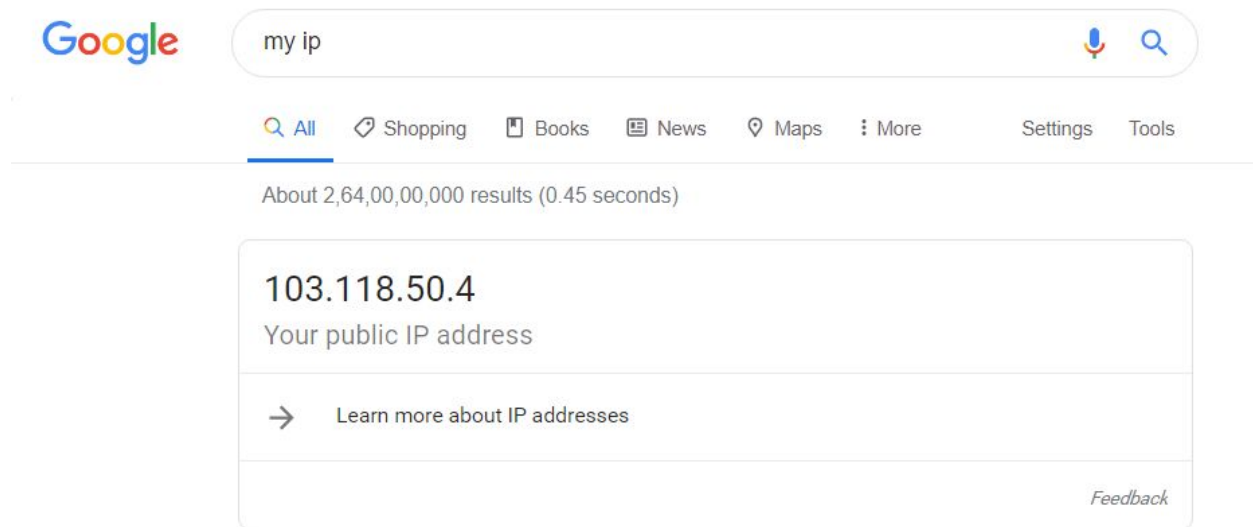
Wireless LAN adapter Local Area Connection* 12:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

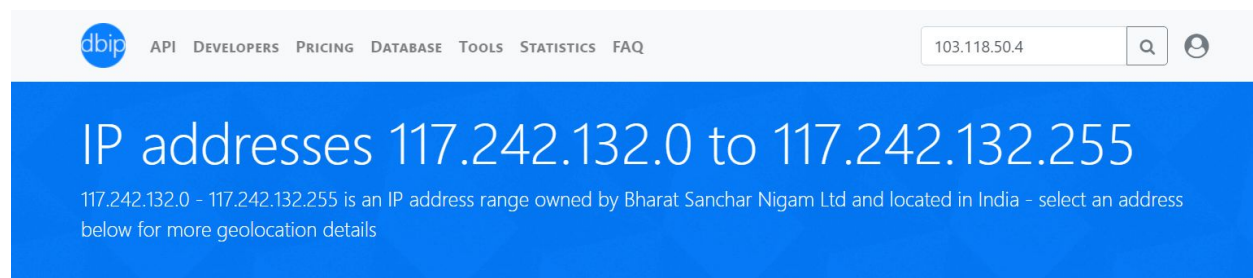
Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . :
    Link-local IPv6 Address . . . . . : fe80::f1a2:649b:5fb6:db6f%14
    IPv4 Address. . . . . : 172.21.5.133
    Subnet Mask . . . . . : 255.255.252.0
    Default Gateway . . . . . : 172.21.4.1
```

Level 2 : 103.118.50.3 is our public IP address of the college.



Level 3 : 117.242.132.26 is an IP address owned by Bharat Sanchar Nigam Ltd which is the ISP of college WLAN.



Level 4 : 218.248.181.22 :
ISP - National Internet Backbone
Organization - BSNL
City - Delhi (20% confidence)

The IP addresses on the route of trace packets are the same because initial levels : default gateway of network(Level 1), public IP of the college(Level 2) and IP of BSNL which is the ISP for college WLAN(Level 3). Initial level of routers will be the same for each target. Every request will take this route, therefore it is the same for most of the websites. After this the packets take different routes to the servers of various target sites(because the routers will differ.) As a result IP of these levels will be different.

SECTION 2 : Socket Programming

There are four parts corresponding to section 2.

To execute, open the terminal and go to a specific directory.

Part 1 :

How to run ?

Go to part1 directory and open terminal in that directory.

Run python server.py

Enter port number(e.g. 1024)

Open another terminal in the same location.

Run python client.py

Enter the hostname of server and port number to which server is listening.

(e.g. hostname = StarkHUB, port = 1024)

Enter username and password.

Part 2 :

This program allows multiple clients to feature.

I have implemented it using threads.

How to run ?

Go to part2 directory and open terminal in that directory.

Run python server.py

Enter port number(e.g. 1024)

Open two terminals in the same location.

Run python client.py in both.

(Enter the following data in any order.)

Enter the hostname of server and port number to which server is listening.

(e.g. hostname = StarkHUB, port = 1024)

Enter username and password.

Part 3 :

This program allows the client and server programs at two different machines.

Assumption : Server will be hosted on wifi network. Client will connect to the IP of the server.

e.g. IP = '172.21.5.133' : Wifi IP of my laptop

This IP will be printed when server.py will run. Clients need to enter this IP in hostname.

To calculate the medium bandwidth :

Open the server (e.g. IP = '172.21.5.133')

Ping this IP with another system and calculate avg-RTT.

56(84) Bytes data sent and 64 Bytes data received.

data = 148 Bytes

avg RTT = 10.7ms

Bandwidth = data/avg-RTT i.e. nearly 13 MBps

How to run ?

Go to part3 directory and open terminal in that directory.

Run python server.py

Enter port number(e.g. 1024)

Open another terminal in the same location on another machine.

Run python client.py

Enter hostname of server and port number to which the server is listening.

(e.g. hostname = 172.21.5.133, port = 1024)

Enter username and password.

Part 4 :

Assumption 1 : IP and port of host A,B,C,D are defined at the top in their files.

If we are changing StarkHUB.rtl file then we need to manually change IP and port at the top.

Assumption 2 : Exclusive access means only access to some people that is whose attendance > 80%.

How to run ?

Go to part4 directory and open terminal in that directory.

To split the file run python splitter.py

It will split login_credentials.csv in three files login_credentials1.csv,

login_credentials2.csv, login_credentials3.csv. Host A, B, C will read from these files.

So if these hosts are running on different machines, we need to provide them with csv files too.

To calculate percentage run python calculate_attendance.py

It will store username, percentage in attendance_percentage.csv

Now run in terminal run on same/different machines :

```
python host_a.py
```

```
python host_b.py
```

```
python host_c.py
```

```
python host_d.py
```

After that, open another terminal in the same location on the same/another machine.

Run python server.py

Enter port number(e.g. 1024)

Open another terminal in the same location on the same/another machine.

Run python client.py

Enter the hostname of server and port number to which server is listening.

(e.g. hostname = 172.21.5.133, port = 1024)

Enter username and password.

To quit enter 'EXIT'.