Computer Networks : Assignment-1

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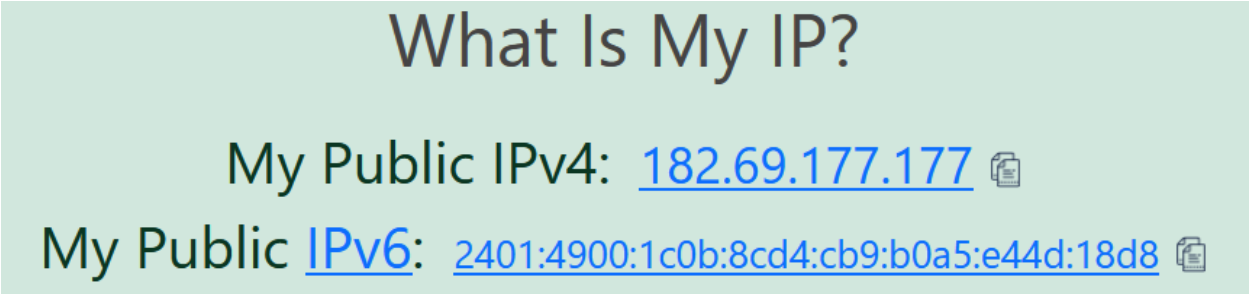
```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1492
        inet 172.168.1.110  netmask 255.255.0.0  broadcast 172.168.255.255
        inet6 fe80::215:5dff:febe:dcc2  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:be:dc:c2  txqueuelen 1000  (Ethernet)
        RX packets 171482  bytes 239908460 (239.9 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 12640  bytes 979642 (979.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

The IP(v4) address of my network interface , as denoted by inet is 172.168.1.110



When I look at the ifconfig output for my local network interface (eth0) , I see IP Address: 172.168.1.110

This eth0 interface is basically my computer's Ethernet adapter, which connects me to my home network. The IP address 172.168.1.110 is a private IP address, likely given to me by my router .

Now, when I check my public IP address on whatismyip.com, I see the IP Address: 182.69.177.177

These public IP addresses aren't directly linked to any interface on my computer. Instead, they're the IP addresses of my router's external interface, or maybe the gateway provided by my ISP that connects my home network to the internet.

So, while my computer uses the private IP address 172.168.1.110 to communicate within my home network, the public IPs are what the internet sees when I connect to it.

Ans 2

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1492
        inet 172.168.1.110  netmask 255.255.0.0  broadcast 172.168.255.255
        inet6 fe80::215:5dff:febe:dcc2  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:be:dc:c2  txqueuelen 1000  (Ethernet)
        RX packets 171370  bytes 239892968 (239.8 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 12640  bytes 979642 (979.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# sudo ifconfig eth0 192.116.10.110 n
etmask 255.255.0.0
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1492
        inet 192.116.10.110  netmask 255.255.0.0  broadcast 192.116.255.255
        inet6 fe80::215:5dff:febe:dcc2  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:be:dc:c2  txqueuelen 1000  (Ethernet)
        RX packets 171398  bytes 239897206 (239.8 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 12640  bytes 979642 (979.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# sudo ifconfig eth0 172.168.1.110 ne
tmask 255.255.0.0
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1492
        inet 172.168.1.110  netmask 255.255.0.0  broadcast 172.168.255.255
        inet6 fe80::215:5dff:febe:dcc2  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:be:dc:c2  txqueuelen 1000  (Ethernet)
        RX packets 171418  bytes 239899834 (239.8 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 12640  bytes 979642 (979.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@LAPTOP-VR1O59AG:/mnt/c/Users/91971#
```

Ans 3

Setting up the server:
This command starts netcat in listening mode (-l) on port 1234 (-p 1234).

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# nc -l 1234
hello
```

Set up the client: Then we can open up another wsl , and run:

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# nc localhost 1234
hello
```

The second entry shows the state of the TCP connection at the client node , and is in **“ESTABLISHED” state .**
1234 is the server port
41778 is the randomly assigned client port **.**

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# netstat -tn | grep 1234
tcp        0      0 127.0.0.1:1234          127.0.0.1:41778         ESTABLISHED
tcp        0      0 127.0.0.1:41778         127.0.0.1:1234          ESTABLISHED
```

Ans 4 a)

```
PS C:\Users\91971> nslookup -type=soa google.in
Server:  UnKnown
Address:  2401:4900:50:9::2e0

Non-authoritative answer:
google.in
        primary name server = ns1.google.com
        responsible mail addr = dns-admin.google.com
        serial  = 668858537
        refresh = 900 (15 mins)
        retry   = 900 (15 mins)
        expire  = 1800 (30 mins)
        default TTL = 60 (1 min)

google.in       nameserver = ns4.google.com
google.in       nameserver = ns2.google.com
google.in       nameserver = ns3.google.com
google.in       nameserver = ns1.google.com
PS C:\Users\91971> nslookup google.in ns1.google.com
Server:  ns1.google.com
Address:  2001:4860:4802:32::a

Name:    google.in
Addresses:  2404:6800:4002:82b::2004
          142.250.206.100
```

We use the command **nslookup -type=soa google.in** to get the start of the authority record of google.in .
Then , we can use any of the nameservers we get in the answer in the first result to query for an authoritative result .

b)

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# nslookup -debug -type=ns chess.com
Server:         10.255.255.254
Address:        10.255.255.254#53

------------
    QUESTIONS:
        chess.com, type = NS, class = IN
    ANSWERS:
    ->  chess.com
        nameserver = dan.ns.cloudflare.com.
        ttl = 86400
    ->  chess.com
        nameserver = sue.ns.cloudflare.com.
        ttl = 86400
    AUTHORITY RECORDS:
    ADDITIONAL RECORDS:
------------
Non-authoritative answer:
chess.com       nameserver = dan.ns.cloudflare.com.
chess.com       nameserver = sue.ns.cloudflare.com.
```

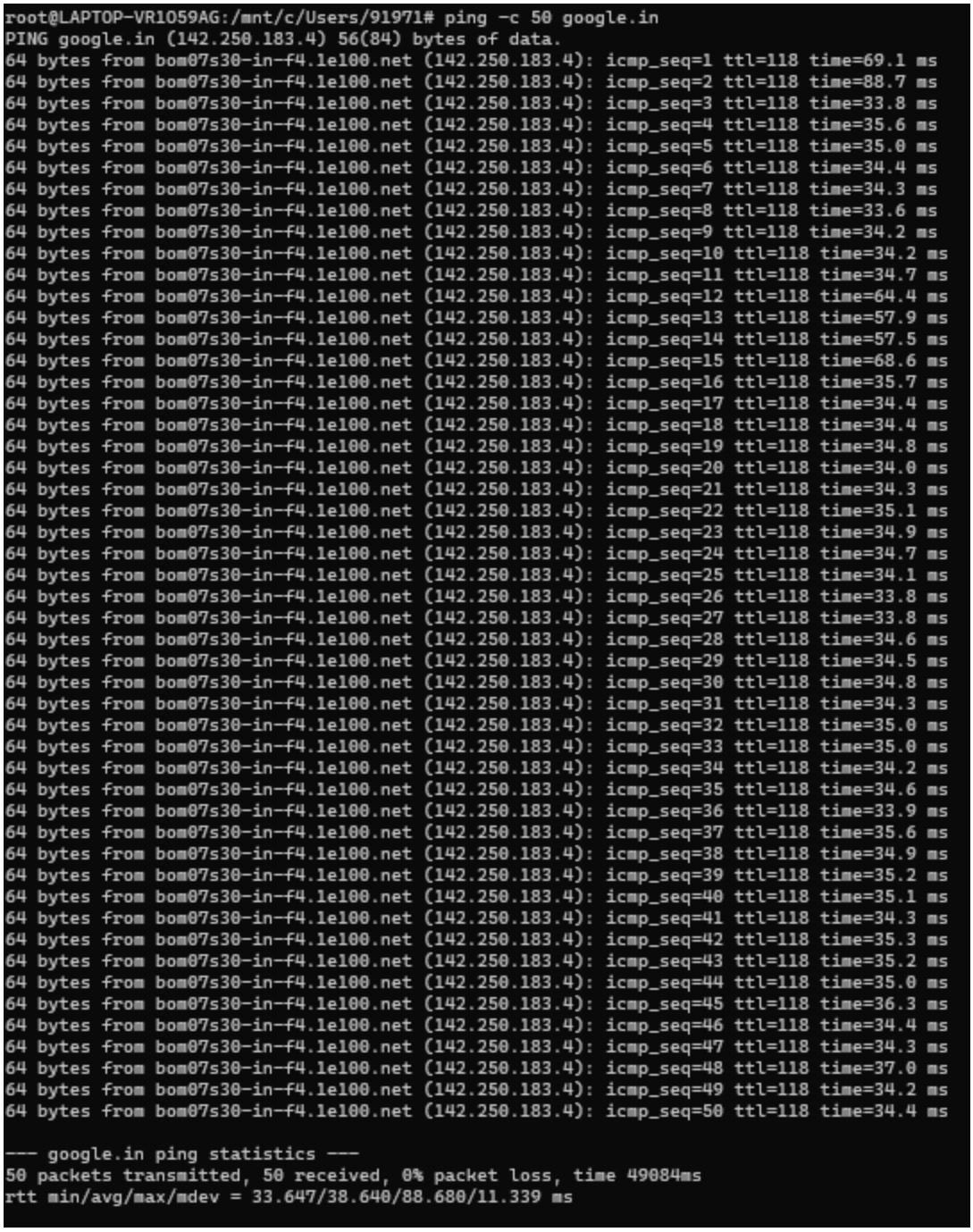
TTL - the time to live is the amount of time that a DNS server caches a DNS record before it expires and a new query is made to the authoritative DNS server for updated information .
The ttl for chess.com from the above image is **86400**

```
root@LAPTOP-VR1059AG:/mnt/c/Users/91971# traceroute google.in
traceroute to google.in (142.250.192.164), 30 hops max, 60 byte packets
 1  LAPTOP-VR1059AG.mshome.net (172.19.208.1)  0.378 ms  0.369 ms  0.366 ms
 2  192.168.1.1 (192.168.1.1)  15.734 ms  16.256 ms  15.159 ms
 3  abts-north-dynamic-255.187.69.182.airtelbroadband.in (182.69.187.255)  21.522 ms  21.519 ms  21.516 ms
 4  125.18.240.149 (125.18.240.149)  21.450 ms 125.18.240.153 (125.18.240.153)  22.297 ms  21.512 ms
 5  116.119.109.8 (116.119.109.8)  22.228 ms  21.445 ms 182.79.208.13 (182.79.208.13)  28.284 ms
 6  72.14.222.116 (72.14.222.116)  22.727 ms  22.030 ms  22.841 ms
 7  * * *
 8  142.251.76.174 (142.251.76.174)  12.005 ms 142.251.76.196 (142.251.76.196)  11.236 ms  11.229 ms
 9  192.178.83.224 (192.178.83.224)  11.204 ms 172.253.73.195 (172.253.73.195)  11.126 ms 172.253.74.179 (172.253.74.179
)  11.191 ms
10  192.178.82.233 (192.178.82.233)  11.954 ms del11s11-in-f4.1e100.net (142.250.192.164)  11.171 ms  11.164 ms
root@LAPTOP-VR1059AG:/mnt/c/Users/91971#
```

Ans 5 a)

Ip Address	Avg Latency
172.19.208.1	0.377
192.168.1.1	15.716
182.69.187.255	21.519
125.18.240.149	21.753

116.119.109.8	23.985
72.14.222.116	22.532
142.251.76.174	11.49
192.178.83.224	11.173
192.178.82.233	11.429



b)
The average latency is 38.640ms

c) The total time for the ping latencies is 0.377 + 15.716 + 21.519 + 21.753 + 23.985 + 22.532 + 11.49 + 11.173 + 11.429 = 139.974 milliseconds.

Ping and traceroute measure different things. Ping checks how long it takes for a packet to go from your computer to another computer and back, which is known as Round-Trip Time (RTT). Traceroute, on the other hand, measures the time it takes for each packet to reach each hop or step along the route to its destination, including any timeout delays. Because traceroute accounts for the time each intermediate step takes and includes potential timeout delays, it usually shows a longer total time compared to ping, which only measures the round-trip time.

d)
The maximum ping latency in part **a)** is 23.985 milliseconds, while in part **b)** it is 88.7 milliseconds. Several factors can affect these measurements, including the protocols used, the nature of the network path, and network congestion. Ping uses the ICMP protocol to measure the round-trip time between your computer and a remote device by sending echo request packets. In contrast, traceroute uses the UDP protocol to trace the path that network packets take and waits for timeout responses from each intermediate host. This difference in how they measure and report latency can lead to varying results.

e) When we see multiple entries for a single hop in traceroute, it means that different gateways are responding to each packet at that point. This shows that there are several possible routes the packet can take to reach its destination at that particular hop.

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# ping -c 50 stanford.edu
PING stanford.edu (171.67.215.200) 56(84) bytes of data.
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=1 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=246 time=278 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=246 time=275 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=246 time=275 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=246 time=275 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=246 time=278 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=246 time=275 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=246 time=275 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=246 time=299 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=246 time=282 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=246 time=275 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=246 time=278 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=246 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=246 time=281 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=246 time=281 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=246 time=278 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=246 time=280 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=246 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=246 time=279 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=246 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=246 time=277 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=246 time=278 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=246 time=276 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=246 time=318 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=246 time=278 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=246 time=286 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49291ms
rtt min/avg/max/mdev = 274.819/278.840/318.319/6.983 ms
```

f) The average latency is **278.840 ms** .

g)

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# traceroute stanford.edu
traceroute to stanford.edu (171.67.215.200), 30 hops max, 60 byte packets
 1  LAPTOP-VR1O59AG.mshome.net (172.19.208.1)  0.878 ms  0.769 ms  0.716 ms
 2  192.168.1.1 (192.168.1.1)  12.067 ms  12.049 ms  12.038 ms
 3  abts-north-dynamic-255.187.69.182.airtelbroadband.in (182.69.187.255)  12.415 ms  12.575 ms  12.294 ms
 4  125.18.240.153 (125.18.240.153)  12.623 ms  34.776 ms  12.597 ms
 5  116.119.112.98 (116.119.112.98)  458.529 ms 116.119.44.134 (116.119.44.134)  458.355 ms  458.344 ms
 6  * * *
 7  port-channel8.core2.lax1.he.net (184.104.197.109)  456.329 ms * *
 8  * * *
 9  * * port-channel9.core2.pao1.he.net (184.105.81.101)  357.342 ms
10  stanford-university.e0-62.core2.pao1.he.net (184.105.177.238)  357.310 ms  264.776 ms  252.966 ms
11  campus-nw-rtr-vl1002.SUNet (171.64.255.196)  268.035 ms campus-ial-nets-b-vl1102.SUNet (171.66.255.196)  260.788 m
s  261.639 ms
12  * * *
13  web.stanford.edu (171.67.215.200)  274.994 ms  275.039 ms  274.756 ms
```

There were 10 hops in case of google.in , there are 13 hops in this case . Every new hop increases the delay , hence we will get faster processing from google.in than stanford.edu .

h) Possible reasons can include :

- The network infrastructure
- Number of hops
- Congestion in the network traffic
- The physical distance
  Among many other possible factors .

Ans 6

```
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# sudo ifconfig lo down
root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1492
        inet 172.19.216.167  netmask 255.255.240.0  broadcast 172.19.223.255
        inet6 fe80::215:5dff:fec8:7ff7  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:c8:7f:f7  txqueuelen 1000  (Ethernet)
        RX packets 3584  bytes 746552 (746.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 385  bytes 72190 (72.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@LAPTOP-VR1O59AG:/mnt/c/Users/91971# 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 ---
14 packets transmitted, 0 received, 100% packet loss, time 13489ms
```

127.0.0.1 is the loopback IPv4 address which the computer uses to communicate with itself and we can essentially deactivate by using the

command **“sudo ifconfig lo down”** . We hence break the connection of the computer to itself , thereby making the ping fail for 127.0.0.1 with 100% packet loss .