CS304 Computer Networks

Lab Assignment - 1

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Question-1

1. **Ping Command:** The term Ping stands for _Packet Internet Groper_. It is widely used to test network connectivity issues between two hosts. It performs the task by sending data packets to the destination, which sends back a reply and acknowledges whether the data was received or not. The ping command returns the following information:
   a. Statistics of the number of data packets sent, received and lost.
   b. The maximum, minimum, average, standard deviation of the _round trip time_(RTT).

   * RTT is the sum of time taken by the request to travel from client to server and time taken by the response to travel from server to client.

A successful ping implies _proper connectivity_ between two hosts.

Syntax: _ping [Name/IP address of Destination host]_

   a. **To specify the number of packets**

   Syntax: _ping -c count [Name/IP address of Destination host]_

   ping -c 10 www.amazon.com

   b. **To specify the packet size**

   Syntax_: ping -s size [Name/IP address of Destination host]_

   ping -s 100 -c 10 www.amazon.com

Number Of Packets	Packet Size	Minimum RTT(ms)	Average RTT(ms)	Maximum RTT(ms)	Standard Deviation(ms)
10	56	75.317	95.166	142.808	17.679
10	100	86.795	96.792	114.281	8.163

```
pranjali@LAPTOP-G4I7EDJ8:~$ ping -c 10 www.amazon.com
PING d3ag4hukkh62yn.cloudfront.net (52.85.128.12) 56(84) bytes of data.
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=1 ttl=242 time=90.4 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=2 ttl=242 time=100 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=3 ttl=242 time=87.5 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=4 ttl=242 time=76.8 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=5 ttl=242 time=95.9 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=6 ttl=242 time=95.5 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=7 ttl=242 time=75.3 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=8 ttl=242 time=143 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=9 ttl=242 time=96.4 ms
64 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=10 ttl=242 time=91.0 m
s

--- d3ag4hukkh62yn.cloudfront.net ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9010ms
rtt min/avg/max/mdev = 75.317/95.166/142.808/17.679 ms
pranjali@LAPTOP-G4I7EDJ8:~$
```

Sending 10 packets to www.amazon.com with default packet size

```
pranjali@LAPTOP-G4I7EDJ8: ~                                               —    □    ✕
pranjali@LAPTOP-G4I7EDJ8:~$ ping -s 100 -c 10 www.amazon.com
PING d3ag4hukkh62yn.cloudfront.net (52.85.128.12) 100(128) bytes of data.
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=1 ttl=242 time=88.4 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=2 ttl=242 time=86.9 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=3 ttl=242 time=100 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=4 ttl=242 time=94.5 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=5 ttl=242 time=104 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=6 ttl=242 time=93.8 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=7 ttl=242 time=101 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=8 ttl=242 time=114 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=9 ttl=242 time=98.7 ms
108 bytes from server-52-85-128-12.ccu50.r.cloudfront.net (52.85.128.12): icmp_seq=10 ttl=242 time=86.8 ms

--- d3ag4hukkh62yn.cloudfront.net ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9011ms
rtt min/avg/max/mdev = 86.795/96.792/114.281/8.163 ms
pranjali@LAPTOP-G4I7EDJ8:~$
```

Sending 10 packets to www.amazon.com with packet size=100

2. **ifconfig/ipconfig command:** The term *ifconfig* stands for Interface configuration. It is used to display information of all the interfaces available.

    It shows that there are 2 interfaces namely, **lo and wifi0. inet6** is the IPv6 address assigned to the interface. **RX packets** is the total number of packets received. **RX errors** show a total number of packets received with error. **TX packets** is the total number of packets transmitted. **TX errors** shows a total number of packets received with error.
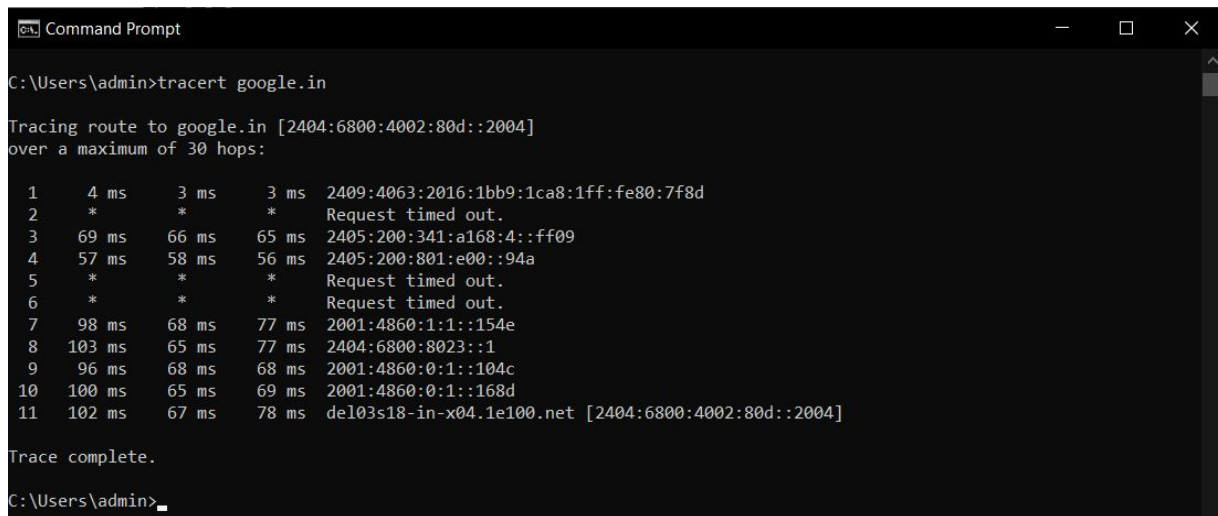
ifconfig command output on Ubuntu

The term ***ipconfig*** stands for *Internet Protocol configuration.* It displays the basic TCP/IP configuration for all adapters, type. The TCP/IP network configuration values include **IPv6 address, IPv4 address, subnet mask, and default gateway.**

3. **traceroute/tracert command:** The traceroute command is used to trace the path that the packets take to reach the host. It displays information of each hop which is actually a router between source and destination. Similar to the ping command it also sends the packet and traces the route of the packet by hopping from server to server.

   Syntax: *tracert [Name/IP Address of Host]*

```
C:\Users\admin>tracert google.in

Tracing route to google.in [2404:6800:4002:80d::2004]
over a maximum of 30 hops:

  1     4 ms     3 ms     3 ms  2409:4063:2016:1bb9:1ca8:1ff:fe80:7f8d
  2     *        *        *     Request timed out.
  3    69 ms    66 ms    65 ms  2405:200:341:a168:4::ff09
  4    57 ms    58 ms    56 ms  2405:200:801:e00::94a
  5     *        *        *     Request timed out.
  6     *        *        *     Request timed out.
  7    98 ms    68 ms    77 ms  2001:4860:1:1::154e
  8   103 ms    65 ms    77 ms  2404:6800:8023::1
  9    96 ms    68 ms    68 ms  2001:4860:0:1::104c
 10   100 ms    65 ms    69 ms  2001:4860:0:1::168d
 11   102 ms    67 ms    78 ms  del03s18-in-x04.1e100.net [2404:6800:4002:80d::2004]

Trace complete.

C:\Users\admin>
```

*Output when **tracert** executed on Command Prompt*

The first line displays the destination host name and IP address and also the maximum number of hops (=30). Subsequent lines show the information of each hop in following format:

 [Hop Number RTT1 RTT2 RTT3 IP Address of destination]

* Here RTT1, RTT2, RTT3 are 3 measurements of Round Trip Time(RTT), since tracert by default sends 3 packets.

* * * in row 2 denotes Request Timed Out which implies that the destination server does not respond within the time limit of tracert.

4. **TCP connections and TCP and UDP Ports on which computer is listening**: The *netstat* command is used to display all the TCP connections and also the TCP and UDP ports on which the computer is listening. It has four fields namely, name of the protocol, local address, foreign address, and state.

Syntax: <u>List all listening/non-listening TCP and UDP ports</u>: *netstat -a*

```
Command Prompt                                                        —    □    ✕

C:\Users\admin>netstat -a

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:445            LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:2343           LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:3580           LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:5040           LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:5432           LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:6646           LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:8733           LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:49664          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:49665          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:49666          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:49667          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:49668          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:49698          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:59110          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    0.0.0.0:59111          LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    127.0.0.1:5354         LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    127.0.0.1:49672        LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    127.0.0.1:49673        LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    127.0.0.1:49673        LAPTOP-G4I7EDJ8:49685   ESTABLISHED
  TCP    127.0.0.1:49673        LAPTOP-G4I7EDJ8:49686   ESTABLISHED
  TCP    127.0.0.1:49673        LAPTOP-G4I7EDJ8:49687   ESTABLISHED
  TCP    127.0.0.1:49673        LAPTOP-G4I7EDJ8:49688   ESTABLISHED
  TCP    127.0.0.1:49673        LAPTOP-G4I7EDJ8:49697   ESTABLISHED
  TCP    127.0.0.1:49685        LAPTOP-G4I7EDJ8:49673   ESTABLISHED
  TCP    127.0.0.1:49686        LAPTOP-G4I7EDJ8:49673   ESTABLISHED
  TCP    127.0.0.1:49687        LAPTOP-G4I7EDJ8:49673   ESTABLISHED
  TCP    127.0.0.1:49688        LAPTOP-G4I7EDJ8:49673   ESTABLISHED
  TCP    127.0.0.1:49697        LAPTOP-G4I7EDJ8:49673   ESTABLISHED
  TCP    127.0.0.1:49699        LAPTOP-G4I7EDJ8:49700   ESTABLISHED
  TCP    127.0.0.1:49700        LAPTOP-G4I7EDJ8:49699   ESTABLISHED
  TCP    127.0.0.1:49707        LAPTOP-G4I7EDJ8:0       LISTENING
  TCP    127.0.0.1:49707        LAPTOP-G4I7EDJ8:55611   ESTABLISHED
  TCP    127.0.0.1:49707        LAPTOP-G4I7EDJ8:57294   ESTABLISHED
  TCP    127.0.0.1:49707        LAPTOP-G4I7EDJ8:57301   ESTABLISHED
  TCP    127.0.0.1:49707        LAPTOP-G4I7EDJ8:57307   ESTABLISHED
  TCP    127.0.0.1:49710        LAPTOP-G4I7EDJ8:49711   ESTABLISHED
  TCP    127.0.0.1:49711        LAPTOP-G4I7EDJ8:49710   ESTABLISHED
  TCP    127.0.0.1:49712        LAPTOP-G4I7EDJ8:49713   ESTABLISHED
  TCP    127.0.0.1:49713        LAPTOP-G4I7EDJ8:49712   ESTABLISHED
  TCP    127.0.0.1:49744        LAPTOP-G4I7EDJ8:49745   ESTABLISHED
  TCP    127.0.0.1:49745        LAPTOP-G4I7EDJ8:49744   ESTABLISHED
  TCP    127.0.0.1:49746        LAPTOP-G4I7EDJ8:49747   ESTABLISHED
  TCP    127.0.0.1:49747        LAPTOP-G4I7EDJ8:49746   ESTABLISHED
```

```
Select Command Prompt                                                              —  □  ✕

TCP    192.168.1.100:52581    180.87.4.157:https        ESTABLISHED
TCP    192.168.1.100:52644    kul06s14-in-f194:https    TIME_WAIT
TCP    192.168.1.100:52653    162.247.243.147:https     ESTABLISHED
TCP    192.168.1.100:52674    218:https                 ESTABLISHED
TCP    192.168.1.100:52677    del03s10-in-f2:https      ESTABLISHED
TCP    192.168.1.100:52708    kul06s14-in-f194:https    ESTABLISHED
TCP    192.168.1.100:52758    151.101.153.44:https      ESTABLISHED
TCP    192.168.1.100:52790    server-13-227-178-29:https  ESTABLISHED
TCP    192.168.1.100:52791    ingress-westus-10b:https   ESTABLISHED
TCP    192.168.1.100:52794    ingress-westus-10c:https   ESTABLISHED
TCP    192.168.1.100:52804    searchsites:https          ESTABLISHED
TCP    192.168.1.100:52839    server-216-137-37-94:https  CLOSE_WAIT
TCP    192.168.1.100:52847    ec2-34-192-124-255:https   ESTABLISHED
TCP    192.168.1.100:52864    kul06s14-in-f194:https     ESTABLISHED
TCP    192.168.1.100:52905    a23-210-68-244:https       ESTABLISHED
TCP    192.168.1.100:52908    223.165.31.172:https       ESTABLISHED
TCP    192.168.1.100:52913    223.165.31.172:https       ESTABLISHED
TCP    192.168.1.100:52922    a72-246-153-119:https      ESTABLISHED
TCP    192.168.1.100:52978    a23-210-69-51:https        ESTABLISHED
TCP    192.168.1.100:52992    del11s04-in-f2:https       ESTABLISHED
TCP    192.168.1.100:53006    223.165.31.117:https       ESTABLISHED
TCP    192.168.1.100:53009    223.165.30.87:https        ESTABLISHED
TCP    192.168.1.100:53010    223.165.30.87:https        ESTABLISHED
TCP    192.168.1.100:53025    162.247.243.146:https      ESTABLISHED
TCP    192.168.1.100:53065    151.101.153.2:https        ESTABLISHED
TCP    192.168.1.100:53071    103.231.98.196:https       ESTABLISHED
TCP    192.168.1.100:53072    26:https                   ESTABLISHED
TCP    192.168.1.100:53073    69.173.159.55:https        ESTABLISHED
TCP    192.168.1.100:53076    103.231.98.196:https       ESTABLISHED
TCP    192.168.1.100:53108    151.101.65.69:https        ESTABLISHED
TCP    192.168.1.100:53109    151.101.65.69:https        ESTABLISHED
TCP    192.168.1.100:53119    stackoverflow:https        TIME_WAIT
TCP    192.168.1.100:53123    del03s16-in-f6:https       ESTABLISHED
TCP    192.168.1.100:53125    77.74.181.71:https         ESTABLISHED
TCP    192.168.1.100:53135    49.44.117.75:https         ESTABLISHED
TCP    192.168.1.100:57238    62.67.238.202:https        ESTABLISHED
TCP    192.168.1.100:57605    40.119.211.203:https       ESTABLISHED
TCP    [::]:135               LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:445               LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:5432              LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:8733              LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:49664             LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:49665             LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:49666             LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:49667             LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:49668             LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::]:49698             LAPTOP-G4I7EDJ8:0          LISTENING
TCP    [::1]:49689            LAPTOP-G4I7EDJ8:49694      ESTABLISHED
TCP    [::1]:49690            LAPTOP-G4I7EDJ8:49693      ESTABLISHED
TCP    [::1]:49691            LAPTOP-G4I7EDJ8:49692      ESTABLISHED
```

```
Command Prompt                                                              —    □    ✕

 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53112   del03s14-in-x03:https   ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53113   del03s09-in-x03:https   ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53115   [2a04:fa87:fffe::c000:4902]:https   TIME_WAIT
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53117   maa03s35-in-x0a:https   ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53118   [2600:9000:21c8:d800:6:44e3:f8c0:93a1]:https
ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53122   del03s07-in-x01:https   ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53128   del03s06-in-x03:https   ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:53134   [2405:200:1630:e81::29a7]:http   TIME_WAIT
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:55484   [2404:6800:4003:c03::bc]:5228   ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:57667   del03s18-in-x0e:https   ESTABLISHED
 TCP    [2409:4063:438d:1f8d:a8b4:d85b:317c:7b11]:58175   del11s04-in-x0e:https   ESTABLISHED
 UDP    0.0.0.0:2343            *:*
 UDP    0.0.0.0:5000            *:*
 UDP    0.0.0.0:5001            *:*
 UDP    0.0.0.0:5050            *:*
 UDP    0.0.0.0:5353            *:*
 UDP    0.0.0.0:5353            *:*
 UDP    0.0.0.0:5353            *:*
 UDP    0.0.0.0:5353            *:*
 UDP    0.0.0.0:5353            *:*
 UDP    0.0.0.0:5355            *:*
 UDP    0.0.0.0:6000            *:*
 UDP    0.0.0.0:6001            *:*
 UDP    0.0.0.0:6646            *:*
 UDP    0.0.0.0:49664           *:*
 UDP    0.0.0.0:49667           *:*
 UDP    127.0.0.1:1900          *:*
 UDP    127.0.0.1:49666         *:*
 UDP    127.0.0.1:53730         *:*
 UDP    192.168.1.100:137       *:*
 UDP    192.168.1.100:138       *:*
 UDP    192.168.1.100:1900      *:*
 UDP    192.168.1.100:5353      *:*
 UDP    192.168.1.100:5353      *:*
 UDP    192.168.1.100:53729     *:*
 UDP    [::]:5353               *:*
 UDP    [::]:5353               *:*
 UDP    [::]:5353               *:*
 UDP    [::]:5355               *:*
 UDP    [::]:49665              *:*
 UDP    [::]:49668              *:*
 UDP    [::1]:1900              *:*
 UDP    [::1]:5353              *:*
 UDP    [::1]:5353              *:*
 UDP    [::1]:49669             *:*
 UDP    [::1]:53728             *:*
 UDP    [fe80::1d09:c9e4:e40b:f0a7%10]:1900   *:*
 UDP    [fe80::1d09:c9e4:e40b:f0a7%10]:53727  *:*
```

*Output of the **netstat** command in Command Prompt*
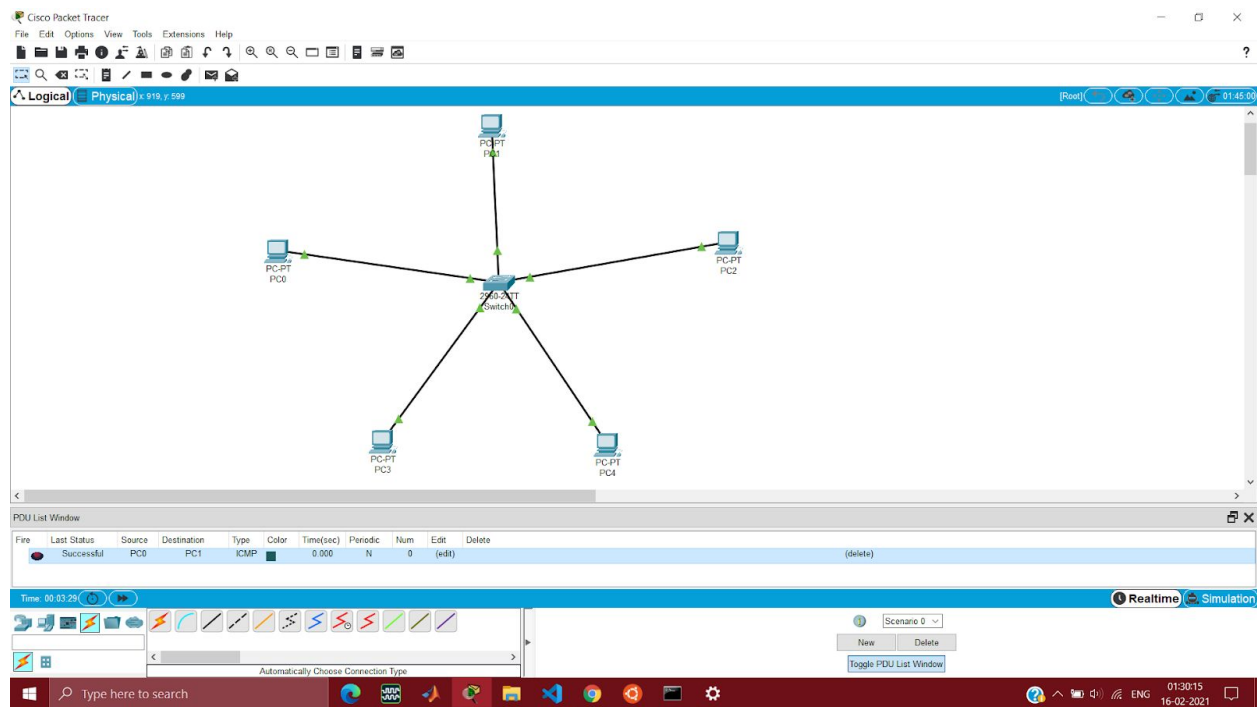

Question-2.

Network Topologies in Cisco Packet Tracer

IP Address given to PCs were:

PC Number	IP Address
PC0	192.168.1.1
PC1	192.168.1.2
PC2	192.168.1.3
PC3	192.168.1.4
PC4	192.168.1.5

Default Gateway: 192.168.2.1

a. Star Topology
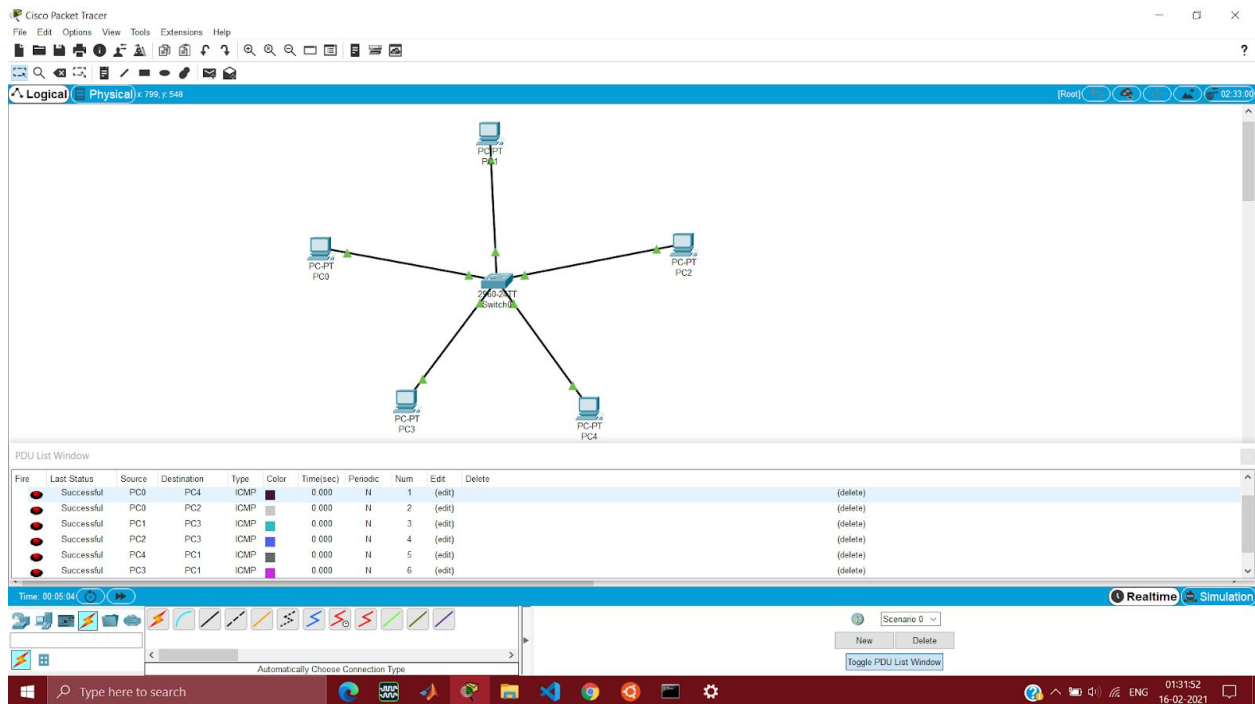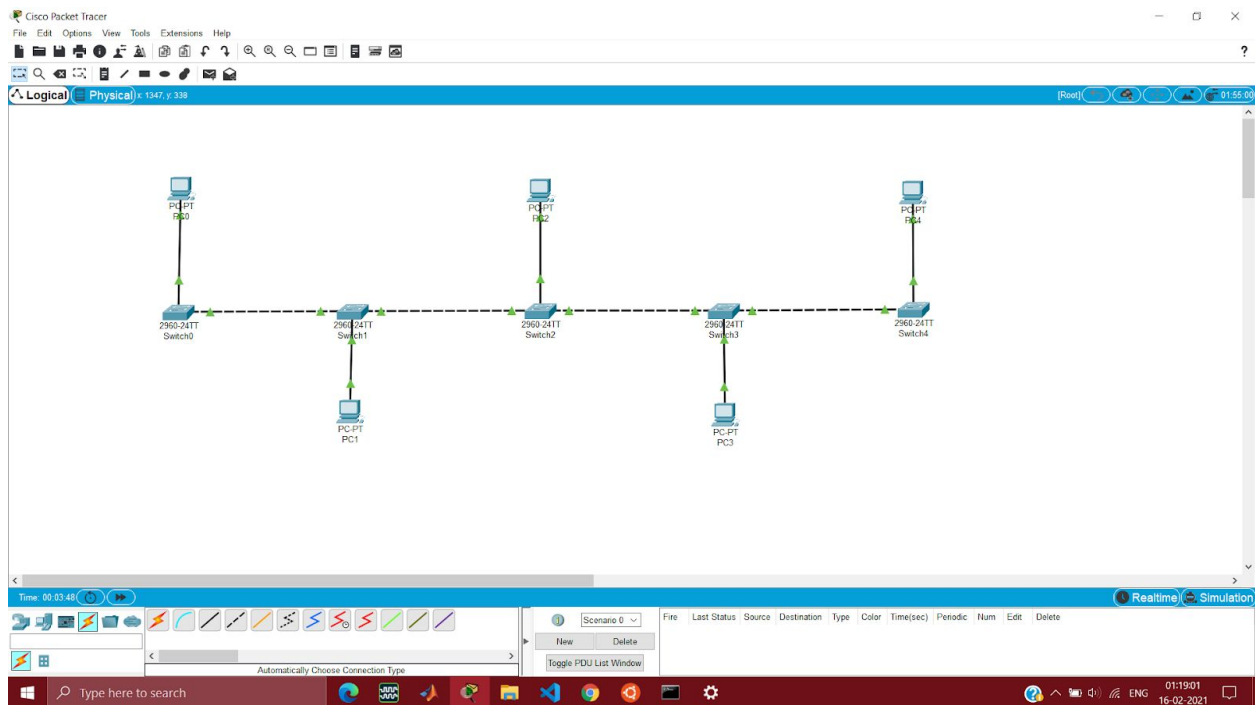

5 PCs connected in Star Topology

Image depicting successful communication between PCs connected in Star Topology
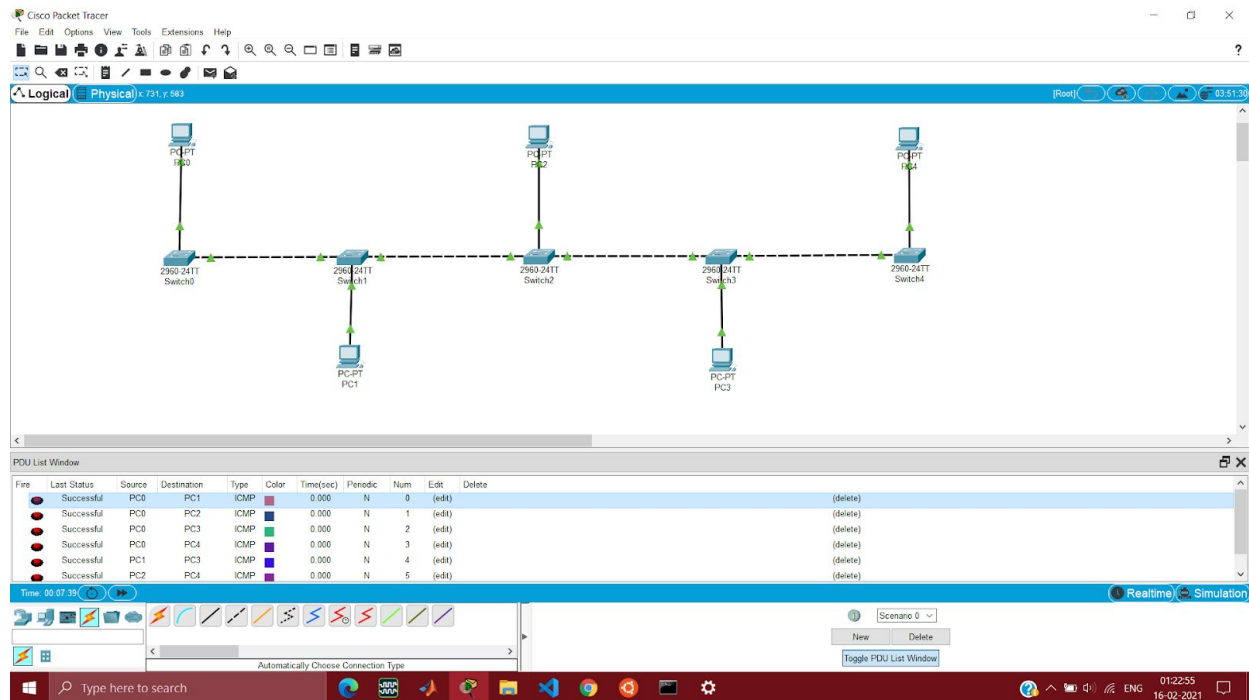
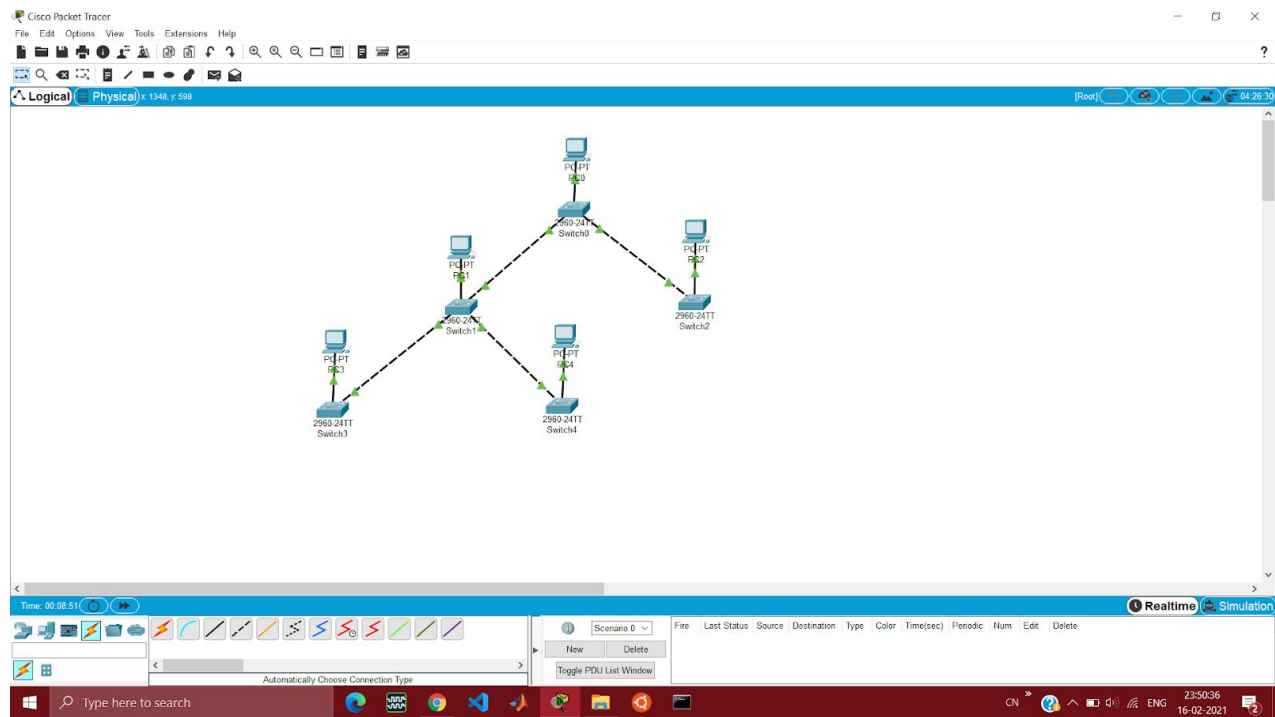## b. Bus Topology

5 PCs connected in Bus Topology

Image depicting successful communication between PCs connected in Bus Topology
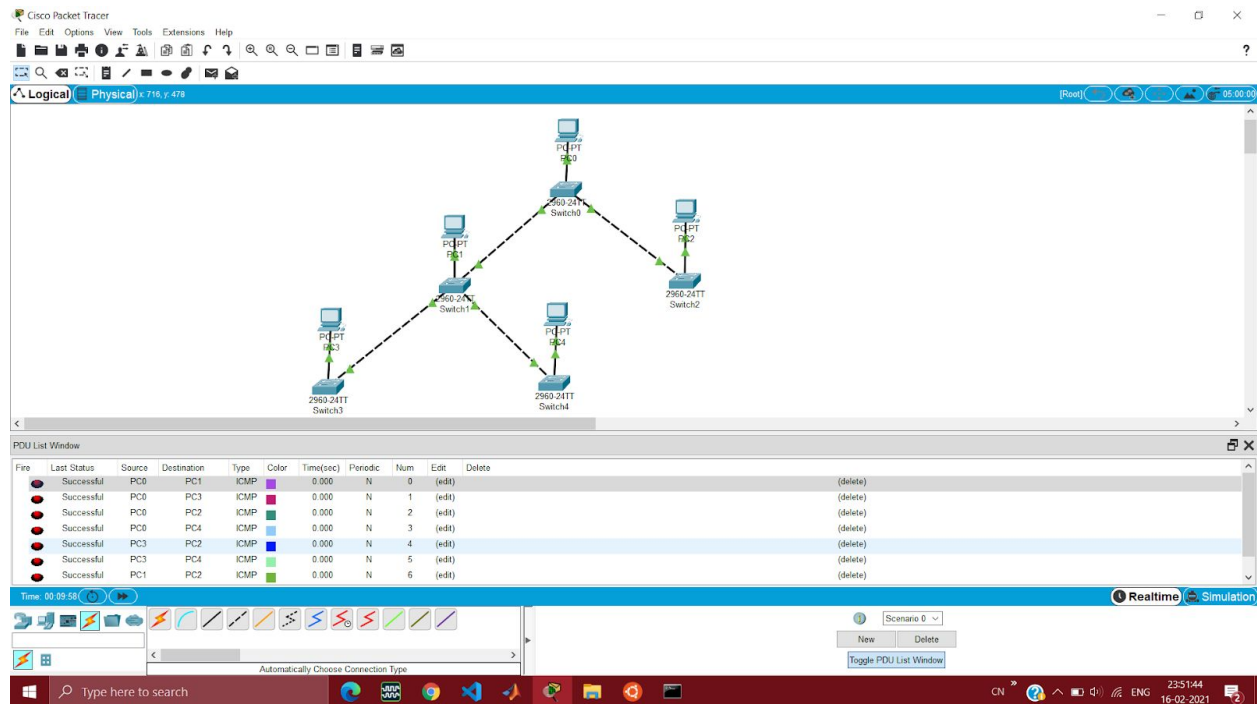
c. Tree Topology

5 PCs connected in Tree Topology

Image depicting successful communication between PCs connected in Tree Topology

References

1. https://goinbigdata.com/demystifying-ifconfig-and-network-interfaces-in-linux/
2. https://www.meridianoutpost.com/resources/articles/command-line/ping.php
3. https://docs.microsoft.com/en-us/windows-server/administration/windows-commands/netstat
4. https://www.inmotionhosting.com/support/server/ssh/read-traceroute/