

CSE 1004

Network and Communication

LAB ASSESSMENT - 1

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Activity-1

1. ifconfig:

The “**ifconfig**” command with no arguments will display all the active interfaces details. The **ifconfig** command also used to check the assigned IP address of an server.

```
vibhu@Vibhu-VirtualBox:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::d63a:bb6b:8bbb:44a8 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:b0:4c:d1 txqueuelen 1000 (Ethernet)
    RX packets 253776 bytes 288730624 (288.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 51753 bytes 5220207 (5.2 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 2642 bytes 272884 (272.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 2642 bytes 272884 (272.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

vibhu@Vibhu-VirtualBox:~$
```

OPTIONS

i. ifconfig -a:

Description:

The following ifconfig command with -a argument will display information of all active or inactive network interfaces on server. It displays the results for **eth0**, **lo**, **sit0** and **tun0**.

Output:

```
vibhu@Vibhu-VirtualBox:~$ ifconfig -a
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::d63a:bb6b:8bbb:44a8 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:b0:4c:d1 txqueuelen 1000 (Ethernet)
    RX packets 553825 bytes 584321273 (584.3 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 126961 bytes 14548298 (14.5 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 8550 bytes 904958 (904.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 8550 bytes 904958 (904.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

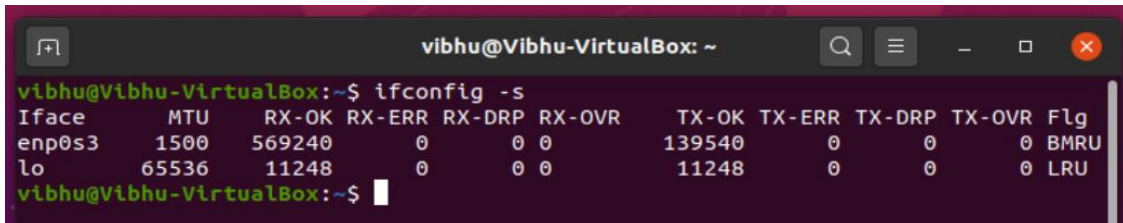
When we use this option, it returns detailed information of interfaces whether they are active or inactive. This can be used primarily when we want to see the detailed information, not just the summary.

ii. ifconfig -s:

Description:

Display a short list, instead of details using **ifconfig -s** option.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ ifconfig -s  
Iface      MTU      RX-OK RX-ERR RX-DRP RX-OVR      TX-OK TX-ERR TX-DRP TX-OVR Flg  
enp0s3     1500     569240 0      0 0      139540 0      0 0      0 BMRU  
lo         65536     11248 0      0 0      11248 0      0 0      0 LRU  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

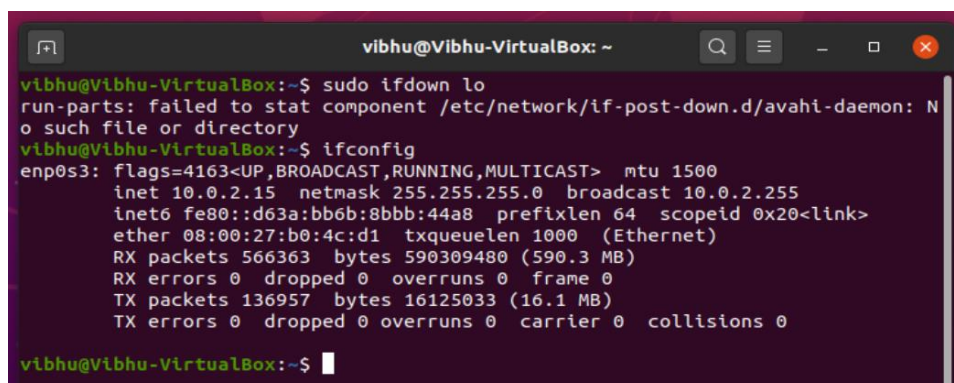
This options returns a short but important list of all the interfaces along with certain details such as MTU value, RX-OK, etc.

iii. ifconfig [interface] down/ ifdown [interface]:

Description:

The “**down**” or “**ifdown**” flag with interface name (**eth0**) deactivates the specified network interface. For example, “**ifconfig eth0 down**” or “**ifdown eth0**” command deactivates the **eth0** interface, if it is in active state.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ sudo ifdown lo  
run-parts: failed to stat component /etc/network/if-post-down.d/avahi-daemon: N  
o such file or directory  
vibhu@Vibhu-VirtualBox:~$ ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255  
inet6 fe80::d63a:bb6b:8bbb:44a8 prefixlen 64 scopeid 0x20<link>  
ether 08:00:27:b0:4c:d1 txqueuelen 1000 (Ethernet)  
RX packets 566363 bytes 590309480 (590.3 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 136957 bytes 16125033 (16.1 MB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

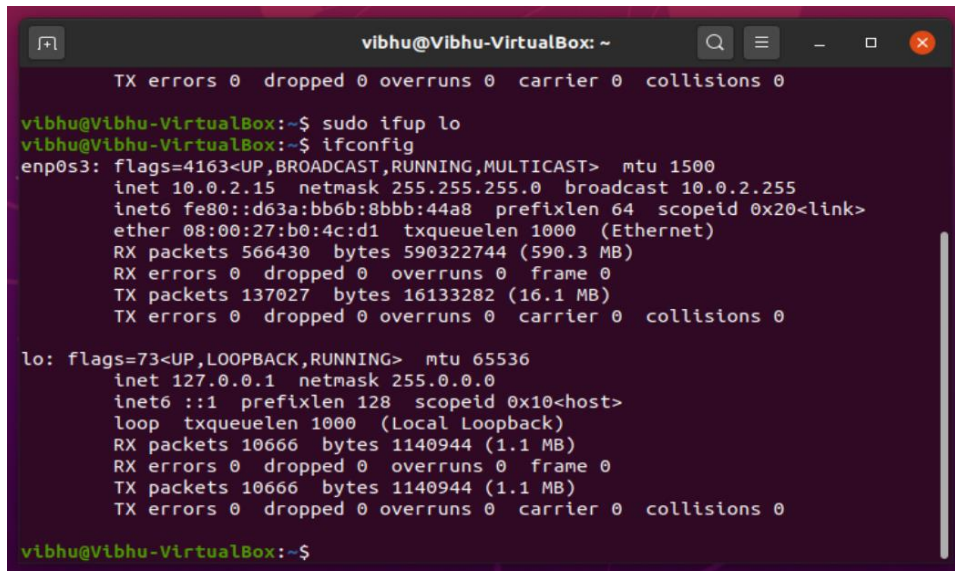
This option is used to disable any interface according to your own wish. It makes the interface disabled until the it is enable again or the system is restarted.

iv. **ifconfig [interface] up/ ifup [interface]:**

Description:

The “**up**” or “**ifup**” flag with interface name (**eth0**) activates an network interface, if it is not in active state and allowing to send and receive information. For example, “**ifconfig eth0 up**” or “**ifup eth0**” will activate the **eth0** interface.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0  
  
vibhu@Vibhu-VirtualBox:~$ sudo ifup lo  
vibhu@Vibhu-VirtualBox:~$ ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500  
    inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255  
    inet6 fe80::d63a:bb6b:8bbb:44a8  prefixlen 64  scopeid 0x20<link>  
    ether 08:00:27:b0:4c:d1  txqueuelen 1000  (Ethernet)  
    RX packets 566430  bytes 590322744 (590.3 MB)  
    RX errors 0  dropped 0  overruns 0  frame 0  
    TX packets 137027  bytes 16133282 (16.1 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 10666  bytes 1140944 (1.1 MB)  
    RX errors 0  dropped 0  overruns 0  frame 0  
    TX packets 10666  bytes 1140944 (1.1 MB)  
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0  
  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

It is used to activate/enable any interface if it was previously disabled.

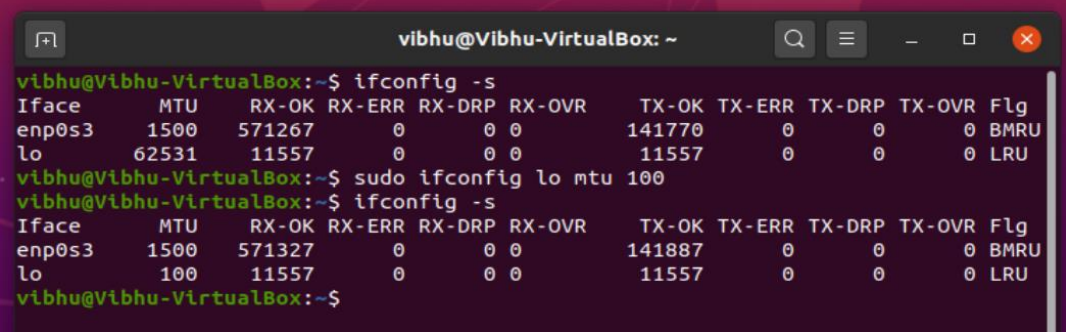
v. **ifconfig [interface] mtu [value]:**

Description:

The “**mtu**” argument set the maximum transmission unit to an interface. The **MTU** allows you to set the limit size of packets that are transmitted on an interface. The **MTU** able to handle maximum number of octets to an interface in one single transaction. For

example, “**ifconfig eth0 mtu 1000**” will set the maximum transmission unit to given set (i.e. **1000**). Not all network interfaces supports **MTU** settings.

Output:



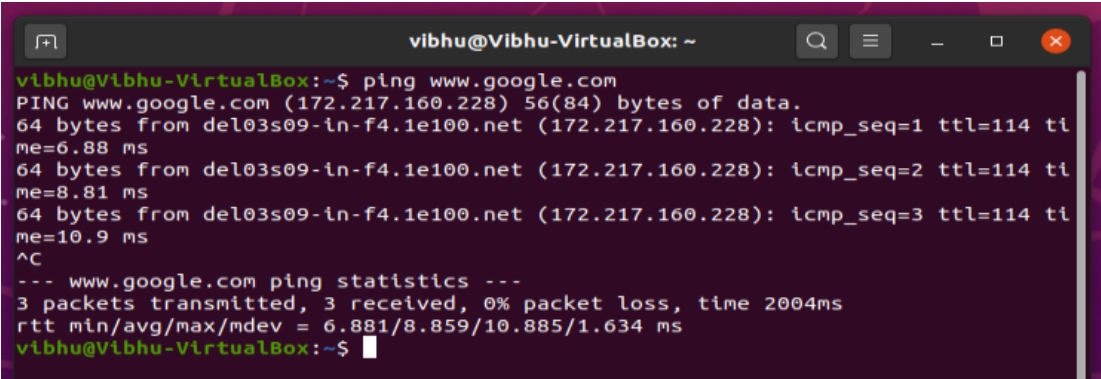
```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ ifconfig -s  
Iface      MTU      RX-OK RX-ERR RX-DRP RX-OVR    TX-OK TX-ERR TX-DRP TX-OVR Flg  
enp0s3    1500    571267      0      0 0      141770      0      0      0 BMRU  
lo        62531    11557      0      0 0      11557      0      0      0 LRU  
vibhu@Vibhu-VirtualBox:~$ sudo ifconfig lo mtu 100  
vibhu@Vibhu-VirtualBox:~$ ifconfig -s  
Iface      MTU      RX-OK RX-ERR RX-DRP RX-OVR    TX-OK TX-ERR TX-DRP TX-OVR Flg  
enp0s3    1500    571327      0      0 0      141887      0      0      0 BMRU  
lo         100    11557      0      0 0      11557      0      0      0 LRU  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

This options allows the user to change the MTU value of any interface where MTU stands for Maximum Transmission Unit.

2. ping:

PING (Packet Internet Groper) command is used to check the network connectivity between host and server/host. This command takes as input the IP address or the URL and sends a data packet to the specified address with the message “PING” and get a response from the server/host this time is recorded which is called latency. Fast ping low latency means faster connection.



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ ping www.google.com  
PING www.google.com (172.217.160.228) 56(84) bytes of data.  
64 bytes from del03s09-in-f4.1e100.net (172.217.160.228): icmp_seq=1 ttl=114 t  
ime=6.88 ms  
64 bytes from del03s09-in-f4.1e100.net (172.217.160.228): icmp_seq=2 ttl=114 t  
ime=8.81 ms  
64 bytes from del03s09-in-f4.1e100.net (172.217.160.228): icmp_seq=3 ttl=114 t  
ime=10.9 ms  
^C  
--- www.google.com ping statistics ---  
3 packets transmitted, 3 received, 0% packet loss, time 2004ms  
rtt min/avg/max/mdev = 6.881/8.859/10.885/1.634 ms  
vibhu@Vibhu-VirtualBox:~$
```

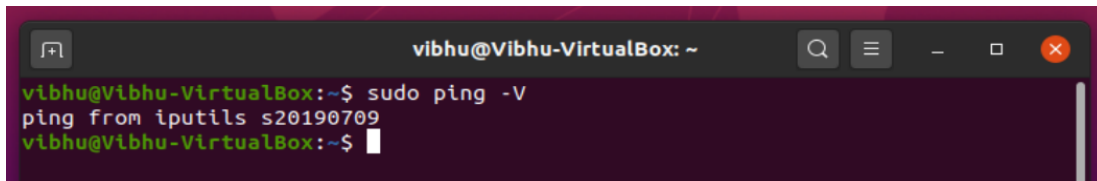

OPTIONS

i. ping -V:

Description:

Used to get the ping version installed on your system.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ sudo ping -V  
ping from iputils s20190709  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

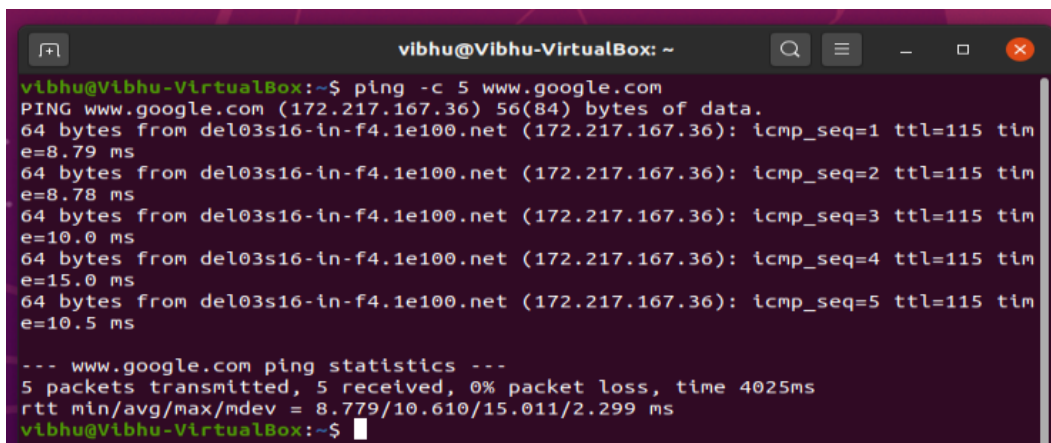
The option is used to return the current version of ping package installed on the system.

ii. ping -c:

Description:

Earlier we did not define the number of packets to send to the server/host by using **-c** option we can do so.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ ping -c 5 www.google.com  
PING www.google.com (172.217.167.36) 56(84) bytes of data.  
64 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=1 ttl=115 time=8.79 ms  
64 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=2 ttl=115 time=8.78 ms  
64 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=3 ttl=115 time=10.0 ms  
64 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=4 ttl=115 time=15.0 ms  
64 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=5 ttl=115 time=10.5 ms  
  
--- www.google.com ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4025ms  
rtt min/avg/max/mdev = 8.779/10.610/15.011/2.299 ms  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

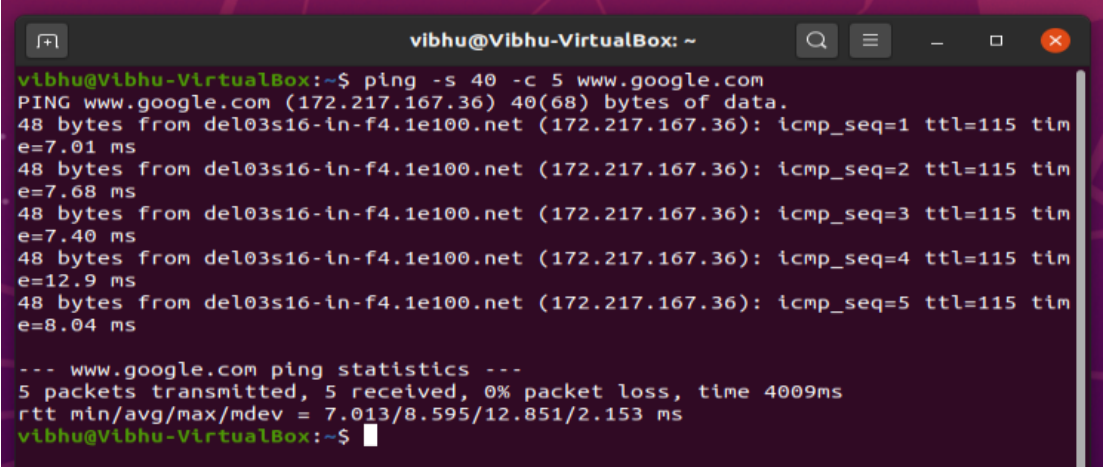
This option helps the user set the number of packets after which the ping process terminates. If nothing is specified, it pings for indefinite amount of time, until user hits ctrl+c.

iii. ping -s:

Description:

Earlier a default sized packets were sent to a host but we can send light and heavy packet by using -s option.

Output:

A terminal window titled 'vibhu@Vibhu-VirtualBox: ~' showing the command 'ping -s 40 -c 5 www.google.com'. The output shows five successful pings to 172.217.167.36 with 48 bytes of data and varying response times. Ping statistics show 5 packets transmitted, 5 received, 0% packet loss, and a total time of 4009ms.

```
vibhu@Vibhu-VirtualBox:~$ ping -s 40 -c 5 www.google.com
PING www.google.com (172.217.167.36) 40(68) bytes of data.
48 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=1 ttl=115 time=7.01 ms
48 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=2 ttl=115 time=7.68 ms
48 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=3 ttl=115 time=7.40 ms
48 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=4 ttl=115 time=12.9 ms
48 bytes from del03s16-in-f4.1e100.net (172.217.167.36): icmp_seq=5 ttl=115 time=8.04 ms

--- www.google.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4009ms
rtt min/avg/max/mdev = 7.013/8.595/12.851/2.153 ms
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

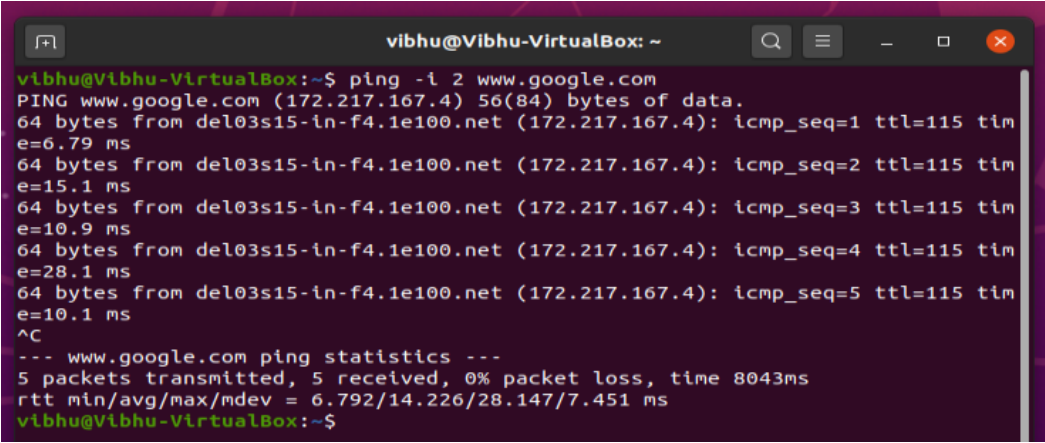
This option allows user to set the size of the packets while pinging.

iv. ping -i:

Description:

By default ping wait for 1 sec to send next packet we can change this time by using -i option.

Output:

A terminal window titled 'vibhu@Vibhu-VirtualBox: ~' showing the command 'ping -i 2 www.google.com'. The output shows five successful pings to 172.217.167.4 with 64 bytes of data and varying response times. Ping statistics show 5 packets transmitted, 5 received, 0% packet loss, and a total time of 8043ms.

```
vibhu@Vibhu-VirtualBox:~$ ping -i 2 www.google.com
PING www.google.com (172.217.167.4) 56(84) bytes of data.
64 bytes from del03s15-in-f4.1e100.net (172.217.167.4): icmp_seq=1 ttl=115 time=6.79 ms
64 bytes from del03s15-in-f4.1e100.net (172.217.167.4): icmp_seq=2 ttl=115 time=15.1 ms
64 bytes from del03s15-in-f4.1e100.net (172.217.167.4): icmp_seq=3 ttl=115 time=10.9 ms
64 bytes from del03s15-in-f4.1e100.net (172.217.167.4): icmp_seq=4 ttl=115 time=28.1 ms
64 bytes from del03s15-in-f4.1e100.net (172.217.167.4): icmp_seq=5 ttl=115 time=10.1 ms
^C
--- www.google.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 8043ms
rtt min/avg/max/mdev = 6.792/14.226/28.147/7.451 ms
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

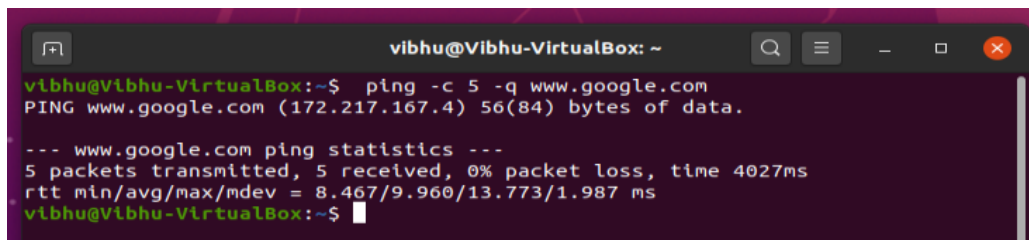
This option allows the user to set the time interval between exchange of packets. Here, we have set the time to 2s. This means that there will be a delay of 2s before each packet is transferred.

v. **ping -q:**

Description:

To only get the summary about the network use **-q** option.

Output:



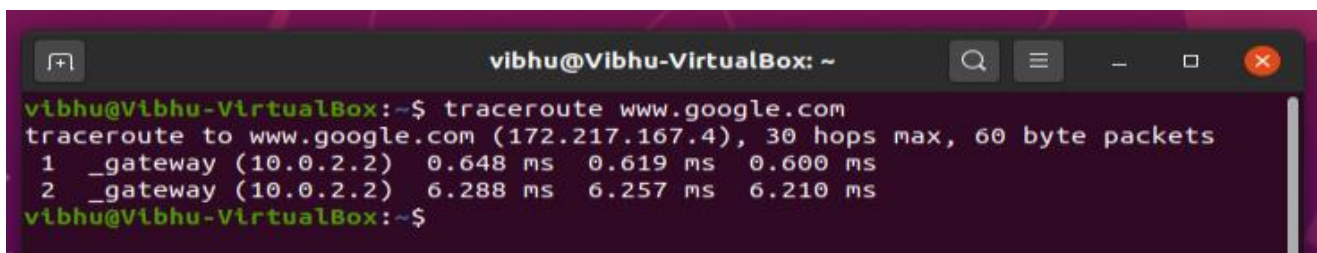
```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ ping -c 5 -q www.google.com  
PING www.google.com (172.217.167.4) 56(84) bytes of data.  
  
--- www.google.com ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4027ms  
rtt min/avg/max/mdev = 8.467/9.960/13.773/1.987 ms  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

This option provides the summary of the process after completing the regular ping process.

3. **traceroute:**

Traceroute command in Linux prints the route that a packet takes to reach the host. This command is useful when you want to know about the route and about all the hops that a packet takes. Below image depicts how traceroute command is used to reach the Google(172.217.26.206) host from the local machine and it also prints detail about all the hops that it visits in between.



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ traceroute www.google.com  
traceroute to www.google.com (172.217.167.4), 30 hops max, 60 byte packets  
1 _gateway (10.0.2.2) 0.648 ms 0.619 ms 0.600 ms  
2 _gateway (10.0.2.2) 6.288 ms 6.257 ms 6.210 ms  
vibhu@Vibhu-VirtualBox:~$
```

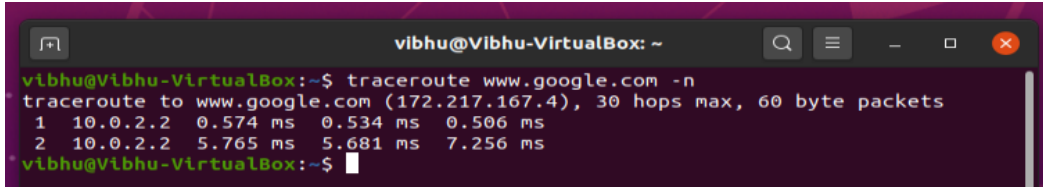

OPTIONS

i. traceroute -n:

Description:

Do not resolve IP addresses to their domain names.

Output:

A terminal window titled 'vibhu@Vibhu-VirtualBox: ~' showing the command 'traceroute www.google.com -n'. The output shows the path to www.google.com (172.217.167.4) with 30 hops max and 60 byte packets. The first hop is 10.0.2.2 with round trip times of 0.574 ms, 0.534 ms, and 0.506 ms. The second hop is 10.0.2.2 with round trip times of 5.765 ms, 5.681 ms, and 7.256 ms.

```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ traceroute www.google.com -n  
traceroute to www.google.com (172.217.167.4), 30 hops max, 60 byte packets  
1 10.0.2.2 0.574 ms 0.534 ms 0.506 ms  
2 10.0.2.2 5.765 ms 5.681 ms 7.256 ms  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

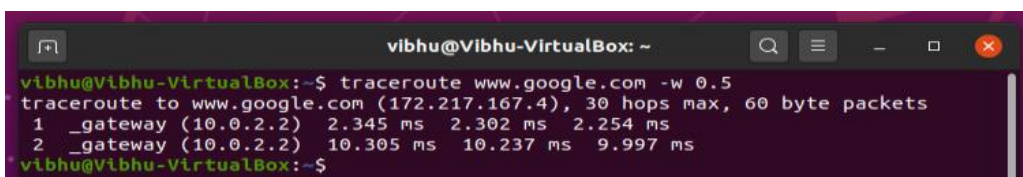
Each line gives the details of interaction with each router encountered. The traceroute not only gives the IP addresses of the intermediate routers, but also three round trip times for that particular router as for each router the traceroute commands fires three packets.

ii. traceroute -w:

Description:

Configures Response Wait Time. This traceroute utility waits after issuing a probe can also be configured.

Output:

A terminal window titled 'vibhu@Vibhu-VirtualBox: ~' showing the command 'traceroute www.google.com -w 0.5'. The output shows the path to www.google.com (172.217.167.4) with 30 hops max and 60 byte packets. The first hop is _gateway (10.0.2.2) with round trip times of 2.345 ms, 2.302 ms, and 2.254 ms. The second hop is _gateway (10.0.2.2) with round trip times of 10.305 ms, 10.237 ms, and 9.997 ms.

```
vibhu@Vibhu-VirtualBox:~$ traceroute www.google.com -w 0.5  
traceroute to www.google.com (172.217.167.4), 30 hops max, 60 byte packets  
1 _gateway (10.0.2.2) 2.345 ms 2.302 ms 2.254 ms  
2 _gateway (10.0.2.2) 10.305 ms 10.237 ms 9.997 ms  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

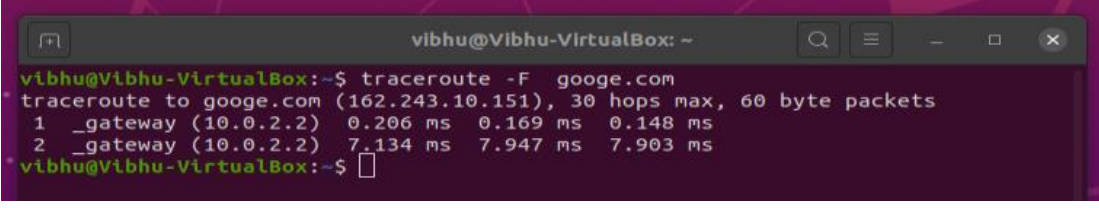
The -w option expects a value which the utility will take as the response time to wait.

iii. traceroute -F:

Description:

Do not fragment packet.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ traceroute -F google.com  
traceroute to google.com (162.243.10.151), 30 hops max, 60 byte packets  
1 _gateway (10.0.2.2) 0.206 ms 0.169 ms 0.148 ms  
2 _gateway (10.0.2.2) 7.134 ms 7.947 ms 7.903 ms  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

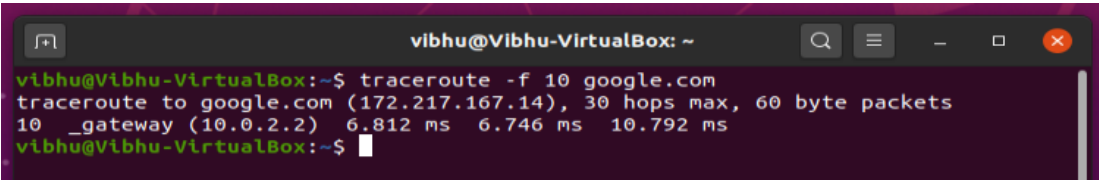
The option doesn't allow the packets to be fragmented. This means that all the packets are transferred in their entirety.

iv. **traceroute -f:**

Description:

Start from the first ttl hop (instead from 1).

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ traceroute -f 10 google.com  
traceroute to google.com (172.217.167.14), 30 hops max, 60 byte packets  
10 _gateway (10.0.2.2) 6.812 ms 6.746 ms 10.792 ms  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

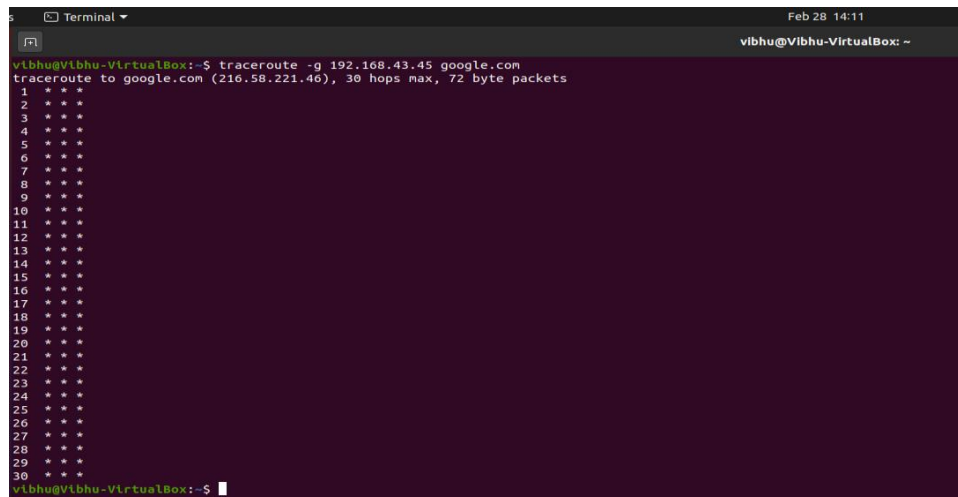
The default value of TTL is 1 which means it starts off with the first router in the path but using the **-f** option a new value of the TTL field can be set. That gives us a nice, condensed report on the state of the connection to the destination.

v. **traceroute -g:**

Description:

Routes the packet through gate.

Output:



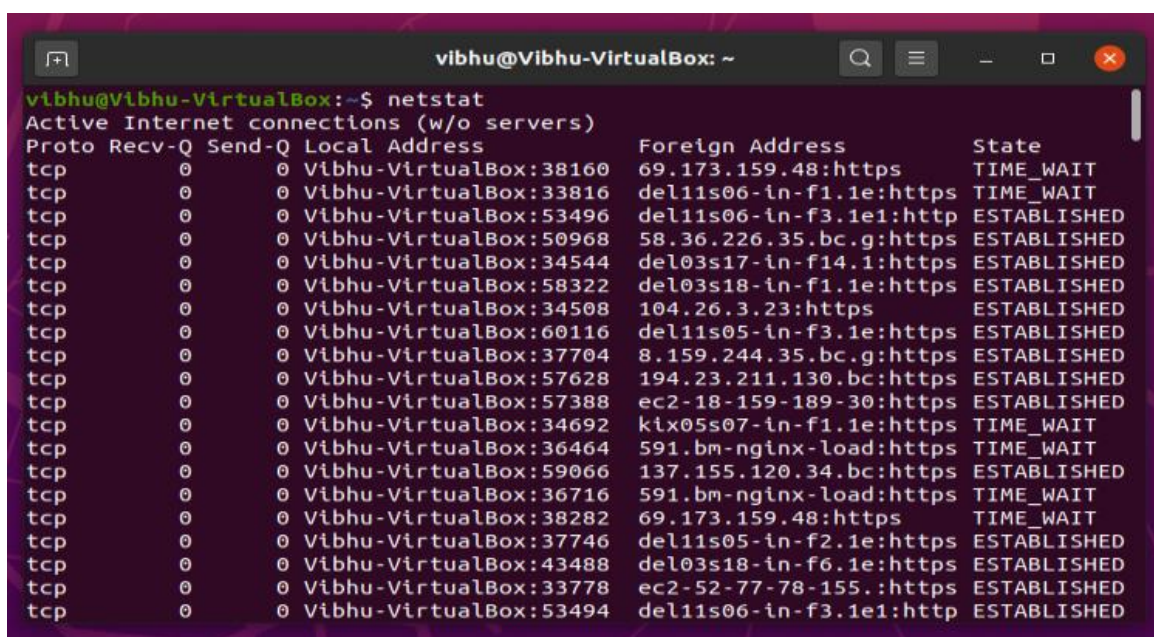
```
vibhu@Vibhu-VirtualBox:~$ tracert -g 192.168.43.45 google.com
tracert to google.com (216.58.221.46), 30 hops max, 72 byte packets
 1 * * *
 2 * * *
 3 * * *
 4 * * *
 5 * * *
 6 * * *
 7 * * *
 8 * * *
 9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

Here, you can see in the screenshot it makes maximum of 30 hops through gates.

4. netstat:

This tool is very important and much useful for Linux network administrators as well as system administrators to monitor and troubleshoot their network-related problems and determine network traffic performance. This article shows usages of netstat command with their examples which may be useful in daily operation.



```
vibhu@Vibhu-VirtualBox:~$ netstat
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp    0      0 Vibhu-VirtualBox:38160  69.173.159.48:https     TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:33816  del11s06-in-f1.1e:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:53496  del11s06-in-f3.1e1:http ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:50968  58.36.226.35.bc.g:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:34544  del03s17-in-f14.1:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:58322  del03s18-in-f1.1e:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:34508  104.26.3.23:https      ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:60116  del11s05-in-f3.1e:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:37704  8.159.244.35.bc.g:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:57628  194.23.211.130.bc:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:57388  ec2-18-159-189-30:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:34692  kix05s07-in-f1.1e:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:36464  591.bm-nginx-load:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:59066  137.155.120.34.bc:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:36716  591.bm-nginx-load:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:38282  69.173.159.48:https     TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:37746  del11s05-in-f2.1e:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:43488  del03s18-in-f6.1e:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:33778  ec2-52-77-78-155:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:53494  del11s06-in-f3.1e1:http ESTABLISHED
```

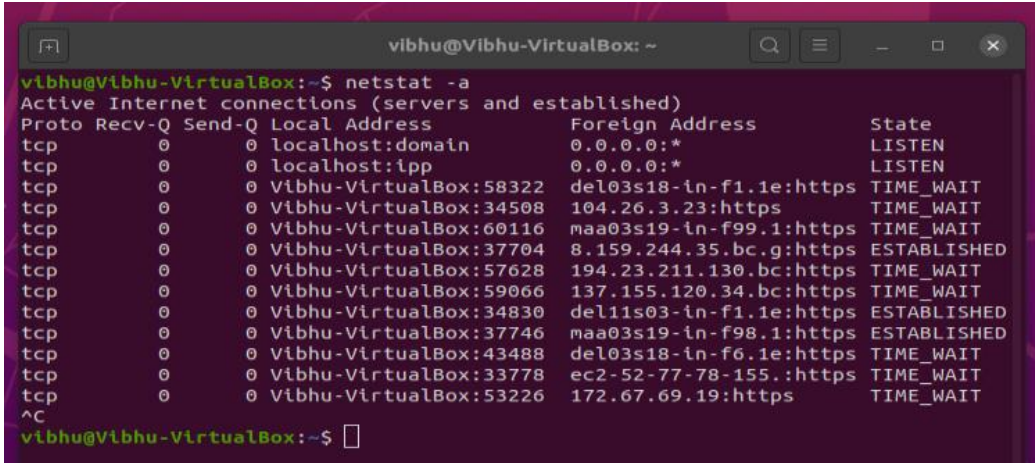
OPTIONS

i. netstat -a:

Description:

Listing all ports (both TCP and UDP) using **netstat -a** option.

Output:

A terminal window titled 'vibhu@Vibhu-VirtualBox: ~' showing the output of the 'netstat -a' command. The output lists active internet connections for both TCP and UDP. The columns are: Proto, Recv-Q, Send-Q, Local Address, Foreign Address, and State. The output shows several listening ports (LISTEN) and established connections (ESTABLISHED) for various services like https, domain, and ippp.

```
vibhu@Vibhu-VirtualBox:~$ netstat -a
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp    0      0 localhost:domain        0.0.0.0:*               LISTEN
tcp    0      0 localhost:ipp           0.0.0.0:*               LISTEN
tcp    0      0 Vibhu-VirtualBox:58322  del03s18-in-f1.1e:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:34508  104.26.3.23:https      TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:60116  maa03s19-in-f99.1:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:37704  8.159.244.35.bc.g:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:57628  194.23.211.130.bc:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:59066  137.155.120.34.bc:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:34830  del11s03-in-f1.1e:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:37746  maa03s19-in-f98.1:https ESTABLISHED
tcp    0      0 Vibhu-VirtualBox:43488  del03s18-in-f6.1e:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:33778  ec2-52-77-78-155.:https TIME_WAIT
tcp    0      0 Vibhu-VirtualBox:53226  172.67.69.19:https     TIME_WAIT
^C
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

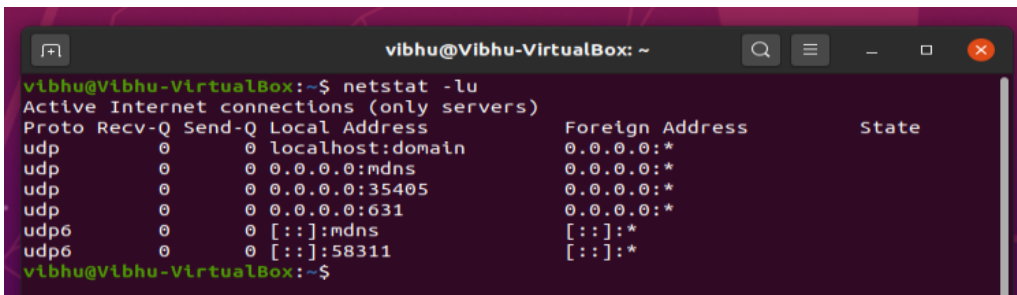
This option allows the user to enlist all the ports including TCP and UDP all in one command.

ii. netstat -lu:

Description:

Listing all active listening UDP ports by using option **netstat -lu**.

Output:

A terminal window titled 'vibhu@Vibhu-VirtualBox: ~' showing the output of the 'netstat -lu' command. The output lists active internet connections for only servers (UDP). The columns are: Proto, Recv-Q, Send-Q, Local Address, Foreign Address, and State. The output shows several listening ports (LISTEN) for various services like domain, mdns, and 35405.

```
vibhu@Vibhu-VirtualBox:~$ netstat -lu
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
udp    0      0 localhost:domain        0.0.0.0:*               LISTEN
udp    0      0 0.0.0.0:mdns            0.0.0.0:*               LISTEN
udp    0      0 0.0.0.0:35405           0.0.0.0:*               LISTEN
udp    0      0 0.0.0.0:631             0.0.0.0:*               LISTEN
udp6   0      0 [::]:mdns               [::]:*                  LISTEN
udp6   0      0 [::]:58311              [::]:*                  LISTEN
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

This option allows the user to enlist all the active listening UDP ports.

iii. netstat -lx:

Description:

Listing all active UNIX listening ports using **netstat -lx**.

Output:

```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ netstat -lx  
Active UNIX domain sockets (only servers)  
Proto RefCnt Flags      Type       State      I-Node      Path  
unix  2      [ ACC ]     STREAM    LISTENING   31554      @/tmp/.ICE-unix/1579  
unix  2      [ ACC ]     STREAM    LISTENING   12699      /run/udev/control  
unix  2      [ ACC ]     STREAM    LISTENING   12672      /run/systemd/private  
unix  2      [ ACC ]     STREAM    LISTENING   29469      @/tmp/dbus-UcwFrKFL  
unix  2      [ ACC ]     STREAM    LISTENING   12674      /run/systemd/userdb/  
io.systemd.DynamicUser  
unix  2      [ ACC ]     STREAM    LISTENING   12685      /run/systemd/fsck.pr  
ogress  
unix  2      [ ACC ]     STREAM    LISTENING   30182      /run/user/1000/syste  
md/private  
unix  2      [ ACC ]     STREAM    LISTENING   30188      /run/user/1000/bus  
unix  2      [ ACC ]     STREAM    LISTENING   12695      /run/systemd/journal  
/stdout  
unix  2      [ ACC ]     STREAM    LISTENING   30189      /run/user/1000/gnupg  
/S.dirmgr  
unix  2      [ ACC ]     STREAM    LISTENING   30190      /run/user/1000/gnupg  
/S.gpg-agent.browse  
unix  2      [ ACC ]     STREAM    LISTENING   30191      /run/user/1000/gnupg  
/S.gpg-agent.extra  
unix  2      [ ACC ]     STREAM    LISTENING   30192      /run/user/1000/gnupg
```

Interpretation:

This option allows the user to get the details of all the active listening linux ports.

iv. netstat -at:

Description:

Listing only **TCP (Transmission Control Protocol)** port connections using **netstat -at**.

Output:

```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ netstat -at  
Active Internet connections (servers and established)  
Proto Recv-Q Send-Q Local Address           Foreign Address         State  
tcp        0      0 localhost:domain        0.0.0.0:*               LISTEN  
tcp        0      0 localhost:ipp           0.0.0.0:*               LISTEN  
tcp        0      0 Vibhu-VirtualBox:47918  server-13-35-217-:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:59076  117.18.237.29:http      TIME_WAIT  
tcp        0      0 Vibhu-VirtualBox:37704  8.159.244.35.bc.g:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:37746  maa03s19-in-f98.1:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:56666  ec2-18-177-253-15:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:34798  104.26.3.23:https       ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:47340  kix05s07-in-f162.:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:42560  ec2-34-214-115-16:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:41736  del03s17-in-f2.1e:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:57814  kul06s14-in-f202.:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:54310  ec2-54-179-40-96.:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:34028  nrt12s11-in-f161.:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:58652  del03s18-in-f1.1e:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:55228  del03s15-in-f3.1e:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:59072  117.18.237.29:http      TIME_WAIT  
tcp        0      0 Vibhu-VirtualBox:34046  del11s06-in-f2.1e:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:60446  ec2-13-229-220-22:https ESTABLISHED  
tcp        0      0 Vibhu-VirtualBox:59074  117.18.237.29:http      TIME_WAIT
```


Interpretation:

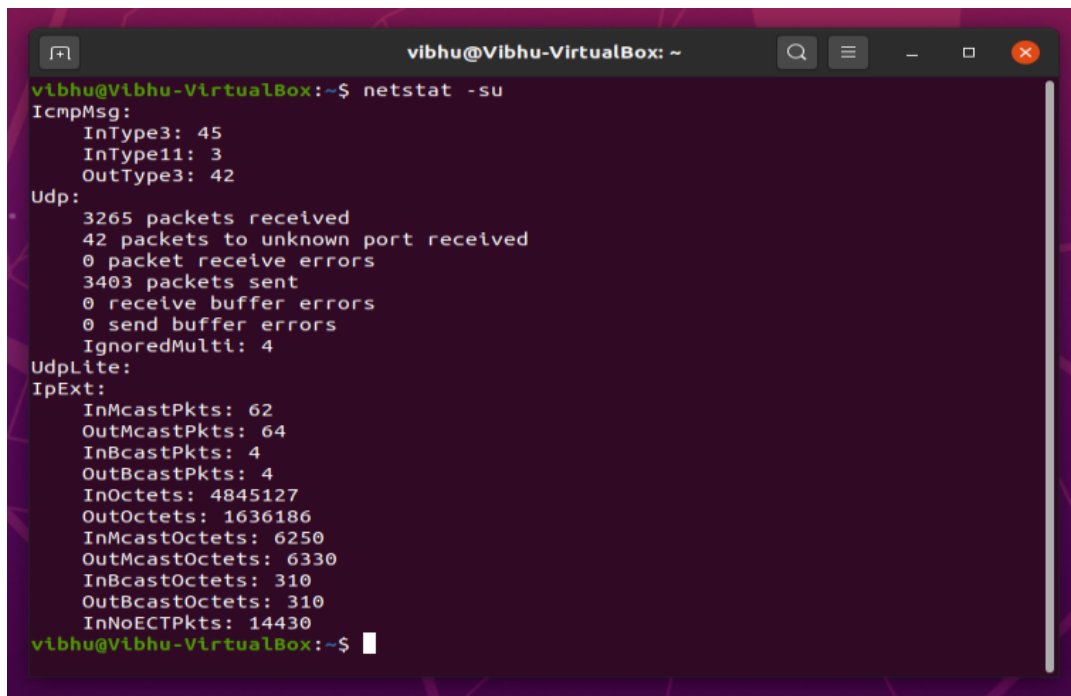
This options returns the details of all the TCP ports in one command.

v. netstat -su:

Description:

To Show Statistics by UDP Protocol, use **netstat -su** option.

Output:

A screenshot of a terminal window titled 'vibhu@Vibhu-VirtualBox: ~'. The terminal shows the command 'netstat -su' and its output. The output is as follows:

```
vibhu@Vibhu-VirtualBox:~$ netstat -su
IcmpMsg:
  InType3: 45
  InType11: 3
  OutType3: 42
Udp:
  3265 packets received
  42 packets to unknown port received
  0 packet receive errors
  3403 packets sent
  0 receive buffer errors
  0 send buffer errors
  IgnoredMultl: 4
UdpLite:
IpExt:
  InMcastPkts: 62
  OutMcastPkts: 64
  InBcastPkts: 4
  OutBcastPkts: 4
  InOctets: 4845127
  OutOctets: 1636186
  InMcastOctets: 6250
  OutMcastOctets: 6330
  InBcastOctets: 310
  OutBcastOctets: 310
  InNoECTPkts: 14430
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

This option can be used to show the statistics by UDP Protocol.

5. nslookup:

Nslookup (stands for “Name Server Lookup”) is a useful command for getting information from 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.

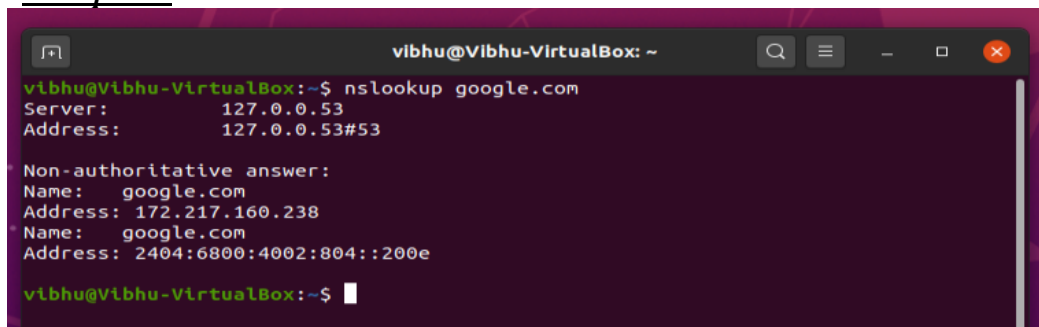
OPTIONS

1. nslookup [website]:

Description:

nslookup followed by the domain name will display the “A Record” (IP Address) of the domain. Use this command to find the address record for a domain. It queries to domain name servers and get the details.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ nslookup google.com  
Server:      127.0.0.53  
Address:     127.0.0.53#53  
  
Non-authoritative answer:  
Name:   google.com  
Address: 172.217.160.238  
Name:   google.com  
Address: 2404:6800:4002:804::200e  
  
vibhu@Vibhu-VirtualBox:~$
```

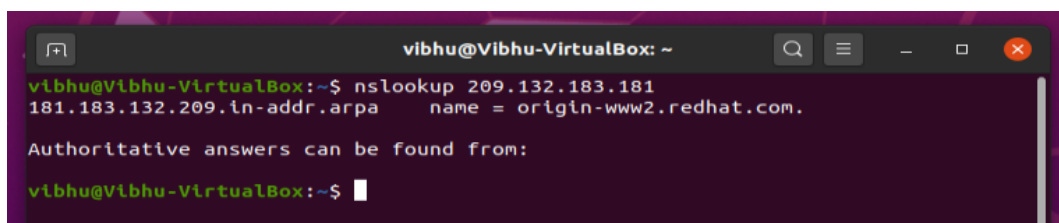
Interpretation:

2. nslookup [I.P. Address]:

Description:

You can do the reverse DNS look-up by providing the IP Address as argument to nslookup.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ nslookup 209.132.183.181  
181.183.132.209.in-addr.arpa    name = origin-www2.redhat.com.  
  
Authoritative answers can be found from:  
  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

We can see from the above screenshot that we can do the reverse DNS lookup and search for the domain name associated with an IP

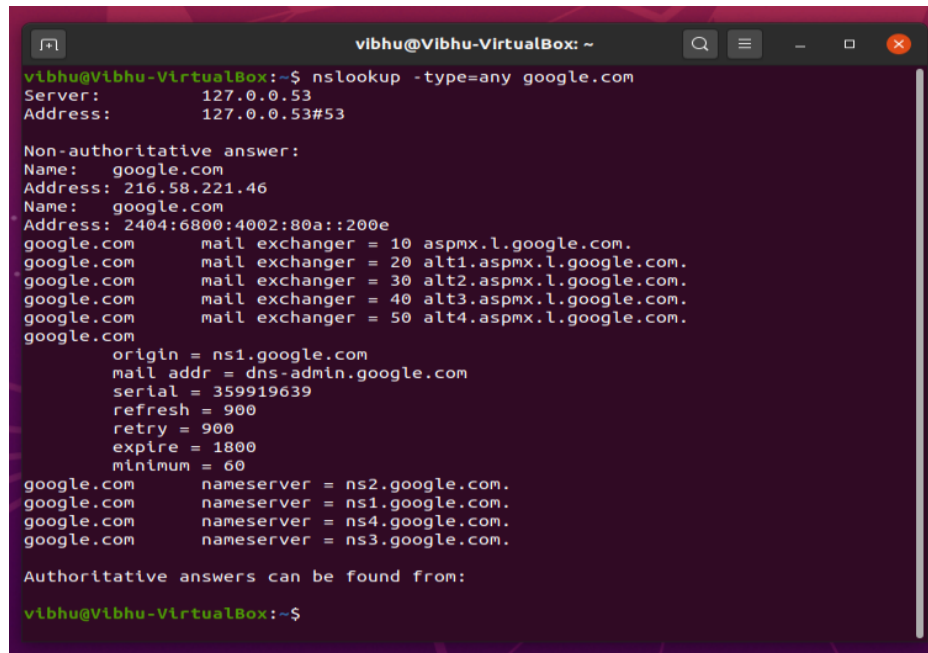
address. The IP address can be founded by simply typing- “nslookup redhat.com”.

3.nslookup -type=any [website]:

Description:

We can view all the available DNS records using **-type=any** option.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ nslookup -type=any google.com  
Server:      127.0.0.53  
Address:     127.0.0.53#53  
  
Non-authoritative answer:  
Name:   google.com  
Address: 216.58.221.46  
Name:   google.com  
Address: 2404:6800:4002:80a::200e  
google.com      mail exchanger = 10 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 = 40 alt3.aspmx.l.google.com.  
google.com      mail exchanger = 50 alt4.aspmx.l.google.com.  
google.com  
      origin = ns1.google.com  
      mail addr = dns-admin.google.com  
      serial = 359919639  
      refresh = 900  
      retry = 900  
      expire = 1800  
      minimum = 60  
google.com      nameserver = ns2.google.com.  
google.com      nameserver = ns1.google.com.  
google.com      nameserver = ns4.google.com.  
google.com      nameserver = ns3.google.com.  
  
Authoritative answers can be found from:  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

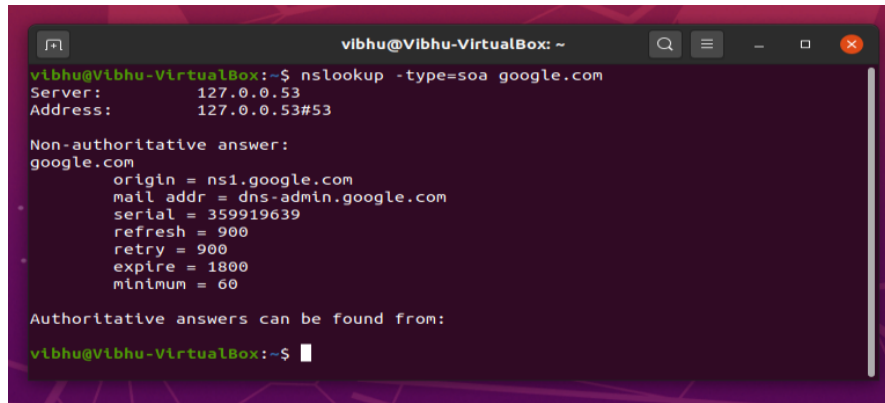
This option provides will all the available DNS records in a list. In this example, the option returns the list of all the available DNS records for ‘www.google.com’.

4.nslookup -type=soa [website]:

Description:

SOA record (start of authority), provides the authoritative information about the domain, the e-mail address of the domain admin, the domain serial number.

Output:



```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ nslookup -type=soa google.com  
Server:      127.0.0.53  
Address:     127.0.0.53#53  
  
Non-authoritative answer:  
google.com  
    origin = ns1.google.com  
    mail addr = dns-admin.google.com  
    serial = 359919639  
    refresh = 900  
    retry = 900  
    expire = 1800  
    minimum = 60  
  
Authoritative answers can be found from:  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

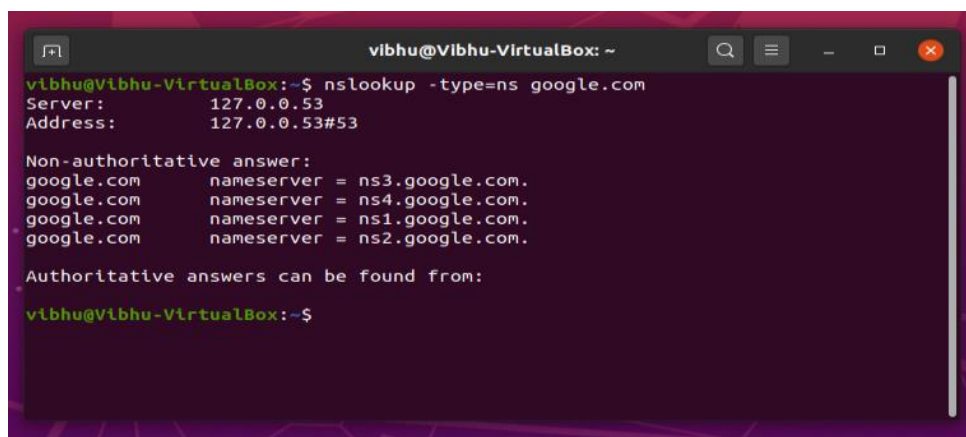
From the above screenshot we can see that SOA record (start of authority), provides the authoritative information about the domain, the e-mail address of the domain admin, the domain serial number, mail address, serial, refresh, retry, expire and minimum.

5.nslookup -type=ns [website]:

Description:

NS (Name Server) record maps a domain name to a list of DNS servers authoritative for that domain. It will output the name servers which are associated with the given domain.

Output:



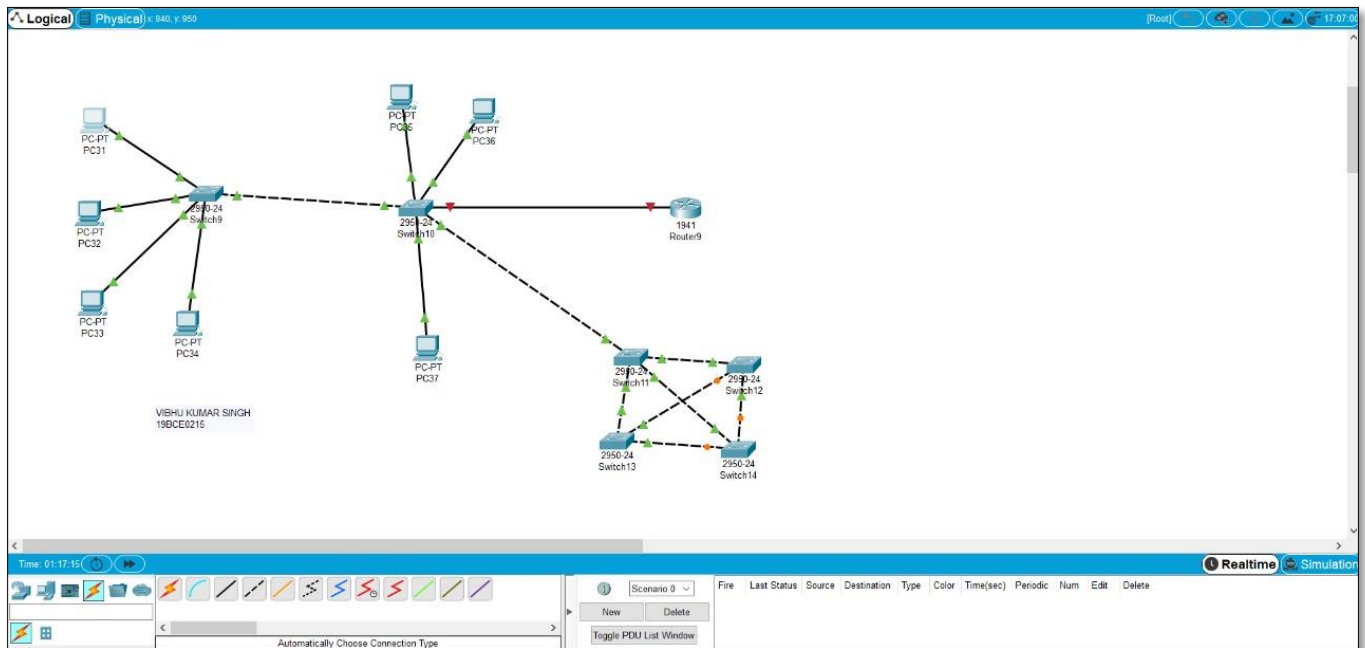
```
vibhu@Vibhu-VirtualBox: ~  
vibhu@Vibhu-VirtualBox:~$ nslookup -type=ns google.com  
Server:      127.0.0.53  
Address:     127.0.0.53#53  
  
Non-authoritative answer:  
google.com    nameserver = ns3.google.com.  
google.com    nameserver = ns4.google.com.  
google.com    nameserver = ns1.google.com.  
google.com    nameserver = ns2.google.com.  
  
Authoritative answers can be found from:  
vibhu@Vibhu-VirtualBox:~$
```

Interpretation:

This option provides will all the Name Server (NS) records in a list. In this example, the option returns the list of all the Name Server records for 'www.google.com'.

Activity-2

1. Network based on basic topology:



For switches

- Network devices
- Switches
- 2960-24 model

For PCs

- End Devices
- PC

For Routers

- Network Devices
- Routers
- 1941 model

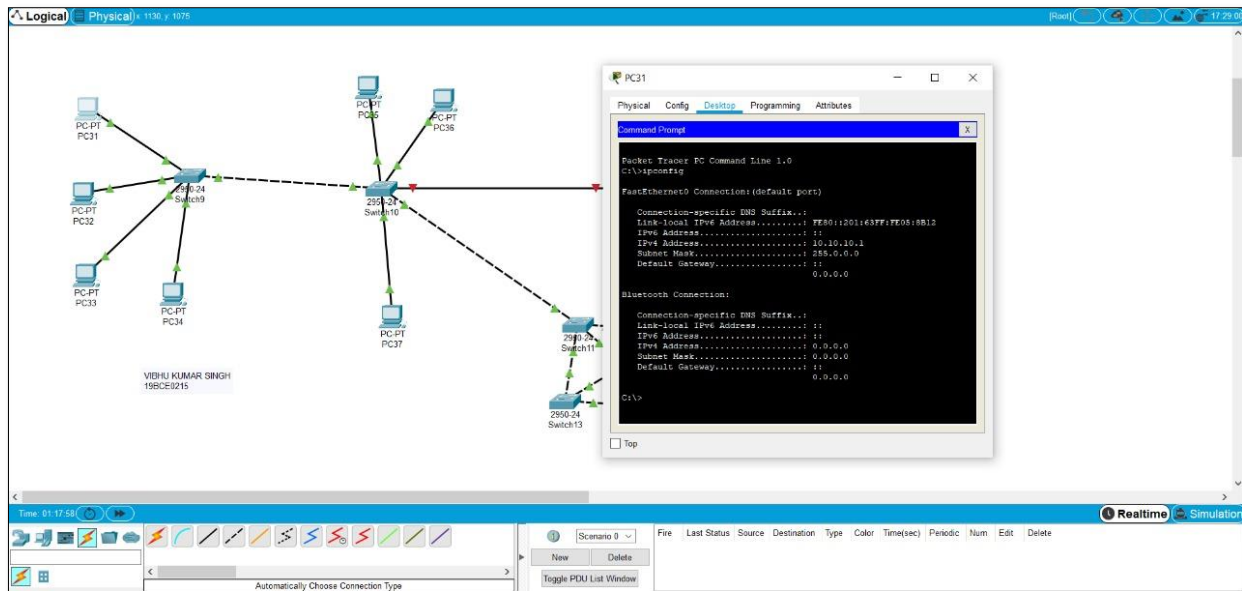
For Connections

- Connections

For connections between switches and PC's, use copper straight-through.

For connections between switches and switch, use copper cross-over.

For connections between switches and router, use copper straight-through.



I.P. Configuration

PC31 – 10.10.10.1

PC32 – 10.10.10.2

PC33 – 10.10.10.3

PC34 – 10.10.10.4

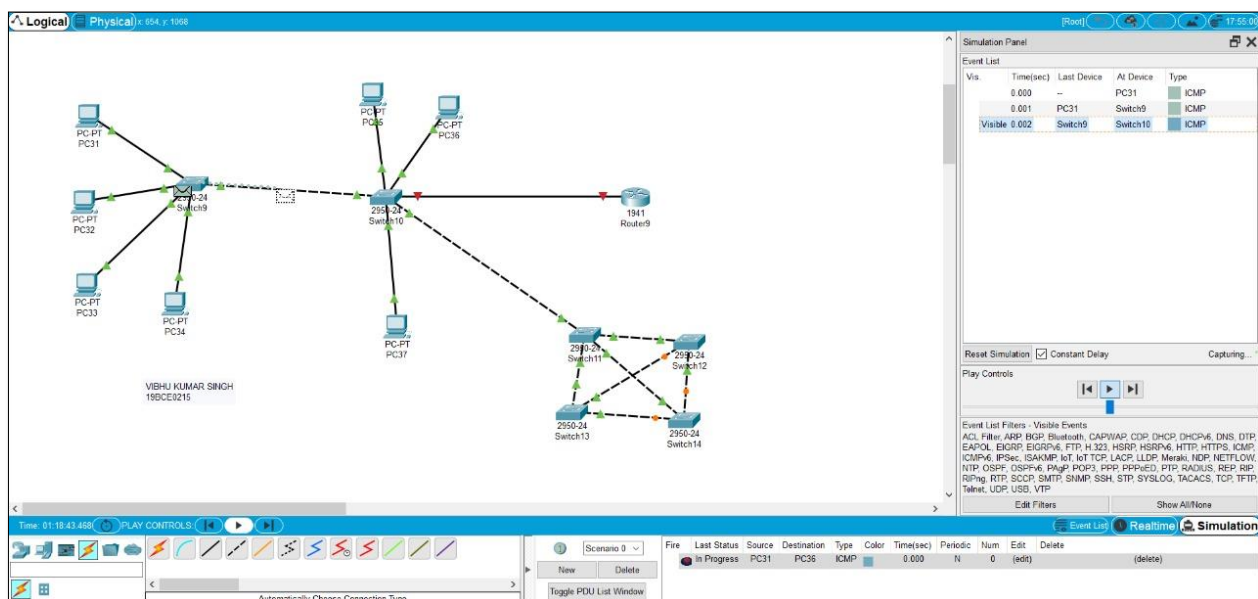
PC35 – 10.10.10.5

PC36 – 10.10.10.6

PC37 – 10.10.10.7

Simulation Results:

- Source: P31
- Destination: P36



Scenario 0

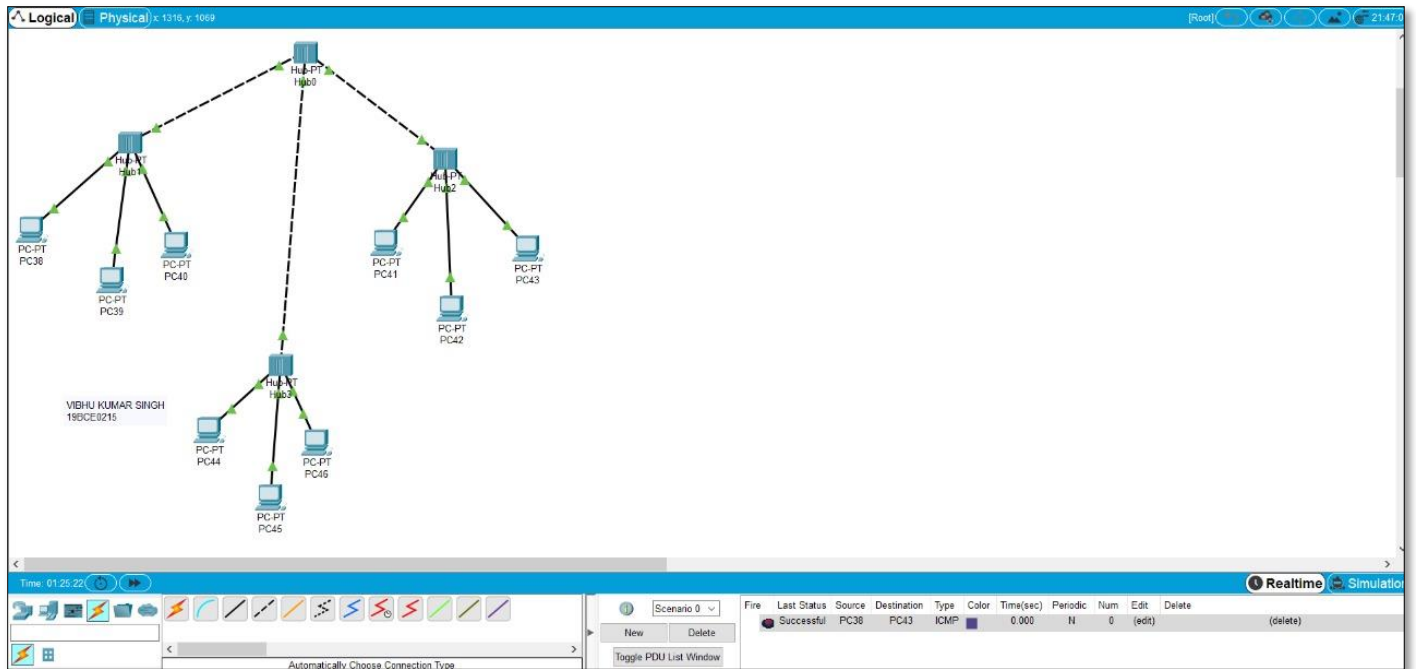
NewDelete

Toggle PDU List Window

Event ListRealtimeSimulation

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC31	PC36	ICMP		0.000	N	0	(edit)	(delete)

2. Network based on Hub:



For PCs

- End devices
- PC

For Hubs

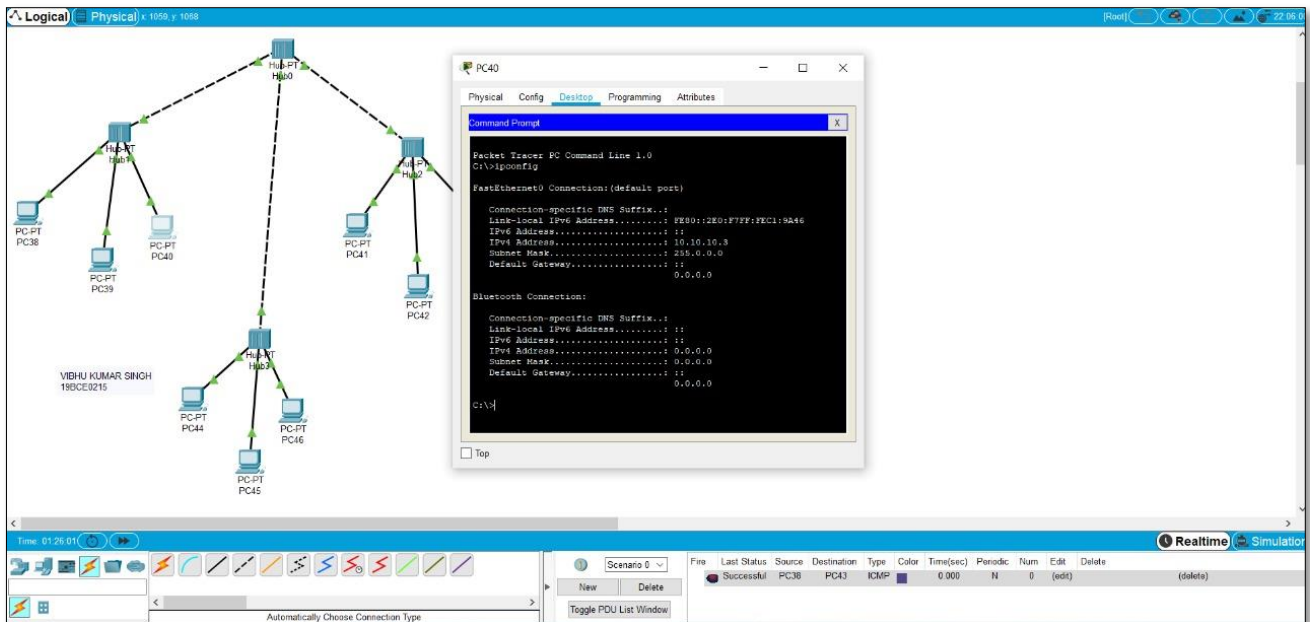
- Network Devices
- Hubs
- PT model

For Connections

- Connections

For connections between Hub's and PC's use copper straight-through

For connections between Hub and Hub use copper cross-over.

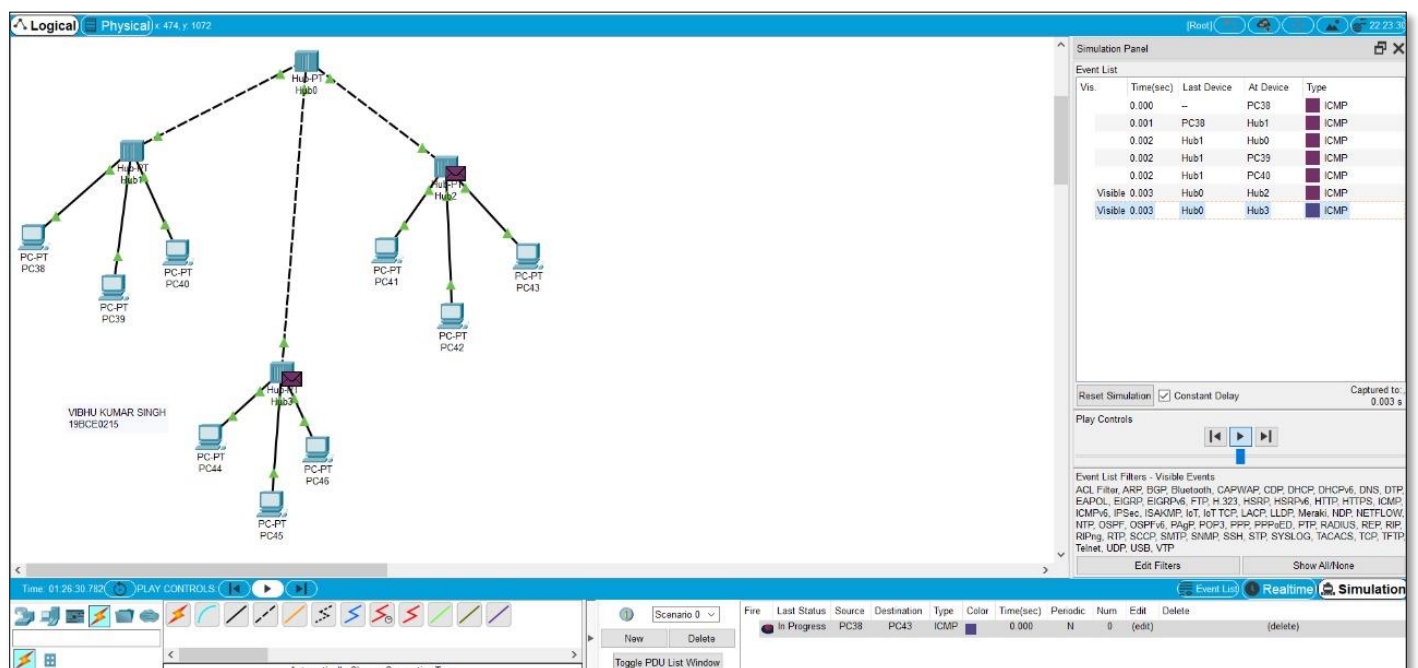




IP Configuration:

PC38 – 10.10.10.1
 PC39 – 10.10.10.2
 PC40 – 10.10.10.3
 PC41 – 10.10.10.4
 PC42 – 10.10.10.5
 PC43 – 10.10.10.6
 PC44 – 10.10.10.7
 PC45 – 10.10.10.8
 PC46 – 10.10.10.9

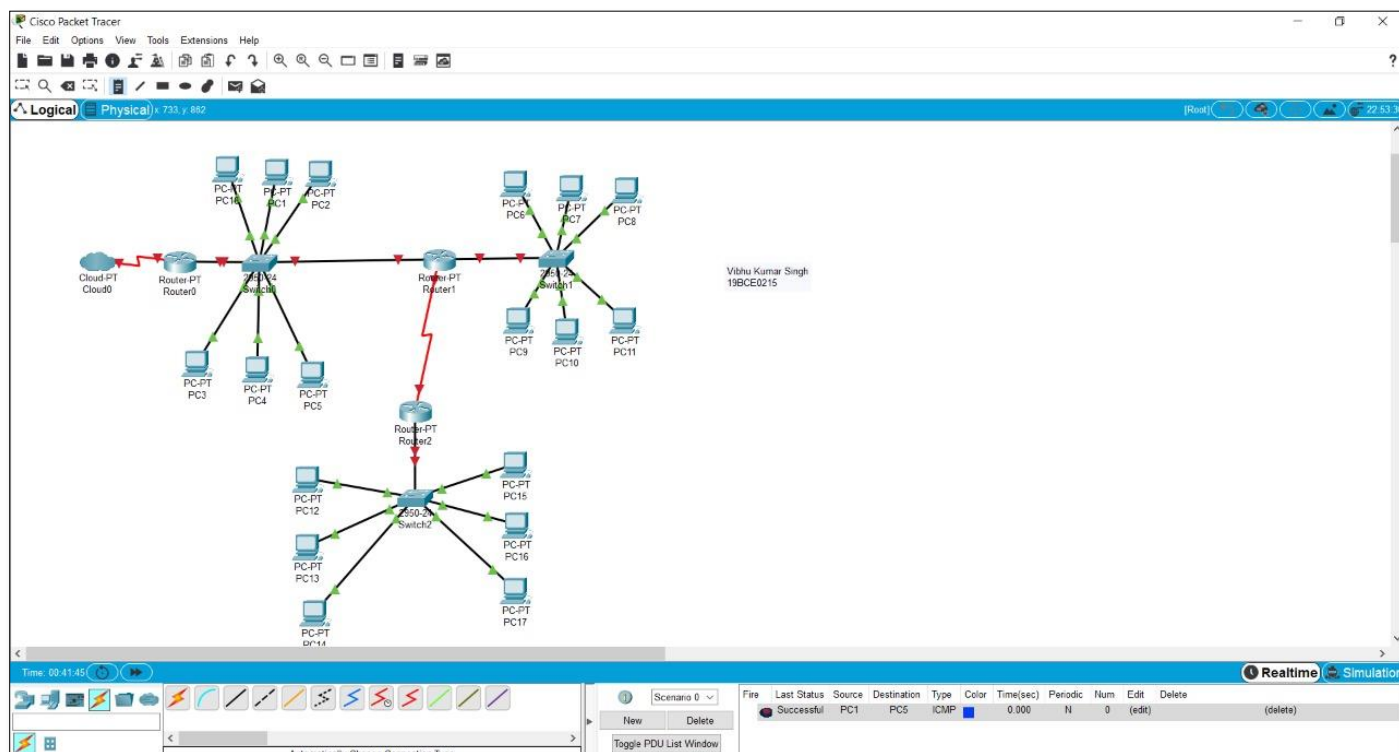
Simulation Results:

- Source: PC38
- Destination: PC43



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC38	PC43	ICMP		0.000	N	0	(edit)	(delete)

3. Network Based on switch



For switches

- Network devices
- Switches
- 2960-24 model

For PCs

- End Devices
- PC

For Routers

- Network Devices
- Routers
- 2811 model

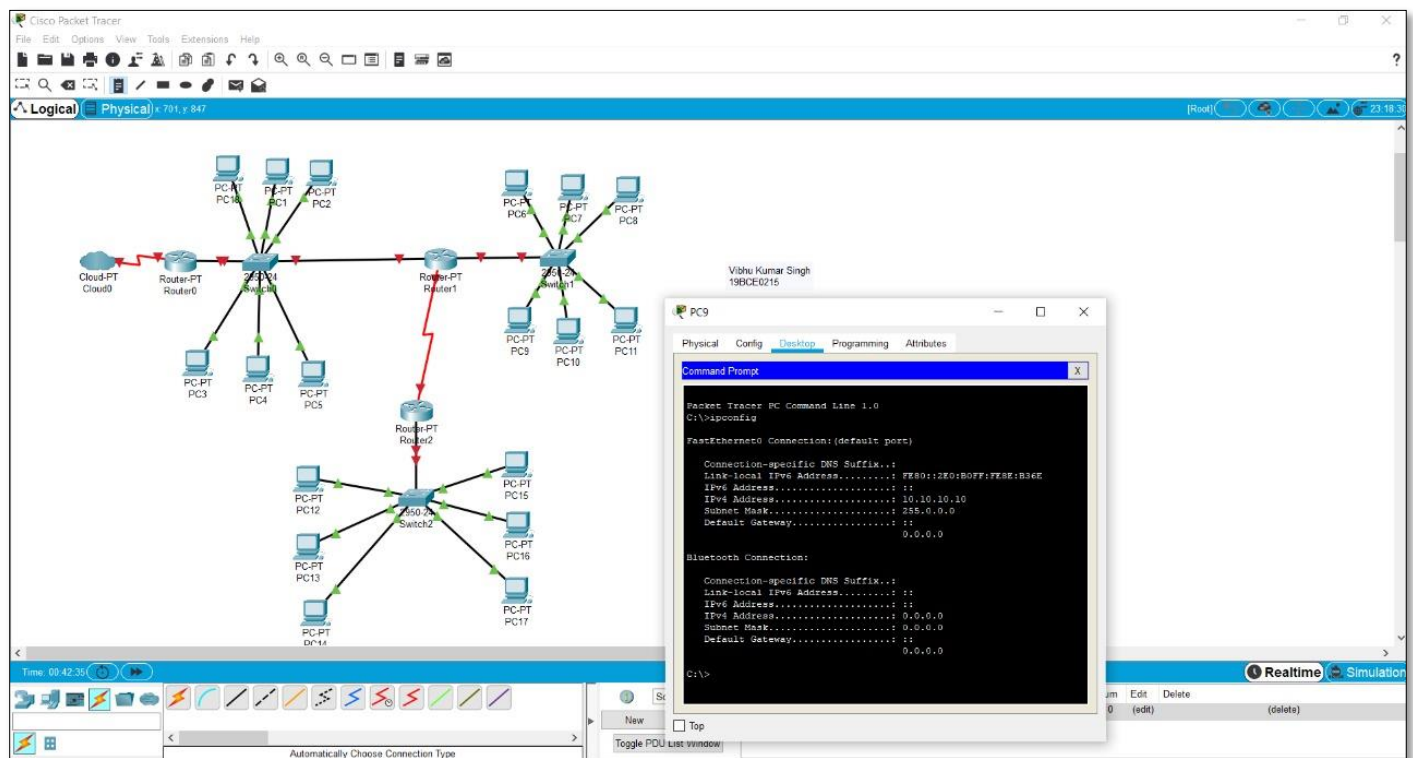
For Connections

- Connections

For cloud

- Network Devices
- WAN Emulation
- PT Cloud

For connections between switches and PC's use copper straight-through
For connections between switch and switch use copper cross-over
For connections between switch and router use copper straight-through
For connections between router and router use Serial DTE
For connection between cloud and router use Serial DTE

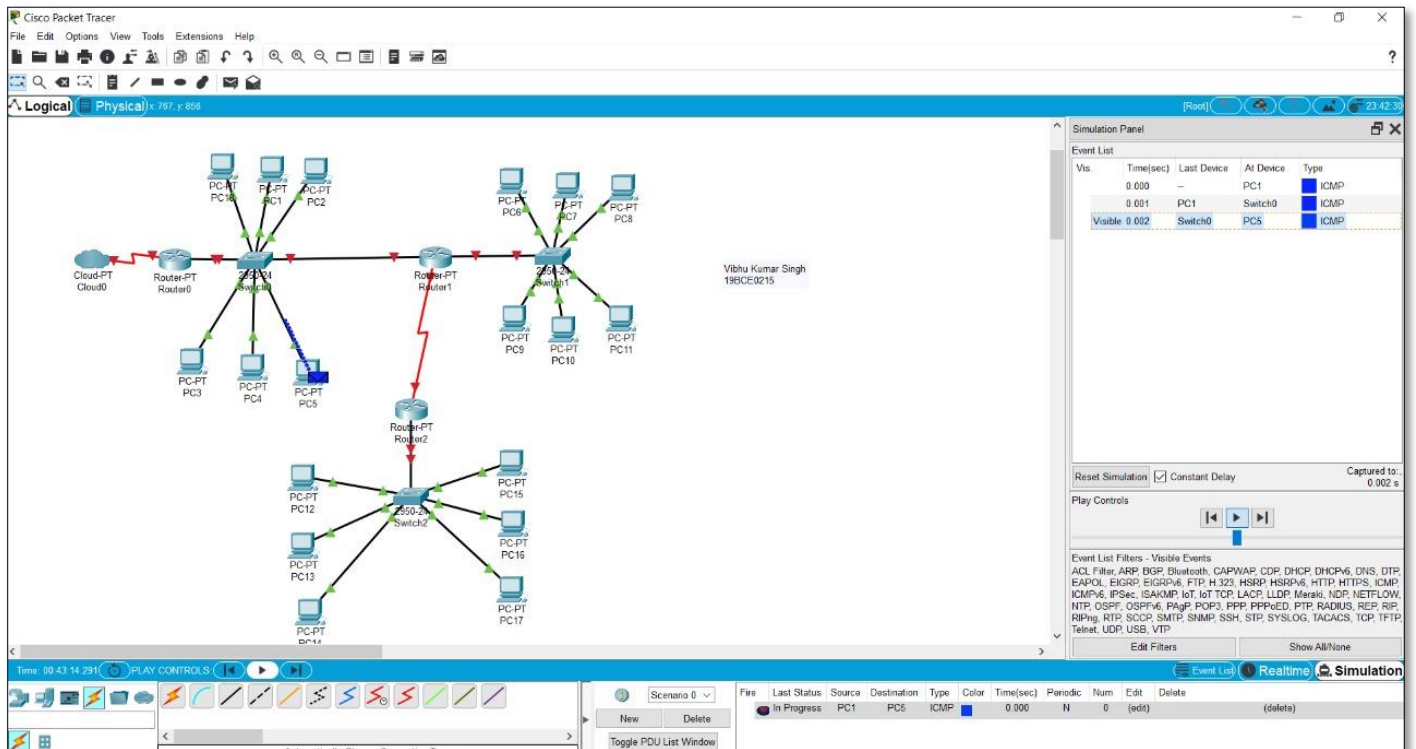


IP configurations

PC0-10.10.10.1
PC1-10.10.10.2
PC2-10.10.10.3
PC3-10.10.10.4
PC4-10.10.10.5
PC5-10.10.10.6
PC6 -10.10.10.7
PC7 - 10.10.10.8
PC8 - 10.10.10.9
PC9 - 10.10.10.10
PC10 - 10.10.10.11
PC11 - 10.10.10.12
PC12 - 10.10.10.13
PC14 - 10.10.10.15
PC15 - 10.10.10.16
PC16 - 10.10.10.17
PC17 - 10.10.10.18
PC18 - 10.10.10.19

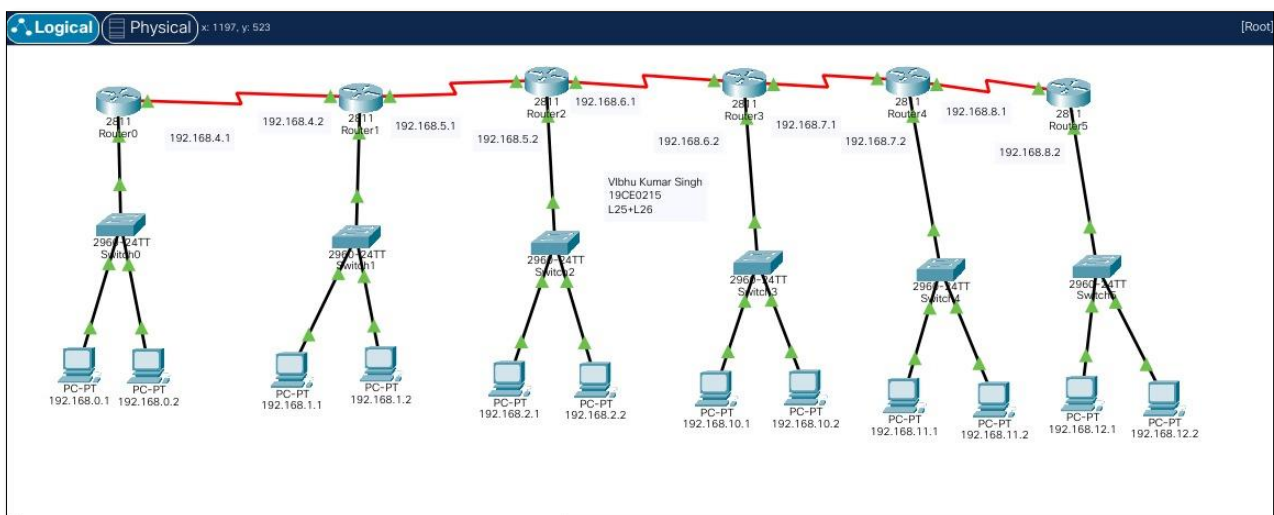
Simulation Results:

- Source: PC1
- Destination: PC5



Realtime Simulation										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC1	PC5	ICMP		0.000	N	0	(edit)	(delete)

4. Based on Switch and Router:



For switches

- Network devices
- Switches
- 2960-24 model

For PC's

- End Devices
- PC

For Routers

- Network Devices
- Routers
- 2811 model

For Connections

- Connections

For connections between switches and PC's use copper straight-through

For connections between switch and router use copper straight-through

For connections between router and router use Serial DTE

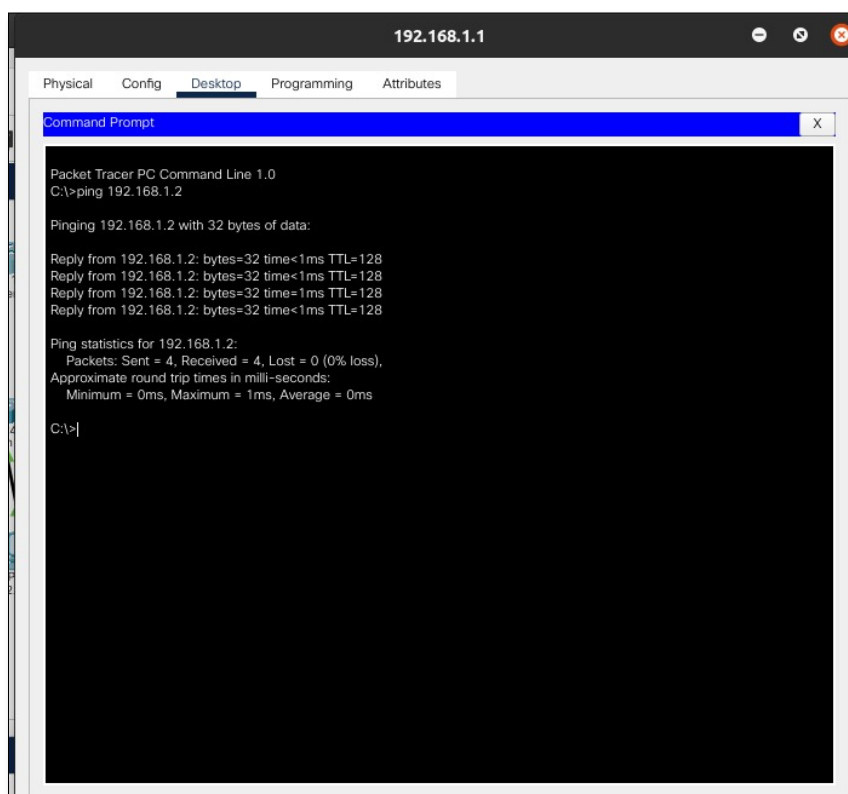
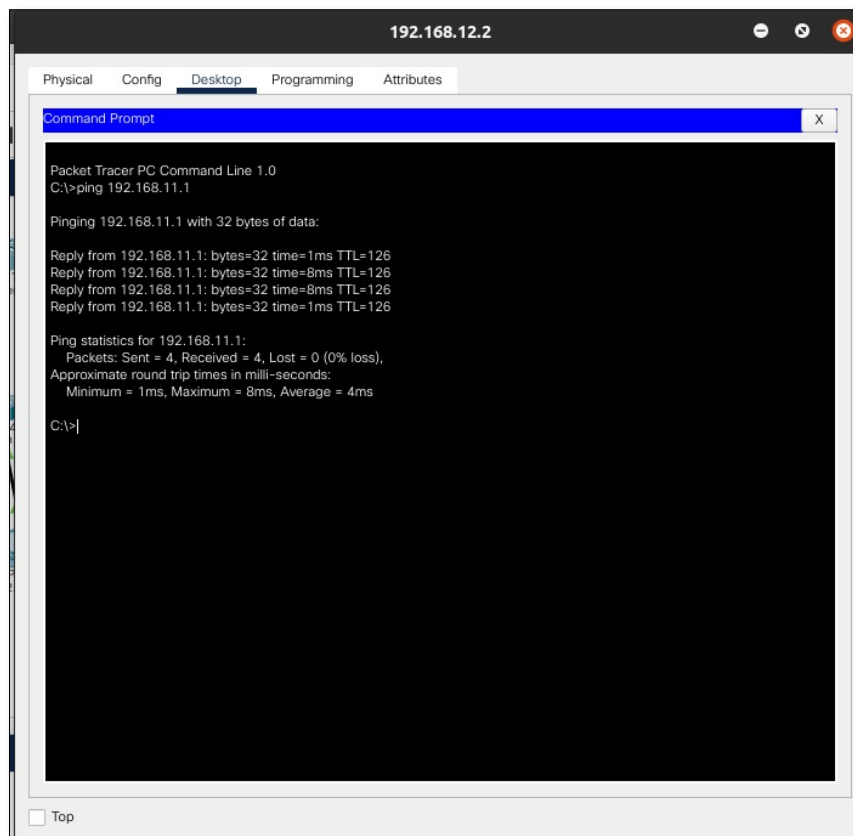
```
C:\>ipconfig

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: FE80::202:16FF:FE32:9A41
    IPv6 Address . . . . .: ::
    IPv4 Address . . . . .: 10.10.0.4
    Subnet Mask . . . . .: 255.0.0.0
    Default Gateway . . . . .: ::
                                   10.10.10.1

Bluetooth Connection:

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: ::
    IPv6 Address . . . . .: ::
    IPv4 Address . . . . .: 0.0.0.0
    Subnet Mask . . . . .: 0.0.0.0
    Default Gateway . . . . .: ::
                                   0.0.0.0
```



I.P. Configurations:

PC0 – 198.168.0.1

PC1 – 198.168.0.2

Default gateway for PC0 and PC1 is 198.168.0.3

PC2 – 198.168.1.1

PC3 – 198.168.1.2

Default gateway for PC2 and PC3 is 198.168.1.3

PC4 – 198.168.2.1

PC5 – 198.168.2.2

Default gateway for PC4 and PC5 is 198.168.2.3

PC6 – 198.168.3.1

PC7 – 198.168.3.2

Default gateway for PC6 and PC7 is 198.168.3.3

Between Router 0 and Router 1 I.P addresses are 198.168.4.1 and 198.168.4.2

Between Router 1 and Router 2 I.P addresses are 198.168.5.1 and 198.168.5.2

Between Router 2 and Router 3 I.P addresses are 198.168.6.1 and 198.168.6.2

Between Router 3 and Router 4 I.P addresses are 198.168.7.1 and 198.168.7.2

Between Router 4 and Router 5 I.P addresses are 198.168.8.1 and 198.168.8.2

For communication between 2 routers static routes are to be enabled

To enable static routes:

Click on router→config→static.

1. In network tab give the I.P. address of the route you want to connect.
2. In mask tab give the mask of the I.P. address.
3. In next hop tab give the address of the router.

Follow the above steps to create all the routes available from a single router

Do the same with all the routers.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC2	ICMP		0.000	N	0	(edit)	(delete)