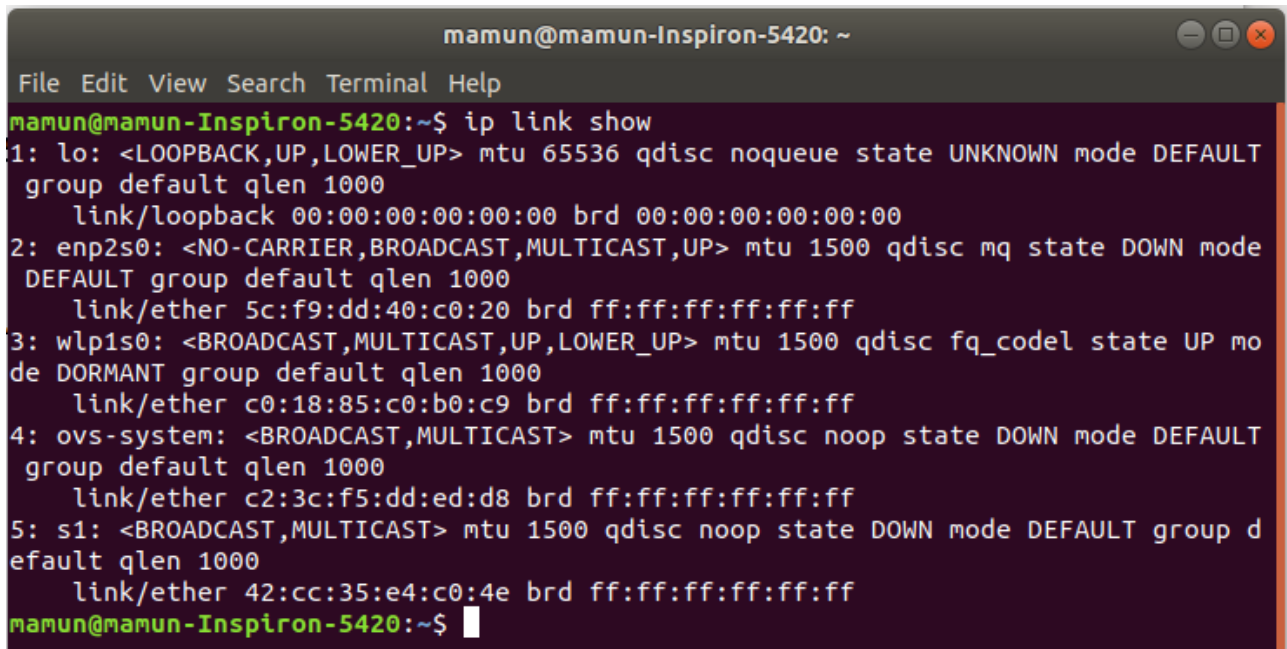


Lab report name: Linux command for networking

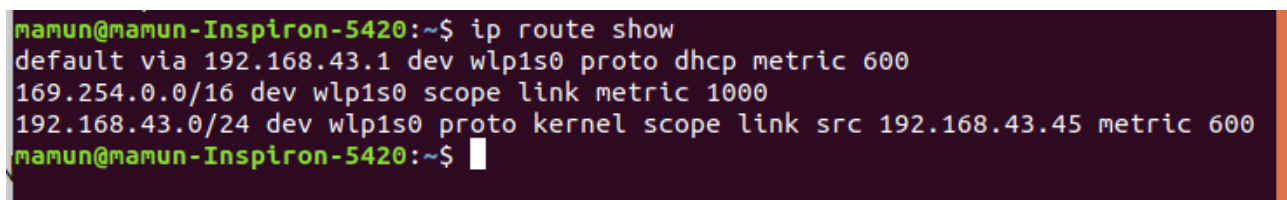
IP link : IP link is for configuring, adding and deleting network interface.

Use “IP Link show” command to display all network interface.

A terminal window titled 'mamun@mamun-Inspiron-5420: ~' with a menu bar (File, Edit, View, Search, Terminal, Help). The command 'ip link show' has been executed, displaying details for five network interfaces: 1. 'lo' (loopback), 2. 'enp2s0' (ethernet), 3. 'wlp1s0' (wireless), 4. 'ovs-system' (Open vSwitch), and 5. 's1' (another ethernet interface). Each entry shows its state, mode, group, and queue length.

```
mamun@mamun-Inspiron-5420: ~  
File Edit View Search Terminal Help  
mamun@mamun-Inspiron-5420:~$ ip link show  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN mode DEFAULT  
   group default qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
2: enp2s0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN mode  
   DEFAULT group default qlen 1000  
    link/ether 5c:f9:dd:40:c0:20 brd ff:ff:ff:ff:ff:ff  
3: wlp1s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP mo  
   de DORMANT group default qlen 1000  
    link/ether c0:18:85:c0:b0:c9 brd ff:ff:ff:ff:ff:ff  
4: ovs-system: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mode DEFAULT  
   group default qlen 1000  
    link/ether c2:3c:f5:dd:ed:d8 brd ff:ff:ff:ff:ff:ff  
5: s1: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mode DEFAULT group d  
   efault qlen 1000  
    link/ether 42:cc:35:e4:c0:4e brd ff:ff:ff:ff:ff:ff  
mamun@mamun-Inspiron-5420:~$
```

IP route: IP route command use to print or display the routing table. The ‘IP route’ command displays the contents of routing table.

A terminal window showing the output of the 'ip route show' command. It displays the default gateway and two specific routes: one for the 169.254.0.0/16 link-local address and another for the 192.168.43.0/24 network.

```
mamun@mamun-Inspiron-5420:~$ ip route show  
default via 192.168.43.1 dev wlp1s0 proto dhcp metric 600  
169.254.0.0/16 dev wlp1s0 scope link metric 1000  
192.168.43.0/24 dev wlp1s0 proto kernel scope link src 192.168.43.45 metric 600  
mamun@mamun-Inspiron-5420:~$
```

Ping command:

Ping command sends an ICMP ECHO_REQUEST packet to the target host and waits to see if it replies.

By default, ping runs in an infinite loop. To send a defined number of packets, use -c flag.

```
mamun@mamun-Inspiron-5420: ~  
File Edit View Search Terminal Help  
mamun@mamun-Inspiron-5420:~$ ping -c 3 google.com  
PING google.com (172.217.31.46) 56(84) bytes of data.  
64 bytes from kul09s04-in-f14.1e100.net (172.217.31.46): icmp_seq=1 ttl=110 time  
=103 ms  
64 bytes from kul09s04-in-f14.1e100.net (172.217.31.46): icmp_seq=2 ttl=110 time  
=570 ms  
64 bytes from kul09s04-in-f14.1e100.net (172.217.31.46): icmp_seq=3 ttl=110 time  
=592 ms  
  
--- google.com ping statistics ---  
3 packets transmitted, 3 received, 0% packet loss, time 2001ms  
rtt min/avg/max/mdev = 103.720/422.454/592.926/225.561 ms  
mamun@mamun-Inspiron-5420:~$
```

Traceroute :

If ping shows missing packets, I will use *traceroute* to see what route the packets are taking. *Traceroute* shows the sequence of gateways through which the packets travel to reach their destination. For example, *traceroute* from my machine to google.com shows the following:

```
mamun@mamun-Inspiron-5420:~$ traceroute google.com  
traceroute to google.com (172.217.31.46), 30 hops max, 60 byte packets  
1 _gateway (192.168.43.1) 2.125 ms 3.961 ms 5.959 ms  
2 * * *  
3 10.17.69.65 (10.17.69.65) 73.520 ms 73.586 ms 73.668 ms  
4 * * *  
5 103.242.22-69.robi.com.bd (103.242.22.69) 73.130 ms 73.577 ms 103.242.22-6  
5.robi.com.bd (103.242.22.65) 73.172 ms  
6 202.134.15-89.robi.com.bd (202.134.15.89) 73.913 ms 103.242.23-14.robi.com.  
bd (103.242.23.14) 43.288 ms 43.471 ms  
7 202.134.15-89.robi.com.bd (202.134.15.89) 44.035 ms 44.547 ms 44.548 ms  
8 123.49.2.5 (123.49.2.5) 43.177 ms 114.130.82.17 (114.130.82.17) 42.906 ms  
123.49.2.5 (123.49.2.5) 56.041 ms  
9 123.49.2.5 (123.49.2.5) 56.030 ms 56.040 ms 123.49.8.34 (123.49.8.34) 54.  
202 ms  
10 123.49.8.34 (123.49.8.34) 54.137 ms 54.040 ms 53.939 ms  
11 * 72.14.242.148 (72.14.242.148) 100.306 ms *  
12 * 108.170.254.225 (108.170.254.225) 103.345 ms *  
13 108.170.240.172 (108.170.240.172) 99.577 ms 74.125.251.204 (74.125.251.204)  
99.237 ms 108.170.240.172 (108.170.240.172) 119.381 ms  
14 108.170.240.241 (108.170.240.241) 119.313 ms 108.170.254.227 (108.170.254.2  
27) 108.809 ms 108.170.254.226 (108.170.254.226) 93.841 ms  
15 66.249.94.208 (66.249.94.208) 96.785 ms 72.14.236.242 (72.14.236.242) 96.4  
17 ms 66.249.95.248 (66.249.95.248) 102.648 ms
```

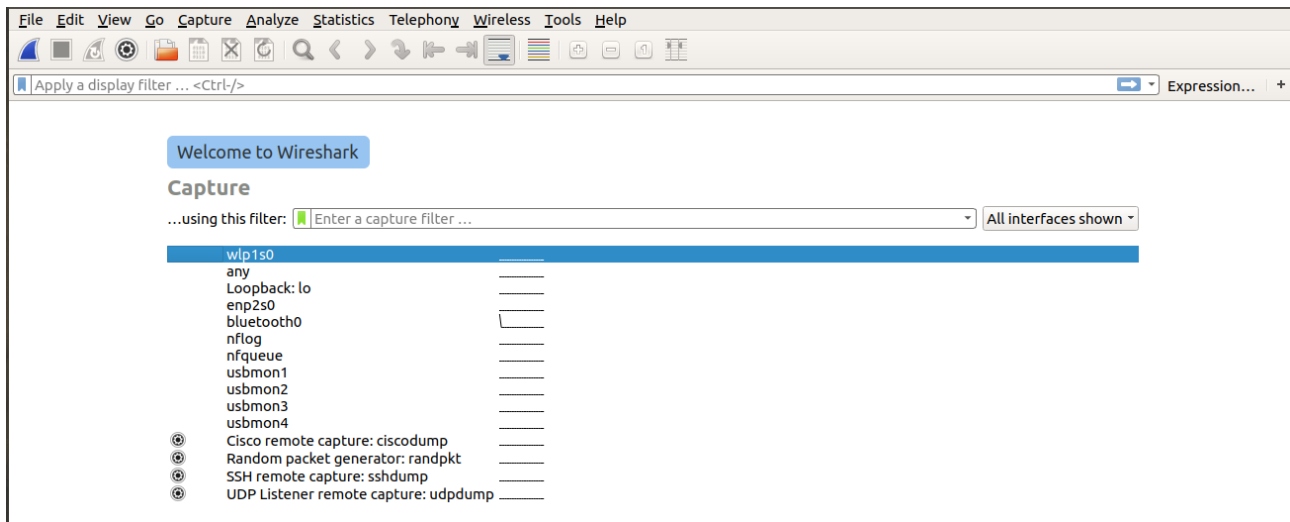
nmap:

“Nmap” is generally used to probe business networks and perform security reviews, the tool can also provide interesting details on my systems and devices at home.

```
mamun@mamun-Inspiron-5420:~$ nmap
Nmap 7.60 ( https://nmap.org )
Usage: nmap [Scan Type(s)] [Options] {target specification}
TARGET SPECIFICATION:
  Can pass hostnames, IP addresses, networks, etc.
  Ex: scanme.nmap.org, microsoft.com/24, 192.168.0.1; 10.0.0-255.1-254
  -iL <inputfilename>: Input from list of hosts/networks
  -iR <num hosts>: Choose random targets
  --exclude <host1[,host2][,host3],...>: Exclude hosts/networks
  --excludefile <exclude_file>: Exclude list from file
HOST DISCOVERY:
  -sL: List Scan - simply list targets to scan
  -sn: Ping Scan - disable port scan
  -Pn: Treat all hosts as online -- skip host discovery
  -PS/PA/PU/PY[portlist]: TCP SYN/ACK, UDP or SCTP discovery to given ports
  -PE/PP/PM: ICMP echo, timestamp, and netmask request discovery probes
  -PO[protocol list]: IP Protocol Ping
  -n/-R: Never do DNS resolution/Always resolve [default: sometimes]
  --dns-servers <serv1[,serv2],...>: Specify custom DNS servers
  --system-dns: Use OS's DNS resolver
  --traceroute: Trace hop path to each host
SCAN TECHNIQUES:
  -sS/sT/sA/sW/sM: TCP SYN/Connect()/ACK/Window/Maimon scans
  -sU: UDP Scan
  -sN/sF/sX: TCP Null, FIN, and Xmas scans
  --scanflags <flags>: Customize TCP scan flags
  -sI <zombie host[:probeport]>: Idle scan
  -sY/sZ: SCTP INIT/COOKIE-ECHO scans
  -sO: IP protocol scan
  -b <FTP relay host>: FTP bounce scan
PORT SPECIFICATION AND SCAN ORDER:
  -p <port ranges>: Only scan specified ports
    Ex: -p22; -p1-65535; -p U:53,111,137,T:21-25,80,139,8080,S:9
  --exclude-ports <port ranges>: Exclude the specified ports from scanning
  -F: Fast mode - Scan fewer ports than the default scan
  -r: Scan ports consecutively - don't randomize
  --top-ports <number>: Scan <number> most common ports
  --port-ratio <ratio>: Scan ports more common than <ratio>
```

Wireshark:

‘Wireshark’ is a popular open source graphical user interface (GUI) tool for analyzing packets. However, it also provides a powerful command-line utility called **TShark** for people who prefer to work on the Linux command line.



Arp command :

ARP stands for Address Resolution Protocol. Arp command manipulates the System's ARP cache. It also allows a complete dump of the ARP cache. The primary function of this protocol is to resolve the IP address of a system to its mac address, and hence it works between level 2(Data link layer) and level 3(Network layer).

```
mamun@mamun-Inspiron-5420:~$ arp
Address          HWtype  HWaddress      Flags Mask    Iface
_gateway         ether    06:b1:a1:4b:e6:20  C             wlp1s
0
mamun@mamun-Inspiron-5420:~$
```

Netstat command:

Netstat command displays various network related information such as network connections, routing tables, interface statistics, masquerade connections, multicast memberships etc.

i) **netstat -a** : To show both listening and non-listening sockets.

```
mamun@mamun-Inspiron-5420:~$ 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 0.0.0.0:ssh             0.0.0.0:*               LISTEN
tcp      0      0 localhost:ipp           0.0.0.0:*               LISTEN
tcp      0      0 localhost:mysql         0.0.0.0:*               LISTEN
tcp      0      0 mamun-Inspiron-54:35990 ec2-52-198-23-247:https ESTABLISHED
tcp      0    518 mamun-Inspiron-54:36262 13.76.45.37:https      FIN_WAIT1
tcp      0      0 mamun-Inspiron-54:49932 maa03s21-in-f4.1e:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:42558 ec2-52-33-219-121:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:47548 172.217.194.95:https   TIME_WAIT
tcp      0      0 mamun-Inspiron-54:59870 74.118.186.210:https   ESTABLISHED
tcp      0      0 mamun-Inspiron-54:33304 sin11s02-in-f1.1e:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:56312 8.159.244.35.bc.g:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:43962 cloudproxy10036.su:http ESTABLISHED
tcp      0      0 mamun-Inspiron-54:47858 ec2-18-140-153-1.:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:60594 maa03s36-in-f13.1:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:43146 dfw25s25-in-f3.1e:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:56478 maa03s35-in-f3.1e1:http ESTABLISHED
tcp      0      0 mamun-Inspiron-54:43960 cloudproxy10036.su:http ESTABLISHED
tcp      0      0 mamun-Inspiron-54:36964 159.127.41.178:https   ESTABLISHED
tcp      0      0 mamun-Inspiron-54:53060 104.16.68.69:https     ESTABLISHED
tcp      0      0 mamun-Inspiron-54:56482 maa03s35-in-f3.1e1:http ESTABLISHED
```


ii) **netstat -at**: To list all tcp ports.

```
mamun@mamun-Inspiron-5420:~$ 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 0.0.0.0:ssh             0.0.0.0:*               LISTEN
tcp      0      0 localhost:ipp           0.0.0.0:*               LISTEN
tcp      0      0 localhost:mysql         0.0.0.0:*               LISTEN
tcp      0      0 mamun-Inspiron-54:47820 maa03s28-in-f2.1e:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:60242 74.118.186.210:https    ESTABLISHED
tcp      0      0 mamun-Inspiron-54:49932 maa03s21-in-f4.1e:https TIME_WAIT
tcp      0      0 mamun-Inspiron-54:56312 8.159.244.35.bc.g:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:47858 ec2-18-140-153-1.:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:43146 lax17s02-in-f3.1e:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:36056 a125-56-230-234.d:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:56478 maa03s35-in-f3.1e1:http TIME_WAIT
tcp      0      0 mamun-Inspiron-54:47766 maa03s28-in-f2.1e:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:44040 cloudproxy10036.su:http TIME_WAIT
tcp      0      0 mamun-Inspiron-54:36836 172.217.194.94:https    ESTABLISHED
tcp      0      0 mamun-Inspiron-54:53060 104.16.68.69:https      ESTABLISHED
tcp      0      0 mamun-Inspiron-54:56482 maa03s35-in-f3.1e1:http TIME_WAIT
tcp      0      0 mamun-Inspiron-54:49956 ec2-18-179-246-14:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:45882 server-13-227-255:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:51438 ec2-52-69-227-24.:https ESTABLISHED
tcp      0      0 mamun-Inspiron-54:52984 ec2-44-239-147-20:https ESTABLISHED
```

iii) **netstat -au**: To list all udp ports.

```
mamun@mamun-Inspiron-5420:~$ netstat -au
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
udp      0      0 0.0.0.0:ipp             0.0.0.0:*
udp      0      0 0.0.0.0:mdns            0.0.0.0:*
udp      0      0 0.0.0.0:36852           0.0.0.0:*
udp      0      0 localhost:domain        0.0.0.0:*
udp      0      0 0.0.0.0:bootpc          0.0.0.0:*
udp6     0      0 [::]:mdns              [::]:*
udp6     0      0 [::]:34767              [::]:*
mamun@mamun-Inspiron-5420:~$
```

iv) **netstat -l**: To list only the listening ports.

```
mamun@mamun-Inspiron-5420:~$ netstat -l
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp      0      0 localhost:domain        0.0.0.0:*               LISTEN
tcp      0      0 0.0.0.0:ssh             0.0.0.0:*               LISTEN
tcp      0      0 localhost:ipp            0.0.0.0:*               LISTEN
tcp      0      0 localhost:mysql          0.0.0.0:*               LISTEN
tcp6     0      0 [::]:ssh                [::]:*                  LISTEN
tcp6     0      0 ip6-localhost:ipp       [::]:*                  LISTEN
udp      0      0 0.0.0.0:ipp             0.0.0.0:*               LISTEN
udp      0      0 0.0.0.0:mdns            0.0.0.0:*               LISTEN
udp      0      0 0.0.0.0:36852           0.0.0.0:*               LISTEN
udp      0      0 localhost:domain        0.0.0.0:*               LISTEN
udp      0      0 0.0.0.0:bootpc          0.0.0.0:*               LISTEN
udp6     0      0 [::]:mdns               [::]:*                  LISTEN
udp6     0      0 [::]:34767              [::]:*                  LISTEN
raw6     0      0 [::]:ipv6-icmp          [::]:*                  LISTEN
Active UNIX domain sockets (only servers)
Proto RefCnt Flags       Type       State       I-Node      Path
unix  2      [ ACC ]   SEQPACKET LISTENING   16067       /run/udev/control
unix  2      [ ACC ]   STREAM    LISTENING   34779       /run/user/1000/systemd/private
```

```
mamun@mamun-Inspiron-5420: ~
File Edit View Search Terminal Help
raw6      0      0 [::]:ipv6-icmp          [::]:*                  7
Active UNIX domain sockets (only servers)
Proto RefCnt Flags       Type       State       I-Node      Path
unix  2      [ ACC ]   SEQPACKET LISTENING   16067       /run/udev/control
unix  2      [ ACC ]   STREAM    LISTENING   34779       /run/user/1000/systemd/private
unix  2      [ ACC ]   STREAM    LISTENING   28321       /run/user/121/systemd/private
unix  2      [ ACC ]   STREAM    LISTENING   34783       /run/user/1000/bus
unix  2      [ ACC ]   STREAM    LISTENING   28325       /run/user/121/snapd-session-agent.socket
unix  2      [ ACC ]   STREAM    LISTENING   34784       /run/user/1000/gnupg-session-agent.extra
unix  2      [ ACC ]   STREAM    LISTENING   28326       /run/user/121/bus
unix  2      [ ACC ]   STREAM    LISTENING   34785       /run/user/1000/gnupg-session-agent
unix  2      [ ACC ]   STREAM    LISTENING   28327       /run/user/121/gnupg-session-agent
unix  2      [ ACC ]   STREAM    LISTENING   22946       /run/uidd/request
unix  2      [ ACC ]   STREAM    LISTENING   34786       /run/user/1000/gnupg-session-agent
unix  2      [ ACC ]   STREAM    LISTENING   28328       /run/user/121/gnupg-session-agent
unix  2      [ ACC ]   STREAM    LISTENING   34800       @/tmp/dbus-j8HWhUcX
```

v)netstat -lt: To list only the listening tcp ports.

```
mamun@mamun-Inspiron-5420:~$ netstat -lt
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 localhost:domain        0.0.0.0:*               LISTEN
tcp        0      0 0.0.0.0:ssh             0.0.0.0:*               LISTEN
tcp        0      0 localhost:ipp           0.0.0.0:*               LISTEN
tcp        0      0 localhost:mysql         0.0.0.0:*               LISTEN
tcp6       0      0 [::]:ssh                [::]:*                  LISTEN
tcp6       0      0 ip6-localhost:ipp      [::]:*                  LISTEN
mamun@mamun-Inspiron-5420:~$
```

vi)netstat -s: To list the statistics for all ports.

```
mamun@mamun-Inspiron-5420:~$ netstat -s
Ip:
  Forwarding: 2
  5700 total packets received
  1 with invalid addresses
  0 forwarded
  0 incoming packets discarded
  5697 incoming packets delivered
  6553 requests sent out
  20 outgoing packets dropped
Icmp:
  40 ICMP messages received
  0 input ICMP message failed
  ICMP input histogram:
    destination unreachable: 40
  45 ICMP messages sent
  0 ICMP messages failed
  ICMP output histogram:
    destination unreachable: 45
IcmpMsg:
  InType3: 40
  OutType3: 45
Tcp:
  291 active connection openings
  0 passive connection openings
  12 failed connection attempts
  9 connection resets received
  5 connections established
  4548 segments received
  5181 segments sent out
  216 segments retransmitted
  43 bad segments received
  369 resets sent
Udp:
  1061 packets received
  45 packets to unknown port received
  0 packet receive errors
  1120 packets sent
```


vii)netstat -lu: To list only the listening udp ports.

```
mamun@mamun-Inspiron-5420:~$ netstat -lu
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
udp      0      0 0.0.0.0:ipp             0.0.0.0:*
udp      0      0 0.0.0.0:47953           0.0.0.0:*
udp      0      0 0.0.0.0:mdns            0.0.0.0:*
udp      0      0 0.0.0.0:36852           0.0.0.0:*
udp      0      0 localhost:domain        0.0.0.0:*
udp      0      0 0.0.0.0:bootpc          0.0.0.0:*
udp6     0      0 [::]:mdns               [::]:*
udp6     0      0 [::]:34767              [::]:*
```

viii)netstat -st(TCP): To list the statistics for TCP ports.

```
mamun@mamun-Inspiron-5420:~$ netstat -st
IcmpMsg:
  InType3: 40
  OutType3: 45
Tcp:
  295 active connection openings
  0 passive connection openings
  12 failed connection attempts
  9 connection resets received
  4 connections established
  4600 segments received
  5242 segments sent out
  227 segments retransmitted
  43 bad segments received
  369 resets sent
UdpLite:
TcpExt:
  71 TCP sockets finished time wait in fast timer
  12 packetes rejected in established connections because of timestamp
  13 delayed acks sent
  Quick ack mode was activated 59 times
  964 packet headers predicted
```

Discussion:

This was an interesting lab. I can successfully understand the all things of this lab. I learned many things from this lab. This lab help me to understand the basic Linux command for networking tools in Ubuntu terminal.