



Assignment: 02

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Theory: Every computer is connected to some other computer through a network whether internally or externally to exchange some information. This network can be small as some computers connected in your home or office, or can be large or complicated as in large University or the entire Internet.

Maintaining a system's network is a task of System/Network administrator. Their task includes network configuration and troubleshooting.

Here is a list of Networking and Troubleshooting commands in Linux:

1. Introduction: If you have a network that ranges from 192.168.1.0 to 192.168.1.255 explain why Individual devices in the network can only be assigned IP addresses in the range of 192.168.1.1 to 192.168.1.254.

Answer: If your IP address ranges from 192.168.1.0 to 192.168.1.255 then you are connected to a private network. Home routers have their local address set to a default, private IP address number. It's usually the same address for the other models from that manufacturer, and it can be seen in the manufacturer's documentation.

Here's a look at the default private (also called "local") IP addresses for popular brands of routers:

- Linksys routers use 192.168.1.1
- D-Link and NETGEAR routers are set to 192.168.0.1
- Cisco routers use either 192.168.1.1, 192.168.1.254 or 192.168.10.2
- Belkin and SMC routers often use 192.168.2.1

192.168.1.254 is a Private IP address, one of the addresses for private networks.

This means that a device in this private network cannot be accessed directly from the internet using a Private IP, but by any other device on the local network.

While the router itself has a Private IP of 192.168.1.254, it assigns any device in the network a different private IP address. All IP addresses on the network must have a unique address on that network to avoid IP address conflicts. Ipv4-addresses are internally 32 bits, they're often divided into 4 groups of 8 bits.

An octet can only be variety from 0 – 255, so as that leaves 256 possibilities for that last number. All addresses within the range of 192.168.1.0 to 192.168.1.255

are within an equivalent network. There are only 254 possibilities for variety. The addresses 192.168.1.0 and 192.168.1.255 are reserved for the network.

192.168.1.0, is reserved for the “network address”.

192.168.1.255, is that the “broadcast address”.

In an IP address, you've some dedicated to the network and a few of the address dedicated to the hosts. During a /24 network, meaning the first 3 octets are for the network.

192.168.1.0 is the subsequent in binary:

11000000.10101000.00000001.00000000

A /24 subnet mask in binary looks like this:

11111111.11111111.11111111.00000000

In decimal, this is: 255.255.255.0, so the first usable address is 192.168.1.1 and thus the last is 192.168.1.254. Since all devices within the network need to have unique addresses meaning that you simply can have 254 devices therein network. Other Private IP addresses used by the modem and router are 192.168.1.100 and 192.168.1.101.

2. Find IP & MAC: Find out about network and hardware information for the computer you are currently using.

Answer: *ifconfig* (interface configurator) command is use to initialize an interface, assign IP Address to interface and enable or disable interface on demand. With this command you can view IP Address and Hardware / MAC address assign to interface and also MTU (Maximum transmission unit) size.

```
shakhera@shakhera-HP-Notebook-PC: ~/IT_18033
File Edit View Search Terminal Help
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ 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::90d6:8cf8:3ad9:8238 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:25:23:01 txqueuelen 1000 (Ethernet)
    RX packets 1 bytes 590 (590.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 77 bytes 8383 (8.3 KB)
    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 10467 bytes 532307 (532.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 10467 bytes 532307 (532.3 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ hostname -i
127.0.1.1
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ |
```

3. Routing Table basics:

The **netstat -r** command is used to show the routing table:

```
shakhera@shakhera-HP-Notebook-PC: ~/IT_18033
File Edit View Search Terminal Help
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
default          _gateway        0.0.0.0         UG      0 0        0 enp0s3
10.0.2.0         0.0.0.0         255.255.255.0   U        0 0        0 enp0s3
link-local       0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$
```

This is what the output indicates:

Destination: This column indicates the destination network.

Gateway: This column indicates the defined gateway for the network. If you see an * in this column, it means that no forwarding gateway is needed for the specified network.

Genmask: This column indicates the netmask of the network.

Flags:	The U output in this columns means that the route is up. The G output indicates that specified gateway should be used for this route. D stands for dynamically installed, M stands for modified, and R means reinstated.
MSS:	This column indicates the default Maximum Segment Size(MSS) for TCP connections for this route.
Window:	This column indicates the default window size for TCP connections over this route.
Irtt:	This column indicates the Initial Round Trip Time for this route.
Iface:	The Iface column shows the network interface. If you had more than one interface, you would see <i>lo</i> (for loopback), <i>eth0</i> (first Ethernet device), and <i>eth1</i> (for the second Ethernet device), and so on for the number of interfaces you have installed.

4. Virtual Interfaces:

a) Create a new virtual interface with the following IP address , 192.168.2.32 and netmask 255.255.255.0 then check to see if the interface was created successfully?

Answer:

```

shakhera@shakhera-HP-Notebook-PC: ~/IT_18033
File Edit View Search Terminal Help
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo ifconfig enp0s3 192.168.2.32
netmask 255.255.255.0
[sudo] password for shakhera:
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 192.168.2.32  netmask 255.255.255.0  broadcast 192.168.2.255
    inet6 fe80::90d6:8cf8:3ad9:8238  prefixlen 64  scopeid 0x20<link>
    ether 08:00:27:25:23:01  txqueuelen 1000  (Ethernet)
    RX packets 1  bytes 590 (590.0 B)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 88  bytes 10306 (10.3 KB)
    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 11025  bytes 560757 (560.7 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 11025  bytes 560757 (560.7 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

shakhera@shakhera-HP-Notebook-PC:~/IT_18033$

```

b) You need to set up a route for this interface so that your computer can see it. Issue the needed command, then issue the “\$ netstat -r” command and check if the route to your added interface is visible?

Answer:

```
shakhera@shakhera-HP-Notebook-PC: ~/IT_18033
File Edit View Search Terminal Help
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo ip route add default via 192.168.2.32 dev enp0s3
RTNETLINK answers: File exists
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ ip route show
default via 192.168.2.32 dev enp0s3
192.168.2.0/24 dev enp0s3 proto kernel scope link src 192.168.2.32 metric 100
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ route
Kernel IP routing table
Destination      Gateway          Genmask         Flags Metric Ref    Use Iface
default          shakhera-HP-Not 0.0.0.0         UG    0      0      0 enp0s3
192.168.2.0      0.0.0.0         255.255.255.0   U     100    0      0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$
```

```
shakhera@shakhera-HP-Notebook-PC: ~/IT_18033
File Edit View Search Terminal Help
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags MSS Window  irtt Iface
default          shakhera-HP-Not 0.0.0.0         UG    0 0      0 enp0s3
192.168.2.0      0.0.0.0         255.255.255.0   U     0 0      0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat r
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address          State
Active UNIX domain sockets (w/o servers)
Proto RefCnt Flags   Type       State           I-Node  Path
unix  23    [ ]     DGRAM      State           220     /run/systemd/journal
/dev-log
unix  2     [ ]     DGRAM      State           62293   /run/user/1000/syste
md/notify
unix  2     [ ]     DGRAM      State           26031   /run/user/121/system
d/notify
unix  3     [ ]     DGRAM      State           196     /run/systemd/notify
unix  2     [ ]     DGRAM      State           210     /run/systemd/journal
/syslog
unix  8     [ ]     DGRAM      State           214     /run/systemd/journal
/socket
```

c) Remove the route for this interface:

```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
default          shakhera-HP-Not 0.0.0.0          UG    0      0      0 enp0s3
192.168.2.0      0.0.0.0          255.255.255.0    U      0      0      0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo route del -net 192.168.2.0 gw
0.0.0.0 netmask 255.255.255.0 dev enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
default          shakhera-HP-Not 0.0.0.0          UG    0      0      0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$
```

d) Then remove the interface completely.

Command for removing the interface completely, *Sudo ifconfig enp0s3 down* is used

```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo ifconfig enp0s3 down
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ ifconfig
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 12535  bytes 638447 (638.4 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 12535  bytes 638447 (638.4 KB)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ |
```

5. Add a New Network:

- a) Enter the command needed to add another network with the same values as your primary network meaning.


```

shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo ifconfig enp0s3 172.168.10.1
netmask 255.255.0.0
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.168.10.1 netmask 255.255.0.0 broadcast 172.168.255.255
    ether 08:00:27:25:23:01 txqueuelen 1000 (Ethernet)
    RX packets 1 bytes 590 (590.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 106 bytes 12160 (12.1 KB)
    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 13471 bytes 685247 (685.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 13471 bytes 685247 (685.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ |

```

- b)** Assign the default gateway for newly added network (Your default Gateway Address):

```

shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
link-local       0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
172.168.0.0      0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$

```

- c)** Look for your newly added network in your routing table by issuing the “\$ netstat -r “command.

```

shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
link-local       0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
172.168.0.0      0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$

```

- d)** Now remove your chang2s meaning the double routing table setup for your primary network. First issue the command needed to delete your newly added route then issue the command to delete you newly added default gateway.


```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
link-local       0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
172.168.0.0      0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo route del -net 172.168.0.0 gw
0.0.0.0 netmask 255.255.0.0 dev enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
link-local       0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$
```

6. Multi network scenario configuration:

a) Assign the firewall IP addresses to eth1 and eth2.

```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo ip route add 10.0.2.0 default
via dev eht0
[sudo] password for shakhera: |
```

```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ sudo ip route add 192.168.1.0/255.
255.255.0 default via dev eth1
```

b) Add the routes for the networks, i.e. 192.168.1.0 on eth1 and 10.0.2.0 on eth0

```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
default          _gateway         0.0.0.0         UG        0 0        0 enp0s3
10.0.2.0         0.0.0.0         255.255.255.0   U        0 0        0 enp0s3
link-local       0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
192.168.1.0      -               255.255.255.255 !H        - -        - -
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ |
```

c) Assign the internet gateway (meaning: 192.168.1.1) as the default gateway.

```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
10.0.2.0         0.0.0.0         255.255.255.0   U        0 0        0 enp0s3
link-local       0.0.0.0         255.255.0.0     U        0 0        0 enp0s3
192.168.1.0      -               255.255.255.255 !H        - -        - -
192.168.1.1      -               255.255.255.255 !H        - -        - -
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ |
```

d) Enter the necessary commands in order for packets belonging to computers in the 10.0.2.0 network to be routed to the 192.168.1.0 network and the internet. In other words this should tell each computer on the 10.0.2.0, which the default

gateway is, i.e., your firewall/router. You do not need to be worry about the route back configuration it is enough to assign the proper default gateway for the 10.0.2.0 network.

```
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ ip route list
default via 10.0.2.2 dev enp0s3 proto dhcp metric 20100
10.0.2.0/24 dev enp0s3 proto kernel scope link src 10.0.2.15 metric 100
169.254.0.0/16 dev enp0s3 scope link metric 1000
shakhera@shakhera-HP-Notebook-PC:~/IT_18033$ |
```

Discussion:

We have seen the uncut concept of “Linux Network Command” with the proper example, explanation and command with different outputs. The Network command is very important for troubleshooting and configuration of the network related things. While integration with a different application, we need to take care of the network establishment things.