

**MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY,  
Santosh, Tangail -1902**



**Lab Report No** : 01  
**Lab Report Name** : Network configuration , Routing table and virtual interfaces  
**Course Name** : Computer Networks Lab

**Submitted by,**

**Name :** Sabrin Afroz

**ID :** IT-17007

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Dept. of ICT, MBSTU.

**Submitted to,**

Nazrul Islam

Assistant Professor

Dept. of ICT, MBSTU.

**Theory :** Networking, also known as computer networking, is the practice of transporting and exchanging data between nodes over a shared medium in an information system. Networking comprises not only the design, construction and use of a network, but also the management, maintenance and operation of the network infrastructure, software and policies.

**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. (write down the answers in your written report).

**Ans :**

The IP address is a fascinating product of modern computer technology designed to allow one connected computer (or "smart" device) to communicate with another device over the Internet. IP addresses allow the location of literally billions of digital devices that are connected to the Internet to be pinpointed and differentiated from other devices.

An IPv4 address consists of four numbers, each of which contains one to three digits, with a single dot (.) separating each number or set of digits. Each of the four numbers can range from 0 to 255.

The IP addresses can be classified into two. They are listed below.

1) Static IP addresses

2) Dynamic IP addresses

An IP network requires that all connected devices - such as servers, switches, routers and other devices - be configured with the TCP/IP suite and have a valid IP address to perform any network communication.

## 2) Find IP and MAC :

Write down the IP and MAC address of your computer

```
sabrin@sabrin-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::e9c6:14bf:8a03:312b  prefixlen 64  scopeid 0x20<link>
    ether 08:00:27:5b:54:08  txqueuelen 1000  (Ethernet)
    RX packets 84  bytes 50861 (50.8 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 124  bytes 24678 (24.6 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 136  bytes 10664 (10.6 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 136  bytes 10664 (10.6 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

### 3) Routing table basis :

Enter the command : “\$ netstat -r” to print my computer’s routing table.

```
sabrin@sabrin-VirtualBox:~$ 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
```

- **Destination** : The destination network or destination host.
- **Gateway** : The Gateway column identifies the defined gateway for the specified network. An asterisk (\*) appears in this column if no forwarding gateway is needed for the network.
- **Genmask** : The netmask for the destination net; 255.255.255.255 for a host destination and 0.0.0.0 for the default route.
- **Flags** : Possible flags include
  - U (route is up)
  - H (target is a host)
  - G (use gateway)
  - R (reinstate route for dynamic routing)
  - D (dynamically installed by daemon or redirect)
  - M (modified from routing daemon or redirect)
  - A (installed by addrconf)
  - C (cache entry)
  - ! (reject route)
- **MSS** : Default maximum segment size for TCP connections over this route.
- **irtt** : Initial RTT (Round Trip Time). The kernel uses this to guess about the best TCP protocol parameters without waiting on (possibly slow) answers.
- **Iface** : Interface to which packets for this route will be sent.

### 4) Virtual interface :

- a) Create a new virtual interfaces according to your computer 192.168.2.32 and netmask 255.255.255.0 , then check to see if the interface was created successfully?

```
sabrin@sabrin-VirtualBox:~$ 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::e9c6:14bf:8a03:312b prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:5b:54:08 txqueuelen 1000 (Ethernet)
    RX packets 1 bytes 590 (590.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 75 bytes 8936 (8.9 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 830 bytes 59849 (59.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 830 bytes 59849 (59.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

- 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?

```

sabin@sabin-VirtualBox:~$ sudo ip route add default via 192.168.2.32 dev enp0s3
[sudo] password for sabin:
sabin@sabin-VirtualBox:~$ 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
sabin@sabin-VirtualBox:~$ route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
default          sabrin-VirtualB 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
sabin@sabin-VirtualBox:~$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask          Flags  MSS Window  irtt Iface
default          sabrin-VirtualB 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
sabin@sabin-VirtualBox:~$ 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   2      [ ]         DGRAM              21834      /run/user/1000/syste
md/notify
unix   17     [ ]         DGRAM              13396      /run/systemd/journal
/dev-log
unix   3      [ ]         DGRAM              13023      /run/systemd/notify
unix   2      [ ]         DGRAM              13036      /run/systemd/journal

```

c) Next remove the route for this interface :

```
sabrin@sabrin-VirtualBox:~$ route -n
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
0.0.0.0          192.168.2.32    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
sabrin@sabrin-VirtualBox:~$ sudo route -0.0.0.0 gw 192.168.2.32 netmask 0.0.0.0
dev enp0s3
route: invalid option -- '0'
route: invalid option -- '.'
route: invalid option -- '0'
route: invalid option -- '.'
route: invalid option -- '0'
route: invalid option -- '.'
route: invalid option -- '0'
Usage: route [-nNvee] [-FC] [<AF>]          List kernel routing tables
        route [-v] [-FC] {add|del|flush} ... Modify routing table for AF.

        route {-h|--help} [<AF>]            Detailed usage syntax for specific
d AF.
        route {-V|--version}                Display version/author and exit.

        -v, --verbose                        be verbose
        -n, --numeric                       don't resolve names
        -e, --extend                         display other/more information
        -F, --fib                           display Forwarding Information Base (default)
        -C, --cache                         display routing cache instead of FIB
```

```
<AF>=Use -4, -6, '-A <af>' or '--<af>'; default: inet
List of possible address families (which support routing):
inet (DARPA Internet) inet6 (IPv6) ax25 (AMPR AX.25)
netrom (AMPR NET/ROM) ipx (Novell IPX) ddp (Appletalk DDP)
x25 (CCITT X.25)
sabrin@sabrin-VirtualBox:~$
```

d) Then remove the interface completely :

```
sabrin@sabrin-VirtualBox:~$ sudo ifconfig enp0s3 down
sabrin@sabrin-VirtualBox:~$ 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 5449 bytes 388444 (388.4 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 5449 bytes 388444 (388.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

**Conclusion :** In this lab, we have learned different types of command of Linux and how it is worked.

A directly connected network is a network that is directly attached to one of the router interfaces. The network address and subnet mask of the interface, along with the interface type and number, are entered into the routing table as a directly connected network.

There are 3 types of routing:

- Static routing
- Default Routing
- Dynamic Routing

Routing is the hub around which all of IP connectivity revolves. At the simplest level, routing establishes basic internetwork communications, implements an addressing structure that uniquely identifies each device, and organizes individual devices into a hierarchical network structure.

Network configuration refers to the initial process of defining a network's operation, flow, and controls—essentially maintaining and arranging the information associated with all your network's components.

Network configuration can reduce downtime by allowing system administrators to rapidly identify changes being made in the network. It also helps ensure that software versions and hardware components are up to date and comply with licensing agreements.