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Lab No : 01
Name of the lab : Network configuration, Routing table and Virtual interfaces

Objectives : (i) Finding IP and MAC address
(ii) Routing Table Basics
(iii) Virtual interfaces
(iv) Adding a Network
(v) Multinetworking Scenario Configuration

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.

Ans:

Ipv4-addresses are internally 32 bits, for it being easier to read for humans, they are often divided into 4 groups of 8 bits.

8 bits converted to decimal can range from 0 to 255. because

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

means 0

1	1	1	1	1	1	1	1
---	---	---	---	---	---	---	---

means 255

It means that all addresses in the ranges of 192.168.1.0 to 192.168.1.255 are in the same network. In all networks, the first address and last address is unusable, so the first usable address is 192.168.1.1 and the last is 192.168.1.254.

Since all devices in the network need to have unique addresses that means that you can have 254 devices in that network.

In the network, generally one address is the default gateway, the router that connects that sub net to the rest of the world. That can be anyone of those 254 addresses, but the most common ones are .1 and 254.

2) Find IP and MAC :

Write down the IP and MAC address of your computer ?

Ans:

We can find our device IP address using “\$ip address” Command in Linux terminal.

```

smmhossain@samim:~$ ip address;
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp2s0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether 58:8a:5a:2c:90:3b brd ff:ff:ff:ff:ff:ff
3: wlp1s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 74:e5:f9:e8:d2:3a brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.105/24 brd 192.168.0.255 scope global dynamic noprefixroute wlp1s0
        valid_lft 4933sec preferred_lft 4933sec
    inet6 fe80::9498:414c:6160:77f9/64 scope link noprefixroute
        valid_lft forever preferred_lft forever

```

We can also find our local computer IP address using `$hostname -i` command in Linux terminal

```

smmhossain@samim:~$ hostname -i;
127.0.1.1

```

MAC address is the physical address of computer. We can find MAC address using “`$ifconfig`” command in Linux terminal. Before using this command we have need some tools. To install these tools we have to write “`$sudo apt install net -tools`”. Then we can find MAC address using “`$ifconfig`” command.

```

smmhossain@samim:~$ ifconfig
enp2s0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 58:8a:5a:2c:90:3b txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    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 3418 bytes 355604 (355.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 3418 bytes 355604 (355.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlp1s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.105 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::9498:414c:6160:77f9 prefixlen 64 scopeid 0x20<link>
    ether 74:e5:f9:e8:d2:3a txqueuelen 1000 (Ethernet)
    RX packets 98984 bytes 134187586 (134.1 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 56130 bytes 7014783 (7.0 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

```

3)Routing Table Basics :

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

We can also see our computers routing table using “\$netstat -r -n” and “\$route -n” command in Linux terminal.

```
smmhossain@samim:~$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
default          _gateway        0.0.0.0         UG      0 0      0 wlp1s0
link-local       0.0.0.0         255.255.0.0     U       0 0      0 wlp1s0
192.168.0.0      0.0.0.0         255.255.255.0   U       0 0      0 wlp1s0
```

- **Destination** : The destination network or destination host.
- **Gateway** : The gateway address or “*” if none set.
- **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)
- **MSS** : Default maximum segment size for TCP connections over this route.
- **Window** : Default window size for TCP connections over this route.
- **irtt** : Initial RTT (Round Trip Time). The kernel uses this to guess about the best TCP
- **Iface** : Interface to which packets for this route will be sent.

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?

```
smmhossain@samim:~$ ifconfig eth0 172.23.215.243 netmask 255.255.255.0
SIOCSIFADDR: Operation not permitted
eth0: ERROR while getting interface flags: No such device
SIOCSIFNETMASK: Operation not permitted
smmhossain@samim:~$ route add default gw 172.23.215.254 eth0
SIOCADDRT: Operation not permitted
smmhossain@samim:~$ route add default gateway 172.23.215.254 eth0
SIOCADDRT: Operation not permitted
smmhossain@samim:~$
```

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?

```
smmhossain@samim:~$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags   MSS Window  irtt Iface
default          _gateway        0.0.0.0         UG      0 0      0 wlp1s0
link-local       0.0.0.0         255.255.0.0     U       0 0      0 wlp1s0
192.168.0.0      0.0.0.0         255.255.255.0   U       0 0      0 wlp1s0
```

c)Next remove the route for this interface ?

```
smmhossain@samim:~$ route del -net 10.1.0.0 netmask 255.255.0.0 metric 2
SIOCDELRT: Operation not permitted
```

d) Then remove the interface completely ?

Ans :To disable our temporary network interface created earlier we can use the **ifconfig** command again but with a down flag.

```
smmhossain@samim:~$ ifconfig eth0:0 down
eth0:0: ERROR while getting interface flags: No such device
```

5) **Add a New network :**

a) Enter the command needed to add another network with the same values as your primary network meaning : (yourPrimaryNetworkAddress) and (netmaskforYourNetwork) .

b)Assign the default gateway for newly added network(YourdefaultGateway Address)

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

d) Now remove your chnages 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.

```

smmhossain@samim:~$ sudo /etc/init.d/networking start;
[ ok ] Starting networking (via systemctl): networking.service.
smmhossain@samim:~$ sudo ifconfig
enp2s0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 58:8a:5a:2c:90:3b txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    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 4370 bytes 462284 (462.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 4370 bytes 462284 (462.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlp1s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.105 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::9498:414c:6160:77f9 prefixlen 64 scopeid 0x20<link>
    ether 74:e5:f9:e8:d2:3a txqueuelen 1000 (Ethernet)
    RX packets 160366 bytes 219392872 (219.3 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 85186 bytes 10542891 (10.5 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

```

```

smmhossain@samim:~$ sudo dhclient
RTNETLINK answers: File exists
cmp: EOF on /tmp/tmp.eIhrONboZW which is empty
smmhossain@samim:~$ sudo /etc/init.d/networking restart
[ ok ] Restarting networking (via systemctl): networking.service.
smmhossain@samim:~$ sudo vim/etc/network/interfaces
sudo: vim/etc/network/interfaces: command not found
smmhossain@samim:~$ /etc/sysconfig/network
bash: /etc/sysconfig/network: No such file or directory

```

6) Multinetwork scenario configuration :

We should now set up a working routing table for a multi-network scenario . Assume that we have two network cards available connected to two different LANs . The destination of the first network is, 10.0.2.0 with netmask 255.0.0.0 and the second, 192.168.1.0 with netmask 255.255.255.0 ,Furthermore , a firewall is assumed to exist between the two networks , where network card eth0 is attached to the 10.0.2.0 network and eth1 is attached to the 192.168.1.0 network.To forward packets on the internet the firewall needs to route packets from the 10.0.2.0 network through the 192.168.1.0 network . The firewall system must be set up with two IP addresses ,10.0.2.1 on eth0 and 192.168.1.25 on eth1 . The gateway to the internet on the 192.168.1.0 network should be 192.168.1.1 .

Provide the necessary commands to route on the firewall/router system.

- Assign the firewall IP addresses to eth1 and eth2 .
- Add the routes for the networks , i.e, 192.168.1.0 on eth1 and 10.0.2.0 on eth0
- Assign the internet gateway(meaning : 192.168.1.1) as the default gateway .

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 worried about the route back configuration it is enough to assign the proper default gateway for the 10.0.2.0 network.