

MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY



DEPARTMENT OF ICT

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Network Configuration, Routing tables & Virtual interfaces

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

That means that all addresses in the range 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 subnet 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:

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ ifconfig
eno1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 30:e1:71:91:75:23 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 4399 bytes 476900 (476.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 4399 bytes 476900 (476.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.210 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::6745:99d7:f3f9:411 prefixlen 64 scopeid 0x20<link>
    ether 98:54:1b:7b:2b:04 txqueuelen 1000 (Ethernet)
    RX packets 257546 bytes 353766345 (353.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 131026 bytes 16235163 (16.2 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

faruk@faruk-HP-250-G5-Notebook-PC:~$

```

3)Routing Table Basics :

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

Route -n same to netstat -nr

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask         Flags       MSS Window  irtt Iface
default          _gateway        0.0.0.0         UG          0 0        0 wlo1
link-local       0.0.0.0         255.255.0.0     U           0 0        0 wlo1
192.168.1.0      0.0.0.0         255.255.255.0   U           0 0        0 wlo1
faruk@faruk-HP-250-G5-Notebook-PC:~$ netstat -nr
Kernel IP routing table
Destination      Gateway          Genmask         Flags       MSS Window  irtt Iface
0.0.0.0          192.168.0.1     0.0.0.0         UG          0 0        0 wlo1
169.254.0.0      0.0.0.0         255.255.0.0     U           0 0        0 wlo1
192.168.0.0      0.0.0.0         255.255.255.0   U           0 0        0 wlo1

```

When you invoke **netstat** with the -nr flag ,it displays the kernel routing table in the way we have been doing with root .

In your destination you should see 0.0.0.0 which would be the network . The second column of **netstat** 's output shows the gateway to which the routing entry points. If no gateway is used, an asterisk is printed instead. The third column shows the “generality” of the route, i.e., the network mask for this route.The fourth column displays the following flags that describe the route:

G ->The route uses a gateway.

U ->The interface to be used is up.

H ->Only a single host can be reached through the route .

The next three columns show the MSS, Window and irtt that will be applied to TCP connections established via this route. The MSS is the Maximum Segment Size and is the size of the largest datagram the kernel will construct for transmission via this route. The Window is the maximum amount of data the system will accept in a single burst from a remote host. The acronym `irtt` stands for “initial round trip time.” The `irtt` value can be set using the **route** command. Values of zero in these fields mean that the default is being used. Finally, the last field displays the network interface that this route will use.

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?

```
faruk@faruk-HP-250-G5-Notebook-PC:~$ 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
faruk@faruk-HP-250-G5-Notebook-PC:~$ route add default gw 172.23.215.254 eth0
SIOCADDRT: Operation not permitted
faruk@faruk-HP-250-G5-Notebook-PC:~$ route add default gateway 172.23.215.254 eth0
SIOCADDRT: Operation not permitted
faruk@faruk-HP-250-G5-Notebook-PC:~$
```

```
faruk@faruk-HP-250-G5-Notebook-PC:~$ clear

faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo lsmod | grep dummy
[sudo] password for faruk:
dummy                16384  0
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo modprobe dummy
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo lsmod | grep dummy
dummy                16384  0
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ip link add eth0 type dummy
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ip link set name eth0 dev dummy0
Cannot find device "dummy0"
faruk@faruk-HP-250-G5-Notebook-PC:~$ ip link show eth0
5: eth0: <BROADCAST,NOARP> mtu 1500 qdisc noop state DOWN mode DEFAULT group default qlen 1000
    link/ether 02:f7:d8:1c:05:0f brd ff:ff:ff:ff:ff:ff
```

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ ip link
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: eno1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN
   mode DEFAULT group default qlen 1000
    link/ether 30:e1:71:91:75:23 brd ff:ff:ff:ff:ff:ff
3: wlo1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP mode
   DORMANT group default qlen 1000
    link/ether 98:54:1b:7b:2b:04 brd ff:ff:ff:ff:ff:ff
4: eth10: <BROADCAST,NOARP> mtu 1500 qdisc noop state DOWN mode DEFAULT group de
   fault qlen 1000
    link/ether 6e:54:ee:07:e1:b7 brd ff:ff:ff:ff:ff:ff
5: eth0: <BROADCAST,NOARP> mtu 1500 qdisc noop state DOWN mode DEFAULT group def
   aut qlen 1000
    link/ether 02:f7:d8:1c:05:0f brd ff:ff:ff:ff:ff:ff

```

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?

Add a new route

The syntax is:

```

ip route add {NETWORK/MASK} via {GATEWAYIP}
ip route add {NETWORK/MASK} dev {DEVICE}
ip route add default {NETWORK/MASK} dev {DEVICE}
ip route add default {NETWORK/MASK} via {GATEWAYIP}

```

Add [a plain route to network 192.168.1.0/24 via gateway 192.168.1.254](#):

```
ip route add 192.168.1.0/24 via 192.168.1.254
```

To [route all traffic via 192.168.1.254 gateway connected via eth0 network](#) interface:

```
ip route add 192.168.1.0/24 dev eth0
```

Delete a route

The syntax is as follows to delete default gateway:

```
ip route del default
```

In this example, delete the route created in [previous subsection](#):

```
ip route del 192.168.1.0/24 dev eth0
```

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ route -n
Kernel IP routing table
Destination      Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0          192.168.0.1    0.0.0.0         UG    600    0      0 wlo1
169.254.0.0      0.0.0.0        255.255.0.0     U     1000   0      0 wlo1
192.168.0.0      0.0.0.0        255.255.255.0   U     600    0      0 wlo1
faruk@faruk-HP-250-G5-Notebook-PC:~$ route add default gateway 192.168.2.32 eth0
SIOCADDRT: Operation not permitted

```

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ ip route
default via 192.168.0.1 dev wlo1 proto dhcp metric 600
169.254.0.0/16 dev wlo1 scope link metric 1000
192.168.0.0/24 dev wlo1 proto kernel scope link src 192.168.0.109 metric 600
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ip route add 192.168.0.116/24 via 192.
168.0.1 dev ens3
Cannot find device "ens3"
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ip route add 192.168.0.116/24 via 192.
168.0.1 dev eth10
Error: Invalid prefix for given prefix length.
faruk@faruk-HP-250-G5-Notebook-PC:~$ ip route show
default via 192.168.0.1 dev wlo1 proto dhcp metric 20600
169.254.0.0/16 dev wlo1 scope link metric 1000
192.168.0.0/24 dev wlo1 proto kernel scope link src 192.168.0.109 metric 600

```

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ route del -net 10.1.0.0 netmask 255.255.0.0 metric 2
SIOCDELRT: Operation not permitted
faruk@faruk-HP-250-G5-Notebook-PC:~$

```

c)Next remove the route for this interface ?

Ans :

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.

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ ifconfig eth0:0 down
eth0:0: ERROR while getting interface flags: No such device
faruk@faruk-HP-250-G5-Notebook-PC:~$

```

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ip addr add 192.168.100.199/24 brd + d
ev eth10 label eth10:0
faruk@faruk-HP-250-G5-Notebook-PC:~$ ifconfig -a eth10
eth10: flags=130<BROADCAST,NOARP> mtu 1500
    ether 6e:54:ee:07:e1:b7 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

faruk@faruk-HP-250-G5-Notebook-PC:~$ ifconfig -a eth10:0
eth10:0: flags=130<BROADCAST,NOARP> mtu 1500
    inet 192.168.100.199 netmask 255.255.255.0 broadcast 192.168.100.255
    ether 6e:54:ee:07:e1:b7 txqueuelen 1000 (Ethernet)

faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ip addr del 192.168.100.199/24 brd + d
ev eth10 label eth10:0
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ip link delete eth10 type dummy
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo rmmod dummy

```

```

faruk@faruk-HP-250-G5-Notebook-PC:~$ ip link
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: eno1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN
    mode DEFAULT group default qlen 1000
    link/ether 30:e1:71:91:75:23 brd ff:ff:ff:ff:ff:ff
3: wlo1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP mode
    DORMANT group default qlen 1000
    link/ether 98:54:1b:7b:2b:04 brd ff:ff:ff:ff:ff:ff

```

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) .


```
faruk@faruk-HP-250-G5-Notebook-PC:~$ ssh 192.168.0.1
The authenticity of host '192.168.0.1 (192.168.0.1)' can't be established.
RSA key fingerprint is SHA256:e0sWu30Lqyn9AqrUXSRDQefzi6glKRtZnpA3AhXTMOQ.
Are you sure you want to continue connecting (yes/no)? y
Please type 'yes' or 'no': yes
Warning: Permanently added '192.168.0.1' (RSA) to the list of known hosts.
faruk@192.168.0.1's password:
Permission denied, please try again.
faruk@192.168.0.1's password:
Connection closed by 192.168.0.1 port 22
faruk@faruk-HP-250-G5-Notebook-PC:~$ ssh 192.168.0.1
faruk@192.168.0.1's password:
Permission denied, please try again.
faruk@192.168.0.1's password:
Permission denied, please try again.
faruk@192.168.0.1's password:
faruk@192.168.0.1: Permission denied (publickey,password).
```

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.

```
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo /etc/init.d/networking start
[sudo] password for faruk:
[ ok ] Starting networking (via systemctl): networking.service.
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo ifconfig
eno1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 30:e1:71:91:75:23 txqueuelen 1000 (Ethernet)
```



```
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo dhclient
RTNETLINK answers: File exists
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo /etc/init.d/networking restart
[ ok ] Restarting networking (via systemctl): networking.service.
faruk@faruk-HP-250-G5-Notebook-PC:~$ sudo vim /etc/network/interfaces
sudo: vim: command not found
faruk@faruk-HP-250-G5-Notebook-PC:~$ /etc/sysconfig/network
bash: /etc/sysconfig/network: No such file or directory
faruk@faruk-HP-250-G5-Notebook-PC:~$
```

6) Multinetwork scenario configuration :

You should now set up a working routing table for a multi-network scenario . Assume that you 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.

- a) Assign the firewall IP addresses to eth1 and eth2 .
- b) Add the routes for the networks , i.e, 192.168.1.0 on eth1 and 10.0.2.0 on eth0
- c) 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 worry about the route back configuration it is enough to assign the proper default gateway for the 10.0.2.0 network.