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Computer Network (CT 657)

LAB 3
Overview of IP Addressing and Sub-netting, Static IP Setting on Linux Machine, Testing

Objective:
1. To understand the theoretical knowledge of IPv4 addressing and sub-netting.
2. To understand IP address setting and testing in Linux machine (Ubuntu)

Apparatus: Linux OS (Ubuntu) on virtual machine

Theory:
   i. IP address
   ii. Types of IP
   iii. IPv4 address class
   iv. Sub-netting
   v. CIDR
   vi. VLSM
   vii.   IP address setting in Ubuntu

IP address Setting in Ubuntu

Checking interfaces
Run the following command
#ifconfig
output:

```
dneshdg@dneshdg-HP-Notebook:~$ ifconfig
enp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.40.206  netmask 255.255.255.0  broadcast 192.168.40.255
        inet6 fe80::141e:30ad:94fb:5ca8  prefixlen 64  scopeid 0x20<link>
        ether ec:8e:b5:f9:2a:2f  txqueuelen 1000  (Ethernet)
        RX packets 32932  bytes 13235640 (13.2 MB)
        RX errors 0  dropped 236  overruns 0  frame 0
        TX packets 7962  bytes 1162398 (1.1 MB)
        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 3148  bytes 724251 (724.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3148  bytes 724251 (724.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.181  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::526f:71bd:841e:5610  prefixlen 64  scopeid 0x20<link>
        ether 54:8c:a0:80:45:17  txqueuelen 1000  (Ethernet)
        RX packets 3169  bytes 729290 (729.2 KB)
        RX errors 0  dropped 46  overruns 0  frame 0
        TX packets 1369  bytes 217947 (217.9 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Temporary IP Address Assignment

Sometimes you may need to assign a temporary IP address on your server. You can configure temporary IP address on Ubuntu using the ifconfig command. However, once you reboot the server, the IP address would no longer be available.

To configure tempory IP address, use the following command syntax:

sudo ifconfig <interface> <ipv4address> netmask <subnetmask>

Example:

#sudo ifconfig ifconfig enp2s0 192.168.40.200 netmask 255.255.255.0

To verify the IP address configuration of enp2s0, you can use the ifconfig command in the following manner.

#ifconfig enp2s0

Output:

```
dneshdg@dneshdg-HP-Notebook:~$ ifconfig enp2s0
enp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.40.206  netmask 255.255.255.0  broadcast 192.168.40.255
        inet6 fe80::141e:30ad:94fb:5ca8  prefixlen 64  scopeid 0x20<link>
        ether ec:8e:b5:f9:2a:2f  txqueuelen 1000  (Ethernet)
        RX packets 38003  bytes 14685394 (14.6 MB)
        RX errors 0  dropped 246  overruns 0  frame 0
        TX packets 9369  bytes 1334544 (1.3 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

dneshdg@dneshdg-HP-Notebook:~$ sudo ifconfig enp2s0 192.168.40.200 netmask 255.255.255.0
dneshdg@dneshdg-HP-Notebook:~$ ifconfig enp2s0
enp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.40.200  netmask 255.255.255.0  broadcast 192.168.40.255
        inet6 fe80::141e:30ad:94fb:5ca8  prefixlen 64  scopeid 0x20<link>
        ether ec:8e:b5:f9:2a:2f  txqueuelen 1000  (Ethernet)
        RX packets 38425  bytes 14742927 (14.7 MB)
        RX errors 0  dropped 246  overruns 0  frame 0
        TX packets 9408  bytes 1339951 (1.3 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

To configure a default gateway, you can use the **route** command in the following manner. Modify the default gateway address to match your network requirements.

#sudo route add default gw 192.168.40.1 enp2s0

To verify your default gateway configuration, you can use the route command in the following manner.
#route -n
Kernel IP routing table
Output:

```
dneshdg@dneshdg-HP-Notebook:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         192.168.40.1    0.0.0.0         UG    100    0        0 enp2s0
169.254.0.0     0.0.0.0         255.255.0.0     U     1000   0        0 enp2s0
192.168.40.0    0.0.0.0         255.255.255.0   U     100    0        0 enp2s0
```

Removing Temporary IP Setting
If you no longer need this configuration and wish to purge all IP configuration from an interface, you can use the ip command with the flush option as shown below.
#sudo ip addr flush enp2s0

#ifconfig enp2s0
output:

```
dneshdg@dneshdg-HP-Notebook:~$ sudo ip addr flush enp2s0
dneshdg@dneshdg-HP-Notebook:~$ ifconfig enp2s0
enp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        ether ec:8e:b5:f9:2a:2f  txqueuelen 1000  (Ethernet)
        RX packets 45631  bytes 16607777 (16.6 MB)
        RX errors 0  dropped 254  overruns 0  frame 0
        TX packets 10018  bytes 1428887 (1.4 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Dynamic IP Address Assignment (DHCP Client)

To configure your server to use DHCP for dynamic address assignment, add the dhcp method to the inet address family statement for the appropriate interface in the file **/etc/network/interfaces**. The example below assumes you are configuring your first Ethernet interface identified as enp2s0.

auto enp2s0
iface enp2s0 inet dhcp

By adding an interface configuration as shown above, you can manually enable the interface through the ifup command which initiates the DHCP process via dhclient.

#sudo ifup enp2s0

To manually disable the interface, you can use the ifdown command, which in turn will initiate the DHCP release process and shut down the interface.

#sudo ifdown enp2s0

Finally, verify the IP address assigned by DHCP server using the command.

ifconfig eth0

Set Static IP Address In Ubuntu

If the above methods do not work or not fulfill your requirement, you can set static IP address in Ubuntu and other Linux variants. To configure static IP address in Ubuntu using the command line, edit the /etc/network/interfaces file as follows:

```
auto eth0
iface eth0 inet static
address <ip-address>
netmask <subnet-mask>
gateway <gateway>
```

For example, to set 172.16.0.1/16 IP address with 172.16.0.255 as gateway address, the file should look like as follow:

```
auto eth0
iface eth0 inet static
address 172.16.0.1
netmask 255.255.0.0
gateway 172.16.0.255
```

The following figure shows how to set static IP address in Ubuntu.

Save the network configuration file. Stop and start the network interface using the below commands.

By adding an interface configuration as shown above, you can manually enable the interface through the ifup command.

#sudo ifup eth0

To manually disable the interface, you can use the ifdown command.
#sudo ifdown eth0

Finally, verify the IP address and other settings that you have set on your Ubuntu server.

#ifconfig eth0

Your Task

set IPv4 address at your VM and test by pinging to your friend's machine.

Exercise:
1. Create your own DHCP server and put the ip range (10.200.100.10 - 10.200.10.90) in the pool.
2. What is IPv6 address? What are its features?
3. Discuss IPv6 addresses and its types.
4. How do you set IPv6 address on your Linux machine? Explain.