INTRO TO NETWORKING

In this lab you'll learn about some basic networking commands in linux.

1.) ifconfig

ifconfig (interface configuration) command is used 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 assigned to an interface and also the MTU (Maximum transmission unit) size.

- Listing network interfaces and their configuration:

`ifconfig` : This will list all the interfaces currently up. The second interface that it shows, `lo`, is the localhost interface. It usually has the IP address 127.0.0.1 and represents the local machine itself. Any connection to 127.0.0.1 will be made to the machine itself.

```
ubuntu@ubuntu-VirtualBox:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 08:00:27:1b:bc:e9
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fe1b:bce9/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:78 errors:0 dropped:0 overruns:0 frame:0
          TX packets:201 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:9282 (9.2 KB)  TX bytes:26055 (26.0 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:301 errors:0 dropped:0 overruns:0 frame:0
          TX packets:301 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:27955 (27.9 KB)  TX bytes:27955 (27.9 KB)
```

Q: How to see the interfaces which are currently down or disabled?

- Closing(Disabling)/Enabling an interface:
  `sudo ifconfig <interface> down/up`

```
ubuntu@ubuntu-VirtualBox:~$ sudo ifconfig eth0 down
[sudo] password for ubuntu:
ubuntu@ubuntu-VirtualBox:~$ ifconfig
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:309 errors:0 dropped:0 overruns:0 frame:0
          TX packets:309 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:28451 (28.4 KB)  TX bytes:28451 (28.4 KB)

ubuntu@ubuntu-VirtualBox:~$
```

Setting the IP address & Network Mask for an Interface:

```
sudo ifconfig <interface> <addr> netmask <mask-addr>
```

```
ubuntu@ubuntu-VirtualBox:~$ sudo ifconfig eth0 10.0.2.16 netmask 255.255.255.0
ubuntu@ubuntu-VirtualBox:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 08:00:27:1b:bc:e9
          inet addr:10.0.2.16  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fe1b:bce9/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:117 errors:0 dropped:0 overruns:0 frame:0
          TX packets:307 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:13682 (13.6 KB)  TX bytes:41356 (41.3 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:374 errors:0 dropped:0 overruns:0 frame:0
          TX packets:374 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:33310 (33.3 KB)  TX bytes:33310 (33.3 KB)

ubuntu@ubuntu-VirtualBox:~$
```

Q: How to set the broadcast address and the MAC Address(Hardware Address)?

- Setting the MTU size:

```
sudo ifconfig <interface> mtu <MTU-sixe>
```

2.) PING(Packet Internet Groper)

This command is the best way to test connectivity between two nodes. Whether it is Local Area Network (LAN) or Wide Area Network (WAN). Ping use ICMP (Internet Control Message Protocol) to communicate to other devices. You can ping host name or ip address using below command.

```
ping <Ip Address/Domain Name>
```

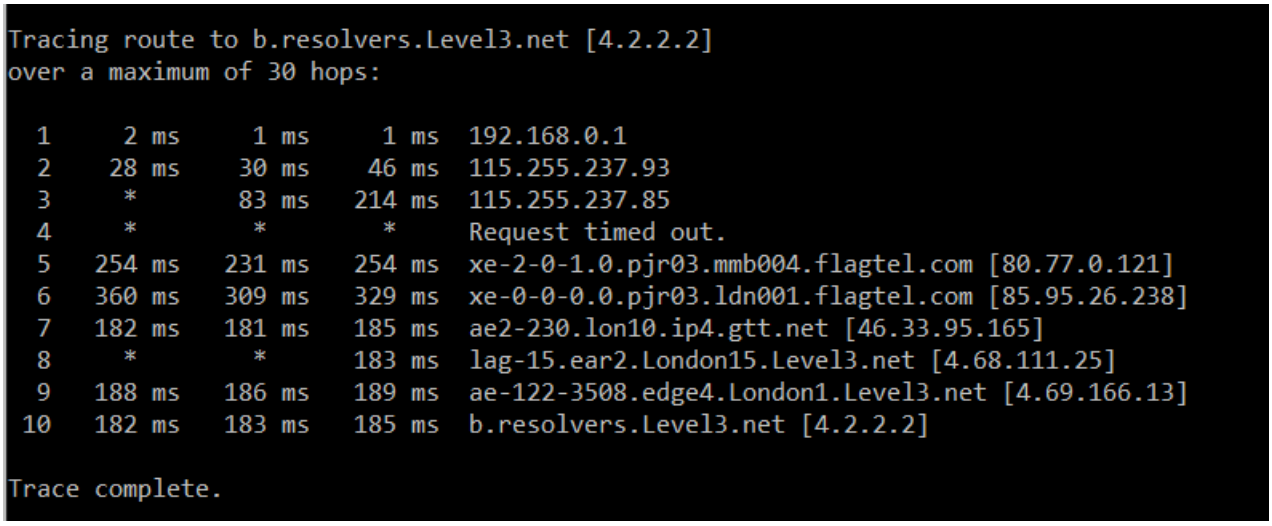
```
ubuntu@ubuntu-VirtualBox:~$ ping 192.168.0.102
PING 192.168.0.102 (192.168.0.102) 56(84) bytes of data.
64 bytes from 192.168.0.102: icmp_seq=1 ttl=127 time=0.702 ms
64 bytes from 192.168.0.102: icmp_seq=2 ttl=127 time=1.20 ms
64 bytes from 192.168.0.102: icmp_seq=3 ttl=127 time=1.18 ms
64 bytes from 192.168.0.102: icmp_seq=4 ttl=127 time=0.739 ms
^C
--- 192.168.0.102 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 0.702/0.957/1.208/0.238 ms
ubuntu@ubuntu-VirtualBox:~$
ubuntu@ubuntu-VirtualBox:~$
ubuntu@ubuntu-VirtualBox:~$ ping www.google.com
PING www.google.com (172.217.24.228) 56(84) bytes of data.
64 bytes from kul06s17-in-f228.1e100.net (172.217.24.228): icmp_seq=1 ttl=53 time=176 ms
64 bytes from kul06s17-in-f228.1e100.net (172.217.24.228): icmp_seq=2 ttl=53 time=198 ms
64 bytes from kul06s17-in-f228.1e100.net (172.217.24.228): icmp_seq=3 ttl=53 time=220 ms
64 bytes from kul06s17-in-f228.1e100.net (172.217.24.228): icmp_seq=4 ttl=53 time=141 ms
^C
--- www.google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 141.734/184.370/220.949/29.170 ms
ubuntu@ubuntu-VirtualBox:~$
```

Note : In linux you will have to manually stop the ping command by pressing CTRL+C.
Q: How can we specify the total number of requests to be sent by the ping command?
Q: What is the default packet size sent by the ping command? Can we change it? If so, how?
Hint: See the man page of ping command :D

3.) TRACEROUTE

Traceroute is a network troubleshooting utility which shows all the intermediate nodes between the source(the computer on which the command is run) and the destination. It also displays the total number of hops between the two. The command format is as follows:

```
traceroute <IP address/Domain Name>
```



Q: What does these times in ms tell?
Q: What does the three * * * signify in the above output? In which cases can this happen?

4.) NETSTAT

Netstat (Network Statistic) command displays all the active connections information, routing table information etc.

```
netstat <options>
```

For eg the following screenshot displays the routing table of the machine.

```
ubuntu@ubuntu-VirtualBox:~$ netstat -r
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
default         10.0.2.2        0.0.0.0         UG        0 0          0 eth0
10.0.2.0        *               255.255.255.0   U         0 0          0 eth0
ubuntu@ubuntu-VirtualBox:~$
```

NOTE: For more examples related to netstat command please follow the link : http://www.tecmint.com/20-netstat-commands-for-linux-network-management/

5.) NSLOOKUP

This command is used to find out DNS related queries. The following example shows the A record(IP address) of www.google.com

```
ubuntu@ubuntu-VirtualBox:~$ nslookup www.google.com
Server:         127.0.1.1
Address:        127.0.1.1#53

Non-authoritative answer:
Name:   www.google.com
Address: 172.217.24.228

ubuntu@ubuntu-VirtualBox:~$
```

For further reference you can consider the man page or follow the link : http://www.tecmint.com/8-linux-nslookup-commands-to-troubleshoot-dns-domain-name-server/

6.)**IP**

`ip` is the swiss-army knife tool for network configuration. Its usage is mostly similar to ifconfig, with slight differences. `Man 8 ip` lists the entire argument structure of this tool. Some examples are given below:

- Display device link configuration:
  `ip link show <interface>`
- Change MAC address of a device:
  `ip link set dev <interface> address <mac-addr>`
- Add an IP address to an interface:
  `ip addr add <address> dev <interface>` *(changed the syntax)*

Apart from these, the `ip` command can also modify the ARP tables, tunnels, multicast addresses etc.
More comprehensive documentation is available at `man 8 ip`
NOTE: Changing MAC address is also known as MAC-spoofing

7.) DHCP :

The Dynamic Host Configuration Protocol(DHCP) is a protocol that automates the assignment of IP addresses, subnet masks, default routers and other IP parameters

How it works:

- DHCP configured machine boots up or regains its connectivity to the network.
- DHCP client sends a request for network configurations(IP address, subnet mask,DNS server,Gateway address)
- DHCP server responds with the requested info.

To configure your Linux machine as a DHCP client:

```
#vi /etc/network/interfaces
auto eth0
iface eth0 inet dhcp
```

Explanation: Lines beginning with the word `auto` are used to identify the physical interfaces to be brought up when `ifconfig up` is run with the `-a` option. Auto should be followed by the interfaces. Next line configures eth0 as dhcp client.

dhclient

`dhclient` is used for DHCP discovery on a network. To automatically get the IP NIC configuration from a DHCP server on the network, do:

```
dhclient <interface>
```

More comprehensive documentation is available at `man 8 dhclient4`

/etc/network/interfaces

The network interfaces can also be configured permanently in the file /etc/network/interfaces. Here's an example:

```
/etc/networks/interfaces
auto eth0 (Automatically start eth0 if available)
iface eth0 inet static
address 192.168.1.174
network 192.168.1.0
netmask 255.255.255.0
broadcast 192.168.1.255
gateway 192.168.1.1
```