DEPARTMENT OF INFORMATION TECHNOLOGY

COMPUTER NETWORKING LAB

LAB1: 18/10/2022

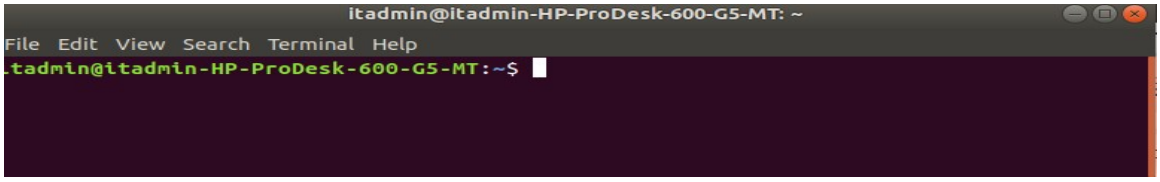
Objective

To understand the configuration of computer network for communication in Linux/Ubuntu system. To Understand the concepts of IP address, subnet mask, PING, traceroute, DNS, etc.

I. PC NETWORK AND TCP/IP CONFIGURATION

Open a terminal in Ubuntu system to enter commands

(a) Gather TCP/IP configuration information



Type the command **ifconfig** in terminal and press enter.

```
tadmin@itadmin-HP-ProDesk-600-G5-MT:~$ ifconfig
eno1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.100.53.195  netmask 255.255.252.0  broadcast 10.100.55.255
        inet6 fe80::116c:13cf:a8bc:19e4  prefixlen 64  scopeid 0x20<link>
        ether c8:d9:d2:29:c5:d4  txqueuelen 1000  (Ethernet)
        RX packets 111735  bytes 56047972 (56.0 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 85185  bytes 41278071 (41.2 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 16  memory 0xf1100000-f1120000

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 1248  bytes 108717 (108.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1248  bytes 108717 (108.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lxcbr0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 10.0.3.1  netmask 255.255.255.0  broadcast 0.0.0.0
        ether 00:16:3e:00:00:00  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
```

The command **ifconfig** provides certain information regarding network configuration. Ifconfig is used to configure the kernel-resident network interfaces It is used at boot time to set up interfaces as necessary. After that, it is usually only needed when debugging or when system tuning is needed.

If no arguments are given, ifconfig displays the status of the currently active interfaces. If a single interface argument is given, it displays the status of the given interface only; if a single -a argument is given, it displays the status of all interfaces, even those that are down. Otherwise, it configures an interface.

Currently supported address families:

inet (TCP/IP, default)
inet6 (IPv6)
ax25 (AMPR Packet Radio)
ddp (Applitalk Phase 2)
ipx (Novell IPX)
netrom (AMPR Packet Radio)

For setting VLAN and bridge, Previously, the script that set uplxcbr0 looked around on the host's network, and picked the first 10.0.*.1 address for the bridge that was available.

- MTU (mtu) indicates Maximum Transmission Unit which provides the details on size of packet. In the above example it is 1500 Bytes.
- The inet address indicates IP address : eg: 10.100.53.195 based on IP version 4 and called as IPv4.
- Netmask is used for identifying the network address from IP address. Eg: 255.255.252.0
- The broadcast address is used for sending the packets all nodes in the current network. Eg: 10.100.55.255
- The internet protocol version 6 means IPv6 address is 128 bit address: eg: fe80::116c:13cf:a8bc:19e4
- Ethernet address is 48 bit address. Eg: c8:d9:d2:29:c5:d4
- In the above figure, **lo** indicates local host with loopback address. It is used to send packets to same system. Loopback IP address is always 127.0.0.1 in any system with net mask 255.0.0.0
- For lxcbr0: inet : 10.0.3.1 netmask: 255.255.255.0 broadcast: 0.0.0.0

(b) Record the following information from your computer.

For interface Eth0 or eno1

IPv4 address : .....…
Subnet Mask: .....…
Broadcast address: ……..
IPv6 address: …….
Ethernet address: ……..

For interface local host lo

IPv4 address : .....…
Subnet Mask: .....…
IPv6 address: …….

For interface anything like lxcbr0 (if present)

IPv4 address : .....…
Subnet Mask: .....…
Broadcast address: ……..
Ethernet address: ……..

Gateway: A gateway is a network node that forms a passage between two networks operating with different transmission protocols. The most common type of gateways, the network gateway operates at layer 3, i.e. network layer of the OSI (open systems interconnection) model. However, depending upon the functionality, a gateway can operate at any of the seven layers of OSI model. It acts as the entry – exit point for a network since all traffic that flows across the networks should pass through the gateway. Only the internal traffic between the nodes of a LAN does not pass through the gateway.

(c) To find gateways configured in any system, following commands can be used:
(1) ip route
(2) route -n
(3) netstat -rn

Execute all three commands. Add screen shots of the screen. And note down following things
Default Gateway for interface: eno1/eth0
Gateway for interface …….:
Gateway for interface …….:
Gateway for interface …….:

(d) Compare the TCP/IP configuration of this computer to others on the LAN
If this computer is on a LAN, compare the information of several machines.
Are there any similarities? _____
What is similar about the IP addresses? _____
What is similar about the default gateways? _____

The IP addresses should share the same network portion. All machines in the LAN should share the same default gateway. Record a couple of the IP Addresses:

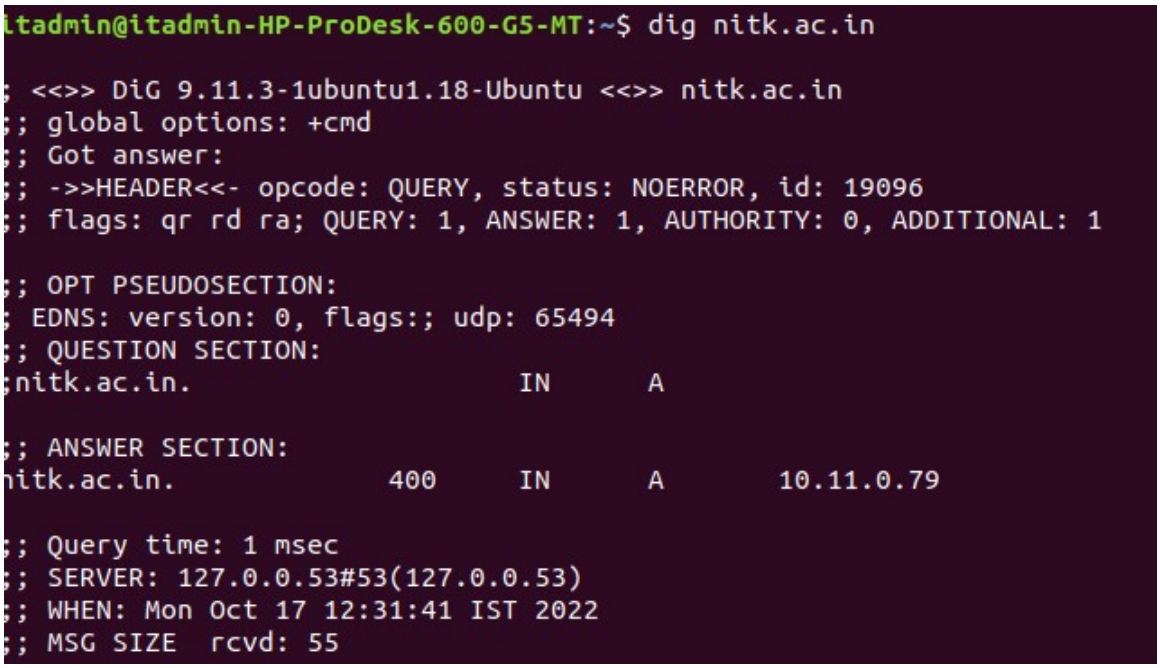
(e) DNS and dig Command

Domain Name System (DNS) : The process of DNS resolution involves converting a hostname (such as www.example.com) into a computer-friendly IP address (such as 192.168.1.1).

The dig The **dig** command in Linux is used to gather DNS information. It stands for Domain Information Groper, and it collects data about Domain Name Servers. The **dig** command is helpful for troubleshooting DNS problems, but is also used to display DNS information.

$dig nitk.ac.in

Here the Answer section shows the IP address for the url nitk.ac.in



$dig google.com

Here answer section shows the IP address for url google.com

```
itadmin@itadmin-HP-ProDesk-600-G5-MT:~$ dig google.com

; <<>> DiG 9.11.3-1ubuntu1.18-Ubuntu <<>> google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 39840
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;google.com.                    IN      A

;; ANSWER SECTION:
google.com.             192     IN      A       142.251.42.110

;; Query time: 0 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Mon Oct 17 12:32:03 IST 2022
;; MSG SIZE  rcvd: 55
```

Use dig command to explore IP address of some urls and note down the IP address.

II . USING PING AND TRACERT FROM A WORKSTATION

PING (Packet Internet Groper) command is used to check the network connectivity between host and server/host. This command takes as input the IP address or the URL and sends a data packet to the specified address with the message “PING” and get a response from the server/host this time is recorded which is called latency. Fast ping low latency means faster connection. Ping uses **ICMP (Internet Control Message Protocol)** to send an **ICMP echo message** to the specified host if that host is available then it sends **ICMP reply message**. Ping is generally measured in millisecond every modern operating system has this ping pre-installed.

(a) ping the IP address of another computer

$ping *ipaddress*

This may enter to infinite loop for sending and receiving packet.

$ping -c 5 ipaddress

Here sending of packets is controlled with -c and only 5 packets will be sent.

If a second networked computer is available, try to ping the IP address of the second machine.

Note the results. _____

```
itadmin@itadmin-HP-ProDesk-600-G5-MT:~$ ping -c 5 10.0.3.1
PING 10.0.3.1 (10.0.3.1) 56(84) bytes of data.
64 bytes from 10.0.3.1: icmp_seq=1 ttl=64 time=0.057 ms
64 bytes from 10.0.3.1: icmp_seq=2 ttl=64 time=0.063 ms
64 bytes from 10.0.3.1: icmp_seq=3 ttl=64 time=0.065 ms
64 bytes from 10.0.3.1: icmp_seq=4 ttl=64 time=0.064 ms
64 bytes from 10.0.3.1: icmp_seq=5 ttl=64 time=0.063 ms

--- 10.0.3.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4077ms
rtt min/avg/max/mdev = 0.057/0.062/0.065/0.007 ms
itadmin@itadmin-HP-ProDesk-600-G5-MT:~$
```

64 bytes is received from destination and time required to receive is mentioned in milliseconds. Total 5 packets are sent and finally mentions 0% packet loss, round trip time (rtt) with various metrics.

(b) ping the IP address of the default gateway

Try to ping the IP address of the default gateway if one was listed in the last exercise. If the ping is successful, it means there is physical connectivity to the router on the local network and probably the rest of the world.

(c) ping the Loopback IP address of this computer

Type the following command: ping 127.0.0.1

The 127.0.0.0 network is reserved for loopback testing. If the ping is successful, then

TCP/IP is properly installed and functioning on this computer.

Was the ping successful? _____

If not, perform appropriate troubleshooting.

(d) ping the nitk website

ping nitk.ac.in

The first output line shows the Fully Qualified Domain Name (FQDN) followed by the IP address.

A Domain Name Service (DNS) server somewhere in the network was able to resolve the name to an IP address. DNS servers resolve domain names, not hostnames, to IP addresses. Without

this name resolution, the ping would have failed because TCP/IP only understands valid IP addresses. It would not be possible to use the web browser without this name resolution.

With DNS, connectivity to computers on the Internet can be verified using a familiar web address, or domain name, without having to know the actual IP address. If the nearest DNS server does not know the IP address, the server asks a DNS server higher in the Internet structure.

(e) ping any other website

Notice that the DNS server was able to resolve the name to an IP address, but there is no response. Some Microsoft and Cisco routers are configured to ignore ping requests. This is a frequently implemented security measure. Ping some other domain names and record the results.

(f) Type traceroute www.google.com and press Enter.

```
itadmin@itadmin-HP-ProDesk-600-G5-MT:~$ traceroute google.com
traceroute to google.com (172.217.167.174), 30 hops max, 60 byte packets
 1  * * *
 2  10.10.54.4 (10.10.54.4)  0.212 ms  0.185 ms  0.162 ms
 3  210.212.194.2 (210.212.194.2)  2.090 ms  2.067 ms  2.045 ms
 4  * * *
 5  * * *
 6  72.14.218.250 (72.14.218.250)  17.467 ms  16.254 ms  16.216 ms
 7  * * *
 8  142.250.224.6 (142.250.224.6)  15.861 ms 108.170.253.97 (108.170.253.97)  17.873 ms 74.125.242.129 (74.125.242.129)  19.464 ms
 9  108.170.253.105 (108.170.253.105)  17.769 ms 108.170.253.122 (108.170.253.122)  16.302 ms 108.170.253.105 (108.170.253.105)  17.740 ms
10  209.85.251.242 (209.85.251.242)  52.387 ms 172.253.73.149 (172.253.73.149)  19.267 ms 209.85.251.242 (209.85.251.242)  61.863 ms
11  108.170.248.161 (108.170.248.161)  47.305 ms  47.290 ms 216.239.54.93 (216.239.54.93)  51.363 ms
12  108.170.232.203 (108.170.232.203)  44.136 ms 108.170.232.205 (108.170.232.205)  49.749 ms 108.170.232.203 (108.170.232.203)  53.470 ms
13  bom12s01-in-f14.1e100.net (172.217.167.174)  52.286 ms 108.170.232.203 (108.170.232.203)  53.429 ms 108.170.232.205 (108.170.232.205)  51.764 ms
itadmin@itadmin-HP-ProDesk-600-G5-MT:~$
```

tracert is TCP/IP abbreviation for trace route. The preceding figure shows the successful result when running tracert from Bavaria in Germany. The first output line shows the FQDN followed by the IP address. Therefore, a DNS server was able to resolve the name to an IP address. Then there are listings of all routers the tracert requests had to pass through to get to the destination. tracert uses the same echo requests and replies as the ping command but in a slightly different way. Observe that tracert actually contacted each router three times. Compare the results to determine the consistency of the route. Notice in the above example that there were relatively long delays after router 10, possibly due to congestion. The main thing is that there seems to be relatively consistent connectivity.

Each router represents a point where one network connects to another network and the packet was forwarded through.

(g) trace route other IP addresses or domain addresses and record the results

(h) Trace a local host name or IP address

III Lab 1 Reflection

Based on observations, what can be deduced about the following results taken from three computers connected to one switch?

Computer 1

IP Address: 192.168.12.113

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.12.1

Computer 2

IP Address: 192.168.12.205

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.12.1

Computer 3

IP Address: 192.168.112.97

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.12.1

Should they be able to talk to each other? _____

Are they all on the same network?_____

Why or why not? _____

If something is wrong, what is most likely the problem? _____

What is the purpose of using ping command?

What is the purpose of using traceroute command?