

**Department of Computer Engineering**

**Batch: A1      Roll No.: 16010123012**  
**Experiment / assignment / tutorial No.: 02**  
**Grade: AA / AB / BB / BC / CC / CD /DD**  
**Signature of the Staff In-charge with date**

**Experiment No. 2**

**Title: Study of basic network administration commands and network configuration.**

**AIM:** Study networking commands –ping, traceroute, nslookup, arp, rarp, netstat, telnet.

**Expected Outcome of Experiment:**

1. Understand the fundamentals of network administration.

**Books/ Journals/ Websites referred:**

1. *Linux Lab - Open source Technology : Ambavade –Dreamtech*
2. <http://manpages.ubuntu.com/manpages/trusty/man8/rarp.8.html>
3. <http://computernetworkingnotes.com/comptia-n-plus-study-guide/network-tool-command.html>

**Pre Lab/ Prior Concepts:** Computer Network

**New Concepts to be learned:** Command line operation to handle networks.

Computers are connected in a network to exchange information or resources each other. Two or more computer connected through network media called computer network. There are number of network devices or media are involved to form computer network. Computer loaded with Windows and Linux Operating System can also be a part of network whether it is small or large network by its multitasking and multiuser natures. Maintaining of system and network up and running is a task of System / Network Administrator's job.

Frequently used network configuration and troubleshoot commands in Linux/Windows are as follows:

## 1. IFCONFIG/ IPCONFIG

ifconfig (interface configurator) command is use 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 assign to interface and also MTU (Maximum transmission unit) size.

ifconfig with interface (eth0) command only shows specific interface details like IP Address, MAC Address etc. with -a options will display all available interface details if it is disable also.

Syntax: `# ifconfig eth0`

**To enable or disable** specific Interface, we use example command as follows.

Enable eth0: `# ifup eth0`

Disable eth0: `# ifdown eth0`

To Setting MTU Size:

By default, MTU size is 1500. We can set required MTU size with below command.

Replace XXXX with size.

Syntax: `# ifconfig eth0 mtu XXXX`

Set Interface in Promiscuous mode.

Network interface only received packets belongs to that particular NIC. If you put interface in promiscuous mode, it will receive all the packets. This is very useful to capture packets and analyse later. For this you may require superuser access.

Syntax: `# ifconfig eth0 - promisc`

## 2. PING

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PING (Packet INternet Groper) 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.

It verifies IP-level connectivity to another TCP/IP computer by sending Internet Control Message Protocol (ICMP) Echo Request messages. The receipt of corresponding Echo Reply messages are displayed, along with round-trip times. Ping is the primary TCP/IP command used to troubleshoot connectivity, reachability, and name resolution.

`ping [-c count] [-i wait] [-l preload][-s packetsize] host`

**-c count**

Stop after sending (and receiving) count ECHO\_RESPONSE packets.

**-i wait**

Wait wait seconds between sending each packet. The default is to wait for one second between each packet. This option is incompatible with the -f option.

**-l preload**

If preload is specified, ping sends that many packets as fast as possible before falling into its normal mode of behavior.

**-s packetsize**

Specifies the number of data bytes to be sent. The default is 56, which translates into 64 ICMP data bytes when combined with the 8 bytes of ICMP header data.

PING Command Example:

```
# ping 4.2.2.2
```

```
# ping -c 5 www.tecmint.com
```

### **3. TRACEROUTE/ TRACERT**

tracert is a network troubleshooting utility which shows number of hops taken to reach destination also determine packets traveling path. Below we are tracing route to global DNS server IP Address and able to reach destination also shows path of that packet is traveling.

Syntax:

**tracert [-d] [-h MaximumHops] [-j HostList] [-w Timeout] [TargetName]**

#### **Parameters**

**-d** : Prevents tracert from attempting to resolve the IP addresses of intermediate routers to

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their names. This can speed up the display of tracer results.

**-h:** MaximumHops Specifies the maximum number of hops in the path to search for the target (destination). The default is 30 hops.

**-j:** HostList Specifies that Echo Request messages use the Loose Source Route option in the IP header with the set of intermediate destinations specified in HostList. The HostList is a series of IP addresses (in dotted decimal notation) separated by spaces.

**-w :** Timeout Specifies the amount of time in milliseconds to wait for the ICMP Time Exceeded or Echo Reply message corresponding to a given Echo Request message to be received. If not received within the time-out, an asterisk (\*) is displayed. The default time-out is 4000 (4 seconds).

#### 4. NETSTAT command

Displays active TCP connections, ports on which the computer is listening, Ethernet statistics, the IP routing table, IPv4 statistics (for the IP, ICMP, TCP, and UDP protocols), and IPv6 statistics (for the IPv6, ICMPv6, TCP over IPv6, and UDP over IPv6 protocols).

Netstat provides statistics for the following:

**Proto** - The name of the protocol (TCP or UDP).

**Local Address** - The IP address of the local computer and the port number being used. The name of the local computer that corresponds to the IP address and the name of the port is shown unless the -n parameter is specified. If the port is not yet established, the port number is shown as an asterisk (\*).

**Foreign Address** - The IP address and port number of the remote computer to which the socket is connected. The names that correspond to the IP address and the port are shown unless the -n parameter is specified. If the port is not yet established, the port number is shown as an asterisk (\*).

**(state)** Indicates the state of a TCP connection. The possible states are as follows:

CLOSE\_WAIT  
CLOSED  
ESTABLISHED  
FIN\_WAIT\_1  
FIN\_WAIT\_2  
LAST\_ACK  
LISTEN  
SYN\_RECEIVED  
SYN\_SEND  
TIMED\_WAIT

Syntax

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**netstat [-a] [-e] [-n] [-o] [-p Protocol] [-r] [-s] [Interval]**

**Parameters**

Used without parameters, netstat displays active TCP connections.

-a Displays all active TCP connections and the TCP and UDP ports on which the computer is listening.

-e Displays Ethernet statistics, such as the number of bytes and packets sent and received. This parameter can be combined with -s.

-n Displays active TCP connections, however, addresses and port numbers are expressed numerically, and no attempt is made to determine names.

-o Displays active TCP connections and includes the process ID (PID) for each connection.

-p Shows connections for the protocol specified by Protocol.

-s Displays statistics by protocol. By default, statistics are shown for the TCP, UDP, ICMP, and IP protocols. If the IPv6 protocol for Windows XP is installed, statistics are shown for the TCP over IPv6, UDP over IPv6, ICMPv6, and IPv6 protocols. The -p parameter can be used to specify a set of protocols.

-r Displays the contents of the IP routing table.

Netstat (Network Statistic) command display connection info, routing table information etc. To displays routing table information use option as -r.

# netstat -r

## **5. DIG**

Dig (domain information groper) query DNS related information like A Record, CNAME, MX Record etc. This command mainly uses to troubleshoot DNS related query.

# dig www. Ipadress.com

## **6. NSLOOKUP**

The name "nslookup" means "name server lookup". nslookup is a network administration command-line tool available for many computer operating systems for querying the Domain Name System (DNS) to obtain domain name or IP address mapping or for any other specific DNS record. It displays information from Domain Name System (DNS) name servers.

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nslookup command also use to find out DNS related query.

**Example:**

```
C:\Documents and Settings\sysadm>nslookup itu.dk
Server: ns3.inet.tele.dk
Address: 193.162.153.164
```

Non-authoritative answer:

```
Name: itu.dk
Address: 130.226.133.2
# nslookup www. Google.com
```

## 7. ROUTE

Route command also shows and manipulate ip routing table. To see default routing table in Linux, type the following command.

```
# route
```

## 8. ARP

When we need an Ethernet (MAC) address we can use arp(address resolution protocol). In other words it shows the physical address of an host.

Syntax

```
arp [-a [InetAddr] [-N IfaceAddr]] [-g [InetAddr] [-N IfaceAddr]] [-d InetAddr  
[IfaceAddr]] [-s InetAddr EtherAddr [IfaceAddr]]
```

Parameters

Used without parameters, ping displays help

-a [InetAddr] [-N IfaceAddr] Displays current ARP cache tables for all interfaces.

-g [InetAddr] [-N IfaceAddr] Identical to -a.

-d InetAddr [IfaceAddr] Deletes an entry with a specific IP address, where InetAddr is the IP address.

-s InetAddr EtherAddr [IfaceAddr] Adds a static entry to the ARP cache that resolves the IP address InetAddr to the physical address EtherAddr.

To add a static ARP cache entry to the table for a specific interface, use the IfaceAddr parameter where IfaceAddr is an IP address assigned to the interface

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ARP (Address Resolution Protocol) is useful to view / add the contents of the kernel's ARP tables. To see default table use the command as.

# arp -e

Address	HWtype	HWaddress	Flags	Mask	Iface
192.168.50.1	ether	00:50:56:c0:00:08	C		eth0

## 9 . ETHTOOL

ethtool is a replacement of mii-tool. It is to view, setting speed and duplex of your Network Interface Card (NIC). You can set duplex permanently in /etc/sysconfig/network-scripts/ifcfg-eth0 with ETHTOOL\_OPTS variable.

Syntax: # ethtool eth0

## 10. TELNET

The telnet command is used to communicate with another host using the TELNET protocol. If telnet is invoked without the host argument, it enters command mode, indicated by its prompt (telnet> ) In this mode, it accepts and executes the commands listed below. If it is invoked with arguments, it performs an open command with those arguments.

To login to a remote machine, use this syntax:

% **telnet** <hostname>

The options are as follows:

- 8 Specifies an 8-bit data path. This causes an attempt to negotiate the TELNET BINARY option on both input and output.
- E Stops any character from being recognized as an escape character.
- K Specifies no automatic login to the remote system.

## 11. HOSTNAME

hostname is to identify in a network. Execute hostname command to see the hostname of your box. You can set hostname permanently in /etc/sysconfig/network. Need to reboot box once set a proper hostname.

# hostname

## 12. SYSTEMINFO

Display information about a system.

### IMPLEMENTATION:

#### 1. IPCONFIG

```
C:\>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::34dd:6a48:4a88:4ba8%6
    IPv4 Address. . . . . : 172.17.14.25
    Subnet Mask . . . . . : 255.255.254.0
    Default Gateway . . . . . : 172.17.15.254
```

#### 2. PING

```
C:\>ping 172.17.14.25

Pinging 172.17.14.25 with 32 bytes of data:
Reply from 172.17.14.25: bytes=32 time<1ms TTL=128
Reply from 172.17.14.25: bytes=32 time<1ms TTL=128
Reply from 172.17.14.25: bytes=32 time<1ms TTL=128
Reply from 172.17.14.25: bytes=32 time<1ms TTL=128

Ping statistics for 172.17.14.25:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

### 3. TRACEROUTE/ TRACERT

```
C:\>tracert -d
A target name or address must be specified.

Usage: tracert [-d] [-h maximum_hops] [-j host-list] [-w timeout]
              [-R] [-S srcaddr] [-4] [-6] target_name

Options:
    -d                Do not resolve addresses to hostnames.
    -h maximum_hops   Maximum number of hops to search for target.
    -j host-list       Loose source route along host-list (IPv4-only).
    -w timeout         Wait timeout milliseconds for each reply.
    -R                Trace round-trip path (IPv6-only).
    -S srcaddr         Source address to use (IPv6-only).
    -4                Force using IPv4.
    -6                Force using IPv6.

C:\>tracert www.google.com

Tracing route to www.google.com [142.251.220.36]
over a maximum of 30 hops:

  0  1 ms    1 ms    1 ms  172.17.15.254
  1  <1 ms   <1 ms   <1 ms  172.17.52.242
  2  <1 ms   <1 ms   <1 ms  172.30.250.250
  3  2 ms    1 ms    1 ms  14.142.143.97.static-mumbai.vsnl.net.in [14.142.143.97]
  4  2 ms    2 ms    2 ms  115.113.165.98.static-mumbai.vsnl.net.in [115.113.165.98]
  5  3 ms    2 ms    2 ms  142.251.225.9
  6  6 ms    3 ms    1 ms  142.251.70.57
  7  16 ms   6 ms    2 ms  pnbomb-ba-in-f4.1e100.net [142.251.220.36]

Trace complete.
```

### 4. DIG

```
C:\>dig
'dig' is not recognized as an internal or external command,
operable program or batch file.
```

## 5. NETSTAT

```
C:\>netstat
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	127.0.0.1:11300	16DCEB217-15:49913	ESTABLISHED
TCP	127.0.0.1:49913	16DCEB217-15:11300	ESTABLISHED
TCP	172.17.14.25:49823	4.213.25.241:https	ESTABLISHED
TCP	172.17.14.25:50101	se-in-f188:5228	ESTABLISHED
TCP	172.17.14.25:50791	23.217.111.25:https	CLOSE_WAIT
TCP	172.17.14.25:50792	104.208.16.92:https	CLOSE_WAIT
TCP	172.17.14.25:50794	204.79.197.254:https	CLOSE_WAIT
TCP	172.17.14.25:50799	150.171.31.254:https	CLOSE_WAIT
TCP	172.17.14.25:50800	204.79.197.222:https	CLOSE_WAIT
TCP	172.17.14.25:50801	4.150.240.254:https	CLOSE_WAIT
TCP	172.17.14.25:50811	pnbomb-bk-in-f14:https	ESTABLISHED
TCP	172.17.14.25:50812	pnbomb-bb-in-f14:https	ESTABLISHED
TCP	172.17.14.25:50813	pnbomb-bp-in-f3:https	ESTABLISHED
TCP	172.17.14.25:50821	bom12s12-in-f10:https	ESTABLISHED
TCP	172.17.14.25:50824	bom12s20-in-f10:https	ESTABLISHED
TCP	172.17.14.25:50827	pnbomb-bp-in-f3:https	ESTABLISHED
TCP	172.17.14.25:50867	bom12s19-in-f5:https	ESTABLISHED
TCP	172.17.14.25:50900	pnbomb-bp-in-f10:https	ESTABLISHED
TCP	172.17.14.25:50920	bom12s19-in-f10:https	ESTABLISHED
TCP	172.17.14.25:50973	bom12s16-in-f10:https	ESTABLISHED
TCP	172.17.14.25:50975	pnbomb-bo-in-f10:https	TIME_WAIT
TCP	172.17.14.25:50976	sd-in-f84:https	TIME_WAIT
TCP	172.17.14.25:50986	4.1.82.185:https	ESTABLISHED

## 6. NSLOOKUP

```
C:\>nslookup
Default Server:  svvpdc.svv.local
Address:  172.31.0.25

C:\>nslookup google.com
Server:  svvpdc.svv.local
Address:  172.31.0.25

Non-authoritative answer:
Name:  google.com
Addresses:  2404:6800:4009:830::200e
           142.251.42.46
```

## 7. ROUTE

```
C:\>route PRINT
=====
Interface List
  6...44 8a 5b 57 26 7c .....Realtek PCIe GbE Family Controller
  1.....Software Loopback Interface 1
=====

IPv4 Route Table
=====
Active Routes:
Network Destination        Netmask          Gateway          Interface        Metric
0.0.0.0                    0.0.0.0          172.17.15.254    172.17.14.25     281
127.0.0.0                  255.0.0.0        On-link          127.0.0.1        331
127.0.0.1                  255.255.255.255  On-link          127.0.0.1        331
127.255.255.255            255.255.255.255  On-link          127.0.0.1        331
172.17.14.0                255.255.254.0    On-link          172.17.14.25     281
172.17.14.25               255.255.255.255  On-link          172.17.14.25     281
172.17.15.255              255.255.255.255  On-link          172.17.14.25     281
224.0.0.0                  240.0.0.0        On-link          127.0.0.1        331
224.0.0.0                  240.0.0.0        On-link          172.17.14.25     281
255.255.255.255            255.255.255.255  On-link          127.0.0.1        331
255.255.255.255            255.255.255.255  On-link          172.17.14.25     281
=====
Persistent Routes:
Network Address            Netmask          Gateway Address  Metric
0.0.0.0                    0.0.0.0          172.17.15.254    Default
=====

IPv6 Route Table
=====
Active Routes:
If Metric Network Destination      Gateway
1    331 ::1/128                      On-link
6    281 fe80::/64                    On-link
6    281 fe80::34dd:6a48:4a88:4ba8/128
                                      On-link
1    331 ff00::/8                      On-link
6    281 ff00::/8                      On-link
=====
Persistent Routes:
None
```

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```

C:\>route PRINT -4
=====
Interface List
  6...44 8a 5b 57 26 7c .....Realtek PCIe GbE Family Controller
  1.....Software Loopback Interface 1
=====

IPv4 Route Table
=====
Active Routes:
Network Destination        Netmask          Gateway          Interface        Metric
    0.0.0.0                0.0.0.0        172.17.15.254    172.17.14.25     281
    127.0.0.0              255.0.0.0           On-link          127.0.0.1       331
    127.0.0.1             255.255.255.255     On-link          127.0.0.1       331
  127.255.255.255         255.255.255.255     On-link          127.0.0.1       331
    172.17.14.0            255.255.254.0       On-link          172.17.14.25     281
    172.17.14.25           255.255.255.255     On-link          172.17.14.25     281
    172.17.15.255          255.255.255.255     On-link          172.17.14.25     281
    224.0.0.0              240.0.0.0           On-link          127.0.0.1       331
    224.0.0.0              240.0.0.0           On-link          172.17.14.25     281
  255.255.255.255         255.255.255.255     On-link          127.0.0.1       331
  255.255.255.255         255.255.255.255     On-link          172.17.14.25     281
=====
Persistent Routes:
Network Address          Netmask  Gateway Address  Metric
    0.0.0.0                0.0.0.0    172.17.15.254   Default
=====
  
```

8. ARP

```

C:\>arp -a

Interface: 172.17.14.25 --- 0x6
 Internet Address      Physical Address      Type
 172.17.15.254         b0-aa-77-66-d1-41     dynamic
 172.17.15.255         ff-ff-ff-ff-ff-ff     static
 224.0.0.2             01-00-5e-00-00-02     static
 224.0.0.22            01-00-5e-00-00-16     static
 224.0.0.251           01-00-5e-00-00-fb     static
 224.0.0.252           01-00-5e-00-00-fc     static
 239.193.0.1           01-00-5e-41-00-01     static
 239.193.0.2           01-00-5e-41-00-02     static
 239.193.0.7           01-00-5e-41-00-07     static
 239.255.255.250       01-00-5e-7f-ff-fa     static
 255.255.255.255       ff-ff-ff-ff-ff-ff     static
  
```

9. ETHTOOL

```
C:\>ethool  
'ethool' is not recognized as an internal or external command,  
operable program or batch file.
```

```
C:\>ethtool eth0  
'ethtool' is not recognized as an internal or external command,  
operable program or batch file.
```

10. TELNET

```
C:\>telnet Aryan  
'telnet' is not recognized as an internal or external command,  
operable program or batch file.
```

11. HOSTNAME

```
C:\>hostname  
16DCEB217-15
```

```
C:\>hostname  
Aryan
```

12. GETMAC

```
C:\>getmac  
  
Physical Address      Transport Name  
=====
```

44-8A-5B-57-26-7C	\Device\Tcpip_{385D4BE6-7076-433C-AC9F-6D42681B3D4C}
-------------------	--

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**13. SYSTEMINFO**

```

C:\>systeminfo

Host Name:                            16DCEB217-15
OS Name:                              Microsoft Windows 10 Pro for Workstations
OS Version:                           10.0.19045 N/A Build 19045
OS Manufacturer:                     Microsoft Corporation
OS Configuration:                    Member Workstation
OS Build Type:                         Multiprocessor Free
Registered Owner:                     ROB-03
Registered Organization:
Product ID:                            00391-90090-00000-AA791
Original Install Date:                 15-02-2024, 14:48:18
System Boot Time:                     31-07-2025, 14:02:23
System Manufacturer:                  LENOVO
System Model:                          10ASA011IG
System Type:                           x64-based PC
Processor(s):                          1 Processor(s) Installed.
                                      [01]: Intel64 Family 6 Model 60 Stepping 3 GenuineIntel ~3700 Mhz
BIOS Version:                         LENOVO FCKT50AUS, 03-04-2014
Windows Directory:                   C:\WINDOWS
System Directory:                     C:\WINDOWS\system32
Boot Device:                          \Device\HarddiskVolume2
System Locale:                         en-us;English (United States)
Input Locale:                         00004009
Time Zone:                            (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Total Physical Memory:                 8,095 MB
Available Physical Memory:             3,684 MB
Virtual Memory: Max Size:              9,375 MB
Virtual Memory: Available:             4,673 MB
Virtual Memory: In Use:                 4,702 MB
Page File Location(s):                 C:\pagefile.sys
Domain:                               SWV.local
Logon Server:                          \\SVVPDC
Hotfix(s):                             18 Hotfix(s) Installed.
                                      [01]: KB5056578
                                      [02]: KB5034468
                                      [03]: KB5011048
                                      [04]: KB5015684
                                      [05]: KB5062554
                                      [06]: KB5032907
                                      [07]: KB5034224
                                      [08]: KB5036447
                                      [09]: KB5037018
                                      [10]: KB5039336
                                      [11]: KB5041579
                                      [12]: KB5043935
                                      [13]: KB5043130
                                      [14]: KB5046823
                                      [15]: KB5050388
                                      [16]: KB5052916
                                      [17]: KB5054682
                                      [18]: KB5063706
Network Card(s):                       1 NIC(s) Installed.
                                      [01]: Realtek PCIe GbE Family Controller
                                          Connection Name: Ethernet
                                          DHCP Enabled:    No
                                          IP address(es)
                                          [01]: 172.17.14.25
                                          [02]: fe80::34dd:6a48:4a88:4ba8
Hyper-V Requirements:                  VM Monitor Mode Extensions: Yes
                                          Virtualization Enabled In Firmware: No
                                          Second Level Address Translation: Yes
                                          Data Execution Prevention Available: Yes
  
```

### **CONCLUSION:**

I have successfully completed the experiment on basic network administration commands and network configuration. Through this experiment, I learned to use essential networking commands such as ping, traceroute, nslookup, netstat, arp, route, telnet, and others to test connectivity, troubleshoot network issues, analyze routing tables, and obtain system and DNS information.

### **Post Lab Questions**

- 1. Give details of minimum 5 commands which are not included in the write-up.**
  - a. curl - Used to fetch or test data from websites and servers
  - b. wget – Helps download files directly from the internet
  - c. ssh – Lets us securely log in and work on another computer over the network
  - d. ftp – Transfers files between local and remote systems
  - e. scp – Securely copies files from one computer to another
  
- 2. Give the reason why some commands are not working in the Lab.**
  - a. They require administrator/sudo rights to run.
  - b. The service isn't running on the target machine (for example, telnet)
  - c. Firewall or network restrictions may be blocking them.