Practical No. 1

AIM: Using, linux-terminal or Windows-cmd, execute following networking commands and note the output: ping, traceroute, netstat, arp, ipconfig, Getmac, hostname, NSLookUp, pathping, SystemInfo.

PROGRAM:

1. **ping:** ping is a computer network administration software utility used to test the reachability of a host on an Internet Protocol It is available for virtually all operating systems that have networking capability, including most embedded network administration software.

```
C:\Users\rdnc2>ping www.google.com

Pinging www.google.com [142.250.182.196] with 32 bytes of data:
Reply from 142.250.182.196: bytes=32 time=5ms TTL=58
Reply from 142.250.182.196: bytes=32 time=4ms TTL=58
Reply from 142.250.182.196: bytes=32 time=4ms TTL=58
Reply from 142.250.182.196: bytes=32 time=4ms TTL=58

Ping statistics for 142.250.182.196:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 5ms, Average = 4ms
```

2. **traceroute:** The traceroute command(tracert) is a utility designed for displaying the time it takes for a packet of information to travel between a host system and the final destination system. This command returns a list of the hops that the data packets take along their path along their way to the destination.

```
C:\Users\rdnc2>tracert www.toolsvilla.com

Tracing route to www.toolsvilla.com [172.66.40.222]
over a maximum of 30 hops:

  1     1 ms    <1 ms    <1 ms  172.16.14.1
  2     3 ms     1 ms     2 ms  103.141.110.254
  3     3 ms     1 ms     2 ms  210.79.152.29
  4     4 ms     3 ms     3 ms  103.250.39.33
  5     3 ms     4 ms     4 ms  103.184.155.253
  6     *        *        *     Request timed out.
  7     4 ms     *        4 ms  162.158.226.48
  8    10 ms     8 ms     8 ms  162.158.226.67
  9     4 ms     3 ms     3 ms  172.66.40.222

Trace complete.
```

3. **netstat:** The netstat provides statistics about all active connections so you that we can find out which computers or networks a PC is connected to Some of the netstat commands commonly used are:

(i) **netstat-in command**

This netstat function shows the state of all configured interfaces.

```
C:\WINDOWS\system32>netstat -in

Displays protocol statistics and current TCP/IP network connections.

NETSTAT [-a] [-b] [-e] [-f] [-n] [-o] [-p proto] [-r] [-s] [-t] [-x] [-y] [interval]

  -a            Displays all connections and listening ports.
  -b            Displays the executable involved in creating each connection or
                listening port. In some cases well-known executables host
                multiple independent components, and in these cases the
                sequence of components involved in creating the connection
                or listening port is displayed. In this case the executable
                name is in [] at the bottom, on top is the component it called,
                and so forth until TCP/IP was reached. Note that this option
                can be time-consuming and will fail unless you have sufficient
                permissions.
  -e            Displays Ethernet statistics. This may be combined with the -s
                option.
  -f            Displays Fully Qualified Domain Names (FQDN) for foreign
                addresses.
  -n            Displays addresses and port numbers in numerical form.
  -o            Displays the owning process ID associated with each connection.
  -p proto      Shows connections for the protocol specified by proto; proto
                may be any of: TCP, UDP, TCPv6, or UDPv6.  If used with the -s
                option to display per-protocol statistics, proto may be any of:
                IP, IPv6, ICMP, ICMPv6, TCP, TCPv6, UDP, or UDPv6.
  -q            Displays all connections, listening ports, and bound
                nonlistening TCP ports. Bound nonlistening ports may or may not
                be associated with an active connection.
  -r            Displays the routing table.
  -s            Displays per-protocol statistics.  By default, statistics are
                shown for IP, IPv6, ICMP, ICMPv6, TCP, TCPv6, UDP, and UDPv6;
                the -p option may be used to specify a subset of the default.
  -t            Displays the current connection offload state.
  -x            Displays NetworkDirect connections, listeners, and shared
                endpoints.
  -y            Displays the TCP connection template for all connections.
                Cannot be combined with the other options.
```

(ii) **netstat-a command**

The netstat-a command shows the state of all sockets.

```
C:\WINDOWS\system32>netstat -a

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            0:0                    LISTENING
  TCP    0.0.0.0:445            0:0                    LISTENING
  TCP    0.0.0.0:3306           0:0                    LISTENING
  TCP    0.0.0.0:4623           0:0                    LISTENING
  TCP    0.0.0.0:4624           0:0                    LISTENING
  TCP    0.0.0.0:5040           0:0                    LISTENING
  TCP    0.0.0.0:5357           0:0                    LISTENING
  TCP    0.0.0.0:7070           0:0                    LISTENING
  TCP    0.0.0.0:7680           0:0                    LISTENING
  TCP    0.0.0.0:33060          0:0                    LISTENING
  TCP    0.0.0.0:49664          0:0                    LISTENING
  TCP    0.0.0.0:49665          0:0                    LISTENING
  TCP    0.0.0.0:49666          0:0                    LISTENING
  TCP    0.0.0.0:49667          0:0                    LISTENING
  TCP    0.0.0.0:49668          0:0                    LISTENING
  TCP    0.0.0.0:49672          0:0                    LISTENING
  TCP    0.0.0.0:49715          0:0                    LISTENING
  TCP    10.128.0.177:139       0:0                    LISTENING
  TCP    10.128.0.177:49152     0:0                    LISTENING
  TCP    10.128.0.177:53480     relay-048e8b10:https   ESTABLISHED
  TCP    10.128.0.177:53481     167.172.20.8:3333      ESTABLISHED
  TCP    10.128.0.177:53530     20.198.118.190:https   ESTABLISHED
  TCP    10.128.0.177:53567     172-105-129-132:https  CLOSE_WAIT
  TCP    10.128.0.177:53569     mx01:8443              ESTABLISHED
  TCP    10.128.0.177:53601     a23-54-82-234:https    ESTABLISHED
  TCP    10.128.0.177:53681     152.195.38.76:http     CLOSE_WAIT
  TCP    10.128.0.177:53724     a96-17-150-107:https   ESTABLISHED
```

(iii) **netstat-s**

The netstat-s command shows statistics for each protocol(while the netstat -p command shows the statistics for the specified protocol).

```
C:\Users\rdnc2>netstat -s

IPv4 Statistics

  Packets Received                   = 1291113
  Received Header Errors             = 0
  Received Address Errors            = 655
  Datagrams Forwarded                = 6959
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 7978
  Received Packets Delivered         = 1286932
  Output Requests                    = 433324
  Routing Discards                   = 0
  Discarded Output Packets           = 64
  Output Packet No Route             = 31
  Reassembly Required                = 5786
  Reassembly Successful              = 1246
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 322
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 797
```

(iv) **netstat-r**

Another option relevant to performance is the display of the discovered Path Maximum Transmission Unit (PMTU).

```
C:\Users\rdnc2>netstat -r
===========================================================================
Interface List
 19...e0 73 e7 bb fd 72 ......Realtek PCIe GbE Family Controller
 14...0a 00 27 00 00 0e ......VirtualBox Host-Only Ethernet Adapter
  4...ce 47 40 73 58 8f ......Microsoft Wi-Fi Direct Virtual Adapter #3
 12...ee 47 40 73 58 8f ......Microsoft Wi-Fi Direct Virtual Adapter #4
 10...cc 47 40 73 58 31 ......Realtek RTL8822CE 802.11ac PCIe Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0      172.16.14.1    172.16.14.130     25
        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
      172.16.14.0    255.255.254.0         On-link     172.16.14.130    281
    172.16.14.130  255.255.255.255         On-link     172.16.14.130    281
    172.16.15.255  255.255.255.255         On-link     172.16.14.130    281
     192.168.56.0    255.255.255.0         On-link      192.168.56.1    281
     192.168.56.1  255.255.255.255         On-link      192.168.56.1    281
   192.168.56.255  255.255.255.255         On-link      192.168.56.1    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      192.168.56.1    281
        224.0.0.0        240.0.0.0         On-link     172.16.14.130    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      192.168.56.1    281
  255.255.255.255  255.255.255.255         On-link     172.16.14.130    281
===========================================================================
Persistent Routes:
  None
```

4. **arp:** The ARP(Address Resolution Protocol) commands are used to view, display, or modify the details/information in an ARP table/cache.
Some of the common arp commands are as follows
(i) arp-a: This command is used to display the ARP table for a particular It also shows all the entries of the ARP cache or table.

```
C:\Users\rdnc2>arp -a

Interface: 192.168.56.1 --- 0xe
  Internet Address      Physical Address      Type
  192.168.56.255        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
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

(ii) arp-g: Same as the arp-a

```
Interface: 172.16.14.130 --- 0x13
  Internet Address      Physical Address      Type
  169.254.65.53         48-9e-bd-9e-6a-34     dynamic
  172.16.14.1           e0-23-ff-61-cf-ee     dynamic
  172.16.14.8           94-e1-ac-04-92-40     dynamic
  172.16.14.16          bc-32-5f-25-e6-9e     dynamic
  172.16.14.17          e4-24-6c-39-50-84     dynamic
  172.16.14.18          38-af-29-d8-cd-8b     dynamic
  172.16.14.19          38-af-29-d8-d0-0d     dynamic
  172.16.14.21          24-52-6a-d8-5c-fe     dynamic
  172.16.14.23          e4-24-6c-39-50-6c     dynamic
  172.16.14.24          38-af-29-d8-ce-31     dynamic
  172.16.14.25          e4-24-6c-39-46-7b     dynamic
  172.16.14.27          44-47-cc-62-71-28     dynamic
  172.16.14.118         84-a9-3e-92-94-ed     dynamic
```

(iii) arp -d: This command is used to delete an entry from the ARP table for a particular interface. To delete an entry, write arp –d command along with the IP address in a command prompt to be

```
C:\Users\rdnc2>arp -d
The ARP entry deletion failed: The requested operation requires elevation.
```

(iv) arp -s: This command is used to add the static entry in the ARP table, which resolves theInetAddr(IPaddress) to the Ether Addr (physicaladdress). To adda static entry in an ARP table, we write arp –s command along with the IP address and MAC address of the device in a command.

```
C:\Users\rdnc2>arp -s

Displays and modifies the IP-to-Physical address translation tables used by
address resolution protocol (ARP).

ARP -s inet_addr eth_addr [if_addr]
ARP -d inet_addr [if_addr]
ARP -a [inet_addr] [-N if_addr] [-v]

  -a            Displays current ARP entries by interrogating the current
                protocol data.  If inet_addr is specified, the IP and Physical
                addresses for only the specified computer are displayed.  If
                more than one network interface uses ARP, entries for each ARP
                table are displayed.
  -g            Same as -a.
  -v            Displays current ARP entries in verbose mode.  All invalid
                entries and entries on the loop-back interface will be shown.
  inet_addr     Specifies an internet address.
  -N if_addr    Displays the ARP entries for the network interface specified
                by if_addr.
  -d            Deletes the host specified by inet_addr. inet_addr may be
                wildcarded with * to delete all hosts.
  -s            Adds the host and associates the Internet address inet_addr
                with the Physical address eth_addr.  The Physical address is
                given as 6 hexadecimal bytes separated by hyphens. The entry
                is permanent.
  eth_addr      Specifies a physical address.
  if_addr       If present, this specifies the Internet address of the
                interface whose address translation table should be modified.
                If not present, the first applicable interface will be used.
Example:
  > arp -s 157.55.85.212   00-aa-00-62-c6-09  .... Adds a static entry.
  > arp -a                                    .... Displays the arp table.
```

5. **ipconfig:** ipconfig (Internet Protocol CONFIGuration) is used to display and manage the IP address assigned to the In Windows, typing ipconfig without any parameters displays the computer's currently assigned IP, subnet mask and default gateway addresses.

```
C:\Users\rdnc2>ipconfig

Windows IP Configuration


Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::730b:5122:f93c:2181%19
   IPv4 Address. . . . . . . . . . . : 172.16.14.130
   Subnet Mask . . . . . . . . . . . : 255.255.254.0
   Default Gateway . . . . . . . . . : 172.16.14.1

Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::9819:6911:a22b:2f20%14
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Local Area Connection* 3:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 4:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Wi-Fi:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

6. **getmac:** getmac is a Windows command used to display the Media Access Control (MAC) addresses for each network adapter in the computer.

```
C:\Users\rdnc2>getmac

Physical Address    Transport Name
=================== ============================================================
E0-73-E7-BB-FD-72   \Device\Tcpip_{97C83E46-BCE7-4112-B67E-AA74A5E16CD8}
0A-00-27-00-00-0E   \Device\Tcpip_{55DD04FA-FD92-4073-A05F-B6290867CBF1}
CC-47-40-73-58-31   Media disconnected
```

7. **hostname:** A hostname is a label that is assigned to a device connected to a computer network and it is used to identify the device.

```
C:\Users\rdnc2>hostname
RDNC
```

8. **NSlookUp:** Using this command we can find the corresponding IP address or domain name system record. The user can also enter a command for it to do a reverse DNS lookup and find the host name for an IP address that is specified.

```
C:\Users\rdnc2>nslookup
Default Server:  dns.google
Address:  8.8.8.8
```

9. Pathping: This command sends multiple echo Request messages to each router between a source and destination, over a period of time, and then computes results based on the packets returned from each router. It can be used to find the routers or links having network problems.

```
C:\Users\rdnc2>pathping

Usage: pathping [-g host-list] [-h maximum_hops] [-i address] [-n]
                [-p period] [-q num_queries] [-w timeout]
                [-4] [-6] target_name

Options:
    -g host-list     Loose source route along host-list.
    -h maximum_hops  Maximum number of hops to search for target.
    -i address       Use the specified source address.
    -n               Do not resolve addresses to hostnames.
    -p period        Wait period milliseconds between pings.
    -q num_queries   Number of queries per hop.
    -w timeout       Wait timeout milliseconds for each reply.
    -4               Force using IPv4.
    -6               Force using IPv6.
```

10. **SystemInfo:** This command is use to display detailed configuration information about a computer and its operating system, including operating system configuration, security information, product ID, and hardware properties.

```
C:\Users\rdnc2>systeminfo

Host Name:                 RDNC
OS Name:                   Microsoft Windows 11 Home Single Language
OS Version:                10.0.26100 N/A Build 26100
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:          rdnc23_24@outlook.com
Registered Organization:   HP
Product ID:                00356-24691-59527-AAOEM
Original Install Date:     23-12-2024, 11:52:23
System Boot Time:          24-01-2025, 08:26:55
System Manufacturer:       HP
System Model:              HP Slim Desktop S01-pF2xxx
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 151 Stepping 5 GenuineIntel ~2500 Mhz
BIOS Version:              AMI F.31, 14-10-2024
Windows Directory:         C:\WINDOWS
System Directory:          C:\WINDOWS\system32
Boot Device:               \Device\HarddiskVolume1
System Locale:             en-us;English (United States)
Input Locale:              00004009
Time Zone:                 (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Total Physical Memory:     7,880 MB
Available Physical Memory: 2,261 MB
Virtual Memory: Max Size:  32,456 MB
Virtual Memory: Available: 23,617 MB
Virtual Memory: In Use:    8,839 MB
Page File Location(s):     C:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:              \\RDNC
Hotfix(s):                 3 Hotfix(s) Installed.
                           [01]: KB5049622
                           [02]: KB5050009
```

```
Network Card(s):                3 NIC(s) Installed.
                                [01]: Realtek PCIe GbE Family Controller
                                      Connection Name: Ethernet
                                      DHCP Enabled:    Yes
                                      DHCP Server:     172.16.14.1
                                      IP address(es)
                                      [01]: 172.16.14.130
                                      [02]: fe80::730b:5122:f93c:2181
                                [02]: VirtualBox Host-Only Ethernet Adapter
                                      Connection Name: Ethernet 2
                                      DHCP Enabled:    No
                                      IP address(es)
                                      [01]: 192.168.56.1
                                      [02]: fe80::9819:6911:a22b:2f20
                                [03]: Realtek RTL8822CE 802.11ac PCIe Adapter
                                      Connection Name: Wi-Fi
                                      Status:          Media disconnected
Virtualization-based security:  Status: Not enabled
                                App Control for Business policy: Enforced
                                App Control for Business user mode policy: Off
                                Security Features Enabled:
Hyper-V Requirements:           VM Monitor Mode Extensions: Yes
                                Virtualization Enabled In Firmware: Yes
                                Second Level Address Translation: Yes
                                Data Execution Prevention Available: Yes
```