Date: 04/06/2025

Lab Practical #01:

Study of basic networking commands and IP configuration.

Practical Assignment #01:

1. Perform and explain various networking commands listed below:
   i. ipconfig
   ii. ping
   iii. getmac
   iv. systeminfo
   v. traceroute / tracert
   vi. netstat
   vii. nslookup
   viii. hostname
   ix. pathping
   x. arp

1. ipconfig

Description:

It is a command-line utility available in MS Windows operating systems that displays all current network configurations.

No.	Option	Description
1	/all	Display full configuration information.
2	/release	Release the IPv4 address for the specified adapter.
3	/renew	Renew the IPv4 address for the specified adapter.
4	/flushdns	Clears the DNS Resolver cache.
5	/displaydns	Displays the contents of the DNS Resolver cache.

Implementation:

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```
C:\Users\Asus>ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : Neel
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : 52-5A-65-F7-86-2D
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
   Physical Address. . . . . . . . . : 52-5A-65-F7-86-3D
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : MediaTek Wi-Fi 6 MT7921 Wireless LAN Card
   Physical Address. . . . . . . . . : 50-5A-65-F7-86-3D
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::44f1:6130:b0a3:9a9c%3(Preferred)
   IPv4 Address. . . . . . . . . . . : 10.20.64.53(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Lease Obtained. . . . . . . . . . : Wednesday, July 23, 2025 12:22:47
   Lease Expires . . . . . . . . . . : Thursday, July 24, 2025 12:22:46
   Default Gateway . . . . . . . . . : 10.20.1.1
   DHCP Server . . . . . . . . . . . : 10.20.1.1
   DHCPv6 IAID . . . . . . . . . . . : 55597669
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2E-B1-15-AA-50-5A-65-F7-86-3D
   DNS Servers . . . . . . . . . . . : 10.20.1.1
                                       8.8.8.8
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

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```
C:\Users\Asus>ipconfig /release

Windows IP Configuration

No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.

Wireless LAN adapter Local Area Connection* 1:

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

Wireless LAN adapter Local Area Connection* 2:

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

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::44f1:6130:b0a3:9a9c%3
   Default Gateway . . . . . . . . . :
```

```
C:\Users\Asus>ipconfig /renew

Windows IP Configuration

No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.

Wireless LAN adapter Local Area Connection* 1:

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

Wireless LAN adapter Local Area Connection* 2:

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

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::44f1:6130:b0a3:9a9c%3
   IPv4 Address. . . . . . . . . . . : 10.20.64.53
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . : 10.20.1.1
```

```
C:\Users\Asus>ipconfig /flushdns

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.
```

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```
C:\Users\Asus>ipconfig /displaydns

Windows IP Configuration
```

2. ping

Description:

It is a network utility used to test the reachability of a host on an IP Network.

No.	Option	Description
1	-t	Ping the specified host until stopped.
2	-a	Resolve addresses to hostnames.
3	-n count	Number of echo requests to send.
4	-l size	Sends packets with a custom byte size.
5	-4	Forces using IPv4.

Implementation:

```
C:\Users\Asus>ping -t darshan.ac.in

Pinging darshan.ac.in [103.13.112.180] with 32 bytes of data:
Reply from 103.13.112.180: bytes=32 time=17ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120

Ping statistics for 103.13.112.180:
    Packets: Sent = 7, Received = 7, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 16ms, Maximum = 17ms, Average = 16ms
Control-C
^C
C:\Users\Asus>
```

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```
C:\Users\Asus>ping /a darshan.ac.in

Pinging darshan.ac.in [103.13.112.180] with 32 bytes of data:
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=17ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120

Ping statistics for 103.13.112.180:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 16ms, Maximum = 17ms, Average = 16ms

C:\Users\Asus>
```

```
C:\Users\Asus>ping /n 4 darshan.ac.in

Pinging darshan.ac.in [103.13.112.180] with 32 bytes of data:
Reply from 103.13.112.180: bytes=32 time=18ms TTL=120
Reply from 103.13.112.180: bytes=32 time=17ms TTL=120
Reply from 103.13.112.180: bytes=32 time=17ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120

Ping statistics for 103.13.112.180:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 16ms, Maximum = 18ms, Average = 17ms
```

```
C:\Users\Asus>ping /l 64 darshan.ac.in

Pinging darshan.ac.in [103.13.112.180] with 64 bytes of data:
Reply from 103.13.112.180: bytes=64 time=16ms TTL=120
Reply from 103.13.112.180: bytes=64 time=16ms TTL=120
Reply from 103.13.112.180: bytes=64 time=16ms TTL=120
Reply from 103.13.112.180: bytes=64 time=16ms TTL=120

Ping statistics for 103.13.112.180:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 16ms, Maximum = 16ms, Average = 16ms
```

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```
C:\Users\Asus>ping -4 darshan.ac.in

Pinging darshan.ac.in [103.13.112.180] with 32 bytes of data:
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=17ms TTL=120
Reply from 103.13.112.180: bytes=32 time=16ms TTL=120
Reply from 103.13.112.180: bytes=32 time=17ms TTL=120

Ping statistics for 103.13.112.180:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 16ms, Maximum = 17ms, Average = 16ms
```

3. getmac

Description:

The 'getmac' command is used to display the Media Access Control (MAC) addresses for network interfaces on a computer.

No.	Option	Description
1	/v	Shows verbose output with more details.
2	/fo table	Displays output in table format.
3	/fo list	Displays output in list format.
4	/fo csv	Displays output in CSV format.
5	/nh	Hides the column headers in the output.

Implementation:

```
C:\Users\Asus>getmac /v

Connection Name Network Adapter Physical Address    Transport Name
=============== =============== =================== ============================================================
Wi-Fi           MediaTek Wi-Fi  50-5A-65-F7-86-3D   \Device\Tcpip_{13635E3E-FCCB-4616-BEB8-68CC85547D5C}


C:\Users\Asus>getmac /fo table

Physical Address    Transport Name
=================== ============================================================
50-5A-65-F7-86-3D   \Device\Tcpip_{13635E3E-FCCB-4616-BEB8-68CC85547D5C}


C:\Users\Asus>getmac /fo list

Physical Address: 50-5A-65-F7-86-3D
Transport Name:   \Device\Tcpip_{13635E3E-FCCB-4616-BEB8-68CC85547D5C}
```

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```
C:\Users\Asus>getmac /fo csv
"Physical Address","Transport Name"
"50-5A-65-F7-86-3D","\Device\Tcpip_{13635E3E-FCCB-4616-BEB8-68CC85547D5C}"

C:\Users\Asus>getmac /nh

50-5A-65-F7-86-3D   \Device\Tcpip_{13635E3E-FCCB-4616-BEB8-68CC85547D5C}
```

4. systeminfo

Description:

The command is used in Windows to display detailed configuration information about a computer and its operating system, including hardware and software details.

No.	Option	Description
1	(no option)	Shows all system information.
2		
3		
4		
5		

Implementation:

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```
C:\Users\Asus>systeminfo

Host Name:                     NEEL
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:              Asus
Registered Organization:       N/A
Product ID:                    00356-24668-74179-AAOEM
Original Install Date:         28-Oct-24, 15:19:27
System Boot Time:              24-Jul-25, 10:55:27
System Manufacturer:           ASUSTeK COMPUTER INC.
System Model:                  Vivobook_ASUSLaptop X1502ZA_X1502ZA
System Type:                   x64-based PC
Processor(s):                  1 Processor(s) Installed.
                               [01]: Intel64 Family 6 Model 154 Stepping 4 GenuineIntel ~1300 Mhz
BIOS Version:                  American Megatrends International, LLC. X1502ZA.317, 30-Jan-24
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:         7,886 MB
Available Physical Memory:     1,376 MB
Virtual Memory: Max Size:      21,710 MB
Virtual Memory: Available:     10,514 MB
Virtual Memory: In Use:        11,196 MB
Page File Location(s):         D:\pagefile.sys
Domain:                        WORKGROUP
Logon Server:                  \\NEEL
Hotfix(s):                     3 Hotfix(s) Installed.
                               [01]: KB5056579
                               [02]: KB5062660
                               [03]: KB5064485
Network Card(s):               1 NIC(s) Installed.
                               [01]: MediaTek Wi-Fi 6 MT7921 Wireless LAN Card
                                     Connection Name: Wi-Fi
                                     DHCP Enabled:    Yes
                                     DHCP Server:     192.168.189.84
                                     IP address(es)
                                     [01]: 192.168.189.201
                                     [02]: fe80::44f1:6130:b0a3:9a9c
                                     [03]: 2409:40c1:3012:7941:456e:85cb:be09:aff4
                                     [04]: 2409:40c1:3012:7941:69b9:f6c:17da:16a4
Virtualization-based security: Status: Running
                               Required Security Properties:
                               Available Security Properties:
                                     Base Virtualization Support
                                     Secure Boot
                                     DMA Protection
                                     UEFI Code Readonly
                                     Mode Based Execution Control
                                     APIC Virtualization
                               Services Configured:
                                     Hypervisor enforced Code Integrity
                               Services Running:
                                     Hypervisor enforced Code Integrity
                               App Control for Business policy: Enforced
                               App Control for Business user mode policy: Off
                               Security Features Enabled:
Hyper-V Requirements:          A hypervisor has been detected. Features required for Hyper-V will not be displayed.
```

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5. tracert

Description:

The command in Windows is used to determine the route taken by packets across an IP network.

No.	Option	Description
1	-d	Prevents resolving Ips to hostnames
2	-h <max>	Sets the maximum number of hops
3	-w <timeout>	Sets the timeout in miliseconds
4	-4	Force using IPv4
5	-6	Force using IPv6

Implementation:

```
C:\Users\Asus>tracert /d darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:

  1     3 ms     2 ms     5 ms  192.168.1.1
  2    10 ms     6 ms     4 ms  182.237.14.17
  3     4 ms     3 ms     5 ms  10.244.21.1
  4    20 ms    37 ms    17 ms  103.241.47.61
  5    18 ms    18 ms    18 ms  103.27.171.191
  6   553 ms   180 ms    82 ms  172.30.11.2
  7    19 ms    20 ms    18 ms  103.13.112.180

Trace complete.
```

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```
C:\Users\Asus>tracert /h 10 darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 10 hops:

  1     2 ms     2 ms     2 ms  gpon.net [192.168.1.1]
  2     4 ms     4 ms     4 ms  182.237.14.17
  3     6 ms     3 ms     3 ms  10.244.21.1 [10.244.21.1]
  4    17 ms    17 ms    18 ms  103.241.47.61
  5    19 ms    19 ms    22 ms  103.27.171.191
  6    40 ms     *       76 ms  172.30.11.2 [172.30.11.2]
  7    33 ms    27 ms    18 ms  darshan.interactivedns.com [103.13.112.180]

Trace complete.
```

```
C:\Users\Asus>tracert -w 2 darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:

  1     2 ms     2 ms     2 ms  gpon.net [192.168.1.1]
  2     9 ms    33 ms     3 ms  182.237.14.17
  3     4 ms     4 ms     4 ms  10.244.21.1 [10.244.21.1]
  4    17 ms    17 ms    21 ms  103.241.47.61
  5    37 ms    17 ms    20 ms  103.27.171.191
  6    36 ms    36 ms     *     172.30.11.2 [172.30.11.2]
  7    18 ms    18 ms    25 ms  darshan.interactivedns.com [103.13.112.180]

Trace complete.
```

```
C:\Users\Asus>tracert -4 darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:

  1     4 ms     2 ms     4 ms  gpon.net [192.168.1.1]
  2     5 ms     8 ms     4 ms  182.237.14.17
  3     4 ms    14 ms     6 ms  10.244.21.1 [10.244.21.1]
  4    26 ms    16 ms    18 ms  103.241.47.61
  5    44 ms    19 ms    18 ms  103.27.171.191
  6    20 ms    18 ms    20 ms  172.30.11.2 [172.30.11.2]
  7    18 ms    17 ms    18 ms  darshan.interactivedns.com [103.13.112.180]

Trace complete.
```

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```
C:\Users\Asus>tracert -6 darshan.ac.in
Unable to resolve target system name darshan.ac.in.

C:\Users\Asus>tracert -6 google.com

Tracing route to google.com [2607:f8b0:4002:c0f::8a]
over a maximum of 30 hops:

  1     *        *        *     Request timed out.
  2    29 ms     6 ms     8 ms  undefined.hostname.localhost [2402:a00:182:1::1111]
  3    26 ms     6 ms     6 ms  undefined.hostname.localhost [2402:a00:80::1001]
  4    50 ms    29 ms    23 ms  undefined.hostname.localhost [2402:a00:80::2e]
  5     *        *        *     Request timed out.
  6    27 ms    27 ms    23 ms  2404:6800:8074::1
  7     *       26 ms     *     2001:4860:0:1::43ba
  8    31 ms    29 ms    26 ms  2001:4860:0:1::77aa
  9    32 ms    22 ms    25 ms  2001:4860::c:4004:153f
 10    43 ms    44 ms    43 ms  2001:4860::9:4001:b922
 11    82 ms    83 ms    82 ms  2001:4860::c:4003:1c92
 12   125 ms   109 ms   112 ms  2001:4860::c:4002:f3dc
 13   338 ms   508 ms   255 ms  2001:4860::c:4003:1cbf
 14   248 ms   252 ms   333 ms  2001:4860::c:4003:5481
 15   269 ms   493 ms   307 ms  2001:4860::c:4004:8002
 16   325 ms   285 ms   288 ms  2001:4860::c:4002:751a
 17   309 ms   300 ms   306 ms  2001:4860::cc:4002:d6
 18     *        *        *     Request timed out.
 19     *        *        *     Request timed out.
 20   288 ms   287 ms   288 ms  yo-in-f138.1e100.net [2607:f8b0:4002:c0f::8a]

Trace complete.
```

6. netstat

Description:

The netstat command is a powerful network utility in Windows used to display network connections (both incoming and outgoing), routing tables, interface statistics, masquerade connections, and multicast memberships.

No.	Option	Description
1	-a	Displays all connections and listening ports.
2	-n	Displays addresses and port numbers numerically.
3	-o	Displays owning process ID associated with each connection.
4	-e	Displays Ethernet statistics.
5	-s	Displays per-protocol statistics.

Implementation:

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```
C:\Users\Asus>netstat -a

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            Neel:0                 LISTENING
  TCP    0.0.0.0:445            Neel:0                 LISTENING
  TCP    0.0.0.0:5040           Neel:0                 LISTENING
  TCP    0.0.0.0:49664          Neel:0                 LISTENING
  TCP    0.0.0.0:49665          Neel:0                 LISTENING
  TCP    0.0.0.0:49668          Neel:0                 LISTENING
  TCP    0.0.0.0:49669          Neel:0                 LISTENING
  TCP    0.0.0.0:49670          Neel:0                 LISTENING
  TCP    0.0.0.0:49680          Neel:0                 LISTENING
  TCP    0.0.0.0:49687          Neel:0                 LISTENING
  TCP    0.0.0.0:49688          Neel:0                 LISTENING
  TCP    0.0.0.0:49689          Neel:0                 LISTENING
  TCP    0.0.0.0:49692          Neel:0                 LISTENING
  TCP    0.0.0.0:49693          Neel:0                 LISTENING
  TCP    0.0.0.0:49694          Neel:0                 LISTENING
  TCP    127.0.0.1:5939         Neel:0                 LISTENING
  TCP    127.0.0.1:19293        Neel:0                 LISTENING
  TCP    127.0.0.1:19294        Neel:0                 LISTENING
  TCP    127.0.0.1:24830        Neel:0                 LISTENING
  TCP    127.0.0.1:27017        Neel:0                 LISTENING
  TCP    127.0.0.1:49708        Neel:49709             ESTABLISHED
  TCP    127.0.0.1:49709        Neel:49708             ESTABLISHED
  TCP    127.0.0.1:49710        Neel:49711             ESTABLISHED
  TCP    127.0.0.1:49711        Neel:49710             ESTABLISHED
  TCP    127.0.0.1:49712        Neel:49713             ESTABLISHED
  TCP    127.0.0.1:49713        Neel:49712             ESTABLISHED
  TCP    192.168.1.21:139       Neel:0                 LISTENING
  TCP    192.168.1.21:49432     4.213.25.240:https     ESTABLISHED
  TCP    192.168.1.21:64345     4.213.25.240:https     ESTABLISHED
  TCP    192.168.1.21:64346     52.104.76.53:https     ESTABLISHED
  TCP    192.168.1.21:64347     20.44.229.112:https    ESTABLISHED
```

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```
TCP    192.168.1.21:64351     whatsapp-chatd-edge-shv-01-bom2:5222  TIME_WAIT
TCP    192.168.1.21:64361     a23-219-58-54:https    ESTABLISHED
TCP    192.168.1.21:64362     a23-219-57-221:https   ESTABLISHED
TCP    192.168.1.21:64363     whatsapp-chatd-edge-shv-01-bom2:5222  TIME_WAIT
TCP    192.168.1.21:64368     whatsapp-chatd-edge-shv-01-bom2:5222  TIME_WAIT
TCP    192.168.1.21:64369     whatsapp-cdn-shv-01-bom2:https  ESTABLISHED
TCP    192.168.1.21:64370     whatsapp-cdn-shv-01-del1:https  ESTABLISHED
TCP    192.168.1.21:64371     whatsapp-cdn-shv-02-bom2:https  ESTABLISHED
TCP    192.168.1.21:64372     103.250.190.228:https  ESTABLISHED
TCP    192.168.1.21:64373     whatsapp-cdn-shv-02-bom1:https  ESTABLISHED
TCP    192.168.1.21:64374     whatsapp-cdn-shv-01-bom1:https  ESTABLISHED
TCP    192.168.1.21:64375     whatsapp-cdn-shv-04-bom2:https  ESTABLISHED
TCP    192.168.1.21:64376     whatsapp-cdn-shv-03-bom2:https  ESTABLISHED
TCP    192.168.1.21:64377     whatsapp-cdn-shv-01-bom2:https  ESTABLISHED
TCP    192.168.1.21:64378     whatsapp-chatd-edge-shv-01-bom2:5222  ESTABLISHED
TCP    [::]:135               Neel:0                 LISTENING
TCP    [::]:445               Neel:0                 LISTENING
TCP    [::]:49664             Neel:0                 LISTENING
TCP    [::]:49665             Neel:0                 LISTENING
TCP    [::]:49668             Neel:0                 LISTENING
TCP    [::]:49669             Neel:0                 LISTENING
TCP    [::]:49670             Neel:0                 LISTENING
TCP    [::]:49680             Neel:0                 LISTENING
TCP    [::1]:42050            Neel:0                 LISTENING
TCP    [::1]:49673            Neel:0                 LISTENING
UDP    0.0.0.0:123            *:*
UDP    0.0.0.0:5050           *:*
UDP    0.0.0.0:5353           *:*
UDP    0.0.0.0:5355           *:*
UDP    0.0.0.0:49665          *:*
UDP    0.0.0.0:63141          *:*
UDP    127.0.0.1:1900         *:*
UDP    127.0.0.1:5353         *:*
UDP    127.0.0.1:49664        127.0.0.1:49664
UDP    127.0.0.1:58136        *:*
UDP    192.168.1.21:137       *:*
UDP    192.168.1.21:138       *:*
UDP    192.168.1.21:1900      *:*
```

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```
C:\Users\Asus>netstat -n

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:49708        127.0.0.1:49709        ESTABLISHED
  TCP    127.0.0.1:49709        127.0.0.1:49708        ESTABLISHED
  TCP    127.0.0.1:49710        127.0.0.1:49711        ESTABLISHED
  TCP    127.0.0.1:49711        127.0.0.1:49710        ESTABLISHED
  TCP    127.0.0.1:49712        127.0.0.1:49713        ESTABLISHED
  TCP    127.0.0.1:49713        127.0.0.1:49712        ESTABLISHED
  TCP    192.168.1.21:49432     4.213.25.240:443       ESTABLISHED
  TCP    192.168.1.21:64345     4.213.25.240:443       ESTABLISHED
  TCP    192.168.1.21:64369     163.70.143.60:443      CLOSE_WAIT
  TCP    192.168.1.21:64370     157.240.198.60:443     CLOSE_WAIT
  TCP    192.168.1.21:64371     163.70.144.60:443      CLOSE_WAIT
  TCP    192.168.1.21:64372     103.250.190.228:443    CLOSE_WAIT
  TCP    192.168.1.21:64373     31.13.79.53:443        CLOSE_WAIT
  TCP    192.168.1.21:64374     157.240.16.52:443      CLOSE_WAIT
  TCP    192.168.1.21:64375     57.144.177.32:443      CLOSE_WAIT
  TCP    192.168.1.21:64376     57.144.125.32:443      CLOSE_WAIT
  TCP    192.168.1.21:64377     163.70.143.60:443      CLOSE_WAIT
  TCP    192.168.1.21:64392     52.104.76.53:443       TIME_WAIT
  TCP    192.168.1.21:64393     43.250.166.91:443      FIN_WAIT_2
  TCP    192.168.1.21:64394     13.107.137.11:443      ESTABLISHED
  TCP    192.168.1.21:64395     52.104.76.53:443       ESTABLISHED
  TCP    192.168.1.21:64396     13.69.239.77:443       ESTABLISHED
  TCP    192.168.1.21:64398     43.250.166.91:443      ESTABLISHED
  TCP    192.168.1.21:64399     204.79.197.203:443     TIME_WAIT
  TCP    192.168.1.21:64404     23.15.33.110:443       FIN_WAIT_2
  TCP    192.168.1.21:64405     104.97.76.227:443      FIN_WAIT_2
  TCP    192.168.1.21:64406     104.97.76.227:443      FIN_WAIT_2
  TCP    192.168.1.21:64409     27.116.54.202:443      ESTABLISHED
  TCP    192.168.1.21:64411     52.109.56.129:443      TIME_WAIT
  TCP    192.168.1.21:64412     13.227.249.35:443      ESTABLISHED
```

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```
C:\Users\Asus>netstat -o

Active Connections

  Proto  Local Address          Foreign Address        State           PID
  TCP    127.0.0.1:49708        Neel:49709             ESTABLISHED     1760
  TCP    127.0.0.1:49709        Neel:49708             ESTABLISHED     1760
  TCP    127.0.0.1:49710        Neel:49711             ESTABLISHED     4632
  TCP    127.0.0.1:49711        Neel:49710             ESTABLISHED     4632
  TCP    127.0.0.1:49712        Neel:49713             ESTABLISHED     2044
  TCP    127.0.0.1:49713        Neel:49712             ESTABLISHED     2044
  TCP    192.168.1.21:49432     4.213.25.240:https     ESTABLISHED     5592
  TCP    192.168.1.21:64345     4.213.25.240:https     ESTABLISHED     10628
  TCP    192.168.1.21:64393     43.250.166.91:https    FIN_WAIT_2      2284
  TCP    192.168.1.21:64394     13.107.137.11:https    ESTABLISHED     10628
  TCP    192.168.1.21:64395     52.104.76.53:https     ESTABLISHED     10628
  TCP    192.168.1.21:64396     13.69.239.77:https     ESTABLISHED     10628
  TCP    192.168.1.21:64399     a-0003:https           TIME_WAIT       0
  TCP    192.168.1.21:64409     27.116.54.202:https    ESTABLISHED     22076
  TCP    192.168.1.21:64411     52.109.56.129:https    TIME_WAIT       0
  TCP    192.168.1.21:64413     whatsapp-chatd-edge-shv-01-bom2:5222  TIME_WAIT       0
  TCP    192.168.1.21:64414     whatsapp-cdn-shv-02-bom2:https  ESTABLISHED     11100
  TCP    192.168.1.21:64415     whatsapp-cdn-shv-01-bom1:https  ESTABLISHED     11100
  TCP    192.168.1.21:64416     whatsapp-cdn-shv-01-bom2:https  ESTABLISHED     11100
  TCP    192.168.1.21:64417     103.250.190.228:https  ESTABLISHED     11100
  TCP    192.168.1.21:64418     whatsapp-cdn-shv-04-bom2:https  ESTABLISHED     11100
  TCP    192.168.1.21:64419     whatsapp-cdn-shv-03-bom2:https  ESTABLISHED     11100
  TCP    192.168.1.21:64420     whatsapp-cdn-shv-01-del1:https  ESTABLISHED     11100
  TCP    192.168.1.21:64421     whatsapp-cdn-shv-02-bom1:https  ESTABLISHED     11100
  TCP    192.168.1.21:64422     whatsapp-cdn-shv-01-bom2:https  ESTABLISHED     11100
  TCP    192.168.1.21:64423     server-13-227-249-35:https  TIME_WAIT       0
  TCP    192.168.1.21:64425     whatsapp-chatd-edge-shv-01-bom2:5222  ESTABLISHED     11100
```

```
C:\Users\Asus>netstat -e
Interface Statistics

                           Received            Sent

Bytes                      19443156         8077914
Unicast packets               19194           17178
Non-unicast packets             558             828
Discards                          0               0
Errors                            0               0
Unknown protocols                 0
```

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

IPv4 Statistics

  Packets Received                    = 725591
  Received Header Errors              = 14
  Received Address Errors             = 26
  Datagrams Forwarded                 = 0
  Unknown Protocols Received          = 2022
  Received Packets Discarded          = 20250
  Received Packets Delivered          = 722228
  Output Requests                     = 441746
  Routing Discards                    = 0
  Discarded Output Packets            = 322
  Output Packet No Route              = 102
  Reassembly Required                 = 8
  Reassembly Successful               = 4
  Reassembly Failures                 = 0
  Datagrams Successfully Fragmented   = 0
  Datagrams Failing Fragmentation     = 0
  Fragments Created                   = 0

IPv6 Statistics

  Packets Received                    = 3382033
  Received Header Errors              = 0
  Received Address Errors             = 24
  Datagrams Forwarded                 = 0
  Unknown Protocols Received          = 0
  Received Packets Discarded          = 5918
  Received Packets Delivered          = 3386124
  Output Requests                     = 1828535
  Routing Discards                    = 0
```

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7. nslookup

Description:

The command in Windows is a network administration command-line tool used for querying the Domain Name System (DNS) to obtain domain name or IP address mapping or other specific DNS records. It's useful for diagnosing DNS problems.

No.	Option	Description
1	<domain>	Retrieves IP address for the domain.
2	<IP>	Retrieves domain name for the given IP (reverse lookup).
3	set type=MX	Retrieves Mail Exchange records.
4	set type=NS	Retrieves Name Server records.
5	server <IP>	Specifies DNS server for the query.

Implementation:

```
C:\Users\Asus>nslookup darshan.ac.in
Server:  gpon.net
Address:  192.168.1.1

Non-authoritative answer:
Name:    darshan.ac.in
Address:  103.13.112.180


C:\Users\Asus>nslookup darshan.ac.in 192.168.1.1
Server:  gpon.net
Address:  192.168.1.1

Non-authoritative answer:
Name:    darshan.ac.in
Address:  103.13.112.180
```

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```
C:\Users\Asus>nslookup -type=mx darshan.ac.in
Server:  gpon.net
Address:  192.168.1.1

Non-authoritative answer:
darshan.ac.in   MX preference = 10, mail exchanger = aspmx3.googlemail.com
darshan.ac.in   MX preference = 5, mail exchanger = alt2.aspmx.l.google.com
darshan.ac.in   MX preference = 10, mail exchanger = aspmx2.googlemail.com
darshan.ac.in   MX preference = 5, mail exchanger = alt1.aspmx.l.google.com
darshan.ac.in   MX preference = 0, mail exchanger = aspmx.l.google.com
```

```
C:\Users\Asus>nslookup -type=ns darshan.ac.in
Server:  gpon.net
Address:  192.168.1.1

Non-authoritative answer:
darshan.ac.in   nameserver = ns2.darshan.interactivedns.com
darshan.ac.in   nameserver = ns1.darshan.interactivedns.com
```

```
C:\Users\Asus>nslookup
Default Server:  gpon.net
Address:  192.168.1.1
```

8. hostname

Description:

The command is a simple utility used to display the name of the current computer (the hostname). This command is available on both Windows and Unix-based systems (including Linux and macOS), though the usage and options might slightly vary.

No.	Option	Description
1	(no option)	Prints current hostname.
2		
3		
4		
5		

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Implementation:

```
C:\Users\Asus>hostname
Neel
```

9. pathping

Description:

pathping is a network utility in Windows that combines the features of ping and tracert. It provides a detailed analysis of the route taken by packets across an IP network and calculates packet loss at each router or link in the path.

No.	Option	Description
1	-n	Prevents resolving hostnames.
2	-h <max>	Sets maximum number of hops.
3	-g <host-list>	Specifies loose source route along host list.
4	-p <ms>	Wait time between pings.
5	-q <num>	Number of queries per hop.

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Implementation:

```
C:\Users\Asus>pathping -n darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:
  0  192.168.1.21
  1  192.168.1.1
  2  182.237.14.17
  3  10.244.21.1
  4  103.241.47.61
  5  103.27.171.191
  6  172.30.11.2
  7  103.13.112.180

Computing statistics for 175 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           192.168.1.21
                                   1/ 100 =  1%   |
  1   50ms     6/ 100 =  6%      5/ 100 =  5%  192.168.1.1
                                   0/ 100 =  0%   |
  2   43ms     1/ 100 =  1%      0/ 100 =  0%  182.237.14.17
                                   1/ 100 =  1%   |
  3   43ms     2/ 100 =  2%      0/ 100 =  0%  10.244.21.1
                                   2/ 100 =  2%   |
  4   75ms     5/ 100 =  5%      1/ 100 =  1%  103.241.47.61
                                   0/ 100 =  0%   |
  5  ---     100/ 100 =100%     96/ 100 = 96%  103.27.171.191
                                   0/ 100 =  0%   |
  6  ---     100/ 100 =100%     96/ 100 = 96%  172.30.11.2
                                   0/ 100 =  0%   |
  7   73ms     4/ 100 =  4%      0/ 100 =  0%  103.13.112.180

Trace complete.
```

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```
C:\Users\Asus>pathping -h 10 darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 10 hops:
  0  Neel [192.168.1.21]
  1  gpon.net [192.168.1.1]
  2  182.237.14.17
  3     *     10.244.21.1 [10.244.21.1]
  4     *        *        *
Computing statistics for 75 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           Neel [192.168.1.21]
                                    6/ 100 =  6%   |
  1   27ms     6/ 100 =  6%      0/ 100 =  0%  gpon.net [192.168.1.1]
                                   45/ 100 = 45%   |
  2  ---     100/ 100 =100%     49/ 100 = 49%  182.237.14.17
                                    0/ 100 =  0%   |
  3   67ms    51/ 100 = 51%      0/ 100 =  0%  10.244.21.1 [10.244.21.1]

Trace complete.
```

```
C:\Users\Asus>pathping -g 192.168.1.1 darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:
  0  Neel [192.168.1.21]
  1     *        *        *
Computing statistics for 0 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           Neel [192.168.1.21]

Trace complete.
```

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```
C:\Users\Asus>pathping -p 300 darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:
  0  Neel [192.168.1.21]
  1  gpon.net [192.168.1.1]
  2  182.237.14.17
  3  10.244.21.1 [10.244.21.1]
  4  103.241.47.61
  5  103.27.171.191
  6  172.30.11.2 [172.30.11.2]
  7  darshan.interactivedns.com [103.13.112.180]

Computing statistics for 210 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           Neel [192.168.1.21]
                                   0/ 100 =  0%   |
  1   24ms     0/ 100 =  0%     0/ 100 =  0%  gpon.net [192.168.1.1]
                                   0/ 100 =  0%   |
  2   22ms     0/ 100 =  0%     0/ 100 =  0%  182.237.14.17
                                   1/ 100 =  1%   |
  3   26ms     1/ 100 =  1%     0/ 100 =  0%  10.244.21.1 [10.244.21.1]
                                   0/ 100 =  0%   |
  4   36ms     1/ 100 =  1%     0/ 100 =  0%  103.241.47.61
                                   0/ 100 =  0%   |
  5  ---     100/ 100 =100%    99/ 100 = 99%  103.27.171.191
                                   0/ 100 =  0%   |
  6  ---     100/ 100 =100%    99/ 100 = 99%  172.30.11.2 [172.30.11.2]
                                   0/ 100 =  0%   |
  7   38ms     1/ 100 =  1%     0/ 100 =  0%  darshan.interactivedns.com [103.13.112.180]

Trace complete.
```

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```
C:\Users\Asus>pathping -q 5 darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:
  0  Neel [192.168.1.21]
  1  gpon.net [192.168.1.1]
  2  182.237.14.17
  3  10.244.21.1 [10.244.21.1]
  4  103.241.47.61
  5  103.27.171.191
  6  172.30.11.2 [172.30.11.2]
  7  darshan.interactivedns.com [103.13.112.180]

Computing statistics for 8 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           Neel [192.168.1.21]
                                     0/   5 =  0%   |
  1   17ms     0/   5 =  0%     0/   5 =  0%  gpon.net [192.168.1.1]
                                     0/   5 =  0%   |
  2   15ms     2/   5 = 40%     2/   5 = 40%  182.237.14.17
                                     0/   5 =  0%   |
  3   53ms     0/   5 =  0%     0/   5 =  0%  10.244.21.1 [10.244.21.1]
                                     0/   5 =  0%   |
  4   40ms     0/   5 =  0%     0/   5 =  0%  103.241.47.61
                                     0/   5 =  0%   |
  5  ---       5/   5 =100%     5/   5 =100%  103.27.171.191
                                     0/   5 =  0%   |
  6  ---       5/   5 =100%     5/   5 =100%  172.30.11.2 [172.30.11.2]
                                     0/   5 =  0%   |
  7   37ms     0/   5 =  0%     0/   5 =  0%  darshan.interactivedns.com [103.13.112.180]

Trace complete.
```

10. arp

Description:

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

No.	Option	Description
1	-a	Displays current ARP entries.
2	-g	Displays current ARP entries (same as -a).
3	-d <IP>	Deletes ARP entry for the specified IP address.
4	-s <IP> <MAC>	Adds a static ARP entry.
5	-v	Shows verbose output.

Implementation:

Date: 04/06/2025

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

Interface: 192.168.1.21 --- 0x3
  Internet Address      Physical Address      Type
  192.168.1.1           b8-dd-71-ef-b9-7c     dynamic
  192.168.1.255         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
```

```
C:\Users\Asus>arp -g

Interface: 192.168.1.21 --- 0x3
  Internet Address      Physical Address      Type
  192.168.1.1           b8-dd-71-ef-b9-7c     dynamic
  192.168.1.255         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
```

```
C:\Users\Asus>arp -d 10.255.1.1
```

```
C:\Users\Asus>arp -s 192.168.1.100 00-aa-bb-cc-dd-ee
```

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```
C:\Users\Asus>arp -v

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.
```