

## LAB 2: Network Commands for Testing and Troubleshooting

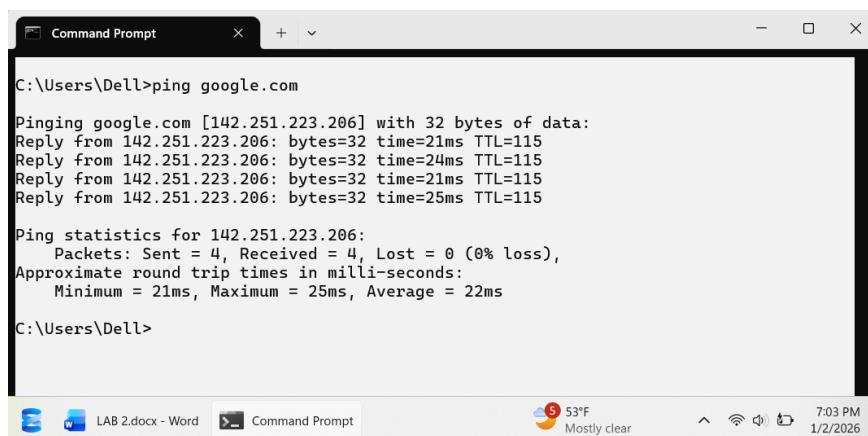
### Objectives:

- To learn and practice essential network commands used for testing, monitoring, and troubleshooting network connectivity.
- To analyze network configurations, connectivity, and routing to identify and resolve potential network issues.

### Theory:

In computer networks, efficient communication and troubleshooting are essential for maintaining connectivity and performance. Network commands are tools that allow users and administrators to monitor, test, and diagnose network issues. By using these commands, we can check connectivity, view configuration details, trace routes, and detect problems in both local and remote networks. This lab focuses on learning common network commands that are widely used for testing and troubleshooting purposes, providing practical skills for network management. Some network commands include:

#### 1. ping



```
C:\Users\Dell>ping google.com

Pinging google.com [142.251.223.206] with 32 bytes of data:
Reply from 142.251.223.206: bytes=32 time=21ms TTL=115
Reply from 142.251.223.206: bytes=32 time=24ms TTL=115
Reply from 142.251.223.206: bytes=32 time=21ms TTL=115
Reply from 142.251.223.206: bytes=32 time=25ms TTL=115

Ping statistics for 142.251.223.206:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 21ms, Maximum = 25ms, Average = 22ms

C:\Users\Dell>
```

- Tests connectivity between your computer and another host.
- Sends ICMP packets to a destination and shows the response time.
- Syntax:  
`ping <hostname or IP>`

#### 2. ipconfig

- Displays the current network configuration of the system.
- Can be used to release and renew IP addresses.
- Syntax:  
`ipconfig`

```

C:\Users\Dell>ipconfig

Windows IP Configuration

Unknown adapter Local Area Connection:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

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

Unknown adapter OpenVPN Connect DCO Adapter:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 1:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 10:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:
  Connection-specific DNS Suffix . :
  Link-Local IPv6 Address . . . . . : fe80::75a2:530c:d7e5:e5af%11
  IPv4 Address . . . . . : 192.168.1.64
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 192.168.1.254

C:\Users\Dell>

```

### 3. tracert

```

C:\Users\Dell>tracert google.com

Tracing route to google.com [142.251.223.206]
over a maximum of 30 hops:
1  1 ms    <1 ms    <1 ms  192.168.1.254
2  12 ms   9 ms    4 ms   27.34.28.1
3  11 ms   3 ms    4 ms   be-81-6.45.gwc-ndc-core-01.wlink.com.np [202.79.45.6]
4  4 ms    5 ms    4 ms   ae-20-136.41.gwj-htda-core-01.wlink.com.np [202.79.41.136]
5  9 ms    7 ms    8 ms   ae-21-139.41.gwj-btvl-core-01.wlink.com.np [202.79.41.139]
6  10 ms   10 ms   11 ms  ae52-ipt-bhwa-01.wlink.com.np [72.9.128.67]
7  *        *        * Request timed out.
8  22 ms   18 ms   20 ms  142.250.174.2
9  22 ms   22 ms   20 ms  192.178.81.9
10 24 ms   19 ms   21 ms  142.251.76.193
11 23 ms   18 ms   18 ms  tzdela-as-in-f14.1e100.net [142.251.223.206]

Trace complete.

C:\Users\Dell>

```

- Shows the path that packets take to reach a destination.
- Helps identify network delays or failures along the route.
- Syntax:

tracert <hostname or IP>

### 4. arp -a

```

C:\Users\Dell>arp -a

Interface: 192.168.1.64 --- 0xb
  Internet Address      Physical Address          Type
  192.168.1.254        5c-8c-30-65-a1-2c      dynamic
  192.168.1.255        ff-ff-ff-ff-ff-ff      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\Dell>

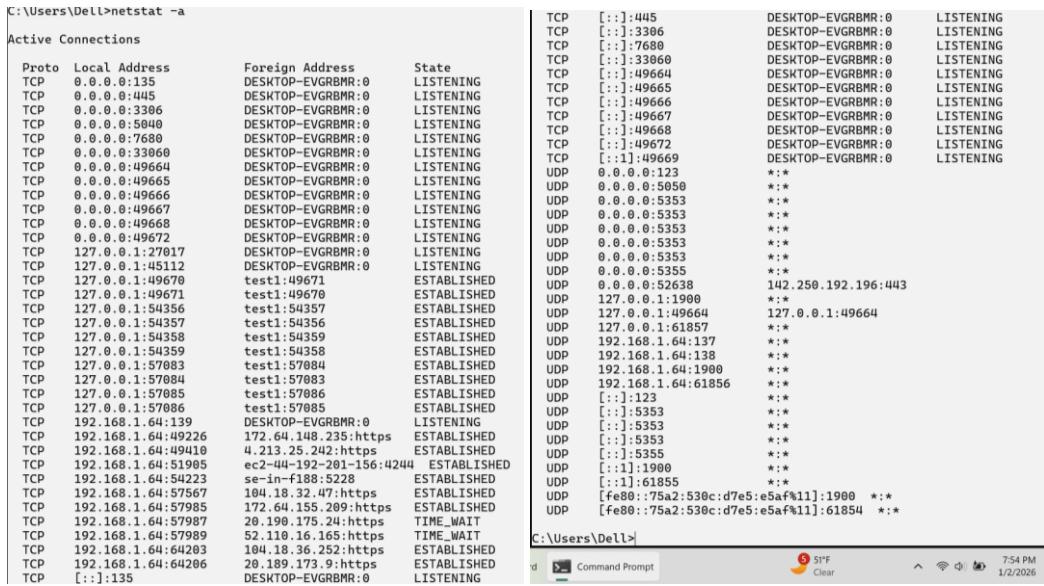
```

- Shows the ARP (Address Resolution Protocol) table of the system.
- Displays IP-to-MAC address mappings on the local network.

- Syntax:

arp -a

## 5. netstat



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

Active Connections

Proto Local Address          Foreign Address        State
TCP   0.0.0.0.135           DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.445           DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.3396          DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.5040          DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.7680          DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.33960         DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.49664         DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.49665         DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.49666         DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.49667         DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.49668         DESKTOP-EVGRBMR:0    LISTENING
TCP   0.0.0.0.49672         DESKTOP-EVGRBMR:0    LISTENING
TCP   127.0.0.1.27817       DESKTOP-EVGRBMR:0    LISTENING
TCP   127.0.0.1.45112       DESKTOP-EVGRBMR:0    LISTENING
TCP   127.0.0.1.49670       test1:49671      ESTABLISHED
TCP   127.0.0.1.49671       test1:49670      ESTABLISHED
TCP   127.0.0.1.54356       test1:54357      ESTABLISHED
TCP   127.0.0.1.54357       test1:54356      ESTABLISHED
TCP   127.0.0.1.54358       test1:54359      ESTABLISHED
TCP   127.0.0.1.54359       test1:54358      ESTABLISHED
TCP   127.0.0.1.57083       test1:57084      ESTABLISHED
TCP   127.0.0.1.57084       test1:57083      ESTABLISHED
TCP   127.0.0.1.57085       test1:57086      ESTABLISHED
TCP   127.0.0.1.57086       test1:57085      ESTABLISHED
TCP   127.0.0.1.57087       DESKTOP-EVGRBMR:0  LISTENING
TCP   192.168.1.64.139      172.64.148.235:https ESTABLISHED
TCP   192.168.1.64.49226     4.212.25.242:https ESTABLISHED
TCP   192.168.1.64.49418     ec3~4u~192~201~156:42u4 ESTABLISHED
TCP   192.168.1.64.51985     se-in-f188:5228 ESTABLISHED
TCP   192.168.1.64.57567     184.18.32.47:https ESTABLISHED
TCP   192.168.1.64.57985     172.64.155.209:https ESTABLISHED
TCP   192.168.1.64.57987     20.199.175.24:https TIME_WAIT
TCP   192.168.1.64.57989     52.119.16.165:https TIME_WAIT
TCP   192.168.1.64.64203     184.18.36.252:https ESTABLISHED
TCP   192.168.1.64.64206     20.189.173.9:https ESTABLISHED
TCP   [::]:135                DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:445                DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:3306               DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:7680               DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:33960              DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:49664              DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:49665              DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:49666              DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:49667              DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:49668              DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:49672              DESKTOP-EVGRBMR:0  LISTENING
TCP   [::]:49669              DESKTOP-EVGRBMR: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   0.0.0.0.52638           142.250.192.196:443
UDP   127.0.0.1.1900           *:*                   *
UDP   127.0.0.1.49664          127.0.0.1:49664
UDP   127.0.0.1.61857          *:*                   *
UDP   192.168.1.64.137          *:*                   *
UDP   192.168.1.64.138          *:*                   *
UDP   192.168.1.64.1900          *:*                   *
UDP   192.168.1.64.61856          *:*                   *
UDP   [::]:123                *:*                   *
UDP   [::]:5353               *:*                   *
UDP   [::]:5353               *:*                   *
UDP   [::]:5353               *:*                   *
UDP   [::]:5355               *:*                   *
UDP   [::]:1980               *:*                   *
UDP   [::]:61855              *:*                   *
C:\Users\DELL>
```

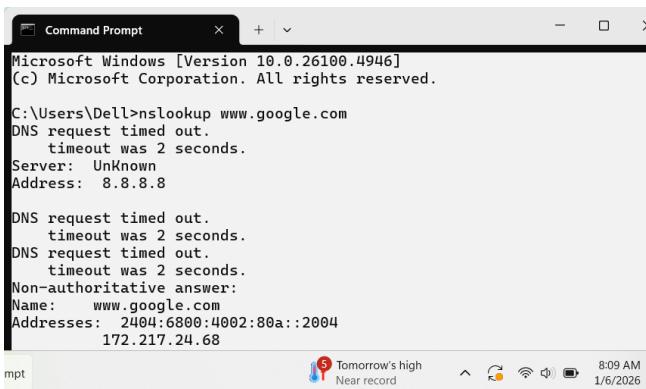
- Displays active network connections, listening ports, and protocol statistics.

- Useful to identify network activity and open connections.

- Syntax:

netstat -a

## 6. nslookup



```
Microsoft Windows [Version 10.0.26100.4946]
(c) Microsoft Corporation. All rights reserved.

C:\Users\DELL>nslookup www.google.com
DNS request timed out.
    timeout was 2 seconds.
Server:  Unknown
Address:  8.8.8.8

DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
Non-authoritative answer:
Name:   www.google.com
Addresses: 2004:6800:4002:80a::2004
          172.217.24.68
```

- Queries DNS servers to find the IP address of a domain or vice versa.

- Helps troubleshoot DNS-related issues.

- Syntax:

nslookup <domain>

## 7. telnet



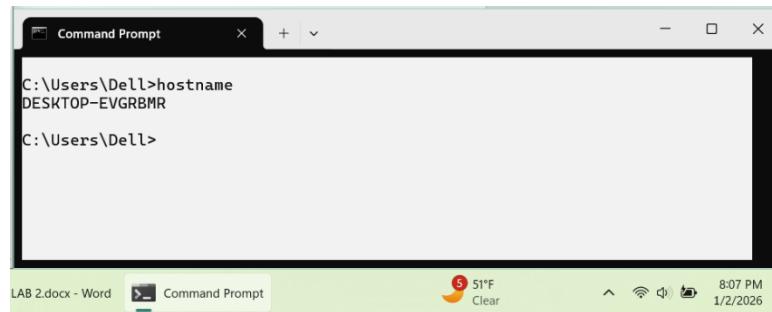
- Tests TCP connectivity to a specific port on a remote host.
- Useful to verify if a service is running on a specific port.
- Syntax:

telnet <hostname> <port>

## 8. hostname

- Displays the name of the local computer.
- Syntax:

hostname



## 9. route print

- Shows the routing table of the system.

```
C:\Users\DELL>route print
=====
Interface List
15...00 ff a6 b2 ca ce ....TAP-Windows Adapter V9 for OpenVPN Connect
7...60 18 95 25 40 b3 ....Realtek PCIe GbE Family Controller
3.....OpenVPN Data Channel Offload
17...f0 9e 4a 0a 24 5a ....Microsoft Wi-Fi Direct Virtual Adapter
20...f2 9e 4a 0a 24 59 ....Microsoft Wi-Fi Direct Virtual Adapter #2
11...f0 9e 4a 0a 24 59 ....Intel(R) Wireless-AC 9462
1.....Software Loopback Interface 1
=====

IPv4 Route Table
=====
Active Routes:
Network Destination      Netmask     Gateway       Interface Metric
          0.0.0.0      0.0.0.0   192.168.1.254  192.168.1.64      35
        127.0.0.0      255.0.0.0    On-link         127.0.0.1      331
        127.0.0.1      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
          192.168.1.0      255.255.255.0    On-link        192.168.1.64      291
        192.168.1.64      255.255.255.255    On-link        192.168.1.64      291
  192.168.1.255      255.255.255.255    On-link        192.168.1.64      291
        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        192.168.1.64      291
  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        192.168.1.64      291
=====

Persistent Routes:
  None

IPv6 Route Table
=====
Active Routes:
If Metric Network Destination      Gateway
  1     331 :1/128    On-link
  11    291 fe80::/64    On-link
  11    291 fe80::75a2:530c:d7e5:e5af/128
  1     331 ff00::/8    On-link
  11    291 ff00::/8    On-link
=====

Persistent Routes:
  None

C:\Users\DELL>
```

## 10. pathping

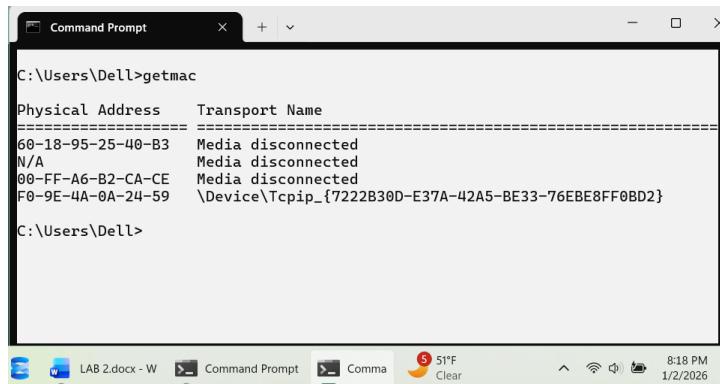
- Combines ping and tracert functionalities to detect packet loss along a path.
- Syntax:

route print

```
C:\Users\DELL>pathping google.com
Tracing route to google.com [142.251.223.206]
over a maximum of 30 hops:
  0  DESKTOP-EVGRBMR [192.168.1.64]
  1  192.168.1.254
  2  27.34.28.1
  3  be-81-6.45.gwc-ndc-core-01.wlink.com.np [202.79.45.6]
  4  ae-20-136.41.gwj-htda-core-01.wlink.com.np [202.79.41.136]
  5  ae-21-139.41.gwj-btwl-core-01.wlink.com.np [202.79.41.139]
  6  ae52-ipt-bhwa-01.wlink.com.np [72.9.128.67]
  7  *           *           *
Computing statistics for 150 seconds...
Source to Here This Node/Link
Hop RTT    Lost/Sent = Pct Lost/Sent = Pct Address
  0          0/ 100 =  0%          0/ 100 =  0% DESKTOP-EVGRBMR [192.168.1.64]
  1  2ms    0/ 100 =  0%    0/ 100 =  0% 192.168.1.254
  2  ---    100/ 100 =100%  100/ 100 =100% 27.34.28.1
  3  7ms    0/ 100 =  0%    0/ 100 =  0% be-81-6.45.gwc-ndc-core-01.wlink.com.np [202.79.45.6]
  4  7ms    0/ 100 =  0%    0/ 100 =  0% ae-20-136.41.gwj-htda-core-01.wlink.com.np [202.79.41.136]
  5  9ms    0/ 100 =  0%    0/ 100 =  0% ae-21-139.41.gwj-btwl-core-01.wlink.com.np [202.79.41.139]
  6  ---    100/ 100 =100%   100/ 100 =100% ae52-ipt-bhwa-01.wlink.com.np [72.9.128.67]

Trace complete.
```

## 11. getmac



```
C:\Users\Dell>getmac
Physical Address      Transport Name
=====
60-18-95-25-40-B3    Media disconnected
N/A                  Media disconnected
00-FF-A6-B2-CA-CE   Media disconnected
F0-9E-4A-0A-24-59   \Device\Tcpip_{7222B30D-E37A-42A5-BE33-76EBE8FF0BD2}

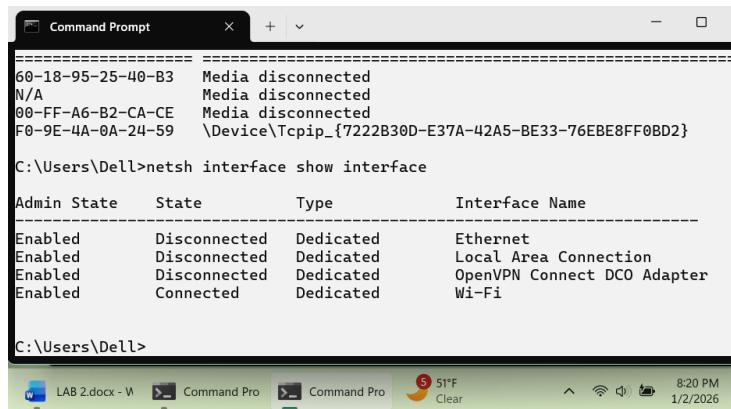
C:\Users\Dell>
```

- Displays the MAC address of the network interfaces.

- Syntax:

```
getmac
```

## 12. netsh



```
60-18-95-25-40-B3  Media disconnected
N/A                Media disconnected
00-FF-A6-B2-CA-CE Media disconnected
F0-9E-4A-0A-24-59 \Device\Tcpip_{7222B30D-E37A-42A5-BE33-76EBE8FF0BD2}

C:\Users\Dell>netsh interface show interface
Admin State      State        Type           Interface Name
-----
Enabled          Disconnected Dedicated       Ethernet
Enabled          Disconnected Dedicated       Local Area Connection
Enabled          Disconnected Dedicated       OpenVPN Connect DCO Adapter
Enabled          Connected     Dedicated       Wi-Fi

C:\Users\Dell>
```

- Configures network interfaces, firewall, and other network settings from the command line.

- Syntax:

```
netsh interface show interface
```

```
netsh interface ip show config
```

## Discussion and Conclusion:

In this lab, we explored essential network commands to test and troubleshoot connectivity and configurations. Commands like ping and tracert helped verify reachability and trace the path of data packets, while ipconfig, getmac, and hostname provided insight into local network settings. Tools such as nslookup, arp -a, and netstat allowed us to check DNS resolution, IP-to-MAC mappings, and active connections, which are vital for diagnosing network problems. Commands like telnet and pathping helped test service availability and packet loss along routes, enhancing our troubleshooting skills.

Overall, using these commands gave practical experience in identifying network issues, understanding connectivity, and monitoring performance. Mastery of these tools equips network users and administrators with the ability to quickly detect, analyze, and resolve problems, ensuring reliable and efficient communication across networks.