

# LAB 2: Network Commands for Testing and Troubleshooting

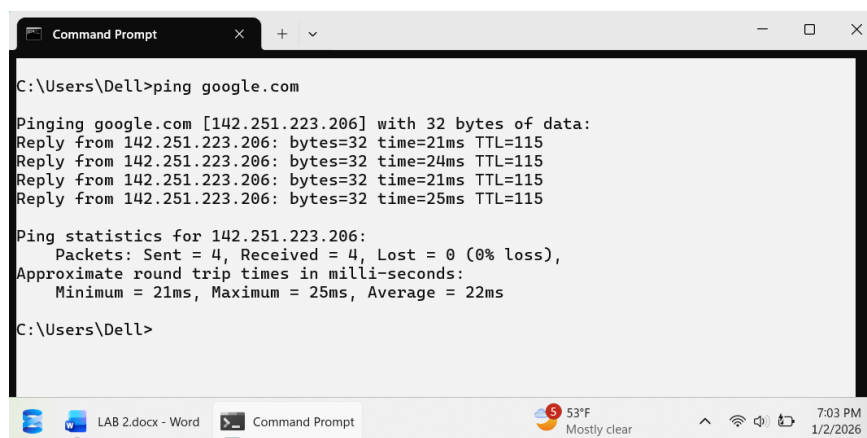
## Objectives:

- 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:

  0  1 ms  <1 ms  <1 ms  192.168.1.254
  1  12 ms  9 ms  4 ms  27.34.28.1
  2  11 ms  3 ms  4 ms  be-81-6.45.gwc-ndc-core-01.wlink.com.np [202.79.45.6]
  3  4 ms  5 ms  4 ms  ae-20-136.41.gwj-htda-core-01.wlink.com.np [202.79.41.136]
  4  9 ms  7 ms  8 ms  ae-21-139.41.gwj-btwn-core-01.wlink.com.np [202.79.41.139]
  5  10 ms  10 ms  11 ms  ae52-ipt-bhwa-01.wlink.com.np [72.9.128.67]
  6  *      *      *      Request timed out.
  7  22 ms  18 ms  20 ms  142.250.174.2
  8  22 ms  22 ms  20 ms  192.178.81.9
  9  24 ms  19 ms  21 ms  142.251.76.193
 10  23 ms  18 ms  18 ms  tzdel-a-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	0.0.0.0:3306	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	0.0.0.0:33060	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	127.0.0.1:27017	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	127.0.0.1:54357	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	192.168.1.64:139	DESKTOP-EVGRBMR:0	LISTENING
TCP	192.168.1.64:49226	172.64.148.235:https	ESTABLISHED
TCP	192.168.1.64:49410	4.213.25.242:https	ESTABLISHED
TCP	192.168.1.64:51905	ec2-44-192-201-156:4244	ESTABLISHED
TCP	192.168.1.64:54223	se-in-f188:5228	ESTABLISHED
TCP	192.168.1.64:57567	104.18.32.47:https	ESTABLISHED
TCP	192.168.1.64:57985	172.64.155.209:https	ESTABLISHED
TCP	192.168.1.64:57987	20.190.175.24:https	TIME_WAIT
TCP	192.168.1.64:57989	52.110.16.165:https	TIME_WAIT
TCP	192.168.1.64:64283	104.18.36.252:https	ESTABLISHED
TCP	192.168.1.64:64286	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	:::33060	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	:::1	DESKTOP-EVGRBMR:0	LISTENING
UDP	0.0.0.0:123	::*	::*
UDP	0.0.0.0:5050	::*	::*
UDP	0.0.0.0:5353	::*	::*
UDP	0.0.0.0:5353	::*	::*
UDP	0.0.0.0:5353	::*	::*
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	:::1	1900	::*
UDP	:::1	61855	::*
UDP	[fe80::75a2:530c:d7e5:e5af%11]:1900	::*	::*
UDP	[fe80::75a2:530c:d7e5:e5af%11]:61854	::*	::*

- 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: 2404:6800:4002:80a::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

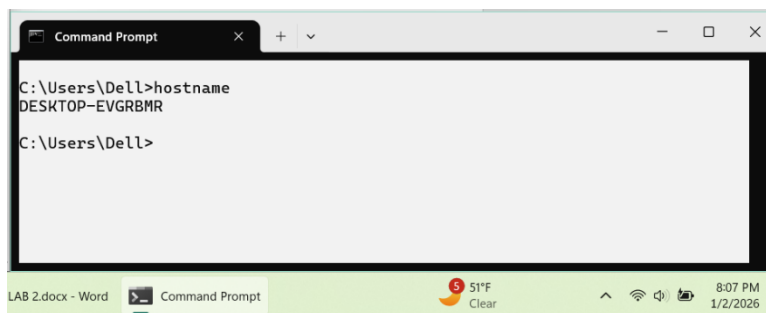


- Tests TCP connectivity to a specific port on a remote host.
- Useful to verify if a service is running on a specific port.
- Syntax:  
`telnet <hostname> <port>`

## 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                  255.255.255.255  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 On-link
1 331 ff00::/8 On-link
11 291 ff00::/8 On-link
=====
Persistent Routes:
None

C:\Users\Dell>
```

## 10. pathping

- Combines ping and traceroute 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-btvl-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      0ms      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-btvl-core-01.wlink.com.np [202.79.41.139]
6     ---    100/ 100 =100%     0/ 100 = 0%        ae52-ipt-bhwa-01.wlink.com.np [72.9.128.67]

Trace complete.
```

## 11. getmac

```
Command Prompt
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\NPF{7222B30D-E37A-42A5-BE33-76EBE8FF0BD2}

C:\Users\Dell>
```

- Displays the MAC address of the network interfaces.
- Syntax:

getmac

## 12. netsh

```
Command Prompt
=====
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\NPF{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.