Lab 2: Important Network Commands for Testing and Troubleshooting

Introduction

Network troubleshooting is an essential skill for any network administrator or IT professional. Network commands help identify, diagnose, and resolve network connectivity issues, check system configurations, and ensure that devices communicate correctly. In this lab, we explore important network commands and their practical usage for testing and troubleshooting network problems.

Objectives

- Learn essential network commands used for testing and troubleshooting.
- Understand how to check network connectivity, IP configuration, and network routes.
- Identify and diagnose common network issues using command-line tools.

Materials Required

- Computer with Windows/Linux/Mac OS
- Active network connection (LAN or Wi-Fi)
- Command Prompt (Windows) / Terminal (Linux, Mac)

Network Commands and Usage

1. ping

- Purpose: Test connectivity to another host on the network.
- Syntax: ping <IP address or hostname>
- Use: Shows if the target is reachable and the time it takes for packets to travel.
- Example:

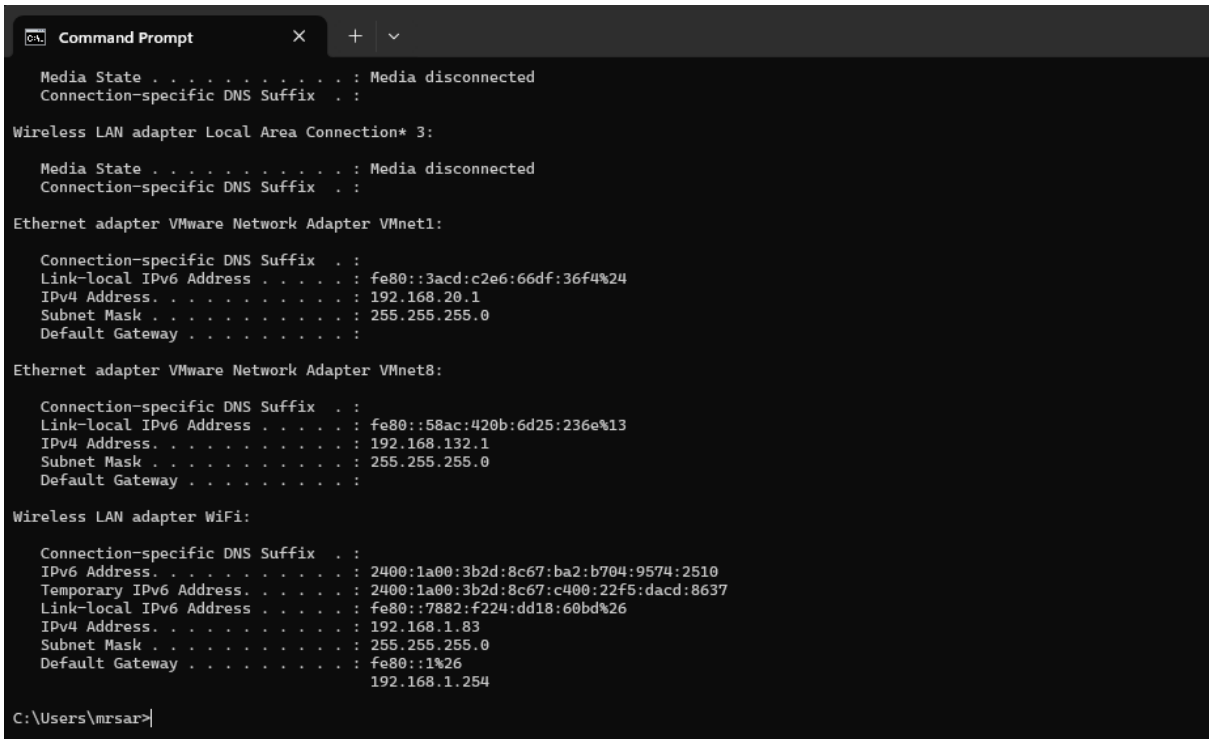
```
C:\Users\mrsar>ping google.com

Pinging google.com [2404:6800:4002:805::200e] with 32 bytes of data:
Reply from 2404:6800:4002:805::200e: time=26ms
Reply from 2404:6800:4002:805::200e: time=18ms
Reply from 2404:6800:4002:805::200e: time=19ms
Reply from 2404:6800:4002:805::200e: time=66ms

Ping statistics for 2404:6800:4002:805::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 18ms, Maximum = 66ms, Average = 32ms
```

2. ipconfig

- Purpose: Display your computer's IP address, subnet mask, and gateway.
- Syntax: ipconfig (windows) / ifconfig(Linux)
- Use: Helps identify which router or hop is slowing down or dropping packets.
- Example:



3. tracert

- Purpose: Find the path that data takes to reach a destination.
- Syntax: tracert <hostname or IP>
- Use: Helps identify which router or hop is slowing down or dropping packets.
- Example:

4. nslookup

- Purpose: Check if a domain name correctly resolves to an IP address.
- Syntax: nslookup <domain>
- Use: Useful to troubleshoot DNS issues.
- Example:

```
C:\Users\mrsar>nslookup www.microsoft.com
Server:  UnKnown
Address:  fe80::1

Non-authoritative answer:
Name:    e13678.dscb.akamaiedge.net
Addresses:  2600:140f:2e00:784::356e
          2600:140f:2e00:78b::356e
          124.41.246.67
Aliases:  www.microsoft.com
          www.microsoft.com-c-3.edgekey.net
          www.microsoft.com-c-3.edgekey.net.globalredir.akadns.net
```

5. netstat

- Purpose: See all active network connections and open ports on your computer.
- Syntax: netstat -a
- Use: Monitor which applications are using network connections.
- Example:

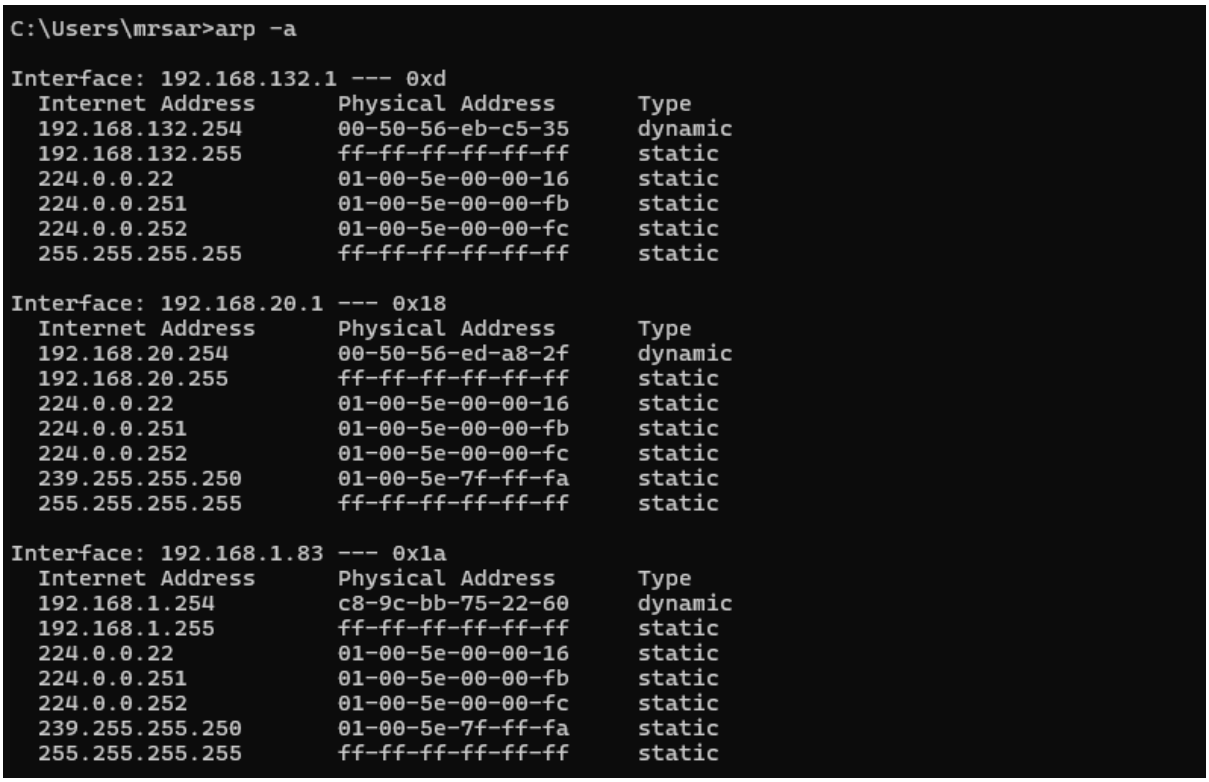
```
C:\Users\mrsar>netstat -a

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            Sarozz:0               LISTENING
  TCP    0.0.0.0:445            Sarozz:0               LISTENING
  TCP    0.0.0.0:902            Sarozz:0               LISTENING
  TCP    0.0.0.0:912            Sarozz:0               LISTENING
  TCP    0.0.0.0:1031           Sarozz:0               LISTENING
  TCP    0.0.0.0:1036           Sarozz:0               LISTENING
  TCP    0.0.0.0:5040           Sarozz:0               LISTENING
  TCP    0.0.0.0:7680           Sarozz:0               LISTENING
  TCP    0.0.0.0:8733           Sarozz:0               LISTENING
  TCP    0.0.0.0:9007           Sarozz:0               LISTENING
  TCP    0.0.0.0:49664          Sarozz:0               LISTENING
  TCP    0.0.0.0:49665          Sarozz:0               LISTENING
  TCP    0.0.0.0:49666          Sarozz:0               LISTENING
  TCP    0.0.0.0:49667          Sarozz:0               LISTENING
  TCP    0.0.0.0:49668          Sarozz:0               LISTENING
```

6. arp

- Purpose: Display or modify the ARP cache (which maps IPs to MAC addresses).
- Syntax: arp -a
- Use: Find MAC addresses of devices on the local network or detect IP conflicts.
- Example:



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

Interface: 192.168.132.1 --- 0xd
  Internet Address      Physical Address      Type
  192.168.132.254       00-50-56-eb-c5-35     dynamic
  192.168.132.255       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
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.20.1 --- 0x18
  Internet Address      Physical Address      Type
  192.168.20.254        00-50-56-ed-a8-2f     dynamic
  192.168.20.255        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

Interface: 192.168.1.83 --- 0x1a
  Internet Address      Physical Address      Type
  192.168.1.254         c8-9c-bb-75-22-60     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
```

7. route

- Purpose: View your computer's IP routing table and diagnose routing paths.
- Syntax: route print
- Use: Check network routes and identify potential routing problems.
- Example:

```
C:\Users\mrsar>route print
===========================================================================
Interface List
  4...08 8f c3 27 33 0f ......Killer E2600 Gigabit Ethernet Controller
 10...00 ff 48 1a ce 31 ......TAP-Windows Adapter V9
  8...00 ff 2f 0a 66 6c ......TAP-Windows Adapter V9 #2
  5...00 ff 27 16 a2 05 ......TAP-Windows Adapter V9 #3
 21...00 ff bb 56 c2 27 ......TAP-Windows Adapter V9 #4
 12...f6 7b 09 74 d6 be ......Microsoft Wi-Fi Direct Virtual Adapter
 19...f4 7b 09 74 d6 bf ......Microsoft Wi-Fi Direct Virtual Adapter #3
 24...00 50 56 c0 00 01 ......VMware Virtual Ethernet Adapter for VMnet1
 13...00 50 56 c0 00 08 ......VMware Virtual Ethernet Adapter for VMnet8
 26...f4 7b 09 74 d6 be ......Killer(R) Wi-Fi 6 AX1650i 160MHz Wireless Network Adapter (201NGW)
  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     192.168.1.83     45
        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      192.168.1.83    301
     192.168.1.83  255.255.255.255         On-link      192.168.1.83    301
    192.168.1.255  255.255.255.255         On-link      192.168.1.83    301
     192.168.20.0    255.255.255.0         On-link      192.168.20.1    291
     192.168.20.1  255.255.255.255         On-link      192.168.20.1    291
   192.168.20.255  255.255.255.255         On-link      192.168.20.1    291
    192.168.132.0    255.255.255.0         On-link     192.168.132.1    291
    192.168.132.1  255.255.255.255         On-link     192.168.132.1    291
  192.168.132.255  255.255.255.255         On-link     192.168.132.1    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      192.168.20.1    291
```

8. telnet

- Purpose: Test connectivity to a specific TCP port on a remote host.
- Syntax: telnet <hostname_or_IP> <port>
- Use: Verify if services like web servers, mail servers, or SSH are reachable.
- Example:

```
C:\Users\mrsar>telnet 192.168.1.1 80
Connecting To 192.168.1.1...
```

10. netsh

- Purpose: Configure, reset, or troubleshoot network interfaces and Windows Firewall.
- Syntax: netsh interface show interface
- Use: View interface status, reset TCP/IP stack, or troubleshoot network configuration issues.
- Example:

```
C:\Users\mrsar>netsh interface show interface

Admin State    State          Type             Interface Name
-------------------------------------------------------------------------
Enabled        Disconnected   Dedicated        Local Area Connection
Enabled        Disconnected   Dedicated        Local Area Connection 3
Enabled        Disconnected   Dedicated        Local Area Connection 2
Enabled        Disconnected   Dedicated        WhitehatVPN
Enabled        Connected      Dedicated        VMware Network Adapter VMnet1
Enabled        Connected      Dedicated        VMware Network Adapter VMnet8
Enabled        Disconnected   Dedicated        Ethernet
Enabled        Connected      Dedicated        WiFi
Enabled        Disconnected   Dedicated        Local Area Connection* 1
```

11. getmac

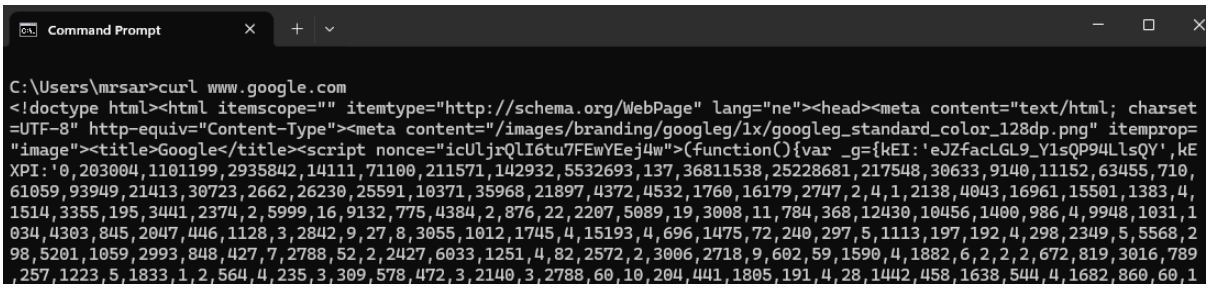
- Purpose: Display MAC addresses of all network adapters on your computer.
- Syntax: getmac
- Use: Identify network interface MAC addresses for troubleshooting or inventory.
- Example:

```
C:\Users\mrsar>getmac

Physical Address    Transport Name
=================== ============================================================
08-8F-C3-27-33-0F   Media disconnected
00-FF-48-1A-CE-31   Media disconnected
00-50-56-C0-00-01   \Device\Tcpip_{CD83D087-CD34-445C-8CF5-4693320FFB41}
00-50-56-C0-00-08   \Device\Tcpip_{5B0B94F3-01AC-4F24-BDC9-E951E8C226E9}
00-FF-2F-0A-66-6C   Media disconnected
00-FF-27-16-A2-05   Media disconnected
F4-7B-09-74-D6-BE   \Device\Tcpip_{E9207A49-FEF1-4A52-B795-3771E0EB92BB}
F6-7B-09-74-D6-BE   Media disconnected
00-FF-BB-56-C2-27   Media disconnected
```

12. curl

- Purpose: Test connectivity and HTTP requests to a URL or API.
- Syntax: curl <URL>
- Use: Verify website accessibility, response codes, or download content for testing.
- Example:



13. systeminfo

- Purpose: View detailed system information including network adapters and host info.
- Syntax: systeminfo
- Use: Check OS, network adapters, and hardware info that might affect connectivity.
- Example:

```
C:\Users\mrsar>systeminfo

Host Name:                 SAROZZ
OS Name:                   Microsoft Windows 11 Home
OS Version:                10.0.26200 N/A Build 26200
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:          mrsarojyad@hotmail.com
Registered Organization:   N/A
Product ID:                00342-20757-90434-AAOEM
Original Install Date:     21/01/2025, 20:08:08
System Boot Time:          08/01/2026, 16:34:00
System Manufacturer:       Acer
System Model:              Predator PH317-55
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 141 Stepping 1 GenuineIntel ~2304 Mhz
BIOS Version:              Insyde Corp. V1.14, 25/10/2022
Windows Directory:         C:\WINDOWS
System Directory:          C:\WINDOWS\system32
Boot Device:               \Device\HarddiskVolume1
System Locale:             en-gb;English (United Kingdom)
```

Procedure:

1. Open CMD (Windows) or Terminal (Linux/Mac).
2. Execute each command using a target IP or domain.
3. Observe and record the output.
4. Take screenshots after running each command.
5. Analyse the results to understand connectivity, routing, or DNS issues.

Results:

- All commands executed successfully.
- ping confirmed connectivity, ipconfig showed IP settings, tracert traced network paths.
- nslookup verified DNS resolution, netstat monitored active connections.

Conclusion:

These network commands allow us to efficiently identify and resolve connectivity and configuration issues. Tools such as ping, tracert, nslookup, and netstat provide valuable insights into network performance, routing paths, and service availability. Mastery of these commands is essential for effective network troubleshooting and maintaining reliable network operations.