Basic Networking Commands

Aim: To study and run basic networking commands to gather network configuration details, diagnose network connectivity issues, and understand network behaviour and performance.

THEORY

Networking Commands:

1. arp -a

Purpose:

ARP is used to resolve IPv4 addresses to physical MAC addresses within a local subnet. The ARP cache stores these mappings to speed up communication.

Output:

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

Interface: 192.168.0.108 --- 0xd
  Internet Address      Physical Address      Type
  192.168.0.1           dc-62-79-c1-93-e8     dynamic
  192.168.0.255         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

Interface: 169.254.83.107 --- 0x17
  Internet Address      Physical Address      Type
  169.254.83.107                              dynamic
  224.0.0.22                                  static
  224.0.0.251                                 static
  239.255.255.250                             static
```

2. hostname

Explanation:

The hostname is the identifier assigned to a device on a network, used in DNS and local network identification.

Output:

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

3. ipconfig

Explanation:

Shows IPv4 address, subnet mask, and default gateway for each network adapter.

Output:

```
C:\Users\Asus>ipconfig

Windows IP Configuration


Unknown adapter Tailscale:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::7c84:3492:1c7b:76a2%23
   Autoconfiguration IPv4 Address. . : 169.254.83.107
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

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::bbc4:8c86:501b:bc9f%13
   IPv4 Address. . . . . . . . . . . : 192.168.0.108
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.0.1
```

4. ipconfig/all

Explanation:

Includes MAC addresses, DHCP status, DNS servers, lease times, and more.

Output:

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

Windows IP Configuration

   Host Name . . . . . . . . . . . . : Kaushlendra
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Mixed
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No

Unknown adapter Tailscale:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Tailscale Tunnel
   Physical Address. . . . . . . . . :
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::7c84:3492:1c7b:76a2%23(Preferred)
   Autoconfiguration IPv4 Address. . : 169.254.83.107(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :
   NetBIOS over Tcpip. . . . . . . . : Disabled

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : CE-47-40-8D-C2-27
   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. . . . . . . . . : CE-47-40-8D-C2-37
   DHCP Enabled. . . . . . . . . . . : Yes
```

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : MediaTek Wi-Fi 6 MT7921 Wireless LAN Card
   Physical Address. . . . . . . . . : CC-47-40-8D-C2-17
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::bbc4:8c86:501b:bc9f%13(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.0.108(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Sunday, November 30, 2025 9:26:26 PM
   Lease Expires . . . . . . . . . . : Sunday, November 30, 2025 11:26:26 PM
   Default Gateway . . . . . . . . . : 192.168.0.1
   DHCP Server . . . . . . . . . . . : 192.168.0.1
   DHCPv6 IAID . . . . . . . . . . . : 164382528
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2E-F6-79-F7-CC-47-40-8D-C2-17
   DNS Servers . . . . . . . . . . . : 192.168.0.1
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

5. netstat

Explanation:

Shows current network connections and ports in use.

Output:

```
C:\Users\Asus>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:49669        Kaushlendra:49670      ESTABLISHED
  TCP    127.0.0.1:49670        Kaushlendra:49669      ESTABLISHED
  TCP    127.0.0.1:49671        Kaushlendra:49672      ESTABLISHED
  TCP    127.0.0.1:49672        Kaushlendra:49671      ESTABLISHED
  TCP    127.0.0.1:49698        Kaushlendra:49699      ESTABLISHED
  TCP    127.0.0.1:49699        Kaushlendra:49698      ESTABLISHED
  TCP    127.0.0.1:49700        Kaushlendra:49701      ESTABLISHED
  TCP    127.0.0.1:49701        Kaushlendra:49700      ESTABLISHED
  TCP    127.0.0.1:49702        Kaushlendra:49703      ESTABLISHED
  TCP    127.0.0.1:49703        Kaushlendra:49702      ESTABLISHED
  TCP    127.0.0.1:49704        Kaushlendra:49705      ESTABLISHED
  TCP    127.0.0.1:49705        Kaushlendra:49704      ESTABLISHED
  TCP    127.0.0.1:60314        Kaushlendra:60315      ESTABLISHED
  TCP    127.0.0.1:60315        Kaushlendra:60314      ESTABLISHED
  TCP    127.0.0.1:60316        Kaushlendra:60317      ESTABLISHED
  TCP    127.0.0.1:60317        Kaushlendra:60316      ESTABLISHED
  TCP    192.168.0.108:54727    48.218.107.66:https    ESTABLISHED
  TCP    192.168.0.108:56137    4.190.204.134:https    ESTABLISHED
  TCP    192.168.0.108:58628    180.149.59.136:https   ESTABLISHED
  TCP    192.168.0.108:58633    40.79.150.121:https    ESTABLISHED
  TCP    192.168.0.108:58634    13.107.246.48:https    ESTABLISHED
  TCP    192.168.0.108:60954    199.165.136.101:https  ESTABLISHED
  TCP    192.168.0.108:61654    4.213.25.241:https     ESTABLISHED
  TCP    192.168.0.108:62274    lb:http                ESTABLISHED
  TCP    192.168.0.108:63031    172.64.148.235:https   ESTABLISHED
  TCP    192.168.0.108:63662    lb-140-82-114-26-iad:https  ESTABLISHED
  TCP    192.168.0.108:63671    52.98.88.242:https     ESTABLISHED
  TCP    192.168.0.108:64583    sl-in-f188:5228        ESTABLISHED
```

6. nslookup <domain>

Explanation:

Interacts with DNS servers to retrieve DNS records.

Output:

```
C:\Users\Asus>nslookup www.google.com
DNS request timed out.
    timeout was 2 seconds.
Server:  UnKnown
Address:  192.168.0.1

Non-authoritative answer:
Name:    www.google.com
Addresses:  2404:6800:4002:81c::2004
          142.250.193.100
```

7. ping <IP/hostname>

Explanation:

Measures round-trip time and packet loss.

Output:

```
C:\Users\Asus>ping www.youtube.com

Pinging youtube-ui.l.google.com [216.58.203.14] with 32 bytes of data:
Reply from 216.58.203.14: bytes=32 time=34ms TTL=115
Reply from 216.58.203.14: bytes=32 time=29ms TTL=115
Reply from 216.58.203.14: bytes=32 time=33ms TTL=115
Request timed out.

Ping statistics for 216.58.203.14:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 29ms, Maximum = 34ms, Average = 32ms
```

8. traceroute <IP/hostname>

Explanation:

Sends ICMP packets with increasing TTL values to identify each hop.

Output:

```
C:\Users\Asus>tracert www.youtube.com

Tracing route to youtube-ui.l.google.com [216.58.203.14]
over a maximum of 30 hops:

  1   147 ms     2 ms     4 ms  192.168.0.1
  2    18 ms    13 ms     *     10.10.15.1
  3    15 ms    14 ms    15 ms  172.16.1.1
  4    15 ms    16 ms     *     10.25.247.9
  5     9 ms     9 ms    11 ms  10.119.234.162
  6     *        *       18 ms  72.14.194.160
  7    15 ms    14 ms    16 ms  142.251.77.23
  8     *       21 ms     *     192.178.83.214
  9    86 ms    20 ms    18 ms  192.178.46.225
 10    99 ms     *        *     142.251.197.114
 11     *       91 ms     *     192.178.254.212
 12    54 ms     *        *     192.178.110.107
 13     *       49 ms   203 ms  172.253.77.23
 14    41 ms    39 ms    38 ms  hkg12s09-in-f14.1e100.net [216.58.203.14]

Trace complete.
```

Category	Commands	Purpose
IP Configuration	ipconfig, ipconfig/all,	View and manage IP settings
Address Resolution	arp -a	Map IP to MAC, NetBIOS name resolution
Connectivity Testing	ping, tracert,	Test reachability and route tracing
DNS Resolution	nslookup	Resolve domain names and manage DNS cache
Network Statistics	netstat	View active connections and routing table
System Info	hostname	Identify local machine name

CONCLUSION:

Basic networking commands are indispensable tools for network management and troubleshooting. They provide visibility into network configurations, connectivity status, routing paths, and DNS resolution. Proficiency in these commands enables IT professionals to quickly diagnose and resolve network issues, ensuring reliable and secure network operations.