CN Practical 1

Aim : Study of basic elements of computer networking with details of networking devices.

Hub

- A **basic networking device** that connects multiple computers in a LAN.
- It **broadcasts** data to **all connected devices**, whether they need it or not.
- Works at **Layer 1 (Physical Layer)** of the OSI model.

Switch

- An **improved hub** that connects multiple devices but is smarter.
- It sends data only to the **specific device** (MAC address) that needs it.
- Works at **Layer 2 (Data Link Layer)**.

Router

- A device that **connects different networks** (like your home network to the internet).
- It finds the **best path** for data packets.
- Works at **Layer 3 (Network Layer)**.

Bridge

- A device that **connects two LAN segments** to make them act as one.
- Filters traffic based on **MAC addresses**.
- Works at **Layer 2 (Data Link Layer)**.

Brouter (Bridge + Router)

- A hybrid device that can act as both a **bridge** and a **router**.
- It **routes** packets for known protocols and **bridges** others.

Repeater

- A device that **amplifies signals** in a network.
- Used to extend the range of a LAN or Wi-Fi by boosting weak signals.
- Works at **Layer 1 (Physical Layer)**.

Gateway

- A device that connects two **different types of networks** (with different protocols).
- Example: Connecting a company's LAN to the internet.

- Works at **all layers** (since it may need protocol conversion).

Modem (Modulator + Demodulator)

- A device that converts **digital signals** (computer) into **analog signals** (telephone lines) and vice versa.
- Used for internet connections over phone lines.

TOPOLOGIES :

Bus Topology

- All devices share a **single communication line (backbone cable)**.
- Data travels in both directions, and only one device can transmit at a time.
- Cheap and simple, but if the main cable fails → entire network goes down.

Star Topology

- All devices are connected to a **central device** (hub or switch).
- If one device fails, others remain unaffected.
- Easy to manage, but if the central hub fails → whole network stops.

Mesh Topology

- Every device is connected to **every other device**.
- Provides **high reliability** (multiple paths for data).
- Expensive and complex due to large number of cables.

Hybrid Topology

- A **combination** of two or more topologies (e.g., star + bus).
- Flexible and scalable, but more complex to design.

Ring Topology

- Devices are connected in a **closed loop** (like a circle).
- Data travels in one direction (or both in dual ring).
- Failure of one node can affect the whole ring, unless fault-tolerant.

Types of Cables :

Twisted Pair Cable

- Made of **pairs of copper wires twisted together** to reduce interference.
- Commonly used in LANs (Ethernet cables: Cat5, Cat6).
- **Cheap**, flexible, but limited distance and speed compared to fiber.

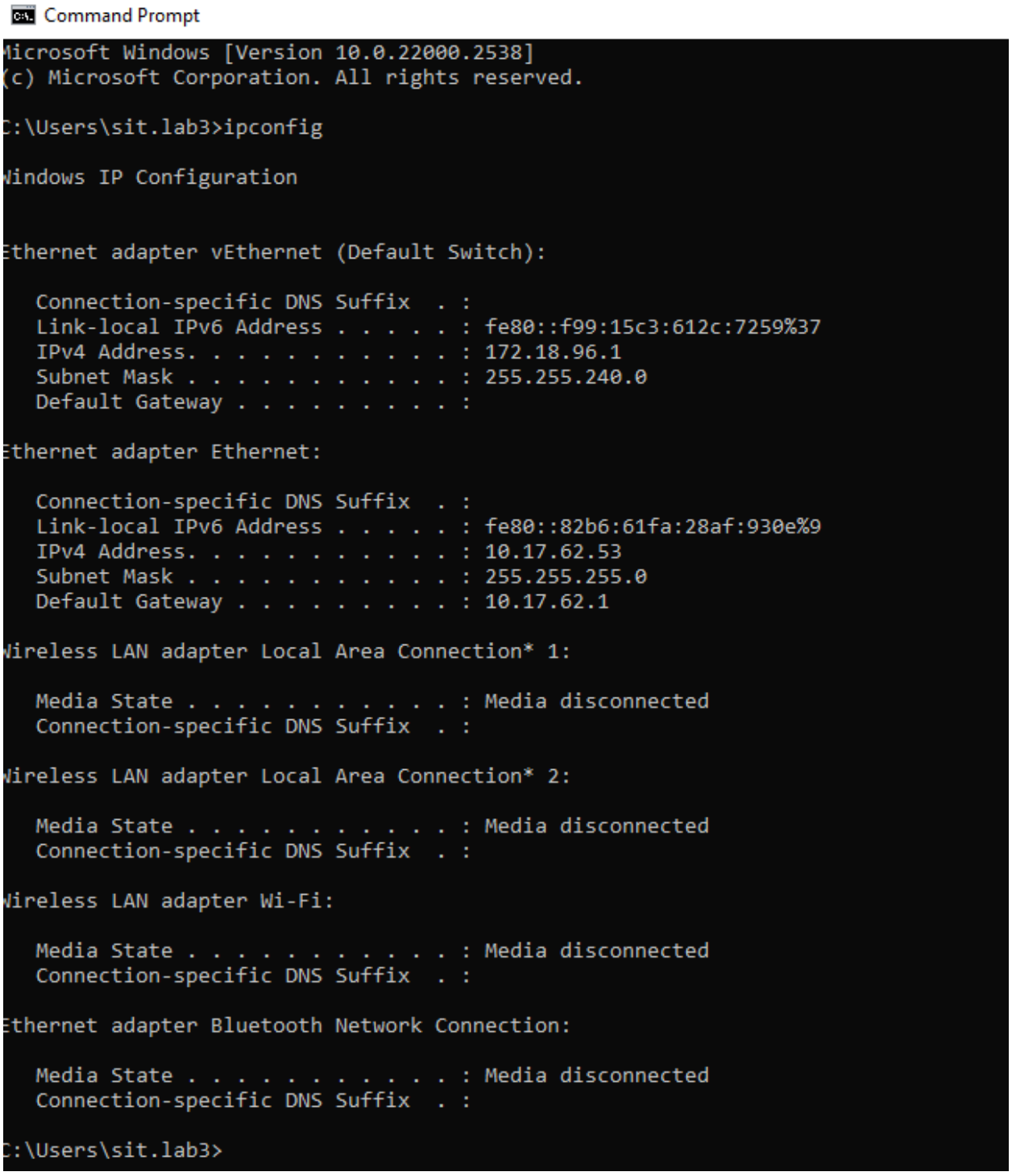
Coaxial Cable

- Has a **central copper conductor**, insulating layer, metallic shield, and outer cover.
- Provides better shielding from interference than twisted pair.
- Used in cable TV, early LANs, and broadband connections.

Fiber Optic Cable

- Uses **thin glass or plastic fibers** to transmit data as **light signals**.
- Very **high speed, long distance, and immune to electromagnetic interference**.
- Expensive and more fragile compared to copper cables.

Network troubleshooting commands :


Command Prompt
Microsoft Windows [Version 10.0.22000.2538]
(c) Microsoft Corporation. All rights reserved.
C:\Users\sit.lab3>ipconfig
Windows IP Configuration
Ethernet adapter vEthernet (Default Switch):
Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::f99:15c3:612c:7259%37
IPv4 Address. . . . . : 172.18.96.1
Subnet Mask . . . . . : 255.255.240.0
Default Gateway . . . . . :
Ethernet adapter Ethernet:
Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::82b6:61fa:28af:930e%9
IPv4 Address. . . . . : 10.17.62.53
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 10.17.62.1
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:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Ethernet adapter Bluetooth Network Connection:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
C:\Users\sit.lab3>

```
C:\Users\sit.lab3>ping www.google.com

Pinging www.google.com [142.250.192.68] with 32 bytes of data:
Reply from 142.250.192.68: bytes=32 time=18ms TTL=117
Reply from 142.250.192.68: bytes=32 time=15ms TTL=118
Reply from 142.250.192.68: bytes=32 time=15ms TTL=118
Reply from 142.250.192.68: bytes=32 time=14ms TTL=117

Ping statistics for 142.250.192.68:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 14ms, Maximum = 18ms, Average = 15ms

C:\Users\sit.lab3>ping 142.250.192.68

Pinging 142.250.192.68 with 32 bytes of data:
Reply from 142.250.192.68: bytes=32 time=31ms TTL=118
Reply from 142.250.192.68: bytes=32 time=14ms TTL=118
Reply from 142.250.192.68: bytes=32 time=15ms TTL=117
Reply from 142.250.192.68: bytes=32 time=14ms TTL=117

Ping statistics for 142.250.192.68:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 14ms, Maximum = 31ms, Average = 18ms
```

```
C:\Users\sit.lab3>tracert www.google.com

Tracing route to www.google.com [142.250.77.36]
over a maximum of 30 hops:

  1   373 ms   873 ms   232 ms  10.17.62.1
  2     *        *        *     Request timed out.
  3     *        *        *     Request timed out.
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6     *        *        *     Request timed out.
  7    43 ms     *        *     bom07s26-in-f4.1e100.net [142.250.77.36]
  8    15 ms    34 ms    16 ms  bom07s26-in-f4.1e100.net [142.250.77.36]

Trace complete.

C:\Users\sit.lab3>tracert www.google.co.in

Tracing route to www.google.co.in [142.250.70.99]
over a maximum of 30 hops:

  1     4 ms     3 ms     3 ms  10.17.62.1
  2     *        *        *     Request timed out.
  3     *        *        *     Request timed out.
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6     *        *        *     Request timed out.
  7     *        *        *     Request timed out.
  8    16 ms     *       16 ms  pnbomb-ac-in-f3.1e100.net [142.250.70.99]

Trace complete.
```

```
C:\Users\sit.lab3>route print
===========================================================================
Interface List
 37...00 15 5d 49 af 00 ......Hyper-V Virtual Ethernet Adapter
  9...00 be 43 8d 96 6b ......Realtek PCIe GbE Family Controller
 11...10 51 07 39 3f 1f ......Microsoft Wi-Fi Direct Virtual Adapter
  7...12 51 07 39 3f 1e ......Microsoft Wi-Fi Direct Virtual Adapter #2
 17...10 51 07 39 3f 1e ......Intel(R) Wi-Fi 6 AX200 160MHz
 15...10 51 07 39 3f 22 ......Bluetooth Device (Personal Area Network)
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0      10.17.62.1      10.17.62.53     25
       10.17.62.0    255.255.255.0         On-link       10.17.62.53    281
      10.17.62.53  255.255.255.255         On-link       10.17.62.53    281
     10.17.62.255  255.255.255.255         On-link       10.17.62.53    281
        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
      172.18.96.0    255.255.240.0         On-link       172.18.96.1    271
      172.18.96.1  255.255.255.255         On-link       172.18.96.1    271
   172.18.111.255  255.255.255.255         On-link       172.18.96.1    271
        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       10.17.62.53    281
        224.0.0.0        240.0.0.0         On-link       172.18.96.1    271
  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       10.17.62.53    281
  255.255.255.255  255.255.255.255         On-link       172.18.96.1    271
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  1    331 ::1/128                  On-link
  9    281 fe80::/64                On-link
 37    271 fe80::/64                On-link
 37    271 fe80::f99:15c3:612c:7259/128
                                   On-link
  9    281 fe80::82b6:61fa:28af:930e/128
                                   On-link
  1    331 ff00::/8                 On-link
  9    281 ff00::/8                 On-link
 37    271 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None
```

```
C:\Users\sit.lab3>nslookup www.google.com
Server:  SYMBINGP.SYMBINGP.SOC
Address:  10.17.28.23

Non-authoritative answer:
Name:    www.google.com
Addresses:  2404:6800:4009:805::2004
          142.251.220.68


C:\Users\sit.lab3>nslookup
Default Server:  SYMBINGP.SYMBINGP.SOC
Address:  10.17.28.23

> www.google.com
Server:  SYMBINGP.SYMBINGP.SOC
Address:  10.17.28.23

Non-authoritative answer:
Name:    www.google.com
Addresses:  2404:6800:4009:805::2004
          142.251.220.68
```