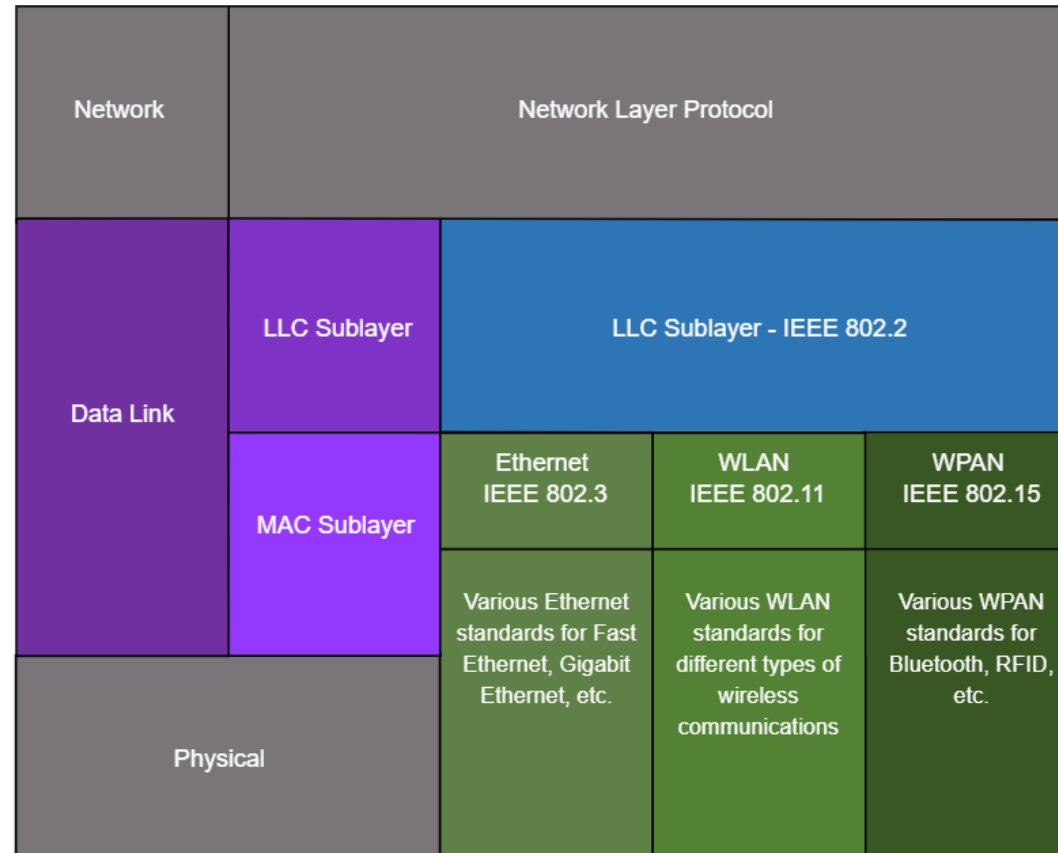# Data Link Layer

The Data Link Layer

- Encapsulate Layer 3 packets into Layer 2 Frames
- Performs **error detection** and **rejects corrupt frames**

Providing Access to Media and Standards

At each hop along the path, a router performs four basic Layer 2 functions:

- **1** Accepts a frame from the network medium.

- **2** De-encapsulates the frame to expose the encapsulated packet.

- **3** Re-encapsulates the packet into a new frame.

- **4** Forwards the new frame on the medium of the next network segment.
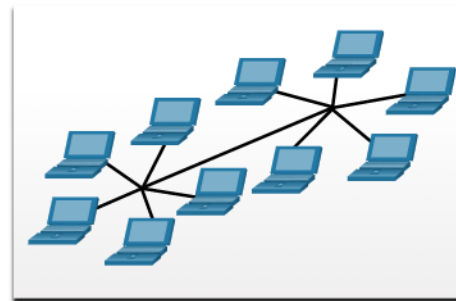
Standards: IEEE, ITU, ISO, ANSI

Topologies

- **WAN:** Point-to-point, Hub and spoke, Mesh

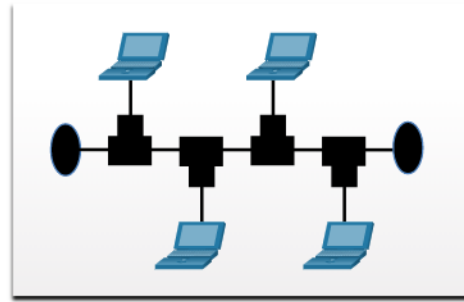- **LAN:** Star, Extended Star, Bus and Ring

Physical Topologies

Star Topology

Extended Star Topology

Bus Topology

Ring Topology

Half and Full Duplex Communication

➡️ **Half-duplex communication:**

- Only allows one device to send or receive at a time on a shared medium.
- Used on WLANs and legacy bus topologies with Ethernet hubs.

↔️ **Full-duplex communication:**

- Allows both devices to simultaneously transmit and receive on a shared medium.
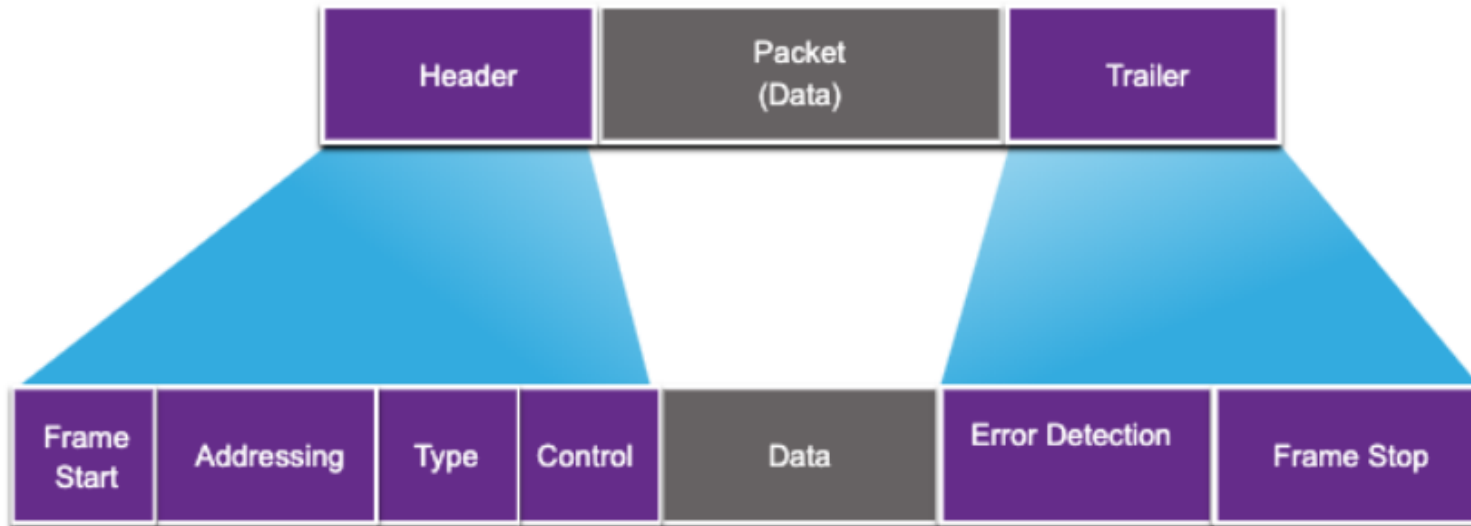- Ethernet switches operate in full-duplex mode.

Access Control Methods

Contention-based access: All nodes operating in **half-duplex**, competing for medium.

- **Carrier Sense Multiple Access with Collision Detection (CSMA/CD)**
  - **Use:** Legacy bus-topology Ethernet LANs. Devices detect the collission and wait a period of time and retransmit data.

- **Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)**
  - **Use:** WLAN. Devices when transmitting include the time duration needed for the transmission. Other devices know how long the medium is unavailable.

Controlled access: Deterministic access where each node has its own time on the medium. Used on legacy networks such as Token Ring and ARCNET.

Frame Fields

| Header | Packet (Data) | Trailer |

| Frame Start | Addressing | Type | Control | Data | Error Detection | Frame Stop |

Field	Description
Frame Start and Stop	Identifies beginning and end of frame
Addressing	Indicates source and destination nodes
Type	Identifies encapsulated Layer 3 protocol
Control	Identifies flow control services
Data	Contains the frame payload
Error Detection	Used for determine transmission errors