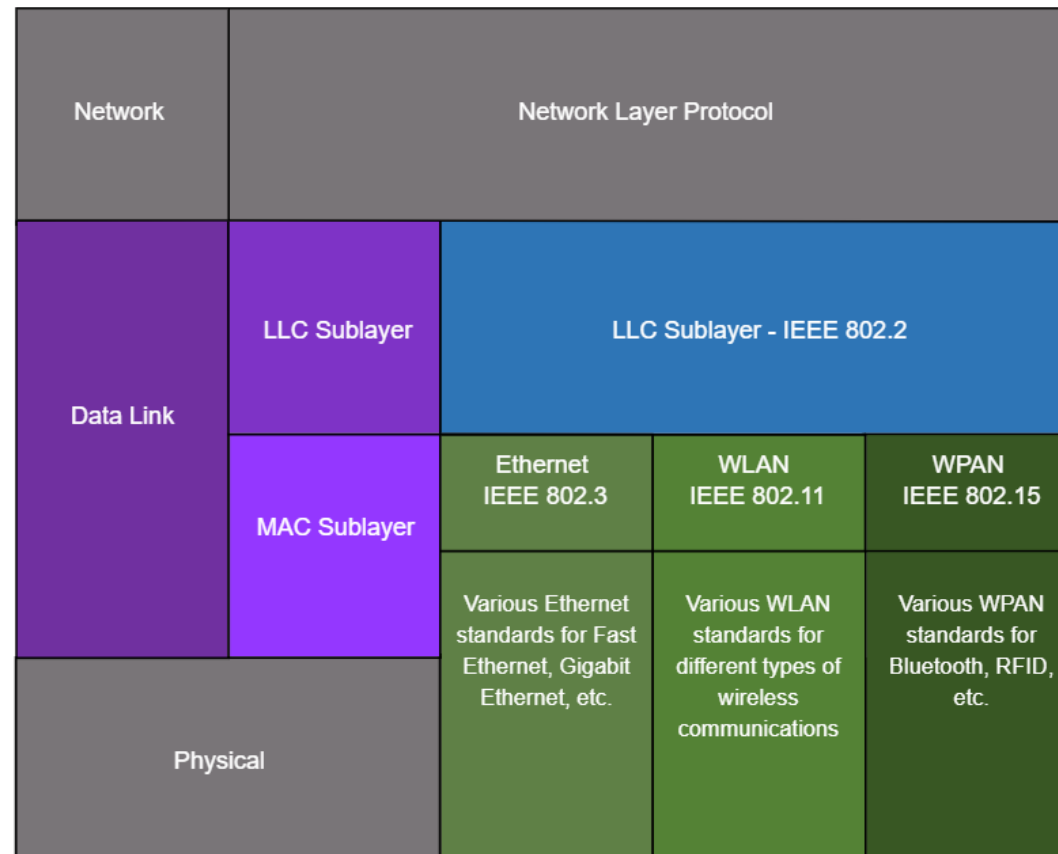


Data Link Layer

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

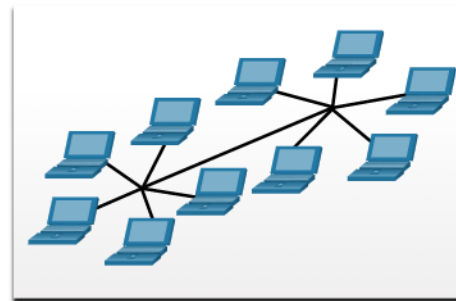
Topologies

- WAN: Point-to-point, Hub and spoke, Mesh
- LAN: Star, Extended Star, Bus and Ring

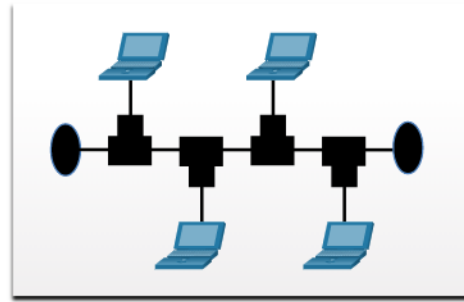
Physical Topologies



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.

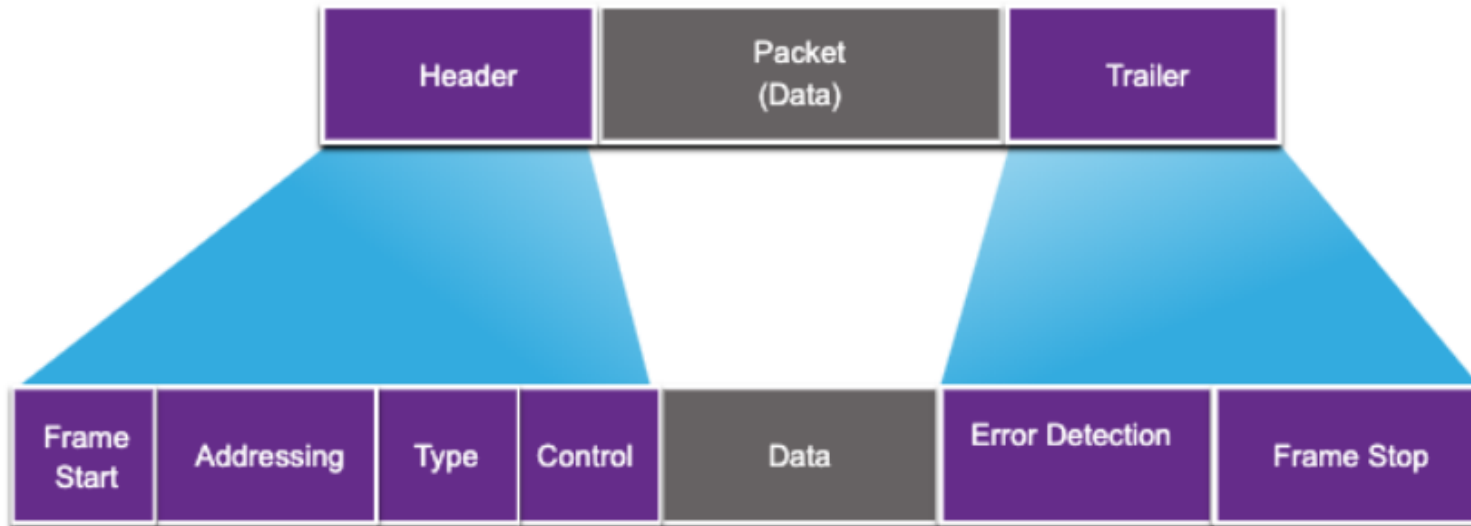
Access Control Methods

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 collision 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



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