

- **Ethernet hubs**—Devices that allow the concentration of many devices into a single segment. They have the following characteristics:
 - Physical layer devices.
 - Do not manipulate or view traffic.
 - Do not create separate collision domains.
 - Use carrier sense multiple access collision detect (CSMA/CD). When a collision occurs, both stations resend the signal after a random period. Collisions increase with the number of stations.
 - Regenerate the signal, allowing traffic to travel longer distances.

Data Link Layer Functions

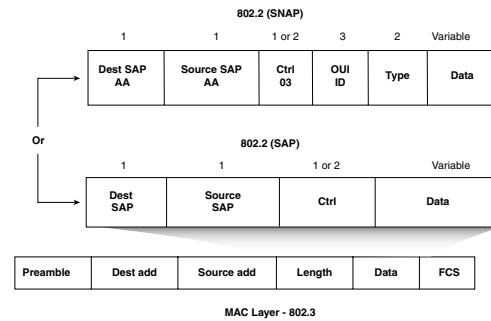
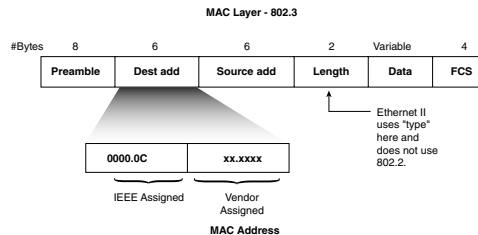
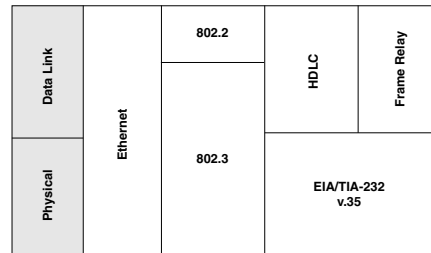
- Perform physical addressing.
- Provide support for connection-oriented and connectionless services.
- Provide for frame sequencing and flow control.

Two sublayers perform the data link functions:

Media Access Control (MAC) sublayer (802.3)—Responsible for how data is sent over the wire. The MAC address is a 48-bit address expressed as 12 hex digits.

MAC defines the following:

- Physical addressing
- Network topology
- Line discipline
- Error notification
- Orderly delivery of frames
- Optional flow control



Logical Link Control (LLC) sublayer (802.2)—Responsible for identifying and encapsulating different protocol types. There are two types of LLC frames: Service Access Point (SAP) and Subnetwork Access Protocol (SNAP).

Data Link Layer Devices

Bridges and Layer 2 switches function at the data link layer. Hardware ASICs allow switches to operate at gigabit speeds, whereas bridges make decisions based on software rules, which takes much longer. When a bridge or switch receives a frame, it processes the frame as follows:

- If the destination device is on the same segment as the originating frame, the bridge blocks the frame from going out other ports. This is known as *filtering*.
- If the destination device is on a different segment than the originating frame, the bridge forwards the frame to the appropriate segment.
- If the destination device is unknown to the bridge, the bridge forwards the frame to all segments except the one on which it was received. This is called *flooding*.

The purpose of Layer 2 Ethernet devices is to reduce collisions. (Other Layer 2 types are discussed later.) They have the following characteristics:

