

Ethernet Switching



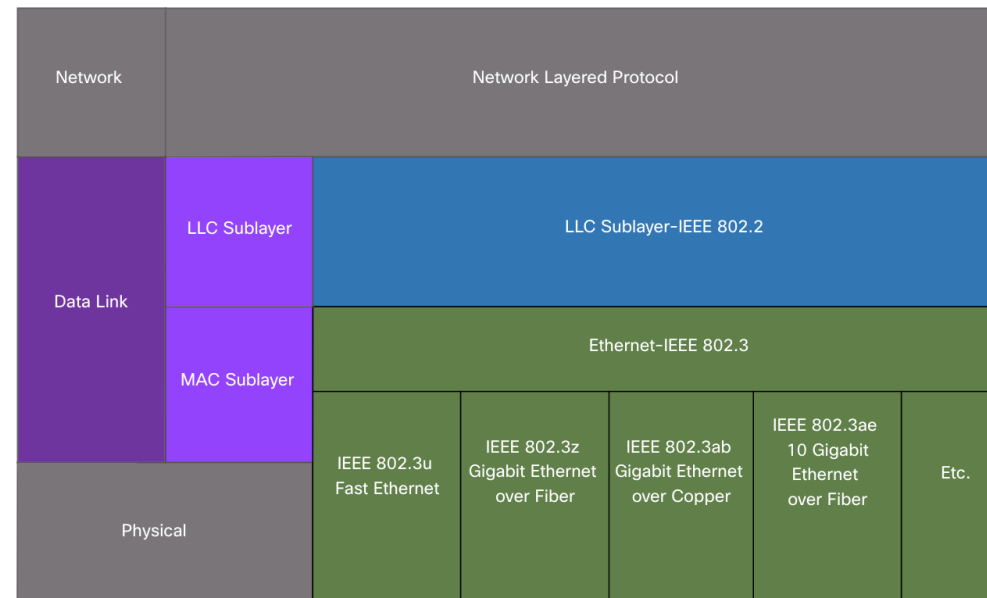
CCNA1v7 Module 7 Ethernet Switching



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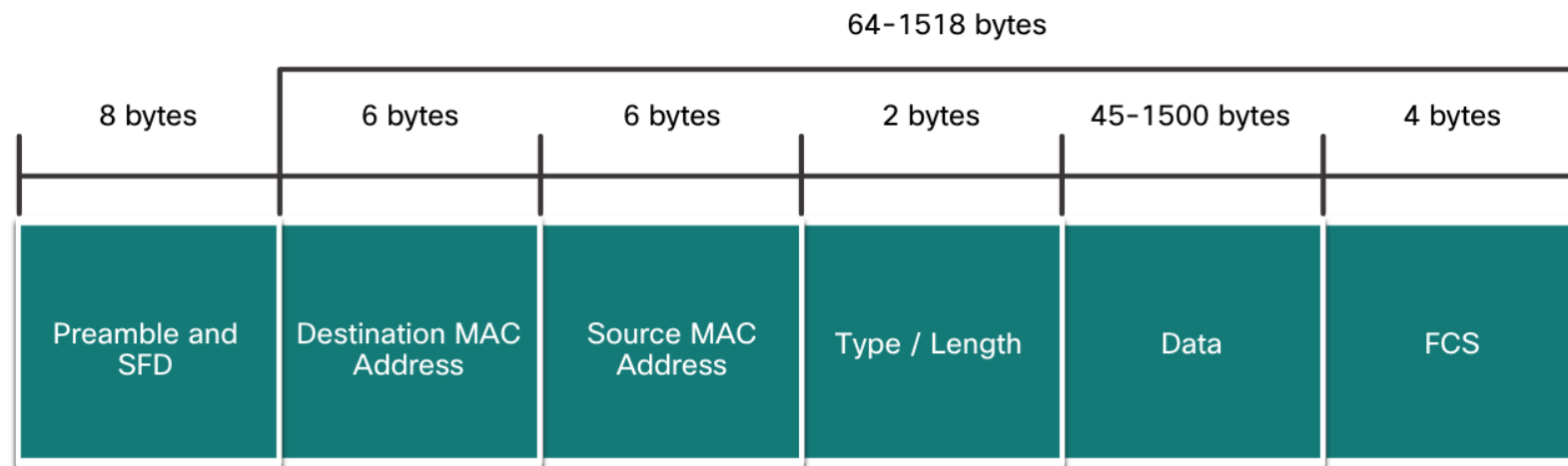
Data Link Sublayers

- **LLC Sublayer:** Places information in the frame to identify which network layer protocol is used for the frame.
- **MAC Sublayer:** Responsible for:
 - **Data encapsulation:** Ethernet frame, Addressing (MAC), Error detection
 - **Media access control:** CSMA/CD, CSMA/CA



Ethernet Frame

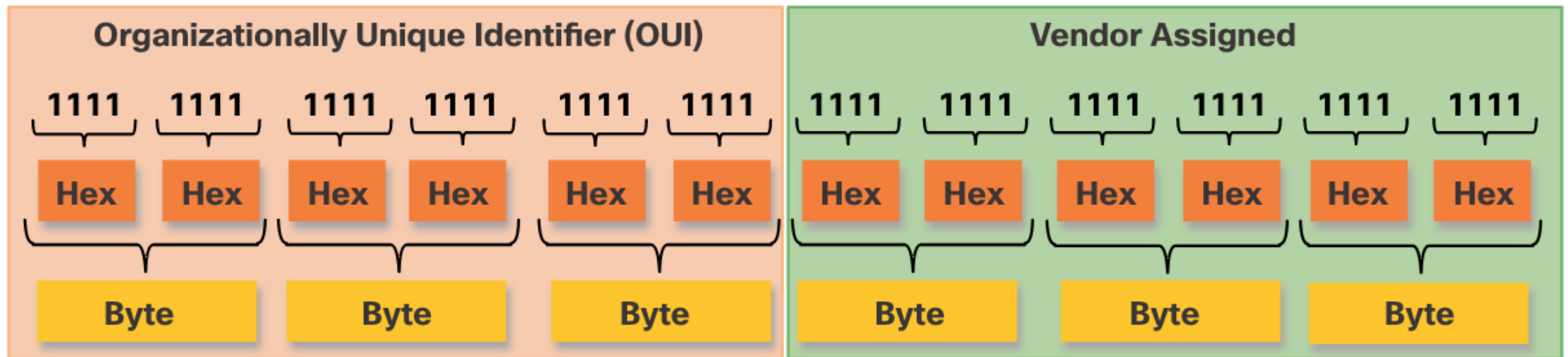
- Ethernet frame size (preamble not included):
 - Minimum = 64 bytes. Maximum = 1518 bytes
- Frame < 64 bytes ➡ "collision fragment" or "runt frame" (discarded)
- Frame > 1500 bytes of data ➡ "jumbo" or "baby giant frames".
- Minimum > Size of transmitted frame > Maximum ➡ device drops the frame



Ethernet MAC Address

Ethernet MAC Address = 48 bits expressed in 12 hexadecimal digits

All MAC addresses must be unique to the Ethernet device or Ethernet interface.



Frame Processing

- Ethernet header include a Source MAC address and a Destination MAC address.
- Device receives frame ➡ examine Destination MAC address
 - Frame received Destination MAC address \neq Device NIC MAC ➡ Discard frame
 - Frame received Destination MAC address = Device NIC MAC ➡ Accept

Types of MAC Addresses

- **Unicast:** Determine MAC Address with an IP: IPv4 (ARP), IPv6 (ND)
- **Broadcast:** FF-FF-FF-FF-FF-FF
- **Multicast:**
 - Multicast IPv4: 01-00-5E
 - Multicast IPv6: 33-33

Switch Fundamentals

Switch makes its forwarding decisions based on the Layer 2 Ethernet MAC addresses.

1 LEARN. Frame enters switch. Switch examines frame source MAC address

- Source MAC address unknown ➡ Adds source MAC to table with incoming port
- Source MAC address known ➡ Refresh timer for that entry (default: 5 min)

2 FORWARD. Find the Destination MAC Address

- Destination is Unicast?
 - Destination MAC known ➡ Forwards out the specified port
 - Destination MAC unknown ➡ Forwards out all ports except incoming port
- Destination is Multicast or Broadcast? ➡ Forwards out all ports except incoming port

Frame Forwarding Methods on Cisco Switches

- **Store-and-forward switching:**
 - Receives the entire frame and computes the CRC.
 - CRC valid? ➡ Forwards frame
 - CRC invalid? ➡ Discards frame
- **Cut-through switching:**
 - **Fast-forward switching:** forwards after reading the destination address.
 - **Fragment-free switching:** switch stores and performs an error check on the first 64 bytes of the frame before forwarding.

Duplex and Speed Settings

- **Full-duplex:** Both ends of the connection can send and receive simultaneously.
- **Half-duplex:** Only one end of the connection can send at a time.

⚠ Gigabit Ethernet ports only operate in full-duplex.

Best practice: configure both Ethernet switch ports as full-duplex.

Auto-MDIX

Most switch devices now support the automatic medium-dependent interface crossover (auto-MDIX) feature. When enabled, the switch automatically detects the type of cable attached to the port and configures the interfaces accordingly. (`mdix auto`)