Router Boot Sequence and Verification Summary

- The major components of the router are RAM, ROM, Flash memory, NVRAM, the configuration register, and the interfaces.
- The four major areas of microcode contained in ROM are bootstrap code, POST code, ROM monitor, and a mini Cisco IOS Software.
- The router configuration can come from NVRAM, a terminal, or a TFTP server.
- You can back up your software image on the network server by using the **copy flash [location]** command.

Catalyst Switch Operations

Basic Layer 2 Switching (Bridging) Functions

Ethernet switching operates at OSI Layer 2, creating dedicated network segments and interconnecting segments. Layer 2 switches have three main functions:

- **MAC address learning**—A Layer 2 switch learns the MAC addresses of devices attached to each of its ports. The addresses are stored in a bridge forwarding database.
- **Forwarding and filtering**—Switches determine which port a frame must be sent out to reach its destination. If the address is known, the frame is sent only on that port; if the address is unknown, the frame is flooded to all ports except the one from which it originated.
- **Loop avoidance**—When the switched network has redundant loops, the switch can prevent duplicate frames from traveling over multiple paths.

Bridging and Switching Comparison

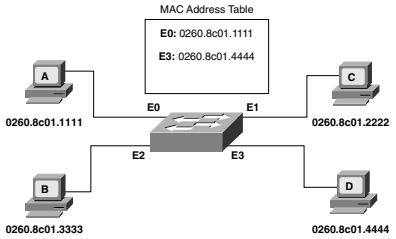
Bridging	Switching
Software-based	Hardware- (ASIC) based
One spanning tree instance per bridge	Many spanning tree instances per switch
Usually up to 16 ports per bridge	More ports on a switch

Frame Transmission Modes

There are three primary frame-switching modes:

- **Cut-through**—The switch checks the destination address and immediately begins forwarding the frame. This can decrease latency.
- **Store and forward**—The switch waits to receive the entire frame before forwarding. The entire frame is read, and a cyclic redundancy check (CRC) is performed. If the CRC is bad, the frame is discarded. Latency increases as a function of frame length.
- **Fragment-free (modified cut-through)**—The switch reads the first 64 bytes before forwarding the frame. 64 bytes is the minimum number of bytes necessary to detect and filter out collision frames. This is the default mode for Catalyst 1900.

How Switches Learn Addresses



A switch uses its bridge forwarding table (called a MAC table in Catalyst) address table when forwarding frames to devices. With an empty bridge forwarding table, the switch must flood frames to all ports other than the one it arrived on. This is the least-efficient way to transmit data.

Initially, the switch MAC address table is empty. Then Station A with the MAC address sends a frame to station C. When the switch receives this frame, it does the following:

- Because the MAC table is empty, the switch must flood the frame to all other ports (except E0, the frame origin).
- The switch notes the source address of the originating device and associates it with port E0 in its MAC address table entry. Note that the table uses the source address to populate the table, not the destination address.

The switch continues to learn addresses in this manner, continually updating the table. As the MAC table becomes more complete, the switching becomes more efficient, because frames are filtered to specific ports rather than being flooded out all ports.

Broadcast and Multicast Frames

Broadcast and multicast frames are flooded to all ports other than the originating port. Broadcast and multicast addresses never appear as a frame's source address, so the switch does not learn these addresses.