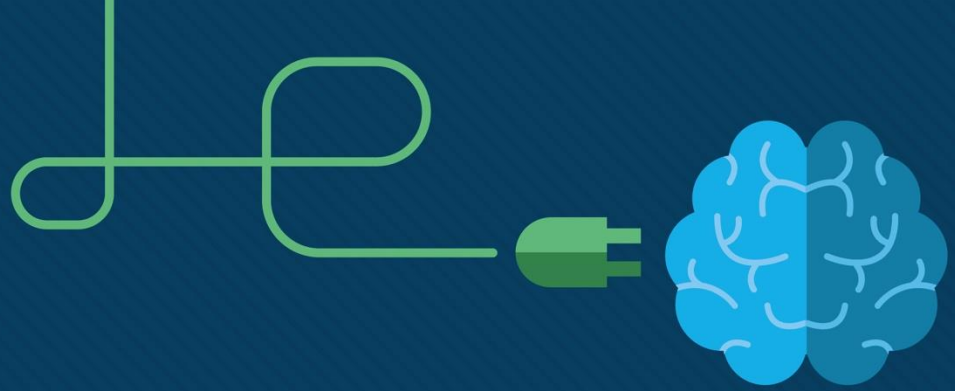


Module 2: Switching Concepts

Switching, Routing, and Wireless Essentials v7.0 (SRWE)

Module Objectives

Module Title: Switching Concepts

Module Objective: Explain how Layer 2 switches forward data.

Topic Title	Topic Objective
Frame Forwarding	Explain how frames are forwarded in a switched network.
Switching Domains	Compare a collision domain to a broadcast domain.

2.1 Frame Forwarding

Switching in Networking

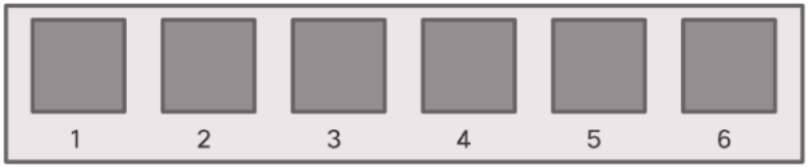
Two terms are associated with frames entering or leaving an interface:

- **Ingress** – entering the interface
- **Egress** – exiting the interface

A switch forwards based on the ingress interface and the destination MAC address.

A switch uses its MAC address table to make forwarding decisions.

Note: A switch will never allow traffic to be forwarded out the interface it received the traffic.



Port Table

Destination Addresses	Port
EE	1
AA	2
BA	3
EA	4
AC	5
AB	6

The Switch MAC Address Table

A switch will use the destination MAC address to determine the egress interface.

Before a switch can make this decision, it must learn what interface the destination is located.

A switch builds a MAC address table, also known as a Content Addressable Memory (CAM) table, by recording the source MAC address into the table along with the port it was received.

The Switch Learn and Forward Method

The switch uses a two-step process:

Step 1. Learn – Examines Source Address

- Adds the source MAC if not in table
- Resets the time out setting back to 5 minutes if source is in the table

Step 2. Forward – Examines Destination Address

- If the destination MAC is in the MAC address table, it is forwarded out the specified port.
- If a destination MAC is not in the table, it is flooded out all interfaces except the one it was received.

Switch Forwarding Methods

Switches use software on application-specific-integrated circuits (ASICs) to make very quick decisions.

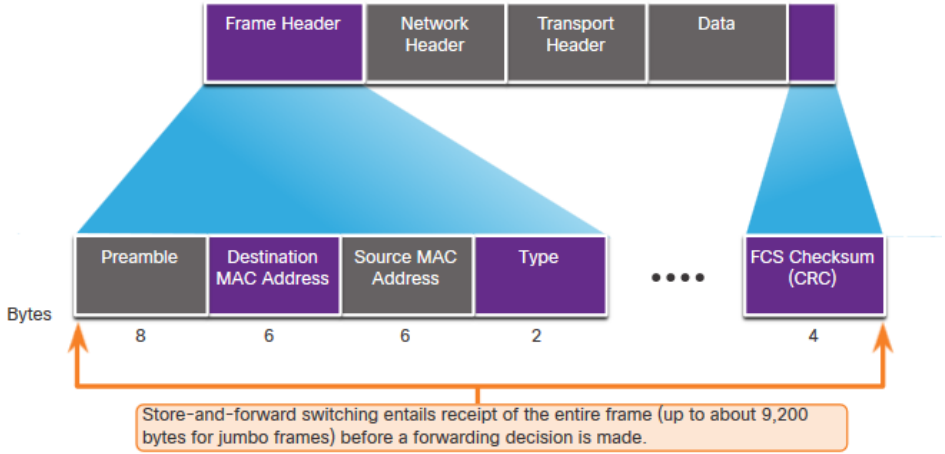
A switch will use one of two methods to make forwarding decisions after it receives a frame:

- **Store-and-forward switching** - Receives the entire frame and ensures the frame is valid. Store-and-forward switching is Cisco's preferred switching method.
- **Cut-through switching** – Forwards the frame immediately after determining the destination MAC address of an incoming frame and the egress port.

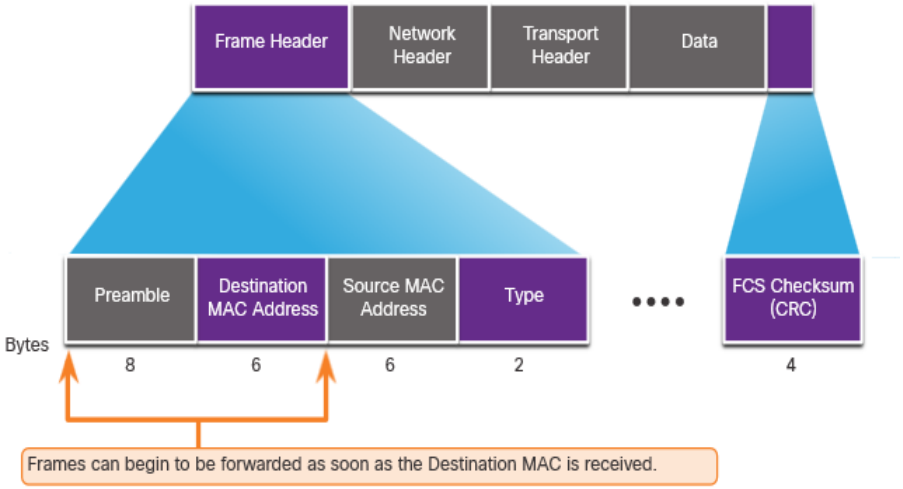
Store-and-Forward Switching

Store-and-forward has two primary characteristics:

- **Error Checking** – The switch will check the Frame Check Sequence (FCS) for CRC errors. Bad frames will be discarded.
- **Buffering** – The ingress interface will buffer the frame while it checks the FCS. This also allows the switch to adjust to a potential difference in speeds between the ingress and egress ports.



Cut-Through Switching



- **Cut-through** forwards the frame immediately after determining the destination MAC.
- **Fragment** (Frag) **Free** method will check the destination and ensure that the frame is at least 64 Bytes. This will eliminate runts.

Concepts of Cut-Through switching:

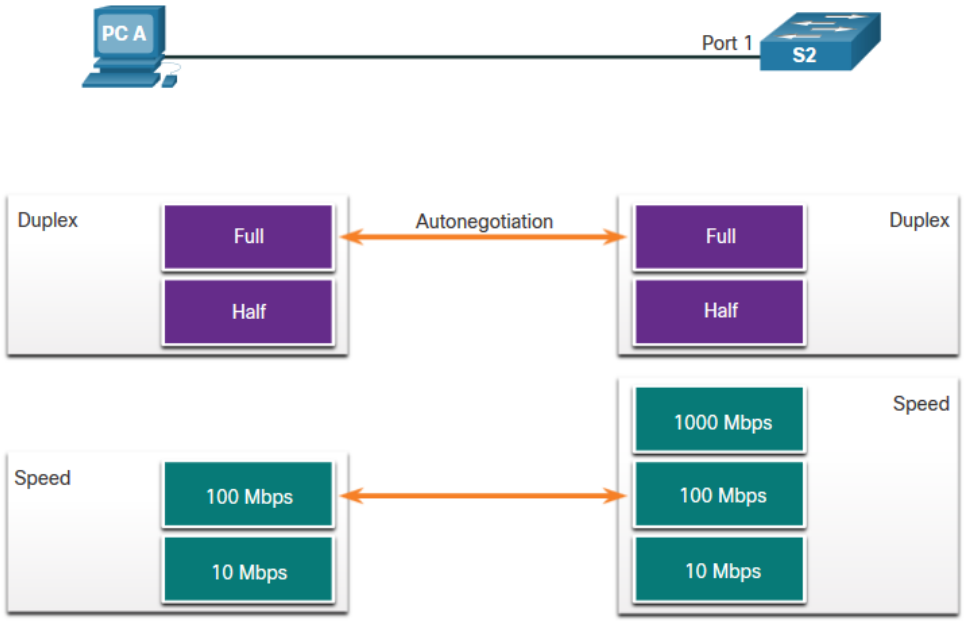
- Is appropriate for switches needing latency to be under 10 microseconds
- Does not check the FCS, so it can propagate errors
- May lead to bandwidth issues if the switch propagates too many errors
- Cannot support ports with differing speeds going from ingress to egress

2.2 Switching Domains

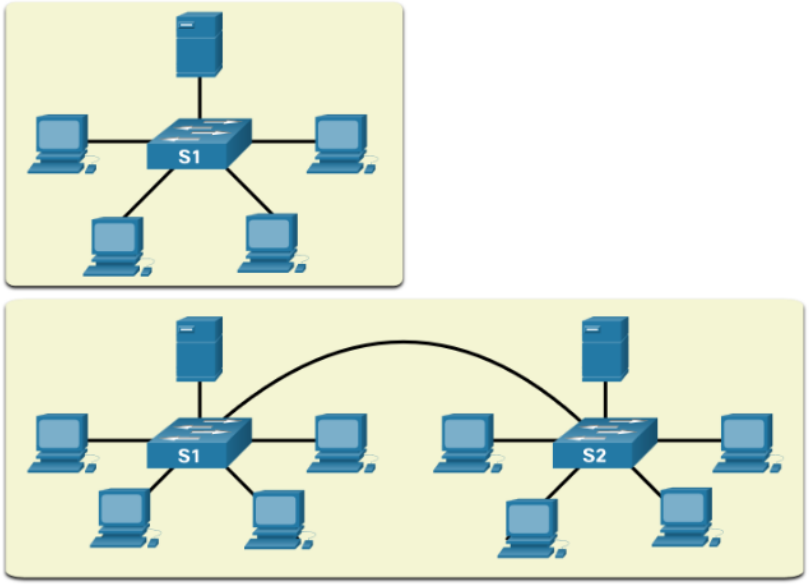
Collision Domains

Switches eliminate collision domains and reduce congestion.

- When there is full duplex on the link the collision domains are eliminated.
- When there is one or more devices in half-duplex there will now be a collision domain.
  - There will now be contention for the bandwidth.
  - Collisions are now possible.
- Most devices, including Cisco and Microsoft use auto-negotiation as the default setting for duplex and speed.



Broadcast Domains



- A broadcast domain extends across all Layer 1 or Layer 2 devices on a LAN.
  - Only a layer 3 device (router) will break the broadcast domain, also called a MAC broadcast domain.
  - The broadcast domain consists of all devices on the LAN that receive the broadcast traffic.
- When the layer 2 switch receives the broadcast it will flood it out all interfaces except for the ingress interface.
- Too many broadcasts may cause congestion and poor network performance.
- Increasing devices at Layer 1 or layer 2 will cause the broadcast domain to expand.

Alleviated Network Congestion

Switches use the MAC address table and full-duplex to eliminate collisions and avoid congestion.

Features of the switch that alleviate congestion are as follows:

Protocol	Function
Fast Port Speeds	Depending on the model, switches may have up to 100Gbps port speeds.
Fast Internal Switching	This uses fast internal bus or shared memory to improve performance.
Large Frame Buffers	This allows for temporary storage while processing large quantities of frames.
High Port Density	This provides many ports for devices to be connected to LAN with less cost. This also provides for more local traffic with less congestion.

What did I learn in this module?

Frame Forwarding

- Ingress is the entry port, egress is the exit port.
- The switch builds a MAC address table to forward frames on the LAN.
- The switch can use either the store-and-forward or cut-through method of switch forwarding.

Switching Domains

- Ethernet ports in half-duplex will be a part of a collision domain.
- Full-duplex will eliminate collision domains.
- A switch will flood out all interfaces except the ingress port if the frame is a broadcast or if the unicast destination MAC is unknown.
- Broadcast domains may be broken up by a layer 3 device, like a router.
- Switches extend broadcast domains, but can eliminate collision domains and relieve congestion.


CISCO