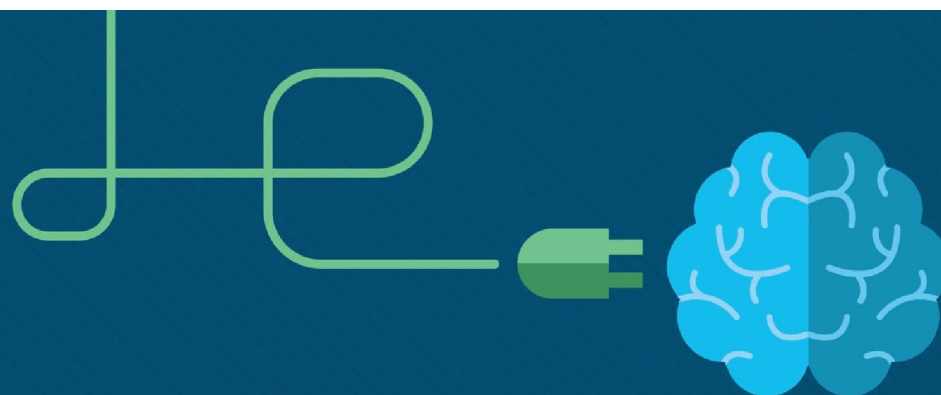




# Module 2: Switching Concepts

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

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# 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

## 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.

Frame Forwarding

## Video – MAC Address Tables on Connected Switches

This video will cover the following:

- How switches build MAC address tables
- How switches forward frames based on the content of their MAC address tables

## 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.

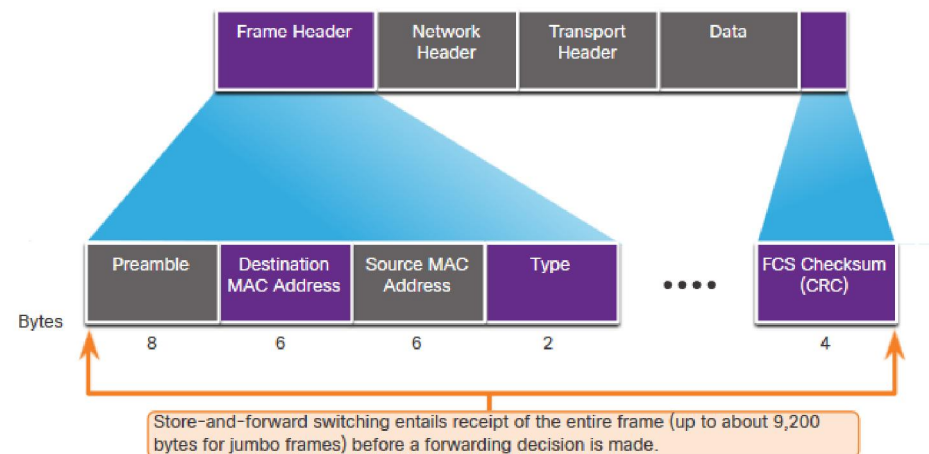


## Frame Forwarding

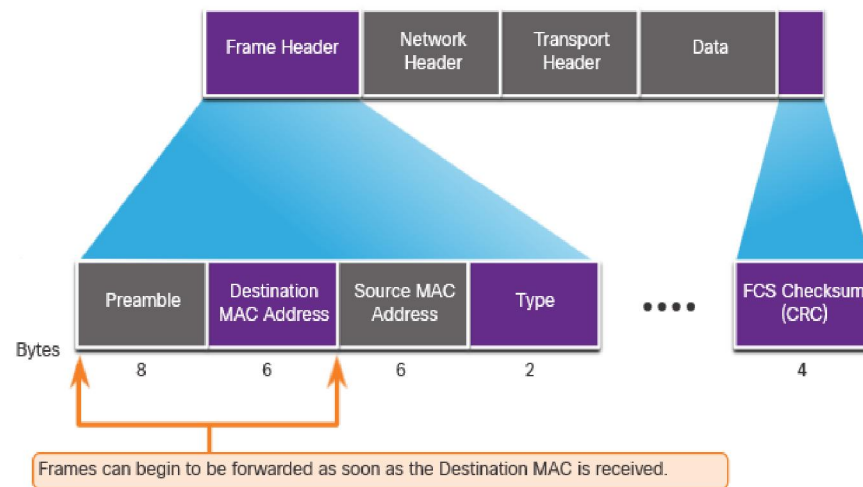
# Store-and-Forward Switching

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.



## Frame Forwarding 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 runs.

### 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

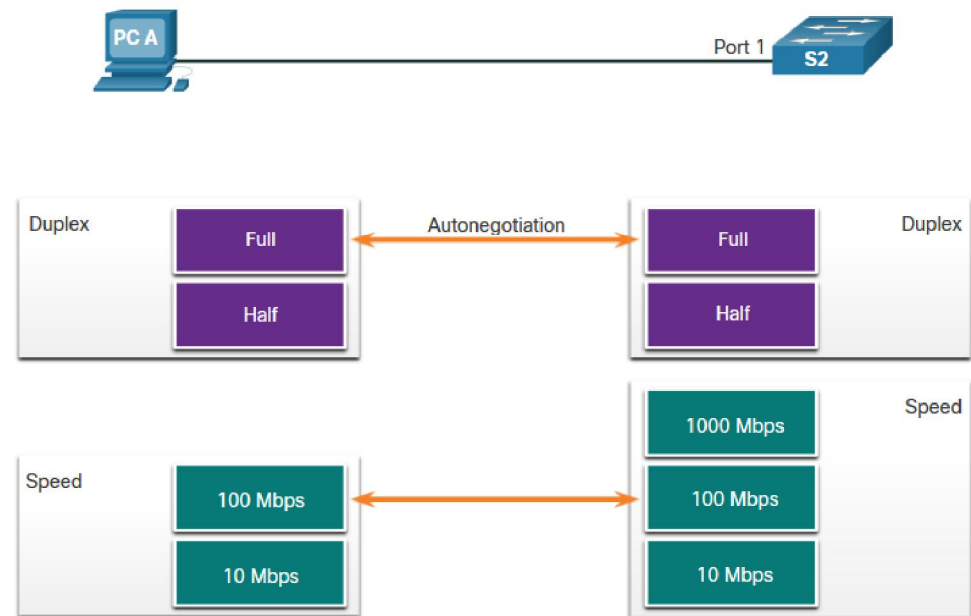
## 2.2 Switching Domains

## Switching Domains

# Collision Domains

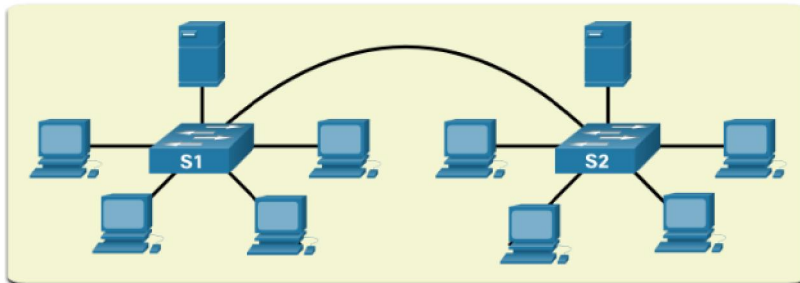
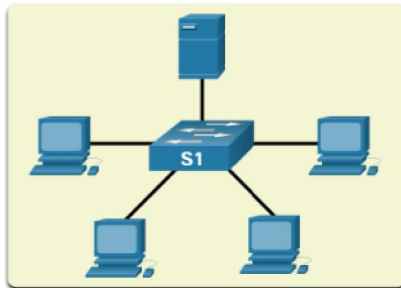
Switches eliminate collision domains and reduce congestion.

- 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.



## Switching Domains

# 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.

## Switching Domains

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

## 2.3 Module Practice and Quiz

## Module Practice and Quiz

# 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.



## New Terms and Commands

- content accessible memory (CAM)
- MAC address table
- store-and-forward switching
- cut-through switching
- automatic buffering
- fragment free switching
- collision domains
- broadcast domains

