

# Lecture 2c - Ethernet Switching

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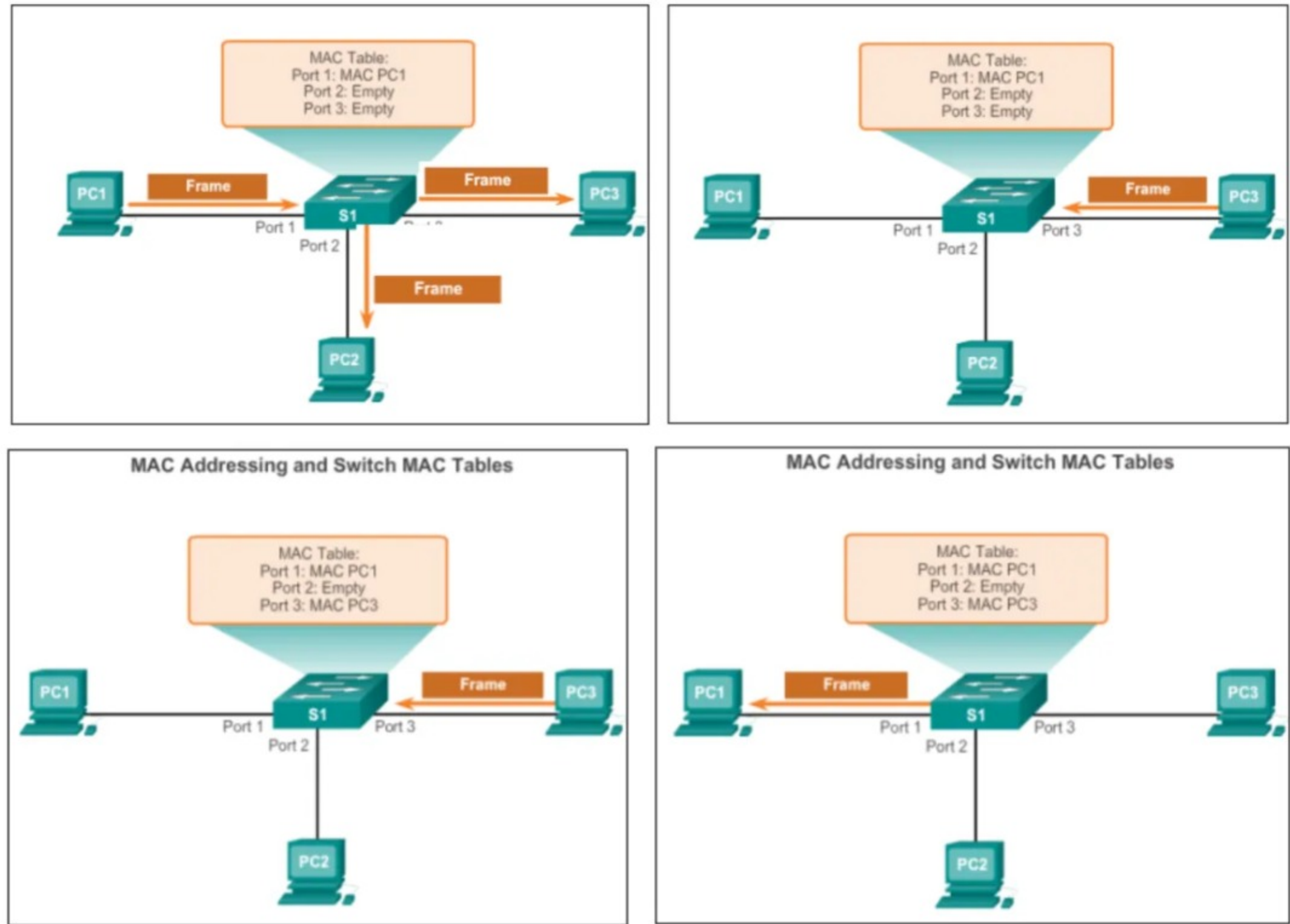
## 1. Collision Domains

- Definition: Portion of network where, if two hosts want to talk at the same time, a collision will occur.
- By definition
  - An entire shared network is a Collision Domain
  - Any two hosts on a hub/shared-segment have the possibility of colliding
- Collisions still happen on a shared network
- Probability increases with number of hosts

## 2. Bridges - Operation

- Ethernet packets contain a source MAC address
  - By listening to traffic we can determine where each Ethernet host is connected to the network
- A bridge connects two shared-Ethernet segments together
  - Learns which MAC addresses are on each side of the switch.

## 3. Switch MAC Address Table



- Steps of building MAC address table:
  - The switch receives a broadcast frame from PC 1 on Port 1
  - Store the source MAC address and switch port into the address table
  - Destination address is **broadcast** – flood the frame to all ports, except the port on which it received the frame.
  - Destination device replies to broadcast with a unicast addressed to PC 1.
  - Store the source MAC address of PC 3 and switch port into the address table
  - Destination address and associate. The destination port is found in the MAC address table
  - The switch can now forward frames between source and destination devices without flooding
- Property of MAC Address Table:
  - It can map **multiple MAC** addresses to a **single switchport**
  - Maps **MAC** addresses to output **switch ports**
  - Switches **observe the source address** of incoming frames to build the table
  - Used by the switch to **make forwarding decisions**

## 4. Collision Domains Revisited

- A **broadcast** (ff:ff:ff:ff:ff:ff) packet is always forwarded out all switch ports
  - Typically an **ARP request**
  - All Ethernet stations need to receive it as the responder is unknown
- A **switch** will create **multiple Collision domains** in a LAN
  - Increases number of concurrent traffic sources
- A switch will not create multiple **Broadcast domains**
  - All attached end-hosts will receive a broadcast packet

## 5. Switching

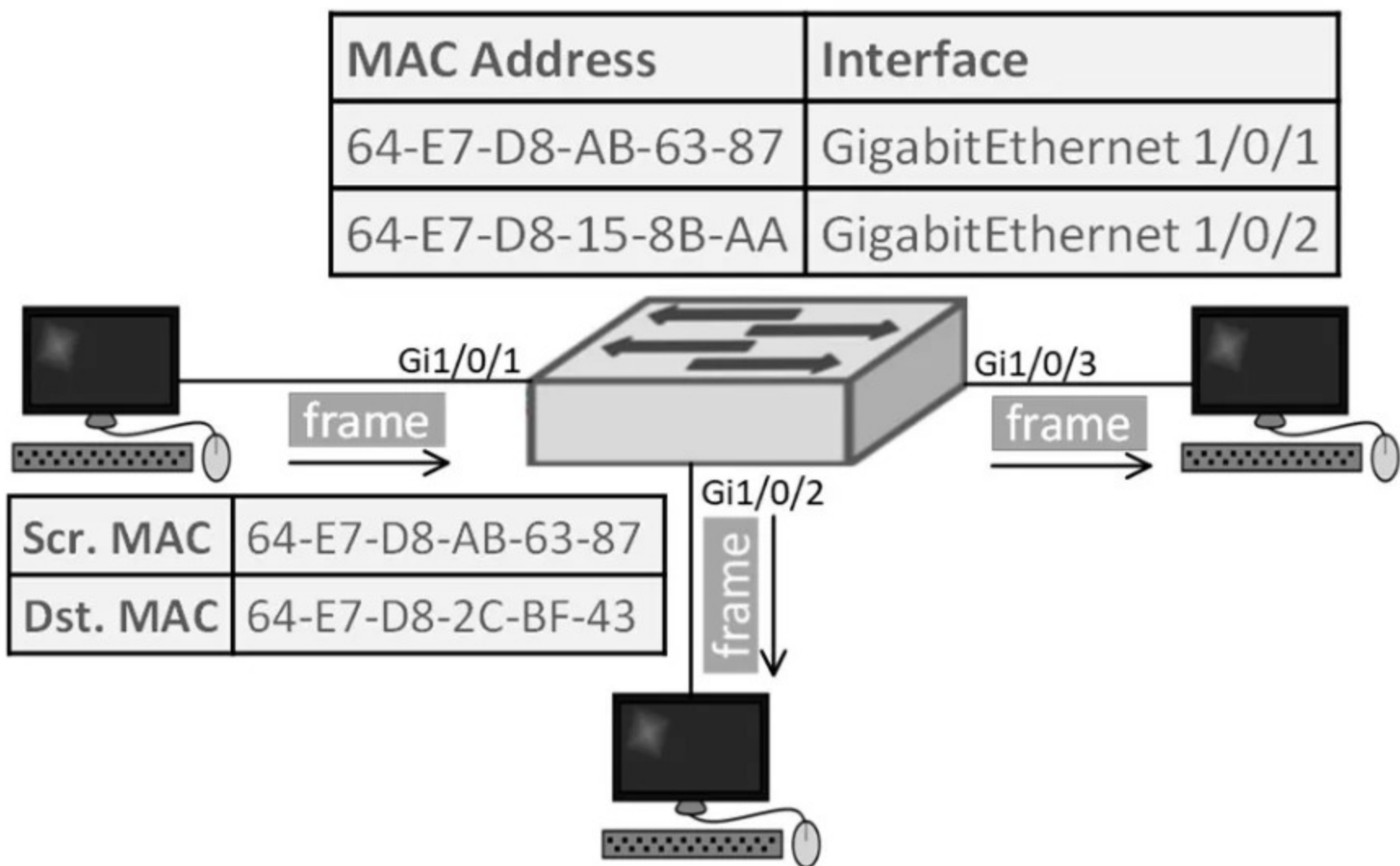
- Store-and-forward Switch
  - A store-and-forward switch receives the **entire frame** and computes the **CRC**.
  - If the **CRC** is valid, the switch looks up the destination address, which determines the outgoing interface.
  - The frame is then forwarded out to the correct port.
- Cut-through Switching
  - This switch forwards the frame **before** it is **entirely received**. At a **minimum**, the **destination address** of the frame must be read before the frame can be forwarded.
  - There are 2 types:
    - Fast-forward switching**: The lowest level of latency **immediately forwards** a packet **after reading** the **destination address**, a typical cut-through method of switching.
    - Fragment-free switching**: Switch stores the **first 64 bytes** of the frame **before forwarding**, most network errors and collisions occur during the first **64 bytes**.

## 6. Quizzes:

- In wired Ethernet connections, separate cables are used for sending and receiving data, allowing for ... communication between the switch and connecting devices.  
⇒ **Full-duplex**
- Do collisions occur in a switched Ethernet network?  
⇒ **No**
  - Each device in a switched network is in an **isolated collision domain** with the switch, therefore, there are no other transmitters for frames to collide with.
  - Moreover, transmission between the switch and a connected device is **full-duplex**, allowing for the switch and the device to send and receive **simultaneously** without collisions.
- What is TRUE about the MAC Address Table? What is FALSE?

TRUE	FALSE
Switches observe the source address of incoming frames to build the table ✓	Switches perform ARP requests to build the table ✓
It can map multiple MAC addresses to a single switchport ✓	Maps MAC addresses to IP address for all connected devices ✓
Maps MAC addresses to output switchports ✓	It can only map one MAC address to a switchport ✓
Used by the switch to make forwarding decisions ✓	Used only for informational purposes ✓

- What figure describes Unicast Frame Flooding?



⇒ If the **destination** address of a frame is **not** in the MAC address table, the frame is **sent out to all ports** except the incoming port. This is known as Unicast Frame Flooding.