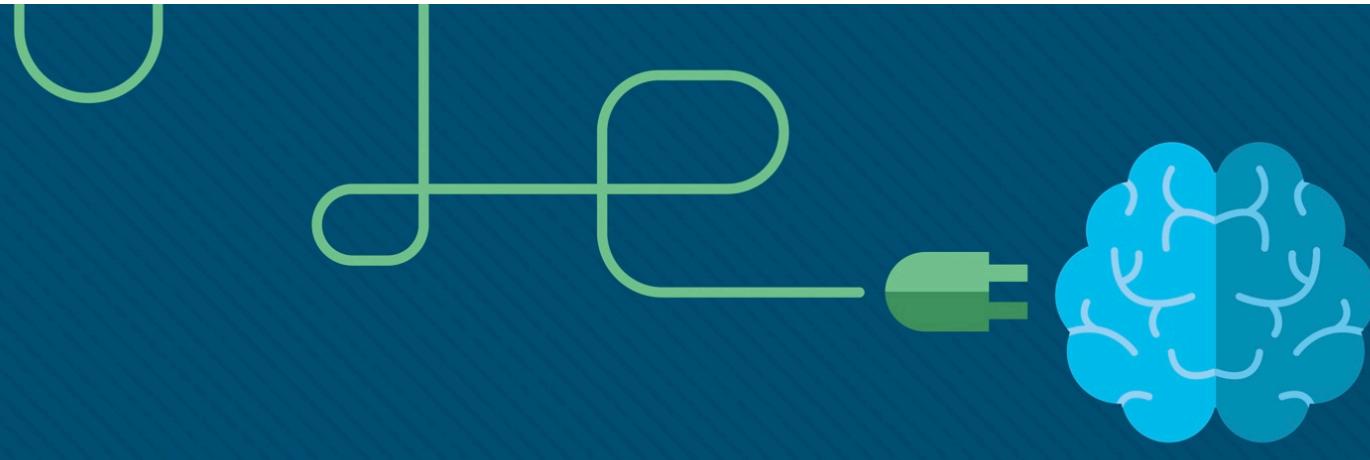




Chapter 4: Switched Networks

CCNA Routing and Switching

Routing and Switching Essentials v6.0



Chapter 4 - Sections & Objectives

- 4.1 LAN Design
 - Explain how switched networks support small to medium-sized businesses.
 - Explain how data, voice, and video are converged in a switched network.
 - Describe a switched network in a small to medium-sized business.
- 4.2 The Switched Environment
 - Explain how Layer 2 switches forward data in a small to medium-sized LAN.
 - Explain how frames are forwarded in a switched network.
 - Compare a collision domain to a broadcast domain.

4.1 LAN Design



Converged Networks

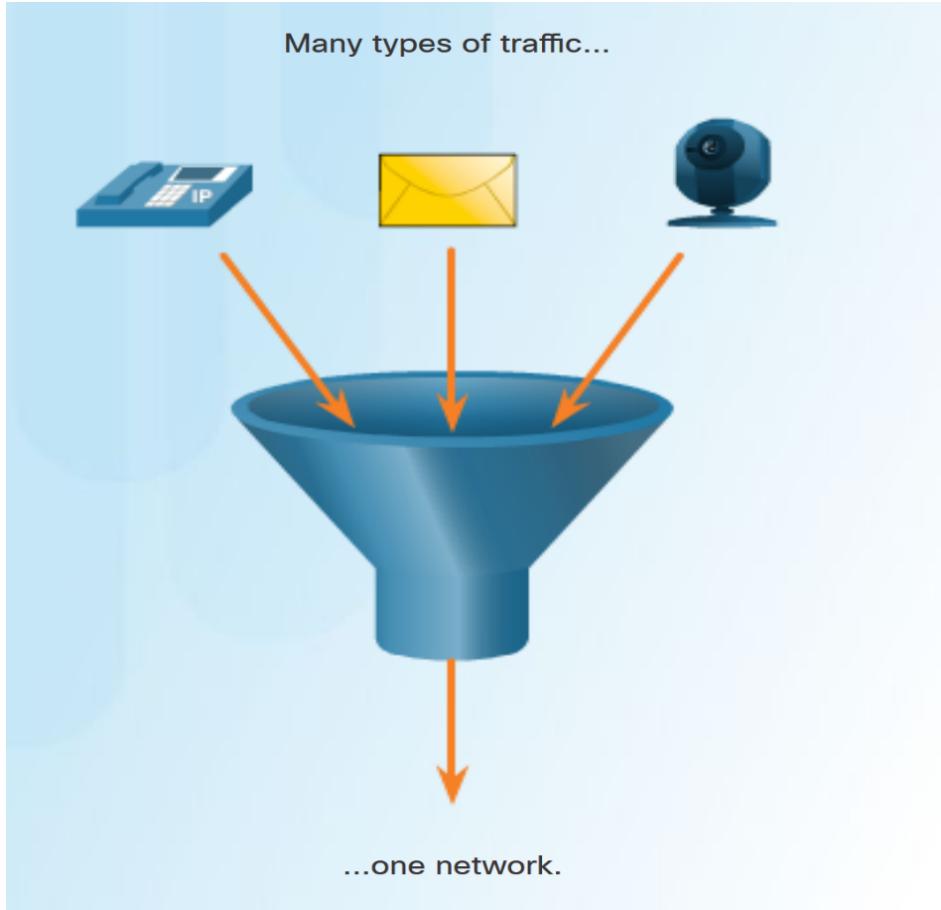
Growing Complexity of Networks

- Next-generation networks need to be secure, reliable, and highly available.
- They must support a globalized workforce.
- They must be able to integrate legacy devices.



Converged Networks

Elements of a Converged Network

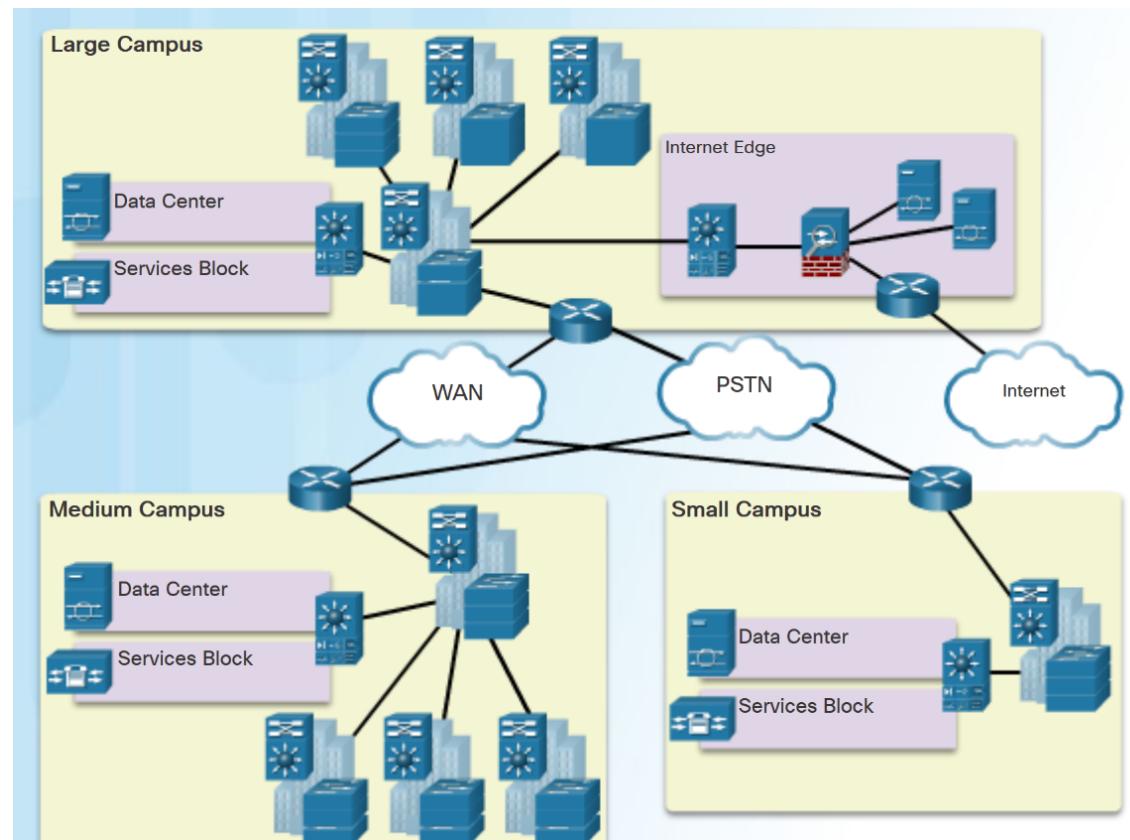


- Converged network solutions integrate voice systems, IP phones, voice gateways, video support, and video conferencing.
- Primary benefit of the converged network - just one physical network to install and manage.

Converged Networks

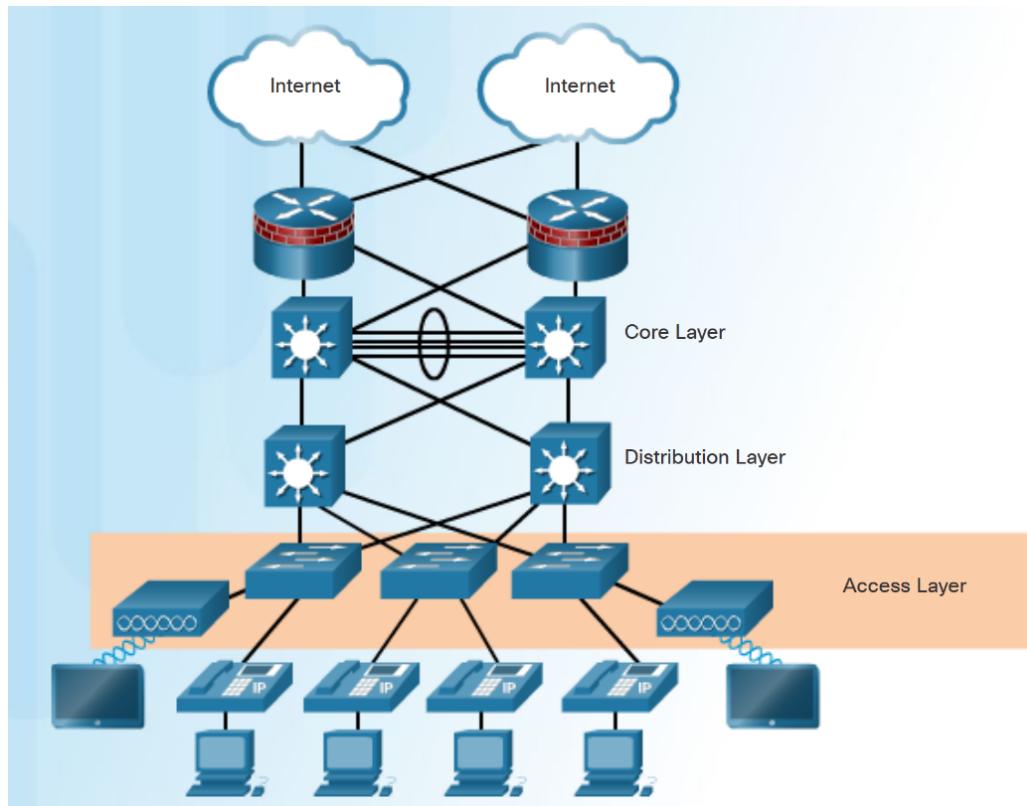
Cisco Borderless Networks

- The Cisco Borderless Network has the following features:
 - Allows organizations to connect anyone, anywhere, anytime, on any device; securely, reliably, and seamlessly.
 - Provides the framework to unify wired and wireless access, including policy, access control, and performance management across many different device types.
 - Provides network services, and user and endpoint services that are all managed by an integrated management solution.



Converged Networks

Hierarchy in the Borderless Switched Network

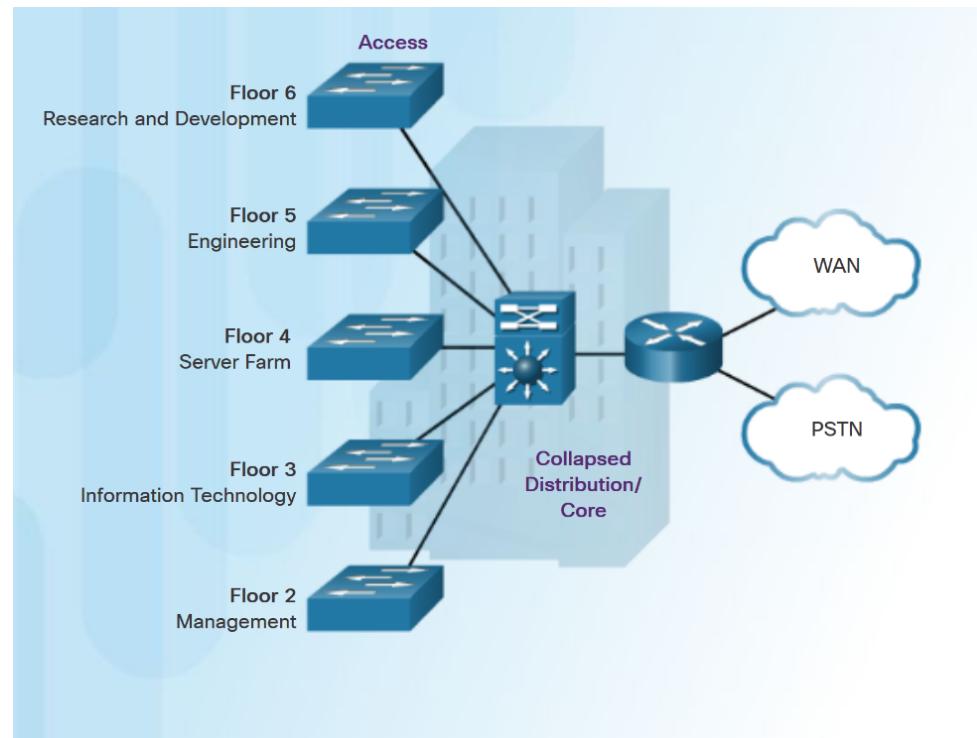


- Borderless switched network design guidelines are based on the following principles:
 - Hierarchical - Facilitates understanding the role of each device at every tier.
 - Modularity - Allows seamless network expansion and integrated services.
 - Resiliency – Provides an always available network.
 - Flexibility - Allows intelligent traffic load sharing.
- The three tiers of the hierarchical model are Access, Distribution and Core layers.

Converged Networks

Access, Distribution, and Core Layers

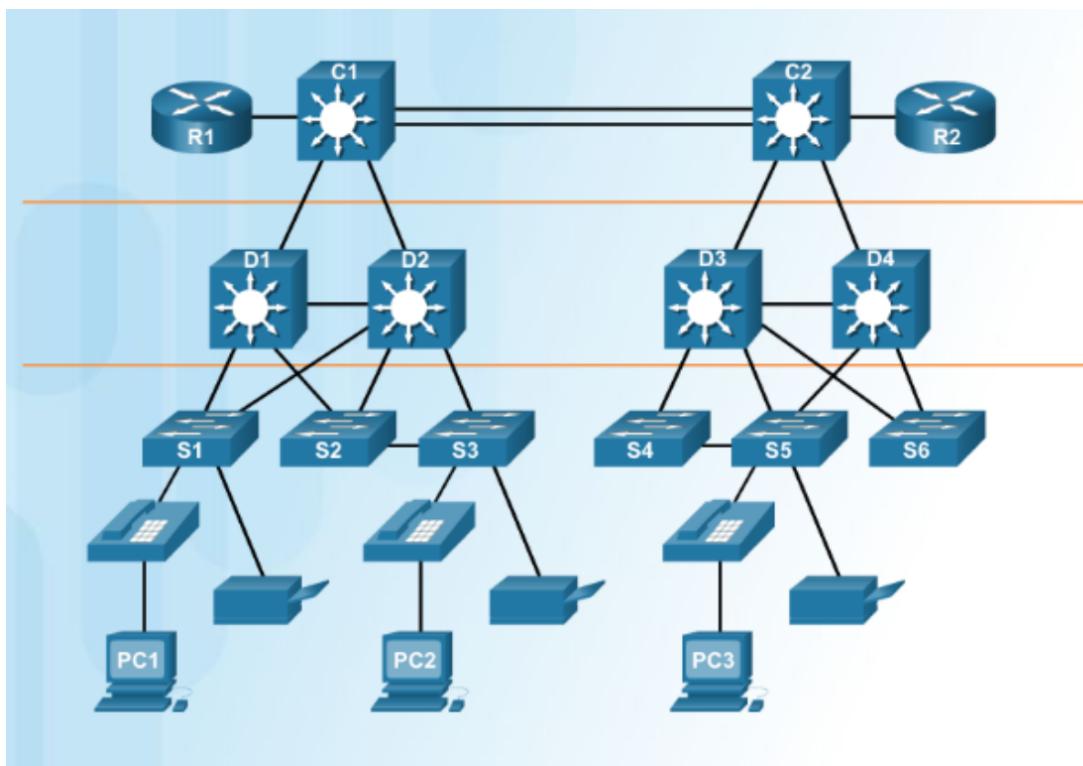
- Access Layer – provides network access to the user.
- Distribution Layer - interfaces between the access layer and the core layer. Provides functions such as:
 - aggregating Layer 2 broadcast domains and Layer 3 routing boundaries.
 - providing intelligent switching, routing, and network access policy functions to access the rest of the network.
- Core Layer - is the network backbone. It provides fault isolation and high-speed backbone connectivity.



Smaller networks that do not need a separate distribution and core layer often use a two-tier campus or collapsed core network design.

Switched Networks

Role of Switched Networks



- A hierarchical switched LAN allows more flexibility, traffic management, and additional features:
 - Quality of service
 - Additional security
 - Support for wireless networking and connectivity
 - Support for new technologies.

Switched Networks Form Factors



Fixed Configuration



Modular Configuration



Stackable Configuration

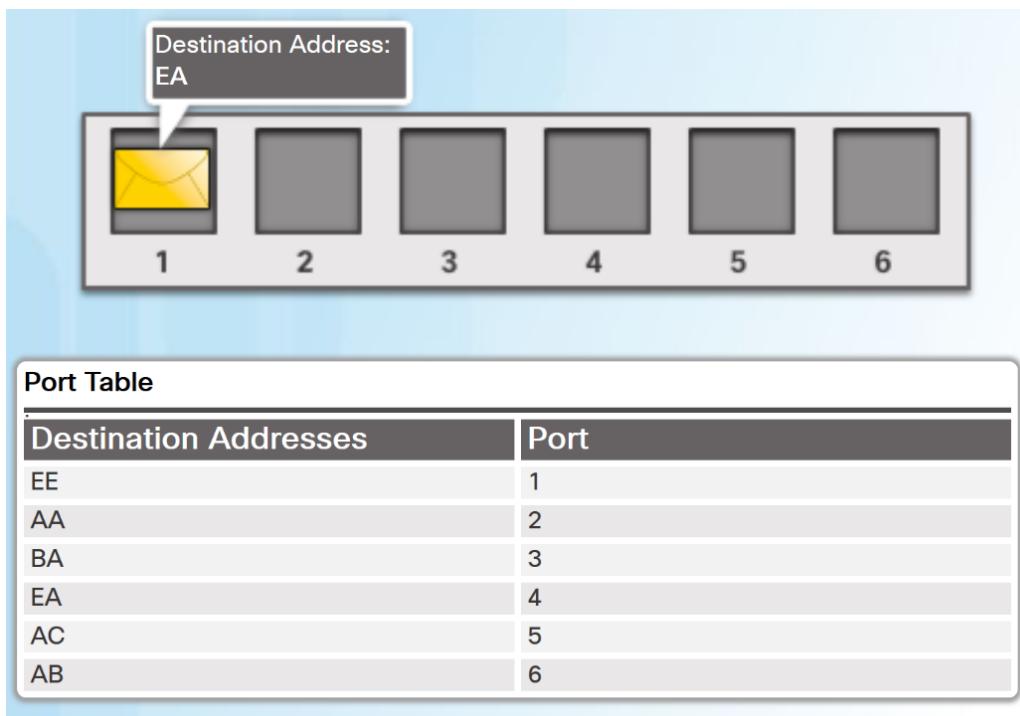
- Considerations when selecting switches:
 - Cost
 - Port Density
 - Power
 - Reliability
 - Port Speed
 - Frame buffers
 - Scalability

4.2 The Switched Environment



Frame Forwarding

Switching as a General Concept in Networking and Telecommunications



- A LAN switch makes decisions based on two criteria:
 - Ingress port - where a frame enters the device
 - Destination address
- A LAN switch maintains a table that it uses to determine how to forward traffic.
- In the diagram, If a message enters switch port 1 with a destination address of EA, then the switch forwards the traffic out port 4.
- Layer 2 Ethernet switches forward frames based on the destination MAC address.

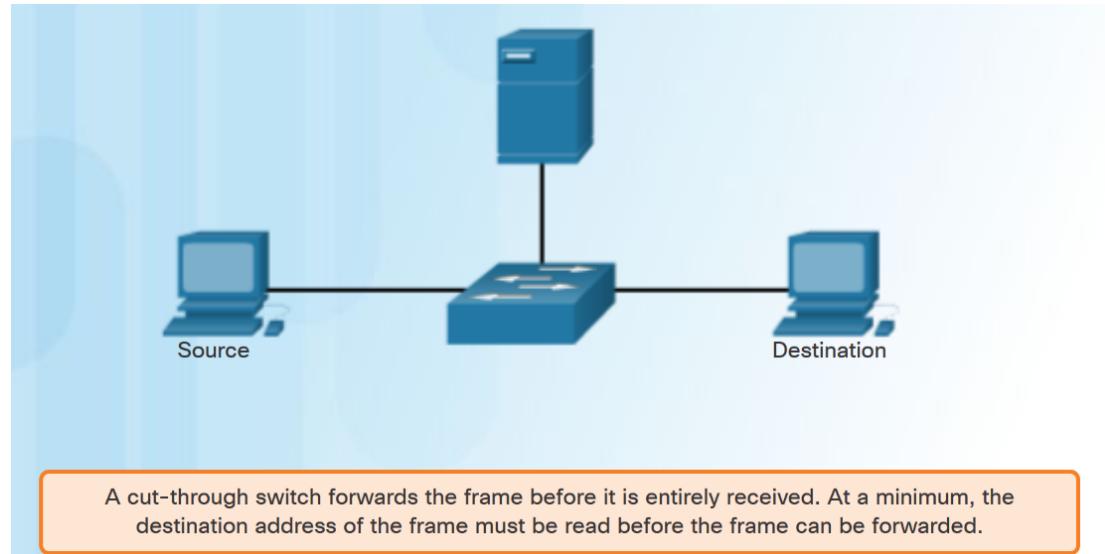
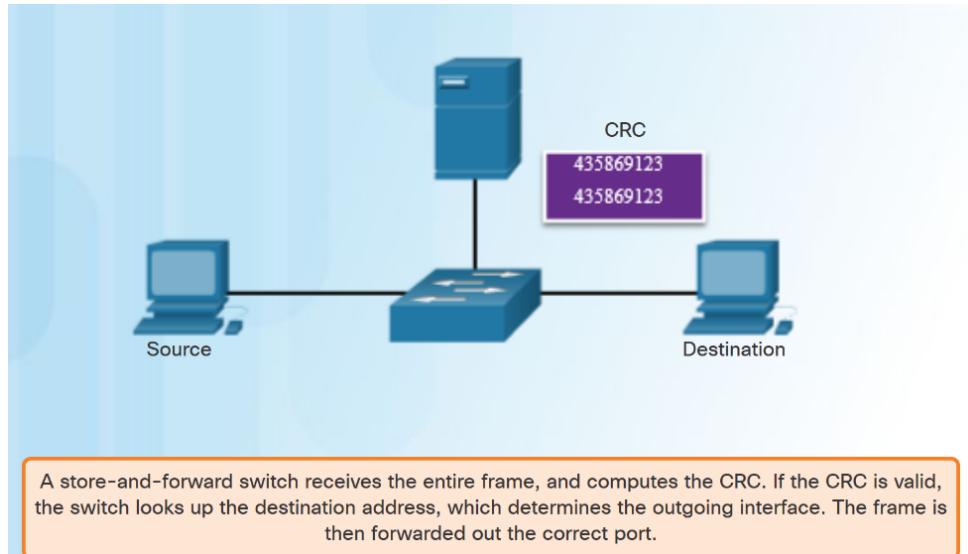
Frame Forwarding

Video Demonstration - MAC Address Tables on Connected Switches

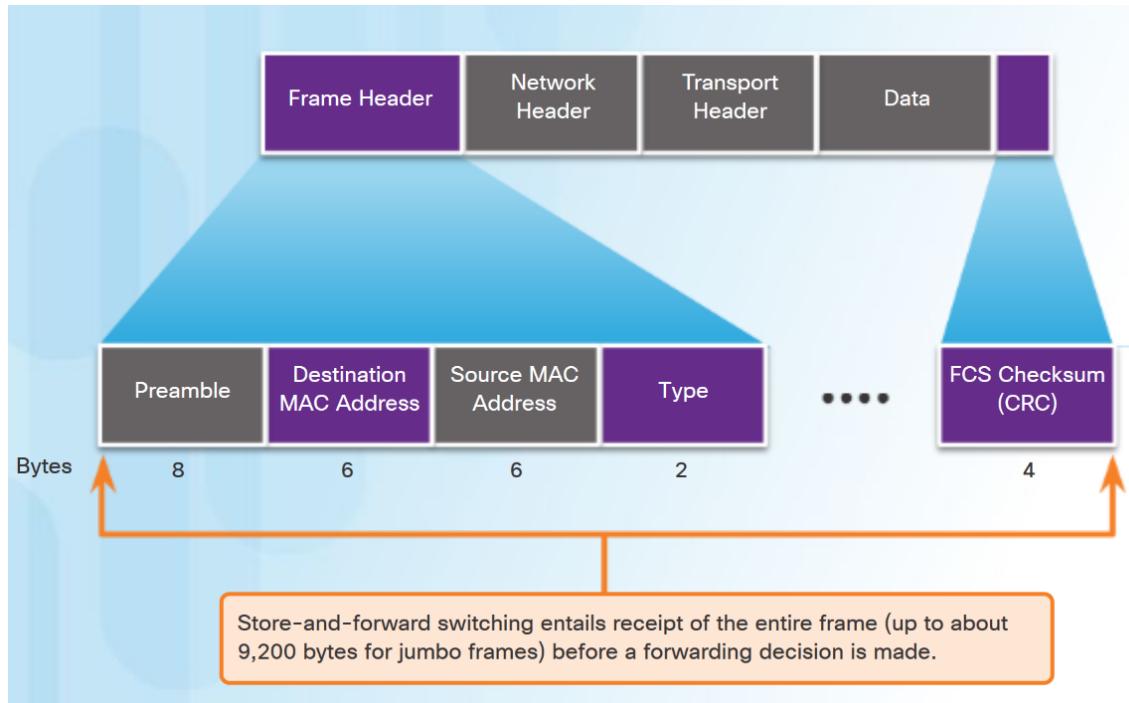
- The video explains how a switch builds its MAC address table by recording the MAC address of each device connected to each of its ports.



Frame Forwarding Switch Forwarding Methods

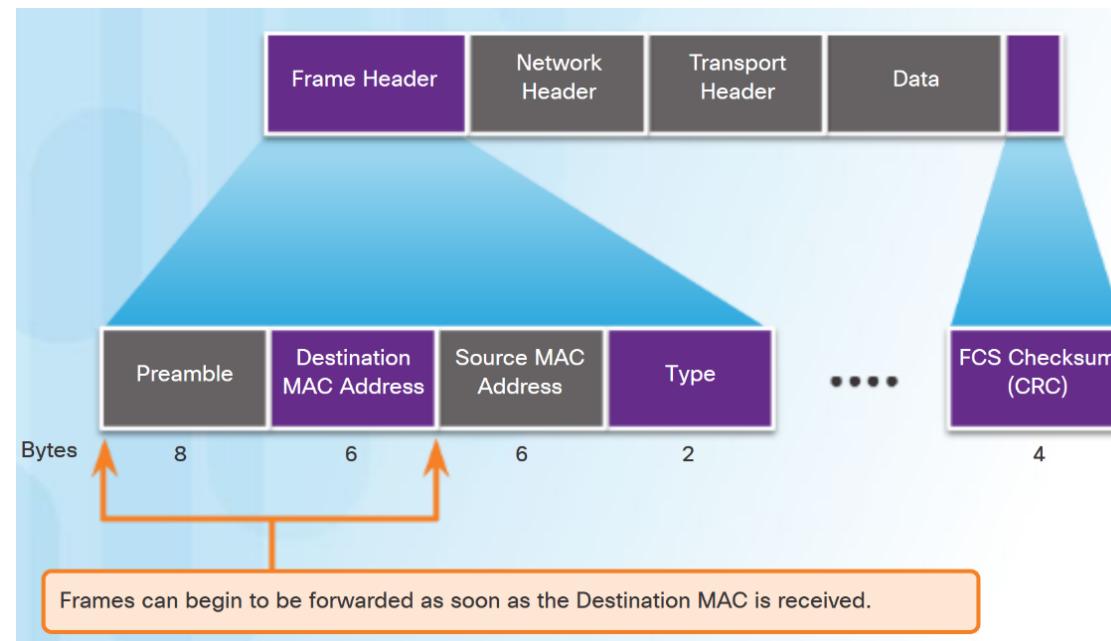


Frame Forwarding Store-and-Forward Switching



- **Features of Store-and-Forward Switching:**
 - **Error Checking**— After receiving the entire frame, the switch compares the frame-check-sequence (FCS) value in the last field against its own FCS calculations. Only error-free frames are forwarded
 - **Automatic Buffering**— ingress port buffering provides the flexibility to support any mix of Ethernet speeds.
- **Store-and-Forward is Cisco's primary LAN switching method.**

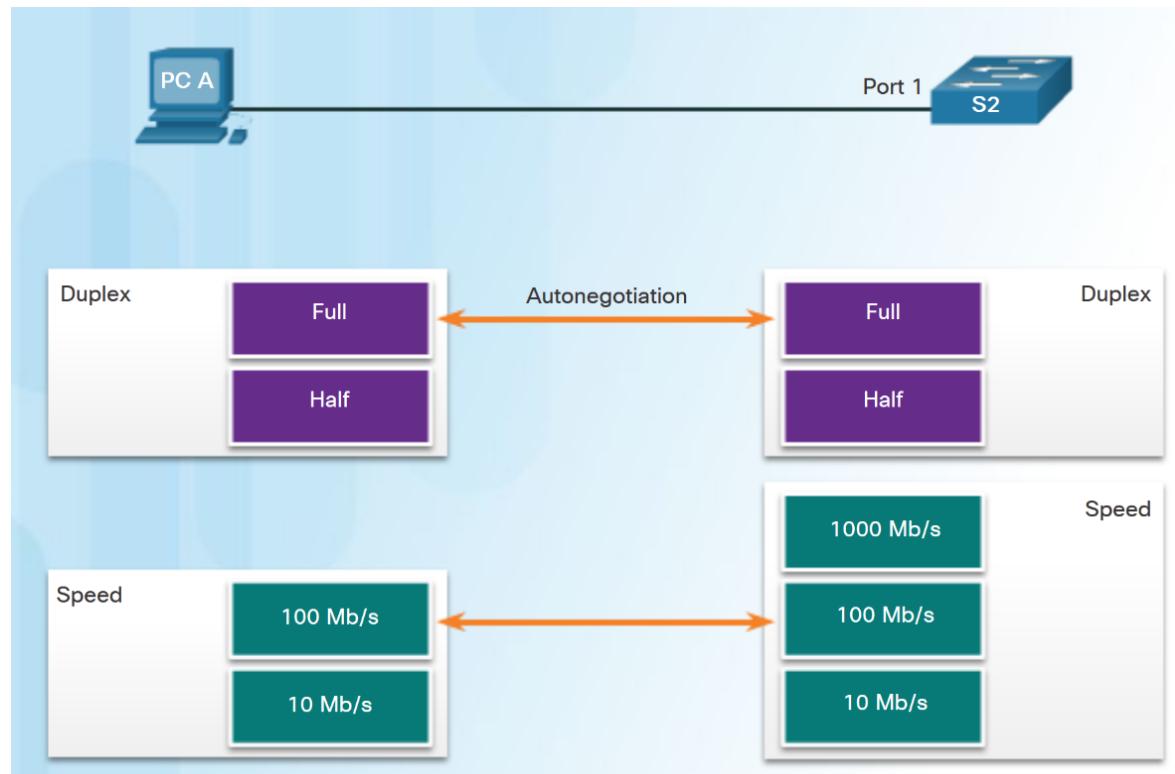
Frame Forwarding Cut-Through Switching



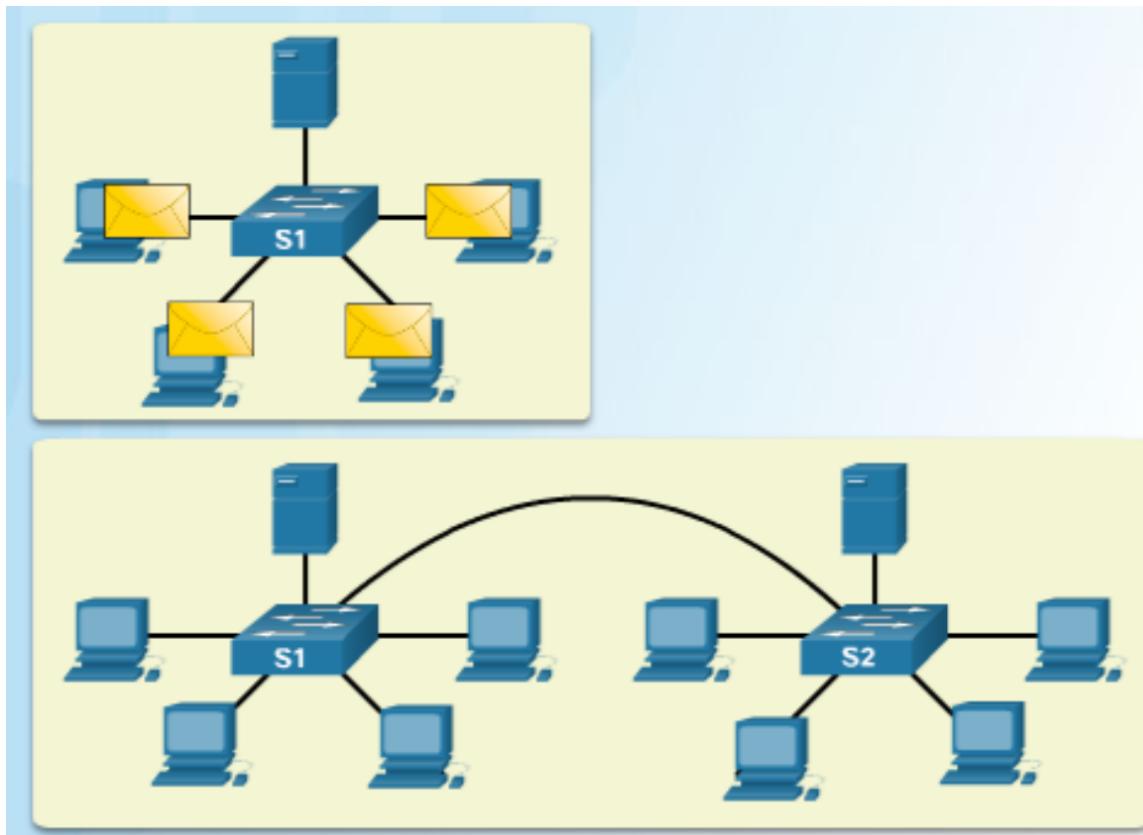
- **Rapid Frame Forwarding** - The switch can make a forwarding decision as soon as it has looked up the destination MAC address.
 - Frames with errors are forwarded.
- **Fragment Free** - modified form of cut-through switching. The switch waits for the collision window (64 bytes) to pass before forwarding the frame.
 - Provides better error checking than cut-through, with practically no increase in latency.

Switching Domains Collision Domains

- In hub-based Ethernet segments, network devices compete for the medium, therefore collisions will occur.
- Ethernet switch ports operating in full duplex eliminate collisions.
- Ethernet switch ports will autonegotiate full-duplex if connected to full-duplex device.
- If connected to a half-duplex device then the switch port will operate in half duplex and be part of a collision domain.



Switching Domains Broadcast Domains



- One switch or multiple interconnected switches form a single broadcast domain.
- When a switch receives a broadcast frame, it forwards the frame out each of its ports, except the ingress port where the broadcast frame was received.
- When two switches or more switches are connected together, the broadcast domain is increased because the broadcast is propagated from switch to switch.
- Too many broadcasts can cause network congestion.

Switching Domains

Alleviating Network Congestion

- The following characteristics of switches help alleviate congestion:
 - Establishing full-duplex links, therefore eliminating collisions.
 - High port density
 - Large frame buffers
 - Port speed
 - Fast internal switching
 - Low per-port cost



4.3 Chapter Summary

Conclusion

Chapter 4: Switched Networks

- Explain how switched networks support small to medium-sized businesses.
- Explain how Layer 2 switches forward data in a small to medium-sized LAN.



