Chapter 1: Introduction to Switched Networks

Routing and Switching

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Chapter 1

1.0 Introduction

1.1 LAN Design

1.2 Switched Environment

1.3 Summary

Chapter 1: Objectives

Upon completion of this chapter, you will be able to:

- Describe convergence of data, voice, and video in the context of switched networks.

- Describe a switched network in a small-to-medium-sized business.

- Explain the process of frame forwarding in a switched network.

- Compare a collision domain to a broadcast domain.

Growing Complexity of Networks

- Our digital world is changing.

- Information must be accessed from anywhere in the world.

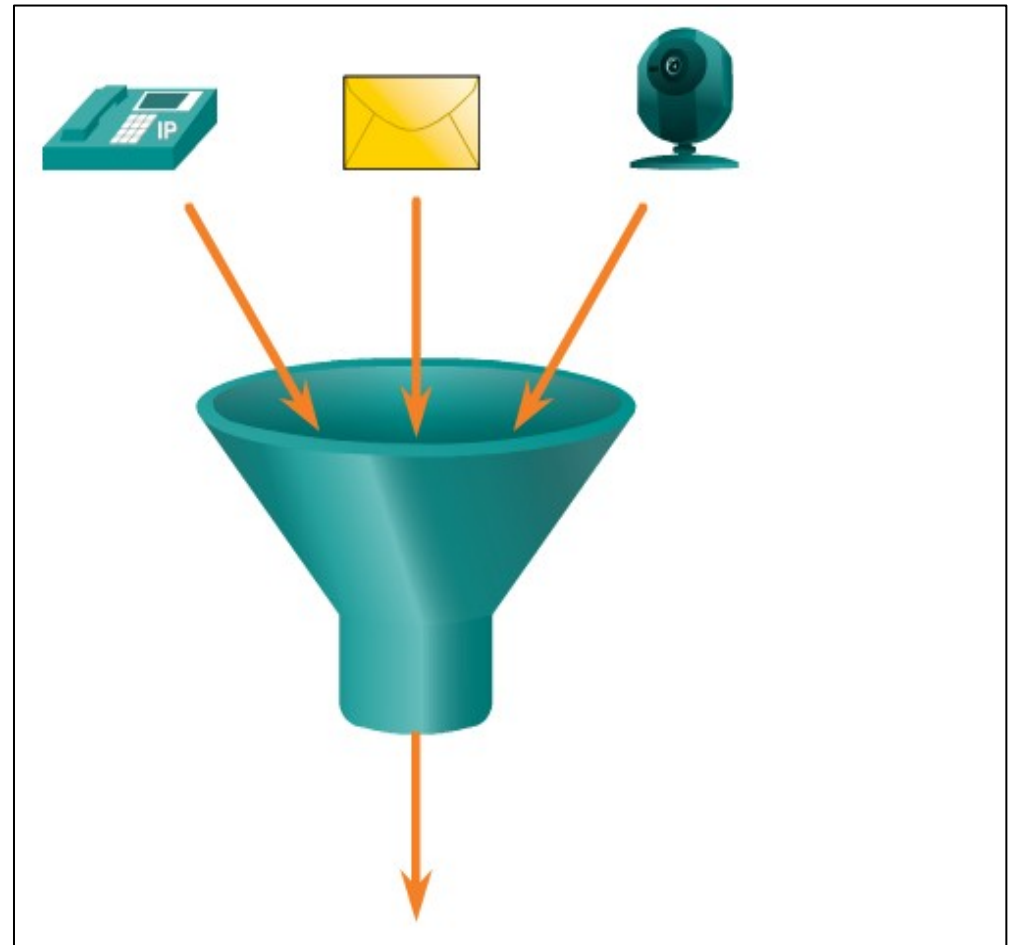- Networks must be secure, reliable, and highly available.

Elements of a Converged Network

- Collaboration is a requirement.

- To support collaboration, networks employ converged solutions.

- Data services include voice systems, IP phones, voice gateways, video support, and video conferencing.

- Call control, voice messaging, mobility, and automated attendant are also common features.
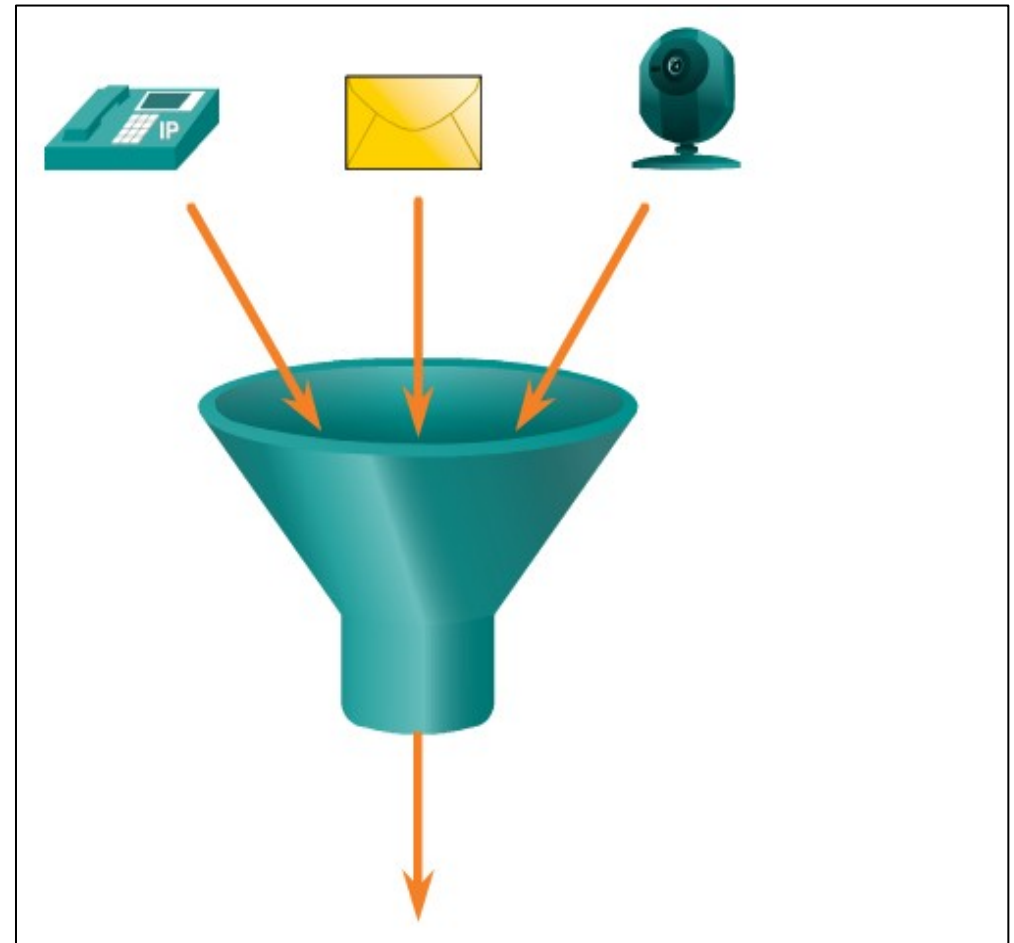
Benefits of a Converged Network

- Multiple types of traffic; only one network to manage.

- Substantial savings over installation and management of separate voice, video, and data networks.

- Integrates IT management.

Borderless Switched Networks

- The Cisco Borderless Network is a network architecture that allows organizations to connect anyone, anywhere, anytime, and on any device securely, reliably, and seamlessly.

- Cisco Borderless Network is designed to address IT and business challenges, such as supporting the converged network and changing work patterns.
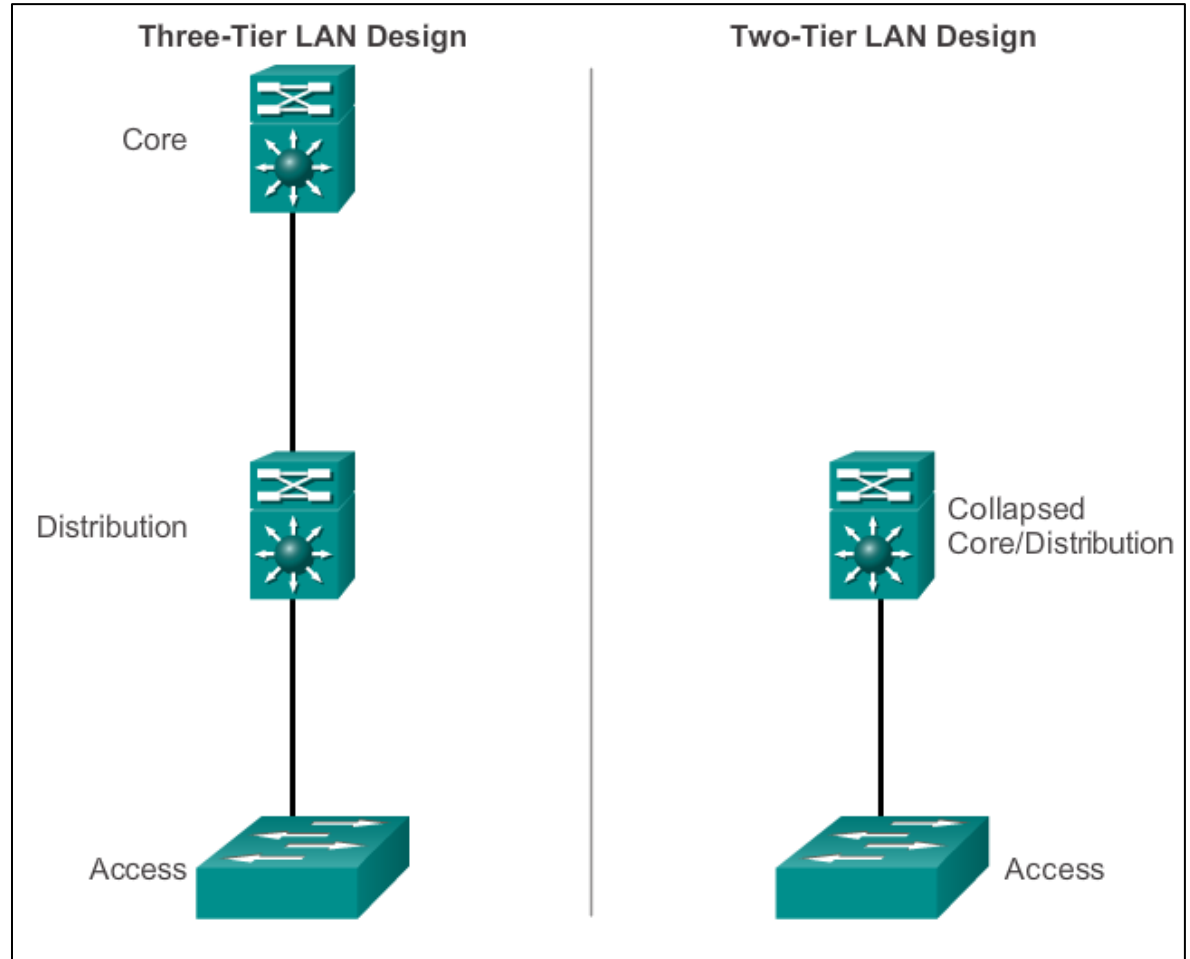
Hierarchy in the Borderless Switched Network

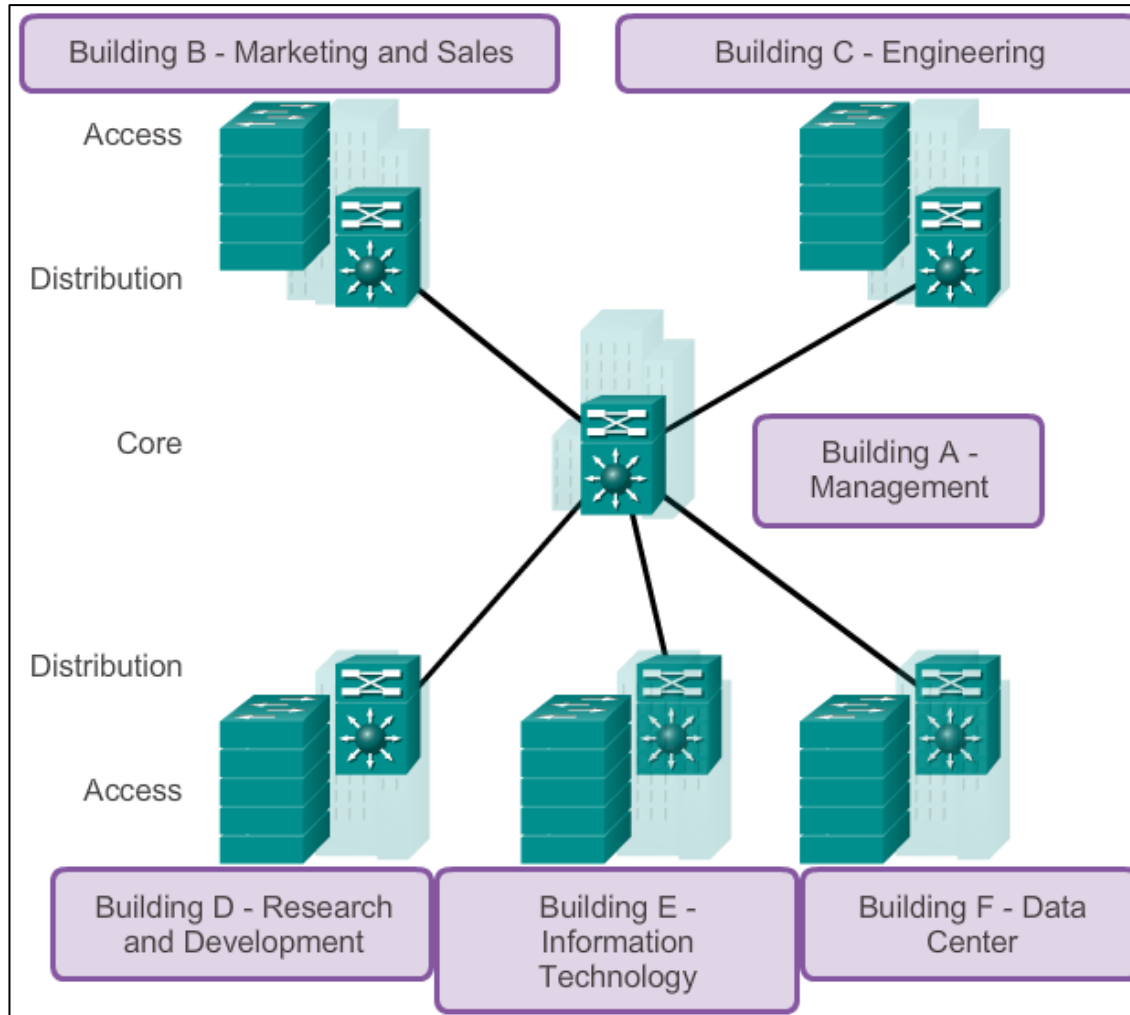Borderless switched network design guidelines are built upon the following principles:

- Hierarchical

- Modularity

- Resiliency

- Flexibility

Core, Distribution, Access

Role of Switched Networks

- Switching technologies are crucial to network design.

- Switching allow traffic to be sent only where it is needed in most cases, using fast methods.

- A switched LAN:

  - Allows more flexibility

  - Allows more traffic management

  - Supports quality of service, additional security, wireless, IP telephony, and mobility services

Form Factor

Fixed Platform

Features and options are limited to those that originally come with the switch.

Form Factor (cont.)

**Modular
Platform**

The chassis accepts line cards that contain th
ports.

Form Factor (cont.)

Stackable Platform

Stackable switches, connected by a special cable, effectively operate as one large switch.

Switching as a General Concept

- A switch makes a decision based on ingress and a destination port.

- A LAN switch keeps a table that it uses to determine how to forward traffic through the switch.

- Cisco LAN switches forward Ethernet frames based on the destination MAC address of the frames.

Dynamically Populating a Switch MAC Address Table

- A switch must first learn which devices exist on each port before it can transmit a frame.

- It builds a table called a MAC address or content addressable memory (CAM) table.

- The mapping device <-> port is stored in the CAM table.

- CAM is a special type of memory used in high-speed searching applications.

- The information in the MAC address table used to send frames.

- When a switch receives an incoming frame with a MAC address that is not found in the CAM table, it floods it to all ports, but the one that received the frame.

Switch Forwarding Methods

Add a header

Store-and-Forward

Cut-Through

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 the correct port.

A cut-through 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.
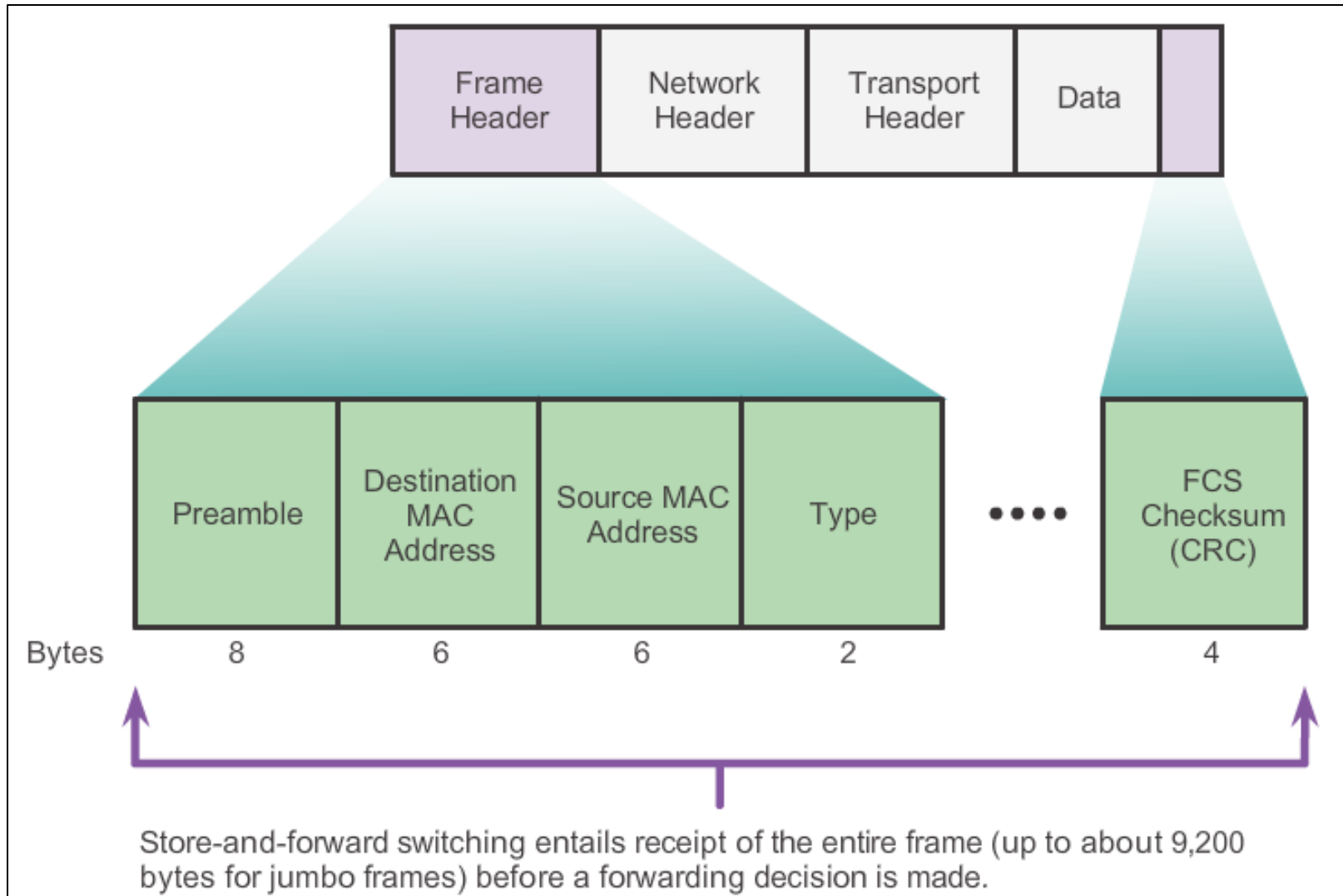
Store-and-Forward Switching

- Allows the switch to:

  - Check for errors (via FCS check)

  - Perform automatic buffering

- Slower forwarding process

Store-and-Forward Switching (cont.)

Store-and-forward switching entails receipt of the entire frame (up to about 9,200 bytes for jumbo frames) before a forwarding decision is made.

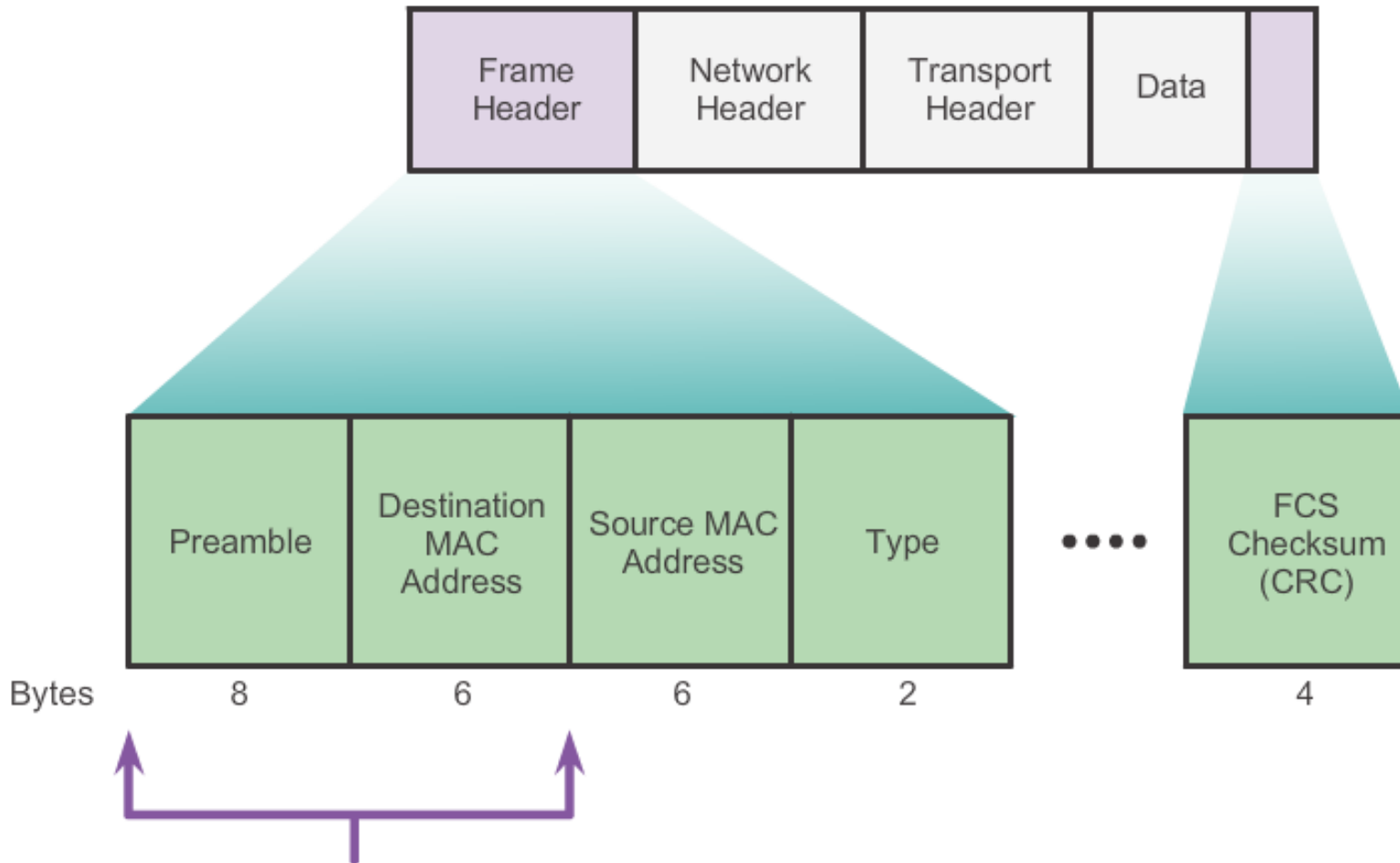# Cut-Through Switching

- Allows the switch to start forwarding in about 10 microseconds

- No FCS check

- No automatic buffering

Cut-Through Switching (cont.)

Frames can begin to be forwarded as soon as the Destination MAC is received.

Collision Domains

A collision domain is the segment where devices must compete to communicate.

- All ports of a hub belong to the same collision domain.

- Every port of a switch is a collision domain on its own.

- A switch break the segment into smaller collision domains, easing device competition.

Broadcast Domains

A broadcast domain is the extend of the network where a broadcast frame can be heard.

- Switches forward broadcast frames to all ports; therefore, switches do not break broadcast domains.

- All ports of a switch, with its default configuration, belong to the same broadcast domain.

- If two or more switches are connected, broadcasts are forwarded to all ports of all switches, except for the port that originally received the broadcast.

Alleviating (zmírnění) Network Congestion

Switches help alleviating network congestion by:

- Facilitating the segmentation of a LAN into separate collision domains

- Providing full-duplex communication between devices

- Taking advantage of their high-port density

- Buffering large frames

- Employing high-speed ports

- Taking advantage of their fast internal switching process

- Having a low, per-port cost

Chapter 1: Summary

In this chapter, you learned:

- The trend in networks is towards convergence using a single set of wires and devices to handle voice, video, and data transmission.

- There has been a dramatic shift in the way businesses operate.

- There are no physical offices or geographic boundaries constraints. Resources must now be seamlessly available anytime and anywhere.

- The Cisco Borderless Network architecture enables different elements, from access switches to wireless access points, to work together and allow users to access resources from any place at any time.

Chapter 1: Summary (cont.)

- The traditional, three-layer hierarchical design model divides the network into core, distribution, and access layers, and allows each portion of the network to be optimized for specific functionality.

- It provides modularity, resiliency, and flexibility, which provides a foundation that allows network designers to overlay security, mobility, and unified communication features.

- Switches use either store-and-forward or cut-through switching.

- Every port on a switch forms a separate collision domain allowing for extremely high-speed, full-duplex communication.

- Switch ports do not block broadcasts and connecting switches can extend the size of the broadcast domain, often resulting in degraded network performance.