



Chapter 1: Introduction to Switched Networks



Routing And Switching

1.0

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Chapter 1

1.0 Introduction

1.1 LAN Design

1.2 The Switched Environment

1.3 Summary

1.0.1.1 - 1.0.1.2



Chapter 1: Objectives

- 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



Converged Networks

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



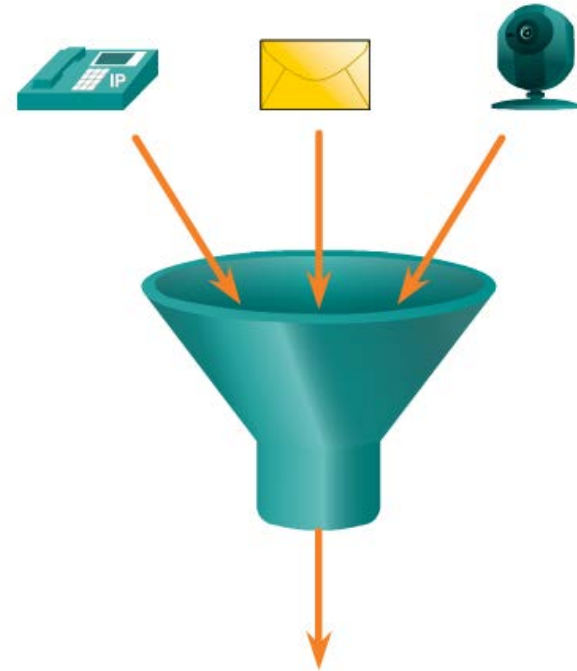
1.1.1.1



Converged Networks

Elements Of A Converged Network

- Collaboration is a requirement
- To support collaboration, networks employ converged solutions
- Data services such as voice systems, IP phones, voice gateways, video support, and video conferencing
- Call control, voice messaging, mobility and automated attendant are also common features



1.1.1.2



Converged Networks

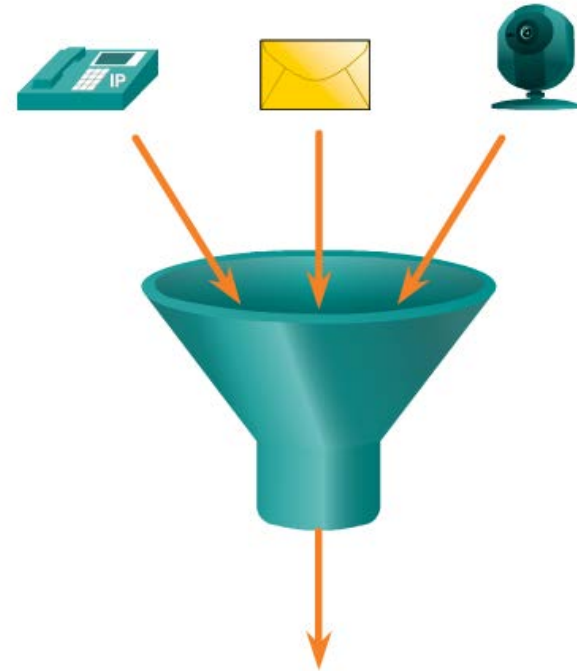
Elements Of A Converged Network

- Benefits of Converged Networks include:

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





Converged Networks

Borderless Switched Networks

- Cisco Borderless Network is a network architecture that allow organizations to connect anyone, anywhere, anytime, and on any device securely, reliably, and seamlessly
- It is designed to address IT and business challenges, such as supporting the converged network and changing work patterns



Converged Networks

Hierarchy in the Borderless Switched Network

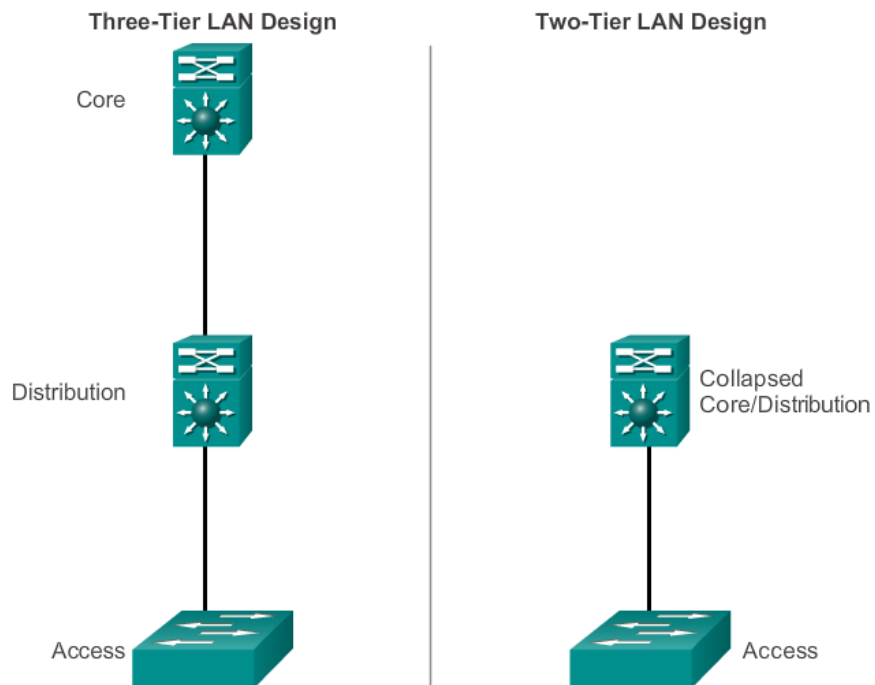
- Borderless switched network design guidelines are built upon the following principles:

Hierarchical

Modularity

Resiliency

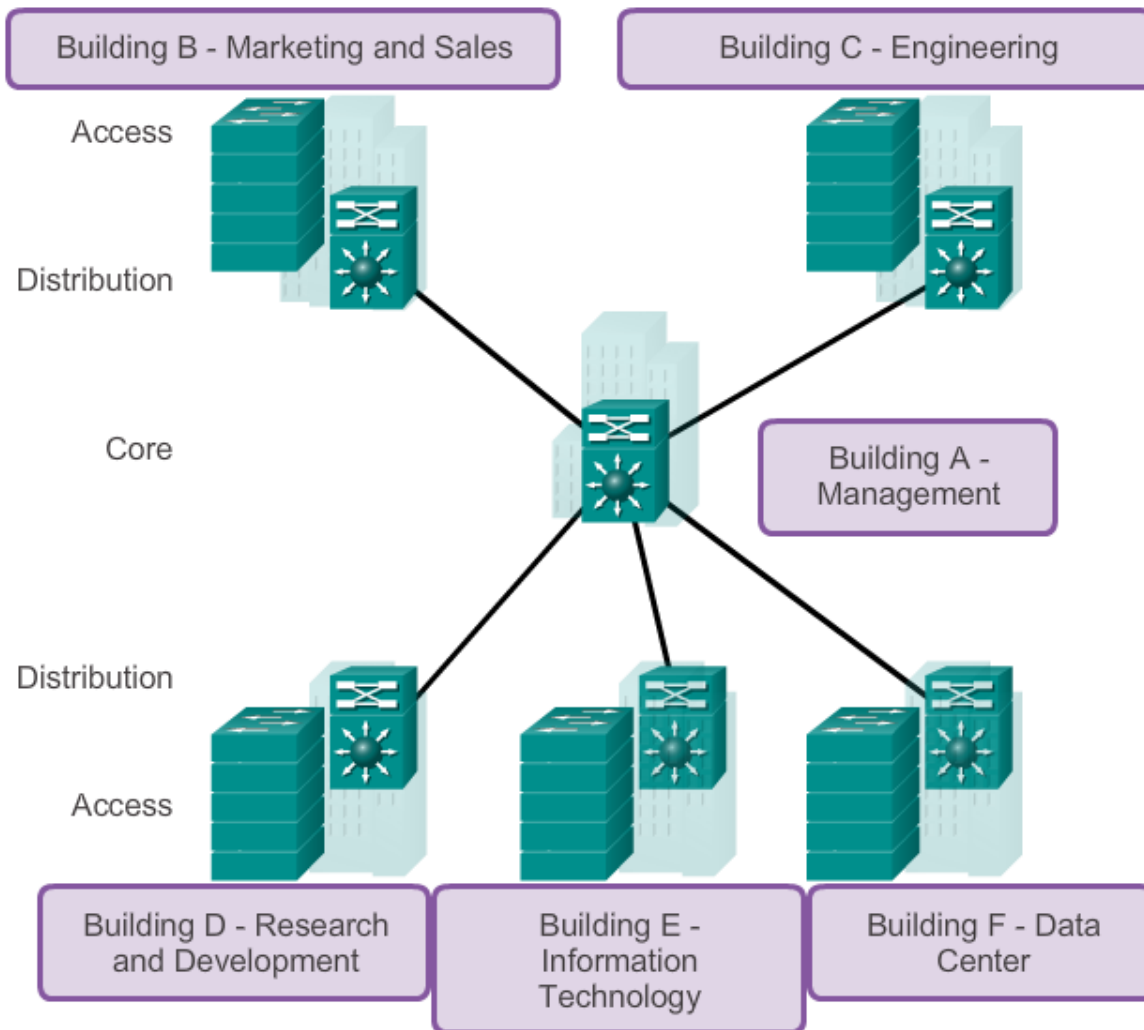
Flexibility





Converged Networks

Core, Distribution, Access



1.1.1.5



Converged Networks

1.1.1.6 Activity - Identify Switched Network Terminology

	Hierarchical	Modularity	Resiliency	Flexibility
Provides a way for the network to always be accessible.				
Allows networks to expand and provide on-demand services.				
Helps for every device on every tier to employ a specific role.				
Uses all network resources available to provide data traffic load sharing.				

Do the Activities on 1.1.1.6 buttons 1 and 2

1.1.1.6



Switched Networks

Role of Switched Networks

- The role of switched networks has evolved
- A switched LAN allows more flexibility, traffic management
- It also support features such as quality of service, additional security, support for wireless, support for IP telephony and mobility services



Switched Networks

Form Factor

- Fixed



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

1.1.2.2



Switched Networks Form Factor

- Modular



The chassis accepts line cards that contain the ports.

1.1.2.2



Switched Networks

Form Factor

- Stackable



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



Converged Networks

1.1.2.3 Activity - Identify Switch Hardware

	Hierarchical	Modularity	Resiliency	Flexibility
Provides a way for the network to always be accessible.				
Allows networks to expand and provide on-demand services.				
Helps for every device on every tier to employ a specific role.				
Uses all network resources available to provide data traffic load sharing.				

Do the Activity on 1.1.2.3

1.1.2.3



Frame Forwarding

Switching as a General Concept

- A Switch makes a decision based on ingress and 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.



Frame Forwarding

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 is 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.

1.2.1.2

Do the Buttons on 1.2.1.2



Frame Forwarding

Switch Forwarding Methods

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.

1.2.1.3

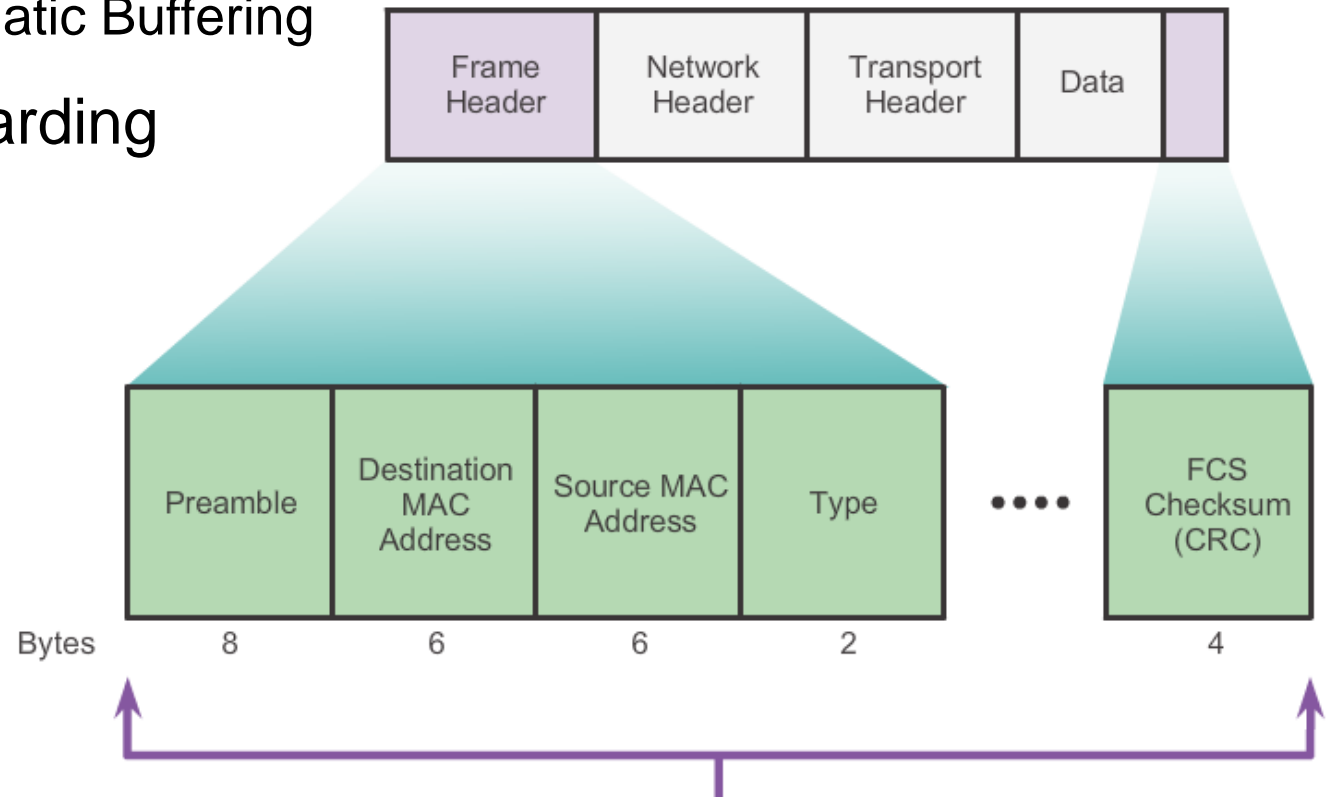
Watch the animations on 1.2.1.3



Frame Forwarding

Store-and-Forward Switching

- Store-and-Forwarding allows the switch to:
 - Check for errors (via FCS check)
 - Perform Automatic Buffering
- Slower forwarding



1.2.1.4

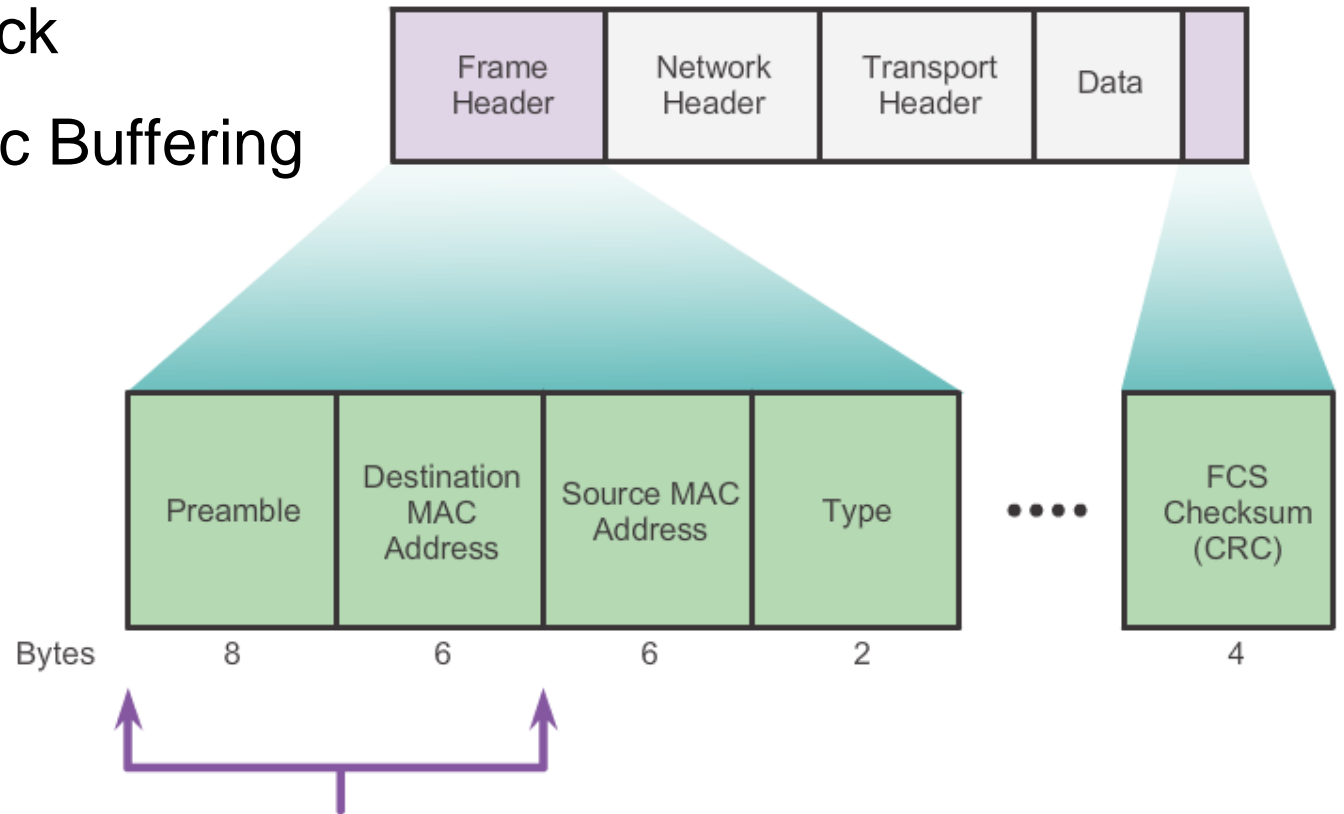
Store-and-forward switching entails receipt of the entire frame (up to about 9,200 bytes for jumbo frames) before a forwarding decision is made.



Frame Forwarding

Cut-Through Switching

- Cut-Through allows the switch to start forwarding in about 10 microseconds
- No FCS check
- No Automatic Buffering



1.2.1.5

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



1.2.1.6 Activity - Frame Forwarding Methods

	Store-and-Forward	Cut-Through
1. Buffers frames until the full frame has been received by the switch.		
2. Checks the frame for errors before releasing it out of its switch ports if the full frame was not received, the switch discards it.		
3. No error checking on frames is performed by the switch before releasing the frame out of its ports.		
4. A great method to use to conserve bandwidth on your network.		
5. The destination Network Interface Card (NIC) discards any incomplete frames using this frame forwarding method.		
6. The faster switching method, but may produce more errors in data integrity therefore, more bandwidth may be consumed.		

Do the Activity on 1.2.1.6

1.2.1.6



1.2.1.7 Activity - Switch It!

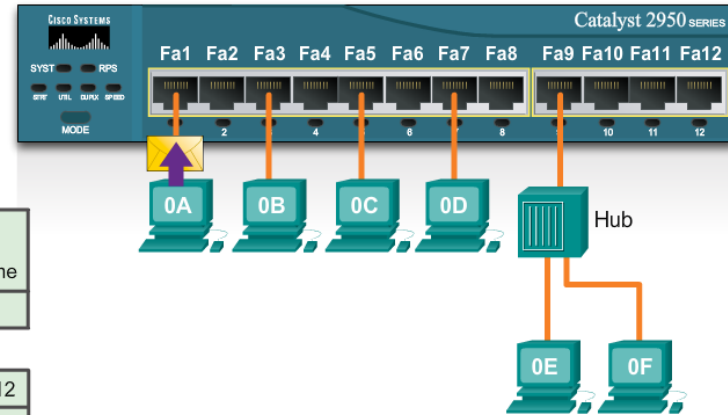
Activity
 Determine how the switch forwards a frame based on the Source MAC and Destination MAC addresses and information in the switch MAC table.
 Answer the questions below using the information provided.

Frame

Preamble	Destination MAC	Source MAC	Length Type	Encapsulated Data	End of Frame
	0F	0A			

MAC Table

Fa1	Fa2	Fa3	Fa4	Fa5	Fa6	Fa7	Fa8	Fa9	Fa10	Fa11	Fa12
0A		0B									



Question 1 - Where will the switch forward the frame?

- Fa1
 Fa2
 Fa3
 Fa4
 Fa5
 Fa6
 Fa7
 Fa8
 Fa9
 Fa10
 Fa11
 Fa12

Question 2 - When the switch forwards the frame, which statement(s) are true?

- Switch adds the source MAC address to the MAC table.
 Frame is a broadcast frame and will be forwarded to all ports.
 Frame is a unicast frame and will be sent to specific port only.
 Frame is a unicast frame and will be flooded to all ports.
 Frame is a unicast frame but it will be dropped at the switch.

Do the Activity on 1.2.1.7

1.2.1.7



Switching Domains

Collision Domains

- 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.



Switching Domains

Broadcast Domains

- Broadcast domain is the extend of the network where a broadcast frame can be heard.
- Switches forward broadcast frames to all ports. Therefore switches don't 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 will be forward to all ports of all switches (except for the port that originally received the broadcast)

1.2.2.2

Watch the animations on 1.2.2.2



Switching Domains

Alleviating 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

1.2.2.4

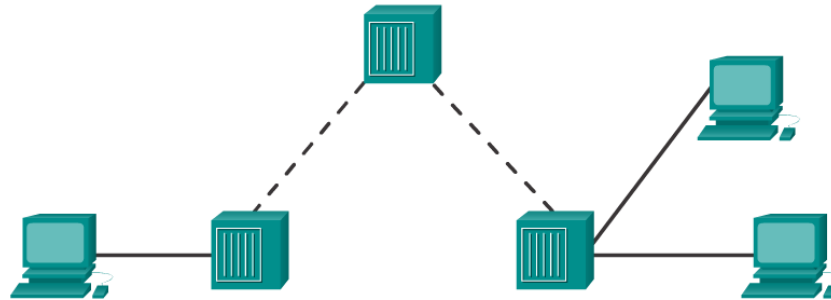


1.2.2.4 Activity - Circle the Domain

Activity – Circle the Domain

- Use the mouse to draw a shape around some, or all, of the devices in each of the diagrams. Drawing a shape around a group of devices will indicate that those devices are part of a broadcast or collision domain. To include a device interface, but not the whole device, encompass the part of the device with the interface you wish to include.
- To draw a shape, move the mouse over the diagram, hold down the mouse button, and draw a circle around the devices you wish to select. While drawing, the cursor will appear as a pencil. The resulting shape is not a perfect circle, but a shaded polygon will encompass the devices you have selected. Practice using the drawing tool, then Click **Reset** any time to clear the screen.
- You can draw more than one shape to encompass different groups of devices. When drawn, shapes cannot be changed, but you can click **Undo** to remove one shape at a time, or click **Reset** to start over again. When ready, click **Check** and your solution will be evaluated. Click **Answer** to see the correct answer drawn for you.

Draw individual shapes around each broadcast domain. (Hint: In some cases there is more than one.)



- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

Check Undo Reset Answer

Do the Activity on 1.2.2.4

1.2.2.4



1.3.1.2 Basic Switch Configuration

This Syntax Checker activity reviews basic switch configurations from the first course.
Configure the switch hostname to be 'HQSw1'.

```
Switch#
```

Reset

Show Me

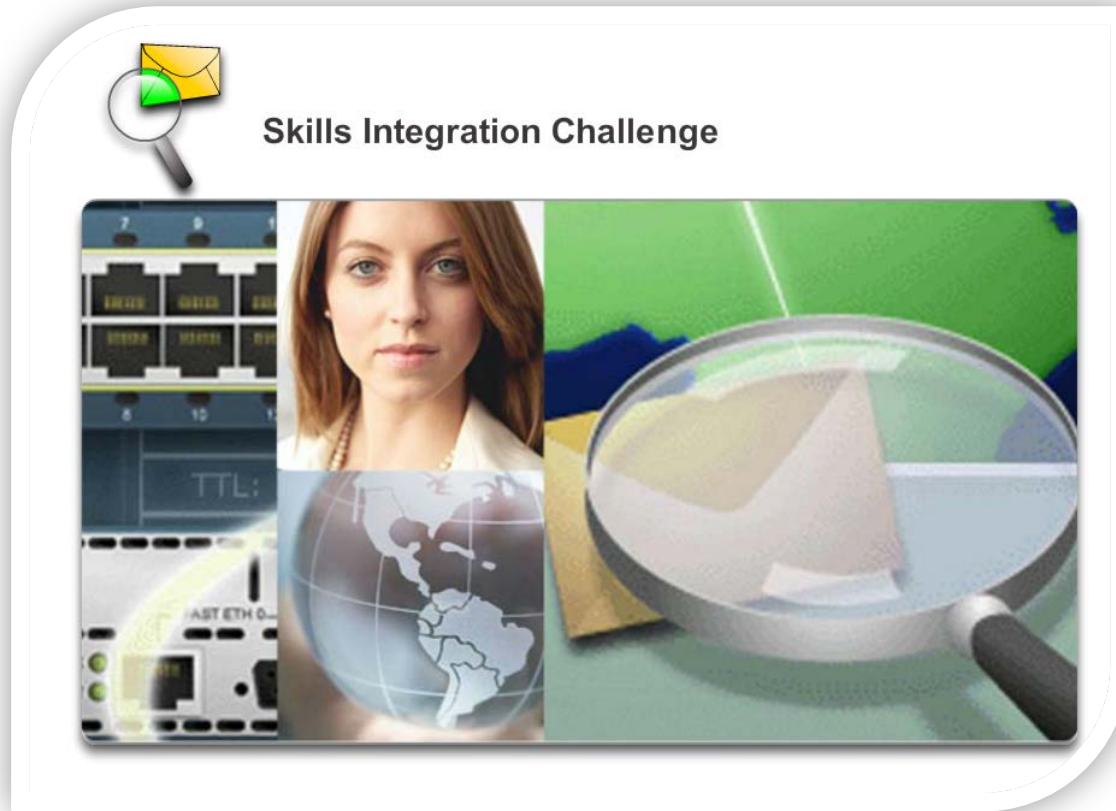
Show All

Do the Activity on 1.3.1.2

1.3 1.2



1.3.1.3 Packet Tracer – Skills Integration Challenge



Do the Packet Tracer from 1.3.1.3
For a grade

1.3 1.3



Chapter 1: Summary

- This chapter showed that the trend in networks is towards convergence using a single set of wires and devices to handle voice, video, and data transmission.
- In addition, there has been a dramatic shift in the way businesses operate.
- 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.

1.3.1.1, 1.3.1.4



Chapter 1: Summary

- 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.

1.3.1.1, 1.3.1.4



Chapter 1: Summary

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

1.3.1.1, 1.3.1.4

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Ta Da !