



## Chapter 4: Switched Networks



### Routing and Switching Essentials v6.0

Cisco | Networking Academy®  
Mind Wide Open™



# 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



**Cisco** | **Networking Academy®**  
Mind Wide Open™



## Converged Networks

# Growing Complexity of Networks

- Our digital world is changing.
- Information must be accessed from anywhere in the world.

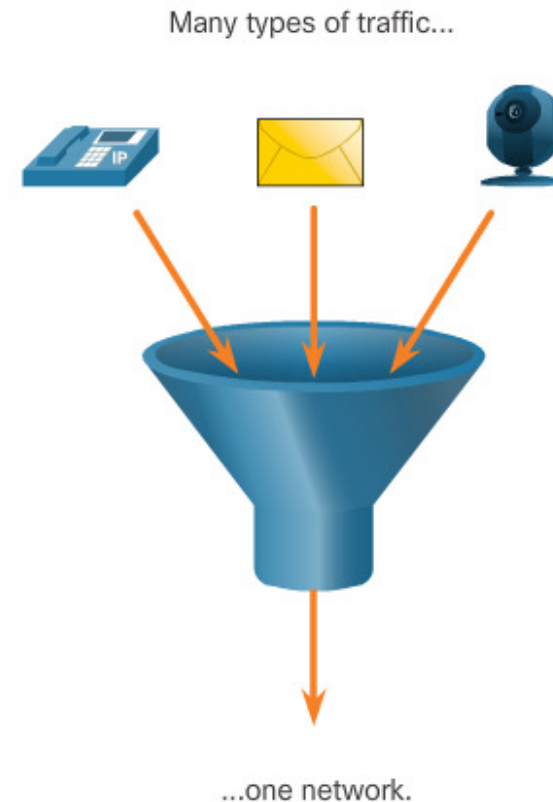




## Converged Networks

# Elements of a Converged Network

- 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.
- 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.

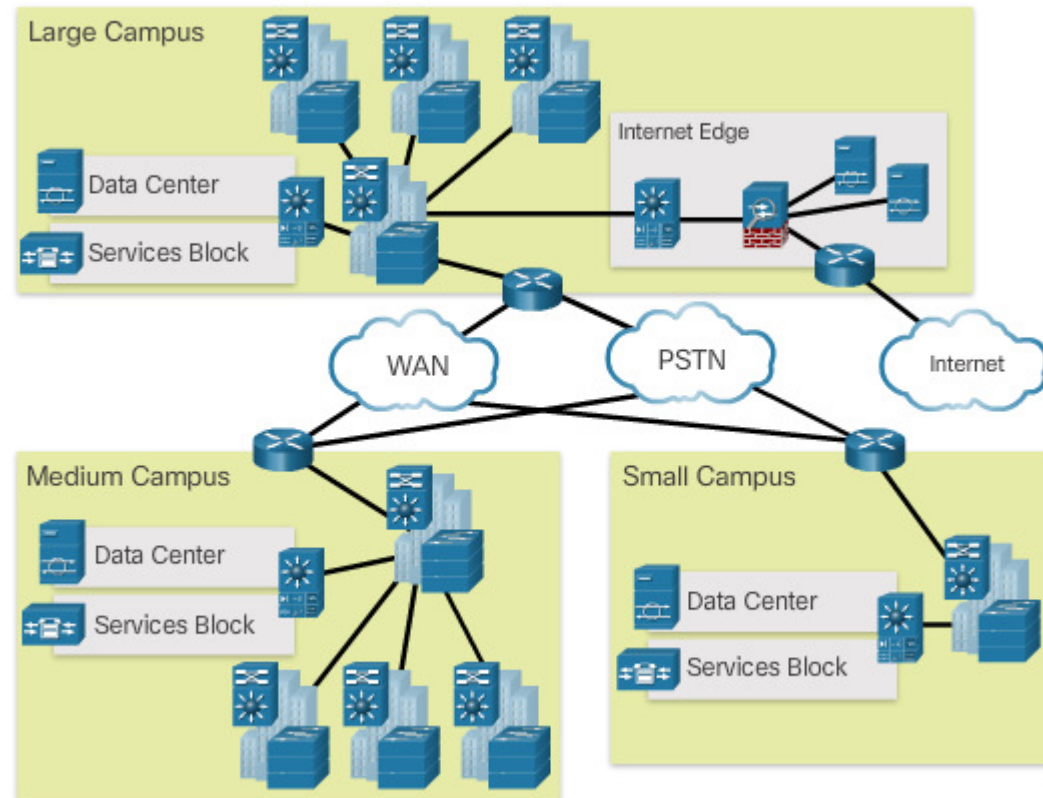




## Converged Networks

# Cisco Borderless Networks

- A network architecture that allows organizations to connect anyone, anywhere, anytime, and on any device securely, reliably, and seamlessly.
- Designed to address IT and business challenges, such as supporting the converged network and changing work patterns.



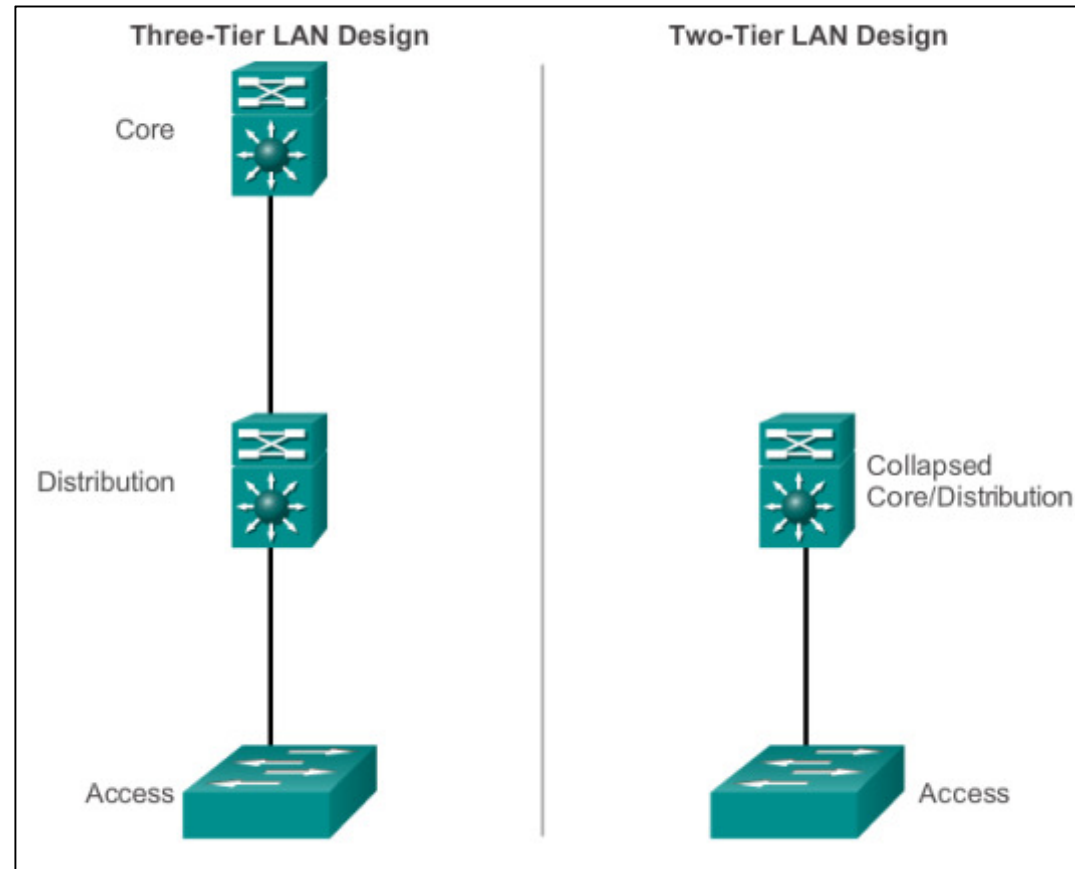


## Converged Networks

# Hierarchy in the Borderless Switched Network

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

- Hierarchical
- Modularity
- Resiliency
- Flexibility

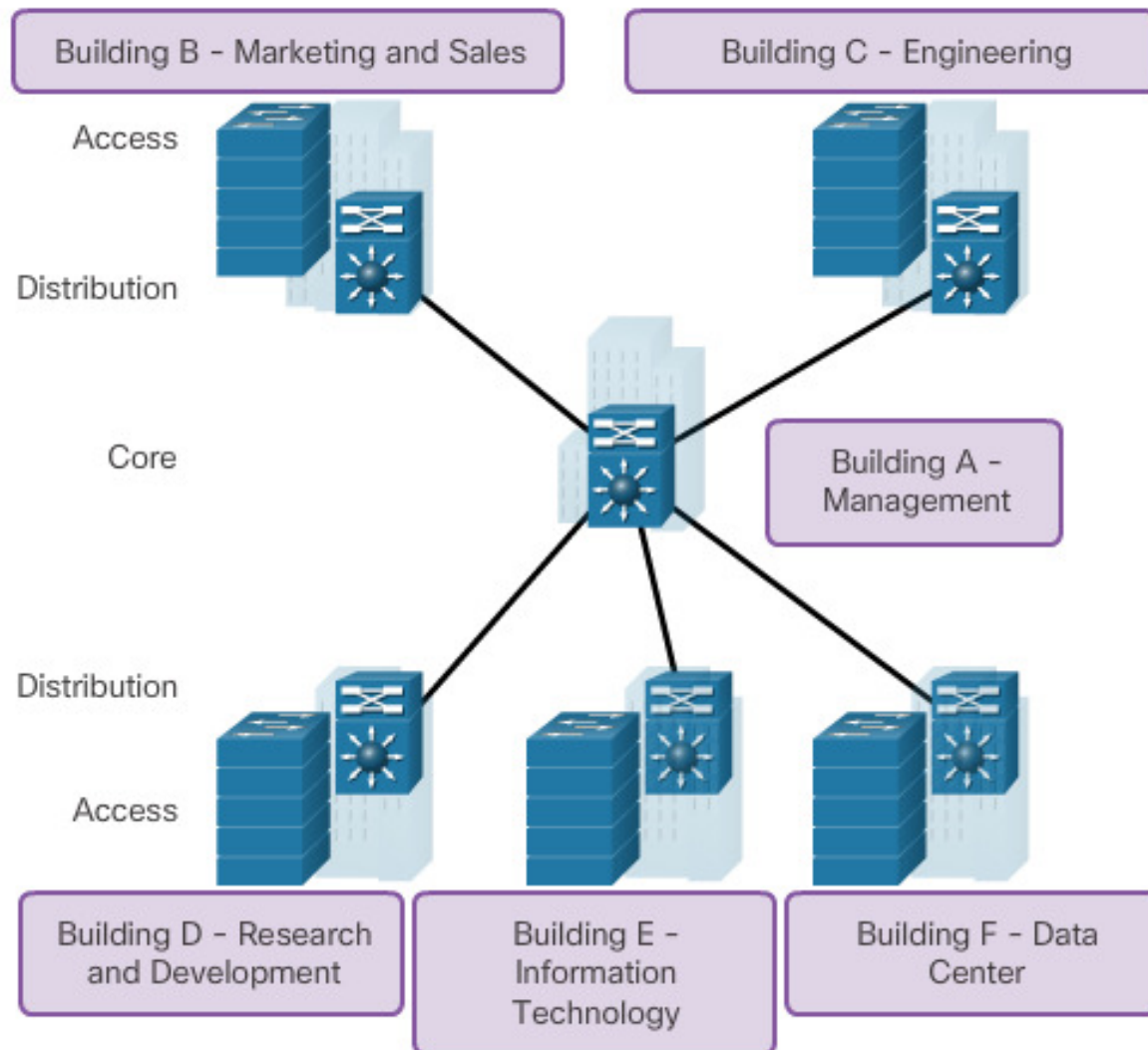






# Converged Networks

## Access, Distribution, and Core Layers



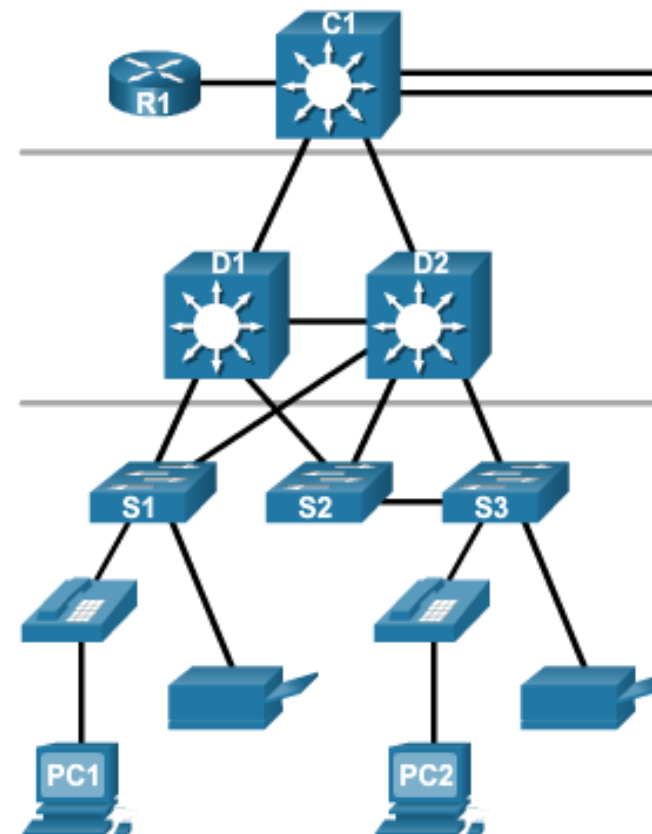




## Switched Networks

# Role of Switched Networks

- Switching technologies are crucial to network design.
- Switching allows 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



# Switched Networks

## Form Factors

### Fixed Configuration Switches



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

# Switched Networks Form Factors

## Modular Platform



The chassis accepts line cards that contain the ports.

# Switched Networks

## Form Factors

### Stackable Configuration Switches



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



## 4.2 The Switched Environment



**Cisco** | **Networking Academy®**  
| **Mind Wide Open™**



## Frame Forwarding

# Switching as a General Concept in Networking and Telecommunications

- 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.



## 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.
- As a switch learns the relationship of ports to devices, it builds a table called a MAC address or content addressable memory (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, except the one that received the frame.



## Frame Forwarding Switch Forwarding Methods

Store-and-Forward



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.

Cut-Through



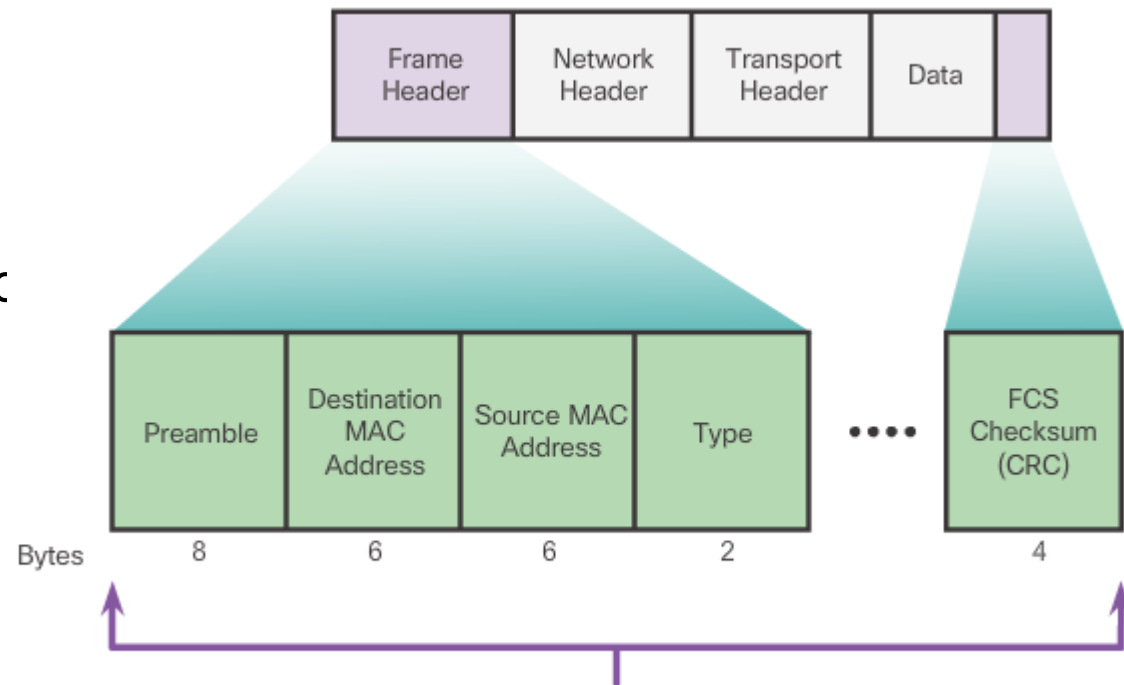
A cut-through switch forwards the frame before it is entirely received. At a minimum, the destination address of the frame must be read before the frame can be forwarded.



# Frame Forwarding

## Store-and-Forward Switching

- Allows the switch to:
  - Check for errors (via FCS check)
  - Perform automatic buffering
- Slower forwarding process



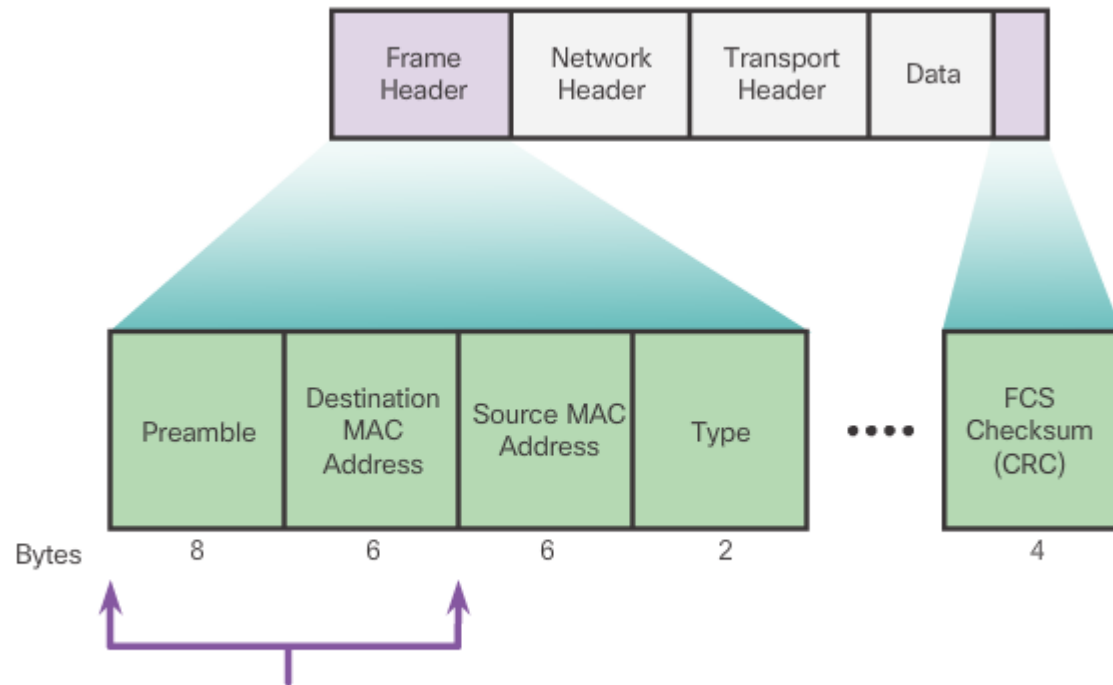
Store-and-forward switching entails receipt of the entire frame (up to about 9,200 bytes for jumbo frames) before a forwarding decision is made.



# Frame Forwarding

## Cut-Through Switching

- Allows the switch to start forwarding in about 10 microseconds
- No FCS check
- No automatic buffering



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



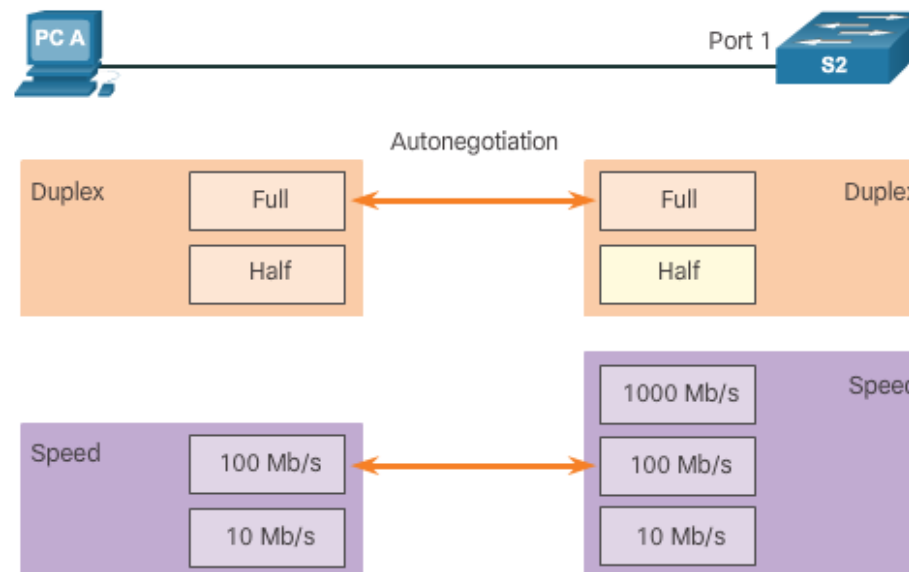
## Switching Domains

# Collision Domains

Collision domain - Segment where devices compete to communicate.

Ethernet switch port:

- Operating in half duplex, each segment is in its own collision domain.
- Operating in full duplex eliminates collisions.
- By default, will auto-negotiate full duplex when the adjacent device can also operate in full duplex.





## Switching Domains

# Broadcast Domains

A broadcast domain is the extent 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.



## Switching Domains

# Alleviating Network Congestion

Switches help alleviate 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.



## 4.3 Chapter Summary



**Cisco** | **Networking Academy®**  
Mind Wide Open™





## Chapter Summary

# Summary

- 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.
- 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.

