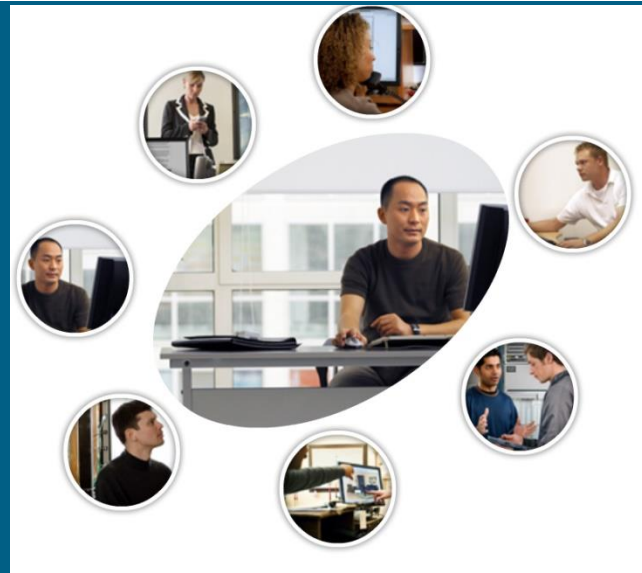


# Switching & LAN Design



# Layer 2 devices

- A layer 2 device is a device that understand MAC, for example:

- ✓ **NIC (Network Interface Card)**



- ✓ **Bridge :**

- address learning
- forwarding decisions are based on software
- bridge is used for LAN segmentation
- max. 16 port.

- ✓ **Switch:**



- a multi-port bridge up to 256 port
- forwarding decisions are based on hardware ASIC (faster than bridge)

# What is the meaning of switching?

- Switching means that the device (router or switch) receive the data on a certain port and forwards it to appropriate port

# Explain the Functions that Enable a Switch to Forward Ethernet Frames in a LAN

## Switch Packet Forwarding Methods

Store-and-forward



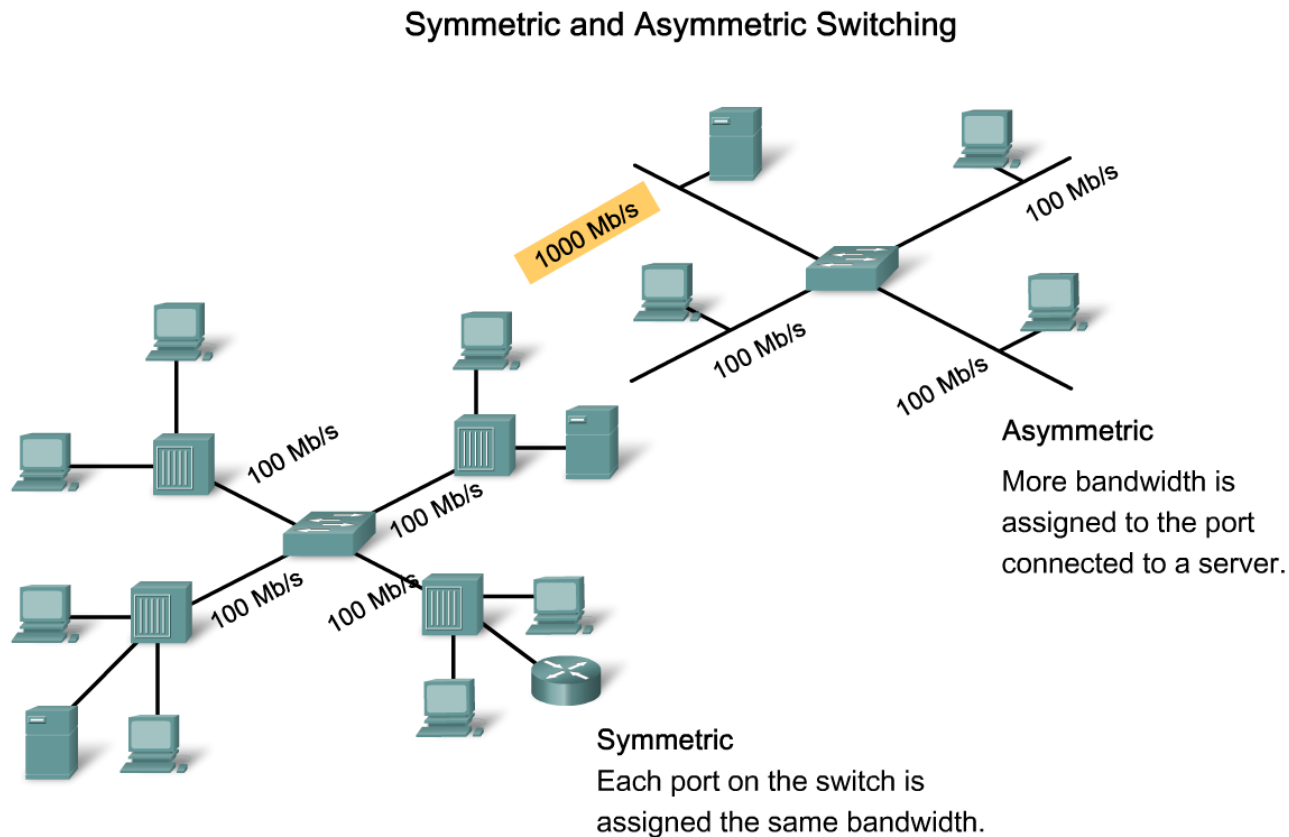
Complete frame is received  
before forwarding.

Cut-through



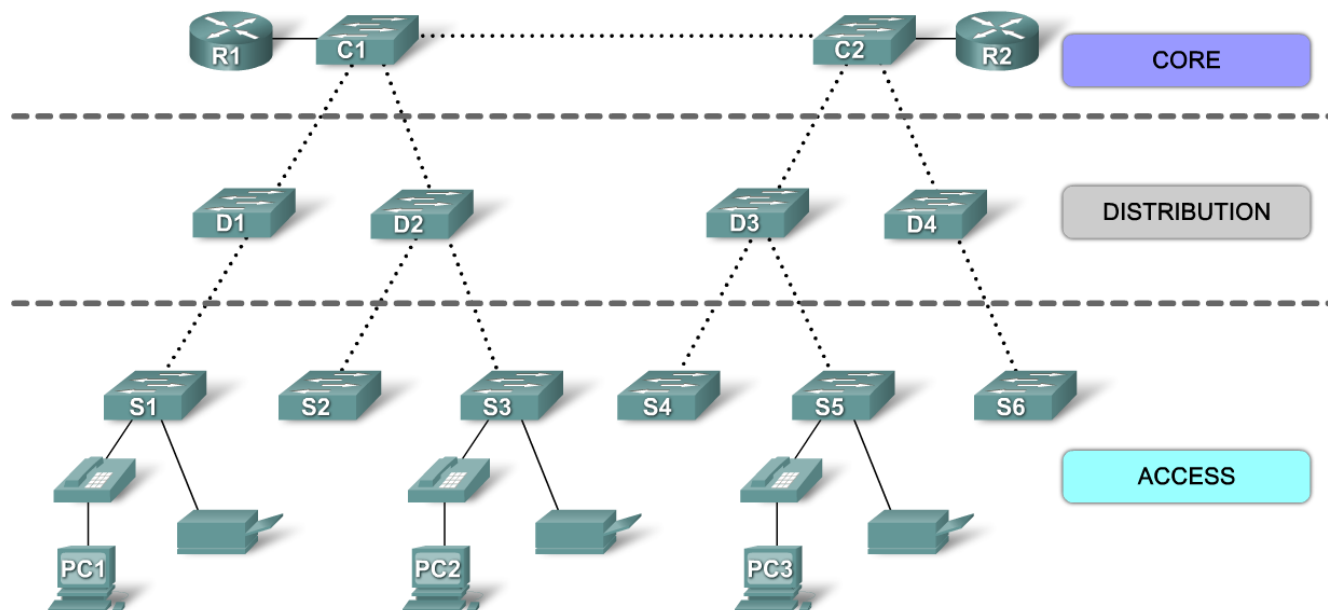
The frame is forwarded  
through the switch before the  
entire frame is received.

# Explain the Functions that Enable a Switch to Forward Ethernet Frames in a LAN



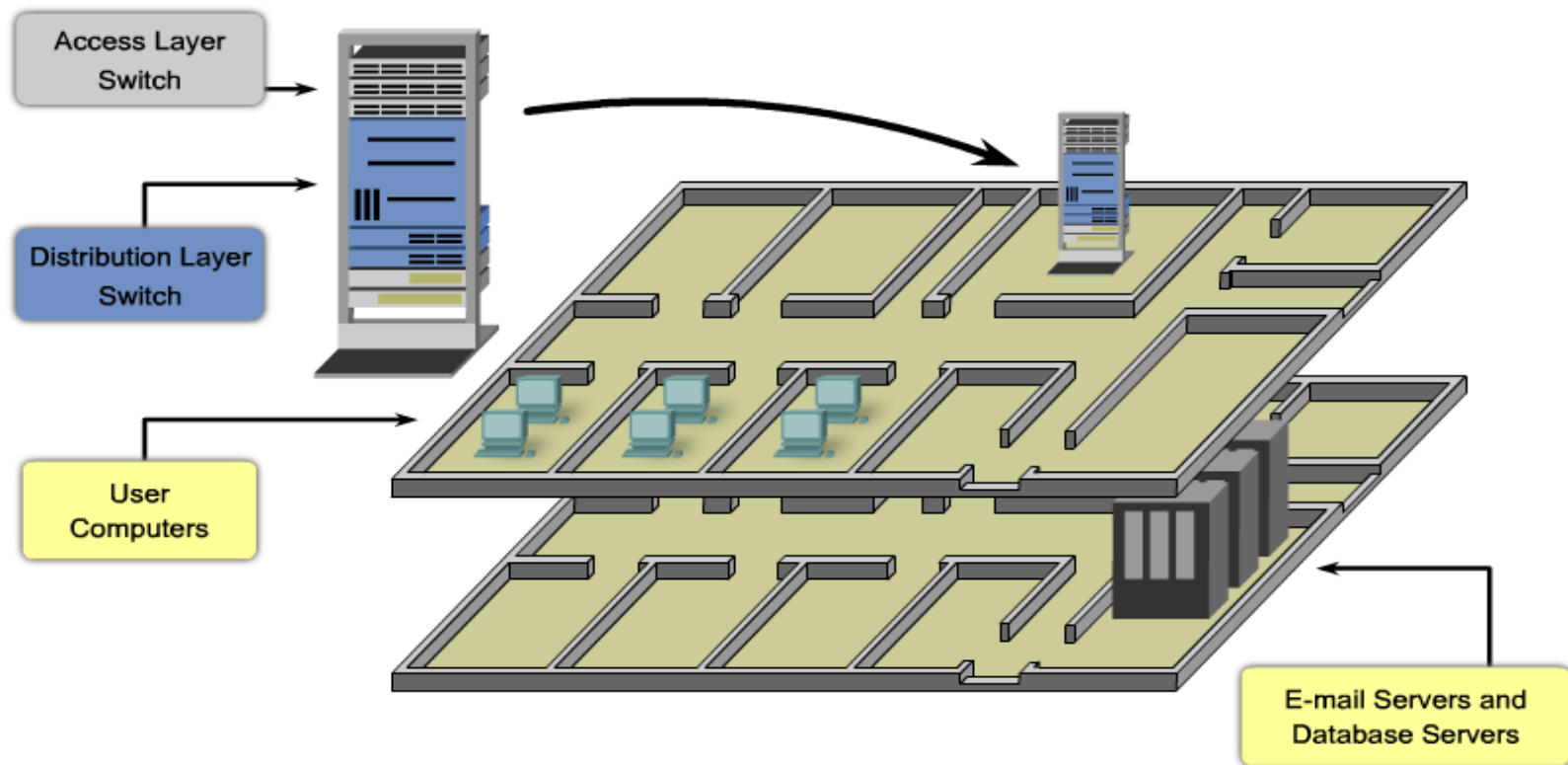
# Hierarchical Network Design

A Hierarchical Network in a Medium-Sized Business



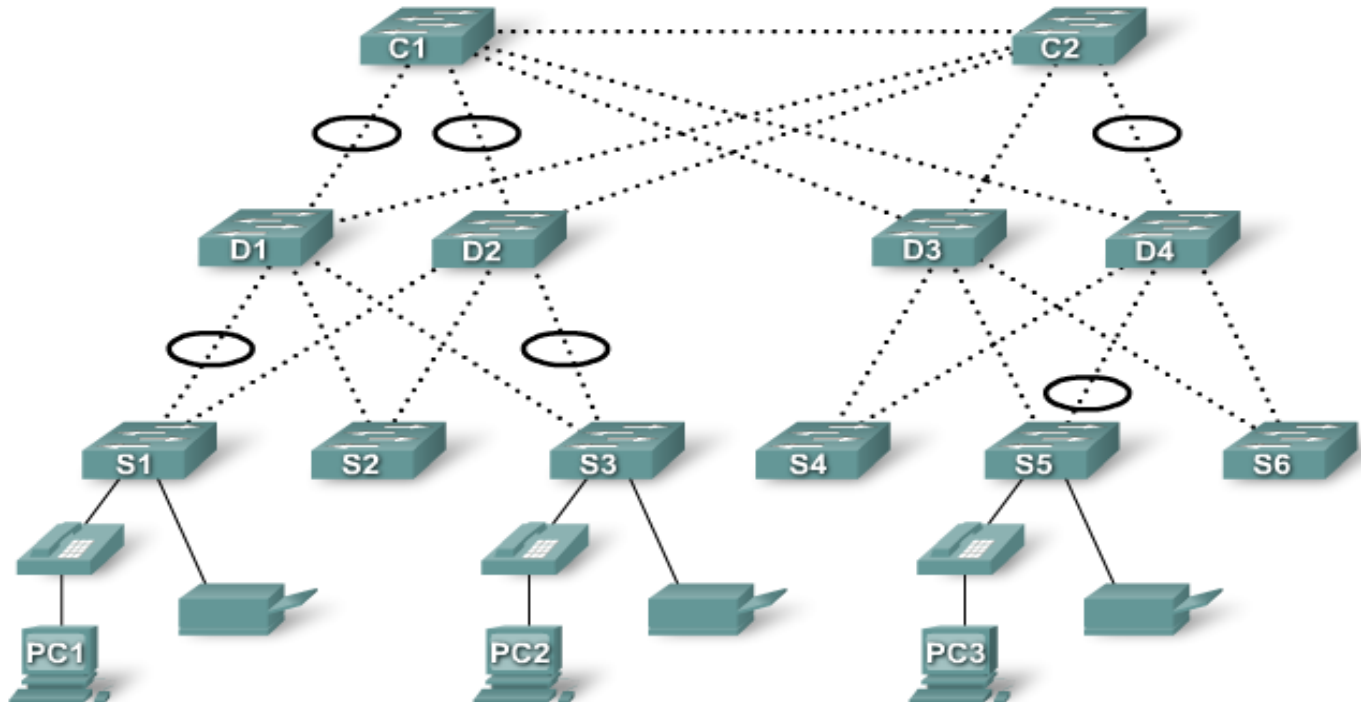
# Hierarchical Network Physical Layout

A Hierarchical Network in a Medium-Sized Business



# Hierarchical Network Design

## Hierarchical Network Design Principles



# Hierarchical Network Design

## Benefits of a Hierarchical Network

### Scalability

- Hierarchical networks can be expanded easily

### Redundancy

- Redundancy at the core and distribution level ensure path availability

### Performance

- Link aggregation between levels and high-performance core and distribution level switches allow for near wire-speed throughout the network

### Security

- Port security at the access level and policies at the distribution level make the network more secure

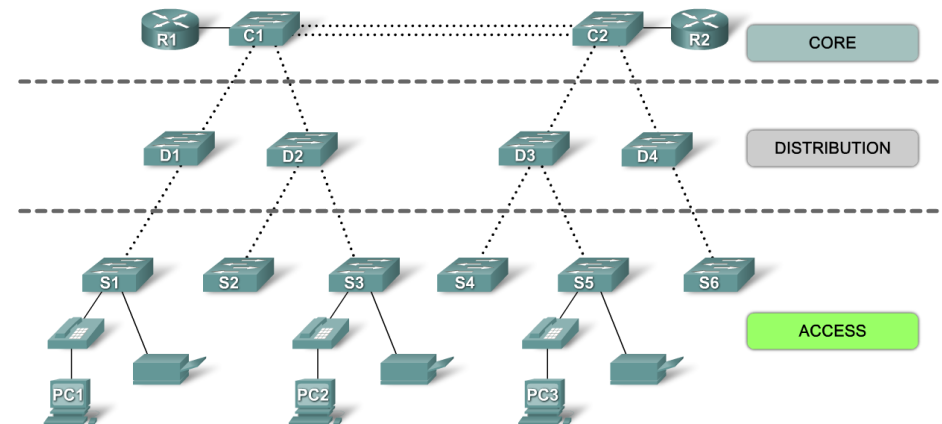
### Manageability

- Consistency between switches at each level makes management more simple

### Maintainability

- The modularity of hierarchical design allows for the network to scale without becoming overly complicated

## The Hierarchical Network Model



# Match the Appropriate Cisco Switch to each Layer in the Hierarchical Network Design Model

Port density is the number of ports available on a single switch.

24-port switch



48-port switch



Modular switch with up to 1000+ ports



# Match the Appropriate Cisco Switch to each Layer in the Hierarchical Network Design Model

## Switch Form Factors

### Fixed Configuration Switches



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

### Modular Configuration Switches



The chassis accepts line cards that contain the ports.

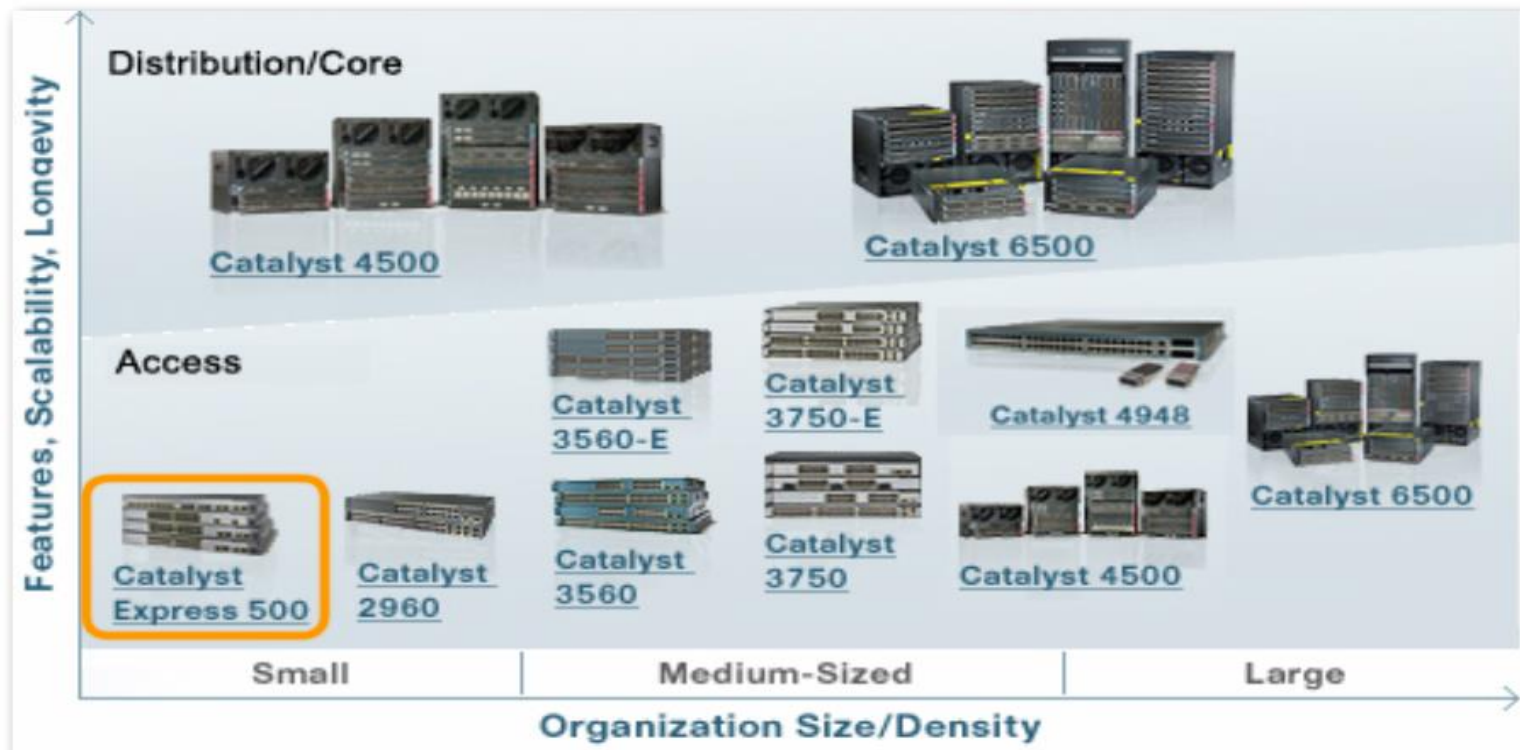
### Stackable Configuration Switches



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

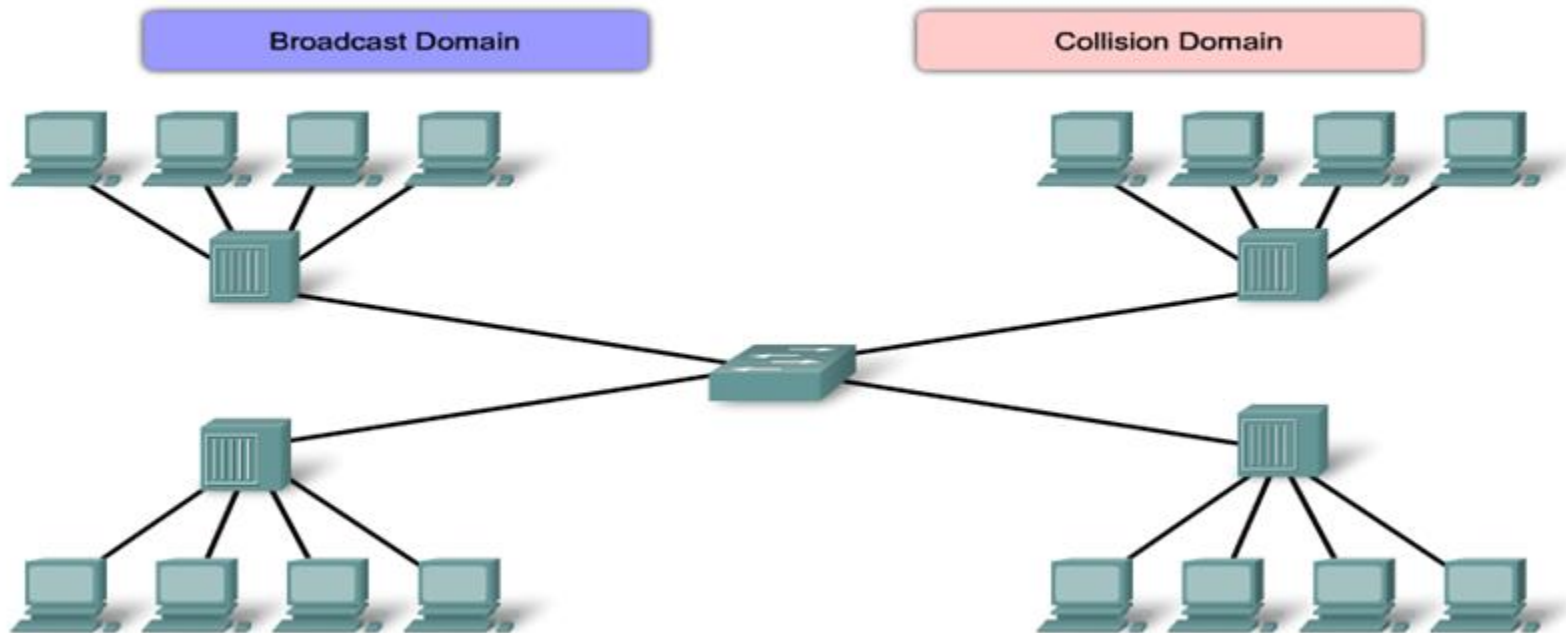
# Match the Appropriate Cisco Switch to each Layer in the Hierarchical Network Design Model

## Features of Cisco Catalyst Switches



# Uncontrolled collision & broadcast domains

Collision and Broadcast Domain

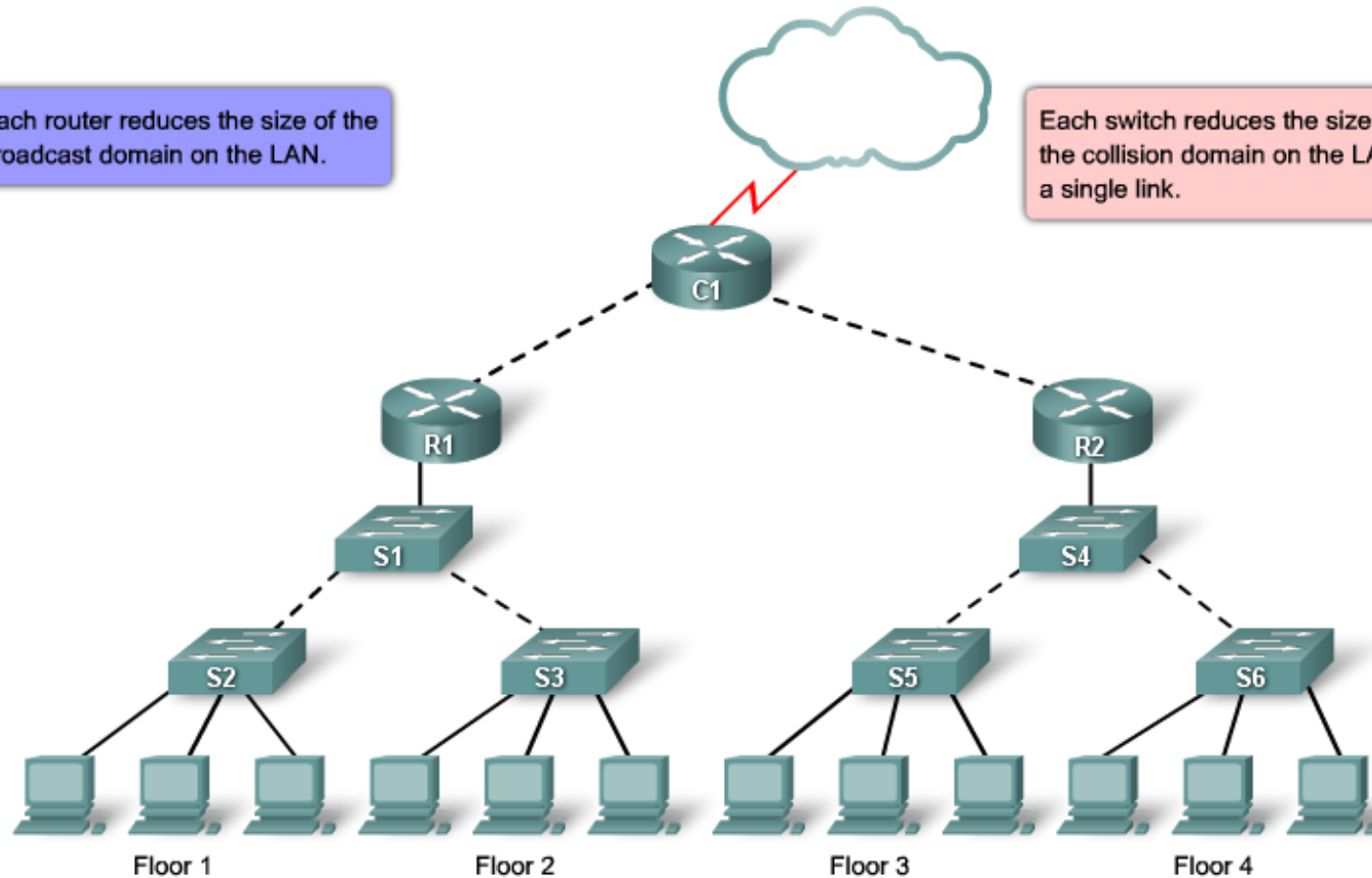


# Controlled collision & broadcast domains

Collision and Broadcast Domain

Each router reduces the size of the broadcast domain on the LAN.

Each switch reduces the size of the collision domain on the LAN to a single link.



# Switch boot sequence

## Describe the Boot Sequence

The boot sequence of a Cisco switch:

- The switch loads the boot loader software from NVRAM.
- The boot loader:
  - Performs low-level CPU initialization.
  - Performs POST for the CPU subsystem.
  - Initializes the flash file system on the system board.
  - Loads a default operating system software image into memory and boots the switch.
- The operating system runs using the config.text file, stored in the switch flash storage.

The boot loader can help you recover from an operating system crash:

- Provides access into the switch if the operating system has problems serious enough that it cannot be used.
- Provides access to the files stored on flash before the operating system is loaded.
- Use the boot loader command line to perform recovery operations.

# Switch boot sequence

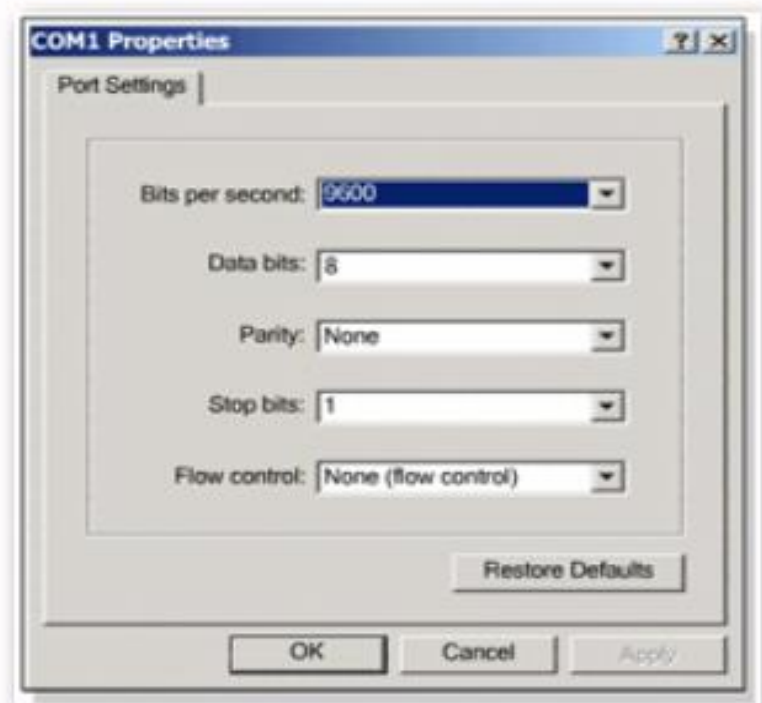
- The switch uses the **flash memory** to store two types of files :
  1. The IOS of the switch
  2. The VLAN database
- The switch uses the **NVRAM** to store two types of files:
  1. The boot loader
  2. The configuration file

# The CLI of the switch

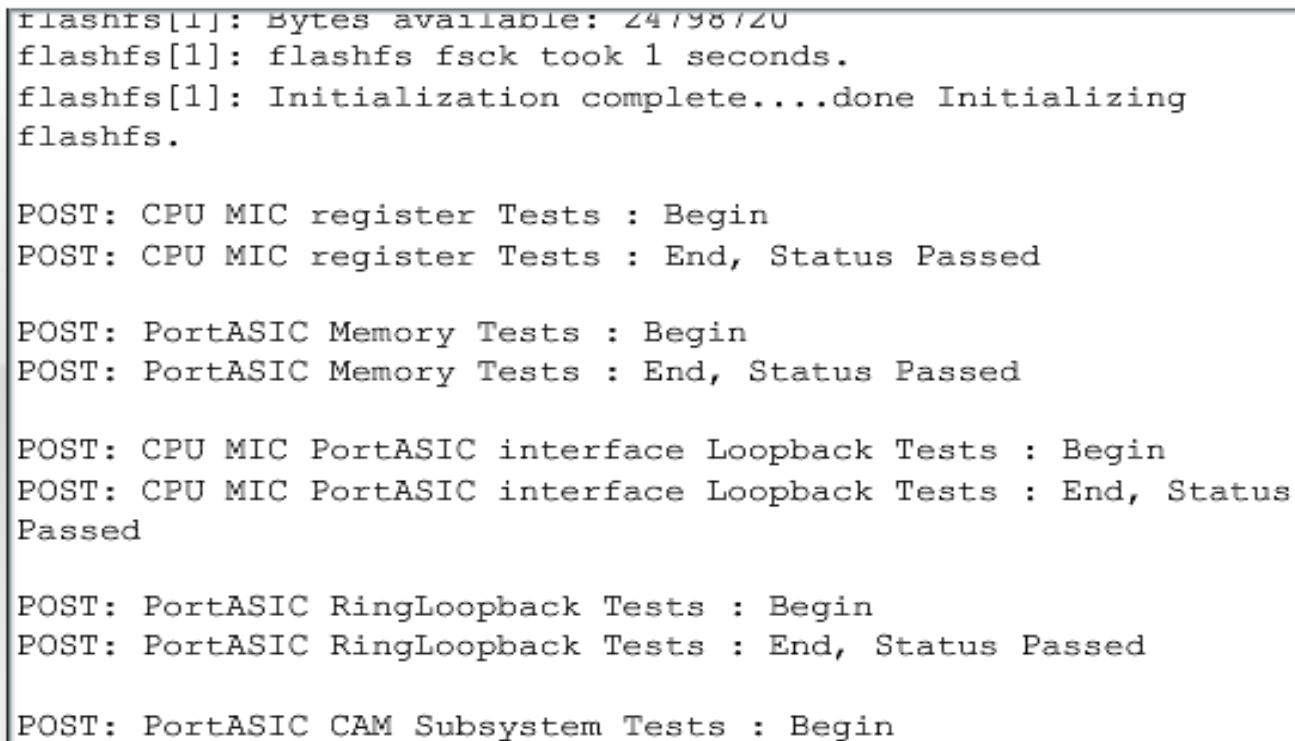
- the CLI of the switch is like the CLI of the router



# The CLI of the switch



# The CLI of the switch



```
flashfs[1]: Bytes available: 24/98/20
flashfs[1]: flashfs fsck took 1 seconds.
flashfs[1]: Initialization complete....done Initializing
flashfs.

POST: CPU MIC register Tests : Begin
POST: CPU MIC register Tests : End, Status Passed

POST: PortASIC Memory Tests : Begin
POST: PortASIC Memory Tests : End, Status Passed

POST: CPU MIC PortASIC interface Loopback Tests : Begin
POST: CPU MIC PortASIC interface Loopback Tests : End, Status
Passed

POST: PortASIC RingLoopback Tests : Begin
POST: PortASIC RingLoopback Tests : End, Status Passed

POST: PortASIC CAM Subsystem Tests : Begin
```

# The CLI of the switch

## The Command Line Interface Modes

| Cisco IOS CLI Command Syntax                                                              |                           |
|-------------------------------------------------------------------------------------------|---------------------------|
| Switch from user EXEC to privileged EXEC mode                                             | switch> <b>enable</b>     |
| If a password has been set for privileged EXEC mode you will be prompted to enter it now. | Password: <b>password</b> |
| The # prompt signifies privileged EXEC mode.                                              | switch#                   |
| Switch from privileged EXEC to user EXEC mode                                             | switch# <b>disable</b>    |
| The > prompt signifies user EXEC mode.                                                    | switch>                   |

# The CLI of the switch

- To configure the basic configuration of the switch, like the router basic configuration:
  1. Set the hostname
  2. Set the message of the day
  3. Set enable password in (clear text or encrypted text)
  4. Set the interfaces configuration (speed and duplex type)

# The CLI of the switch

## The Command Line Interface Modes

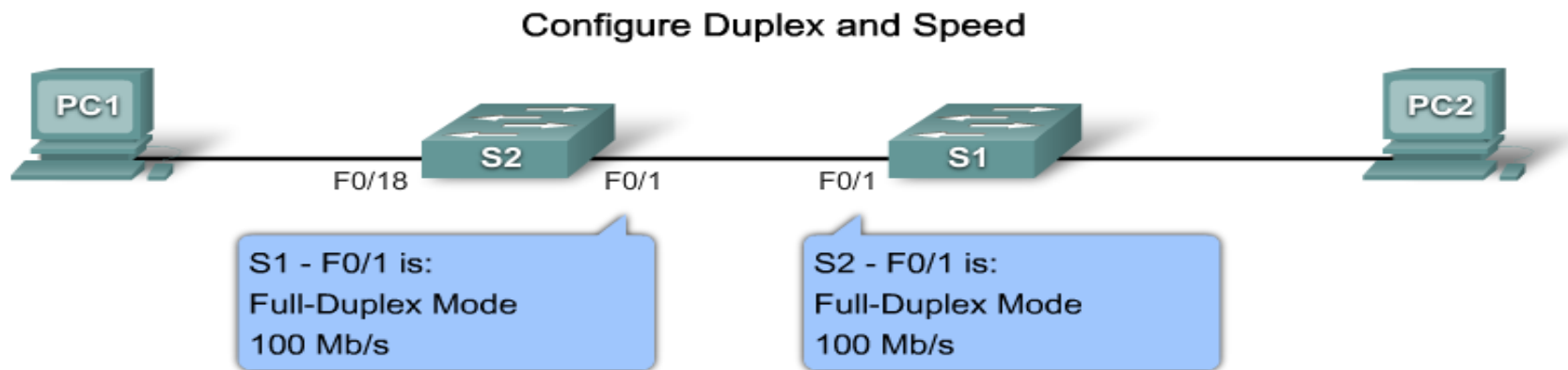
| Cisco IOS CLI Command Syntax                                                                           |                                                    |
|--------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Switch from privileged EXEC mode to global configuration mode                                          | switch# <b>configure terminal</b>                  |
| The (config)# prompt signifies that the switch is in global configuration mode.                        | switch(config) #                                   |
| Switch from global configuration mode to interface configuration mode for fast ethernet interface 0/1. | switch(config) # <b>interface fastethernet 0/1</b> |
| The (config-if)# prompt signifies that the switch is in the interface configuration mode.              | switch(config-if) #                                |
| Switch from interface configuration mode to global configuration mode.                                 | switch(config-if) # <b>exit</b>                    |
| The (config)# prompt signifies that the switch is in global configuration mode.                        | switch(config) #                                   |
| Switch from global configuration mode to privileged EXEC mode.                                         | switch(config) # <b>exit</b>                       |
| The # prompt signifies that the switch is in privileged EXEC mode.                                     | switch#                                            |

# The CLI of the switch

## Configure EXEC Mode Passwords

| Cisco IOS CLI Command Syntax                                                |                                                    |
|-----------------------------------------------------------------------------|----------------------------------------------------|
| Switch from privileged EXEC mode to global configuration mode.              | S1# <b>configure terminal</b>                      |
| Configures the <b>enable password</b> to enter privileged EXEC mode.        | S1(config)# <b>enable password</b> <i>password</i> |
| Configures the <b>enable secret</b> password to enter privileged EXEC mode. | S1(config)# <b>enable secret</b> <i>password</i>   |
| Exit from line configuration mode and return to privileged EXEC mode.       | S1(config)# <b>end</b>                             |

# The CLI of the switch



| Cisco IOS CLI Command Syntax                                              |                                               |
|---------------------------------------------------------------------------|-----------------------------------------------|
| Switch from privileged EXEC mode to global configuration mode.            | S1# <b>configure terminal</b>                 |
| Enter the interface configuration mode.                                   | S1(config)# <b>Interface fastethernet 0/1</b> |
| Configure the interface duplex mode to enable AUTO duplex configuration   | S1(config-if)# <b>duplex auto</b>             |
| Configure the interface duplex speed and enable AUTO speed configuration. | S1(config-if)# <b>speed auto</b>              |
| Return to privileged EXEC mode.                                           | S1(config-if)# <b>end</b>                     |
| Save the running configuration to the switch start-up configuration.      | S1# <b>copy running-config startup-config</b> |

# The CLI of the switch

- Set console password

## Configure Console Access

| Cisco IOS CLI Command Syntax                                                         |                                        |
|--------------------------------------------------------------------------------------|----------------------------------------|
| Switch from privileged EXEC mode to global configuration mode.                       | S1# <b>configure terminal</b>          |
| Switch from global configuration mode to line configuration mode for console 0.      | S1(config)# <b>line con 0</b>          |
| Set cisco as the password for the console 0 line on the switch.                      | S1(config-line)# <b>password cisco</b> |
| Set the console line to require the password to be entered before access is granted. | S1(config-line)# <b>login</b>          |
| Exit from line configuration mode and return to privileged EXEC mode.                | S1(config-line)# <b>end</b>            |

# The CLI of the switch

- Set the telnet password

## Configure Virtual Terminal Access

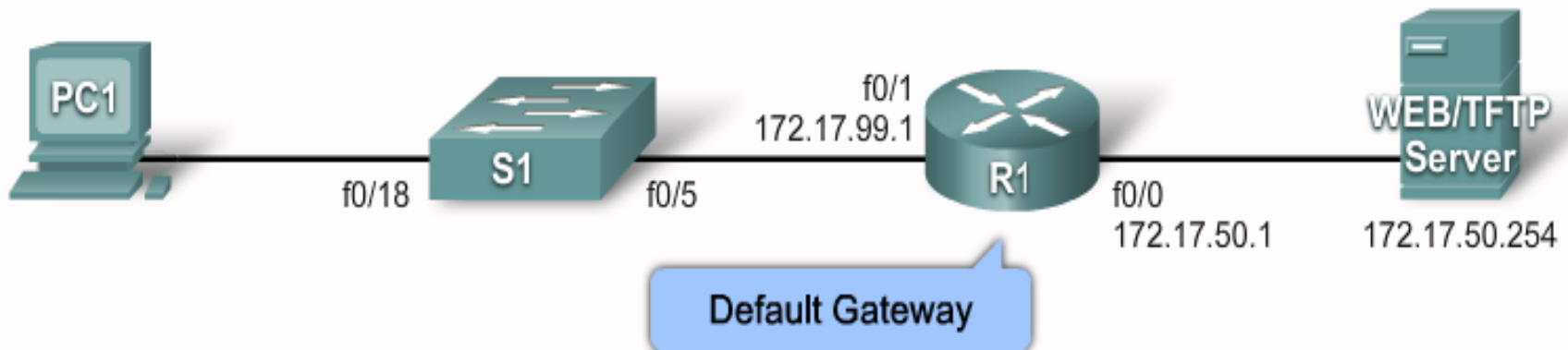
| Cisco IOS CLI Command Syntax                                                         |                                             |
|--------------------------------------------------------------------------------------|---------------------------------------------|
| Switch from privileged EXEC mode to global configuration mode.                       | <code>S1#configure terminal</code>          |
| Switch from global configuration mode to line configuration mode for console 0.      | <code>S1(config)#line vty 0 4</code>        |
| Set <b>cisco</b> as the password for the console 0 line on the switch.               | <code>S1(config-line)#password cisco</code> |
| Set the console line to require the password to be entered before access is granted. | <code>S1(config-line)#login</code>          |
| Exit from line configuration mode and return to privileged EXEC mode.                | <code>S1(config-line)#end</code>            |

# The CLI of the switch

- To be able to telnet to or from the switch you should set an IP address and the default gateway on the switch as it is a normal PC
- To do so:
  - Switch(config)# interface vlan1
  - Switch(config-vlan)# ip address 10.10.10.10 255.255.255.0
  - Switch(config-vlan)# no shutdown
  - Switch(config-vlan)# exit
  - Switch(config)# ip default-gateway 10.10.10.1

# The CLI of the switch

## Configure IP Connectivity



### Cisco IOS CLI Command Syntax

Configures the default gateway on the switch.

```
S1(config)#ip default-gateway 172.17.99.1
```

Return to privileged EXEC mode.

```
S1(config)#end
```

Save the running configuration to the switch start-up configuration.

```
S1#copy running-config startup-config
```