



Module 1: Basic Device Configuration

Switching, Routing and Wireless
Essentials v7.0 (SRWE)



Module Objectives

Module Title: Basic Device Configuration

Module Objective: Configure devices using security best practices.

Topic Title	Topic Objective
Configure a Switch with Initial Settings	Configure initial settings on a Cisco switch.
Configure Switch Ports	Configure switch ports to meet network requirements.
Secure Remote Access	Configure secure management access on a switch.
Basic Router Configuration	Configure basic settings on a router to route between two directly-connected networks, using CLI.
Verify Directly Connected Networks	Verify connectivity between two networks that are directly connected to a router.

1.1 Configure a Switch with Initial Settings

Configure a Switch with Initial Settings

Switch Boot Sequence

After a **Cisco switch is powered on**, it goes through the following **five-step** boot sequence:

Step 1: First, the switch loads a **power-on self-test (POST)** program stored in **ROM**. POST checks the CPU subsystem. It tests the CPU, DRAM, and the portion of the flash device that makes up the flash file system.

Step 2: Next, the switch loads the **boot loader software**. The boot loader is a small program stored in **ROM** that is run immediately after POST successfully completes.

Step 3: The boot loader performs **low-level CPU initialization**. It initializes the CPU registers, which control where **physical memory is mapped**, the **quantity of memory**, and its **speed**.

Step 4: The boot loader initializes the **flash file system** on the system board.

Step 5: Finally, the boot loader **locates and loads a default IOS operating system** software image into memory and gives control of the switch over to the IOS.

Configure a Switch with Initial Settings

The boot system Command

- The switch attempts to automatically boot by using information in the BOOT environment variable. If this variable is not set, the switch attempts to load and execute the first executable file it can find.
- The IOS operating system then initializes the interfaces using the Cisco IOS commands found in the startup-config file. The startup-config file is called **config.text** and is located in flash.
- In the example, the BOOT environment variable is set using the **boot system** global configuration mode command. Notice that the IOS is located in a distinct folder and the folder path is specified. Use the command **show boot** to see what the current IOS boot file is set to.

```
S1(config)# boot system flash:/c2960-lanbasek9-mz.150-2.SE/c2960-lanbasek9-mz.150-2.SE.bin
```

Command	Definition
boot system	The main command
flash:	The storage device
c2960-lanbasek9-mz.150-2.SE/	The path to the file system
c2960-lanbasek9-mz.150-2.SE.bin	The IOS file name

Configure a Switch with Initial Settings

Switch LED Indicators



System LED (SYST): Shows whether the system is **receiving power** and functioning properly.

Redundant Power Supply LED (RPS): Shows the **RPS status**.

Port Status LED (STAT): **When green**, indicates port status mode is selected, which is the default. Port status can then be understood by the light associated with each port.

Port Duplex LED (DUPLEX): **When green**, indicates port duplex mode is selected. Port duplex can then be understood by the light associated with each port.

Port Speed LED (SPEED): **When green**, indicates port speed mode is selected. Port speed can then be understood by the light associated with each port.

Power over Ethernet LED (PoE): **Present if the switch supports PoE.**

Indicates the PoE status of ports on the switch.

The Mode button is used to resetting the switch, entering day-zero setup mode, and move between the different modes – STAT, DUPLEX, SPEED, and PoE

Configure a Switch with Initial Settings

Switch LED Indicators



Table 3-5 Port LEDs

Port Mode	Port LED Color	Description
STAT	Cyan (off)	No link.
	Green	Link present.
	Amber	Link fault. Error frames can affect connectivity, and errors such as excessive collisions, CRC errors, and alignment and jabber errors are monitored for a link-fault indication. Port is not forwarding. Port was disabled by management, by an address violation, or by Spanning Tree Protocol (STP). Note After a port is reconfigured, the port LED can remain amber for up to 30 seconds as STP checks the switch for possible loops.
DUPLX	Brown	No link and port is administratively shut down.
	Cyan (off)	Port is operating in half-duplex mode.
	Green	Port is operating in full-duplex mode.
SPEED	Cyan (off)	Port is operating at 10 Mbps (10/100 ports) or no link (10/100/1000 ports and GBIC module ports).
	Green	Port is operating at 100 Mbps (10/100 ports) or 1000 Mbps (GBIC module ports).
	Blinking green	Port is operating at 1000 Mbps (10/100/1000 ports).

Configure a Switch with Initial Settings Recovering from a System Crash

The **boot loader** provides access into the switch if the operating system cannot be used because of **missing or damaged system files**. The boot loader has a command line that provides access to the files stored in flash memory. The boot loader can be accessed through a console connection following these steps:

Step 1. Connect a PC by **console cable** to the switch console port. Configure terminal emulation software to connect to the switch.

Step 2. **Unplug** the switch power cord.

Step 3. **Reconnect** the power cord to the switch and, within **15 seconds, press and hold down the **Mode** button** while the System LED is still flashing green.

Step 4. Continue pressing the **Mode** button until the System LED turns **briefly amber and then solid green**; then release the **Mode** button.

Step 5. The boot loader **switch:** prompt appears in the terminal emulation software on the PC.

The boot loader command line supports commands to **format the flash file system, reinstall the operating system software, and recover a lost or forgotten password**. For example, the **dir** command can be used to view a list of files within a specified directory.

Configure a Switch with Initial Settings

Recovering a lost or forgotten passwords

Step 1. Connect your PC or terminal into the switch console port with the blue console cable.

Step 2. **Unplug the power cable to the switch.**

Step 3. **Reconnect** the power cord to the switch and, within **15 seconds, press and hold down the Mode button** while the System LED is still flashing green.

Step 4. Your display on your Teraterm should look like this--> switch:

Step 5. Enter these commands into the switch

- switch: flash_init
- switch: load_helper
- switch: dir flash:
- switch: rename flash:config.text flash:config.text.old
- switch: boot

Step 5. Get into the privilege prompt and change any password and don't forget to save conf. to start-up

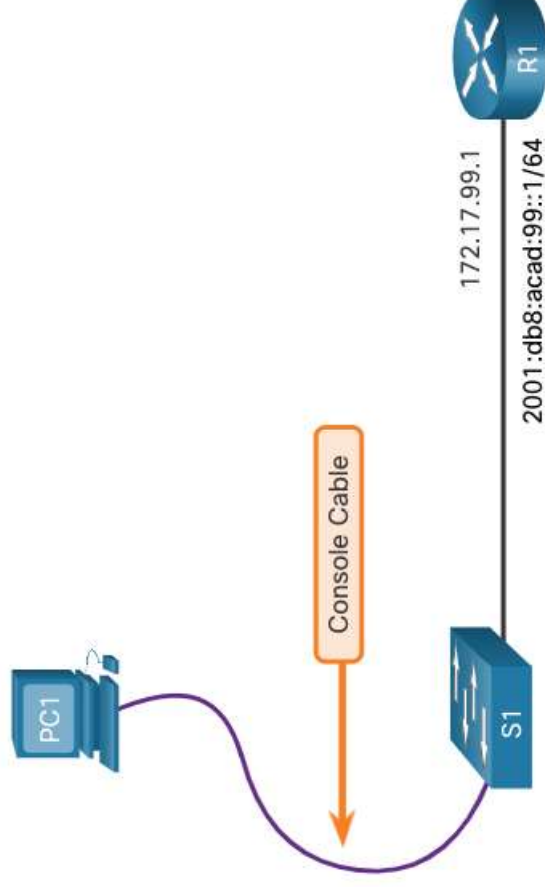
- Switch>enable
- Switch#rename flash:config.text.old flash:config.text
- Switch#copy flash:config.text system:running-config



Configure a Switch with Initial Settings Switch Management Access

To prepare a switch for remote management access, the switch must be configured with **an IP address and a subnet mask**.

- To manage the switch from a remote network, the switch must be configured with a **default gateway**. This is very similar to configuring the IP address information on host devices.
- In the figure, the switch virtual interface **(SVI) on S1** should be assigned an IP address. **The SVI is a virtual interface**, not a physical port on the switch. A console cable is used to connect to a PC so that the switch can be initially configured.



Configure a Switch with Initial Settings Switch SVI Configuration Example

By default, the switch is configured to have its management **controlled through VLAN 1**. All ports are assigned to VLAN 1 by default. For security purposes, it is considered a best practice to use a VLAN other than VLAN 1 for the management VLAN,

Step 1: Configure the Management Interface: From VLAN interface configuration mode, an IPv4 address and subnet mask is applied to the management SVI of the switch.

Note: The SVI for VLAN 99 will not appear as “up/up” until VLAN 99 is created and there is a device connected to a switch port associated with VLAN 99.

Note: The switch may need to be configured for IPv6. For example, before you can configure IPv6 addressing on a Cisco Catalyst 2960 running IOS version 15.0, you will need to enter the global configuration command **sdm prefer dual-ipv4-and-ipv6 default** and then **reload** the switch.

Configure a Switch with Initial Settings Switch SVI Configuration Example (Cont.)

Task	IOS Commands
Enter global configuration mode.	S1# configure terminal
Enter interface configuration mode for the SVI.	S1(config)# interface vlan 99
Configure the management interface IPv4 address.	S1(config-if)# ip address 172.17.99.11 255.255.255.0
Configure the management interface IPv6 address	S1(config-if)# ipv6 address 2001:db8:acad:99::1/64
Enable the management interface.	S1(config-if)# no shutdown
Return to the privileged EXEC mode.	S1(config-if)# end
Save the running config to the startup config.	S1# copy running-config startup-config

Configure a Switch with Initial Settings Switch SVI Configuration Example (Cont.)

Step 2: Configure the Default Gateway

- The switch should be configured with a default gateway if it will be managed remotely from networks that are not directly connected.
- **Note:** Because, it will receive its default gateway information from a router advertisement (RA) message, the switch does not require an IPv6 default gateway.

Task	IOS Commands
Enter global configuration mode.	S1# configure terminal
Configure the default gateway for the switch.	S1(config)# ip default-gateway 172.17.99.1
Return to the privileged EXEC mode.	S1(config-if)# end
Save the running config to the startup config.	S1# copy running-config startup-config

Configure a Switch with Initial Settings Switch SVI Configuration Example (Cont.)

Step 3: Verify Configuration

- The **show ip interface brief** and **show ipv6 interface brief** commands are useful for determining the status of both physical and virtual interfaces. The output shown confirms that interface VLAN 99 has been configured with an IPv4 and IPv6 address.

Note: An IP address applied to the SVI is only for remote management access to the switch; this does not allow the switch to route Layer 3 packets.

```

S1# show ip interface brief
Interface      IP-Address      OK? Method      Status      Protocol
Vlan99         172.17.99.11    YES manual      down        down
(output omitted)
S1# show ipv6 interface brief
Vlan99                                     [down/down]
FE80::C27B:BCFP:FECD:A9C1
2001:DB8:ACAD:99::1
(output omitted)
```

Configure a Switch with Initial Settings

Lab – Basic Switch Configuration

In this lab, you will complete the following objectives:

- Part 1: Cable the Network and Verify the Default Switch Configuration
- Part 2: Configure Basic Network Device Settings
- Part 3: Verify and Test Network Connectivity
- Part 4: Manage the MAC Address Table

1.2 Configure Switch Ports

Configure Switch Ports

Duplex Communication

- **Full-duplex communication** increases bandwidth efficiency by allowing both ends of a connection to transmit and receive data simultaneously. This is also known as bidirectional communication and it requires microsegmentation.
- A microsegmented LAN is created when a switch port has only one device connected and is operating in full-duplex mode. There is no collision domain associated with a switch port operating in full-duplex mode.
- Unlike full-duplex communication, **half-duplex communication is unidirectional**. Half-duplex communication creates performance issues because data can flow in only one direction at a time, often resulting in collisions.
- **Gigabit Ethernet and 10 Gb NICs require full-duplex connections to operate**. In full-duplex mode, the collision detection circuit on the NIC is disabled. Full-duplex offers 100 percent efficiency in both directions (transmitting and receiving). This results in a doubling of the potential use of the stated bandwidth.

Configure Switch Ports

Configure Switch Ports at the Physical Layer

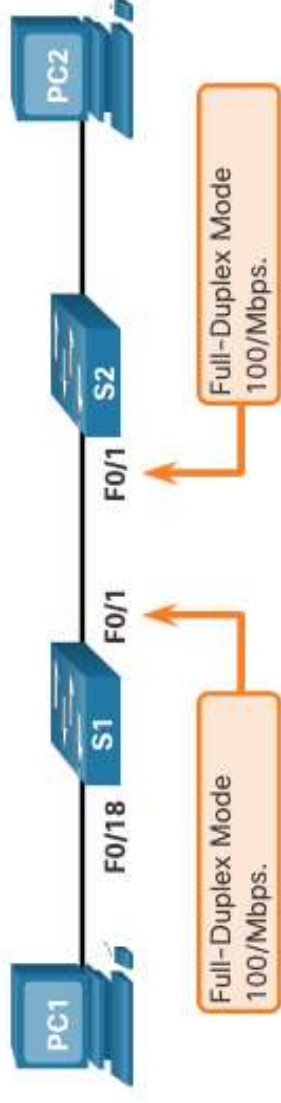
- Switch ports **can be manually** configured with specific **duplex and speed settings**. The respective interface configuration commands are **duplex** and **speed**.
- The default setting for both duplex and speed for switch ports on Cisco Catalyst 2960 and 3560 **switches is auto**. The **10/100/1000 ports operate in either half- or full-duplex mode** when they are set to 10 or 100 Mbps and operate only in full-duplex mode when it is set to 1000 Mbps (1 Gbps).
- **Autonegotiation** is useful when the speed and duplex settings of the device connecting to the port are **unknown or may change**. When connecting to known devices such as servers, dedicated workstations, or network devices, a best practice is **to manually set the speed and duplex settings**.
- When troubleshooting switch port issues, it is important that **the duplex and speed settings are checked**.

Note: Mismatched settings for the duplex mode and speed of switch ports can cause connectivity issues. Autonegotiation failure creates mismatched settings.

All fiber-optic ports, such as 1000BASE-SX ports, operate **only at one preset speed and are always full-duplex**



Configure Switch Ports Configure Switch Ports at the Physical Layer (Cont.)



Task	IOS Commands
Enter global configuration mode.	S1# configure terminal
Enter interface configuration mode.	S1(config)# interface FastEthernet 0/1
Configure the interface duplex.	S1(config-if)# duplex full
Configure the interface speed.	S1(config-if)# speed 100
Return to the privileged EXEC mode.	S1(config-if)# end
Save the running config to the startup config.	S1# copy running-config startup-config

Configure Switch Ports Auto-MDIX

- When automatic medium-dependent interface crossover (auto-MDIX) is enabled, the switch interface automatically detects the required cable connection type (straight-through or crossover) and configures the connection appropriately.
- When connecting to switches without the auto-MDIX feature, straight-through cables must be used to connect to devices such as servers, workstations, or routers. Crossover cables must be used to connect to other switches or repeaters.
- With auto-MDIX enabled, either type of cable can be used to connect to other devices, and the interface automatically adjusts to communicate successfully.
- On newer Cisco switches, **the mdix auto** interface configuration mode command enables the feature. When using auto-MDIX on an interface, the interface speed and duplex must be set to **auto** so that the feature operates correctly.

Note: The auto-MDIX feature **is enabled by default on Catalyst 2960 and Catalyst 3560 switches** but is not available on the **older Catalyst 2950 and Catalyst 3550 switches**.

To examine the auto-MDIX setting for a specific interface, use the **show controllers ethernet-controller** command with the **phy** keyword. To limit the output to lines referencing auto-MDIX, use the **include Auto-MDIX** filter.

Configure Switch Ports Switch Verification Commands

Task	IOS Commands
Display interface status and configuration.	S1# show interfaces <i>[interface-id]</i>
Display current startup configuration.	S1# show startup-config
Display current running configuration.	S1# show running-config
Display information about flash file system.	S1# show flash
Display system hardware and software status.	S1# show version
Display history of command entered.	S1# show history
Display IP information about an interface.	S1# show ip interface <i>[interface-id]</i> OR S1# show ipv6 interface <i>[interface-id]</i>
Display the MAC address table.	S1# show mac-address-table OR S1# show mac address-table

Configure Switch Ports

Verify Switch Port Configuration

The **show running-config** command can be used to verify that the switch has been correctly configured. From the sample abbreviated output on S1, some important information is shown in the figure:

- Fast Ethernet 0/18 interface configured with the management VLAN 99
- VLAN 99 configured with an IPv4 address of 172.17.99.11 255.255.255.0
- Default gateway set to 172.17.99.1

```
S1# show running-config
Building configuration...
Current configuration : 1466 bytes
!
(output omitted)
interface Vlan99
 ip address 172.17.99.11 255.255.255.0
 ipv6 address 2001:DB8:ACAD:99::1/64
!
 ip default-gateway 172.17.99.1
```

Configure Switch Ports Verify Switch Port Configuration (Cont.)

The **show interfaces** command is another commonly used command, **which displays status and statistics information on the network interfaces of the switch**. The **show interfaces** command is frequently used when configuring and monitoring network devices.

The first line of the output for the **show interfaces fastEthernet 0/18** command indicates that the FastEthernet 0/18 interface is up/up, meaning that it is operational. Further down, the output shows that the duplex is full and the speed is 100 Mbps.

```
SI# show interfaces fastEthernet 0/18
FastEthernet0/18 is up, line protocol is up (connected)
  Hardware is Fast Ethernet, address is 0025.83e6.9092 (bia 0025.83e6.9092)
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, media type is 10/100BaseTX
```