

CCNA 1 v7.0 Curriculum: Module 10 – Basic Router Configuration

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10.1. Introduction

10.0.1. Why should I take this module?

Welcome to Basic Router Configuration!

Have you ever run a relay? The first person runs the first leg of the race and hands off the baton to the next runner, who continues forward in the second leg of the race and hands off the baton to the third runner, and on it goes. Routing packets is very similar to a relay. But if the first runner does not know where to find the second runner, or drops the baton in the first leg, then that relay team will most certainly lose the race.

Routing packets is very similar to a relay. As you know, routing tables are created and used by routers to forward packets from their local networks on to other networks. But a router cannot create a routing table or forward any packets until it has been configured. If you plan to become a network administrator you definitely must know how to do this. The good news? It is easy! This module has Syntax Checker activities so that you can practice your configuration commands and see the output. There are also some Packet Tracer activities to get you started. Let's go!

10.0.2. What will I learn in this module?

Module Title: Basic Router Configuration

Module Objective: Implement initial settings on a router and end devices.

Topic Title	Topic Objective
Configure Initial Router Settings	Configure initial settings on an IOS Cisco router.
Configure Interfaces	Configure two active interfaces on a Cisco IOS router.
Configure the Default Gateway	Configure devices to use the default gateway.

10.1. Configure Initial Router Settings

10.1.1. Basic Router Configuration Steps

The following tasks should be completed when configuring initial settings on a router.

1. Configure the device name.

```
Router(config)# hostname
```

2. Secure privileged EXEC mode.

```
Router(config)# enable secret password
```

3. Secure user EXEC mode.

```
Router(config)# line console 0  
Router(config-line)# password password  
Router(config-line)# login
```

4. Secure remote Telnet / SSH access.

```
Router(config-line)# line vty 0 4  
Router(config-line)# password password  
Router(config-line)# login  
Router(config-line)# transport input {ssh | telnet}
```

5. Secure all passwords in the config file.

```
Router(config-line)# exit  
Router(config)# service password-encryption
```

6. Provide legal notification.

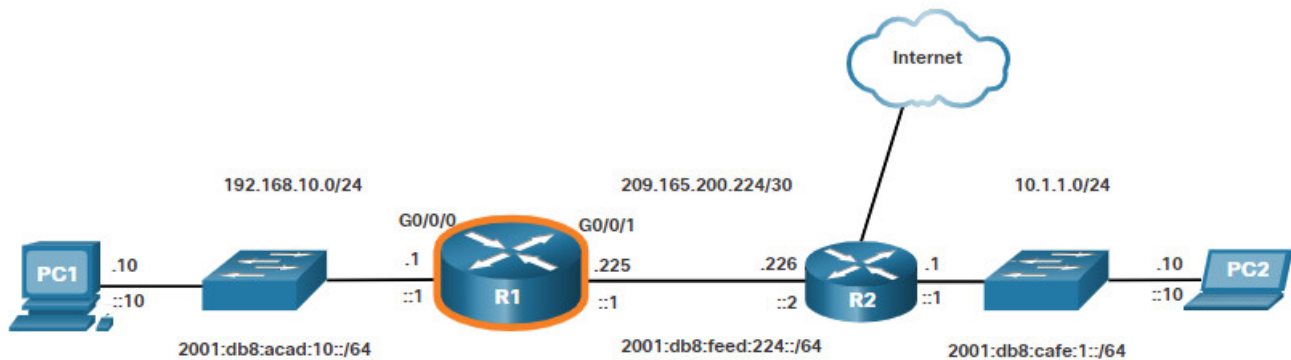
```
Router(config)# banner motd delimiter message delimiter
```

7. Save the configuration.

```
Router(config)# end  
Router# copy running-config startup-config
```

10.1.2. Basic Router Configuration Example

In this example, router R1 in the topology diagram will be configured with initial settings.



To configure the device name for R1, use the following commands.

```
Router> enable
Router# configure terminal
Enter configuration commands, one per line.
End with CNTL/Z.
Router(config)# hostname R1
R1(config)#
```

Note: Notice how the router prompt now displays the router hostname.

All router access should be secured. Privileged EXEC mode provides the user with complete access to the device and its configuration. Therefore, it is the most important mode to secure.

The following commands secure privileged EXEC mode and user EXEC mode, enable Telnet and SSH remote access, and encrypt all plaintext (i.e., user EXEC and VTY line) passwords.

```
R1(config)# enable secret class
R1(config)#
R1(config)# line console 0
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# exit
R1(config)#
R1(config)# line vty 0 4
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# transport input ssh telnet
R1(config-line)# exit
R1(config)#
R1(config)# service password-encryption
R1(config)#
```

The legal notification warns users that the device should only be accessed by permitted users. Legal notification is configured as follows.

```
R1(config)# banner motd #
Enter TEXT message. End with a new line and the #
*****
WARNING: Unauthorized access is prohibited!
*****
#
R1(config)#
```

If the previous commands were configured and the router accidentally lost power, all configured commands would be lost. For this reason, it is important to save the configuration when changes are implemented. The following command saves the configuration to NVRAM.

```
R1# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1#
```

10.1.3. Syntax Checker – Configure Initial Router Settings

Use this syntax checker to practice configuring the initial settings on a router.

- Configure the device name.
- Secure the privileged EXEC mode.
- Secure and enable remote SSH and Telnet access.
- Secure all plaintext passwords.
- Provide legal notification.

Enter global configuration mode to configure the name of the router as "R1".

```
Router>enable
```

```
Router#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
Router(config)#hostname R1
```

Configure 'class' as the secret password.

```
R1(config)#enable secret class
```

Configure 'cisco' as the console line password, require users to login, and return to global configuration mode.

```
R1(config)#line console 0
```

```
R1(config-line)#password cisco
```

```
R1(config-line)#login
```

```
R1(config-line)#exit
```

For vty line 0 through 4, configure 'cisco' as the password, require users to login, enable SSH and Telnet access, and return to global configuration mode.

```
R1(config)#line vty 0 4
```

```
R1(config-line)#password cisco
```

```
R1(config-line)#login
```

```
R1(config-line)#transport input ssh telnet
```

```
R1(config-line)#exit
```

Encrypt all clear text passwords.

```
R1(config)#service password-encryption
```

Enter the banner 'Authorized Access Only!' and use # as the delimiting character.

```
R1(config)#banner motd #Authorized Access Only!#
```

Exit global configuration mode.

```
R1(config)#exit
```

```
R1#
```

You have successfully configured the initial settings on router R1.

10.1.4. Packet Tracer – Configure Initial Router Settings

In this activity, you will perform basic router configurations. You will secure access to the CLI and console port using encrypted and plaintext passwords. You will also configure messages for users logging into the router. These banners also warn unauthorized users that access is prohibited. Finally, you will verify and save your running configuration.

10.1.4 Packet Tracer – Configure Initial Router Settings

10.2. Configure Interfaces

10.2.1. Configure Router Interfaces

At this point, your routers have their basic configurations. The next step is to configure their interfaces. This is because routers are not reachable by end devices until the interfaces are configured. There are many different types of interfaces available on Cisco routers. For example, the Cisco ISR 4321 router is equipped with two Gigabit Ethernet interfaces:

- GigabitEthernet 0/0/0 (Go/o/o)
- GigabitEthernet 0/0/1 (Go/o/1)

The task to configure a router interface is very similar to a management SVI on a switch. Specifically, it includes issuing the following commands:

```
Router(config)# interface type-and-number
Router(config-if)# description description-text
Router(config-if)# ip address ipv4-address subnet-mask
Router(config-if)# ipv6 address ipv6-address/prefix-length
Router(config-if)# no shutdown
```

Note: When a router interface is enabled, information messages should be displayed confirming the enabled link.

Although the **description** command is not required to enable an interface, it is good practice to use it. It can be helpful in troubleshooting on production networks by providing information about the type of network connected. For example, if the interface connects to an ISP or service carrier, the **description** command would be helpful to enter the third-party connection and contact information.

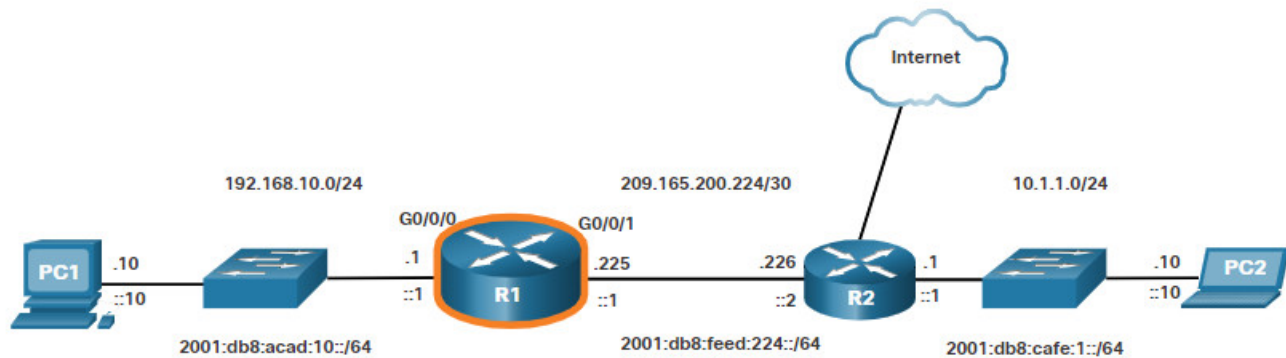
Note: The *description-text* is limited to 240 characters.

Using the **no shutdown** command activates the interface and is similar to powering on the interface. The interface must also be connected to another device, such as a switch or a router, for the physical layer to be active.

Note: On inter-router connections where there is no Ethernet switch, both interconnecting interfaces must be configured and enabled.

10.2.2. Configure Router Interfaces Example

In this example, the directly connected interfaces of R1 in the topology diagram will be enabled.



To configure the the interfaces on R1, use the following commands.

```
R1> enable
R1# configure terminal
Enter configuration commands, one per line.
End with CNTL/Z.
R1(config)# interface gigabitEthernet 0/0/0
R1(config-if)# description Link to LAN
R1(config-if)# ip address 192.168.10.1 255.255.255.0
R1(config-if)# ipv6 address 2001:db8:acad:10::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#
*Aug 1 01:43:53.435: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0, changed state to
down
*Aug 1 01:43:56.447: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0, changed state to
up
*Aug 1 01:43:57.447: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/0, changed state to up
R1(config)#
R1(config)#
R1(config)# interface gigabitEthernet 0/0/1
R1(config-if)# description Link to R2
R1(config-if)# ip address 209.165.200.225 255.255.255.252
R1(config-if)# ipv6 address 2001:db8:feed:224::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#
*Aug 1 01:46:29.170: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/1, changed state to
down
*Aug 1 01:46:32.171: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/1, changed state to
up
*Aug 1 01:46:33.171: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/1, changed state to up
R1(config)#
```

Note: Notice the informational messages informing us that Go/o/o and Go/o/1 are enabled.

10.2.3. Verify Interface Configuration

There are several commands that can be used to verify interface configuration. The most useful of these is the **show ip interface brief** and **show ipv6 interface brief** commands, as shown in the example.

```
R1# show ip interface brief
Interface                IP-Address      OK? Method Status        Protocol
GigabitEthernet0/0/0     192.168.10.1    YES manual up            up
GigabitEthernet0/0/1     209.165.200.225 YES manual up            up
Vlan1                    unassigned      YES unset  administratively down down
R1# show ipv6 interface brief
GigabitEthernet0/0/0     [up/up]
    FE80::201:C9FF:FE89:4501
    2001:DB8:ACAD:10::1
GigabitEthernet0/0/1     [up/up]
    FE80::201:C9FF:FE89:4502
    2001:DB8:FEED:224::1
Vlan1                    [administratively down/down]
    unassigned
R1#
```

10.2.4. Configuration Verification Commands

The table summarizes the more popular **show** commands used to verify interface configuration.

Commands	Description
show ip interface brief show ipv6 interface brief	The output displays all interfaces, their IP addresses, and their current status. The configured and connected interfaces should display a Status of “up” and Protocol of “up”. Anything else would indicate a problem with either the configuration or the cabling.
show ip route show ipv6 route	Displays the contents of the IP routing tables stored in RAM.
show interfaces	Displays statistics for all interfaces on the device. However, this command will only display the IPv4 addressing information.
show ip interfaces	Displays the IPv4 statistics for all interfaces on a router.
show ipv6 interface	Displays the IPv6 statistics for all interfaces on a router.

Click each tab to see the command output for each configuration verification command.

- show ip interface brief
- show ipv6 interface brief
- show ip route
- show ipv6 route
- show interfaces
- show ip interface
- show ipv6 interface

R1# **show ip interface brief**

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0/0	192.168.10.1	YES	manual	up	up
GigabitEthernet0/0/1	209.165.200.225	YES	manual	up	up
Vlan1	unassigned	YES	unset	administratively down	down

R1#

10.2.5. Syntax Checker – Configure Interfaces

Use this syntax checker to practice configuring the GigabitEthernet 0/0 interface on a router.

- Describe the link as ‘Link to LAN’.
- Configure the IPv4 address as 192.168.10.1 with the subnet mask 255.255.255.0.
- Configure the IPv6 address as 2001:db8:acad:10::1 with the /64 prefix length.
- Activate the interface.

Enter global configuration mode.

```
R1#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
Configure interface gigabitethernet 0/0/0.
```

```
R1(config)#interface gigabitethernet 0/0/0
```

Describe the link as "Link to LAN".

```
R1(config-if)#description Link to LAN
```

Configure the interface with IPv4 address 192.168.10.1 and subnet mask 255.255.255.0.

```
R1(config-if)#ip address 192.168.10.1 255.255.255.0
```

Configure the interface with IPv6 address 2001:db8:acad:10::1 and the prefix length /64.

```
R1(config-if)#ipv6 address 2001:db8:acad:10::1/64
```

Enable the interface and return to global configuration mode.

```
R1(config-if)#no shutdown
```

```
\*Aug 1 01:43:53.435: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0, changed state to down
```

```
\*Aug 1 01:43:56.447: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0, changed state to up
```

```
\*Aug 1 01:43:57.447: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up
```

```
R1(config-if)#exit
```

```
R1#
```

You have successfully configured the initial settings on router R1.

10.3. Configure the Default Gateway

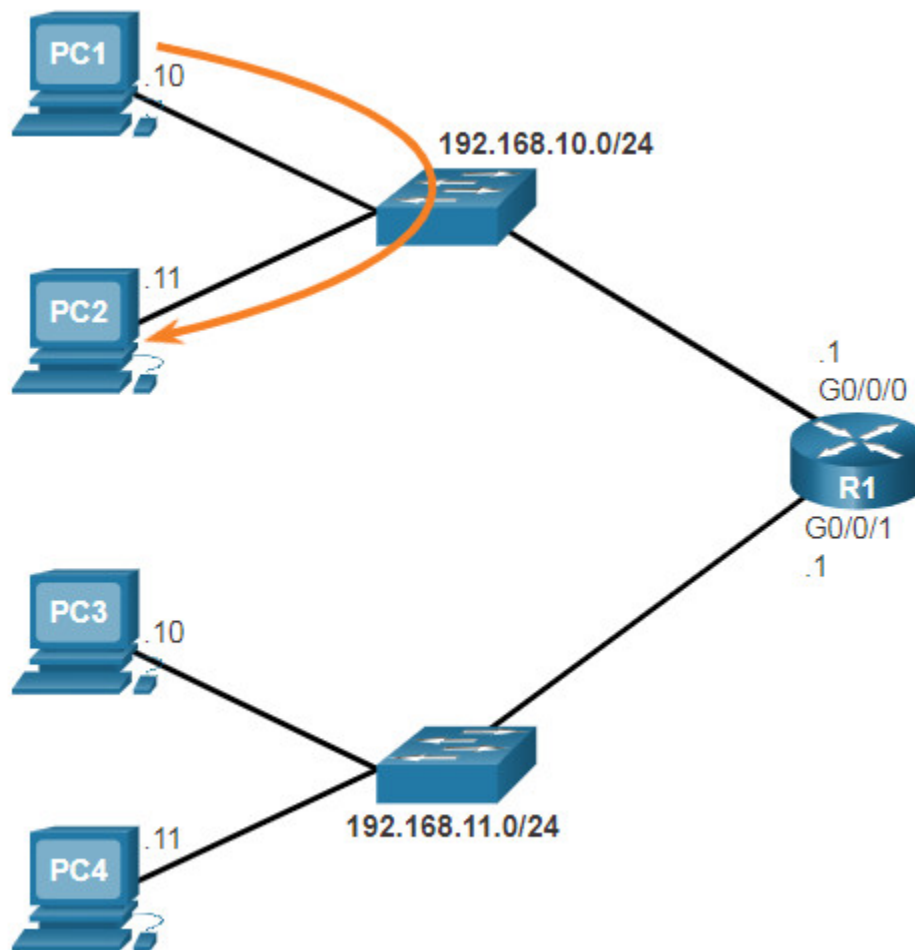
10.3.1. Default Gateway on a Host

If your local network has only one router, it will be the gateway router and all hosts and switches on your network must be configured with this information. If your local network has multiple routers, you must select one of them to be the default gateway router. This topic explains how to configure the default gateway on hosts and switches.

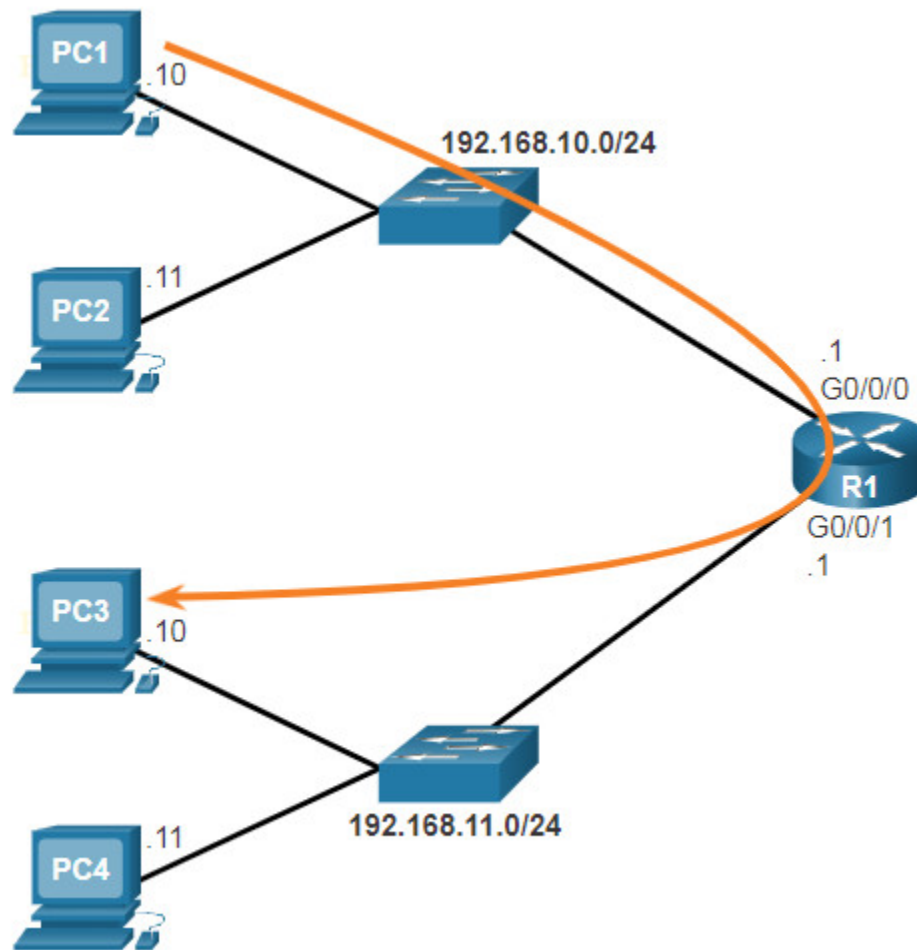
For an end device to communicate over the network, it must be configured with the correct IP address information, including the default gateway address. The default gateway is only used when the host wants to send a packet to a device on another network. The default gateway address is generally the router interface address attached to the local network of the host. The IP address of the host device and the router interface address must be in the same network.

For example, assume an IPv4 network topology consisting of a router interconnecting two separate LANs. Go/o/o is connected to network 192.168.10.0, while Go/o/1 is connected to network 192.168.11.0. Each host device is configured with the appropriate default gateway address.

In this example, if PC1 sends a packet to PC2, then the default gateway is not used. Instead, PC1 addresses the packet with the IPv4 address of PC2 and forwards the packet directly to PC2 through the switch.



What if PC1 sent a packet to PC3? PC1 would address the packet with the IPv4 address of PC3, but would forward the packet to its default gateway, which is the Go/o/o interface of R1. The router accepts the packet and accesses its routing table to determine that Go/o/1 is the appropriate exit interface based on the destination address. R1 then forwards the packet out of the appropriate interface to reach PC3.



The same process would occur on an IPv6 network, although this is not shown in the topology. Devices would use the IPv6 address of the local router as their default gateway.

10.3.2. Default Gateway on a Switch

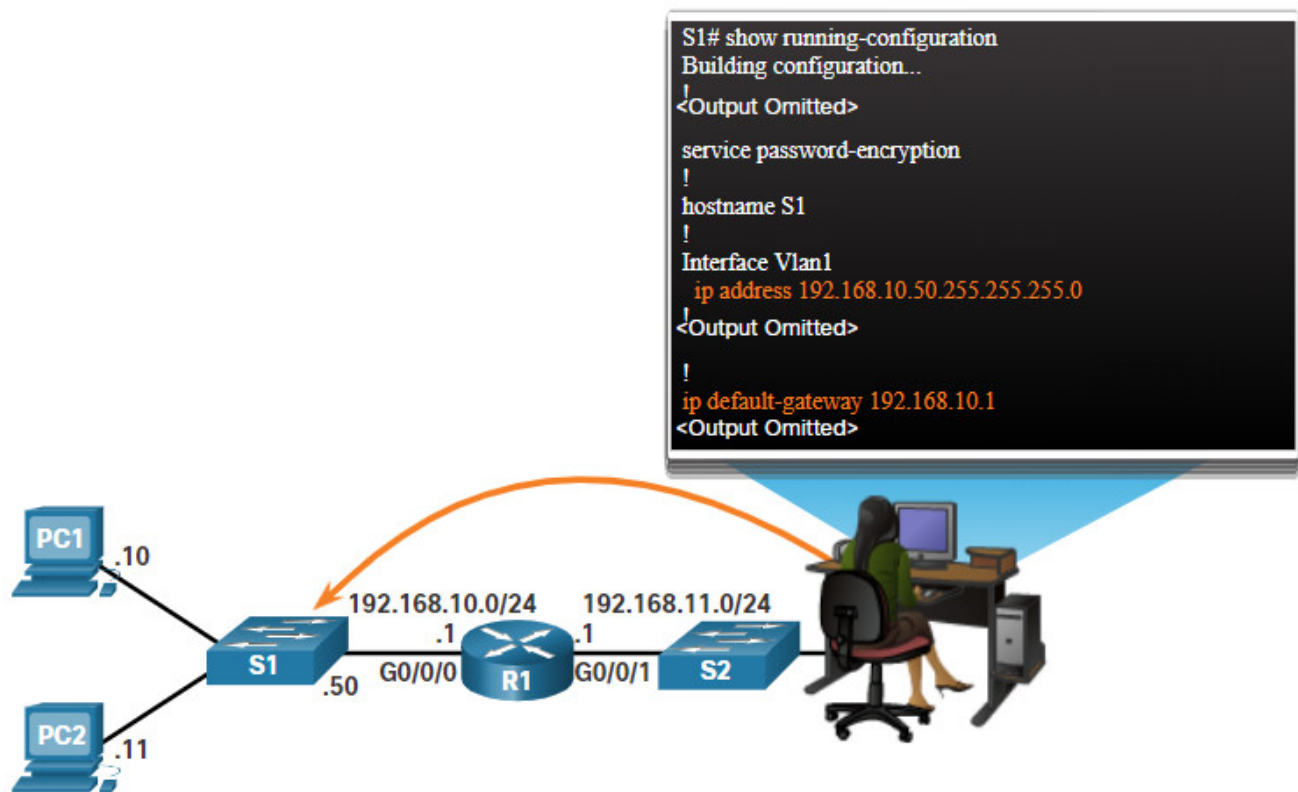
A switch that interconnects client computers is typically a Layer 2 device. As such, a Layer 2 switch does not require an IP address to function properly. However, an IP configuration can be configured on a switch to give an administrator remote access to the switch.

To connect to and manage a switch over a local IP network, it must have a switch virtual interface (SVI) configured. The SVI is configured with an IPv4 address and subnet mask on the local LAN. The switch must also have a default gateway address configured to remotely manage the switch from another network.

The default gateway address is typically configured on all devices that will communicate beyond their local network.

To configure an IPv4 default gateway on a switch, use the **ip default-gateway ip-address** global configuration command. The ip-address that is configured is the IPv4 address of the local router interface connected to the switch.

The figure shows an administrator establishing a remote connection to switch S1 on another network.



In this example, the administrator host would use its default gateway to send the packet to the Go/o/1 interface of R1. R1 would forward the packet to S1 out of its Go/o/o interface. Because the packet source IPv4 address came from another network, S1 would require a default gateway to forward the packet to the Go/o/o interface of R1. Therefore, S1 must be configured with a default gateway to be able to reply and establish an SSH connection with the administrative host.

Note: Packets originating from host computers connected to the switch must already have the default gateway address configured on their host computer operating systems.

A workgroup switch can also be configured with an IPv6 address on an SVI. However, the switch does not require the IPv6 address of the default gateway to be configured manually. The switch will automatically receive its default gateway from the ICMPv6 Router Advertisement message from the router.

10.3.3. Syntax Checker – Configure the Default Gateway

Use this syntax checker to practice configuring the default gateway of a Layer 2 switch.

Enter global configuration mode.

```
S1#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

Configure 192.168.10.1 as the default gateway for S1.

```
S1(config)#ip default-gateway 192.168.10.1
```

```
S1(config)#
```

You have successfully set the default gateway on switch S1.

10.3.4. Packet Tracer – Connect a Router to a LAN

In this activity, you will use various show commands to display the current state of the router. You will then use the Addressing Table to configure router Ethernet interfaces. Finally, you will use commands to verify and test your configurations.

10.3.4 Packet Tracer – Connect a Router to a LAN

10.3.5. Packet Tracer – Troubleshoot Default Gateway Issues

For a device to communicate across multiple networks, it must be configured with an IP address, subnet mask, and a default gateway. The default gateway is used when the host wants to send a packet to a device on another network. The default gateway address is generally the router interface address attached to the local network to which the host is connected. In this activity, you will finish documenting the network. You will then verify the network documentation by testing end-to-end connectivity and troubleshooting issues. The troubleshooting method you will use consists of the following steps:

1. Verify the network documentation and use tests to isolate problems.
2. Determine an appropriate solution for a given problem.
3. Implement the solution.
4. Test to verify the problem is resolved.
5. Document the solution.

10.3.5 Packet Tracer – Troubleshoot Default Gateway Issues

10.4. Module Practice and Quiz

10.4.1. Video – Network Device Differences: Part 1

Click Play in the figure to view Part 1 of a video explaining the different router and switch devices you may experience during your Packet Tracer and Lab practices.

10.4.2. Video – Network Device Differences: Part 2

Click Play in the figure to view Part 2 of a video explaining the different router and switch devices you may experience during your Packet Tracer and Lab practices.

10.4.3. Packet Tracer – Basic Device Configuration

Your network manager is impressed with your performance in your job as a LAN technician. She would like you to now demonstrate your ability to configure a router connecting two LANs. Your tasks include configuring basic settings on a router and a switch using the Cisco IOS. You will then verify your configurations, as well as configurations on existing devices by testing end-to-end connectivity.

10.4.3 Packet Tracer – Basic Device Configuration

10.4.4. Lab – Build a Switch and Router Network

In this lab, you will complete the following objectives:

- Part 1: Set up the topology and initialize devices.
- Part 2: Configure devices and verify connectivity.
- Part 3: Display device information.

You can practice these skills using the Packet Tracer or lab equipment, if available.

Packet Tracer – Physical Mode (PTPM)

10.4.4 Packet Tracer – Build a Switch and Router Network – Physical Mode

Lab Equipment

10.4.4 Lab – Build a Switch and Router Network

10.4.5. What did I learn in this module?

Configure Initial Router Settings

The following tasks should be completed when configuring initial settings on a router.

1. Configure the device name.
2. Secure privileged EXEC mode.
3. Secure user EXEC mode.
4. Secure remote Telnet / SSH access.
5. Secure all passwords in the config file.
6. Provide legal notification.
7. Save the configuration.

Configure Interfaces

For routers to be reachable, the router interfaces must be configured. The Cisco ISR 4321 router is equipped with two Gigabit Ethernet interfaces: GigabitEthernet 0/0/0 (Go/o/o) and GigabitEthernet 0/0/1 (Go/o/1). The tasks to configure a router interface are very similar to a management SVI on a switch. Using the **no shutdown** command activates the interface. The interface must also be connected to another device, such as a switch or a router, for the physical layer to be active. There are several commands that can be used to verify interface configuration including the **show ip interface brief** and **show ipv6 interface brief**, the **show ip route** and **show ipv6 route**, as well as **show interfaces**, **show ip interface** and **show ipv6 interface**.

Configure the Default Gateway

For an end device to communicate over the network, it must be configured with the correct IP address information, including the default gateway address. The default gateway address is generally the router interface address for the router that is attached to the local network of the host. The IP address of the host device and the router interface address must be in the same network. To connect to and manage a switch over a local IP network, it must have a switch virtual interface (SVI) configured. The SVI is configured with an IPv4 address and subnet mask on the local LAN. The switch must also have a default gateway address configured to remotely manage the switch from another network. To configure an IPv4 default gateway on a switch, use the **ip default-gateway ip-address** global configuration command. Use the IPv4 address of the local router interface that is connected to the switch.

10.4.6 Module Quiz – Basic Router Configuration

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