Lab - Build a Switch and Router Network

# Topology



# Addressing Table

| Device | Interface | IP Address / Prefix | Default Gateway |
| --- | --- | --- | --- |
| R1 | G0/0/0 | 192.168.0.1 /24 | N/A |
| R1 | G0/0/0 | 2001:db8:acad::1/64 | N/A |
| R1 | G0/0/0 | fe80::1 | N/A |
| R1 | G0/0/1 | 192.168.1.1 /24 | N/A |
| R1 | G0/0/1 | 200:db8:acad:1::1/64 | N/A |
| R1 | G0/0/1 | fe80::1 | N/A |
| S1 | VLAN 1 | 192.168.1.2 /24 | 192.168.1.1 |
| PC-A | NIC | 192.168.1.3 /24 | 192.168.1.1 |
| PC-A | NIC | 2001:db8:acad:1::3/64 | fe80::1 |
| PC-B | NIC | 192.168.0.3 /24 | 192.168.0.1 |
| PC-B | NIC | 2001:db8:acad::3/64 | fe80::1 |

# Objectives

Part 1: Set Up the Topology and Initialize Devices

Part 2: Configure Devices and Verify Connectivity

# Background / Scenario

This is a comprehensive lab to review previously covered IOS commands. In this lab, you will cable the equipment as shown in the topology diagram. You will then configure the devices to match the addressing table. After the configurations have been saved, you will verify your configurations by testing for network connectivity.

After the devices have been configured and network connectivity has been verified, you will use IOS commands to retrieve information from the devices to answer questions about your network equipment.

This lab provides minimal assistance with the actual commands necessary to configure the router. Test your knowledge by trying to configure the devices without referring to the content or previous activities.

**Note**: The routers used with CCNA hands-on labs are Cisco 4221 with Cisco IOS XE Release 16.9.4 (universalk9 image). The switches used in the labs are Cisco Catalyst 2960s with Cisco IOS Release 15.2(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and the output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of the lab for the correct interface identifiers.

**Note**: Ensure that the routers and switches have been erased and have no startup configurations. Consult with your instructor for the procedure to initialize and reload a router and switch.

The **default bias** template used by the Switch Database Manager (SDM) does not provide IPv6 address capabilities. Verify that SDM is using either the **dual-ipv4-and-ipv6** template or the **lanbase-routing** template. The new template will be used after reboot even if the configuration is not saved.

S1# **show sdm prefer**

Use the following commands to assign the **dual-ipv4-and-ipv6** template as the default SDM template.

S1# **configure terminal**

S1(config)# **sdm prefer dual-ipv4-and-ipv6 default**

S1(config)# **end**

S1# **reload**

# Required Resources

* 1 Router (Cisco 4221 with Cisco IOS XE Release 16.9.4 universal image or comparable)
* 1 Switch (Cisco 2960 with Cisco IOS Release 15.2(2) lanbasek9 image or comparable)
* 2 PCs (Windows with a terminal emulation program, such as Tera Term)
* Console cables to configure the Cisco IOS devices via the console ports
* Ethernet cables as shown in the topology

**Note**: The Gigabit Ethernet interfaces on Cisco 4221 routers are autosensing and an Ethernet straight-through cable may be used between the router and PC-B. If using another model Cisco router, it may be necessary to use an Ethernet crossover cable.

# Instructions

## Set Up Topology and Initialize Devices

### Cable the network as shown in the topology.

* + - 1. Attach the devices shown in the topology diagram, and cable, as necessary.
      2. Power on all the devices in the topology.

### Initialize and reload the router and switch.

If configuration files were previously saved on the router and switch, initialize and reload these devices back to their default configurations.

## Configure Devices and Verify Connectivity

In Part 2, you will set up the network topology and configure basic settings, such as the interface IP addresses, device access, and passwords. Refer to the **Error! Reference source not found.** and **Error! Reference source not found.** at the beginning of this lab for device names and address information.

### Assign static IP information to the PC interfaces.

* + - 1. Configure the IP address, subnet mask, and default gateway settings on PC-A.
      2. Configure the IP address, subnet mask, and default gateway settings on PC-B.
      3. Ping PC-B from a command prompt window on PC-A.

**Note**: If pings are not successful, the Windows Firewall may need to be turned off.

#### Question:

Why were the pings not successful?

The router interfaces (default gateways) have not been configured yet so Layer 3 traffic is not being routed between subnets.

Vì khi gửi đến một địa chỉ IP khác mạng (192.168.0.3) thì PC-A (192.168.1.3) sẽ gửi gói đến Default-Gateway, nhưng chúng ta chưa có máy nào trong mạng có địa chỉ IP như IP gateway của PC-A nên ping không thành công.

### Configure the router.

* + - 1. Console into the router and enable privileged EXEC mode.

Open configuration window

* + - 1. Enter configuration mode.
      2. Assign a device name to the router.
      3. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.
      4. Assign **class** as the privileged EXEC encrypted password.
      5. Assign **cisco** as the console password and enable login.
      6. Assign **cisco** as the VTY password and enable login.
      7. Encrypt the plaintext passwords.
      8. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.
      9. Configure and activate both interfaces on the router.
      10. Configure an interface description for each interface indicating which device is connected to it.
      11. To enable IPv6 routing, enter the command ipv6 unicast-routing.

R1(config)# **ipv6 unicast-routing**

* + - 1. Save the running configuration to the startup configuration file.
      2. Set the clock on the router.

**Note**: Use the question mark (**?**) to help with the correct sequence of parameters needed to execute this command.

Close configuration window

* + - 1. Ping PC-B from a command prompt window on PC-A.

**Note**: If pings are not successful, the Windows Firewall may need to be turned off.

#### Question:

Were the pings successful? Explain.

Yes. The router is routing the ping traffic across the two subnets. The default settings for the 2960 switch will automatically turn up the interfaces that are connected to devices.

Sau khi chúng ta cấu hình cho Router thì cổng G0/0/1 kết nối với Switch và PC-A có địa chỉ IP là 192.168.1.1, chính là địa chỉ IP gateway mà chúng ta đã cấu hình trên PC-A. Khi PC-A gửi yêu cầu ping đến Default-gateway (192.168.1.1) chính là port g0/0/1 trên router. Router biết rằng gói tin này cần gửi đến port g0/0/0 với địa chỉ 192.168.0.1 có cùng mạng với địa chỉ IP đích của yêu cầu từ phía PC-A. Sau đó yêu cầu được gửi đến PC-B và PC-B gửi gói ICMP reply ngược lại.

### Configure the switch.

In this step, you will configure the hostname, the VLAN 1 interface and its default gateway.

Open configuration window

* + - 1. Console into the switch and enable privileged EXEC mode.
      2. Enter configuration mode.
      3. Assign a device name to the switch.
      4. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.
      5. Configure and activate the VLAN interface on the switch S1.
      6. Configure the default gateway for the switch S1.
      7. Save the running configuration to the startup configuration file.

### Verify connectivity end-to-end connectivity.

* + - 1. From PC-A, ping PC-B.
      2. From S1, ping PC-B.

All the pings should be successful.

Close configuration window

## Display Device Information

In Part 3, you will use **show** commands to retrieve interface and routing information from the router and switch.

### Display the routing table on the router.

* + - 1. Use the **show ip route** command on the router R1 to answer the following questions.

A screenshot of a computer

Description automatically generated

Open configuration window

#### Questions:

What code is used in the routing table to indicate a directly connected network?

***The C designates a directly connected subnet. An L designates a local interface. Both answers are correct.***

How many route entries are coded with a C code in the routing table?

2

What interface types are associated to the C coded routes?

Answers may vary depending of router type, but on the 4221 the correct answer is G0/0/0 and G0/0/1.

* + - 1. Use the **show ipv6 route** command on router R1 to display the IPv6 routes.

A computer screen shot of a computer program

Description automatically generated

### Display interface information on the router R1.

* + - 1. Use the **show ip interface g0/0/1** to answer the following questions.

A screenshot of a computer

Description automatically generated

#### Questions:

What is the operational status of the G0/0/1 interface?

GigabitEthernet0/0/1 is up, line protocol is up

What is the Media Access Control (MAC) address of the G0/1 interface?

0001.c9d7.7d02

How is the Internet address displayed in this command?

Internet address is 192.168.1.1/24.

* + - 1. For the IPv6 information, enter the **show ipv6 interface *interface*** command.

A screenshot of a computer

Description automatically generated

### Display a summary list of the interfaces on the router and switch.

There are several commands that can be used to verify an interface configuration. One of the most useful of these is the **show ip interface brief** command. The command output displays a summary list of the interfaces on the device and provides immediate feedback to the status of each interface.

* + - 1. Enter the **show ip interface brief** command on the router R1.

R1# **show ip interface brief**

A screenshot of a computer

Description automatically generated

* + - 1. To see the IPv6 interface information, enter the **show ipv6 interface brief** command on R1.

R1# **show ipv6 interface brief**

A screenshot of a computer

Description automatically generated

Close configuration window

* + - 1. Enter the **show ip interface brief** command on the switch S1.

Open configuration window

S1# **show ip interface brief**

A screenshot of a computer

Description automatically generated

Close configuration window

# Reflection Questions

* 1. If the G0/0/1 interface showed that it was administratively down, what interface configuration command would you use to turn the interface up?

R1(config-if)# no shutdown

* 1. What would happen if you had incorrectly configured interface G0/0/1 on the router with an IP address of 192.168.1.2?

PC-A would not be able to ping PC-B. This is because PC-B is on a different network than PC-A which requires the default-gateway router to route these packets. PC-A is configured to use the IP address of 192.168.1.1 for the default-gateway router, but this address is not assigned to any device on the LAN. Any packets that need to be sent to the default-gateway for routing will never reach their destination.

# Router Interface Summary Table

| Router Model | Ethernet Interface #1 | Ethernet Interface #2 | Serial Interface #1 | Serial Interface #2 |
| --- | --- | --- | --- | --- |
| 1800 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 1900 | Gigabit Ethernet 0/0 (G0/0) | Gigabit Ethernet 0/1 (G0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 2801 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/1/0 (S0/1/0) | Serial 0/1/1 (S0/1/1) |
| 2811 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 2900 | Gigabit Ethernet 0/0 (G0/0) | Gigabit Ethernet 0/1 (G0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 4221 | Gigabit Ethernet 0/0/0 (G0/0/0) | Gigabit Ethernet 0/0/1 (G0/0/1) | Serial 0/1/0 (S0/1/0) | Serial 0/1/1 (S0/1/1) |
| 4300 | Gigabit Ethernet 0/0/0 (G0/0/0) | Gigabit Ethernet 0/0/1 (G0/0/1) | Serial 0/1/0 (S0/1/0) | Serial 0/1/1 (S0/1/1) |

**Note**: To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.

End of Document