Lab - Build a Switch and Router Network(shahriar\_1802009)

# 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?

Type your answers here.

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

### Configure the router.

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

Open configuration window

Router> **enable**

* + - 1. Enter configuration mode.

Router# **config terminal**

* + - 1. Assign a device name to the router.

Router(config)# **hostname R1**

* + - 1. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.

R1(config)# **no ip domain lookup**

* + - 1. Assign **class** as the privileged EXEC encrypted password.

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

* + - 1. Assign **cisco** as the console password and enable login.

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

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

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

* + - 1. Assign **cisco** as the VTY password and enable login.

R1(config)# **line vty 0 15**

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

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

* + - 1. Encrypt the plaintext passwords.

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

* + - 1. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.

R1(config)# **banner motd $** unauthorized access is prohibited **$**

* + - 1. Configure and activate both interfaces on the router.

R1(config)# **interface g0/0/0**

R1(config-if)# **ip address 192.168.0.1 255.255.255.0**

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

R1(config-if)# **ipv6 address FE80::1 link-local**

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

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

R1(config)# **interface g0/0/1**

R1(config-if)# **ip address 192.168.1.1 255.255.255.0**

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

R1(config-if)# **ipv6 address fe80::1 link-local**

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

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

* + - 1. Configure an interface description for each interface indicating which device is connected to it.

R1(config)# **interface g0/0/1**

R1(config-if)# **description Connected to F0/5 on S1**

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

R1(config)# **interface g0/0/0**

R1(config-if)# **description Connected to Host PC-B**

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

* + - 1. 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.

R1(config)# **exit**

R1# **copy running-config startup-config**

* + - 1. Set the clock on the router.

R1# **clock set 07:03:00 12 Oct 2022**

**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.

Type your answers here.

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.

### 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.

Switch> **enable**

* + - 1. Enter configuration mode.

Switch# **config terminal**

* + - 1. Assign a device name to the switch.

Switch(config)# **hostname S1**

* + - 1. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.

S1(config)# **no ip domain-lookup**

* + - 1. Configure and activate the VLAN interface on the switch S1.

S1(config)# **interface vlan 1**

S1(config-if)# **ip address 192.168.1.2 255.255.255.0**

S1(config-if)# **no shutdown**

S1(config-if)# **exit**

* + - 1. Configure the default gateway for the switch S1.

S1(config)# **ip default-gateway 192.168.1.1**

S1(config-if)# **exit**

* + - 1. 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

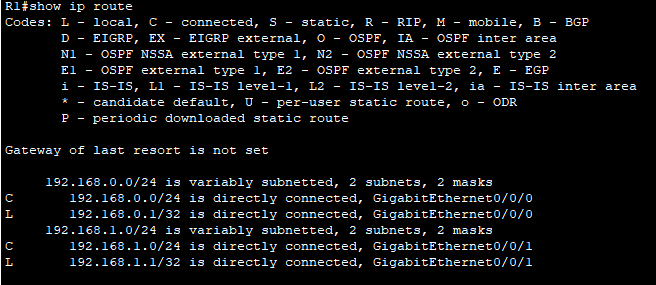
## Display Device Information

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.

Open configuration window



R1#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area

\* - candidate default, U - per-user static route, o - ODR

P - periodic downloaded static route

Gateway of last resort is not set

192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.0.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.0.1/32 is directly connected, GigabitEthernet0/0/0

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.1.1/32 is directly connected, GigabitEthernet0/0/1

#### Questions:

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

Type your answers here.

“C” and “L” (for local)

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

Type your answers here.

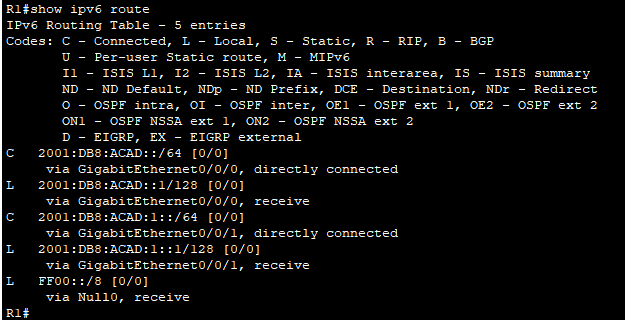
2

What interface types are associated to the C coded routes?

Type your answers here.

G0/0/0 and G0/0/1.

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



R1#show ipv6 route

IPv6 Routing Table - 5 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

D - EIGRP, EX - EIGRP external

C 2001:DB8:ACAD::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:ACAD::1/128 [0/0]

via GigabitEthernet0/0/0, receive

C 2001:DB8:ACAD:1::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:1::1/128 [0/0]

via GigabitEthernet0/0/1, receive

L FF00::/8 [0/0]

via Null0, receive

### Display interface information on the router R1.

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

#### R1#show ip interface g0/0/1

#### GigabitEthernet0/0/1 is up, line protocol is up (connected)

#### Internet address is 192.168.1.1/24

#### Broadcast address is 255.255.255.255

#### Address determined by setup command

#### MTU is 1500 bytes

#### Helper address is not set

#### Directed broadcast forwarding is disabled

#### Outgoing access list is not set

#### Inbound access list is not set

#### Proxy ARP is enabled

#### Security level is default

#### Split horizon is enabled

#### ICMP redirects are always sent

#### ICMP unreachables are always sent

#### ICMP mask replies are never sent

#### IP fast switching is disabled

#### IP fast switching on the same interface is disabled

#### IP Flow switching is disabled

#### IP Fast switching turbo vector

#### IP multicast fast switching is disabled

#### IP multicast distributed fast switching is disabled

#### Router Discovery is disabled

#### IP output packet accounting is disabled

#### IP access violation accounting is disabled

#### TCP/IP header compression is disabled

#### RTP/IP header compression is disabled

#### Probe proxy name replies are disabled

#### Policy routing is disabled

#### Network address translation is disabled

#### BGP Policy Mapping is disabled

#### Input features: MCI Check

#### WCCP Redirect outbound is disabled

#### WCCP Redirect inbound is disabled

#### WCCP Redirect exclude is disabled Questions:

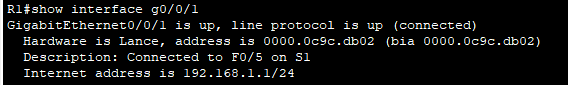
What is the operational status of the G0/0/1 interface?

Type your answers here.

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

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

Type your answers here.



0000.0c9c.db02 (bia 0000.0c9c.db02)

How is the Internet address displayed in this command?

Type your answers here.

Internet address is 192.168.1.1/24.

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

R1#show ipv6 interface g0/0/1

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

IPv6 is enabled, link-local address is FE80::1

No Virtual link-local address(es):

Global unicast address(es):

2001:DB8:ACAD:1::1, subnet is 2001:DB8:ACAD:1::/64

Joined group address(es):

FF02::1

FF02::2

FF02::1:FF00:1

MTU is 1500 bytes

ICMP error messages limited to one every 100 milliseconds

ICMP redirects are enabled

ICMP unreachables are sent

ND DAD is enabled, number of DAD attempts: 1

ND reachable time is 30000 milliseconds

ND advertised reachable time is 0 (unspecified)

ND advertised retransmit interval is 0 (unspecified)

ND router advertisements are sent every 200 seconds

ND router advertisements live for 1800 seconds

ND advertised default router preference is Medium

Hosts use stateless autoconfig for addresses.

### 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**

Interface IP-Address OK? Method Status Protocol

GigabitEthernet0/0/0 192.168.0.1 YES manual up up

GigabitEthernet0/0/1 192.168.1.1 YES manual up up

Vlan1 unassigned YES NVRAM administratively down down

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

R1#show ipv6 interface brief

GigabitEthernet0/0/0 [up/up]

FE80::1

2001:DB8:ACAD::1

GigabitEthernet0/0/1 [up/up]

FE80::1

2001:DB8:ACAD:1::1

Vlan1 [administratively down/down]

unassigned

Close configuration window

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

Open configuration window

S1#show ip interface brief

Interface IP-Address OK? Method Status Protocol

FastEthernet0/1 unassigned YES manual down down

FastEthernet0/2 unassigned YES manual down down

FastEthernet0/3 unassigned YES manual down down

FastEthernet0/4 unassigned YES manual down down

FastEthernet0/5 unassigned YES manual up up

FastEthernet0/6 unassigned YES manual up up

FastEthernet0/7 unassigned YES manual down down

FastEthernet0/8 unassigned YES manual down down

FastEthernet0/9 unassigned YES manual down down

FastEthernet0/10 unassigned YES manual down down

FastEthernet0/11 unassigned YES manual down down

FastEthernet0/12 unassigned YES manual down down

FastEthernet0/13 unassigned YES manual down down

FastEthernet0/14 unassigned YES manual down down

FastEthernet0/15 unassigned YES manual down down

FastEthernet0/16 unassigned YES manual down down

FastEthernet0/17 unassigned YES manual down down

FastEthernet0/18 unassigned YES manual down down

FastEthernet0/19 unassigned YES manual down down

FastEthernet0/20 unassigned YES manual down down

FastEthernet0/21 unassigned YES manual down down

FastEthernet0/22 unassigned YES manual down down

FastEthernet0/23 unassigned YES manual down down

FastEthernet0/24 unassigned YES manual down down

GigabitEthernet0/1 unassigned YES manual down down

GigabitEthernet0/2 unassigned YES manual down down

Vlan1 192.168.1.2 YES manual up up

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?

Type your answers here.

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

# Device Configs

# Router R1

# R1#show run

# Building configuration...

# Current configuration : 1037 bytes

# !

# version 15.4

# no service timestamps log datetime msec

# no service timestamps debug datetime msec

# service password-encryption

# !

# hostname R1

# !

# !

# !

# enable secret 5 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1

# !

# !

# !

# !

# !

# !

# no ip cef

# ipv6 unicast-routing

# !

# no ipv6 cef

# !

# !

# !

# !

# !

# !

# !

# !

# !

# !

# no ip domain-lookup

# !

# !

# spanning-tree mode pvst

# !

# !

# !

# !

# !

# !

# interface GigabitEthernet0/0/0

# description Connected to Host PC-B

# ip address 192.168.0.1 255.255.255.0

# duplex auto

# speed auto

# ipv6 address FE80::1 link-local

# ipv6 address 2001:DB8:ACAD::1/64

# !

# interface GigabitEthernet0/0/1

# description Connected to F0/5 on S1

# ip address 192.168.1.1 255.255.255.0

# duplex auto

# speed auto

# ipv6 address FE80::1 link-local

# ipv6 address 2001:DB8:ACAD:1::1/64

# !

# interface Vlan1

# no ip address

# shutdown

# !

# ip classless

# !

# ip flow-export version 9

# !

# !

# !

# banner motd ^Cunauthorized access is prohibited. ^C

# !

# !

# !

# !

# line con 0

# password 7 0822455D0A16

# login

# !

# line aux 0

# !

# line vty 0 4

# password 7 0822455D0A16

# login

# line vty 5 15

# password 7 0822455D0A16

# login

# !

# !

# !

# end

# Switch S1

S1#show run

Building configuration...

Current configuration : 1142 bytes

!

version 15.0

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname S1

!

!

!

no ip domain-lookup

!

!

!

spanning-tree mode pvst

spanning-tree extend system-id

!

interface FastEthernet0/1

!

interface FastEthernet0/2

!

interface FastEthernet0/3

!

interface FastEthernet0/4

!

interface FastEthernet0/5

!

interface FastEthernet0/6

!

interface FastEthernet0/7

!

interface FastEthernet0/8

!

interface FastEthernet0/9

!

interface FastEthernet0/10

!

interface FastEthernet0/11

!

interface FastEthernet0/12

!

interface FastEthernet0/13

!

interface FastEthernet0/14

!

interface FastEthernet0/15

!

interface FastEthernet0/16

!

interface FastEthernet0/17

!

interface FastEthernet0/18

!

interface FastEthernet0/19

!

interface FastEthernet0/20

!

interface FastEthernet0/21

!

interface FastEthernet0/22

!

interface FastEthernet0/23

!

interface FastEthernet0/24

!

interface GigabitEthernet0/1

!

interface GigabitEthernet0/2

!

interface Vlan1

ip address 192.168.1.2 255.255.255.0

!

ip default-gateway 192.168.1.1

!

!

!

!

line con 0

!

line vty 0 4

login

line vty 5 15

login

!

!

!

!

end