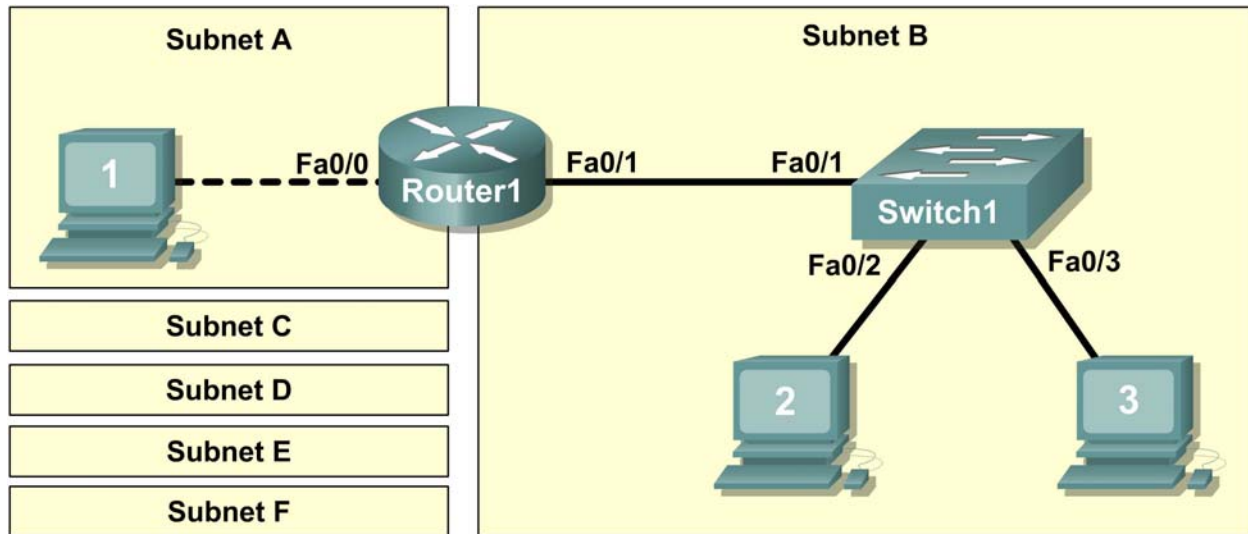


## Lab 11.5.4: Network Testing

### Topology Diagram



### Learning Objectives

Upon completion of this lab, you will be able to:

- Design the logical lab topology.
- Configure the physical lab topology.
- Configure the logical LAN topology.
- Verify LAN connectivity.

### Background

Hardware	Qty	Description
Cisco Router	1	Part of CCNA Lab bundle
Cisco Switch	1	Part of CCNA Lab bundle
*Computer (Host)	3	Lab computer
CAT-5 or better straight-through UTP cables	3	Connects Router1, Host1, and Host2 to switch1
CAT-5 crossover UTP cable	1	Connects Host 1 to Router1
Console (rollover) cable	1	Connects Host1 to Router1 console

**Table 1. Equipment and Hardware for this Lab**

Gather the necessary equipment and cables. To configure the lab, make sure the equipment listed in Table 1 is available.

The Appendix contains Cisco IOS configuration syntax for this lab.

## Scenario

In this lab, you will create a small network that requires connecting network devices and configuring host computers for basic network connectivity. SubnetA and SubnetB are subnets that are currently needed. SubnetC, SubnetD, SubnetE, and SubnetF are anticipated subnets, not yet connected to the network.

### Task 1: Design the Logical Lab Topology.

Given an IP address and mask of 172.20.0.0 / 24 (address / mask), design an IP addressing scheme that satisfies the following requirements:

Subnet	Number of Hosts
SubnetA	As shown in topology diagram
SubnetB	Between 80 – 100
SubnetC	Between 40 – 52
SubnetD	Between 20 – 29
SubnetE	12
SubnetF	5

**Note:** Always start with the subnet with the largest number of hosts and work your way down. Therefore, you should start with SubnetB and finish with SubnetA.

#### Step 1: Design SubnetB address block.

Begin the logical network design by satisfying the requirement of SubnetB, which requires the largest block of IP addresses. Using binary numbers to create your subnet chart, pick the first address block that will support SubnetB.

1. Fill in the following table with IP address information for SubnetB:

Network Address	Mask	First Host Address	Last Host Address	Broadcast

2. What is the bit mask in binary? \_\_\_\_\_

#### Step 2: Design SubnetC address block.

Satisfy the requirement of SubnetC, the next largest IP address block. Using binary numbers to create your subnet chart, pick the next available address block that will support SubnetC.

1. Fill in the following table with IP address information for SubnetC:

Network Address	Mask	First Host Address	Last Host Address	Broadcast

2. What is the bit mask in binary? \_\_\_\_\_

#### Step 3: Design SubnetD address block.

Satisfy the requirement of SubnetD, the next largest IP address block. Using binary numbers to create your subnet chart, pick the next available address block that will support SubnetD.

1. Fill in the following table with IP address information for SubnetD:

Network Address	Mask	First Host Address	Last Host Address	Broadcast

2. What is the bit mask in binary? \_\_\_\_\_

#### Step 4: Design SubnetE address block.

Satisfy the requirement of SubnetE, the next largest IP address block. Using binary numbers to create your subnet chart, pick the next available address block that will support SubnetE.

1. Fill in the following table with IP address information for SubnetE:

Network Address	Mask	First Host Address	Last Host Address	Broadcast

2. What is the bit mask in binary? \_\_\_\_\_

#### Step 5: Design SubnetF address block.

Satisfy the requirement of SubnetF, the next largest IP address block. Using binary numbers to create your subnet chart, pick the next available address block that will support SubnetF.

1. Fill in the following table with IP address information for SubnetF:

Network Address	Mask	First Host Address	Last Host Address	Broadcast

2. What is the bit mask in binary? \_\_\_\_\_

#### Step 6: Design SubnetA address block.

Satisfy the requirement of SubnetA, the smallest IP address block. Using binary numbers to create your subnet chart, pick the next available address block that will support SubnetA.

1. Fill in the following table with IP address information for SubnetA:

Network Address	Mask	First Host Address	Last Host Address	Broadcast

2. What is the bit mask in binary? \_\_\_\_\_

## Task 2: Configure the Physical Lab Topology.

### Step 1: Physically connect lab devices.

1. Cable the network devices as shown in Figure 1. Pay special attention to the crossover cable required between Host1 and Router1.

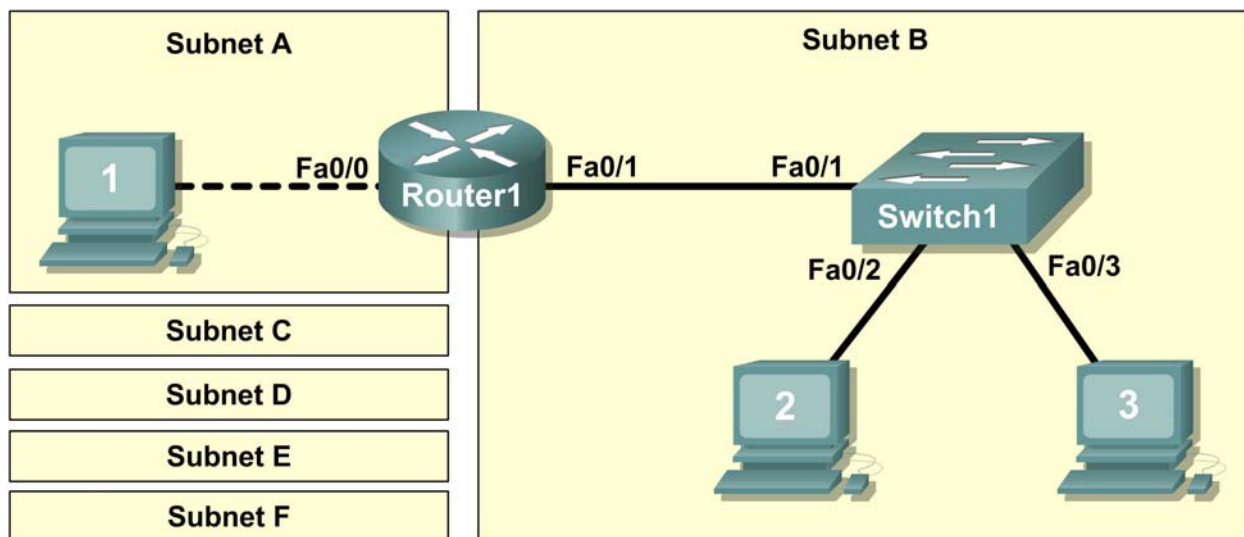


Figure 1. Cabling the Network

2. If not already enabled, turn power on to all devices.

### Step 2: Visually inspect network connections.

After cabling the network devices, take a moment to verify the connections. Attention to detail now will minimize the time required to troubleshoot Layer 1 connectivity issues later.

## Task 3: Configure the Logical Topology.

### Step 1: Document logical network settings.

On SubnetA, Host1 will use the first IP address in the subnet. Router1, interface Fa0/0, will use the last host address. On SubnetB, host computers will use the first and second IP addresses in the subnet, respectively. Router1, interface Fa0/1, will use the last network host address.

To properly route Layer 2 frames between LAN devices, Switch1 does not require Layer 3 configuration. The IP address assigned to Switch 1, interface VLAN 1, is used to establish Layer 3 connectivity between external devices and the switch. Without an IP address, upper-layer protocols such as TELNET and HTTP will not work. The default gateway address permits the switch to respond to protocol requests from devices on distant networks. For example, the IP gateway address extends Layer 3 connectivity beyond Subnet B. Switch1 will use the next-to-last host address.

Write down the IP address information for each device:

Device	Subnet	IP Address	Mask	Gateway
Host1				
Router1-Fa0/0				
Host2				

Host3				
Switch1				
Router1-Fa0/1				

### Step 2: Configure host computers.

1. On each computer, in turn, click **Start > Control Panel > Network Connections**. Right-click the LAN icon, and choose **Properties**. On the **General** tab, select **Internet Protocol (TCP/IP)**, and then click the, **Properties** button.
2. Verify that the Host1 Layer 3 IP address is on a different subnet than Host2 and Host3. Configure each host computer using the IP address information recorded in Step 1.
3. Verify proper configuration of each host computer with the **ipconfig** command and fill in the following table:

Device	IP Address	Mask	Default Gateway
Host1			
Host2			
Host3			

### Step 3: Configure Router1.

1. From the Windows taskbar, start the HyperTerminal program by clicking **Start > Programs > Accessories > Communications > HyperTerminal**. Configure HyperTerminal for access to Router1. Configuration for Router1 includes the following tasks:

Tasks (Refer to the Appendix for help with commands)
Specify Router name: <code>Router1</code>
Specify an encrypted privileged EXEC password: <code>cisco</code>
Specify a console access password: <code>class</code>
Specify a telnet access password: <code>class</code>
Configure the MOTD banner
Configure Router1 interface Fa0/0: <ul style="list-style-type: none"> <li>• Set the description</li> <li>• Set the Layer 3 address</li> <li>• Issue <b>no shutdown</b></li> </ul>
Configure Router1 interface Fa0/1: <ul style="list-style-type: none"> <li>• Set the description</li> <li>• Set the Layer 3 address</li> <li>• Issue <b>no shutdown</b></li> </ul>

2. Save the configuration in NVRAM.
3. Display the contents of RAM:
4. Write the configuration specifications below:  
 Hostname: \_\_\_\_\_

Enable secret password: \_\_\_\_\_

Console access password: \_\_\_\_\_

Telnet access password: \_\_\_\_\_

MOTD banner: \_\_\_\_\_

5. Display configuration information for interface Fa0/0: **show interface Fa0/0**

FastEthernet 0/0 status (up / down): \_\_\_\_\_

Line protocol: \_\_\_\_\_

MAC Address: \_\_\_\_\_

6. Display configuration information for interface Fa0/1: **show interface Fa0/1**

FastEthernet 0/0 status (up / down): \_\_\_\_\_

Line protocol: \_\_\_\_\_

MAC Address: \_\_\_\_\_

7. Display brief IP address information about each interface: **show ip interface brief**

```
Interface          IP-Address      OK? Method Status  Protocol
FastEthernet0/0
FastEthernet0/1
```

8. Take corrective action with any problems, and retest.

#### Step 4: Configure Switch1.

1. Move the console cable from Router1 to Switch1.
2. Press **Enter** until a response is received.
3. Configuration for Switch1 includes the following tasks:

<b>Tasks</b> <b>(Refer to the Appendix for help with commands)</b>
Specify Switch name- <code>Switch1</code>
Specify an encrypted privileged exec password- <code>cisco</code>
Specify a console access password- <code>class</code>
Specify a telnet access password- <code>class</code>
Configure the MOTD banner
Configure Switch1 interface Fa0/1: Set the description
Configure Switch1 interface Fa0/2: Set the description
Configure Switch1 interface Fa0/3: Set the description
Configure management VLAN 1 IP address: <ul style="list-style-type: none"> <li>• Set the description</li> <li>• Set the Layer 3 address</li> <li>• Issue <b>no shutdown</b></li> </ul>
Configure default IP gateway address

4. Display the contents of RAM:
5. Write the configuration specifications below:  
 Hostname: \_\_\_\_\_  
 Enable secret password: \_\_\_\_\_  
 Console access password: \_\_\_\_\_  
 Telnet access password: \_\_\_\_\_  
 MOTD banner: \_\_\_\_\_  
 Interface VLAN 1: \_\_\_\_\_  
 Default IP gateway address: \_\_\_\_\_
6. Display configuration information for interface VLAN 1: **show interface vlan1**  
 VLAN 1 status (up / down): \_\_\_\_\_  
 Line protocol: \_\_\_\_\_

#### Task 4: Verify Network Connectivity.

##### Step 1: Use the **ping** command to verify network connectivity.

Network connectivity can be verified with the **ping** command. It is very important that connectivity exists throughout the network. Corrective action must be taken if there is a failure.

1. Use the following table to methodically verify connectivity with each network device:

From	To	IP Address	Ping results
Host1	LocalHost (127.0.0.1)		
Host1	NIC IP address		
Host1	Gateway (Router1, Fa0/0)		
Host1	Router1, Fa0/1		
Host1	Switch1		
Host1	Host2		
Host1	Host3		
Host2	LocalHost (127.0.0.1)		
Host2	NIC IP address		
Host2	Host3		
Host2	Switch1		
Host2	Gateway (Router1, Fa0/1)		
Host2	Router1, Fa0/0		
Host2	Host1		
Host3	LocalHost (127.0.0.1)		
Host3	NIC IP address		

From	To	IP Address	Ping results
Host3	Host2		
Host3	Switch1		
Host3	Gateway (Router1, Fa0/1)		
Host3	Router1, Fa0/0		
Host3	Host1		

2. Take corrective action to establish connectivity if a test fails.

**Note:** If pings to host computers fail, temporarily disable the computer firewall and retest. To disable a Windows firewall, click **Start > Control Panel > Windows Firewall**, choose **Off**, and then click **OK**.

### Step 2: Use the `tracert` command to verify local connectivity.

1. From Host1, issue the `tracert` command to Host2 and Host3.
2. Record the results:

From Host1 to Host2: \_\_\_\_\_

From Host1 to Host3: \_\_\_\_\_

### Step 3: Verify Layer 2 connectivity.

1. If not already connected, move the console cable from Router1 to Switch1.
2. Press the **Enter** key until there is a response from Switch1.
3. Issue the command `show mac-address-table`. This command will display static (CPU) and dynamic, or learned, entries.
4. List the dynamic MAC addresses and corresponding switch ports:

MAC Address	Switch Port

5. Verify that there are three dynamically learned MAC addresses, one each from Fa0/1, Fa0/2, and Fa0/3.

### Task 5: Reflection

Review any physical or logical configuration problems encountered during this lab. Make sure you have a thorough understanding of the procedures used to verify network connectivity.

### Task 6: Challenge

Ask your instructor or another student to introduce one or two problems in your network when you aren't looking or are out of the lab room. Problems can be either physical (wrong UTP cable) or logical (wrong IP address or gateway). To fix the problems:

1. Perform a good visual inspection. Look for green link lights on Switch1.
2. Use the table provided in Task 3, above, to identify failed connectivity. List the problems:



---

---

---

---

3. Write down your proposed solution(s):

---

---

---

---

---

4. Test your solution. If the solution fixed the problem, document the solution. If the solution did not fix the problem, continue troubleshooting.

---

---

---

---

---

### Task 7: Clean Up.

Unless directed otherwise by the instructor, restore host computer network connectivity, and then turn off power to the host computers.

Before turning off power to the router and switch, remove the NVRAM configuration file from each device with the privileged exec command **erase startup-config**.

Carefully remove cables and return them neatly to their storage. Reconnect cables that were disconnected for this lab.

Remove anything that was brought into the lab, and leave the room ready for the next class.

### Appendix—List of Cisco IOS commands used in this lab

Purpose	Command
Enter the global configuration mode.	<b>configure terminal</b> Example: Router> <b>enable</b> Router# <b>configure terminal</b> Router(config)#
Specify the name for the Cisco device.	<b>hostname name</b> Example: Router(config)# <b>hostname Router1</b> Router(config)#
Specify an encrypted password to prevent unauthorized access to the privileged EXEC mode.	<b>enable secret password</b> Example: Router(config)# <b>enable secret cisco</b> Router(config)#
Specify a password to prevent unauthorized access to the console.	<b>password password</b> <b>login</b> Example: Router(config)# <b>line con 0</b> Router(config-line)# <b>password class</b> Router(config-line)# <b>login</b> Router(config)#
Specify a password to prevent unauthorized Telnet access. Router vty lines: 0 4 Switch vty lines: 0 15	<b>password password</b> <b>login</b> Example: Router(config)# <b>line vty 0 4</b> Router(config-line)# <b>password class</b> Router(config-line)# <b>login</b> Router(config-line)#
Configure the MOTD banner.	<b>Banner motd %</b> Example: Router(config)# <b>banner motd %</b> Router(config)#
Configure a Router interface. Router interface is OFF by default	Example: Router(config)# <b>interface Fa0/0</b> Router(config-if)# <b>description description</b> Router(config-if)# <b>ip address address mask</b> Router(config-if)# <b>no shutdown</b> Router(config-if)#
Switch interface is ON by default (VLAN interface is OFF by default)	Example: Switch(config)# <b>interface Fa0/0</b> Switch(config-if)# <b>description description</b> Switch(config)# <b>interface vlan1</b> Switch(config-if)# <b>ip address address mask</b> Switch(config-if)# <b>no shutdown</b> Switch(config-if)#
Switch- create a default IP gateway	Switch(config)# <b>ip default-gateway address</b>
Save the configuration to NVRAM.	<b>copy running-config startup-config</b> Example:

	Router# <b>copy running-config startup-config</b>
--	---------------------------------------------------