

Experiment Number 6

Basic Router and Switch Configuration: Static Routing

Learning Objectives

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

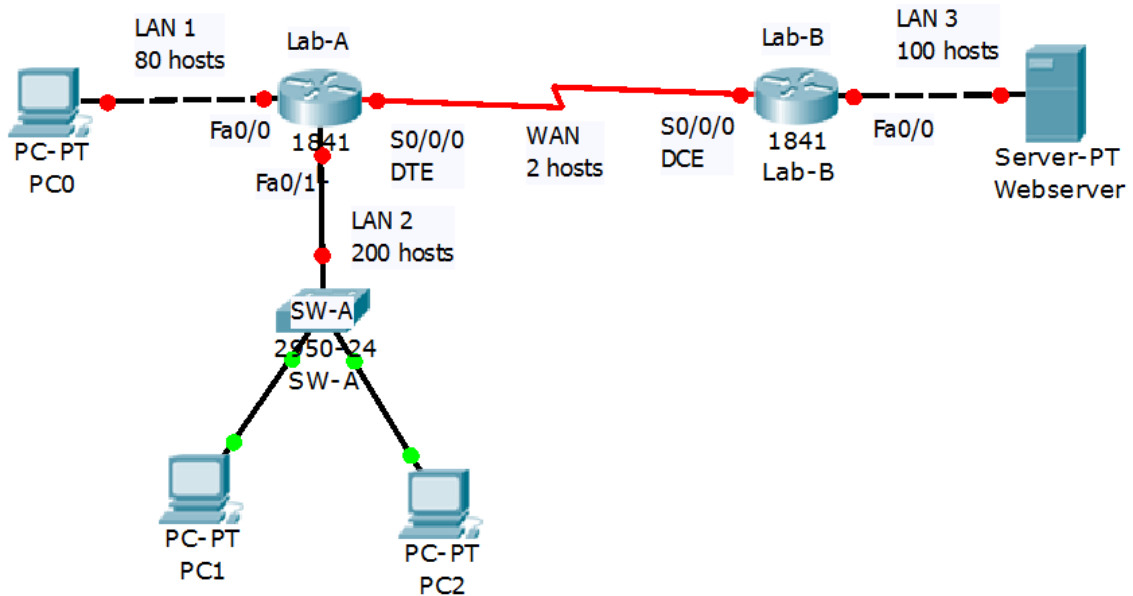
- Design an appropriate addressing scheme.
- Assign addresses and subnet mask pairs to device interfaces.
- Examine the use of the available network address space.
- Configure Cisco router global configuration settings.
- Configure Cisco router password access.
- Configure Cisco router interfaces.
- Configure a Cisco switch
- Save the router configuration file.
- Configure static routes for remote connectivity.

Part I. IP Addressing Scheme

Scenario

In this lab, you have been given the network address 172.20.0.0/16 to subnet and provide the IP addressing for the networks shown in the Topology Diagram. You must determine the number of networks needed then design an appropriate addressing scheme. Place the

correct address and mask in the Addressing Table. Design an IP addressing scheme that satisfies the following requirements:



How many networks are there? _____

Task: Record Subnet and Addressing table information.

Step 1: Fill in the following chart with the subnet information.

Subnet Number	No. of Hosts	Network Address	Subnet Mask	Host Address Range
LAN 1	200			
LAN 2	100			
LAN 3	80			
WAN	2			

Step 2: Fill in the following chart with the appropriate addressing information.

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
Lab-A	Fa0/0			N/A
	S0/0/0			N/A
Lab-B	Fa0/0			N/A
	S0/0/0			N/A
SW-A	VLAN 1			
PC0				
PC1	NIC			
PC2	NIC			
Webserver				

IP Addressing Requirements

- Assign the last usable address to all router Fast Ethernet interfaces.
- Assign the lowest usable address to all hosts and the server.
- Assign the second highest usable address to the Switch management interface (VLAN1)
- Assign the highest usable address to the DCE router.
- Assign the lowest usable address to the DTE router.

Part II. Configure Cisco Router Global Configuration Settings.

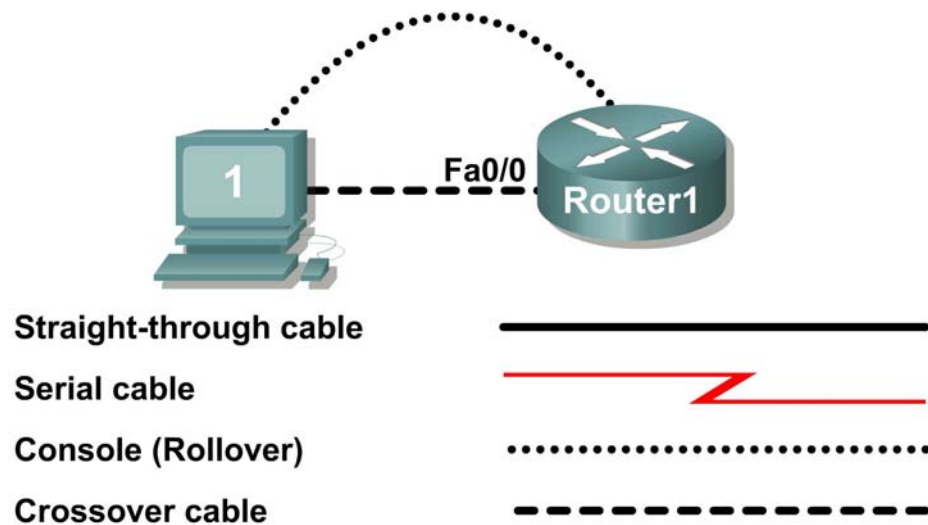


Figure 1. Lab cabling.

Step 1: Physically connect devices.

Refer to Figure 1. Connect the console or rollover cable to the console port on the router. Connect the other end of the cable to the host

computer using a DB-9 or DB-25 adapter to the COM 1 port. Connect the crossover cable between the host computer's network interface card (NIC) and Router interface Fa0/0. Connect a straight-through cable between the Router interface Fa0/1 and any of the switch's interfaces.

Ensure that power has been applied to the host computer, switch and router.

Step 2: Connect host computer to router through HyperTerminal.

From the Windows taskbar, start the HyperTerminal program by clicking on Start | Programs | Accessories | Communications | HyperTerminal.

Configure HyperTerminal with the proper settings:

Connection Description

Name: **Expt6**

Icon: **Personal choice**

Connect to

Connect Using: **COM1** (or appropriate COM port)

COM1 Properties

Bits per second: **9600**

Data bits: **8**

Parity: **None**

Stop bits: **1**

Flow Control: **None**

When the HyperTerminal session window comes up, press the **Enter** key until there is a response from the router.

If the router terminal is in the configuration mode, exit by typing **NO**.

Would you like to enter the initial configuration dialog? [yes/no]:

no

Press RETURN to get started!

Router>

When in privileged exec command mode, any misspelled or unrecognized commands will attempt to be translated by the router as a domain name. Since there is no domain server configured, there will be a delay while the request times out. This can take between several seconds to several minutes. To terminate the wait, simultaneously hold down the **<CTRL><SHIFT>6** keys then release and press **x**:

```
Router>enabel
```

```
Translating "enabel"...domain server (255.255.255.255) %
```

```
Briefly hold down the keys <CTRL><SHIFT>6, release and  
press x
```

```
Name lookup aborted
```

```
Router>
```

From the user exec mode, enter privileged exec mode:

```
Router> enable
```

```
Router#
```

Verify a clean configuration file with the privileged exec command **show running-config**. If a configuration file was previously saved, it will have to be removed. Depending on router's model and IOS version, your configuration may look slightly different. However, there should be no configured passwords or IP addresses. If your router does not have a default configuration, ask the instructor to remove the configuration.

Step 3: Configure global configuration hostname setting.

What two commands may be used to leave the privileged exec mode?

What shortcut command can be used to enter the privileged exec mode?

From the privileged exec mode, enter global configuration mode:

Router# **configuration terminal**

Router(config)#

What three commands may be used to leave the global configuration mode and return to the privileged exec mode?

What shortcut command can be used to enter the global configuration mode?

Set the device hostname to Lab-A:

Router(config)# **hostname Lab-A**

Lab-A(config)#

How can the hostname be removed?

Step 4: Configure the MOTD banner.

In production networks, banner content may have a significant legal impact on the organization. For example, a friendly "Welcome" message may be interpreted by a court that an attacker has been granted permission to hack into the router. A banner should include information about authorization, penalties for unauthorized access, connection logging, and applicable local laws. The corporate security policy should provide policy on all banner messages.

Create a suitable MOTD banner. Only system administrators of the ABC Company are authorized access, unauthorized access will be prosecuted, and all connection information will be logged.

Examine the different banner modes that can be entered. Write down the list of banner modes and description.

Lab-A(config)# banner ?

Choose a terminating character that will not be used in the message text.

Configure the MOTD banner. The MOTD banner is displayed on all connections before the login prompt. Use the terminating character on a blank line to end the MOTD entry:

Lab-A(config)# **banner motd %**

Enter TEXT message. End with the character '%'

***You are connected to an ABC network device. Access is granted to only current ABC company system administrators with prior written approval. ***

*** Unauthorized access is prohibited, and will be prosecuted. ***

*** All connections are continuously logged. ***%

Lab-A(config)#

What is the global configuration command to remove the MOTD banner?

Task 2: Configure Cisco router password access.

Access passwords are set for the privileged exec mode and user entry point such as console, aux, and virtual lines. The privileged exec mode password is the most critical password, since it controls access to the configuration mode.

Step 1: Configure the privileged exec password.

Cisco IOS supports two commands that set access to the privileged exec mode. One command, **enable password**, contains weak cryptography and should never be used if the **enable secret** command is available. The **enable secret** command uses a very secure MD5 cryptographic hash algorithm. Cisco says "As far as anyone at Cisco knows, it is impossible to recover an enable secret based on the contents of a configuration file (other than by obvious dictionary attacks)." Password security relies on the password algorithm, and the password. . In production environments, strong passwords should be used at all times. A strong password consists of at least nine characters of upper and lower case letters, numbers, and symbols. In a lab environment, we will use weak passwords.

Set the privileged exec password to **cisco**.

```
Lab-A(config)# enable secret cisco
```

```
Lab-A(config)#
```

Step 2: Configure the console password.

Set the console access password to **class**. The console password controls console access to the router.

```
Lab-A(config)# line console 0
```

```
Lab-A(config-line)# password class
```

```
Lab-A(config-line)# login
```

What is the command to remove the console password?

Step 3: Configure the virtual line password.

Set the virtual line access password to **class**. The virtual line password controls Telnet access to the router. In early Cisco IOS versions, only five virtual lines could be set, 0 through 4. In newer Cisco IOS versions, the number has been expanded. Unless a telnet password is set, access on that virtual line is blocked.

```
Lab-A(config-line)# line vty 0 4
```

```
Lab-A(config-line)# password class
```

```
Lab-A(config-line)# login
```

There are three commands that may be used to exit the line configuration mode:

Command	Effect
Exit	Return to the global configuration mode.
End	Exit configuration and return to the
CTRL-Z	privileged exec mode.

Issue the command **exit**. What is the router prompt? What is the mode?

```
Lab-A(config-line)# exit
```

Issue the command **end**. What is the router prompt? What is the mode?

Task 3: Configure Cisco Router Interfaces.

All cabled interfaces should contain documentation about the connection. On newer Cisco IOS versions, the maximum description is 240 characters.

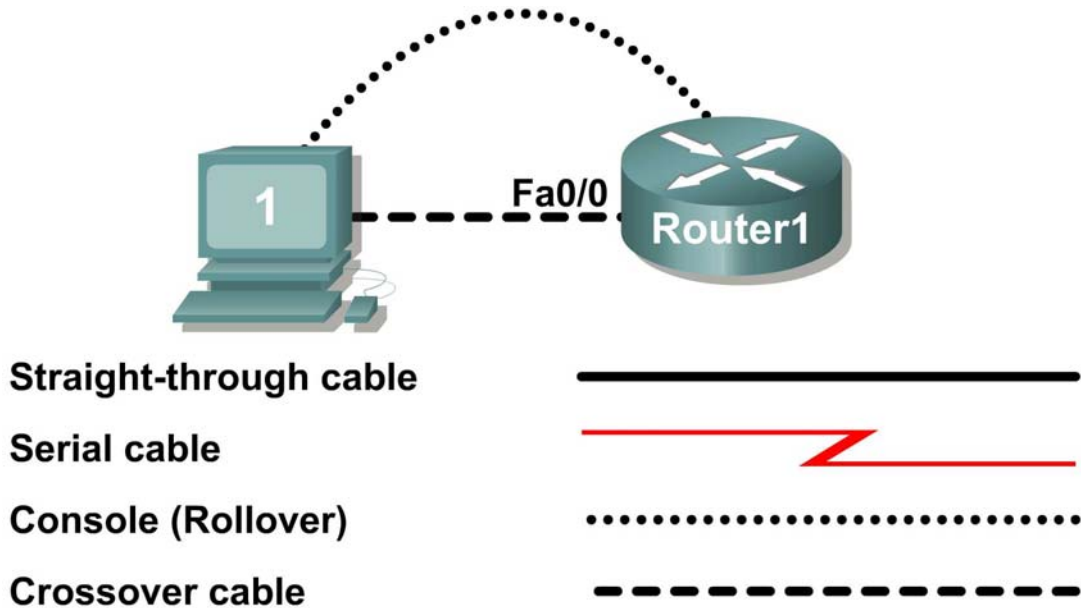


Figure 2. Physical lab topology.

Figure 2 shows a network topology where a host computer is connected to Lab-A, interface Fa0/0.

Step 1: Configure the router fa0/0 interface.

Apply a description on the router interface with the interface configuration command, **description**:

```
Lab-A(config)# interface fa0/0
```

```
Lab-A(config-if)# description Connection to Host1 with  
crossover cable
```

```
Lab-A(config-if)# ip address address mask
```

```
Lab-A(config-if)# no shutdown
```

```
Lab-A(config-if)# end
```

```
Lab-A#
```

Look for the interface to become active:

```
*Mar 24 19:58:59.602: %LINEPROTO-5-UPDOWN: Line protocol on  
Interface FastEthernet0/0, changed state to up
```

Step 2: Configure the router Fa0/1 interface.

Apply a description on the router interface with the interface configuration command, **description**:

```
Lab-A(config)# interface fa0/1
```

```
Lab-A(config-if)# description Connection to switch with  
straight-through cable
```

```
Lab-A(config-if)# ip address address mask
```

```
Lab-A(config-if)# no shutdown
```

```
Lab-A(config-if)# end
```

Look for the interface to become active:

*Mar 24 19:58:59.602: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Step 3: Configure the router Serial0/0/0 interface.

Apply a description on the router interface with the interface configuration command, **description**:

```
Lab-A(config)# interface Serial0/0
```

```
Lab-A(config-if)# description WAN Connection to Lab-B
```

```
Lab-A(config-if)# ip address address mask
```

```
Lab-A(config-if)# no shutdown
```

```
Lab-A(config-if)# end
```

```
Lab-A#
```

Look for the interface to become active. (This interface will be active once the other serial interface connecting it, Lab-B Serial 0/0/0, has been configured.)

Step 4: Configure the host computer.

Configure PC0 for LAN connectivity. Recall that the LAN configuration window is accessed through Start | Control Panel | Network Connections. Right-click on the LAN icon, and select Properties. Highlight the Internet Protocol field, and select Properties. Fill in the IP address, subnet mask and default gateway fields as answered on the addressing table.

Click OK, and then Close. Open a terminal window, and verify network settings with the **ipconfig** command.

Do the same for PC1, PC 2 and the wserver.

Step 4: Verify network connectivity.

Use the **ping** command to verify network connectivity with the router.

If ping replies are not successful troubleshoot the connection.

What Cisco IOS command can be used to verify the interface status?

What Windows command can be used to verify host computer configuration?

Task 4: Save the Router Configuration File.

Cisco IOS refers to RAM configuration storage as running-configuration, and NVRAM configuration storage as startup-configuration. For configurations to survive rebooting or power restarts, the RAM configuration must be copied into non-volatile RAM (NVRAM). This does not occur automatically, NVRAM must be manually updated after any changes are made.

Step 1: Compare router RAM and NVRAM configurations.

Use the Cisco IOS **show** command to view RAM and NVRAM configurations. The configuration is displayed one screen at a time. A line containing " -- more -- " indicates that there is additional information to display. The following list describes acceptable key responses:

Key	Description
<SPACE>	Display the next page.
<RETURN>	Display the next line.
Q	Quit
<CTRL> c	Quit

Display the contents of NVRAM. If the output of NVRAM is missing, it is because there is no saved configuration.:

```
Lab-A# show startup-config
```

```
startup-config is not present
```

Display the contents of RAM.

```
Lab-A#show running-config
```

Use the output to answer the following questions:

How large is the configuration file?

What is the enable secret password?

Does your MOTD banner contain the information you entered earlier?

Do your interface descriptions contain the information you entered earlier?

Write down one possible shortcut command that will display the contents of RAM.

Step 2: Save RAM configuration to NVRAM.

For a configuration to be used the next time the router is powered on or reloaded, it must be manually saved in NVRAM. Save the RAM configuration to NVRAM:

```
Lab-A# copy running-config startup-config
```

```
Destination filename [startup-config]? <ENTER>
```

```
Building configuration...
```

```
[OK]
```

```
Lab-A#
```

Write down one possible shortcut command that will copy the RAM configuration to NVRAM.

Review the contents of NVRAM, and verify that the configuration is the same as the configuration in RAM.

Task 5: Configure a Cisco Switch.

Cisco IOS switch configuration is similar to configuring a Cisco IOS router. The benefit of learning IOS commands is that they are similar to many different devices and IOS versions.

Step 1: Connect the host to the switch.

Move the console, or rollover, cable to the console port on the switch. Ensure power has been applied to the switch. In Hyperterminal, press Enter until the switch responds.

Step 2. Configure global configuration hostname setting.

Depending on router model and IOS version, your configuration may look slightly different. However, there should be no configured passwords. If your router does not have a default configuration, ask the instructor to remove the configuration.

From the user exec mode, enter global configuration mode:

```
Switch> en
```

```
Switch# config t
```

```
Switch(config)#
```

Set the device hostname to SW-A.

```
Switch(config)# hostname SW-A
```

```
SW-A(config)#
```

Step 3: Configure the MOTD banner.

Create a suitable MOTD banner. Only system administrators of the ABC company are authorized access, unauthorized access will be prosecuted, and all connection information will be logged.

Configure the MOTD banner. The MOTD banner is displayed on all connections before the login prompt. Use the terminating character on a blank line to end the MOTD entry. For assistance, review the similar step for configuring a router MOTD banner.

```
SW-A(config)# banner motd %
```

Step 4: Configure the privileged exec password.

Set the privileged exec password to **cisco**.

```
SW-A(config)# enable secret cisco
```

```
SW-A(config)#
```

Step 5: Configure the console password.

Set the console access password to **class**.

```
SW-A(config)# line console 0
```

```
SW-A(config-line)# password class
```

```
SW-A(config-line)# login
```

Step 6: Configure the virtual line password.

Set the virtual line access password to **class**. There are 16 virtual lines that can be configured on a Cisco IOS switch, 0 through 15.

```
SW-A(config-line)# line vty 0 15
```

```
SW-A(config-line)# password class
```

```
SW-A(config-line)# login
```

Step 7: Configure the switch management interface.

```
SW-A(config)# interface vlan 1
```

```
SW-A(config-if)# ip address address mask
```

```
SW-A(config-if)# no shutdown
```

```
SW-A(config-if)# exit
```

```
SW-A(config)# ip default-gateway default gateway of SW-A
```

Step 8: Save RAM configuration to NVRAM.

For a configuration to be used the next time the switch is powered on or reloaded, it must be manually saved in NVRAM. Save the RAM configuration to NVRAM:

```
SW-A# copy run start
```

```
Destination filename [startup-config]? <ENTER>
```

```
Building configuration...
```

```
[OK]
```

```
SW-A#
```

Review the contents of NVRAM, and verify that the configuration is the same as the configuration in RAM.

Task 6: Configuring the second router, Lab-B

Perform the same housekeeping procedures done to router Lab-A to router Lab-B. Apply the appropriate address configurations to the Fast Ethernet and Serial interface of the router, adding the clock rate command to the serial interface.

```
Lab-B(config)# interface fa0/0
```

```
Lab-B(config-if)# description WAN Connection to Lab-A
```

```
Lab-B(config-if)# ip address address mask
```

```
Lab-B(config-if)# clock rate 64000
```

```
Lab-B(config-if)# no shutdown
```

```
Lab-B(config-if)# end
```

```
Lab-B#
```

Look for the interface to become active. (This interface will be active once the other serial interface connecting it, Lab-A Serial 0/0/0, has been configured.)

Task 7: Verify initial connectivity

Upon configuration of the two routers, switch and the hosts, the following must be initially verified:

- PC0 must successfully ping PC1 and PC2
- SW-A must successfully ping PC0, PC1 and PC2
- PC0, PC1 must successfully telnet to Lab-A Fast Ethernet's interface. (at PC's command prompt: telnet *Lab-A Fa0/0 ip address*)
- Lab-A must successfully ping Lab-B's Serial 0/0/0 interface
- Webserver must successfully telnet to Lab-B Fast Ethernet's interface. (at PC's command prompt: telnet *Lab-B Fa0/0 ip address*)

At this point, routers only know about directly connected networks.

Task 8: Configuring Static Routes Using a Next-Hop Address

Step 1: View the routing table information for all two routers.

```
Lab-A#sh ip route
```

What networks are present in the Topology Diagram but not in the routing table for Lab-A?

Lab-B#sh ip route

What networks are present in the Topology Diagram but not in the routing table for Lab-B?

Why are all the networks not in the routing tables for each of the routers?

What can be added to the network so that devices that are not directly connected can ping each other?

Step 3: Configure a Static Route Using a Next-Hop Address.

To configure static routes with a next-hop specified, use the following syntax:

Router(config)# **ip route** *network-address subnet-mask ip-address*

- *network-address*:—Destination network address of the remote network to be added to the routing table.
- *subnet-mask*—Subnet mask of the remote network to be added to the routing table. The subnet mask can be modified to summarize a group of networks.
- *ip-address*—Commonly referred to as the next-hop router's IP address.

On Lab-A router, configure a static route to the LAN of Lab-B router using the Serial 0/0/0 interface of Lab-A as the next-hop address. Write the command for this static route.

Lab-A(config)# _____

Note: There are other methods of creating static routes but wont be covered in the scope of this experiment.

Step 4: View the routing table to verify the new static route entry.

Notice that the route is coded with an **S**, which means that the route is a **static** route.

On Lab-B router, configure two static routes to reach the LANs of Lab-A router, one network connected via Fa0/0 and the other network connected via Lab-A's Fa0/1.

Lab-B(config)# _____

Lab-B(config)# _____

View the routing table to verify the static route entries for the two routers. Are all networks in the routing table of Lab-A also present in the routing table of Lab-B? How many networks are present in both routers?

Step 5: Use ping and telnet to check connectivity for all hosts and routers

- Pings for hosts on remote network should be successful.
- Telnet of a host to a remote router should be successful.

Instructor's Signature: _____