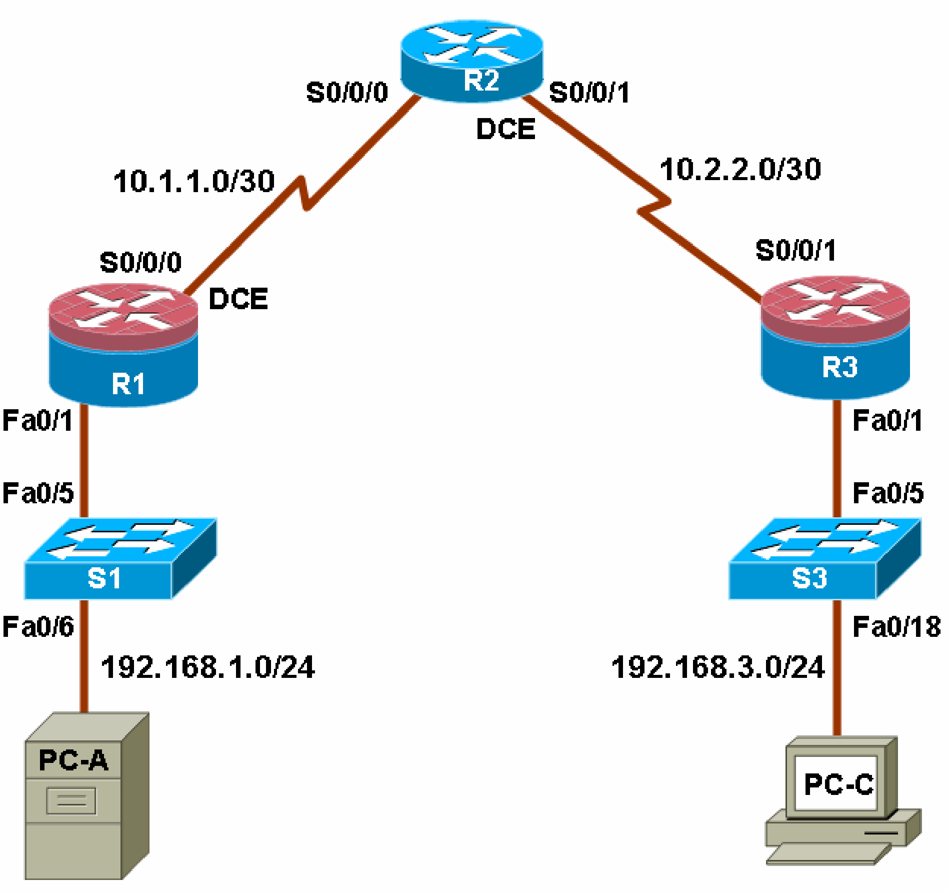
Chapter 2 Lab A: Securing the Router for Administrative Access

Topology



IP Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway	Switch Port
R1	FA0/1	192.168.1.1	255.255.255.0	N/A	S1 FA0/5
	S0/0/0 (DCE)	10.1.1.1	255.255.255.252	N/A	N/A
R2	S0/0/0	10.1.1.2	255.255.255.252	N/A	N/A
	S0/0/1 (DCE)	10.2.2.2	255.255.255.252	N/A	N/A
R3	FA0/1	192.168.3.1	255.255.255.0	N/A	S3 FA0/5
	S0/0/1	10.2.2.1	255.255.255.252	N/A	N/A
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1	S1 FA0/6
PC-C	NIC	192.168.3.3	255.255.255.0	192.168.3.1	S3 FA0/18

Objectives

Part 1: Basic Network Device Configuration

- Cable the network as shown in the topology.
- Configure basic IP addressing for routers and PCs.
- Configure static routing, including default routes.
- Verify connectivity between hosts and routers.

Part 2: Control Administrative Access for Routers

- Configure and encrypt all passwords.
- Configure a login warning banner.
- Configure enhanced username password security.
- Configure enhanced virtual login security.
- Configure an SSH server on a router.
- Configure an SSH client and verify connectivity.

Part 3: Configure Administrative Roles

- Create multiple role views and grant varying privileges.
- Verify and contrast views.

Part 4: Configure Cisco IOS Resilience and Management Reporting

- Secure the Cisco IOS image and configuration files.
- Configure a router as a synchronized time source for other devices using NTP.
- Configure Syslog support on a router.
- Install a Syslog server on a PC and enable it.
- Configure trap reporting on a router using SNMP.
- Make changes to the router and monitor syslog results on the PC.

Part 5: Configure Automated Security Features

- Lock down a router using AutoSecure and verify the configuration.
- Use the SDM Security Audit tool to identify vulnerabilities and lock down services.
- Contrast the AutoSecure configuration with SDM.

Background/Scenario

The router is a key component that controls the movement of data into and out of the network and between devices within the network. It is particularly important to protect the network routers because the failure of one of these devices due to malicious activity could make sections of the network or the entire network inaccessible. Controlling access to routers and enabling reporting on routers are critical to network security and should be part of a comprehensive security policy.

In this lab, you build a multi-router network and configure the routers and hosts. You use various CLI and SDM tools to secure local and remote access to the routers, analyze potential vulnerabilities, and take steps to mitigate them. You also enable management reporting to monitor router configuration changes.

The router commands and output in this lab are from Cisco 1841s using Cisco IOS software, release 12.4(20)T (advanced IP image). Other routers and Cisco IOS versions can be used. See the Router Interface Summary table at the end of the lab to determine which interface identifiers to use based on the equipment in the lab. Depending on the model of the router, the commands available and output produced may vary from what is shown in this lab.

Note: Make sure that the routers and the switches have been erased and have no startup configurations.

Required Resources

- 3 routers with SDM 2.5 installed (Cisco 1841 with Cisco IOS software, release 12.4(20)T1 or comparable)
- 2 switches (Cisco 2960 or comparable)
- PC-A: Windows XP, Vista, or Windows Server with PuTTy SSH Client (no ACS required for this lab)
- PC-C: Windows XP or Vista with PuTTy SSH Client and Kiwi or Tftpd32 Syslog server
- Serial and Ethernet cables as shown in the topology
- Rollover cables to configure the routers via the console port

Part 1: Basic Router Configuration

In Part 1 of this lab, you set up the network topology and configure basic settings such as interface IP addresses and static routing.

Step 1: Cable the network.

Attach the devices shown in the topology diagram and cable as necessary.

Step 2: Configure basic settings for each router.

a. Configure host names as shown in the topology.

b. Configure interface IP addresses as shown in the IP Addressing Table.

c. Configure a clock rate for routers with a DCE serial cable attached to their serial interface. Router R1 is shown here as an example.

```
R1(config)#interface S0/0/0
R1(config-if)#clock rate 64000
```

d. To prevent the router from attempting to translate incorrectly entered commands as though they were host names, disable DNS lookup. Router R1 is shown here as an example.

```
R1(config)#no ip domain-lookup
```

Step 3: Configure static routing on the routers.

a. Configure a static default route from R1 to R2 and from R3 to R2.

b. Configure a static route from R2 to the R1 LAN and from R2 to the R3 LAN.

Step 4: Configure PC host IP settings.

Configure a static IP address, subnet mask, and default gateway for PC-A and PC-C as shown in the IP Addressing Table.

Step 5: Verify connectivity between PC-A and R3.

a. Ping from R1 to R3.

Were the ping results successful? _____

If the pings are not successful, troubleshoot the basic device configurations before continuing.

b. Ping from PC-A on the R1 LAN to PC-C on the R3 LAN.

Were the ping results successful? _____

If the pings are not successful, troubleshoot the basic device configurations before continuing.

Note: If you can ping from PC-A to PC-C you have demonstrated that static routing is configured and functioning correctly. If you cannot ping but the device interfaces are up and IP addresses are correct, use the **`show run`** and **`show ip route`** commands to help identify routing protocol related problems.

Step 6: Save the basic running configuration for each router.

Use the **Transfer > Capture text** option in HyperTerminal or some other method to capture the running configs for each router. Save the three files so that they can be used to restore configs later in the lab.

Part 2: Control Administrative Access for Routers

In Part 2 of this lab, you will:

- Configure and encrypt passwords.
- Configure a login warning banner.
- Configure enhanced username password security.
- Configure enhanced virtual login security.
- Configure an SSH server on router R1 using the CLI.
- Research terminal emulation client software and configure the SSH client.

Note: Perform all tasks, on both R1 and R3. The procedures and output for R1 are shown here.

Task 1. Configure and Encrypt Passwords on Routers R1 and R3

Step 1: Configure a minimum password length for all router passwords.

Use the **`security passwords`** command to set a minimum password length of 10 characters.

```
R1(config)#security passwords min-length 10
```

Step 2: Configure the enable secret password.

Configure the enable secret encrypted password on both routers.

```
R1(config)#enable secret cisco12345
```

How does configuring an enable secret password help protect a router from being compromised by an attack?

____

____

____

Step 3: Configure basic console, auxiliary port, and virtual access lines.

Note: Passwords in this task are set to a minimum of 10 characters but are relatively simple for the benefit of performing the lab. More complex passwords are recommended in a production network.

a. Configure a console password and enable login for routers. For additional security, the **`exec-timeout`** command causes the line to log out after 5 minutes of inactivity. The **`logging synchronous`** command prevents console messages from interrupting command entry.

Note: To avoid repetitive logins during this lab, the **`exec-timeout`** command can be set to 0 0, which prevents it from expiring. However, this is not considered a good security practice.

```
R1(config)#line console 0
R1(config-line)#password ciscocon
R1(config-line)#exec-timeout 5 0
R1(config-line)#login
R1(config-line)#logging synchronous
```

When you configured the password for the console line, what message was displayed?

____

b. Configure a new password of **ciscoconpass** for the console.

c. Configure a password for the AUX port for router R1.

```
R1(config)#line aux 0
R1(config-line)#password ciscoauxpass
R1(config-line)#exec-timeout 5 0
R1(config-line)#login
```

d. Telnet from R2 to R1.

```
R2>telnet 10.1.1.1
```

Were you able to login? Why or why not? ______________________________________

What messages were displayed?

____

____

____

e. Configure the password on the vty lines for router R1.

```
R1(config)#line vty 0 4
R1(config-line)#password ciscovtypass
R1(config-line)#exec-timeout 5 0
R1(config-line)#login
```

f. Telnet from R2 to R1 again. Were you able to login this time? ____________________

g. Enter privileged EXEC mode and issue the show run command. Can you read the enable secret password? Why or why not? ____________________

Can you read the console, aux, and vty passwords? Why or why not? ____________________

h. Repeat the configuration portion of steps 3a through 3g on router R3.

Step 4: Encrypt clear text passwords.

a. Use the **`service password-encryption`** command to encrypt the console, aux, and vty passwords.

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

b. Issue the **`show run`** command. Can you read the console, aux, and vty passwords? Why or why not? ____________________

c. At what level (number) is the enable secret password encrypted? _____

d. At what level (number) are the other passwords encrypted? _____

e. Which level of encryption is harder to crack and why? ____________________

Task 2. Configure a Login Warning Banner on Routers R1 and R3

Step 1: Configure a warning message to display prior to login.

a. Configure a warning to unauthorized users with a message-of-the-day (MOTD) banner using the **`banner motd`** command. When a user connects to one of the routers, the MOTD banner appears before the login prompt. In this example, the dollar sign ($) is used to start and end the message.

```
R1(config)#banner motd $Unauthorized access strictly prohibited and
prosecuted to the full extent of the law$
R1(config)#exit
```

b. Issue the **show run** command. What does the $ convert to in the output? ____________________

c. Exit privileged EXEC mode using the **`disable`** or **`exit`** command and press **`Enter`** to get started. Does the MOTD banner look like what you created with the **`banner motd`** command? _____

Note: If the MOTD banner is not as you wanted it, recreate it using the **`banner motd`** command.

Task 3. Configure Enhanced Username Password Security on Routers R1 and R3.

Step 1: Investigate the options for the username command.

In global configuration mode, enter the following command:

```
R1(config)#username user01 password ?
```

What options are available?

____

____

____

Step 2: Create a new user account using the username command.

a. Create the user01 account, specifying the password with no encryption.

```
R1(config)#username user01 password 0 user01pass
```

b. Use the **show run** command to display the running configuration and check the password that is enabled.

You still cannot read the password for the new user account. Even though unencrypted (0) was specified because the **service password-encryption** command is in effect.

Step 3: Create a new user account with a secret password.

a. Create a new user account with MD5 hashing to encrypt the password.

```
R1(config)#username user02 secret user02pass
```

b. Exit global configuration mode and save your configuration.

c. Display the running configuration. Which hashing method is used for the password?

____

Step 4: Test the new account by logging in to the console.

a. Set the console line to use the locally defined login accounts.

```
R1(config)#line console 0
R1(config-line)#login local
R1(config-line)#end
R1#exit
```

b. Exit to the initial router screen which displays: **R1 con0 is now available, Press RETURN to get started.**

c. Log in using the user01 account and password previously defined.

What is the difference between logging in at the console now and previously?

____

d. After logging in, issue the **show run** command. Were you able to issue the command? Why or why not? ____

e. Enter privileged EXEC mode using the **enable** command. Were you prompted for a password? Why or why not? ____

Step 5: Test the new account by logging in from a Telnet session.

a. From PC-A, establish a Telnet session with R1.

```
PC-A>telnet 192.168.1.1
```

Were you prompted for a user account? Why or why not? ______________________________

b. Set the vty lines to use the locally defined login accounts.

```
R1(config)#line vty 0 4
R1(config-line)#login local
```

c. From PC-A, telnet to R1 again.

```
PC-A>telnet 192.168.1.1
```

Were you prompted for a user account? Why or why not? ________________________________

d. Log in as user01 with a password of user01pass.

e. While telnetted to R1, access privileged EXEC mode with the **enable** command.

What password did you use? ____

f. For added security, set the AUX port to use the locally defined login accounts.

```
R1(config)#line aux 0
R1(config-line)#login local
```

g. End the Telnet session with the **exit** command.

Task 4. Configure Enhanced Virtual Login Security on Routers R1 and R3

Step 1: Configure the router to watch for login attacks.

Use the **login block-for** command to help prevent brute-force login attempts from a virtual connection, such as Telnet, SSH, or HTTP. This can help slow down dictionary attacks and help protect the router from a possible DoS attack.

a. From the user EXEC or privileged EXEC prompt, issue the **show login** command to see the current router login attack settings.

```
R1#show login
   No login delay has been applied.
   No Quiet-Mode access list has been configured.
   Router NOT enabled to watch for login Attacks
```

b. Use the **login block-for** command to configure a 60 second login shutdown (quiet mode timer) if two failed login attempts are made within 30 seconds.

```
R1(config)#login block-for 60 attempts 2 within 30
```

c. Exit global configuration mode and issue the **show login** command.

```
R1#show login
```

Is the router enabled to watch for login attacks? _______

What is the default login delay? ____________________________________

Step 2: Configure the router to log login activity.

a. Configure the router to generate system logging messages for both successful and failed login attempts. The following commands log every successful login and log failed login attempts after every second failed login.

```
R1(config)#login on-success log
R1(config)#login on-failure log every 2
R1(config)#exit
```

b. Issue the **show login** command. What additional information is displayed?

____

Step 3: Test the enhanced login security login configuration.

a. From PC-A, establish a Telnet session with R1.

```
PC-A> telnet 10.1.1.1
```

b. Attempt to log in with the wrong user ID or password two times. What message was displayed on PC-A after the second failed attempt? ____

What message was displayed on the router R1 console after the second failed login attempt?

____

c. From PC-A, attempt to establish another Telnet session to R1 within 60 seconds. What message was displayed on PC-A after the attempted Telnet connection?

____

What message was displayed on router R1 after the attempted Telnet connection?

____

Task 5. Configure the SSH Server on Router R1 and R3 Using the CLI

In this task, you use the CLI to configure the router to be managed securely using SSH instead of Telnet. Secure Shell (SSH) is a network protocol that establishes a secure terminal emulation connection to a router or other networking device. SSH encrypts all information that passes over the network link and provides authentication of the remote computer. SSH is rapidly replacing Telnet as the remote login tool of choice for network professionals.

Note: For a router to support SSH, it must be configured with local authentication, (AAA services, or username) or password authentication. In this task, you configure an SSH username and local authentication.

Step 1: Configure a domain name.

Enter global configuration mode and set the domain name.

```
R1#conf t
R1(config)#ip domain-name ccnasecurity.com
```

Step 2: Configure a privileged user for login from the SSH client.

a. Use the **username** command to create the user ID with the highest possible privilege level and a secret password.

```
R1(config)#username admin privilege 15 secret cisco12345
```

b. Exit to the initial router login screen, and log in with this username. What was the router prompt after you entered the password? ____

Step 3: Configure the incoming vty lines.

Specify a privilege level of 15 so that a user with the highest privilege level (15) will default to privileged EXEC mode when accessing the vty lines. Other users will default to user EXEC mode. Use the local user accounts for mandatory login and validation, and accept only SSH connections.

```
R1(config)#line vty 0 4
R1(config-line)#privilege level 15
R1(config-line)#login local
R1(config-line)#transport input ssh
R1(config-line)#exit
```

Note: The **login local** command should already be configured in a previous step. It is included here to provide all commands if you were doing this for the first time.

Note: If you add the keyword **telnet** to the **transport input** command, users can log in using Telnet as well as SSH, however, the router will be less secure. If only SSH is specified, the connecting host must have an SSH client installed.

Step 4: Erase existing key pairs on the router.

```
R1(config)#crypto key zeroize rsa
```

Note: If no keys exist, you might receive this message: `% No Signature RSA Keys found in configuration`.

Step 5: Generate the RSA encryption key pair for the router.

The router uses the RSA key pair for authentication and encryption of transmitted SSH data.

Configure the RSA keys with 1024 for the number of modulus bits. The default is 512, and the range is from 360 to 2048.

```
R1(config)#crypto key generate rsa general-keys modulus 1024
R1(config)#exit

% The key modulus size is 1024 bits
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]
R1(config)#
*Dec 16 21:24:16.175: %SSH-5-ENABLED: SSH 1.99 has been enabled
```

Note: The details of encryption methods are covered in Chapter 7.

Step 6: Verify the SSH configuration.

a. Use the **show ip ssh** command to see the current settings.

```
R1#show ip ssh
```

b. Fill in the following information based on the output of the **show ip ssh** command.

SSH version enabled: ____________________________
Authentication timeout: ____________________________
Authentication retries: ____________________________

Step 7: Configure SSH timeouts and authentication parameters.

The default SSH timeouts and authentication parameters can be altered to be more restrictive using the following commands.

```
R1(config)#ip ssh time-out 90
R1(config)#ip ssh authentication-retries 2
```

Step 8: Save the running-config to the startup-config.

```
R1#copy running-config startup-config
```

Task 6. Research Terminal Emulation Client Software and Configure the SSH Client

Step 1: Research terminal emulation client software.

Conduct a web search for freeware terminal emulation client software, such as TeraTerm or PuTTy. What are some capabilities of each?

____
____
____

Step 2: Install an SSH client on PC-A and PC-C.

a. If the SSH client is not already installed, download either TeraTerm or PuTTY.

b. Save the application to the desktop.

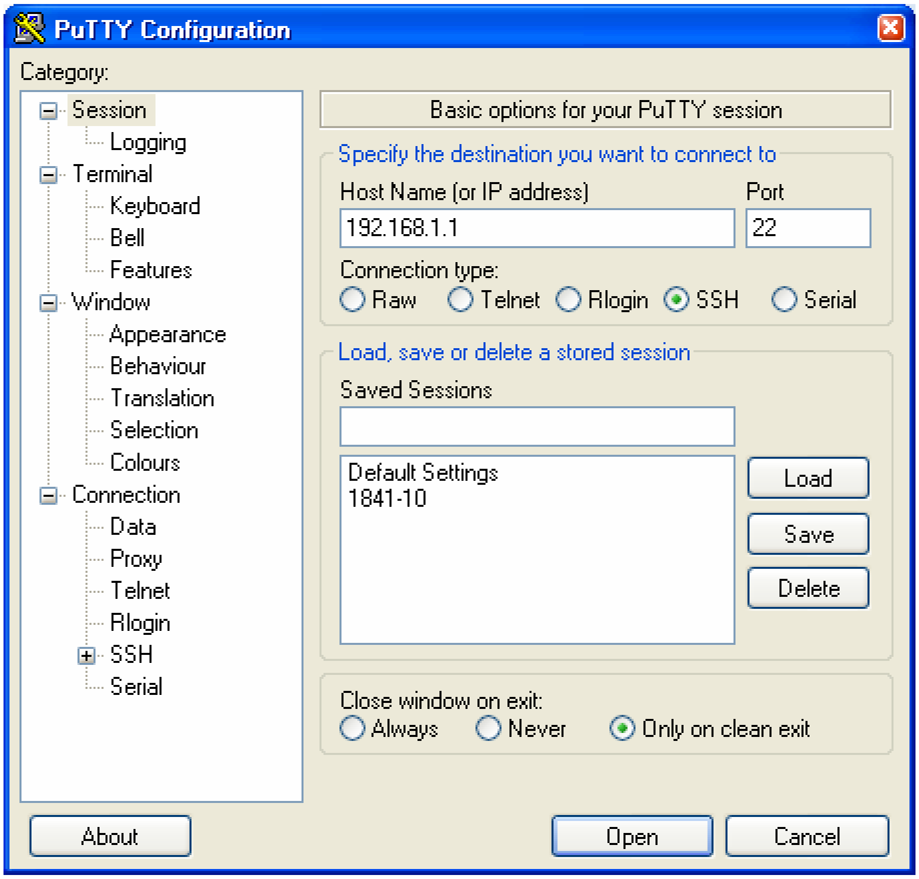
Note: The procedure described here is for PuTTY and pertains to PC-A.

Step 3: Verify SSH connectivity to R1 from PC-A.

a. Launch PuTTY by double-clicking the putty.exe icon.

b. Input the R1 Fa0/1 IP address 192.168.1.1 in the **Host Name or IP address** field.

c. Verify that the **SSH** radio button is selected.



Host Name (or IP address): 192.168.1.1

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Saved Sessions

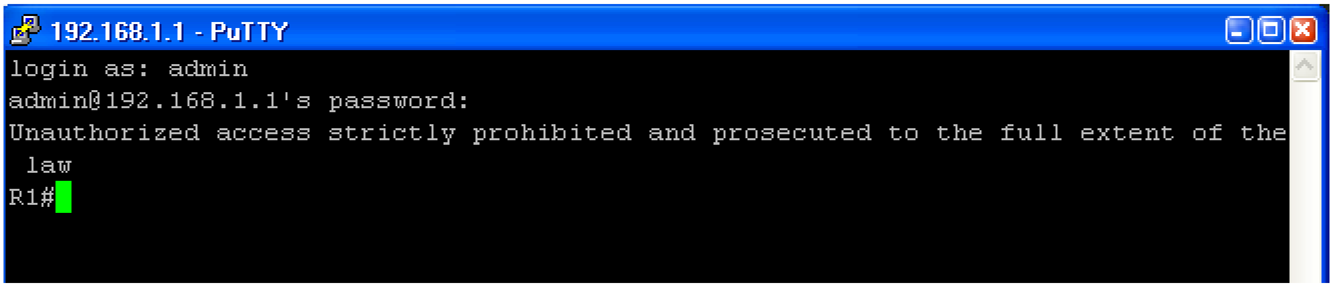
Default Settings
1841-10

Close window on exit: ○ Always ○ Never ● Only on clean exit

d. Click **Open**.

e. In the PuTTY Security Alert window, click **Yes**.

f. Enter the admin username and password cisco12345 in the PuTTY window.



```
login as: admin
admin@192.168.1.1's password:
Unauthorized access strictly prohibited and prosecuted to the full extent of the
 law
R1#
```

g. At the R1 privileged EXEC prompt, enter the **`show users`** command.

```
R1#show users
```

What users are connected to router R1 at this time?

____

h. Close the PuTTY SSH session window.

i. Try to open a Telnet session to your router from PC-A. Were you able to open the Telnet session? Why or why not?

____

j. Open a PuTTY SSH session to the router from PC-A. Enter the user01 username and password user01pass in the PuTTY window to try connecting for user who does not have privilege level of 15. Were you able to login? _____ What was the prompt? _________________________________

k. Use the **enable** command to enter privilege EXEC mode and enter the enable secret password **cisco12345**.

l. Disable the generation of system logging messages for successful login attempts.

```
R1(config)#no login on-success log
```

Step 4: Save the configuration.

Save the running configuration to the startup configuration from the privileged EXEC prompt.

```
R1#copy running-config startup-config
```

Part 3: Configure Administrative Roles

In Part 3 of this lab, you will:

- Create multiple administrative roles or views on routers R1 and R3.
- Grant each view varying privileges.
- Verify and contrast the views.

The role-based CLI access feature allows the network administrator to define views, which are a set of operational commands and configuration capabilities that provide selective or partial access to Cisco IOS EXEC and configuration (config) mode commands. Views restrict user access to the Cisco IOS CLI and configuration information. A view can define which commands are accepted and what configuration information is visible.

Note: Perform all tasks on both R1 and R3. The procedures and output for R1 are shown here.

Task 1. Enable Root View on R1 and R3

If an administrator wants to configure another view to the system, the system must be in root view. When a system is in root view, the user has the same access privileges as a user who has level-15 privileges, but the root view user can also configure a new view and add or remove commands from the view. When you are in a CLI view, you have access only to the commands that have been added to that view by the root view user.

Step 1: Enable AAA on router R1.

To define views, AAA must be enabled.

```
R1#config t
R1(config)#aaa new-model
R1(config)#exit
```

Note: AAA is covered in Chapter 3.

Step 2: Enable the root view.

Use the command **enable view** to enable the root view. Use the enable secret password **cisco12345**. If the router does not have an enable secret password, create one now.

```
R1# enable view
Password: cisco12345
*Dec 16 22:41:17.483: %PARSER-6-VIEW_SWITCH: successfully set to view
'root'.
```

Task 2. Create New Views for the Admin1, Admin2, and Tech Roles on R1 and R3

Step 1: Create the admin1 view, establish a password, and assign privileges.

a. The admin1 user is the top-level user below root that is allowed to access this router. It has the most authority. The admin1 user can use all show, config, and debug commands. Use the following command to create the admin1 view while in the root view.

```
R1(config)#parser view admin1
R1(config-view)#
*Dec 16 22:45:27.587: %PARSER-6-VIEW_CREATED: view 'admin1’
successfully created.
<ENTER>
```

Note: To delete a view, use the command **no parser view** *viewname.*

b. Associate the admin1 view with an encrypted password.

```
R1(config-view)#secret admin1pass
R1(config-view)#
```

c. Review the commands that can be configured in the admin1 view. Use the **commands ?** command. The following is a partial listing of the available commands.

```
R1(config-view)#commands ?
  RITE-profile            Router IP traffic export profile command mode
  RMI Node Config         Resource Policy Node Config mode
  RMI Resource Group      Resource Group Config mode
  RMI Resource Manager    Resource Manager Config mode
  RMI Resource Policy     Resource Policy Config mode
  SASL-profile            SASL profile configuration mode
  aaa-attr-list           AAA attribute list config mode
  aaa-user                AAA user definition
  accept-dialin           VPDN group accept dialin configuration mode
  accept-dialout          VPDN group accept dialout configuration mode
  address-family          Address Family configuration mode
<output omitted>
```

d. Add all config, **show**, and **debug** commands to the admin1 view and then exit from view configuration mode.

```
R1(config-view)#commands exec include all show
R1(config-view)#commands exec include all config terminal
R1(config-view)#commands exec include all debug
R1(config-view)#end
```

e. Verify the admin1 view.

```
R1#enable view admin1
Password:admin1pass
```

```
*Dec 16 22:56:46.971: %PARSER-6-VIEW_SWITCH: successfully set to view
'admin1'

R1#show parser view
R1#Current view is ‘admin1’
```

f. Examine the commands available in the admin1 view.

```
R1#?
Exec commands:
  configure  Enter configuration mode
  debug      Debugging functions (see also 'undebug')
  enable     Turn on privileged commands
  exit       Exit from the EXEC
  show       Show running system information
```

g. Examine the **show** commands available in the admin1 view.

```
R1#show ?
  aaa           Show AAA values
  accounting    Accounting data for active sessions
  adjacency     Adjacent nodes
  alignment     Show alignment information
  appfw         Application Firewall information
  archive       Archive of the running configuration information
  arp           ARP table
<output omitted>
```

Step 2: Create the admin2 view, establish a password, and assign privileges.

The Admin2 user is a junior administrator in training who is allowed to view all configurations but is not allowed to configure the routers or use debug commands.

a. Use the **enable view** command to enable the root view, and enter the enable secret password cisco12345.

```
R1#enable view
Password:cisco12345
```

b. Use the following command to create the admin2 view.

```
R1(config)#parser view admin2
R1(config-view)#
*Dec 16 23:02:27.587: %PARSER-6-VIEW_CREATED: view 'admin2’
successfully created. <ENTER>
```

c. Associate the admin2 view with a password.

```
R1(config-view)#secret admin2pass
R1(config-view)#
```

d. Add all show commands to the view and then exit from view configuration mode.

```
R1(config-view)#commands exec include all show
R1(config-view)#end
```

e. Verify the admin2 view.

```
R1(config-view)#end
R1#enable view admin2
Password: admin2pass
*Dec 16 23:05:46.971: %PARSER-6-VIEW_SWITCH: successfully set to view
'admin2'
```

```
R1#show parser view
R1# Current view is ‘admin2’
```

f. Examine the commands available in the admin2 view.

```
R1#?
Exec commands:
  enable     Turn on privileged commands
  exit       Exit from the EXEC
  show       Show running system information

What is missing from the list of admin2 commands that is present in the
admin1 commands? _____________________________________________________
```

Step 3: Create the tech view, establish a password, and assign privileges.

a. The Tech user typically installs end-user devices and cabling. Tech users are only allowed to use selected show commands.

b. Use the **enable view** command to enable the root view, and enter the enable secret password cisco12345.

```
R1#enable view
Password:cisco12345
```

c. Use the following command to create the tech view.

```
R1(config)#parser view tech
R1(config-view)#
```

*Dec 16 23:10:27.587: %PARSER-6-VIEW_CREATED: view 'tech’ successfully created.
<ENTER>

d. Associate the tech view with a password.

```
R1(config-view)#secret techpasswd
R1(config-view)#
```

e. Add the following show commands to the view and then exit from view configuration mode.

```
R1(config-view)#commands exec include show version
R1(config-view)#commands exec include show interfaces
R1(config-view)#commands exec include show ip interface brief
R1(config-view)#commands exec include show parser view
R1(config-view)#end
```

f. Verify the tech view.

```
R1#enable view tech
Password:techpasswd
*Dec 16 23:13:46.971: %PARSER-6-VIEW_SWITCH: successfully set to view
'tech'
R1#show parser view
R1#Current view is ‘tech’
```

g. Examine the commands available in the tech view.

```
R1#?
Exec commands:
  enable     Turn on privileged commands
  exit       Exit from the EXEC
  show       Show running system information
```

h. Examine the show commands available in the tech view.

```
R1#show ?
  flash:       display information about flash: file system
  interfaces   Interface status and configuration
  ip           IP information
  parser       Show parser commands
  version      System hardware and software status
```

i. Issue the **`show ip interface brief`** command. Were you able to do it as the tech user? Why or why not? ____

j. Issue the **`show ip route`** command. Were you able to do it as the tech user? _______________

k. Return to root view with the **`enable view`** command.

```
R1# enable view
Password: cisco12345
```

l. Issue the **`show run`** command to see the views you created. For tech view, why are the **`show`** and **`show ip`** commands listed as well as **`show ip interface`** and **`show ip interface brief`**?

____

Step 4: Save the configuration on routers R1 and R3.

Save the running configuration to the startup configuration from the privileged EXEC prompt.

Part 4: Configure IOS Resilience and Management Reporting

In Part 4 of this lab, you will:

- Secure the Cisco IOS image and configuration files.
- Configure a router as a synchronized time source for other devices using NTP.
- Configure syslog support on a router.
- Install a syslog server on a PC and enable it.
- Configure the logging trap level on a router.
- Make changes to the router and monitor syslog results on the PC.

Note: Perform all tasks on both R1 and R3. The procedure and output for R1 is shown here.

Task 1. Secure Cisco IOS Image and Configuration Files on R1 and R3

The Cisco IOS Resilient Configuration feature enables a router to secure the running image and maintain a working copy of the configuration so that those files can withstand malicious attempts to erase the contents of persistent storage (NVRAM and flash). The feature secures the smallest working set of files to preserve persistent storage space. No extra space is required to secure the primary Cisco IOS image file. In this task, you configure the Cisco IOS Resilient Configuration feature.

Step 1: Display the files in flash memory for R1.

```
R1#show flash
-#- --length-- -----date/time------ path
```

```
1      37081324 Dec 16 2008 21:57:10 c1841-advipservicesk9-mz.124-20.T1.bin
2       6389760 Dec 16 2008 22:06:56 sdm.tar
3       1505280 Dec 16 2008 22:08:52 common.tar
4        527849 Dec 16 2008 17:13:40 128MB.sdf
5          1821 Dec 16 2008 00:11:30 sdmconfig-18xx.cfg
6        931840 Dec 16 2008 17:14:42 es.tar
7        112640 Dec 16 2008 17:15:06 home.tar
8          1038 Dec 16 2008 17:15:22 home.shtml
9       1697952 Dec 16 2008 17:17:54 securedesktop-ios-3.1.1.45-k9.pkg
10       415956 Dec 16 2008 17:21:16 sslclient-win-1.1.4.176.pkg

14815232 bytes available (49197056 bytes used)
```

Step 2: Secure the Cisco IOS image and archive a copy of the running configuration.

a. The **`secure boot-image`** command enables Cisco IOS image resilience, which hides the file from **`dir`** and **`show`** commands. The file cannot be viewed, copied, modified, or removed using EXEC mode commands. (It can be viewed in ROMMON mode.) When turned on for the first time, the running image is secured.

```
R1(config)#secure boot-image
.Dec 17 25:40:13.170: %IOS_RESILIENCE-5-IMAGE_RESIL_ACTIVE: Successfully
secured running image
```

b. The **`secure boot-config`** command takes a snapshot of the router running configuration and securely archives it in persistent storage (flash).

```
R1(config)#secure boot-config
.Dec 17 25:42:18.691: %IOS_RESILIENCE-5-CONFIG_RESIL_ACTIVE:
Successfully secured config archive [flash:.runcfg-20081219-224218.ar]
```

Step 3: Verify that your image and configuration are secured.

a. You can use only the **`show secure bootset`** command to display the archived filename. Display the status of configuration resilience and the primary bootset filename.

```
R1#show secure bootset
IOS resilience router id FTX1111W0QF

IOS image resilience version 12.4 activated at 25:40:13 UTC Wed Dec 17
2008
Secure archive flash:c1841-advipservicesk9-mz.124-20.T1.bin type is
image (elf)
[]
  file size is 37081324 bytes, run size is 37247008 bytes
  Runnable image, entry point 0x8000F000, run from ram

IOS configuration resilience version 12.4 activated at 25:42:18 UTC Wed
Dec 17 2008
Secure archive flash:.runcfg-20081219-224218.ar type is config
configuration archive size 1986 bytes
```

b. What is the name of the archived running config file and on what is the name based?

____

Step 4: Display the files in flash memory for R1.

a. Display the contents of flash using the **`show flash`** command.

```
R1#show flash
-#- --length-- -----date/time------ path
1      6389760 Dec 16 2008 22:06:56 sdm.tar
2      1505280 Dec 16 2008 22:08:52 common.tar
3       527849 Dec 16 2008 17:13:40 128MB.sdf
4         1821 Dec 16 2008 00:11:30 sdmconfig-18xx.cfg
5       512000 Dec 16 2008 17:14:24 dg_sdm.tar
6       931840 Dec 16 2008 17:14:42 es.tar
7       112640 Dec 16 2008 17:15:06 home.tar
8         1038 Dec 16 2008 17:15:22 home.shtml
10     1697952 Dec 16 2008 17:17:54 securedesktop-ios-3.1.1.45-k9.pkg
11      415956 Dec 16 2008 17:21:16 sslclient-win-1.1.4.176.pkg

14807040 bytes available (49205248 bytes used)
```

b. Is the Cisco IOS image or the archived running config file listed? ___________________________

c. How can you tell that the Cisco IOS image is still there? __________________________________

Step 5: Disable the IOS Resilient Configuration feature.

a. Disable the Resilient Configuration feature for the Cisco IOS image.

```
R1#config t
R1(config)#no secure boot-image
.Dec 17 25:48:23.009: %IOS_RESILIENCE-5-IMAGE_RESIL_INACTIVE: Disabled
secure image archival
```

b. Disable the Resilient Configuration feature for the running config file.

```
R1(config)#no secure boot-config
.Dec 17 25:48:47.972: %IOS_RESILIENCE-5-CONFIG_RESIL_INACTIVE: Disabled
secure config archival [removed flash:.runcfg-20081219-224218.ar]
```

Step 6: Verify that the Cisco IOS image is now visible in flash.

```
R1#show flash
-#- --length-- -----date/time------ path
1     37081324 Dec 16 2008 21:57:10 c1841-advipservicesk9-mz.124-20.T1.bin
2      6389760 Dec 16 2008 22:06:56 sdm.tar
3      1505280 Dec 16 2008 22:08:52 common.tar
4       527849 Dec 16 2008 17:13:40 128MB.sdf
5         1821 Dec 16 2008 00:11:30 sdmconfig-18xx.cfg
6       931840 Dec 16 2008 17:14:42 es.tar
7       112640 Dec 16 2008 17:15:06 home.tar
8         1038 Dec 16 2008 17:15:22 home.shtml
9      1697952 Dec 16 2008 17:17:54 securedesktop-ios-3.1.1.45-k9.pkg
10      415956 Dec 16 2008 17:21:16 sslclient-win-1.1.4.176.pkg

14815232 bytes available (49197056 bytes used)
```

Step 7: Save the configuration on both routers.

Save the running configuration to the startup configuration from the privileged EXEC prompt.

Task 2. Configure a Synchronized Time Source Using NTP

Router R2 will be the master NTP clock source for routers R1 and R3.

Note: R2 could also be the master clock source for switches S1 and S3, but it is not necessary to configure them for this lab.

Step 1: Set Up the NTP Master using Cisco IOS commands.

R2 is the master NTP server in this lab. All other routers and switches learn their time from it, either directly or indirectly. For this reason, you must first ensure that R2 has the correct Coordinated Universal Time set.

Note: If you are using SDM to configure R2 to support NTP, skip this step and go to Step 2.

a. Display the current time set on the router using the **`show clock`** command.

```
R2#show clock
*01:19:02.331 UTC Mon Dec 15 2008
```

b. To set the time on the router, use the **`clock set`** *`time`* command.

```
R2#clock set 20:12:00 Dec 17 2008
R2#
*Dec 17 20:12:18.000: %SYS-6-CLOCKUPDATE: System clock has been updated
from 01:20:26 UTC Mon Dec 15 2008 to 20:12:00 UTC Wed Dec 17 2008,
configured from console by admin on console.
```

c. Configure R2 as the NTP master using the **`ntp master`** *`stratum-number`* command in global configuration mode. The stratum number indicates the distance from the original source. For this lab, use a stratum number of 3 on R2. When a device learns the time from an NTP source, its stratum number becomes one greater than the stratum number of its source.

```
R2(config)#ntp master 3
```

Step 2: Configure R1 and R3 as NTP clients using the CLI.

a. R1 and R3 will become NTP clients of R2. To configure R1, use the global configuration command **`ntp server`** ***`hostname`***. The host name can also be an IP address. The command **`ntp update-calendar`** periodically updates the calendar with the NTP time.

```
R1(config)#ntp server 10.1.1.2
R1(config)#ntp update-calendar
```

b. Verify that R1 has made an association with R2 with the **`show ntp associations`** command. You can also use the more verbose version of the command by adding the **`detail`** argument. It might take some time for the NTP association to form.

```
R1#show ntp associations

address    ref clock    st  when  poll reach  delay  offset   disp
~10.1.1.2  127.127.1.1   3    14    64     3  0.000  -280073  3939.7
*sys.peer, #selected, +candidate, -outlyer, x falseticker, ~ configured
```

c. Issue the **`debug ntp all`** command to see NTP activity on R1 as it synchronizes with R2.

```
R1#debug ntp all
NTP events debugging is on
NTP core messages debugging is on
NTP clock adjustments debugging is on
NTP reference clocks debugging is on
NTP packets debugging is on

Dec 17 20.12:18.554: NTP message sent to 10.1.1.2, from interface
'Serial0/0/0' (10.1.1.1).
```

```
Dec 17 20.12:18.574: NTP message received from 10.1.1.2 on interface
'Serial0/0/0' (10.1.1.1).
Dec 17 20:12:18.574: NTP Core(DEBUG): ntp_receive: message received
Dec 17 20:12:18.574: NTP Core(DEBUG): ntp_receive: peer is 0x645A3120, next
action is 1.
Dec 17 20:12:18.574: NTP Core(DEBUG): receive: packet given to
process_packet
Dec 17 20:12:18.578: NTP Core(INFO): system event 'event_peer/strat_chg'
(0x04)
status 'sync_alarm, sync_ntp, 5 events, event_clock_reset' (0xC655)
Dec 17 20:12:18.578: NTP Core(INFO): synchronized to 10.1.1.2, stratum 3
Dec 17 20:12:18.578: NTP Core(INFO): system event 'event_sync_chg' (0x03)
status
 'leap_none, sync_ntp, 6 events, event_peer/strat_chg' (0x664)
Dec 17 20:12:18.578: NTP Core(NOTICE): Clock is synchronized.
Dec 17 20:12:18.578: NTP Core(INFO): system event 'event_peer/strat_chg'
(0x04)
status 'leap_none, sync_ntp, 7 events, event_sync_chg' (0x673)
Dec 17 20:12:23.554: NTP: Calendar updated.
```

d. Issue the **undebug all** or the **no debug ntp all** command to turn off debugging.

```
R1#undebug all
```

e. Verify the time on R1 after it has made an association with R2.

```
R1#show clock
*20:12:24.859 UTC Wed Dec 17 2008
```

Step 3: (Optional) Configure R1 and R3 as NTP clients using SDM.

You can also use SDM to configure the router to support NTP. If you configured R1 as an NTP client using Cisco IOS commands in Step 2, you can skip this step, but read through it to become familiar with the process. If you configured R1 and R3 as NTP clients using Cisco IOS commands in Step 2 you can still perform this step but you need to issue the following commands first on each router.

```
R1(config)#no ntp server 10.1.1.2
R1(config)#no ntp update-calendar
```

a. From the CLI, enable the http server on R1.

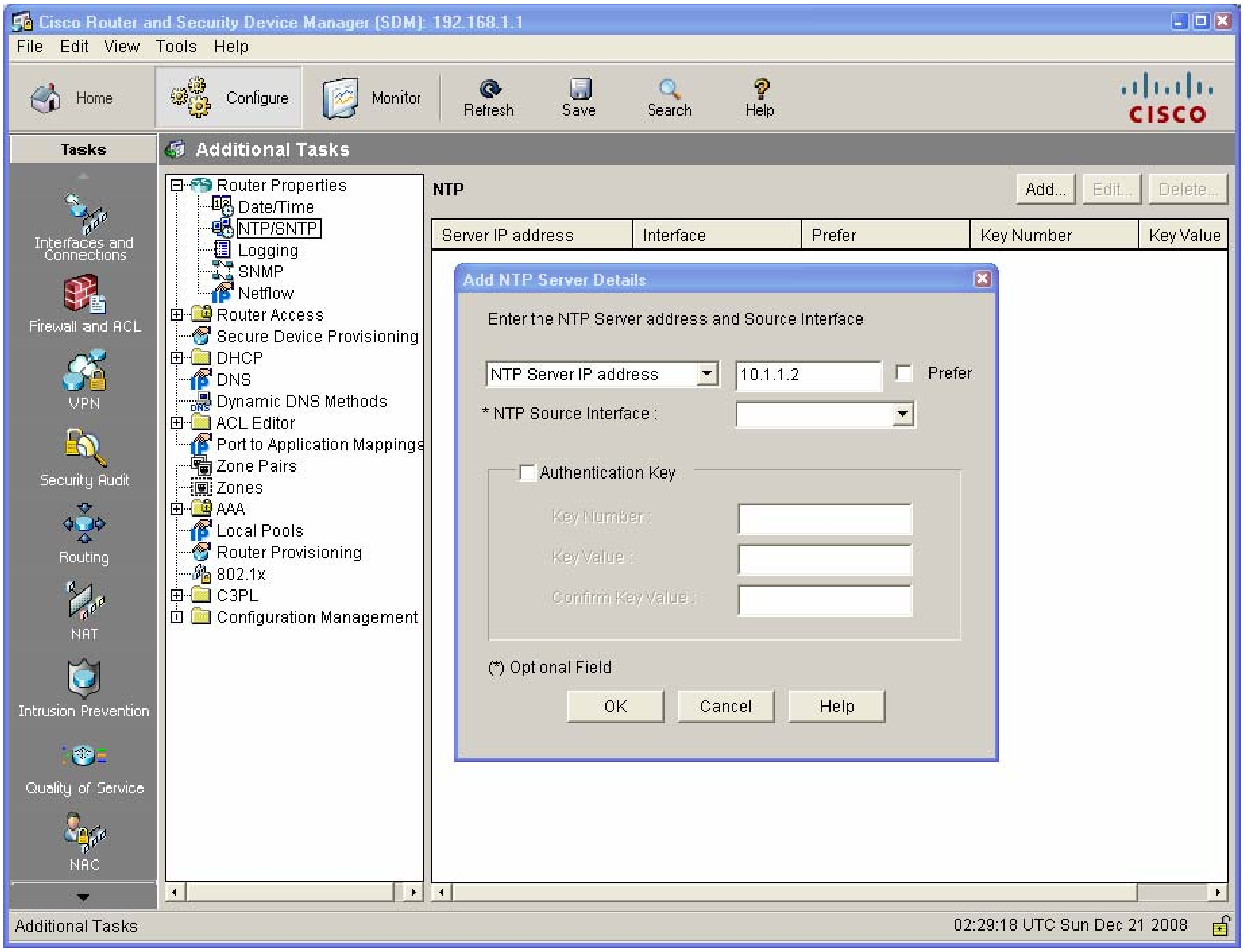
```
R1(config)#ip http server
```

b. Open a browser window on PC-A and start SDM by entering the R1 IP address 192.168.1.1 in the address field. Log in as admin with password cisco12345.

c. To configure SDM to allow you to preview the commands before sending them to the router, select **Edit** > **Preferences.**

d. In the **User Preferences** window, select **Preview commands before delivering to router** and click **OK**.

e. To configure an NTP server, click the **Configure** button and select **Additional Tasks > Router Properties > NTP/SNTP**. Click **Add**.



Server IP address	Interface	Prefer	Key Number	Key Value

Add NTP Server Details

Enter the NTP Server address and Source Interface

NTP Server IP address: 10.1.1.2 □ Prefer

* NTP Source Interface :

□ Authentication Key

Key Number :

Key Value :

Confirm Key Value :

(*) Optional Field

f. In the NTP Server IP Address field, enter the IP address of the R2 master NTP router (10.1.1.2) and click **OK**.

g. In the Deliver Configuration to Router window, make sure that the **Save running config to router's startup config** check box is checked and click **Deliver**.

h. Click **OK** in the Commands Delivery Status window.

i. Open a console connection to the router, and verify the associations and time on R1 after it has made an association with R2. It might take some time for the NTP association to form.

```
R1#show ntp associations

address      ref clock     st  when  poll reach  delay  offset   disp
~10.1.1.2   127.127.1.1    3    14    64     3  0.000  -280073  3939.7
*sys.peer, #selected, +candidate, -outlyer, x falseticker, ~ configured

R1#show clock
*20:12:24.859 UTC Wed Dec 17 2008
```

Task 3. Configure syslog Support on R1 and PC-A

Step 1: Install the syslog server.

The Kiwi Syslog Daemon is a dedicated syslog server. Another application is Tftpd32, which includes a TFTP server, TFTP client, and a syslog server and viewer. You can use either with this lab. Both are available as a free version and run with Microsoft Windows.

If a syslog server is not currently installed on the host, download the latest version of Kiwi from http://www.kiwisyslog.com or Tftpd32 from http://tftpd32.jounin.net and install it on your desktop. If it is already installed, go to Step 2.

Note: This lab uses the Kiwi syslog server.

Step 2: Configure R1 to log messages to the syslog server using the CLI.

a. Verify that you have connectivity between R1 and the host by pinging the R1 Fa0/1 interface IP address 192.168.1.1. If it is not successful, troubleshoot as necessary before continuing.

b. NTP was configured in Task 2 to synchronize the time on the network. Displaying the correct time and date in syslog messages is vital when using syslog to monitor a network. If the correct time and date of a message is not known, it can be difficult to determine what network event caused the message.

   Verify that the timestamp service for logging is enabled on the router using the **show run** command. Use the following command if the timestamp service is not enabled.

```
R1(config)#service timestamps log datetime msec
```

c. Configure the syslog service on the router to send syslog messages to the syslog server.

```
R1(config)#logging 192.168.1.3
```

Step 3: Configure the logging severity level on R1.

Logging traps can be set to support the logging function. A trap is a threshold that when reached triggers a log message. The level of logging messages can be adjusted to allow the administrator to determine what kinds of messages are sent to the syslog server. Routers support different levels of logging. The eight levels range from 0 (emergencies), indicating that the system is unstable, to 7 (debugging), which sends messages that include router information.

Note: The default level for syslog is 6, informational logging. The default for console and monitor logging is 7, debugging.

a. Use the **logging trap** command to determine the options for the command and the various trap levels available.

```
R1(config)#logging trap ?
<0-7>          Logging severity level
alerts         Immediate action needed           (severity=1)
critical       Critical conditions               (severity=2)
debugging      Debugging messages                (severity=7)
emergencies    System is unusable                (severity=0)
errors         Error conditions                  (severity=3)
informational  Informational messages            (severity=6)
notifications  Normal but significant conditions (severity=5)
warnings       Warning conditions                (severity=4)
```

```
<cr>
```

b. Define the level of severity for messages sent to the syslog server. To configure the severity levels, use either the keyword or the severity level number (0–7).

Severity level	Keyword	Meaning
0	emergencies	System unusable
1	alerts	Immediate action required
2	critical	Critical conditions
3	errors	Error conditions
4	warnings	Warning conditions
5	notifications	Normal but significant condition
6	informational	Informational messages
7	debugging	Debugging messages

Note: The severity level includes the level specified and anything with a lower severity number. If you set the level to 4 or use the keyword **`warnings`**, you capture messages with severity level 4, 3, 2, 1, and 0.

c. Use the **`logging trap`** command to set the severity level for R1.

```
R1(config)#logging trap warnings
```

d. What is the problem with setting the level of severity too high or too low?

____

____

____

e. If the command **`logging trap critical`** were issued, which severity levels of messages would be logged? ____

Step 4: Display the current status of logging for R1.

a. Use the **`show logging`** command to see the type and level of logging enabled.

```
R1#show logging
Syslog logging: enabled (0 messages dropped, 1 messages rate-limited,
                0 flushes, 0 overruns, xml disabled, filtering
disabled)

No Active Message Discriminator.
No Inactive Message Discriminator.

    Console logging: level debugging, 271 messages logged, xml
disabled,
                     filtering disabled
    Monitor logging: level debugging, 0 messages logged, xml disabled,
                     filtering disabled
    Buffer logging:  disabled, xml disabled,
                     filtering disabled
    Logging Exception size (4096 bytes)
    Count and timestamp logging messages: disabled
    Persistent logging: disabled

No active filter modules.

ESM: 0 messages dropped
```

```
            Trap logging: level warnings, 0 message lines logged
                Logging to 192.168.1.3  (udp port 514,  audit disabled,
                      authentication disabled, encryption disabled, link up),
                      0 message lines logged,
                      0 message lines rate-limited,
                      0 message lines dropped-by-MD,
                      xml disabled, sequence number disabled
                      filtering disabled
```

b. At what level is console logging enabled? ____

c. At what level is trap logging enabled? ____

d. What is the IP address of the syslog server? _____________________________________

e. What port is syslog using? ____

Step 5: (Optional) Configure R1 to log messages to the syslog server using SDM.

You can also use SDM to configure the router for syslog support. If you configured R1 for syslog and trap levels previously, you can skip this step. If you configured R1 syslog and trap levels using Cisco IOS commands in Step 4 you can still perform this step but you need to issue the following commands first on the router:

```
R1(config)#no logging 192.168.1.3
R1(config)#no logging trap warnings
```

a. Open a browser on PC-A, and start SDM by entering the R1 IP address 192.168.1.1 in the address field. Log in as admin with password cisco12345.

b. Select Configure > Additional Tasks > Router Properties > Logging, and double-click Syslog.

c. In the Logging window, click Add and enter the IP address of the syslog server, PC-A (192.168.1.3). Click OK.

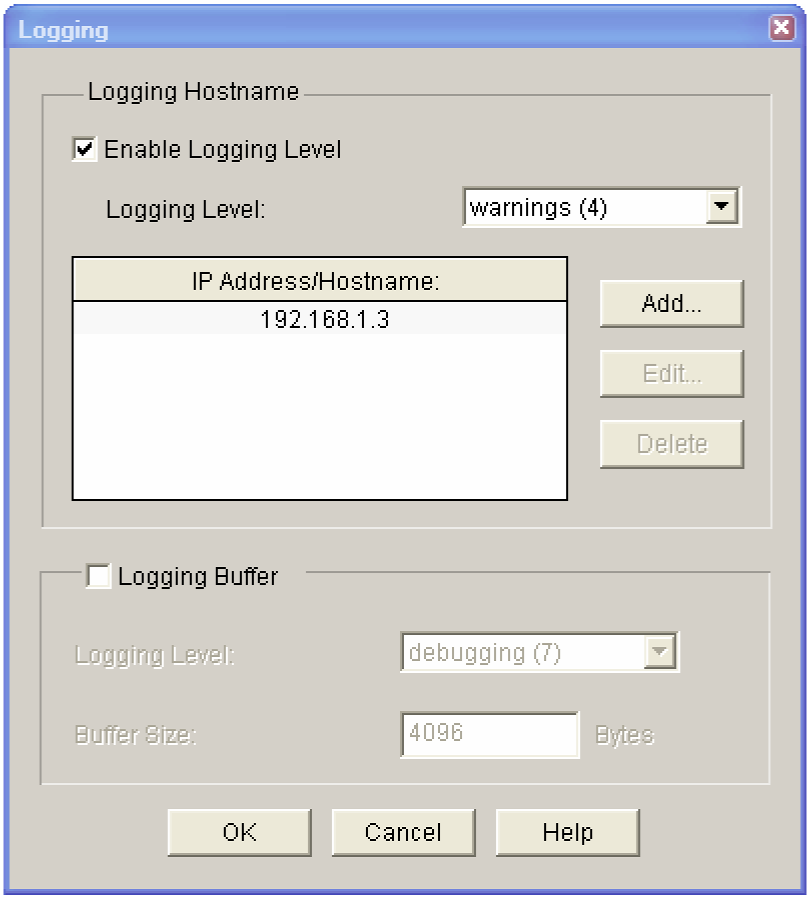
d. From the Logging Level drop-down menu, select the logging level of Warnings (4).

e. Deselect Logging Buffer, and then click OK.

f. Click Yes in the SDM Warning dialog box.

g. In the Deliver Configuration to Router window, click Deliver. Click OK in the Commands Delivery Status window.

h. Click Save on the toolbar. Click Yes in the SDM Write to Startup Config Warning window.



Logging

Logging Hostname

☑ Enable Logging Level

Logging Level: warnings (4)

IP Address/Hostname:
192.168.1.3

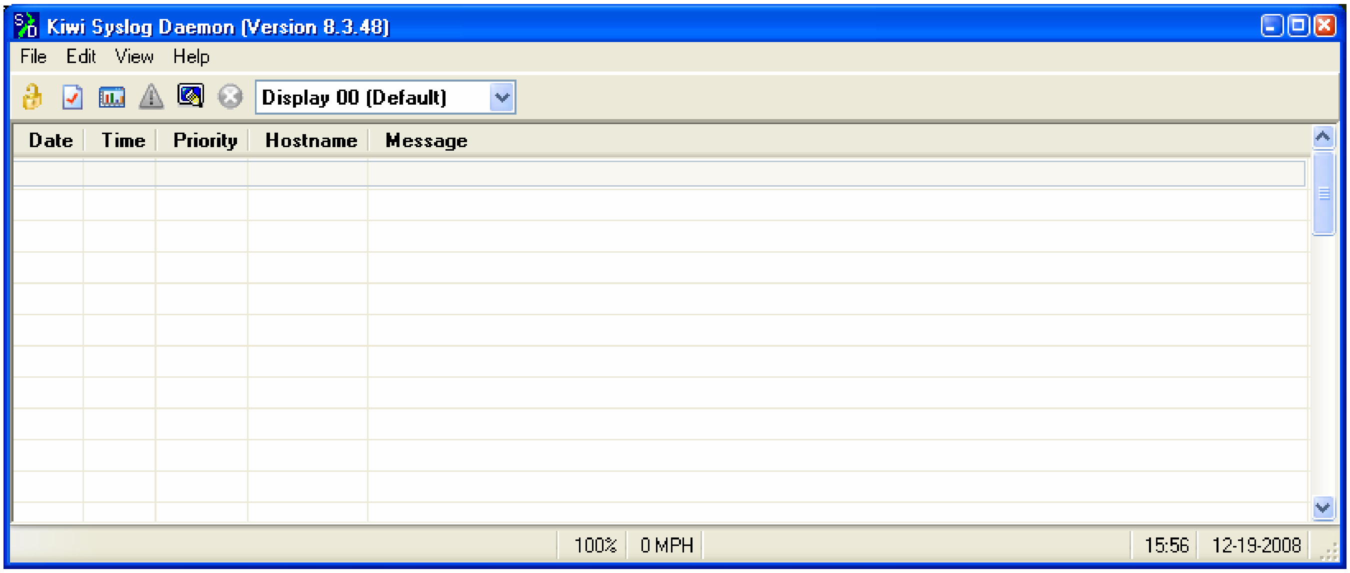
□ Logging Buffer

Logging Level: debugging (7)

Buffer Size: 4096 Bytes

Step 6: Start the Kiwi Syslog Server.

Open the Kiki Syslog Daemon application on your desktop or click the **Start** button and select **Programs > Kiwi Enterprises > Kiwi Syslog Daemon**.



Kiwi Syslog Daemon (Version 8.3.48)

Date	Time	Priority	Hostname	Message

Step 7: Verify that logging to the syslog server is occurring.

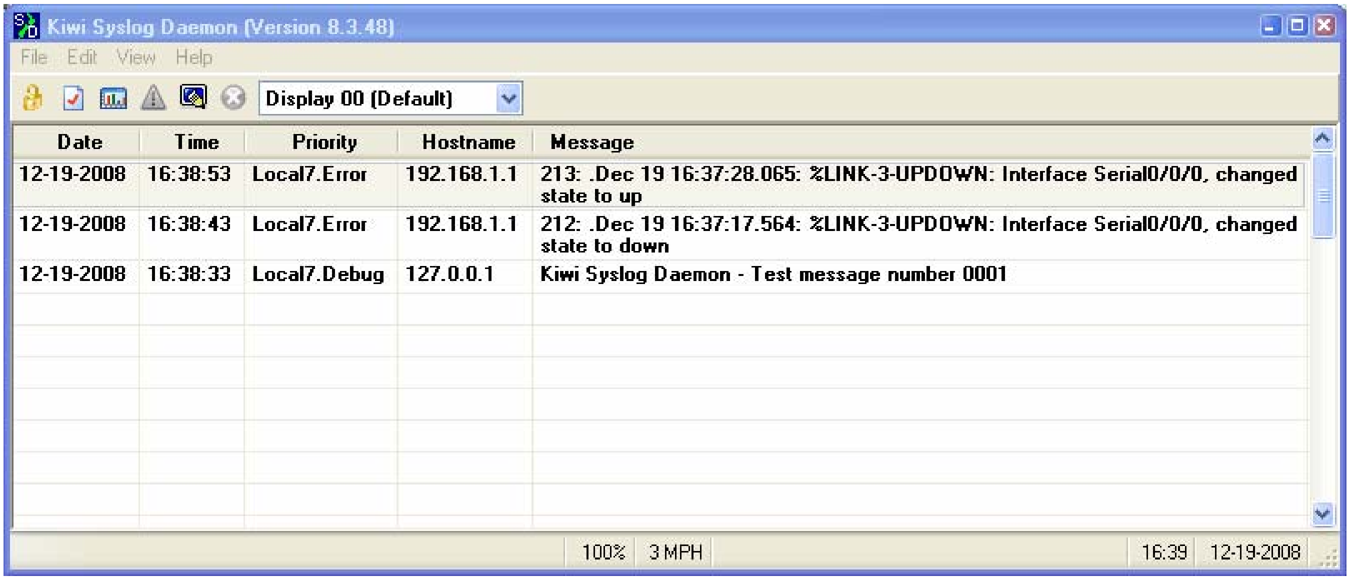
On the syslog server host PC-A, observe messages as they are sent from R1 to the syslog server.

a. Send a test log message to the kiwi syslog server by choosing **File > Send test message to local host**.

b. Generate a logging message by shutting down the Serial0/0/0 interface on R1 or R2 and then re-enabling it.

```
R1(config)#interface S0/0/0
R1(config-if)#shutdown
R1(config-if)#no shutdown
```

The Kiwi syslog screen should look similar to the one below.



Date	Time	Priority	Hostname	Message
12-19-2008	16:38:53	Local7.Error	192.168.1.1	213: .Dec 19 16:37:28.065: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up
12-19-2008	16:38:43	Local7.Error	192.168.1.1	212: .Dec 19 16:37:17.564: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to down
12-19-2008	16:38:33	Local7.Debug	127.0.0.1	Kiwi Syslog Daemon - Test message number 0001

c. What would happen if you were shut down the Fa0/1 interface on R1 (do not actually perform this action)? ____

d. From the R1 global configuration mode, enable the logging of user info when enabling privileged mode and reset the trap level to informational.

```
R1(config)#logging userinfo
R1(config)#logging trap informational
```

e. On the Kiwi Syslog Daemon, click **View > Clear Display** to clear the log display.

f. Exit to the login screen, and enable the admin1 view that you created in Part 3 of this lab. Enter the password admin1pass.

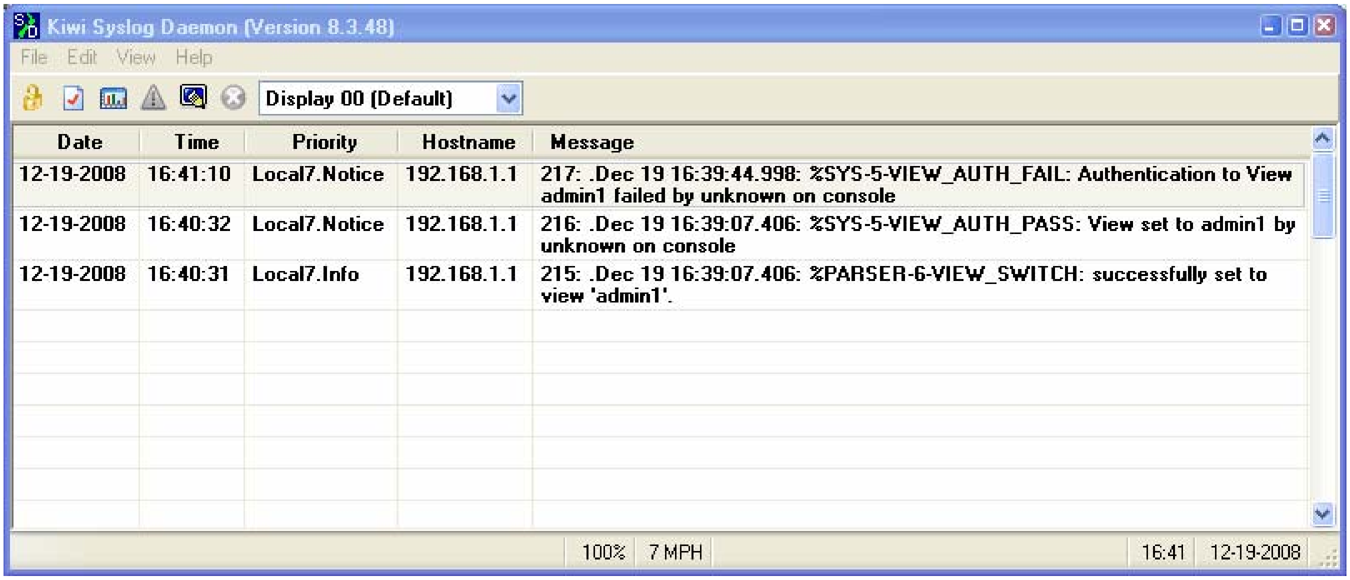
```
R1>enable view admin1
Password:
```

Note: You can enable the desired view from the user EXEC prompt. This allows different users to login without having to know the privileged EXEC mode enable secret password.

g. Exit to the login screen again, and enable the admin1 view. This time enter the password incorrectly. What message was displayed on the syslog server?

```
R1>enable view admin1
Password:
```

Your screen should look similar to the one below



Date	Time	Priority	Hostname	Message
12-19-2008	16:41:10	Local7.Notice	192.168.1.1	217: .Dec 19 16:39:44.998: %SYS-5-VIEW_AUTH_FAIL: Authentication to View admin1 failed by unknown on console
12-19-2008	16:40:32	Local7.Notice	192.168.1.1	216: .Dec 19 16:39:07.406: %SYS-5-VIEW_AUTH_PASS: View set to admin1 by unknown on console
12-19-2008	16:40:31	Local7.Info	192.168.1.1	215: .Dec 19 16:39:07.406: %PARSER-6-VIEW_SWITCH: successfully set to view 'admin1'.

Part 5: Configure Automated Security Features

In Part 5 of this lab, you will:

- Restore routers R1 and R3 to their basic configuration.
- Use AutoSecure to secure R3.
- Use the SDM Security Audit tool on router R1 to identify security risks.
- Fix security problems on R1 using the Security Audit tool.
- Review router security configurations with SDM and the CLI.

Task 1: Restore Router R3 to Its Basic Configuration

To avoid confusion as to what was already entered and what AutoSecure provides for the router configuration, start by restoring router R3 to its basic configuration.

Step 1: Erase and reload the router.

a. Connect to the R3 console and login as admin.

b. Enter privileged EXEC mode.

c. Erase the startup config and then reload the router.

Step 2: Restore the basic configuration.

a. When the router restarts, restore the basic configuration for R3 that was created and saved in Part 1 of this lab.

b. Issue the **`show run`** command to view the current running configuration. Are there any security related commands? ____

c. Test connectivity by pinging from host PC-A on the R1 LAN to PC-C on the R3 LAN. If the pings are not successful, troubleshoot the router and PC configurations until they are.

d. Save the running config to the startup config using the **`copy run start`** command.

Task 2. Use AutoSecure to Secure R3

By using a single command in CLI mode, the AutoSecure feature allows you to disable common IP services that can be exploited for network attacks and enable IP services and features that can aid in the defense of a network when under attack. AutoSecure simplifies the security configuration of a router and hardens the router configuration.

Step 1: Use the AutoSecure Cisco IOS feature.

a. Enter privileged EXEC mode using the **`enable`** command.

b. Issue the **`auto secure`** command on R3 to lock down the router. Router R2 represents an ISP router, so assume that R3 S0/0/1 is connected to the Internet when prompted by the AutoSecure questions. Respond to the AutoSecure questions as shown in the following output. The responses are bolded.

```
R3#auto secure
                --- AutoSecure Configuration ---

*** AutoSecure configuration enhances the security of the router, but it will
not make it absolutely resistant to all security attacks ***

AutoSecure will modify the configuration of your device. All configuration
changes will be shown. For a detailed explanation of how the configuration
changes enhance security and any possible side effects, please refer to
Cisco.com for
Autosecure documentation.
At any prompt you may enter '?' for help.
Use ctrl-c to abort this session at any prompt.

Gathering information about the router for AutoSecure

Is this router connected to internet? [no]:  yes
   Enter the number of interfaces facing the internet [1]:  Press ENTER to
   accept the default of 1 in square brackets.


   Interface          IP-Address  OK?  Method Status                  Protocol

   FastEthernet0/0    unassigned  YES  NVRAM  administratively down   down

   FastEthernet0/1    192.168.3.1 YES  NVRAM  up                      up

   Serial0/0/0        unassigned  YES  NVRAM  administratively down   down

   Serial0/0/1        10.2.2.1    YES  NVRAM  up                      up


   Enter the interface name that is facing the internet: serial0/0/1

   Securing Management plane services...

   Disabling service finger
   Disabling service pad
   Disabling udp & tcp small servers
   Enabling service password encryption
   Enabling service tcp-keepalives-in
   Enabling service tcp-keepalives-out
   Disabling the cdp protocol

   Disabling the bootp server
   Disabling the http server
   Disabling the finger service
   Disabling source routing
   Disabling gratuitous arp

   Here is a sample Security Banner to be shown
   at every access to device. Modify it to suit your
```

```
enterprise requirements.

Authorized Access only
  This system is the property of So-&-So-Enterprise.
  UNAUTHORIZED ACCESS TO THIS DEVICE IS PROHIBITED.
  You must have explicit permission to access this
  device. All activities performed on this device
  are logged. Any violations of access policy will result
  in disciplinary action.

Enter the security banner {Put the banner between
k and k, where k is any character}:

# Unauthorized Access Prohibited #

Enable secret is either not configured or
 is the same as enable password
Enter the new enable secret: cisco12345
Confirm the enable secret : cisco12345
Enter the new enable password: cisco67890
Confirm the enable password: cisco67890

Configuration of local user database
Enter the username: admin
Enter the password: cisco12345
Confirm the password: cisco12345
Configuring AAA local authentication
Configuring Console, Aux and VTY lines for
local authentication, exec-timeout, and transport
Securing device against Login Attacks
Configure the following parameters

Blocking Period when Login Attack detected: 60

Maximum Login failures with the device: 2

Maximum time period for crossing the failed login attempts: 30

Configure SSH server? [yes]: Press ENTER to accept the default of yes

Enter the domain-name: ccnasecurity.com

Configuring interface specific AutoSecure services
Disabling the following ip services on all interfaces:

 no ip redirects
 no ip proxy-arp
 no ip unreachables
 no ip directed-broadcast
 no ip mask-reply
Disabling mop on Ethernet interfaces

Securing Forwarding plane services...

Enabling CEF (This might impact the memory requirements for your platform)
Enabling unicast rpf on all interfaces connected
to internet
```

```
Configure CBAC Firewall feature? [yes/no]: no
Tcp intercept feature is used prevent tcp syn attack
on the servers in the network. Create autosec_tcp_intercept_list
to form the list of servers to which the tcp traffic is to
be observed


Enable tcp intercept feature? [yes/no]: yes

This is the configuration generated:

no service finger
no service pad
no service udp-small-servers
no service tcp-small-servers
service password-encryption
service tcp-keepalives-in
service tcp-keepalives-out
no cdp run
no ip bootp server
no ip http server
no ip finger
no ip source-route
no ip gratuitous-arps
no ip identd
banner motd ^C Unauthorized Access Prohibited ^C
security passwords min-length 6
security authentication failure rate 10 log
enable secret 5 $1$FmV1$.xZUegmNYFJwJv/oFwwvG1
enable password 7 045802150C2E181B5F
username admin password 7 01100F175804575D72
aaa new-model
aaa authentication login local_auth local
line con 0
 login authentication local_auth
 exec-timeout 5 0
 transport output telnet
line aux 0
 login authentication local_auth
 exec-timeout 10 0
 transport output telnet
line vty 0 4
 login authentication local_auth
 transport input telnet
line tty 1
 login authentication local_auth
 exec-timeout 15 0
login block-for 60 attempts 2 within 30
ip domain-name ccnasecurity.com
crypto key generate rsa general-keys modulus 1024
ip ssh time-out 60
ip ssh authentication-retries 2
line vty 0 4
 transport input ssh telnet
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
logging facility local2
logging trap debugging
```

```
service sequence-numbers
logging console critical
logging buffered
interface FastEthernet0/0
 no ip redirects
 no ip proxy-arp
 no ip unreachables
 no ip directed-broadcast
 no ip mask-reply
 no mop enabled
interface FastEthernet0/1
 no ip redirects
 no ip proxy-arp
 no ip unreachables
 no ip directed-broadcast
 no ip mask-reply
 no mop enabled
interface Serial0/0/0
 no ip redirects
 no ip proxy-arp
 no ip unreachables
 no ip directed-broadcast
 no ip mask-reply
interface Serial0/0/1
 no ip redirects
 no ip proxy-arp
 no ip unreachables
 no ip directed-broadcast
 no ip mask-reply
interface Vlan1
 no ip redirects
 no ip proxy-arp
 no ip unreachables
 no ip directed-broadcast
 no ip mask-reply
 no mop enabled
ip cef
access-list 100 permit udp any any eq bootpc
interface Serial0/0/1
 ip verify unicast source reachable-via rx allow-default 100
ip tcp intercept list autosec_tcp_intercept_list
ip tcp intercept drop-mode random
ip tcp intercept watch-timeout 15
ip tcp intercept connection-timeout 3600
ip tcp intercept max-incomplete low 450
ip tcp intercept max-incomplete high 550
!
end

Apply this configuration to running-config? [yes]: <ENTER>

Applying the config generated to running-config
The name for the keys will be: R3.ccnasecurity.com

% The key modulus size is 1024 bits
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]

R3#
```

```
000037: *Dec 19 21:18:52.495 UTC: %AUTOSEC-1-MODIFIED: AutoSecure
configuration
has been Modified on this device
```

Step 2: Establish an SSH connection from PC-C to R3.

a. Start PuTTy or another SSH client, and log in with the **admin** account and password **cisco12345** created when AutoSecure was run. Enter the IP address of the R3 Fa0/1 interface 192.168.3.1.

b. Because AutoSecure configured SSH on R3, you will receive a PuTTY security warning. Click **Yes** to connect anyway.

c. Enter privileged EXEC mode, and verify the R3 configuration using the **`show run`** command.

d. Issue the **`show flash`** command. Is there a file that might be related to AutoSecure, and if so what is its name and when was it created? ____

e. Issue the command **`more flash:pre_autosec.cfg`**. What are the contents of this file, and what is its purpose? ____

f. How would you restore this file if AutoSecure did not produce the desired results?

____

Step 3: Contrast the AutoSecure-generated configuration of R3 with the manual configuration of R1.

a. What security-related configuration changes were performed on R3 by AutoSecure that were not performed in previous sections of the lab on R1?

____
____
____
____

b. What security-related configuration changes were performed in previous sections of the lab that were not performed by AutoSecure?

____
____

c. Identify at least five unneeded services that were locked down by AutoSecure and at least three security measures applied to each interface.

Note: Some of the services listed as being disabled in the AutoSecure output above might not appear in the **`show running-config`** output because they are already disabled by default for this router and Cisco IOS version.

Services disabled include:

____
____
____

For each interface, the following were disabled:

____
____
____

Step 4: Test connectivity.

Ping from PC-A on the R1 LAN to PC-C on the router R3 LAN. Were the pings successful? _____

If pings from PC-A to PC-C are not successful, troubleshoot before continuing.

Task 3. Restore R1 to Its Basic Configuration

To avoid confusion as to what was previously configured and what SDM Security Audit tool provides for the router configuration, start by restoring router R1 to its basic configuration.

Step 1: Erase and reload the router.

a. Connect to the R1 console and log in as admin.

b. Enter privileged EXEC mode.

c. Erase the startup config and then reload the router.

Step 2: Restore the basic config.

a. When the router restarts, cut and paste the basic startup config for R1 that was created and saved in Part 1 of this lab.

b. Test connectivity by pinging from host PC-A to R1. If the pings are not successful, troubleshoot the router and PC configurations to verify connectivity before continuing.

c. Save the running config to the startup config using the **`copy run start`** command.

Task 4. Use the SDM Security Audit Tool on R1 to Identify Security Risks

In this task, you use the SDM graphical user interface to analyze security vulnerabilities on router R1. SDM is faster than typing each command and gives you more control than the AutoSecure feature.

Step 1: Verify whether SDM is installed on router R1.

```
R1#show flash
-#- -length-- --date/time------ path
1    37081324   Dec 16 2008 21:57:10 c1841-advipservicesk9-mz.124-20.T1.bin
2    6389760    Dec 16 2008 22:06:56 sdm.tar
<Output omitted>
```

Note: SDM can be run from the PC or the router. If SDM is not installed on your router, check to see if it is installed on the PC. Otherwise, consult your instructor for directions.

Step 2: Create an SDM user and enable the HTTP secure server on R1.

a. Create a privilege-level 15 username and password on R1.

```
R1(config)#username admin privilege 15 secret 0 cisco12345
```

b. Enable the HTTP secure server on R1.

```
R1(config)#ip http secure-server
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]
```

```
R1(config)#
*Dec 19 17:01:07.763: %SSH-5-ENABLED: SSH 1.99 has been enabled
*Dec 19 17:01:08.731: %PKI-4-NOAUTOSAVE: Configuration was modified.
Issue
"write memory" to save new certificate
```

c. Enable local HTTP authentication on R1.

```
R1(config)#ip http authentication local
R1(config)#end
```

d. Save the running config to the startup config.

```
R1#copy run start
```

Step 3: Start SDM.

a. From PC-A, run the SDM application and enter the IP address of R1 FA0/1 (192.168.1.1) or open a web browser and navigate to https://192.168.1.1.

b. **Note:** Make sure that you have all pop-up blockers turned off in your browser. Also make sure that Java is installed and updated.

c. When the certification error message is displayed, click **Continue to this web site**.

d. Log in with the previously configured username and password.

```
username: admin
password: cisco12345
```

e. At the **Warning Security** messages, click **Yes.**

f. At the **Password Needed – Networking** message, enter the username and password again.

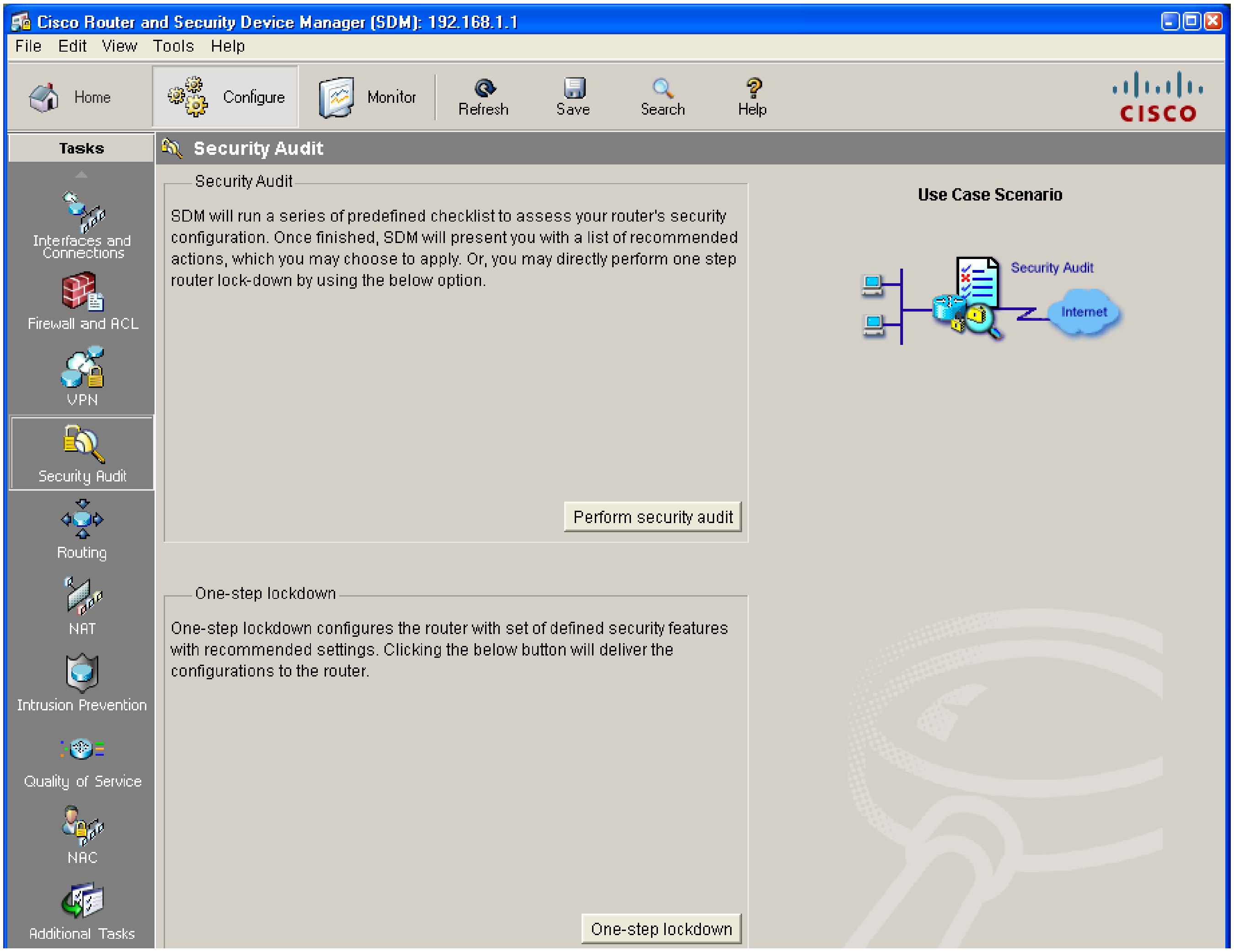
Step 4. Back up the current router configuration.

a. Back up the router configuration from within SDM by choosing **File > Save Running Config to PC**.

b. Save the configuration on the desktop using the default name of SDMConfig.txt.

Step 5. Begin the security audit.

a. Select **Configure > Security Audit**.



Security Audit

SDM will run a series of predefined checklist to assess your router's security configuration. Once finished, SDM will present you with a list of recommended actions, which you may choose to apply. Or, you may directly perform one step router lock-down by using the below option.

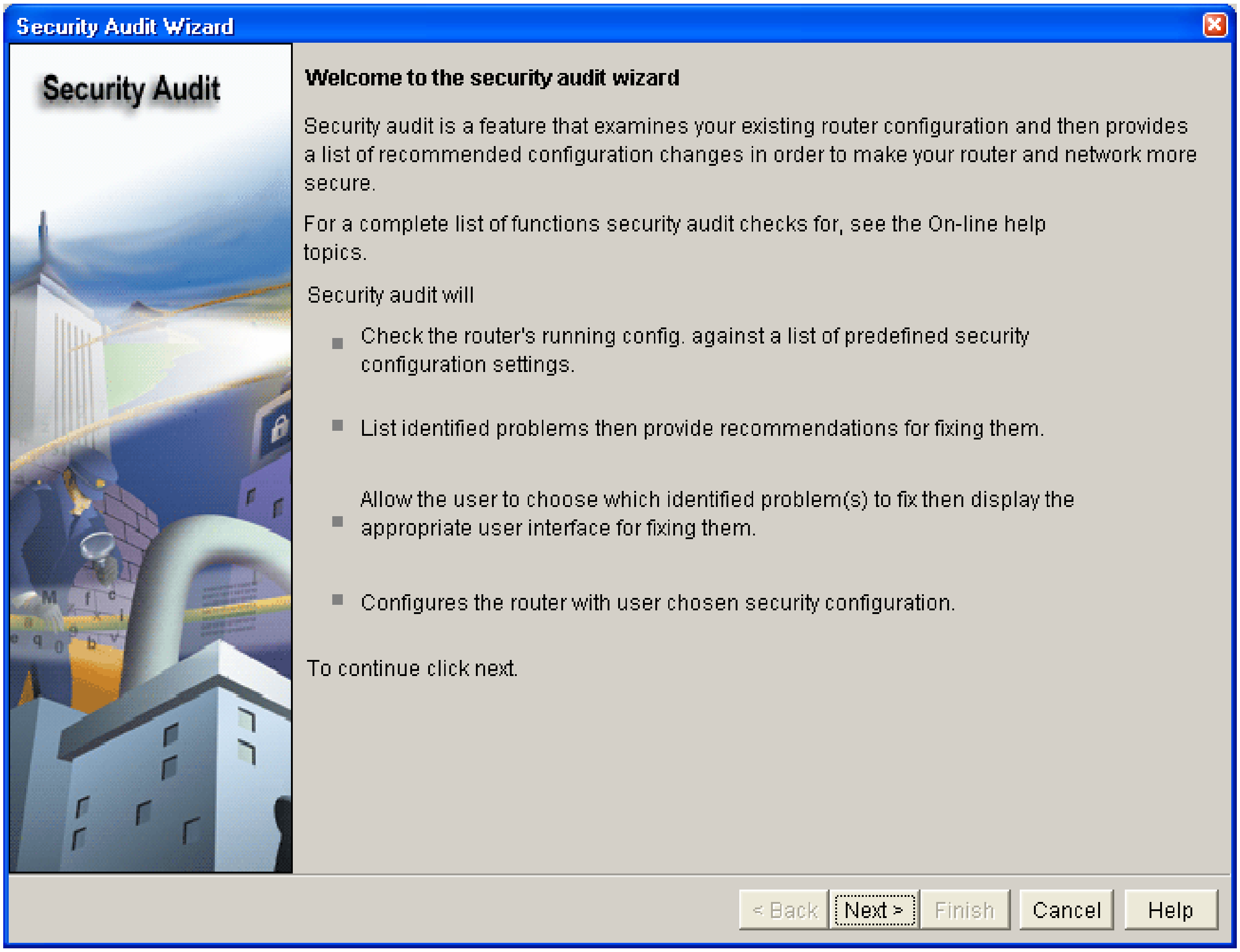
One-step lockdown

One-step lockdown configures the router with set of defined security features with recommended settings. Clicking the below button will deliver the configurations to the router.

b. Click the **Perform Security Audit** button to start the Security Audit wizard, which analyzes potential vulnerabilities. This helps you become familiar with the types of vulnerabilities that **Security Audit** can identify. You will be given an opportunity to fix all or selected security problems after the audit finishes..

Note: The Security Audit tool also provides a **One-Step Lockdown** option that performs a function similar to AutoSecure but does not prompt the user for input.

c. After you have familiarized yourself with the wizard instructions, click **Next**.



Welcome to the security audit wizard

Security audit is a feature that examines your existing router configuration and then provides a list of recommended configuration changes in order to make your router and network more secure.

For a complete list of functions security audit checks for, see the On-line help topics.

Security audit will

- Check the router's running config. against a list of predefined security configuration settings.
- List identified problems then provide recommendations for fixing them.
- Allow the user to choose which identified problem(s) to fix then display the appropriate user interface for fixing them.
- Configures the router with user chosen security configuration.

To continue click next.

d. On the Security Audit Interface Configuration window, indicate which of the interfaces that are shown are inside (trusted) and which are outside (untrusted). For interface Fa0/1, select **Inside (trusted)**. For interface S0/0/0, select **Outside (untrusted)**.

e. Click **Next** to check security configurations. You can watch the security audit progress.

Step 6: Identify Security Audit unneeded services and recommended configurations.

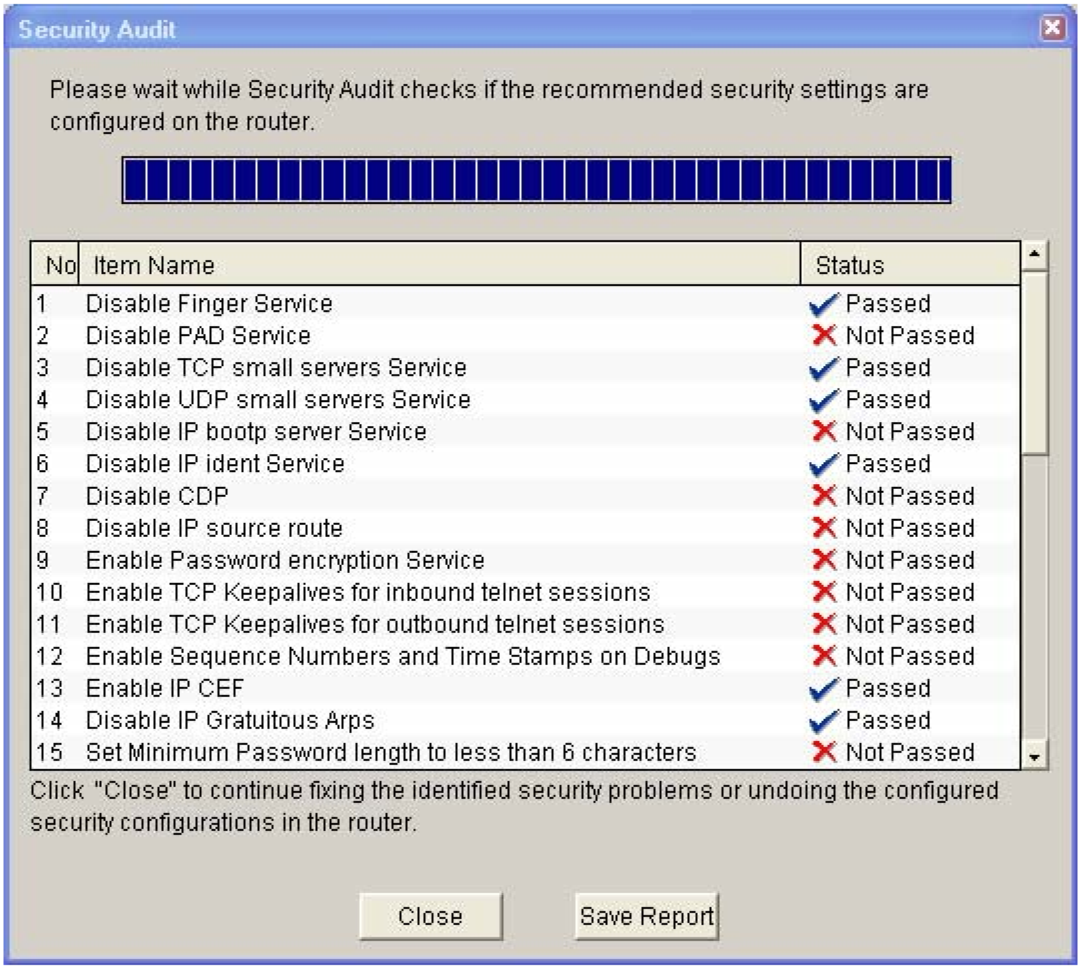
a. Scroll through the Security Audit results screen. What are some of the major vulnerabilities listed as Not Passed?

____

____

____

b. After reviewing the Security Audit report, click **Save Report**. Save it to the desktop using the default name SDMSecurityAuditReportCard.html.



Please wait while Security Audit checks if the recommended security settings are configured on the router.

No	Item Name	Status
1	Disable Finger Service	✓ Passed
2	Disable PAD Service	✗ Not Passed
3	Disable TCP small servers Service	✓ Passed
4	Disable UDP small servers Service	✓ Passed
5	Disable IP bootp server Service	✗ Not Passed
6	Disable IP ident Service	✓ Passed
7	Disable CDP	✗ Not Passed
8	Disable IP source route	✗ Not Passed
9	Enable Password encryption Service	✗ Not Passed
10	Enable TCP Keepalives for inbound telnet sessions	✗ Not Passed
11	Enable TCP Keepalives for outbound telnet sessions	✗ Not Passed
12	Enable Sequence Numbers and Time Stamps on Debugs	✗ Not Passed
13	Enable IP CEF	✓ Passed
14	Disable IP Gratuitous Arps	✓ Passed
15	Set Minimum Password length to less than 6 characters	✗ Not Passed

Click "Close" to continue fixing the identified security problems or undoing the configured security configurations in the router.

c. Open the report card HTML document you saved on the desktop to view the contents and then close it.

Task 5. Fix Security Problems on R1 Using the Security Audit Tool

In this task, you will use the Security Audit wizard to make the necessary changes to the router configuration.

Step 1: Review the Security Problems Identified window for potential items to fix.

a. In the Security Audit window, click **Close**.

b. A window appears listing the items that did not pass the security audit. Click **Next** without choosing any items. What message did you get? ____

c. Click **OK** to remove the message.

Step 2: Fix security problems.

With the Security Audit tool, you can fix selected problems or all security problems identified.

a. Click **Fix All** and then click **Next** to fix all security problems.

b. When prompted, enter an enable secret password of cisco12345 and confirm it.

c. Enter the text for the login banner: Unauthorized Access Prohibited. Click **Next**.

d. Add the logging host IP address 192.168.1.3, and accept the logging defaults. Click **Next**.

e. Accept the default security settings for inside and outside interfaces and click **Next**.

f. Deselect **URL Filter Server,** and click **Next**.

g. For the security level, select **Low Security** and click **Next**.

h. At the Firewall Configuration Summary, review the configuration and click **Finish**.

i. Scroll through the Summary screen. This screen shows what Security Audit will configure for the router.

j. Click **Finish** to see the actual commands that are delivered to the router. Scroll to review the commands.

k. Make sure that **Save running config to router's startup config** is selected, and click **Deliver**.

l. Click **OK** in the Commands Delivery Status window to exit the Security Audit tool. How many commands were delivered to the router? ________________

Task 6. Review Router Security Configurations with SDM and the CLI

In this task, you will use Cisco SDM to review changes made by Security Audit on router R1 and compare them to those made by AutoSecure on R3.

Step 1: View the running configs for R1 and R3.

a. From the PC-A SDM session with R1, click the **View** option from the main menu and select **Running Config**.

b. Using PuTTY, open an SSH connection to router R3, and log in as admin.

c. Enter privileged EXEC mode, and issue the **`show run`** **c**ommand.

Step 2: Contrast AutoSecure with SDM Security Audit.

a. Compare the function and ease of use between AutoSecure and SDM Security Audit. What are some similarities and differences?

____

____

____

____

b. Refer to the AutoSecure configuration on R3 and the SDM Security Audit configuration on R1. What are some similarities and differences between the configurations generated by AutoSecure and Security Audit?

____

____

____

____

____

Step 3: Test connectivity.

a. Ping from router R1 to the router R3 S0/0/1 interface (10.2.2.1). Were the pings successful? Why or why not? ____

Note: Firewalls are covered in detail in Chapter 4.

b. Ping from PC-A on the R1 LAN to PC-C on the router R3 LAN. Were the pings successful? Why or why not? ____

c. Ping from router R3 to the router R2 S0/0/0 interface (10.1.1.2). Were the pings successful? Why or why not? ____

d. Ping from router R3 to the router R1 S0/0/0 interface (10.1.1.1). Were the pings successful? Why or why not? ____

e. Ping from PC-C on the R3 LAN to PC-A on the router R1 LAN. Were the pings successful? Why or why not? ____

Task 7. Reflection

a. How important is securing router access and monitoring network devices to ensure responsibility and accountability and for thwarting potentially malicious activity.

____

____

____

b. What advantages does SSH have over Telnet?

____

____

c. What advantages does Telnet have over SSH?

____

____

d. How scalable is setting up usernames and using the local database for authentication?

____

____

____

e. Why it is better to have centralized logging servers rather than only have the routers log locally?

____

____

____

f. What are some advantages to using automated security mechanisms like AutoSecure and SDM Security Audit?

____

____

____

Router Interface Summary Table

Router Interface Summary				
Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
1700	Fast Ethernet 0 (FA0)	Fast Ethernet 1 (FA1)	Serial 0 (S0)	Serial 1 (S1)
1800	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2600	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0 (S0/0)	Serial 0/1 (S0/1)
2800	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)

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.