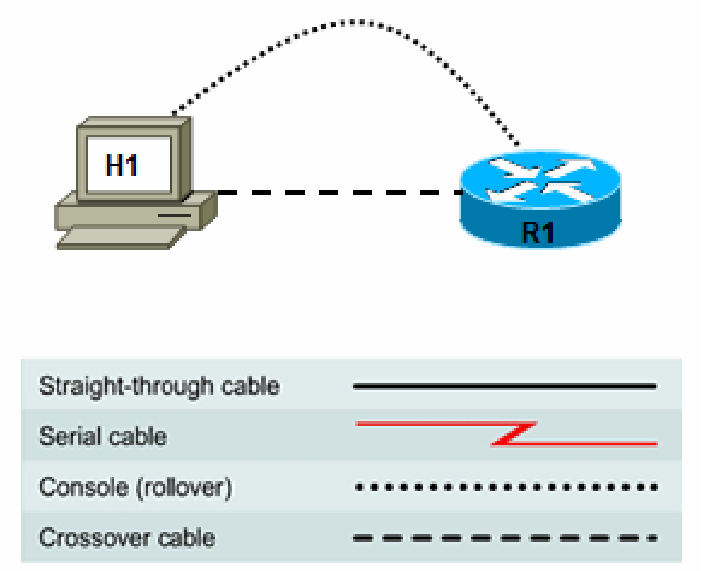
Lab 8.3.3b Configuring a Remote Router Using SSH



Objectives

- Use SDM to configure a router to accept SSH connections.
- Configure SSH client software on a PC.
- Establish a connection to a Cisco ISR using SSH version 2.
- Check the existing running configuration.
- Configure a non-SDM router for SSH using the Cisco IOS CLI.

Background / Preparation

In the past, Telnet was the most common network protocol used to remotely configure network devices. However, protocols such as Telnet do not authenticate or encrypt the information between the client and server. This allows a network sniffer to intercept passwords and configuration information.

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. SSH is most often used to log in to a remote machine and execute commands; however, it can also transfer files using the associated SFTP or SCP protocols.

For SSH to function, the network devices communicating must support it. In this lab, you enable the SSH server on a router and then connect to that router using a PC with an SSH client installed. On a local network, the connection is normally made using Ethernet and IP. Network devices connected via other types of links, such as serial, can also be managed using SSH as long as they support IP. Like Telnet, SSH is an in-band, TCP/IP-based Internet protocol.

You can use either Cisco SDM or Cisco IOS CLI commands to configure SSH on the router. The Cisco 1841 ISR supports SSH versions 1 and 2; version 2 is preferred. The SSH client used in this lab is PuTTY, which can be downloaded free of charge. If you are working with a router that does not have SDM installed, use

Cisco IOS CLI commands to configure SSH. Instructions are provided in Step 2 of this lab. To perform the basic router configuration, see Lab 5.3.5, “Configuring Basic Router Settings with the Cisco IOS CLI.”

The Cisco SDM is supported on a wide range of Cisco routers and Cisco IOS software releases. Many newer Cisco routers come with SDM pre-installed. This lab uses a Cisco 1841 router, which has SDM (and SDM Express) pre-installed. You can use another router model that supports SDM. If the router does not have SDM installed, you can download the latest version free of charge at http://www.cisco.com/pcgi-bin/tablebuild.pl/sdm. From this web page, you can also view or download “Downloading and Installing Cisco Router and Security Device Manager.” This document provides instructions and system requirements for installing SDM.

Note: If you are using SDM to configure SSH, you must complete Lab 5.2.3, “Configuring an ISR with SDM Express,” on the router to be used before performing this lab. This lab assumes that the router has been previously configured with basic settings.

Note: If the startup-config is erased from an SDM router, SDM no longer comes up by default when the router is restarted. In this case, it is necessary to build a basic router configuration using Cisco IOS commands. See the procedure at the end of this lab or contact the instructor.

Required Resources

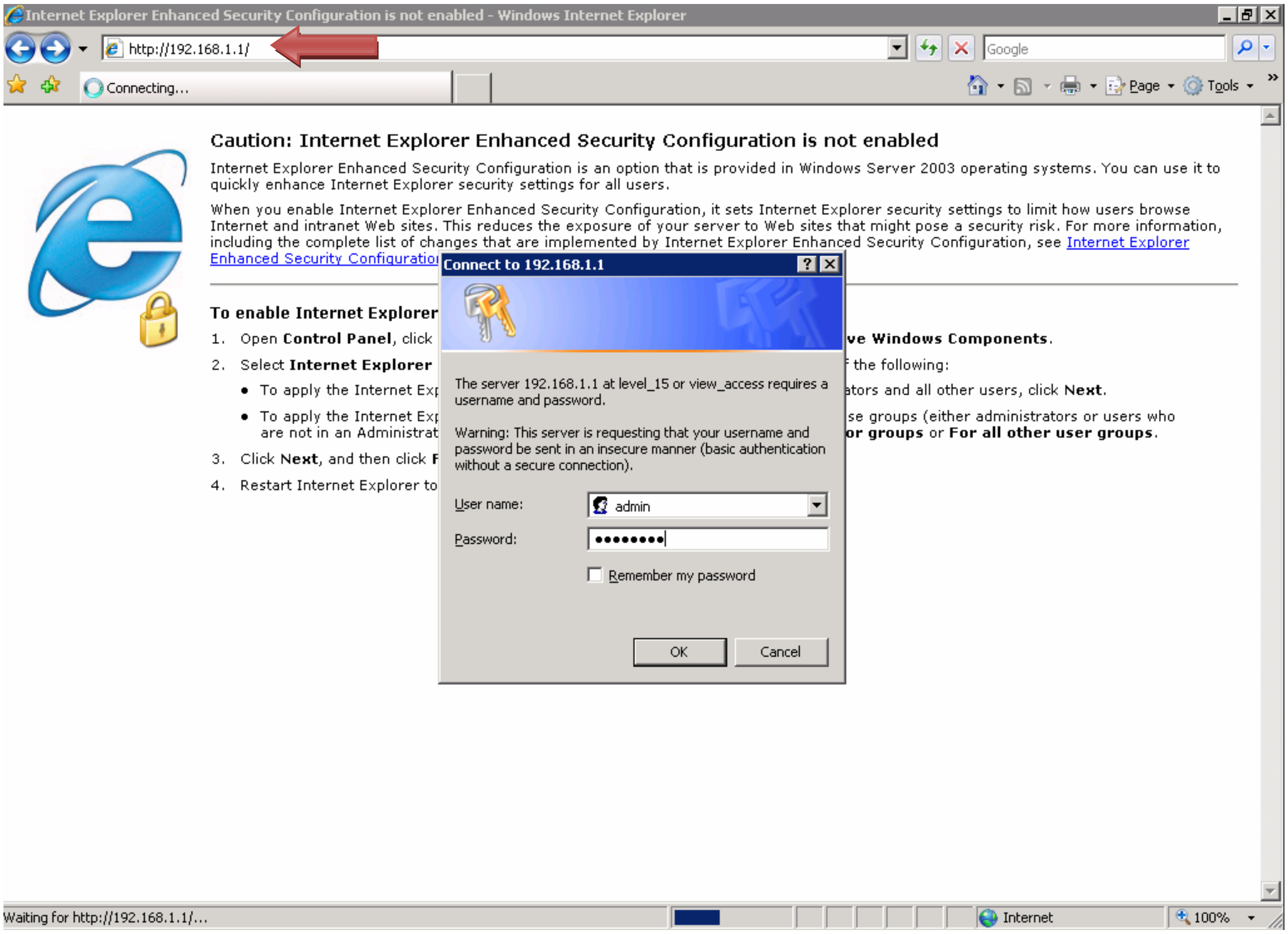
The following resources are required:

- Cisco 1841 ISR router with SDM version 2.4 installed and with basic configuration completed
- (Optional) Other Cisco router model with SDM installed
- (Optional) Other Cisco router model without SDM installed (Cisco IOS software version 12.2 or later; must support SSH)
- Windows XP computer with Internet Explorer 5.5 or later and Sun Java Runtime Environment (JRE) version 1.4.2_05 or later (or Java Virtual Machine (JVM) 5.0.0.3810)
- Latest release of putty.exe client installed on the PC and accessible on the desktop
- Straight-through or crossover Category 5 Ethernet cable (for SDM and SSH)
- (Optional) Console cable, if router is to be configured using the CLI
- Access to the PC command prompt
- Access to PC network TCP/IP configuration

Step 1: Use SDM to configure the router to accept SSH connections.

Note: If you are configuring a router that does not have SDM installed, just read through Step 1 to see how SSH is set up as a separate task when using SDM, and then go to Step 2.

a. Connect to the router Fa0/0 interface. Open the web browser and connect to http://192.168.1.1. When prompted, enter **admin** for the username and **cisco123** for the password. Click **OK**. Cisco SDM loads.


Internet Explorer Enhanced Security Configuration is not enabled - Windows Internet Explorer
http://192.168.1.1/
Google
Connecting...
Page
Tools

Caution: Internet Explorer Enhanced Security Configuration is not enabled

Internet Explorer Enhanced Security Configuration is an option that is provided in Windows Server 2003 operating systems. You can use it to quickly enhance Internet Explorer security settings for all users.

When you enable Internet Explorer Enhanced Security Configuration, it sets Internet Explorer security settings to limit how users browse Internet and intranet Web sites. This reduces the exposure of your server to Web sites that might pose a security risk. For more information, including the complete list of changes that are implemented by Internet Explorer Enhanced Security Configuration, see Internet Explorer Enhanced Security Configuratio

To enable Internet Explorer

1. Open **Control Panel**, click ve **Windows Components**.
2. Select **Internet Explorer** f the following:
   - To apply the Internet Exp ators and all other users, click **Next**.
   - To apply the Internet Exp se groups (either administrators or users who are not in an Administrat or groups or **For all other user groups**.
3. Click **Next**, and then click **F**
4. Restart Internet Explorer to

Connect to 192.168.1.1

The server 192.168.1.1 at level_15 or view_access requires a username and password.

Warning: This server is requesting that your username and password be sent in an insecure manner (basic authentication without a secure connection).

User name: admin

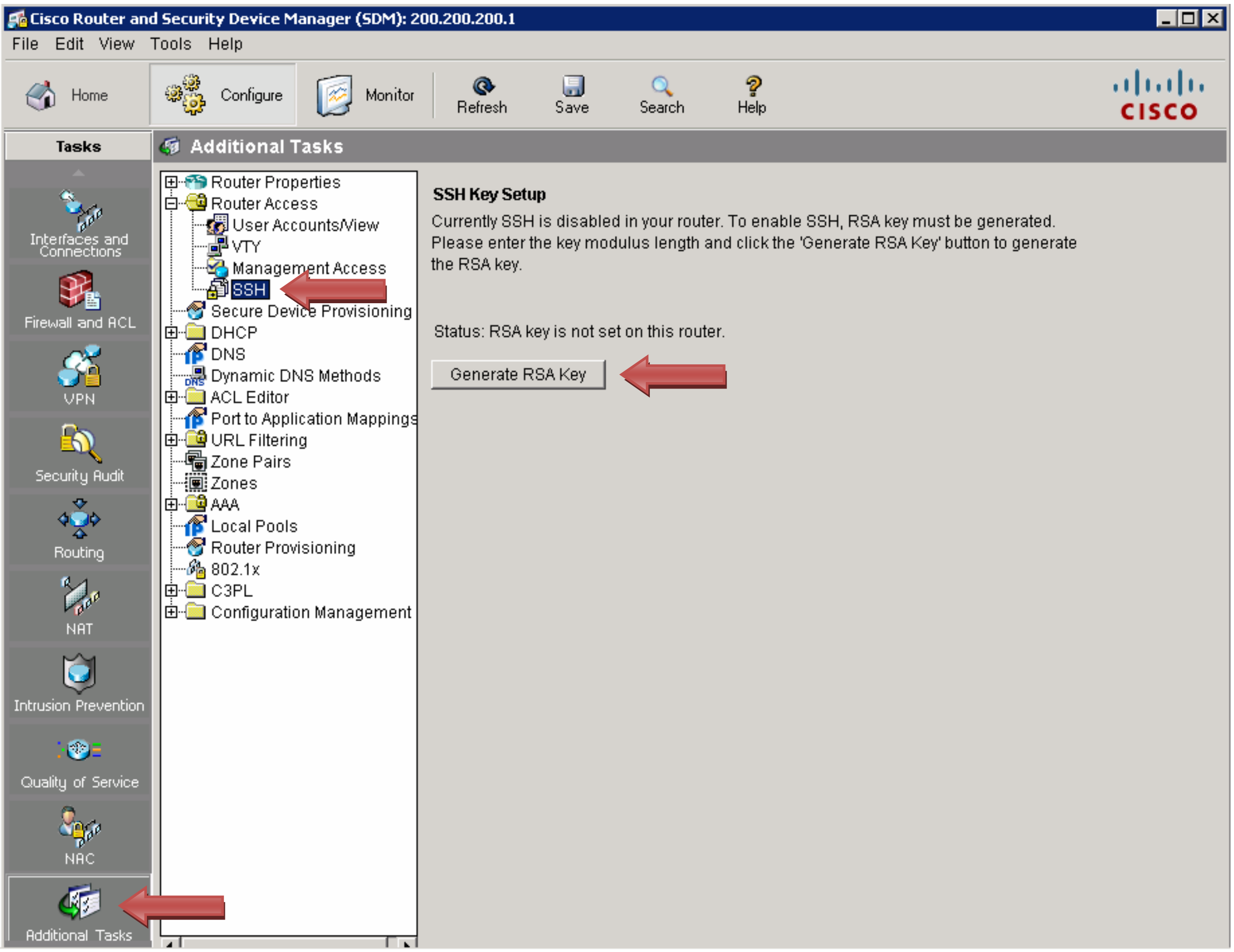
Password: ••••••••

☐ Remember my password

OK Cancel

Waiting for http://192.168.1.1/...

b. Click the **Configure** button on the tool bar. In the Tasks pane, click **Additional Tasks**. In the Additional Tasks pane, expand **Router Access** and click the **SSH** task. Then click the **Generate RSA Key** button.



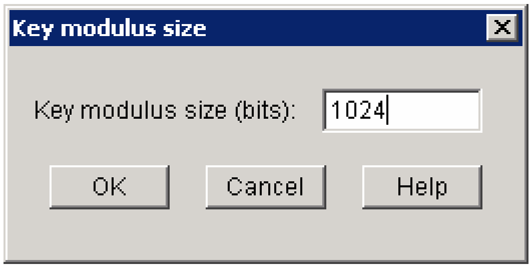
SSH Key Setup

Currently SSH is disabled in your router. To enable SSH, RSA key must be generated. Please enter the key modulus length and click the 'Generate RSA Key' button to generate the RSA key.

Status: RSA key is not set on this router.

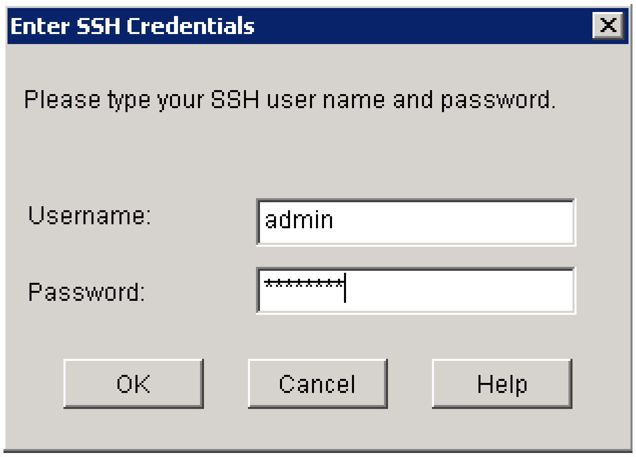
Note: If the **SSH Key Setup** message says: “RSA key exists and SSH is enabled in your router” and the **Status** is “RSA key is set on this router,” you probably completed Lab 5.2.3, “Configuring an ISR with SDM Express.” In that lab, when you configured security, one of the recommended security settings enabled by default is “Enhance security on this router.” If this box is checked, it automatically configures SSH for router access, sets the banner to warn intruders, enforces minimum password length, and restricts the number of unsuccessful login attempts.

c. In the **Key modulus size** dialog box, enter a key size of **1024** bits. Click **OK**.



Key modulus size (bits): 1024

d. In the **Enter SSH Credentials** dialog box, enter **admin** for the username and **cisco123** for the password. Click **OK**.

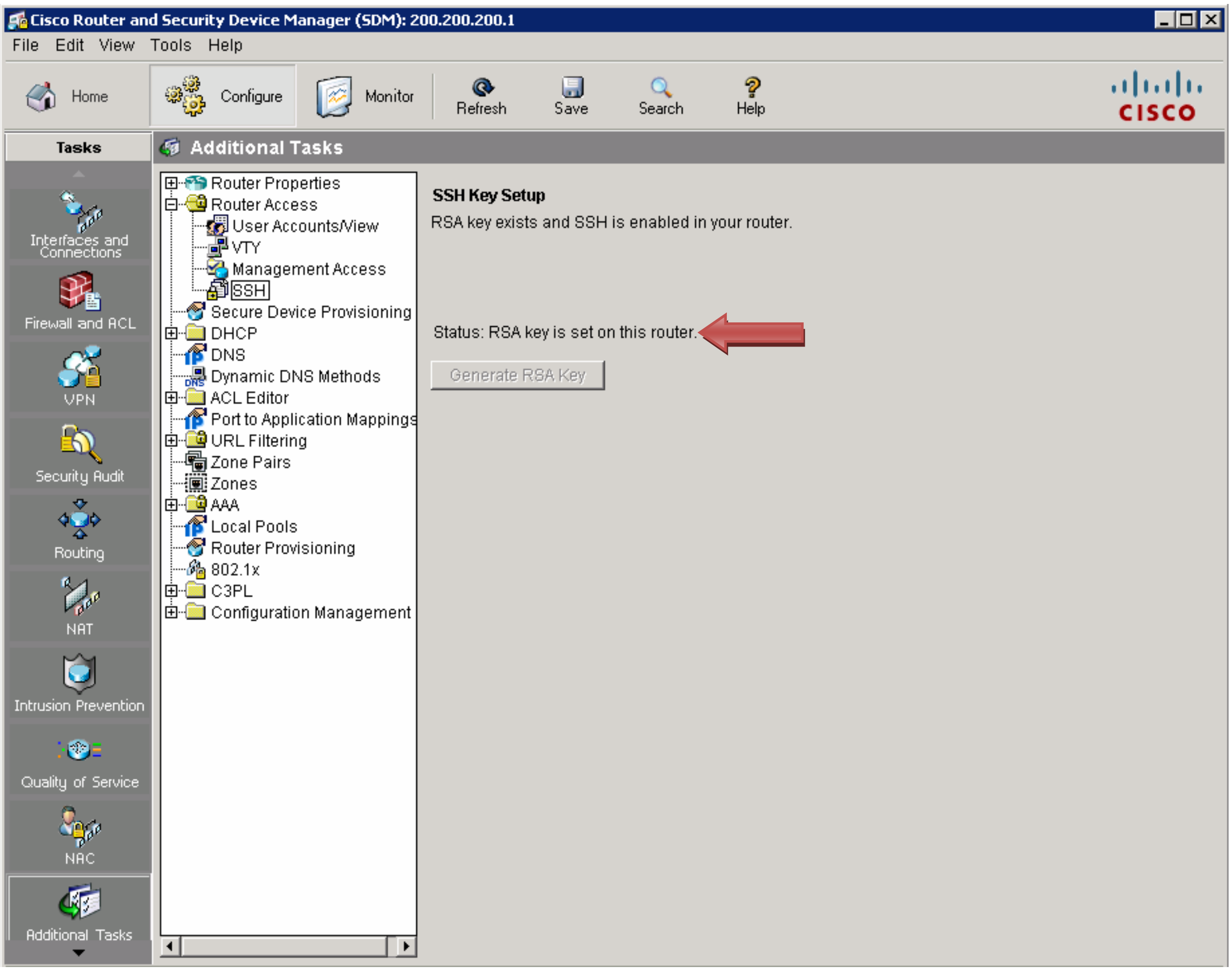


Please type your SSH user name and password.

Username: admin

Password: ********

e. Notice that the RSA key is now set on the router.

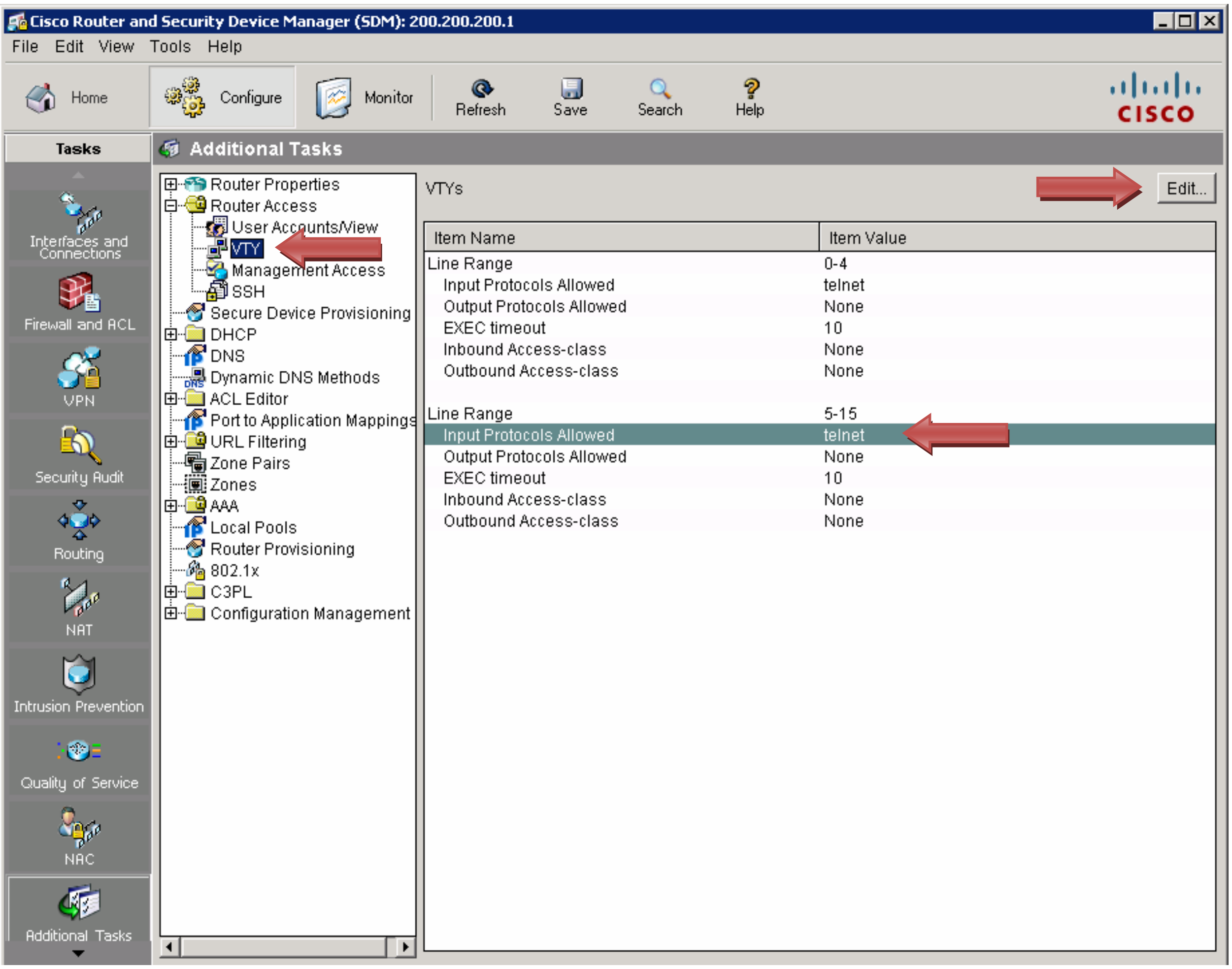


SSH Key Setup

RSA key exists and SSH is enabled in your router.

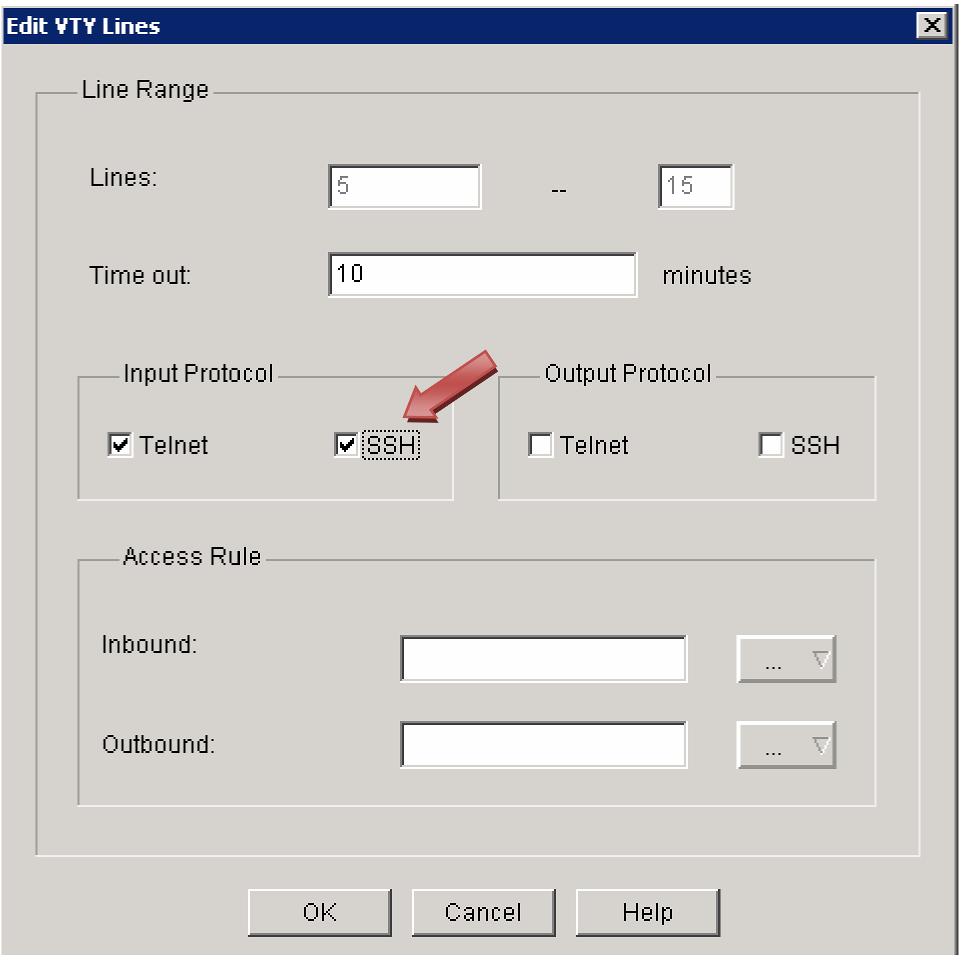
Status: RSA key is set on this router.

f. In the Additional Tasks pane, click the **VTY** option. Select **Input Protocols Allowed,** and then click the **Edit** button.



Item Name	Item Value
Line Range	0-4
Input Protocols Allowed	telnet
Output Protocols Allowed	None
EXEC timeout	10
Inbound Access-class	None
Outbound Access-class	None
Line Range	5-15
Input Protocols Allowed	telnet
Output Protocols Allowed	None
EXEC timeout	10
Inbound Access-class	None
Outbound Access-class	None

g. Check the **SSH** box for the Input Protocol, and then click **OK**.


Edit VTY Lines

Line Range

Lines: 5 -- 15

Time out: 10 minutes

Input Protocol: ☑ Telnet ☑ SSH

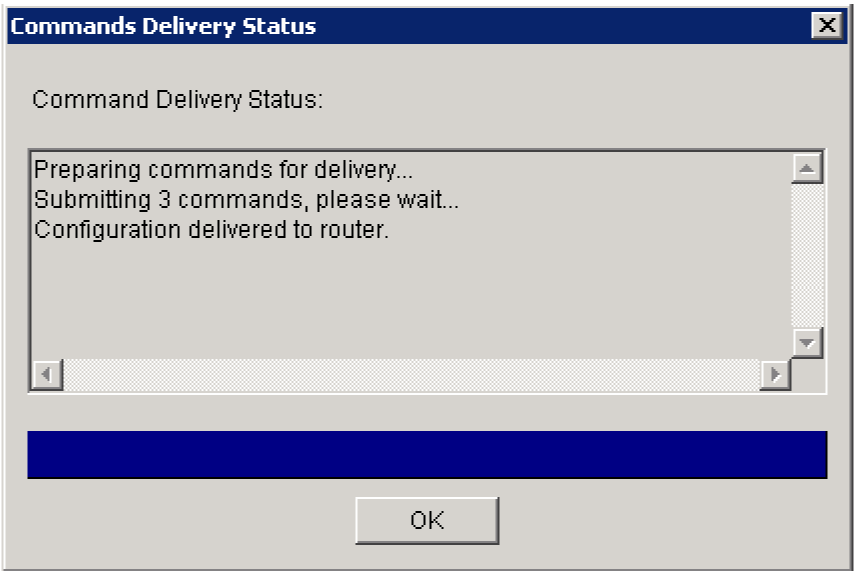
Output Protocol: □ Telnet □ SSH

Access Rule

Inbound:

Outbound:

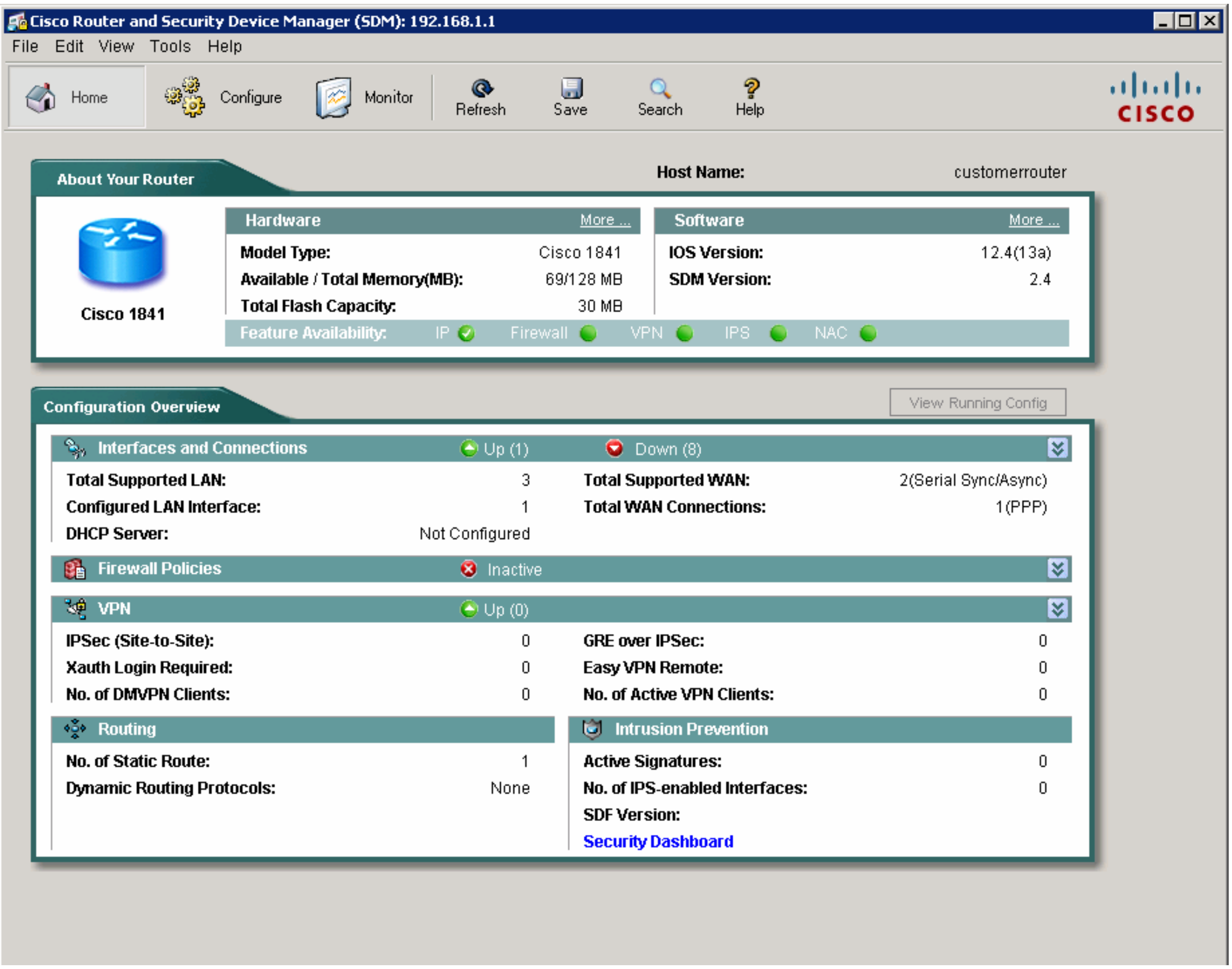
h. When the **Commands Delivery Status** window opens, click **OK**.


Commands Delivery Status

Command Delivery Status:

```
Preparing commands for delivery...
Submitting 3 commands, please wait...
Configuration delivered to router.
```

i. Close the Cisco SDM by clicking the **X** in the upper right corner of the window.


Cisco Router and Security Device Manager (SDM): 192.168.1.1
File Edit View Tools Help
Home
Configure
Monitor
Refresh
Save
Search
Help
CISCO
More ...
View Running Config

About Your Router

Host Name: customerrouter

Cisco 1841

Hardware	
Model Type:	Cisco 1841
Available / Total Memory(MB):	69/128 MB
Total Flash Capacity:	30 MB

Software	
IOS Version:	12.4(13a)
SDM Version:	2.4

Feature Availability: IP ✓ Firewall ● VPN ● IPS ● NAC ●

Configuration Overview

Interfaces and Connections — Up (1) Down (8)

Total Supported LAN:	3	Total Supported WAN:	2(Serial Sync/Async)
Configured LAN Interface:	1	Total WAN Connections:	1(PPP)
DHCP Server:	Not Configured		

Firewall Policies — Inactive

VPN — Up (0)

IPSec (Site-to-Site):	0	GRE over IPSec:	0
Xauth Login Required:	0	Easy VPN Remote:	0
No. of DMVPN Clients:	0	No. of Active VPN Clients:	0

Routing		Intrusion Prevention	
No. of Static Route:	1	Active Signatures:	0
Dynamic Routing Protocols:	None	No. of IPS-enabled Interfaces:	0
		SDF Version:	
		Security Dashboard	

j. Click **Yes** to confirm the closing of SDM, and go to Step 3. (Step 2 shows you how to configure SSH on a non-SDM router.)

Step 2: (Optional) Configure SSH on a non-SDM router.

Note: If you are configuring a router for SSH that already has SDM installed, you can skip Step 2 and go directly to Step 3.

a. Connect the router console port with a PC and the HyperTerminal program, as described in Lab 5.1.3, “Powering up an Integrated Services Router.”

b. Log in to the router. At the privileged EXEC mode prompt, enter the Cisco IOS CLI commands as shown below. These commands do not include all the passwords that need to be set. See Lab 5.3.5, “Configuring Basic Router Settings with the Cisco IOS CLI,” for the configuration settings.

   Note: The router must be running Cisco IOS software release 12.2 or later. In this example, the router is a Cisco 2620XM running Cisco IOS software release 12.2(7r).

c. Configure the basic router and interface information.

```
Router#config terminal
Router(config)#hostname CustomerRouter
CustomerRouter(config)#ip domain-name customer.com
CustomerRouter(config)#username admin privilege 15 password 0 cisco123
CustomerRouter(config)#interface FastEthernet 0/0
CustomerRouter(config-if)#ip address 192.168.1.1 255.255.255.0
CustomerRouter(config-if)#no shutdown
CustomerRouter(config-if)#exit
```

d. Configure the remote incoming vty terminal lines to accept Telnet and SSH.

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

e. Generate the RSA encryption key pair for the router to use for authentication and encryption of SSH data that is transmitted. Enter **768** for the number of modulus bits. The default is 512.

```
CustomerRouter(config)#crypto key generate rsa

How many bits in the modulus [512] 768

CustomerRouter(config)#exit
```

f. Verify that SSH is enabled and the version being used.

```
CustomerRouter#show ip ssh
```

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

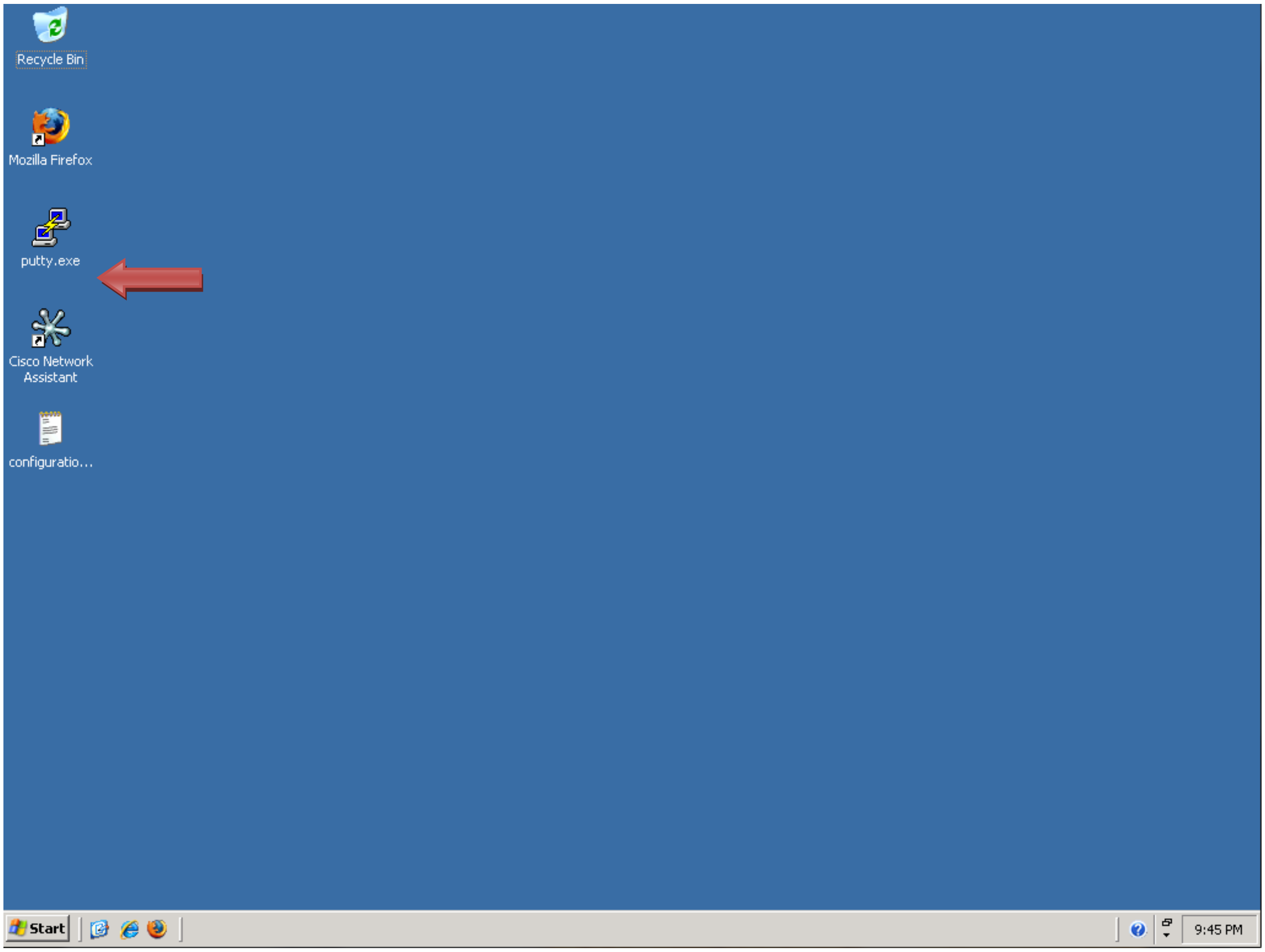
   SSH version enabled _________________
   Authentication timeout _________________
   Authentication retries __________________

h. Save the running-config to the startup-config.

```
CustomerRouter#copy running-config startup-config
```

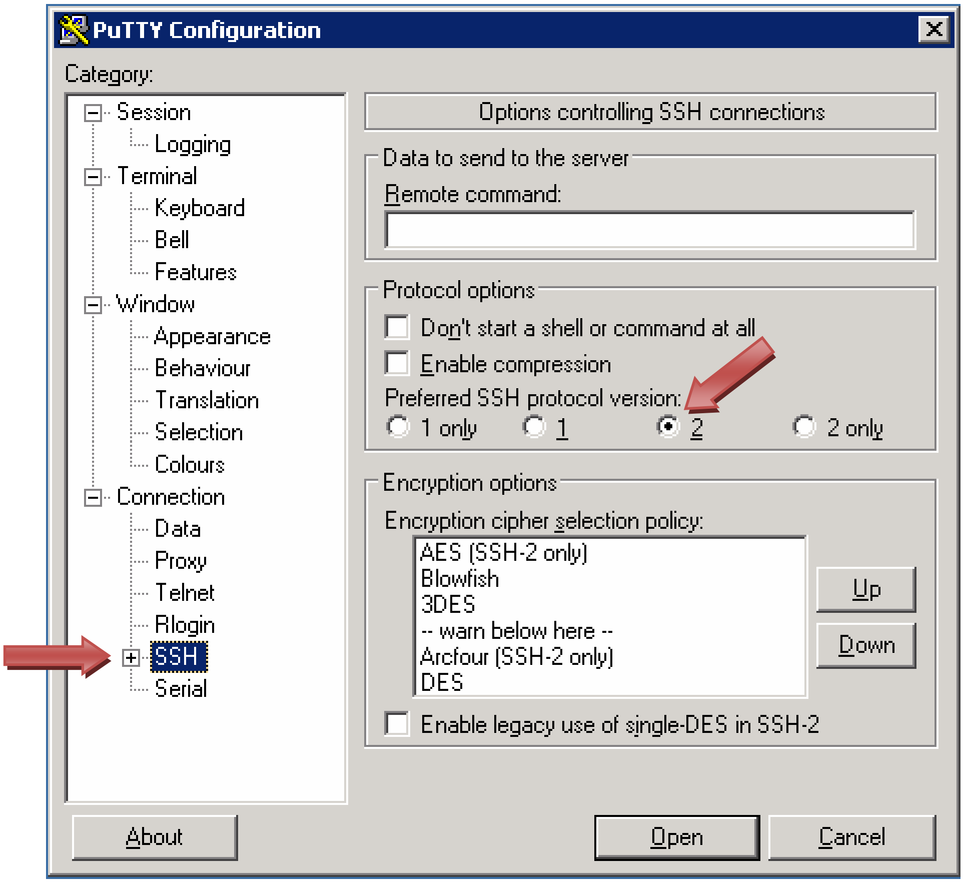
Step 3: Configure the SSH client and connect the PC to the ISR.

a. Download putty.exe and place the application on the desktop. Launch PuTTY by double-clicking the putty.exe icon.


Recycle Bin
Mozilla Firefox
putty.exe
Cisco Network Assistant
configuratio...
Start
9:45 PM

b. In the Category pane, click **SSH**. Verify that the preferred SSH protocol version is set to **2**.

Note: The Putty client still connects even if the SSH server is running SSH version 1.



Data to send to the server

Remote command:

Protocol options

□ Don't start a shell or command at all

□ Enable compression

Preferred SSH protocol version:

○ 1 only ○ 1 ● 2 ○ 2 only

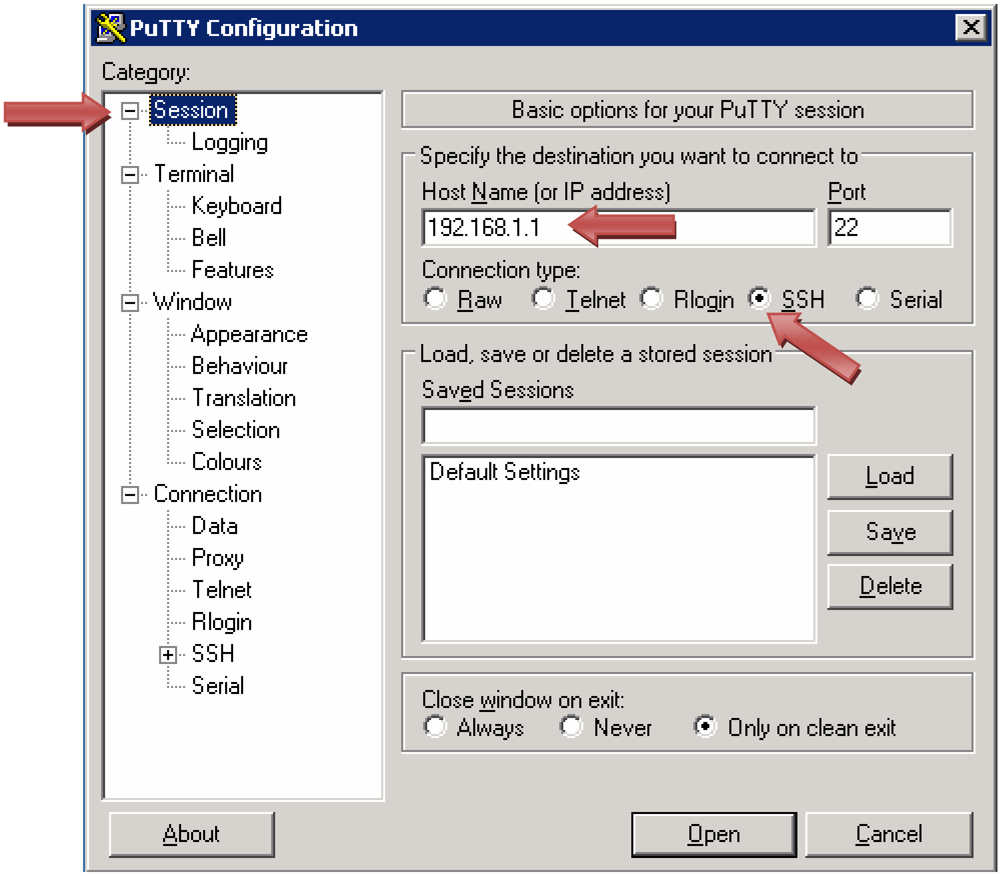
Encryption options

Encryption cipher selection policy:

AES (SSH-2 only)
Blowfish
3DES
-- warn below here --
Arcfour (SSH-2 only)
DES

□ Enable legacy use of single-DES in SSH-2

c. In the Category pane, click **Session**. Enter the IP address of the router LAN interface, which is 192.168.1.1. Verify that SSH is selected for the connection type. Click **Open**.



PuTTY Configuration

Category: Session

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address): 192.168.1.1

Port: 22

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

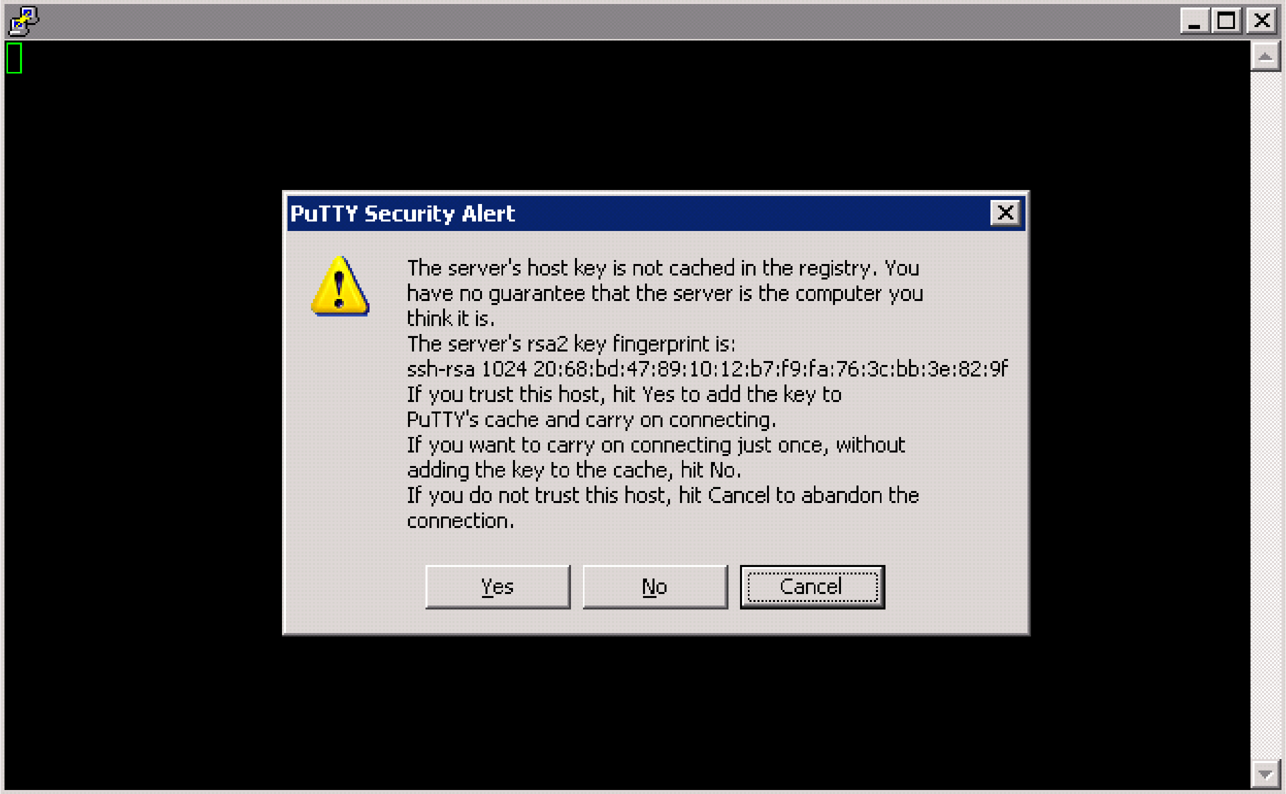
Load, save or delete a stored session

Saved Sessions:

Default Settings

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

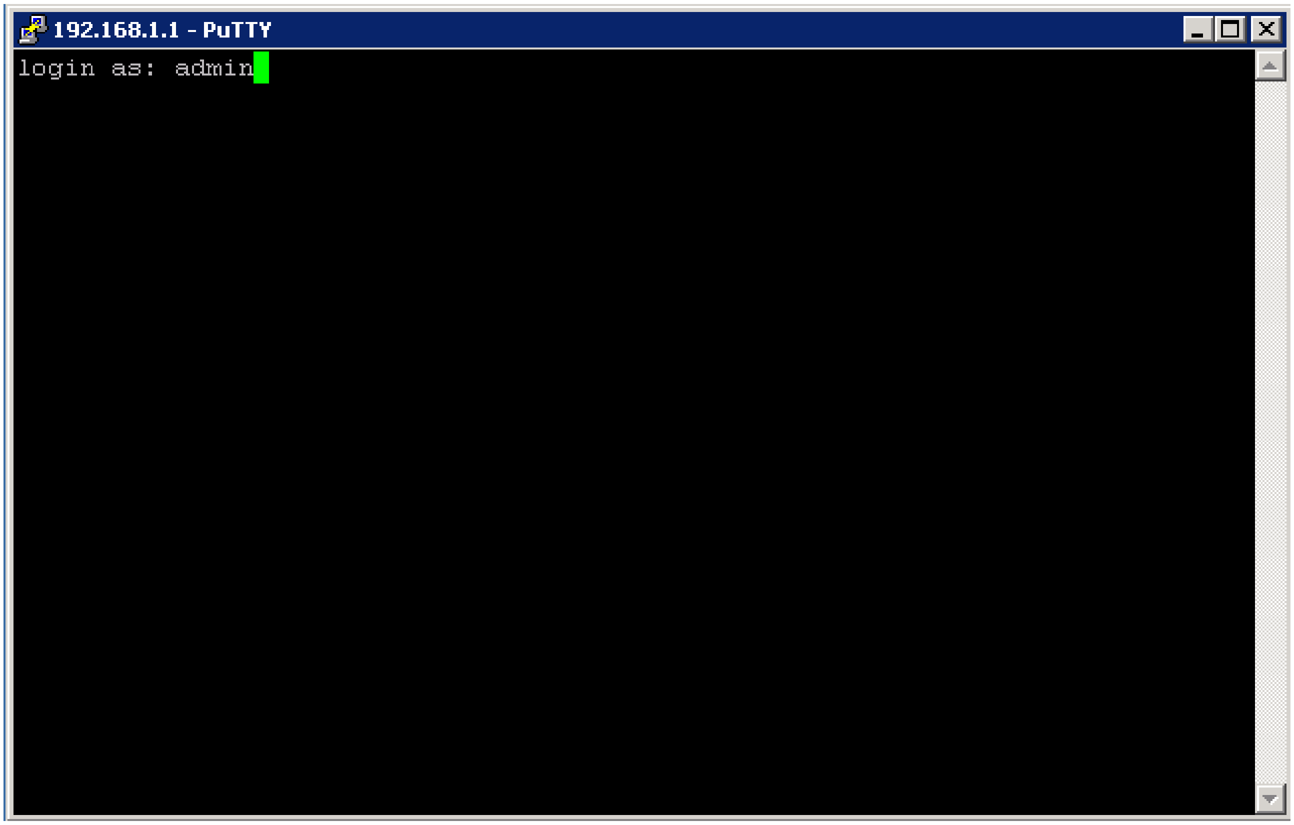
d. The first time a connection is made to SSH on the Cisco 1841 ISR using an SSH client, a connection key is cached in the local machine registry. In the PuTTY Security Alert window, click **Yes** to continue.



PuTTY Security Alert

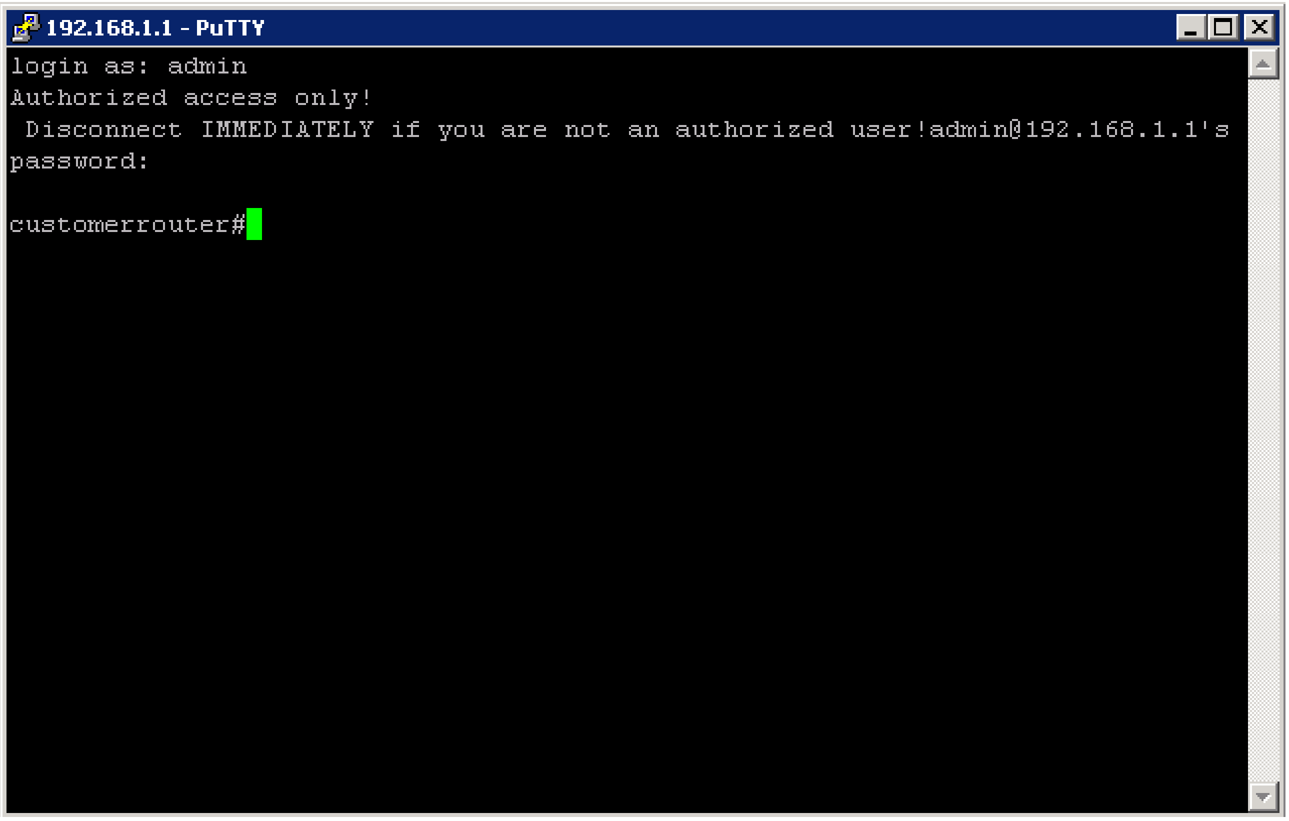
The server's host key is not cached in the registry. You
have no guarantee that the server is the computer you
think it is.
The server's rsa2 key fingerprint is:
ssh-rsa 1024 20:68:bd:47:89:10:12:b7:f9:fa:76:3c:bb:3e:82:9f
If you trust this host, hit Yes to add the key to
PuTTY's cache and carry on connecting.
If you want to carry on connecting just once, without
adding the key to the cache, hit No.
If you do not trust this host, hit Cancel to abandon the
connection.

e. At the login prompt, type the administrator username **admin**, and press **Enter**.



```
login as: admin
```

f. At the password prompt, type the administrator password **cisco123**, and press **Enter**.



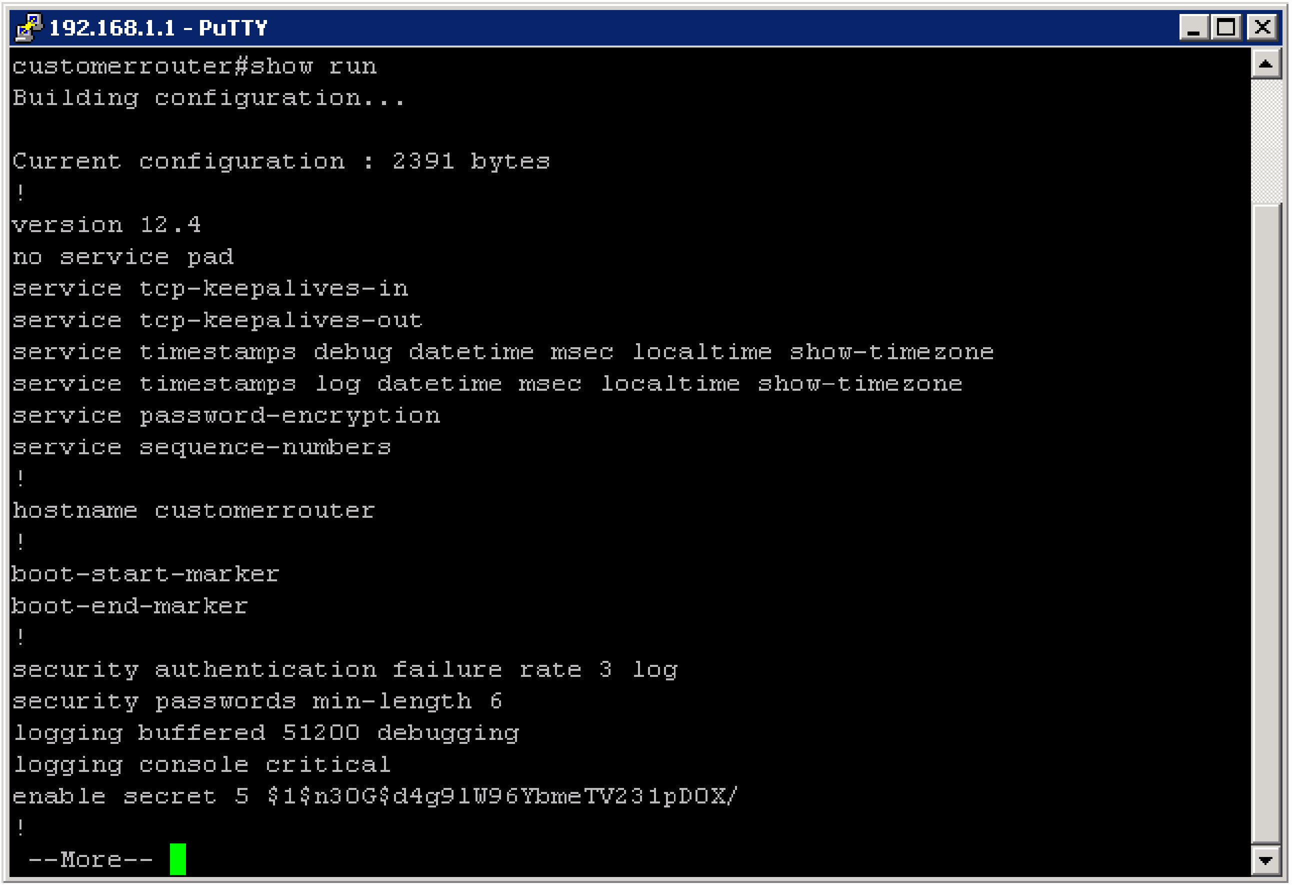
```
login as: admin
Authorized access only!
 Disconnect IMMEDIATELY if you are not an authorized user!admin@192.168.1.1's
password:

customerrouter#
```

Step 4: Check the configuration of the Cisco 1841 ISR.

a. To verify the configuration of the router, type **show run** at the privileged mode prompt, and press **Enter**.

   Note: There is no need to switch from user mode to privileged mode if you are using SDM, because privileged mode is the default mode.

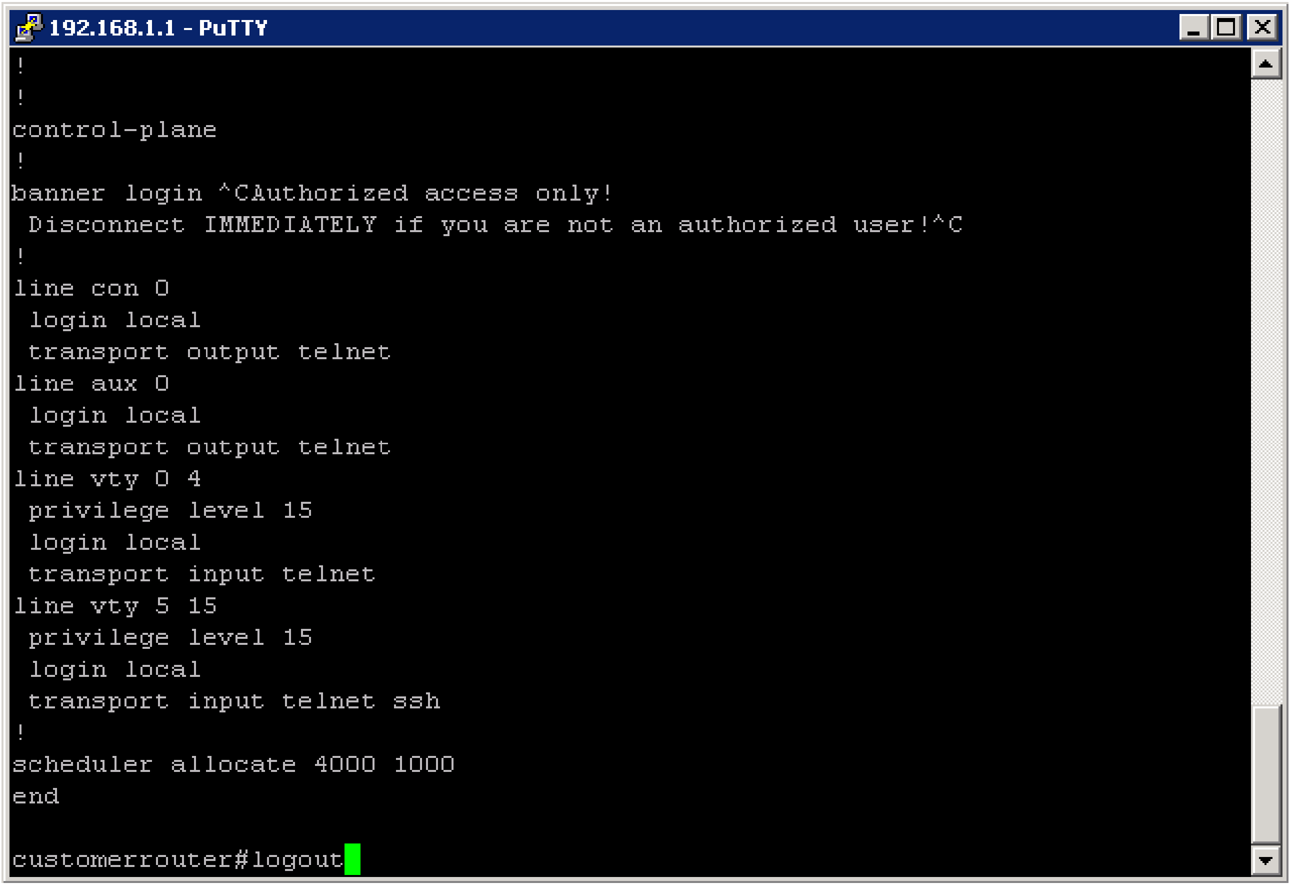
b. Press the **Spacebar** to scroll through the current configuration of the router.



```
customerrouter#show run
Building configuration...

Current configuration : 2391 bytes
!
version 12.4
no service pad
service tcp-keepalives-in
service tcp-keepalives-out
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
service password-encryption
service sequence-numbers
!
hostname customerrouter
!
boot-start-marker
boot-end-marker
!
security authentication failure rate 3 log
security passwords min-length 6
logging buffered 51200 debugging
logging console critical
enable secret 5 $1$n3OG$d4g91W96YbmeTV231pDOX/
!
 --More--
```

Step 5: Log out of the Cisco 1841 ISR.

To log out of the router when you are finished verifying the configuration, type **logout** at the privileged mode prompt, and then press **Enter**.



```
!
!
control-plane
!
banner login ^CAuthorized access only!
 Disconnect IMMEDIATELY if you are not an authorized user!^C
!
line con 0
 login local
 transport output telnet
line aux 0
 login local
 transport output telnet
line vty 0 4
 privilege level 15
 login local
 transport input telnet
line vty 5 15
 privilege level 15
 login local
 transport input telnet ssh
!
scheduler allocate 4000 1000
end

customerrouter#logout
```

Step 6: Reflection

a. When comparing Telnet and SSH, what are some advantages and disadvantages?

____

____

b. What is the default port for SSH? __________ What is the default port for Telnet? __________

c. What Cisco IOS software version was displayed in the running-config?

____

Basic Cisco IOS Configuration to Bring Up SDM

If the startup config is erased in an SDM router, SDM no longer comes up by default when the router is restarted. It is then necessary to build a basic config as follows. Further details regarding the setup and use of SDM can be found in the SDM Quick Start Guide

http://www.cisco.com/en/US/products/sw/secursw/ps5318/products_quick_start09186a0080511c89.html#wp44788

1) Set the router Fa0/0 IP address. (This is the interface that a PC connects to using a browser to bring up SDM. The PC IP address should be set to 10.10.10.2 255.255.255.248.)

Note: An SDM router other than the 1841 may require a connection to a different port to access SDM.

```
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.10.10.1 255.255.255.248
Router(config-if)#no shutdown
```

2) Enable the HTTP/HTTPS server of the router.

```
Router(config)#ip http server
Router(config)#ip http secure-server
Router(config)#ip http authentication local
```

3) Create a user account with privilege level 15 (enable privileges). Replace *username* and *password* with the username and password that you want to configure.

```
Router(config)#username <username> privilege 15 password 0 <password>
```

4) Configure SSH and Telnet for local login and privilege level 15.

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