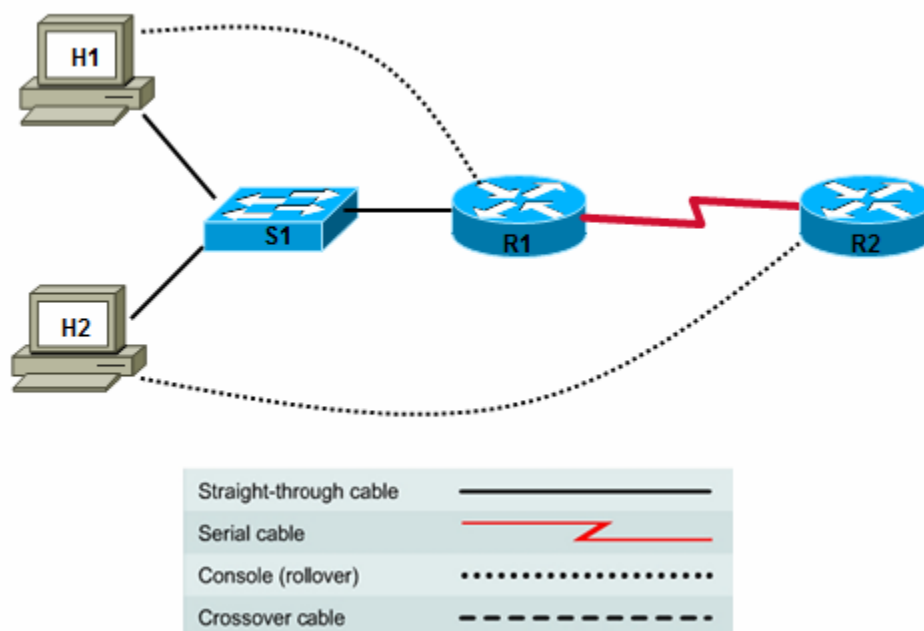


Lab 5.3.8 Configuring PAT with SDM and Static NAT using Cisco IOS Commands



Device	Host Name	Interface	IP Address	Subnet Mask
R1	CustomerRouter	Serial 0/0/0 (DTE)	209.165.200.225	255.255.255.224
		Fast Ethernet 0/0	192.168.1.1	255.255.255.0
R2	ISP	Serial 0/0/0 (DCE)	209.165.200.226	255.255.255.224

Objectives

- Configure basic router settings using the Cisco IOS CLI.
- Configure NAT Port Address Translation (PAT) with the Cisco SDM Basic NAT wizard.
- Verify NAT translations using Cisco IOS commands.
- Configure and verify static NAT using Cisco IOS commands.

Background / Preparation

In Task 1 of this lab, you use the Cisco SDM Basic NAT wizard to configure Network Address Translation (NAT) using a single external global IP address. This address can support connections to the Internet from many internal private addresses. This is also referred to as NAT Overload or Port Address Translation (PAT).

In Task 2, you use Cisco IOS commands to configure the customer router for static NAT to permanently map a public address to an internal server private address.

This lab assumes the use of a Cisco 1841 router. You can use another router model as long as it is capable of supporting SDM. If you are using a supported router that does not have SDM installed, you can download the latest version free of charge from the following location: <http://www.cisco.com/pcgi-bin/tablebuild.pl/sdm>.

From the URL shown above, view or download the document "Downloading and Installing Cisco Router and Security Device Manager." This document provides instructions for installing SDM on your router. It lists specific model numbers and IOS versions that can support SDM, and the amount of memory required.

The following resources are required:

- Cisco 1841 ISR router (or comparable) with SDM version 2.4 or later installed to act as the customer router
- Cisco 1841 router (or other router) to act as the ISP router
- Cisco 2960 switch (or other switch/hub) to connect hosts H1, H2, and the customer router
- Windows XP computer (host H1) with Internet Explorer 5.5 or higher and Sun Java Runtime Environment (JRE) version 1.4.2_05 or later (or Java Virtual Machine (JVM) 5.0.0.3810)
- Windows XP computer (host H2)
- Straight-through Category 5 Ethernet cables
- Null serial cable (R1 to R2)
- Console cables (H1 to R1 and H2 to R2)
- Access to the host H1 and H2 command prompt
- Access to the host H1 and H2 network TCP/IP configuration

From each host computer, start a HyperTerminal session to the attached router.

Note: Make sure that the routers and the switches have been erased and have no startup configurations. Instructions for erasing are provided in the Lab Manual, located on Academy Connection in the Tools section. Check with the instructor if you are unsure of how to do this.

Task 1: Configure Basic Router Settings and PAT

Step 1: Build the network and configure host computer IP settings.

- a. Make sure that the host computers are connected according to the topology diagram.

Note: A router other than the 1841 may require a host connection to a port other than Fast Ethernet 0/0 to access SDM.

- b. Configure the hosts with static IP addresses using the following settings.

Host H1:

IP address: 192.168.1.5

Subnet mask: 255.255.255.0

Default gateway: 192.168.1.1

Host H2:

IP address: 192.168.1.9

Subnet mask: 255.255.255.0
Default gateway: 192.168.1.1

Step 2: Configure the customer router basic settings with the Cisco IOS CLI.

Configure the host name, passwords, and interfaces in preparation for the use of SDM.

```
Router>enable
Router#config t
Router(config)#hostname CustomerRouter
CustomerRouter(config)#enable secret class
CustomerRouter(config)#username admin privilege 15 secret cisco123
CustomerRouter(config)#line con 0
CustomerRouter(config-line)#password cisco
CustomerRouter(config-line)#login
CustomerRouter(config-line)#line vty 0 4
CustomerRouter(config-line)#password cisco
CustomerRouter(config-line)#login
CustomerRouter(config-line)#exit
CustomerRouter(config)#interface FastEthernet0/0
CustomerRouter(config-if)#description LAN Default Gateway
CustomerRouter(config-if)#ip address 192.168.1.1 255.255.255.0
CustomerRouter(config-if)#no shutdown
CustomerRouter(config-if)#interface Serial0/0/0
CustomerRouter(config-if)#ip address 209.165.200.225 255.255.255.224
CustomerRouter(config-if)#description WAN link to ISP
CustomerRouter(config-if)#no shutdown
CustomerRouter(config-if)#exit
CustomerRouter(config)#ip http server
CustomerRouter(config)#ip http authentication local
```

Step 3: Configure the ISP router basic settings with the Cisco IOS CLI.

- Establish a HyperTerminal session with the ISP router and erase the startup configuration using the **erase startup-config** command from the privileged mode prompt. Restart the router using the **reload** command.
- Configure the host name, passwords, and interfaces.

```
Router>enable
Router#configure terminal
Router(config)#hostname ISP
ISP(config)#enable secret class
ISP(config)#line console 0
ISP(config-line)#password cisco
ISP(config-line)#login
ISP(config)#line vty 0 4
ISP(config-line)#password cisco
ISP(config-line)#login
ISP(config-line)#exit
ISP(config)#exit
ISP(config)#interface serial 0/0/0
ISP(config-if)#description WAN link to CustomerRouter
ISP(config-if)#ip address 209.165.200.226 255.255.255.224
ISP(config-if)#clock rate 64000
ISP(config-if)#no shutdown
ISP(config-if)#exit
ISP(config)#ip http server
ISP(config)#exit
```

Step 4: Connect to CustomerRouter using SDM.

- a. On host H1, disable any popup blocker programs. Popup blockers prevent SDM windows from displaying.
- b. The SDM GUI does not load automatically on the router. You must open a web browser to access SDM. Go to <http://192.168.1.1>.

Note: If the browser cannot connect, check the cabling and connections and make sure that the PC IP configuration is correct.

- c. In the **Connect to** dialog box, enter **admin** for the username and **cisco123** for the password. The login information was configured in Step 2. Click **OK**. The main SDM web application starts. If you are prompted to use HTTPS, click **Cancel**. If a Security Warning window displays, click **Yes** to trust the Cisco application.

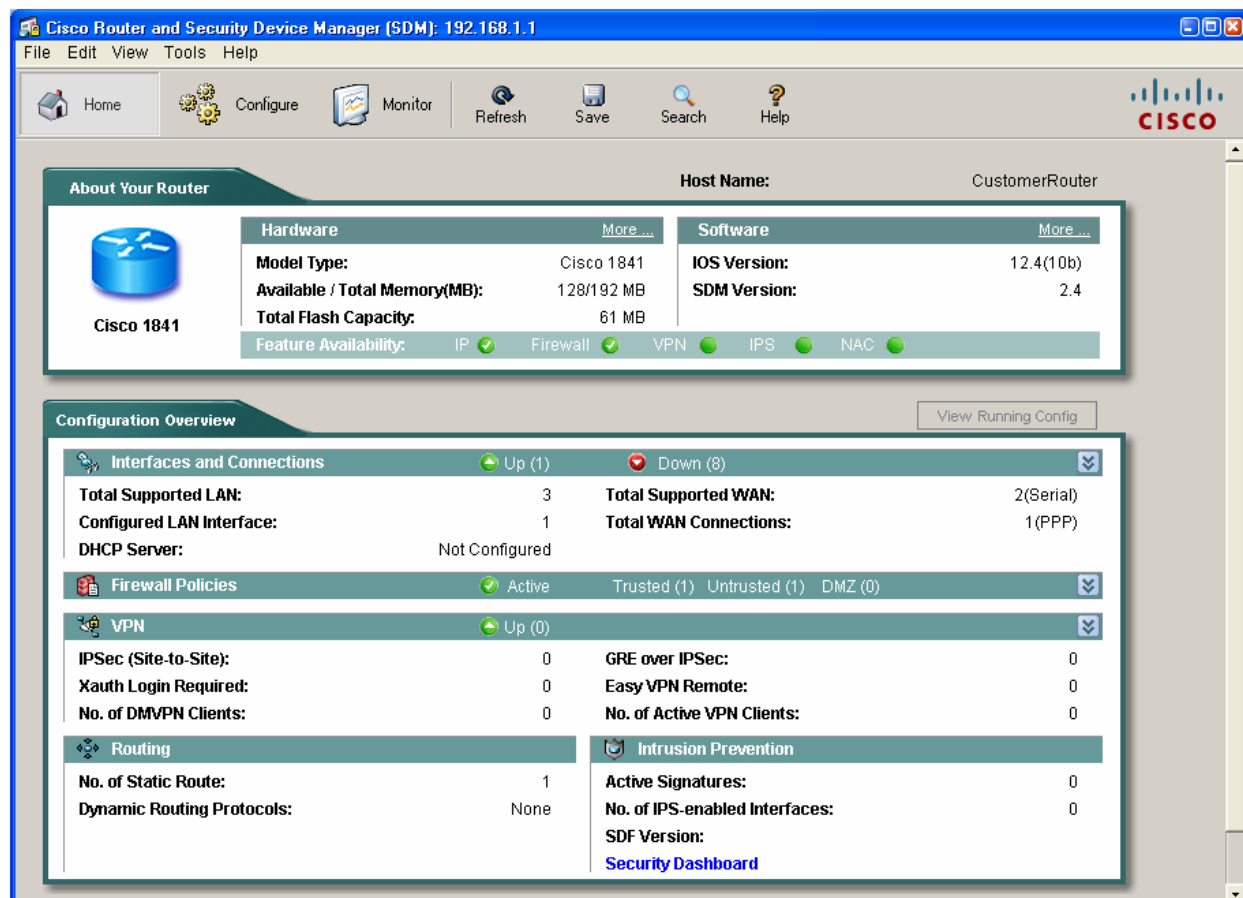


- d. Verify that you are using SDM 2.4 or later. The initial SDM screen that displays immediately after the login shows the current version number. It is also displayed on the main SDM screen as shown below, along with Cisco IOS version.

Note: If the version is not 2.4 or later, notify the instructor before continuing with this lab. You must download the latest zip file on the host H1 PC. From the Tools menu of the SDM GUI, choose **Update SDM** to specify the location of the zip file and install the update.

CCNA Discovery

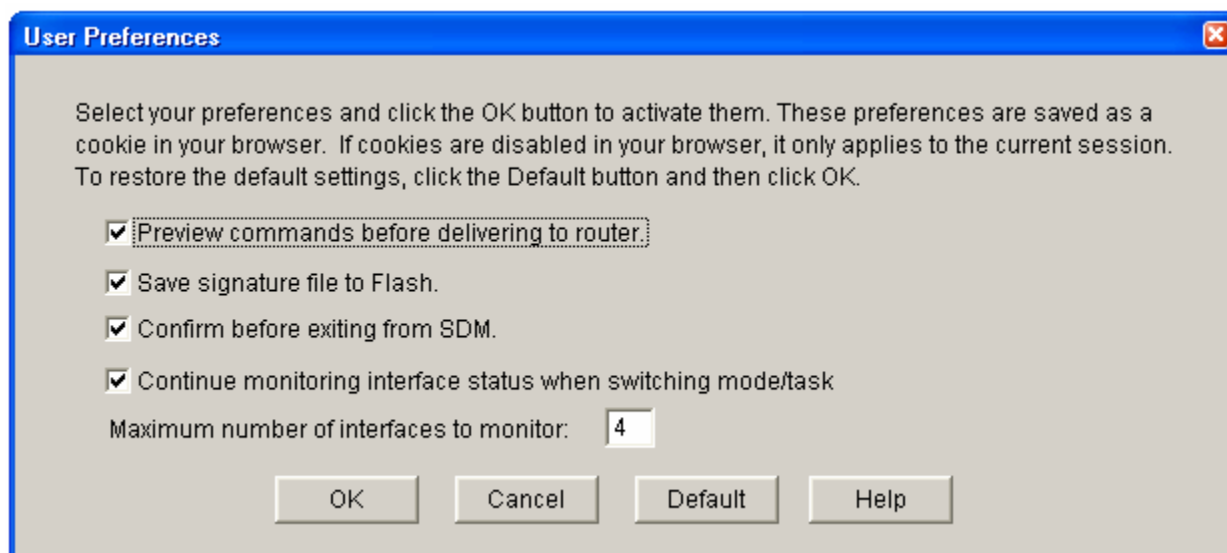
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Step 5: Configure SDM to show the Cisco IOS CLI commands.

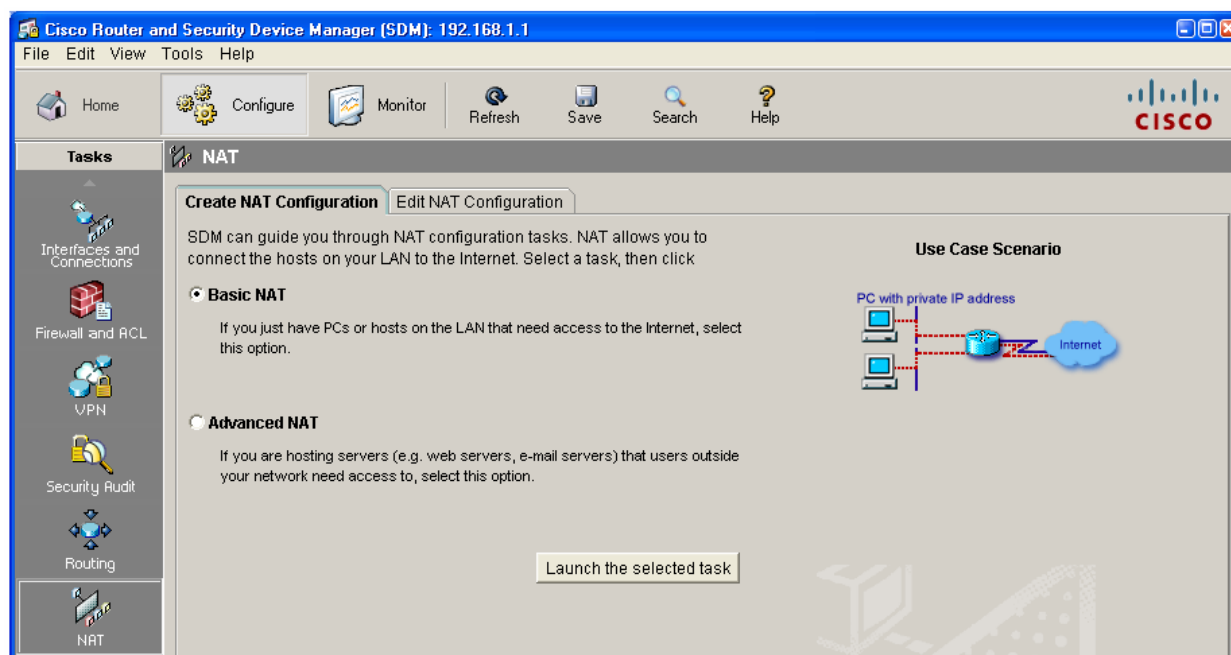
- From the Edit menu in the main SDM window, choose **Preferences**.

- b. Check the **Preview commands before delivering to router** box. When this option is checked, you can view the Cisco IOS CLI configuration commands before they are sent to the router, which is a good way to learn about the commands used.

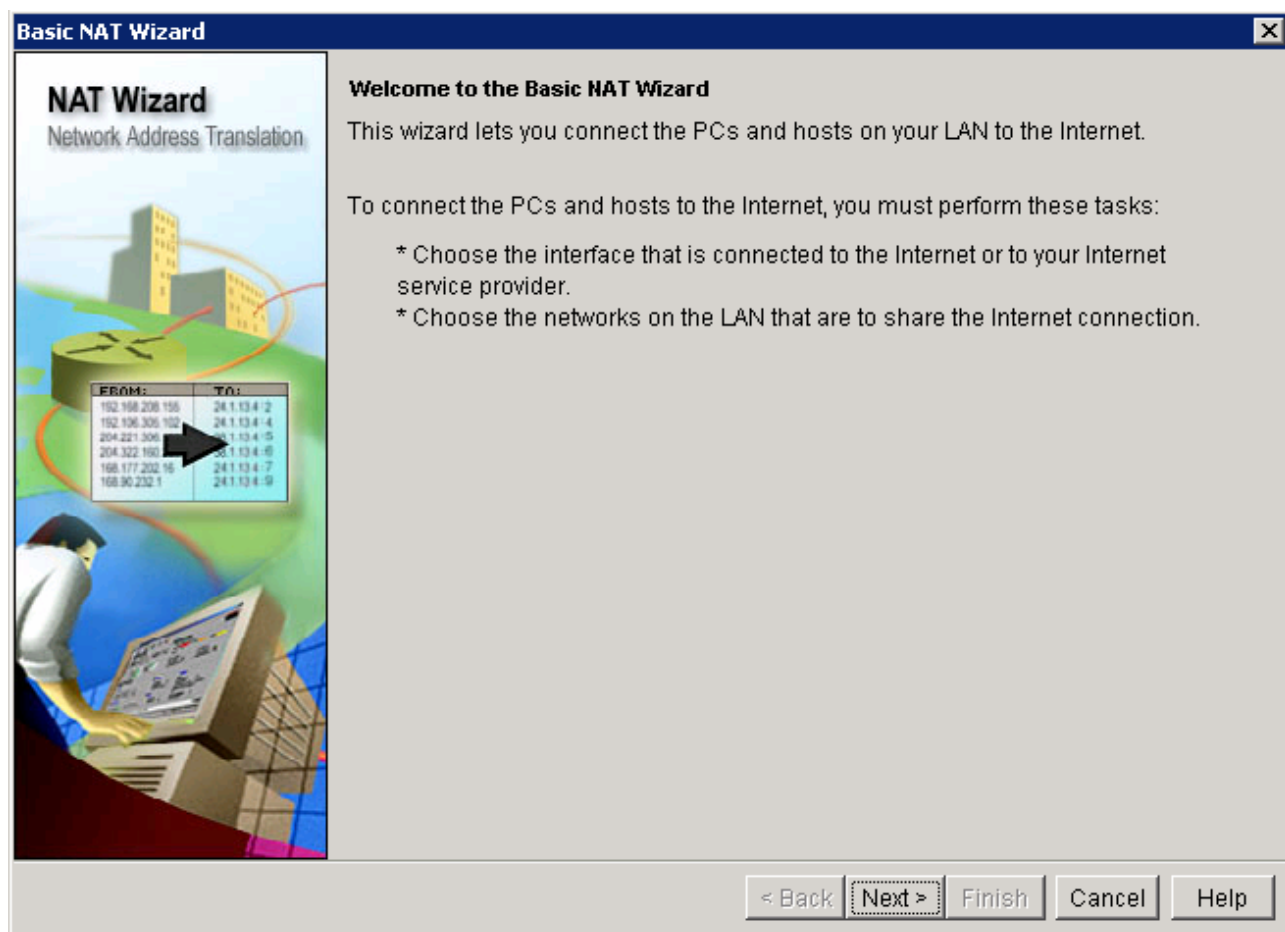


Step 6: Launch the Basic NAT wizard.

- a. From the Configure menu, click the **NAT** button to view the NAT configuration page. Click the **Basic NAT** radio button, and then click **Launch the selected task**.



- b. In the Welcome to the Basic NAT Wizard window, click **Next**.



Step 7: Select the WAN interface for NAT.

- a. Choose the WAN interface Serial0/0/0 from the list. Check the box for the IP address range that represents the internal network of 192.168.1.0 to 192.168.1.255. This is the range that requires conversion using the NAT process.

The screenshot shows the 'Basic NAT Wizard' window with the 'Sharing the Internet Connection' step. On the left is a graphic titled 'NAT Wizard Network Address Translation' showing a router and a table of IP mappings. The main area contains instructions to choose an interface and select IP ranges. The 'Serial0/0/0' interface is selected in the dropdown. Below, a table lists two IP ranges: '192.168.1.0 to 192.168.1.255' (checked) and '209.165.200.224 to 209.165.200.255' (unchecked). The 'Connected Through' column shows 'FastEthernet0/0' and 'Serial0/0/0' respectively. A note at the bottom explains how to configure NAT on a designated interface. Navigation buttons at the bottom include '< Back', 'Next >', 'Finish', 'Cancel', and 'Help'.

Basic NAT Wizard

NAT Wizard
Network Address Translation

Sharing the Internet Connection

If this router has a connection to the Internet, specify how you want PCs and hosts on the LAN to share this connection.

Choose the interface that connects to the Internet or your Internet service provider:

Serial0/0/0 Details...

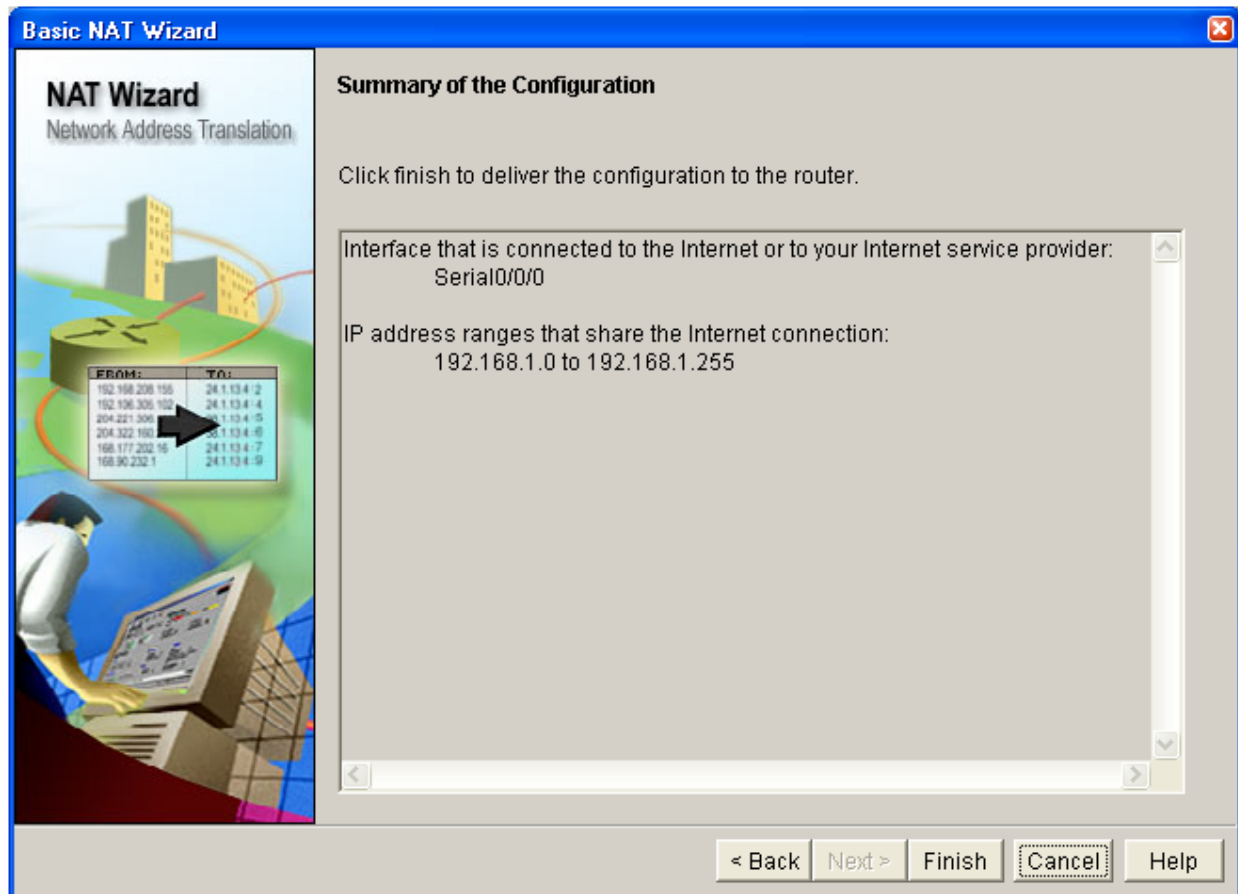
The following ranges of IP addresses are allocated to networks directly connected to the router. Check the box next to each network that is to share the connection that you specified:

	IP address range	Connected Through	Comment
<input checked="" type="checkbox"/>	192.168.1.0 to 192.168.1.255	FastEthernet0/0	
<input type="checkbox"/>	209.165.200.224 to 209.165.200.255	Serial0/0/0	

Note: To configure NAT on an interface marked as Designated, exit this wizard, click Edit NAT Configuration, and uncheck that interface in the Designate NAT Interfaces window. For details see help.

< Back Next > Finish Cancel Help

- b. Click **Next** and, once you have read the Summary of the Configuration, click **Finish**.

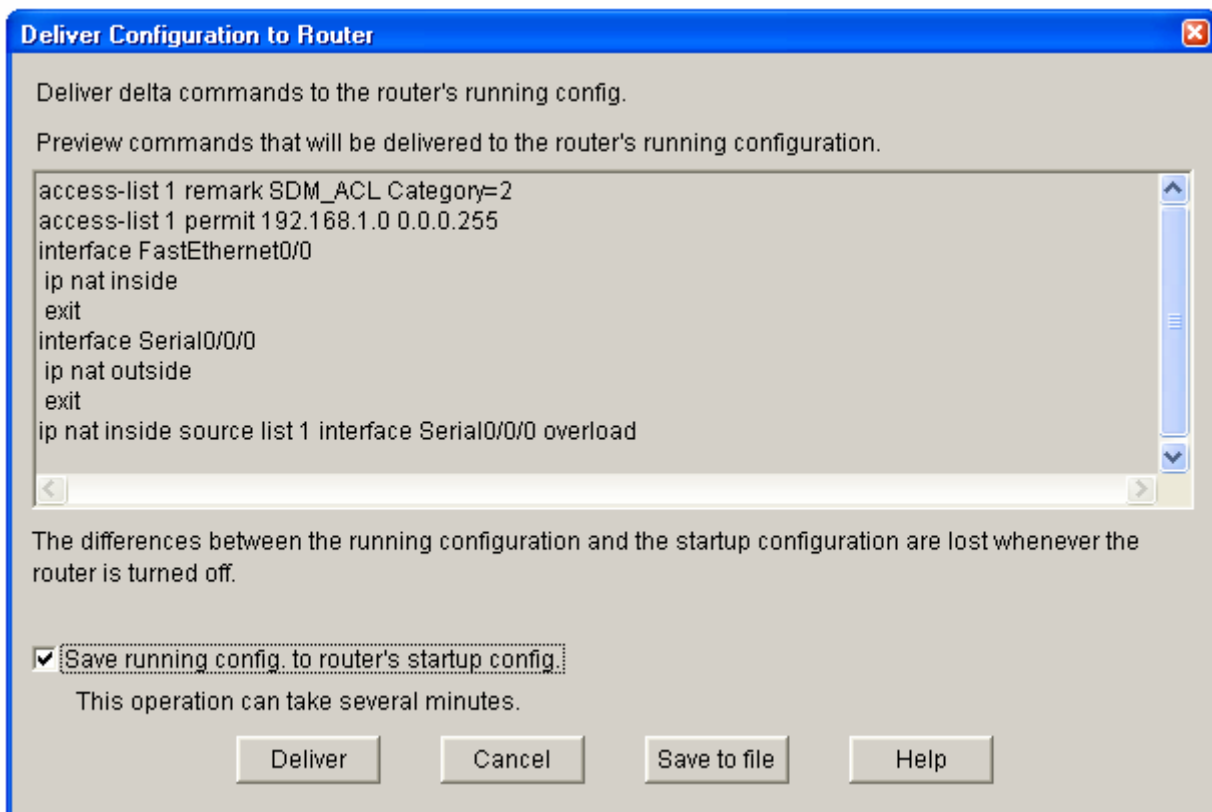


- c. In the **Deliver Configuration to Router** window, review the CLI commands that were generated by the SDM. These are the commands that will be delivered to the router to configure NAT. The commands can also be manually entered from the CLI to accomplish the same task. Check the box for **Save running config to router's startup config**.

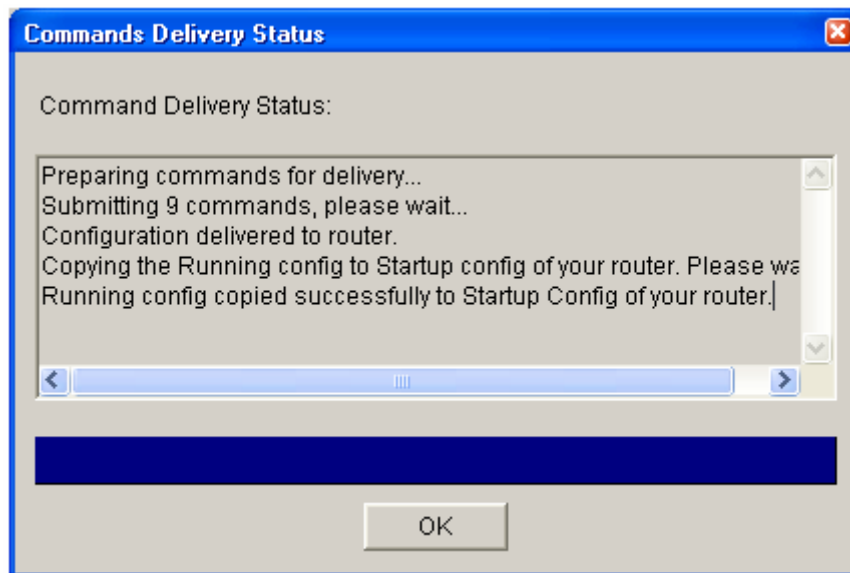
Note: By default, the commands that you just generated only update the running configuration file when delivered. If the router is restarted, the changes you made are lost. Checking this box updates the startup config file so that when the router is restarted, it loads the new commands into the running config.

If you choose to not save the commands to the startup config at this time, use the **File > Write to Startup config** option in SDM or use the **copy running-config startup-config** command from the CLI using a terminal or Telnet session.

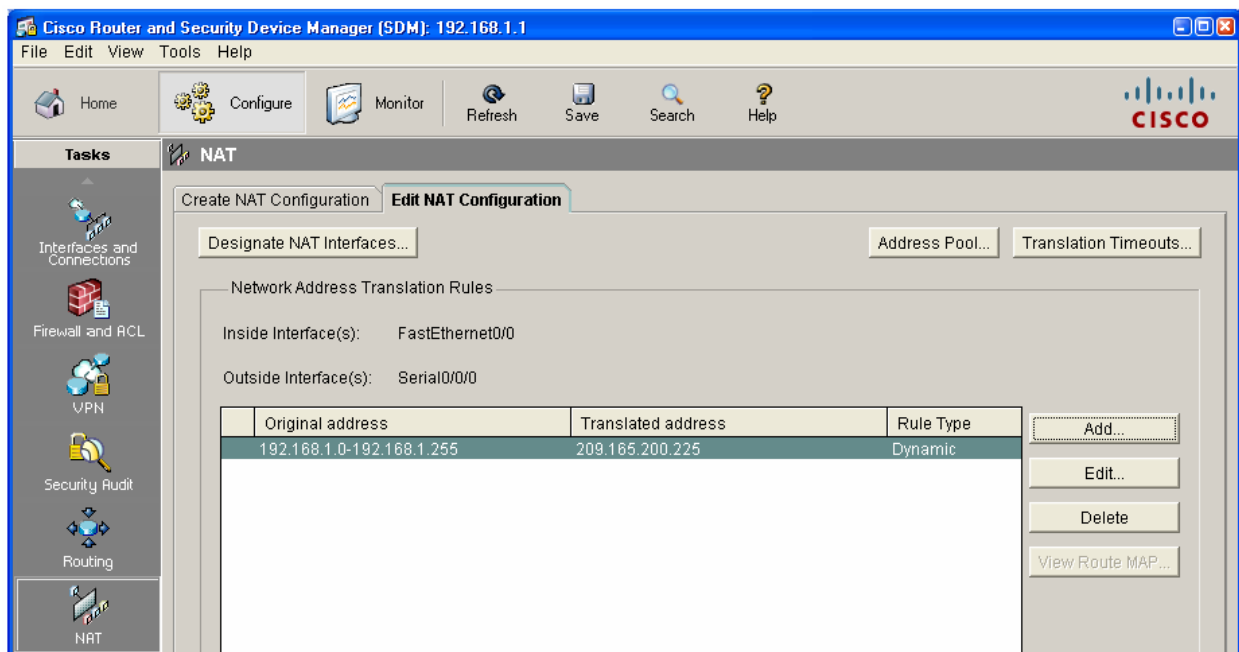
- d. Click **Deliver** to finish configuring the router.



- e. In the **Commands Delivery Status** window, notice the text that says that the running config was successfully copied to the startup config. Click **OK** to exit the Basic NAT wizard.



- f. The final NAT screen shows that the Inside Interface is Fa0/0 and the outside interface is S0/0/0. The internal private (original) addresses are translated dynamically to the external public address.



- g. Choose **File > Exit** from the SDM main menu to end the SDM session. Click **Yes** to confirm exiting SDM.

Step 8: Verify NAT functionality.

- a. On host H1, open a command prompt window and ping the ISP router serial interface at 209.165.200.226. Are the pings successful? _____

- b. From the CustomerRouter terminal window, issue the **show ip nat translations** command to see the H1 internal private address being translated to the serial 0/0/0 external public address.

```
CustomerRouter#show ip nat translations
Pro  Inside global      Inside local      Outside local      Outside global
icmp 209.165.200.225:512 192.168.1.2:512   209.165.200.226:512 209.165.200.226:512
```

- c. What type of NAT address is the host H1 IP address? _____
- d. What type of NAT address is the CustomerRouter serial 0/0/0 public IP address? _____
- e. What type of NAT address is the ISP router serial 0/0/0 public IP address? _____
- f. Ping first from H1, and then from H2, in quick succession to the ISP router serial interface at 209.165.200.226. Were the pings successful? _____
- g. Use the **show ip nat translations** command to see the H1 internal private address being translated to the serial 0/0/0 external public address.

```
CustomerRouter#show ip nat translation
Pro  Inside global      Inside local      Outside local      Outside global
icmp 209.165.200.225:512 192.168.1.2:512   209.165.200.226:512 209.165.200.226:512
icmp 209.165.200.225:513 192.168.1.9:512   209.165.200.226:512 209.165.200.226:513
```

- h. What is the difference between the H1 and H2 translations?

- i. Use the **clear ip nat translations *** command to clear the router NAT translation table, and issue the **show ip nat translations** command again to verify that they are gone.

```
CustomerRouter#clear ip nat translations *
CustomerRouter#show ip nat translation
```

- j. From H1, ping the CustomerRouter serial interface at 209.165.200.225. Are the pings successful?

- k. From the CustomerRouter terminal window, use the **show ip nat translations** command again to see the address translations.
- l. Are there any translations this time? _____ Why?

- m. On host H1, open a browser such as Internet Explorer, and enter the IP address of the ISP router serial interface at <http://209.165.200.226> in the address area. What is the result?

- n. Display the NAT translation table using the **show ip nat translations** command. Does the translation appear in the NAT table? _____

```
CustomerRouter#show ip nat translations
Pro  Inside global      Inside local      Outside local      Outside global
tcp  209.165.200.225:1059 192.168.1.2:1059   209.165.200.226:80 209.165.200.226:80
---  209.165.200.229      192.168.1.9
```

- o. For the translation of the H1 IP inside local address, what is the protocol and the IP address:port number for the outside local and outside global (destination) addresses, and what does the outside port number represent?

Task 2: Configure and Verify Static NAT Using the Cisco IOS CLI

Step 1: Configure a static mapping for the server.

Host H2, with IP address 192.168.1.9/24, has been designated as the public web server. Thus, it needs a permanently assigned public IP address. This mapping is defined using a static NAT mapping.

- a. To configure a static IP NAT mapping, use the **ip nat inside source static** command.

```
Gateway(config)#ip nat inside source static 192.168.1.9 209.165.200.229
```

This permanently maps public address 209.165.201.229 to 192.168.1.9, the inside address of the web server. Any attempt to access public address 209.165.200.229 is passed by the router to host H2 at private address 192.168.1.9.

- b. Display the NAT translation table using the **show ip nat translations** command. Does the static mapping appear in the output of the command? _____

```
CustomerRouter#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
--- 209.165.200.229    192.168.1.9      ---               ---
```

Step 2: Test static NAT functionality

- a. Ping from host H1 to the public static NAT address mapped to host H2. Are the pings successful?

- b. Display the NAT translation table using the **show ip nat translations** command. Does the translation appear in the NAT table? _____

```
CustomerRouter#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
icmp 209.165.200.225:512 192.168.1.2:512 209.165.200.229:512 209.165.200.229:512
--- 209.165.200.229    192.168.1.9      ---               ---
```

- c. What is the outside local and outside global address used in the translation?

- d. From the ISP router HyperTerminal window, ping the H2 host with the static NAT translation at 192.168.1.9. Are the pings successful? _____

- e. From the ISP router, ping the public static addressed mapped to the H2 internal server at 209.165.201.229. Are the pings successful? _____ Why?

- f. What is the translation of the inside global address to the inside local host address?

```
CustomerRouter#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
icmp 209.165.200.229:5 192.168.1.9:5    209.165.200.226:5 209.165.200.226:5
--- 209.165.200.229    192.168.1.9      ---               ---
```

Step 3: Save the router configurations.

In privileged EXEC mode, save the running configuration to the startup configuration.

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

Task 3: Reflection

- a. Consider the skills that you need to configure NAT using Cisco IOS CLI commands. What do you think the benefits and disadvantages are to using the Cisco SDM?

- b. Why do you think that the default, after the commands have been generated, is to only update the router's running configuration file when delivered? Why not always update the startup config file as well? What are the advantages and disadvantages of one over the other?
