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Lab 5.3.7 Configuring DHCP with SDM and the Cisco IOS CLI
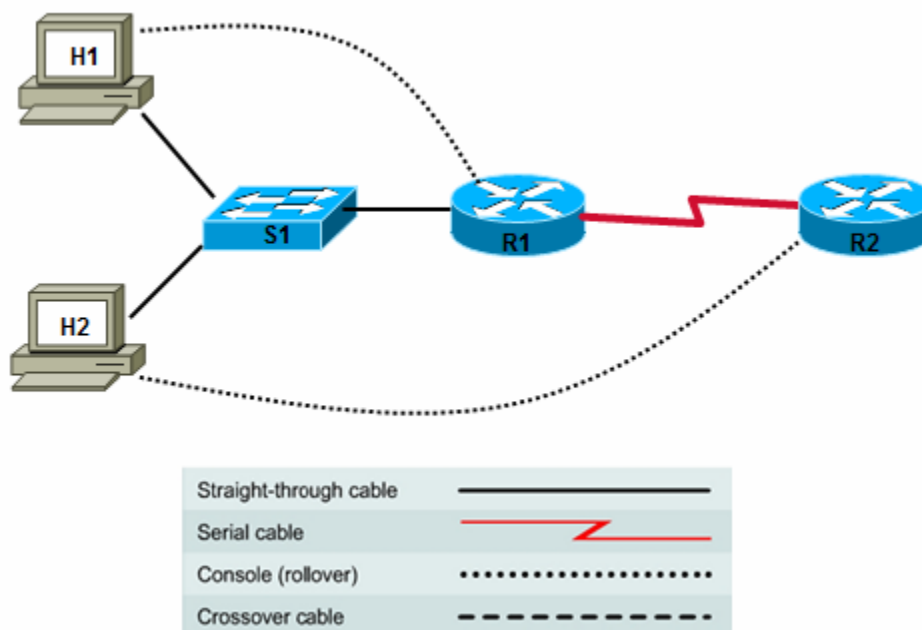
Device	Host Name	Interface	IP Address	Subnet Mask
R1	Customer	Serial 0/0/1 (DTE)	209.165.200.225	255.255.255.224
		Fast Ethernet 0/0	192.168.1.1	255.255.255.0
R2	ISP	Serial 0/0/0 (DCE)	209.165.200.226	255.255.255.224

Objectives

- Configure a customer router for DHCP using SDM.
- Configure a customer router for DHCP using the Cisco IOS CLI.
- Configure a DHCP client.
- Verify DHCP functionality.

Background / Preparation

In this lab, you set up a customer router to act as a DHCP server for internal client computers. DHCP assigns an address, subnet mask, and default gateway to hosts dynamically from a defined pool of addresses.

Set up a network similar to the one shown in the topology diagram. Any router that meets the interface requirements displayed in that diagram – such as 800, 1600, 1700, 1800, 2500, and 2600 routers, or a combination – may be used. Refer to the Router Interface Summary table at the end of the lab to determine which interface identifiers to be used based on the equipment in the lab. Depending on the router model, output may vary somewhat from that shown in this lab.

Required Resources

The following resources are required:

- Cisco 1841 ISR router (or comparable) with SDM version 2.4 or above 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 later 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 hosts H1 and H2, start a HyperTerminal session with each router.

Note: Make sure that the routers and the switch 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

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 connection to a port other than Fast Ethernet 0/0 to access SDM.

b. Configure host H1 with the following static IP information.

> IP address: 192.168.1.101
> Subnet mask: 255.255.255.0
> Default gateway: 192.168.1.1

c. Configure host H2 as a DHCP client. Choose **Start > Settings > Control Panel > Network Connections > Local Area Connection**. Click the **Properties** button and then **Internet Protocol (TCP/IP) Properties**. Select the options **Obtain an IP address automatically** and **Obtain a DNS server address automatically**.

d. On hosts H1 and H2, open a command prompt. Click **Start > Run,** and then type **cmd** and press **Enter**. Alternatively, choose **Start > All Programs > Accessories > Command Prompt**. Issue the **ipconfig /all** command. Record the MAC addresses for H1 and H2.

Host H1 MAC address _____

Host H2 MAC address _____

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

Configure the host name, passwords, interfaces, and HTTP service in preparation for the use of SDM. Also configure a default route to the ISP.

```
Router>enable
Router#config t
Router(config)#hostname Customer
```

```
Customer(config)#enable secret class
Customer(config)#username admin privilege 15 secret cisco123
Customer(config)#no ip domain-lookup
Customer(config)#line con 0
Customer(config-line)#password cisco
Customer(config-line)#logging synchronous
Customer(config-line)#login
Customer(config-line)#line vty 0 4
Customer(config-line)#password cisco
Customer(config-line)#login
Customer(config-line)#exit
Customer(config)#interface FastEthernet0/0
Customer(config-if)#description LAN Default Gateway
Customer(config-if)#ip address 192.168.1.1 255.255.255.0
Customer(config-if)#no shutdown
Customer(config-if)#interface Serial0/0/1
Customer(config-if)#ip address 209.165.200.225 255.255.255.224
Customer(config-if)#description WAN link to ISP
Customer(config-if)#no shutdown
Customer(config-if)#exit
Customer(config)#ip http server
Customer(config)#ip http authentication local
Customer(config)#ip route 0.0.0.0 0.0.0.0 209.165.200.226
```

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

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 Customer
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: Save the router configurations.

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

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

Step 5: Connect to Customer with host H1 using SDM.

a. On 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. (The IP address of the Customer FastEthernet 0/0 interface – the H1 default gateway)

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.
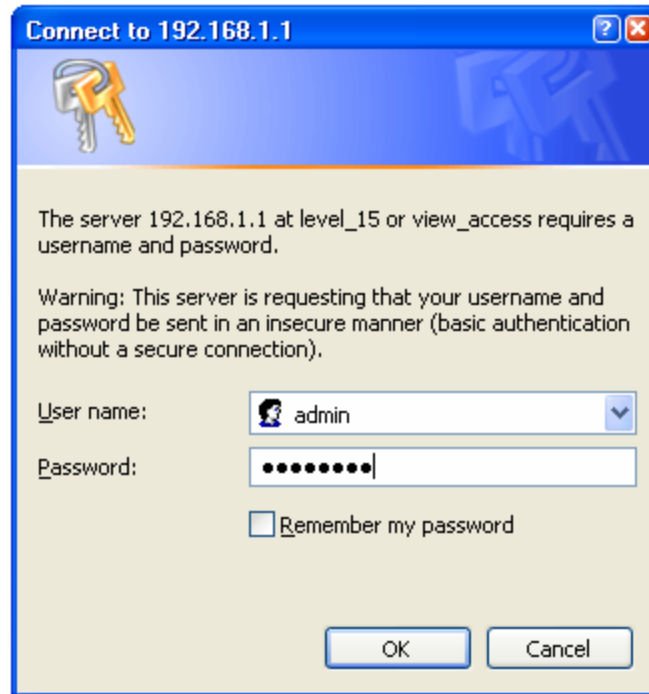

d. Verify that you are using SDM 2.4 or later. The initial SDM screen that displays immediately after the login shows the current version number. It is also displayed on the main SDM screen as shown below, along with the Cisco IOS version.

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 from the SDM web page and save it to the PC. From the Tools menu of the SDM GUI, choose **Update SDM** to specify the location of the zip file and install the update.
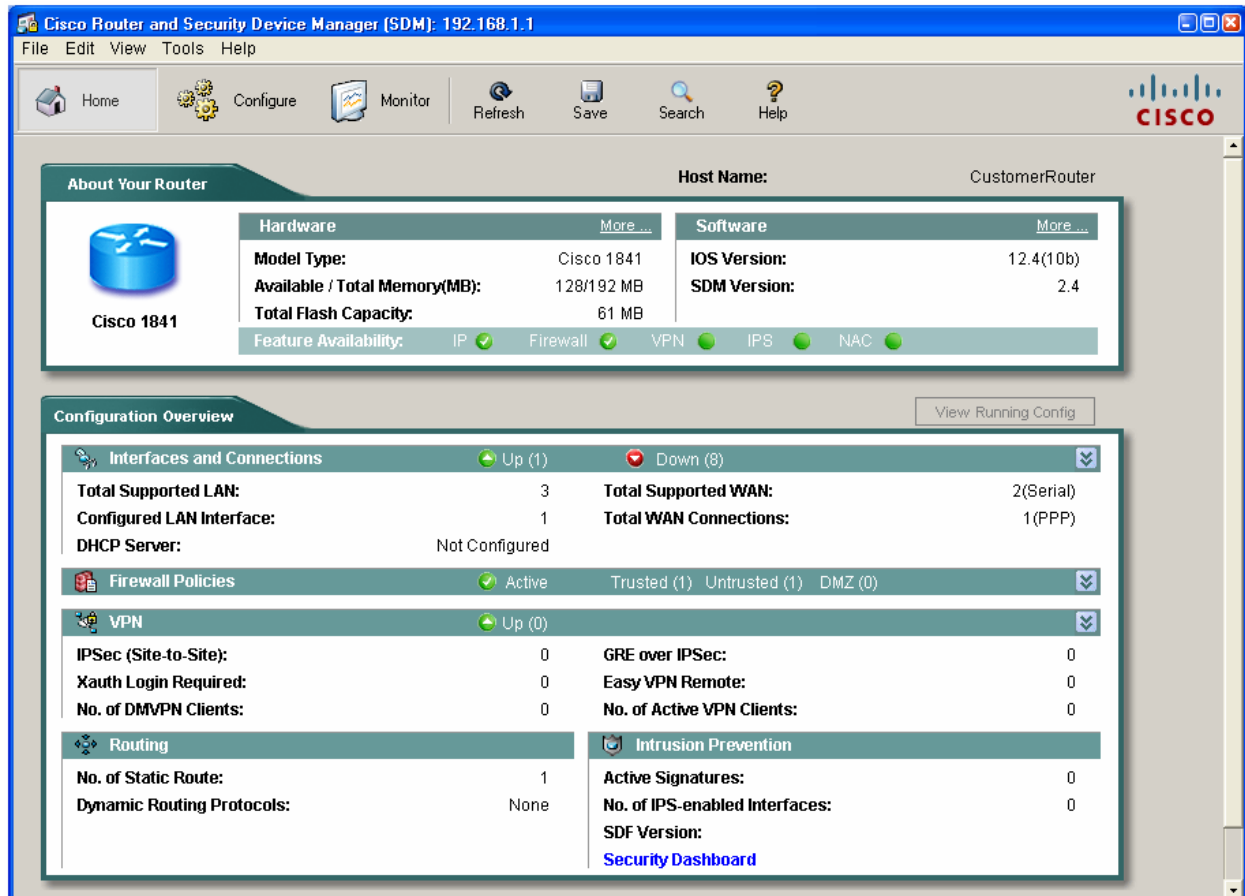
Step 6: Configure SDM to show the Cisco IOS CLI commands.

  a. 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.
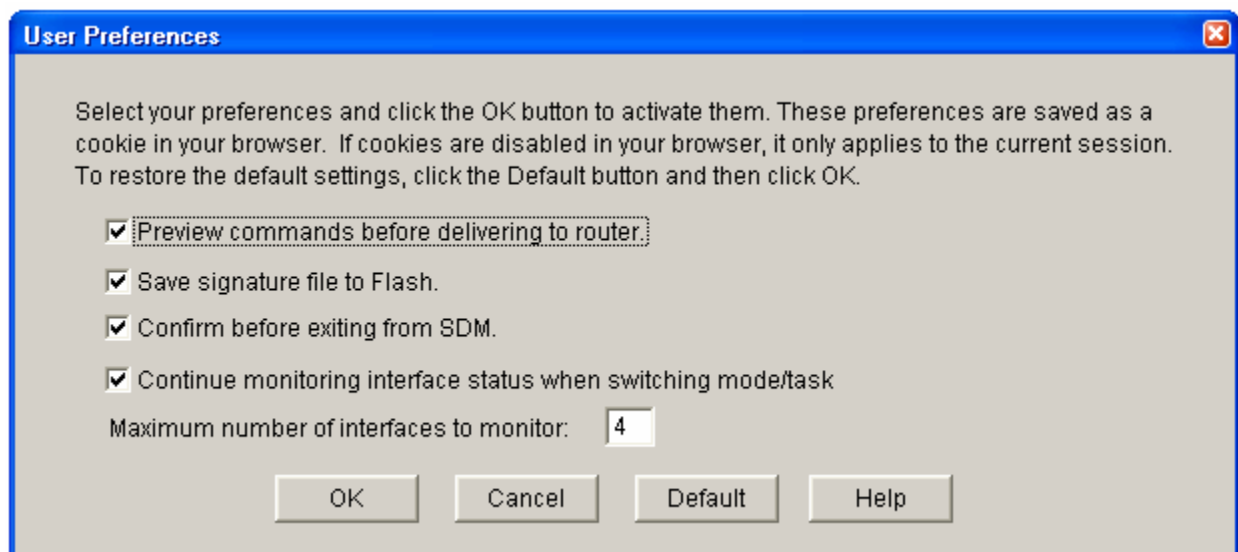
Step 7: Select additional tasks from the Configure menu.

a. Click the **Configure** button at the top of the SDM window and select **Additional Tasks** from the Task menu at the left of the screen. In the Additional Tasks menu, click the plus sign (+) next to DHCP to expand the menu, and then click **DHCP Pools**.
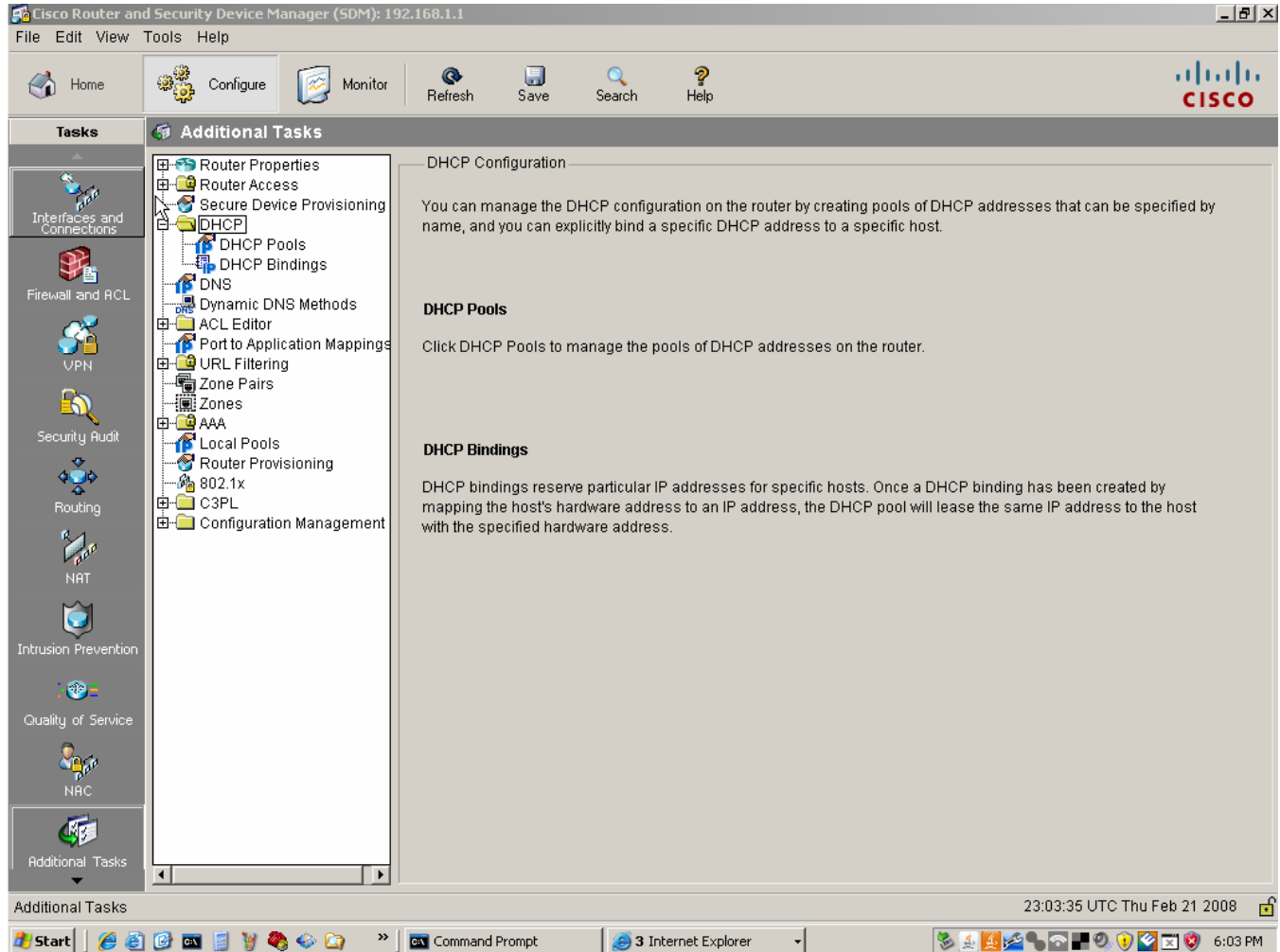
b. In the DHCP Pools screen, click the **Add** button to create a new DHCP pool. Enter the values shown in the following screen to define the DHCP pool name, network, subnet mask, start and end of the IP address range, DNS server address, domain name, and default gateway router. Click **OK** when you have entered all the values.

c. Why is the starting IP address set to 192.168.1.2 instead of 192.168.1.1?

    _____

    _____

d. In the **Deliver Configuration to Router** window, review the CLI commands that were generated by the SDM. These are the commands that are delivered to the router to configure DHCP. The commands can also be manually entered from the CLI to accomplish the same task, which you will do in Task 2 of this lab. Do *not* check the box **Save running config to router's startup config**. Click **Deliver** to finish configuring the router.

    Note: By default, the commands that you just generated only update the running configuration file when delivered. When finished configuring the router for DHCP with SDM, you will configure DHCP using the CLI. When you restart the router, you want it to revert back to the configuration that you saved in Step 2.

Deliver Configuration to Router   ⊠

Deliver delta commands to the router's running config.

Preview commands that will be delivered to the router's running configuration.

```
ip dhcp pool INTERNAL
 network 192.168.1.0 255.255.255.0
 domain-name abc-widgets.inc
 dns-server 192.168.1.200
 default-router 192.168.1.1
 import all
 lease 1
 exit
ip dhcp excluded-address 192.168.1.1
ip dhcp excluded-address 192.168.1.101 192.168.1.254
```

The differences between the running configuration and the startup configuration are lost whenever the router is turned off.

☐ Save running config. to router's startup config.
    This operation can take several minutes.

    [Deliver]   [Cancel]   [Save to file]   [Help]

e. What is the purpose of the last two commands in this configuration?

_____

_____

_____

f. After the commands are delivered, the final DHCP screen showing the details of the DHCP pool is displayed.

Details of DHCP Pool   INTERNAL

Parameters Pushed to client	Value
DHCP Pool Range	192.168.1.2-192.168.1.100
Default router IP address	192.168.1.1
DNS Servers	192.168.1.200
WINS Servers	<None>
Domain Name	abc-widgets.inc
Lease Time	1 Day(s)
Import All	True

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

Step 8: Test the DHCP pool configuration with SDM.

a. On the customer host H2, open a command prompt, and issue the **ipconfig** command.

b. What IP address is issued to H2? _____

c. From host H1, ping the default gateway (the router Ethernet interface). Does the ping succeed?
    _____

    Troubleshoot as necessary, and do not proceed until the ping is successful.

Task 2: Configure and Verify DHCP Using the CLI

Step 1: Restart the Customer router to remove the DHCP commands added by SDM.

a. Because you did not save the DHCP configuration created using SDM to NVRAM, restarting the router restores the basic configuration created in Task 1, Step 2. On the Customer router, issue the **reload** command.

b. When prompted to save the configuration, respond with **no**.

c. When prompted with **Proceed with reload? [confirm]**, press **Enter**.

d. Press Enter at the **Press RETURN to get started!** prompt. You should now see the **Customer>** prompt.

Step 2: Check the host DHCP client H2 IP configuration.

a. Open a command prompt window on H2 and issue the **ipconfig /release** and **ipconfig /renew** commands. Because there is no DHCP server currently configured, it may take a while to timeout.

b. At the command prompt, now issue the **ipconfig** command. What is the IP address and subnet mask for H2?
    _____

Step 3: Configure the DHCP server excluded addresses on the Customer router.

To prevent certain addresses from being assigned they must be excluded from the pool. This includes the IP address of the router Fast Ethernet 0/0 interface (the default gateway). In this lab, also exclude addresses from 192.168.1.101 through 192.168.1.254 to reserve them for other purposes, such as servers and printers, which need to have a fixed IP address.

a. To exclude addresses, issue the **ip dhcp excluded-address** command.

```
Customer(config)#ip dhcp excluded-address 192.168.1.1
Customer(config)#ip dhcp excluded-address 192.168.1.101 192.168.1.254
```

b. Why do you want to exclude addresses before the DHCP pool is even created?

    _____

    _____

Step 4: Configure the DHCP pool.

On the Customer router, configure a DHCP pool for the internal clients.

```
Customer(config)#ip dhcp pool INTERNAL
Customer(dhcp-config)#network 192.168.1.0 255.255.255.0
Customer(dhcp-config)#domain-name abc-widgets.inc
Customer(dhcp-config)#default-router 192.168.1.1
Customer(dhcp-config)#dns-server 192.168.1.200
```

Step 5: Test the DHCP pool for H2.

a. On H2, open a command prompt and issue the **ipconfig /release** and **ipconfig /renew** commands.

b. On H2, issue the **ipconfig /all** command.

c. What IP address is issued to H2? _____

   d.   What is the subnet mask of H2? _____.

   e.   What is the default gateway of H2? _____

   f.   What is the connection-specific DNS suffix (domain name) of host H2? _____

   g.   What is the DHCP server IP address? _____

   h.   What is the DNS server IP address? _____

   i.   What is the MAC address of H2? _____

   j.   From H2, ping the default gateway (the router Ethernet interface). Does the ping succeed? _____

       Troubleshoot as necessary, and do not proceed until the ping is successful.

Step 6: Test the DHCP pool for H1.

   a.   On H1, choose **Start > Settings > Control Panel > Network Connections > Local Area Connection** and change the IP configuration from static to dynamic to make H1 a DHCP client like host H2. Click the **Properties** button, and then click **Internet Protocol (TCP/IP) Properties**. Select **Obtain an IP address automatically** and **Obtain a DNS server address automatically**. Click **OK** to exit the configuration window.

   b.   Open a command prompt on H1 and issue the **ipconfig /release** and **ipconfig /renew** commands. Because there is no DHCP server currently configured, it may take a while to timeout.

   c.   At the command prompt, now issue the **ipconfig** command.

   d.   What IP address is issued to H1? _____

Step 7: Display the DHCP binding on the Customer router.

   a.   To see the IP address and host hardware (MAC) address combination assigned by the DHCP server, issue the **show ip dhcp binding** command on the Customer router.

```
Customer#show ip dhcp binding
IP address    Client-ID/          Lease expiration         Type
              Hardware address
192.168.1.2   0100.0bdb.04a5.cd   Feb 22 2008 11:19 AM     Automatic
192.168.1.3   0100.07e9.63ce.53   Feb 22 2008 11:27 AM     Automatic
```

   b.   Do the hardware addresses displayed match those recorded for hosts H1 and H2 in Task 1, Step 1? _____

   c.   On the Customer router, display the characteristics of the DHCP pool using the **show ip dhcp pool** command**.**

```
Customer#show ip dhcp pool
Pool INTERNAL :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 2
 Pending event                  : none
 1 subnet is currently in the pool :
 Current index    IP address range                Leased addresses
 192.168.1.4      192.168.1.1 - 192.168.1.254      2
```

   d.   How many addresses have been leased? _____

   e.   In the output from the command, what do you think **Current Index** means?

       _____

Step 8: Reflection

    a.   What are some advantages and disadvantages of using DHCP?

        _____

        _____

    b.   What are some advantages and disadvantages of using SDM to configure DHCP on a router as compared to the CLI?

        _____

        _____

Router Interface Summary				
Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
800 (806)	Ethernet 0 (E0)	Ethernet 1 (E1)		
1600	Ethernet 0 (E0)	Ethernet 1 (E1)	Serial 0 (S0)	Serial 1 (S1)
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)
2500	Ethernet 0 (E0)	Ethernet 1 (E1)	Serial 0 (S0)	Serial 1 (S1)
2600	Fast Ethernet 0/0 (FA0/0)	Fast Ethernet 0/1 (FA0/1)	Serial 0/0 (S0/0)	Serial 0/1 (S0/1)

Note: To find out exactly how the router is configured, look at the interfaces. The interface identifies the type of router and how many interfaces the router has. There is no way to effectively list all combinations of configurations for each router class. What is provided are the identifiers for the possible combinations of interfaces in the device. This interface chart 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 information in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.