



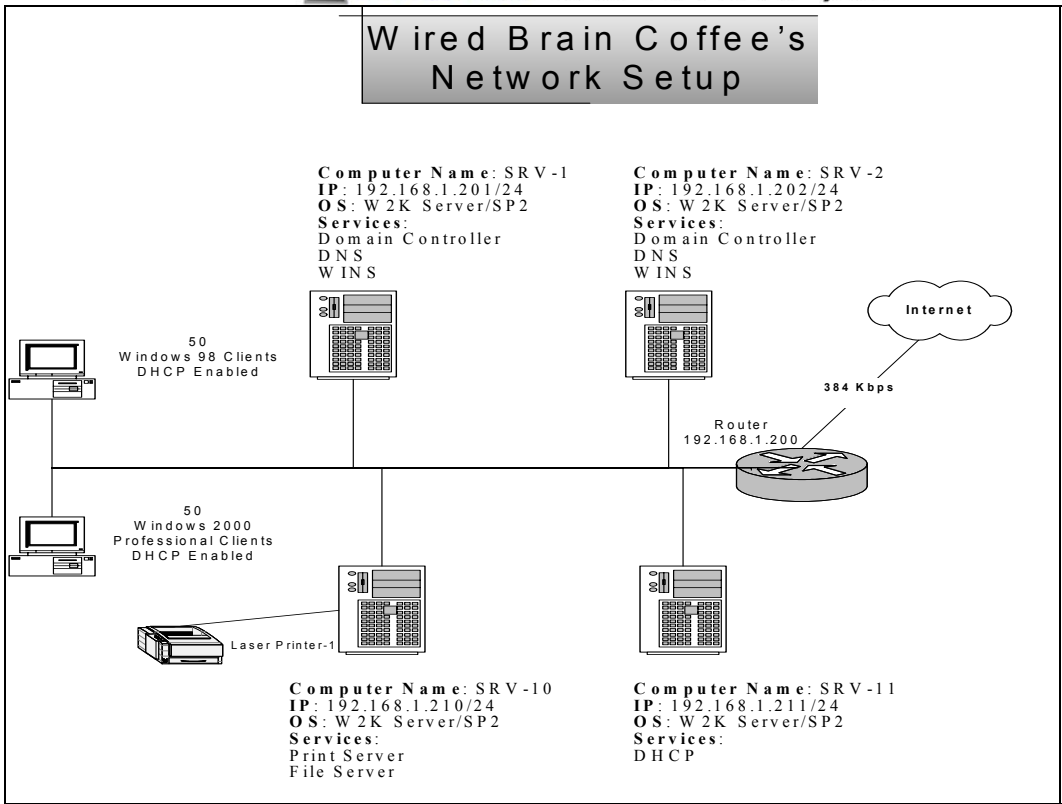
Windows 2000/Server 2003  
**MEGA LAB SERIES**  
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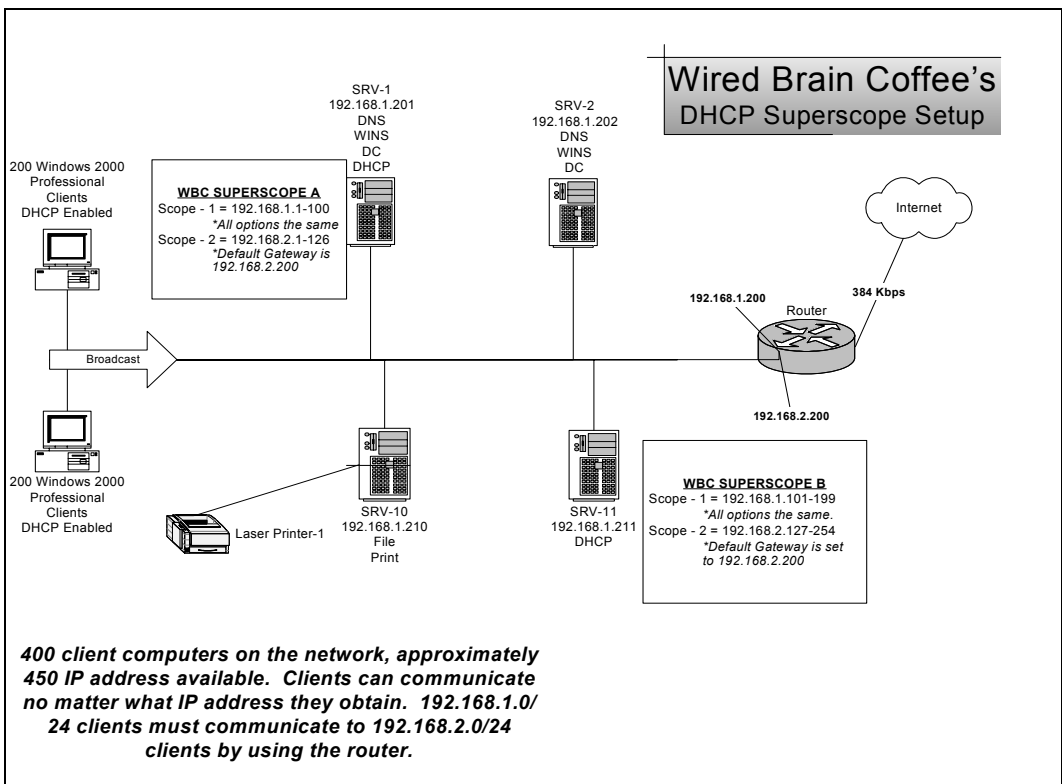
Building a Windows 2000 DHCP Infrastructure  
for Wired Brain Coffee, Inc.

## **Mega Lab 5**

Part 2 of 3 in the Building a Windows 2000/Server 2003  
Network Infrastructure Series

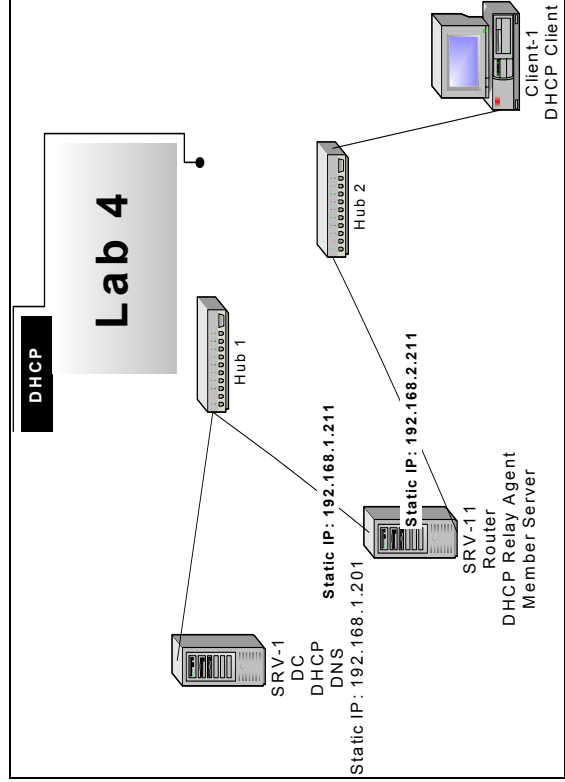
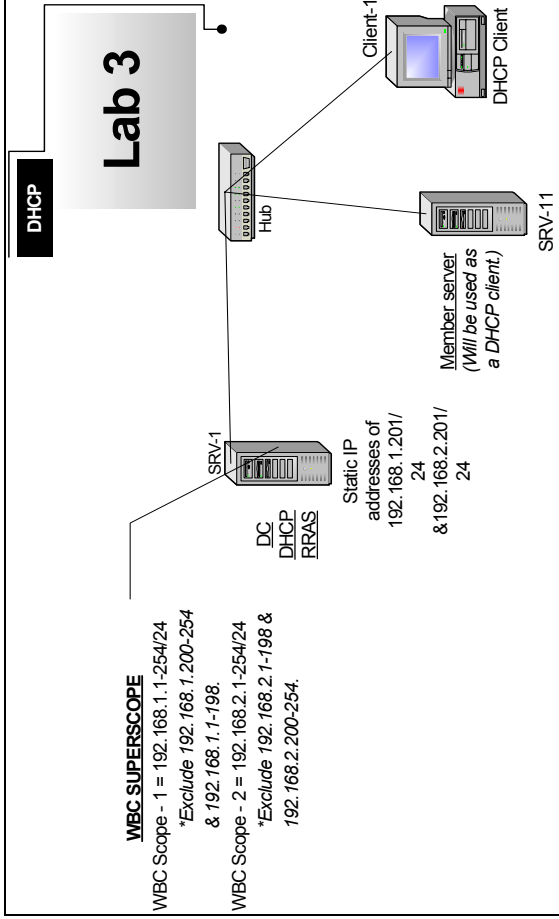
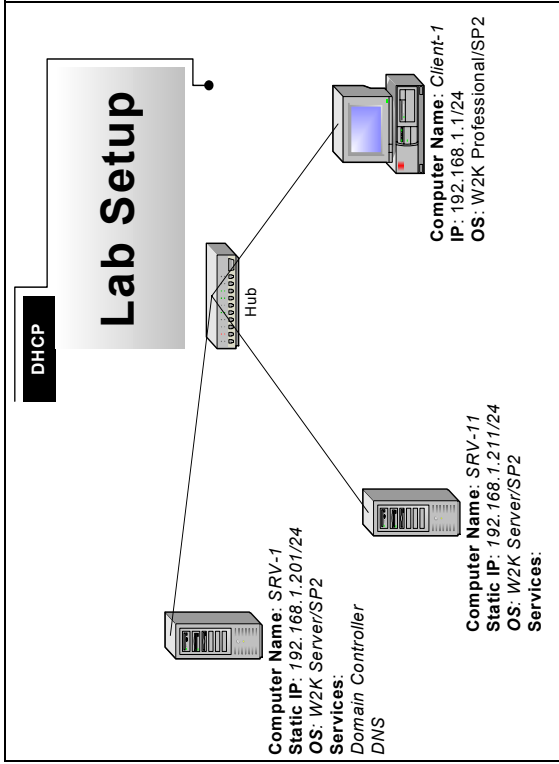


**Lab 1**



**400 client computers on the network, approximately 450 IP address available. Clients can communicate no matter what IP address they obtain. 192.168.1.0/24 clients must communicate to 192.168.2.0/24 clients by using the router.**

**Lab 3**



# **Building a DHCP Infrastructure for Wired Brain Coffee, Inc.**

## **Mega Lab 5**

**Part 2 of 3 in the  
Building a Windows 2000  
Network Infrastructure Series**



## **About the Authors**

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## Introduction

Welcome to Train Signal!

This series of labs on Windows 2000 is designed to give you detailed, hands-on experience working with Windows 2000. Train Signal's Audio-Visual Lab courses are targeted towards the serious learner, those who want to know more than just the answers to the test questions. We have gone to great lengths to make this series appealing to both those who are seeking Microsoft certification and to those who want an excellent overall knowledge of Windows 2000.

Each of our courses put you in the driver's seat, working for different fictitious companies, deploying complex configurations and then modifying them as your company grows. They are not designed to be a "cookbook lab," where you follow along with the steps of the "recipe" until you have completed the lab and have learned nothing. Instead, we recommend that you perform each step and then analyze the results of your actions in detail.

To complete these labs yourself, you will need three computers equipped as described in the Lab Setup section. You also need to have a foundation in Windows 2000 and TCP/IP concepts. You should be comfortable with installing Windows 2000 Professional or Server and getting the basic operating system up and running. Each of the labs in this series will start from a default installation of Windows 2000 and will then run you through the basic configurations and settings that you must use for the labs to be successful. It is very important that you follow these guidelines **exactly**, in order to get the best results from this course.

The course also includes a CD-ROM that features an audio-visual walk-through of all of the labs in the course. In the walk-through, you will be shown all of the details from start to finish on each step, for every lab in the course. During the instruction, you will also benefit from live training that discusses the current topic in great detail, making you aware of many of the fine points associated with the current topic.

Thank you for choosing Train Signal!



# Lab Setup



## Setting up the Lab

### 1. Computer Equipment Needed

Item	Minimum	Recommended
Computers	(3) Pentium I 133 MHz	(3) Pentium II 300MHz or greater
Memory	128 MB	256 MB
Hard Drive	2 GB	4 GB or larger
NIC	1/machine ( 2 <sup>nd</sup> NIC needed for Lab 4)	1 computer should have 2 NICs
Hubs	1	2 (or 1 hub and a cross-over cable)
Network Cable	(3) Category 5 cables	(4) Category 5 cables

I strongly urge you to acquire all of the recommended equipment in the list above. It can all be easily purchased from eBay or another source, for around \$500 (less if you already have some of the equipment). This same equipment is used over and over again in all of Train Signal's labs and will also work great in all sorts of other network configurations that you may want to set up in the future. It will be an excellent investment in your education. You may also want to look into a disk-imaging product such as Norton Ghost. Disk imaging software will save you a tremendous amount of time when it comes to reinstalling Windows 2000 for future labs. Many vendors offer trial versions or personal versions of their products that are very inexpensive.



## 2. Computer Configuration Overview

Computer Number	1	2	3
Computer Name	SRV-1	SRV-11	Client-1
IP Address	192.168.1.201/24	192.168.1.211/24	192.168.1.1/24
OS	W2K Server	W2K Server	W2K Pro
Additional Configurations	Domain Controller DNS Server SP2	SP2	SP2

## 3. Detailed Lab Configuration

### \*\*\*Important Note\*\*\*

This lab should NOT be performed on a live production network. You should only use computer equipment that is not part of a business network AND is not connected to a business network. Train Signal Inc., is not responsible for any damages. Refer to the full disclaimer and limitation of liability which appears at the beginning of this document and on our web site, [www.trainsignal.com](http://www.trainsignal.com).

### Computer 1

Computer 1 will be named SRV-1 and the operating system on this computer will be Windows 2000 Server or Advanced Server. You should also install Service Pack 2 to avoid any unforeseen problems. If you do not have a copy of Windows 2000 Server you can obtain an evaluation copy of Windows 2000 Advanced Server within the Microsoft Press series of books and Service Pack 2 is available for download on Microsoft's web site.

SRV-1 will have a static IP address of 192.168.1.201 with a 255.255.255.0 subnet mask. The default gateway field can be left blank but you should enter this computer's own IP address for the Preferred DNS field (192.168.1.201). The alternate DNS Server field can be left blank. This computer will be set up as a Domain Controller by using the `dcpromo.exe` program. If you are unsure of this procedure, watch the Pre Lab video on the CD-Rom to



get a better understanding of the process. In order to make this machine a domain controller, DNS will need to be installed as well. There are 2 ways to install DNS at this point - automatically when you run dcpromo.exe or manually **before** you run dcpromo.exe. For our purposes, we are going to install DNS automatically, when we run dcpromo.exe. Run dcpromo.exe on this machine and make the following selections as you are prompted: Create a new domain; Create a new domain tree; Create a new forest of domain trees. The domain name for the scenario is wiredbraincoffee.com. Leave all the other settings at their defaults. When the wizard asks, install DNS, by selecting install and configure DNS now. Next, choose permissions compatible for pre-Windows 2000 computers. Then you will be asked for an AD password. For our purposes we will leave this blank. Active directory installation should then take place and you can restart the computer when you are prompted. **MAKE SURE** that the network card is plugged into a hub or into another computer with a crossover cable. Otherwise, Active Directory installation will fail, without giving you a clear cause. See figure 1, next page.

### **Computer 2**

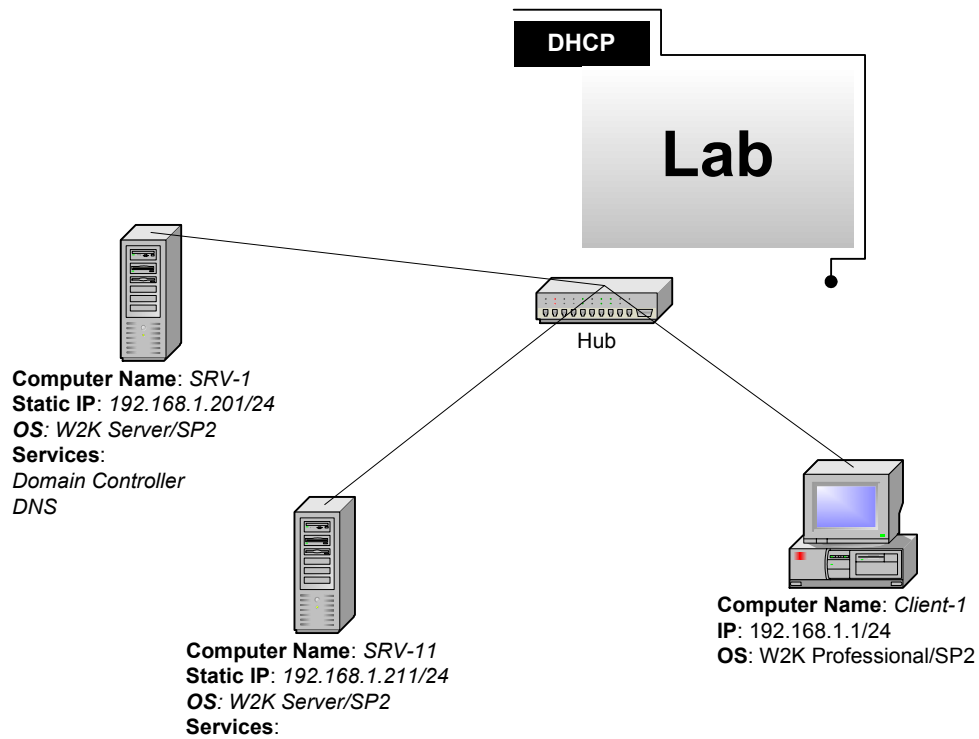
Computer 2 will be named SRV-11 and Windows 2000 (either version once again) will be installed on this computer with Service Pack 2. The computer will be joined to the Wired Brain Coffee domain as a member server. SRV-11 will have a static IP address of 192.168.1.211 with a 255.255.255.0 subnet mask. The default gateway can be left alone at this point. Configure the preferred DNS server setting to point to SRV-1, 192.168.1.201 and leave the alternate DNS setting blank. You will need to make this computer a member server of wiredbraincoffee.com by simply right-clicking on the “My Computer” icon on the desktop and selecting properties. Select the Network identification tab, select properties, select domain and type in the domain name of the domain it will join, which is wiredbraincoffee.com and click OK. It will then ask for a username and password. Use the administrator account name and password from the wiredbraincoffee.com domain. When it has joined successfully it will “welcome you to the domain” and then tell you that it needs to restart in order for the changes to take effect. After restarting the computer, **make sure you change the “Log on to” dialog box to the domain rather than “this computer.”** See figure 1, next page.

### **Computer 3**

Computer 3 will be named Client-1 and have Windows 2000 Professional installed as the operating system. Client-1 will be joined to the wiredbraincoffee.com domain just as SRV-11 was. Client-1 will eventually be a DHCP client, but initially will have an IP address of 192.168.1.1 with a 255.255.255.0 subnet mask. See figure 1, next page.

### ***\*\*\*Important\*\*\****

*You should test the network connections (using the PING command) between each of these machines to ensure that your network is set up properly. Testing before you get started will save you major time and effort later.*



(figure 1)

**\*\*\*Important Note\*\*\***

This lab should NOT be performed on a live production network. You should only use computer equipment that is not part of a business network AND is not connected to a business network. Train Signal Inc., is not responsible for any damages. Refer to the full disclaimer and limitation of liability which appears at the beginning of this document and on our web site, [www.trainsignal.com](http://www.trainsignal.com).





# Lab 1

## Creating the first DHCP Server for Wired Brain Coffee, Inc.

You will learn how to:

- Install and configure a DHCP server
- Assign IP addresses for the Router, WINS, and DNS servers using DHCP client scope options
  - Create DHCP exclusions
- Configure and test DHCP from the client





## Scenario - Part One

Wired Brain Coffee, Inc., a distributor of specialty coffees, has upgraded to Windows 2000 and is rebuilding their corporate network. You are one of two network administrators that WBC, Inc., has hired. Your network manager has put you in charge of deploying DHCP for your corporate network.

Wired Brain Coffee, Inc., is located in Seattle and currently has 100 employees, all located in the Seattle office. Presently, your network consists of 50 Windows 98 machines and 50 Windows 2000 Professional machines. WBC, Inc., also has 4 servers running Windows 2000 on the network, 2 domain controllers and 2 member servers, performing assorted duties. Wired Brain uses the domain name wiredbraincoffee.com for their public web presence and they use the same domain name for their internal Windows 2000 domain name as well. They are connected to the Internet via a router that performs NAT (Network Address Translation) with a 384Kbps fractional T1 connection.

The outside consultant who originally designed WBC's network used the network ID 192.168.1.0/24 and your IT manager has chosen to keep this scheme for the new network. Your IT manager has also stipulated that **all** servers, routers or other network devices (basically everything except client machines) will be assigned static IP addresses. The host numbers between 192.168.1.200 – 192.168.1.254 will be set aside on your network for servers, routers and other network devices.

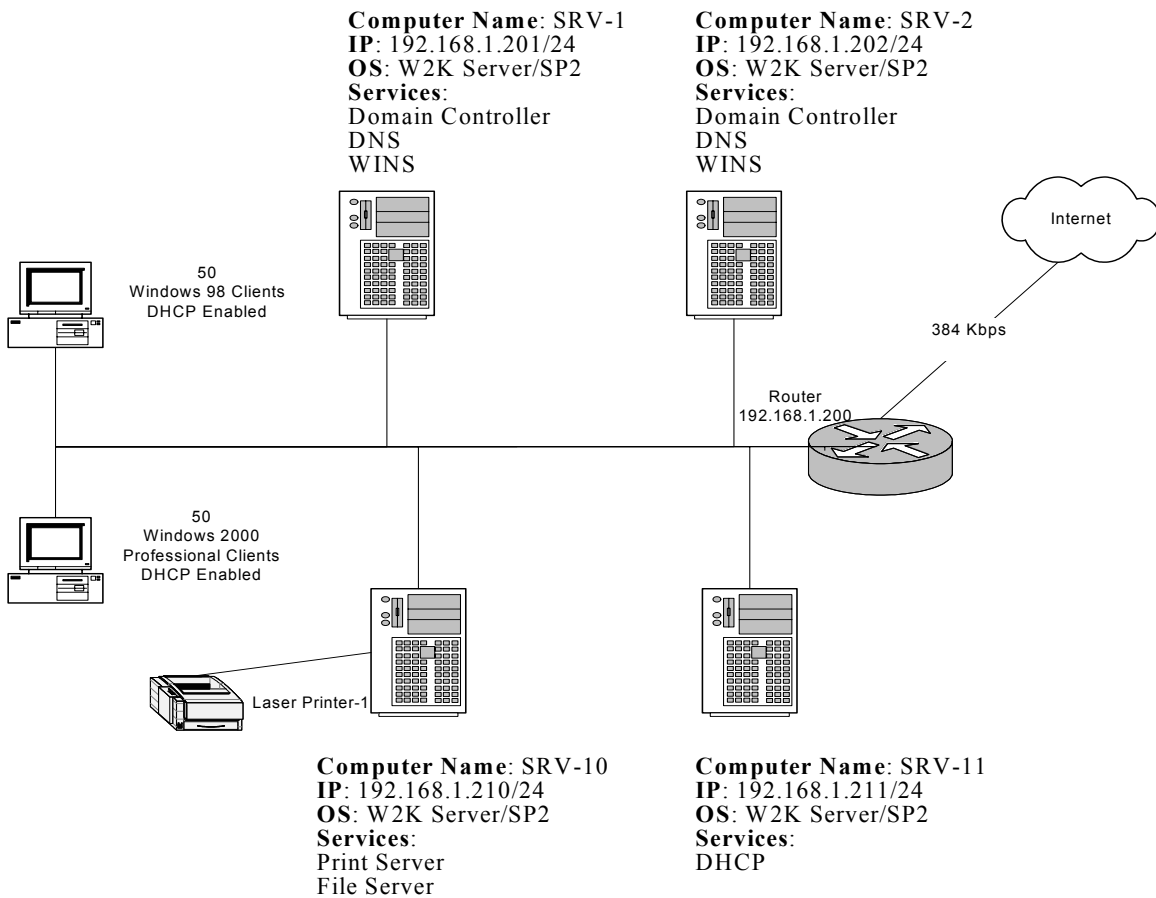
The servers on WBC's network will be configured as follows (see figure 2, next page):

Server Name	SRV-1	SRV-2	SRV-10	SRV-11
Server Role	Domain Controller	Domain Controller	Member Server	Member Server
Additional Configuration	DNS (Primary) WINS	DNS (Secondary) WINS	File Server Print Server	DHCP

### **\*\*\*Important Note\*\*\***

*Additional servers, services, network devices and configurations are included in this network to give you a feel for the different configurations that a network might take on and should **NOT** be completed prior to this lab or during the lab unless specified.*

**Wired Brain Coffee**  
(proposed design)



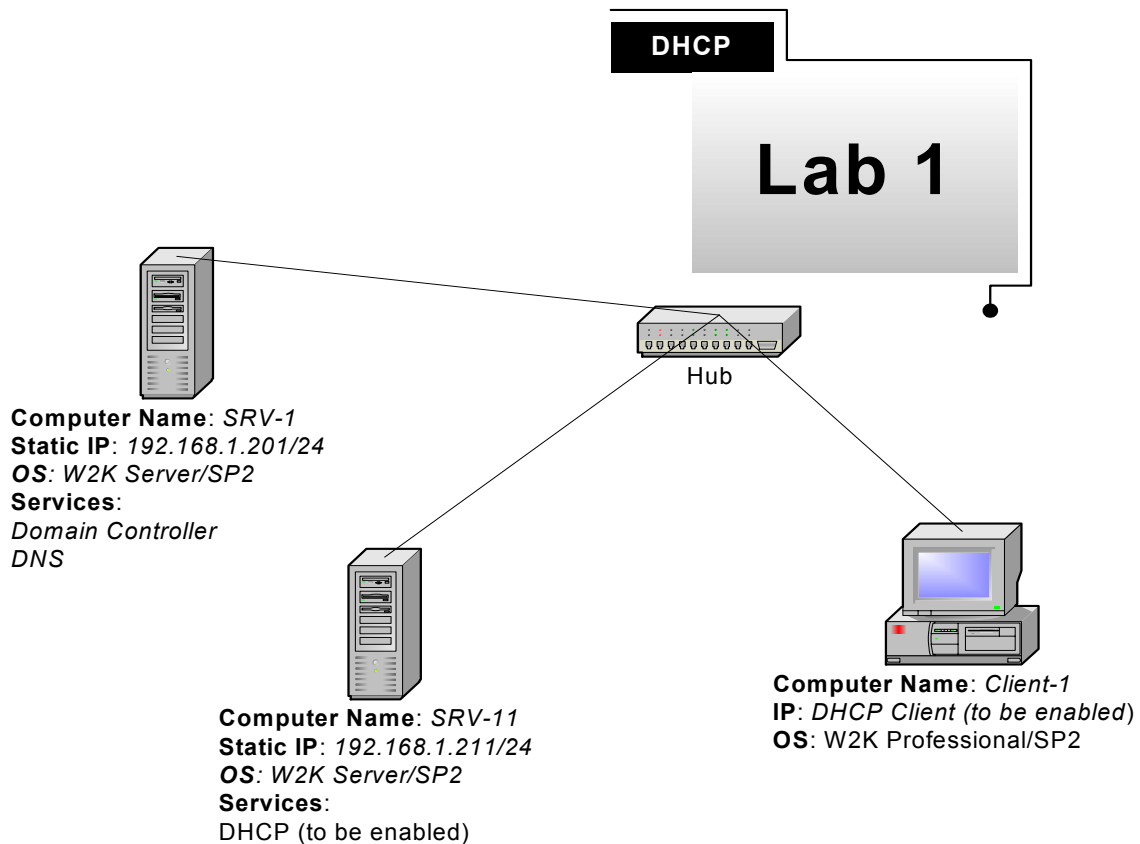
*(figure 2)*



## Scenario – Part Two

You have researched your ideas, discussed them with your manager and tested them in a lab, and the day has now come to put your hard work into practice. The plan calls for taking your existing member server named SRV-11 and making this the first DHCP server in your network. SRV-11 will provide the DHCP clients (all of the Windows 2000 Professional and Windows 98 machines) on the network with an IP address as well as the proper DNS, WINS & default gateway configurations.

In this lab you will install the DHCP service on SRV-11, a member server in the wiredbraincoffee.com domain. You will authorize SRV-11 in Active Directory and then create a scope on it to satisfy the requests of the DHCP clients on your network. Client-1 will serve as the test PC to ensure that all of the appropriate IP information is being pulled down from the DHCP server. See figure 3.

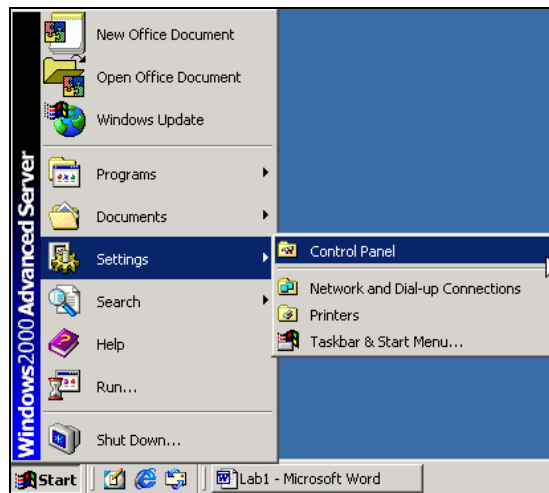


(figure 3)



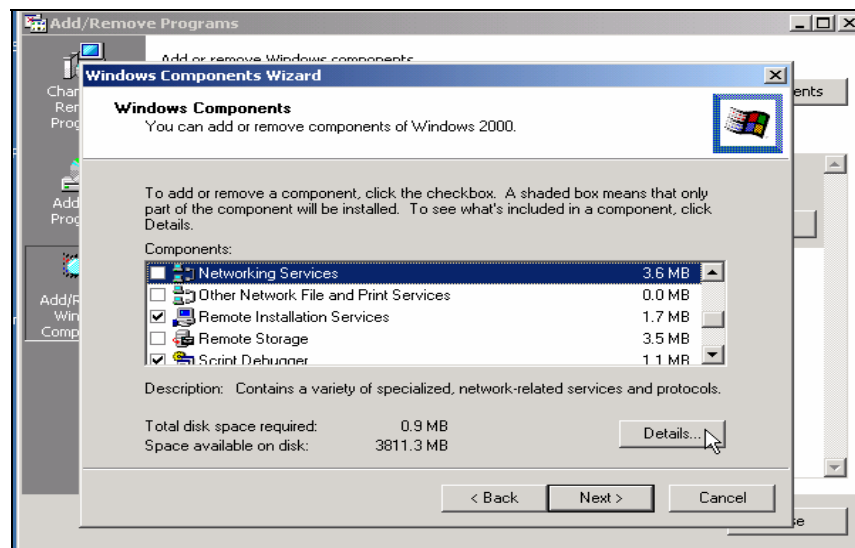
## Installing and configuring a DHCP server

1. On SRV-11 go to **Start, Settings and Control Panel** (See figure 4).



(figure 4)

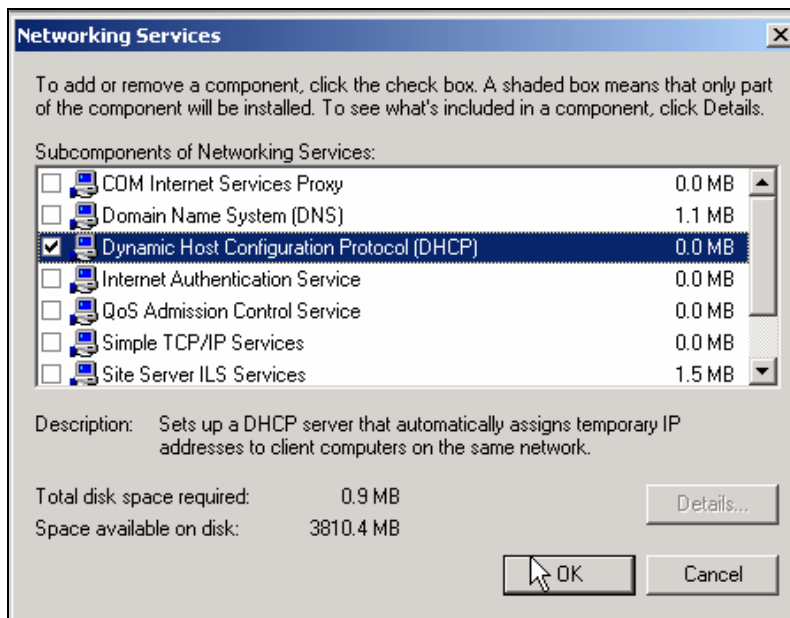
2. Double click on **Add/Remove Programs** and then click on **Add/Remove Windows Components**.
3. In the Windows Components window, scroll down and click on **Networking Services**. Click **Details** (**DO NOT** check the box next to Networking Services. This will install all of the Networking Services and you only want DHCP installed presently). See figure 5.



(figure 5)



4. Under the Networking Services window find and select **Dynamic Host Configuration Protocol (DHCP)**. Click OK. See figure 6.



(figure 6)

5. Click **Next** and make sure you have your Windows 2000 server CD in the CD-ROM Drive (or specify where the I386 source files are located when you are prompted). Click **Next** for the installation to begin.
6. When the installation is done, click **Finish**.

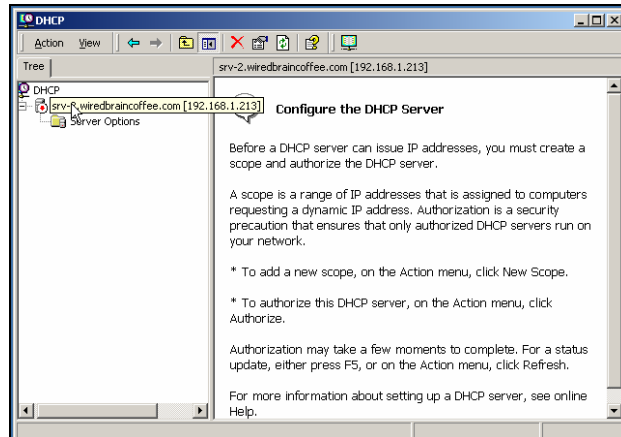
### Authorizing the DHCP server

Before a Windows 2000 DHCP server can start giving out IP addresses it must be authorized within Active Directory. Requiring authorization helps to prevent "rogue" DHCP servers from giving out bad TCP/IP information to DHCP clients.

1. From your desktop go to **Start, Programs, Administrative Tools** and select **DHCP**.

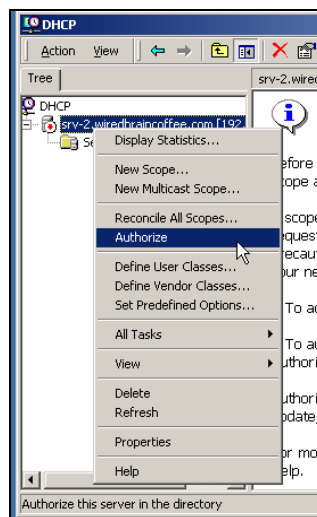


- This will bring up the management console for DHCP. Notice the server you installed is there, but it has a red arrow pointing down next to it. This indicates that the server is not authorized in Active Directory. See figure 7.



(figure 7)

- In order to authorize SRV-11 in Active Directory, right-click on the server and select **Authorize**. If you have the proper permissions to authorize the server, the red arrow will become a green arrow pointing up within a few seconds. See figure 8.



(figure 8)

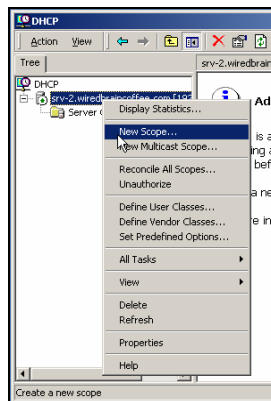
**\*\*\*Note\*\*\***

*In some cases you will have to close and open the DHCP management console to show the green arrow next to the server.*



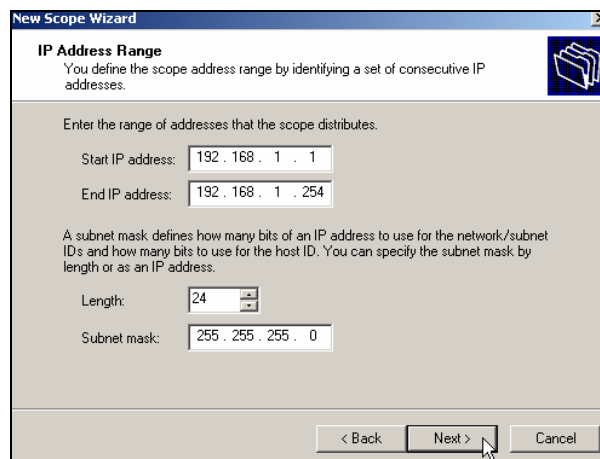
## Creating the DHCP scope

1. The next step is to create a scope specifying the correct IP addresses to distribute. Start by right clicking on the server and select **New Scope**. See figure 9.



(figure 9)

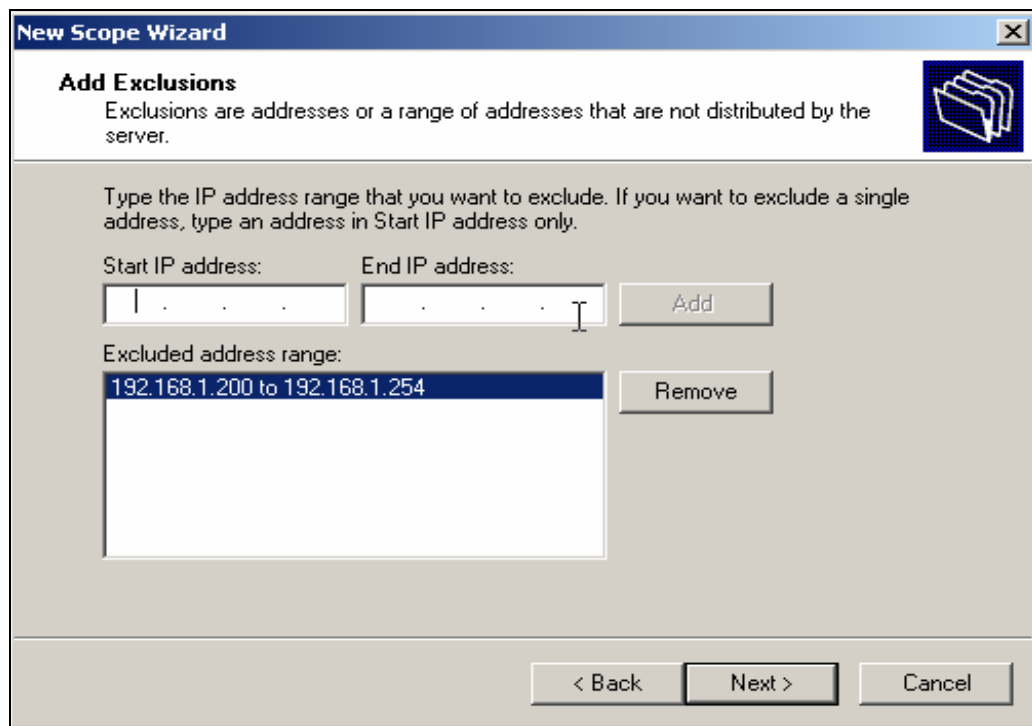
2. Selecting New Scope will bring up a wizard that will help you through the process of creating a scope and configuring some of the options that can be set on the scope.
3. First click **Next** and then enter **WBC-Scope 1** for the name and enter **Seattle** for the scope description. The description of the scope is helpful if multiple scopes exist on one server. When you have finished, click Next.
4. The wizard will then prompt you for a range of IP addresses to distribute with this scope. Enter the range beginning with 192.168.1.1 and ending with 192.168.1.254. This is the range of IP addresses planned for Wired Brain Coffee. Next enter the subnet mask. This can be configured by entering the number of bits that make up the subnet mask (Length) or by entering the decimal number. The Subnet Mask should be 255.255.255.0. Click Next. See figure 10.



(figure 10)



5. The Add Exclusions screen is where you enter any IP addresses from your specified range that you want to exclude from being distributed by the DHCP server. Here you will enter **192.168.1.200** through **192.168.1.254**, which are the IP addresses that WBC's network manager designated for servers, routers and other network devices. Make sure to Click **Add** before you Click **Next**. See figure 11.



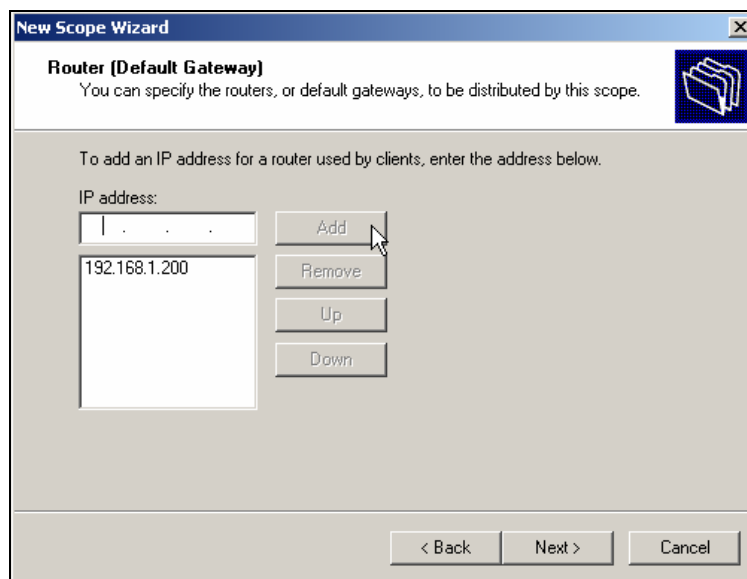
(figure 11)

6. In the next step you are asked the amount of time you want the IP addresses to be leased for. The default value is 8 days and you should leave it at 8 days for this scenario. Keep in mind that if you make the lease time shorter it will create more traffic on the network because clients will try to renew their leases more often. Click **Next**.





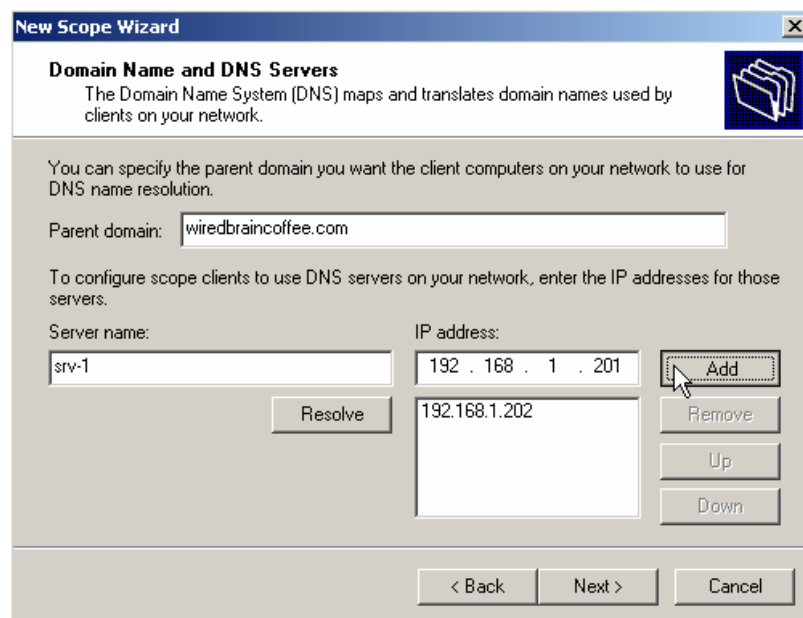
7. Next, you will be asked if you would like to configure scope options now or later. These options allow you to specify the IP addresses of a DNS server, WINS server, router (default gateway) as well as other information. Select **Yes** and click **Next**.
8. The first option is the Router (default gateway). Wired Brain Coffee only has one network segment but they do connect to the Internet. The default gateway of the network clients will be 192.168.1.200, the internal side of the router. Enter the IP address of the router, **192.168.1.200**. Click **Add** and then **Next** when finished. See figure 12.



*(figure 12)*



- The second scope option allows you to enter the DNS information that should be configured on each of the client computers. Remember, the name of the domain is wiredbraincoffee.com. This is what you should enter for the Parent domain field. The bottom section of this screen is used to configure the IP addresses of any DNS servers that you want your client computers to use. You can enter a server name and click the Resolve button to get the IP address or you can enter the IP address directly. WBC, Inc., has two DNS servers that the DHCP clients should use, **192.168.1.201** and **192.168.1.202**. Click **Add** to choose an IP address and **Next** when finished. See figure 13.



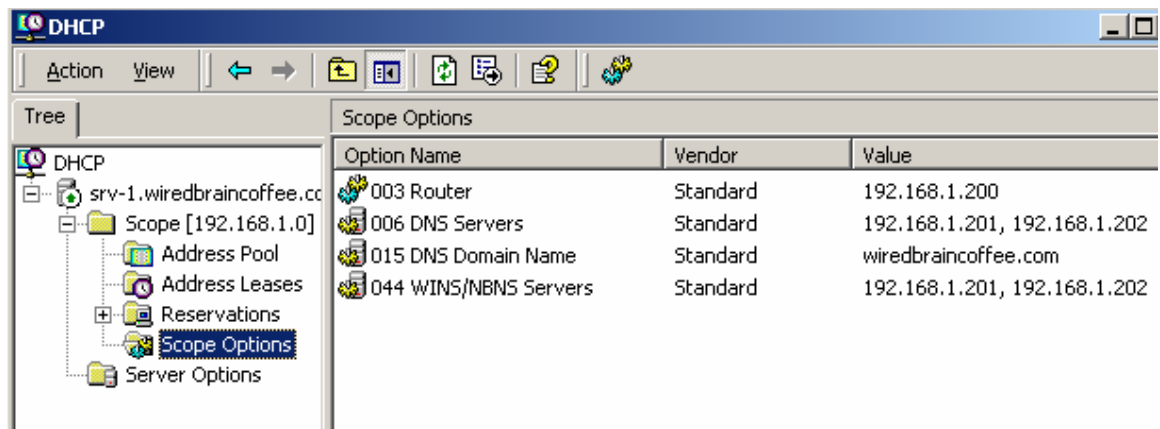
(figure 13)

- The third option allows you to enter the IP addresses of any WINS servers on the network. It works just like the previous screen, only now you're adding the IP addresses of WINS servers instead of DNS servers. Once again, type in the IP addresses **192.168.1.201 & 192.168.1.202** (WBC has DNS & WINS running on the same servers). Click **Add** and **Next** when finished.
- The last step in the new scope wizard will ask you if you want to activate the scope now or later. If you're ready to start distributing IP addresses on the network immediately, select **Yes**. If you choose No, you can activate the scope at a later time by right clicking on the scope and selecting Activate. In order to test the scope it will need to be activated, so choose **Yes**. Click **Next** and **Finish**.



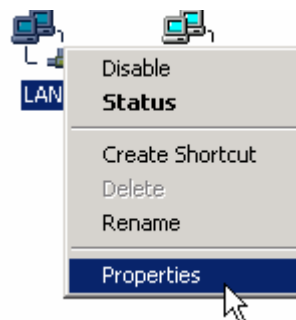
## Configuring & testing the DHCP client

1. First, verify that everything looks OK on the DHCP server. The server should be authorized and your scope should be active. You should also see scope options on your computer that look similar or identical to what you see below. See figure 14.



(figure 14)

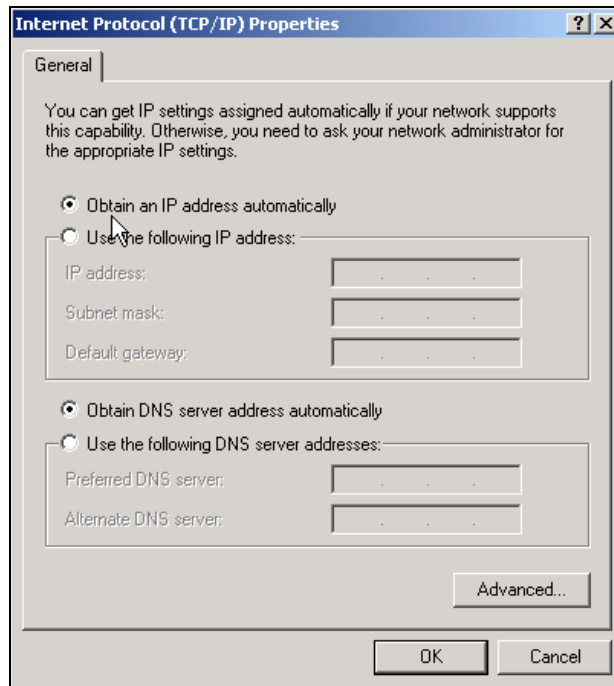
2. Next, log on to the client-1 computer. Right-click on **My Network Places** and select **Properties**. Then right-click on the **LAN connection** and select **Properties**. See figure 15.



(figure 15)

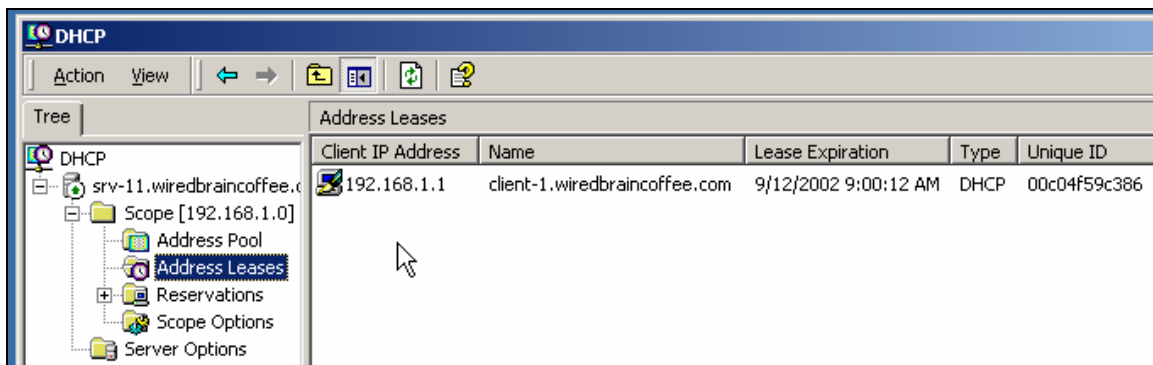


- On the LAN connection properties page select TCP/IP properties and make sure that it is set to **obtain an IP address and DNS address automatically**. See figure 16.



(figure 16)

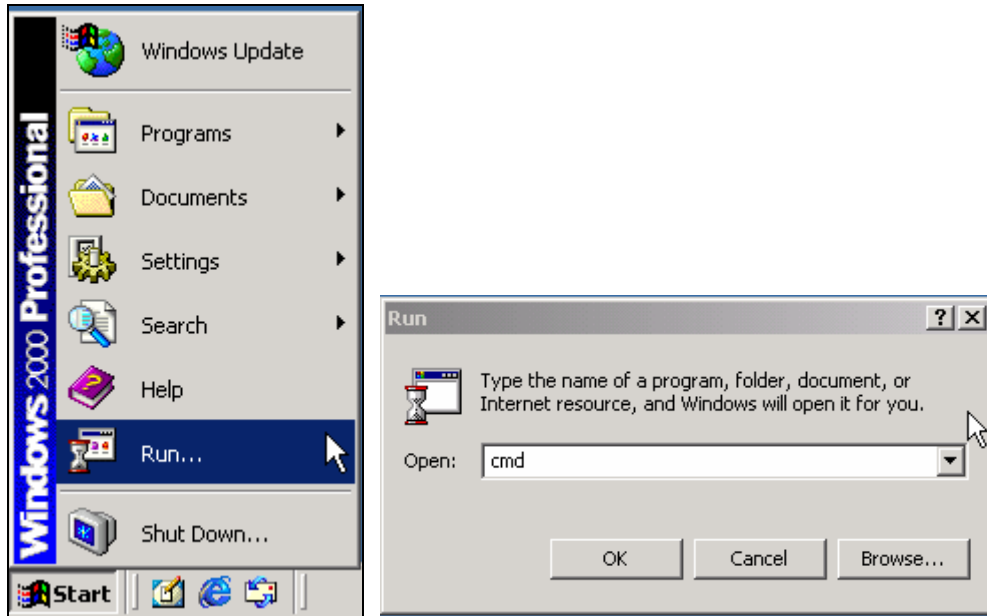
- Go back to SRV-11 and look at the DHCP console once again. Click on **Address Leases** and it should have an entry for the computer, client-1. It will show the IP address assigned, the computer name, the date the lease expires and the unique ID also known as the MAC address. See figure 17.



(figure 17)



- Another way to check that the DHCP service is working is from the client. Go back to client-1 and open the command prompt by going to **Start, Run...** then type in **cmd** and click OK. See figure 18.



(figure 18)

- At the prompt type in the command **ipconfig /all** and press Enter. This should give you all the detailed information about the network settings on the PC. They should all match the settings that were set on the scope options from the DHCP console. See figure 19.

```
C:\>ipconfig/all
Windows 2000 IP Configuration

Host Name . . . . . : Client-1
Primary DNS Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : wiredbraincoffee.com

Ethernet adapter Local Area Connection:

Connection-specific DNS Suffix . : wiredbraincoffee.com
Description . . . . . : 3Con 3C918 Integrated Fast Ethernet
Controller (3C905B-1X Compatible)
Physical Address. . . . . : 00-C0-4F-59-C3-86
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes
IP Address. . . . . : 192.168.1.1
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.1.200
DHCP Server . . . . . : 192.168.1.211
DNS Servers . . . . . : 192.168.1.201
                          192.168.1.202
Primary WINS Server . . . . . : 192.168.1.201
Secondary WINS Server . . . . . : 192.168.1.202
Lease Obtained. . . . . : Wednesday, September 18, 2002 12:17:
15 PM
Lease Expires . . . . . : Thursday, September 26, 2002 12:17:
5 PM
C:\>_
```

(figure 19)



# Lab 2

## Adding Fault Tolerance to Wired Brain Coffee's DHCP Infrastructure

You will learn how to:

- Install and Configure additional DHCP Servers
  - Create Fault Tolerant DHCP scopes
- Test the DHCP client for connectivity after DHCP failure



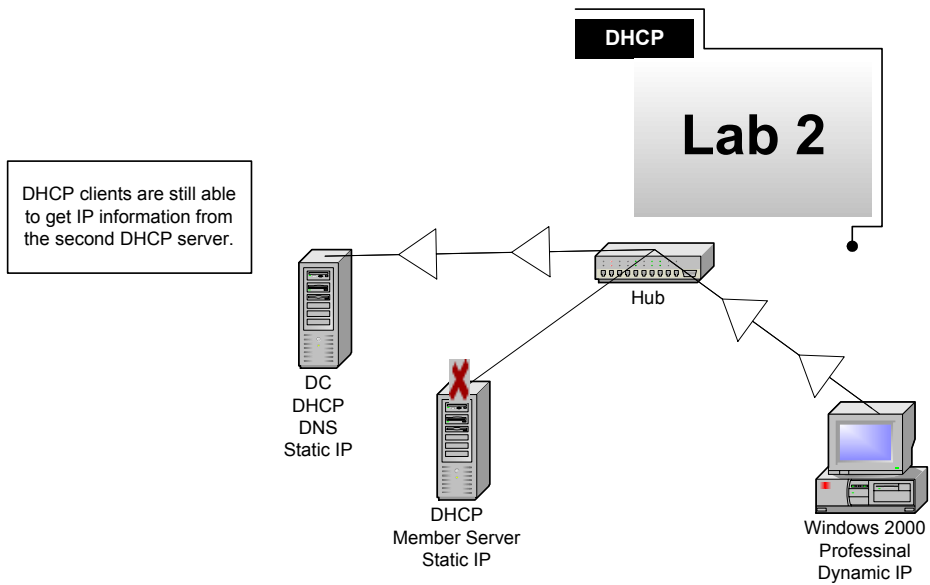
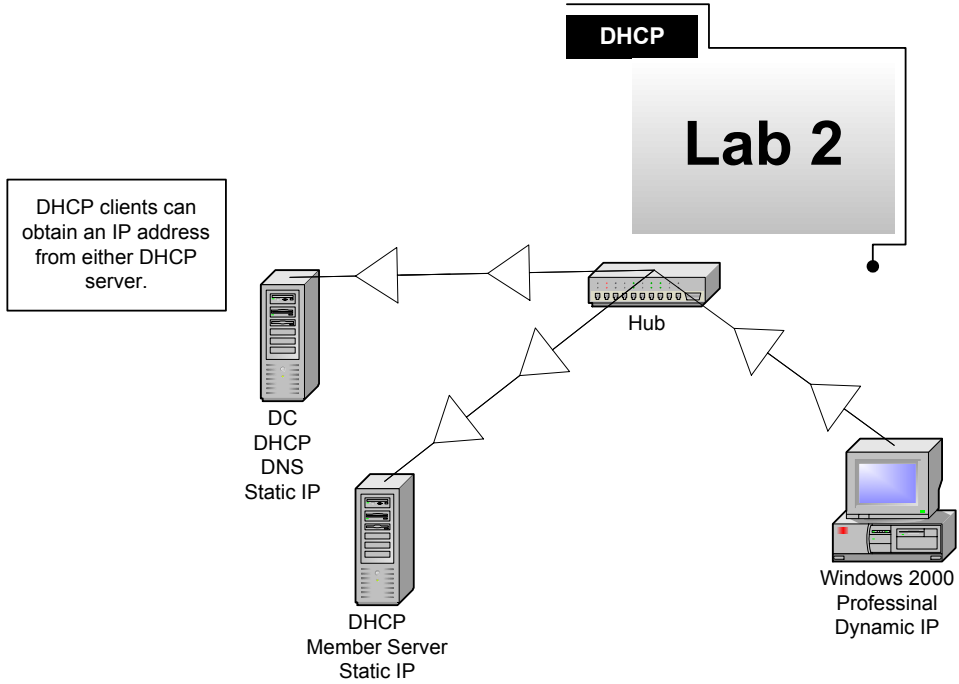
## Scenario

It's Monday morning after a long rough weekend and your pager is already going off, before you're even in the shower. After the third page in less than 10 minutes you decide you better suck it up and call your manager, Charlie. Unfortunately, Charlie gives you the bad news you knew was coming. "A lot of users are unable to log onto the network. Their computers boot up fine but when they try to log on they receive some sort of error message." You know better than to ask Charlie "what *type* of error message," because the last time he answered that question, you laughed in his face. He was quite irritated.

When you get into work you notice that one of your servers has an error message and it is not booted into the operating system. It's SRV-11, your DHCP server. After running through a checklist of possible problems, you come to the conclusion that a hard drive went bad in the server. Later that day, you finally get SRV-11 fixed and Charlie calls you in to his office. "Downtime like that is not acceptable, what can we do to prevent this from happening in the future?" After he nixes your idea of doubling the IT budget you are left to come up with another solution. What should you do?

One solution to this problem is creating a little fault tolerance in the DHCP service. This can be done by installing DHCP on another server in your network and configuring a scope on the second server to service the same subnet as SRV-11. If SRV-11 fails again, the second DHCP server will be able to cover for SRV-11 while it is out of commission.

In this lab you will install the DHCP service on SRV-1, a domain controller. Under normal circumstances, you would probably not install DHCP on a domain controller but SRV-1 has a light workload and Wired Brain Coffee is working on a small budget. After you install DHCP on SRV-1, you will then create a scope that services the same subnet that SRV-11 serves. This will allow clients on the network to obtain their IP address from either DHCP server. Be careful though! If the IP address ranges in the scopes cross over you will start getting duplicate IP addresses, which will cause communication issues on the network. See figure 20, next page.



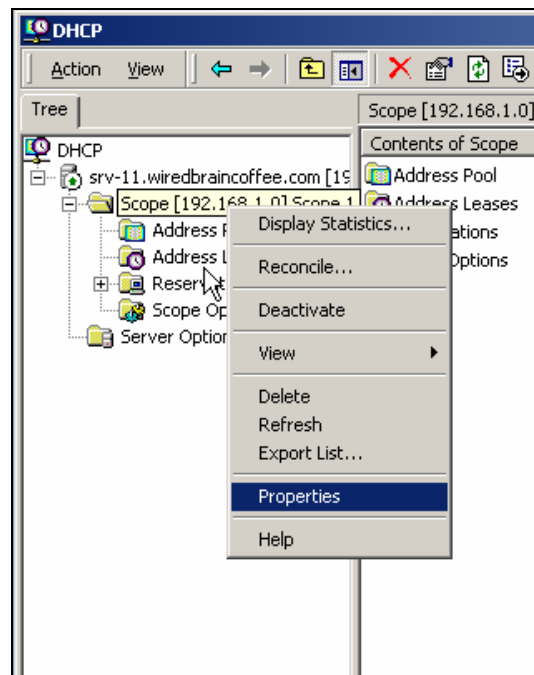
(figure 20)





## Adding the second DHCP server

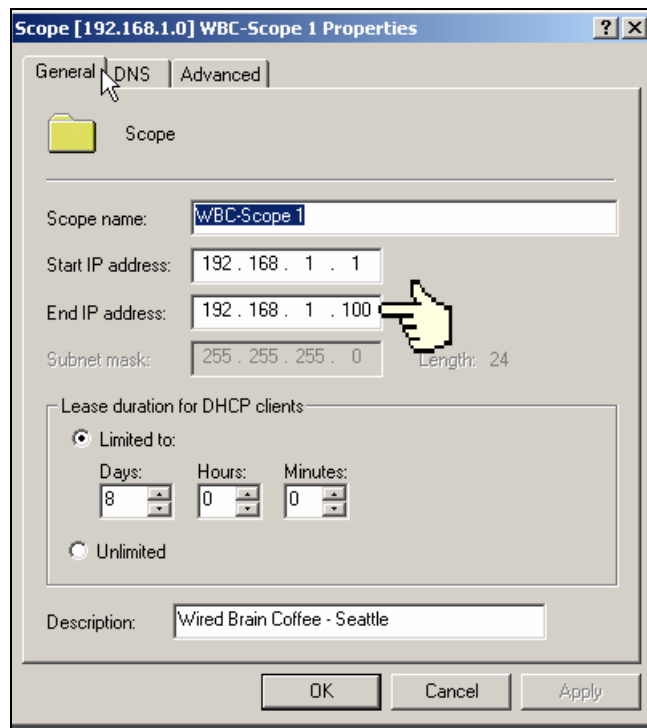
1. The first step is to revise the scope that is currently running on SRV-11. Instead of giving out all of the available IP addresses, you want it to only give out half of the IP address available and then have the new DHCP server give out the other half. In Lab 1, you configured the DHCP server to give out IP addresses between 192.168.1.1 and 192.168.1.199 (200 – 254 are reserved for servers and other network devices) with a 24 bit subnet mask. Therefore, you will use half of that range on the first scope, which will be 192.168.1.1 to 192.168.1.100.
2. Log on to SRV-11. Open the DHCP console on SRV-11. Right-click on the scope and from the menu, select **Properties**. See figure 21.



*(figure 21)*



3. From the Properties menu, under the General Tab, change the ending IP Address from 192.168.1.254 to 192.168.1.100. Then click **OK**. See figure 22.



(figure 22)

4. Next, log onto SRV-1 and install the DHCP service just as you did for SRV-11 in Lab 1, through Add/Remove Programs.
5. Once the installation is complete, you will need to authorize the server in Active Directory. Open up the DHCP console and Right Click SRV-1. Choose **Authorize**. Once the server is authorized, you will create a scope for the new server.

\*\*\*Once again, sometimes you will have to close and re-open the DHCP console several times before it shows up as authorized.



- Next, create a new scope by right clicking on SRV-1. Name the scope **WBC-Scope 2**. The description will be: **Wired Brain Coffee – Seattle - Backup**. Click **Next**. See figure 23.

The screenshot shows the "New Scope Wizard" dialog box. The title bar reads "New Scope Wizard". The main heading is "Scope Name". Below the heading, it says "You have to provide an identifying scope name. You also have the option of providing a description." There are two text input fields: "Name:" with the value "WBC-Scope 2" and "Description:" with the value "Wired Brain Coffee - Seattle - Backup". At the bottom, there are three buttons: "< Back", "Next >", and "Cancel". A mouse cursor is pointing at the "Next >" button.

(figure 23)

- For the scope range enter the portion left out from WBC-Scope 1 on SRV-11. This will be **192.168.1.101** through **192.168.1.254** with **255.255.255.0** as the subnet mask. Click **Next**. See figure 24.

The screenshot shows the "New Scope Wizard" dialog box at the "IP Address Range" step. The title bar reads "New Scope Wizard". The main heading is "IP Address Range". Below the heading, it says "You define the scope address range by identifying a set of consecutive IP addresses." There are two text input fields: "Start IP address:" with the value "192 . 168 . 1 . 101" and "End IP address:" with the value "192 . 168 . 1 . 254". Below these, it says "A subnet mask defines how many bits of an IP address to use for the network/subnet IDs and how many bits to use for the host ID. You can specify the subnet mask by length or as an IP address." There are two more input fields: "Length:" with a dropdown menu set to "24" and "Subnet mask:" with the value "255 . 255 . 255 . 0". At the bottom, there are three buttons: "< Back", "Next >", and "Cancel". A mouse cursor is pointing at the "Next >" button.

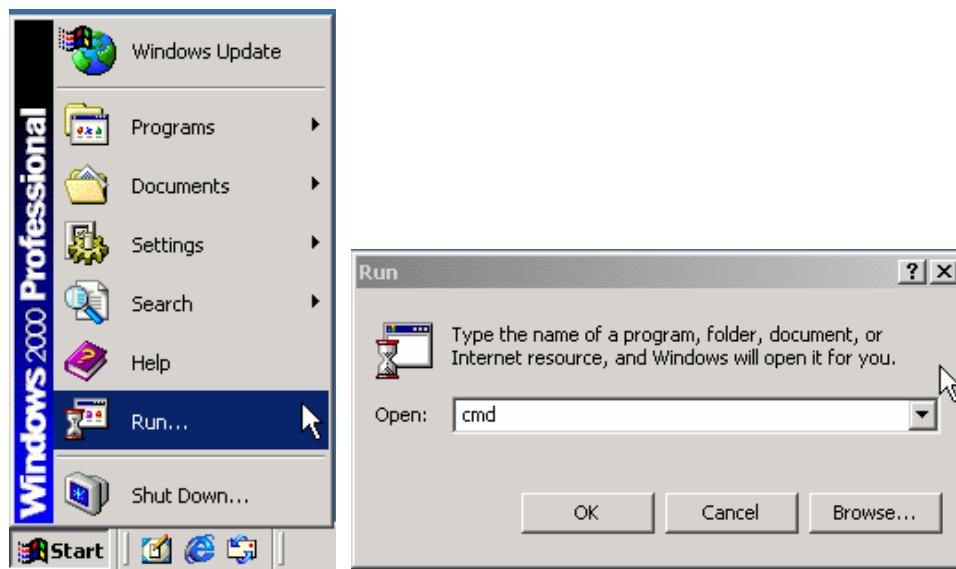
(figure 24)



8. All of the scope options will be identical to the options on WBC-Scope 1. The exclusion range is 192.168.1.200 through 192.168.1.254. The router/default gateway is 192.168.1.200. The Parent Domain is: wiredbraincoffee.com. The DNS servers are 192.168.1.201 and 192.168.1.202. The WINS servers are also 192.168.1.201 and 192.168.1.202. The last step is to activate the scope and put the DHCP server into action.

### Testing for DHCP fault tolerance

1. In order to test our new configuration and see if the backup plan will work, we have to take SRV-11 out of commission. We can do this by simply unplugging the network cable that goes from SRV-11 to the hub. Unplug the cable from SRV-11. See figure 20.
2. Now log on to the client computer (client-1) and open the **Command prompt**. See figure 25.



(figure 25)



- From the Command prompt run the **IPCONFIG /ALL** command to view client-1's settings. Notice that, although the DHCP server, SRV-11, is no longer available on the network, it still shows the IP address that was obtained from SRV-11 because the lease has not yet expired. This is an important concept to remember, because if a DHCP server fails it does not mean that the DHCP clients must immediately give back the IP addresses they received. They will continue to use them until the lease expires. See figure 26.

```

C:\>ipconfig/all

Windows 2000 IP Configuration

    Host Name . . . . . : Client-1
    Primary DNS Suffix . . . . . :
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : wiredbraincoffee.com

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . . : wiredbraincoffee.com
    Description . . . . . : 3Com 3C918 Integrated Fast Ethernet
    Controller (3C905B-TX Compatible) . . . . . :
    Physical Address. . . . . : 00-C0-4F-59-C3-86
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . . : Yes
    IP Address. . . . . : 192.168.1.1 ← WBC Scope -1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.200
    DHCP Server . . . . . : 192.168.1.211 ← SRV-11
    DNS Servers . . . . . : 192.168.1.201
    . . . . . : 192.168.1.202
    Primary WINS Server . . . . . : 192.168.1.201
    Secondary WINS Server . . . . . : 192.168.1.202
    Lease Obtained. . . . . : Wednesday, September 18, 2002 12:17:
15 PM
    Lease Expires . . . . . : Thursday, September 26, 2002 12:17:
5 PM

C:\>_

```

(figure 26)

- In order to properly test the new DHCP server on SRV-1, you have to wait for the lease to expire or force the client to request a new IP address. This can be accomplished by first running **ipconfig /release** from the command prompt to force the client to release its current IP address. See figure 27.

```

C:\>ipconfig/release

Windows 2000 IP Configuration

IP address successfully released for adapter "Local Area Connection"

C:\>_

```

(figure 27)



5. After successfully releasing the IP address, you next have to force the client to request a new IP address by running `ipconfig /renew` from the command prompt. See figure 28.

```
C:\>ipconfig/renew

Windows 2000 IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : wiredbraincoffee.com
    IP Address. . . . . : 192.168.1.199
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.200

C:\>_
```

(figure 28)

6. Now run the `ipconfig /all` command again to view the network settings. Notice how all settings are identical to the first time we ran IPCONFIG/ALL except for the client's IP address, which is now from the range of WBC-Scope 2 and the IP address of the DHCP server it was obtained from, which is now from SRV-1. See figure 29.

```
C:\>ipconfig/all

Windows 2000 IP Configuration

    Host Name . . . . . : Client-1
    Primary DNS Suffix . . . . . :
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : wiredbraincoffee.com

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : wiredbraincoffee.com
    Description . . . . . : 3Com 3C918 Integrated Fast Ethernet
    Controller (3C905B-TX Compatible) . . . . . :
    Physical Address. . . . . : 00-C0-4F-59-C3-86
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . . : Yes
    IP Address. . . . . : 192.168.1.199 ← WBC Scope - 2
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.200
    DHCP Server . . . . . : 192.168.1.201 ← SRV-1
    DNS Servers . . . . . : 192.168.1.201
    . . . . . : 192.168.1.202
    Primary WINS Server . . . . . : 192.168.1.201
    Secondary WINS Server . . . . . : 192.168.1.202
    Lease Obtained. . . . . : Wednesday, September 18, 2002 12:23:10 PM
    Lease Expires . . . . . : Thursday, September 26, 2002 12:23:10 PM

C:\>_
```

(figure 29)





# Lab 3

## Accommodating Growth (using a Superscope) on Wired Brain Coffee's Network

Learn how to:

- Configure Scope and Server options
  - Plan for a Superscope
  - Create a Superscope
  - Install a router using RRAS
- Setup the router to forward traffic between subnets
  - Test DHCP clients on remote subnets





## Scenario

Wired Brain Coffee is growing tremendously and during a discussion with your manager, Charlie, you have been informed that WBC is going to hire even more people in the upcoming weeks. Charlie is preparing for the onslaught by ordering more computers but he is concerned that the current TCP/IP structure might not be adequate enough to support all of the additional machines.

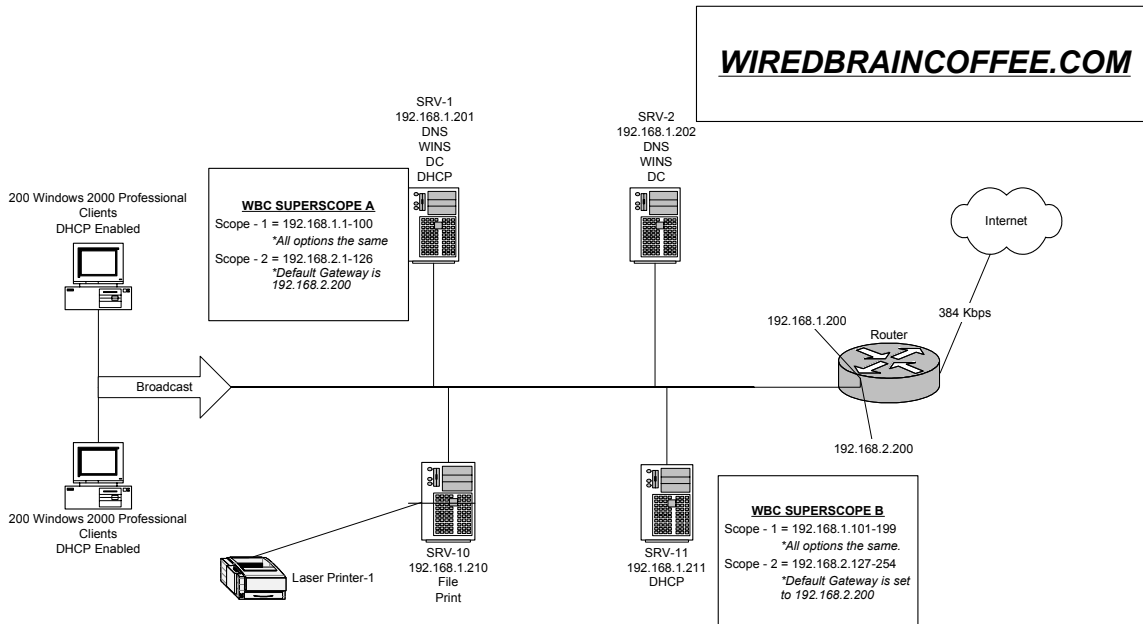
Since you did a bang-up job on the DHCP setup the first time, Charlie has decided to assign that task to you once again. Here's the issue: with all of these new hires, the Wired Brain Coffee network is going to have to support about 400 client computers. All of these computers will be running W2K Pro (the old W98 machines were upgraded) and will need IP addresses to participate on the same network. All of these machines will be on one network segment and will need to access all of the resources on the network. Unfortunately, the original network designer did not anticipate this type of growth and there won't be nearly enough IP addresses to support all of the new computers.

To temporarily accommodate this problem, Charlie wants you to create superscopes on your DHCP servers. This will allow the DHCP servers to assign IP addresses from multiple subnets (192.168.1.0 and 192.168.2.0 in your case) to any computer that exists on the local segment. Remember, that this normally can't be done. A DHCP server with a normal scope would only assign IP addresses from the local segment to computers on the same physical segment. It would **not** be able to give out IP address from the 192.168.2.0 range to computers that existed on the same physical segment as the DHCP server (we're assuming here, going along with the lab, that the DHCP server **is** on the 192.168.1.0 subnet).

In this lab you will create a superscope on SRV-1 that will service your one physical segment. SRV-1 will also be used to perform routing functions between the two logical subnets. Pay close attention to the diagram and the lab configuration, this can be a tricky one!

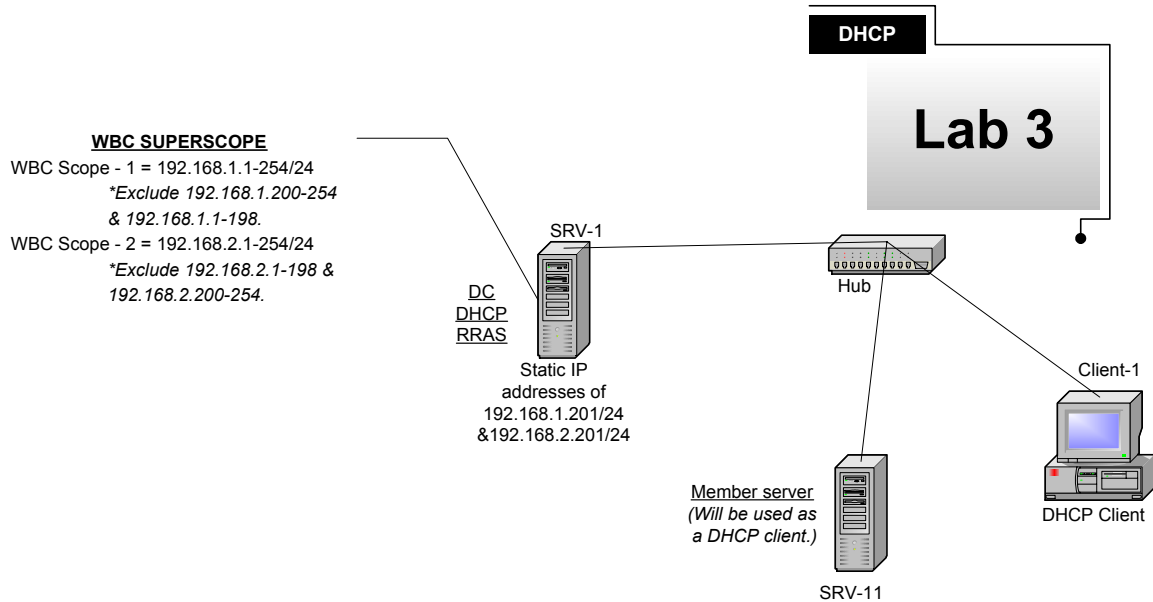
### **\*\*\*Note\*\*\***

*In this lab you will be uninstalling the DHCP service from SRV-11 and there will only be one DHCP server on the network. You might think we are reverting back to our "old ways" of having no fault tolerance in DHCP, to accommodate the superscope. This is not the case. In a production environment, you would still want to have multiple DHCP servers and each would have their own superscopes, but in order to keep the lab requirements down to three computers, SRV-11 will act as a DHCP client in this lab.*



**400 client computers on the network, approximately 450 IP address available. Clients can communicate no matter what IP address they obtain. 192.168.1.0/24 clients must communicate to 192.168.2.0/24 clients by using the router.**

*(figure 30)*



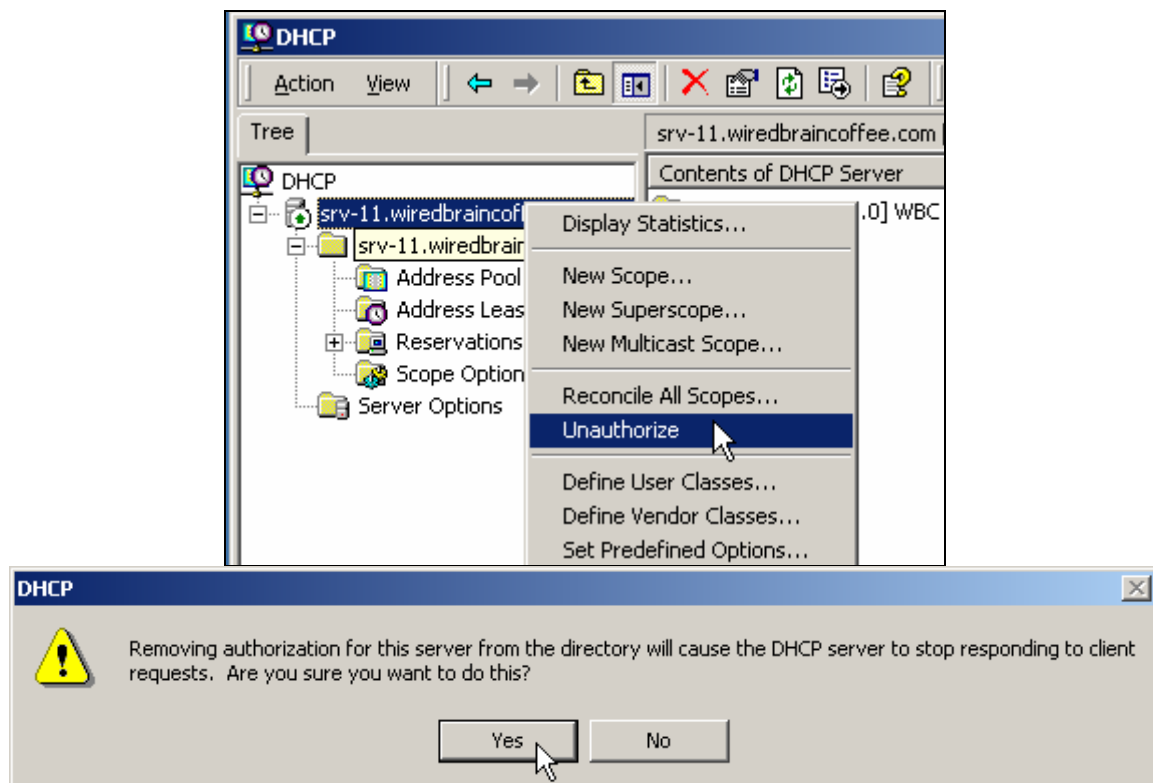
There is only 1 IP address available in each range.  
SRV-11 & Client-1 will be on different logical networks. They will only be able to communicate if their Default Gateway's are configured correctly and RRAS is enabled on SRV-1. Setup, configuration and testing of the above will be the premise of the this lab.

*(figure 31)*



## Unauthorizing DHCP

Log on to SRV-11. Open the DHCP console. Right-Click on SRV-11 and select Unauthorize. It will then warn you that, by removing the authorization, the DHCP server will stop responding to clients, which is OK because we set up the scope on SRV-1 to handle all client requests. Click Yes. There should now be a red arrow next to SRV-11 to show that the server is no longer authorized. Therefore it will not be handling any client DHCP requests. Close the Console. See figure 32.



(figure 32)

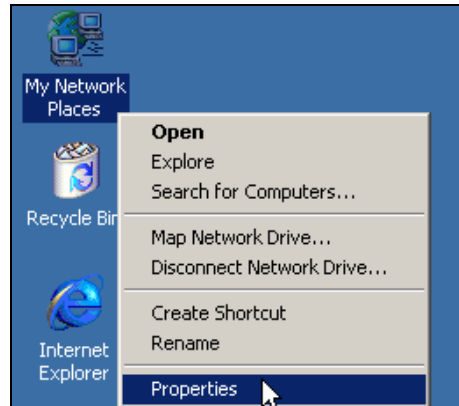
## Uninstalling DHCP

The next step is to uninstall the DHCP service from SRV-11. Follow the same steps as installing the service. Start, Settings, Add/Remove Software, Add/Remove System components. Select Networking services, click on Details, Uncheck DHCP, click next and Finish. Close all windows.



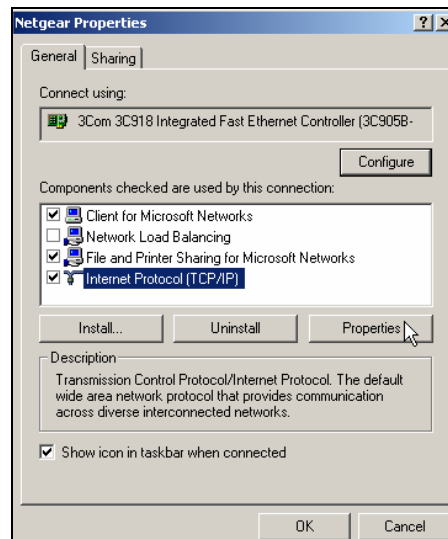
## Configure SRV-11 as a DHCP Client

1. From SRV-11 still, right click on My Network Places and select **Properties**. See figure 33.



(figure 33)

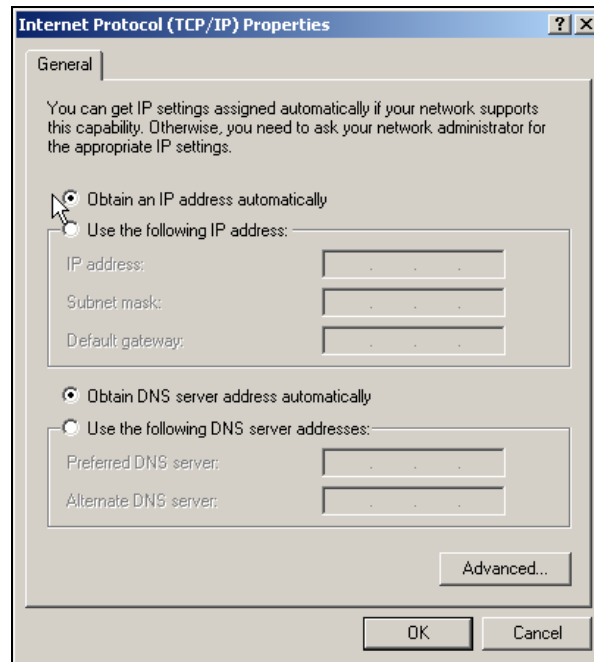
2. Then, open the TCP/IP properties by selecting it and clicking on **Properties**. See figure 34.



(figure 34)



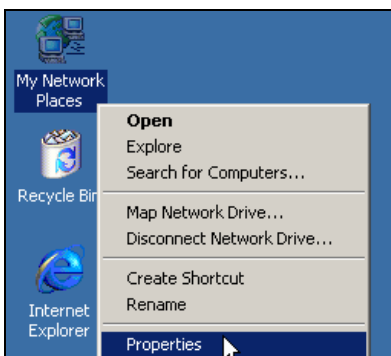
3. From the TCP/IP Properties screen, check the relevant marks to **obtain an IP address automatically and to obtain a DNS server address automatically**. Click OK. See figure 35.



(figure 35)

### Adding multiple IP addresses to one NIC (SRV-1)

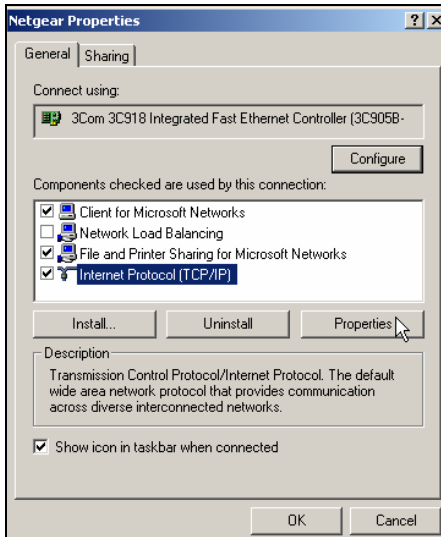
1. Log on to SRV-1 and from the desktop, right click on **My Network Places** and select **Properties**. See figure 36.



(figure 36)

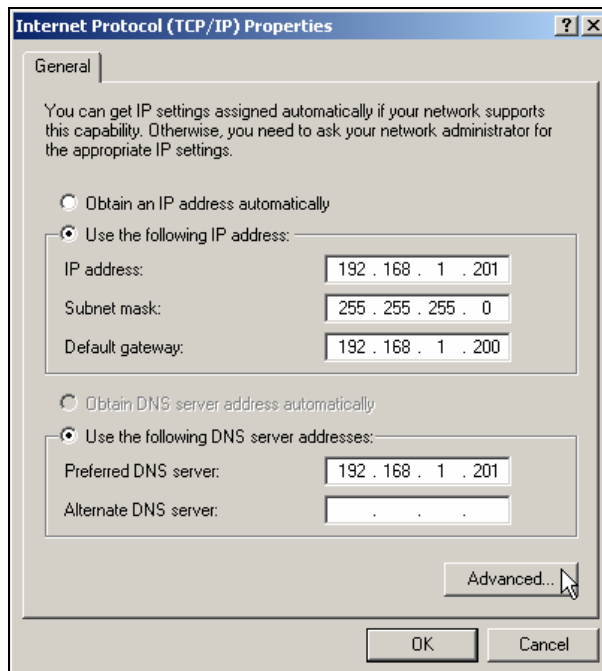


2. Then open the TCP/IP properties by selecting TCP/IP and clicking on **Properties**. See figure 37.



(figure 37)

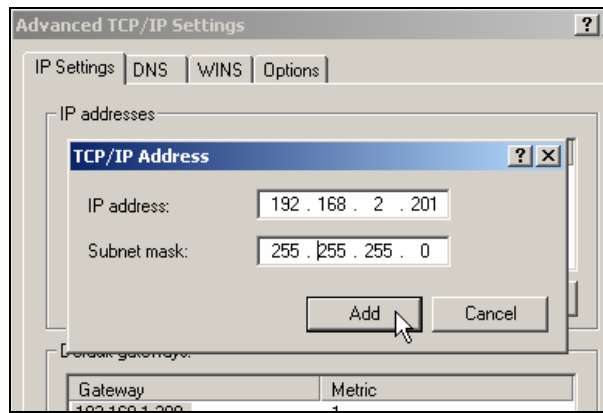
3. From the TCP/IP Properties screen click on the **Advanced** button on the bottom right hand side. See figure 38.



(figure 38)



4. In the Advanced Settings window, make sure you are on the IP Settings tab and click on **Add an IP address**. A small window should appear asking for an IP Address and subnet mask. Type in: **192.168.2.201** for the IP address and **255.255.255.0** for the subnet mask. This will act as a second IP address for this one NIC and will allow clients from both networks to communicate with SRV-1. Click **Add** and then **OK** for all of the windows until you get back to your desktop. See figure 39.



*(figure 39)*

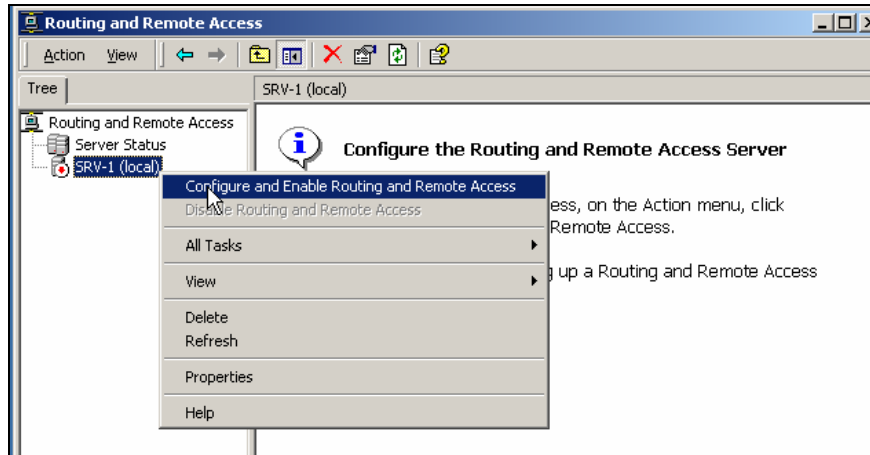
### Enabling routing and remote access

1. In order for traffic to be passed between the two logical networks, routing has to be enabled on SRV-1.
2. Go to **Start, Programs, Administrative Tools** and open the Routing and Remote Access console.



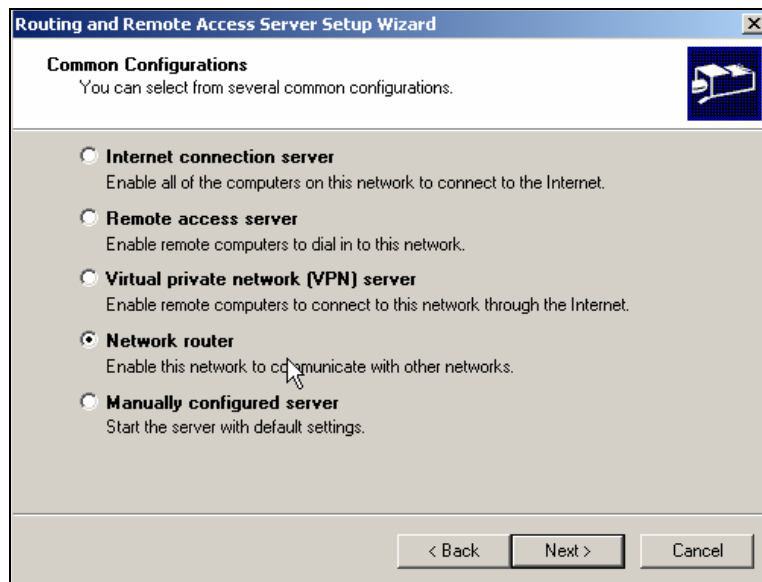


3. Right-click on SRV-11 and select **Configure and Enable Routing and Remote Access**. See figure 40.



(figure 40)

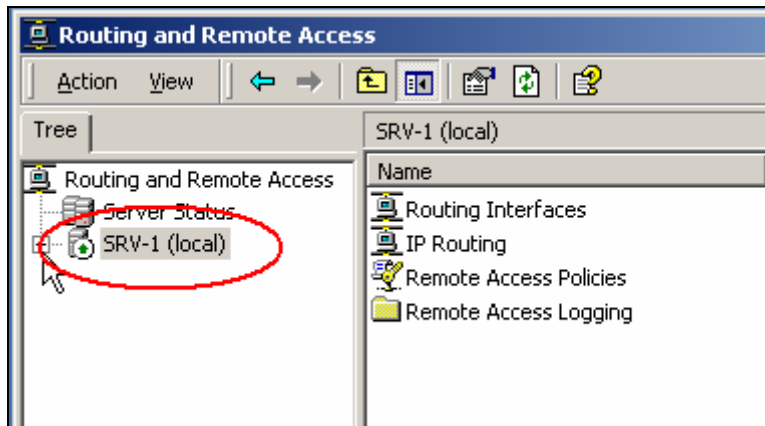
4. The next window will give you the options available for Routing and Remote Access. Select **Network Routing**. Click **Next**, then wait for the installation to end and click **Finish**. See figure 41.



(figure 41)



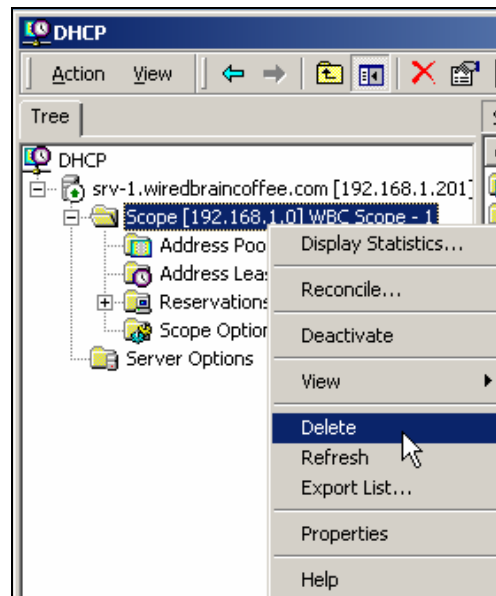
5. On the RRAS console there should now be a green arrow next to SRV-11 letting you know that it is enabled. This is all you will need to do for the router. Close the console. See figure 42.



(figure 42)

## Deleting scopes

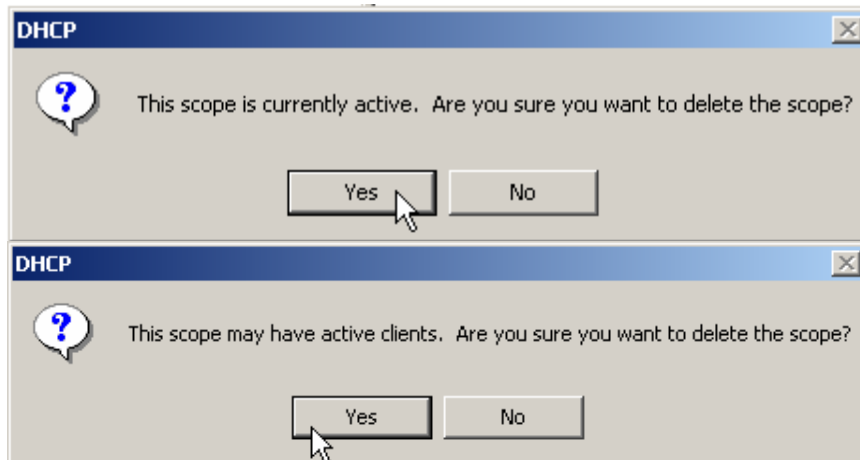
1. The next step is to delete the scope on SRV-1. Deleting the scope is not a technical requirement, but will ensure that your DHCP server is configured correctly from the start. Open the DHCP console, right click on the scope and select **delete**. See figure 43.



(figure 43)

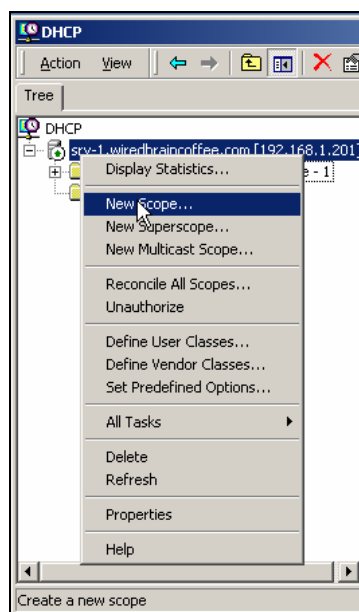


2. After you select delete, you will get two warnings asking you if you are sure you want to delete the scope. The first will warn you that the scope is currently active. Click **Yes** and then the second warning will appear and warn you that the scope may have active clients, click **Yes**. See figure 44.



(figure 44)

3. That should bring you to the DHCP console. There should be no scopes on this server. Now you will create a new scope similar to the first one. Start the new scope wizard. See figure 45.



(figure 45)



4. On the welcome screen, click **Next**. Name the scope, **WBC-Scope 1** and for the description use **Seattle**. Click **Next**.
5. For the IP range type in **192.168.1.1** through **192.168.1.254** with a 24-bit subnet mask. Click **Next**. See figure 46.

**New Scope Wizard**

**IP Address Range**  
You define the scope address range by identifying a set of consecutive IP addresses.

Enter the range of addresses that the scope distributes.

Start IP address: 192 . 168 . 1 . 1

End IP address: 192 . 168 . 1 . 254

A subnet mask defines how many bits of an IP address to use for the network/subnet IDs and how many bits to use for the host ID. You can specify the subnet mask by length or as an IP address.

Length: 24

Subnet mask: 255 . 255 . 255 . 0

< Back   **Next >**   Cancel

(figure 46)

6. The exclusion range will stay the same as before, type in **192.168.1.200** through **192.168.1.254**. Click **Add** and **Next**. See figure 47.

**New Scope Wizard**

**Add Exclusions**  
Exclusions are addresses or a range of addresses that are not distributed by the server.

Type the IP address range that you want to exclude. If you want to exclude a single address, type an address in Start IP address only.

Start IP address:   End IP address:   Add

Excluded address range:

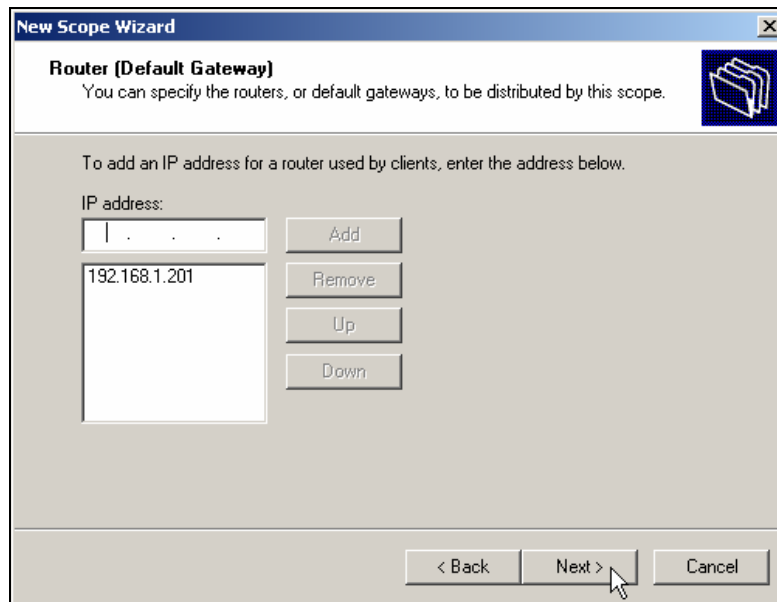
192.168.1.200 to 192.168.1.254   Remove

< Back   **Next >**   Cancel

(figure 47)

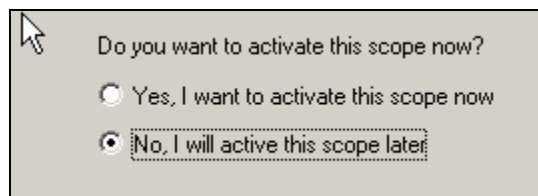


- The next screen will ask if you would like to configure options now. Select **Yes**, but you will only configure the router option. Type in **192.168.1.201** for the router. Click **Add** and **Next**. See figure 48.



(figure 48)

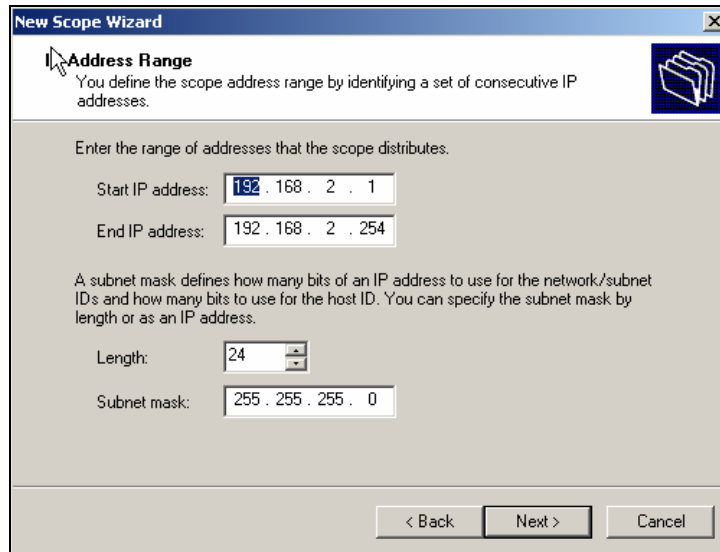
- Continue to click **Next** until you get to the screen that asks if you would like to activate the scope now. We are leaving the rest of the scope options blank because we will set them up on the server rather than using scope options. Select **No, I will activate this scope later**. See figure 49.



(figure 49)

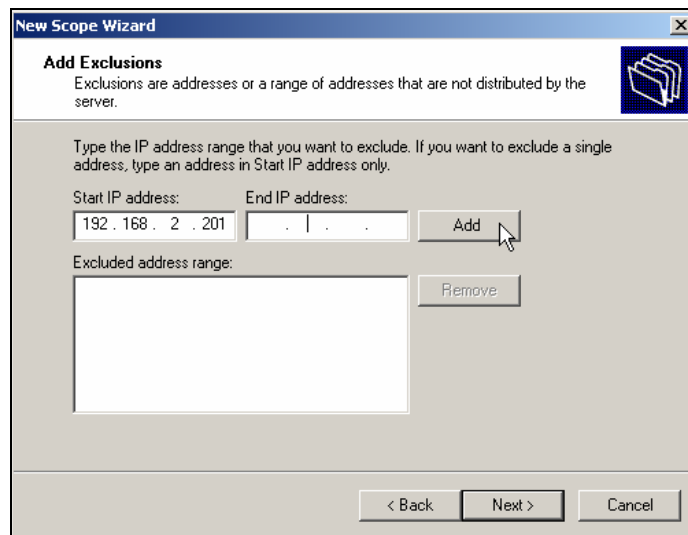


9. Now you need to create the second scope. Right click on srv-1 and start the new scope wizard again. On the welcome screen, click **Next**. This time name the scope **WBC- Scope 2 with Seattle** as the description. Click **Next**.
10. For the IP range type in **192.168.2.1** through **192.168.2.254** with a 24-bit subnet mask. Click **Next**. See figure 50.



(figure 50)

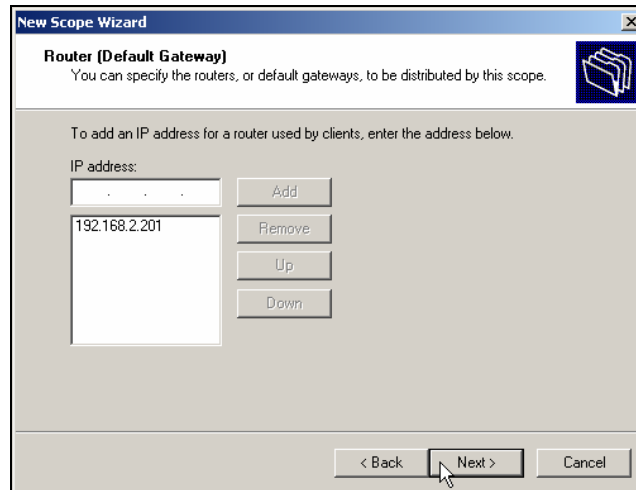
11. The exclusion range will be **192.168.2.201** (the second IP address of SRV-1) because that's the only address that is statically assigned on the 192.168.2.0/24 network. Click **Add** and **Next**. See figure 51.



(figure 51)

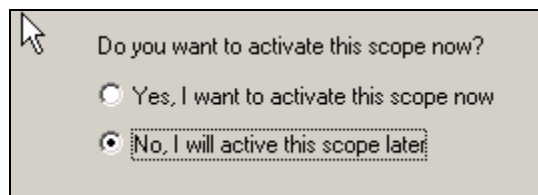


12. The next screen will ask if you would like to configure options now. Select **Yes**, but, just like you did for WBC-Scope 1, only configure the router option. Type in **192.168.2.201** for the router. Click **Add** and **Next**. See figure 52.



(figure 52)

13. Continue to click next until you get to the screen where it asks if you would like to activate the scope now. You will leave the rest of the scope options blank because you will set them on the server rather than through the scope. Select **No, I will activate this scope later**. See figure 53.



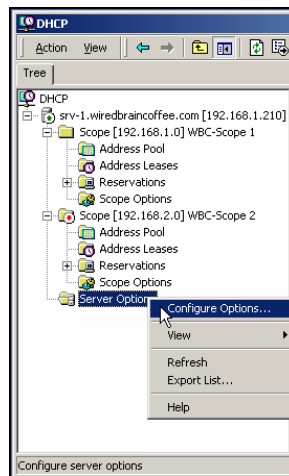
(figure 53)



## Configuring Server options

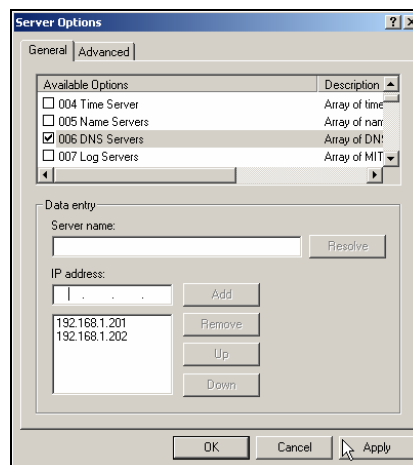
Instead of assigning individual scope options you may opt to assign server options, which apply to all of the scopes configured on a server. If contradicting server options and scope options exist, the client scope options have a higher priority.

1. Configuring the scope options at the server level will give all of the scopes on SRV-1 the same settings. The only option that will be different between WBC-Client 1 and WBC-Client 2 will be the default gateway (router) setting that was configured individually on each scope.
2. From the DHCP console right-click on Server Options and select **Configure Options**. See figure 54.



(figure 54)

3. Then, under the General tab, select option **006-DNS Servers**. Add the IP address of the DNS servers **192.168.1.201** and **192.168.1.202**. Click **Apply**. See figure 55.

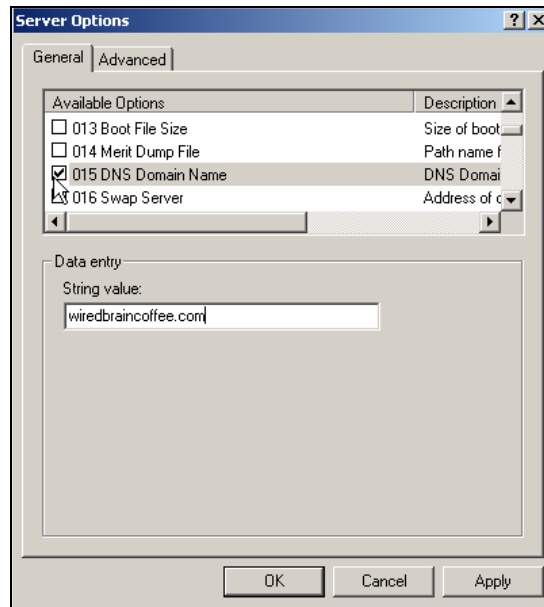


(figure 55)



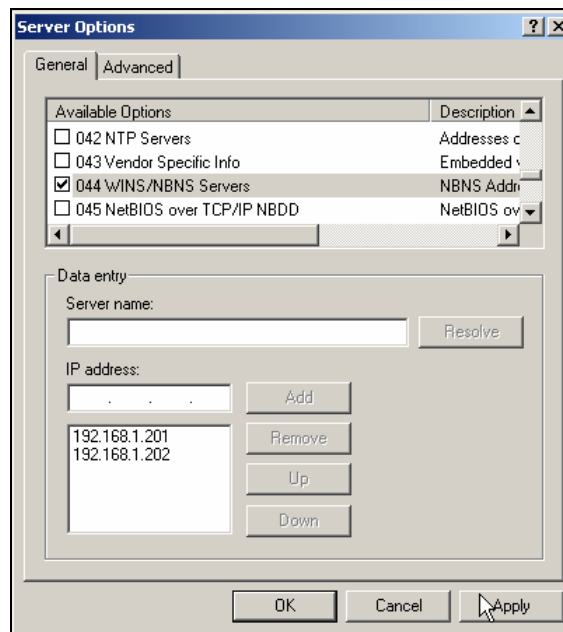


- Next, scroll down and select option **015-DNS Domain Name**. For the String value enter: **wiredbraincoffee.com**. Click **Apply**. See figure 56.



(figure 56)

- Next, under the General tab, select option **044-WINS/NBNS Servers**. Add the IP address of the WINS servers **192.168.1.201** and **192.168.1.202**. Click **OK**. See figure 57.

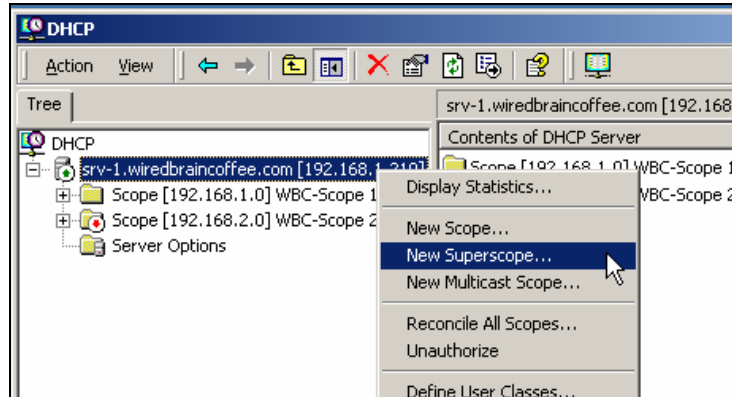


(figure 57)



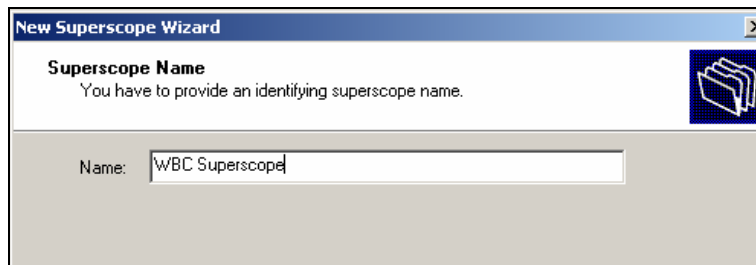
## Creating a superscope

1. From the DHCP console right-click on SRV-1 and select **New Superscope** and a wizard will begin. On the first window click **Next**. See figure 58.



(figure 58)

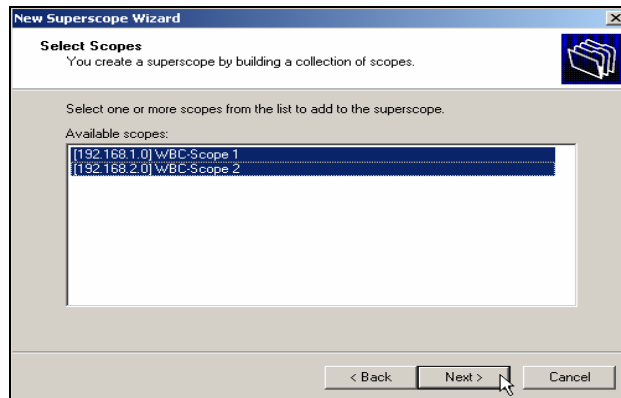
2. On the next window enter **WBC Superscope** for the name. Click **Next**. See figure 59.



(figure 59)

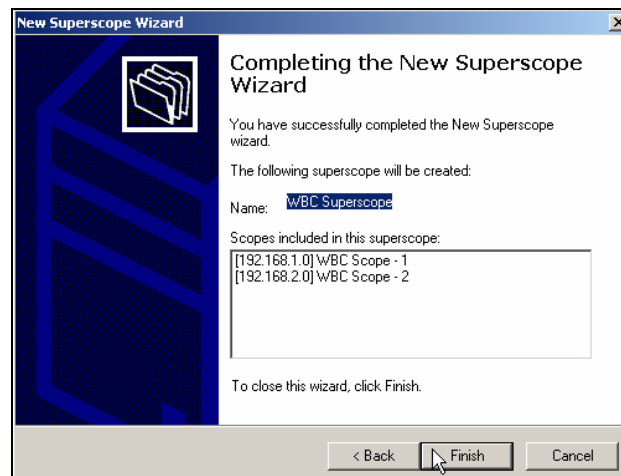


3. Here you will select the scopes that will be part of the superscope. Click on **WBC-Scope 1** and, while holding the Ctrl button down on the keyboard, select **WBC-Scope 2**. They should both be highlighted. Click **Next**. See figure 60.



(figure 60)

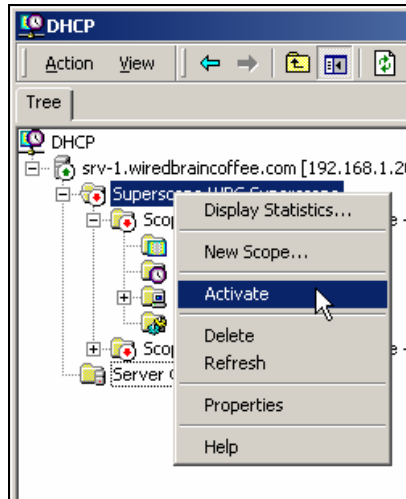
4. Confirm that both scopes are included and click **Finish**. See figure 61.



(figure 61)



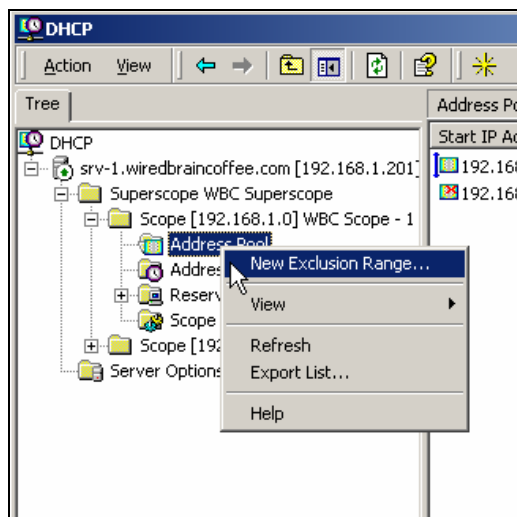
5. The last step is to activate the superscope. Right click on the superscope and select **Activate**. That should automatically activate both the scopes underneath it. See figure 62.



(figure 62)

### Creating additional exclusions

1. Now that the superscope has been created, there will be plenty of IP addresses on the WBC network. In order to test the superscope in your lab setup, you will need to exclude all of the IP addresses, except for one in each scope.
2. Under WBC-Scope 1, right click on Address Pool and select **New Exclusion range**. See figure 63.



(figure 63)



- The new exclusion range will be **192.168.1.1** through **192.168.1.198**. This will leave 192.168.1.199, as the only available IP address from WBC-Scope 1. Click **Add** then **Close**. See figure 64.

A screenshot of a Windows-style dialog box titled "Add Exclusion". The dialog has a blue title bar with a question mark and a close button. The main area contains the text: "Type the IP address range that you want to exclude. If you want to exclude a single address, type an address in Start IP address only." Below this text are two input fields. The "Start IP address:" field contains "192 . 168 . 1 . 1". The "End IP address:" field contains "192 . 168 . 1 . 198". At the bottom right, there are two buttons: "Add" and "Close". A mouse cursor is pointing at the "Add" button.

(figure 64)

- Now under WBC-Scope 2, right click on Address Pool and select **New Exclusion range**.
- The new exclusion range will be **192.168.2.1** through **192.168.2.198**. Click **Add** then **Close**. Find and **delete** the exclusion for **192.168.2.201**. After deleting the address, add another exclusion for the range of **192.168.2.200** through **192.168.2.254**. Click **Add**, then **Close**. When all is said and done, you should have exclusions for every IP address except for 192.168.2.199. See figure 65.

Two screenshots of the "Add Exclusion" dialog box are shown. The top screenshot shows the "Start IP address:" field with "192 . 168 . 2 . 1" and the "End IP address:" field with "192 . 168 . 2 . 198". A mouse cursor is pointing at the "Add" button. The bottom screenshot shows the "Start IP address:" field with "192 . 168 . 2 . 200" and the "End IP address:" field with "192 . 168 . 2 . 254". A mouse cursor is pointing at the "Add" button.

(figure 65)



## Testing the clients

1. Log on to Client-1. Open the command prompt and run **ipconfig /release** to release the current IP address and then run **ipconfig /renew** to request a new IP address. The new IP address should be either 192.168.2.199 or 192.168.1.199 because those are the only two addresses we left available on the DHCP server. See figure 66.

```
C:\>ipconfig/all

Windows 2000 IP Configuration

    Host Name . . . . . : Client-1
    Primary DNS Suffix . . . . . :
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : wiredbraincoffee.com

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . : wiredbraincoffee.com
    Description . . . . . : 3Con 3C918 Integrated Fast Ethernet
    Controller (3C905B-TX Compatible) . . . . . : 00-C0-4F-59-C3-86
    Physical Address. . . . . : 00-C0-4F-59-C3-86
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . . : Yes
    IP Address. . . . . : 192.168.1.199
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.201
    DHCP Server . . . . . : 192.168.1.201
    DNS Servers . . . . . : 192.168.1.201
    . . . . . : 192.168.1.202
    Primary WINS Server . . . . . : 192.168.1.201
    Secondary WINS Server . . . . . : 192.168.1.202
    Lease Obtained. . . . . : Tuesday, September 17, 2002 1:40:11
    Lease Expires . . . . . : Wednesday, September 25, 2002 1:40:11

PM
1 PM
C:\>_
```

(figure 66)

2. Log on to SRV-11. Open the command prompt and run **ipconfig /release** to release the current IP address and then run **ipconfig /renew** to request a new IP address. Again the new IP address should be either 192.168.2.199 or 192.168.1.199 because those are the only two addresses we left available on the DHCP server. See figure 67.

```
C:\>ipconfig/all

Windows 2000 IP Configuration

    Host Name . . . . . : SRU-11
    Primary DNS Suffix . . . . . : wiredbraincoffee.com
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : Yes
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : wiredbraincoffee.com

Ethernet adapter LAN-1 192.168.1.0:

    Connection-specific DNS Suffix . : wiredbraincoffee.com
    Description . . . . . : 3Com 3C918 Integrated Fast Ethernet
    Controller (3C905B-TX Compatible) . . . . . : 00-C0-4F-59-91-96
    Physical Address. . . . . : 00-C0-4F-59-91-96
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . . : Yes
    IP Address. . . . . : 192.168.2.199
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.2.201
    DHCP Server . . . . . : 192.168.1.201
    DNS Servers . . . . . : 192.168.1.201
    . . . . . : 192.168.1.202
    Primary WINS Server . . . . . : 192.168.1.201
    Secondary WINS Server . . . . . : 192.168.1.202
    Lease Obtained. . . . . : Tuesday, September 17, 2002 1:37:50
    Lease Expires . . . . . : Wednesday, September 25, 2002 1:37:50

PM
0 PM
C:\>
```

(figure 67)



3. Now you have to test to make sure there is connectivity between the two client computers. From the command prompt on SRV-11 type in the “ping” command followed by the IP address of client-1. In this case you would type in **PING 192.168.1.199**. If you receive four replies from 192.168.1.199 then you are able to communicate with Client-1 through the router. See figure 68.

```
C:\>PING 192.168.1.199

Pinging 192.168.1.199 with 32 bytes of data:

Reply from 192.168.1.199: bytes=32 time<10ms TTL=127
Reply from 192.168.1.199: bytes=32 time<10ms TTL=127
Reply from 192.168.1.199: bytes=32 time<10ms TTL=127
Reply from 192.168.1.199: bytes=32 time<10ms TTL=127

Ping statistics for 192.168.1.199:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

(figure 68)

4. Now run the same test on client-1 and make sure there is connectivity between the two. From the command prompt on Client-1 type in the ping command followed by the IP address of SRV-11. In this case you would type in **PING 192.168.2.199**. If you receive four replies from 192.168.2.199 then you are able to communicate with SRV-11 across the router. See figure 69.

```
C:\>ping 192.168.2.199

Pinging 192.168.2.199 with 32 bytes of data:

Reply from 192.168.2.199: bytes=32 time<10ms TTL=127
Reply from 192.168.2.199: bytes=32 time<10ms TTL=127
Reply from 192.168.2.199: bytes=32 time<10ms TTL=127
Reply from 192.168.2.199: bytes=32 time<10ms TTL=127

Ping statistics for 192.168.2.199:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>_
```

(figure 69)



# Lab 4

## Managing DHCP on Wired Brain Coffee's Segmented Network

Learn how to:

- Install a basic Windows 2000 router
- Configure a DHCP Relay Agent on a Windows 2000 router.
  - Configure TCP/IP between two segmented networks





## Scenario

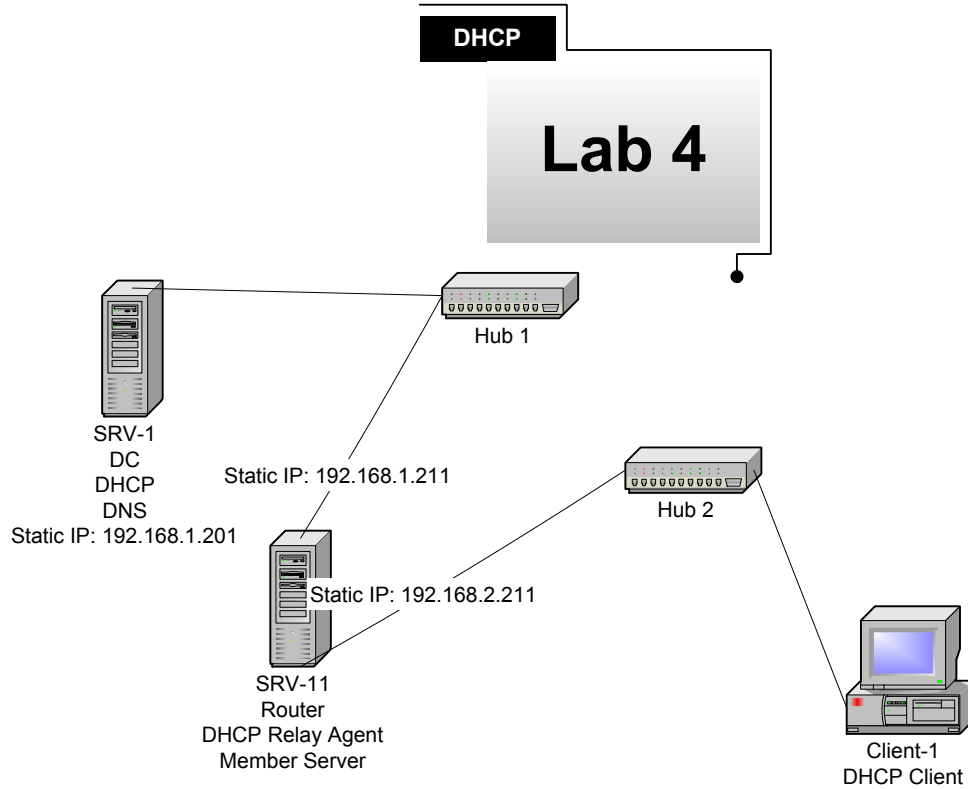
The new computers are all in, set up and configured. New employees have also been showing up to work by the dozens. The superscope you set up for Wired Brain Coffee is accomplishing what it was supposed to. The last couple of weeks have actually been pretty quiet, all things considered.

Today however, has been a different story. You and the rest of your team have been bombarded with complaints about how slow the network is. Email, file access and even printing... complaints seem to be coming at you from all directions.

Suddenly, it dawns on you. Today, a giant group of new employees (around 125) completed their training and started *really* using the network for the first time. The network had been carrying about 275 users pretty efficiently, but now that there are an extra 125 computers transmitting on the network, traffic is out of hand. This network simply can't support over 400 users without *really* sacrificing speed. "Should we start laying people off to get the network back to a reasonable level?" Charlie doesn't think you are funny.

No, it is time to segment the network into two pieces and separate them with a router. A router will prevent broadcasts from being forwarded from one side of the network to the other, which will cut down on the amount of overall traffic on both sides of the network. As usual, your thoughts turn to DHCP. "How will the DHCP clients on one side of the router be able to broadcast and reach my DHCP servers if routers don't forward broadcasts?" you think to yourself. "The DHCP relay agent," Charlie blurts out, reading the confused look on your face. "The DHCP relay agent will field the broadcasts from the DHCP clients and direct them to the DHCP server," Charlie tells you.

In Lab 4, you will configure SRV-11 as a router, with two network cards connected to two different networks. You will then install a DHCP relay agent on SRV-11. Client-1 will act as a DHCP client on a network segment without a DHCP server. In order to obtain IP address information from SRV-1, which will be sitting on a different physical segment, client-1 will use the DHCP relay agent installed on SRV-11. It is very important in this lab to take your time and get the initial configuration set up properly first. As detailed below, **make sure** that you follow the steps carefully. It is very important that you delete the extra IP address off of SRV-1 and disable Routing and Remote Access (RRAS). See figure 70, next page.



*(figure 70)*

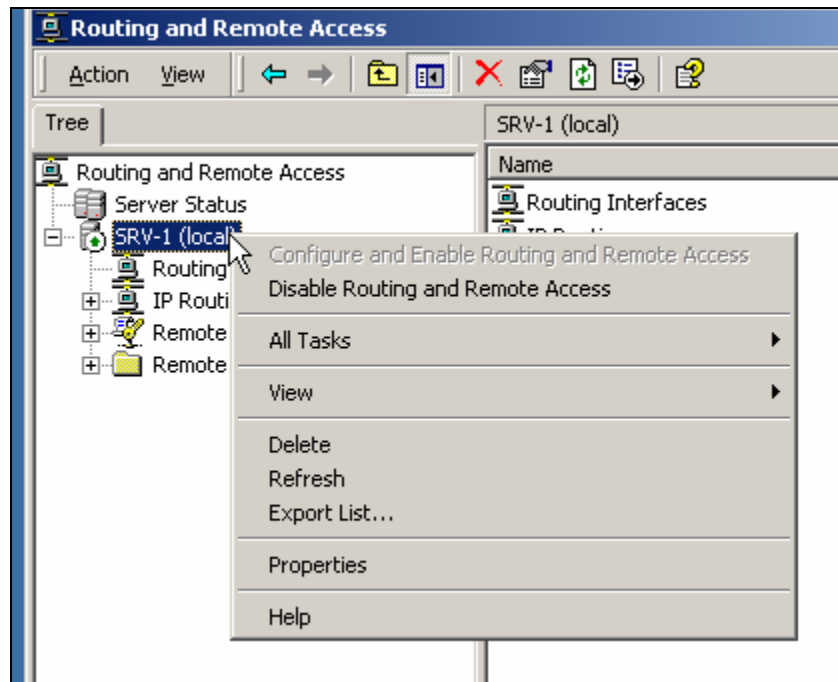
**\*\*\*\*\*Your Lab Setup has changed!\*\*\*\*\***

Pay close attention to this diagram and the Pre-Requisite steps in this lab



## Pre-requisite steps for Lab 4

1. SRV-11 should have 2 NICs installed, one plugged into Hub 1 and the other plugged into Hub 2 (see Figure 54 above). You can also substitute a cross-over cable between SRV-11 and Client-1, instead of Hub 2, if you do not have an extra hub or switch.
2. Disable Routing and Remote Access on SRV-1 by first opening the Routing and Remote Access console from the Administrative Tools menu. Right click on SRV-1 and select **Disable Routing and Remote Access**. Close the console when finished. SRV-1 will only serve as a Domain Controller and a DHCP server for this lab. See figure 71.

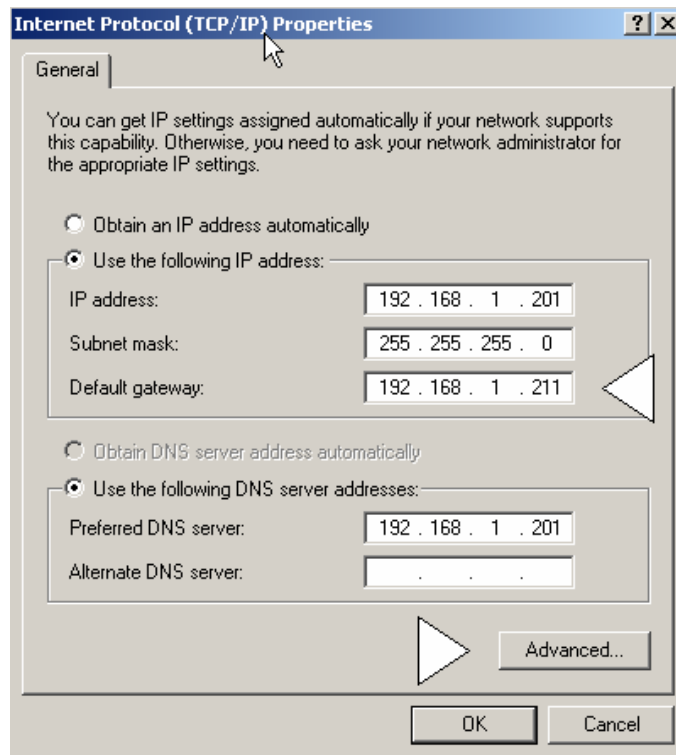


*(figure 71)*

3. Change the Default Gateway setting on SRV-1. The Default Gateway of SRV-1 needs to be set to 192.168.1.211. Right click on My Network Places and select **Properties**. Next, choose the properties of TCP/IP and change the Default Gateway address to 192.168.1.211. Leave this dialog box open for the next step. See figure 72

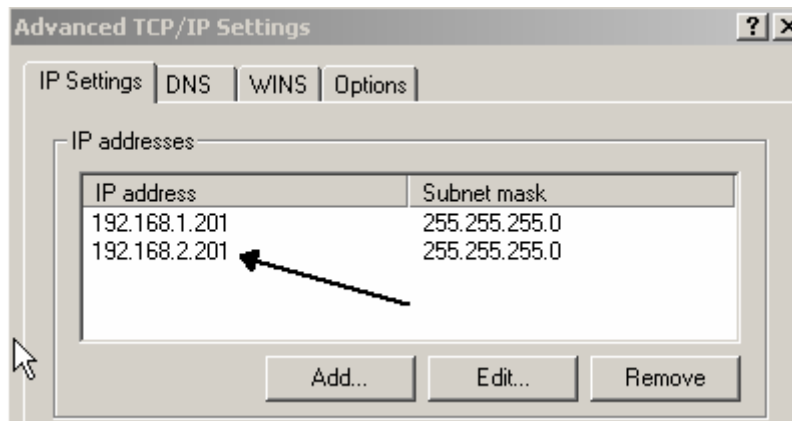


- In Lab 3, you assigned an additional, logical IP address to the NIC. This IP address now needs to be deleted so it does not conflict with settings in Lab 4. From the TCP/IP configuration windows, click on the **Advanced** tab. See figure 72.



(figure 72)

- Select the logical IP address 192.168.2.201 and click on **Remove**. Click **OK** on each of the open windows, in order to confirm your changes. See figure 73.



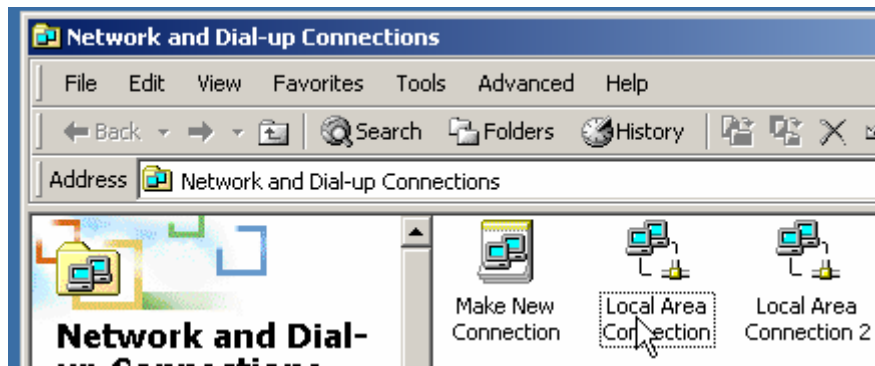
(figure 73)



## Configuring a router in Windows 2000 (SRV-11)

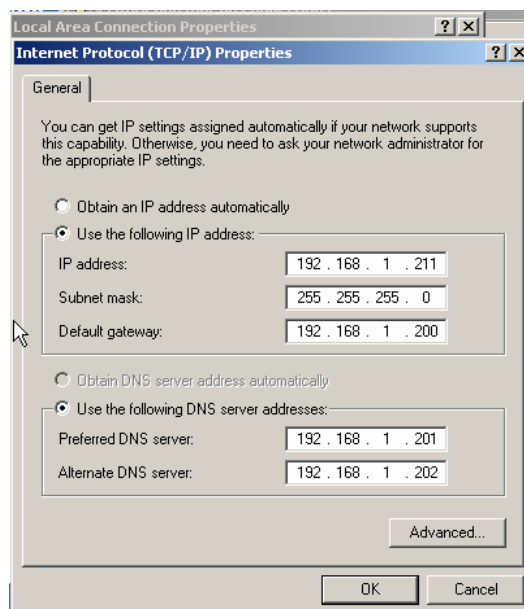
In this section, the computer SRV-11, will be configured as a router, allowing traffic to pass back and forth between the 192.168.1.0/24 and 192.168.2.0/24 networks.

1. On Srv-11, Right click on **My Network Places** and choose **Properties**. Within the Network and Dial-up Connections window you should see two network cards. See figure 74.



(figure 74)

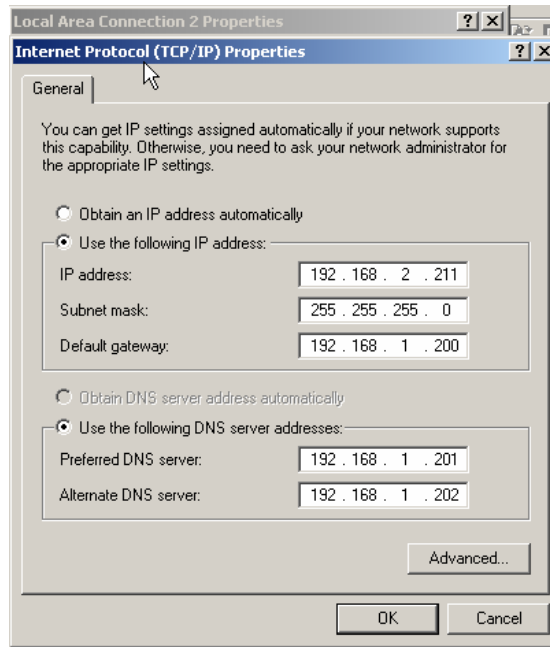
2. Right click on the network card that is plugged into the same hub as SRV-1 and select **Properties** (unplug one of the network cards and wait for the disconnection notice, if you are not sure). Select TCP/IP and click on the **Properties** button. Manually configure your TCP/IP information so that this network card is able to communicate on the same network as SRV-1. See figure 75.



(figure 75)

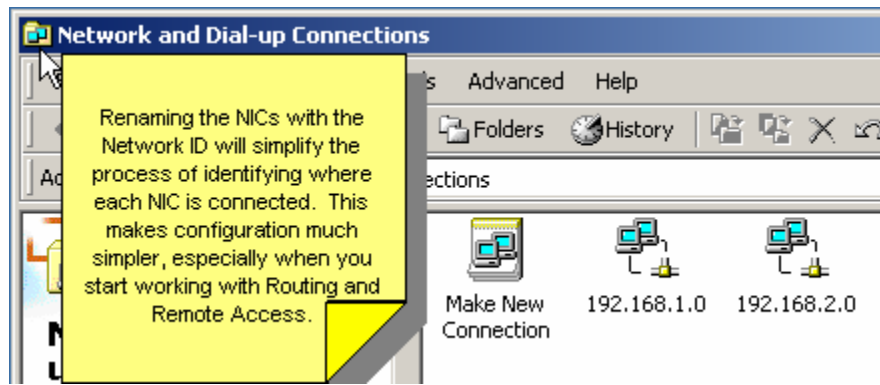


3. Configure Local Area Connection 2, in the same fashion, but modify the TCP/IP information to allow SRV-11 to communicate with Client-1 through Hub 2. See figure 76.



(figure 76)

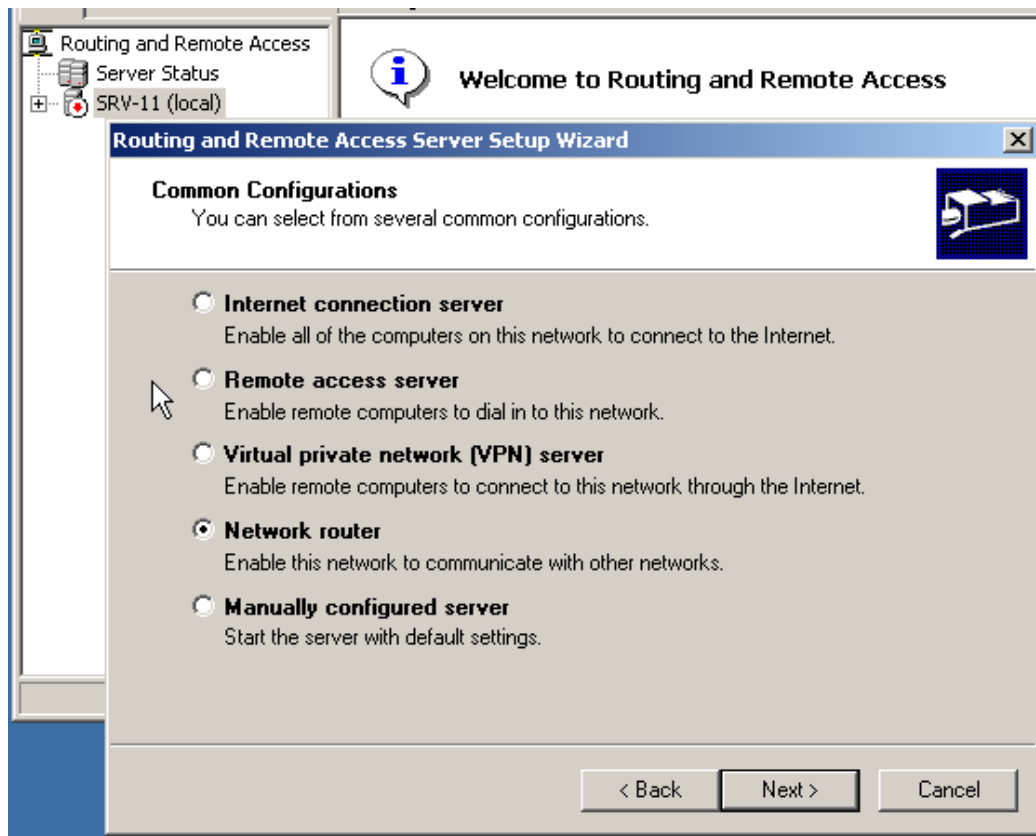
4. After configuring the TCP/IP information for both NICs, right click on each of them and **rename** them to reflect the Network ID of the network to which they are attached. See figure 77.



(figure 77)



- Next, Routing and Remote Access needs to be enabled on SRV-11. Click on **Start, Programs, Administrative Tools** and select **Routing and Remote Access**. Routing and Remote Access should be disabled. **If it is not, disable it before continuing** (this resets any previous configuration that may have been on the system).
- Choose the **Configure and Enable Routing and Remote Access** option. Click **Next** and then select the **Network Router** option. See figure 78.



*(figure 78)*

- On the next screen, select **Yes**, indicating that you only want to route the TCP/IP protocol. Click **Next**.
- Choose **No**, you do not want to set up demand-dial connections. Click **Next** and then **Finish**. SRV-11 is now capable of forwarding data between the two networks.



## Setting up the DHCP server (SRV-1)

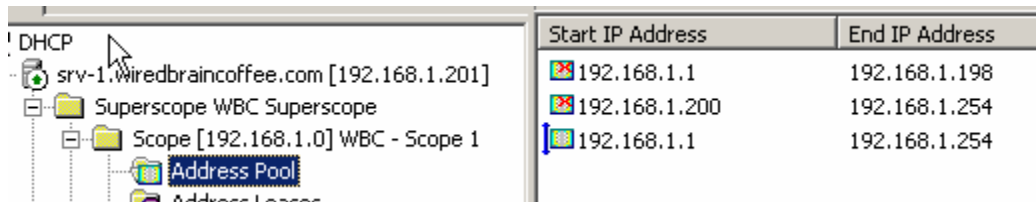
SRV-1 is the only DHCP server on our test network. Most of the configurations should still be in place from Lab 3 but you may want to verify the following settings: 2 scopes (192.168.1.0 & 192.168.2.0) combined together to form one Superscope. Each scope should still be configured to only allow one IP address. Verify your settings with the information below. DHCP must be setup and properly configured in Lab 3 for this lab to be successful.

In the next section, you will change the Default Gateway (Router) for both scopes. This **must** be changed in order for this lab to work correctly.

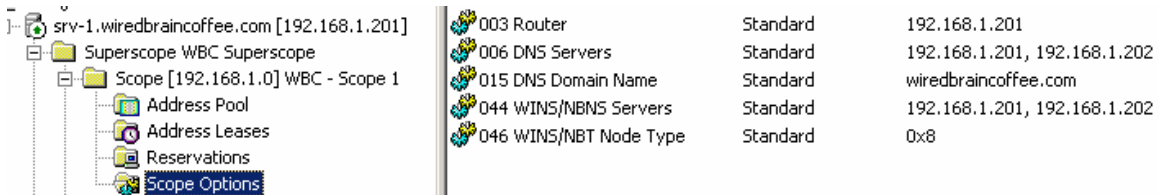
### Superscope Settings



### Scope 1 Address Pool (only 192.168.1.199 is available)



### Scope 1 – Scope Options







### Scope 2 Address Pool (only 192.168.2.199 is available)

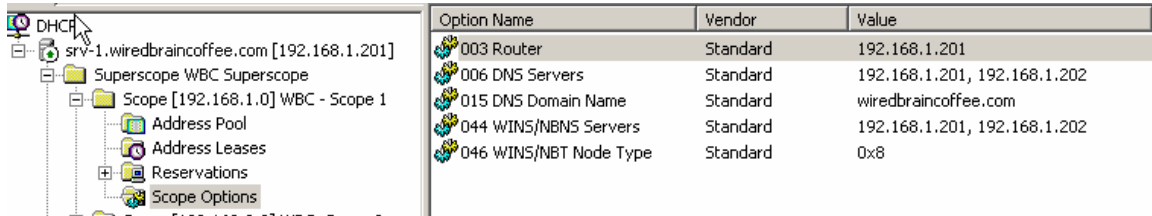
Start IP Address	End IP Address
192.168.2.1	192.168.2.254
192.168.2.200	192.168.2.200
192.168.2.1	192.168.2.198
192.168.2.201	192.168.2.254

### Scope 2 – Scope Options

Option Name	Vendor	Value
003 Router	Standard	192.168.2.201
006 DNS Servers	Standard	192.168.1.201, 192.168.1.202
015 DNS Domain Name	Standard	wiredbraincoffe.com
044 WINS/NBNS Servers	Standard	192.168.1.201, 192.168.1.202
046 WINS/NBT Node Type	Standard	0x8

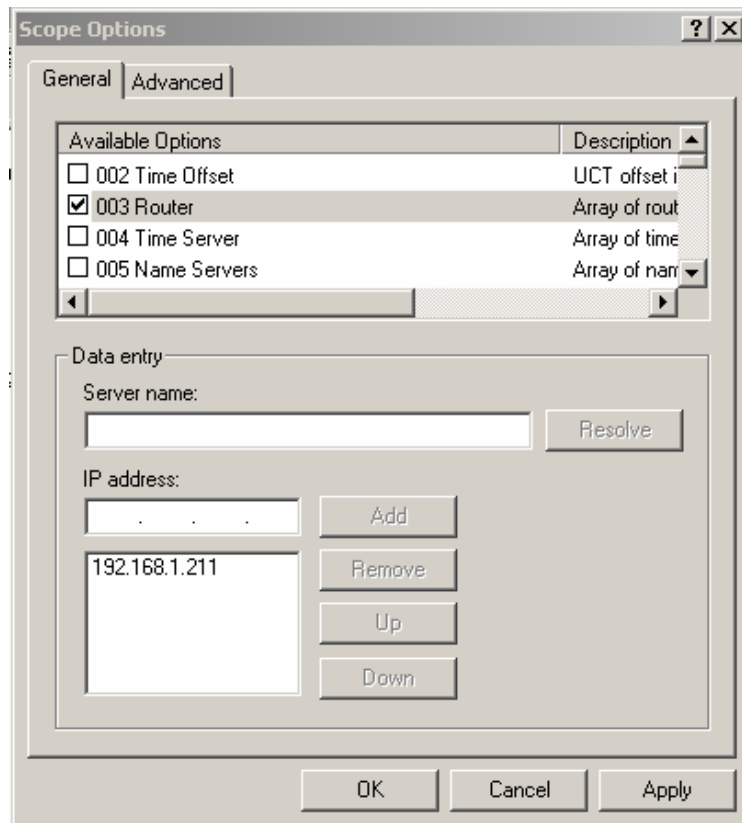


1. Open the DHCP console and click on the **scope options** for WBC – Scope 1. See figure 79.



(figure 79)

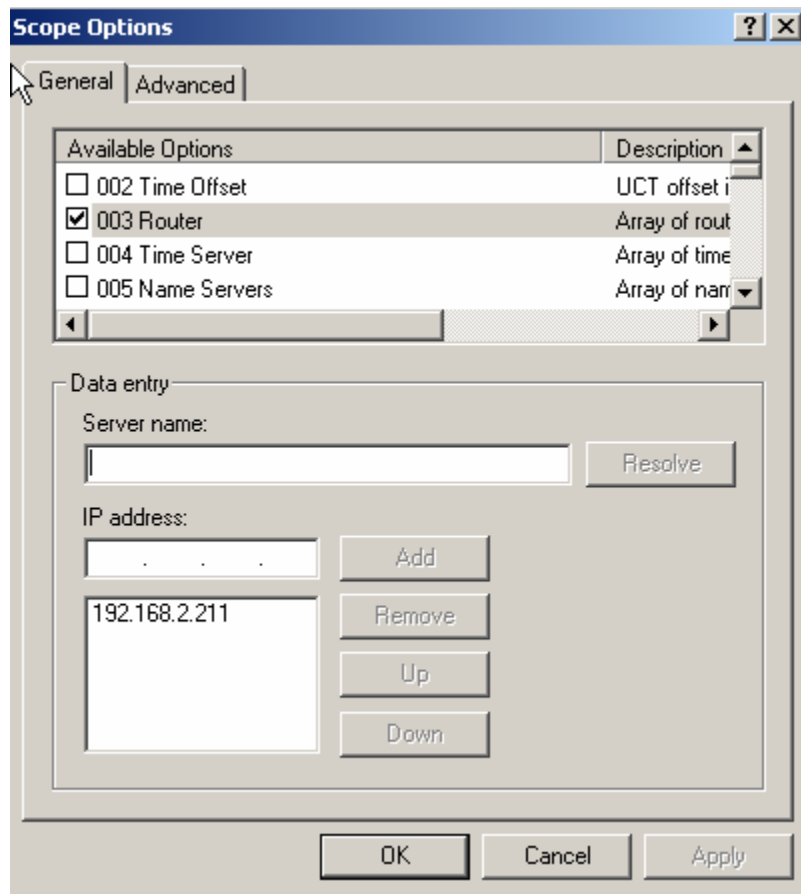
2. On the right hand side, right click **003 Router** and select **Properties**. Select the IP address **192.168.1.201**, and click **Remove**.
3. Add the new Default Gateway address, **192.168.1.211**, and click **Add**. Click **OK**. See figure 80.



(figure 80)



- Next, select **WBC - Scope 2** and click on **Scope Options**. Once again, right click **003 Router** and select **Properties**. Scope 2 services the 192.168.2.0 side of the network, so the Default Gateway should be **192.168.2.211**.
- Remove the old entry and add **192.168.2.211** as the new Default Gateway for WBC-Scope 2. See figure 81.



(figure 81)

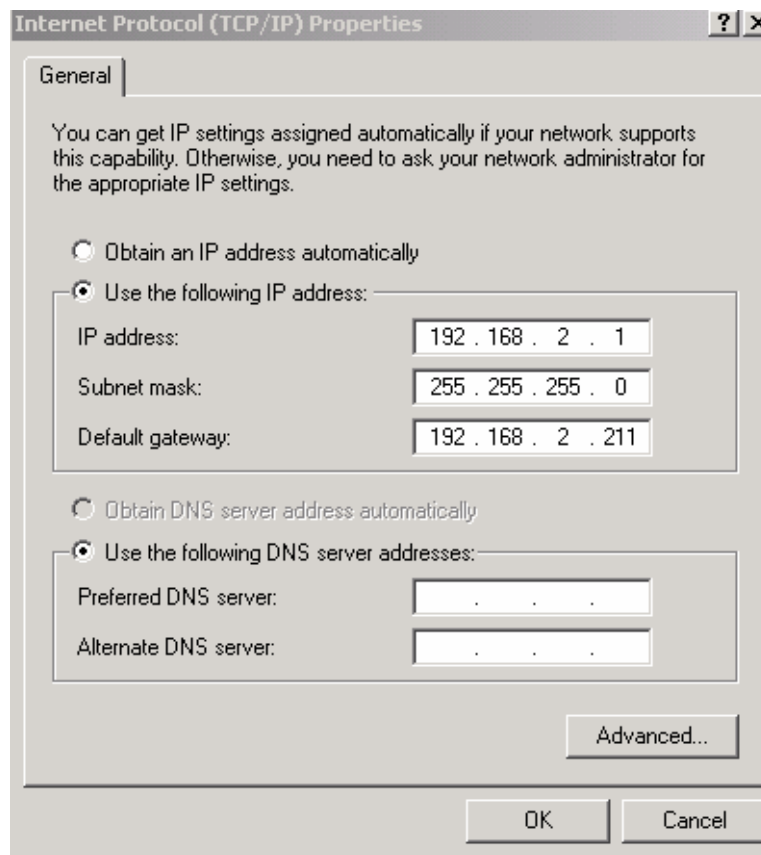


## Configuring the DHCP client (Client-1)

Keep in mind, Wired Brain Coffee's network is now segmented into two physical networks, divided by a router. There will be DHCP clients on both sides of the router.

DHCP clients on the 192.168.1.0 side of the network will have no problem reaching the DHCP server, because that is where the DHCP server is located. Clients on the 192.168.2.0 side of the network, will not be able to reach the DHCP server without enabling BOOTP/DHCP Forwarding on the router or configuring a DHCP relay agent. You will be enabling a DHCP relay agent on the router (SRV-11) in this lab.

1. First, you should test your network to make sure that you have everything configured correctly. To do this, assign a static IP address, subnet mask and a default gateway to Client-1. Use the IP address 192.168.2.1 with the 255.255.255.0 subnet mask. The default gateway should be set to 192.168.2.211. See figure 82.



*(figure 82)*



- Next, go to the Command Prompt, and attempt to **Ping** both IP addresses on SRV-11 (192.168.2.211 & 192.168.1.211) and the IP address of SRV-1 (192.168.1.201). If you cannot successfully Ping all of these IP addresses, you have a configuration error, and you need to correct this before moving on.

**Ping sent to 192.168.2.211 (Client-1 side of the router, SRV-11)**

```
C:\>ping 192.168.2.211
Pinging 192.168.2.211 with 32 bytes of data:
Reply from 192.168.2.211: bytes=32 time<10ms TTL=128
Reply from 192.168.2.211: bytes=32 time<10ms TTL=128
Reply from 192.168.2.211: bytes=32 time<10ms TTL=128
Reply from 192.168.2.211: bytes=32 time<10ms TTL=128
Ping statistics for 192.168.2.211:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

**Ping sent to 192.168.1.211 (other side of the router, SRV-11)**

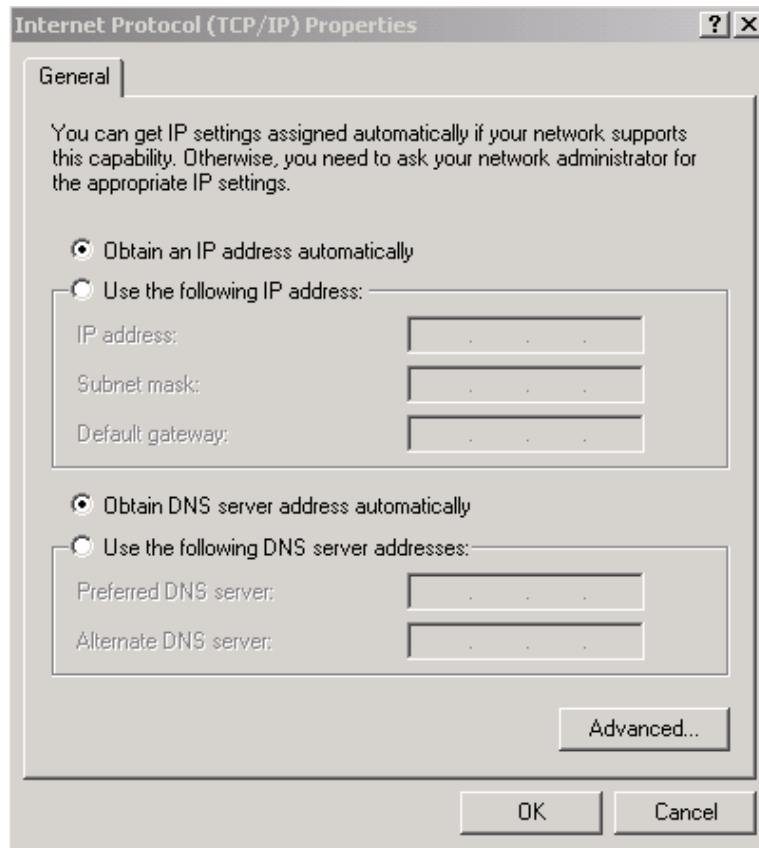
```
C:\>ping 192.168.1.211
Pinging 192.168.1.211 with 32 bytes of data:
Reply from 192.168.1.211: bytes=32 time<10ms TTL=128
Reply from 192.168.1.211: bytes=32 time<10ms TTL=128
Reply from 192.168.1.211: bytes=32 time<10ms TTL=128
Reply from 192.168.1.211: bytes=32 time<10ms TTL=128
Ping statistics for 192.168.1.211:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

**Ping sent to 192.168.1.201 (SRV-1 on the other side of the router)**

```
C:\>ping 192.168.1.201
Pinging 192.168.1.201 with 32 bytes of data:
Reply from 192.168.1.201: bytes=32 time<10ms TTL=127
Reply from 192.168.1.201: bytes=32 time<10ms TTL=127
Reply from 192.168.1.201: bytes=32 time<10ms TTL=127
Reply from 192.168.1.201: bytes=32 time<10ms TTL=127
Ping statistics for 192.168.1.201:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```



3. Once you have verified that your network is configured correctly, change the IP address of Client-1, to **obtain an IP address automatically**. See figure 83.



*(figure 83)*

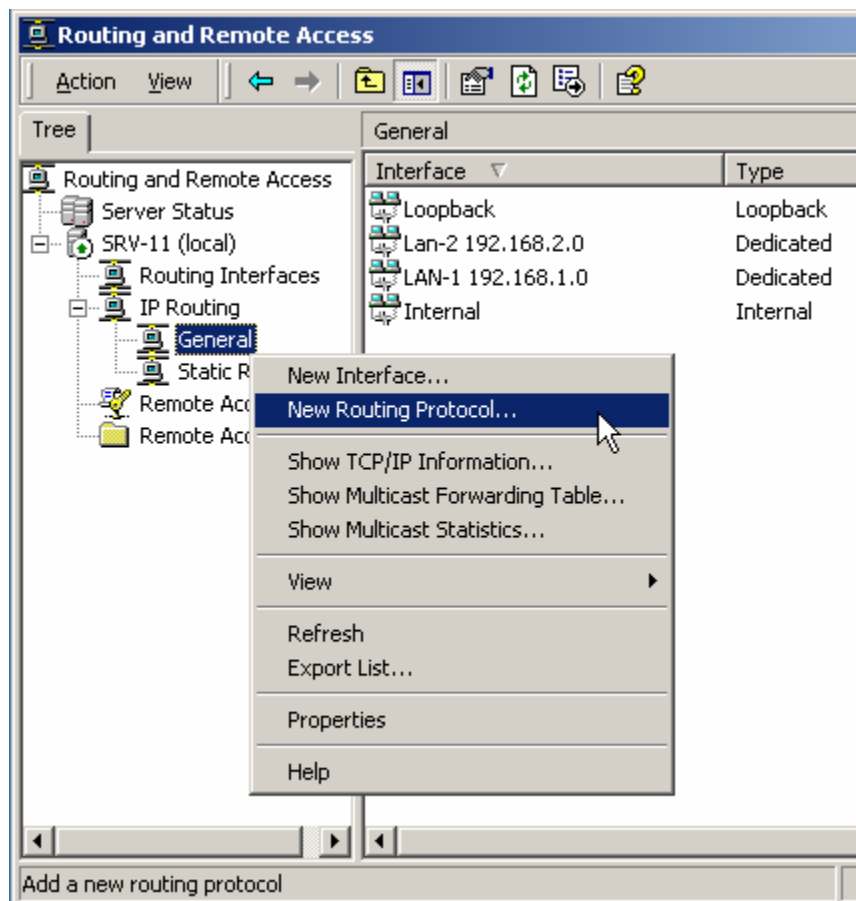
4. Run **ipconfig /all** from the Command Prompt and notice the IP address that you are receiving. You should be receiving an Automatic Private IP Address (APIPA), 169.254.x.y, with 255.255.0.0 as the Subnet Mask. Client-1's broadcasts for a DHCP server are not able to pass through the router (SRV-11).



## Installing the DHCP relay agent on the router (SRV-11)

The DHCP Relay agent is installed on a Windows 2000 router to pick up DHCP broadcasts from network segments that do not have a DHCP server. The relay agent then redirects the request to a DHCP server on another network segment.

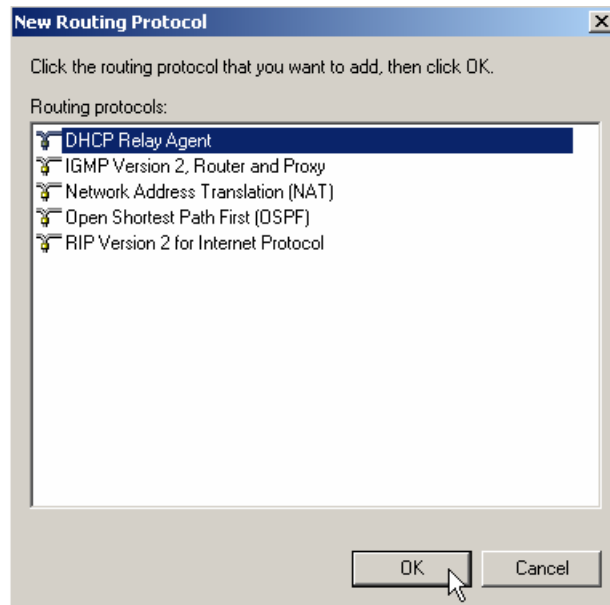
1. Open up the Routing and Remote Access tool by clicking on **Start, Programs, Administrative Tools** and **Routing and Remote Access**.
2. Install the DHCP relay agent by right clicking on **General** (under IP Routing) and selecting **New Routing Protocol**. See figure 84.



(figure 84)

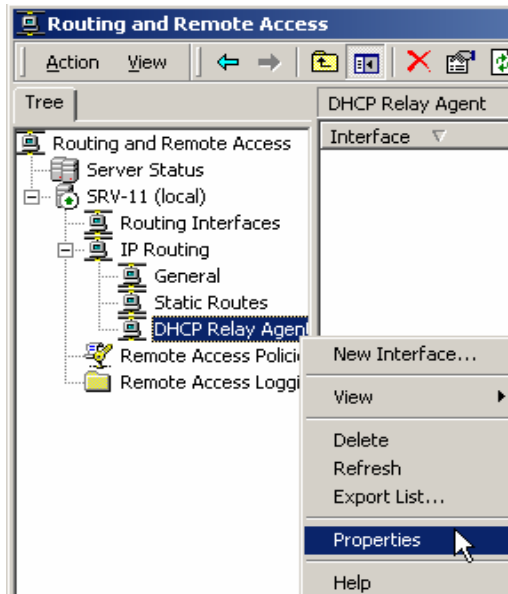


- This will bring up a window with all of the available routing protocols. Select **DHCP Relay Agent** and click OK. See figure 85.



(figure 85)

- In the console you should now see DHCP Relay Agent under IP Routing. To configure the DHCP Relay Agent, right-click on it and select **Properties**. See figure 86.

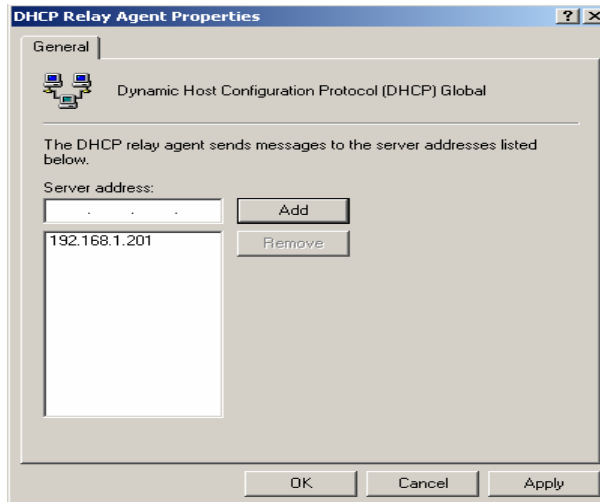


(figure 86)



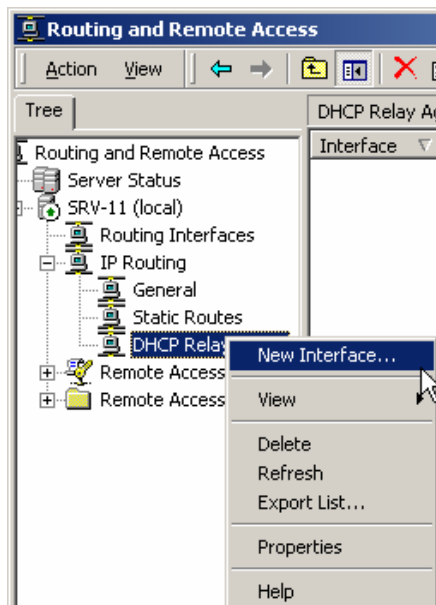


- From the Properties window type in the IP address of the DHCP server, **192.168.1.201**. Click **OK**. See figure 87.



(figure 87)

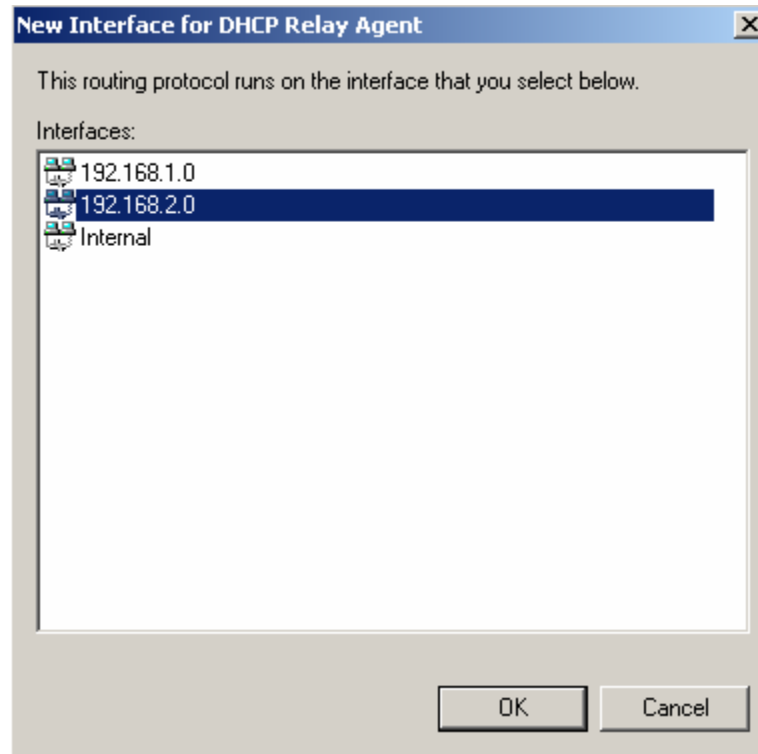
- The next step is to create a new interface for the DHCP relay agent. Right-click on DHCP relay agent and select **New interface**. See figure 88.



(figure 88)



7. This will bring up a window showing your network connections. Select **192.168.2.0** and click **OK** twice. You would choose this connection because the DHCP Relay Agent is always installed on the side of the router that does not have a DHCP Server, in our case, 192.168.2.0. See figure 89.



*(figure 89)*



## Testing the DHCP relay agent (Client-1 and SRV-11)

Now that the setup is complete, the DHCP client should be able to obtain an IP address from the DHCP server. The next step is to test your configuration and see if there are any issues.

1. Log on to Client-1. Open the command prompt. Run **ipconfig /release**. Then run **ipconfig /renew**. This will force the client to release the current IP address lease and send a broadcast out for a new one. See figure 90.

```
C:\>ipconfig /renew

Windows 2000 IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : wiredbraincoffe.com
    IP Address . . . . . : 192.168.2.199
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.2.211
```

(figure 90)

2. Sometimes this is not successful the first time. Try running **ipconfig /release** followed by **ipconfig /renew** several times. If it is still not successful, no worries, this sometimes happens. Let's take a look at this from the router's perspective.
3. On SRV-11, open the Routing and Remote Access tool and select **DHCP Relay Agent** on the left side. Look at the Requests received compared to the Replies Received. In my case (your numbers will probably be different), 4 DHCP requests were received from the DHCP client and the DHCP server responded (Replies Received) 3 times. If you have 0 replies received, it means that the DHCP server is not communicating with the router and your client will never get an IP address. This has happened to me on several occasions. Deleting the Relay Agent and recreating it, often does the trick. Also, try rebooting the client computer. See figure 91.

Interface	Relay mode	Requests received	Replies received	Requests discarded	Replies discarded
192.168.2.0	Enabled	4	3	1	0

(figure 91)



4. Once client-1 receives an IP address, check all of the IP information to ensure that it is correct by running `ipconfig /all`. See figure 92.

```
C:\>ipconfig /all

Windows 2000 IP Configuration

    Host Name . . . . . : client-1
    Primary DNS Suffix . . . . . : wiredbraincoffee.com
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : wiredbraincoffee.com
                                        wiredbraincoffe.com

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . . : wiredbraincoffe.com
    Description . . . . . : 3Com 3C918 Integrated Fast Eth
Controller (3C905B-TX Compatible)
    Physical Address. . . . . : 00-B0-D0-25-14-4B
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 192.168.2.199
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.2.211
    DHCP Server . . . . . : 192.168.1.201
    DNS Servers . . . . . : 192.168.1.201
                                192.168.1.202
    Primary WINS Server . . . . . : 192.168.1.201
    Secondary WINS Server . . . . . : 192.168.1.202
    Lease Obtained. . . . . : Tuesday, September 17, 2002 6:
PM
    Lease Expires . . . . . : Wednesday, September 25, 2002
4 PM

C:\>
```

(figure 92)

5. To ensure proper communication throughout the network, Ping SRV-1 from Client-1 and vice-versa.