EXAM OBJECTIVES

Professional ▶

Exam 70-210

- Perform an unattended installation of Windows 2000 Professional.
  - Install Windows 2000 Professional by using Windows 2000 Server Remote Installation Services (RIS).
  - Install Windows 2000 Professional by using the System Preparation Tool.
  - Create unattended answer files by using Setup Manager to automate the installation of Windows 2000 Professional.

Server ▶

Exam 70-215

- Perform an unattended installation of Windows 2000 Server.
  - Create unattended answer files by using Setup Manager to automate the installation of Windows 2000 Server.
  - Create and configure automated methods for installation of Windows 2000.

Directory Services ▶

Exam 70-217

- Deploy Windows 2000 by using Remote Installation Services (RIS).
  - Install an image on a RIS client computer.
  - Create a RIS boot disk.
  - Configure remote installation options.
  - Troubleshoot RIS problems.
  - Manage images for performing remote installations.
- Configure RIS security.
  - Authorize a RIS server.
  - Grant computer account creation rights.
  - Prestage RIS client computers for added security and load balancing.

CHAPTER

19

Deploying Windows 2000 on Your Network

In the "olden days" of computer networks, which weren't so very long ago, deployment wasn't a major issue. After all, most computer networks were fairly simple and relatively small. Today, however, many computer networks are vast enterprises encompassing several sites and thousands of workstations. Because of this, deployment has become vastly more important. After all, who wants to install Windows 2000 Professional on a thousand desktops?

Windows 2000 includes technologies to enable you to deploy Windows 2000 Professional and Server in a logical, organized, and—in most cases—automated manner. In this chapter, I'll examine the deployment tools and issues you need to know as an administrator, and for the Windows 2000 exams.

Chapter Pre-Test

1. Where are the Windows 2000 deployment tools located?
2. Which deployment tool can you use to create answer files by using a wizard?
3. What is the default name of a Windows 2000 unattended installation answer file?
4. Which tool can be used to prepare a Windows 2000 computer for disk duplication?
5. When using Sysprep, what additional tools do you need?
6. What must you do before a RIS server can respond to RIS client requests?
7. What operating systems can you deploy by using RIS?

Overview of Windows 2000 Deployment

Consider these scenarios: Your company has just purchased 20 new servers. You are handed a Windows 2000 Server installation CD-ROM and told to get busy. Just think — hours and hours of answering the same setup questions, endless reboots and hardware detection — just how you wanted to spend your next week. Or, what if you are faced with installing Windows 2000 Professional on 3,000 client computers by using an installation compact disc?

Fortunately, these scenarios don't have to be reality. Microsoft recognizes the size and complexity of distributed networks today, and Windows 2000 gives you several deployment tools and options. In the past, the concept of deployment referred to server-based deployment only, but in Windows 2000, deployment now refers to automated installations over the network using deployment tools, such as Setup Manager, Sysprep, and Remote Installation Services (RIS). For real-world deployment and for the Windows 2000 exams, you need to know what these tools are and how to use them.

Using Setup Manager

Windows 2000 includes a handy tool, the Windows 2000 Setup Manager wizard (called *Setup Manager* for short), which enables you to easily create answer files in order to automate Windows 2000 setup. *Answer files* are designed to "answer" setup questions without intervention from the administrator or user. You can use Setup Manager to automate over-the-network unattended installations, Sysprep installations, and RIS installations — all of which you'll learn about in the upcoming sections. In a nutshell, you can install many Windows 2000 Server or Professional computers over the network without having to physically sit at the computer to answer the setup questions. Answer files are not new, but Setup Manager simplifies the process by giving you a wizard to create the answer file.

Setup Manager is not installed by default when you install Windows 2000, and it is not a component that you can install by using Add/Remove Programs in Control Panel. Rather, Setup Manager is found in the `\SUPPORT\TOOLS` folder on both the Windows 2000 Professional and Server compact discs. You can install Setup Manager and the other deployment and support tools by copying them from the `DEPLOY.CAB` file in the `\SUPPORT\TOOLS` folder.

STEP BY STEP

INSTALLING SETUP MANAGER

1. Insert your Windows 2000 compact disc (either Professional or Server) into your computer's CD-ROM drive. Close the Microsoft Windows 2000 CD dialog box.
2. From the desktop, right-click My Computer, and select Explore from the menu that appears.
3. In the left pane, highlight Local Disk (C:). Select File ➪ New ➪ Folder.
4. In the right pane, type in a new folder name of **Deployment** and press Enter.
5. In the left pane, click the + next to your CD-ROM drive. Click the + next to the `SUPPORT` folder. Highlight the `TOOLS` folder. In the right pane, double-click the `DEPLOY` file. Select Edit ➪ Select All. Select Edit ➪ Copy To Folder.
6. In the Browse For Folder dialog box, click the + next to My Computer. Click the + next to Local Disk (C:). Highlight Deployment. Click OK.
7. Windows 2000 extracts and copies the contents of the `DEPLOY.CAB` file to the `DEPLOYMENT` folder. Close Windows Explorer.

Creating an Answer File by Using Setup Manager

An answer file is a file that responds to the Windows 2000 Setup program. The file answers the questions the Setup program poses to the user. With an answer file, you can completely automate the installation and setup of Windows 2000 Professional or Windows 2000 Server. You can use Setup Manager to create an answer file.

STEP BY STEP

CREATING AN ANSWER FILE BY USING SETUP MANAGER

1. Right-click My Computer, and select Explore from the menu that appears.
2. In the left pane, click the + next to Local Disk (C:). Highlight the `Deployment` folder. In the right pane, double-click `setupmgr`.
3. The Windows 2000 Setup Manager wizard starts. Click Next.
4. The New or Existing Answer File screen appears. There are three basic options on this screen:
   - **Create a new answer file:** Select this option to create a new answer file.

STEP BY STEP *Continued*

- **Create an answer file that duplicates this computer's configuration:** Select this option to create an answer file that mirrors your computer's current configuration. This method is effective if you want to create several computers that are exactly the same.
- **Modify an existing answer file:** Select this option to edit an existing answer file. If you select this option, you'll need to enter the path to the answer file you want to modify.

To create a new answer file, accept the default selection of "Create a new answer file" and click Next.

5. In the Product to Install screen, select the Windows 2000 Unattended Installation option, as shown in Figure 19-1. Click Next.

FIGURE 19-1 Creating an answer file for an unattended installation

6. In the Platform screen, select the operating system this answer file will be used to install. Choose either Windows 2000 Professional or Windows 2000 Server. Click Next.
7. The User Interaction Level screen appears, as shown in Figure 19-2. Notice that a description of the selected option is displayed across the lower part of the dialog box.

   Select the appropriate option for the answer file you're creating:

   - **Provide defaults:** The user has full interaction with the Setup program. The answer file provides the default Setup answers, and the user must interact with the Setup program by accepting the default selections or making changes. This is the default setting.

STEP BY STEP *Continued*

FIGURE 19-2 Selecting the level of user interaction during Windows Setup

- **Fully automated:** The user has no interaction with the Setup program except for possibly entering a product key. A product key must be entered for all OEM and retail versions of Windows 2000, but is not required for versions purchased through a "select" agreement with Microsoft. All of the answers are provided in the answer file, and the user cannot intervene or make changes.
- **Hide pages:** The user has some interaction with the Setup program. Setup screens for which the answer file provides answers are not displayed to the user. Setup screens that are not answered are displayed to the user. This feature enables you to automate some portions of Setup, but to collect user-specific information as necessary.
- **Read only:** The user has no interaction with the Setup program. All Setup screens are displayed to the user, but the user can't make any changes to these screens.
- **GUI attended:** The user has some interaction with the Setup program. The text mode phase of the installation is automated, but the user must respond to all of the screens in the Windows 2000 Setup Wizard phase.

Click Next.

8. If you selected the "Fully automated" option, the License Agreement screen appears. Select the check box to accept the terms of the license agreement. Click Next.

STEP BY STEP *Continued*

9. In the Customize the Software screen, enter the default name and organization name you want to use. Click Next.
10. The next several screens prompt you to enter information that the answer file will use to install Windows 2000. The screens vary, depending on whether you selected Windows 2000 Professional or Windows 2000 Server.
11. The Distribution Folder screen appears. In this screen, choose one of the following options and click Next.
    - **Yes, create or modify a distribution folder:** Select this option if this answer file will be used for an over-the-network installation. If you select this option, Setup Manager copies the Windows 2000 source files to a folder on the local hard disk, and shares this folder, so that over-the-network installations can be performed. If you select this option, Steps 12 through 17 prompt you to enter information about this distribution folder, including its name and any additional files and drivers you may want copied to the distribution folder.
    - **No, this answer file will be used to install from a CD:** Select this option if this answer file will be used to perform an installation using a compact disc. If you select this option, skip to Step 18.
12. The Distribution Folder Name screen appears, as shown in Figure 19-3. Notice the default names of the distribution folder and distribution share.

FIGURE 19-3 Specifying a distribution folder

STEP BY STEP *Continued*

Choose whether you want to create a new distribution folder, or to modify an existing distribution folder. Then, specify a full path to the distribution folder and a share name that will be used by this folder. Click Next.

13. In the Additional Mass Storage Drivers screen, add any manufacturer-supplied hard disk controller drivers for the computer(s) that this answer file will be used to install Windows 2000 on. Use the Browse button to locate and select these driver files. If you don't have any additional device drivers, or once you have selected the drivers, click Next.
14. In the Hardware Abstraction Layer screen, you can specify a custom HAL that will be used by the answer file for installing Windows 2000. Use this option only if your computer's manufacturer supplies you with a custom HAL. Use the Browse button to locate and select this file. Click Next.
15. In the Additional Commands screen, you can specify one or more commands that will be run at the completion of the Windows 2000 installation and setup. These commands are often used to install additional software. You can specify any Windows 2000 command that doesn't require you to be logged on. Add commands as needed and click Next.
16. In the OEM Branding screen, you can specify a path to a custom logo and a path to a custom background. This logo and background will be displayed during the installation process. This screen is typically used by original equipment manufacturers (OEMs) to customize their installations of Windows 2000 on new computers. Configure this screen as needed and click Next.
17. In the Additional Files or Folders screen, you can specify additional files and folders you want Windows 2000 Setup to copy to the hard disk of the computer on which you plan to install Windows 2000 by using this answer file. If this computer has more than one hard disk, you can specify which disk the files and folders will be copied to. Add files and folders as needed, then click Next.
18. In the Answer File Name screen, either accept the default answer file location and filename, or specify a new one. By default, the answer file is named `unattend.txt`. Click Next.
19. If you chose to create or modify a distribution folder, the Location of Setup Files screen appears. In this screen, specify whether Setup Manager will copy the Windows 2000 source files from the Windows 2000 compact disc, or from a specified location on the network. Make your selection, then click Next. The wizard copies the files to the distribution folder.
20. In the Completing the Windows 2000 Setup Manager Wizard screen, click Finish.

When Setup Manager creates your answer file, it stores it in one of two places. If you chose to create a distribution folder, the answer file is stored

in the distribution folder. If you chose not to create a distribution folder, the answer file is stored in the folder from which you ran Setup Manager.

You can view or edit your answer file (which is named `unattend.txt` by default) by using Notepad or any other text editor.

TIP

For more information on the format and parameters used in an answer file, I recommend you print the `unattend.doc` file, which is located in the folder in which you installed Setup Manager.

In addition to creating the answer file, Setup Manager creates one or two more additional files and stores these files in the same location as the answer file. First, an `unattend.bat` file is created. This is a batch file used to launch the Windows 2000 installation. Then, if you specified more than one computer name when you used the wizard, Setup Manager creates an `unattend.udf` file. This file is a uniqueness database file that contains differences between computers when multiple installations will be performed by using a single answer file.

Now that you've created an answer file, you can use this answer file to perform unattended installations of Windows 2000 on your network.

Using an Answer File to Perform an Unattended Installation

Performing an unattended installation of Windows 2000 Professional or Windows 2000 Server by using an answer file is fairly straightforward if you have a good DOS background. However, there are a few different steps in the process, depending on whether you're installing from a compact disc, or performing an over-the-network installation by using a shared distribution folder.

TIP

If you need to get up to speed on DOS, try *DOS for Dummies,* third edition, by Dan Gookin (IDG Books Worldwide) or *A+ Certification Study System,* By Michael A. Pastore and Bill Karow.

If you're installing Windows 2000 from a compact disc, the first thing you should do is use MS-DOS (or Windows 95 DOS, or Windows 98 DOS) to partition and format the hard disk on the computer on which you want to perform the installation (the target computer). Next, boot this computer to DOS, and load CD-ROM drivers for the computer's

CD-ROM drive. Then place the Windows 2000 compact disc in the CD-ROM drive. Next, copy the `unattend.txt`, the `unattend.bat`, and, if appropriate, the `unattend.udf` files to a floppy disk and place this disk in the `A:` drive on the target computer. At the DOS prompt, type **A:** and press Enter, then type **unattend** and press Enter. (Or, if you have a `.udf` file, type **unattend** *computer_name* and press Enter.) This starts the unattended installation of Windows 2000.

To install Windows 2000 over-the-network by using a shared distribution folder, the target computer must have a network adapter card installed in it. The first thing you should do is use MS-DOS (or Windows 95 DOS, or Windows 98 DOS) to partition and format the hard disk on the target computer. Next, boot this computer to DOS, and load Client for Microsoft Networks (or equivalent client software) to enable this computer to function on the network. This software doesn't ship with Windows 2000; however, it was included with Windows NT Server 4.0. Map a network drive to the shared distribution folder on the network server. At the DOS prompt, change the default drive to the mapped network drive, then type **unattend** and press Enter. (Or, if you have a `.udf` file, type **unattend** *computer_name* and press Enter.) This starts the unattended installation of Windows 2000.

Using Sysprep

The System Preparation Tool (`sysprep.exe`), often referred to as *Sysprep* in Microsoft documentation, is a Windows 2000 deployment tool designed for large organizations and OEMs. Sysprep prepares a Windows 2000 computer's hard disk for duplication, thus making it possible for that computer's hard disk to be copied to other computers. This feature is particularly useful to OEMs who install Windows 2000 along with a number of custom applications and other data on multiple computers.

TIP

Sysprep works on both Windows 2000 Professional and Windows 2000 Server computers. However, it doesn't work on Windows 2000 Server domain controllers.

`Sysprep.exe` is located in the same file as Setup Manager (the `DEPLOY.CAB` file in the `\SUPPORT\TOOLS` folder), and is installed in the same manner. In fact, if you've installed Setup Manager, Sysprep is installed at the same time.

Here's how Sysprep is typically used. First, you install Windows 2000 and all desired applications and services on a computer — this is called the *master computer*. Then you prepare the master computer's hard disk for duplication by using Sysprep. Sysprep works by removing user-specific data from the original master computer and by placing a Mini-Setup routine on the master computer's hard disk. Next, you use a third-party software utility, such as PowerQuest's Drive Image Pro, to copy the master computer's hard disk, and to duplicate this copy on the hard disk of each target computer. Finally, when the target computer boots for the first time, a Mini-Setup wizard runs, which gathers user-specific information from the user and assigns the target computer a unique SID. The whole process enables you to deploy one disk image to many computers. The result — cloned machines that are user unique.

In the next several sections I'll show you how to perform the many steps in this process.

Installing Windows 2000 and Applications on the Master Computer

When you are preparing to use Sysprep, it's important to keep in mind that the purpose of this utility is to enable you to create a *complete disk image*. This image is then copied to other computers that have identical hardware, called target computers or clones.

Use care when installing and configuring the master computer. Every installation or configuration option you select on the master computer will be copied to the target computers. So, don't do anything to the master computer unless you want it duplicated on all of the target computers. For example, don't map network drives, connect to printers, create desktop shortcuts, or install applications or drivers unless you want these items duplicated. In addition, when you install Windows 2000 on the master computer, be careful that you select only the Windows 2000 components you want installed on the target computers. Remember, everything you do on the master computer will be copied to the target computers.

After you've installed and configured the master computer, you must copy the contents of the Administrator's profile folder over the contents of the `Default User` profile folder. This ensures that all of the applications, shortcuts, and other user preference settings you configured on the master computer will be available to the users of the target computers. When you copy the Administrator's profile, ensure that the Everyone group is permitted to use the copied profile.

CROSS-REFERENCE

If you've forgotten how to copy user profiles, see Chapter 9.

Using Sysprep to Prepare the Master Computer for Duplication

Now that your master computer is installed and configured, you're almost ready to use Sysprep. Before using Sysprep to prepare your master computer, spend some time checking the hardware on the target computers. Especially take note of the following issues:

- The master and target computers must use the same Hardware Abstraction Layer (HAL).
- The master and target computers should have identical mass storage controllers (either IDE or SCSI).
- Hard disk sizes on the master and target computers must be identical, unless your disk duplication software permits you to dynamically alter partition sizes.
- Modems, sound cards, video cards, and so on do not have to be the same on the master and target computers. Plug and Play can detect and install these devices, although you should have drivers readily available.

Before you run Sysprep, you might want to create a `sysprep.inf file`, which enables you to partially or fully automate Mini-Setup. You can use Setup Manager to create this file. The process is similar to creating an answer file. When you create the `sysprep.inf` file, you should save it on the master computer in a folder named `C:\sysprep`.

STEP BY STEP

CREATING A SYSPREP.INF FILE

1. Right-click My Computer, and select Explore from the menu that appears.
2. In the left pane, click the + next to Local Disk (C:). Highlight the Deployment folder. In the right pane, double-click `setupmgr`.
3. The Windows 2000 Setup Manager wizard starts. Click Next.

STEP BY STEP *Continued*

4. In the New or Existing Answer file screen, select the “Create a new answer file” option. Click Next.
5. In the Product to Install screen, select the Sysprep Install option, as shown in Figure 19-4. Click Next.

FIGURE 19-4 Creating a `Sysprep.inf` file

6. In the Platform screen, select the appropriate Windows 2000 option (Professional or Server), then click Next.
7. In the License Agreement screen, you choose whether to fully automate the installation. If you select the Yes option, you are accepting the license agreement for the end user. If you select the No option, the user must agree to the terms of the license agreement during Mini-Setup. Select the appropriate option and click Next.
8. In the Customize the Software screen, enter a default user name and organization, then click Next.
9. In the Computer Name screen, enter a default computer name and click Next.
10. In the Administrator Password screen, provide an Administrator password or choose the “Prompt the user for an Administrator password” option. Make your selection and click Next.
11. In Display Settings screen, use the drop-down list boxes to select the desired color, screen area, and refresh frequency, or accept the Windows default settings. Click Next.

STEP BY STEP *Continued*

12. In the Network Settings screen, select either the Typical or Custom settings option. If you select Custom settings, you will be prompted to select the networking components you want to install. Click Next.
13. In the Workgroup or Domain screen, choose whether you want the computer to be a member of a workgroup or a domain. Click Next.
14. In the Time Zone screen, specify a time zone if desired by using the drop-down list box. Click Next.
15. In the Additional Settings screen, you can choose whether to edit additional Windows settings. If you choose to edit additional settings, other screens will prompt you to configure various Windows components. Make your selection and click Next.
16. The Sysprep Folder screen appears, shown in Figure 19-5. This window enables you to create a `Sysprep` folder where Setup Manager will store your Sysprep files. I recommend that you create this folder. Select the Yes option, then click Next.

FIGURE 19-5 Creating a `Sysprep` folder

17. In the Additional Commands window, you can specify additional commands or scripts that will run at the end of Mini-Setup. Add commands as needed and click Next.
18. In the OEM Branding screen, you can specify a path to a custom logo and a path to a custom background. Configure this screen as needed and click Next.
19. In the Additional Files and folders screen, specify any additional files and folders you want copied to the hard disk of the target computer. Click Next.

STEP BY STEP *Continued*

20. The OEM Duplicator String screen appears. In this screen you can enter Sysprep information that will be written to the target computer's registry. This information enables you to determine which master computer was used to create the target computer. Configure this screen as appropriate, then click Next.
21. In the Answer File Name screen, accept the default name for the `sysprep.inf` file, and ensure that it will be saved in the `C:\sysprep` folder on the master computer. Click Next.

TIP

The `sysprep.inf` file must be stored in the `C:\sysprep` folder on the master computer, or it will not be used by Sysprep.

22. In the Completing the Windows 2000 Setup Manager Wizard screen, click Finish.

You're almost ready to run Sysprep, but there are a few last tasks that must be done. First, if you didn't create a `sysprep.inf` file, you must create a `C:\sysprep` folder on the master computer. Then, you must copy `setupcl.exe` and `sysprep.exe` from the folder in which you've installed Setup Manager to the `C:\sysprep` folder. This folder will also contain the `sysprep.inf` file if you created one. Now you're ready to run Sysprep on the master computer.

STEP BY STEP

RUNNING SYSPREP ON THE MASTER COMPUTER

1. On the Windows 2000 master computer, select Start ➪ Programs ➪ Accessories ➪ Command Prompt.
2. At the command prompt, type **cd sysprep** and press Enter.
3. At the command prompt, type **sysprep** and press Enter.

   Or, If your target computer has any hardware that is different from the master computer, such as a different modem, sound card, and so on, type **sysprep –pnp** and press Enter. The `–pnp` parameter will cause Mini-Setup to perform full Plug and Play hardware detection when the target computer boots.

   For more information on `sysprep.exe` command-line parameters, type **sysprep /?** at the command prompt and press Enter.
4. A message appears indicating that you should not run Sysprep unless you are preparing a disk for duplication. Click OK to continue.

STEP BY STEP *Continued*

5. Sysprep runs on the master computer. This may take a few minutes, and once this is done, your computer should automatically shut down. If, after several minutes, there is no activity on the master computer, power it off. The master computer is now ready for disk duplication.
6. Later, after you've used a third-party utility to duplicate the master computer's hard disk, you can reboot the master computer. When you reboot the computer, the Mini-Setup wizard runs. You are prompted to enter user-specific settings for the master computer. Complete the Mini-Setup wizard to restore the master computer to a usable state. The Mini-Setup wizard also removes the `C:\sysprep` folder.

Duplicating the Master Computer's Hard Disk

The Sysprep utility included with Windows 2000 enables you to prepare a master computer for disk duplication. However, Windows 2000 doesn't include any capability to physically duplicate the hard disk. This process must be done by using a third-party software utility, such as PowerQuest's Drive Image Pro. Once the master computer's hard disk is duplicated, it can be copied to the hard disks in target computers.

After the master computer's hard disk has been copied to a target computer, and the target computer is booted, the Mini-Setup wizard runs so that the user can enter appropriate user-specific information. If you created a `sysprep.inf` file before you ran Sysprep, you may have configured Mini-Setup to be partially or fully automated. The Mini-Setup wizard also removes the `C:\sysprep` folder.

Using Remote Installation Services (RIS)

Windows 2000 Server includes another tool that can be used for deploying Windows 2000 Professional — *Remote Installation Services (RIS)*. RIS is designed to allow a Windows 2000 Server computer to hold Windows 2000 Professional installation files and to deploy those files to target computers while also providing each computer with a unique SID.

RIS is similar in many ways to an unattended installation or to Sysprep, but the main differences are that RIS is only used to roll out Windows 2000 Professional (not Server), and that it works by deploying Windows 2000 *from a Windows 2000 RIS server*. With a RIS server, you can perform over-the-network attended installations of Windows 2000 Professional, over-the-network unattended installations of Windows 2000 Professional, and over-the-network imaged installations (either attended or unattended) of Windows 2000 Professional. The imaged installations are similar to Sysprep installations, but use a RIS server and tools instead of Sysprep and a third-party disk duplication utility.

EXAM TIP

Microsoft intends for RIS to be the preferred method of rolling out Windows 2000 Professional. So, make sure you know all about it for the Windows 2000 exams, especially the Directory Services exam.

RIS can only be used on Windows 2000 networks that use DHCP, DNS, and Active Directory. RIS requires all of these components to function.

In the next sections I'll explain how to install and configure RIS, how to manage RIS images, how to prestage RIS clients, and finally, how to install a RIS image on a client computer. I'll also provide you with some tips for troubleshooting RIS problems.

Installing and Configuring RIS

Before you install RIS, you should determine which Windows 2000 Server computer on your network will be the RIS server. You can have more than one RIS server if you want to.

The Windows 2000 Server computer on which you install RIS must have at least two volumes, or preferably two hard disks. One volume (or hard disk) contains your Windows 2000 Server installation, and the second volume (or hard disk) will be used for the RIS installation folder and images. The volume (or hard disk) used for the RIS installation folder and images must be formatted with NTFS. You should also ensure that this volume (or hard disk) is large enough (and has enough free space) to store multiple RIS images.

You can install RIS just as you do other Windows 2000 Server components, by using Add/Remove Programs in Control Panel.

STEP BY STEP

INSTALLING RIS ON A WINDOWS 2000 SERVER COMPUTER

1. Select Start ➪ Settings ➪ Control Panel.
2. In the Control Panel dialog box, double-click Add/Remove Programs.
3. In the Add/Remove Programs dialog box, click Add/Remove Windows Components.
4. In the Windows Components screen, select the check box next to Remote Installation Services, then click Next.
5. When prompted, insert your Windows 2000 Server compact disc into your computer's CD-ROM drive, and click OK. When the Microsoft Windows 2000 CD dialog box appears, close it. Windows 2000 installs RIS.
6. In the Completing the Windows Components Wizard screen, click Finish. When prompted, click Yes to restart your computer.

Once your Windows 2000 Server computer reboots, you'll need to do a few more things to make it function as a RIS server. Some of these tasks may seem a little odd, but you'll need to perform the actions in the next few sections to get your RIS server up and running.

Authorizing a RIS Server in Active Directory

Before a RIS server can be used, it must be authorized in Active Directory. If you installed RIS on a DHCP server on your network that is already authorized in Active Directory, no further action is necessary to accomplish this task — because the DHCP server is authorized, the RIS server is also authorized.

If you installed RIS on a Windows 2000 Server computer that is *not* a DHCP server, you'll have to use the DHCP administrative tool on a DHCP server on your network to remotely authorize the RIS server as a DHCP server. This sounds a bit strange, but the long and short of it is that RIS is tied to DHCP in terms of Active Directory authorization.

STEP BY STEP

AUTHORIZING A RIS SERVER IN ACTIVE DIRECTORY

1. On a Windows 2000 DHCP Server, select Start ➪ Programs ➪ Administrative Tools ➪ DHCP.

STEP BY STEP *Continued*

2. In the DHCP dialog box, select Action➪Manage authorized servers.
3. In the Manage Authorized Servers dialog box, click Authorize.
4. In the Authorize DHCP Server dialog box, enter the name or IP address of the RIS server and click OK.
5. A DHCP message appears, indicating that the server you specified will be added to the authorized DHCP servers list. Click Yes.
6. In the Manage Authorized Servers dialog box, the RIS server now appears in the Authorized DHCP servers list. Click Close. Close DHCP.

Setting Up a RIS Server

Once the RIS server is authorized in Active Directory, your next step is to set up the RIS server. Windows 2000 Server includes a RIS Setup wizard to help you with this task. The wizard sets up the RIS server and creates the default RIS image. The default RIS image is a copy of the Windows 2000 Professional source files that will be used for deploying Windows 2000 Professional to client computers. The following steps show you how to set up the RIS server.

STEP BY STEP

SETTING UP THE RIS SERVER

1. From the desktop, select Start➪Run.
2. In the Run dialog box, type **risetup** and click OK.
3. The Remote Installation Services Setup wizard starts. Click Next.
4. In the Remote Installation Folder location screen, either accept the default path or enter the location for the installation folder. (This can't be the volume in which Windows 2000 is installed.) In addition, the volume the installation folder is created on must be formatted with NTFS. Click Next.
5. The Initial Settings screen appears. By default, the RIS server is not configured to respond to client computers. You can manually configure it to do so, after this setup wizard runs, but the easiest way to accomplish this is to select the check box next to "Respond to client computers requesting service" in this screen. If you want this RIS server to respond to client requests, select this check box and click Next.

STEP BY STEP *Continued*

6. In the Installation Source Files Location screen, you specify the location of the Windows 2000 Professional source files that the wizard will copy to create the default RIS image. Either accept the default path to the Windows 2000 Professional installation files, or specify a new path. This path can be to a CD-ROM drive or to a network share. Click Next.
7. In the Windows Installation Image Folder Name screen, either accept the default name for the folder that will contain the default RIS image, or type in a new name. By default, the folder name is `win2000.pro`. Click Next.
8. In the Friendly Description and Help Text screen, you can enter a description and any help text you wish to enter for the default RIS image. The purpose of this information is to help an end user or a technician select the appropriate RIS image. Configure this screen as desired, and click Next.
9. In the Review settings screen, click Finish. The RIS server copies files, creates the remote installation folder, creates the default image of Windows 2000 Professional, and sets up the RIS server. This process takes several minutes. When this process completes, click Done.

Granting Permission to Create Computer Objects

Once the RIS server is set up, you're almost ready to begin using it. However, before doing so, you have to assign the appropriate permission. During the installation of Windows 2000 Professional on a client computer that will be a domain member, you must create a computer object in Active Directory for that client computer. For security reasons, you don't want just anyone to be able to create computer objects in Active Directory. So, in order to permit specific users or technicians to perform this task, you need to assign these users the "Create Computer Objects" advanced Active Directory permission.

In order to assign this permission, you must be a member of the Domain Admins group in the domain. The easiest way to assign this permission is by using the Delegation of Control wizard in Active Directory Users and Computers. Depending on how you use RIS, you may want to create a specific group to which you assign this permission.

STEP BY STEP

ASSIGNING THE "CREATE COMPUTER OBJECTS" PERMISSION

1. Select Start ➪ Programs ➪ Administrative Tools ➪ Active Directory Users and Computers.
2. In the left pane of Active Directory Users and Computers, right-click the domain in which computer objects will be created when performing RIS installations, then select Delegate Control from the menu that appears.
3. The Delegation of Control wizard starts. Click Next.
4. In the Users or Groups screen, click Add.
5. In the Select Users, Computers, or Groups dialog box, double-click each user or group to which you want to assign the "Create Computer Objects" permission. Click OK.
6. In the Users or Groups screen, click Next.
7. The Tasks to Delegate screen appears, as shown in Figure 19-6. Select the check box next to "Join a computer to the domain." By selecting this check box, you are assigning the "Create Computer Objects" permission. Click Next.

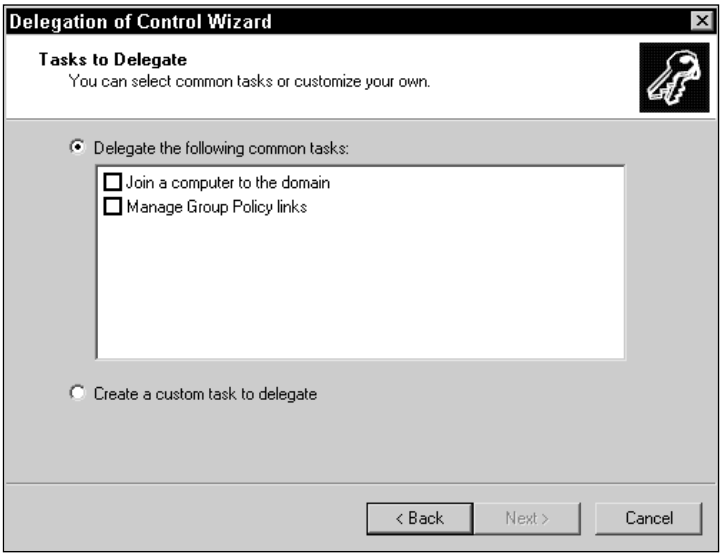

FIGURE 19-6 Delegating permission to join a computer to the domain

8. In the Completing the Delegation of Control Wizard screen, click Finish. The users or groups you selected have now been assigned the "Create Computer Objects" advanced Active Directory permission.

Creating a RIS Client Boot Disk

Before you can use a RIS server to deploy Windows 2000 Professional, the client computers on which you want to install Windows 2000 Professional must be able to communicate with the RIS server.

There are two ways to accomplish this. First, depending on your client computer hardware, you may not have to do anything to get the client to communicate with the server. Some computers come equipped with a network adapter that has a Preboot Execution Environment (PXE) ROM. When you start a client computer that has a PXE ROM, a message is displayed, asking if you want to start the computer from the network. If you select Yes, the computer obtains an IP address from the network's DHCP server, then contacts the DNS server to locate a RIS server. Finally, the client computer contacts the RIS server and starts an over-the-network installation.

If your client computer's network adapter does not have a PXE ROM, you can simulate the existence of the PXE ROM by using a RIS boot disk. You can use the `rbfg.exe` utility on the RIS server to create a RIS boot disk from a blank, formatted floppy disk. A RIS boot disk can be used by computers that have a supported network adapter card. RIS supports only PCI-based network adapter cards.

STEP BY STEP

CREATING A RIS BOOT DISK

1. On the RIS server, right-click My Computer and select Explore from the menu that appears.
2. In the left pane, click the + next to the volume that contains the RIS installation folder. Click the + next to RemoteInstall. Click the + next to Admin. Highlight the `i386` folder. In the right pane, double-click `rbfg.exe`.
3. The Windows 2000 Remote Boot Disk Generator dialog box appears, as shown in Figure 19-7. Notice the Adapter List button. Click this button to view a list of network adapter cards for which a RIS boot disk can be used. Only PCI-based network adapter cards are supported.

TIP

Since RIS only supports PCI network adapter cards, this means most laptop computers can't use RIS.

STEP BY STEP *Continued*

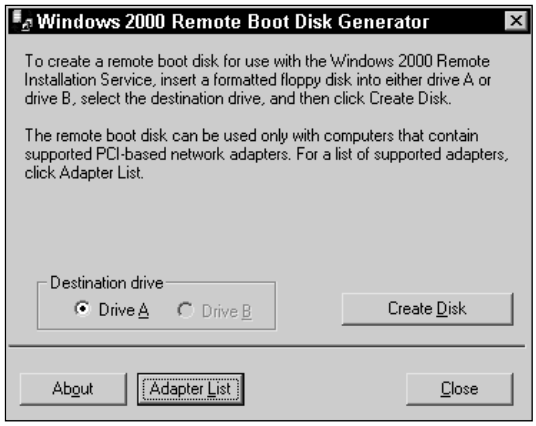

FIGURE 19-7 Creating a RIS boot disk

Insert a blank, formatted floppy disk into drive `A:`, then click Create Disk.

4. The Remote Boot Disk Generator creates the RIS boot disk. Click No when asked if you want to create another disk.
5. In the Windows 2000 Remote Boot Disk Generator dialog box, click Close. Close Windows Explorer.

Configuring RIS Server Options

Before you use your RIS server, you'll probably want to configure it. For example, if you didn't configure the RIS server to respond to client computers requesting service when you set up the RIS server, you'll need to configure the server to do so now. In addition, you might also want to configure how RIS will generate client computer names during RIS installations, and where in Active Directory the new client computer objects will be created.

The RIS server is configured by configuring its Properties in Active Directory Users and Computers. I'll show you how to configure the RIS server in the steps that follow.

STEP BY STEP

CONFIGURING THE RIS SERVER

1. Select Start ➪ Programs ➪ Administrative Tools ➪ Active Directory Users and Computers.
2. In the left pane of the Active Directory Users and Computers dialog box, expand domains and OUs as appropriate until the RIS server you want to configure is displayed in the right pane. (By default, all computers are stored in the Computers container.) In the right pane, right-click the RIS server and select Properties from the menu that appears.
3. In the RIS server's Properties dialog box, click the Remote Install tab.
4. The Remote Install tab appears, as shown in Figure 19-8.

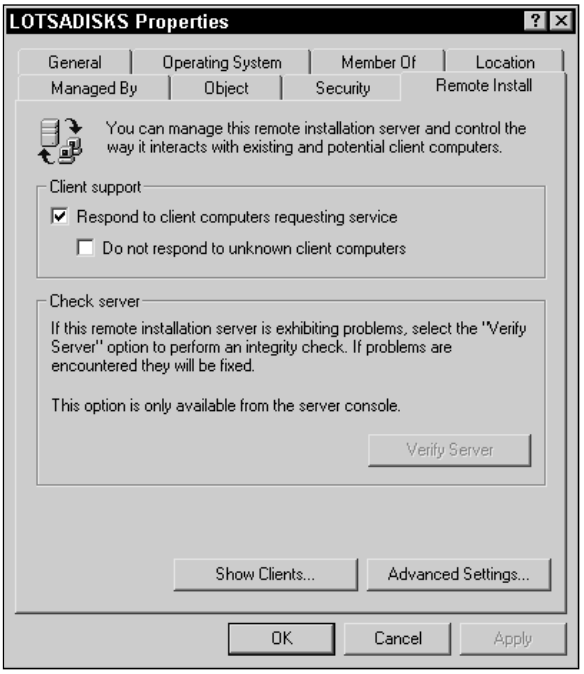

FIGURE 19-8 The Remote Install tab

If you didn't configure the RIS server to respond to client requests when you set up the RIS server, select the check box next to "Respond to client computers requesting service."

STEP BY STEP *Continued*

There are a few other options in this dialog box:

- **Verify Server:** If you're having problems with the RIS server, and if you're running Active Directory Users and Computers on the RIS server, you can click Verify Server to have Windows 2000 attempt to locate and correct problems on the RIS server.
- **Show Clients:** To view a list of all client computers that have received a RIS image from this server, click Show Clients. (This list is currently empty, but will not be after you start using the RIS server.)
- **Advanced Settings:** To configure advanced properties of the RIS server, click Advanced Settings. Continue to Step 5.

5. The server's Remote-Installation-Services Properties dialog box appears, as shown in Figure 19-9.

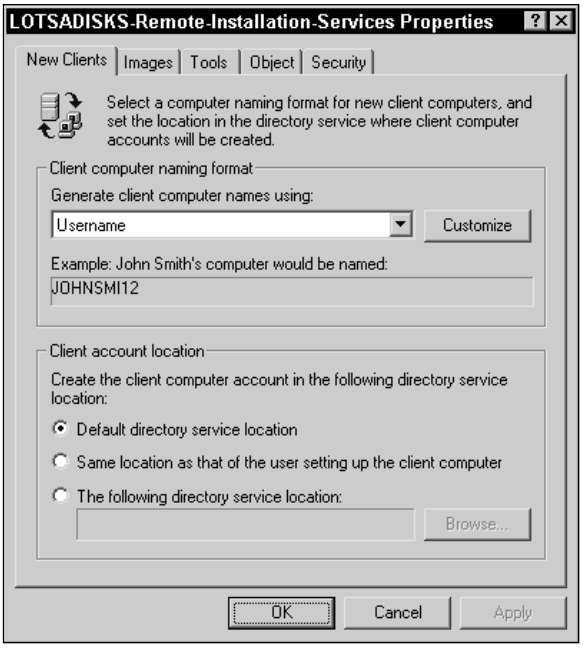

FIGURE 19-9 Configuring a RIS server's properties

STEP BY STEP *Continued*

On the New Clients tab, select how the RIS server will assign computer names to client computers that use the RIS server by selecting a naming scheme from the drop-down list box. By default, the RIS server uses the user's logon name (username) when assigning computer names. This means that the username of the person performing the installation will be used as the computer name. If one technician performs multiple RIS installations, this naming scheme may not be your best choice.

In the "Client account location" section, choose where in Active Directory computer accounts for new client computers will be created. The default selection is "Default directory service location." This means that new computer accounts will be created in the Computers container.

Configure options on this tab as appropriate, then click OK.

6. In the RIS server's Properties dialog box, click OK.

That about wraps up how to configure basic RIS server properties. In the sections that follow, I'll explain how to configure even more RIS server properties, including RIS server security, and how to manage RIS images.

Configuring RIS Security

In addition to configuring basic RIS server properties, you can also configure other security options for RIS. You can:

- Configure the RIS server to only respond to client computers that have been prestaged for RIS installation in Active Directory.
- Control access to the RIS server object in Active Directory by configuring the Security tab in the Remote-Installation-Services Properties dialog box.
- Restrict the number of installation options and operating system choices of users performing a remote installation.
- Assign NTFS permissions to an answer file once it is associated with a RIS image and stored on an NTFS volume.

In the rest of this section I'll explain each of these security measures in more detail.

To restrict the RIS server so that it responds only to preauthorized client computers, you can select the "Do not respond to unknown client

computers" check box in the RIS server's Properties dialog box. This check box is located on the Remote Install tab that was shown in Figure 19-8. When selected, this option prevents a RIS server from responding to a client computer *unless the client computer has been prestaged for RIS installation in Active Directory.* I'll get into the details of prestaging client computers a bit later in this chapter, but prestaging essentially consists of creating a computer object for the new client computer in Active Directory, and assigning the user(s) of the new client computer appropriate Active Directory permissions to the computer object. If you select this check box, you can rest at ease, knowing that only computers that you have authorized will be able to install Windows 2000 Professional by using your RIS server.

To control access to the RIS server's properties in Active Directory, you can configure the Security tab in the Remote-Installation-Services Properties dialog box for the RIS server. To access this Security tab, start Active Directory Users and Computers, access the Properties of the RIS server, click the Remote Install tab, then click Advanced Settings, and finally, click the Security tab. Figure 19-10 shows the Security tab.

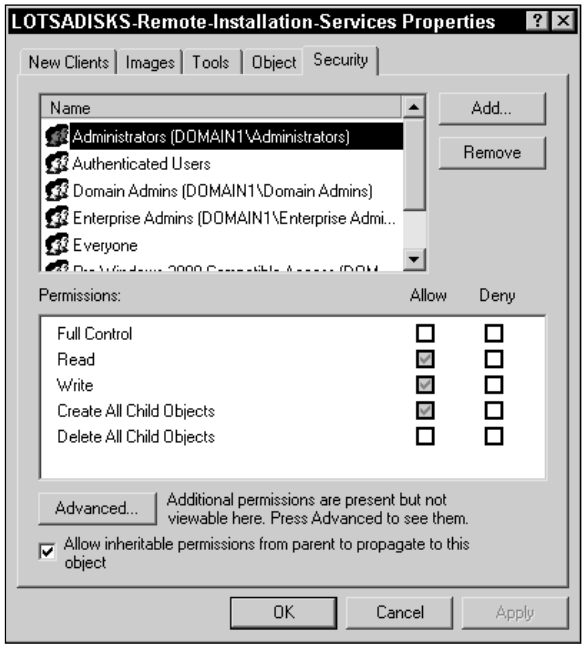

FIGURE 19-10 The Security tab

On the Security tab, you can assign Active Directory permissions to the RIS server object to appropriate users and groups. Assigning permissions

on this tab is the same as assigning permissions to any other Active Directory object.

CROSS-REFERENCE

For more information on configuring permissions on Active Directory objects, see Chapter 8.

Another configuration you can make to increase RIS security is to use Group Policy to restrict the number of installation options and operating system choices available to users performing a remote installation. When a user of a client computer initiates a remote installation of Windows 2000 Professional from the RIS server, the user interacts with the Client Installation wizard to perform the remote installation. This feature enables you to limit the options and choices the Client Installation wizard offers to the user.

STEP BY STEP

RESTRICTING INSTALLATION OPTIONS

1. Select Start ➪ Programs ➪ Administrative Tools ➪ Active Directory Users and Computers.
2. In the left pane of the Active Directory Users and Computers dialog box, expand domains and OUs until the domain or OU for which you want to configure Group Policy is displayed. Right-click the domain or OU, then select Properties from the menu that appears.
3. In the domain or OU's Properties dialog box, click the Group Policy tab.
4. On the Group Policy tab, highlight the GPO you want to edit and click Edit.
5. In the left pane of the Group Policy dialog box, in the User Configuration section, click the + next to Windows Settings. Then highlight Remote Installation Services. In the right pane, double-click Choice Options.
6. The Choice Options Properties dialog box appears, as shown in Figure 19-11.

   In this screen, you can configure screen options that will be offered to all users in the domain or OU who perform remote installations by using the RIS server. For each option, you can select one of the following choices:

   - **Allow:** If this option is selected, the Client Installation wizard will display this option to users affected by this GPO.
   - **Don't care:** If this option is selected, the Client Installation wizard will display this option to users affected by this GPO *unless* a GPO associated with a parent container specifically denies this option.

STEP BY STEP *Continued*

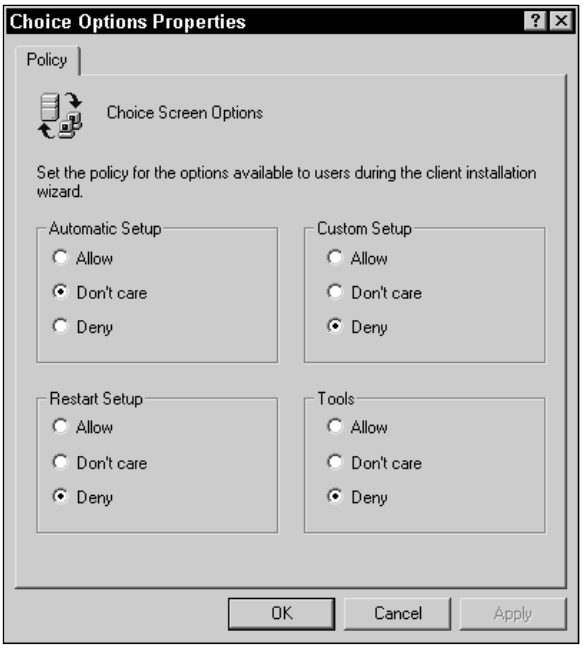

FIGURE 19-11 Configuring remote installation screen options

- **Deny:** If this option is selected, the Client Installation wizard will *not* display this option to users affected by this GPO.

Select the appropriate options in this dialog box, and click OK.

7. Close the Group Policy dialog box.
8. In the domain or OU's Properties dialog box, click OK.
9. Close Active Directory Users and Computers.

Finally, because all RIS images and their associated answer files are stored on an NTFS volume, you can increase RIS security by assigning NTFS permissions to RIS answer files once these files have been associated with a RIS image. All RIS answer files have a file extension of `.sif`, and, once associated with a RIS image, are stored in:

`\\`*`RIS_server_name`*`\REMINST\Setup\`*`language`*`\Images\`*`image_name`*`\i386\templates`

CROSS-REFERENCE

For more information on assigning NTFS permissions to files and folders, see Chapter 11.

Managing RIS Images

RIS works by storing Windows 2000 Professional images on a server, and making those images available, over-the-network, for installation on client computers.

RIS supports two types of images: CD-based images and Remote Installation Preparation wizard (RIPrep) images. A CD-based image consists of the `i386` folder from the Windows 2000 Professional compact disc, plus any other files needed to complete the installation. A Remote Installation Preparation wizard (RIPrep) image is a complete copy of a master computer's hard disk that has been prepared for duplication. I'll explain how to manage both of these types of images in the next two sections.

Working with CD-Based Images

When you set up a RIS server, the Remote Installation Services Setup wizard creates a default image containing the Windows 2000 Professional source files by copying these files from a Windows 2000 Professional compact disc. This default image has a default answer file associated with it that can't be used to perform an unattended installation.

If you want to use the RIS server to perform unattended over-the-network installations, you must associate an appropriate RIS answer file with the default image on the RIS server. You can either use one of the two sample RIS answer files included with Windows 2000, or use Setup Manager to create the answer file. If you use Setup Manager, be sure to select the Remote Installation Services option on the Product to Install screen. Answer files for RIS installations end with an `.sif` extension. You can't use an `unattend.txt` or a `sysprep.inf` file for RIS installations.

When you associate a RIS answer file with a RIS image, the Windows 2000 Server user interface calls this "adding" an image. Windows 2000 Server even adds a new image description to the Images tab. However, all that's really happening is that an answer file is being associated with the default image — the Windows 2000 Professional source files aren't being copied to the RIS server again. This makes it relatively simple for an administrator to create different RIS answer files for different groups of

users in the organization without having to take up a lot of disk space on the RIS server.

There is an occasion when you might really want to add a new CD-based image that does contain a full set of the Windows 2000 Professional source files from the compact disc, and this is when you want to deploy Windows 2000 Professional in more than one language version. For example, some of your users might require an English language version of Windows 2000 Professional, and other users might require a Japanese language version. I should point out here that I'm not talking about simply the ability to read and write files in another language — I'm talking about an entire version of Windows 2000 Professional where all dialog boxes are displayed and captioned in another language.

In the steps that follow, I'll show you how to add an additional CD-based image to the RIS server.

STEP BY STEP

ADDING AN ADDITIONAL CD-BASED IMAGE

1. Select Start ➪ Programs ➪ Administrative Tools ➪ Active Directory Users and Computers.
2. In the left pane of the Active Directory Users and Computers dialog box, expand domains and OUs until the RIS server on which you want to create an additional image is displayed in the right pane. Right-click the RIS server, then select Properties from the menu that appears.
3. In the RIS server's Properties dialog box, click the Remote Install tab.
4. On the Remote Install tab, click Advanced Settings.
5. In the RIS server's Remote-Installation-Services Properties dialog box, click the Images tab.
6. On the Images tab, click Add.
7. The New Answer File or Installation Image screen appears, as shown in Figure 19-12.

   In this screen, you choose whether to associate an RIS answer file to an existing RIS image, or to add a completely new installation image. The "Associate a new answer file to an existing image" option is selected by default, and is the option most commonly used.

   The "Add a new installation image" option is only available when running Active Directory Users and Computers on the RIS server.

STEP BY STEP *Continued*

FIGURE 19-12 Adding a RIS image

TIP

If your RIS server is not a domain controller, you can install the ADMINPAK on this computer to make Active Directory Users and Computers available on the RIS server.

Select the appropriate option, and click Next. (The steps that follow assume that you selected the "Associate a new answer file to an existing image" option. If you chose to "Add a new installation image," follow the instructions presented on-screen to create this image.)

8. In the Unattended Setup Answer File Source screen, select the source where the answer file you want to associate with the image can be found. Your choices are:
   - **Windows image sample files:** Select this option if you want to use one of the two sample RIS answer files included with Windows 2000.
   - **Another remote installation server:** Select this option if you want to use a RIS answer file located on a different RIS server.
   - **An alternate location:** Select this option if you want to specify the path to a RIS answer file you've created by using Setup Manager.
9. Depending on the selection you make, you are either presented with the available RIS answer files or prompted to browse for one. Specify the answer file you want to associate with the image and click Next.
10. In the Select an Installation Image screen, specify the image with which you want to associate the RIS answer file you selected. Click Next.

STEP BY STEP *Continued*

11. In the Friendly Description and Help Text screen, you can enter a description and any help text you wish to enter for this RIS image. The purpose of this information is to help an end user or a technician select the appropriate RIS image. Configure this screen as desired, and click Next.
12. In the Review Settings screen, click Finish.
13. The RIS image is created, and is added to the list on the Images tab. Click OK.
14. In the RIS server's Properties dialog box, click OK.
15. Close Active Directory Users and Computers.

Creating and Managing RIPrep Images

In addition to supporting CD-based images, RIS also supports Remote Installation Preparation wizard (RIPrep) images. A RIPrep image is a complete copy of a master computer's hard disk that has been prepared for duplication.

RIPrep works in much the same manner as Sysprep (which I discussed earlier in this chapter). The major difference is that when you use Sysprep you have to use a third-party disk duplicating utility to copy the master computer's hard disk, and when you use RIPrep it copies the master computer's hard disk, in the form of an image, to the RIS server, where it can be copied over-the-network to target computers.

RIPrep is slightly more versatile than Sysprep, however, in that the target computer's hardware does not have to match the master computer's hardware as exactly as it does to use Sysprep. With RIPrep you don't have to match mass storage controllers and hard disk sizes on the master and target computers. The only requirement is that RIS client computers must use the same HAL as the master computer.

Preparing a master computer for RIPrep is basically the same as preparing a master computer for Sysprep. (You might want to take another look at the "Installing Windows 2000 and Applications on the Master Computer" section earlier in this chapter.) You need to install Windows 2000 Professional on the master computer, configure all desktop settings, and install and configure applications so that the master computer is configured *exactly* the same way you want the target computers to be configured. You also need to copy the contents of the Administrator's profile folder over the contents of the `Default User` profile folder on the master computer.

When preparing your master computer for RIPrep, there are a couple of things you should be careful of.

- Install Windows 2000 Professional and all applications on the master computer's `C:` drive. RIPrep will *only* copy the master computer's `C:` drive.
- Try to use the smallest volume size for the master computer's `C:` drive as possible that will still accommodate the Windows 2000 Professional operating system and all desired applications. If the `C:` drive is larger than it needs to be, you might not be able to copy the image of this drive to client computers that have a smaller hard disk than the master computer.

Once you've prepared your master computer for imaging, you're ready to use RIPrep on it to create an RIPrep image. Before you start RIPrep, close all other applications that may be running on the master computer.

STEP BY STEP

USING RIPREP TO CREATE AN RIPREP IMAGE

1. On the Windows 2000 Professional master computer, log on as Administrator. Select Start ➪ Run.
2. In the Run dialog box, type ***RIS_server_name*\Reminst\Admin\i386\riprep.exe** and click OK. For example, if your RIS server was named RIS1, you would type `\\RIS1\Reminst\Admin\i386\riprep.exe`.
3. The Remote Installation Preparation wizard starts. Click Next.
4. In the Server Name screen, enter the name of the RIS server you want this image to be copied to, then click Next.
5. In the Folder Name screen, type the name of the folder on the RIS server in which you want RIPrep to store this image. I recommend that you name the folder after the master computer, so that you can easily recognize the image on the RIS server. If the folder does not exist, RIPrep will create it for you. Click Next.
6. In the Friendly Description and Help Text screen, you can enter a description and any help text you wish to enter for this image. The purpose of this information is to help an end user or a technician select the appropriate RIS image. Configure this screen as desired, and click Next.
7. If any programs, services, or applications are running on the master computer, a Programs or Services are Running screen appears, as shown in Figure 19-13.

STEP BY STEP *Continued*

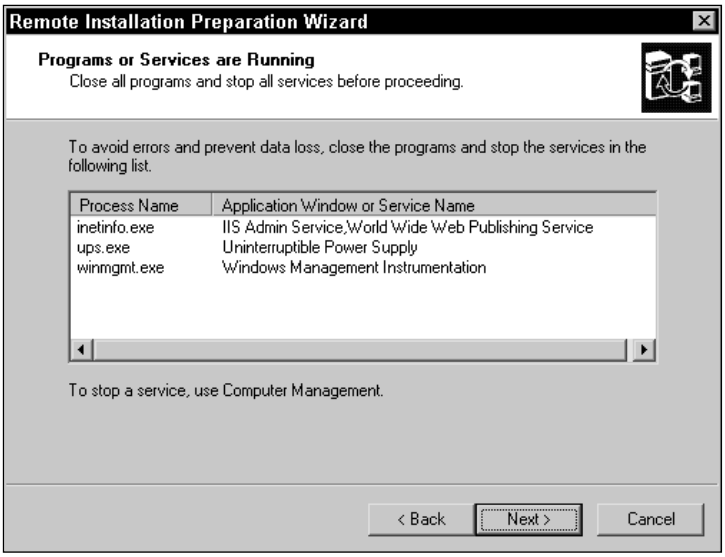

FIGURE 19-13 Notification of programs or services that should be stopped

If this screen appears, write down all programs, services, or applications that need to be stopped. *Don't close the wizard.*

First, close any open applications. Then, use the Services tool in Computer Management to stop each of the listed services.

Back in the Programs or Services are Running screen, click Next.

8. In the Review Settings screen, click Next.
9. In the Completing the Remote Installation Preparation Wizard screen, click Next.
10. RIPrep copies the master computer's hard disk, creates the RIPrep image, and stores this image in the specified folder on the RIS server. This process takes quite a while. When it completes, RIPrep shuts down the master computer.
11. The next time you start the master computer, the Mini-Setup wizard runs, and you must complete this wizard to return the master computer to a usable state.

One final note about using RIPrep images. You must have at least one CD-based image installed on your RIS server, in addition to the RIPrep image(s), in order to perform a RIS installation of an RIPrep image on a client computer. The reason for this requirement is that if a client computer needs a specific hardware driver that wasn't used on the master computer, RIS can obtain that driver for the client from the CD-based

image during installation. Normally this requirement isn't an issue, because during the setup of the RIS server a default CD-based image is created. However, sometimes a well-meaning administrator might consider deleting all CD-based images to make room on the hard disk for RIPrep images. A nice thought, but it won't work that way.

Prestaging RIS Clients

Prestaging the RIS client is the last step you need to accomplish before performing an over-the-network installation using RIS. Prestaging the RIS client is only necessary if you configured security on your RIS server by selecting the "Do not respond to unknown client computers" check box.

Prestaging essentially consists of:

- Creating a computer object for the new client computer in Active Directory
- Specifying a particular RIS server that will service the computer object, or permitting the computer object to use any RIS server. This feature is useful for load balancing between two or more RIS servers when multiple installations will be performed simultaneously.
- Assigning the user(s) of the new client computer appropriate Active Directory permissions to the computer object

STEP BY STEP

PRESTAGING A RIS CLIENT

1. Select Start ➪ Programs ➪ Administrative Tools ➪ Active Directory Users and Computers.
2. In the left pane of the Active Directory Users and Computers dialog box, expand domains and OUs until the domain or OU in which you want to create the computer account is displayed. Right-click the OU, then select New ➪ Computer from the menus that appear.
3. In the New Object - Computer dialog box, enter a name for the new client computer and click Next.
4. In the Managed dialog box, select the check box next to "This is a managed computer." Then enter the GUID (globally unique identifier) of the client computer. You can get the GUID from the system BIOS or on the computer's case.

STEP BY STEP *Continued*

TIP

Only computers that are PC98 or Net PC–compliant have GUIDs. If the client computer doesn't have a GUID, you can't prestage it.

Figure 19-14 shows this dialog box after it has been configured. Notice the beginning and ending brackets on the GUID. These brackets are required.

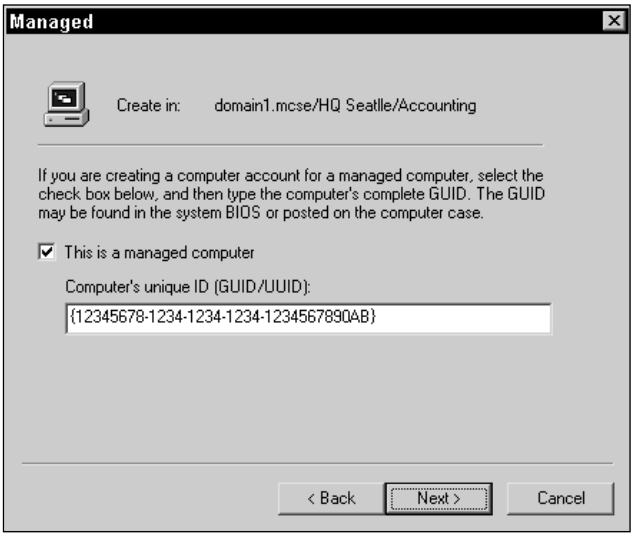

FIGURE 19-14 Configuring the new computer object's GUID

Click Next.

5. In the "Host server" dialog box, select one of these options:
   - ► **Any available remote installation server**
   - ► **The following remote installation server**

   If you select "The following remote installation server" option, specify the FQDN of the RIS server you want this client computer to use. You can browse for the RIS server's name if you need to.

   Click Next.
6. In the New Object - Computer dialog box, click Finish to create the computer object.
7. In the left pane of the Active Directory Users and Computers dialog box, ensure that the domain or OU in which you created the computer account is highlighted. Then, in the right pane, right-click the new computer object and select Properties from the menu that appears.
8. In the computer's Properties dialog box, click the Security tab.

STEP BY STEP *Continued*

9. On the Security tab, click Add.
10. In the Select Users, Computers, or Groups dialog box, double-click each user or group that you want to permit to perform an over-the-network installation on this computer by using the RIS server. Click OK.
11. On the Security tab, highlight each user or group you added, and select the Allow check boxes for the Read, Write, Change Password, and Reset Password permissions. After you have granted permissions to each user and group, click OK.
12. Close Active Directory Users and Computers.

Installing a RIS Image on a Client Computer

Now that you've installed and configured RIS, created the appropriate RIS images, and prestaged your client computers (if necessary), you're ready to perform an over-the-network installation of Windows 2000 Professional on a client computer by using the RIS server.

If the client computer has a network adapter card that supports PXE, you can start a RIS installation by powering on the computer and choosing to boot from the network. The client computer locates the RIS server, and then prompts the user to press F12 to begin the installation.

If the client computer doesn't have a network adapter card that supports PXE (but does have a network adapter card supported by the Remote Boot Disk), place a RIS boot disk in the client computer's `A:` drive and power on the computer. The client computer locates the RIS server, and then prompts the user to press F12 to begin the installation.

If the client computer doesn't have a network adapter card that supports PXE, and doesn't have a network adapter card that's supported by the Remote Boot Disk, you won't be able to use RIS to install Windows 2000 Professional on this client computer.

STEP BY STEP

INSTALLING WINDOWS 2000 PROFESSIONAL BY USING RIS

1. If the client computer has a network adapter that supports PXE, power on the computer, then type **y** to boot from the network.

   Or, if the client computer has a network adapter that doesn't support PXE but that is supported by a RIS boot disk, insert the RIS boot disk into the computer's `A:` drive and power on the computer.

   When prompted, press F12.
2. The Client Installation wizard starts. A Welcome message appears, indicating that you need a valid logon name and password to begin the RIS installation.
3. In the Logon screen, enter your user name and password. After the logon is complete, if you are using a RIS boot disk, remove the disk from the `A:` drive.
4. When the Setup Options screen appears, choose the type of installation you want to perform: Automatic, Custom, Restart, Maintenance, or Troubleshooting. (The actual options displayed in this screen depend on how the administrator configured Choice Options in Group Policy.)
5. The Operating System Choice screen appears, listing the available images that can be installed on this computer. Select the appropriate image.
6. The Caution screen is displayed, warning that the client computer's hard disk will be formatted by this process.
7. The Summary screen is displayed, which lists the options you've selected for this installation.
8. RIS starts the Windows 2000 Professional installation. Follow the instructions presented onscreen to complete the installation of Windows 2000 Professional. Depending on the answer file associated with the RIS image, you may have little or no interaction during the installation. Depending on the type of image you selected, you may have to reboot the client computer one or more times to complete the installation.

CROSS REFERENCE

See Chapter 3 for detailed information on how to respond to the screens displayed during the installation of Windows 2000 Professional.

Troubleshooting RIS Problems

Using RIS is fairly straightforward. However, occasionally problems using RIS do crop up. The most common RIS-related problems involve a client computer's inability to contact or communicate with the RIS server. When troubleshooting RIS problems, keep these tips in mind:

- Remember that RIS only supports Windows 2000 Professional as an installation image. No other operating systems can be installed by using RIS.
- Ensure that the DHCP server (and the RIS server, if RIS is installed on a different computer) is authorized in Active Directory.
- Only network adapter cards that support PXE version .99c or later are supported by RIS. If the client computer is unable to communicate with the RIS server, check the version of PXE, and, if necessary, upgrade the network adapter card.
- Only a limited number of PCI-based network adapter cards that don't support PXE are supported by the RIS boot disk. If a client computer is unable to communicate with the RIS server, ensure that the computer's network adapter card is on the list of supported network adapters.
- If a client computer is unable to communicate with the RIS server, consider examining the System log (in Event Viewer) on the DHCP server and the RIS server for DHCP and BINLSVC error messages.
- When you run the Client Installation wizard on the client computer, if the choices displayed on the Setup Options screen don't include the options you were expecting, verify that the choice options are correctly configured in Group Policy, and that this policy applies to the user performing the installation.
- If the "Do not respond to unknown client computers" check box is selected on the RIS server, ensure that client computers have been correctly prestaged.
- Ensure that users performing installations on non-prestaged client computers have been granted the Create Computer Objects advanced Active Directory permission for the domain or OU in which the computer objects (for the new client computers) are being created.

KEY POINT SUMMARY

This chapter introduced several important Windows 2000 deployment topics:

- Setup Manager is a wizard included in Windows 2000 that enables you to create answer files that can automate the installation and setup of Windows 2000 Professional and Windows 2000 Server.
- You can use Setup Manager to create different types of answer files. You can create an answer file for a standard, unattended installation; an answer file for a Sysprep installation; and an answer file for a RIS installation.
- You can install Setup Manager and the other deployment and support tools by copying them from the `DEPLOY.CAB` file in the `\SUPPORT\TOOLS` folder on the Windows 2000 compact disc.
- Sysprep, another Windows 2000 deployment tool, prepares a Windows 2000 Professional or Windows 2000 Server computer for hard disk duplication by removing user-specific settings. Sysprep doesn't work on Windows 2000 Server domain controllers.
- Sysprep can't be used to actually copy the master computer's hard disk—you must use a third-party software utility to duplicate the hard disk and copy the data to the target computer.
- Remote Installation Services (RIS) is a Windows 2000 Server service used to deploy Windows 2000 Professional over-the-network to client computers. RIS can only be used on Windows 2000 networks that use DHCP, DNS, and Active Directory.
- RIS servers must be authorized in Active Directory.
- You can configure security on the RIS server. If the "Do not respond to unknown client computers" check box is selected, client computers must be prestaged.
- RIS supports two types of Windows 2000 Professional images: CD-based images and RIPrep images.
- RIS clients must have PCI-based network adapter cards that either support PXE or are supported by a RIS boot disk.

STUDY GUIDE

This section contains several exercises that are designed to solidify your knowledge about deploying Windows 2000 and to help you prepare for the Professional, Server, and Directory Services exams:

- **Assessment Questions:** These questions test your knowledge of the Windows 2000 deployment topics covered in this chapter. You'll find the answers to these questions at the end of this chapter.
- **Scenarios:** The situation-based questions in scenarios challenge you to apply your understanding of the material to solve a hypothetical problem. In this chapter's scenarios, you are asked to analyze Windows 2000 deployment scenarios, and then answer the question or questions that follow each scenario. You don't need to be at a computer to do scenarios. Answers to this chapter's scenarios are presented at the end of this chapter.
- **Lab Exercise:** These exercises are hands-on practice activities that you perform on a computer. The lab in this chapter gives you an opportunity to practice several Windows 2000 deployment tasks.

Assessment Questions

1. You want to create an answer file that duplicates the computer's configuration on which you are creating the answer file. What is the easiest way to do this?
   A. Manually create an answer file
   B. Use Setup Manager
   C. Use RIS
   D. This type of answer file cannot be created
2. You want to use Sysprep to prepare a Windows 2000 Server domain controller for disk duplication, but you can't get the utility to work. What is the problem?
   A. The server is not authorized in Active Directory
   B. You do not have Administrative permissions

C. The server contains more than one hard disk

D. Sysprep can't be used on domain controllers

3. When you run Sysprep on a Windows 2000 computer, what happens to the user-specific information on the computer?

A. It is preserved in `usset.inf`.

B. It is saved and automatically reinstalled.

C. It is removed.

D. It is not altered.

4. How do you install RIS?

A. By using the Windows 2000 deployment tools

B. By using the Windows 2000 Server Resource Kit

C. By using Add/Remove Programs

D. You don't have to install RIS because it is installed by default.

5. Which tool should you use to authorize a RIS server in Active Directory?

A. The DHCP administrative tool

B. The DNS administrative tool

C. Active Directory Users and Computers

D. Active Directory Sites and Services

6. What must the PCI-based network adapter card in a client computer support in order to use a RIS server?

A. TCP/IP

B. PXE

C. DHTML

D. UDP

7. What type of images are supported by RIS? (Choose all that apply.)

A. CD-based images

B. Sysprep images

C. RIPrep images

D. Windows 2000 Server images

E. Windows 2000 Professional images

F. Windows 98 images

8. What can you use to create a RIS image that contains an operating system and applications?
   A. RIPrep
   B. Sysprep
   C. Setup Manager
   D. Third-party disk imaging software

Scenarios

Deploying Windows 2000 on a network is a complex task. For each of the following situations, consider the given facts and answer the question or questions that follow.

1. You want to perform an unattended over-the-network installation of Windows 2000 Professional. What basic steps should you take to accomplish this?
2. You want to perform an unattended CD-based installation of Windows 2000 Server. What basic steps should you take to accomplish this?
3. You want to use Sysprep to install Windows 2000 Professional on 100 identical computers. How should you prepare the master computer?
4. You want to use the RIS server on your network to install Windows 2000 Professional and several applications on 100 client computers. The computers don't have identical mass storage device controllers, and don't have identical hard disks.
   a. What type of image should you create?
   b. How should you create this image?
5. Your company's network has two RIS servers. Over the next few weeks you want to deploy Windows 2000 Professional on 1,000 client computers. The RIS servers are configured to "not respond to unknown client computers."
   a. What should you do to prestage the client computers?
   b. How can you distribute the load between the two RIS servers?

6. You create a RIS boot disk, but it does not work on some of your client computers.
   a. What is the most likely cause of this problem?
   b. What should you do to solve the problem?
7. You want to deploy Windows 2000 Professional to 200 client computers on your network by using a RIS server. Each of the client computers has a network adapter that has a PXE ROM. You create an RIPrep image on the RIS server. What steps should you take to install the image on each of the client computers?

Lab Exercise

Lab 19-1 Deploying Windows 2000

- Professional
- Server
- Directory Services

The purpose of this lab is to provide you with an opportunity to practice several of the Windows 2000 deployment tasks you learned in this chapter.

There are five parts to this lab:

- Part 1: Using Setup Manager to Create an Answer File for an Automated Installation of Windows 2000 Professional
- Part 2: Using Setup Manager to Create an Answer File for an Automated Installation of Windows 2000 Server
- Part 3: Installing and Configuring RIS
- Part 4: Creating a RIS Boot Disk
- Part 5: Configuring RIS Server Security and Options

Begin this lab by booting your computer to Windows 2000 Server and logging on as Administrator.

Part 1: Using Setup Manager to Create an Answer File for an Automated Installation of Windows 2000 Professional

In this part, you install Setup Manager and the Windows 2000 deployment tools. Then you use Setup Manager to create an answer file that can be used to automate the installation of Windows 2000 Professional.

1. Insert your Windows 2000 Professional compact disc into your computer's CD-ROM drive. Close the Microsoft Windows 2000 CD dialog box.
2. From the desktop, right-click My Computer, and select Explore from the menu that appears.
3. In the left pane, highlight Local Disk (C:). Select File ➪ New ➪ Folder.
4. In the right pane, type in a new folder name of **Deployment** and press Enter.
5. In the left pane, click the + next to your CD-ROM drive. Click the + next to the `SUPPORT` folder. Highlight the `TOOLS` folder. In the right pane, double-click the `DEPLOY` file. Select Edit ➪ Select All. Select Edit ➪ Copy To Folder.
6. In the Browse For Folder dialog box, click the + next to My Computer. Click the + next to Local Disk (C:). Highlight Deployment. Click OK.
7. Windows 2000 extracts and copies the contents of the `DEPLOY.CAB` file to the `DEPLOYMENT` folder.
8. In the left pane, click the + next to Local Disk (C:). Highlight the `Deployment` folder. In the right pane, double-click `setupmgr`.
9. The Windows 2000 Setup Manager wizard starts. Click Next.
10. In the New or Existing Answer File screen, accept the default selection of "Create a new answer file" and click Next.
11. In the Product to Install screen, select the Windows 2000 Unattended Installation option. Click Next.
12. In the Platform screen, select the Windows 2000 Professional option. Click Next.
13. In the User Interaction Level screen, select the "Fully automated" option and click Next.
14. In the License Agreement screen, select the check box next to "I accept the terms of the License Agreement." Click Next.

15. In the Customize the Software screen, enter a default user name of **User**. Enter your company's name in the Organization text box. Click Next.
16. In the Computer Names screen, enter a computer name of **w2ktest**, then click Add. Click Next.
17. In the Administrator Password screen, type in a password of **password** and confirm it by retyping it. Click Next.
18. In the Display Settings screen, accept the default settings and click Next.
19. In the Network Settings screen, accept the default option of "Typical settings" and click Next.
20. In the Workgroup or Domain screen, accept the default option of Workgroup and click Next.
21. In the Time Zone screen, select your time zone from the drop-down list box, and click Next.
22. In the Additional Settings screen, select the "No, do not edit the additional settings" option and click Next.
23. In the Distribution Folder screen, accept the default selection of Yes and click Next.
24. In the Distribution Folder Name screen, accept the default folder name and share name. Click Next.
25. In the Additional Mass Storage Drivers screen, click Next.
26. In the Hardware Abstraction Layer screen, click Next.
27. In the Additional Commands screen, click Next.
28. In the OEM Branding screen, click Next.
29. In the Additional Files or Folders screen, click Next.
30. In the Answer File Name screen, accept the default answer filename and location. Click Next.
31. In the Location of Setup Files screen, accept the default option of "Copy the files from CD" and click Next. Setup Manager copies the files from the compact disc.
32. In the Completing the Windows 2000 Setup Manager Wizard screen, click Finish. Remove the Windows 2000 compact disc from your computer's CD-ROM drive. Close Windows Explorer.

Part 2: Using Setup Manager to Create an Answer File for an Automated Installation of Windows 2000 Server

In this part, you use Setup Manager to create an answer file that can be used to automate the installation of Windows 2000 Server.

1. Insert your Windows 2000 Server compact disc into your computer's CD-ROM drive. Close the Microsoft Windows 2000 CD dialog box.
2. Start Windows Explorer. (Select Start ➪ Programs ➪ Accessories ➪ Windows Explorer.)
3. Repeat Steps 8 through 32 in Part 1 of this lab, except:

   In Step 12, select Windows 2000 Server instead of Windows 2000 Professional.

   At the completion of Step 15, in the Licensing Mode screen, accept the default option of "Per server" and click Next. Continue on to Step 16.

   In Step 24, type in a distribution folder name of **C:\win2000srv** and a share name of **win2000srv** and click Next.

Part 3: Installing and Configuring RIS

In this part, you install RIS on a Windows 2000 Server computer. Then you authorize the RIS server in Active Directory, grant permission to create computer objects to authenticated users, and set up the RIS server. *Steps 21 through 29 are optional* because they require a second hard disk, formatted with NTFS, in your Windows 2000 Server computer.

1. Select Start ➪ Settings ➪ Control Panel.
2. In the Control Panel dialog box, double-click Add/Remove Programs.
3. In the Add/Remove Programs dialog box, click Add/Remove Windows Components.
4. In the Windows Components screen, select the check box next to Remote Installation Services, then click Next.
5. When prompted, insert your Windows 2000 Server compact disc into your computer's CD-ROM drive, and click OK. When the Microsoft Windows 2000 CD dialog box appears, close it. Windows 2000 installs RIS.

6. In the Completing the Windows Components Wizard screen, click Finish. When prompted, click Yes to restart your computer. Remove your Windows 2000 Server compact disc from your computer's CD-ROM drive. Boot to Windows 2000 Server and log on as Administrator. Close Control Panel.
7. Select Start ➪ Programs ➪ Administrative Tools ➪ DHCP.
8. In the DHCP dialog box, select Action ➪ Manage authorized servers.
9. In the Manage Authorized Servers dialog box, click Authorize.
10. In the Authorize DHCP Server dialog box, enter a computer name of **Server01** and click OK.
11. A DHCP message appears, indicating that the server you specified will be added to the authorized DHCP servers list. Click Yes. Because you have previously authorized this server as a DHCP server, another message appears, indicating that the specified server is already present. Click OK.
12. In the Manage Authorized Servers dialog box, click Close. Close DHCP.
13. Select Start ➪ Programs ➪ Administrative Tools ➪ Active Directory Users and Computers.
14. In the left pane of Active Directory Users and Computers, right-click domain1.mcse, then select Delegate Control from the menu that appears.
15. The Delegation of Control wizard starts. Click Next.
16. In the Users or Groups screen, click Add.
17. In the Select Users, Computers, or Groups dialog box, double-click the Authenticated Users group. Click OK.
18. In the Users or Groups screen, click Next.
19. In the Tasks to Delegate screen, select the check box next to "Join a computer to the domain." Click Next.
20. In the Completing the Delegation of Control Wizard screen, click Finish. Close Active Directory Users and Computers.

CAUTION

Skip the rest of this part, and Parts 4 and 5 unless you have a second hard disk in your Windows 2000 computer that is formatted with NTFS.

21. Insert your Windows 2000 Professional compact disc into your computer's CD-ROM drive. Close the Microsoft Windows 2000 CD dialog box. From the desktop, select Start ➪ Run.
22. In the Run dialog box, type **risetup** and click OK.
23. The Remote Installation Services Setup wizard starts. Click Next.
24. In the Remote Installation Folder location screen, accept the default path and click Next.
25. In the Initial Settings screen, select the check box next to "Respond to client computers requesting service." Click Next.
26. In the Installation Source Files Location screen, accept the default path to your computer's CD-ROM drive. Click Next.
27. In the Windows Installation Image Folder Name screen, accept the default name for the folder that will contain the default RIS image. Click Next.
28. In the Friendly Description and Help Text screen, accept the default friendly description and help text, and click Next.
29. In the Review settings screen, click Finish. The RIS server copies files, creates the remote installation folder, creates the default image of Windows 2000 Professional, and sets up the RIS server. This process takes several minutes. When this process completes, click Done.

Part 4: Creating a RIS Boot Disk

In this part, you use your Windows 2000 RIS server to create a RIS boot disk. *This part is optional* because it requires that you have a second hard disk in your Windows 2000 Server computer, formatted with NTFS, and you must have completed all of Part 3.

1. Right-click My Computer and select Explore from the menu that appears.
2. In the left pane, click the + next to the volume that contains the RIS installation folder (this is your second hard disk). Click the + next to RemoteInstall. Click the + next to Admin. Highlight the `i386` folder. In the right pane, double-click `rbfg.exe`.
3. The Windows 2000 Remote Boot Disk Generator dialog box appears. Insert a blank, formatted floppy disk into drive `A:`, then click Create Disk.

4. The Remote Boot Disk Generator creates the RIS boot disk. Click No when asked if you want to create another disk.
5. In the Windows 2000 Remote Boot Disk Generator dialog box, click Close. Close Windows Explorer.

Part 5: Configuring RIS Server Security and Options

In this part, you configure various RIS server options, including security options. You also configure RIS security settings in Group Policy. *This part is optional* because it requires that you have a second hard disk in your Windows 2000 Server computer, formatted with NTFS, and you must have completed all of Part 3.

1. Select Start ➪ Programs ➪ Administrative Tools ➪ Active Directory Users and Computers.
2. In the left pane of Active Directory Users and Computers dialog box, click the + next to domain1.mcse. Highlight the Domain Controllers OU. In the right pane, right-click Server01, and select Properties from the menu that appears.
3. In the SERVER01 Properties dialog box, click the Remote Install tab.
4. On the Remote Install tab, notice that the check box next to "Respond to client computers requesting service" is selected. To secure your RIS server, select the check box next to "Do not respond to unknown client computers." Then, click Advanced Settings.
5. In the SERVER01-Remote-Installation-Services Properties dialog box, select the NP plus MAC naming scheme from the "Generate client computer names using" drop-down list box. Then select the "Same location as that of the user setting up the client computer" option. Click OK.
6. In the SERVER01 Properties dialog box, click OK.
7. In the left pane of the Active Directory Users and Computers dialog box, right-click domain1.mcse, and select Properties from the menu that appears.
8. In domain1.mcse Properties dialog box, click the Group Policy tab.
9. On the Group Policy tab, highlight the Default Domain Policy and click Edit.

10. In the left pane of the Group Policy dialog box, in the User Configuration section, click the + next to Windows Settings. Then highlight Remote Installation Services. In the right pane, double-click Choice Options.
11. In the Choice Options Properties dialog box, in the Automatic Setup section, select the Allow option. In the Custom Setup section, select the Allow option. Click OK.
12. Close the Group Policy dialog box.
13. In the domain1.mcse Properties dialog box, click OK.
14. Close Active Directory Users and Computers.

Answers to Chapter Questions

Chapter Pre-Test

1. The deployment tools are located in the `\SUPPORT\TOOLS` folder on the Windows 2000 Professional or Server compact disc. The support tools are located in `DEPLOY.CAB`.
2. Setup Manager
3. `unattend.txt`
4. Sysprep (`sysprep.exe`)
5. You need a third-party software utility to duplicate the master computer's hard disk, and to copy that data onto the hard disk of a target computer.
6. A RIS server must be authorized in Active Directory before it can be used.
7. Only Windows 2000 Professional can be deployed by using RIS.

Assessment Questions

1. **B.** Setup Manager provides you with an option to create an answer file that "duplicates this computer's configuration."
2. **D.** You can use Sysprep on Windows 2000 Professional and Windows 2000 Server computers, but you can't use Sysprep on Windows 2000 Server domain controllers.

3. **C.** The user-specific settings are removed by Sysprep.
4. **C.** RIS is installed by using Add/Remove Programs in Control Panel.
5. **A.** You must use the DHCP administrative tool to authorize a RIS server in Active Directory.
6. **B.** The client computer's network adapter must support PXE (Preboot Execution Environment), or the client computer can use a RIS boot disk if the computer's PCI-based network adapter card is supported by the RIS boot disk.
7. **A, C, E.** RIS supports CD-based images, RIPrep images, and Windows 2000 Professional images.
8. **A.** RIPrep is used to create RIS images that contain both an operating system and applications.

Scenarios

1. Use Setup Manager to create an answer file for the unattended installation, and to create a shared distribution folder on your network server. Then, on the target computer, partition and format the computer's hard disk by using MS-DOS (or Windows 95 or Windows 98 DOS). Then load the Client for Microsoft Networks on the target computer, and map a network drive to the shared distribution folder. At the command prompt, change the default drive to the mapped network drive, then type **unattend.bat** and press Enter to begin the unattended installation.
2. Use Setup Manager to create an answer file for the unattended installation, and copy the `unattend.txt` and `unattend.bat` files to a floppy disk. Then, on the target computer, partition and format the computer's hard disk by using MS-DOS (or Windows 95 or Windows 98 DOS). Next, boot the computer to DOS and load CD-ROM drivers for the computer's CD-ROM drive. Then place the floppy disk in drive `A:` and the Windows 2000 Server compact disc in the CD-ROM drive. At the command prompt, type **A:\unattend.bat** and press Enter to begin the unattended installation.
3. Install Windows 2000 Professional and all desired applications on the master computer. Configure desktop settings, shortcuts, and other configurable options exactly the way you want them to appear on the target computers. Then, copy the contents of the Administrator's profile folder over the contents of the `Default User` profile folder.

4. You should create an RIPrep image to accomplish this task. An RIPrep image is the only image RIS supports that can be used to install applications as well as the Windows 2000 Professional operating system. Once the master computer is prepared, use `riprep.exe` to create the RIPrep image on the RIS server.
5. To prestage the client computers, you should perform several tasks. First, create a computer object for each new client computer in Active Directory. When you create the computer objects, specify which RIS server will service each computer — this will enable you to distribute the load between your two RIS servers by assigning equal numbers of computers to each RIS server. Of course, you must have more than one RIS server to perform load balancing. Finally, assign the users of the new client computers appropriate Active Directory permissions to the computer objects.
6. The most likely cause of this problem is that the client computers don't have network adapter cards that are supported by the RIS boot disk. RIS boot disks only support a limited number of PCI-based network adapter cards. There is no workaround for this, except to install a supported PCI-based network adapter card on each of the client computers.
7. Power on the client computer, then type **y** to boot from the network. When prompted, press F12. The Client Installation wizard starts. Enter your user name and password. Choose the type of installation you want to perform. Then select the appropriate image to install. Accept the summary and follow the instructions presented on-screen to complete the installation of Windows 2000.

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