

Automating Client Installation and Upgrade



You are now ready to develop and perform the automated installation of Microsoft® Windows® 2000 Professional and associated applications. This is a prerequisite for performing any level of deployment: test, pilot, or production rollout. This chapter presents the automated installation methods that are available, including preparation requirements and example configurations. It is recommended that network engineers involved in the design of the installation process and system administrators involved in the installation of Windows 2000 and associated applications become familiar with this chapter.

Installing Windows 2000 Professional involves either clean installations to computers that have no pre-Windows 2000 operating systems installed or clean installations and upgrades to computers that are currently running Microsoft® Windows® 95, Microsoft® Windows® 98, Microsoft® Windows NT® Workstation version 3.51, or Microsoft® Windows NT® Workstation version 4.0. Before you can determine whether to perform clean installations or upgrades, you need to resolve certain critical planning issues, as discussed in the Planning Overview in this book.

In This Chapter

- Determining Whether to Upgrade or Clean Install 919
- Preparing for Installation 921
- Automating the Installation of Client Applications 939
- Automating the Installation of Windows 2000 Professional 944
- Installation Configuration Examples 966
- Installation Task List 971

Chapter Goals

This chapter will help you develop the following planning document:

- Automated Installation Plan

Related Information in the Resource Kit

- For more information about planning, see the “Planning Overview” in this book.
- For more information about automating server installation, see “Automating Server Installation and Upgrade” in this book.
- For more information about administering client computers, see “Defining Client Administration and Configuration Standards” in this book.
- For more information about the Unattended Setup parameters referenced in this chapter, see the “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system compact disk (CD). The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS®, use the **Extract** command to access the file.
- For more information about Unattended Setup, including sample answer files, see the Appendix “Sample Answer Files for Unattended Setup” in this book.

Determining Whether to Upgrade or Clean Install

In the enterprise environment, it is not cost-effective to install Windows 2000 using the standard interactive setup on each computer. To greatly lower the total cost of ownership (TCO), you can perform automated installations of Windows 2000 Professional on multiple computers.



Critical Decision Before you can automate the installation of Windows 2000 Professional, you must decide whether the installation will be an upgrade from Windows NT or a clean installation.

The following two items will help you determine whether to upgrade or to perform a clean installation:

- If your organization has already implemented a Windows operating system and your information technology (IT) department is centrally managed, you will probably want to perform an upgrade. If you are planning to create a managed environment but one does not currently exist in your organization, then you will want to perform a clean installation so that you can implement standard configurations as you perform your installation.
- If you plan to use currently existing hardware and software applications, you need to perform an upgrade. Alternatively, if you plan to purchase new hardware and install new software applications, you need to perform a clean installation.

Resolving Critical Planning Issues

If you plan to install Windows 2000 Professional on computers that have no pre-Windows 2000 operating systems installed, a clean installation is the obvious choice. If the computers are currently running Windows 95, Windows 98, Windows NT Workstation 3.51, or Windows NT Workstation 4.0, you need to determine whether it is more cost-effective to upgrade the existing operating system or perform a clean installation.

Typical planning issues are summarized in Table 25.1

Table 25.1 Planning Issues to Be Resolved Before Upgrade or Installation

| Issue | Task |
|--------------------------|--|
| Organizational goals | Define your company's primary goals. |
| Regional needs | Identify specific regional needs, and determine whether business is going to include international branches or companies. |
| User groups | Analyze user groups, including specific job categories and needs; computer knowledge and experience of users; security requirements; and locations of users and their network connectivity issues, including link speed. |
| Application needs | Determine which products are going to be preinstalled on all computers, which products are going to be advertised only to specific users, and which products are going to be distributed to specific categories of users. |
| Computer/user strategies | Evaluate current data storage and user settings; identify migration requirements for user settings; and evaluate mandatory, roaming, and local profiles. |
| Hardware | <p>Inventory existing hardware, and determine expectations for new hardware.</p> <p>Set minimum hardware requirements before upgrade or installation.</p> <p>Plan for future computer needs.</p> <p>Determine how computers are cycled through the organization.</p> <p>Determine whether all computers have bootable CD-ROMs.</p> |
| Risks and problem areas | Identify potential risks, including application incompatibility with Windows 2000, timeline issues, multiple sites, noncentralized budget, and the impact of possible upcoming mergers. |
| Growth expectations | Identify growth expectations over the course of the project at 1 year, 3 years, and 5 years. Planned mergers, new sites, countries, and so on, must be accounted for when they become known. |
| Network concerns | Determine whether remote sites have application deployment servers. Identify how servers outside the central site are upgraded. |
| Software management | Determine whether a software management system, such as Microsoft® Systems Management Server (SMS), is in place so that deployments can be scheduled. |
| Connectivity | Determine whether the servers and the connections between them are set up to distribute large packages to everyone in the company. |

Choosing Your Installation Method

After you resolve your critical planning issues, you can choose the methods that you are going to use to automate the installations. Table 25.2 lists the automated installation methods and shows whether they can be used for upgrade, clean installation, or both.

Table 25.2 Automated Installation Methods

| Method | Windows 2000 Edition | Upgrade | Clean Installation |
|--------------------------------------|-------------------------|---------|--------------------|
| Syspart | Server and Professional | No | Yes |
| Sysprep | Server and Professional | No | Yes |
| SMS | Server and Professional | Yes | Yes |
| Bootable CD-ROM | Server and Professional | No | Yes |
| Remote Operating System Installation | Professional | No | Yes |

Preparing for Installation

To prepare for a clean installation of Windows 2000 Professional, you need to do the following:

- Create the distribution folder
- Understand how to use the answer file
- Understand the Windows 2000 Setup commands

Note The principles of performing an automated installation that are described in this section apply to both a clean installation and an upgrade. The most common scenario is to perform a clean installation.

Figure 25.1 is a flowchart showing the installation process.

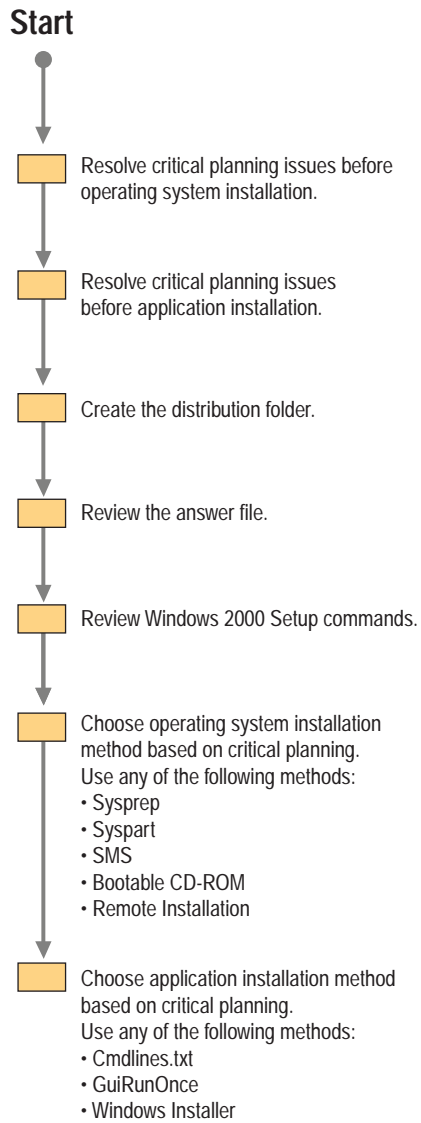


Figure 25.1 Automated Installation Flowchart

Creating the Distribution Folders

To install Windows 2000 Professional on multiple computers over a network, you must create at least one set of distribution folders. The distribution folders typically reside on a server where computers can connect and install Windows 2000 by running Winnt.exe or Winnt32.exe on the destination computer. You can use the same set of distribution folders with different answer files for different system implementations. Even if you intend to use disk imaging as your installation method, starting with distribution folders will provide consistent implementations for a variety of system types. In addition, you can use distribution folders to update future images by editing the files in the distribution folders or by modifying the answer files to generate updated images without having to start from the beginning.

To help load balance the servers and make the file-copy phase of Windows 2000 Setup faster for computers already running Windows 95, Windows 98, Windows NT, or Windows 2000, you can create distribution folders on multiple servers. You can then run Winnt32.exe with up to eight source file locations. For more information about Professional on multiple computers.



Critical Decision Before you can automate the installation of Windows 2000 Professional, you must decide if the installation will be an upgrade from Windows NT or a clean installation.

The following two items will help you determine whether to Setup commands, see “Reviewing the Windows 2000 Setup Commands” later in this chapter.

Note In this chapter, the term “Windows NT” refers to both Windows NT 3.51 and Windows NT 4.0.

The distribution folders contain the Windows 2000 Professional installation files, as well as any device drivers and other files needed for the installation. Setup Manager, a tool that is available on the Windows 2000 Professional CD, can help you automate the process of creating a distribution folder. For more information about Setup Manager, see “Creating the Answer File” later in this chapter.

Note In this chapter, “Windows 2000 Setup” is also referred to as “Setup.”

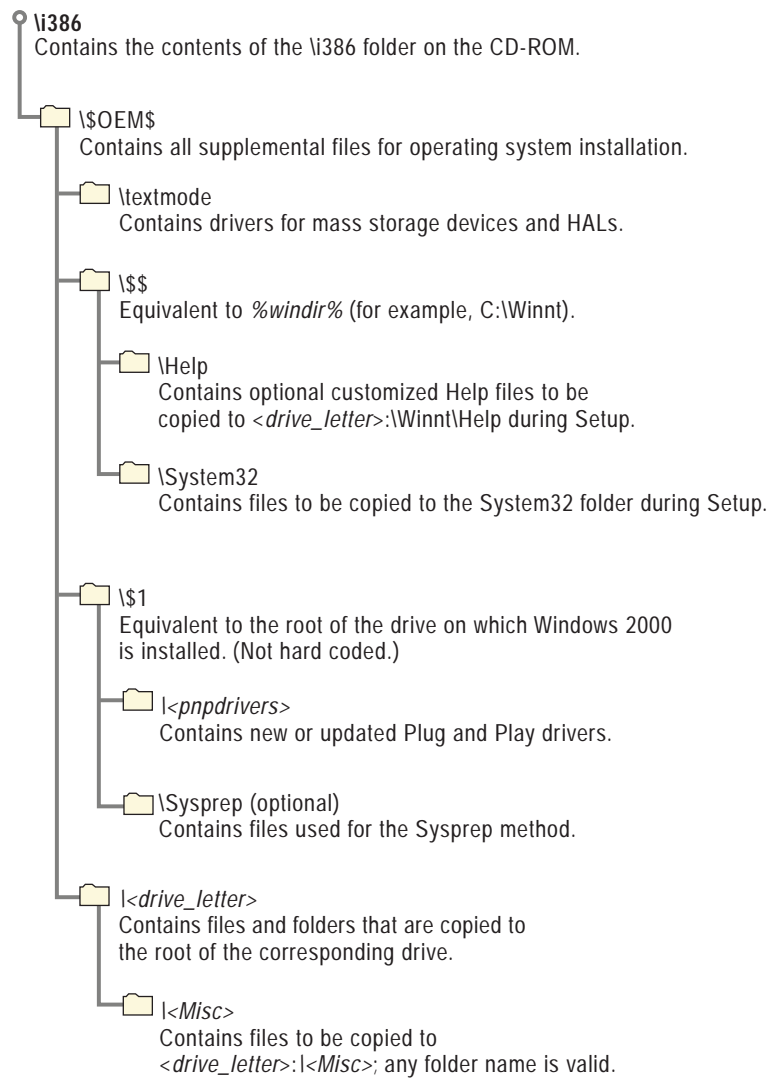
- **To create a distribution folder**
 1. Connect to the network server on which you want to create the distribution folder.
 2. Create an \i386 folder on the distribution share of the network server.

To help differentiate between multiple distribution shares for the different editions of Windows 2000 (Windows 2000 Professional, Microsoft® Windows® 2000 Server, and one for Microsoft® Windows® 2000 Advanced Server), you can choose another name for this folder. If you plan to use localized language versions of Windows 2000 for international branches of your organization, you can create separate distribution shares for each localized version.
 3. Copy the contents of the \i386 folder from the Windows 2000 Professional CD to the folder that you created.
 4. In the folder that you created, create a subfolder named \$OEM\$.

The \$OEM\$ subfolder provides the necessary folder structure for supplemental files to be copied to the target computer during Setup. These files include drivers, utilities, applications, and any other files required for deployment of Windows 2000 Professional within your organization.

Structuring the Distribution Folder

An example of the structure for the distribution folder is shown in Figure 25.2.

**Figure 25.2 Example Structure for the Distribution Folder**

i386

This is the distribution folder, which contains all of the files required to install Windows 2000. You create this folder at the root of the distribution share by copying the contents of the i386 folder on the Windows 2000 Professional CD to the distribution folder.

\$OEM\$

You create the \$OEM\$ subfolder in the distribution folder directly beneath the i386 folder. During Setup, you can automatically copy directories, standard 8.3 format files, and any tools needed for your automated installation process to the \$OEM\$ subfolder.

If you use the OEMFILES_PATH key in the answer file, you can create the \$OEM\$ subfolder outside the distribution folder. For information about the definition of the answer file, see “Reviewing the Answer File” later in this chapter. For more information about answer file parameters and syntax, see “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

The \$OEM\$ subfolder can contain the optional file Cmdlines.txt, which contains a list of commands to be run during the graphical user interface (GUI) portion of Setup. These commands can be used to install additional tools that you want to include with your installations. For more information about the Cmdlines.txt file, see “Using Cmdlines.txt” later in this chapter.

As long as Setup finds the \$OEM\$ subfolder in the root of the distribution point, it copies all of the files found in this directory to the temporary directory that is created during the text portion of Setup.

Note In this chapter, the GUI portion of Setup is referred to as “GUI mode,” and the text portion of Setup is referred to as “text mode.”

\$OEM\$\textmode

The \$OEM\$\textmode subfolder contains new or updated files for installing mass storage device drivers and hardware abstraction layers (HALs). These files can include OEM HALs, drivers for Small Computer System Interface (SCSI) devices, and Txtsetup.oem, which directs the loading and installing of these components. Make sure to include the Txtsetup.oem file. All files placed in the \$OEM\$\textmode subfolder (HALs, drivers, and Txtsetup.oem) must be listed in the [OEMBootFiles] section of the answer file.

\$OEM\$\\$\\$

The \$OEM\$\\$\\$ subfolder is equivalent to the %systemroot% or %windir% environment variables. The subfolder contains additional files that you want copied to the various subfolders of the Windows 2000 installation directory. The structure of this subfolder must match the structure of a standard Windows 2000 installation, where \$OEM\$\\$\\$ matches %systemroot % or %windir% (for example, C:\winnt), \$OEM\$\\$\\$\System32 matches %windir%\System32, and so on. Each subfolder must contain the files that need to be copied to the corresponding system folder on the target computer.

\$OEM\$\\$1

The \$OEM\$\\$1 subfolder, which is new for Windows 2000, points to the drive on which Windows 2000 is installed. \$1 is equivalent to the %systemdrive% environment variable. For example, if you are installing Windows 2000 on drive D, \$OEM\$\\$1 points to drive D.

\$OEM\$\\$1\pnprvrs

You can use the \$OEM\$\\$1\pnprvrs subfolder, which is new for Windows 2000, to place new or updated Plug and Play device drivers in your distribution folders. These folders are copied to the %systemdrive%\pnprvrs location on the target computer. Adding the OemPnPDriversPath parameter to your answer file directs Windows 2000 to look (both during and after Setup) for new or updated Plug and Play drivers in the folders that you created, as well as those originally included with the system. Note that you can replace *pnprvrs* with a name of your own that is eight characters long or less.

\$OEM\$\\$1\Sysprep

The \$OEM\$\\$1\Sysprep subfolder is optional. This subfolder contains the files that you need to run the Sysprep tool. For information about these files, see “Using Sysprep to Duplicate Disks” later in this chapter.

\$OEM\$\drive_letter

During text mode, the structure of each \$OEM\$\drive_letter subfolder is copied to the root of the corresponding drive in the target computer. For example, files that you place in the \$OEM\$\D subfolder are copied to the root of drive D. You can also create subfolders within these subfolders. For example, \$OEM\$\E\Misc causes Setup to create a subfolder called Misc on drive E.

Files that have to be renamed must be listed in \$\$Rename.txt. For more information about renaming files, see “Converting File Name Size Using \$\$Rename.txt” later in this chapter. Note that the files in the distribution folders must have short file names that use the format 8.3 naming convention.

Installing Mass Storage Devices

In Windows 2000, Plug and Play detects and installs most hardware devices, which can be loaded later during Setup. However, mass storage devices, such as hard disks, must be properly installed for full Plug and Play support to be available during GUI mode.

Note You do not need to specify a device if it is already supported by Windows 2000.

To install SCSI devices during text mode—that is, before full Plug and Play support is available—you must provide a Txtsetup.oem file that describes how Setup must install the particular SCSI device.

Important Before you use updated drivers, verify that they are signed. If they are not signed, Setup will fail. You can check the signed status for individual drivers in Device Manager, or you can run Sigverif.exe to generate a Sigverif.txt file in the %windir% subfolder. Sigverif.txt lists the signed status for all drivers on the system.

- **To install a mass storage device**
 1. Create the Textmode subfolder in the \$OEM\$ subfolder in the distribution folder.
 2. Copy the following files, which you obtain from the device vendor, to the Textmode subfolder (replace the word *Driver* with the appropriate driver name):
 - *Driver.sys*
 - *Driver.dll*
 - *Driver.inf*
 - Txtsetup.oem

Note Some drivers, such as SCSI miniport drivers, might not include a .dll file.

3. In the answer file, create a [MassStorageDrivers] section, and in this section type the driver entries that you want to include. For example, a possible entry in the [MassStorageDrivers] section would be the following:

```
"Adaptec 2940..." = "OEM"
```

Information for this section can be obtained from the Txtsetup.oem file, which is provided by the hardware manufacturer.

For more information about answer file parameters and syntax, see “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

4. In the answer file create an [OEMBootFiles] section, and in this section type a list of the files in the \$OEM\$\Textmode folder. For example, a possible entry to the [OEMBootFiles] section would be the following:

```
[OEMBootFiles]
Driver.sys
Driver.dll
Driver.inf
Txtsetup.oem
```

Where *Driver* is the driver name.

5. If your mass storage device is a Plug and Play device, it will have a section named [HardwareIds.Scsi.yyyyy] in the Txtsetup.oem file. If it does not have such a section, you will need to create one and then type the following entry in the section:

```
"xxxx" , "yyyy"
```

where *xxxx* represents the device identifier (ID), and *yyyy* represents the service associated with the device.

For example, to install the Ssymc810 driver, which has a device ID of PCI\VEN_1000&DEV_0001, verify that your Txtsetup.oem file contains the following additional section:

```
[HardwareIds.scsi.ssymc810]
id = "PCI\VEN_1000&DEV_0001" , "ssymc810"
```

Installing Hardware Abstraction Layers

To specify hardware abstraction layers (HALs) for installation, you need a Txtsetup.oem file and the HAL files, which the vendor provides. You must use the same Txtsetup.oem file if you are installing mass storage device drivers. Only one Txtsetup.oem file can be used, so if you need to install HALs and mass storage device drivers, you need to combine entries into one file.

To use third-party drivers, you must also make appropriate changes to the answer file. For more information about answer file parameters and syntax, see the “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

- **To install a HAL**

1. If you have not already done so, create a Textmode subfolder in the \$OEM\$ folder.
2. Copy the files that you receive from the device vendor to the Textmode subfolder.
3. In the answer file, edit the [Unattend] section for the HAL, adding any drivers that you want to install. For example, type the following:

```
[Unattend]
Computertype = "HALDescription ", OEM
```

Information for the *HALDescription* can be obtained from the [Computer] section of the Txtsetup.oem file from the driver provider.

4. In the answer file, create an [OEMBootFiles] section, and enter the names of the files in the \$OEM\$\Textmode folder.

Installing Plug and Play Devices

The following procedure demonstrates how to install Plug and Play devices that are not mass storage devices or HALs, and are not included on the Windows 2000 operating system CD.

- **To install Plug and Play devices**

1. Create a subfolder in the distribution folder for special Plug and Play drivers and their .inf files. For example, you can create a folder called PnPDrvs:

```
$OEM$\$1\PnPDrvs
```

2. Add the path to the list of Plug and Play search drives by adding the following line to the Unattend.txt file:

```
OEMnPDriversPath = "PnPDrvs"
```

If you have subfolders in the PnPDrvs folder, you must specify the path to each subfolder. The paths must be separated by semicolons.

To easily maintain the folders so that they can accommodate future device drivers, create subfolders for potential device drivers. By dividing the folders into subfolders, you can store device driver files by device type, rather than having all device driver files in one folder. Suggested subfolders include Audio, Modem, Net, Print, Video, and Other. An Other folder can give you the flexibility to store new hardware devices that might not be currently known.

For example, if the PnPDrvs folder contains the subfolders Audio, Modem, and Net, the answer file must contain the following line:

```
OEMPNPDriversPath = "PnPDrvs\Audio;PnPDrvs\Modem;PnPDrvs\Net"
```

Converting File Name Size Using \$\$Rename.txt

The \$\$Rename.txt file changes short file names to long file names during Setup. \$\$Rename.txt lists all of the files in a particular folder that need to be renamed. Each folder that contains short file names that should be renamed must contain its own version of \$\$Rename.txt.

To use \$\$Rename.txt, put the file in a folder that contains files that need to be converted. The syntax for \$\$Rename.txt is as follows:

```
[section_name_1]
short_name_1 = "long_name_1"
short_name_2 = "long_name_2"
```

```
short_name_x = "long_name_x"
```

```
[section_name_2]
short_name_1 = "long_name_1"
short_name_2 = "long_name_2"
```

```
short_name_x = "long_name_x"
```

Parameters are defined as follows:

section_name_x. The path to the subfolder that contains the files. A section does not need to be named, or it can have a backslash (\) as a name, which indicates that the section contains the names of the files or subfolders that are in the root of the drive.

short_name_x. The name of the file or subfolder within this subfolder to be renamed. The name must *not* be enclosed in quotation marks.

long_name_x. The new name of the file or subfolder. This name must be enclosed in quotation marks if it contains spaces or commas.

Tip If you are using MS-DOS to start the installation, and your MS-DOS-based tools cannot copy folders with path names longer than 64 characters, you can use short file names for the folders and then use `$$Rename.txt` to rename them later.

Reviewing the Answer File

The answer file is a customized script that answers the Setup questions without requiring user input. The Windows 2000 Server CD contains a sample answer file that you can modify and use. The answer file is usually named `Unattend.txt`, but you can rename it. (For example, `Comp1.txt`, `Install.txt`, and `Setup.txt` are all valid names for an answer file, as long as those names are correctly specified in the Setup command.) By renaming the answer file, you can build and use multiple answer files if you need to maintain different scripted installations for different parts of your organization. Note that answer files are also used by other programs such as Sysprep, which uses the optional `Sysprep.inf` file.

The answer file tells Setup how to interact with the distribution folders and files that you have created. For example, in the `[Unattend]` section of the answer file there is an “`OEMPreinstall`” entry that tells Setup to copy the `OEM` subfolders from the distribution folders to the target computer.

The answer file contains multiple optional sections that you can modify to supply information about your installation requirements. The answer file supplies Setup with answers to all the questions that you are asked during a standard, interactive installation of Windows 2000. The `Unattend.doc` file has detailed information about answer file keys and values. For more information about answer file sections and their associated parameters, see the “Microsoft Windows 2000 Guide to Unattended Setup” (`Unattend.doc`) on the Microsoft Windows 2000 operating system CD. The `Unattend.doc` file is part of the `Deploy.cab` file in the `\Support\Tools` folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file. To perform an unattended installation of Windows 2000 Server, you must create an answer file and specify that file when Setup begins, either by using the bootable method or by running `Winnt.exe` or `Winnt32.exe`. The following is an example of a Setup command using `Winnt.exe`:

```
Winnt /S:Z:\I386 /U:Z:\unattend.txt
```

Note the use of the `/U:` command-line switch, which indicates an unattended installation. For more information about `Winnt.exe` and `Winnt32.exe`, see “Reviewing the Windows 2000 Setup Commands” later in this chapter.

Creating the Answer File

The answer file is a customized script that you can use to run an unattended installation of Windows 2000 Professional. There are two ways to create an answer file: You can use Setup Manager, or you can create the file manually.

Creating the Answer File with Setup Manager

To help you create or modify the answer file, the Setup Manager application is available on the Windows 2000 operating system CD in the Deploy.cab file of the \Support\Tools folder. By using Setup Manager, you can add consistency to the process of creating or updating the answer file.

For more information about answer file parameters and syntax, see the “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

You can use Setup Manager to perform the following tasks; it then generates the results as answer file parameters:

- Specify the platform for the answer file (Windows 2000 Professional, Windows 2000 Server, Remote Operating System Installation, or Sysprep).
- Specify the level of automation for unattended Setup mode. (Levels include “Provide Defaults,” “Fully Automated,” “Hide Pages,” “Read Only,” and “GUI-mode Setup.”)
- Specify default user information.
- Define computer name options, including creating a Uniqueness Database File (/UDF) to access a file of valid computer names.
- Configure network settings.
- Create distribution folders.
- Add a custom logo and background files.
- Add files to the distribution folders.
- Add commands to the [GuiRunOnce] section.
- Create Cmdlines.txt files.
- Specify code pages.
- Specify regional options.
- Specify a time zone.
- Specify TAPI information.

Setup Manager cannot perform the following functions:

- Specify system components, such as Internet Information Services.
- Create Txtsetup.oem files.
- Create subfolders in the distribution folder.

Table 25.3 describes some of the most common answer file specifications that are created by Setup Manager.

Table 25.3 Answer File Specifications Created by Setup Manager

| Parameter | Purpose |
|-----------------------------------|--|
| Installation path | Specifies the desired path on the target computer in which to install Windows 2000 Server. |
| Upgrade option | Specifies whether to upgrade from Windows 95 or Windows 98, Windows NT, or Windows 2000. |
| Target computer name | Specifies the user name, organization name, and computer name to apply to the target computer. |
| Product ID | Specifies the product identification number obtained from the product documentation. |
| Workgroup or domain | Specifies the name of the workgroup or domain to which the computer belongs. |
| Time zone | Specifies the time zone for the computer. |
| Network configuration information | Specifies the network adapter type and configuration with network protocols. |

Creating the Answer File Manually

To create the answer file manually, you can use a text editor such as Notepad. In general, an answer file consists of section headers, parameters, and values for those parameters. Although most section headers are predefined, you can also define additional section headers. Note that you do not have to specify all possible parameters in the answer file if the installation does not require them.

Invalid parameter values generate errors or result in incorrect behavior after Setup.

The answer file format is as follows:

```
[section1]
;
; Section contains keys and the corresponding
; values for those keys/parameters.
; keys and values are separated by ` = ` signs
; Values that have spaces in them usually require double quotes
; " " around them
;
key = value
.
.
[section2]
key = value
.
.
```

Using the Answer File to Set Passwords

By using the answer file with Setup, you can set parameters for the following password commands:

- AdminPassword
- UserPassword
- DefaultPassword
- DomainAdminPassword
- AdministratorPassword
- Password

For information about the definitions of these commands, see the “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

In addition, you can find examples of answer files that use some of these parameters in the Appendix “Sample Answer Files for Unattended Setup” in this book.

Note Passwords are limited to 127 characters. If you specify a password that contains more than 127 characters, you are not going to be able to log on to the system because the password will be invalid.

After the installation is completed, an answer file with all the settings used to configure the computer remains on the computer; however, all password information is removed from the local copy of the answer file so that security is not compromised.

Caution During the Setup process, however, the answer file is available on the hard disk. If you are concerned about the security implications, do not add password information to the answer file that you created for the unattended installation.

Using the local answer file allows you to automatically set up optional components by running commands that contain the parameters you already provided in the original answer file that was used with Setup. These components can include configuring the server as a domain controller, as a cluster server, or enabling Message Queuing.

Extending Hard Disk Partitions

You can start an install on a small partition (about 1 gigabyte [GB] on a larger disk) and cause that partition to be extended during the Windows 2000 Setup process by using the `ExtendOEMPartition` parameter in the answer file. The `ExtendOEMPartition` parameter works only on NTFS file system partitions and can be used in both a regular answer file and one used for a Sysprep-based installation.

For more information about Sysprep and the `Sysprep.inf` file, see “Using Sysprep to Duplicate Disks” later in this chapter.

Note `ExtendOEMPartition` acts only on the active system partition. It does not work on other partitions on the same hard disk or other hard disks in the computer. In addition, when `ExtendOemPartition=1` is used, it extends to all remaining space on the hard disk, but leaves the last cylinder blank. This is by design so that you have the option of enabling dynamic volumes.

If you are using `ExtendOEMPartition` during an unattended install on a file allocation table (FAT) partition, you need to specify the `FileSystem=ConvertNTFS` in the `[Unattended]` section of your answer file to first convert the partition to NTFS. For information about using the `ExtendOEMPartition` for a Sysprep-based installation, see “Using Sysprep to Extend Disk Partitions” later in this chapter.

For more information about using `ExtendOemPartition`, see “Microsoft Windows 2000 Guide to Unattended Setup” (`Unattend.doc`) on the Microsoft Windows 2000 operating system CD. The `Unattend.doc` file is part of the `Deploy.cab` file in the `\Support\Tools` folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

Reviewing the Windows 2000 Setup Commands

To install Windows 2000, you must run the appropriate Windows 2000 Setup program, either `Winnt.exe` or `Winnt32.exe`. In this chapter, `Winnt.exe` and `Winnt32.exe` are both referred to as Setup. The version of Setup that you need to run is determined as follows:

- For a clean installation on a computer running MS-DOS or Microsoft® Windows® 3.x, run `Winnt.exe` from the MS-DOS prompt.
- For a clean installation or upgrade from Windows NT, Windows 95 or Windows 98, run `Winnt32.exe`.

Note that you can start a standard, interactive Setup directly from the boot floppy disks that come with the Windows 2000 Professional CD.

Caution If you update any applications on the computer before upgrading it to Windows 2000, make sure that you restart the computer before running Setup.

For more information about installation methods, see “Automating the Installation of Windows 2000 Professional” later in this chapter.

Winnt.exe

The `Winnt.exe` command, including the parameters that apply to automated installation, is as follows:

```
winnt [/S[:sourcepath]][/T[:tempdrive]]/U[:answer_file][/R[x]:folder]
[/E:command]
```

For the parameter definitions, see the Appendix “Setup Commands” in this book. For hard disk drives with multiple partitions, the Winnt.exe version of Setup installs Windows 2000 to the active partition if the partition contains sufficient space. Otherwise, Setup looks for additional partitions containing sufficient space and prompts you to choose the desired partition. For automated installations, you can bypass the prompt by running Setup with the /T parameter to automatically point to the desired partition. For example:

```
winnt [/unattend] [:<path>\answer.txt] [/T[:d]]
```

Winnt32.exe

The Winnt32.exe command, including the parameters that apply to automated installation, is as follows:

```
winnt32 [/s:sourcepath] [/tempdrive:drive_letter]
[/unattend[num]:answer_file] [/copydir:folder_name]
[/copysource:folder_name] [/cmd:command_line] [/debug[level]:filename]
[/udf:id[,UDB_file]] [/syspart:drive_letter] [/noreboot]
[/makelocalsource] [/checkupgradeonly] [/m:folder_name]
```

For information about the parameter definitions, see the Appendix “Setup Commands” in this book.

For hard disk drives with multiple partitions, the Winnt32.exe version of Setup installs Windows 2000 to the active partition if the partition contains sufficient space. Otherwise, Setup looks for additional partitions containing sufficient space and prompts you to choose the desired partition. For automated installations, you can bypass the prompt by running Setup with the /tempdrive parameter to automatically point to the desired partition. For example:

```
winnt32 [/unattend] [:<path>\answer.txt] [/tempdrive:d]
```

Windows 2000 can use up to eight /s switches to point to other distribution servers as source locations for installation to the destination computer. This functionality helps to speed up the file-copy phase of Setup to the destination computer, as well as providing additional load balancing capability to the distribution servers from which Setup can be run. For example:

```
<path to distribution folder 1>\winnt32 [/unattend] [:<path>\answer.txt]
[/s:<path to distribution folder 2>] [/s:<path to distribution folder
3>] [/s:<path to distribution folder 4>]
```

Table 25.4 shows the Setup commands and how they are used with Windows 2000.

Table 25.4 Using Setup Commands

| Setup Command | Windows 2000 Edition | Upgrade | Clean Installation |
|---------------|-------------------------|---------|--------------------|
| Winnt.exe | Server and Professional | No | Yes |
| Winnt32.exe | Server and Professional | Yes | Yes |

Automating the Installation of Client Applications

After resolving your critical planning issues, you can decide how you will automate the installation of server applications. In almost all cases, you will want to use an application's unattended installation features to install it.

You can choose from among the following three methods:

- Cmdlines.txt
- Running the application installation program or batch file from the [GuiRunOnce] section of the answer file.
- Windows Installer Service

Using Cmdlines.txt

The Cmdlines.txt file contains the commands that GUI mode executes when installing optional components, such as applications that must be installed immediately after Windows 2000 Professional is installed. If you plan to use Cmdlines.txt, you need to place it in the \$OEM\$ subfolder of the distribution folder. If you are using Sysprep, place Cmdlines.txt in the \$OEM\$\\$1\Sysprep subfolder.

Use Cmdlines.txt when the following conditions exist:

- You are installing from the \$OEM\$ subfolder of the distribution folder.
 - The application that you are installing has the following properties:
 - It does not configure itself for multiple users (for example, Microsoft® Office 95).
- Or–
- It is designed to be installed by one user and to replicate user-specific information.

The syntax for Cmdlines.txt is as follows:

```
[Commands]
"<command_1>"
"<command_2>"
.
.
"<command_x>"
```

Parameters are defined as follows:

- “<command_1>”, “<command_2>”, ... “<command_x>” refer to the commands that you want to run (and in what order) when GUI mode calls Cmdlines.txt. Note that all commands must be in quotation marks.

When you use Cmdlines.txt, be aware of the following:

- When the commands in Cmdlines.txt are executed during Setup, there is no logged-on user and there is no guaranteed network connectivity. Therefore, user-specific information is written to the default user registry, and all subsequently created users also receive that information.
- Cmdlines.txt requires that you place the files that are necessary to run an application or tool in directories that are accessed during the Setup process, which means that the files must be on the hard disk.

Using the [GuiRunOnce] Section of the Answer File

The [GuiRunOnce] section of the answer file contains a list of commands that run the first time a user logs on to the computer after Setup runs. For example, you enter the following line to the [GuiRunOnce] section to start the application installation program automatically.

```
[GuiRunOnce]
"%systemdrive%\appfolder\appinstall -quiet"
```

If you plan to use the [GuiRunOnce] section to initiate an installation, there are some additional factors to take into consideration:

If the application forces a reboot, determine whether there is a way to suppress the reboot

This is important because any time the system reboots, all previous entries in the [GuiRunOnce] section are lost. If the system reboots before completing entries previously listed in the [GuiRunOnce] section, the remaining items will not be run. If there is no way within the application to suppress a reboot, you can try to repackage the application into a Windows Installer package. There are third-party products that provide this functionality.

Windows 2000 includes WinINSTALL Limited Edition (LE), a repackaging tool for Windows Installer. You can use WinINSTALL LE to efficiently repackage pre-Windows Installer applications into packages that can be distributed with Windows Installer. For more information about WinINSTALL LE, see the Valueadd\3rdparty\Mgmt\Winstle folder on the Windows 2000 operating system CD. For more information about Windows Installer packaging, see “Using Windows Installer Service” later in this chapter.

Important If you are installing an application to multiple localized language versions of Windows 2000, it is recommended that you test the repackaged application on the localized versions to ensure that it copies the files to the correct locations and writes the required registry entries appropriately.

If an application requires a Windows Explorer shell to install, the [GuiRunOnce] section will not work because the shell is not loaded when the Run and RunOnce commands are executed.

Check with the application vendor to determine whether they have an update or patch that can address this situation for the application setup. If not, you can repackage the application as a Windows Installer package or use another means of distribution.

Applications that use the same type of installation mechanism might not run properly if a /wait command is not used

This can happen when an application installation is running and starts another process. When the setup routine is still running, initiating another process and closing an active one might cause the next routine listed in the RunOnce registry entries to start. Because more than one instance of the installation mechanism is running, the second application will usually fail. For information about how to control this by using a batch file, see “Using a Batch File to Control How Multiple Applications Are Installed” later in this chapter.

Using Application Installation Programs

The preferred method for preinstalling an application is to use the installation routine supplied with the application. You can do this if the application that you are preinstalling is able to run in *quiet* mode (that is, without user intervention) by using a /q or /s command-line switch. For a list of command-line parameters supported by the installation mechanism, see the application Help file or documentation

The following is an example of a line that you can place in the [GuiRunOnce] section to initiate the unattended installation of an application by using its own installation program.

```
<path to setup>\Setup.exe /q
```

Setup parameters vary between applications. For example, the */l* parameter included in some applications is useful when you want to create a log file to monitor the installation. Some applications have commands that can keep them from restarting automatically. These commands are useful in helping to control application installations with a minimal number of reboots.

Make sure that you check with the application vendor for information, instructions, tools, and best practices information before you preinstall any application.

Important You must meet the licensing requirements for any application that you install, regardless of how you install it.

Using a Batch File to Control How Multiple Applications Are Installed

If you want to control how multiple applications are installed, you can create a batch file that contains the individual installation commands and uses the **Start** command with the */wait* command-line switch. This method ensures that your applications install sequentially and that each application is fully installed before the next application begins its installation routine. The batch file is then run from the [GuiRunOnce] section.

The following procedure explains how to create the batch file, how to install the application, and then how to remove all references to the batch file after the installation is complete.

- **To install applications using a batch file**

1. Create the batch file containing lines similar to the following example:

```
Start /wait <path to 1st application>\Setup <command line parameters>
Start /wait <path to 2nd application>\Setup <command line parameters>
Exit
```

where:

- *<path>* is the path to the executable file that starts the installation. This path must be available during Setup.
- *Setup* is the name of the executable file that starts the installation.

- *<command line parameters>* are any available quiet-mode parameters appropriate for the application that you want to install.
2. Copy the batch file to the distribution folders or another location that can be accessed during Setup.
 3. With *<filename>.bat* as the name of the batch file, include an entry in the [GuiRunOnce] section of the answer file to run the batch file, similar to the following example. This example assumes that the batch file was copied to the Sysprep folder on the local hard disk drive, though it can be located anywhere to which Setup has access during an installation.

```
[GuiRunOnce]
"%systemdrive%\sysprep\<filename>.bat" = "<path-1>\Command-1.exe"
"<path-n>\Command-n.exe"
"%systemdrive%\sysprep\sysprep.exe -quiet"
```

where:

<path-1>\Command-1.exe and *<path-n>\Command-n.exe* are fully qualified paths to additional applications or tool installations or configuration tools. This can also be a path to another batch file. These paths must be available during Setup.

Using Windows Installer Service

Windows Installer Service is a Windows 2000 component that standardizes the way applications are installed on multiple computers.

When you install applications without using Windows Installer Service, every application must have its own setup executable file or script. Each application has to ensure that the proper installation rules (for example, rules for creating file versions) are followed. This is because the application setup was not an integral part of the operating system development, so no central reference for installation rules exists. Windows Installer Service implements all the proper Setup rules in the operating system itself. To follow those rules, applications must be described in a standard format known as a Windows Installer package. The data file containing the format information is known as the *Windows Installer package file* and has an .msi extension. Windows Installer Service uses the Windows Installer package file to install the application.

Windows Installer Terminology

The following terms are used to describe the installation process that uses Windows Installer technology:

Resource. A file, registry entry, shortcut, or other element that an installer typically delivers to a computer.

Component. A collection of files, registry entries, and other resources that are installed or uninstalled as a unit. When a particular component is selected for installation or removal, all of the resources in that component are either installed or removed.

Feature. The granular pieces of an application that a user can choose to install. Features typically represent the functional features of the application itself.

Product. A single product, such as Microsoft® Office. Products contain one or more features.

Windows Installer Package File

The package file is a database format that is optimized for installation performance. Generally, this file describes the relationships between features, components, and resources for a specific product.

The Windows Installer package file is typically located in the root folder of the product CD or network image, alongside the product files. The product files can exist as compressed files known as cabinet files (which have a .cab extension). Each product has its own package file. At installation time, Windows Installer Service opens up the package file for the product in question, and uses the information inside the Windows Installer package to determine all the installation operations that must be performed for that product.

Automating the Installation of Windows 2000 Professional

In the enterprise environment, it is not cost-effective to install Windows 2000 using the standard interactive setup on each computer. To greatly lower the total cost of ownership (TCO), you can perform automated installations of Windows 2000 Professional on multiple computers.

You can automate the installation of the following:

- The core operating system of Windows 2000 Professional.
- Standard productivity applications such as Microsoft® Office 2000 or any other application that does not run as a service.
- Additional language support for Windows 2000 Professional through the installation of various language packs.
- Service packs for Windows 2000 Professional.

Automated installation of Windows 2000 Professional involves running Setup with an answer file. Setup can take place in unattended fashion. An unattended Setup includes the following steps:

- Creating an answer file.
- Determining and implementing a process to configure computer-specific information.
- Using Windows Installer packages to prepare for installing additional files.
- Determining and implementing the process to automate the selected distribution method, such as using a network distribution point or hard disk duplication.

New Options for Automated Installation

In Windows 2000 automated installation, there are several new options available in the answer file for controlling how and what should run. For more information about answer file parameters and syntax, see the “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

Flexible networking In Windows 2000, there are flexible network configurations available for each computer, including additional support for protocols, services, and clients. It is now possible to set the binding order, to easily set default information, and to install more than one network adapter in a system. In addition, to make installation and configuration easier, Windows 2000 can automatically install and configure network device drivers. By default, Windows 2000 installs the default networking components to each network adapter installed in a system, unless otherwise specified in the answer file. The default networking components include Client for Microsoft Networks, TCP/IP, File and Printer Sharing for Microsoft Networks, and enabling Dynamic Host Configuration Protocol (DHCP).

Automatic logon capability You can customize the answer file to allow the computer to automatically log on as the administrator either the first time that the computer starts Windows 2000 after Setup is completed or a specified number of times thereafter. If you need Windows 2000 to automatically log on for a specific number of times to accomplish tasks that are run in the [GuiRunOnce] entries, you need to provide a non-null administrator password (AdminPassword) in the answer file. You can then use AutoAdminLogonCount to specify the number of times that you need the system to automatically log on to complete the desired tasks. If a null password is used, Setup can automatically log on to the system only once without providing credentials through other means for each subsequent reboot. This is done to help reduce security risks. Note that providing administrator account credentials in a text file always introduces security risks if a user gains access to the file.

Automatic command execution The [GuiRunOnce] section of the answer file contains a list of commands that are to be executed consecutively as part of Setup when after GUI mode completes. By using the [GuiRunOnce] section, you can specify lists of applications to install, tools to configure the system, or other tools to run the first time a user logs on to the installed computer.

Simplified time-zone specification In the answer file, you can specify the computer time zone more easily and with less debugging than what was required by Windows NT. By enumerating the possible time zones, there is less opportunity for error because you are no longer required to enter the full time-zone string.

Enhanced regional and language settings In the answer file, you can specify the system and user locales, the keyboard and input method, and the language support to be installed. Setup Manager can help to make this even easier when you use the GUI interface of the wizard to select the settings to install on the system.

Simpler device preinstallation With the introduction of Plug and Play, the OemPnPDriversPath key, and the new distribution share point structure, preinstalling devices is now as easy as adding the new drivers into a folder in the distribution share and specifying the OemPnPDriversPath key.

Automated Installation Methods

You can run an automated installation of Windows 2000 Professional by using several methods. The method that you choose depends on the outcome of your critical planning, as discussed earlier in this chapter.

Methods for performing automated installations on client computers include the following:

- Using Syspart on computers that have dissimilar hardware
- Using Sysprep to duplicate disks
- Using Systems Management Server
- Using a bootable CD-ROM
- Using Remote Operating System Installation

Note Remote Operating System Installation automatically installs Windows 2000 Professional and applications on client computers from a designated Remote Installation Service (RIS) server. RIS is an optional component that is included with Windows 2000 Server.

Table 25.5 describes when you can use each automated installation method.

Table 25.5 When to Use Automated Installation Methods

| Method | Use |
|--------------------------------------|--|
| Syspart | Use for clean installations to computers that have dissimilar hardware. |
| Sysprep | Use when the master computer and the target computers have identical hardware, which includes the HAL and mass storage device controllers. |
| SMS | Use to perform managed upgrades of Windows 2000 Server to multiple systems, especially those that are geographically dispersed. |
| Bootable CD-ROM | Use with a computer whose basic input/output system (BIOS) allows it to start from the bootable CD-ROM. |
| Remote Operating System Installation | Use to remotely install an image of Windows 2000 Professional on supported computers, eliminating the need to physically visit each computer to perform an installation. |

Using Syspart for Computers with Dissimilar Hardware

Syspart executes through an optional parameter of Winnt32.exe. If the master computer and the computers on which you are installing Windows 2000 Professional do not have similar hardware, you can use the Syspart method. This method also reduces deployment time by eliminating the file-copy phase of Setup.

Syspart requires that you use two physical disks and that there is a primary partition on the target hard disk.

If you require a similar installation and operating system configuration on hardware types in which the HALs or mass storage controllers differ, you can use Syspart to create a master set of files that have the necessary configuration information and driver support that can then be imaged. Those images can then be used on the dissimilar systems to properly detect the hardware and to consistently configure the base operating system. If your environment includes multiple types of hardware-dependent systems, you can use Syspart to create a master for each type. You install Windows 2000 on one computer of each type, and then you use Sysprep to help create images to be used on the remaining computers of each type. For more information about Sysprep, see “Using Sysprep to Duplicate Disks” later in this chapter.

Before you begin, choose a computer to use as a reference computer. The reference computer must have either Windows NT or Windows 2000 installed.

- **To install Windows 2000 Professional by using Syspart**

1. Start the reference computer, and connect to the installation distribution folder.
2. Run Setup.

Click **Start**, click **Run**, and then type the following:

```
winnt32 /unattend:unattend.txt /s:install_source  
/syspart:second_drive /tempdrive:second_drive/ noreboot
```

Important You must use the */tempdrive* parameter for a successful Syspart installation. When you use the */tempdrive* command line switch, make sure you have sufficient free disk space on your second partition to install both Windows 2000 Server and your applications. The geometry of the disk that you plan to use as a target for Syspart must be the same as the geometry of the disk on the computer to which you plan to duplicate.

Note that the */syspart* and */tempdrive* parameters must point to the same partition of a secondary hard disk. The Windows 2000 Professional installation must take place on the primary partition of the secondary hard disk.

Caution Syspart automatically marks the drive as active and as the default boot device. For this reason, remove the drive before turning on the computer again.

Related definitions include the following:

Unattend.txt. The answer file used for an unattended setup. It provides answers to some or all the prompts that the end user normally responds to during Setup. Using an answer file is optional when creating the master image.

install_source. The location of the Windows 2000 Professional files. Specify multiple */s* switches if you want to install from multiple sources simultaneously.

second_drive. An optional second drive on which you preinstall Windows 2000 and your applications.

Using Sysprep to Duplicate Disks

Disk duplication is a good choice if you need to install an identical configuration on multiple computers. On a master computer, you install Windows 2000 and any applications that you want installed on all of the target computers. Then you run Sysprep to transfer the image to the other computers. Sysprep prepares the hard disk on the master computer for duplication to other computers and then runs a third-party disk-imaging process. This method decreases deployment time dramatically compared to standard or scripted installations.

To use Sysprep, your master and target computers must have identical HALs, Advanced Configuration and Power Interface (ACPI) support, and mass storage controller devices. Windows 2000 automatically detects Plug and Play devices, and Sysprep redetects and reenumerates the devices on the system when the computer is turned on after Sysprep has run. This means that Plug and Play devices, such as network adapters, modems, video adapters, and sound cards do not have to be the same on the master and target computers. The major advantage of Sysprep installation is speed. The image can be packaged and compressed; only the files required for the specific configuration are created as part of the image. Additional Plug and Play drivers that you might need on other systems are also created. The image can also be copied to a CD and distributed to remote sites that have slow links.

Note Because the master and target computers are required to have identical HALs, ACPI support, and mass storage devices, you might need to maintain multiple images for your environment.

Important When performing disk duplication, check with your software vendor to make certain that you are not violating the licensing agreement for installation of the software that you want to duplicate.

Overview of the Sysprep Process

This section describes the process of building a source computer to use for disk duplication.

1. Install Windows 2000.—Install Windows 2000 Professional on a computer that has hardware similar to the intended target computers. While building the computer, you must not join it to a domain, and you must keep the local administrative password blank.
2. Configure the computer – Log on as the administrator, and then install and customize Windows 2000 Professional and associated applications. This might include your productivity application such as Microsoft® Office 2000, business-specific applications, and any other applications or settings that you want included in a common configuration for all clients.
3. Validate the image – Run an audit, based on your criteria, to verify that the image configuration is correct. Remove residual information, including anything left behind from audit and event logs.
4. Prepare the image for duplication – After you are confident that the computer is configured exactly the way that you want, you are ready to prepare the system for duplication. You accomplish this by running Sysprep with the optional Sysprep.inf file, which is described later in this chapter. When Sysprep has completed, the computer will shut down automatically or will indicate that it is safe to shut down.
5. Duplicate – At this point, the computer hard disk is triggered to run Plug and Play detection, create new security identifiers (SIDs), and run Mini-Setup Wizard the next time that the system is started. You are now ready to duplicate or image the system by using a hardware or software solution. The next time that Windows 2000 is started from this hard disk, or is started from any duplicated hard disk created from this image, the system will detect and re-enumerate the Plug and Play devices to complete the installation and configuration on the target computer.

Important Components that depend on Active Directory cannot be duplicated.

Sysprep Files

To use Sysprep, run Sysprep.exe manually or configure Setup to run Sysprep.exe automatically by using the [GuiRunOnce] section of the answer file. To run Sysprep, the files Sysprep.exe and Setupcl.exe must be located in a Sysprep folder at the root of the system drive (%systemdrive%\Sysprep\). To place the files in the correct location during an automated Setup, you must add these files to your distribution folders under the \$OEM\$\\$1\Sysprep subfolder. For more information about this subfolder, see “Structuring the Distribution Folder” earlier in this chapter.

These files prepare the operating system for duplication and start the Mini-Setup Wizard. You can also include an optional answer file, `Sysprep.inf`, in the `Sysprep` folder. `Sysprep.inf` contains default parameters that you can use to provide consistent responses where they are appropriate. This limits the requirement for user input, thereby reducing potential user errors. You can also place the `Sysprep.inf` file on a floppy disk to be placed in the floppy disk drive after the Windows startup screen appears in order to allow further customization at the target computer's location. The floppy disk drive is read when the "Please Wait..." Mini-Setup Wizard screen appears. When the Mini-Setup Wizard has successfully completed its tasks, the system restarts one last time, the `Sysprep` folder and all of its contents are deleted, and the system is ready for the user to log on.

The `Sysprep` files are defined in the sections that follow.

Sysprep.exe

`Sysprep.exe` has the following three optional parameters:

- *quiet* — runs `Sysprep` without displaying onscreen messages.
- *nosidgen* — runs `Sysprep` without regenerating SIDs that are already on the system. This is useful if you do not intend to duplicate the computer on which you are running `Sysprep`.
- *reboot* — automatically restarts the computer after `Sysprep` shuts it down. This eliminates the need for you to manually turn on the computer again.

Sysprep.inf

`Sysprep.inf` is an answer file that is used to automate the Mini-Setup process. It uses the same `.ini` file syntax and key names (for supported keys) as the Setup answer file. You need to place the `Sysprep.inf` file in the `%systemdrive%\Sysprep` folder or on a floppy disk. If you use a floppy disk, you can provide the floppy after the Windows startup screen appears. Note that if you do not include `Sysprep.inf` when running `Sysprep`, the Mini-Setup Wizard displays all the available dialog boxes listed under "Mini-Setup Wizard" later in this chapter.

Note If you provided a `Sysprep.inf` file on the master computer and you want to change `Sysprep.inf` on a per-computer basis, you can use the floppy disk method previously discussed.

The following is an example of a Sysprep.inf file:

```
[Unattended]
;Prompt the user to accept the EULA.
OemSkipEula=No
;Use Sysprep's default and regenerate the page file for the system
;to accommodate potential differences in available RAM.
KeepPageFile=0
;Provide the location for additional language support files that
;may be needed in a global organization.
InstallFilePath=%systemdrive%\Sysprep\i386

[GuiUnattended]
;Specify a non-null administrator password.
;Any password supplied here will only take effect if the original source
;for the image (master computer) specified a non-null password.
;Otherwise, the password used on the master computer will be
;the password used on this computer. This can only be changed by
;logging on as Local Administrator and manually changing the password.
AdminPassword=""
;Set the time zone
TimeZone=20
;Skip the Welcome screen when the system boots
OemSkipWelcome=1
;Do not skip the regional options dialog so that the user can indicate
;which regional options apply to them.
OemSkipRegional=0

[UserData]
;Prepopulate user information for the system
FullName="Authorized User"
OrgName="Organization Name"
ComputerName=XYZ_Computer1

[Identification]
;Join the computer to the domain ITDOMAIN
JoinDomain=ITDOMAIN

[Networking]
;Bind the default protocols and services to the (s) network card used
;in this computer.
InstallDefaultComponents=Yes
```

Note You can change the administrative password using Sysprep.inf only if the existing administrative password is null. This is also true if you want to change the administrator password through the Sysprep GUI.

For more information about answer file parameters and syntax, see the “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

Setupcl.exe

Setupcl.exe does the following:

- Regenerates new SIDs for the computer.
- Starts the Mini-Setup Wizard.

Mini-Setup Wizard

The Mini-Setup Wizard starts the first time that a computer starts from a disk that has been duplicated by the Sysprep method. The wizard gathers any information that is needed to further customize the target computer. If you do not use Sysprep.inf, or if you leave some sections of the file blank, the Mini-Setup Wizard displays screens for which no answer was provided in Sysprep.inf. The possible screens include the following:

- End-User License Agreement (EULA)
- Regional options
- User name and company
- Computer name and administrator password
- Network settings
- TAPI settings (displayed only if a modem or a new modem device exists on the computer)
- Server licensing (server only)
- Time zone selection
- Finish/Restart

If you want to bypass these screens, you can specify certain parameters within Sysprep.inf. These parameters are listed in Table 25.6.

Note Because Setup detects optimal settings for display devices, you will no longer see the “Display Settings” screen when Setup or Mini-Setup Wizard are running. You can specify the settings in the [Display] section either in the answer file that is used for your master computer or in the Sysprep.inf file used for your target computer. If settings in the [Display] section are in the answer file that is used for your master computer, Sysprep will retain those settings unless Sysprep.inf contains different settings or unless a video adapter or monitor requiring settings different from those of the master computer is detected.

Table 25.6 Parameters in Sysprep.inf for Bypassing the Mini-Setup Wizard

| Parameter | Value |
|--|--|
| Regional options | [RegionalSettings] section [GuiUnattended] OemSkipRegional=1 |
| User name and company | [UserData] FullName="User Name" OrgName="Organization Name" |
| Computer name and administrator password | [UserData] ComputerName=W2B32054 [GuiUnattended] AdminPassword="" |
| TAPI settings | [TapiLocation] AreaCode=425 |
| Network settings | [Networking] InstallDefaultComponents=Yes |
| Server licensing (server only) | [LicenseFilePrintData] AutoMode = PerServer AutoUsers = 5 |
| Time zone selection | [GuiUnattended] TimeZone=<desired time zone index> |
| Finish/Restart | N/A |

Running Sysprep Manually

After you install Windows 2000 Professional, you can use Sysprep to prepare the system for transfer to other similarly configured computers. To run Sysprep manually, you must first install Windows 2000 Professional, configure the system, and install the applications. Then run Sysprep without the *-reboot* command-line switch. After the system shuts down, duplicate the image of the drive to the similarly configured computers.

When users start up their duplicated computers for the first time, Sysprep Mini-Setup will run, allowing the users to customize their systems. You can also preassign all or some of the Sysprep configuration parameters by using Sysprep.inf. The Sysprep folder (which contains Sysprep.exe and Setupcl.exe) is automatically deleted after Sysprep Mini-Setup is completed.

- **To prepare a Windows 2000 Professional installation for duplication**

1. On the **Start** menu, click **Run**, and then type:

```
cmd
```

2. At the command prompt, change to the root folder of drive C, and then type :

```
md sysprep
```

3. Insert the Windows 2000 Professional CD into the appropriate drive. Open the Deploy.cab file in the \Support\Tools folder.

4. Copy Sysprep.exe and Setupcl.exe to the Sysprep folder.

If you are using Sysprep.inf, also copy this file to the Sysprep folder. Note that Sysprep.exe, Setupcl.exe, and Sysprep.inf must exist in the same folder for Sysprep to function properly.

5. At the command prompt, change to the Sysprep folder by typing:

```
cd sysprep
```

6. Type one of the following, as required:

```
Sysprep  
Sysprep -reboot  
Sysprep /<optional parameter>  
Sysprep /<optional parameter> -reboot  
Sysprep /<optional parameter 1>.../<optional parameter X>  
Sysprep /<optional parameter 1>.../<optional parameter X> -reboot
```

7. If the *-reboot* command-line switch was not specified, perform the following:

When a message requesting that you shut down the computer appears, on the **Start** menu, click **Shut Down**. You are now ready to use a third-party disk-imaging tool to create an image of the installation.

8. If the `-reboot` command-line switch was specified for auditing purposes only, the computer restarts and the Mini-Setup Wizard runs. Perform the following:
 - Verify that the Mini-Setup Wizard provides the desired prompts. At this time, you can also audit the system and other applications. After the auditing is completed, run Sysprep again without the `-reboot` command line switch.
 - When a message requesting that you shut down the computer appears, on the **Start** menu, click **Shut Down**. You are now ready to use a third-party disk-imaging tool to create an image of the installation.

Note You can add a `Cmdlines.txt` file to the Sysprep folder, to be processed by Setup. This file is used to run post-Setup commands, including commands for application installation.

Running Sysprep Automatically After Setup Completes

The `[GuiRunOnce]` section of the answer file contains commands to be executed after Setup completes. You can use the `[GuiRunOnce]` section to create an installation that completes Setup, automatically logs on to the computer, runs Sysprep in `-quiet` mode, and then shuts down the computer. For this to occur, you need to do the following:

1. To copy the files to the correct location on the system drive, include the required Sysprep files in the distribution folders under `OEM\$1\Sysprep\`.
2. In the `[GuiRunOnce]` section of the answer file, make the following the last command that is run on the computer:

```
%systemdrive%\Sysprep\Sysprep.exe -quiet
```

If multiple reboots are required, make this the last command used the last time the `[GuiRunOnce]` section is used.

Using Sysprep to Extend Disk Partitions

Windows 2000 GUI Setup and Mini-Setup can be used to extend NTFS partition through the answer files. This new functionality does the following:

- Allows you to create images that can be extended into larger disk partitions to take full advantage of hard disks that might have more space than the original hard disk on the master computer.
- Provides a way to create images on smaller hard disks.

To determine the best way to integrate this functionality in your environment, you need to review the steps that follow and choose the method that will work best for you based on the tools that you are using to image the operating system.

Caution If you can use your imaging tools to modify the image, you can delete the files Pagefile.sys, Setupapi.log, and Hyberfil.sys (if applicable) because these files will be recreated when the Mini-Setup Wizard runs on the target computer. You must not delete these files on an active system because this can cause the system to function improperly. These files should only be deleted, if desired, only from the image.

- **To extend a hard disk partition when using a third-party imaging product or a hardware imaging device that supports NTFS used by Windows 2000**

1. Configure the partition on the master computer hard disk to the minimum size required to install Windows 2000 with all the components and applications that you intend to preinstall. This will reduce your overall image size requirements.
2. Include the FileSystem=ConvertNTFS in the [Unattended] section of the answer file that is used to create the master image. You do not need to include ExtendOemPartition here because you want to maintain the smallest possible image size.

Note ConvertNTFS does not work in Sysprep.inf because this is a Text Mode-only function and Sysprep does not go through Text Mode.

3. In the [Unattended] section of Sysprep.inf, include the statement:

```
ExtendOemPartition = 1
```

(or additional size in megabytes to extend the partition)

4. Install Windows 2000 to the master computer. Sysprep will shut down the system automatically.
5. Image the drive.
6. Place the image on the target computer where the target computer has the same size system partition as the master computer.
7. Restart the target computer.

The Mini-Setup Wizard starts and the partition is extended almost instantaneously.

- **To extend a hard disk partition when using an imaging product that does not support NTFS used by Windows 2000**
 1. Configure the partition on the master computer hard disk to the minimum size required to install Windows 2000 with all the components and applications that you intend to preinstall. This will reduce your overall image size requirements.
 2. Convert the file system to NTFS by using the Convert.exe tool provided in Windows 2000.
 3. Include the following items as the last two items of the [GuiRunOnce] section of the answer file that is used to create the master image:

```
[GuiRunOnce]
Command1 = "command line"
Command2 = "command line"
...
Commandn-1 = "Convert c:\ /fs:ntfs"
Commandn = "%systemdrive%\sysprep\sysprep.exe - quiet"
```

where:

- <command line> includes any commands that you need to run to install applications or configure the operating system before you image it.
- <Commandn-1> is the next-to-last command to be executed in the [GuiRunOnce] section of the answer file. This will run the "Convert" command. Because Convert cannot convert the active system to NTFS while the operating system is running, the operating system is set to do so the next time the computer restarts. Because Sysprep is the next item to run, the system will not be converted to NTFS during that process.
- <Commandn> is the last command to run on the computer. This command is Sysprep.exe. When Sysprep is run, it prepares the computer for imaging and then shuts down the computer.

Note You cannot include ExtendOemPartition in the master answer file for this step because the partition on which the image is generated is not NTFS. You also might want to keep the image as small as possible.

4. In the [Unattended] section of Sysprep.inf, include the statement:

```
ExtendOemPartition = 1
```

(or additional size in megabytes to extend the partition)

5. Install Windows 2000 to the master computer. Sysprep will shut down the system automatically.

Important Do not restart the computer.

6. Image the drive.
7. Place the image on the target computer where the target computer has the same size system partition as the master computer.
8. Restart the target computer.

The computer will initially start in conversion mode to convert the system partition on the target computer to NTFS.

The computer will automatically restart.

The Mini-Setup Wizard starts, and the partition is extended almost instantaneously.

Using Systems Management Server

You can use SMS to perform managed upgrades of Windows 2000 Professional to multiple systems, especially those that are geographically dispersed. Note that SMS is used only for installations to computers that contain a previously installed operating system. Before you upgrade using SMS, it is important to have assessed your existing network infrastructure, including bandwidth, hardware, and geographical constraints. The primary advantage of upgrading using SMS is that you can maintain centralized control of the upgrade process. For example, you can control when upgrades take place (for example, during or after training, after hardware verification, and after user data is backed up), which computers will be upgraded, and how you apply network constraints. For more information about SMS deployment, see “Using Systems Management Server to Deploy Windows 2000” in this book.

Using a Bootable Compact Disk

You use the bootable CD method to install Windows 2000 Professional on a computer whose basic input/output system (BIOS) allows it to start from a CD. This method is quite useful for computers at remote sites with slow links and no local IT department. The bootable CD method runs Winnt32.exe, which allows for a fast installation.

Note You can use only the bootable CD method for clean installations. To perform upgrades, you must run Winnt32.exe from within the existing operating system.

To ensure maximum flexibility, set the boot order in BIOS as follows:

- Network adapter
- CD
- Hard disk

- Floppy disk

To use a bootable CD, the following criteria must be met:

- Your computer must have El Torito No Emulation support for bootable CDs.
- The answer file must contain a [Data] section that has the required keys.
- The answer file must be named Winnt.sif and be located on a floppy disk.

For more information about answer file parameters and syntax, see the “Microsoft Windows 2000 Guide to Unattended Setup” (Unattend.doc) on the Microsoft Windows 2000 operating system CD. The Unattend.doc file is part of the Deploy.cab file in the \Support\Tools folder. In Windows 98 or Windows 2000, use Windows Explorer to extract this document. In Windows 95 and earlier, or in MS-DOS, use the **Extract** command to access the file.

- **To install Windows 2000 using a bootable CD**
 1. Start the system from the Windows 2000 CD.
 2. When the blue text-mode screen with “Windows 2000 Setup” is displayed, place the floppy disk containing the Winnt.sif file into the floppy disk drive.
 3. After the computer reads from the floppy disk drive, remove the floppy disk. Setup will now run from the CD as specified by the Winnt.sif file.

Note The bootable CD-ROM method requires that all necessary files be on the CD-ROM. Uniqueness Database Files (UDFs) cannot be used with this method.

Using Remote Operating System Installation

Remote Operating System Installation is an optional component included with Windows 2000 Server and is based on Remote Installation Services (RIS) technology. Because RIS uses Pre-Boot eXecution Environment (PXE)-based remote-boot technology and server-based software, you can remotely install an image of Windows 2000 Professional on supported computers, eliminating the need to physically visit each computer to perform an installation. You must ensure that the hardware for each computer is compatible and that a bootable network adapter is installed. You can set up a different RIS image for each configuration specific to a group of computers. During Setup, a list of installation choices are provided that can be limited according to the policies set for that particular user or group. There might be as many RIS images to maintain as there are different sets of group policies. In this case, it would be beneficial if only the installation choices common to all configurations were installed by this method.

For more information about Remote Operating System Installation, see “Applying Change and Configuration Management” in this book, and see “Remote OS Installation” in the *Microsoft® Windows® 2000 Server Resource Kit Distributed Systems Guide*.

RIS Server Network Load Implications

Because a RIS server is used to install operating system images on client computers, the amount of traffic the server produces is similar to that of other servers performing as software installation points on your network. Generally, the traffic from RIS servers is more predictable than traffic from a general-purpose software installation point that provides applications and regular updates. RIS-generated traffic is higher when many users are loading images—for example, during a new deployment of operating system images or when a group of new computers is added to the network. After systems are installed, daily traffic is going to be lower.

As a general rule, place a RIS server near the client computers that it services. This will localize the resulting network traffic and reduce its impact.

If your environment requires either of the following processes, make sure that these processes can be optimized without affecting other applications:

- Frequent reinstallation of systems, as in a classroom.
- Regular installation of a large number of systems, as in preinstallation of all new systems before delivering them to users.

For the classroom example, consider segmenting the physical network and providing a dedicated RIS server for each classroom or set of classrooms that your RIS server hardware can support.

For the preinstallation example, consider implementing preinstallation labs where computers can be processed in volume by using high-speed networking and RIS server hardware to reduce installation time.

Optimizing Performance

Because Remote Operating System Installation is primarily a file-copy process, the common RIS server performance factors are similar to those of other file input/output (I/O) intensive servers such as Web servers and file and print servers. These factors include server disk throughput and network bandwidth. When optimizing performance of your RIS servers, evaluate these factors and other constraints that might exist on the network between RIS servers and the clients that are being serviced. When a RIS server or its network connection is overloaded, the result is increased installation time for client computers and TFTP time-outs during the initial file-copy phase.

DHCP and DHCP Servers

Because Remote Operating System Installation (PXE-enabled) clients use the DHCP discovery mechanism to obtain a network address and to locate RIS servers, the relationship of RIS to DHCP in your organization plays a key role in determining your RIS server placement strategy.

In simple environments, adding RIS to each DHCP server in use is a common solution. When a combination Windows 2000 DHCP/RIS server approach is used, the number of initial network packets sent between the RIS client and the DHCP and RIS servers is reduced, and the initial server response is faster. In addition, a combination Windows 2000 DHCP/RIS server always answers a client together. This provides a simple form of load balancing by taking advantage of any existing planning that groups client computers to DHCP servers, and it also simplifies troubleshooting and administrative procedures.

Although RIS servers must be located close to client computers and can generate large network loads, often requiring these servers to have high-end hardware, DHCP servers are just the opposite. DHCP servers generate far less traffic, do not typically require high-end server hardware, and are sometimes centralized rather than close to client computers. Therefore, you might find that simply adding RIS to your existing DHCP servers is impractical. In such cases, you might want to add RIS services to existing software installation point servers because they have similar planning and placement requirements as RIS servers, or you might want to make your RIS servers independent of other supporting servers.

When RIS servers are separate from DHCP servers, or when non-Windows 2000 DHCP servers are in use, controlling which RIS servers answer specific clients becomes a primary consideration. This is because the PXE-based remote boot process does not provide a way to determine from which server a client is going to receive service. For information about methods for controlling this process, see “Controlling RIS Server Selection and Balancing Load” later in this chapter.

Regardless of the approach that you take to combine DHCP and RIS servers, every RIS server must be authorized in Active Directory as a method of preventing unauthorized servers from servicing clients on the network. The authorization process for both RIS and Windows 2000 DHCP servers takes place through the Windows 2000 DHCP snap-in in Microsoft Management Console (MMC). The process has no direct relation either to combining or separating RIS and DHCP servers or with using Windows 2000 DHCP. The Windows 2000 DHCP snap-in is simply reused as an authenticating mechanism and can be run without installing the DHCP service on any Windows 2000–based computer that has the Administrator Tools pack installed.

Caution Do not attempt to install Windows 2000 DHCP on a RIS server simply to obtain the snap-in. To service RIS clients, any combined Windows 2000 DHCP and RIS server must have a fully functional DHCP service (including defined and active scopes). This is because the Windows 2000 DHCP service on a combined server is aware that RIS is also installed. If a client indicates that it requires both DHCP and remote boot services in its DHCP discovery broadcast, DHCP will issue a single reply containing the specific details on DHCP and remote boot for that server. If the Windows 2000 DHCP service on the server is not properly answering clients, that server will not generate a remote boot reply.

Controlling RIS Server Selection and Balancing Load

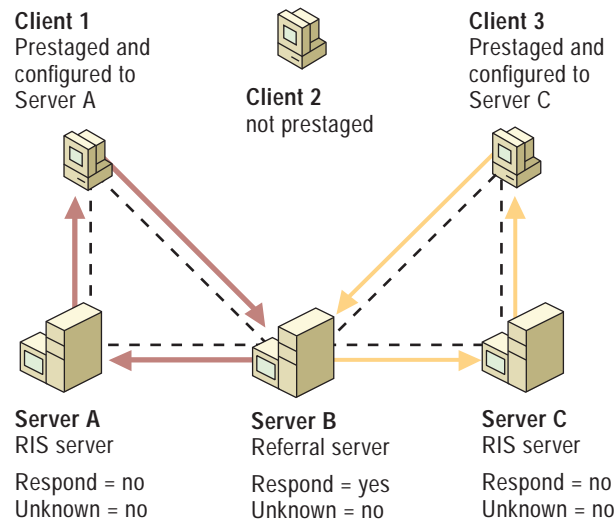
By default, when a PXE-based client broadcasts its request for service, all servers that receive the request will reply. The first server to respond is the one that provides service; preference is given to responses from combined DHCP/RIS servers over responses from separate servers. Although this provides fundamental load balancing when multiple servers are available to clients in order to prevent clients from using improper servers, it is often best to restrict which servers can answer specific clients. An example is a server that is local to the client and is busy or down when the client requests service.

The first way to control server selection is to physically control network routing so that DHCP discovery broadcasts are forwarded only when it is appropriate. This physically allows answers by only those DHCP/RIS servers that are permitted to receive the client service requests. If your DHCP/RIS servers are in similar locations on the network in relation to clients, this might be all that is necessary.

To accommodate a variety of scenarios, Remote Operating System Installation provides additional features for controlling server selection. These features involve configuring client computer accounts within Active Directory to use a specific RIS server, which is a process known as “prestaging.” Prestaging can be performed on existing computer accounts, as well as when creating new computer accounts before the system joins the domain. When a RIS server answers a service request from a client, the server checks Active Directory (the entire forest) for the existence of a computer account with a globally unique identifier (GUID) that matches the GUID that is included in the service request. If a matching computer account is found, the account is also checked to see whether it has been configured to use a specific RIS server. If so, the RIS server specified in the computer account is always supplied in the reply to the client, even if it is a different server from the one providing the initial reply to the client. This is known as a *server referral* and provides a simple way to control which RIS servers end up providing operating system installation services to specific client computers, regardless of which particular RIS server replied to the initial request for service from the client.

To allow additional flexibility and security, the prestaging and referral concepts can also be combined with RIS server settings that control how servers respond to clients. Each RIS server has two settings: “Respond to client computers requesting service” and “Do not respond to unknown client computers.” By prestaging all computer accounts and selectively controlling which RIS servers are configured to respond to clients, servers can become dedicated to either replying to client service requests and providing the appropriate referrals, or to providing the actual Remote OS Installation services to clients.

Figure 25.3 illustrates an example of how client computers can relate to RIS servers.



Server Configuration Key:

Respond- Respond to Client Computers

Unknown- Do Not Respond to Unknown Client Computers

Figure 25.3 Example of How Client Computers Relate to RIS Servers

In Figure 25.3, only server B will reply to client computers that request service. Because client computers 1 and 3 have been prestaged and configured to obtain service from a specific RIS server, they will receive a reply that refers them to the appropriate server (A or C). If it is appropriate, multiple dedicated referral servers such as server B can be established, all of which will use the prestaged computer accounts in Active Directory to determine the proper referral to make. Servers A and C will never reply to initial client service requests; but through referrals, the servers provide the actual operating system installation services to clients.

You can then determine whether the “Do not respond to unknown client computers” configuration option needs to be selected on referral servers such as server B.

Selecting this option ensures that:

- Server B sends replies only to client computers that have been prestaged.
- If any clients are configured to receive service specifically from it, server B will effectively become a dedicated referral server or will also provide the actual operating system installation services.

If the “Do not respond to unknown client computers” option is not selected, server B will reply to service requests from nonprestaged clients (client computer 2 in the example), offering itself as the remote boot server.

Whether or not referral servers are used, selecting “Do not respond to unknown client computers” provides a measure of security by preventing client computers that have not been prestaged from performing operating system installation from RIS servers. In addition, not all vendors offering solutions based on the same remote-boot protocol as Remote Operating System Installation provide options for controlling which client service requests are replied to. By using prestaging and restricting all RIS servers to respond to known client computers, you allow Remote Operating System Installation to be implemented without disruption on a network containing other remote-boot products.

Working with Routers

Because client service requests are based on the DHCP discovery process, configuring your network to support Remote Operating System Installation across routers has the same requirements as doing so to support DHCP across routers.

Routers that are configured to forward DHCP broadcasts will also automatically forward client service requests; however, you must ensure that the requests are forwarded to the proper RIS servers in addition to any DHCP servers. Depending on the router models in use, the specific router configuration of DHCP broadcast forwarding might be supported to either a subnet (or router interface) or to a specific host. If you use Windows 2000 DHCP but have your RIS servers on separate computers, or if you use non-Windows 2000 DHCP, you must ensure that the routers forward the DHCP broadcasts to both the DHCP and RIS servers. Otherwise the client will not receive a reply to the remote boot request.

Because of the amount of network traffic involved in installing an operating system, carefully consider where to place your RIS servers and how to use prestaging and referral servers to accommodate your existing network design so that the impact of client installations is minimized.

Installation Configuration Examples

The examples included here provide procedures for installation of Windows 2000 Professional to computers either with preexisting client configurations or without any existing configuration.

Existing Client Computers

The examples in this section are for computers that have the following preexisting client configurations.

Example 1: Windows NT Workstation 4.0 with Windows 2000 Compatible Client Applications

Perform an upgrade. Client operating systems that can be upgraded include Windows 95, Windows 98, Windows NT Workstation 4.0, and Windows NT Workstation 3.51.

For information about applications that are compatible with Windows 2000 Professional, see the Directory of Windows 2000 Applications link on the Web Resources page at <http://windows.microsoft.com/windows2000/reskit/webresources>.

- **To install Windows 2000 Professional on computers that have compatible hardware**
 1. Back up user settings.
 2. Upgrade the system by using one of the following methods:
 - Initiate a “push” (completely automated) installation by doing the following:
 - Using systems management software such as Microsoft® Systems Management Server.
 - Or–
 - Performing a network installation.
 - Or–
 - Performing a remote boot. This requires that Remote Installation Server be configured and a bootable network adapter installed.
 - Initiate local installation by running Winnt32.exe with the desired parameters from the command line and:
 - Perform a manual installation (with no answer file). Answer all prompts.
 - Or–
 - Perform an automated or semiautomated installation with an answer file. In a completely automated installation, the answer file provides answers for all questions. You can use a semiautomated installation to permit some user input for applications that you choose.

- **To install Windows 2000 Professional on a computer that has noncompatible hardware and whose hard disk does not need to be replaced**
 1. Replace any necessary hardware except the hard disk.
 2. Verify that all new hardware functions properly.
 3. Back up user settings.

4. Upgrade the system using one of the following methods:
 - Initiate a “push” (completely automated) installation by doing the following:
 - Using systems management software such as Systems Management Server.
 - Or–
 - Performing a network installation.
 - Or–
 - Performing a remote boot. This requires that Remote Installation Server be configured and a bootable network adapter installed.
 - Initiate a local installation by running Winnt32.exe with the desired parameters from the command line and:
 - Perform a manual installation (with no answer file). Answer all prompts.
 - Or–
 - Perform an automated or semiautomated installation.
- **To install Windows 2000 Professional on a computer that has noncompatible hardware and whose hard disk must be replaced**
 1. Upgrade at least one of the following:
 - RAM
 - Processor
 2. Verify that all new hardware functions properly.
 3. Back up user settings.

Note Although it is possible to back up the entire contents of the hard disk to a new hard disk before upgrading the computer, this is not generally feasible for client computers.

4. Replace the hard disk. Copy the image that was backed up.
5. Run Winnt.exe from the command prompt with the desired parameters by using one of the following methods:
 - Perform a manual installation (no answer file), and answer all prompts.
 - Or–

- Perform an automated or semiautomated installation. Use one of the following methods:
 - CD-ROM Boot Setup.
 - Syspart. This is useful when installing new hard disks in the computers.
 - Sysprep. Use when installing to identical computers (HALs and mass storage device controllers must be identical).
 - Remote boot. This requires Remote Installation Server to be configured and a bootable network adapter to be installed.
- 6. Install applications compatible with Windows 2000 Professional.
- 7. Verify system functions as required.
- 8. Import user settings (for example, Regedit/Regedt32, logon scripts, policies, roaming profiles).

Example 2: Windows NT Workstation 3.5 or Earlier, and Non-Microsoft Client Computers

Client operating systems that cannot be upgraded include MS-DOS, Windows 3.x, Windows NT Workstation 3.5 or earlier, and OS/2.

To prepare for a clean installation, obtain a client computer built by an OEM/Solution Provider. To perform a clean installation on a new computer or install the operating system on an existing computer, perform the following procedure.

Note For information about applications that are compatible with Windows 2000 Professional, see the Directory of Windows 2000 Applications link on the Web Resources page at <http://windows.microsoft.com/windows2000/reskit/webresources>.

- **To install Windows 2000 Professional on a client operating system that cannot be upgraded**

1. Back up user settings.

Caution If you install Windows 2000 Professional on an existing computer running an operating system that cannot be upgraded to Windows 2000, all user settings will be lost.

2. Run Winnt.exe from the command prompt with the desired parameters by using one of the following methods:
 - Perform a manual installation (no answer file), and answer all prompts.

–Or–

- Perform an automated or semiautomated installation. Use one of the following methods:
 - CD-ROM Boot Setup.
 - Syspart. This is useful when installing new hard disks in the computers.
 - Sysprep. Use when installing to identical computers (HALs and mass storage device controllers must be identical).
 - Remote boot. This requires Remote Installation Server to be configured and a bootable network adapter to be installed.
- 3. Install applications that are compatible with Windows 2000 Professional.
- 4. Verify system functions as required.
- 5. Import user settings (for example, Regedit/Regedt32, logon scripts, policies, roaming profiles).

New Client Computers

Client computers without any pre-Windows 2000 Professional operating system installed require a clean installation of Windows 2000 Professional.

To prepare for installation, obtain a client computer built by an OEM/Solution Provider.

- **To install Windows 2000 Professional on a computer that does not have any pre-Windows 2000 operating system installed**
 - Perform a manual installation (no answer file), and answer all prompts.
–Or–
 - Perform an automated or semiautomated installation. Use one of the following methods:
 - CD-ROM Boot Setup.
 - Syspart. This is useful when installing new hard disks in the computers.
 - Sysprep. Use when installing to identical computers (HALs and mass storage device controllers must be identical).
 - Start disk and run Setup with an answer file.
 - Remote boot. This requires RIS to be configured and a bootable network adapter to be installed.

Installation Task List

Table 25.7 is a summary of the tasks involved in performing the installation of Windows 2000 Professional and required applications on client computers.

Table 25.7 Summary of Installation Tasks

| Task | Location in Chapter |
|---|--|
| Resolve critical planning issues. | Resolving Critical Planning Issues |
| Create the distribution folder. | Preparing for Installation |
| Review the answer file. | Reviewing the Answer File |
| Review the Windows 2000 Setup commands. | Preparing for Installation |
| Choose an application installation method based on critical planning. | Automating the Installation of Client Applications |
| Choose a method for operating system installation based on critical planning. | Automating the Installation of Windows 2000 Professional |
