EXAM OBJECTIVES

Professional ▶

Exam 70-210

- Monitor and configure removable media, such as tape devices.
- Recover systems and user data.
  - Recover systems and user data by using Windows Backup.
  - Troubleshoot system restoration by using Safe Mode.
  - Recover systems and user data by using the Recovery Console.

Server ▶

Exam 70-215

- Manage and optimize availability of system state data and user data.
- Recover systems and user data.
  - Recover systems and user data by using Windows Backup.
  - Troubleshoot system restoration by using Safe Mode.
  - Recover systems and user data by using the Recovery Console.

Directory Services ▶

Exam 70-217

- Back up and restore Active Directory.
  - Perform an authoritative restore of Active Directory.
  - Recover from a system failure.

CHAPTER

14 Backup and Recovery

This chapter covers backup and recovery in a Windows 2000 environment. If you're reading this book, it's probably important for you to know how to back up and restore data. I'll begin by discussing how to manage and optimize the availability of data on your network. I'll also define a couple of key terms: user data and System State data. Next, I'll jump right in to using Backup, the backup utility that ships with Windows 2000. I'll cover what to back up and backup types and strategies, as well as how to actually use Backup to perform backups, schedule backups, and create an Emergency Repair Disk.

Then I'll move on to using Backup to restore user data and System State data. In this section I'll address restoring the Active Directory database, which is a component of System State data, and the differences between performing a nonauthoritative restore versus an authoritative restore.

Next, I'll explore how to recover from a system failure. You'll learn how to use Safe Mode to troubleshoot and restore a system, and how to use the Recovery Console and the Emergency Repair Disk to restore a system. Finally, I'll discuss monitoring and configuring removable media.

Chapter Pre-Test

1. What is user data?
2. What is System State data?
3. How can you access the Windows 2000 backup program called Backup?
4. What are the three primary tasks you can perform by using Backup?
5. What is an Emergency Repair Disk?
6. Who can perform backups and restores?
7. What are the two types of restores you can perform of Active Directory?
8. List three Windows 2000 tools you can use to recover from a system failure.
9. What is the name of the Windows 2000 management tool used to manage removable media?

Managing and Optimizing the Availability of User Data and System State Data

As a network administrator, it's your job to manage and optimize the availability of data on your network. In a nutshell, this means you have to secure the data on your company's network, protect it from loss, and ensure that it's always available when users need it. That's a tall order.

The data on your Windows 2000 network can be divided into two primary types: user data and System State data.

User data is a broad category that includes application files and folders, operating system files and folders, and user-created files and folders. In short, user data includes all files and folders on the Windows 2000 computer that aren't held open at all times by Windows 2000.

System State data includes various critical operating system files, folders, and databases. The actual components of System State data vary depending on the Windows 2000 operating system you're using and the services installed on that operating system. For all Windows 2000 computers, System State data includes the operating system boot files, the registry, and the COM+ Class Registration database. On a Windows 2000 Server computer that has Certificate Services installed, System State data also includes the Certificate Services database. Finally, on a Windows 2000 Server that is a domain controller, System State data also includes the Active Directory data store and the contents of the `SYSVOL` folder.

EXAM TIP

Make sure you know what's included in System State data—and what's not—on both domain controllers and nondomain controllers when you take the exams.

In this book, I've already discussed several ways you can manage and optimize the availability of your network's data, including using NTFS and permissions to restrict access to files and folders and using mirrored volumes and RAID-5 volumes to provide fault tolerance. Another important part of your overall fault tolerance plan is performing regular backups of data.

A tape backup is not a replacement for other fault tolerance methods, such as mirrored volumes and RAID-5 volumes. Tape backup is an additional safety precaution to use when other fault tolerance methods fail. I don't recommend that you rely solely on mirrored volumes, RAID-5

volumes, or tape backup. A comprehensive fault tolerance policy typically should include two or more of these strategies.

Backing Up User Data and System State Data

As I mentioned in the previous section, backing up data is an important part of your network fault tolerance plan. Planning and adhering to a regular backup schedule can make recovering from a corrupt file or a failed hard disk a straightforward, if somewhat painful, task. Failing to make regular backups of your system's critical data can be harmful (or even fatal) to your business, to your employment status, or both.

Always remember that a tape backup is your last line of defense against data loss. If the data on the tape is too old to be of value, or if it is corrupt, or if the tape has been damaged due to fire or other causes, then you have nothing. And having nothing is very hard to explain to upper management.

IN THE REAL WORLD

On more than one occasion I've had to explain to a client that both disks in a mirrored volume (or two disks in a RAID-5 volume) have failed, *and* that the most recent tape backup is corrupt. This is a difficult and extremely unpleasant thing to explain to a client or to your manager.

I can't stress enough the importance of carefully performing regular tape backups, and periodically testing the validity of those backups. Once you've experienced a partial or total disk failure, you'll never regret the time it takes you to perform backups again.

In the following sections I'll discuss what to back up, backup types, backup strategies, and how to use Backup to perform various tasks.

What to Back Up

Before you can create a backup strategy, you need to determine which data on your network will be backed up. I recommend that all network data be backed up regularly. This includes both user data and System State data.

In general, operating systems, applications, and System State data need to be backed up less frequently than user-created data files. You may find it sufficient to back up these types of data once a week, once a month, or

even less often. An exception to this general rule is System State data on domain controllers. System State data on Windows 2000 domain controllers should be backed up fairly frequently because it contains the Active Directory data store.

Depending on the importance of your data, user-created data files can be backed up once a week, once a day, once an hour, or at any frequency that meets your organization's needs. When determining which files to back up and how often, ask yourself how much data you can really afford to lose. For example, if you decide to back up only once a week, can you afford to lose six days of sales information and other employee-created data?

Backup Types

Before I talk about the specific backup types, a short discussion on the archive attribute, and how the operating system and backup programs use this attribute, is in order.

The archive attribute is a marker that the operating system automatically assigns to all files and folders when they are first installed or created. Depending on the backup type, backup programs remove the archive attribute from a file or folder to indicate that the file or folder has been backed up. If a file or folder is modified after it is backed up, the operating system reassigns the archive attribute to it.

There are five standard types of backups you can perform:

- **Normal:** A normal backup backs up all selected files and folders. It removes the archive attribute from the backed up files and folders. A normal backup is a full, complete backup — it is the backbone of your backup plan or strategy.
- **Copy:** A copy backup backs up all selected files and folders. It does not remove or otherwise affect the archive attribute. The copy backup can be performed without disrupting the normal backup schedule, because it does not affect the archive attribute. You could use a copy backup to create an extra backup to store off-site.
- **Incremental:** An incremental backup backs up all selected files and folders that have changed since the last normal or incremental backup. An incremental backup removes the archive attribute from the backed up files and folders. An incremental backup is not cumulative — it contains only the changes made since the last normal or incremental backup. If a normal backup is performed

on Sunday, and incremental backups are performed Monday through Friday, Monday's incremental backup will contain all changes made to data on Monday, Tuesday's incremental backup will contain all changes made to data only on Tuesday, Wednesday's incremental backup will contain all changes made to data only on Wednesday, and so on. Because less data is backed up, an incremental backup takes less time to perform than a normal backup, and also takes less time to perform than a differential backup.

- **Differential:** A differential backup backs up all selected files and folders that have changed since the last normal backup. A differential backup does not remove the archive attribute from any files and folders. A differential backup is a cumulative backup since the last normal backup. Because the differential backup does not remove the archive attribute, if a normal backup is performed on Sunday, and differential backups are performed Monday through Friday, Monday's differential backup will contain all changes made to data on Monday; Tuesday's differential backup will contain all changes made to data on Monday and Tuesday; Wednesday's differential backup will contain all changes made to data on Monday, Tuesday, and Wednesday, and so on. A differential backup is often used in between normal backups, because it takes less time to perform a differential backup than a normal backup.
- **Daily:** A daily backup backs up all selected files and folders that have changed during the day the backup is made. It does not remove or otherwise affect the archive attribute.

Companies often use a combination of the standard backup types in their backup strategy.

Backup Strategies

There are a number of acceptable backup strategies, and three fairly common ones:

- **Perform a normal backup every day.** This is the most time-consuming of the three common strategies in terms of the time required to perform backups. However, should a restore be necessary, only the last normal backup is required, and restore time is greatly less than either of the other two strategies.

- **Perform a weekly normal backup and daily differential backups.** As the week progresses, the time required to perform the differential backups increases. However, should a restore be necessary, only two backup sets will be needed — the most recent normal backup, and the most recent differential backup. (This is because the most recent differential backup contains all files and folders that have changed since the last normal backup.) The restore can be accomplished relatively quickly.
- **Perform a weekly normal backup and daily incremental backups.** Incremental backups tend to take about the same amount of time each day, and are considered the fastest backup method. However, should a restore be necessary, multiple backup sets will be required — the most recent normal backup, and every incremental backup since the most recent normal backup. (This is because the incremental backups eachcontain different data and are not cumulative.) The restore will typically take more time than if a differential backup had been used.

When planning your backup strategy, the big trade-off you need to consider is time — the time it takes to perform backups versus the time it takes to restore data.

Security Considerations

When planning your company's backup strategy, there are a few security considerations to take into account:

- If the data is of a sensitive nature, consider physically securing the tape drive and the backup tapes in a locked room. While your server may require a password and permissions to access confidential data, when a backup tape is taken and restored on another server, your server's security measures are defeated.
- Consider rotating backup tapes to an off-site location. This can prevent or minimize data loss due to a single catastrophic event, such as a theft, fire, flood, or earthquake. Consider using a third-party company that will store your data tapes in a secure, climate-controlled environment.
- If you store backup tapes in a fireproof safe, remember that fireproof doesn't necessarily mean that heat or smoke can't destroy the data on magnetic tapes. Make sure the safe is capable of protecting magnetic media as well as papers and other important items.

- Finally, depending on your organization's security needs, consider who should perform backups. In very high-security environments, consider allowing only administrators to perform backups. In medium- to low-security situations, consider separating the backup and restore functions by designating certain personnel to perform only backups, and other employees to perform only restores.

Tape Rotation

Most organizations rotate their magnetic tapes in order to reduce the cost of backups. Instead of using a new tape every day, tapes are reused in a systematic manner.

There are probably almost as many tape rotation methods as there are network administrators. Consider the following tape rotation example, which is illustrated in Table 14-1.

TABLE 14-1 Sample Backup Tape Rotation Scheme

Monday	Tuesday	Wednesday	Thursday	Friday
Tape #1	Tape #2	Tape #3	Tape #4	Tape #5
Tape #1	Tape #2	Tape #3	Tape #4	Tape #6
Tape #1	Tape #2	Tape #3	Tape #4	Tape #7
Tape #1	Tape #2	Tape #3	Tape #4	Tape #8 – Archived

This example requires eight tapes for a four-week period. Tapes one through four are reused each week, with the Monday tape used again the following Monday, and so on. Depending on the amount of data backed up and the tape's capacity, the data from the previous backup can be appended or replaced. A different tape is used for the backup made each Friday, so that files that are deleted during the course of the previous weeks can be recovered. The eighth tape is permanently archived and removed from the tape rotation scheme.

When choosing a tape rotation method, consider the following:

- **The useful life of a tape:** Tapes need to be eventually removed from the rotation scheme and replaced with new tapes. The number of times a magnetic tape can be reused depends on the tape's quality and storage conditions.

- **Tape cost versus the cost of lost data:** Some tapes are guaranteed for life—but only for the cost of the tape. The cost of lost data is not guaranteed.
- **Archiving tapes:** Removing a tape from the rotation schedule weekly, monthly, or quarterly is a good way to provide a permanent, long-term archive of your company's data. These tapes are often stored off-site for disaster recovery purposes (such as in the case of a fire).

Documenting Backups

Documenting your backups will make restoring after a failure a much easier task. Consider keeping a backup log book that documents each backup procedure performed. You should record the date and time the backup was performed, a brief description of the data backed up, the name of the person who performed the backup, the tape number used, and its storage location. You can also include a detailed or summarized printed log of the backup. If you have this information readily available, the person performing the restore will be able to quickly identify and locate the most recent backup tape(s) needed.

Speaking of logs, most backup programs can be configured to create detailed logs that list the individual files and folders backed up. These logs can be quite helpful if a user tells you that he or she has accidentally deleted an important file, and asks you to restore it from tape. A log (either printed, or written to a file on a disk) will enable you to locate the appropriate tape needed to restore the file quickly and easily.

Using Backup to Perform a Backup

Windows 2000 ships with a backup program called Backup. Backup is a basic tape backup program that gives you full capability to back up and restore a Windows 2000 computer, including user data on local and network drives, and System State data on the local computer.

EXAM TIP

You can't use Backup to back up or restore System State data on a remote Windows 2000 computer. In other words, you can't back up or restore System State data over the network. Keep this in mind when you take the exams.

You can use Backup to back up files and folders to a local disk, a network drive, or a tape device. I recommend you ensure that your tape drive is listed on the Windows 2000 Hardware Compatibility List (HCL) and that it has enough capacity to back up your entire server on a single tape. This is a big help, especially if you perform unattended tape backups.

Before you perform a tape backup, make sure that you have the appropriate permissions and user rights to perform a backup. To perform a backup, you need to be a member of the Administrators or Backup Operators groups, or you need to have the "Back up files and directories" user right assigned to you. If you are backing up a Windows 2000 domain controller, members of the Server Operators group also have the necessary permissions to back up files and folders on this computer.

Consider the time of day when performing backups. Because of the use of processor and memory during backups, it's normally best to perform this task during the periods of lowest server and network usage — often during nonbusiness hours.

Backup provides you with two different methods to perform a backup. You can either use the Backup Wizard, or you can manually configure a backup on the Backup tab.

STEP BY STEP

PERFORMING A BACKUP BY USING THE BACKUP WIZARD

1. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
2. The Backup dialog box appears, as shown in Figure 14-1. Notice the three buttons in this dialog box: Backup Wizard, Restore Wizard, and Emergency Repair Disk. Click the button next to Backup Wizard.
3. The Backup Wizard starts. Click Next.
4. In the What to Back Up screen, select the types of data you want to back up. Options available include:
   - ► Back up everything on my computer
   - ► Back up selected files, drives, or network data
   - ► Only back up the System State data

   Select the appropriate option and click Next.
5. Depending on the option you selected in Step 4, an "Items to Back Up screen" may appear. In this screen, select the check boxes next to the drives, files, or folders you want to back up. Click Next.

STEP BY STEP *Continued*

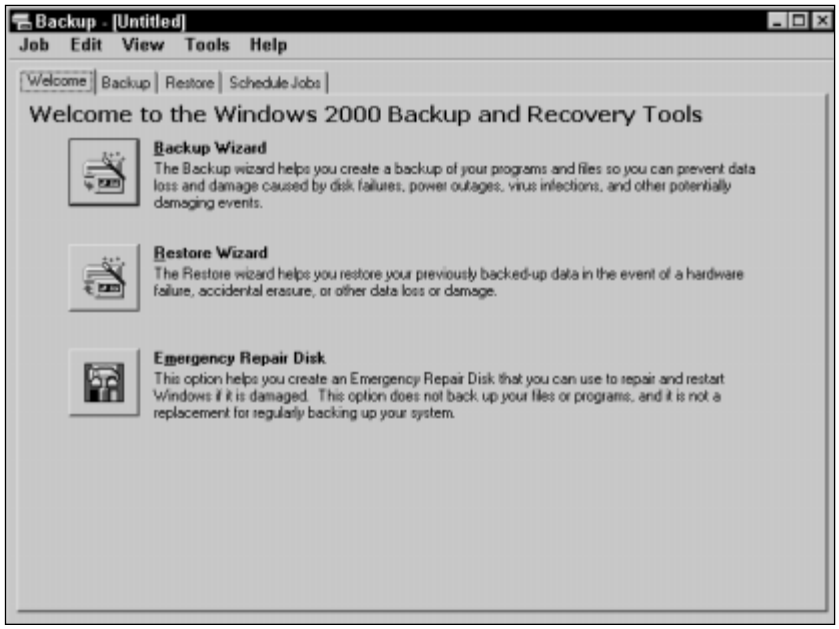

FIGURE 14-1 The opening Backup dialog box

6. In the Where to Store the Backup screen, select the backup media type you want to use for this backup from the "Backup media type" drop-down list box. Media types include files and any tape devices installed and configured on your Windows 2000 computer.

   Then, if you selected a backup media type of file, in the "Backup media or file name" text box, either accept the default path or type in a complete path to the file that will contain your backup data. You can browse for this file if you want to.

   If you selected a specific tape drive in the "Backup media type" drop-down list box, select the specific media you want to use in the "Backup media or file name" drop-down list box.

   Click Next.

7. The Completing the Backup Wizard screen appears. If you are finished configuring your backup, click Finish and skip to Step 14.

   If you want to configure advanced backup options, such as the type of backup, click Advanced.

8. If you clicked Advanced, the Type of Backup screen appears. In this screen, select the type of backup you want to perform. Available options include: Normal, Copy, Incremental, Differential, and Daily. Click Next.

STEP BY STEP *Continued*

9. In the How to Back Up screen, you can configure Backup to verify your data after it is backed up, to use your tape device's hardware compression capabilities, if any, or both. If you select the check box next to "Verify data after backup," this will approximately double the time it takes to perform the backup. Select the appropriate option(s), and click Next.
10. In the Media Options screen, you can specify whether Backup will append the data in this backup to the data already contained on the backup tape or file, or whether Backup will replace (overwrite) the data on the tape or file with this backup. Select the appropriate option and click Next.
11. In the Backup Label screen, either accept the default backup and media labels, or type in different backup and media labels to meet your needs. Click Next.
12. In the When to Back Up screen, you configure whether the backup will run now or at a later time. If you select the "Later" option, you can schedule the backup to start at the date and time you choose. Select and configure the appropriate option, and click Next.
13. In the Completing the Backup Wizard screen, click Finish.
14. If you configured the backup to run now, Windows 2000 performs the backup. At the completion of the backup, a Backup Progress dialog box is displayed, as shown in Figure 14-2. Notice that various backup statistics are displayed, and that you can choose to view a report containing even more detailed information about the backup.

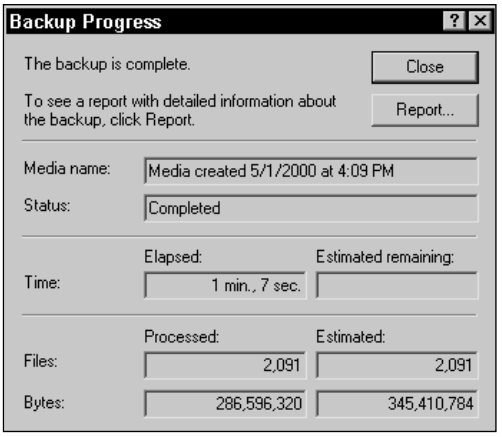

FIGURE 14-2 The Backup Progress dialog box

STEP BY STEP *Continued*

If you want to view the backup report, click Report. Close Notepad when you finish viewing the report.

Click Close.

15. Close Backup.

If you're comfortable using the Backup user interface, you may decide to configure backups manually instead of using the Backup Wizard. I'll show you how to manually configure a backup in the steps that follow.

STEP BY STEP

MANUALLY CONFIGURING A BACKUP

1. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
2. In the Backup dialog box, click the Backup tab.
3. The Backup tab appears, as shown in Figure 14-3. Notice the check box next to System State.

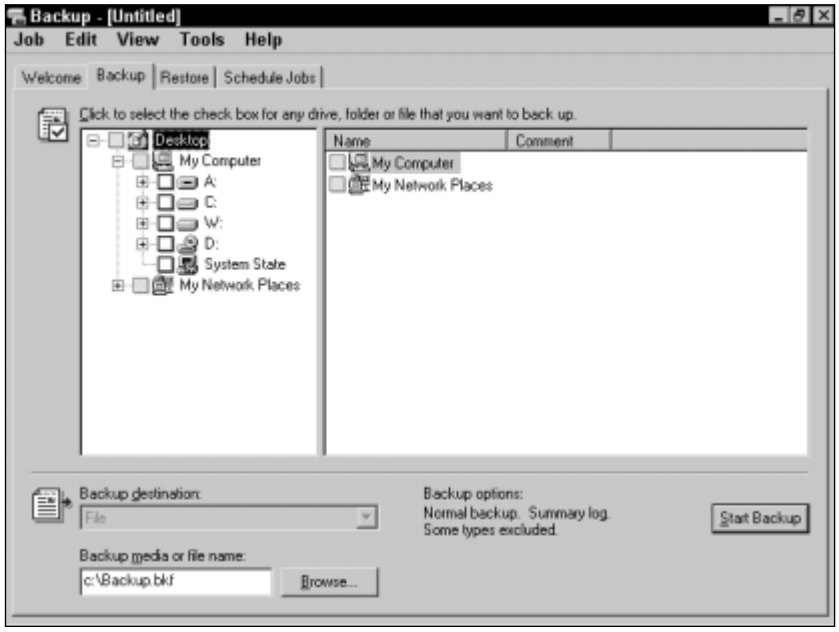

FIGURE 14-3 The Backup tab

STEP BY STEP *Continued*

On this tab, select the check box next to the drives, files, and folders you want to back up. You can expand drives and folders as necessary by clicking the + next to the drive or folder.

Next, select the destination for this backup from the "Backup destination" drop-down list box. Destinations include File and any tape devices installed and configured on your Windows 2000 computer.

Then, if you selected a backup destination of File, in the "Backup media or file name" text box, either accept the default path or type in a complete path to the file that will contain your backup data. You can browse for this file if you want to.

If you selected a specific tape drive in the "Backup destination" drop-down list box, select the specific media you want to use in the "Backup media or file name" drop-down list box.

4. On the Backup tab, view the Backup options displayed. If you want to modify any of these options, select Tools ➪ Options.
5. The Options dialog box appears. This dialog box contains five tabs: General, Restore, Backup Type, Backup Log, and Exclude Files. You can use these tabs to customize your backup. Make the appropriate configurations, then click OK.
6. In the Backup dialog box, click Start Backup.
7. The Backup Job Information dialog box appears, as shown in Figure 14-4. Notice that you can schedule the backup, configure advanced backup options, enter a backup description, choose whether to append or replace data on the backup tape, and start the backup in this dialog box.

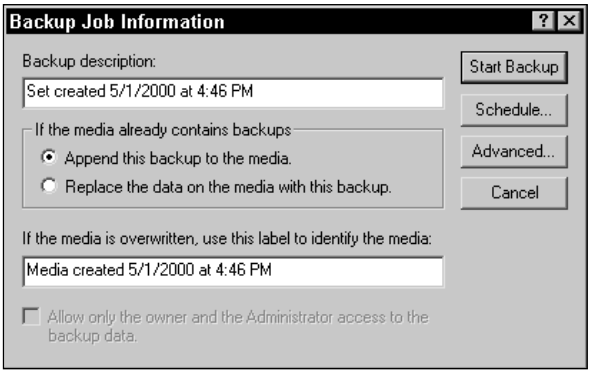

FIGURE 14-4 Configuring backup job information

Configure the appropriate options, and either click Start Backup or Schedule, as appropriate.

Scheduling Backups

Not only can you schedule an individual backup when you configure it, you can use the Schedule Jobs tab in Backup to view the backup schedule and to schedule periodic backups on your Windows 2000 computer.

The Schedule Jobs tab enables you to automate the implementation of your company's backup strategy.You can use this tool to schedule recurring unattended normal, incremental, differential, and other types of backups. The Schedule Jobs tab is fairly straightforward to use.

STEP BY STEP

SCHEDULING A BACKUP

1. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
2. In the Backup dialog box, click the Schedule Jobs tab.
3. The Schedule Jobs tab appears, as shown in Figure 14-5. Notice that no jobs appear yet on the schedule.

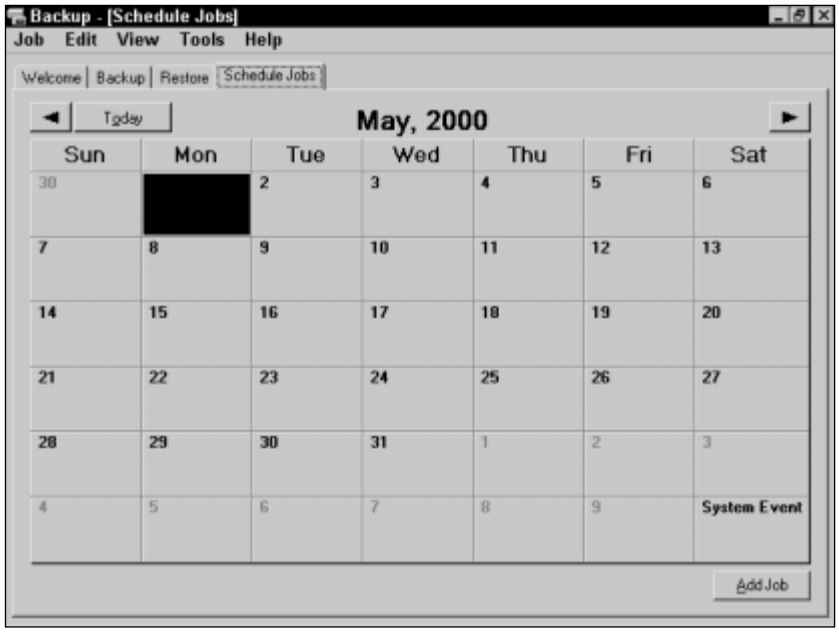

FIGURE 14-5 The Schedule Jobs tab

If you have already scheduled jobs, you can view them on this schedule.

To add a job to the schedule, click Add Job.

STEP BY STEP *Continued*

4. The Backup Wizard starts. Follow the instructions presented on-screen to schedule one or more periodic backups. (Detailed instructions on using this wizard were presented in the step-by-step section titled " Performing a Backup by Using the Backup Wizard" earlier in this chapter.)
5. Once you've scheduled one or more backups, these jobs appear on the Schedule Jobs tab. Close Backup.

Using Backup to Create an Emergency Repair Disk

You can also use Backup to create an Emergency Repair Disk. An *Emergency Repair Disk* is a floppy disk used to repair Windows 2000 system files that become accidentally corrupted or erased due to viruses or other causes. An Emergency Repair Disk is primarily used to repair and restart a Windows 2000 computer that won't boot. I'll cover how to use an Emergency Repair Disk later in this chapter, but before you can use one, you have to create it.

To create an Emergency Repair Disk, you'll need one blank, formatted floppy disk.

STEP BY STEP

CREATING AN EMERGENCY REPAIR DISK

1. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
2. In the Backup dialog box, click the Emergency Repair Disk button.
3. The Emergency Repair Diskette dialog box appears. By default, the computer's registry is not copied to the Emergency Repair Disk, nor to the computer's `repair` folder, which is located in *`SystemRoot`*`\repair`. If you want the registry to be copied to the computer's `repair` folder (and I recommend that you do so), select the check box in this dialog box.

TIP

Unlike Windows NT 4.0, in Windows 2000 the computer's registry is *never* copied to the Emergency Repair Disk.

Insert a blank, formatted floppy disk into your computer's `A:` drive and click OK.

STEP BY STEP *Continued*

4. Windows 2000 creates the Emergency Repair Disk. After the Emergency Repair Disk is successfully created, remove it from the computer's `A:` drive and store it in a safe place. Click OK in the Emergency Repair Diskette dialog box.
5. Close Backup.

Recovering User Data and System State Data

Hopefully, you'll never have to restore files and folders after a catastrophic data loss. Nevertheless, it's a good practice to be comfortable with the process of restoring data to your system, just in case.

For this reason, and also to ensure that your backup tapes contain valid copies of your data files, you should periodically test your backup by performing a trial restore. A trial restore involves restoring at least one folder that contains several data files to a *different* folder than it was originally backed up from. The folder you restore is a test folder, and probably shouldn't contain files that are critical to your operations. For example, you could restore the `D:\Public` folder to `D:\Public2` or to `E:\Public2`. The trial restore process verifies that the tape can be read, and that files and folders can be restored from it.

Once you've performed a trial restore of your test folder, you should compare its contents with the contents of the original folder on your computer's hard disk. To determine whether the files in the two folders are identical, you can use the `comp.exe` command-line utility. If there are no differences between the files in the two folders, then presumably all of the files on the backup tape are valid and not corrupt.

The same Backup program you used to back up data on your Windows 2000 computer is also used to restore data. In order to restore data, you need to be a member of the Administrators or Backup Operators groups, or you need to have the "Restore files and directories" user right assigned to you. If you're restoring data on a Windows 2000 domain controller, members of the Server Operators group also have the necessary permissions to restore files and folders on this computer.

In the following sections I'll explain how to use Backup to restore user data, System State data, and the Active Directory data store.

Using Backup to Restore User Data

You can use Backup to perform a full or partial restore of user data from a backup created by using Backup. You can restore user data to both local and network drives.

Backup provides you with two different methods to perform a restore. You can either use the Restore Wizard, or you can manually configure a restore on the Restore tab.

STEP BY STEP

RESTORING USER DATA BY USING THE RESTORE WIZARD

1. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
2. In the Backup dialog box, click the Restore Wizard button.
3. The Restore Wizard starts. Click Next.
4. In the What to Restore screen, select the check boxes next to the drives, files, or folders you want to restore. Click Next.
5. The Completing the Restore Wizard screen appears. If you are finished configuring your restore, click Finish and skip to Step 10.

   If you want to configure advanced restore options, such as the location to which files should be restored, click Advanced.
6. In the Where to Restore screen, select the location to which you want the selected files and folders to be restored. Available options include "Original location," "Alternate location," or "Single folder." The default option is "Original location." Select the appropriate option.

   If you select an option other than "Original location," you also need to specify a complete path to the desired restoration location in the "Alternate location" text box. Click Next.
7. In the How to Restore screen, select from one of the three options for restoring a file that already exists in the restoration location:
   - ► Do not replace the file on my disk (recommended and default option)
   - ► Replace the file on disk only if it is older than the backup copy
   - ► Always replace the file on disk

   Click Next.

STEP BY STEP *Continued*

8. In the Advanced Restore Options screen, select one or more of the appropriate options:
   - ▶ Restore security
   - ▶ Restore Removable Storage database
   - ▶ Restore junction points, not the folders and file data they reference

   Click Next.
9. In the Completing the Restore Wizard screen, click Finish.
10. If you are restoring from a file, the Enter Backup File Name dialog box appears. If this dialog box appears, ensure that the name of the file that contains the backup you want to restore from is displayed in the "Restore from backup file" text box. You can browse for this file if you need to. Click OK.
11. Windows 2000 performs the restore. At the completion of the restore, a Restore Progress dialog box is displayed. This dialog box displays various restore statistics.

    The Restore Progress dialog box also has an option that enables you to view a report on the restore. To view this report, click Report. Close Notepad when you finish viewing the report.

    Click Close.
12. Close Backup.

Using Backup to Restore System State Data

In addition to restoring user data, you can also use Backup to restore System State data from a backup created by using Backup. Remember, you can only restore System State data on the local computer. You can't restore System State data over the network to a remote Windows 2000 computer.

Restoring System State data is an all-or-nothing proposition. Unlike restoring user data, you can't pick and choose which parts of System State data will be restored.

Restoring System State data returns your Windows 2000 computer to the state it was in when the System State data was backed up. Any changes you have made to the system will be lost.

CAUTION

Only restore System State data when you have to. Typically, this is a last-resort measure that is only used when all other attempts to correct a damaged Windows 2000 system configuration (including using Safe Mode and the Emergency Repair Disk) have failed.

Restoring System State Data on Nondomain Controllers

Restoring System State data is fairly straightforward. However, there are some differences in the process, depending on which computer on your network you're restoring System State data to. First, I'll take a look at how to restore System State data on a Windows 2000 computer that is *not* a domain controller. (A bit later in this chapter, I'll cover how to restore System State data, including the Active Directory data store, on domain controllers.)

STEP BY STEP

RESTORING SYSTEM STATE DATA ON A NONDOMAIN CONTROLLER

1. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
2. In the Backup dialog box, click the Restore Wizard button.
3. The Restore Wizard starts. Click Next.
4. In the "What to Restore" screen, expand components in the left pane until System State is displayed. Select the check box next to System State, as shown in Figure 14-6. Click Next.

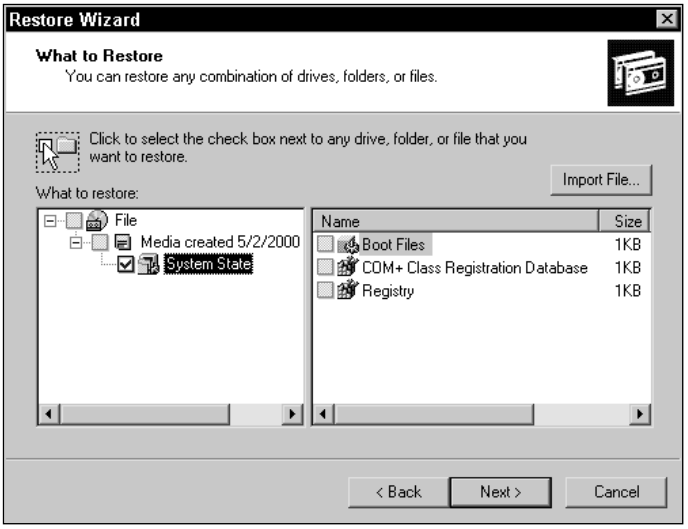

FIGURE 14-6 Restoring System State data

STEP BY STEP *Continued*

5. The Completing the Restore Wizard screen appears. If you want to configure advanced restore options, such as the location to which the System State data should be restored, click Advanced. (For information on how to configure Advanced options, see Steps 6 through 8 in the step-by-step section titled "Restoring User Data by Using the Restore Wizard" earlier in this chapter.) Otherwise, click Finish.
6. If you are restoring from a file, the "Enter Backup File Name" dialog box appears. If this dialog box appears, ensure that the name of the file that contains the backup you want to restore from is displayed in the "Restore from backup file" text box. You can browse for this file if you need to. Click OK.
7. Windows 2000 performs the restore of System State data. At the completion of the restore, a Restore Progress dialog box is displayed. This dialog box displays various restore statistics.

   The Restore Progress dialog box also has an option that enables you to view a report on the restore. To view this report, click Report. Close Notepad when you finish viewing the report.

   Click Close.
8. A Backup warning dialog box appears, indicating that you must shut down and restart your computer to complete the restore. Click Yes.

Restoring System State Data on Domain Controllers

Because System State data includes the Active Directory data store on a Windows 2000 domain controller, restoring System State data on a domain controller includes restoring Active Directory.

There are two types of restores you can perform of Active Directory:

- **Nonauthoritative restore of Active Directory:** This is a full restore of System State data, including Active Directory, on a Windows 2000 domain controller. When this type of restore is performed, Active Directory entries on other domain controllers (that are more recent than the corresponding entries that have been restored from backup) will replace the restored entries when replication of Active Directory occurs. You should use this type of restore when you only have one domain controller on your network, or when you are primarily concerned with restoring the *other* components of System State data, such as the registry and system boot files, and you don't want to overwrite the more

recent copy of Active Directory located on other domain controllers on your network.

- **Authoritative restore of Active Directory:** Like a nonauthoritative restore, this is also a full restore of System State data, including Active Directory, on a Windows 2000 domain controller. After the restore is completed, however, an additional step is required. Some or all of the restored Active Directory objects are marked as being authoritative. During this process, the objects' attribute version numbers are increased. When this type of restore is performed, the restored Active Directory entries that are marked as authoritative will replace the corresponding Active Directory entries on other domain controllers on your network when replication of Active Directory occurs. You should use this type of restore when the Active Directory data store on your network's domain controllers is damaged, or when a portion of Active Directory has been accidentally deleted.

So, whether you decide to perform a nonauthoritative or an authoritative restore of Active Directory, the first step will be to perform a restore of System State data on your domain controller. I'll show you how to perform this task in the steps that follow.

TIP

In order to restore System State data on a domain controller, which includes the Active Directory data store, you'll need the Administrator's password that was entered in the "Directory Services Restore Mode Administrator Password" screen during the installation of Active Directory.

STEP BY STEP

RESTORING SYSTEM STATE DATA, INCLUDING ACTIVE DIRECTORY

1. Shut down and restart the domain controller. During the boot process, press F8.
2. On the Windows 2000 Advanced Options Menu, select Directory Services Restore Mode and press Enter.
3. If you have more than one operating system installed on this computer, select Microsoft Windows 2000 Server and press Enter.
4. Windows 2000 Server boots in Safe Mode – Directory Services Repair. Press Ctrl+Alt+Delete.

STEP BY STEP *Continued*

5. In the Log On to Windows dialog box, accept the default user name of administrator. Enter the Administrator's password that was entered in the "Directory Services Restore Mode Administrator Password" screen during the installation of Active Directory. (This is probably not the current Administrator's password.) Click OK.
6. A Desktop warning message appears, indicating that Windows is running in Safe Mode. Click OK.
7. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
8. In the Backup dialog box, click the Restore Wizard button.
9. The Restore Wizard starts. Click Next.
10. In the "What to Restore" screen, expand components in the left pane until System State is displayed. Select the check box next to System State. Click Next.
11. The Completing the Restore Wizard screen appears. If you want to configure advanced restore options, such as the location to which the System State data should be restored, click Advanced. (For information on how to configure Advanced options, see Steps 6 through 8 in the step-by-step section titled "Restoring User Data by Using the Restore Wizard" earlier in this chapter.) Otherwise, click Finish.
12. If you are restoring from a file, the Enter Backup File Name dialog box appears. If this dialog box appears, ensure that the name of the file that contains the backup you want to restore from is displayed in the "Restore from backup file" text box. You can browse for this file if you need to. Click OK.
13. Windows 2000 performs the restore of System State data, including Active Directory. At the completion of the restore, a Restore Progress dialog box is displayed. This dialog box displays various restore statistics, and contains an option that enables you to view a report on the restore. To view this report, click Report. Close Notepad when you finish viewing the report. Click Close.
14. A Backup warning dialog box appears, indicating that you must shut down and restart your computer to complete the restore.

    If you are performing a nonauthoritative restore of Active Directory, click Yes. Reboot the domain controller normally.

    If you are performing an authoritative restore of Active Directory, click No, close Backup, and complete the steps listed in the next section.

CAUTION

Don't reboot the domain controller now if you're performing an authoritative restore—if you do, you'll have to do the restore all over again before you can mark objects.

So, as the previous steps point out, if you're performing a nonauthoritative restore of Active Directory, your work is done. However, if you're performing an authoritative restore of Active Directory, you'll need to use the `ntdsutil.exe` command-line utility to mark some or all of the restored Active Directory objects as being authoritative. The next set of steps explains how to accomplish this task.

STEP BY STEP

MARKING RESTORED ACTIVE DIRECTORY OBJECTS AS AUTHORITATIVE

1. After performing a restore of System State data on your domain controller, but *before* rebooting the computer, select Start ➪ Programs ➪ Accessories ➪ Command Prompt.
2. In the Command Prompt dialog box, at the command prompt, type **ntdsutil** and press Enter.
3. At the `ntdsutil:` prompt, type **authoritative restore** and press Enter.
4. To restore the entire Active Directory data store, at the `authoritative restore:` prompt, type **restore database** and press Enter.

   Or, to restore a portion of the Active Directory data store, at the `authoritative restore:` prompt, type

   ```
   restore subtree OU=OU_name,DC=domain_name,DC=root_domain
   ```

   and press Enter. For example, to restore only an OU named London in a domain named `domain2.com`, you would type

   ```
   restore subtree OU=London,DC=domain2,DC=com
   ```

5. In the Authoritative Restore Confirmation Dialog box, click Yes.
6. Windows 2000 marks the objects you selected by increasing their attribute version numbers. At the `authoritative restore:` prompt, type **quit** and press Enter.
7. At the `ntdsutil:` prompt, type **quit** and press Enter.
8. At the command prompt, type **exit** and press Enter.
9. Shut down the domain controller, and restart it normally.

For additional syntax information on the `ntdsutil.exe` command-line utility, type **help** at any `ntdsutil` prompt in the Command Prompt dialog box.

Recovering from a System Failure

When you can't get a Windows 2000 computer to boot, you've got a system failure on your hands. If the computer that won't boot has any importance at all in your organization, your plans for the day have just been changed. Unfortunately, recovering from a system failure is a difficult — and sometimes impossible — task.

There are several tools you can use to attempt to recover from a Windows 2000 system failure. In this section I'll explain how to use three Windows 2000 tools: Safe Mode, the Recovery Console, and the Emergency Repair Disk. Sometimes these tools will enable you to quickly restore your system, and sometimes they won't. If you are unable to recover your Windows 2000 system by using these tools, you can try restoring System State data on the computer experiencing the problem. If that doesn't work, you'll probably have to reinstall Windows 2000 on the computer, and then restore all user and System State data from a backup. You do have a backup, don't you?

Before you use any of these tools to recover from a system failure, make sure you're not really dealing with a hardware problem in the computer. I recommend you use your computer manufacturer's hardware diagnostics to rule out hardware problems first. You don't really want to reconfigure your operating system if your problem is an overheated processor.

Using Safe Mode to Troubleshoot and Restore a System

Safe Mode is a special startup mode of Windows 2000 that uses default settings and the minimum number of files and device drivers required to start Windows 2000. If a Windows 2000 computer won't boot normally, you may be able to boot it in Safe Mode.

When you boot a Windows 2000 computer in Safe Mode, there are several versions of Safe Mode you can choose from:

- **Safe Mode:** This is the basic, bare-bones version of Safe Mode.
- **Safe Mode with Networking:** This is regular Safe Mode plus the services and drivers required to start networking.
- **Safe Mode with Command Prompt:** This is regular Safe Mode except that when the computer boots in this mode, the computer starts at a command prompt, rather than at the Windows 2000 desktop.

Safe Mode can be helpful when you are troubleshooting a Windows 2000 computer. For example, if a computer's problem does not occur when you start the computer in Safe Mode, you can rule out the default Windows 2000 settings and minimum drivers as causes of that problem.

Safe Mode can also be used to restore a system. For example, suppose that a newly installed device or a recently updated driver is causing a problem. You can start the computer in Safe Mode, and then uninstall the device or reverse the change you previously made to the device driver.

Finally, Safe Mode isn't helpful if the files required to boot Windows 2000 are accidentally deleted or damaged, although the Emergency Repair Disk (covered later in this chapter) might be.

STEP BY STEP

BOOTING A WINDOWS 2000 COMPUTER IN SAFE MODE

1. Start the Windows 2000 computer. During the boot process, press F8.
2. On the Windows 2000 Advanced Options Menu, select Safe Mode (or Safe Mode with Networking, or Safe Mode with Command Prompt) and press Enter.
3. If you have more than one operating system installed on this computer, select the operating system you want to start in Safe Mode and press Enter.
4. Windows 2000 boots in Safe Mode. Press Ctrl+Alt+Delete.
5. In the Log On to Windows dialog box, enter your user name and password for this computer.

TIP

If this computer is a domain controller, you must log on as Administrator and enter the Administrator's password that was entered in the "Directory Services Restore Mode Administrator Password" screen during the installation of Active Directory. (This is probably not the current Administrator's password.)

Click OK.

6. A Desktop warning message appears, indicating that Windows is running in Safe Mode. Click OK.
7. The Windows 2000 desktop is displayed.

Once you've started a Windows 2000 computer in Safe Mode, you can use Windows 2000 applications and tools to diagnose and correct your computer's problem. For example, you can use Control Panel applications, such as the Add/Remove Hardware application and Device Manager (a component of the System application) to diagnose and resolve hardware, hardware configuration, and device driver problems. You can also use the various Troubleshooters in Help to aid you in diagnosing the problem.

TIP

Because only the minimum files and drivers are used when Windows 2000 boots in Safe Mode, don't be surprised when many services and devices don't work. For example, in regular Safe Mode you won't be able to access any network resources.

After you've resolved your Windows 2000 computer's problem in Safe Mode, shut down the computer and try restarting it normally.

Another option to consider, instead of selecting Safe Mode, is selecting the Last Known Good Configuration from the Windows 2000 Advanced Options Menu when you start your Windows 2000 computer. This configuration boots Windows 2000 by using the registry settings that were saved the last time you successfully logged on to the computer. This option can be useful when you need to reverse a configuration change you made the last time you were logged on. You should be aware, however, that all changes made to the computer's configuration during the last logon session will be lost.

Using the Recovery Console to Restore a System

The Windows 2000 *Recovery Console* is a limited version of the Windows 2000 operating system that only has a command-line interface. Consider using the Recovery Console when you aren't able to resolve a computer's problem by using Safe Mode or the Emergency Repair Disk. The Recovery Console is helpful when you need to manually start or stop a service, repair the master boot record, or manually copy files from a floppy disk or compact disc to the computer's hard disk to restore a system.

CAUTION

Only experienced system administrators with extensive troubleshooting and diagnostic skills should use the Recovery Console because it's easy to damage critical operating system files and because the Recovery Console's interface is not particularly user-friendly.

There are two ways you can start the Recovery Console. You can boot the computer from the Windows 2000 compact disc and select Recovery Console from the menu that appears; or, if the Recovery Console has been installed in the computer's boot menu, you can select the Recovery Console option from the boot loader menu when the computer starts.

You need to log on as Administrator to use the Recovery Console.

STEP BY STEP

STARTING THE RECOVERY CONSOLE BY BOOTING FROM THE WINDOWS 2000 CD

1. Place the Windows 2000 compact disc in your Windows 2000 computer's CD-ROM drive. Start the computer and boot from the compact disc.
2. If your compact disc contains an evaluation version of Windows 2000, when prompted, press Enter to continue.
3. The Welcome to Setup screen appears. Press R.
4. In the Windows 2000 Repair Options screen, press C to start the Recovery Console.
5. The Recovery Console starts. If you have more than one Windows 2000 installation on your computer, type in the number of the installation you want to repair and press Enter.
6. When prompted, type the Administrator password (this is the password for the Administrator on the local computer) and press Enter.

TIP

If this computer is a domain controller, type the Administrator's password that was entered in the "Directory Services Restore Mode Administrator Password" screen during the installation of Active Directory and press Enter.

7. Use the appropriate Recovery Console commands to perform the necessary system repairs.
8. To quit the Recovery Console, at the command prompt, type **exit** and press Enter.
9. Remove the Windows 2000 compact disc and start the computer normally.

Many of the commands available in the Recovery Console are identical to MS-DOS commands. For a complete list of the commands available for use in the Recovery Console, at the Recovery Console command prompt, type **help** and press Enter. For information about a specific command, at the Recovery Console command prompt, type **help** *command_name* and press Enter. For example, to get more information on the `fixmbr` command, at the command prompt, type **help fixmbr** and press Enter.

There is an easier way to access the Recovery Console, but you have to think about it ahead of time—*before* your computer has a problem that renders it unbootable. You can add the Recovery Console to the boot menu of a healthy Windows 2000 computer. Then, if at some later point a problem arises and you need it, you can easily select it from the computer's boot loader menu.

STEP BY STEP

ADDING THE RECOVERY CONSOLE TO THE BOOT MENU

1. Place your Windows 2000 compact disc into your computer's CD-ROM drive. Close the Microsoft Windows 2000 CD dialog box.
2. Select Start ➪ Programs ➪ Accessories ➪ Command Prompt.
3. In the Command Prompt dialog box, at the command prompt, type in the drive letter of your CD-ROM drive followed by a colon (for example, `D:`) and press Enter.
4. At the command prompt, type **cd \i386** and press Enter.
5. At the command prompt, type **winnt32 /cmdcons** and press Enter.
6. A Windows 2000 Setup dialog box appears, as shown in Figure 14-7.

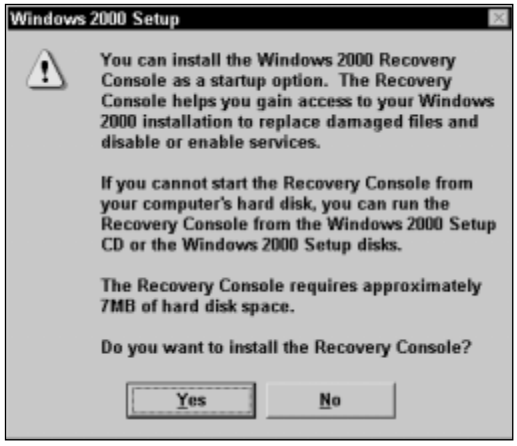

FIGURE 14-7 Installing the Recovery Console as a startup option

STEP BY STEP *Continued*

Click Yes to install the Recovery Console as an option in the boot loader menu.

7. A Windows 2000 Setup wizard starts and installs the Recovery Console. When the installation is complete, a Microsoft Windows 2000 [Server or Professional] Setup dialog box appears, notifying that the Recovery Console has been successfully installed. Click OK.
8. At the command prompt, type **exit** and press Enter.

Using the Emergency Repair Disk to Restore a System

An Emergency Repair Disk is a floppy disk used to restore Windows 2000 system files that become accidentally corrupted or erased due to viruses or other causes. Earlier in this chapter I explained how to create an Emergency Repair Disk, and in this section I'll show you how to use it.

An Emergency Repair Disk is primarily used to repair and restart a Windows 2000 computer that won't boot. In particular, an Emergency Repair Disk is useful for repairing damaged Windows 2000 operating system files and the partition boot sector. You can't use an Emergency Repair Disk to repair the registry or other System State data.

TIP

You need to create the Emergency Repair Disk on your Windows 2000 computer when it's functioning properly. If you don't think about making an Emergency Repair Disk *before* you have a problem, you'll be out of luck, because you can't create one on a computer that won't start.

You should only use an Emergency Repair Disk to repair the computer on which it was created. If you attempt to use an Emergency Repair Disk to repair another computer, changes to the computer's configuration and startup files (`AUTOEXEC.NT` and `CONFIG.NT`) may occur. In addition, the disk may not contain the information needed to successfully repair the computer.

STEP BY STEP

PERFORMING THE EMERGENCY REPAIR PROCESS

1. Place the Windows 2000 compact disc in your Windows 2000 computer's CD-ROM drive. Start the computer and boot from the compact disc.
2. If your compact disc contains an evaluation version of Windows 2000, when prompted, press Enter to continue.
3. The Welcome to Setup screen appears. Press R.
4. In the Windows 2000 Repair Options screen, press R to start the emergency repair process.
5. In the Windows 2000 Professional Setup screen, select from one of two options:
   - **Manual Repair:** To choose from a list of repair options, press M.
   - **Fast Repair:** To perform all repair options, press F and skip to Step 7.
6. In the next screen, select one or more of the following repair tasks:
   - **Inspect startup environment**
   - **Verify Windows 2000 system files**
   - **Inspect boot sector**

   All three tasks are selected by default. When you finished making your selections, highlight "Continue (perform selected tasks)" and press Enter.
7. When prompted, insert your Windows 2000 Emergency Repair Disk into drive `A:` and press Enter.
8. Windows 2000 performs the emergency repair process and replaces any damaged system files that it detects. When prompted, remove your Emergency Repair Disk from drive `A:`. Windows 2000 restarts your computer.

After you've performed the emergency repair process and restarted your Windows 2000 computer, you should reapply any Windows 2000 Service Packs that were previously installed on this computer.

Monitoring and Configuring Removable Media

I don't want to leave a chapter on backup and recovery without discussing how to monitor and configure removable media, such as tapes and optical discs.

Windows 2000 includes a management tool, called Removable Storage, which works in conjunction with your data-management programs, such as Backup. You can use Removable Storage to:

- Perform specific maintenance tasks, such as ejecting, preparing, mounting, and dismounting tapes and other removable media.
- Organize removable media into media pools, which can be accessed by all of the data-management programs on a Windows 2000 computer.
- Manage the removable media within a jukebox or a media changer.
- Configure the properties of removable media devices, including permissions.
- Configure a media library, or an individual drive or a cleaning cartridge within a media library.
- Monitor the various removable media tasks that have been completed by users, as well as tasks that are waiting in the work queue to be completed.
- Monitor the assignment of removable media to media pools and to specific applications.
- View all removable media associated with the Windows 2000 computer, whether this media is currently online or offline.

To access Removable Storage, from the desktop, right-click My Computer and select Manage from the menu that appears. Then, in the left pane of the Computer Management dialog box, expand Removable Storage and select the specific Removable Storage component you want to use.

Using Removable Storage is fairly straightforward, and, to a large degree, self-explanatory. The Removable Storage tool has a standard MMC user interface, which by now you've had a fair amount of experience with.

Because Removable Storage is included in Computer Management, you can use Removable Storage on the local computer, or you can connect to another computer and use Removable Storage to remotely manage removable media on another Windows 2000 computer on your network.

CAUTION

If you use Removable Storage as a part of your backup strategy, be sure to test it thoroughly to ensure that it is working correctly, and that you are getting the backups you want.

KEY POINT SUMMARY

This chapter introduced several important backup and recovery topics:

- User data includes application files and folders, operating system files and folders, and user-created files and folders.
- System State data includes critical operating system files, folders, and databases. The actual components of System State data vary depending on the Windows 2000 operating system you're using and the services installed on that operating system.
- Tape backup is an important part of your overall network fault tolerance plan. There are five standard backup types: Normal, Copy, Incremental, Differential, and Daily. A backup strategy often includes a combination of these backup types.
- The backup utility that ships with Windows 2000 is called Backup. You can use this program to perform backups, schedule backups, perform restores, and create an Emergency Repair Disk.
- An Emergency Repair Disk is a floppy disk used to repair Windows 2000 system files that become accidentally corrupted or erased due to viruses or other causes.
- You can back up and restore user data to both local and network drives. However, you can only back up and restore System State data on the local computer.
- In order to perform a backup (or restore) you need to be a member of the Administrators or Backup Operators groups, or have the "Back up files and directories" (or the "Restore files and directories") user right assigned to you. On a domain controller, members of the Server Operators group can also back up (and restore) files and folders.
- To restore the Active Directory data store, you must also have the Administrator's password that was entered during the installation of Active Directory.
- There are two types of restores you can perform of Active Directory: a nonauthoritative restore, and an authoritative restore.
- There are several Windows 2000 tools you can use to attempt to recover from a system failure, including: Safe Mode, the Recovery Console, and the Emergency Repair Disk.

- Removable Storage is a Windows 2000 management tool you can use to manage, monitor, and configure removable media associated with your Windows 2000 computer.

STUDY GUIDE

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

- **Assessment questions:** These questions test your knowledge of the backup and recovery topics covered in this chapter. You'll find the answers to these questions at the end of this chapter.
- **Scenarios:** The situation-based questions in scenarios challenge you to apply your understanding of the material to solve a hypothetical problem. In this chapter's scenarios, you are asked to analyze several situations involving backup and recovery-related topics. You don't need to be at a computer to do scenarios. Answers to this chapter's scenarios are presented at the end of this chapter.
- **Lab Exercises:** These exercises are hands-on practice activities that you perform on a computer. The lab in this chapter gives you an opportunity to practice numerous backup and recovery tasks.

Assessment Questions

1. You want to create an Emergency Repair Disk for your Windows 2000 computer. Which tool should you use?
   A. Windows 2000 Setup
   B. Backup
   C. System
   D. `ntdsutil.exe`
2. You perform a normal backup for your company once a week. In addition, you want to perform a backup of data each day in between normal backups. You want to minimize the amount of time it takes to perform these backups. Which backup type should you use on the days in between normal backups?
   A. Normal
   B. Incremental

C. Differential

D. Copy

3. Which Windows 2000 tool should you use to perform a restore of user data on a domain controller?

   A. Backup

   B. Active Directory Users and Computers

   C. Computer Management

   D. Disk Management

4. Your Windows 2000 computer won't boot. Which tools can you use to attempt to recover from the system failure? (Choose all that apply.)

   A. Backup

   B. Recovery Console

   C. Emergency Repair Disk

   D. Safe Mode

5. You want to monitor and configure your organization's removable media, including a tape library and optical discs. Which Windows 2000 tool can you use to do this?

   A. Remote Storage

   B. Sounds and Multimedia

   C. Imaging

   D. Removable Storage

6. You recently discovered that another administrator on your network accidentally deleted an OU and all of its users. As a result of replication, the Active Directory data store on all of your network's domain controllers is damaged. You want to restore Active Directory so that the restored Active Directory objects will replace the corresponding Active Directory entries on other domain controllers on your network when replication of Active Directory takes place. What kind of restore should you perform on the domain controller?

   A. An authoritative restore

   B. A nonauthoritative restore

   C. A partial restore of user data

   D. A full restore of user data

7. You want to add the Recovery Console to the boot loader menu of your Windows 2000 computer. You place your Windows 2000 compact disc into your CD-ROM drive and start a command prompt. At the command prompt, you change to the drive letter of the CD-ROM drive, and then change directories to the `i386` folder. What should you type at the command prompt?
   A. winnt32 /rcvcons
   B. winnt /rcvcons
   C. winnt32 /cmdcons
   D. winnt /cmdcons
8. You are performing an authoritative restore of Active Directory. After performing a restore of System State data on your domain controller, but before rebooting the computer, you start a command prompt. What should you type at the command prompt?
   A. authoritative restore
   B. restore database
   C. restore subtree
   D. ntdsutil

Scenarios

I introduced a lot of backup and recovery-related topics in this chapter, and here's your chance to sink your teeth into a few situations that you might encounter in real life. For each of the scenarios listed, consider the given facts and answer the questions that follow.

1. When you arrived at the office this morning, you found your Windows 2000 Server computer locked up, and you were unable to reboot it successfully.
   a. What are three tools you can use to attempt to recover from the system failure?
   b. If none of these attempts works, what should you do next?

2. You are the new administrator of your company's Windows 2000 network. Part of your job responsibilities include managing and optimizing the availability of user data and System State data on your network. What techniques can you use to accomplish this?
3. Your job, as assistant administrator for your organization's Windows 2000 network, is to manage your company's removable media libraries. Specifically, you want to:
   - ► Configure the properties of your removable media changers, including security
   - ► Monitor all removable media associated with your company's Windows 2000 computers

   How can you accomplish these tasks?

Lab Exercises

Lab 14-1 Backup and Recovery

► Professional
► Server
► Directory Services

The purpose of this lab is to provide you with an opportunity to use several Windows 2000 backup and recovery tools.

There are four parts to this lab:

- Part 1: Backing Up User Data and System State Data, Including Active Directory
- Part 2: Restoring User Data and System State Data, Including an Authoritative Restore of Active Directory
- Part 3: Installing and Using the Recovery Console
- Part 4: Using Safe Mode

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

Part 1: Backing Up User Data and System State Data, Including Active Directory

In this part, you use Backup to back up the `Apps` folder and all of the System State data (including the Active Directory data store) on your Windows 2000 domain controller.

1. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
2. In the Backup dialog box, click the button next to Backup Wizard.
3. The Backup Wizard starts. Click Next.
4. In the What to Back Up screen, select the "Back up selected files, drives, or network data" option. Click Next.
5. In the Items to Back Up screen, click the + next to My Computer. Click the + next to `C:`. Select the check box next to the `Apps` folder. Scroll down and select the check box next to System State. Click Next.
6. In the Where to Store the Backup screen, select a backup media type of File (if this option is not already selected and grayed out) from the "Backup media type" drop-down list box. Then, in the "Backup media or file name" text box, type **C:\Backup.bkf**. Click Next.
7. The Completing the Backup Wizard screen appears. Click Advanced.
8. In the Type of Backup screen, select Normal from the drop-down list box. Click Next.
9. In the How to Back Up screen, accept the default selections and click Next.
10. In the Media Options screen, select the "Replace the data on the media with this backup" and click Next.
11. In the Backup Label screen, accept the default backup and media labels, and click Next.
12. In the When to Back Up screen, ensure that the Now option is selected and click Next.
13. In the Completing the Backup Wizard screen, click Finish.
14. Windows 2000 performs the backup. (This process takes a few minutes.) If a Replace Data dialog box appears during the backup, click Yes. When the Backup Progress dialog box indicates that the backup is complete, click Report and view the backup report. Close Notepad when you finish viewing the report. Click Close.
15. Close Backup.

Part 2: Restoring User Data and System State Data, Including an Authoritative Restore of Active Directory

In this part, you use Backup to restore the `Apps` folder and all of the System State data on your Windows 2000 domain controller. You perform an authoritative restore of Active Directory by using Backup and the `ntdsutil.exe` command-line utility.

1. Shut down and restart your Windows 2000 Server computer (which is configured as a domain controller). During the boot process, press F8.
2. On the Windows 2000 Advanced Options Menu, select Directory Services Restore Mode and press Enter.
3. Select Microsoft Windows 2000 Server from the boot loader menu and press Enter.
4. Windows 2000 Server boots in Safe Mode – Directory Services Repair. When prompted, press Ctrl+Alt+Delete.
5. In the Log On to Windows dialog box, accept the default user name of administrator. Enter a password of **password**. Click OK.
6. A Desktop warning message appears, indicating that Windows is running in Safe Mode. Click OK.
7. Select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
8. In the Backup dialog box, click the Restore Wizard button.
9. The Restore Wizard starts. Click Next.
10. In the What to Restore screen, click the + next to File. Click the + next to "Media created *date.*" Select the check boxes next to `C:` and System State. Click Next.
11. The Completing the Restore Wizard screen appears. Click Advanced.
12. In the Where to Restore screen, accept the default selection of Original location and click next.
13. In the How to Restore screen, select the "Always replace the file on disk" option and click Next.
14. In the Advanced Restore Options screen, accept the default selections and click Next.
15. In the Completing the Restore Wizard screen, click Finish.
16. In the Enter Backup File Name dialog box, ensure that `C:\Backup.bkf` is displayed in the "Restore from backup file" text box. Click OK.

17. Windows 2000 performs the restore of the `Apps` folder and System State data, including Active Directory. When the Restore Progress dialog box indicates that the restore is complete, click Report to view the restore report. Close Notepad when you finish viewing the report. Click Close.
18. When a Backup warning dialog box appears, click No, and close Backup.

CAUTION

Don't click Yes—If you do, you'll have to re-perform Part 2 of this lab up to this point.

19. Select Start ➪ Programs ➪ Accessories ➪ Command Prompt.
20. In the Command Prompt dialog box, at the command prompt, type **ntdsutil** and press Enter.
21. At the `ntdsutil:` prompt, type **authoritative restore** and press Enter.
22. At the `authoritative restore:` prompt, type **restore database** and press Enter.
23. In the Authoritative Restore Confirmation Dialog box, click Yes.
24. Windows 2000 opens the Active Directory database and marks the objects you selected by increasing their attribute version numbers. At the `authoritative restore:` prompt, type **quit** and press Enter.
25. At the `ntdsutil:` prompt, type **quit** and press Enter.
26. At the command prompt, type **exit** and press Enter.
27. Shut down your computer, and restart it normally. Boot to Windows 2000 Server and log on as Administrator.

Part 3: Installing and Using the Recovery Console

In this part, you install the Recovery Console in your computer's boot loader menu. Then you start the Recovery Console and view Recovery Console help.

1. Place your Windows 2000 compact disc into your computer's CD-ROM drive. Close the Microsoft Windows 2000 CD dialog box.
2. Select Start ➪ Programs ➪ Accessories ➪ Command Prompt.

3. In the Command Prompt dialog box, at the command prompt, type in the drive letter of your CD-ROM drive followed by a colon (for example, `D:`) and press Enter.
4. At the command prompt, type **cd \i386** and press Enter.
5. At the command prompt, type **winnt32 /cmdcons** and press Enter.
6. In the Windows 2000 Setup dialog box, click Yes to install the Recovery Console as an option in the boot loader menu.
7. A Windows 2000 Setup wizard starts and installs the Recovery Console. When the installation is complete, a Microsoft Windows 2000 Server Setup dialog box appears, notifying that the Recovery Console has been successfully installed. Click OK.
8. At the command prompt, type **exit** and press Enter.
9. Remove the Windows 2000 compact disc from your computer's CD-ROM drive. Then shut down your computer and restart it. During the boot process, select Microsoft Windows 2000 Recovery Console from the boot loader menu and press Enter.
10. The Recovery Console starts. When prompted, type **1** to log on to the Windows 2000 Server installation and press Enter.
11. When prompted, type the Administrator password (it's **password**) and press Enter.
12. At the command prompt, type **help** and press Enter. Notice the various commands that you can use in the Recovery Console. Press the spacebar to view the remaining commands.
13. At the command prompt, type **enable /?** and press Enter to view the help for the `enable` command.
14. At the command prompt, type **exit** and press Enter.
15. Windows 2000 restarts your computer. Press F8 during the reboot process, and continue to Part 4.

Part 4: Using Safe Mode

In this part, you boot your Windows 2000 computer in Safe Mode. Then you use Device Manager and one of the Windows 2000 Troubleshooters.

1. After you have pressed F8 during the reboot process, select Safe Mode from the Windows 2000 Advanced Options Menu and press Enter.
2. Select Microsoft Windows 2000 Server from the boot loader menu and press Enter.

3. Windows 2000 Server boots in Safe Mode. Press Ctrl+Alt+Delete.
4. In the Log On to Windows dialog box, enter a user name of **Administrator** and a password of **password**. Click OK.
5. A Desktop warning message appears, indicating that Windows is running in Safe Mode. Click OK.
6. The Safe Mode version of the Windows 2000 desktop is displayed. Right-click My Computer, and select Properties from the menu that appears.
7. In the System Properties dialog box, click the Hardware tab.
8. On the Hardware tab, click Device Manager.
9. Device Manager starts. Click the + next to "Mice and other pointing devices." Double-click your mouse underneath this heading.
10. In the Mouse Properties dialog box, click Troubleshooter.
11. The Mouse Troubleshooter starts. You can use this troubleshooter to diagnose a mouse problem. You can access many other Troubleshooters by using Device Manager. Close the Windows 2000 dialog box.
12. In the Mouse Properties dialog box, click OK.
13. Close Device Manager.
14. In the System Properties dialog box, click OK.
15. Shut down your Windows 2000 computer.

Answers to Chapter Questions

Chapter Pre-Test

1. User data is a broad category that includes application files and folders, operating system files and folders, and user-created files and folders. In short, user data includes all files and folders on the Windows 2000 computer that aren't held open at all times by Windows 2000.
2. System State data includes various critical operating system files, folders, and databases. The actual components of System State data vary depending on the Windows 2000 operating system you're using and the services installed on that operating system. For all Windows 2000 computers, System State data includes the operating system boot files, the registry, and the COM+ Class Registration database.

On a Windows 2000 Server computer that has Certificate Services installed, System State data also includes the Certificate Services database. Finally, on a Windows 2000 Server that is a domain controller, System State data also includes the Active Directory data store and the contents of the `SYSVOL` folder.

3. From the desktop select Start ➪ Programs ➪ Accessories ➪ System Tools ➪ Backup.
4. You can use Backup to perform a backup, to perform a restore, and o create an Emergency Repair Disk.
5. An Emergency Repair Disk is a floppy disk used to repair Windows 2000 system files that become accidentally corrupted or erased due to viruses or other causes. An Emergency Repair Disk is primarily used to repair and restart a Windows 2000 computer that won't boot.
6. In order to backup (or restore) data you need to be a member of the Administrators or Backup Operators groups, or you need to have the "Backup files and directories" (or the "Restore files and directories") user right assigned to you. If you're backing up or restoring data on a Windows 2000 domain controller, members of the Server Operators group also have the necessary permissions to backup and restore files and folders on this computer.
7. You can perform a nonauthoritative restore or an authoritative restore of Active Directory.
8. Safe Mode, the Recovery Console, and the Emergency Repair Disk
9. Removable Storage

Assessment Questions

1. **B.** Of the choices presented, only the Backup program can be used to *create* an Emergency Repair Disk. You can boot your computer to the Windows 2000 compact disc and use the Windows 2000 Setup program to *use* the Emergency Repair Disk, but you can't create it by using this program.
2. **B.** In terms of the time it takes to perform backups, the incremental backup will take the least amount of time because it is not a cumulative backup, like the differential backup.

3. **A.** Use Backup to perform restores as well as backups.
4. **A, B, C, D.** You can start by using the Recovery Console, the Emergency Repair Disk, and the Recovery Console to recover from the system failure. If none of these tools work, you can use Backup to try to restore System State data to the Windows 2000 computer. If none of these things work, you'll probably have to reinstall Windows 2000.
5. **D.** Removable Storage is the Windows 2000 tool used to manage removable media. Remote Storage is not the correct answer here because it is used to manage nonremovable (fixed) media on a Windows 2000 computer.
6. **A.** In order for the restored Active Directory objects to replace existing objects on the other domain controllers when replication occurs, you'll need to perform an authoritative restore of Active Directory on the domain controller.
7. **C.** `Winnt32 /cmdcons` is the appropriate command to install the Recovery Console.
8. **D.** At the first command prompt, you must type **ntdsutil**. At subsequent command prompts you type **authoritative restore** and **restore database** (or **restore subtree**, depending on whether you are restoring all or a portion of the Active Directory data store).

Scenarios

1. You can use Safe Mode, the Recovery Console, and the Emergency Repair Disk to attempt to recover from the system failure. If none of these techniques work, you could also try restoring System State data on the Windows 2000 Server computer.
2. There are several techniques you could consider when you want to manage and optimize the availability of your network's data. For example, you can use NTFS and permissions to restrict access to files and folders, and use mirrored volumes and RAID-5 volumes to provide fault tolerance. Another important part of your overall fault tolerance plan is performing regular backups of data.

3. To manage your company's removable media libraries, you can use the Removable Storage tool in Computer Management. To access Removable Storage, from the desktop, right-click My Computer and select Manage from the menu that appears. Then, in the left pane of the Computer Management dialog box, expand Removable Storage and select the specific Removable Storage component you want to use. To configure the properties of a removable media changer, right-click the specific device under the `Physical Locations` folder, and select Properties from the menu that appears. To monitor all removable media associated with a Windows 2000 computer, view the contents of each of the media pools.

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MATERIAL