

Windows® 7 Inside Out

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Chapter 11

Backup, Restore, and Recovery

Using the Windows Backup Program

Configuring System Protection Options

Rolling Back to a Stable State with System Restore

In the Unabridged Edition of Murphy's Law, you'll find an entire chapter of corollaries that apply to computers in general and your important data files in particular. Murphy says, "Anything that can go wrong will go wrong." That's certainly true of hard disks, where it's not a matter of whether they'll fail but when. When a disk crashes, it's usually impossible to recover your data without spending a small fortune at a data recovery service.

Even if your hardware never lets you down, human error can wreak havoc with data. You can press the wrong key and inadvertently delete a group of files you meant to move. If you're not paying attention, you might absent-mindedly click the wrong button in a dialog box, saving a new file using the same name as an old one, wiping out weeks' worth of work in the process.

In any of those circumstances, you're almost certainly going to lose data. When a hard disk crashes, for instance, all files you've created or saved since your last backup are gone for good. But you can avoid the worst data losses if you get into the habit of backing up regularly.

What's in Your Edition?

All editions of Windows 7 include the Windows Backup program and have the capability to perform file backups and create and restore system images. The capability to specify a network location as a backup destination is restricted to the business editions: Professional, Ultimate, and Enterprise. All System Protection features discussed in this chapter, including the capability to create restore points and recover previous versions of files and folders, are available in all editions.

In this chapter, we cover the backup tools included with Windows 7, which contain everything you need to undo the damage from data disasters and human errors. We also explain how to configure and use the powerful but nearly invisible backup and recovery features known collectively as System Protection.

If you're looking for assistance on how to fix problems that affect your computer's ability to start, see "Making Repairs with the Windows Recovery Environment".

Using the Windows Backup Program

The Windows Backup program (Sdclt.exe) is installed by default in all editions of Windows 7. Its feature set is dramatically improved over its predecessor in Windows Vista, which was **roundly (and deservedly) criticized for its inflexibility and for Microsoft's decision to remove important features from the program in home editions. And it's light-years beyond the NT Backup program included with Windows XP, which was designed before the turn of the millennium.**

Before you can create a backup, you are strongly encouraged to run through a brief setup routine. The purpose of this one-time operation is twofold: to help you choose a backup type (system image, data files, or both), and then to help you build a schedule that will automate future backups. You can save one and only one collection of backup settings.

Alternatives to Windows Backup

Windows Home Server as an alternative

For your first backup, you can start from either of the following two locations:

- Under the Maintenance heading in Action Center, click the Set Up Backup link.



- In Control Panel, click Backup And Restore under the System And Security heading, and then click the Set Up Backup link, as shown in Figure 11-1.

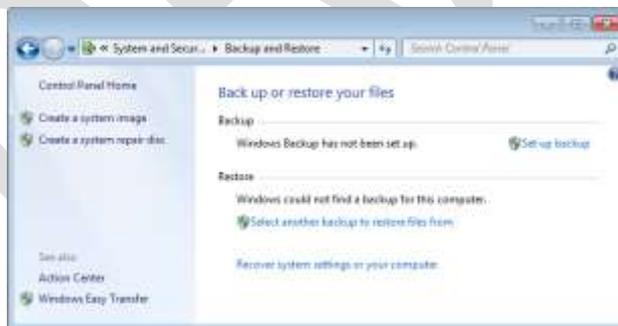


Figure 11-1 Before you can perform your first backup, you're encouraged to set up a backup schedule using the Set Up Backup button here.

Note You can skip the initial setup if you simply want to create a one-time backup of your system volume (an excellent idea if you've just finished performing a clean installation with all your drivers

and programs installed and ready to use). Click the Create A System Image link in the Action pane on the left.

The basic steps for performing a backup are simple and straightforward. You have to make some decisions first, which in turn dictate which tools you use and what actions you need to take.

1. Select a destination where your backup will be saved. The Set Up Backup dialog box, shown in Figure 11-2, lists all available destinations. Note that the system volume is not included in this list.

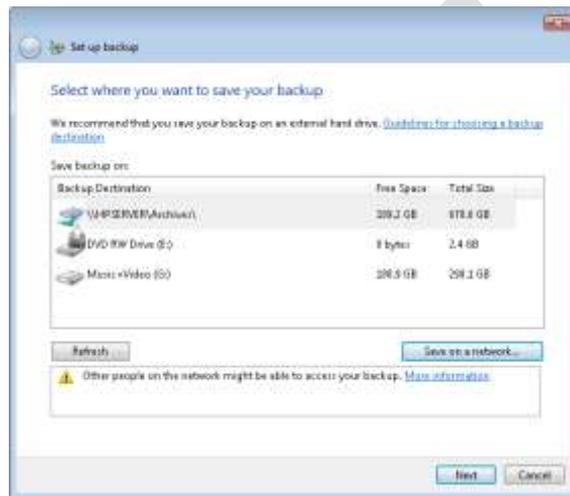


Figure 11-2 The system volume is excluded from the list of available backup destinations, and network locations are available only on business editions of Windows 7.

Your choices include the following:

- A separate volume on the same internal hard drive that holds your system volume We strongly advise against this option, because in the event of a physical disk failure your backup files will be wiped out at the same time as the originals.
- An external hard drive This is the simplest and best option. The external drive can connect to your PC via a USB 2.0, IEEE 1394, or eSATA cable. You can leave the drive permanently attached to your PC so that scheduled backups happen regularly, or you can unplug it after the backup is complete and then store it in a secure location such as a fireproof safe or a locked cabinet. For extremely valuable data, consider storing the backup drive offsite.

- Removable media such as writeable CDs or DVDs This option is available only if you are performing a **one-time image backup**; you can't define a scheduled backup using removable media. Windows Backup will prompt you to swap media as needed. This option is especially useful after you perform a clean backup and before you add any data files.
- A shared network folder This option is available only on the business editions of **Windows 7: Professional, Ultimate, and Enterprise**. It's an excellent choice for file-based backups if another PC or server on your network has ample storage space. You'll need to enter credentials that the scheduled task can use to access the shared location, as shown here:



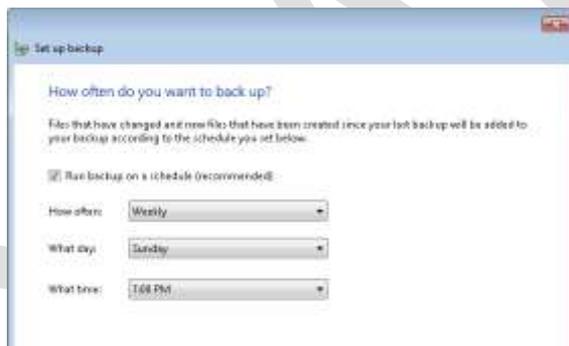
As we note later in this chapter, using a network location to store system image backups has one major downside: you can store only the most recent image file per computer. For more details, see “Creating a System Image Backup.”

2. Choose a backup type. The easy option is the first one shown here: Let Windows Choose (Recommended). This option is selected by default, and if you click Next without changing the selection, Windows will do the following: create a system image and save it in the location you specified earlier; back up all local files that are stored in libraries, on the desktop, and in default folders within all user profiles; and create a scheduled task to repeat the backup weekly.



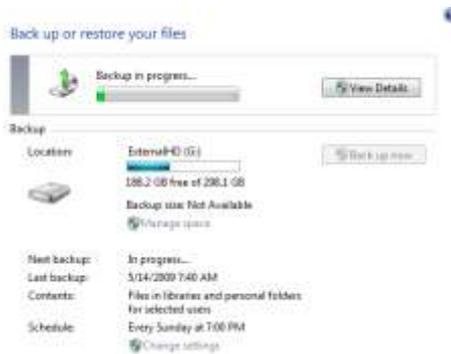
If you prefer to exercise fine-grained control over what gets backed up and when, select **the second option, Let Me Choose**, and then click **Next**. We'll describe these options in more detail in the following section.

3. Create a backup schedule. By default, the Windows Backup program will run automatically, using the same settings you just saved, at 7:00 PM every Sunday night. If you prefer to back up more or less frequently or at a different time, click **Change Schedule** on the **Review Your Backup Settings** page to open the **How Often Do You Want To Back Up** window shown here:



Your scheduling options are extremely limited. You can choose Daily, Weekly, or Monthly backups, picking a day of the week or a date each month and a fixed time when the automatic backups will take place. After the original full backup, updates to your backup set include only files that have changed since the last backup.

After the initial setup is complete, click **Save Settings And Run Backup** to perform the backup operation. While your backup is running, the **Backup And Restore Control Panel** displays its progress, as shown here:



While a backup is in progress, you can click View Details to see more information and to stop the backup.

Customizing a Backup

If you choose the default settings, you can be assured that all data files in all user profiles on your PC will be backed up, along with the contents of any local folder included in a library in any user profile. (Shared network folders in a library are never backed up.) If the backup destination has sufficient room, the backup will also include an image of the system drive.

If you want more granular control of exactly which files and folders are backed up, begin setting up a new backup and click Let Me Choose when you reach the What Do You Want to Backup window. That opens a dialog box like the one shown in Figure 11-3.

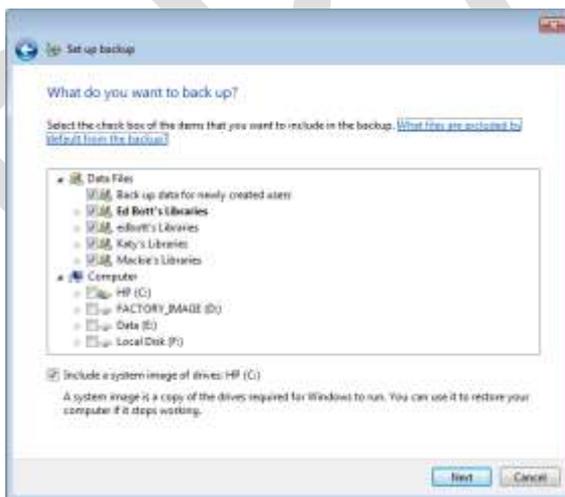
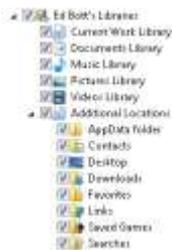


Figure 11-3 Windows Backup normally backs up only libraries and user profiles, but you can choose specific locations for backup instead.

The customization options here are divided into two hierarchies. At the top of the list is the Data Files heading, which includes an entry for each existing user account. Clear the box to the left of any entry to remove all files from that user profile from the current backup settings. (You might want to do this if you've created an account that you use exclusively for testing and you're certain that none of the files it contains are worth preserving. If you've enabled the Guest account, you'll probably want to exclude it from backups as well.)

Although the entry for each account under the Data Files heading suggests that it includes only libraries, that description isn't entirely accurate. When you fully expand the list of available options for an entry in the Data Files list, you see a selection similar to the one shown here:



Every one of the libraries for the selected account, including the standard libraries created by Windows and any custom libraries you've created, is selected by default. You can skip one or more libraries by clearing the associated check box, but it's an all-or-nothing proposition: you can't choose to include some locations within a library and exclude others. You might want to skip backups for a specific library, especially if it's full of large files for which you have a separate backup strategy. If you're already synchronizing hundreds of gigabytes of files in the Music and Videos folders with another computer on your network, for example, you might leave those space-gobbling files out of your regular backup settings.

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Use custom libraries for foolproof backups

Do you store important data files outside your user profile? Custom libraries can help you ensure that those files are always backed up. Create a new library, call it Backup, and make sure it's selected in your current backup settings. Add locations to the new library that you want to ensure are backed up. The files themselves remain in their original location, but as long as they're on a local drive they'll be backed up. If you remove a folder from the Backup library, it will no longer be backed up. Any new folder you add here, even if it's outside your user profile, will automatically be included in your next backup.

The entry just after the final library for each account in this list is Additional Locations. Click **the arrow to its left to expand it, and you'll see that it includes the AppData Folder** for the selected account, which contains data files and settings that are typically created and managed by programs. Microsoft Outlook and Windows Live Mail, for example, store user **data here; if this location isn't backed up, you risk losing** all your e-mail messages and contacts in the event of a disk failure. Countless other programs from Microsoft and third-party software developers store user data here as well; one popular example is Mozilla Firefox, which stores user profiles and settings in a subfolder of AppData.

The other options under the Additional Locations heading represent the default folders from your user profile other than those already included in the standard libraries; Desktop, Downloads, and Favorites are included in Additional Locations, but not Documents, Music, Pictures, and Videos, which are part of other libraries. Note that additional subfolders within your user profile folder (whether created by you or by a program) are not added to this list and thus will not be included by default in your backup settings.

For a full explanation of what's in a user profile, see "How Windows 7 Organizes Data."

The Computer tree at the bottom of this dialog box exists for those who prefer old-school backup programs that back up everything in designated locations. The list includes every local volume on an internal hard disk (removable drives are not included). You can select an entire drive or drill into each one to include and exclude specific folders and subfolders in your backup settings.

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Future-proof your backup settings

When **you're** setting up a new general-purpose backup routine, we recommend that you leave the first option, Back Up Data For Newly Created Users, intact. Its purpose is to make sure that your backups will include libraries and data files for any new user accounts you create in the future. If you clear this check box, only the data files and locations you specify when you create your backup settings will be backed up. So when should you clear this box? **If you've set up a regular backup routine specifically intended to back up only a single user's data files and some custom locations, you might want to avoid the prospect of having unwanted locations added to your backup sets later.**

The final option in the What Do You Want To Back Up dialog box is an option to include a system image with your backup. You can save a system image automatically with each backup or use the techniques we describe later in this chapter to create a system image on demand.

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What's not backed up?

Every file on your computer that matches the criteria you select is backed up, regardless of which user account it belongs to. But not every file is included in a file backup. Even if you select every box under the Data Files and Computer headings, Windows excludes some files. For starters, files stored on any disk formatted with the FAT or FAT32 file system are ignored; drives to be backed up must be formatted with NTFS. System files are excluded, as are program files and any files in the Recycle Bin. Temporary files are backed up only on drives that are larger than 1 GB in size.

Creating a System Image Backup

With a system image backup (previously known as a Complete PC Backup in Windows Vista), you can rebuild your computer from bare metal in the event of a catastrophic failure—or if **you just want to start fresh. You don't need to install, update, and activate Windows, reinstall all your applications, and then configure your applications to work the way you like; instead, you boot into the Windows Recovery Environment, choose an image file to restore, and then complete the process by restoring from your latest file backup, which is likely to be more recent than the image. The image files that Windows Backup creates are largely hardware independent, which means that—with some limitations—you can restore your backup image to a new computer of a different brand and type without missing a beat.**

As we noted earlier in this chapter, you can create a system image backup as part of your regularly scheduled backup routine. However, if your goal is to quickly create a complete copy of the contents of all drives that contain Windows system files, you can do so here without having to mess with backup settings. In the Backup And Restore Control Panel, click Create A System Image in the task pane on the left and follow the prompts to select a backup destination. The disk space requirements for an image-based backup can be substantial. Windows will warn you if the destination you choose doesn't **have sufficient free disk space.**

When you create a system image backup, it stores the complete contents of all selected drives during its first backup. If the backup target is a local (internal or external) hard drive, subsequent backup operations store only new and changed data. Therefore, the subsequent, incremental backup operation typically runs much faster, depending upon how much data has been changed or added since the previous image backup operation. If you choose a shared network folder as the backup destination (using Windows 7 Professional or Ultimate), you can save only one image backup. Any subsequent image backup will wipe out the previous image backup.

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Save multiple image backups on a network

If you specify a shared network folder as the destination for an image backup, beware of the consequences if you try to reuse that location for a subsequent backup of the same computer. If the backup operation fails for any reason, the older backup will be overwritten, but the newer backup will **not be usable**. In other words, you'll have no backup.

You can avoid this risk by creating a new subfolder in the shared network folder to hold each new image backup. The disadvantage, of course, is that each image file will occupy as much space as the original disk, unlike an incremental image backup on an external hard drive, which stores only the changed data.

If you have multiple hard drives, Windows displays a dialog box like the one shown in Figure 11-4, in which you choose the volumes you want to include in the backup. By default, any volume that contains Windows system files is selected. You can optionally choose to include other drives in the backup image as well.

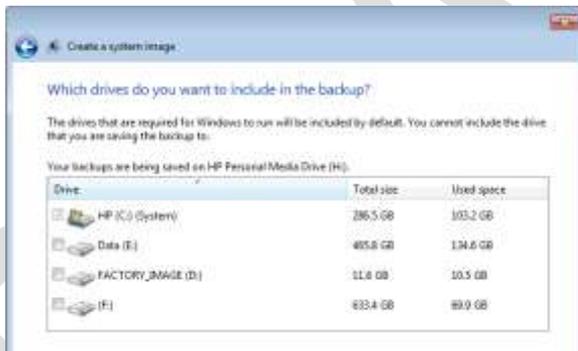


Figure 11-4 Windows system volumes (indicated by the logo on the drive icon) must be included in a system image. Other volumes are optional.

After you confirm your settings, click Next and then click Start Backup to begin the process of building and saving your image.

System images are stored in virtual hard drive (.vhd) format. Although the data is not compressed, it is compact because **the image file does not include the hard drive's unused space** and some other unnecessary files, such as hibernation files, page files, and restore points. Incremental system image backups on a local drive are not written to a separate folder. Instead, new and updated files (actually, the changed blocks in those files) are written

to the same .vhd file. The older blocks are stored as shadow copies in the .vhd file, allowing you to restore any previous version.

Restoring Files from a Backup Set

Backing up is pointless if you never need to restore a file. You should be so lucky.

To restore one or more files, open the Backup And Restore Control Panel. If the file was backed up from a location within your user profile or one of your libraries, click **Restore My Files**. **To restore files from another user's account or to select a different backup, you'll need to click one of the other links here and supply an administrator's credentials.**



The Restore Files wizard is unlike other backup/restore programs you might have used in the past. The list starts out empty. You fill it by searching and browsing for files and folders to be restored. Using the Search button allows you to enter all or part of a file or folder name, and then add one or more items from the search results to your list. To add individual files, click Browse For Files and make one or more selections. Click Browse For Folders to select an entire folder and all its subfolders.

Repeat the search-browse-select process as many times as needed, adding files and folders **until you've selected everything you want to restore**. Figure 11-5 shows the Browse Or Search Your Backup For Files And Folders To Restore page of the Restore Files dialog box with a handful of items selected.

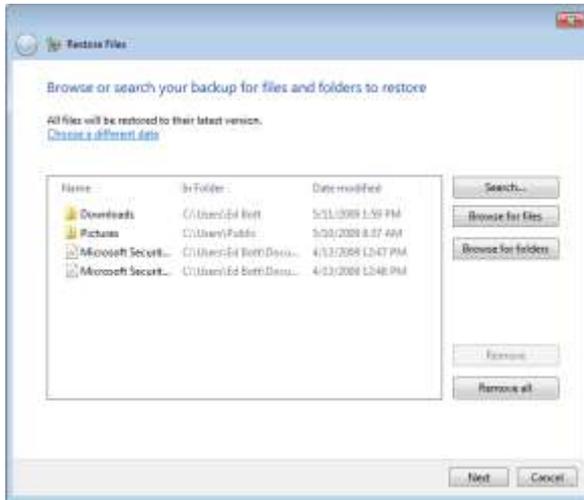
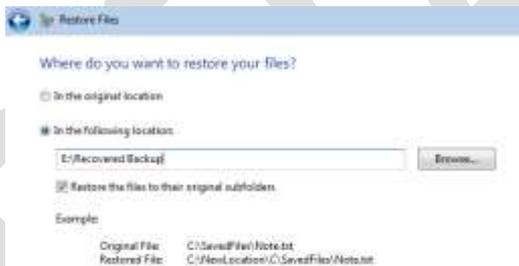


Figure 11-5 Use the three buttons to the right of this list to search or browse for files and folders to be restored from the most recent backup.

Click **Next** to specify the location where you want to restore the selected files. If you're simply recovering an accidentally deleted file, you'll want to restore it to its original location; if you want to sift through a group of recovered files before deciding which ones to keep, restore them to a new folder, as shown here.



The final step of the image backup process offers to help you create a system repair disc on a writeable CD or DVD. We highly recommend that you take advantage of this option; if you **don't have a blank disc or don't want to take the minute or so to create the repair disc** at this point, you can do so later using the link in the task pane on the left of the Backup And Restore Control Panel.

You might find it easier to restore a file using the Previous Versions feature in Windows *Explorer*, as described in *"Recovering Lost or Damaged Files and Folders."*

Restoring a System Image Backup

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The system image capabilities in Windows Backup are intended for creating an emergency recovery kit for a single PC. In that role, they function exceptionally well. If your hard drive fails catastrophically, or if you want to wipe your existing Windows installation and start with a clean image you created a few weeks or months earlier, you've come to the right place.

Your options (and potential gotchas) become more complex if you want to use these basic image backup and restore tools to work with a complex set of physical disks and partitions, especially if the disk layout has changed from the time you created the original image.

In this chapter, we assume that you have created an image backup of your system disk and you want to restore it to a system that is essentially the same (in terms of hardware and disk layout) as the one you started with. In that case, you can restart your computer using the System Repair disc you created as part of the initial backup (or use the Windows 7 installation DVD and choose the Repair Your Computer option). Either route will lead you to the dialog box shown next. Select the second option to restore your computer using a system image.



Click Next to select the image backup to restore from. If you're restoring the most recent image backup to the same system on which it was originally created and the backup is stored on an external hard drive attached to the computer, your job is easy. The latest system image should be available for your selection. Verify that the date and time and other details of the image match the one you want to restore and then click Next to continue.



If the image file you're planning to restore from is on a network share or if you want to use a different image, choose **Select A System Image** and then click **Next**. You'll see a dialog box that lists additional image files available on local drives. Select the correct file, and click **Next** to select an image created on a specific date if more than one is available. If the image file you're looking for is on a shared network folder, click the **Advanced** button and then enter the network location and a user name and password that have authorized access to that account.

Restoring an image backup completely replaces the current contents of each volume in the image file. The restore program offers to format the disk or disks to which it is restoring **before it begins the restore process**; if you have multiple drives and/or volumes and you're nervous about wiping out valuable data files, it offers an option to exclude certain disks from formatting.

The important thing to recognize about restoring a system image is that it will replace the current contents of system volumes with the exact contents as they existed at the time of the image backup you select. That means that your Windows system files and registry will be returned to health (provided the system was in good shape when you performed your most recent backup and that no hardware-related issues have cropped up since then). Whatever programs were installed when you backed up your system will be restored entirely. All other files on the restored disk, including your documents, will also be returned to their prior states, and any changes made subsequent to your most recent backup will be lost.

CAUTION!

If you keep your documents on the same volume as your system files, restoring a system image is likely to entail the loss of recent work—unless, of course, you have an up-to-date file backup or you have the good fortune to have made an image backup almost immediately before your current troubles began. The same is true if you save documents on a volume separate from your system files but you have included that data volume in your image backup. If you have documents that have not been backed up, you can avoid losing recent work by copying them to a disk that will not be affected by the restore process—a USB flash drive, for example, or some other form of removable media. You can use the Command Prompt option in the Windows Recovery Environment to copy these documents. (For details about using the Command Prompt option, see **"Working at the Command Prompt"**) If you do have a recent file backup, you will be able to restore files after you have restored the image backup and your system is running again.

Note The main hardware limitation for restoring a system image backup is that the target computer must have at least as many hard drives as the source system, and each drive must be at

least as big as its corresponding drive in the source system. This means, for example, that you can't restore a system image from a system that has a 500-GB hard drive to a system with a 320-GB hard drive, even if the original system had less than 100 GB of data on its drive. Keep in mind also that, on a system with multiple hard drives, the BIOS determines which one is the bootable drive, and this is the one on which Windows will restore the image of your system volume. (You have no choice in the matter, aside from reconnecting the drives or, if your BIOS permits it, selecting a different bootable drive.)

If your new computer meets the space requirements, restoring a system image should work. This is true even when the source and target computers use different disk controllers, such as SCSI, PATA (IDE), or SATA. Similarly, other differences—such as different graphics cards, audio cards, processors, and so on—**shouldn't prevent you from restoring a system image to a different computer**. This is because hardware drivers are isolated from the rest of the image information and are rebuilt as part of the restore process.

Managing Saved Backups

The first time you back up files, Windows performs a complete backup of the files you specify. Subsequent scheduled backups are incremental backups, which include only new files and files that have changed. The incremental backups are stored separately from the original, complete backup, which means that—in the case of files that change—the backup set includes each file as it existed at the time of each backup. (A backup set comprises the original backup and all incremental backups.)

A file backup—like a system image backup—relies upon the Volume Shadow Copy Service to **create a volume snapshot when a backup operation runs. This “point-in-time” image** enables the backup program to reliably back up files that are open or in use and constantly changing, such as a .pst file for Microsoft Outlook data. The Volume Shadow Copy Service also keeps track of changes made between shadow copies. For more information, see **“How Volume Shadow Copy Service Works” on the Microsoft TechNet site** at technet.microsoft.com/en-us/library/cc785914.aspx.

Backups are saved to the location you specify in a folder that has the same name as your computer. That folder contains a subfolder for each backup set; the set folder contains a subfolder for the original backup and each subsequent incremental backup, using a naming convention that includes the date and time when the backup was created. Within the backup folders, the archived files are saved in ordinary .zip files, each with a maximum size of 200 MB. **This makes the data accessible even from a computer that's not running Windows Vista;** simply use the tool of your choice to browse the content of the .zip files. This storage method has another benefit: if you back up to removable media such as CDs and your backup spans several discs, even if one disc is damaged you can retrieve your data from all undamaged discs, thereby limiting the amount of lost data.

To see a summary of disk space in use by your current collection of backups, click Manage Space in the Backup And Restore Control Panel. The resulting display, like the one shown here, shows how much disk space is in use on the current backup destination.



To see a full list of backed-up files by set, click View Backups. This dialog box allows you to delete a full set of backups from a specific period, including the initial backup and all incremental changes. Under the System Image heading, click Change Settings to remove all backed-up images or save the most recent image and delete all previous ones.

TROUBLESHOOTING

Your backup folders are “empty”

If you use Windows Explorer to browse to your backup folders, when you rest the mouse pointer over a folder name, the pop-up tip might indicate that the “folder is empty.” Alarmed, you right-click the folder and choose Properties, only to find that the folder apparently contains 0 bytes, 0 files, and 0 folders. Don’t worry. This is the normal condition when your backups are stored on an NTFS volume, because by default, only the SYSTEM user account has permission to view the files. (That’s a reasonable security and reliability precaution, which prevents you or another user from inadvertently deleting a key backup file.) If you’re confident of your ability to work safely with backup files in their native format, the solution is simple: Double-click the folder name. Follow the prompts, including a User Account Control (UAC) consent dialog box, to permanently add your user account to the folder’s permissions list, giving you Full Control access to the folder.

Configuring System Protection Options

System Restore made its first shaky appearance in the late, unlamented Windows Me. With each successive version of Windows, this important feature has taken on whole new responsibilities. System Restore is now part of a larger feature known as System Protection, whose primary job is to take periodic snapshots of designated local storage volumes. These snapshots make note of differences in the details of your system configuration (registry settings, driver files, third-party applications, and so on), allowing you to undo changes and roll back a system configuration to a time when it was known to work correctly. In Windows 7 (as in Windows Vista), the volume snapshots also include data files on designated drives. The effect of this expansion is to create real-time backups of individual data files, allowing you to recover from unwanted edits or unexpected deletions by restoring a previous version of a file or folder from Windows Explorer.

For a full description of how the Previous Versions feature works and how to use it, see *"Recovering Lost or Damaged Files and Folders."*

Periodically checking the status of System Protection is an essential part of a comprehensive backup strategy: Is the feature enabled and working properly on the drives where you need its protection? Is the proper amount of space set aside for it, not too much or too little?

The mechanics of System Protection in Windows 7 are substantially changed from those of its predecessors in Windows Vista and Windows XP. It uses disk space more intelligently and offers significantly more customization options. In this section, we explain how this feature works and what it backs up, how to turn it on or off for a given disk, and how to create a manual restore point.

If you're looking for step-by-step instructions on how to use System Restore to recover from a crash, see "Rolling Back to a Stable State with System Restore." For information about *recovering files that have been inadvertently edited or deleted, see "Recovering Lost or Damaged Files and Folders."* For technical details about the implementation of System Restore in Windows 7, see the associated MSDN reference pages *"Volume Shadow Copy Service"* ([msdn.microsoft.com/en-us/library/bb968832\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/bb968832(VS.85).aspx)) and *"System Restore"* ([msdn.microsoft.com/en-us/library/dd408121\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/dd408121(VS.85).aspx)).

Normally, automatic restore points are created at least once every 3.5 days. (This is a significant change from Windows Vista, which created snapshots daily.) Restore points are also created automatically before the following major system events:

- Installation of any application that uses an installer that complies with System Restore requirements. In practice, any program that qualifies for the

Windows Vista or Windows 7 logo will create a new restore point before performing any installation tasks (including removal).

- Installation of any updates provided through Windows Update or Microsoft Update. System Restore creates a restore point before the installation of the update begins, whether the update is installed automatically or manually.
- System restore. If you choose to use System Restore to roll back to an earlier configuration, the system creates a fresh restore point first. If necessary, you can undo the restore operation by choosing the freshly created restore point.
- Any backup operation performed by Windows Backup. System Restore points are created by Windows Backup as part of both file backups and system images.

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What's in a restore point?

Restore points created by Windows Vista and Windows 7 include information about changes made to any files on that volume since the previous snapshot was created. If you have enabled the option to monitor system settings, snapshots contain two additional data points: a full copy of the registry as of the time of the snapshot, and a list of files that include any of 250+ file-name extensions specifically designated for monitoring. This list (which cannot be modified) contains many file types that are clearly programs and system files, with extensions such as EXE, DLL, and VBS. But it also includes other files that you might not think of as system files, including INF and INI, and some that are truly head-scratchers, such as D01 through D05 and D32. (D06 through D31 are apparently unmonitored.) The entire list is available at [msdn.microsoft.com/en-us/library/aa378870\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/aa378870(VS.85).aspx). **It's most useful for programmers and system administrators, but you might want to take a look at it if you're curious why using System Restore deleted a file that you thought was perfectly safe.**

To access the full set of System Restore options, open System in Control Panel and click the System Protection link in the Tasks pane. (To go directly to the System Properties dialog box, click Start, type `systempropertiesprotection`, and press Enter.) The resulting dialog box, shown in Figure 11-6, lists all available NTFS-formatted drives (internal and external). The value under Protection Settings indicates whether restore points are being created automatically for each drive.



Figure 11-6 By default, System Restore monitors changes to the System drive. Select another drive and click Configure to enable System Protection for that drive.

Using the System Properties dialog box, you can enable or disable automatic monitoring for any local drive. In addition, you can specify whether you want restore points for a given drive to include system configuration settings and previous versions of files or to save previous versions only. By design, system protection is fully enabled for the system drive and is disabled for all other local drives.

Caution!

System Restore is a powerful and useful tool, and you shouldn't disable it on your system drive without a good reason. If you're extremely low on disk space and a hard disk upgrade is impractical or impossible (as on some notebook computers), you might choose to do so, although you should try limiting its use of disk space, as we explain later in this section, before shutting it down completely.

If you've set aside one or more drives exclusively for data, you might want to enable the creation of automatic restore points on those drives, which has the effect of creating shadow copies of files you change or delete on that drive. This step is especially important if you've relocated one or more profile folders to drives other than the one on which Windows is installed. To enable or disable the creation of automatic restore points for a drive, open the System Properties dialog box, select the drive letter from the list under Protection Settings, and click Configure. Figure 11-7 shows the recommended settings for a secondary drive that contains data files and system image backups only. We've chosen the second option, Only Restore Previous Versions Of Files, rather than the default, which also tracks system settings.



Figure 11-7 For this drive, which is used to store data files only, we've enabled System Protection but configured it to ignore system settings and only save previous versions of files.

The information under the Disk Space Usage heading shows both the current usage and the maximum amount of space that will be used for snapshots before System Protection begins deleting old restore points to make room for new ones. By default, a clean installation of Windows 7 sets aside space for system protection based on the size of the hard drive. On a volume larger than 64 GB, the default amount of reserved space is 5 percent of the disk or 10 GB, whichever is less. On a volume that is smaller than 64 GB, the default disk space usage is **limited to a maximum of 3 percent of the drive's total space.** (The minimum space required is 300 MB.)

Note—The disk space usage rules for system protection in Windows 7 represent a significant change over those in place for Windows Vista and Windows XP. If you upgrade a PC from Windows Vista to Windows 7, Windows does not adjust the maximum disk space settings previously in place. Thus, for an upgrade, you might discover that a given drive has reserved as much as 30 percent of your free disk space for volume snapshots. In that case, you might want to manually lower the reserved space, using the steps in this section.

To adjust the maximum amount of disk space available for volume snapshots, click the System Protection tab on the System Properties dialog box, select a drive letter from the list of available drives, and move the Max Usage slider to the value you prefer. For drives greater than 64 GB in size, you can choose any value between 1 percent and 100 percent; for drives that are smaller than 64 GB, the minimum reserved space is 300 MB.

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Don't follow old System Restore advice

In Windows Vista, the tools for configuring system protection were relatively inflexible. By default, the system set aside 15 percent of each drive for System Restore snapshots. This value could be adjusted using the DiskPercent value in the registry key HKLM\Software\Microsoft\WindowsNT\CurrentVersion\SystemRestore\Cfg. Although this key is created on a clean installation of Windows 7, it does not appear to have any effect. In addition, the only way to adjust the size of reserved space for System Protection files in Windows Vista was by opening an elevated command prompt and using the vssadmin resize shadowstorage command. Although the vssadmin command is still available in Windows 7, you can accomplish the same goal in much simpler fashion with the Max Usage slider on the System Protection tab of the System Properties dialog box.

You can also use the System Protection tab at any time to manually create a restore point for all drives that have system protection enabled by clicking the Create button at the bottom of **the tab**. **If you're concerned about disk space usage and you're confident that you won't need** to use any of your currently saved restore points in the near future, you can click the Delete button under the Disk Space Usage heading to remove all existing restore points without changing other System Protection settings.

Note The default location for System Restore data is d:\System Volume Information, where d is the letter of each drive. Each restore point is stored in its own subfolder, under a name that includes a unique 32-character alphanumeric identifier called a GUID. This location cannot be changed. On an NTFS drive, these files are not accessible to users, even those in the Administrators group: the default NTFS permissions grant access only to the System account, and there is no easy way to view these files or to take ownership of them (nor should you even consider doing so, as these data structures are not intended for use by anything other than a program working through tightly controlled application programming interfaces).

If you've set up a dual-boot system with Windows XP and Windows 7 (or Windows Vista) on the same system, you should be aware of one unfortunate side effect caused by this configuration. When you boot into Windows XP, the system wipes out all restore points created by the later Windows version. New restore points are created at the usual times when you return to Windows 7, but all previous restore points are gone. This unfortunate state of **affairs is caused because Windows XP doesn't recognize the format of the newer restore points; assuming they're corrupt, it deletes them and creates new ones.**

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Customize System Restore intervals

As we noted earlier, Windows 7 creates restore points in response to specific system events, including the installation of a program, a device driver, or an update delivered via Automatic Updates. Using a scheduled task, the system checks at every startup and at midnight every day to see when the last restore point was created. If more than 3.5 days have passed, the system automatically creates a new restore point. If you prefer to have regular checkpoints created more often, you can do so in either of two ways. The easiest way is to schedule a daily backup that includes a system image. The more complicated solution involves a script and a custom scheduled task.

Create a text file using the following code:

```
Set oRP = getobject("winmgmts:\\.\root\default:Systemrestore")
newRestore = oRP.createrestorepoint ("Created by a custom scheduled task", 0, 100)
```

Running this script will create a restore point using the generic description "Created by a custom scheduled task." Save the file using a name such as `Instant_RP` and the file name extension `.vbs`. Then, using the techniques we describe in "Using the Windows 7 Task Scheduler", create a scheduled task to run the script at the interval you prefer.

Rolling Back to a Stable State with System Restore

In the previous section, we described how to set up the System Protection feature so that it creates regular snapshots of your system configuration. In this section, we explain how to make use of those snapshots.

The System Restore utility provides controlled access to snapshots created by the System Protection feature. **It can't perform miracles—it won't bring a dead hard drive back to life, unfortunately—but it can be a lifesaver in any of the following situations:**

- You install a program that conflicts with other software or drivers on your system. **If uninstalling the program doesn't cure the problem, you can restore your system configuration to a point before you installed the program.** That should remove any problematic files or registry settings added by the program.
- You install one or more updated drivers that cause performance or stability problems. Rather than using the Roll Back Driver command in Device Manager, use System Restore to replace the new, troublesome driver (or drivers) with those that were installed the last time you saved a restore point.

- Your system develops performance or stability problems for no apparent reason. This scenario is especially likely if you share a computer with other family members or coworkers who have administrator accounts and are in the habit of casually installing untested, incompatible software and drivers. If you know the system was working properly on a certain date, you can use a restore point from that date, undoing any changes made since then and, if all goes well, returning your system to proper operation.

Caution!

Don't count on System Restore to protect you from viruses, worms, Trojan horses, and other malware. Use a reliable up-to-date antivirus program.

Using System Restore

The quickest way to get to System Restore is to type `rstrui` at a command prompt. Here are a few alternatives:

- Open the Start menu, click All Programs, click Accessories, click System Tools, and click System Restore.
- On the System Protection tab of the System Properties dialog box, click System Restore.
- In the Start menu search box, type `restore` and then, in the list of search results, click the System Restore shortcut under the Programs heading.
- Open Control Panel, type `system restore` in the Search box, and click Restore System Files And Settings From A Restore Point.

If you're running under a standard user account, you'll need to enter an administrator's credentials in a UAC dialog box to continue.

When the System Restore wizard appears, it might recommend the most recent restore point. To see a complete list of available restore points, select Choose A Different Restore Point and click **Next**. **If the restore point you're looking for is older than the oldest entry in the list, click Show More Restore Points to see the complete, unfiltered list, as shown in Figure 11-8.**

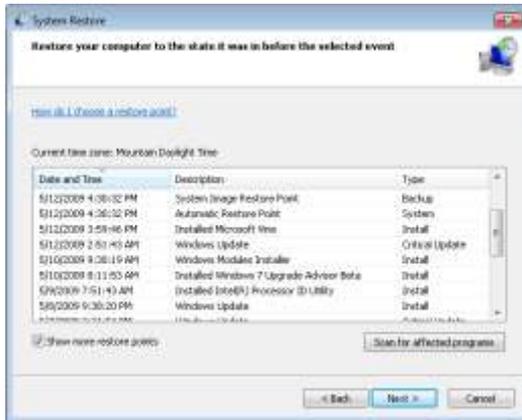


Figure 11-8 You must clear the check box at the bottom of this dialog box to see the complete list of available restore points, regardless of how they were created.

What impact will your choice of restore points have? To see a full list of programs and drivers that will be deleted or restored, select the restore point you're planning to use, and then click Scan For Affected Programs. That displays a dialog box like the one shown in Figure 11-9, highlighting every change you've made since that restore point was created. This capability is new in Windows 7.



Figure 11-9 Check this report before using System Restore to roll back to an earlier configuration so that you know what changes the operation will make.

After selecting a restore point, click Next to display a confirmation dialog box like the one shown in Figure 11-10. The summary shown here lets you know which drives will be affected

and gives you a chance to create a password reset disk—an important precaution if you've recently added or changed a password for your user account.



Figure 11-10 Review this description carefully. After you begin the system restore operation, it cannot be interrupted.

When you're satisfied, click Finish. That takes you to one more confirmation prompt, advising you that the restore process must not be interrupted. Answer Yes, and the system creates a new restore point, and then begins replacing system files and registry settings with those in the previous restore point you selected. As part of the restore process, your computer will restart and various messages will appear, all counseling you to be patient and not to interfere with the goings-on.

When System Restore reinstates a previously saved configuration using a restore point, your data files—documents, pictures, music files, and the like—are not tampered with in any way. (The only exception is if you or a program created or saved a file using file-name extensions from the list of monitored extensions, as described in the previous section.) Before System Restore begins the process of returning your system to a previous restore point, it creates a new restore point—making it easy for you to return to the present if this time machine **doesn't meet your expectations.**

When the process is complete and you have logged back on to Windows 7, do some testing to see if the restoration has improved the stability of your system. If it has not and you want to return the system to the state it was in before you restored it, retrace your steps to System Restore. At or near the top of the list of available restore points, you will find one labeled **Undo: Restore Operation. Restore that one and you're back where you started.**

System Restore Do's and Don'ts

You don't have to be a science fiction aficionado to appreciate the hazards of time travel.

Here are some to be aware of:

- If you create a new user account and then use System Restore to roll back your system configuration to a point before the new account was created, the new user will no longer **be able to log on, and you will receive no warning.** (The good news is that the new user's documents will be intact.)
- System Restore does not uninstall programs, although it does remove executable files, dynamic-link libraries (DLLs), and registry entries created by the installer. To avoid having orphaned program shortcuts and files, view the list of programs and drivers that will be **affected when you return to the restore point you're about to roll back to.** If you don't want the program anymore, uninstall it in the normal way before running the restore operation. If you want to continue using the program, reinstall it after the restore is complete.
- Any changes made to your system configuration using the Windows Recovery Environment are not monitored by System Protection. This can produce unintended consequences if you make major changes to system files and then roll back your system configuration with System Restore.
- Although you can restore your system to a previous configuration from Safe Mode, you cannot create a new restore point in Safe Mode or in the Windows Recovery Environment. As a result, you cannot undo a restore operation that you perform in either of these ways. You should use System Restore from Safe Mode or the Windows Recovery Environment only if you are unable to start Windows normally to perform a restore operation.

For information about the Windows Recovery Environment, see "Making Repairs with the Windows Recovery Environment".