



User's Manual

Diskeeper[®] for Windows[®]

May 2006

This document describes the installation and operation of Diskeeper Corporation's Diskeeper, *The Number One Automatic Defragmenter*[™] for Microsoft[®] Windows. It is intended primarily for Windows system administrators and managers.

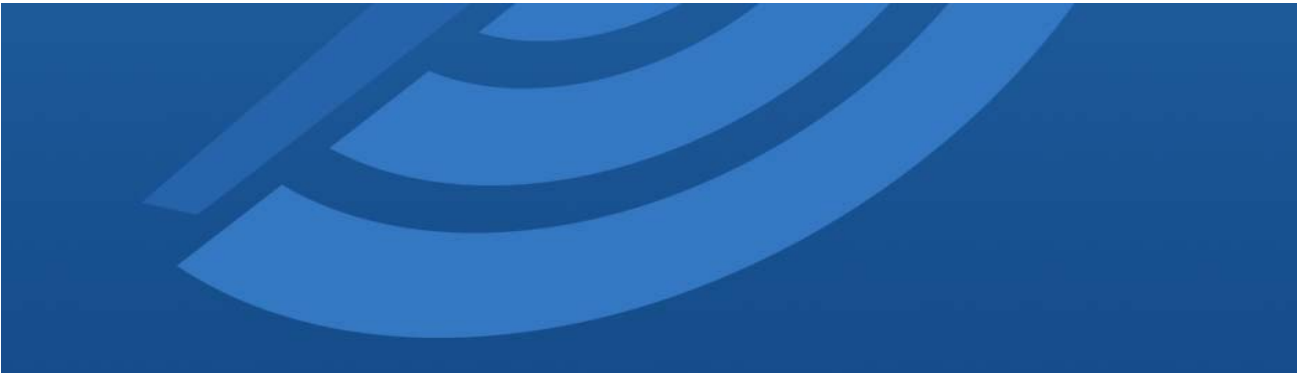
Revision/Update Information: This is a revised manual

Software Versions: Diskeeper 10.0 Professional Edition
Diskeeper 10.0 Professional Premier Edition
Diskeeper 10.0 Server Standard Edition
Diskeeper 10.0 Server Enterprise Edition

Operating Systems:
(varies by Diskeeper edition) Windows Server[™] 2003
Windows XP
Windows 2000
Windows NT 4.0 (SP 6 or higher)
Windows Millennium Edition (Me)
Windows 98



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Preface

What This Book is About

Welcome to the Diskeeper User's Manual. We realize software manuals tend to be one of the least-favorite pieces of reading material around, so we intend to make this one as painless as possible. This book will first help you get Diskeeper quickly installed and running. Next, it describes the various Diskeeper features and how to use them. Finally, it defines disk fragmentation and how it affects your Windows systems.

Structure of This Book

- Chapter 1 describes how to install Diskeeper.
- Chapter 2 explains how to start using Diskeeper and how to see the amount of fragmentation on your disk volumes.
- Chapter 3 gives a brief overview of Diskeeper.
- Chapter 4 explains the various features of Diskeeper in detail.
- Chapter 5 presents the theory of Diskeeper operation.
- Appendix A has tables showing the different Diskeeper editions, and the operating systems, features and capacities they support.
- Appendix B provides answers to frequently asked questions.
- Appendix C explains how to contact your Diskeeper Corporation Customer Service Representative for Support Services.
- Appendix D discusses methods you can use to install Diskeeper network-wide.
- Appendix E describes using Microsoft Group Policy Editor with Diskeeper.
- Appendix F explains how to run Diskeeper as a cluster-aware application on a cluster server.
- The Glossary provides definitions of technical terms used in this manual.

Introduction

Diskeeper 10 represents another step forward in defragmentation technology, with refinements to existing features and the addition of new options that are the result of Diskeeper Corporation's ongoing technical and market research.

As in earlier versions, Diskeeper 10 is designed to solve fragmentation problems for everyone, from home users to the world's largest IT departments.

This User's Manual describes the operation of these Diskeeper editions:

- ***Diskeeper Professional Edition***—for desktop systems running:
 - Windows XP Professional
 - Windows XP Professional x64 Edition
 - Windows XP Home Edition
 - Windows 2000 Professional
 - Windows NT® 4.0 Workstation (SP 6 or higher)

- Windows Millennium Edition (Me)
- Windows 98
- ***Diskeeper Professional Premier Edition***—for desktop systems running:
 - Windows XP Professional
 - Windows XP Professional x64 Edition
 - Windows XP Home Edition
 - Windows 2000 Professional
 - Windows NT® 4.0 Workstation (SP 6 or higher)
 - Windows Millennium Edition (Me)
 - Windows 98
- ***Diskeeper Server Standard Edition***—for systems running:
 - Windows XP (all editions)
 - Windows 2000 (all editions except Datacenter Server)
 - Windows NT 4 (all editions)
 - Windows Server 2003 (all editions except Datacenter Server)
- ***Diskeeper Server Enterprise Edition***—for systems running:
 - Windows XP (all editions)
 - Windows 2000 (all editions)
 - Windows Server 2003 (all editions)

In addition to these versions, the Diskeeper family of products also includes *Diskeeper Home Edition* for home users and *Diskeeper Administrator Edition*, an administrative console for controlling Diskeeper installations throughout your network.

Diskeeper Home Edition incorporates simplified controls, and does not support the network defragmentation capabilities available in the other Diskeeper editions.

Diskeeper Administrator Edition is not a defragmenter, but an application that provides a single point of control by which you can control all the Diskeeper version 9 and 10 installations on your network.

See *Appendix A* for tables showing all the Diskeeper editions with the features and operating system versions they support.

About Fragmentation

As used in this manual, the term *disk fragmentation* means two things:

- a condition in which pieces of individual files on a disk volume are not contiguous, but rather are broken up and scattered around the disk; and
- a condition in which the free space on a disk volume consists of little pieces of space here and there rather than a few large free spaces.

The effects of excessive fragmentation are twofold as well:

- file access takes longer because a file must be collected in pieces here and there, requiring several disk accesses instead of just one; and
- file creations take longer because space for the file must be allocated in little pieces here and there instead of just one contiguous allocation.

The bottom line—fragmentation slows Windows system performance. The longer you wait to defragment your disk volumes, the slower your computer runs.

With Diskeeper, all the volumes in a Windows operating system can be kept defragmented indefinitely. Diskeeper cleans them up and keeps them that way. This includes volumes with compressed, encrypted and sparse files on NTFS volumes.

Running either invisibly as a background job or as a manual defragmenter, Diskeeper carefully rearranges files and free space on a disk volume so they consist of as few pieces as possible. Because Diskeeper runs online, there is no need to lock users off a disk while it is being defragmented.

Diskeeper is the complete “Set It and Forget It”® solution to the loss in system performance caused by disk fragmentation!

What’s New in Diskeeper 10

Whether you’ve used Diskeeper before or not, you may already be familiar with some of its features, but version 10 represents a milestone in the progression of Diskeeper development. New users will find Diskeeper to be easy to use, yet comprehensive in its capabilities. Experienced Diskeeper users will recognize familiar features, presented in a new, more streamlined way. This list gives a summary of what’s new in this version.

▪ Breakthrough I-FAAST™ Technology

Intelligent File Access Acceleration Sequencing Technology (I-FAAST) improves file access and creation by up to 80% (average 10%-20%). This is the first industry implementation of “Disk Performance Calibration”, the modern evolution of the outdated and inconclusive disk optimization strategies of the past.

When I-FAAST is enabled, Diskeeper runs specially-engineered benchmarks on your disk volumes to learn their performance characteristics. Diskeeper then transparently monitors volumes for file access frequency on an ongoing basis to determine which files are requested most often. Special analysis techniques prevent Diskeeper from being “fooled” by files that have been recently accessed.

Using newly-developed technology, Diskeeper sequences the files to take best advantage of both the logical characteristics and physical characteristics of the volume. The sequencing process is integrated with background defragmentation, so it’s virtually transparent to you.

I-FAAST intelligence allows Diskeeper to adapt to changing situations—so if the demands on a given system change, Diskeeper automatically adjusts its behavior accordingly.

This feature is included in Diskeeper Server Enterprise, Diskeeper Server Standard and Diskeeper Professional Premier editions.

▪ I/O Smart™ Enhancements

I/O Smart has been enhanced to completely eliminate performance slows related to disk I/Os incurred by defragmentation.

I/O Smart technology actively “listens” for I/O requests. During a Diskeeper defragmentation job, if another application or process needs access to the hard drive, Diskeeper intelligently pauses defragmentation until the other program I/O requests are fulfilled. Once that happens, Diskeeper gets the go-ahead to resume defragmentation until another request comes along. Combined with its high-speed engine, Diskeeper can easily defragment using the “spaces” between I/O requests, even on busy servers.

This feature is included in all Diskeeper Editions.

▪ Core Defragmentation Engine Enhancements

Improvements to innovative Diskeeper technology provide enhanced defragmentation in low free space conditions (even for very large files) and unsurpassed free space consolidation. Further advancements to “comprehensive” defragmentation will consolidate a volume’s free space into 1 or a small handful of chunks.

Here is example test comparison between Diskeeper 9 and Diskeeper 10 on a Windows XP Professional system:

Windows XP Professional (with severe file and free space fragmentation, and 17% free space)

		Diskeeper 9	Diskeeper 10
Number of excess fragments	Before	129,112	129,112
	After	0	0
Number of free space fragments	Before	34,432	34,432
	After	8,851	5
Elapsed CPU time (Hr:Min:Sec)		1:36:11	1:18:06
Number of Defragmentation Runs		29	2
Peak Memory Size		5,080	4,768
Virtual Memory Size		3,384	3,168

▪ Terabyte Volume Engine™ Improvements

The new Terabyte Volume Engine (TVE™) has improvements to consolidate free space more thoroughly. The TVE is specially designed for volumes with a large number of files. It is the fastest and most resource-conservative defragmentation technology ever developed. Also note the TVE now supports volumes 60 GB or larger, instead of the 100 GB lower limit in Diskeeper 9.

Diskeeper users with large volumes benefit from faster defragmentation, lower overhead and dramatically reduced total cost of ownership (TCO).

Here are some sample TVE performance numbers:

On a terabyte (1,000GB) volume	Standard Engine Time Hr:Min:Sec	TVE Time Hr:Min:Sec	Improvement
250,000 files	00:29:35	00:10:07	192%
500,000 files	01:07:11	00:17:52	276%
1M files	02:30:36	00:33:49	345%
2M files	06:46:30	01:05:49	518%

This feature is included in Diskeeper Server Enterprise Edition.

▪ Smart Scheduling® Enhancements

The improved Smart Scheduling is more proactive and adjusts more quickly to changes in volume fragmentation levels.

Rather than your “best-guesses” as to the optimal frequency of defragmentation for a particular volume, Diskeeper Smart Scheduling algorithms are tuned to dynamically adjust automatic defragmentation based on a volume-level rate of fragmentation. This gives you proactive defragmentation—before fragmentation builds up—preventing system performance issues, and subsequently providing faster defragmentation run times.

This feature is included in all Diskeeper Editions.

- **New Historical Reports**

Diskeeper now gives you an easy-to-access Historical Report of defragmentation results and cumulative fragments eliminated. View fragmentation and defragmentation trends over days weeks or months.

This feature is included in all Diskeeper Editions.

- **Support for 64 bit Windows Operating Systems**

x64 support is included in Diskeeper Professional, Professional Premier, Diskeeper Server Standard and Diskeeper Server Enterprise editions.

- **Redesigned User Interface**

The Diskeeper console has been redesigned for both simplified “basic” use and intuitive “advanced” product configuration.

The new console design is included in all Diskeeper Editions, but note that Diskeeper Home Edition does not include advanced configuration options.

- **Non-Administrator Access to Diskeeper**

Now you can allow your non-Administrator users to control Diskeeper.

This feature is included in Diskeeper Professional and Professional Premier editions, and is controlled by a System/Network Administrator via Diskeeper Administrator.

- **Group Policy Administrative Templates**

All Diskeeper editions (except Home Edition) include Group Policy templates to manage product settings and scheduling via the Group Policy feature included with Windows Active Directory. These templates have been updated with new functionality in this version.

- **Improved Reporting**

The new Job Report contains comprehensive data on file fragmentation, drive health and file access times for each of your disk volumes. The new Job Log reports on defragmentation activity for each day and defragmentation job type. Also, all these reports can now be printed or saved directly from within Diskeeper.

- **Efficient Defragmentation of Large Files**

The Diskeeper algorithms used for efficiently defragmenting large files to the point of performance gain can now combined with the three specialized defragmentation methods available in Diskeeper—Quick, Recommended and Comprehensive.

This feature is included in all Diskeeper Editions.

- **Product Update/Upgrade Improvements**

Diskeeper and Diskeeper Administrator can be configured to automatically check and report on available updates and upgrades. Diskeeper clients can now be configured to retain all previous settings and report data when updated and upgraded.

- **New Command Line Options**

New command line qualifiers include the ability to display Diskeeper schedules.

This feature is not available in Diskeeper Home Edition.

Chapter 1

Diskeeper Installation

This chapter provides information you need before, during, and after installing Diskeeper.

Before the Installation

Windows Versions and Platforms Supported

Diskeeper runs on the Intel® x86 platform (including Pentium™ and compatible CPUs from other manufacturers) running Windows Server 2003, Windows XP Professional, Windows 2000 Professional or Server, Windows NT 4.0 Workstation or Server, Windows Me, or Windows 98.

The Windows versions supported varies by Diskeeper edition. See *Appendix A* for a table showing the different Diskeeper editions and the Windows versions they support.

File Systems Supported

Operating System	File Systems
Windows XP Windows 2000 Windows Server 2003	NTFS, FAT16 and FAT32
Windows NT (SP 6 or higher)	NTFS and FAT16
Windows Me Windows 98	FAT16 and FAT32

Note that the 12-bit FAT file system is not supported. (The 12-bit FAT file system is used on FAT volumes smaller than 16 megabytes in size, such as floppy disks). In addition, NTFS volumes formatted with a cluster size larger than 4 kilobytes are not supported (except on Windows XP and Windows Server 2003, which support cluster sizes up to 64 KB).

Disks Supported

Diskeeper supports a wide range of SCSI, IDE, PATA and SATA disks, including:

- Primary Partitions
- Extended Partitions
- Logical Drives
- Volume Sets
- RAID Arrays

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- Mirrored Disks
- Mounted Volumes (letterless drives)

Resource Requirements

The disk space requirements for Diskkeeper depend on several factors. On Windows Server 2003, Windows XP and Windows 2000 systems, Diskkeeper will need about 11 MB. Allow about 10 MB of extra free space for temporary files during the installation. If Internet Explorer is not present on your computer, some other needed files (hhupd.exe, 50comupd.exe, and windist.exe) may be added. Further, your system may require a new or updated version of the Microsoft Management Console (MMC), which is less than 6 MB.

Additional Software Requirements

On Windows NT 4.0 computers, Service Pack 6 is required for Diskkeeper to function properly. Diskkeeper will not install on Windows NT systems running Service Pack 5 or lower.

Diskkeeper relies on the Microsoft Management Console (MMC). The MMC provides a single point of control for system utilities such as Diskkeeper. The MMC is used as a central location for a variety of Microsoft and third party administrative tools.

Note: The MMC normally has to be installed separately, except on Windows 2000, Windows XP and Windows Server 2003 systems, where it is already built into the operating system. The Diskkeeper setup process will automatically install the MMC on your computer if needed.

Installation Procedure—The Short Version

The Diskkeeper installation is typically fast and simple. Here are the basic steps:

Note: On Windows NT, Windows 2000, Windows XP, or Windows Server 2003, make sure you are logged onto an account that is a member of the Administrators group.

1. Insert the Diskkeeper CD-ROM into the appropriate drive on your computer. (If you are installing from a downloaded file, double-click the file you downloaded.)
2. Follow the screens displayed, answering the questions asked as prompted.

That's it! It would still be a good idea to read *After the Installation* on page 4, but you're done with the installation.

Installation Procedure—The Details

Installation Overview

Diskkeeper can be installed from a CD-ROM, or it may be downloaded from the Web. This procedure applies to both methods. Before you start the installation, please note the following:

- Windows NT 4.0 computers must have Service Pack 6 or higher installed
- On Windows NT 4.0 machines, if you have previously installed Diskkeeper Lite on your computer, Diskkeeper Corporation recommends that you uninstall it before proceeding with the installation of Diskkeeper. If, however, you decide to leave Diskkeeper Lite on your system, be aware that uninstalling Diskkeeper Lite after the installation will remove certain Windows NT registry entries used by Diskkeeper,

and you will need to re-install Diskkeeper. Use the Add/Remove Programs applet in Control Panel to uninstall Diskkeeper Lite.

- On Windows 2000, Windows XP and Windows Server 2003 machines, installing Diskkeeper will not remove the built-in defragmenter, but Diskkeeper will automatically become the default defragmenter. (The built-in defragmenter will be restored if you uninstall Diskkeeper.)
- To install Diskkeeper on Windows NT, Windows 2000, Windows XP, or Windows Server 2003 systems, you must be logged into an account that is a member of the Administrators group.
- Diskkeeper is installed by the SETUP.EXE program supplied on the Diskkeeper CD-ROM. The SETUP.EXE program:
 - Confirms that you have Administrator privileges (on Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems).
 - Determines which Windows version you are running.
 - Checks for sufficient space on the disk for the installation.
 - Detects and removes any previously installed Diskkeeper software.
 - Copies the Diskkeeper files to the destination directories, updates the Windows registry, starts the Diskkeeper service, creates a link in the Windows Start menu for Diskkeeper, and creates a desktop shortcut (if you choose the option to do so).

Installation Procedure

This installation procedure assumes you are installing from CD-ROM. If the Diskkeeper software was downloaded from the Web, double-click the executable file in the directory into which it was downloaded and go directly to step 3.

1. Insert the Diskkeeper CD-ROM into the appropriate drive on your computer.
2. The Windows AutoPlay feature automatically displays a screen that allows you to install Diskkeeper or choose from an assortment of trialware versions of Diskkeeper Corporation products.

If you have disabled the AutoPlay feature, simply double-click the **Setup.exe** file in the root-level folder on the CD-ROM and follow the instructions displayed.

3. Click **Next** when the welcome message appears.
4. After you have read and accepted the license agreement, click **Next** to continue.
5. As an option, you can change the destination location for the Diskkeeper files. By default, Diskkeeper is installed here:

\Program Files\Diskkeeper Corporation\Diskkeeper

You can choose a different disk volume or directory for the installation as follows:

- a) Click **Change**.
 - b) Make the desired changes to the destination and click **OK** to accept the new destination. If the directory you specify does not exist, a new directory will be created.
 - c) Click **Next**.
6. If Internet Explorer 4.01 or higher is not installed on your computer, another installation program is started and a package of necessary components is installed on your computer. Microsoft Management Console (MMC), which is the interface for Diskkeeper, requires these components. These components are a small subset of Internet Explorer—not the complete Internet Explorer product. Installing these components (hhupd.exe, 50comupd.exe, and wintdist.exe) will not affect your current web browser. Note that you must restart your computer after installing Diskkeeper if these components are installed.

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7. If the MMC is not installed on your computer, the MMC Setup program is started automatically. After the MMC files are installed, the Diskeeper Setup program resumes.
8. Setup detects and removes any previously installed Diskeeper software. (Any previous Diskeeper settings are not saved.)
9. On a Windows 2000, Windows XP or Windows Server 2003 system, after Setup is complete, you can immediately start Diskeeper after clicking **Finish**. On Windows 98/Me and Windows NT systems, you may be required to restart your computer before running Diskeeper.
10. To run Diskeeper, click the Windows **Start** button, select **Programs**, and then **Diskeeper Corporation Diskeeper**.

After the Installation

Registering Diskeeper

After the Diskeeper installation is complete, you may be given the option to register your Diskeeper purchase online. You can also register Diskeeper by mailing or faxing the registration card that comes with the CD.

Be sure to register your Diskeeper purchase to receive the free 90 days of technical support included with Diskeeper.

Check for Product Update

The first time you run Diskeeper, it automatically checks to see if a more recent version of Diskeeper is available. If so, you are given the option to download and install the newer version. When the download screen is displayed, click **Run this program from its current location** to begin installing the update. Or, click **Save this program to disk** to save the Diskeeper update installation package on your computer for later installation. (To install an update stored on your computer in this manner, simply double-click the file you download and follow the instructions displayed.)

You can check for Diskeeper updates any time you want. Use the **Updates and Upgrades** option in the Diskeeper Configuration Properties to see if a newer version of Diskeeper is available.

About the Diskeeper Service

Diskeeper is primarily designed as a “Set It and Forget It” disk defragmenter. In order to accomplish this goal, it creates a Windows service. The service allows Diskeeper to run in the background while other applications are running. As long as your operating system is up and running, Diskeeper can defragment your disks, whether you are logged on or not.

After installation, the Diskeeper service starts automatically each time your computer is restarted. The Diskeeper service runs all the time, whether or not defragmentation is occurring. This service consumes negligible system resources, and in most cases will never need to be disabled.

The Windows Application Event Log

When running under Windows NT, Windows 2000, Windows XP, and Windows Server 2003, Diskeeper places messages in the Windows Application Event Log. By default, this log is 512 kilobytes in size (except on Windows Server 2003), and is set to overwrite events older than 7 days old. Diskeeper can potentially fill the log file if these default settings are used, particularly if you choose to log each file movement. To prevent this, perform these steps to change the size and overwriting characteristics of the Application Event Log:

On Windows 2000 and Windows XP

1. Right-click the **My Computer** icon on your desktop and select **Manage**.

2. When the Computer Management Console is displayed, select **System Tools**, and then **Event Viewer**.
3. Expand the Event Viewer (by double-clicking it) and select **Application**.
4. Next, click the **Action** menu and select **Properties**.
 - a) Set the **Maximum log size** to **2048 KB**.
 - b) Enable the **Overwrite events as needed** option.
 - c) Click **OK**.

Diskeeper allows you to specify what information is written to the Application Event Log. For more information, see page 50.

On Windows NT 4.0

1. From the Windows NT **Start** button, choose **Programs**, then the **Administrative Tools** Program Group.
2. In the **Administrative Tools** Program Group, choose the **Event Viewer**.
3. In the **Event Viewer**, open the **Log** menu and choose the **Log Settings** option.
4. In the **Event Log Settings** dialog box, perform these steps:
 - a) Set the **Change Setting** to **Application Log**.
 - b) Set the **Maximum Log Size** to **2048 KB**.
 - c) Enable the **Overwrite Events as Needed** option.
 - d) Click **OK**.

Event Logging under Windows 98/Me

When running on Windows 98/Me, Diskeeper provides the option of logging Diskeeper events into a text file. When Diskeeper logs an event, the event and its message are appended to the Diskeeper log file. These events are written as a text file, which can then be viewed with Notepad, or your choice of text editor programs.

The Diskeeper log file is named **DkEventLog.txt** and it is stored in the directory folder where Diskeeper is installed. The file is limited to 1 MB in size. When it reaches this size, the log is purged completely and the event log is started from scratch.

Remote Installation

Diskeeper can be installed simultaneously on multiple computers in a network, using Diskeeper Administrator Edition.

Remote installation can be a tremendous time saver for system administrators, especially on large networks, where they may have to install Diskeeper on hundreds, or even thousands of computers.

For more information on remotely installing Diskeeper, see *Appendix D*.

Uninstalling Diskeeper

To uninstall Diskeeper on Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems, you must be logged into an account that is a member of the Administrators group.

Note that the controls may have slightly different names, depending on your version of Windows.

Follow these steps to completely remove and uninstall Diskeeper from your computer:

1. From the Control Panel, double-click **Add/Remove Programs**. (On Windows 98/Me or Windows NT systems, click the **Install/Uninstall** tab.)

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2. Highlight the **Diskeeper** entry.
3. Click **Remove** or **Add/Remove** (Windows 98/Me and Windows NT). This removes the Diskeeper program files from your computer. In most cases, the Diskeeper installation directory will not be removed.
4. On Windows 2000, Windows XP, or Windows Server 2003 systems, the Windows Disk Defragmenter is restored to the state it was in before Diskeeper was installed.
5. Manually delete the Diskeeper installation directory if it exists.

Note: If the Microsoft Management Console (MMC) has been installed on your computer, it will not be removed when Diskeeper is uninstalled.

Chapter 2

Getting Started

This chapter explains how to analyze the fragmentation on a disk volume, save the results, defragment the volume, and do a “before and after” comparison.

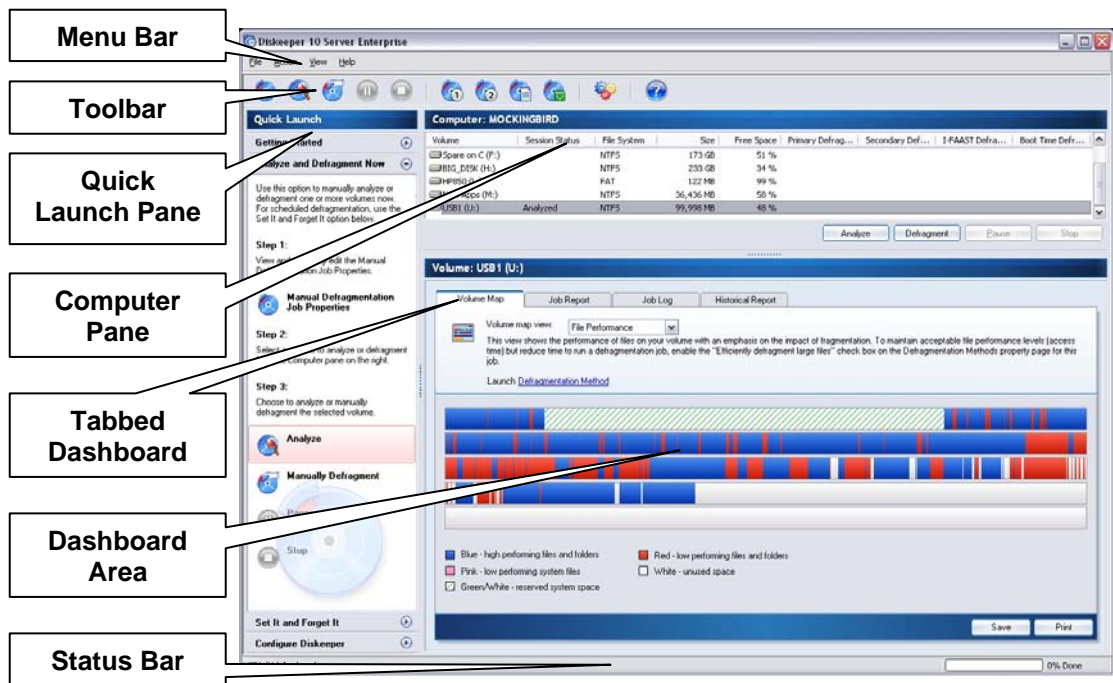
Introduction

If you are new to Diskeeper, here are some helpful tips for getting the best results.

Diskeeper has an entirely new approach to defragmenting when compared to what you may be accustomed to. Diskeeper was designed to allow you to automate background defragmentation without impacting the use of other programs. This procedure will demonstrate how to set up and use Diskeeper as it is intended to be used—for automatic system maintenance.

The Diskeeper Console

Before we go too far, here’s a look at the Diskeeper console:



Menu Bar—The Diskeeper menus provide an alternative way to access the features available from the toolbar and Quick Launch pane.

Toolbar—The Diskeeper toolbar gives quick access to commonly-used controls. Note that all the functions on the toolbar are available from the Diskeeper menus, and many can also be activated from the menu displayed when you right-click on a selected volume in the volume area. See page 17 for more information.


Quick Launch Pane—The Quick Launch pane is where you'll find easy access to the commonly-used Diskeeper features, as well as several shortcuts for performing common tasks. See page 19 for more information.

Computer Pane—The Computer pane shows all the supported disk volumes detected on your computer, and general information about each volume and any schedules that have been established. See page 19 for more information.

Tabbed Controls—The tabs in the Dashboard area allow you to easily change between the Volume Map, the Job Report, the Job Log, and the Historical Report. See page 20 for more information.

Dashboard Area—This is the main “Operations Center” for Diskeeper. Each tabbed pane shows a different aspect of your disks’ condition. See page 20 for more information.

Status Bar—This section of the Diskeeper display shows the progress of any Diskeeper tasks currently running. The status bar also shows other useful information, like the folder location and name of the file being moved, as well as numbers showing the size of the file chunk being moved and the total size of the file.

System Tray Icon—The Diskeeper icon  in the Windows system status area (or system tray) provides a convenient way to see when Diskeeper is defragmenting one or more volumes on your computer. When the icon is displayed, you can right-click it to access these options:

- Diskeeper (opens the Diskeeper console)
- Stop running engines
- Delay scheduled defragmentation

Let's Look At Your Hard Drive

The following brief steps will give you a quick and easy demonstration of Diskeeper on your own workstation or server, and introduce recommended settings.

1. In the Computer pane, locate and select one of your system's volumes.

Volume	Session Status	File System	Size	Free Space	Primary Defragmentation...	Secondary Defr...	I-FAAST Defr...	Boot Time Defr...
ES-335 System (C:)	Analyzed	NTFS	60,682 MB	71 %	Screen Saver	every 12 hours	Weekly	
New Data (D:)		NTFS	78,003 MB	54 %	Smart Scheduling After H...		Daily	
Spare on C (F:)	Analyzed	NTFS	173 GB	51 %				
BIG_DISK (H:)	Defragmentin...	NTFS	233 GB	34 %	Every Night		Daily	
HP850 (L:)		FAT	122 MB	99 %				

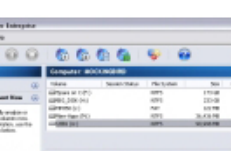
Analyze

Defragment

Pause


Stop

2. In the Quick Launch pane, expand the **Analyze and Defragment Now** task. Next, click **Analyze** to start the analysis. Keep in mind the analysis may take a few seconds—the larger your volume, the longer this will take.




Step 3:

Choose to analyze or manually defragment the selected volume.

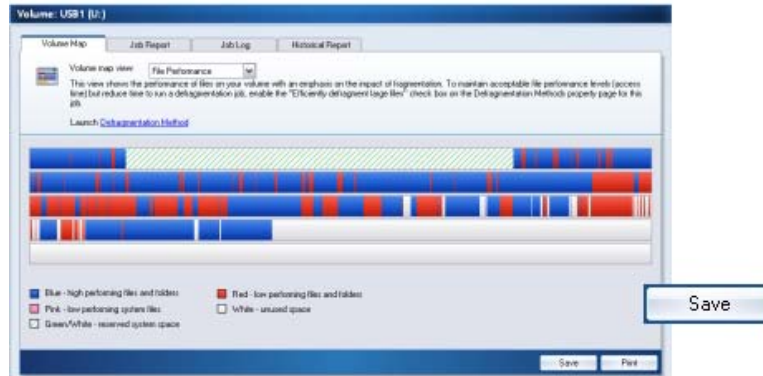


Analyze

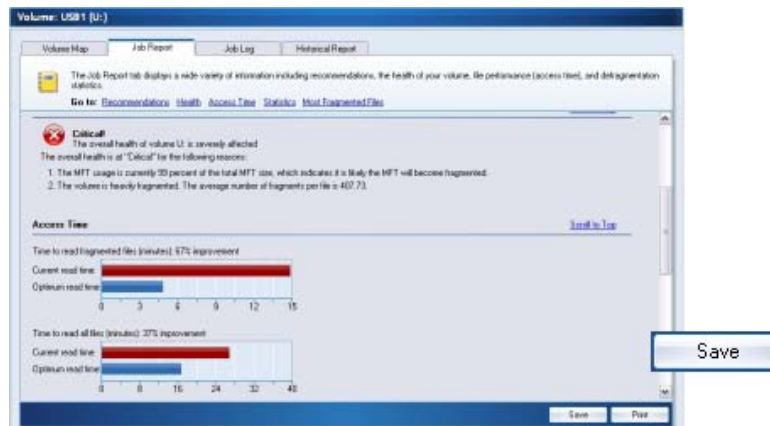


Manually Defragment

- The Volume Map tab gives you an at-a-glance view of the condition of your volume. As the legend at the bottom of the screen explains, the red areas show the extent of fragmentation on the volume. You can click **Save** at the bottom of the screen to save a bitmap file of the Volume Map.



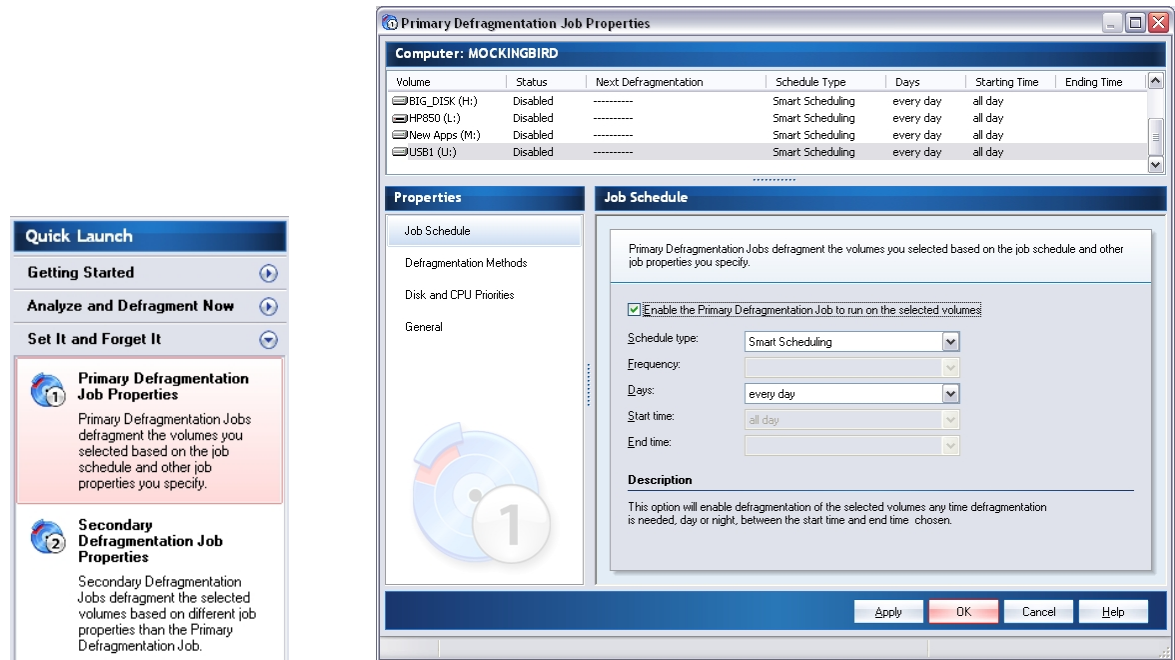
- After the analysis completes click the **Job Report** tab. The Job Report tab provides fragmentation statistics, volume health information, file access times, lists of the most fragmented files on the volume, and recommendations for achieving and maintaining optimal performance. Save this particular analysis by clicking **Save** at the bottom of the Diskeeper console.



- Repeat steps 1 through 4 above for each volume on your system.

Let's Set It and Forget It

Next, navigate to and click **Set It and Forget It** in the Quick Launch pane. Once open, select **Primary Defragmentation Job**. The Primary Defragmentation Job Properties page is displayed. After highlighting all volumes on your system in this window, click the check box to **Enable the Primary Defragmentation Job**. Click **OK** and you're done! You have set a "Smart Schedule" for each of the volumes on your computer.



From this point forward Diskeeper will automatically maintain your volumes, working in the background with no further intervention from you.

Following Up

To check on Diskeeper progress, open Diskeeper the next day (after Diskeeper has executed your defragmentation schedule) and re-run the analysis. Repeat steps 1 through 5 above to record analysis data (remember to save the results to a different file name than the "before" analysis results). By comparing the "before" and "after" reports, you can see the benefit Diskeeper provides to your system's performance and reliability.

The Historical Report tab is another great way to see the benefits for automatic defragmentation. The Historical Report shows graphs indicating the total number of fragments eliminated, the overall fragmentation level, and the file performance improvement gained by using Diskeeper. This information is shown for your computer overall, as well as on a per-volume basis. As you highlight each volume in the Computer pane, the information displayed in the Historical Report changes to reflect the selected volume.

Each graph in the Historical Report shows "before and after" results. Over time, the Historical Report tab will give you a good measure of the benefit Diskeeper provides.

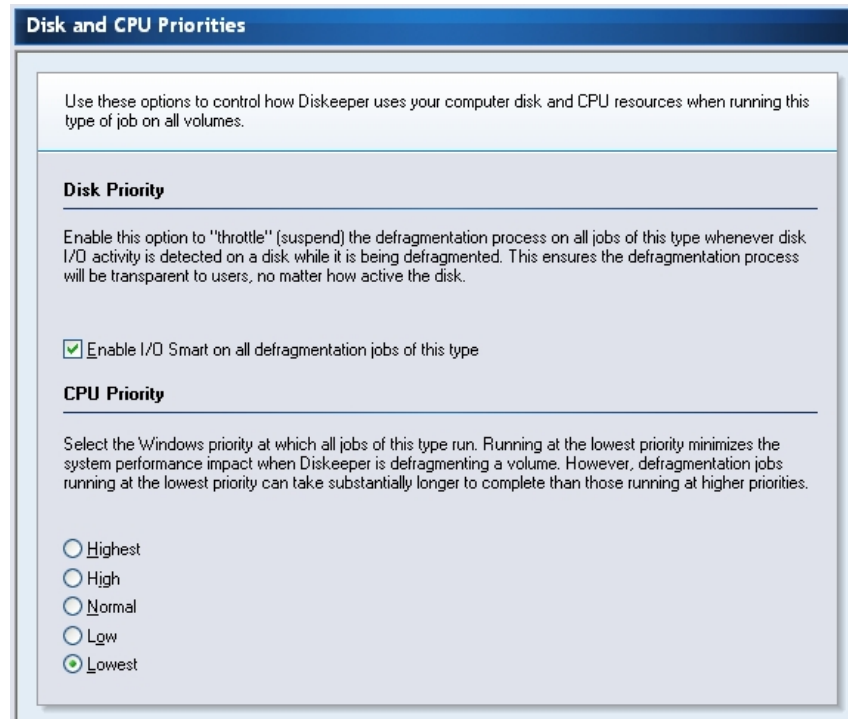
Making Diskeeper Operation Transparent

After seeing the benefits of Diskeeper, you can set it up to run as unobtrusively as possible. Doing so ensures your disk volumes are kept in top shape, and your computer's performance is not slowed down by the defragmentation process itself.

Diskeeper is designed to be run automatically. Doing so ensures the least amount of system resource utilization, in part because the Diskeeper console (required for manual operation) is not running, thus saving resources, and also because I/O Smart is enabled and the CPU Priority is set to "Lowest" (by default).

By default, Manual Defragmentation Jobs run at a higher CPU priority, and I/O Smart is not enabled, so Manual Defragmentation Jobs can have more of a noticeable impact on your system when the job is running.

Of course, the Disk and CPU Priority settings are adjustable in the various Defragmentation Job Properties dialogs:



As another way of making Diskeeper "transparent", it is also highly recommended that you use the exclusive Smart Scheduling feature in Diskeeper. Smart Scheduling goes beyond the limitations of fixed schedules and eliminates fragmented files based on the actual needs of your disks. It defragments your volumes as often as needed no more and no less to achieve and maintain peak system speed. Since all systems (and volumes within a system) fragment at different and ever-changing rates, this self-learning feature dynamically adjusts to changing conditions on a "per-volume" level, eliminating the need for any additional work on your part to maintain ideal file system performance and health.

About Diskeeper Jobs

As it relates to Diskeeper, the term "job" is a request to have a disk volume defragmented. This can be in the form of an immediate request (a Manual Defragmentation Job) or a request to have the defragmentation performed at a later time a Set It and Forget It job.

Depending on your Diskeeper Edition, there are up to four different types of Set It and Forget It jobs you can run:

- **Primary Defragmentation Jobs**
- **Secondary Defragmentation Jobs** (not available in Diskeeper Home Edition)
- **I-FAAST Defragmentation Jobs** (available in Diskeeper Professional Premier, Server Standard and Server Enterprise editions only)
- **Boot-Time Defragmentation Jobs**

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You can run one or more of each job type on each of your volumes. For example, you can establish a Primary Defragmentation job to run periodically on a volume during the day when the computer is active, and a Secondary Defragmentation job running on a different schedule in the off-hours. At the same time, you can have an I-FAAST Defragmentation job scheduled to run once a week on the same volume.

Along with the actual defragmentation operation, there are a number of job “properties” you can apply to each job. These properties differ depending on the job type, but they include things like the job schedule (when the job will run), the defragmentation method used (Quick, Recommended, or Comprehensive), the priority at which the job runs, and other useful “adjustments” to the defragmentation process.

Chapter 3

Overview of Diskeeper

This chapter provides important general information about Diskeeper.

Diskeeper Features

The following list summarizes the most important Diskeeper features:

Diskeeper Family of Products—The Diskeeper family of products offers specialized automatic defragmentation of Windows operating systems ranging from Windows 98 through Windows Server 2003 Datacenter. See the tables in *Appendix A* for the complete Diskeeper lineup.

Descriptive Console Interface—The Diskeeper console provides an intuitive and informative defragmentation experience. Common commands are grouped together in the Quick Launch pane, and a group of tabbed panes show you a wide variety of information. Diskeeper shows you the condition of your disks, and provides suggestions for improving or maintaining your disks.

Performance and Volume Health Analysis—Diskeeper collects and displays data regarding the performance and overall health of your volumes in the Job Report tab. This information allows you to be more proactive in the management and maintenance of your computers.

Terabyte Volume Engine—A Diskeeper exclusive, the terabyte volume engine (TVE) is designed to efficiently defragment extremely large (larger than 60 GB) volumes. This feature is available in selected Diskeeper editions. The table in *Appendix A* shows the Diskeeper editions with TVE support, and more information about the TVE is available on page 53.

Set It and Forget It Operation—Diskeeper is designed to operate without your intervention. Set a schedule for the times you want Diskeeper to run, then sit back and let Diskeeper take care of your disk fragmentation. Of course, you can also run Diskeeper manually. (But you probably have better things to do with your time that's what Set It and Forget It is for!)

Smart Scheduling—This feature allows Diskeeper to automatically determine the optimum defragmentation schedule for each disk volume individually, and adjust that schedule as disk usage changes.

Secondary Schedules—Diskeeper supports secondary defragmentation schedules for each of your volumes. This allows you to set one schedule for weekdays, and another for weekends. Or you can run low-priority defragmentation jobs during the day when the computer is active, and another, higher-priority job in the off-hours.

Selectable Disk and CPU Priority—You can set the disk and CPU priorities at which Diskeeper Defragmentation jobs run. Set the priority independently for all Primary Defragmentation and all Secondary Defragmentation Jobs you establish, as well as for all Manual Defragmentation Jobs.

Frag Shield™—One situation that can impair the performance and reliability of your computer is fragmentation of the Master File Table (MFT) on NTFS volumes and your paging files. Since the operating system relies heavily on the MFT and paging file, the effect of fragmentation is often much greater than when a normal file is fragmented. Special measures must be taken to defragment these files, so it is better to prevent their fragmentation in the first place. The Frag Shield feature helps you configure these critical system files optimally, to help keep them contiguous from the start.

I-FAAST — Intelligent File Access Acceleration Sequencing Technology (I-FAAST) improves file access/creation by up to 80% (average 10%-20%) above and beyond the improvement provided by

defragmentation alone. This is the first industry implementation of “Disk Performance Calibration”, the modern evolution of the outdated and inconclusive disk optimization strategies of the past.

Exclusion Lists—Diskkeeper exclusion lists allow you to specify files and directories that will not be allowed to be processed by Diskkeeper.

Event Logging—Diskkeeper records information about its activity in two ways. First, general information about previously-run defragmentation job is shown in the Job Log tab within the Diskkeeper console. Additional information can also be stored in a log file. A wide variety of information can be saved for future reference.

Simultaneous Analysis or Defragmentation Operations—You can analyze and/or defragment more than one disk volume at a time. Different Diskkeeper editions support different numbers of simultaneous operations. See *Appendix A* for more information.

Boot-Time Defragmentation—Defragment files at boot-time that cannot be moved safely when Windows is running.

Group Policy Support—Diskkeeper can be configured network-wide with the Group Policy Editor provided with Windows 2000 Server and Windows Server 2003.

Other Things to Know

- When running Diskkeeper in the Set It and Forget It or Manual Defragmentation modes, you can run other tasks while defragmentation is occurring.
- When Diskkeeper runs at higher priority levels, performance of other active processes will usually be affected.
- When Diskkeeper runs at lower priority levels, defragmentation may take longer, since Diskkeeper “backs off” for higher-priority processes, including screen savers.
- With the exception of boot-time operations, Diskkeeper runs as a Windows Service and it optionally logs useful defragmentation information into either the Windows Application Event Log (under Windows NT, Windows 2000, Windows XP and Windows Server 2003) or to a text file (under Windows 98/Me).
- Diskkeeper can be uninstalled in the standard manner using the Add/Remove Programs applet in the Windows Control Panel.
- Due to limits built into the Windows NT/2000 file systems, Diskkeeper cannot defragment files on NTFS volumes with a cluster size greater than 4KB (4096 bytes), except during Boot-Time Defragmentation. This limitation has been removed in Windows XP and Windows Server 2003, where Diskkeeper can defragment NTFS volumes with cluster sizes of up to 64 kilobytes. Note the boot-time defragmentation operations are not affected by this limit.
- You must be logged into an account that is a member of the Administrators group to run Diskkeeper on Windows NT, Windows 2000, Windows XP and Windows Server 2003 systems.
- Diskkeeper relies on the Microsoft Management Console (MMC), which is available for Windows 98. The MMC is built into Windows 2000, Windows XP and Windows Server 2003. For more information about the MMC, see the Glossary.

Exclusion List

In some cases, you may have files or directory folders you do not want to defragment. For example, you may not want to defragment temporary files that will soon be deleted. Any files or directories can be excluded from Diskkeeper processing by adding them to the exclusion list.

For more information, see page 42.

Defragmentation Methods

Diskkeeper allows you to choose the type of defragmentation that best suits your needs. Diskkeeper provides defragmentation methods that emphasize:

- Quick defragmentation
- A balanced (and recommended) combination of file and free space defragmentation
- Comprehensive defragmentation with additional emphasis on free space defragmentation

For more information, see page 43.

Priority

The default priority for scheduled Set It and Forget It defragmentation jobs is “Lowest.” while manual defragmentation jobs run at “Normal” priority. You can change the priority independently for both Set It and Forget It and manual defragmentation jobs. If you raise the priority, defragmentation runs tend to complete faster, but may also slow down the users on the system. Lowering the priority will have the opposite effect.

For more information, see page 44.

Frag Shield

One situation that can impair the performance and reliability of your computer is fragmentation of the Master File Table (MFT) on NTFS volumes and your paging files. Since the operating system relies heavily on the MFT and paging file, the effect of fragmentation is often much greater than when a normal file is fragmented. Special measures must be taken to defragment these files, so it is better to prevent their fragmentation in the first place. The Frag Shield feature helps you configure these critical system files optimally, to help keep them contiguous from the start.

For more information, see page 45.

Event Logging

Diskkeeper allows you to record information about its activity in a log file. You can alternately enable or disable the logging of various events to the Diskkeeper Event Log. The logging method varies, depending on the version of Windows you are using.

For more information, see page 50.

Command Line Interface

Diskkeeper can be run from the Windows command prompt. To defragment your local disk volume C:, for example, you would enter this at the command prompt:

diskkeeper C:

Diskkeeper informs you when the defragmentation starts and completes. Press CTRL+C if you want to stop Diskkeeper before it completes the defragmentation run. The Diskkeeper command line interface supports optional control parameters. See page 54 for more information about these options.

Getting the Most from Diskkeeper

Diskkeeper provides a variety of features, all of which are designed to help you get the best performance from your computer. While there are no “hard and fast” rules governing the use of Diskkeeper, here are some general guidelines that will help you get the most from Diskkeeper.

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- When you first install Diskkeeper, analyze all the disk volumes on your computer. This gives you good information about the extent of fragmentation on your computer.
- After you have analyzed your volumes, establish defragmentation schedules for each of your volumes and enable automatic defragmentation. You can even allow Diskkeeper to determine the best schedule for each of your volumes, based on the fragmentation level and file activity on each individual volume. For more information on how to establish a Set It and Forget It schedule, see page 30.
- If the analysis shows fragmentation of the Master File Tables (MFTs) or paging files of your volumes, and you are running Diskkeeper on Windows NT, Windows 2000, Windows XP, or Windows Server 2003, you should next prepare for Boot-Time defragmentation to defragment MFTs and paging files. Since these critical system files cannot be moved while your operating system is up and running, the Boot-Time defragmentation operation defragments the paging file and/or MFT on your volumes while your computer is booting. After running the Boot-Time operation once, regular online defragmentation by Diskkeeper can help prevent the MFT and paging file from becoming fragmented again.

It is recommended you run the Boot-Time defragmentation operation on one disk volume at a time, because it can be time consuming and the computer cannot be used for any other purpose while the boot-time program is running.

Also, it is important to defragment your volumes before running the Boot-Time defragmentation in order to create a contiguous free space for your directories and/or paging files to be moved into. For more information about Boot-Time defragmentation, see page 38.

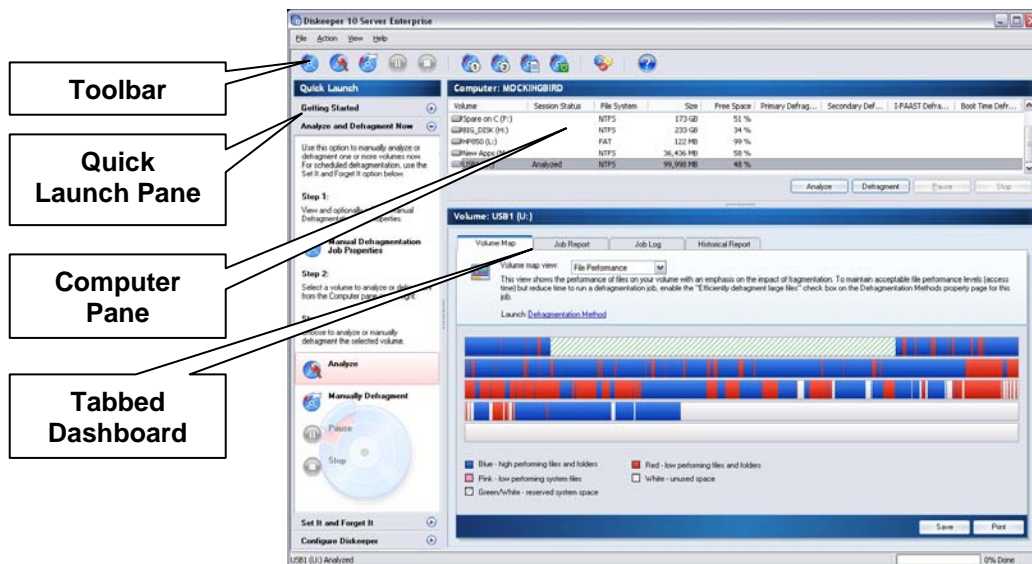
Chapter 4

Diskeeper Operation

This chapter describes how to operate Diskeeper.

The Diskeeper Interface

As briefly explained in Chapter 2, the Diskeeper user interface (or console) is made up of several distinct components. Of particular note:



Toolbar—The Diskeeper toolbar gives quick access to commonly-used controls. Note that all the functions on the toolbar are available from the Diskeeper menus, and many can also be activated from the menu displayed when you right-click on a selected volume in the volume area. See page 17.

Quick Launch Pane—The Quick Launch pane is where you'll find easy access to the commonly-used Diskeeper features, as well as several shortcuts for performing common tasks. See page 19.

Computer Pane—The Computer pane shows all the supported disk volumes detected on your computer, and general information about each volume and any schedules that have been established. See page 19.

Tabbed Dashboard—The tabs in the Dashboard area allow you to easily change between the Volume Map, the Job Report, the Job Log, and the Historical Report. See page 20.

Toolbar Buttons

Diskeeper displays a toolbar of commonly-used controls near the top of the console.

Note that many of the functions on the toolbar are available from the **Action** menu, and are also shown as options when you right-click on a volume in the Computer pane.



Analyze Button—Click this button in the Diskeeper toolbar, the **Analyze** option in the Quick Launch pane, or the **Analyze** option on the Action menu to begin the analysis of the selected volume.



Defragment Button—Click this button in the Diskeeper toolbar, the **Manually Defragment** option in the Quick Launch pane, or the **Defragment** option on the Action menu to start a Manual Defragmentation job on the selected volume.



Pause Button—Click this button in the Diskeeper toolbar or the **Pause** option in the Action menu to temporarily pause an analysis or defragmentation job on the selected volume. Note that the Pause button changes to the Resume button shown below when a job is paused.



Resume Button—Click this button in the Diskeeper toolbar or the **Resume** option in the Action menu to continue a paused Diskeeper analysis or defragmentation job.



Stop Button—Click this button in the Diskeeper toolbar or the **Stop** option in the Action menu to stop an analysis or the defragmentation of the selected volume. Any file movement in progress will be safely ended as Diskeeper stops.



Manual Defragmentation Job Properties Button—Click this button in the Diskeeper toolbar or within the **Analyze and Defragment Now** task in the Quick Launch pane to view and edit the properties applied to all Manual Defragmentation jobs.



Primary Defragmentation Job Properties Button—Click this button in the Diskeeper toolbar or within the **Set It and Forget It** task in the Quick Launch pane to enable a Primary Defragmentation job on the selected volumes and to view and edit the schedule and other properties applied to that job.



Secondary Defragmentation Job Properties Button—Click this button in the Diskeeper toolbar or within the **Set It and Forget It** task in the Quick Launch pane to enable a Secondary Defragmentation job on the selected volumes and to view and edit the schedule and other properties applied to that job.



I-FAAST Defragmentation Job Properties Button—Click this button in the Diskeeper toolbar or within the **Set It and Forget It** task in the Quick Launch pane to enable an I-FAAST Defragmentation job on the selected volumes and to view and edit the schedule and other properties applied to that job.



Boot-Time Defragmentation Job Properties Button—Click this button in the Diskeeper toolbar or within the **Set It and Forget It** task in the Quick Launch pane to enable a Boot-Time Defragmentation job on the selected volumes and to view and edit the schedule and other properties applied to that job.



Diskeeper Configuration Properties Button—Click this button in the Diskeeper toolbar or within the **Configure Diskeeper** task in the Quick Launch pane to view and edit properties that determine how Diskeeper looks and behaves



Help Button—Click this button in the Diskeeper toolbar or within the **Getting Started** task in the Quick Launch pane to access the Diskeeper help.

Quick Launch Pane

The Quick Launch pane offers these options:

Getting Started—Use these options to view Help topics intended to help you begin using Diskeeper.

- Quick Start Guide
- Diskeeper Overview
- Frequently Asked Questions
- Help

Analyze and Defragment Now—Use these options to start the manual analysis or defragmentation of a volume, and to review or change the job properties for all Manual Defragmentation jobs.

- Manual Defragmentation Job Properties
- Analyze
- Manually Defragment Now

Set It and Forget It—Use these options to set up and start Set It and Forget It defragmentation jobs, and to review or change the job properties for the respective jobs.

- Primary Defragmentation Job Properties
- Secondary Defragmentation Job Properties
- FFAST Defragmentation Job Properties
- Boot-Time Defragmentation Job Properties

Configure Diskeeper—Use these options to change Diskeeper behaviors, check for more recent versions of Diskeeper, or see information about the Diskeeper version installed on your computer.

- Diskeeper Configuration Properties
- Updates and Upgrades
- About Diskeeper

Computer Pane

The Computer pane section of the Diskeeper console shows all the supported disks detected on your computer.

Computer: MOCKINGBIRD								
Volume	Session Status	File System	Size	Free Space	Primary Defragmentation...	Secondary Defr...	I-FAAST Defr...	Boot Time Defr...
ES-335 System (C:)	Analyzed	NTFS	60,682 MB	71 %	Screen Saver	every 12 hours	Weekly	
New Data (D:)		NTFS	78,003 MB	54 %	Smart Scheduling After H...		Daily	
Spare on C (F:)	Analyzed	NTFS	173 GB	51 %				
BIG_DISK (H:)	Defragmentin...	NTFS	233 GB	34 %	Every Night		Daily	
HP850 (L:)		FAT	122 MB	99 %				

Analyze Defragment Pause Stop

The Computer pane is a quick way to see:

- Volume letter and name
- Session status (shows what Diskeeper is doing or has done on the volume)
- File system on the volume

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- Capacity of the volume
- Percentage of volume size that is free space
- Information about the type of schedule set for any Primary, Secondary, I-FAAST, and Boot-Time Defragmentation jobs

The Computer Pane also includes buttons for starting, pausing and stopping manual analysis and defragmentation jobs.

Tabbed Dashboard

The tabbed “pages” in the Diskeeper dashboard allow you to easily change between the Volume Map, the Job Report, the Job Log, and the Historical Report.

Volume Map Tab

The horizontal bars in the Volume Map give a graphic representation of the fragmentation of your volume. The Volume Map displays information for a single volume at a time. The disk highlighted in the Computer pane is the disk shown in the Volume Map.

You can choose between views representing either the degree of fragmentation as it relates to file performance, or the file structure on the volume. You can switch between these two views with the **Volume Map view:** option shown at the top of the Volume Map tab.

The **File Performance** view shows the fragmentation on your volume with an emphasis on the performance impact of that fragmentation. In this view, a file is shown as fragmented only if that fragmentation is affecting the performance of your computer.

The **File Structure** view shows additional detail, including the paging file (if it exists) and other system files like the MFT on NTFS volumes. It also shows all the fragmentation (even fragmented file that are not affecting your system’s performance).

What the Colors Mean

The group of horizontal bars in the Volume Map gives a graphic representation of the fragmentation of your volume. The colors of the display indicate the type and condition of the data on your volume. The colors represent different aspects of your volume when you are viewing the two different Volume Map views available.

When the **File Performance** view is displayed, the colors available are:

- **Dark blue** areas show high-performing files and folders.
- **Red** areas show low-performing files and folders.
- **Pink** areas show low-performing system files.
- **White** areas show free space on the volume.
- **Green/White** striped areas (on Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems only) show space on the volume reserved for expansion of the MFT. This space is reserved when a volume is formatted, and cannot be used by applications, including Diskeeper. However, the operating system will write files to this area when the volume becomes extremely full and no other free space is available. Windows provides the capability for Diskeeper to move files out of this reserved area, but does not allow Diskeeper to move files into it. These areas appear only on NTFS volumes.

When the **File Structure** view is displayed, the colors available are:

- **Dark blue** areas show contiguous (non-fragmented) files.
- **Red** areas show fragmented files.
- **Yellow** areas show the paging file (for Windows NT, Windows 2000, Windows XP, and Windows Server 2003) or the swap file (for Windows 98/Me) if it exists on the volume.
- **Green** areas show unmovable system files. On Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems, green areas show the Master File Table (MFT), as well as several other unmovable files. These files cannot be moved safely by Diskeeper (or any other defragmenter), except at boot-time. Keep in mind, however, although these area are referred to as "system files", these are not the files that make up the operating system (which Diskeeper can successfully defragment in the Manual or Set It and Forget It defragmentation modes). Instead, they make up the NTFS file system. The green areas of the display appear only on NTFS volumes.
- **White** areas show free space on the volume.
- **Green/White striped** areas (on Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems only) show space on the volume reserved for expansion of the MFT. This space is reserved when a volume is formatted, and cannot be used by applications, including Diskeeper. However, the operating system will write files to this area when the volume becomes extremely full and no other free space is available. Windows provides the capability for Diskeeper to move files out of this reserved area, but does not allow Diskeeper to move files into it. These areas appear only on NTFS volumes.
- **Light blue** areas show the directory folders on the volume (and their fragments).

Note: When the Terabyte Volume Engine (TVE) or I-FAAST are being used to defragment a volume, the graphic display usually shown in the Volume Map tab is replaced with numerical data showing the progress of the defragmentation operation. This reduction in system resource usage pays off in lower CPU consumption and faster defragmentation of very large volumes. (You can optionally disable this resource-saving feature. See page 52 for more information.)

You can also save the Volume Map (as a bitmap file) or print it by using the respective buttons on the Volume Map tab.

Job Report Tab

The Job Report tab shows detailed information about a volume after it has been analyzed or defragmented. The Job Report displays information for a single disk volume at a time. The volume highlighted in the Computer pane is the volume reflected in the Job report tab.

You can also save the Job Report (as a text file) or print it by using the respective buttons on the Job Report tab.

The Job Report tab includes these sections:

Recommendations Section

This section of the Job Report contains recommendations for improving or maintaining the performance of the volume.

Volume Health Section

This section of the Job Report tab includes an evaluation of the overall health of the volume, the reasons for that rating, and recommendations for improving or maintaining the reliability of the volume.

Diskeeper Corporation has done extensive research into the causes of disk performance and reliability problems. This research has shown these factors play a significant role in regards to disk performance and reliability—the overall health of a disk volume:

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- Overall fragmentation
- MFT fragmentation
- Paging file fragmentation
- Available free space

Diskeeper uses these factors to determine a volume health index each time it analyzes or defragments a volume.

Volume health is rated into three categories—Healthy, Warning and Critical.

This table shows the Warning and Critical levels used in determining the reliability index.

Reliability Factor	Warning Level	Critical Level
Overall Fragmentation	> 10% fragmentation	> 50% fragmentation
MFT Fragmentation	> 250 fragments	>2000 fragments
Paging File Fragmentation	> 250 fragments	>1500 fragments
Free Space	< 15% free space	< 5% free space

I-FAAST Statistics Section

Displayed only on Diskeeper editions that include the Intelligent File Access Acceleration Sequencing Technology (I-FAAST) feature, this section of the Job Report tab provides statistical information about I-FAAST Defragmentation Jobs and the related performance improvement. The values shown in this section are based on measurements taken during I-FAAST processing, and they show the potential performance gain you can expect from the selected volume, as well as the actual measured throughput rates for the volume.

The actual performance gain from using I-FAAST will fluctuate depending volume activity, but the statistics shown in this section of the Job Report tab give you an indication of the improvement you can expect to see.

Access Time Section

This section of the Job Report tab displays a graph illustrating the performance characteristics of the volume, based on current read times calculated by Diskeeper—both for all the files on the drive and for only the fragmented files on the volume. It also shows the expected optimum read time for all the files and for only the fragmented files. This gives you a detailed picture of your performance losses due to fragmentation, and the expected improvement you will see after defragmentation.

Each time you analyze or defragment a disk, Diskeeper calculates the read time of the disk in two ways. First, it shows the predicted time to read all the files on the disk. Secondly, it shows the time to read only the fragmented files. Additionally, it determines the optimum (fastest) read time potential for the disk.

It should be noted that by default, the performance analysis is based on pre-determined disk performance values measured as a part of disk performance research done by Diskeeper Corporation. To get a more accurate performance measurement of your actual disks, Diskeeper must scan your drives to measure their performance. Since this measurement can briefly slow down your computer, this scan operation is disabled by default, but you can turn it on easily. The **Enable volume performance data collection** option is described in the **Diskeeper Configuration Properties** section on page 49.

Statistics Section

This section of the Job Report tab shows useful information about your volume after either analysis or defragmentation. Note that most of the information shown here can also be recorded in the Diskeeper Event Log.

Volume Size

This section of the Job Report tab or event log entry shows the total amount of space on the disk volume. This includes files and free space, as well as disk space used by the operating system (such as directory files and the Master File Table) but not reported in “Used Space.”

Cluster Size

This section of the Job Report tab or event log entry shows the cluster size for the volume. A disk cluster represents a number of disk sectors treated as a single unit. The entire disk is divided into clusters, each one a minimum increment of storage.

Used Space

This section of the Job Report tab or event log entry shows the total amount of disk space (in kilobytes) currently occupied by files. This does not include zero-length files, or certain files used by the operating system, such as directory files and the Master File Table.

Free Space

This section of the Job Report tab or event log entry shows the total amount of free space on the disk volume.

Percent Free Space

This section of the Job Report tab or event log entry shows the percentage of space on the disk volume that is free. This includes the free space in the area reserved for the Master File Table (MFT) on NTFS volumes.

Volume Fragmentation

This section of the Job Report tab or event log entry shows the overall percentage of fragmentation on the disk volume.

The Volume fragmentation figure gives you an overall view of the fragmentation on your volume, by taking both the file fragmentation level and the free space fragmentation level into account. These two values are weighted depending on the ratio of free space to used space on the disk. The formula is:

$$\text{Fragmented space on the volume} * 100 / \text{Total space on the volume}$$

Where *Fragmented space on the volume* is the summed cluster count of all fragmented files times the bytes per clusters.

Data Fragmentation

This section of the Job Report tab or event log entry shows the percentage of file fragmentation on the disk volume.

Data fragmentation is calculated like this:

$$\text{Volume Fragmentation} * \text{Total Space on the Volume} / \text{Used Space on the volume}$$

Note: The calculations for both Data fragmentation and Volume fragmentation are done based on the uncompressed size of the files. If a volume has a large number of fragmented compressed files, these values can exceed 100%. This is similar to looking at files in Windows Explorer—if a large number of files are compressed, the total size of the data can exceed the volume size. This is why you can compare the volume size in Disk Management to the total number of bytes on a volume, and they don’t “add up”.

Total Directories

This section of the Job Report tab or event log entry shows the total number of directories present on the disk volume.

Fragmented Directories

This section of the Job Report tab or event log entry shows the number of fragmented directories on the disk volume.

Excess Directory Fragments

This section of the Job Report tab or event log entry shows the total number of directory fragments on the disk volume. Contiguous directories are not counted in this total, but each additional piece of any fragmented directory is counted.

Total Files

This section of the Job Report tab or event log entry shows the total number of files on the disk volume. This number does not include zero-length files or (in most cases) files less than one cluster in size on NTFS volumes. Files less than one cluster in size may be included, depending on the file size and the cluster size.

Average File Size

This section of the Job Report tab or event log entry shows the average size of all the files on the disk volume. This number does not include any zero-length files or paging files.

Total Fragmented Files

This section of the Job Report tab or event log entry shows the total number of fragmented files on the disk volume.

Total Excess Fragments

This section of the Job Report tab or event log entry shows the total number of file fragments on the disk volume. Contiguous files are not counted in this total, but each additional piece of any fragmented file *is* counted.

Average Fragments per File

This section of the Job Report tab or event log entry shows the average number of fragments per file on the disk volume. This is a good index of how fragmented the files on the volume are.

If the average fragment per file figure is 1.00, the files are contiguous. If the figure is 1.10, then 10% of the files, on average, are in two pieces. 1.20 means 20%, 1.30 means 30%, etc. A figure of 2.00 means the files average two fragments each. 1.00 is the best figure attainable, indicating that all files or nearly all files are contiguous.

Files with Performance Loss

This section of the Job Report tab or event log entry shows the number of files for which fragmentation is causing a loss in performance. For example, although it is fragmented, a large file in two pieces will not exhibit any significant performance loss, so it would not be included in this figure.

Paging/Swap File Size

This section of the Job Report tab or event log entry shows the size of the paging file (or swap file on Windows 98/Me systems) on the disk volume. This section displays zero when no paging file is present.

Total Fragments

This section of the Job Report tab or event log entry shows the number of fragments the paging file is broken into (if it exists on the disk volume).

Total MFT Size

This section of the Job Report tab or event log entry shows the size of the Master File Table (MFT).

Since the MFT is only used on NTFS volumes, this section is not displayed for FAT volumes in the text analysis display, and shows as zeros in the event log.

MFT Records in Use

This section of the Job Report tab or event log entry shows the number of individual file records found in the Master File Table (MFT). This figure will not necessarily correspond with the number of files presently on the volume, since the file records remain in the MFT, even after a file is deleted.

Since the MFT is only used on NTFS volumes, this section is not displayed on FAT volumes.

Percent of MFT In Use

This section of the Job Report tab or event log entry shows the percentage of the Master File Table (MFT) in use.

The MFT grows as the number of files on the volume increases, but is not reduced in size when files are deleted from the volume.

Since the MFT is only used on NTFS volumes, this section is not displayed on FAT volumes.

Total MFT Fragments

This section of the Job Report tab or event log entry shows the number of fragments the Master File Table (MFT) is broken into.

Since the MFT is only used on NTFS volumes, this section is not displayed on FAT volumes.

Most Fragmented Files

Click the **View** button in the Most Fragmented Files section of the Job Report tab to see a list of the most fragmented files on the volume. For each fragmented file listed, this listing shows:

Fragments

Shows the number of fragments associated with the most fragmented files on your disk volume.

File Size

Shows the size of the most fragmented files on your disk volume.

File Name

Shows the names of the most fragmented files on your volume.

If these files are ones that users access frequently, the impact to your system performance may be worse than indicated by the Average Fragments per File figure.

In addition to the names of the most fragmented files, the Most Fragmented Files report also shows information explaining reasons why certain files were not moved or defragmented. The following “tags” may be added to specific filenames in the Most Fragmented Files listing:

Tag	Displayed After	File System	Description
[Cannot Open]	Defragmentation Only	NTFS and FAT	This file cannot be opened (and thus moved) by Diskeeper. This is often the result of the access controls (permissions) on the file being set to prevent Diskeeper from accessing it. File permissions must allow SYSTEM to have full control of a file in order for Diskeeper to defragment it.
[Excluded]	Defragmentation Only	NTFS and FAT	This file is listed on one of the Diskeeper exclusion lists. This can be either the user-specified exclusion list or the internal exclusion list.

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[Excess Allocation]	Analysis and Defragmentation	NTFS Only	With the NTFS file system, a file can be allocated more clusters than its data is actually using. On Windows NT 4 and Windows 2000, only the data portion of the allocation can be defragmented. As a result, even though a file is reported as fragmented, the data portion of the file may in fact be contiguous. This most commonly occurs with registry files and (under Windows 2000) files that have been decompressed. In some cases, files of this type can be defragmented after a system restart
[Partially Defragmented]	Defragmentation Only	NTFS and FAT	This file has been partially defragmented. Its fragments have been reduced in number, but the file is not yet contiguous.
[Insufficient Contiguous Free Space]	Terabyte Volume Engine Defragmentation Only	NTFS Only	There was insufficient free space to defragment the file.
[Move refused by OS]	Terabyte Volume Engine Defragmentation Only	NTFS Only	Although Diskeeper requested the file move, the operating system denied the request. This can happen when free space previously located by Diskeeper is overwritten by other file activity, or if a file is deleted or extended during the defragmentation attempt.

Job Log Tab

The Job Log tab shows information about all the defragmentation jobs you have run on each volume. As you highlight each volume in the Computer pane, the information displayed in the Job Log changes to reflect the selected volume. The Job Log information includes:

- **Job Type**—This column shows the type of defragmentation job run (Primary, Secondary, I-FAAST, or Manual defragmentation)
- **Date**—This column shows the date each job was run.
- **Volume**—This column shows volume label for the selected volume.
- **Times Run**—This column shows the number of times each particular job type has been run on the selected volume.
- **Fragments Eliminated**—This column shows a cumulative total of the number of fragments eliminated for each defragmentation job type.

The Job Log saves up to six months worth of data. New data afterwards will overwrite the oldest data in the Job Log.

You can also save the Job Log (as an HTML file) or print it by using the respective buttons on the Job Log tab.

Historical Report Tab

The Historical Report tab shows graphs indicating the total number of fragments eliminated, the overall fragmentation level, and the file performance improvement gained by using Diskeeper. This information is shown for your computer overall, as well as on a per-volume basis. As you highlight each volume in the Computer pane, the information displayed in the Historical Report changes to reflect the selected volume.

Each graph in the Historical Report shows "before and after" results. Over time, the Historical Report tab will give you a good measure of the benefit Diskeeper provides. Hover your pointer over each point of the graph to see more detailed information about that point.

Use the controls at the bottom of the display to customize the scale and range of the graphs. You can also save the report (as a bitmap file) or print it by using the respective buttons on the Historical Report tab.

Saving and Printing Dashboard Information

Click the **Save** or **Print** buttons at the bottom of any tab page to save or print the information shown on that tab. When you save dashboard information, the file format varies depending on the tab:

Volume Map — saves as a bitmap (.bmp) file

Job Report — saves as a text (.txt) file

Job Log — saves as an HTML (.htm) file

Historical Report — saves as a bitmap (.bmp) file

When you click **Save**, a dialog box is displayed allowing you to specify the name of the report and the location where you want to store it.

Similarly, when you click **Print**, a dialog box is displayed allowing you to specify the printer and any print properties available.

A Word About Job Properties

As mentioned earlier, in addition to Manual Defragmentation Jobs there are up to four different types of Set It and Forget It Jobs you can run, depending on your Diskeeper Edition:

- **Primary Defragmentation Jobs**
- **Secondary Defragmentation Jobs** (not available in Diskeeper Home Edition)
- **I-FAAST Defragmentation Jobs** (available in Diskeeper Professional Premier, Server Standard and Server Enterprise editions only)
- **Boot-Time Defragmentation Jobs**

Each of these different job types have a number of job "properties" you can apply to each job. These properties differ depending on the job type, but they include useful things like the job schedule (when the job will run), the defragmentation method used (Quick, Recommended, or Comprehensive), the priority at which the job runs, and other useful "adjustments" to the defragmentation process.

Keep in mind that many of the job properties apply to all jobs of a particular type. For example, if you specify to use the "Lowest" CPU priority for a Primary Defragmentation Job, all of your Primary Defragmentation Jobs will be run at "Lowest" priority. Or if you choose to use the "Quick" defragmentation method for a Manual Defragmentation Job, then all your subsequent Manual Defragmentation Jobs will use the same defragmentation method.

The notable exceptions to this are Set It and Forget It defragmentation schedules. Defragmentation schedules are applied to one or more disk volumes—whichever volumes you choose when you enable the schedule.

To access the properties for any type of job, click the respective toolbar button, or select the same from the Quick Launch pane. This launches a separate dialog, which varies depending on the job type. For example, the Job Properties dialog for any of the four Set It and Forget It job types includes a Computer pane, listing the volumes available for that particular job type. On the other hand, the Manual Defragmentation Job Properties dialog does not show the Computer Pane, since it is only used for job scheduling, and Manual Defragmentation Jobs are, by their very nature, not scheduled. In all cases, the Job Properties Dialog contains instructive text describing the options available and or other useful information.


Manual Defragmentation Mode

Diskeeper is designed to be operated in two ways —the Manual Defragmentation mode and Set It and Forget It mode.

The Manual Defragmentation mode allows you to control Diskeeper operation directly. You have direct control over which volumes are defragmented, when defragmentation is started and stopped, and other Manual Defragmentation jobs properties.

There are several ways by which to start Diskeeper manually, but the most direct method is simply to highlight the volume you want to defragment, then click the **Defragment** button below the Computer pane. Alternatively, right-click a volume and select **Defragment**.



Tip: You can also use the **Defragment** button  to start defragmenting the selected volume.

With most editions of Diskeeper, you can run more than one manual defragmentation job at the same time. Note that different editions of Diskeeper support different numbers of simultaneous operations. See page 61 for a table showing the different Diskeeper editions and the number of simultaneous operations each supports.

To stop a manual Diskeeper job, first highlight the volume you want to stop defragmenting, then either click the **Stop** button on the Diskeeper toolbar or right-click the volume and select **Stop**.

If you exit from Diskeeper (or even log off your computer) while a manual defragmentation job is running, the job will continue running until it is complete.

There are several options available to control how Manual Defragmentation Jobs run. These options are available via the Manual Defragmentation Job Properties dialog. To view and edit the Manual Defragmentation Job Properties, click the **Manual Defragmentation Job Properties** button in the toolbar, or click **Analyze and Defragment Now** in the Quick Launch pane and select **Manual Defragmentation Job Properties**.

Manual Defragmentation Jobs offer you a choice of two different defragmentation methods—the “Quick” defragmentation method and the “Recommended” (default) defragmentation method. Select the method of your choice via the Manual Defragmentation Job Properties dialog described above. The method you choose will be applied to all Manual Defragmentation Jobs. See page 43 for more information about the defragmentation methods available.

By default, manual defragmentation jobs are run at “Normal” priority, the mid-level Windows priority. Because of this, the performance of tasks running on your computer other than the defragmentation job can be affected. As an option, you can change the priority at which Diskeeper runs for manual defragmentation jobs via the Manual Defragmentation Job Properties dialog described above. Lowering the priority of Diskeeper jobs can help speed the performance of other tasks on your system running at the same time, but can cause Diskeeper to take longer to defragment your volumes. See page 44 for more information about setting the Diskeeper priority.

Note: Diskeeper Home Edition does not support changing the defragmentation priority.

Set It and Forget It Mode

The Set It and Forget It mode allows Diskeeper to run automatically in the background, either after hours or while users and other processes are active on the system, according to a predetermined schedule you set.

This schedule is what sets a Set It and Forget It defragmentation job apart from a Manual defragmentation job.

Diskeeper Corporation pioneered the concept of “Set It and Forget It” defragmentation many years ago, and it remains one of the most useful features in Diskeeper.

Depending on your Diskeeper Edition, there are up to four different types of Set It and Forget It jobs you can run:

- **Primary Defragmentation Jobs**—Primary Defragmentation Jobs are the core component of Set It and Forget It defragmentation. Establish primary jobs for any volumes you want defragmented on a regular basis.
- **Secondary Defragmentation Jobs** (not available in Diskeeper Home Edition)—Secondary Defragmentation Jobs are essentially a second, independent defragmentation job type you can assign to a volume. They have the same, but separate options as Primary Defragmentation Jobs. This allows you to use a Primary Defragmentation Job to set one schedule for weekdays, and a Secondary Defragmentation Job with another schedule on the same volumes for weekends. Or you can run low-priority defragmentation jobs during the day when the computer is active, and another, higher-priority job in the off-hours.
- **I-FAAST Defragmentation Jobs** (available in Diskeeper Professional Premier, Server Standard and Server Enterprise editions only)—I-FAAST (Intelligent File Access Acceleration Sequencing Technology) Defragmentation Jobs are specialized operations that use intelligent technology to defragment and maximize the performance of your most commonly accessed files. Note that I-FAAST Defragmentation Jobs are intended to run along with, not instead of, Primary or Secondary Defragmentation Jobs. See page 35 for more information.
- **Boot-Time Defragmentation Jobs** (not available on Windows 98/Me)—Boot-Time Defragmentation Jobs are useful for the occasional times when you need to defragment files that cannot be safely moved when Windows is running. Boot-Time Defragmentation consists of directory consolidation, paging file defragmentation, and Master File Table (MFT) defragmentation. See page 38 for more information.

To enable Set It and Forget It jobs, open the Set It and Forget It option in the Quick Launch pane, select a job type, select one or more volumes, then specify the schedule and other job properties you want applied to the selected volumes.



Tip: Diskeeper includes several preset schedule types for many typical scenarios, pre-configured and ready to use. These schedules are available in the **Schedule Type**. See page 32 for more information.

You can use the Screen Saver mode to automatically start defragmenting the selected volume(s) any time the screen saver starts on your computer. The defragmentation operation is paused whenever keyboard or mouse activity is detected on the computer.

As a further enhancement to Set It and Forget It, Diskeeper includes the Smart Scheduling feature, which will schedule defragmentation runs more often when the fragmentation level increases, and less often when it decreases. Note that by default, Diskeeper Home Edition enables Smart Scheduling automatically on all your volumes.

After a defragmentation schedule is created for a volume, Diskeeper will follow that schedule until you explicitly stop it. The defragmentation job will run as scheduled, whether you are logged onto the computer or not. With most Diskeeper editions, multiple Set It and Forget It defragmentation jobs can be run at the same time on separate volumes. Note that different editions of Diskeeper support different numbers of simultaneous operations. See page 61 for a table showing the different Diskeeper editions and the number of simultaneous operations each supports.

To cancel (or clear) a scheduled Set It and Forget It job, select the Properties option for the respective job type (Primary, Secondary, I-FAAST, or Boot-Time Defragmentation) from the toolbar or Set It and Forget It task list in the Quick Launch pane, and clear the **Enable the [job type] Defragmentation Job to run on the selected volumes** option (where [job type] is either Primary, Secondary or I-FAAST).

To stop a Set It and Forget It Diskeeper job while it is running, right-click the volume you want to stop defragmenting and select Stop. Or, select the volume and click the Stop button in the Diskeeper toolbar or select the Stop option from the Action menu. This will stop the currently-running job, but will not disable the schedule. A defragmentation job stopped in this way will resume at the next scheduled run time.

If you exit from Diskeeper (or even log off your computer) while a Set It and Forget It job is running, the job will continue running until the current scheduled run is complete. It will then be re-scheduled to run at the next specified run time.

By default, Set It and Forget It defragmentation jobs are run at the lowest Windows priority. Because of this, Set It and Forget It jobs should have no impact on other tasks that are running at the same time. As an option, you can change the priority at which Diskeeper runs for each Set It and Forget It job. See page 44 for more information about setting the Diskeeper priority.


Setting a Defragmentation Schedule

Diskeeper is primarily intended as a "Set It and Forget It" solution to your fragmentation problems. When you establish a defragmentation schedule, you specify the times of day Diskeeper will or will not run on the volumes you select. You can create a Primary Defragmentation Job schedule and a separate, independent Secondary Defragmentation Job schedule for each volume. In addition to Primary and Secondary Defragmentation Job schedules, you can set a schedule for Boot-Time Defragmentation Jobs and I-FAAST (Intelligent File Access Acceleration Sequencing Technology) Defragmentation Jobs in the Diskeeper editions that support these job types.

The steps for setting a defragmentation schedule are the same for either Primary or Secondary Defragmentation Jobs. The I-FAAST and Boot-Time Defragmentation Job schedules offer similar, but slightly different options.

Scheduling Primary or Secondary Defragmentation Jobs

Follow these steps to enable and schedule a Primary Defragmentation Job on one or more volumes. The steps are the same for Secondary Defragmentation Jobs—just select the respective Job Properties option. Note, however, that Secondary Defragmentation Jobs offer the "Custom Schedule" option only:


1. Click **Primary Defragmentation Job Properties**  on the Diskeeper toolbar or select it from the **Set It and Forget It** task list in the Quick Launch Pane.
2. Select one or more volumes in the dialog displayed and select the **Enable the Primary Defragmentation Job to run on the selected volumes** check box on the General properties page.
3. Click **Job Schedule** in the task list to open the Job Schedule page and use the options provided to select a schedule type and to specify how often you want the Primary Defragmentation Job to run, and starting and ending times for the job. (Two particularly useful options are the Smart Scheduling and Screen Saver scheduling modes. There are also several preset schedule types configured for many typical scenarios.) See page 32 for more information about the scheduling options.
4. You can optionally click **Defragmentation Methods** in the task list to open the Defragmentation Methods page and select the defragmentation method you want applies to all Primary Defragmentation Jobs. Note that this will apply to all Primary Defragmentation Jobs. See page 43 for more information about the different defragmentation methods available.
5. As another option, you can click **Disk and CPU Priorities** in the task list to open the Disk and CPU Priorities page. Similar to the Defragmentation Methods option, the disk and CPU priority settings you

establish will apply to all Primary Defragmentation Jobs. See page 44 for more information about the Disk and CPU Priority options.

- Click **OK** to save the schedule you have set and close the Primary Defragmentation Job Properties dialog or click **Apply** to save the schedule without closing the dialog. Click **Cancel** to close the dialog without saving the schedule.

Scheduling I-FAAST Defragmentation Jobs

Follow these steps to enable and schedule an I-FAAST Defragmentation Job on one or more volumes:

- Click **I-FAAST Defragmentation Job Properties**  on the Diskeeper toolbar or select it from the **Set It and Forget It** task list in the Quick Launch Pane.
- Select one or more volumes in the dialog displayed and select the **Enable the I-FAAST Defragmentation Job to run on the selected volumes** check box on the Job Schedule properties page. Note that this option may not be available when certain volumes are highlighted. See below for more information.
- Use the options provided in the Job Schedule page to specify how often you want the I-FAAST Defragmentation Job to run (daily or weekly), and starting and ending times for the job.
- Click **OK** to save the schedule you have set and close the I-FAAST Defragmentation Job Properties dialog or click **Apply** to save the schedule without closing the dialog. Click **Cancel** to close the dialog without saving the schedule.

When you first enable an I-FAAST Defragmentation Job on a volume, Diskeeper evaluates the volume to determine if the volume will benefit from I-FAAST defragmentation. If the volume will not benefit, a message is displayed to explain why, and you are given the choice of enabling I-FAAST Defragmentation or not.

It should be noted that the I-FAAST evaluation creates a hidden **\Diskeeper** folder at the root level of each volume on which it is run. This folder contains relatively small data files used by I-FAAST and should not be deleted when I-FAAST is enabled.

After the evaluation has been performed, the **General** properties page of the I-FAAST Defragmentation Job Properties dialog shows the potential file acceleration from running I-FAAST on the volume and other useful information.

Scheduling Boot-Time Defragmentation Jobs

Unlike other defragmentation jobs, Boot-Time Defragmentation Jobs are intended to only be run occasionally, and in the case of many volumes it may not be necessary. It is important to understand how Boot-Time Defragmentation Jobs differ from other Set It and Forget It jobs. See page 38 for an overview of Boot-Time Defragmentation.

Follow these steps to enable and schedule a Boot-Time Defragmentation Job on one or more volumes.

Note: Boot-Time defragmentation may take a long time, especially on very large volumes that are severely fragmented. Therefore, before running Boot-Time operations, you should schedule the Boot-Time operation to occur at a time when the computer is not needed immediately. Diskeeper Corporation also recommends that you run a Boot-Time Defragmentation Job on only one volume at a time.

- Click **Boot-Time Defragmentation Job Properties**  on the Diskeeper toolbar or select it from the **Set It and Forget It** task list in the Quick Launch Pane.
- Select a volume in the dialog displayed.
- Specify whether you want the Boot-Time Defragmentation Job to run on the next manual reboot of the computer, or specify the time and date you want it to run. Note that if you schedule the Boot-Time

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Defragmentation Job to run at a later time, Diskeeper will automatically restart the computer at the scheduled time.

4. Next, select your choice of the Boot-Time Defragmentation options. See below for descriptions of the options available.
5. Click **OK** to save the schedule and other options you have set and close the Boot-Time Defragmentation Job Properties dialog or click **Apply** to save the schedule without closing the dialog. Click **Cancel** to close the dialog without saving the schedule.

Primary and Secondary Job Scheduling Options

When setting a schedule for a Primary or Secondary Defragmentation Job, you are given these options. Note that Secondary Defragmentation Jobs offer the “Custom Schedule” Schedule Type only:

Enable the [job type] Defragmentation Job to run on the selected volumes

Click this check box to alternately enable and disable the Primary or Secondary Defragmentation Job on the volumes you select in the Computer pane displayed in the Defragmentation Job Properties dialog. (Note that [job type] will be either Primary, Secondary, or I-FAAST, depending on the type of job you are enabling.)

Schedule Type

Use this section of the Job Schedule page to specify a custom schedule or to choose from several preset schedules designed for many common scenarios. You can choose any of these schedule types:

Custom Schedule
Smart Scheduling (see the description of Smart Scheduling later in this chapter)
Screen Saver (see the description of Screen Saver mode later in this chapter)
Smart Scheduling after hours
Every Night
Weekends Only

Frequency

Use this section of the Job Schedule page to specify how often Diskeeper should run on the selected disk volumes. You can specify any of these run frequencies:

One Time
Continuously
Every 2 hours
Every 4 hours
Every 8 hours
Every 12 hours
Every 24 hours
Every 48 hours
Every 72 hours

Days

Use this section of the Job Schedule page to specify days the Diskeeper job will (or will not) be allowed to run on the selected volumes. You can specify any of these time periods to control when Diskeeper is allowed to run:

Everyday	Except Everyday
Weekends	Except Weekends
Weekdays	Except Weekdays
Mondays	Except Mondays
Tuesdays	Except Tuesdays
Wednesdays	Except Wednesdays
Thursdays	Except Thursdays
Fridays	Except Fridays
Saturdays	Except Saturdays
Sundays	Except Sundays

Start Time

Use this section of the Job Schedule page to specify the beginning of a time period the Diskeeper job will (or will not) be allowed to run on the selected volumes. You can specify any of these time periods to specify the beginning of a Diskeeper schedule period:

12:00 midnight through 11:00 P.M., in one hour increments

End Time

Use this section of the Job Schedule page to specify the end of a time period the Diskeeper job will (or will not) be allowed to run on the selected volumes. You can specify any of these time periods to specify the end of a time period Diskeeper will (or will not) be allowed to run:

12:00 midnight through 11:00 P.M., in one hour increments

Description

The bottom section of the Job Schedule page gives a description of the various scheduling options available. The description changes as you select different options.

Smart Scheduling

With Smart Scheduling, you no longer have to decide how often to defragment your disks—Diskeeper will automatically determine the optimum defragmentation schedule for each of your disk volumes and adjust it accordingly.

The method used to determine how often Diskeeper should run is elegant in its simplicity. When Smart Scheduling is enabled, Diskeeper keeps track of the number of files moved every time it runs on each disk volume. When the number of fragmented files moved during a defragmentation run increases, Diskeeper is automatically scheduled to run more often. When the number of files moved decreases, the time between defragmentation runs is increased.

The Smart Scheduling option is available within the **Schedule type:** drop-down list in the Job Schedule page of the Primary Defragmentation Job Properties dialog

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You can also set exclusion times when the Smart Scheduling option will be prevented from scheduling a defragmentation run. When Smart Scheduling is selected, the **Days** drop-down option list will be limited to these times:

Except Everyday
Except Weekends
Except Weekdays
Except Monday
Except Tuesday
Except Wednesday
Except Thursday
Except Friday
Except Saturday
Except Sunday

You can use the **Start time:** and **End time:** drop down lists to further define times when the scheduling of automatic defragmentation runs will not be allowed. For example, a schedule set like this:

Type of Schedule	Which Days
Smart Scheduling	Except Weekdays
Start Time	End Time
1:00 am	3:00 am

will allow Diskeeper to automatically determine how often to run, but will also prevent it from running between 1:00 am and 3:00 am on weekdays (i.e., when your nightly backup is running).

Screen Saver Mode

When enabled, Screen Saver mode automatically starts defragmenting the selected volumes any time the screen saver starts on your computer. The defragmentation operation is paused whenever keyboard or mouse activity is detected on the computer. This option is available under the **Schedule type:** drop-down list in Job Schedule page of the Primary Defragmentation Job Properties dialog.

If you only have a single volume selected for Screen Saver mode, the defragmentation operation is re-started at the logical “beginning” of the volume each time the screen saver re-starts after being interrupted (by keyboard activity, for example).

When more than one volume is selected for Screen Saver mode, the volumes are handled in a round-robin manner. If a defragmentation pass is stopped, the operation resumes on the next volume when the screen saver starts again. For example, if you select volumes C and D to be schedule with Screen Saver mode, when your screen saver starts, Diskeeper begins a defragmentation pass on volume C. If that pass is interrupted, and then the screen saver starts again, Diskeeper will begin a pass on volume D.

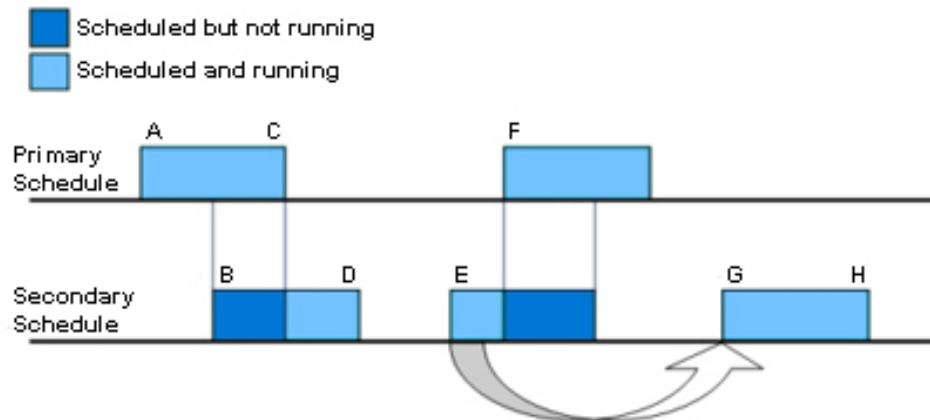
If the screen saver has not been interrupted after Diskeeper completes the defragmentation pass on each of the selected volumes, Diskeeper is automatically scheduled to re-start the defragmentation operation in one hour.

Because of the “start and stop” nature of the Screen Saver mode, it is not recommended on volumes that are heavily fragmented, unless you expect the computer's screen saver to be on for several hours. In cases where your screen saver activity is only for short periods of time, a thorough manual defragmentation or scheduled Set It and Forget It defragmentation should be performed before running Diskeeper in Screen Saver mode.

Note: Screen Saver mode is not recommended for servers. Since many servers spend a good deal of time with the screen saver active, enabling this option could cause Diskeeper to run more often than necessary.

Primary schedule / Secondary schedule Interaction

Diskeeper allows you to set separate schedules for Primary Defragmentation Jobs and Secondary Defragmentation Jobs. In the event of overlapping schedule times, Primary schedules override Secondary schedules. This diagram illustrates how Primary and Secondary schedules operate together:



At point A, the primary schedule starts its job. At point B, the secondary schedule should start its job, but is preempted by the primary schedule's job, which is still running. At point C, the primary job is done, either by completing the defragmentation, or by having its allotted time elapse. At this point, the secondary schedule's job can start, so it does. The secondary job continues until its originally scheduled time slot is up, or the engine completes, whichever is first.

In a second scenario, the span from points E to G represents a secondary schedule slot, which starts before the primary schedule slot at point F.

The secondary schedule runs from E to F, at which time the primary schedule is scheduled to start a job. At that point (F), the primary schedule preempts the secondary schedule and starts its job. The secondary schedule is stopped. As part of its normal procedure in stopping, it re-schedules to the next appointed time for that schedule, point H (shown by the arrow).

I-FAAST Defragmentation Overview

Note: This feature is only available with Diskeeper Server Enterprise, Diskeeper Server Standard and Diskeeper Professional Premier Editions, on Windows 2000 and higher systems.

Also Note: This feature is only available for NTFS volumes. FAT volumes are not supported.

Intelligent File Access Acceleration Sequencing Technology (I-FAAST) improves file access and creation on NTFS volumes by up to 80% (average 10%-20%) above and beyond the improvement provided by defragmentation alone. This is the first industry implementation of "Disk Performance Calibration", the modern evolution of the outdated and inconclusive disk optimization strategies of the past.

When an I-FAAST Defragmentation Job is enabled, Diskeeper runs specially-engineered benchmarks on the selected NTFS volumes to learn their performance characteristics. Diskeeper then transparently monitors these

volumes for file access frequency on an ongoing basis in to determine which files are requested most often. Special analysis techniques prevent Diskeeper from being “fooled” by files that have been recently accessed.

Using newly-developed technology, Diskeeper sequences the files to take best advantage of both the logical characteristics and physical characteristics of the volume. The sequencing process is integrated with background defragmentation, so it’s virtually transparent to you.

Note that I-FAAST Defragmentation Jobs are intended to be used in conjunction with Primary or Secondary Defragmentation Jobs, and these defragmentation jobs will follow rules established by the I-FAAST engine based on the I-FAAST evaluation of the volume.

Also note that since I-FAAST defragmentation is an ongoing process based on conditions and activity patterns detected on your specific volumes, it can take up to a week or more for the full benefits of I-FAAST to become apparent.

When you first enable an I-FAAST Defragmentation Job on a volume, Diskeeper evaluates the volume to determine if the volume will benefit from I-FAAST defragmentation. In order to gather the most accurate data about your volumes, the I-FAAST evaluation should be done when no other activity is occurring on the computer. Any currently-running defragmentation jobs will be stopped before the I-FAAST evaluation is performed. Manual Defragmentation Jobs will not be resumed, but Primary or Secondary Defragmentation Jobs will resume at their next scheduled starting time.

After the evaluation has been completed, if any of the selected volumes will not benefit from running I-FAAST, a message is displayed to explain why, and you are given the choice of enabling I-FAAST Defragmentation or not on those volumes.

It should be noted that the I-FAAST evaluation creates a hidden **\Diskeeper** folder at the root level of each volume on which it is run. This folder contains data files used by I-FAAST and should not be deleted when I-FAAST is enabled.


After the evaluation, the **General** properties page of the I-FAAST Defragmentation Job Properties dialog shows the potential file acceleration from running I-FAAST on the volume and other useful information.

I-FAAST intelligence allows Diskeeper to adapt to changing situations—so if the demands on a given system change, Diskeeper automatically adjusts its behavior accordingly.

Setting an I-FAAST Defragmentation Job Schedule

Keep in mind that I-FAAST (Intelligent File Access Acceleration Technology) Defragmentation Jobs are designed to run along with either Primary or Secondary Defragmentation Jobs. I-FAAST Defragmentation Jobs are intended to supplement regular scheduled defragmentation jobs, not replace them. As the Primary and Secondary Defragmentation Jobs run, they will follow rules established by the I-FAAST engine based on the I-FAAST evaluation of the volume.

Follow these steps to enable and schedule an I-FAAST Defragmentation Job on one or more volumes:

1. Click **I-FAAST Defragmentation Job Properties**  on the Diskeeper toolbar or select it from the Set It and Forget It task list in the Quick Launch Pane.
2. Select one or more volumes in the dialog displayed and enable the **Enable I-FAAST to run on the selected volumes** check box on the Job Schedule properties page. Note that this option may not be available when certain volumes are highlighted. See below for more information.
3. Use the options provided to specify how often you want the I-FAAST Defragmentation Job to run (daily or weekly), and starting and ending times for the job.
4. Click **OK** to save the schedule you have set and close the I-FAAST Defragmentation Job Properties dialog or click **Apply** to save the schedule without closing the dialog. Click **Cancel** to close the dialog without saving the schedule.

When you first enable an I-FAAST Defragmentation Job on a volume, Diskeeper evaluates the volume to determine if the volume will benefit from I-FAAST defragmentation. If the volume will not benefit, a message is displayed to explain why, and you are given the choice of enabling I-FAAST Defragmentation or not.

I-FAAST Job Scheduling Options

When setting a schedule for an I-FAAST Defragmentation Job, you are given these options:

Enable the I-FAAST Defragmentation Job to run on the selected volumes

Click this check box to alternately enable and disable the I-FAAST job on the volumes you select in the Computer pane displayed in the I-FAAST Defragmentation Job Properties dialog.

Schedule Type

Since I-FAAST defragmentation is a specialized operation, only the “Custom” schedule type is available.

Frequency

Use this section of the Job Schedule page to specify how often the I-FAAST Defragmentation Job should run on the selected disk volumes. You can choose to run it either Daily or Weekly. The options available under the “Days” section of the Job Schedule page (described below) differ, depending on whether you choose Daily or Weekly

Days

Use this section of the Job Schedule page to specify days the Diskeeper job will (or will not) be allowed to run on the selected volumes.

If you select the Weekly option in the “Frequency” section of the Job Schedule page, these options are available:

Mondays
Tuesdays
Wednesdays
Thursdays
Fridays
Saturdays
Sundays

If you select the Daily option in the “Frequency” section of the Job Schedule page, these options are available:

Everyday
Except Weekends
Except Mondays
Except Tuesdays
Except Wednesdays
Except Thursdays
Except Fridays
Except Saturdays
Except Sundays

Start Time

Use this section of the Job Schedule page to specify the beginning of a time period the Diskeeper job will (or will not) be allowed to run on the selected volumes. You can specify any of these time periods to specify the beginning of a Diskeeper schedule period:

12:00 midnight through 11:00 P.M., in one hour increments

End Time

Use this section of the Job Schedule page to specify the end of a time period the Diskeeper job will (or will not) be allowed to run on the selected volumes. You can specify any of these time periods to specify the end of a time period Diskeeper will (or will not) be allowed to run:

12:00 midnight through 11:00 P.M., in one hour increments

Description

The bottom section of the Job Schedule page gives a description of the various scheduling options available. The description changes as you select different options.

I-FAAST and the Volume Map Tab

When the I-FAAST engine is defragmenting a volume, the graphic display usually shown in the Volume Map tab is replaced with numerical data showing the progress of the defragmentation operation. This reduction in system resource usage pays off in lower CPU consumption and faster I-FAAST defragmentation. (You can optionally disable this resource-saving feature. See page 52 for more information.)

Here is a description of the information displayed in the Volume Map tab when the I-FAAST engine is defragmenting a volume:

File record examinations

This is the number of times a file record (MFT record) was examined and is basically used to show that progress is occurring. The number may be larger than the number of file records on the volume if a full job runs, because a file record may be examined more than once, or it may be smaller than the number of file records on the volume if the job didn't run to completion.

Fragmented file examinations

This is the number of the above file record examinations that located fragmented files. Again, a file may be examined more than once during a defragmentation job, so this number will not match the number of fragmented files reported in the Job Report tab.

Fragments eliminated

This is the number of fragments that were eliminated by the TVE. It may not match the number of fragments reported in the Job Report tab because the job was only partially completed, or because files became more or less fragmented as the result of other processes during the period when the engine runs.

Contiguous file examinations

This is the number of the above file record examinations that located contiguous files that could be moved to help consolidate free space. Not all files on the volume are candidates for this action, so the number will most likely be far less than the number of contiguous files in the Job Report tab.

Files that could not be processed

This is the number of times that a file couldn't be moved. The most common reasons for a file not moving are:

- Diskeeper was denied permission to open the file (the file did not allow the SYSTEM process Full Control)
- The file was open for exclusive use by another process
- Free space was no longer available when the move was attempted.

The Windows application event log stores the reason(s) for the first fifty files that could not be processed.

Boot-Time Defragmentation Overview

Note: The Boot-Time defragmentation option is only available in Diskeeper when running on Windows NT, Windows 2000, Windows XP, or Windows Server 2003.

Boot-Time defragmentation consists of three independent activities:

- **Directory Defragmentation and Consolidation**—moves directories to a single location. Windows NT, Windows 2000, Windows XP, and Windows Server 2003 write directories into random locations all over a volume. This, in effect, breaks up the free space on the volume. By grouping all the directories into a single location on a volume, larger areas of contiguous free space become available. Therefore, new files are more likely to be written to the volume in a contiguous manner. This also helps make Diskeeper more effective when it is run in either the Set It and Forget It or Manual defragmentation modes.

Note that on NTFS volumes on Windows 2000, Windows XP and Windows Server 2003 systems, directories can be moved and defragmented online, which makes directory consolidation on these volumes unnecessary. This is also why directory consolidation is not necessary on Windows 98/Me systems.

In most cases, you should run Boot-Time directory consolidation shortly after the first time you use Diskeeper defragmentation on a volume, or after any operation (such as installing a new application), that creates multiple directories. By moving all the directories together, you create more contiguous free space for file defragmentation.

- **Master File Table (MFT) Defragmentation**—defragments the Master File Table (MFT). The MFT is a critical section of Windows NTFS disk volumes. The MFT is used by the NTFS file system to locate files on a volume, so fragmentation of the MFT slows the retrieval of files on the disk—whether these files themselves are fragmented or not. Defragmenting the MFT will improve the overall performance of the volume.

Note that on Windows XP and Windows Server 2003 systems, most, but not all of the Master File Table can be defragmented by Diskeeper online during normal Set It and Forget It or manual defragmentation operations. The boot-time process is still required to fully defragment the MFT, but it usually does not need to occur as often as it does on Windows NT and Windows 2000.

- **Paging File Defragmentation**—defragments the paging file. Fragmented paging files can slow Windows performance. They can also hurt the effectiveness of Diskeeper, since the unmovable paging file fragments break up the free space on the volume. By defragmenting your paging file, you can help maintain peak Windows performance, and help Diskeeper run better at the same time. After a paging file has been defragmented, it should remain contiguous unless its size is changed.

Boot-time defragmentation opens up larger areas of contiguous free space for new file creation and modification.

Important: For best results with the Boot-Time defragmentation feature, Diskeeper Corporation strongly recommends:

1. Make sure you have sufficient contiguous free space. Delete unneeded files and perform one or more manual defragmentation runs to defragment the volume as much as possible.
2. Enable the **Run the system “CHKDSK” utility before defragmentation** option. This will help prevent vital files from being moved to bad disk sectors.
3. Boot-Time defragmentation can take a long time, especially on very large disk volumes that are severely fragmented. Therefore, before running Boot-Time operations, you should:
 - Schedule the Boot-Time operation on weekends or other time when the machine is not needed immediately.

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- Perform the Boot-Time operation on only one disk volume at a time.

On Windows NT, directory consolidation, MFT defragmentation and paging file defragmentation are done at boot-time, because the directories, the MFT, and the paging file cannot be moved safely while Windows NT is active. (Note that under Windows 2000, Windows XP and Windows Server 2003, directories on NTFS volumes can be moved and defragmented online, which makes directory consolidation on these volumes unnecessary.)

Several points about Boot-Time defragmentation:

- Keep in mind that for maximum efficiency, the Boot-Time defragmentation operation concentrates only on files that cannot be defragmented online. It is not intended to defragment all the files on your disk.
- Boot-Time defragmentation relies on having a contiguous free space into which to move the directories and/or paging file on your volume. Therefore, it is beneficial to run Diskeeper in either the Set It and Forget It or Manual Defragmentation mode *before* running Boot-Time defragmentation.
- Boot-Time defragmentation is a one-time operation. After it runs on a volume, it is not automatically set up to run again. You must set it each time you want it to run on a volume. It is usually not necessary to run Boot-Time defragmentation repeatedly on a volume.
- It is safe to restart your computer midway through the Boot-Time defragmentation operation. However, if you do so, you should use the Error Checking option in **Drive Properties | Tools** on the volume that was being processed when you restarted your computer, and enable both the fix and the scan options, or (if you are running from the Windows Command Prompt) run CHKDSK, using the /F qualifier. This ensures the files and free space on the volume are correctly allocated.
- After running the Boot-Time defragmentation, use the Set It and Forget It option to keep the volume defragmented.

Boot-Time Defragmentation Options

The following controls are available in the Boot-Time Defragmentation Job Properties dialog:

Available Volumes

Use this section of the Boot-Time Defragmentation Properties dialog to specify the volume(s) upon which you want to consolidate the directories and/or defragment the paging file and Master File Table (MFT). You can select more than one volume at a time, but be aware that the volumes will be processed one at a time, and your computer will be restarted automatically after each volume is processed. This will substantially increase the time needed to complete the operation.

Always select at least one volume before choosing any of the other options in the Boot-Time Defragmentation Properties dialog.

Schedule boot-time defragmentation

Use this section of the Boot-Time Defragmentation Properties dialog to specify when you want the boot-time defragmentation operation to occur. You can choose from any one of these options:

- **On next manual reboot**—The boot-time operation will take place the next time the computer is rebooted
- **At scheduled time**—Use these controls to specify when you want the computer to be automatically rebooted.

About one hour before a scheduled Boot-Time defragmentation is due, a message is broadcast at regular intervals to all users logged on to the computer, informing them that a scheduled reboot is about to take place and requesting them to log off. If at the scheduled time someone is still logged on and **Perform boot-time defragmentation even if this drive is being used by remote users** is cleared, the computer will not reboot, but will instead perform the Boot-Time defragmentation the next time the computer is rebooted manually. If this option is set, however, the machine will reboot at the scheduled time, regardless of whether or not any users are logged on.

- **Don't run boot-time defragmentation**—Use this option to clear a previously-scheduled boot-time operation. This option is useful for cases where you've scheduled a boot-time defragmentation, then decided to postpone the operation.

Put all folders together on the volume

Check this box to defragment and consolidate the directories of the selected volumes, next time your computer starts up.

Run the system "CHKDSK" utility before defragmentation

Use this control to specify whether the Windows CHKDSK disk error checking utility is run (using the /F qualifier) before the boot-time operation. Running CHKDSK adds time to the Boot-Time defragmentation operation, but it can correct disk errors that otherwise would hamper effective directory consolidation.

Note: Enabling the CHKDSK option will cause CHKDSK to run on each selected volume before the Boot-Time defragmentation process. The time increase can be considerable and Diskeeper Corporation therefore recommends performing boot-time defragmentation on one volume at a time.

Also Note: After enabling the CHKDSK option, you will not be able to run either Set It and Forget It or manual defragmentation on the disk until you reboot. For this reason, Diskeeper Corporation recommends waiting to enable this option until just before you are ready to reboot your computer.

Defragment the paging file

Check this box to defragment the paging file of the selected volume the next time your computer starts up.

Defragment the Master File Table (MFT)

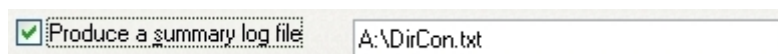
Check this box to defragment the MFT of the selected volume the next time your computer starts up.

Pause to view screen after defragmentation

When enabled, this option causes the Boot-Time operation to pause after completion. It remains in this paused state until you manually restart your computer (by either pressing the Reset button or turning off the power switch). If this option is not enabled, the Boot-Time defragmentation operation pauses a short 15 seconds (to allow you to read any messages on the monitor screen), then automatically restarts your computer.

Produce a summary log file

Use this option to cause a text file to be written that summarizes the Boot-Time defragmentation operation. When this option is enabled, a default volume letter, directory, and file name are shown in the dialog box similar to this:



By default, the summary file is written to your floppy drive (A:). This dialog box can be edited to specify another volume, directory path, and filename. However, the summary file cannot be written to the volume upon which you are running Boot-Time defragmentation. Also note that the filename should not contain any spaces.

Note: Some computers read the floppy drive at boot-time. We therefore recommend not writing the summary file to the A: drive, unless no other volumes are available.

Perform Boot-Time Defragmentation Job even if this drive is being used by remote users

When this option is set, the computer will force a reboot at the scheduled date and time, if the **At scheduled time** option has been selected, regardless of whether or not anyone is logged on to the machine. Users who are logged on will be notified at regular intervals, starting one hour before the scheduled reboot, to give them an opportunity to log off.

If this option is cleared, a scheduled reboot will not occur at the scheduled date and time if one or more users are still logged on when the reboot due. In that case, the Boot-Time defragmentation run will occur the next time the machine is rebooted manually.

OK

Click **OK** to schedule Boot-Time defragmentation of one or more selected volumes and close the Boot-Time Defragmentation Properties dialog. Boot-Time defragmentation will be run as scheduled on any volumes that are set.

Apply

Click **Apply** to schedule Boot-Time defragmentation of one or more selected volumes without closing the Boot-Time Defragmentation Properties dialog. When a volume has been scheduled, it will be noted in the Available Volumes box. Also, use the Apply button to change the characteristics of a previously set Boot-Time defragmentation (such as enabling/disabling the Summary File option).

Boot-Time defragmentation will be run as scheduled on any volumes that are set.

Cancel

Click **Cancel** to close the Boot-Time defragmentation dialog box without making any changes.

Primary and Secondary Defragmentation Job Properties

Primary Defragmentation Jobs and Secondary Defragmentation Jobs are controlled via separate Properties dialogs for each of the two defragmentation job types. Although these dialog are separate, they offer the same set of options. See page 35 for more information about how Primary and Secondary Defragmentation Jobs work together.

Click **Primary Defragmentation Job Properties**  or **Secondary Defragmentation Job Properties**

 in the Diskeeper toolbar or the **Set It and Forget It** task group in the Quick Launch pane to display the respective Job Properties dialog.

The Job Properties dialog consists of three sections, somewhat similar to the main Diskeeper console:

Computer Pane—The upper section of the Job Properties dialog shows a listing of the volumes on your computer, the scheduling status, the date and time of the next scheduled defragmentation job of this type (Primary or Secondary), the schedule type and other details about any schedules set.

Task List—The left side of the Job Properties dialog contains a list of optional tasks you can use to customize the way Primary or Secondary Defragmentation Jobs behave. See below for additional details about the options available.

Dashboard Area—The main “body” of the Job Properties dialog displays information and options available for each different task you select from the Task List. The information shown in the dashboard area is intended to help you understand the options available and answer most questions that may arise.

Of particular interest, the Job Schedule page of the Job Properties dialog contains a check box that alternately enables and disables a Primary or Secondary Defragmentation Job on the volumes selected in the Computer pane. When this check box is enabled, a Primary or Secondary Defragmentation Job will be run on the selected volumes, using the schedule, defragmentation methods, and disk and CPU priorities specified within the other properties pages.

Task List Options

The Task List in the Job Properties dialog includes these options:

- **Job Schedule** — See page 32 for more information
- **Defragmentation Method** — See page 43 for more information
- **Disk and CPU Priorities** — See page 44 for more information
- **General** — For each selected volume in the Computer pane of the Job Properties dialog, the General page of the Job Properties dialog shows when the Primary or Secondary Defragmentation Job last ran, the number of fragments eliminated today, and the cumulative total of all fragments eliminated.

I-FAAST Defragmentation Job Properties

Since I-FAAST Defragmentation Jobs are a specialized operation, the only “Property” available is the job scheduling option described on page 31.



Click **I-FAAST Defragmentation Job Properties** in the Diskeeper toolbar or the **Set It and Forget It** task group in the Quick Launch pane to display the I-FAAST Job Properties dialog.

As with Primary and Secondary Defragmentation Jobs, the I-FAAST Job Properties dialog consists of three sections, somewhat similar to the main Diskeeper console:

Computer Pane—The upper section of the Job Properties dialog shows a listing of the volumes on your computer, the scheduling status, the date and time of the next scheduled defragmentation job of this type (I-FAAST), the schedule type and other details about any schedules set.

Task List—Due to the unique nature of I-FAAST Defragmentation Jobs, the left side of the Job Properties dialog only contains two options: The Job Schedule option and the General option. The Job Schedule option, as the name implies, is used to enable I-FAAST Defragmentation schedules. The General option shows details about the potential performance gains for the selected volume from I-FAAST, and details about when it last ran on the volume and the number of fragments eliminated.

Dashboard Area—The main “body” of the Job Properties dialog displays information and options available for each different task you select from the Task List. The information shown in the dashboard area is intended to help you understand the options available and answer most questions that may arise.

Of particular interest, the Job Schedule page of the Job Properties dialog contains a check box that alternately enables and disables an I-FAAST Defragmentation Job on the volumes selected in the Computer pane. When this check box is enabled, an I-FAAST Defragmentation Job will be run on the selected volumes, using the schedule specified within the Job Schedule page.

Using Different Defragmentation Methods

Diskeeper allows you to choose the type of defragmentation that best suits your needs. You can specify different defragmentation methods for each Primary and Secondary defragmentation job you establish. Diskeeper provides these defragmentation methods:

- **Quick Defragmentation** — This method provides the fastest defragmentation. It reduces the defragmentation time by placing the emphasis on defragmenting the fragmented files, rather than free space consolidation, since this returns the greatest system performance gain. This defragmentation method will complete faster and use fewer resources, but note that the free space consolidation will not be as thorough as the other methods.
- **Recommended Defragmentation** — This is the default, proven and balanced mix of file defragmentation and free space consolidation. It is designed to gain the best disk performance without using excessive system resources.
- **Comprehensive Defragmentation** — This defragmentation method performs additional free space consolidation. This method performs a normal Diskeeper defragmentation, but then additionally performs


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extra processing to further improve free space consolidation. It is important to note this method requires additional processing and time, and free space consolidation improvement will be gradual as the option is used over time. Since the Comprehensive Defragmentation method is best suited for scheduled defragmentation jobs, it is not available for Manual Defragmentation Jobs.



In addition to these options, you can specify how Diskeeper handles large files. When the **Efficiently defragment large files** option is enabled, Diskeeper defragments large files only to the point where access time is improved and further defragmentation will not return a significant improvement. This can save considerable system resources and can significantly reduce the time to run a job.

The Defragmentation Methods options are available within the Primary and Secondary Job Properties options described on page 43.

To change the defragmentation method for Manual Defragmentation Jobs, click **Manual Defragmentation Job**

Properties  in the toolbar, then select **Defragmentation Methods**. Note the defragmentation method you set for Manual Defragmentation jobs will apply to all manual defragmentation jobs on all your volumes.

To change the defragmentation method for Primary or Secondary defragmentation jobs, click **Primary**

Defragmentation Job Properties  or **Secondary Defragmentation Job Properties**  in the toolbar,, select one or more volumes, then select **Defragmentation Method**.

Note that the defragmentation method you set for Primary or Secondary defragmentation jobs will apply to all jobs of that type. For example, you can use the “Quick Defragmentation” method for all Primary Defragmentation Jobs, and use the “Comprehensive Defragmentation” method for your Secondary Defragmentation Jobs.


Setting Disk and CPU Priority

You can control the amount of disk input/output (I/O) and CPU resources used by Diskeeper for Manual, Primary and Secondary defragmentation jobs. For each of these job types, the Properties option allows you to control the disk and CPU priority.



Running at the lowest CPU priority minimizes the system performance impact when Diskeeper is defragmenting a volume. However, defragmentation jobs running at the lowest priority can take substantially longer to complete than those running at higher priorities, since Diskeeper “backs off” for any process running at a higher priority (even screen savers). For this reason, you may have occasions where you want to run Diskeeper at a higher CPU priority. Keep in mind, though, that your system performance may be impaired when Diskeeper is run at higher priorities.

In addition to the different levels of CPU priorities to choose from, Diskeeper also offers I/O Smart. This option takes the concept of run priorities one step farther by “throttling” (suspending) the defragmentation process whenever disk I/O activity is detected on a disk while it is being defragmented. This ensures the defragmentation process will be transparent to users, no matter how active the disk.

To change the priority for Manual Defragmentation Jobs, click **Manual Defragmentation Job Properties**

 in the toolbar, then select **Disk and CPU Priority**. Note the disk and CPU priority properties you set for Manual Defragmentation jobs will apply to all manual defragmentation jobs on all your volumes.

To change the priority for Primary or Secondary defragmentation jobs, click **Primary Defragmentation Job**

Properties  or **Secondary Defragmentation Job Properties**  in the toolbar, select one or more volumes, then select **Disk and CPU Priority**.

Note that the Disk and CPU Priority properties you set for Primary or Secondary defragmentation jobs will apply to all jobs of that type. For example, you can set the priority for all Primary Defragmentation Jobs to run

at the Lowest Windows priority, and have all Secondary Defragmentation Jobs run at the Normal Windows priority.

Diskeeper Configuration Properties

Click **Diskeeper Configuration Properties**  in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane to display the Diskeeper Configuration Properties dialog.

The Diskeeper Configuration Properties dialog allows you to view and edit properties that determine how Diskeeper looks and behaves. The different options in the task pane on the left side of the Diskeeper Configuration Properties dialog give you quick access to these options:

- **General**—See version, copyright and customer support information about your copy of Diskeeper.
- **Updates and Upgrades**—Check for newer versions of Diskeeper. More information
- **Frag Shield (Paging File and MFT Settings)**—Assistance for configuring your paging files and Master File Tables (MFTs) to help prevent them from fragmenting in the first place. See page 45 for more information.
- **File Exclusions**—Specify files and folders that you do not want Diskeeper to process. See page 48 for more information.
- **Data Collection**—Specify the type of data Diskeeper collects for its performance and historical reports. See page 49 for more information.
- **Event Logging**—Specify the information Diskeeper writes to the Event Log. See page 50 for more information.
- **Display Behaviors**—Specify how different parts of the Diskeeper console are displayed. See page 52 for more information.
- **Power Management**—Specify how Diskeeper operates when your computer is running on battery power. See page 52 for more information.

Updates and Upgrades

Click **Diskeeper Configuration Properties**  in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Updates and Upgrades** option. The Updates and Upgrades page offers these options:

- **Check Now**—Use this option to check immediately for a more recent version of Diskeeper.


If a newer version of Diskeeper is available, you are given the option of downloading it. When the download screen is displayed, click Run this program from its current location to begin installing the update.

Otherwise, click Save this program to disk to save the Diskeeper update installation package on your computer for later installation. (To install an update stored on your computer in this manner, simply double-click the file you download and follow the instructions displayed.)

- **Check Automatically**—Use this option to allow Diskeeper to automatically check for newer versions on a periodic basis.

Frag Shield

Note: This feature is only available when Diskeeper is running on Windows NT 4.0, Windows 2000, Windows XP, and Windows Server 2003.

 Click **Diskeeper Configuration Properties** in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Frag Shield (Paging File and MFT Settings)** option. Use the Frag Shield option to configure the Master File Tables (MFTs) and paging files on your volumes, and help prevent them from becoming fragmented. Click **Edit** to open the Frag Shield dialog, which guides you through configuring your MFTs and paging files.

Frag Shield helps you configure your MFTs and paging files as recommended in published Microsoft guidelines. Following these recommendations will help keep these critical system files contiguous.

Frag Shield is comprised of two components: the MFT configuration tool and the paging file configuration tool. These tools allow you to set up your paging files and MFTs such that fragmentation will be very unlikely to occur in the future.

After running Frag Shield once, data gathered by Diskeeper during future analysis and defragmentation jobs as well as data gathered periodically on paging file usage is used to determine if either configuration tool should be run again. Should the need arise to run either tool again, you are given a recommendation and are provided a link to easily access the appropriate tool. In most cases, once these tools are run they will not be needed again.

Note that any scheduled defragmentation jobs are temporarily suspended when the Frag Shield dialog is opened. Also note that any running Diskeeper defragmentation engines will be automatically stopped before Frag Shield makes any changes to your computer configuration.

Configuring the MFT

The Master File Table (MFT) is, in a sense, a file containing records about each file on an NTFS volume. In general terms, one file record exists in the MFT for each file on the volume. (There are exceptions to this. For example, a highly-fragmented file can require multiple file records in the MFT to store the information about the many fragments that make up the file.) When an NTFS volume is first created, Windows reserves a portion of the volume for the MFT. As files are added to the volume, the MFT grows as additional file records are added to it. As the disk fills, it is possible for the MFT to outgrow the space originally reserved for it. When this happens, additional new space is reserved for the MFT, but this new space is usually not adjacent to the original MFT zone. This is the cause of MFT fragmentation.

Also, when free space becomes too low, files get written into the space reserved for the MFT, thus causing the MFT to eventually expand around these files in a fragmented manner. This is another common cause of MFT fragmentation.

The MFT configuration tool helps pre-extend the MFT in a contiguous manner, so future growth of the MFT will not result in fragmented extensions of the file. Approximately one spare file record is needed for each file that will occupy the volume in the future. The number of file records to add is determined in one of two ways:

- Frag Shield recommends the size increase based on the estimated number of files that could occupy the volume. This estimate is based on the current average file size and amount of available free space.
- You can enter in how many files you estimate will potentially occupy the volume.



Tip: Pre-extending the MFT can be beneficial in the early stages of setting up a computer system, including cases where you are creating “images” of the system to deploy to other computers.

Once the number of file records to add has been determined, Frag Shield ensures it is safe to add these records. In other words, there must be adequate free space in the volume (20% after the MFT has been expanded) and if adding the records would fragment the MFT, or the MFT is already too fragmented, then the MFT is defragmented and/or files are moved to allow the MFT to extend continuously. (Windows NT and Windows 2000 require MFT defragmentation be done at boot-time.)

On an ongoing basis, whenever analysis and defragmentation of the volume is done, the percentage of free MFT space is checked and if it is beyond a certain percentage of use, the Reliability pane shows this information, recommends the MFT configuration tool be run again, and provides a link to run the tool.

Note: Once the MFT is extended, it cannot be reduced in size without reformatting the volume.

Configuring Paging Files

The paging file is an area of a disk set aside to temporarily hold data intended to reside in computer memory. As the operating system needs physical memory (RAM), it temporarily moves less-used data from the RAM to the hard disk. Data is copied back and forth between the paging file and the system memory as needed. This is known as “paging” or “swapping”.

When Windows is first installed, a paging file is initially created based on the amount of physical memory (RAM) detected on your computer. Windows establishes both an initial and a maximum size for the paging file. Over time, this default paging file can become too small, so Windows extends the file, often in a non-contiguous manner. When the paging file becomes fragmented, it takes the operating system longer to move data into and out of the paging file, thus slowing the computer.

The Frag Shield paging file configuration tool helps you set the paging file size correctly and handles any fragmentation incurred during the process. By specifying a correct size for the paging file, you allow it to handle all the memory needs of the system without needing for it to grow and potentially fragment as a result. Since the paging file can only be defragmented when the computer boots, it is especially beneficial to prevent it from fragmenting.

One possible solution to paging file fragmentation is to choose a size for the paging file that is large enough to accommodate current and future memory needs in such a way that it would never grow, then set the initial and the maximum paging file sizes to this value. The main disadvantage to this approach is that it could increase the paging file size unnecessarily, thus robbing you of disk space.

Microsoft recommends the following method to determine the appropriate size of a paging file¹:

“You can also determine the appropriate size of a paging file by multiplying the Paging File\% Usage Peak counter value by the size of Pagefile.sys. The % Usage Peak counter indicates how much of the paging file is being used. Consider expanding the page file whenever either this counter reaches 70 percent of the total size in bytes of all paging files or the Memory\% Committed Bytes In Use counter reaches 85 percent, whichever occurs first.”

Frag Shield monitors these counters to periodically compute the appropriate size of the paging file. When you open Frag Shield, and whenever a defragmentation or analysis is done, Frag Shield uses the collected paging file usage data to make a recommendation as to whether the paging file minimum size and maximum size should be expanded, and by how much. You are given other basic statistical data regarding your memory usage and can elect to use the recommendation or choose different values for the initial and maximum paging file sizes.

When you choose to make size changes to the paging file, the paging file configuration tool determines if a reboot or defragmentation is needed and takes the necessary actions.

As a note, you might occasionally open a very large file or open many files at once, which will expand the paging file. Later, the operating system will reduce the page file in size. Thus, in this case it is beneficial to have a different initial and maximum paging file size, as it allows it to only take up space on the disk as needed. If expanding the page file under these circumstances would fragment it, when it is reduced in size again the extra fragments would be eliminated due to the size reduction. Therefore, some expansion and contraction is useful and does not cause any long term fragmentation.

On an ongoing basis, whenever analysis and defragmentation of the volume is done, the calculated optimum page file size is checked against the current page file size. If the current size is determined inadequate, the

¹ Windows 2000 Professional Resource Kit, Chapter 28 – Evaluating Memory and Cache Usage

Reliability pane shows this information, recommends the page file configuration tool be run again, and provides a link to run it.

File Exclusions

Diskeeper exclusion lists allow you to specify files and directories that will not be allowed to be processed by Diskeeper in the Set It and Forget It or Manual defragmentation modes. For example, you might not want to defragment temporary files that will soon be deleted.

Keep in mind that fragmented files that are excluded from defragmentation can "skew" the analysis results displayed in the Job Report tab.

Diskeeper uses two lists one that you specify, and second "internal" list that you cannot modify. The exclusion list that you create is described below. See page 49 for more information about the Diskeeper Internal Exclusion List.



Click **Diskeeper Configuration Properties** in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **File Exclusions** option. Within this page, you can specify the files, folders and volumes you want to be excluded from Diskeeper processing.

The following controls are available in the File Exclusions page:

Note: Wildcard file specifications such as * or ? are allowed.

Files

Use this section of the File Exclusions page to choose specific files (by name) to be excluded from defragmentation. Highlight the file(s) to be excluded, and then click **Add Files** to add the file to the exclusion list.

Path

Use this section of the File Exclusions page to choose specific directories to be excluded from defragmentation. Select a directory by highlighting it, and then click **Add Folder** to add the directory to the exclusion list.

When a directory folder is added to the exclusion list, any subdirectories below the directory in the tree are also excluded.

Volumes

Use this section of the File Exclusions page to choose the volume from which you want to exclude files or directories from defragmentation.

Add Files Button

Click **Add Files** to add the selected file(s) to the Diskeeper exclusion list.

Add Folder Button

Click **Add Folder** to add the selected directory path to the Diskeeper exclusion list.

Exclusion List Box

This box shows the files, directories, and volumes that will be excluded from defragmentation.

Remove Button

Click **Remove** to remove specific files, directories, or volumes from the Diskeeper exclusion list. To remove one or more items from the list, highlight the items in the Exclusion List Box and click **Remove**.

Save Button

Click **Save** to save the exclusion list and return to Diskeeper.

Cancel Button

Click **Cancel** to cancel any changes you have made to the Diskeeper exclusion list and return to the main Diskeeper display.

Diskeeper Internal Exclusion List

There are certain files that should not be moved under any circumstances. These files may be system files or files related to specific applications. Moving these specific files can cause system or application failure. As a result, Diskeeper uses an “internal” exclusion list to ensure these files are always excluded from Diskeeper processing. This list is fixed in memory and cannot be modified. These are the files that are currently in the Diskeeper internal exclusion list:

- bootsect.dos
- hiberfil.sys
- memory.dmp
- safeboot.fs
- safeboot.csv
- safeboot.rsv

Note that these files are not displayed in the Diskeeper user-defined exclusion list. See *Diskeeper won't move some files no matter what I do. Is there a problem with Diskeeper?* on page 63 for more information about the Diskeeper internal exclusion list.

Data Collection

Diskeeper can provide useful information about file performance loss on your volumes, and also historical data about the fragmentation levels on your volumes.



Click **Diskeeper Configuration Properties** in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Data Collection** option. Within the Data Collection page, you are presented with these options:

Enable volume performance data collection

By default, Diskeeper uses pre-determined disk performance values when calculating your performance loss due to fragmentation. To get a more accurate picture of the performance of your volumes, Diskeeper can perform a performance data scan of all your hard drives.

Use the **Enable volume performance data collection** option to enable or disable the scanning of your volumes to gather volume performance data.

Diskeeper uses the data gathered during the performance data scan to measure the performance of each of your volumes. It uses this information to determine how much performance you are losing due to fragmentation, and shows the results in the Job Report tab when you run an analysis or defragmentation.

Allowing this scan to take place improves the accuracy of the performance data displayed by Diskeeper after the analysis or defragmentation of a disk. When this option is disabled, Diskeeper uses default disk performance values when calculating your performance loss due to fragmentation.

This performance scan may take several minutes to complete and may temporarily slow down your computer, but only while the scan is running.


Enable volume fragmentation data collection

In order to provide accurate information in the Historical Report tab, and the Job Log tab, Diskeeper must analyze your volumes daily and save that data to a data file.

Use the **Enable volume fragmentation data collection** option to enable or disable the daily analysis of your volumes to gather fragmentation data.

Event Logging

Diskeeper allows you to record information about its activity in a log file.

Click **Diskeeper Configuration Properties**  in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Event Logging** option. Within this page, you can alternately enable and disable the logging of various events to the Diskeeper Event Log. The logging method varies, depending on the version of Windows you are using.

See below for information about specifying what gets logged.

Under Windows NT, Windows 2000, Windows XP and Windows Server 2003

A log of Diskeeper activity is stored in the Windows Application Event Log file.

When Diskeeper logs an event, the event and its message are appended to the Windows Application Event Log file, along with the date, time, user, and other identifying information. These events can then be viewed with the Windows Event Viewer by choosing the **Application** option in the Event Viewer Log menu.

The Event Viewer is found in the Windows **Administrative Tools** group.

Note: Left in its default configuration, the Windows Application Event log on Windows NT, Windows 2000 and Windows XP can fill up quickly. See page 4 for information on how to set up the Application Event Log under these operating systems to avoid this situation.

Under Windows 98/Me

A log of Diskeeper activity is stored in a text file.

When Diskeeper logs an event, the event and its message are appended to the Diskeeper log file. These events are written as a text file, which can then be viewed with Notepad, or your choice of text editor programs.

The Diskeeper log file is named **DkEventLog.txt** and it is stored by default in the directory folder where Diskeeper was installed. The file is limited to 1 MB in size. Once it reaches this size, the log file is purged completely and the event log is started from scratch.

Specifying What Gets Logged

Note: Left in its default configuration, the Windows Application Event log on Windows NT, Windows 2000, and Windows XP can fill up quickly. See page 4 for information on how to set up the Application Event Log under these operating systems to avoid this situation.

Also Note: Since Windows 98 and Windows Me do not have an Application Event Log, Diskeeper events are written to a text file named **DkEventLog.txt** and it is stored by default in the directory folder where Diskeeper was installed.

Click **Diskeeper Configuration Properties**  in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Event Logging** option to access the Event Logging page.

The Event Logging page displays a list of events for which logging can be enabled or disabled. Use the check boxes for the following options to alternately enable or disable each option:

Service start and stop

When this option is enabled, an entry is made to the Event Log each time the Diskeeper service starts or stops.

This option is enabled by default.

Defragmentation start and stop

When this option is enabled, an entry is made to the Event Log whenever a defragmentation run starts or stops. The Event Log entry for this option also includes information about files that cannot be moved, either because the files are on a Diskeeper exclusion list, or the files cannot be opened. Common causes preventing a file from being opened include access controls or permissions on the file being set to prevent Diskeeper from accessing it. File permissions must allow SYSTEM to have full control of a file in order for Diskeeper to defragment it. See page 66 for more information about setting access permissions.

This option is enabled by default.

Defragmented files

When this option is enabled, an entry is made to the Event Log listing each file that is defragmented by Diskeeper. Note that enabling this option can cause the Event Log to fill rather quickly, especially if Diskeeper defragments a high number of fragmented files. (This will be particularly likely when Diskeeper is first run on a volume, since Diskeeper will probably be defragmenting a large number of files.)

This option is not enabled by default.

Moved files

When this option is enabled, an entry is made to the Event Log each time a file is moved for reasons other than to defragment the file. This would include cases where files are moved in order to create more contiguous free space. This option also notes when files could not be moved, such as files that are on a Diskeeper exclusion list or files that cannot be opened. Common causes preventing a file from being opened include access controls or permissions on the file being set to prevent Diskeeper from accessing it. As mentioned previously, file permissions must allow SYSTEM to have full control of a file in order for Diskeeper to defragment it. See page 66 for more information about setting access permissions.

Here again, enabling this option can cause the Event Log to fill quickly. This option is not enabled by default.

Disk information

On Windows NT, Windows 2000, Windows XP, and Windows Server 2003: When this option is enabled, an entry is made to the Application Event Log at the end of each defragmentation run showing general information about the volume that was defragmented. This appears in the Windows Event Viewer as Diskeeper Event 15. This option is not enabled by default.

On Windows 98/Me: When this option is enabled, an entry is made in the Diskeeper EventLog.txt file containing information as described above. This option is not enabled by default.

For a description of information contained in the Description box, see page 22.

File information

On Windows NT, Windows 2000, Windows XP, and Windows Server 2003: When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the files on the volume that was defragmented. This appears in the Windows Event Viewer as Diskeeper Event 16. This option is not enabled by default.

On Windows 98/Me: When this option is enabled, an entry is made in the Diskeeper EventLog.txt file containing information described above. This option is not enabled by default.

For a description of information contained in the Description box, see page 22.

Paging File information

On Windows NT, Windows 2000, Windows XP, and Windows Server 2003: When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the paging

file on the volume that was defragmented (if it exists on the volume). This appears in the Windows Event Viewer as Diskeeper Event 17. This option is not enabled by default.

On Windows 98/Me: When this option is enabled, an entry is made in the Diskeeper EventLog.txt file containing information as described above. This option is not enabled by default.

For a description of information contained in the Description box, see page 22.

Directory information

On Windows NT, Windows 2000, Windows XP, and Windows Server 2003: When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the directories on the volume that was defragmented. This appears in the Windows Event Viewer as Diskeeper Event 18. This option is not enabled by default.

On Windows 98/Me: When this option is enabled, an entry is made in the Diskeeper EventLog.txt file containing information as described above. This option is not enabled by default.

For a description of information contained in the Description box, see page 22.


MFT information

On Windows NT, Windows 2000, Windows XP, and Windows Server 2003: When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the Master File Table (MFT) on the volume that was defragmented. (Keep in mind, since only NTFS volumes have an MFT, this information will only apply to NTFS volumes.) The entry appears in the Windows Event Viewer as Diskeeper Event 19. This option is not enabled by default.

This option does not exist on Windows 98/Me machines, as MFT files are unique to Windows NT through Windows Server 2003.

For a description of information contained in the Description box, see page 22.

Display Behaviors

Click **Diskeeper Configuration Properties**  in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Display Behaviors** option to control the following option:

TVE Display

Enable this option to have Diskeeper display “before and after” volume maps when defragmenting volumes with the Terabyte Volume Engine (TVE). Because of the additional system overhead required to gather and display the volume map information, enabling this display can significantly increase the time required to complete a defragmentation job. (Note this option is only available in Diskeeper editions that support the TVE.)

Power Management

Click **Diskeeper Configuration Properties**  in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Power Management** option to control the how Diskeeper operates on computers running on battery power.

When this option is enabled and the computer is running on battery power, any scheduled defragmentation jobs are postponed, and a message noting this is written to the Windows Application Event Log. If you start a Manual Defragmentation Job when this option is enabled (and the computer is running on battery power), a message is displayed asking if you want to continue, even though running Diskeeper on battery power may reduce the available battery time.

When this option is enabled and the computer switches from normal power to battery power, any ongoing scheduled analysis or defragmentation jobs are safely stopped and a message noting this is written to the

Windows Application Event Log. If you are running Diskeeper manually and the computer switches to battery power when this option is enabled, a message is displayed informing you that Diskeeper has stopped running.

Using Power Management on Windows Server 2003

The Diskeeper Power Management option under Windows Server 2003 differs somewhat than on other platforms. This is due to the VSS Volume Shadowing functionality available in the Windows Server 2003 operating system.

The Windows Volume Shadow Copy Service (VSS) provides the ability to create snapshots, or point-in-time (PIT) copies, of shares and volumes. These snapshots are images of the data on the disk as it looks at a particular point in time. By keeping these images of data, you can quickly recover individual files or entire volumes directly from the disk as they appeared when the snapshot was taken.

Important Note: On volumes with a cluster allocation unit of less than 16 KB, VSS will see file movement done by the defragmentation process as "changed data" and take a point-in-time snapshot, even though only the location of the data has changed. Defragmentation on volumes with cluster sizes greater than 16 KB is correctly recognized by VSS and defragmentation jobs will not cause these unnecessary snapshots. Unnecessary snapshots will cause the VSS storage area to increase in size, possibly resulting in the deletion of earlier VSS snapshots. For this reason, Diskeeper gives you options to control the defragmentation process on systems with VSS enabled.

See Microsoft Knowledge Base Article 312067 [Shadow copies may be lost when you defragment a volume](#) for more information. Diskeeper Corporation concurs with the Microsoft recommendation to use 16 KB or larger clusters on volumes on which you plan to both defragment and employ VSS.

In addition to the basic option to stop defragmentation when running on battery power (as described above), you will also see these options when using the Power Management option on Windows Server 2003:

- Defragment even if changes to the volume due to defragmentation are saved by VSS Shadow Copy
Enabling this option can cause the VSS storage area to increase in size, potentially deleting earlier snapshots.
- Show pop-up message when scheduled defragmentation cannot be started because of VSS Shadow Copy
This option alerts you to cases where the defragmentation process cannot be started due to VSS activity.

Permissions

Note: This option is only available in Diskeeper Professional and Professional Premier editions, and is not supported on Windows 98/Me or Windows NT 4.0.

Click **Diskeeper Configuration Properties**  in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Permissions** option to specify whether users with non-Administrator accounts can access and run Diskeeper.

In keeping with published Microsoft guidelines, by default, Diskeeper only allows users who are members of the Administrators group to analyze and defragment volumes. This option can be used to override that default.

When this option is enabled, all users can access and run Diskeeper. When it is not enabled, only those users who are members of the Administrators group can access and run Diskeeper.

Terabyte Volume Engine

Diskeeper Server Enterprise edition includes the Terabyte Volume Engine (TVE), which is a specialized defragmentation engine for very large NTFS volumes (60 GB or larger in size). The TVE is designed to efficiently handle volumes containing millions of files. Note that the TVE is only used on NTFS volumes.

The TVE operates differently from the standard Diskeeper defragmentation engines since it is designed specifically for very large volumes. For example, when the TVE is defragmenting a volume, the graphic display usually shown in the Volume Map tab is replaced with numerical data showing the progress of the defragmentation operation. This reduction in system resource usage pays off in lower CPU consumption and faster defragmentation of very large volumes. (You can optionally disable this resource-saving feature. See page 52 for more information.)

Also, the TVE may or may not examine the whole volume in a single process. This saves system memory resources.

Here is a description of the information displayed in the Volume Map tab when the TVE is defragmenting a volume:

File record examinations

This is the number of times a file record (MFT record) was examined and is basically used to show that progress is occurring. The number may be larger than the number of file records on the volume if a full job runs, because a file record may be examined more than once, or it may be smaller than the number of file records on the volume if the job didn't run to completion.

Fragmented file examinations

This is the number of the above file record examinations that located fragmented files. Again, a file may be examined more than once during a defragmentation job, so this number will not match the number of fragmented files reported in the Job Report tab.

Fragments eliminated

This is the number of fragments that were eliminated by the TVE. It may not match the number of fragments reported in the Job Report tab because the job was only partially completed, or because files became more or less fragmented as the result of other processes during the period when the engine runs.

Contiguous file examinations

This is the number of the above file record examinations that located contiguous files that could be moved to help consolidate free space. Not all files on the volume are candidates for this action, so the number will most likely be far less than the number of contiguous files in the Job Report tab.

Files that could not be processed

This is the number of times that a file couldn't be moved. The most common reasons for a file not moving are:

- Diskeeper was denied permission to open the file (the file did not allow the SYSTEM process Full Control)
- The file was open for exclusive use by another process
- Free space was no longer available when the move was attempted.

The Windows application event log stores the reason(s) for the first fifty files that could not be processed.

Running Diskeeper From the Command Prompt

In addition to its Graphical User Interface (GUI), Diskeeper supports commands from the Windows command prompt. This provides an alternative method of defragmenting disk volumes. The single command supports several optional command qualifiers.

To use this command, follow these steps:

1. Open the Windows command prompt window.
2. Type **Diskeeper** at the command prompt, followed by a drive letter and any of the optional command parameters.

The Diskeeper command defragments the files of the selected volume. Use the command in this form:

Diskeeper <volume> [/b] [/?]

Parameters

<volume>

This is a required parameter that will accept any valid drive letter. A colon after the drive letter is not required.

/b

Boot—On Windows XP and Windows Server 2003 systems, this option causes specific files that are critical to booting your system to be moved adjacent to each other into a contiguous piece of free space, and defragments them if necessary. Using this option can decrease the time needed to boot your computer.

/?

Help—Displays the command prompt Help text.

/f

Not Used—This switch is only used for compatibility with the built-in defragmenter and is ignored by Diskeeper.

Examples

Diskeeper D

Defragments volume D.

Diskeeper D /b

Defragments volume D and performs a boot optimization.

Diskeeper /?

Displays the following Help text:

```
Copyright (c) 2004 by Diskeeper Corporation
```

```
Diskeeper <volume> [ /b ] [ /? ] [/f]
```

```
<volume> is a required parameter that will accept a valid drive letter.
```

```
The switches are:
```

```
/b Boot - Performs the Windows XP boot optimization process, if needed. Ignored on other platforms.
```

```
/? Help - Displays this help message.
```

```
/f - This switch is only used for compatibility with the built-in defragmenter and is ignored by Diskeeper.
```


Chapter 5

Theory of Operation

This chapter describes the Diskkeeper design goals and how those goals were met.

Introduction

As described in the introduction of this manual, the term *disk fragmentation* means two things:

- a condition in which pieces of individual files on a disk are not contiguous, but rather are broken up and scattered around the disk volume; and
- a condition in which the free space on a disk volume consists of little pieces of space here and there rather than a few large free spaces.

The effects of excessive fragmentation are twofold as well:

- file access takes longer because a file must be collected in pieces here and there, requiring several disk accesses instead of just one; and
- file creation takes longer because space for the file must be allocated in little pieces here and there instead of just one contiguous allocation.

Before the introduction of Diskkeeper, there was no method for completely correcting the problems of file and free space fragmentation on Windows NT computers or in a mixed Windows network.

Design Goals

In designing Diskkeeper for Windows, the following goals were established:

- The product must be completely safe to use.
- It must improve Windows system performance. It is not designed to make the disk look “pretty”—it is designed to improve disk performance and, as a result, overall system performance.
- It should process live disks without interfering with user access to files.
- It should run without operator intervention.
- It must defragment all possible files and consolidate free space into the smallest possible number of large spaces.

Diskkeeper defragments files and free space on a disk, allowing access to the files on the disk at any time while Diskkeeper is running.

Safety

Diskkeeper is designed with *safety* as the highest priority.

To ensure the safe movement of files on Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems, Diskkeeper uses mechanisms built into the operating system that were developed and implemented by Diskkeeper Corporation (then known as Executive Software), and fully incorporated into Windows NT, Windows 2000, Windows XP, and Windows Server 2003 by Microsoft. On Windows 98 and Windows Me systems, Diskkeeper uses similar mechanisms used by Microsoft and others.

By using these built-in mechanisms, Diskkeeper maintains cache coherency, file security and permissions information, and file content integrity no matter how fragmented the files on the disk are.

The foremost design goal for Diskeeper is to make sure that no data is ever lost. To accomplish this goal Diskeeper uses the following criteria for accessing files:

- the contents of data files are never modified under any circumstances
- only one file is processed at a time, not the whole disk
- each processing pass is independent of the other passes
- no information is stored on any other device or in a “scratch space”
- Diskeeper accesses a file in such a way that no user access can conflict with Diskeeper during the critical portion of the relocation process
- file relocation is aborted if any error is encountered, leaving the file in its original state

Diskeeper was designed to err on the side of caution. In other words, it only moves a file on the volume when it is absolutely certain that no data will be lost, including file attributes. The only change to file attribute-type information is the physical location of the file on the volume. None of the file dates are changed and no other fields in the file record header are used to store Diskeeper information.

Diskeeper never defragments or moves files that are specifically stored at a specific physical location on the volume.

If anything causes your computer to crash while Diskeeper is running, or if you abort the Diskeeper defragmentation run in the middle of the file relocation process, no data is ever at risk.

Windows 98/Me Note: Stopping or pausing a Diskeeper job through its menus or toolbars is completely safe. Note, however, that in the event of a system crash or other non-standard termination of the Diskeeper process while it is running, it is possible for free space and file information to be stored incorrectly. Diskeeper Corporation strongly recommends running the Windows Scandisk error checking utility immediately when Diskeeper is stopped abnormally. Scandisk will correct any potential file errors.

Performance

When running in the “Set It and Forget It” mode, Diskeeper is designed to run in the background, without adversely affecting performance of your Windows computer. Steps have been taken to assure that, by default, Diskeeper overhead has the lowest possible impact on system performance. Diskeeper can be run at the lowest possible Windows priority, using only otherwise unused CPU cycles. Diskeeper was designed in such a way to ensure it will not interfere with other processes on your Windows computer.

However, for cases where you want to defragment disks more quickly, Diskeeper allows you to increase the defragmentation priority. For more information, see page 44.

Process Live Disks

It is not acceptable to force users off the disk while performing routine defragmentation. To do so would be a case of the cure being worse than the disease. Access to fragmented files is better than no access at all.

The best solution is to defragment online with users active on the same disk volume. Diskeeper was designed with this in mind. During most of the time Diskeeper is processing a file, it shares the file with any other users that may access the same file. The last step of processing the file, however, involves locking the file for a very brief period, a matter of milliseconds. If another user requests a file that Diskeeper has locked, that request is suspended for the brief period until Diskeeper releases the file. Then the request is serviced. There is never an interruption of either process as a result of this delay.

This solution allows Diskeeper to defragment open files safely, regardless of whether they are open for read operations or for write operations.

Note: Due to the Windows NT 4.0 design, directories, MFT and paging files cannot be moved safely on live disks. (NTFS directories *can* be moved on Windows 2000, Windows XP and Windows Server 2003.) Therefore, Diskeeper performs these operations at the only safe time, while the computer is starting up.

No Operator Intervention

In keeping with the design goals, after Diskeeper has been started in the “Set It and Forget It” mode, it runs automatically in the background, without the need for operator intervention. It runs indefinitely, unless told otherwise by you.

Appendix A

Table of Diskeeper Editions

The table below shows the different editions of Diskeeper available, as well as the features and capabilities of each:

	Diskeeper 10 Editions					
	Home	Professional	Professional Premier	Server Standard	Server Enterprise	Administrator
Defragmentation	✓	✓	✓	✓	✓	N/A
Performance Analysis	✓	✓	✓	✓	✓	N/A
Reliability Analysis	✓	✓	✓	✓	✓	N/A
Fragmentation Analysis	✓	✓	✓	✓	✓	N/A
Set It and Forget It Scheduling	✓	✓	✓	✓	✓	N/A
Boot-Time Defragmentation	✓	✓	✓	✓	✓	N/A
Defragmentation Method Combinations	1	6	6	6	6	N/A
Efficient Defragmentation of Large Files		✓	✓	✓	✓	N/A
Comprehensive Defragmentation		✓	✓	✓	✓	N/A
Exclusion List	✓	✓	✓	✓	✓	N/A
Event Logging	✓	✓	✓	✓	✓	N/A
Adjustable Priority		✓	✓	✓	✓	N/A
I/O Smart (Disk I/O Throttling)	✓	✓	✓	✓	✓	N/A
Frag Shield Paging File and MFT Configuration		✓	✓	✓	✓	N/A
I-FAAST (Intelligent File Access Acceleration Technology)			✓	✓	✓	N/A
Command Line Interface		✓	✓	✓	✓	N/A
Maximum Single Volume Size Supported	768 GB	768 GB	2 TB	2 TB	No limit	N/A
Total Disk Space Supported (all volumes)	No limit	No limit	No limit	No limit	No limit	N/A
Simultaneous Operations	1	4	8	16	No limit	N/A
Terabyte Volume Engine					✓	N/A
64-bit Processor Compatible	✓	✓	✓	✓	✓	N/A
Support for 64-bit Operating Systems		✓	✓	✓	✓	N/A
Allows Control by Diskeeper Administrator		✓	✓	✓	✓	N/A
Group Policy Support		✓	✓	✓	✓	N/A
Remote Control of Local Diskeeper Editions						✓

This table shows the different Diskeeper editions available and the Windows operating systems they support:

	Diskeeper 10 Editions					
	Home	Professional	Professional Premier	Server Standard	Server Enterprise	Administrator
Windows 98	✓	✓				
Windows Me	✓	✓				
Windows XP Home	✓	✓	✓	✓		
Windows XP Tablet PC	✓	✓	✓	✓		
Windows XP Media Center	✓	✓	✓	✓	✓	
Windows NT 4.0 Workstation		✓	✓ *	✓ *		✓
Windows 2000 Professional	✓	✓	✓	✓	✓	✓
Windows XP Professional	✓	✓	✓	✓	✓	✓
Windows XP Professional for x64		✓	✓	✓	✓	
Windows NT 4.0 Server				✓		✓
Windows NT 4.0 Enterprise Server				✓		✓
Windows 2000 Server				✓	✓	✓
Windows Server 2003 Web				✓	✓	✓
Windows Server 2003 Standard				✓	✓	✓
Windows Server 2003 Standard for x64				✓	✓	
Windows Server 2003 Enterprise				✓	✓	✓
Windows 2000 Advanced Server				✓	✓	✓
Windows 2000 Datacenter Server					✓	✓
Windows Server 2003 Datacenter Server					✓	✓
Windows 2000 w/Server Appliance Kit				✓	✓	
Windows Server 2003 w/Server Appliance Kit				✓	✓	
Windows Server 2003 Enterprise Itanium					✓	

* The I-FAAST feature in Diskeeper Professional Premier and Server Standard editions is not available under Windows NT.

Appendix B

Answers to Frequently Asked Questions

Does Diskeeper work with Windows XP Service Pack 2?

Yes. However, if you are installing or running Diskeeper on a computer running Windows XP Service Pack 2 (SP2), be sure to visit www.diskeeper.com/sp2 for the latest information about running Diskeeper with SP2. Note that this information also applies to Windows Server 2003 SP1.

Why won't my volume defragment completely?

This can be the result of several situations. If your volume is extremely full, there may not be sufficient free space to defragment the files completely. In that case, we recommend temporarily moving some of the files off the volume, particularly large files. This temporary measure often allows Diskeeper the “working room” it needs to complete the defragmentation process. It also allows Diskeeper to defragment the free space on the volume, increasing the possibility that the temporarily-moved files can be moved back to the volume in a contiguous or less fragmented condition.

Another cause of incomplete defragmentation is a fragmented paging file. For more information, see *Can Diskeeper defragment paging files?* on page 64.

A volume that, at some time, has been filled to capacity may have a severely fragmented Master File Table (MFT). Volumes that have been converted from FAT to NTFS often also have a fragmented MFT. A White Paper describing the causes and effects of MFT fragmentation is available from the Diskeeper Corporation website at www.diskeeper.com/products/documentation/documentation.asp. Use the Boot-Time defragmentation option to defragment a fragmented MFT. For more information, see page 38.

Another situation that can prevent complete defragmentation of a volume is the existence of a large number of directories on the volume. For more information, see *Can Diskeeper move directories?* on page 64.

Yet another cause for incomplete defragmentation on Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems can be a security access situation. Both SYSTEM and ADMINISTRATOR must have full control over a file (or the directory folder it is in) in order for Diskeeper to have access to move the file. This is because the Diskeeper service runs under the Administrator account, and System access is necessary to defragment files safely. This security feature is governed by the Windows NT, Windows 2000, Windows XP, and Windows Server 2003 C2 security requirements. Included with Diskeeper is a batch file that sets the access permissions on a disk volume to allow Diskeeper to run properly. See page 66 for information about using this batch procedure.

Diskeeper won't move some files no matter what I do. Is there a problem with Diskeeper?

Diskeeper has a built-in list of files that it will not move under any circumstances. This list is referred to as the Diskeeper internal exclusion list.

The most common reason for a file existing on the Diskeeper internal exclusion list is safety. The file cannot or should not be moved in order to maintain the integrity of your system.

For example, the file `memory.dmp` is on the Diskeeper internal exclusion list. This file is on the exclusion list because the disk locations where this file is stored are loaded by the kernel when the system boots and stored in memory. These disk locations are then used to write the dump file should it need writing. If Diskeeper were to move this file, then the system failed, the dump file would be written over other files or in space considered to be free space. This could result in a very corrupted disk.

The same situation applies to hiberfil.sys. When your system goes into hibernation mode, the pre-fetched disk locations are overwritten with the hibernation data. If Diskeeper moved hiberfil.sys out and moved other files into those disk locations, then disk corruption would occur.

Why doesn't Diskeeper move all of the files into one place on the volume?

Our primary philosophy with Diskeeper is improving and maintaining the performance of your computer. The disk drives are the primary bottleneck in your computer's performance. Diskeeper restores the disks to top speed by eliminating fragmentation.

It is a common misconception that a defragmented disk should look very neat and tidy in the Volume Map tab, with solid blue bars all the way across the screen (representing fragmentation-free files) and the rest white space (representing consolidated space).

Clearly, the speed of the volume (meaning how fast you can access the data on it) is more important than the prettiness of the display or the consolidation of all the free space into one place. Free space consolidation might be important if the next file that you plan to create needs to be one gigantic contiguous file, but it has no effect on performance. In fact, the operating system may or may not write the next file into a contiguous location even if there is a large enough space.

Because of this, when using the “Quick” or “Recommended” defragmentation methods, Diskeeper uses algorithms that achieve the highest speed from your volumes regardless of the arrangement of the free spaces on the disk and on the screen—and it does so without wasting time on excessive consolidation of free space. We simply go for the fastest possible file access times and then stop.

Even so, you might ask why we don't continue and rearrange the files further to get a neat display? Because it takes computer power to do so. We long ago decided that it would be wrong for Diskeeper to consume more of your computer's performance than it gives back. So Diskeeper defragments until the disk is in top shape performance-wise and then stops.

Now this might not be important to you if you like to sit and watch the display as Diskeeper defragments your drive, but it is a very big deal to large corporate data centers and people who depend on their computers for their work. They need all the performance they can get and can't hold up production while the defragmenter works to enhance the “look” of the disk but not improve its performance. This is why Diskeeper is designed to run in the background at the lowest possible priority, giving way to any other program that needs to run. And it is also why Diskeeper stops defragmenting when maximum performance has been achieved.

Of course, for those who want to expend the additional computer resources, the “Comprehensive” defragmentation method is also available. This defragmentation method performs additional processing to further consolidate the free space on your volumes.

Can Diskeeper move directories?

Windows NT 4.0 does not allow directories to be moved, because of data integrity issues related to how Windows NT maintains directory information. Since Diskeeper runs while other processes are active on the system, it does not attempt to move directories online.

However, directories on Windows NT 4.0 volumes can be moved safely while your computer is being started—a time when Windows has not yet taken complete control of the files and directories on your disk. For more information on how to consolidate Windows NT 4.0 directories, see page 38.

On Windows 98/Me computers, and NTFS volumes on Windows 2000, Windows XP, and Windows Server 2003 systems, Diskeeper can safely move and defragment directories, which makes consolidation unnecessary.

Can Diskeeper defragment paging files?

Diskeeper does not defragment active paging files, since paging files must be open for exclusive use by Windows at all times. However, Diskeeper can defragment paging files safely when your computer is being started—a time when the operating system has not yet taken full control of the files and directories on your disk. For more information about defragmenting paging files, see page 38.

Can Diskeeper defragment the Master File Table?

The Master File Table (MFT) is the area on an NTFS disk volume where Windows NT, Windows 2000, Windows XP, and Windows Server 2003 keep the necessary information for retrieving files from the disk volume. The MFT also contains information such as file creation, modification, and backup dates and times. Because the MFT is held open for exclusive use by Windows, Diskeeper does not move any pieces of this critical system file while Windows is running, but can do so safely at boot-time. For more information, see page 38.

Why doesn't Diskeeper completely consolidate the free space on my volume?

Several factors can prevent the free space on a volume from being defragmented:

- A fragmented paging file. For more information, see page 38.
- A large number of directories on the volume. For more information, see “Can Diskeeper move directories?” on page 64.

On NTFS volumes, a portion of the free space on the volume is reserved by Windows for the Master File Table (MFT). For more information, see *Why don't my files get moved to the beginning of the volume?* on page 65.

Note that you can specify the “Comprehensive” defragmentation method, which emphasizes free space consolidation. See page 43 for more information about the different defragmentation methods available.

It is important to know that having all of the free space in a single, contiguous piece provides very little (if any) performance benefit. Free space fragmented into hundreds of pieces will impact disk performance, but free space that's in a few pieces should not have any effect on the performance of your disk.

Why don't my files get moved to the beginning of the volume?

On NTFS volumes, Windows NT, Windows 2000, Windows XP, and Windows Server 2003 reserve a portion of the free space on a disk volume for the Master File Table (MFT). This free space is usually most noticeable at the physical “beginning” of the volume (easily seen using Volume Map tab), but space is also reserved for use by the MFT in other areas of the volume.

Since this space is reserved for exclusive use, Diskeeper will not move files into these areas of the volume, but will move them out of these areas.

Why don't all of my NTFS volumes appear in the Diskeeper Volume List?

Both SYSTEM and ADMINISTRATOR must have full control over a file (or the directory folder it is in) in order for Diskeeper to have access to move the file. This is because the Diskeeper service runs under the Administrator account, and System access is necessary to defragment files safely. This is a security feature governed by the Windows NT, Windows 2000, Windows XP, and Windows Server 2003 C2 security requirements.

If the root-level directory folder does not have SYSTEM and ADMINISTRATOR set for full control (as seen in the Permissions section under the Security tab in the Properties dialog box) Diskeeper will not display the disk volume in the Volume list under some circumstances.

How do I determine how often to run Diskeeper on my volume?

This depends on many factors, including the level of file activity, the sizes and types of files used, and the amount of free space available on the volume. While there are no set rules on how often to defragment your disk volumes, here are some guidelines.

- Of course, the first suggestion is to let the Diskeeper Smart Scheduling feature automatically and dynamically determine the optimum run frequency for your particular disk volumes. Smart Scheduling monitors the fragmentation levels of your volumes and adjusts the defragmentation schedule to best fit your needs, even as those needs change. See *Smart Scheduling* on page 33.
- Disk volumes on busy file servers should be defragmented more often than those on single-user workstations. You may need to run Diskeeper on a server volume as often as every two to four hours to

maintain optimum system performance, while on a workstation, you may only need to run Diskkeeper once a day or less. As a general rule, the busier the disk—the more often it will need to be defragmented.

- To determine how often to run Diskkeeper on your disk volumes, you can use the logging function of Diskkeeper to monitor the number of files moved during each Diskkeeper run. For information about how files that are moved by Diskkeeper are logged, see page 50. In general, if Diskkeeper moves fewer than 50 files per run, you are running Diskkeeper frequently enough to maintain the performance of your Windows system at an optimum level. If the number of files moved during each run is greater, or is increasing, schedule Diskkeeper to run more frequently. (Here again, you can automate this by letting the Diskkeeper Smart Scheduling feature control when to run Diskkeeper.)

How do I set access permissions to allow Diskkeeper to defragment my files?

In order for Diskkeeper to have access to move files on NTFS volumes, both SYSTEM and ADMINISTRATOR must have full control over a file (or the directory folder it is in). This version of Diskkeeper includes a batch file that sets the access permissions on a disk volume to allow Diskkeeper to run properly. This batch file is called **setdkaccls.bat**, and it is located in the directory folder where Diskkeeper is installed.

If you find you have made files inaccessible to Diskkeeper, or that you have some files inaccessible to Diskkeeper, open a command-prompt window, change directory to the Diskkeeper installation directory, and type:

```
setdkaccls x:
```

where *x*: is the letter name of the disk volume on which you want to change access permissions.

The **setdkaccls.bat** procedure automates the following sequence of commands:

```
cd /d x:
cd \
cacls * /e /t /c /g Administrators:F System:F
```

For more information about the **cacls** command, type **cacls /?** at a command prompt.

This batch procedure will only work if the account you are logged onto has been granted access to the file(s) you are wanting to defragment.

Why don't my defragmentation jobs all start at the same time?

Most editions of Diskkeeper allow you to defragment more than one disk volume at a time. However, when the defragmentation of two or more disks is scheduled to begin at the same time, Diskkeeper will start each job separately, in one-minute intervals. For this reason, you will notice the start times for each Diskkeeper job run in the Application Event Log can vary by several minutes. This is no cause for alarm.

Why doesn't the free space reported by the post-analysis (or post-defragmentation) summary pop-up screen match what the Diskkeeper Fragmentation pane shows?

Several post-analysis and post-defragmentation summary screens include information about the amount of free space available on the volume for defragmentation. This figure is based on the space available to Diskkeeper, which may be less than the total free space on an NTFS volume. NTFS volumes reserve a percentage of the total volume for the Master File Table (MFT), which Diskkeeper cannot use for defragmenting files. Because of this, the figure shown in the Diskkeeper post-analysis and post-defragmentation summaries on NTFS volumes will not match the total free space figure displayed in the Diskkeeper Fragmentation pane (or other utilities like Disk Properties in Windows Explorer).

Should I use Diskkeeper on RAID arrays?

Yes—Diskkeeper supports all levels of software- and hardware-based RAID arrays. RAID arrays are often used to increase system performance. In a RAID array of four disk drives, for example, a file can be accessed up to four times as fast as on a single drive. This is because the file is spread between the four drives, and all four drives can be accessed at the same time, so the file can be retrieved much faster. However, like the files on a single disk drive, these file parts can become fragmented on the individual drives, which reduces the speed

advantage of RAID. In fact, the effects of fragmentation can be more obvious in a RAID array than in a single disk drive.

Diskeeper defragments RAID arrays just as it does single disk drives. Diskeeper improves the speed and performance of a RAID environment by eliminating wasteful and unnecessary I/Os from being issued by the file system. In our four-drive array example, it would defragment the pieces of the file on each separate drive as though they were separate files, and as directed by the RAID controller.

Why do I get an incorrect excess fragment count after defragmenting an NTFS drive under Windows 2000?

Under Windows 2000, NTFS files that have been compressed, then decompressed, accumulate excess space allocations that Diskeeper cannot move. (The defragmentation APIs can only move actual data, not unused allocated space in the file.)

Microsoft states in knowledge base article Q228198 "Disk Defragmenter Analysis Shows More File Fragments Than File Size Suggests" that the "excess allocation" is released when the file is closed. Experiments performed in our labs show that this is not the case. The disk must be dismounted and remounted (or the system rebooted) followed by an open and a close of the file for the excess allocation to be released.

Therefore, when this condition exists on an NTFS volume, Diskeeper moves the data portion of a file, and if the file has an excess allocation, it can actually fragment the file—one piece being the data just moved, the other piece being the excess allocation "left behind". Diskeeper notes this properly in its statistics. However, sometime after the file movement is completed and the file is closed, the excess allocation is released by Windows 2000. Thus, a subsequent analysis shows the fragmentation figures reported at the end of the defragmentation run to be wildly wrong.

This excess allocation phenomena was introduced in Windows 2000, but is not present in Windows XP or Windows Server 2003.

Diskeeper engineers are working on a solution for this inconsistency. Until it is found, you can (1) avoid using NTFS disk compression or (2) perform a subsequent disk analysis to get the correct information.

Does Diskeeper support Windows clustering?

Diskeeper is certified for Windows clustering. To run Diskeeper in a clustered environment, perform the following steps:

1. On the system that has control of the clustered disk(s), install Diskeeper and schedule it.
2. Fail the clustered disks over to the other system, install Diskeeper and schedule it.

After you perform these steps, Diskeeper will run on the clustered system that remains in operation after the other clustered system has experienced a system failure. Diskeeper will also run on the clustered disk/partition in an active-active cluster, defragmenting the clustered disk/partition on the system that currently has control of the disk/partition.

Note: the Diskeeper Boot-Time Defragmentation will not run on clustered partitions.

How can I run Diskeeper from an account that is not a member of the Administrators group?

If the account you are using is not a member of the Administrators group, you will not be able to install or operate Diskeeper. We recommend that you simply use the Set and Forget It feature to set a schedule to allow Diskeeper to run in the background on all systems. Since the Set It and Forget It operation runs under the SYSTEM process, there is no need for an administrator to be logged in when it is running.

Do I need to have the Diskeeper service running all the time?

Yes. **DkService** is the program that actually runs Diskeeper defragmentation jobs. It monitors the Diskeeper schedule file and starts defragmentation jobs when they are needed. If the Diskeeper service is disabled or not present, you will not be able to run Diskeeper at all.

That said, if you look at the DkService process using Task Manager, you will see that it uses only a few seconds of CPU time each week. The fact that it is running all the time is not going to use up system resources, or cause any problems.

Since installing Diskeeper, the number of disk errors I get has increased. Why is that?

Diskeeper tends to increase disk activity, and just by running, it can make weak points in the system break. In this case, you have some disk error, most likely in the free space where the Windows disk error checking utility (CHKDSK) cannot find it. This by no means indicates a problem with Diskeeper.

Run CHKDSK/R on your operating system volume at least, preferably on all volumes. That should correct any errors. (CHKDSK/F may not correct this issue.)

If CHKDSK itself aborts when it reaches the bad block, it indicates a disk problem which CHKDSK can't handle, and which will likely cause more trouble in the future. You should back up the volume and reformat (or replace) it to prevent the possibility of data loss due to drive failure.

If you are running Windows 98/ME, run Scandisk Thorough instead of CHKDSK.

How can I find which version of Diskeeper I have installed?

Open Diskeeper, click the **Action** menu, then select **About**. This tells you which Diskeeper edition, version and build is installed.

Appendix C

Support Services

U.S., Asian and Latin American Support Services

Registered users are entitled to 90 days of free technical support, as well as special upgrade pricing, from Diskeeper Corporation. If you have not yet registered your Diskeeper purchase, register your purchase online via our website at:

diskeeper.com/register

Technical support questions can be answered from the Technical Support section of our website at:

diskeeper.com/support

If you are a home user, you should contact our technical support team at:

homesupport@diskeeper.com

You can also contact our technical support team by submitting e-mail to them directly from within our website at:

diskeeper.com/supportrequest

Or via fax at:

818-252-5514

If you are within your 90-day free support period, or have purchased telephone support, you can call:

818-771-1600

When your 90-day free support period has expired, you can purchase the support plan which best suits your needs. Diskeeper Corporation offers 24-hour, 7-day support plans. Contact Diskeeper Corporation to find out which support options suit you best.

Diskeeper Corporation's address is:

**Diskeeper Corporation
7590 North Glenoaks Boulevard
Burbank, California, USA 91504**

European Support Services

Registered users are entitled to 90 days of free technical support, as well as special upgrade pricing, from Diskeeper Corporation. Our free European technical support is available Monday through Friday during the first 90 days from 8:30 to 17:30. If you have not yet registered your Diskeeper purchase, register your purchase online via our website at:

diskeepereurope.com/register.htm

Technical support questions can be answered from the Support section of our website at:

diskeepereurope.com

You can also contact our technical support team via e-mail at:

tech.support@diskeeper.co.uk

Or via fax at:

+44 (0) 1342-327390

If you are within your 90-day free support period, or have purchased telephone support, you can call:

+44 (0) 1342-327477

When your 90-day free support period has expired, you can purchase the support plan that best suits your needs. Diskeeper Corporation offers 24-hour, 7-day support plans. Contact Diskeeper Corporation to find out which support options suit you best.

Diskeeper Corporation's address is:

**Diskeeper Corporation
Kings House, Cantelupe Road
East Grinstead, West Sussex RH19 3BE
England**

Appendix D

Diskeeper and Group Policy

Diskeeper can be administered network-wide via several different methods. The primary network administration tool for Diskeeper is *Diskeeper Administrator Edition*, a single point of control for all your Diskeeper administration needs. However, sites using Microsoft Group Policy can use the **Diskeeper.adm** administrative template file available from Diskeeper Corporation to control many aspects of Diskeeper operation through Group Policy. The Diskeeper.adm template file is available free of charge from the Diskeeper Corporation website at www.diskeeper.com/diskeeper/grouppolicy.asp.

The Group Policy Editor is the desktop tool used to administer Group Policy on your network. When the Diskeeper template is installed, the Group Policy Editor allows you to configure Diskeeper options such as scheduling, defragmentation methods and defragmentation priority.

Note: This section assumes you have a certain level of experience using the Group Policy Editor. Refer to the Microsoft Group Policy documentation for complete information about using the Group Policy Editor.

Follow these steps to add the Diskeeper.adm file to the Computer Configuration\Administrative Templates group:

1. Open the Group Policy Editor for your site, domain, or organizational unit. (**Start | Run | gpedit.msc**)
2. Right-click **Administrative Templates** in the tree view.
3. Select **Add/Remove Templates**.
4. Click **Add...** in the Add/Remove Templates dialog that is displayed.
5. Navigate to and select the **Diskeeper.adm** file in the File Open window. This file will be in the location you specified when you downloaded it from the Diskeeper Corporation website.
6. Click **Close** in the Add/Remove Templates dialog box.

After the Diskeeper.adm template has been added, you will see a new entry for **Diskeeper 10.0** in the Administrative Templates section of the Computer Configuration group.

These options are available for Diskeeper within the Group Policy Editor:

Allow Local Override

This policy makes it possible for the administrator at the local machine to have local settings override the Group Policy settings.

When this policy is enabled, Group Policy will take precedence over user preferences. When this policy is either disabled or not configured, local Diskeeper preferences will take precedence over Group Policy settings.

Defragmentation Priority Levels

These settings determine the degree of CPU usage the defragmentation engine will use.

When this policy is enabled, the priorities defined here will apply to all computers. When this policy is either disabled or not configured, the priorities established locally will be followed.

By default, scheduled, Set It and Forget It Defragmentation Jobs run at the lowest possible Windows priority. Also by default, Manual Defragmentation Jobs run at the normal Windows priority. The priority for either type of defragmentation job can be changed with this policy.

Running at the lowest priority minimizes the system performance impact when Diskeeper is defragmenting a disk volume. However, defragmentation jobs running at the lowest priority can take substantially longer to complete than those running at higher priorities, since Diskeeper “backs off” for any process running at a higher priority (even screen savers).

Defragmentation Method

These settings determine the type of defragmentation to perform for each of these defragmentation job types:

- Primary Defragmentation Jobs
- Secondary Defragmentation Jobs
- Manual Defragmentation Jobs

When this policy is enabled, the method defined here will apply to all computers. When this policy is either disabled or not configured, the defragmentation method established locally will be followed. These defragmentation methods are available:

Quick Defragmentation — This method provides the fastest defragmentation. It reduces the defragmentation time by placing the emphasis on defragmenting the fragmented files, rather than free space consolidation, since this returns the greatest system performance gain. This defragmentation method will complete faster and use fewer resources, but note that the free space consolidation will not be as thorough as the other methods.

Recommended Defragmentation — This is the default, proven and balanced mix of file defragmentation and free space consolidation. It is designed to gain the best disk performance without using excessive system resources.

Comprehensive Defragmentation — This defragmentation method performs additional free space consolidation. This method performs a normal Diskeeper defragmentation, but then additionally performs extra processing to further improve free space consolidation. It is important to note this method requires additional processing and time, and free space consolidation improvement will be gradual as the option is used over time. Since the Comprehensive Defragmentation method is best suited for scheduled defragmentation jobs, it is not available for Manual Defragmentation Jobs.

In addition to each of these defragmentation methods, you can alternately enable and disable the **Efficiently defragment large files** option for each job type.

Power Management

This option is intended primarily for laptop and portable computers.

When this option is enabled and the computer is running on battery power, any scheduled defragmentation jobs are postponed, and a message noting this is written to the Windows Application Event Log. If a defragmentation job is started manually when this option is enabled (and the computer is running on battery power), a message is displayed asking if you want to continue, even though running Diskeeper on battery power may reduce the available battery time.

When this option is enabled and the computer switches from normal power to battery power, any ongoing scheduled analysis or defragmentation jobs are safely stopped and a message noting this is written to the Windows Application Event Log. If Diskeeper is running manually and the computer switches to battery power when this option is enabled, a message is displayed informing you that Diskeeper has stopped running.

When this policy is enabled, the Power Management feature will be turned on for all computers. When this policy is not configured, the setting established locally will be followed.

When this policy is disabled, the Power Management feature will be turned off for all computers.

System Tray Defragmentation Delay

This policy allows non-administrative users to use the Diskeeper icon in the system status area (also known as the system tray) to postpone defragmentation operations.

When this policy is enabled, users who are not members of the Administrators group can right-click the Diskeeper system tray icon to delay a currently-running defragmentation operation. When this policy is disabled, only users who are members of the Administrators group can use the Diskeeper icon in the system tray to control Diskeeper operations.

I/O Smart

This policy takes the concept of run priorities one step further by “throttling” (suspending) the defragmentation process whenever disk I/O activity is detected on a disk while it is being defragmented. This ensures the defragmentation process will be transparent to users, no matter how active the disk.

When this policy is enabled, defragmentation will only proceed when there are no other processes requesting disk I/O operations from the volume currently being defragmented. When this policy is disabled, Diskeeper shares disk I/O bandwidth with requests from other processes.

Event Logging

These settings determine what Diskeeper events and other related information is saved in the Windows Application Event Log.

When this policy is enabled, the event logging settings here will apply to all computers. When this policy is either disabled or not configured, the event logging settings established locally will be followed. These events are available for logging:

- Service start and stop
- Defragmentation start and stop
- Defragmented files
- Moved files
- Disk information
- File information
- Directory information
- Paging file information
- MFT information

Smart Schedule All Volumes

This policy allows you to set Smart Scheduling for all volumes on all computers affected.

When this policy is enabled, the schedule defined here will apply to all computers. When this policy is either disabled or not configured, the schedule established locally will be followed.

With Smart Scheduling, you no longer have to decide how often to defragment your disk volumes—Diskeeper will automatically determine the optimum defragmentation schedule for each volume and adjust it accordingly.

When Smart Scheduling is enabled, Diskeeper keeps track of the number of files moved every time it runs on each volume. When the number of fragmented files moved during a defragmentation run increases, Diskeeper is automatically scheduled to run more often. When the number of files moved decreases, the time between defragmentation runs is increased.

You can use the “starting” and “ending” time drop down lists to further define times when the scheduling of automatic defragmentation runs will not be allowed.

Smart Schedule for Volume Group 1

Smart Schedule for Volume Group 2

Smart Schedule for Volume Group 3

These three policies allow you to set Smart Scheduling for three separate groups of volumes on all the computers affected by the policy. Each group can include up to three specified volumes on the affected computers.

When this policy is enabled, the schedule defined will apply to all computers. When this policy is either disabled or not configured, the schedule established locally will be followed.

Set Custom Schedule for All Volumes

This policy allows you to set a custom schedule to be applied to all volumes on all computers affected.

When this policy is enabled, the schedule defined here will apply to all computers. When this policy is either disabled or not configured, the defragmentation schedule established locally will be followed.

Set Custom Schedule for Volume Group 1

Set Custom Schedule for Volume Group 2

Set Custom Schedule for Volume Group 3

These three policies allow you to set a custom schedule for three separate groups of volumes on all the computers affected by the policy. Each group can include up to three specified volumes on the affected computers.

When this policy is enabled, the schedule defined will apply to all computers. When this policy is either disabled or not configured, the schedule established locally will be followed.

Set Screen Saver Schedule for All Volumes

This policy allows you to set Screen Saver Scheduling for all volumes on all computers affected.

When this policy is enabled, the schedule defined here will apply to all computers. When this policy is either disabled or not configured, the schedule established locally will be followed.

When enabled, Screen Saver mode automatically starts defragmenting the selected volumes any time the screen saver starts on your computer. The defragmentation operation is paused whenever keyboard or mouse activity is detected on the computer.

Set Screen Saver Schedule for Volume Group 1

Set Screen Saver Schedule for Volume Group 2

Set Screen Saver Schedule for Volume Group 3

These three policies allow you to set a Screen Saver schedule for three separate groups of volumes on all the computers affected by the policy. Each group can include up to three specified volumes on the affected computers.

When this policy is enabled, the schedule defined will apply to all computers. When this policy is either disabled or not configured, the schedule established locally will be followed.

Set I-FAAST Schedule for All Volumes

This policy allows you to schedule I-FAAST Defragmentation Jobs for all volumes on all computers affected.

When this policy is enabled, the schedule defined here will apply to all computers. When this policy is either disabled or not configured, the schedule established locally will be followed.

When enabled, Intelligent File Access Acceleration Sequencing Technology (I-FAAST) improves file access and creation on NTFS volumes by up to 80% (average 10%-20%) above and beyond the improvement provided by defragmentation alone.

Note that I-FAAST Defragmentation Jobs are intended to be used in conjunction with Primary or Secondary Defragmentation Jobs, and these defragmentation jobs will follow rules established by the I-FAAST engine based on the I-FAAST evaluation of the volume.

Set I-FAAST Schedule for Volume Group 1**Set I-FAAST Schedule for Volume Group 2****Set I-FAAST Schedule for Volume Group 3**

These three policies allow you to schedule I-FAAST Defragmentation Jobs for three separate groups of volumes on all the computers affected by the policy. Each group can include up to three specified volumes on the affected computers.

When this policy is enabled, the schedule defined will apply to all computers. When this policy is either disabled or not configured, the schedule established locally will be followed.

Appendix E

Remote Installation

Here are some methods for installing Diskeeper on multiple computers in a network.

Diskeeper Deployment with Diskeeper Administrator

The preferred method for installing Diskeeper on computers across your network is the PushInstall feature, available in Diskeeper Administrator Edition. Using the Push Install feature, Diskeeper Administrator Edition can install Diskeeper Professional Edition or Diskeeper Server Standard Edition simultaneously to multiple computers on a network from a single machine acting as an administrative console. Diskeeper PushInstall can save you a tremendous amount of time and effort, especially on large networks, where the same software needs to be installed on hundreds, or even thousands of computers.

To make use of the PushInstall feature, you must install Diskeeper Administrator Edition on a computer that will act as the administrative console for all your Diskeeper installations network-wide. You must also be logged into a domain administrator account. The receiving computers must be running a Windows version supported by Diskeeper Professional Edition or Diskeeper Server Standard Edition.

Refer to the Diskeeper Administrator Edition User's Manual or Help system for detailed instructions on using the PushInstall feature.

Ports Used by Diskeeper Administrator

In order to deploy Diskeeper and remotely control Diskeeper computers with Diskeeper Administrator, the computers running Diskeeper must be configured to allow Diskeeper Administrator to communicate via these ports:

- Diskeeper Administrator PushInstall port: 31029 — Diskeeper Administrator uses this port to deploy Diskeeper to remote computers.
- Diskeeper Administrator server port: 31037 — The Diskeeper Administrator service receives data from remote Diskeeper computers via this port.
- Diskeeper Administrator console port: 31036 — The Diskeeper Administrator remote control console receives data from remote Diskeeper computers via this port.
- Spare Diskeeper Administrator console ports: 31056, 31076, 31096, 31116, 31136, 31156, 31176, 31196, and 31216 — Diskeeper Administrator will use these ports if the default ports are unavailable.
- Diskeeper Administrator SQL port: 1434 — Diskeeper Administrator uses this port if the SQL database is located on a remote computer.

Diskeeper Administrative Installation

Diskeeper can be installed via various tools and procedures besides the PushInstall feature in Diskeeper Administrator Edition.

The complete Diskeeper installation package is contained in a single **Setup.exe** file that can be sent to remote machines and executed. The following qualifiers are available for this type of administrative installation:

/a

Administrative installation—The **/a** switch causes Setup.exe to perform an administrative installation. An administrative installation copies (and uncompresses) all the Diskeeper files to a directory specified by you, but it does not create shortcuts or fully register Diskeeper for use. This “exposes” the .msi file and is useful when applying a transform to modify a base MSI package. (See the *Microsoft Windows Installer* documentation for more information about applying a transform.)

/s

Silent installation—The **/s** switch causes Setup.exe to install Diskeeper without displaying any information on the target machine. Note that the **/s** switch must be used together with the **/qn** switch described in the *MSIEXE Arguments* section below.

/x

Uninstall mode—The **/x** switch causes Setup.exe to uninstall a previously installed version of Diskeeper.

Command Line Installation Arguments

You can pass arguments (or switches) via command line or batch procedure to the various components that perform the Diskeeper installation.

The Microsoft Windows Installer executable, **MSIEXEC.exe**, accepts qualifiers from the command line. Also, there are Diskeeper-specific arguments that can be passed to MSIEXEC as well.

MSIEXEC Arguments

The MSIEXEC Windows Installer executable accepts a number of arguments in the command line. Here are two that are useful with Diskeeper. Refer to the Microsoft Windows Installer documentation on the Microsoft website for more information about Windows Installer arguments.

/v

The **/v** switch passes arguments to the MSIEXEC installation executable. The **/v** argument is used to pass Windows Installer command line switches and values of public properties through to MSIEXEC.exe.

/qn

The **/qn** switch causes MSIEXEC to run silently, with no information displayed on the target computer.

Diskeeper-Specific MSIEXEC Arguments

The following MSIEXEC arguments apply only to Diskeeper installations.

SMART="YES"

This argument causes Diskeeper Smart Scheduling to be set up for every disk volume on the target computer.

CREATEDESKTOPSHORTCUT=1

This argument causes a desktop shortcut for running Diskeeper to be created on the target computer.

Passing Information to the Installation

Here is an example of an installation command line, using several Windows Installer arguments. This command line will install Diskeeper with Smart Scheduling set for all drives, all day everyday:

```
Setup.exe /v"SMART=\"YES\" \" "
```

For a more complex example, to perform a silent install while setting Smart Scheduling all day, use this command line:

```
Setup.exe /s /v"/qn SMART=\"YES\" CREATEDESKTOPSHORTCUT=1 "
```

Note that /s makes Setup.exe run silently, /v says pass all the subsequent information to MSIEXEC.exe, and /qn causes MSIEXEC to run silently. SMART="YES" means that Smart Scheduling should be set for all drives and CREATEDESKTOPSHORTCUT=1 creates a Diskeeper icon on the desktop of the target computer.

Appendix F

Diskeeper as a Cluster-Aware Application on a Cluster Server

Diskeeper can be run as a cluster-aware application in a clustered server environment.

A server cluster is a group of independent servers working collectively and running the Microsoft Cluster Service (MSCS). Server clusters provide high availability, failback, scalability, and manageability for resources and applications².

Running Diskeeper on a server cluster allows scheduled defragmentation to continue automatically when the primary cluster node fails.

Requirements

Note: This feature is only available on Windows 2000 and Windows Server 2003 systems.

Diskeeper must be installed on all the nodes of the cluster upon which you want to run Diskeeper, under the same drive names and directories.

Setting Up Diskeeper on the Cluster

Follow these steps to set up the Diskeeper cluster resource and bring it online:

1. Install Diskeeper on both the primary and failover nodes of the cluster and set defragmentation schedules on each. Keep in mind that you may want to use a different defragmentation schedule when the cluster is in failover mode.
2. Set up a cluster group in the Cluster Administrator named Diskeeper and use the failover parameters you need for the specific use. Here are two suggestions:
 - Set **Threshold** to **0** (fails over immediately), or decide what value is wanted here. (The threshold value is the number of times the application will return to the same computer before it fails over to the next computer.)
 - Set **Period** to **1000**. (Period is the time interval in seconds, during which the threshold count is tracked. After that time has elapsed, the threshold count starts over.)

There are no dependencies or registry replication to specify.

3. Take the group offline.
4. Create a cluster resource.
5. Name the newly-created resource.
6. Make the new resource generic.
7. Right-click the **Diskeeper** group in the right-hand pane, select **Properties**, then select the **Parameters** tab.

² Ref: Microsoft TechNet Article *Guide to Creating and Configuring a Server Cluster under Windows Server 2003*

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8. In the **Command Line** field, type this command, using the directory path appropriate to your system:
`C:\winnt\system32\mmc.exe "C:\Program Files\Diskeeper Corporation\Diskeeper\Diskeeper.msc"`
9. In the **Current Directory** field, type this command, again substituting the directory path as necessary:
`C:\Program Files\Diskeeper Corporation\Diskeeper`
10. Select the **Allow application to interact with the desktop** checkbox.
11. Bring the group online, and you're done.

Glossary

access: To store *data* on, or retrieve data from, a *disk drive* or other *peripheral device*. See also *file*.

administrator: See *system administrator*.

applet: A small *application* program that is usually built into an *operating system* or a larger application program. For example, the built-in writing and drawing programs that come with *Windows* are sometimes called “applets.”

application: A computer *program*, which causes a computer *system* to perform some useful work for the user.

ATA: Advanced Technology Attachment. One of several standard types of *interfaces* used to connect a *disk drive* and a *computer*. See also PATA and SATA.

AutoPlay: A feature of some *Windows* applications on *CD-ROM* that causes the program to start automatically when the CD-ROM is placed in the drive.

background processing: The execution of certain operations during momentary lulls in the primary (foreground) process. An example of a background process is printing while a word processor is waiting for keystrokes.

binary: From Latin “bini,” meaning two by two and “ary,” meaning of, or pertaining to. Computers use the binary number system, which is a way of counting in which only two *digits* (0 and 1) are used. Contrast with the familiar decimal number system, in which we count with 10 digits (0 through 9).

bit: Short for *binary digit*. The smallest unit of information handled by a computer. Like a light switch, a bit is either on or off, which corresponds to a numerical value of one or zero. Larger numbers are expressed by groups of bits. See also *byte*.

boot: Refers to the initial start-up of a computer, such as when you turn on the computer’s power. From the word “bootstrap,” indicating the computer “lifts itself by the bootstraps;” that is, it gets itself going.

boot-time: The time during which a computer *boots*; that is, the computer is starting up and the *operating system* has not yet taken over control of the computer.

browser: A software program, such as Microsoft’s *Internet Explorer*, designed to locate and view Web pages on the *Internet*. In addition to displaying text, modern browsers also can display pictures and play sounds.

byte: A group of eight *bits*, which can represent a number from zero through 255, a letter of the alphabet, or a variety of other things.

cache: From the French word *cache*, meaning “to hide.” A temporary storage facility designed to speed things up by providing information to software that would otherwise have to be obtained from a slower *medium*. Caches exist for Web browsers, *disk drives* and *CPUs*. See also *cache memory*.

cache coherency: A condition where the *data* contained in the *cache memories* in a computer with multiple processors is kept consistent at all times.

cache memory: In computers, a cache is a small amount of very fast *memory* that is placed close to (or inside) the *CPU chip*, in order to improve performance. The cache memory holds copies of recently accessed *data*. Because computer programs often run the same instructions repeatedly, many times the CPU will find the data it needs in the cache and therefore will run faster because it does not need to access the computer’s main memory.

CD-ROM: Compact Disk Read-Only Memory. A stiff plastic disk commonly used by *software* manufacturers to distribute software to customers. As the name implies, the original contents of a CD-ROM cannot be changed.

central processing unit (CPU): The part of the computer hardware that controls the computer's overall operation and performs computations. Most modern CPUs are built into a single *integrated circuit* or *chip*. See also *Pentium*, *x86*.

chip: See *integrated circuit*.

CHKDSK: A program (supplied with Windows NT, Windows 2000, Windows XP, and Windows Server 2003) that checks the integrity of a disk and corrects disk errors such as lost *clusters*. See also *scandisk*.

client: In a computer *network*, a computer that uses the services of another computer, called a *server*. For example, a client can “ask” a server to provide it with needed data, or to print a file for the client. See also *server*, *workstation*.

cluster: Smallest addressable unit of space on a disk. A one-byte file will actually use a cluster of disk space. The minimum size of a cluster depends on the size of the disk *volume*. The *FAT file system* allows a maximum of 65,536 clusters per volume, which means that the cluster size on a 64-megabyte disk volume is one kilobyte, while a 128-megabyte volume uses two-kilobyte clusters. Thus, the FAT file system can be very wasteful of disk space on large volumes. The *NTFS* file system does not suffer from this limitation.

COM: Acronym for Component Object Model, a specification developed by Microsoft for building software *components* that can be made into programs or add functionality to existing programs running on Microsoft Windows platforms.

component: A small modular *program* that performs a specific function and is designed to work interactively with other components and *applications*. See also *applet*, *COM*.

contiguous: Adjacent; placed one after the other. A contiguous file is not fragmented; that is, it takes up a single “chunk” of disk space. See also *fragmentation*, *defragmentation*.

control file: A file (**Diskeep.ctl**) used by *Diskeeper* to keep track of and control scheduled defragmentation of disk volumes. See also *Set It and Forget It*.

controller: A specialized electronic circuit, which serves as an *interface* between a *device*, such as a *disk drive*, and a computer. See also *IDE*, *SCSI*.

CPU: see *central processing unit*.

data: Information, as processed by a computer. Plural of the Latin word *datum*, meaning an item of information.

database: A collection of related information about a subject, organized in a useful manner that provides a base or foundation for procedures such as retrieving information, drawing conclusions, and making decisions.

datum: Singular of *data*.

defragmentation: The reduction or elimination of *fragmentation*, by making files and/or free disk space more *contiguous*.

device: A machine, such as a printer or a *disk drive*.

digit: From Latin “digitus,” meaning finger. Any of the numbers 0 through 9 in the decimal number system, called a digit because people originally used their fingers for counting. Computers use a *binary* number system with only two digits (0 and 1).

directory: A file that contains a catalog of files and other directories stored on a disk, which allows you to organize your files into groups, making them easier to find.

directory consolidation: A *Diskeeper* feature which, at *boot-time*, gathers (almost) all *directory* entries on a disk *volume* into a single area on the disk, instead of scattered in many places. Directory consolidation makes *defragmentation* more effective than it would otherwise be. Directory consolidation requires sufficient contiguous free disk space into which the directories can be moved.

disk drive: A *device* containing one or more disks, treated as a unit by a computer.

Diskkeeper: A *software* product that increases *system* performance through disk *defragmentation*. It eliminates *resource-wasting file fragmentation* safely, by consolidating fragmented files and free space.

diskette: See *floppy disk*.

domain: In *Windows NT*, *Windows 2000*, *Windows XP* and *Windows Server 2003*, a group of *workstations* and *servers*, defined by an *administrator*, that share a common directory database and allow a user to log onto any *resource* in the domain with a single user ID and password. Each domain in a network has a unique name.

drive: See *disk drive*.

drive letter: In *Windows* and *MS-DOS operating systems*, the naming convention for *disk drives*, consisting of a letter, followed by a colon. Drives A: and B: are normally reserved for *floppy disk* drives and C: typically indicates the first *hard drive*. See also *volume*.

encrypted file: A file that has been scrambled and made unrecognizable by anyone who does not have the proper “key” to decode it. The Windows 2000, Windows XP and Windows Server 2003 Encrypting File System (EFS) allows users to encrypt files and folders on an NTFS volume to prevent access by unauthorized individuals.

event logging: The process of recording audit information when certain events occur, such as *services* starting and stopping, users logging on and off and accessing *resources*. When running Diskkeeper on Windows NT, Windows 2000, Windows XP, and Windows Server 2003 systems, logged events can be viewed with the *Event Viewer* utility (in Administrative Tools.) When run on Windows 98/Me systems, Diskkeeper logs events to a text file that can be viewed with a variety of text editor programs such as Notepad.

Event Viewer: A utility available on Windows NT, Windows 2000, Windows XP, and Windows Server 2003, which permits the viewing of logged events. See also *event logging*.

extended partition: A type of *partition* that permits the limitation of four partitions per disk drive to be overcome. A disk drive may be partitioned into a maximum of four *primary partitions*, or three primary partitions plus an extended partition. One or more *logical drives* may be created within an extended partition.

FAT: See *file allocation table*.

FAT file system: The *file system* used by *MS-DOS* and adapted for *Windows* to store information on disks, which makes use of a *file allocation table*. There are three types of FAT file system. The FAT12 (12-bit) is used on FAT volumes smaller than 16 megabytes in size, such as *floppy disks*—it is not supported by Diskkeeper. FAT16 can be found on all versions of Windows from *Windows 95* through *Windows Server 2003*. Windows Server 2003, Windows 2000, Windows Me, Windows 98, and the later OSR 2 version of Windows 95 also support FAT32; Windows NT does not.

field: A subdivision of a *record* in a *file*. For example, a record in a customer file may contain a name field, an address field and a phone number field.

file: A complete, named collection of *data*, such as a *program*, a set of data used by a program, or a user-created document. See also *record*, *field*.

file allocation table (FAT): A table or list maintained by some *operating systems*, to keep track of how *files* are stored on a disk.

file system: The method used by an *operating system*, of naming, *accessing* and organizing *files* and *directories* on a disk. See also *NTFS*, *FAT file system*.

floppy disk: A removable storage *medium*, consisting of a small magnetic disk made of flexible plastic, housed in a square protective envelope or cartridge. Originally, floppy disks really were “floppy,” because they were enclosed in a paper envelope. Also called a *diskette*, which is a better name for the more recent design that uses a stiff plastic cartridge. Contrast with *hard disk*.

formatting: A method of preparing a disk surface for use by placing certain magnetic patterns on it, which are used by the *file system* in storing and retrieving *data*.

fragmentation: The word *fragmentation* means “the state of being fragmented.” The word *fragment* means “a detached, isolated or incomplete part.” It is derived from the Latin “fragmentum,” which in turn is derived from “frangere,” meaning “break.” So, *fragmentation* means that something is broken into parts that are detached, isolated or incomplete.

gigabyte: A measure of computer storage capacity equal to approximately a billion bytes. A gigabyte is two to the 30th power, or 1,073,741,824 bytes.

graphical user interface (GUI): Pronounced “goeey.” A user *interface*, as used in the *Windows operating systems*, which uses a mouse and graphic displays to interact with the user, with the purpose to make the computer system easier to use than other operating systems, such as *MS-DOS*.

GUI: See *graphical user interface*.

hard disk: One or more rigid metal platters, coated with magnetic material. Contrast with *floppy disk*, or *diskette*, which is made of plastic. Also used to refer to the physical unit that makes up a *disk drive*.

hardware: The physical parts of a computer *system*, including *devices* such as printers and *disk drives*. Contrast with *software*.

I-FAAST: A Diskeeper exclusive, Intelligent File Access Acceleration Sequencing Technology (I-FAAST) improves file access and creation on NTFS volumes by up to 80% (average 10%-20%) above and beyond the improvement provided by defragmentation alone. This is the first industry implementation of “Disk Performance Calibration”, the modern evolution of the outdated and inconclusive disk optimization strategies of the past.

I/O Smart: The Diskeeper I/O Smart feature intelligently monitors drive access during defragmentation to ensure top system speed. When this option is selected, Diskeeper will temporarily suspend defragmentation whenever other disk activity needs to occur (I/O throttling). This proprietary technology detects whether or not the disk is busy with other I/O requests and pauses defragmentation to eliminate any potential interference with user or system needs at the “disk” level.

IDE: Integrated Device Electronics. One of several types of *interfaces* between a *disk drive* and a computer, where the *controller* is built into the disk drive, which eliminates the need for a separate controller card in the computer. See also *ATA* and *SCSI*.

integrated circuit: Also called a *chip*. A collection of electronic parts with a specific purpose, built into a single physical package. See also *central processing unit*.

Intel: Manufacturer of *processor chips*, known especially for the *Pentium* and *x86* processors.

interface: The connection and interaction between *hardware*, *software* and/or the user. For example, a disk *controller* provides a physical interface between a computer and a *disk drive*. The keyboard, mouse and display are an interface between a computer and the user.

Internet: A global *network* that links millions of computers. One popular section of the Internet is the World Wide Web, which allows computer users to view text and pictures with the aid of a browser, such as *Internet Explorer*. E-mail (electronic mail) is another popular part of the Internet, which allows computer users to send and receive written messages.

Internet Explorer: A software package developed by Microsoft for browsing the *Internet*, but increasingly used with other applications.

job: A request to have the computer or its *peripherals* perform some activity. In relation to *Diskeeper*, it is a request to have a disk *defragmented*.

log file: A *file* that keeps track of certain events as they occur. The *Windows NT/2000/XP operating system* maintains several log files that can be viewed with the *Event Viewer*. On *Windows 98/Me* systems, *Diskeeper* uses a specially created text file for the same purpose. See also *Event Logging*.

logical drive: That portion of the space on a *disk drive* that is considered by the *software* to be a single unit. In this context, *logical* means “conceptual.” because there is no direct relationship between the name and a physical object. See also *partition*, *volume*.

long filenames: In the DOS operating system, filenames were limited to a maximum of eight characters, followed by a period and up to three characters to indicate the type of file. This is also referred to as the 8.3 file naming convention. The Windows 98/Me, Windows NT, Windows 2000, Windows XP, and Windows Server 2003 operating systems allow filenames that are over 200 characters long. In addition, these filenames may contain a mixture of upper- and lowercase characters and embedded spaces.

master file table (MFT): On an *NTFS volume*, the master file table is a *file*, which contains information about all other files in that volume. This includes the name of each file, its physical location on the disk, and other information.

media: A collective word for the physical material on which computer-based information is stored, such as a *CD-ROM* or *floppy disk*. Media is the plural of *medium*, but like *data* is often used in the singular form.

medium: See *media*.

memory: The computer’s temporary working storage, where *program* instructions and *data* are kept, permitting the *CPU* to process the instructions.

MFT: See *master file table*.

Microsoft: A computer *software* company, with its head office in the state of Washington; creators of the *MS-DOS* and *Windows operating systems*.

MMC: Microsoft Management Console. MMC can be used to create, save and open administrative tools (called *snap-ins*), such as Diskkeeper. MMC provides a common user interface for system tools, as well as a system for managing hardware, software and network components.

MS-DOS: Microsoft Disk Operating System. An *operating system* designed for a small computer with a single user running one *application program* at a time.

multitasking: A feature of an *operating system*, where the computer can work on more than one *task* at a time. See also *background processing*.

network: A group of computers that are connected together and capable of exchanging data with each other. See also *server*, *client*.

NTFS: New Technology File System. A file system designed specifically for use with Windows NT, Windows 2000, Windows XP, and Windows Server 2003.

OEM: Acronym for original equipment manufacturer. The term is misleading, because an OEM typically buys computers from another manufacturer, customizes them for a particular application, and then sells them under the OEM’s own brand name.

operating system: A collection of *programs*, which perform *system* functions and control the running of *application* programs and the allocation of *resources*.

OSR 2: Acronym for *OEM Service Release 2*, a version of *Windows 95* released in late 1996, which features an improved file system, called *FAT32*, while the original version of *Windows 95* used *FAT16*.

page file or paging file: An area of a disk that is set aside to hold *data* intended to reside in the computer’s *memory*. Portions of the paging file are copied to memory as needed. This mechanism requires a much smaller amount of physical memory than would be required if the entire *program* were to be loaded into memory all at once. See also *swap file*.

partition: A subdivision of the space on a *disk drive* that is treated as though it were a separate physical unit. A computer with only one hard disk drive can have a single partition, often called drive C:, or it can have several partitions, such as drive C:, drive D:, and drive E:. See also *volume*, *drive letter*, *primary partition*, *extended partition*, *logical drive*.

PATA: Parallel Advanced Technology Attachment. Originally called *ATA*, but retroactively renamed *PATA* with the introduction of Serial Advanced Technology Attachment (*SATA*) *interfaces*. One of several methods of interfacing *disk drives* and other *devices* to computers. See also *ATA*, *IDE*, *SATA* and *SCSI*.

Pentium: The name of a type of *processor*, introduced by *Intel* in 1993. It is the successor to the 80486 and equivalent to the 80586 chip in the *x86* series.

peripheral device: (Related to *periphery*, roughly meaning “on the outside.”) A *device*, such as a *disk drive*, printer, keyboard or mouse, connected to and used by a computer.

permission: The ability of a user on a computer *system* to *access* or modify *files*, especially those that he or she did not create. Permissions exist for security reasons, to prevent unauthorized access to sensitive information. The *system administrator* assigns permissions, or “who has access to what.”

platform: The environment, in which a computer system operates, either based on the computer’s CPU or its operating system. For example: the *x86* platform, or the *Windows Server 2003* platform.

platter: A *disk drive* consists of one or more platters, each of which can receive magnetic recordings on both sides. The platter spins like a phonograph record on a turntable.

primary partition: In *Windows* and *MS-DOS operating systems*, the disk space on a *disk drive* may be divided into a maximum of four primary partitions; or three primary partitions plus an *extended partition*, which in turn can contain one or more *logical drives*.

priority: On a *Windows system*, several *programs* can appear to be running at once, even though the *CPU* can only process one instruction at a time. With the help of the *operating system*, the CPU processes a few instructions from one program, then a few instructions of the next program, and so on, over and over. Without priority assignments, each program would be given about the same amount of time in each “time slot.” but by assigning priorities, the more important programs can be given longer time intervals than the less important ones, allowing them to complete faster.

process: A *program*, along with the system *resources* the program requires to run. A process represents a unit of resource ownership and work to be done. The *operating system* creates processes to keep track of resources and to ensure the proper scheduling of *tasks*.

processor: See *central processing unit*.

program: A set of instructions that tell a computer what to do. Synonym: *software*.

RAID: Redundant Array of Independent Disks. A method of combining several *disk drives* to make one large volume. Typically used on a *network file server* to achieve faster *access*, greater protection against disk failure, or both.

record: A collection of related *data* items, treated as a unit. For example, in a *file* containing information about a company’s customers, one record would consist of the particulars (name, address, phone number, etc.) of one customer. See also *field*.

registry: A *database* that contains information about current *hardware* settings, installed *software*, user preferences and associations between *file* types, and *applications* that *access* those files.

resource: Any part of a computer system, such as a *disk drive*, printer, or *memory*, which can be used by a *program*.

scandisk: A program (supplied with *Windows 95*, *Windows 98* and *Windows Me*) that checks the integrity of a disk and corrects disk errors such as lost *clusters*. See also *CHKDSK*.

SCSI: Small Computer System Interface. One of several methods of *interfacing disk drives* and other *devices* to computers. See also *ATA*, *IDE*, *PATA*, and *SATAI*.

SATA: Serial Advanced Technology Attachment. A successor to *ATA* (which was later renamed *PATA*). One of several methods of interfacing *disk drives* and other *devices* to computers. See also *ATA*, *IDE*, *PATA* and *SCSI*.

server: On a computer network, a computer that makes *resources* available to other computers (*clients* or *workstations*.) For example, all the computers on a network can be set up to share a single high-speed printer, which is connected to the server. Usually, the server is faster and more powerful than the client computers connected to it.

service: A process that performs a specific system function and often provides an application programming interface (API) for other processes to call. *Diskeeper* uses a *Windows* service, which allows *Diskeeper* to run in the *background* while other applications are running.

Service Pack: A collection of *software* used to issue corrections and updates to software between major releases. Usually refers to compilations of corrections and updates to a *Windows* operating system.

Set It and Forget It: A term that was created by *Diskeeper* Corporation, which is a registered trademark and hallmark of the company. A “Set It and Forget It” product can operate transparently (unseen by the user) and in the *background* (concurrent with other *applications*). After a schedule is set up for its operation, it thereafter performs its functions at predetermined times, without further intervention or attention from the user or *administrator*.

Smart Scheduling: A feature, introduced with *Diskeeper* 6.0, which has a built-in mechanism to determine how frequently a disk *volume* needs to be *defragmented*. With Smart Scheduling, *Diskeeper* automatically schedules defragmentation runs to occur more often when a disk volume becomes more fragmented, or less often when it becomes less fragmented.

SMS: System Management Server. A *software* product from *Microsoft*, which permits the *system administrator* on a *Windows* NT, *Windows* 2000 or *Windows* Server 2003 *network* to do such things as install and run new software on different computers on the network, all from a single location.

snap-in: A program, such as *Diskeeper*, that can be used with the *Microsoft* Management Console (*MMC*). For more information, see the *MMC* Help facility.

software: A generic term for computer *programs*, taken collectively. Contrast with *hardware*. Software can be categorized into *application* software and *system* software.

sparse files: A method of storing large files—that contain mostly empty space and not much data—in a way that uses much less disk space than would otherwise be used. Sparse file support allows an application to create very large files without committing disk space for every byte.

swap file: A *file* on a *disk drive* that *Windows* 98/Me uses to hold temporary *data* that will not fit into *memory*. When needed, the *operating system* moves data from the swap file to memory. See also *paging file*.

system: The collection of one or more computers and *peripheral devices*. Sometimes used as a synonym for *operating system*, or the combination of *hardware* and *software*, as a logical unit.

system administrator: The person in charge of maintaining a multi-user computer *system*.

system file: In general, a *file* that is part of, or *accessed* by, the *operating system*. The *Diskeeper* Drive Map display shows certain system files in green, particularly the *master file table* (MFT) and several other files that cannot be moved safely by *Diskeeper* (or any other defragmenter). These are not the files that make up the *Windows* *operating system*, but the files that make up the *NTFS* *file system*.

task: A *program* or portion thereof that is run as an independent entity.

terabyte: A measure of computer storage capacity equal to 2 to the 40th power or approximately a thousand billion *bytes* (or a thousand *gigabytes*).

trialware: A free software package from *Diskeeper* Corporation, such as *Diskeeper*, that has the same functionality as the official version of the software, but which works for a limited time period, after which it expires. Trialware allows you to try the software before making a buying decision.

utility: A *program* that provides basic services or functions.

volume: A subdivision of the space on a *disk drive* that is treated as though it were a separate physical unit, or a combination of physical disks treated as a single unit. A computer with only one hard disk drive can have a

single volume, often called drive C:, or it can have several volumes, such as drive C:, drive D:, and drive E:. See also *drive letter*, *logical drive*, *partition*.

volume set: In *Windows*, a single *logical drive*, which is composed of up to 32 areas of free space on one or more *disk drives*. Volume sets can be used to combine small areas of free space on one or more disk drives into a larger logical drive, or to create a single large logical drive out of two or more small disks.

Windows: A family of *operating systems*, first introduced by *Microsoft* in 1983, with a *graphical user interface* and which ran on *MS-DOS* based computers. See also *Windows 95*, *Windows 98*, *Windows NT*, *Windows 2000*, *Windows XP* and *Windows Server 2003*.

Windows 2000: Originally named *Windows NT 5.0*, Windows 2000 is a family of operating systems for desktop computers and network servers, announced by *Microsoft* in 1998. Windows 2000 resembled *Windows NT 4.0* and *Windows 98*, but had many enhancements and new features. Windows 2000 is available in several editions, ranging from Windows 2000 Professional to Windows 2000 Advanced Server.

Windows 95: A version of *Windows* released in 1995. New features in Windows 95 with regard to its predecessor, Windows 3.1, included a new user interface and support for 32-bit applications. See also *OSR 2*.

Windows 98: Successor to the *Windows 95* operating system, Windows 98 featured support for the *FAT32 file system*, greater Internet integration, and support for the latest (at the time) hardware developments.

Windows Me: Short for Windows Millennium Edition, an operating *system* released by *Microsoft* in September 2000. Successor to *Windows 98* and designed for home use, Windows Me offers enhancements in the areas of *digital media*, *user interface*, *home networking*, and the *Internet*.

Windows NT: An *operating system* released by *Microsoft* in 1993 (NT stands for New Technology.) It has a similar *graphical user interface* to *Windows*, but it does not run over *MS-DOS* and was designed specifically for computer *network* environments.

Windows Server 2003: An operating system released by *Microsoft* in 2003 as the follow-up version to Windows 2000 Server. Like its predecessor, it has a similar graphical user interface to Windows, but it does not run over MS-DOS and has been designed specifically for computer network environments. Windows Server 2003 is available in Standard, Web, Enterprise, and Datacenter editions.

Windows XP: An operating system released by *Microsoft* in 2001 as the follow-up version to *Windows 2000*. Like its predecessor, it has a similar *graphical user interface* to other Windows versions, but it does not run over MS-DOS and has been designed specifically for computer network environments. Windows XP is available in several editions for different uses, such as Windows XP Professional for corporate use, or Windows XP Home Edition for home users.

workgroup: In *Windows NT*, *Windows 2000*, *Windows XP*, or *Windows Server 2003*, a workgroup consists of one or more computers that do not participate in a *domain* and are therefore responsible for their own security and administration.

workstation: A computer that has been set up for use by an individual typically connected to a *network*. The term is also used to indicate a *client* computer, in contrast with a *server*.

x86: Symbol to represent a series of *CPUs*, manufactured by *Intel* and others, including model numbers 8086, 80286, 80386, 80486 and 80586 (*Pentium*). All of the CPUs in this series have certain characteristics in common, which permits *software* to be written that will run on any of them.

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