# Diskeeper Can Boost Your SQL Server's Performance

## Software Spotlight by Brad M. McGehee

One of the biggest hardware bottlenecks of any SQL Server is disk I/O. And anything that we, as DBAs, can do to reduce SQL Server's use of disk I/O will help boost its performance. Some of the most common things DBAs do to reduce disk I/O bottlenecks include:

- Tuning queries to minimize the amount of data returned.
- Using fast disks and arrays.
- Using lots of RAM, so more data is cached.
- Frequent DBCC REINDEXing of data to remove logical database fragmentation.

Another less frequently used method to reduce overall disk I/O, but nonetheless important, is to perform physical defragmentation of SQL Server program files, database files, transaction logs, and backup files. Physical file fragmentation occurs in two different ways. First, individual files are broken into multiple pieces and scattered about a disk or an array (they are not contiguous on the disk). Second, free space on the disk or array consists of little pieces that are scattered about, instead of existing as fewer, larger free spaces. The first condition requires a disk's head to make more physical moves to locate the physical pieces of the file than contiguous physical files. The more physically fragmented a file, the more work the disk drive has to do, and disk I/O performance is hurt. The second condition causes problems when data is being written to disk. It is faster to write contiguous data than noncontiguous data scattered over a drive or array. In addition, lots of empty spaces contribute to more physical file fragmentation.

If your SQL Server is highly transactional, with mostly INSERTS, UPDATES, and DELETES, physical disk fragmentation is less of an issue because few data pages are read, and writes are small. But if your are performing lots of SELECTS on your data, especially any form of a scan, then physical file fragmentation can become a performance issue as many data pages need to be read, causing the disk head to perform a lot of extra work.

Built into Windows 2000 and Windows 2003 is a built-in defragmentation utility, but it is slow, doesn't always do a good job of defragmentation, and cannot be easily scheduled. Because of this, I decided to give Executive Software's Diskeeper 8.0 software a try. This defragmentation utility comes in five different versions, including:

- Home
- Professional
- Administrator
- Standard Server
- Server Enterprise

For this article, I used both Professional and Standard Server. Both are very similar, but have a slightly different feature set, as you might expect. The Professional Edition is designed for your desktop, while the Standard Server is designed for servers. The goal of this article is to tell you how Diskeeper works; it is not an article testing the pros and cons of the software.

### **Diskeeper in Action**

One of the best ways to see what Diskeeper can do for you is to give it a try, and that's what I am going to do here. To see what Diskeeper can do for one of my SQL Server's, I installed it on a SQL Server that had been in production for about 5 months, and had never been defragged before.

Diskeeper includes a tool that allows you to analyze the amount of fragmentation before and after the defragmentation occurs, which can be enlightening, as you will soon see.

So after installing Diskeeper, I started it up, and here's what the screen looks like (modified to fit the web page).

Diskeeper Sie Action View Help					-	
	SOLTEST2					
Set It and Forget It				A 94		(e
Analyze selected drive				🛎 🂝 🕓		C
Defragment selected drive	Volume Session Status	File System	Capacity	Free Space	% Free Space	
	(C:)	NTES	10,001 MB	5,050 MB	50 %	-
Change your settings	New Volume (F:)	NTES	332 GB	282 GB	84 %	
	To find out how fragmented files are affecting your machine's performance: Select a drive from the list above. Cick "Analyze selected drive" from the menu on the left. Gick "Start". Diskeeper will determine the lost performance on the drive by analyzing how long it takes to read the volume in its current state, and how long it takes to read the volume in its ence the files have been defragmented. You will see how much the performance of your computer		Understanding the problem of fragmentation fragmentation means that the pieces of a file are scattered all over the disk, making it difficult for the computer to access the file. The more pieces a file is in, the more difficult that file is to access. Also, when many files are fragmented, the computer will become much slower, making common tasks like opening e-mail and pictures take longer. Diskeeper not only finds out how badly the files are fragmented, but it finds out how much your computer is slowed down because of it. More importantly, Diskeeper can eliminate the fragmentation on the volume, and keeper			
	is being degraded, and using Diskeper, y regain the lost performance and keep it th life of your computer.	ou will be able to	it eliminated witho	ut you having to do	anything.	~

The first thing I wanted to do was to see how fragmented the files were on the server, especially on drive F, where the database MDFs, LDFs, and backup files were located. In addition, the SQL Server executable files were also located on drive F. Drive C only had the OS.

So my first step was to analyze drive F. Diskeeper produces several reports after an analysis is done, as you can see here

Analysis Completed
Findings on F:
Diskeeper has completed analysis of this volume and found 244 fragmented files and/or directories and 1831 excess fragments.
The average number of fragments per file is 1.32.
This volume is heavily fragmented, with 72% of the total volume space available for defragmentation. If you haven't run Diskeeper on this volume yet, it is time to do so. If you have run Diskeeper on this volume, you should schedule Diskeeper to run more often than it has been running to reduce the current fragmentation and maintain a lower level of fragmentation. Also, scheduling Diskeeper to run at times when system activity is low improves the overall performance of your computer.
✓ Show this screen after analysis.

As you can see in this report, it has found 244 fragmented files and 1,831 fragments, which Diskeeper considers a heavily fragmented disk, and it recommends that fragmentation take place. Besides the summary above, it also produces some addition reports, which we see below.

Performance Reliability Fragmentation Drive Map Se	t It and Forget It
Performance Analysis results for drive F:	Recommendations
Time to read <b>only</b> fragmented files on drive F Current read time:	Defragment now to get the performance improvements shown in the graphs.
Optimum read time: 1% improvement	Use Smart Scheduling to keep performance loss at a minimum.
0 3 6 9 12 15 read time (minutes)	What do the numbers mean?
Time to read <b>all</b> files on drive F Current read time:	Overall, the performance of your computer on drive F is not affected by fragmentation.
Optimum read time:	Click to find out more about fragmentation
read time (minutes) Values shown are estimated.	

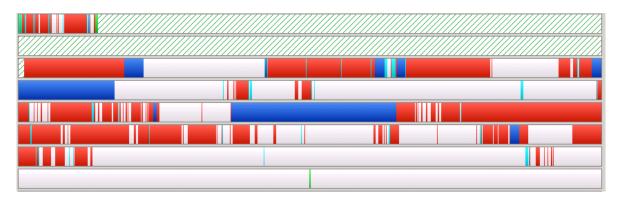
The Performance Report above is a little more ambiguous than the first report. The graph above indicate that disk I/O performance will only be improved about 1% if defragmentation is performed. The recommendation is to defragment now, but under the section that says, "What do the numbers mean?" the report says that overall, performance is not affected by the current level of fragmentation.

Performance	Reliability	Fragmentation	Drive Map	Set It and Forget It			
The reliability le	Reliability analysis results for drive F: Critical! The computer's reliability is severely affected on drive F: The reliability level is at "Critical" for the following reasons: 1. The volume is heavily fragmented (73% fragmentation).		Fragm Used f these have t and ha	Understanding the effects of fragmentation on reliability Fragmentation often occurs with important files that are used frequently by Windows. When the fragmentation of these files gets beyond a certain level, Windows begins to have trouble doing its normal, everyday work. Crashes and hangs can occur, leaving you open to loss of data and productivity.			
	ations for drive ant drive F now us		files u: as to f recom	per will check for fragmentation on co ed by Windows. It will then make ar ow vulnerable your computer is, and nendations for fixing the problem. <u>Ind out more about fragmentation</u>	n assessment		

On the other hand, the Reliability Report is not ambiguous at all. It claims the computer's reliability is severely affected by the current level of fragmentation and that the drive needs to be defragged. The claim here is that the fragmentation can lead the OS to having trouble doing its normal, everyday work, and can cause crashes and program hangs if not corrected.

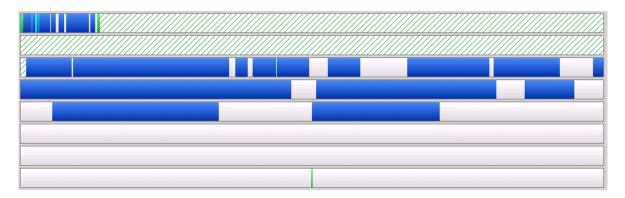
Results of fragmentation analysi	s for the drive F	:	
Volume New Volume (F:):		Paging file fragmentation	
Volume size =	332 GB	Paging/Swap file size =	0 bytes
Cluster size =	4 KB	Total fragments =	0
Used space =	51,050 MB	_	
Free space =	282 GB	Directory fragmentation	
Percent free space =	84 %	Total directories =	127
		Fragmented directories =	23
Fragmentation percentage		Excess directory fragments=	298
Volume fragmentation =	11 %		
Data fragmentation 🛛 🗕	73 %	Master File Table (MFT) fragmentation	
		Total MFT size =	5,652 KB
File fragmentation		MFT records In Use =	4,880
Total files =	4,734	Percent MFT in use =	86 %
Average file size 🛛 🗕 🚽	12,542 KB	Total MFT fragments =	2
Total fragmented files =	221		
Total excess fragments 😑	1,533	Print report	
Average fragments per file =	1.32	Save report	
		Click to view the most fragmented files	

The Fragmentation Report provides a lot of interesting data, which is used to support the recommendations made earlier.



The Drive Map Report is the most visually interesting one to me, and show how the file fragments are spread about the disk. The blue indicates non-fragmented files, and the red indicates fragmented files. Green refers to files that cannot be moved, such as some system files.

Based on Diskeeper's recommendation to defrag the drive, I manually selected this option and waited for the defragmentation to complete. When it did, here's what the drive map looked like.



As you can see, Diskeeper virtually eliminated all disk fragmentation on this drive. I won't bore you by showing you all of the other reports again, but they indicated that the disk was now 100% defragged. At this point, file fragmentation is not an issue and cannot negatively affect SQL Server's performance.

#### Now What?

Now that the disk is defragged, are we done? No. Fragmentation never stops. Although NTFS will try to minimize file fragmentation, it doesn't do a very good job at it. Because of this, defragmentation need to be done continually, if you want optimal disk I/O performance. To accomplish this goal, Diskeeper allows you to schedule defragmentation on an as needed basis. While you have several scheduling options, the easiest to use is the "Set it and Forget It" option. By selecting this option, Diskeeper automatically works to defrag your system while using the least amount of resources possible, on an ongoing basis. This setting should work well for most SQL Server's, assuming they are not already overextended. If your SQL Server is very busy, you will want to manually schedule defrags at time when the server's resources are less taxed.

#### Can Diskeeper Defrag Open SQL Server MDF and LDF Files?

One of the biggest concerns about disk defragmentation is defragmenting files that are currently is use. In other words, if the file is actively being used, can Diskeeper, or any defrag utility for that matter, defrag it?

When I directed this question to Executive Software, the response was: "Diskeeper defragments the drive on the OS level, using the Windows MoveFile API's". Having this in mind, Diskeeper is able to safely defragment a drive on an OS level whether or not it is running a SQL or Exchange Server.

While my tests are not finitely conclusive, I ran my experiment above, the SQL Server MDF and LDF files were indeed defragged, even though they were open at the time.

#### Give Diskeeper a Try

Fortunately, you can try Diskeeper (any version) for free. That is the best way to find out if it will meet your needs.

About the author: Brad M. McGehee is a full-time DBA with a large manufacturing company, and publisher of <u>www.SQL-Server-Performance.Com</u>, a website specializing in SQL Server performance tuning and clustering. He is an MVP, MCSE+I, MCSD, and former MCT.

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