

NEWSKEEPER

WINDOWS® IT PRO
WHITE PAPER

THE IMPACT of Disk Fragmentation on Servers

PAGE 4 ►

FROM OUR DEVELOPERS

The Story Behind The **Titan** Defrag Engine™

PAGE 3 ►

Increasing Server Efficiency

It's tough but IT still has to bring it

CONTENTS

From Our Developers: The Story Behind the Titan Defrag Engine	3
Windows IT Pro White Paper: The Impact of Disk Fragmentation on Servers	4
Saving Time, Money and Manpower: 12 reasons Diskeeper is an essential part of your network infrastructure	6
Case Study: No Downtime for KSPS Public Television	7

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CONTACT DETAILS

For general information on Diskeeper Corporation or any of our products, please e-mail, telephone or write to us. If there is specific information you require, contact any of the representatives below and they will be pleased to help with any inquiries.

General Contact Info:

Diskeeper Corporation
7590 N. Glenoaks Blvd.
Burbank, California
91504 USA

Tel: (800) 829-6468
Fax: (818) 252-5514
E-mail: info@diskeeper.com
Web: www.diskeeper.com

Technical: technicalsupport@diskeeper.com
PR: Colleen Toumayan – ctoumayan@diskeeper.com
Sales: salesinfo@diskeeper.com

ABOUT DISKEEPER CORPORATION

Innovators in Performance and Reliability Technologies®

Diskeeper Corporation, formerly Executive Software®, was founded on July 22, 1981 and has contributed such technical innovations as Diskeeper with InvisiTasking, I-FAAST® and HyperFast technologies.

With over 35 million licenses sold, large corporations and home users alike rely on Diskeeper software to provide unparalleled performance and reliability to their laptops, desktops and servers. Diskeeper Corporation further provides real-time protection and real-time recovery with Undelete. A variety of system management tools, trialware and free utilities are available at www.diskeeper.com.

FROM OUR DEVELOPERS

When we started working on Diskeeper 2009, one of our major design goals was to increase the efficiency of large disk defrag beyond anything previously possible.

With workstation and consumer disk sizes now approaching 1 TB and with multi-terabyte disks being common in server environments, innovation was imperative.

The sheer volume of the data we are dealing with presents a considerable challenge for a disk defragmenter. For example, at 25 MB/sec data throughput rate (respectable and sustainable for most laptops today), it would take over 11 hours to move 1 TB of data. This, of course, assumes perfect utilization of the bandwidth and nothing else happening on the system at the same time. While data transfer rates in server environments can be several times faster, the amount of disk storage data can also be much higher than 1 TB.

Presented with this challenge, our engineers realized defragmenting very large disk volumes required a different approach to moving data from what we used for smaller disks.

Taking a closer look, we determined that significant portions of files were fragmented in a way that did not cause performance degradation. At the same time, the same files may have other parts that are badly fragmented in a way that significantly impacts file access time. We realized that we can do some truly innovative things by performing “targeted” defragmentation, which eliminates the fragmentation causing file access performance degradation, while at the same time minimizing the amount of data that needs to be moved on the disk.

It is from this that the Titan Defrag Engine was born. The primary innovation in the ‘Titan engine’, as we like to call it for short, is that by targeting performance-impacting fragmentation we were able to dramatically reduce the amount of effort needed to restore the system to its original performance. Using special analysis techniques, the Titan engine examines

each file and determines which parts of the file (if any) require defragmentation to restore the file to the optimal performance state. The main source of performance degradation due to fragmentation is the seek time required to move the read/write head from one area of the disk to another to read different parts of the same file.

We were able to come up with an algorithm that determines which fragments need to be eliminated for maximum file access performance. So the main difference between Titan and traditional defragmentation engines is that in very large file scenarios, Titan avoids working on certain large file fragments that would provide no additional performance gain.

The innovative technology developed enables Titan to determine which fragments affect performance and work only on those.

Another innovation is how Titan achieves free space consolidation.

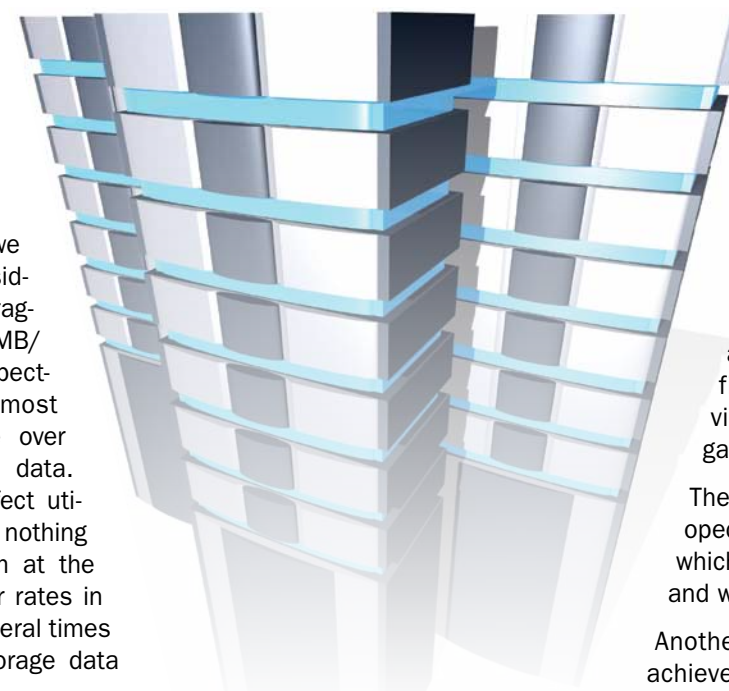
Although Titan is very effective in consolidating free space, it does it only when it is necessary and avoids moving large amounts of data that will not improve performance. The Titan free space consolidation algorithm takes advantage of the fact that it is much more likely to find

a reasonable amount of free space on extremely large volumes. For example, if a 10 TB volume only has 5% free space left, it is still 500 GB of storage space.

The mission of the Titan engine is to allow large servers with volumes containing millions of files to run at top speed without incurring fragmentation-related problems and without having to be taken off line to defrag. To this end, Titan is a resounding success.

Written by George Dzieciol, Diskeeper Corporation Senior Technical Manager

George Dzieciol holds a Master's in Computer Science from the Warsaw Technical University in Warsaw, Poland and has over 20 years of experience in software development. Prior to joining Diskeeper in 2008 George spent over 12 years with Symantec Corporation managing engineering for the corporate AntiVirus product.



The Story Behind The Titan Defrag Engine

WINDOWS IT PRO WHITE PAPER

THE IMPACT of Disk Fragmentation on Servers

From the report: “Every application that touches the hard drive will benefit from a good tool that defragments and manages the files on your servers.” And now here’s the proof! Through a series of precise performance test results, you’ll discover the surprising difference defragmentation makes in key areas of server operation such as time to copy a file, open a document, backup and AV scan. Get the inside data on how fragmentation affects SQL and Exchange operations. It’s absolutely vital data for all IT staff.

Common Server Task Tests

File Copy Test – up to 45% faster

The basic task of moving data from one location to another on the server shows that a fragmented disk has a major negative impact on the file copy. Defragmented disks are a significant time saver for common user tasks.

Fragmentation Level	Seconds
Low – Fragmented	44
Low – Defragmented	39
Medium – Fragmented	72
Medium – Defragmented	60
High – Fragmented	97
High – Defragmented	54

Document Open Test – up to 30% faster

To prevent this type of file fragmentation, the best methodology is an ongoing background file defragmentation process, the benefits of which are clearly demonstrated by this test. And given how often this type of task is performed in most business environments, the value of the defragmentation cannot be understated.

Fragmentation Level	Seconds
Low – Fragmented	11.7
Low – Defragmented	10
Medium – Fragmented	12.7
Medium – Defragmented	10.7
High – Fragmented	14.7
High – Defragmented	10.3

Backup Test – 17% reduction in time

Reducing or eliminating disk fragmentation prior to backup will allow larger amounts of data to be backed up, especially if time is a constraint in your backup process.

Fragmentation Level	Seconds
Low – Fragmented	1193
Low – Defragmented	1130
Medium – Fragmented	2787
Medium – Defragmented	2300
High – Fragmented	6960
High – Defragmented	6620

Anti-Virus Scan Test – 10% performance improvement

The fragmentation level of the disk has a direct impact on the length of the AV scan process. Disk defragmentation resulted in upwards of a 10 percent performance improvement.

Fragmentation Level	Seconds
Low – Fragmented	256
Low – Defragmented	238
Medium – Fragmented	1485
Medium – Defragmented	1359
High – Fragmented	4428
High – Defragmented	4004

Server Application Tests

EXCHANGE TESTS

Opening Messages Test – 40% performance improvement

While the impact of server fragmentation gets significantly greater as the disk becomes more fragmented, even the common lower levels of fragmentation will have a large impact on user response time when you consider that hundreds of users may be accessing the data store at the same time.

Fragmentation Level	Seconds
Low – Fragmented	7.7
Low – Defragmented	7
Medium – Fragmented	10.7
Medium – Defragmented	8.6
High – Fragmented	18.4
High – Defragmented	11.6

“The single, consistent result that appears in all of our tests is that defragmented server drives using Diskeeper deliver better performance.”

Moving Folder Contents Test – 50% faster

If users are often found reorganizing the data in the Exchange mailbox, the impact of fragmentation can be quite severe.

Fragmentation Level	Seconds
Low – Fragmented	9
Low – Defragmented	8
Medium – Fragmented	13.8
Medium – Defragmented	9
High – Fragmented	24.9
High – Defragmented	12.3

SQL TESTS

SQL Server Bulk Test – 40% improvement

A highly fragmented database structure can have a severe negative impact on loading and extracting data from server applications, with the test showing a performance improvement of 40 percent in the most heavily fragmented environment.

Fragmentation Level	Seconds
Low – Fragmented	22.1
Low – Defragmented	20.9
Medium – Fragmented	31
Medium – Defragmented	25
High – Fragmented	53.3
High – Defragmented	33.4

Table Key Creation Test – 11% improvement

SQL Server 2008 does a very good job of managing its databases, but defragmentation shows appreciable improvement in the performance of tasks.

Fragmentation Level	Seconds
Low – Fragmented	12.5
Low – Defragmented	12
Medium – Fragmented	14.1
Medium – Defragmented	12.4
High – Fragmented	25.5
High – Defragmented	20.6

SQL Queries Test – approximately 18% improvement

The tests shows running simple SQL queries can be drastically slowed down when fragmentation exists.

Fragmentation Level	Seconds
Low – Fragmented	23.9
Low – Defragmented	22.3
Medium – Fragmented	28.2
Medium – Defragmented	24.8
High – Fragmented	43.5
High – Defragmented	33

Read the full Windows IT Pro White Paper at:
www.diskeeper.com/serverimpact



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You may also contact us directly at (800) 829-6468 x1228 or MBerger@diskeeper.com.

Saving Time, Money and Manpower:

12 reasons Diskeeper is an essential part of your network infrastructure.

- 1** All laptops, workstations and servers suffer losses in performance and reliability from fragmentation. Only Diskeeper has the power and technical sophistication to eliminate this issue without additional effort from the system administrator.
- 2** Diskeeper's return on investment is realized in a matter of weeks, not months or years.
- 3** Diskeeper allows a company to do more with less, by increasing the efficiency of existing staff/equipment. The result is a leaner company that is able to produce greater work output.
- 4** Unlike solutions that require ongoing management and maintenance, Diskeeper operates in real time without resource conflicts, eliminating the need for scheduling or administrative attention. It keeps servers, workstations and laptops at peak production levels 24/7.
- 5** Diskeeper boosts system speed 20% or more while simultaneously ensuring top system reliability. Get faster application load times, database searches, web apps, virus scans, backups and other time intensive procedures.
- 6** In a virtual system platform, the weak link is the disk drive. It is required to serve multiple operating systems, resulting in an exponential increase in file fragmentation. Without Diskeeper, the entire platform can eventually come to a halt.
- 7** Diskeeper extends system hardware life an additional 1 to 3 years. Save on both refresh costs and installation.
- 8** Diskeeper reduces energy costs with a savings of .12 kilowatts per hour on each desktop system. For a large company that represents a considerable amount of money. As the excess use of power is proportionate to the degree of fragmentation, and servers typically have even more severe fragmentation, the wasted energy costs are even greater.
- 9** Diskeeper increases server uptime and efficiency and unlocks the full performance value of the server by eliminating in real time any accumulation of fragmentation without causing resource conflicts.
- 10** Diskeeper prevents potentially expensive data loss due to high amounts of fragmentation, especially in critical operations such as backups. One significant unrecoverable data loss event can put a company out of business. Diskeeper can significantly speed up backup time and reduce the chance of error.
- 11** Diskeeper has been proven repeatedly to reduce Help Desk calls (15% and more) by increasing the overall reliability and better-than-new-speed of systems across the network.
- 12** Built-in or fixed schedule-based defragmentation solutions cost a company far more in incomplete defrag than Diskeeper costs to cover a network. Only Diskeeper provides the full range of "Set It and Forget It®" technologies that comprehensively address system performance and reliability.

CASE STUDY

No Downtime for KSPS Public Television

"The Diskeeper Server edition is a necessity in my company's business. We cannot afford downtime for any of our servers. We must stay on the air 24 hours a day so we rely on Diskeeper to keep our servers running at top speed, maintaining reliability," said Glen Martin, the KSPS IT Administrator.

KSPS Television, with over 35,000 viewers, is the flagship Inland Pacific Northwest PBS station.

The Trial

In 2000, during the evaluation of Diskeeper on Windows® 98, the KSPS staff were outraged when the trialware expired and they no longer were able to defrag their PCs automatically. Their hard drives slowed down and they learned the hard way how fragmented drives cause work slowdowns.

The Outcome

The daunting task of combining video devices with network connectivity has been a learning experience for the television industry. To integrate computer operations and 24/7 maintenance, KSPS turned to Diskeeper for the ON-AIR computers and all employee desktops as well.

"Your viewer at home doesn't care if you need to do Windows updates on your SQL Server, or if you need to defrag and reboot your fileserver. They simply want their TV show on the air 24/7 with no excuses," Martin emphasized. "Diskeeper keeps your hard drives in the best possible shape for those critical times. Everyone should adopt a maintenance plan for their

computers, starting with Diskeeper as the core tool."

Martin added "I completely rely on Diskeeper and recommend it to everyone who asks me what they should do to clean up their PC and maintain performance. The InvisiTasking technology helps to defrag in the background. I expect a lack of help desk calls complaining that the defrag program is causing slowdowns."

KSPS uses Diskeeper on the Web and Mail Servers, SQL Server and a Fundraising Server. Since they are a PBS Station almost 80% of the funding comes through public donation. The station relies on Diskeeper to maintain their most critical servers from the SQL Server Database computer to the Cash Register Server for the fundraising database. Martin noted, "We no longer require active downtime to perform defrag routines. Our servers are kept at top performance."

The Diskeeper EnterpriseServer has the incredible task of defragging their Nearline Storage RAID5 for the ON-AIR Server. This powerful server has 48 hard disk drives striped in a RAID5 configuration, comprising a sizable 37.2 TB volume. This Nearline Storage drive holds high definition and standard definition clips which air at a later date than what is currently stored in their ON-AIR Server.

KSPS's ON-AIR Server is quickly filled with files ranging in size from a few hundred megabytes up to 20 gigabytes per

"Your viewer at home doesn't care if you need to do Windows updates on your SQL Server, or if you need to defrag and reboot your Fileserver. They simply want their TV show on the air 24/7 with no excuses."

file. Therefore they have to use alternative Nearline Storage and keeping the Nearline RAID defragged is very important. Without help from the truly robust Titan Defrag Engine technology in Diskeeper EnterpriseServer, the files couldn't be easily fitted into consecutive storage spaces.

Conclusion

"I am now able to keep our computers working in tip-top shape without devoting time for manual defrag maintenance.

If I were asked what things I would change or add to improve computer functionality they would be:

- 1) Buy Diskeeper for your computer.
- 2) Add more system memory.

If you simply do the two items listed above, you will regain the vigor and speed your older computers used to have when they were new. The benefits of well-maintained hard drives outweigh the small cost associated with the purchase of Diskeeper licenses."

Glen Martin, KSPS Television Engineering/IT Department IT Administrator

"Leaving a PC turned on overnight for a defragmentation scan is no longer necessary, saving electricity, and PC wear and tear."

Put Diskeeper on every laptop, workstation and server on your network.

Get a quote at www.diskeeper.com/topup

CUSTOMER SUCCESS

“ Since first installing Diskeeper I have seen blinding speed and far less hang-ups with Windows, which is a tremendous improvement.

“The trialware expired and within three days my PC was grinding to a halt and hanging on a regular basis. The standard defrag product with Windows made little improvement and took a long time to run. After the Diskeeper product was registered properly it found over 13,000 fragments and brought my dragging PC back to full brilliancy!

NO NOTICEABLE RESOURCES CONSUMED!

“I can run all of the servers at once without ANY issues, but if I stop Diskeeper with InvisiTasking, even for a very short time, it really slows down in a hurry.

“I wouldn't have a client machine or a Windows based server without Diskeeper on it. PERIOD.”

James Moore, *Operations and Maintenance*
Boeing, #28 Fortune 100 List



Get Diskeeper-driven performance on every laptop, workstation, and server on your network.

- Manually identifying needy systems is inaccurate and time consuming
- Get the best volume license discount level
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- Greatly reduces Help Desk issues
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