

Realtime  
publishers

Why Windows Defragmentation Isn't Enough  
The Essentials Series

# How Native Windows Defragmentation Works

sponsored by



Greg Shields

# Introduction to Realtime Publishers

---

by Don Jones, Series Editor

For several years now, Realtime has produced dozens and dozens of high-quality books that just happen to be delivered in electronic format—at no cost to you, the reader. We've made this unique publishing model work through the generous support and cooperation of our sponsors, who agree to bear each book's production expenses for the benefit of our readers.

Although we've always offered our publications to you for free, don't think for a moment that quality is anything less than our top priority. My job is to make sure that our books are as good as—and in most cases better than—any printed book that would cost you \$40 or more. Our electronic publishing model offers several advantages over printed books: You receive chapters literally as fast as our authors produce them (hence the “realtime” aspect of our model), and we can update chapters to reflect the latest changes in technology.

I want to point out that our books are by no means paid advertisements or white papers. We're an independent publishing company, and an important aspect of my job is to make sure that our authors are free to voice their expertise and opinions without reservation or restriction. We maintain complete editorial control of our publications, and I'm proud that we've produced so many quality books over the past years.

I want to extend an invitation to visit us at <http://nexus.realtimedpublishers.com>, especially if you've received this publication from a friend or colleague. We have a wide variety of additional books on a range of topics, and you're sure to find something that's of interest to you—and it won't cost you a thing. We hope you'll continue to come to Realtime for your educational needs far into the future.

Until then, enjoy.

Don Jones

Introduction to Realtime Publishers..... i

How Native Windows Defragmentation Works..... 1

    Disk Activity = Fragmentation ..... 1

    Solving Fragmentation, the Windows Way ..... 2

    Fragmentation Impacts Performance. So Can Defragmentation. .... 4

## Copyright Statement

© 2010 Realtime Publishers. All rights reserved. This site contains materials that have been created, developed, or commissioned by, and published with the permission of, Realtime Publishers (the "Materials") and this site and any such Materials are protected by international copyright and trademark laws.

THE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. The Materials are subject to change without notice and do not represent a commitment on the part of Realtime Publishers its web site sponsors. In no event shall Realtime Publishers or its web site sponsors be held liable for technical or editorial errors or omissions contained in the Materials, including without limitation, for any direct, indirect, incidental, special, exemplary or consequential damages whatsoever resulting from the use of any information contained in the Materials.

The Materials (including but not limited to the text, images, audio, and/or video) may not be copied, reproduced, republished, uploaded, posted, transmitted, or distributed in any way, in whole or in part, except that one copy may be downloaded for your personal, non-commercial use on a single computer. In connection with such use, you may not modify or obscure any copyright or other proprietary notice.

The Materials may contain trademarks, services marks and logos that are the property of third parties. You are not permitted to use these trademarks, services marks or logos without prior written consent of such third parties.

Realtime Publishers and the Realtime Publishers logo are registered in the US Patent & Trademark Office. All other product or service names are the property of their respective owners.

If you have any questions about these terms, or if you would like information about licensing materials from Realtime Publishers, please contact us via e-mail at [info@realtimepublishers.com](mailto:info@realtimepublishers.com).

# How Native Windows Defragmentation Works

---

*This is a story you might think you know. But the pieces of it you don't know could be causing you grief.*

This is a story about fragmentation—*the hard disks' silent killer*.

Left alone, the hard drive in a Windows computer will quickly create file fragments as data is created, modified, and later deleted. Left alone, these fragments will grow to become a significant performance problem, slowing disk reads and writes and ultimately your user experience. In extreme cases, fragments left alone can eventually add to the risk of data corruption. With files splintering into pieces strewn around a disk, reassembling that file over time requires more and more effort. The loss of even a single piece, due to a bad sector or any other reason, usually means also losing the file.

## Disk Activity = Fragmentation

Fragmentation itself is a natural byproduct of normal file system operations. With Windows alone, there's simply no way to stop file fragmentation. Any time you create a file, work with a file, or delete a file, those operations will naturally further your fragmentation problem.

File fragments are also created when you're not even working with files. Just interacting with your computer, allowing it to complete the background tasks it's been assigned, will also create file fragments. Other activities, such as Web browsing or working with applications, create and delete uncountable numbers of temporary files, all of which add to the problem.

Some estimates suggest that as many as 3000 file fragments per day can be created on a typical business desktop. Without constant attention, these fragments become an additive problem. Today's 3000 fragments combine with tomorrow's and the next day's to create a growing problem that must be resolved. The alternative is to steadily see your system performance degrade over time.

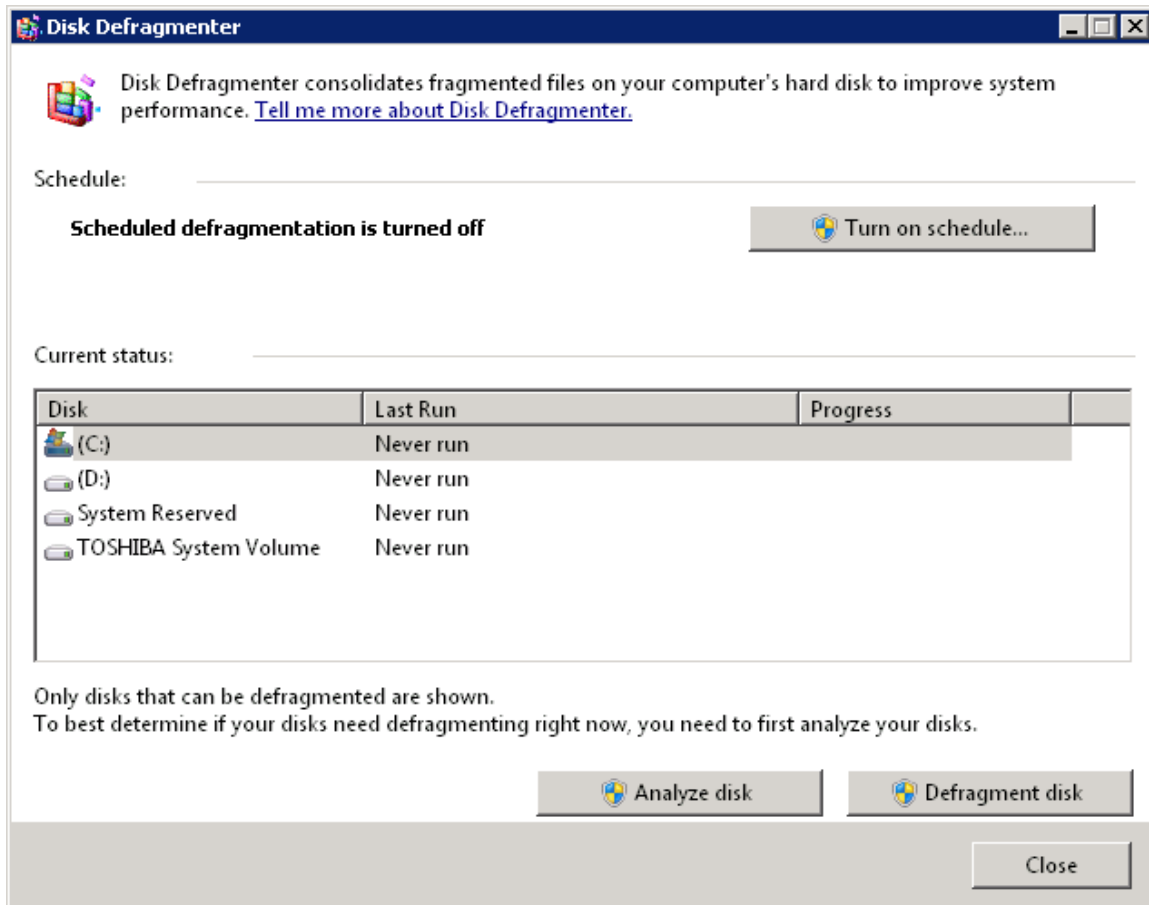
### Note

Ultimately the purpose of eliminating fragmentation is to *increase system performance*.

## Solving Fragmentation, the Windows Way

Think you know this story? Perhaps, but read on, because sometimes this story's solutions can be as problematic as the problems they intend to fix.

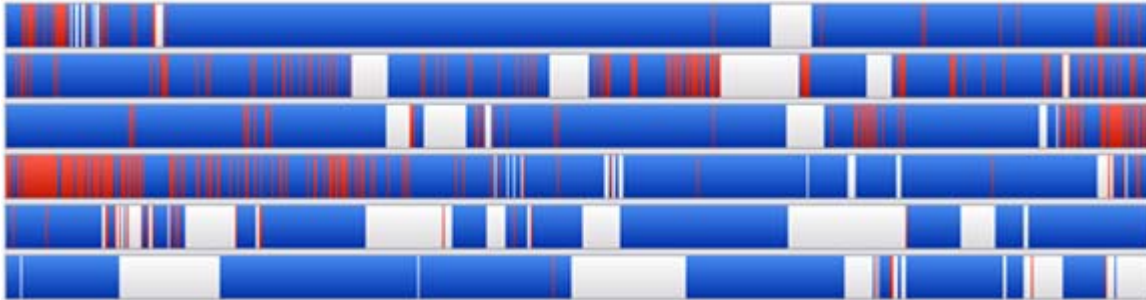
With Windows all by itself, fragmentation's only solution occurs through regular defragmentation. Built into every modern version of the Microsoft Windows operating system (OS) is a native defragmentation tool. Figure 1 shows an example of the tool as seen in Windows Server 2008 R2. There you can see each disk with selections for analyzing the disk, defragmenting it, or turning on scheduled defragmentation.



**Figure 1: The native Windows defragmentation tool.**

A native part of the OS, this internal defragmentation tool can and will remove fragmented files on a Windows computer. It accomplishes this by running a *defragmentation pass* across each connected disk. During each pass, the tool analyzes the disk to look for areas where fragmentation has occurred. Files that have been broken into multiple pieces and scattered across the disk are reassembled into a single and contiguous set of data. The reassembled data is then written back to a section of free space, with the tool moving on to the next fragment.

A graphical representation of how this looks is seen in Figure 2. There, a disk is shown as a series of rows, from the disk's first sector in its upper-left to its last sector in the lower-right. Fragmented areas are displayed in red, with free spaces in white. Files that aren't yet fragmented are displayed in blue.



**Figure 2: A fragmented disk with fragmented files displayed in red and empty space in white.**

You can easily see in Figure 2 what needs to be accomplished. The file pieces in red must be identified, re-assembled, and then written back to an available white space. At first blush, this seems like a trivial activity: read each file piece, put it back together, and write it. Yet the computational resources required to complete this task can be significant. Disk defragmentation, being a file system-heavy operation, can and often does impact the overall performance of the OS to the point where user activities are impacted.

#### **Windows' Native Defrager's Default Settings Tell a Story**

You don't want the operation of a background process to impact your users while they work. And yet a defragmentation pass can do just that. Running that defragmentation pass requires memory and CPU resources just like user applications.

That's why the native defragmentation tool in Windows 7 (and previous desktop OS versions) has always been configured to run at night and only once per week. By default, the Windows native defragmentation tool runs at 1:00 AM every Wednesday of every week.

Windows servers are another situation entirely. Unlike Microsoft's desktop OS, Windows Servers often have additional responsibilities once people leave work for the day. Backups, anti-malware, and nightly background processes are all often scheduled to run throughout the night.

*For this reason among others, the native Windows defragmentation tool isn't even scheduled to run on Windows servers. If you've done nothing, your servers may be accumulating fragments and losing performance.*

Windows' native defragmentation tool indeed provides basic functionality, but that functionality comes with an added cost. The defragmentation process itself represents a tax on system resources. The native tool also lacks in key administrative capabilities that are necessary for enterprise organizations. Policy-based configuration is severely limited. Standard users cannot adjust settings to suit their needs. Enterprise monitoring and alerting is non-existent. Enterprise reporting to show pain points and return on investment (ROI) simply doesn't exist. With its basic functionality, the Windows native defragmentation tool doesn't come with the tools your enterprise needs for most-effective management.

## **Fragmentation Impacts Performance. So Can Defragmentation.**

This series' first article is purposefully written to be a bit alarmist. That's because fragmentation is obviously a problem. If it weren't, Microsoft wouldn't have gone through the effort to include a rudimentary fragmentation solution with its OS. At issue, however, is the notion that *getting rid of those fragments can be as much of a problem as the fragments themselves*.

You don't want a solution that operates only once per week. You don't want a solution that cannot properly defragment special files like the paging file (pagefile.sys) or the hibernation file (hiberfil.sys). You also don't want a solution that you can't centrally manage, can't enable for user control, and can't glean useful metrics or reports from.

What you want is a solution that is always on; one that is always eliminating fragments as they occur. What you want is *fragmentation prevention*. And that's the topic of this series' next article.