Windows Defragmenter: Not Good Enough

By Gary Quan, SVP Product Strategy

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This technical advisory letter addresses some users' belief that the Windows built-in Disk Defragmenter is good enough to handle data fragmentation. When I see a lot of customer feedback like this:

"Without Diskeeper the data volume was so heavily fragmented that the team could not maintain a defragmented drive with the tools included with Windows 7."

Michael R. Schmidt, Senior Associate, Booz, Allen, Hamilton
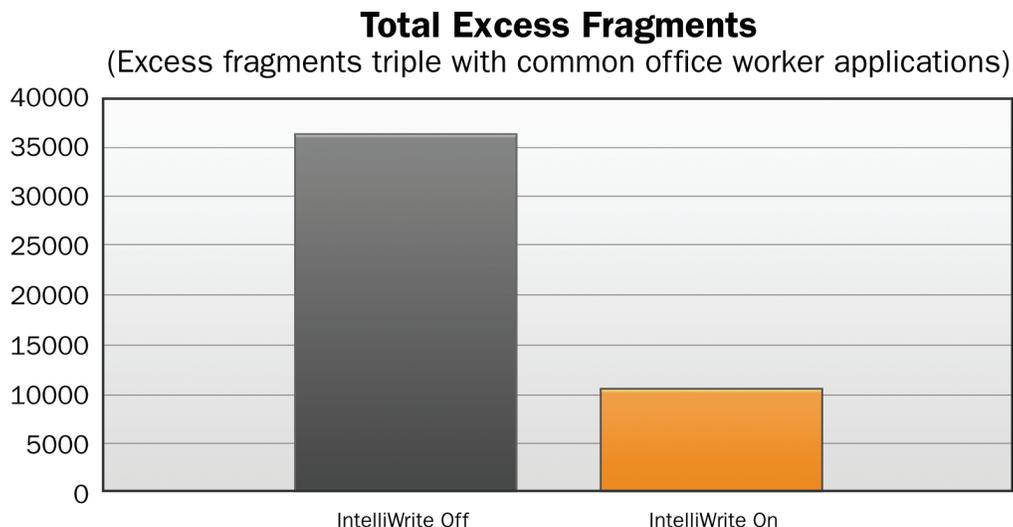
I then have to ask, what is good enough?

- Getting optimal Storage Performance resulting in optimal system performance?

- Getting performance results immediately?

- Getting longer lasting systems that are more energy efficient?

- Getting a solution built for Enterprise Environments?

If these points are NOT wanted, then it is good enough. If you want these benefits, then you need the technologies and innovations found in Diskeeper® and V-locity.® These products are designed for the Enterprise market and designed to intelligently and efficiently get you back the best performance from your I/O system right now. Since I was one of the senior developers involved in the creation of all three of these products, I think I am qualified to address this.

The Windows Built-in Disk Defragmenter was originally designed as a band-aid for low active systems and, although it has evolved, Diskeeper and V-locity have evolved leaps and bounds in this same time period to keep up with the ever-evolving technologies, such as Virtualization and the huge growth demands for storage capacity. Let me go over the technologies and innovations in Diskeeper and V-locity that provide the complete solution.

1. IntelliWrite

The best cure for a problem is to prevent it before it occurs. This is exactly what IntelliWrite® technology does and it is only found in Diskeeper and V-locity. It implements intelligence (with no overhead) into the Windows I/O system that prevents up to 85% of the fragmentation from occurring in the first place. This provides the performance benefits back to the user immediately. Here is the result from testing.

Total Excess Fragments
(Excess fragments triple with common office worker applications)

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By preventing write fragmentation from occurring, read operations will complete much faster as the data is now in a contiguous state from the beginning, but it provides much more than that. By causing the writes to be more sequential rather than random (which fragmented writes will do), these will also occur much quicker, both on the file system side and on the storage device side. This applies to all types of devices, including SSDs and SANs where sequential writes can perform much faster than random writes.

Below is the result of a customer using the Windows Performance Monitor to measure the Disk Bytes/Sec on his Windows Server system for a week before Diskeeper was installed and then for a week after Diskeeper was installed. See the gains achieved and many of our customers have repeated this same test with similar results.

	For a Week before Diskeeper Installed	For a Week after Diskeeper Installed	% improvement
Average Disk Bytes/Sec	46,449	186,904	402%
Peak Disk Bytes/Sec	9,659,580	129,138,152	1,337%

2. Invisitasking, CogniSAN, V-Aware

If implementing the cure is worse than the problem itself, then what good is that cure? In this case, the act of processing the storage for optimization must not impact other applications running on the system. InvisiTasking® V-Aware,™ CogniSAN™ are all technologies that maintain zero resource impact on system and user applications that are running. InvisiTasking ensures that only unused resources are used when optimizing the storage. V-Aware and CogniSAN are designed for the similar purpose in Virtualized and SAN environments respectively. Here is a test showing this, where a file copy was performed without V-locity running and with V-locity running. It can be seen that there is no impact on the system while it is optimizing the volume for better performance. More test results are available on our website.

	File Copy Time Before Defrag (mm:ss)	File Copy Time During Defrag (mm:ss)	Percent Improvement
Average	12:35	12:27	1.06%

InvisiTasking, CogniSAN & V-Aware: File Copy Times
### (Lower is better)
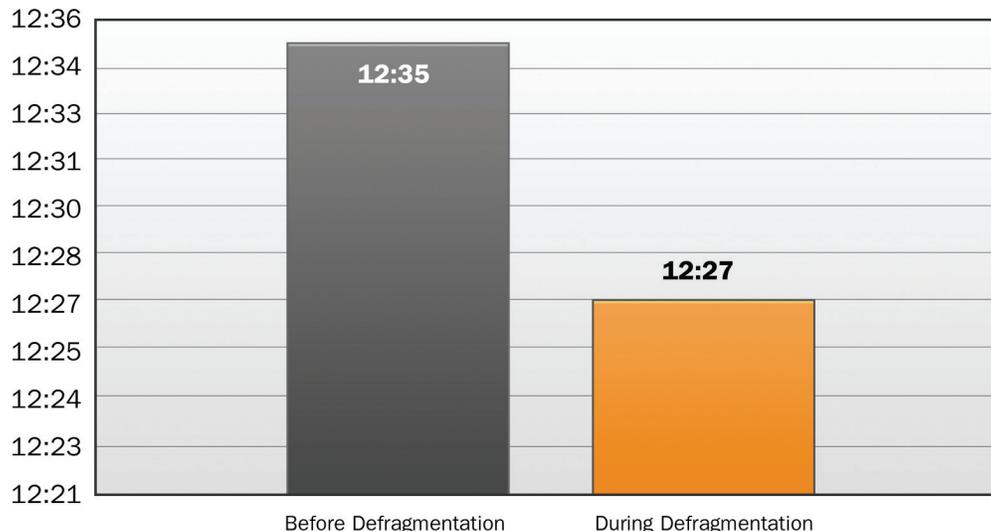
This allows Diskeeper and V-locity to run invisibly while providing all the performance benefits. The user does not have to worry when to schedule as all this is done automatically for the user. In contrast, on Windows Servers, the built-in defragmenter is disabled by default and Microsoft recommends the following to ensure it can get enough resources and avoid any impact to the users: *"Given the variability of server workloads, defragmentation should be enabled and scheduled only by an administrator who understands those workloads."*

3. Specialized Engines

The workload and the volume fragmentation state on systems will be different for every company and user. Unlike the built-in defragmenter which was designed with one processing engine to handle all the different states, Diskeeper and V-locity contain over 20 specialized processing engines. It will intelligently determine which one is the best to use to get the best performance back to the user. For example, there are different engines to handle cases such as extremely fragmented cases or low free space cases or even engines to handle specific storage devices like SSDs (HyperFast® feature). It even has engines to get the utmost performance out of devices by determining where the fast and slow regions are, then determine where to place the data to take full advantage of this. For example, files getting accessed the most will go to the fastest region. As shown below, the speed to access data with I-FAAST® provides performance improvement beyond just defragmentation.

File Optimization vs. Defragmentation
(Lower Scores Are Faster)
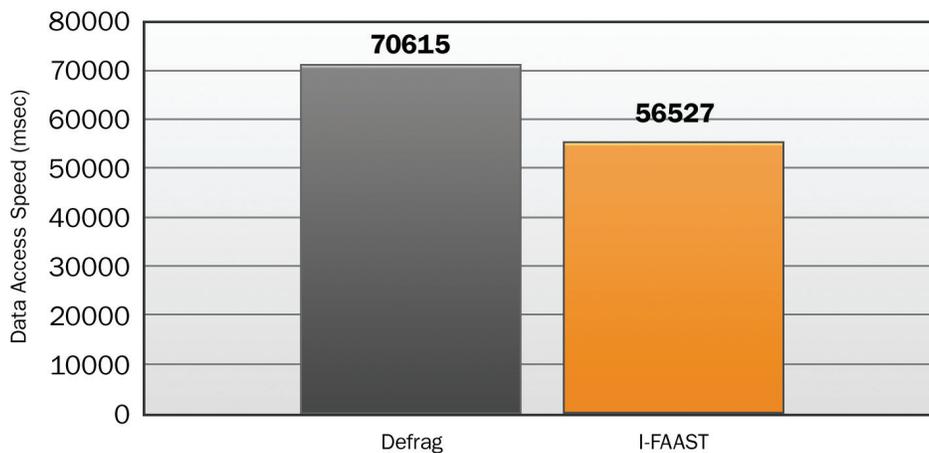
What does this mean to the user? Getting the optimal performance from the storage in the most efficient and fastest means. Don't forget about IntelliWrite, which can prevent up to 85% of the fragmentation from occurring in the first place, so there is even less processing these engines have to do as much of the work was already eliminated. It also gets the performance gains back immediately. Below are some comparison results showing the advantage of Diskeeper over the built-in Windows Disk Defragmenter (WDD). More results can be found in white papers on our website.

In a test performed with the PCMark® Vantage benchmarking tool, the PCMark HDD test scores showed a 14% performance improvement over the built-in defragmenter.
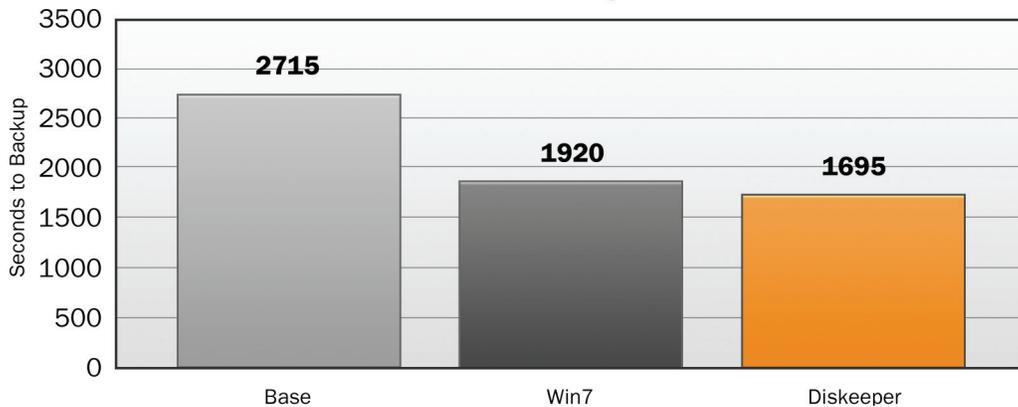
After Defragmentation
(Higher numbers = better performance)

4763.2	Fragmentation Volume
4823.6	Windows 7 Built-in
5484.6	Diskeeper
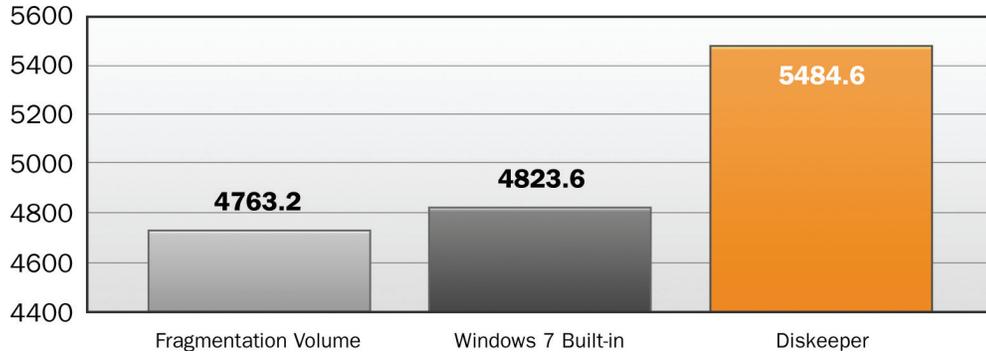
Microsoft Backup Test Results

Backup times are 12% faster with Diskeeper 12.

Backups

| Seconds to Backup		
2715	1920	1695
Base	Win7	Diskeeper

Free Space Consolidation

Compared to the Windows 7 Disk Defragmenter, Diskeeper 12 provided far superior results, eliminating free space fragmentation as a performance issue. Diskeeper 12 grouped free space segments so as to create a much larger average size (measured in GB) and created a 33+GB "largest" chunk size. This also helps prevent fragmentation from occurring in the first place.

	Baseline	After Windows 7	After Diskeeper
Free space count	91,440	18,240	28
Average free space size	492KB	2.47MB	1.58GB
Largest free space size	512MB	509.76MB	33.55GB
Anti-virus scan	1,268,093	849,176	418,917

Comparison of free space consolidation on Windows 7 (default mode)

Efficiency

Since the amount of data being stored keeps growing at an enormous rate, the process to optimizing these volumes has to become smarter. Older methods that handled hundreds of gigabytes of storage will not handle the terabytes, petabytes, and exabytes of storage being used today. Diskeeper has the scalable engines to handle this.

Time to Complete

Windows Defragmenter	54:54:00
Diskeeper	39:20:00
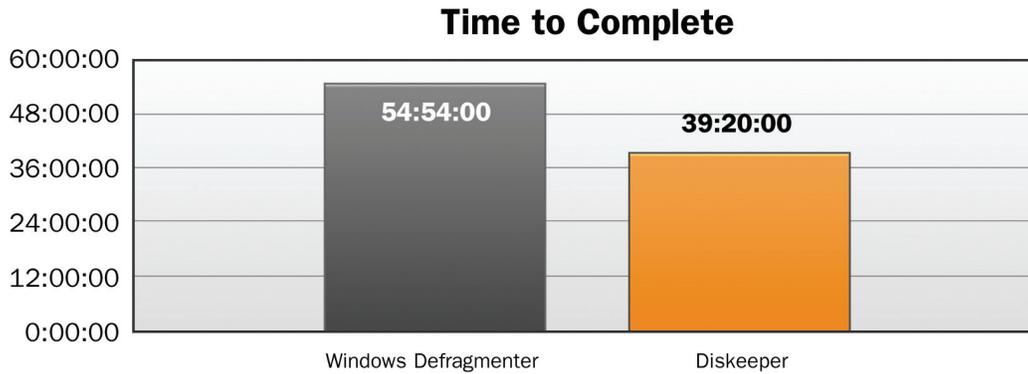
At this point, I would like to comment about two other false beliefs I have heard.

• Some believe that with larger volumes that fragmentation is no longer a problem. It is actually just the opposite. With the larger volumes, more and more data is getting stored on them and, guess what, these results in even more fragmentation which means more performance degradation. The need to keep this under control is even greater.

• The other belief is that with Windows 7 fragmentation does not occur as much. The file system is still the same and it still fragments just as much as it did before. An easy indication is to install a fresh installation of Windowns7 on a newly formatted large volume. After installation, check the fragmentation state and you will see a lot of fragments. Now install one of the latest service packs and see it get even worse. Fragmentation is still there.

4. Energy Savings

It has already been shown how defragmentation and the prevention of it (IntelliWrite) can make the storage system more efficient which leads to performance gains, but it also provides gains in energy savings as shown in the graph below. This may not seem much at first, but when you apply this to hundreds or thousands of systems, it adds up. A nice benefit of going green and saving money.

Power Usage
(Lower is better)

Without IntelliWrite	139.15
With IntelliWrite	131.67
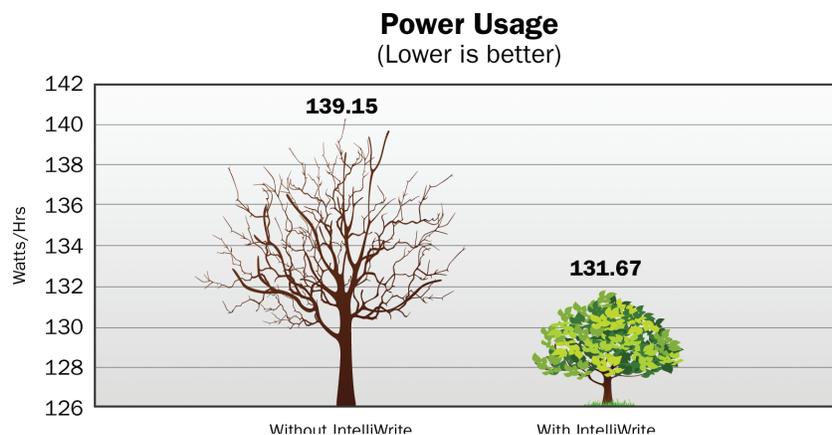
5. Enterprise Solution

Diskeeper and V-locity were designed from day one for the Enterprise environment, from the user interface to the internals on how it automatically optimizes the volume. One example of this is the Diskeeper Administration Console that allows an administrator to manage thousands of Diskeeper installations from a single control point. This includes installations, reports, any special settings desired, even alerts for such things as when a volume is running critically low on free space. This makes it even easier for the Enterprise users.

Summary

Storage performance problems, including fragmentation, still need to be handled if you want the ultimate performance from your systems and maintain it. With new technologies being used such as Virtualization, different storage devices such as SANs, and changes such as the extreme amount of storage being used, these all bring new challenges to attain the optimal performance. The new innovations in Diskeeper and V-locity meet these challenges.