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The Essentials Series: Why You Need to Defragment

Fragmentation Is a Problem!

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Fragmentation Is a Problem!

Why do we defragment? Simply put, because we must!

Data fragmentation on a computer's disk drives quickly creates a major source of performance loss. It increases the time required to accomplish every task on your system, including launching applications, working with data, interacting with page files and hibernation files, all the way to the otherwise-innocuous startup and shutdown activities. It adds an unnecessary layer of complexity to the storage of files and folders, shattering the contiguous storage of on-disk data into dozens or even hundreds of individual pieces. Its constant reordering makes data less reliable to restore in the case of a loss and more difficult to reassemble when needed for processing.

Fragmentation on the disks of Windows servers and workstations has been around since the very first disk. It is a necessary evil of disk-based storage, and is an almost unavoidable consequence of the ever-present process of reading, writing, deleting, and writing again to a computer's storage. Left unmanaged, virtually every time a piece of data is touched by a Windows computer's file system, its action forces the creation of yet another fragment.

In essence, if you've worked with the Microsoft Windows operating system (OS) for any period of time, you've heard of this problem. But in hearing about fragmentation, do you truly understand its meaning? Do you recognize why fragmentation is an endemic problem on each and every Windows computer, one that must be continuously managed if it is to be kept under control? Were you aware of the true scope of fragmentation, and how many fragments an average knowledge worker's desktop produces each and every week? If not, read on.

Fragmentation, the Silent Killer

Testing has shown that an average desktop, one commonly used in a business network environment, can accumulate upwards of 12,000 individual fragments per week (Source: http://downloads.diskeeper.com/pdf/Real-Time-Defrag-Whitepaper.pdf). This number is cumulative, meaning that additional weeks add additional fragments over the top. The net result is a linearly-scaling level of fragmentation on a computer's hard drive that must be managed. Without tools to reassemble fragments into contiguous files on disk or prevent their occurrence in the first place, this problem will eventually scale to slow the overall performance of that system.

Fragmentation is a naturally-occurring phenomenon that is associated with the storage of file system data on a computer. The process of fragmenting a file is not something that can be stopped in a file system without the assistance of specific third-party algorithms. To combat its effects, a separate process must be incorporated to manage the reassembly of file fragments in parallel with a file system's operation.

Data fragmentation occurs when a unit of data on a computer's hard disk is broken up into many pieces. This happens due to the natural use and expansion of data within a computer system. Computer disks store data linearly, meaning that a unit of data is laid down in a contiguous fashion by a disk's head. The rotation of that disk causes the head to pass by the disk's platter, reading and writing data across that disk's sectors and tracks. This is represented in Figure 1, where disks at three points in time are shown as rectangles. In the top representation, File A is written to the disk. In the next unit of time, File B is written to the disk as shown in the middle rectangle.

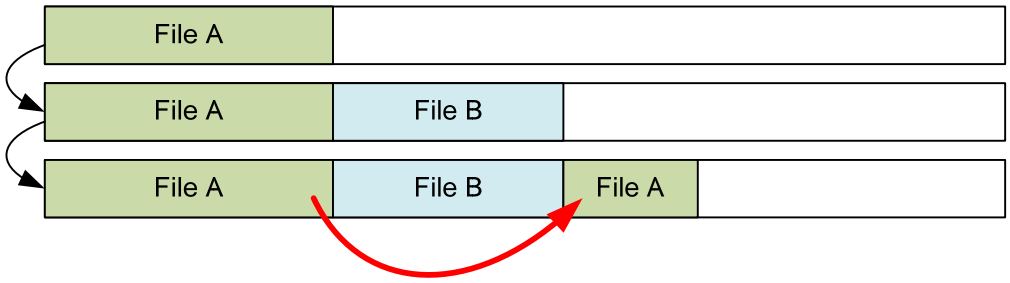

Figure 1: When File A must expand in size, it must fragment to the next available area of storage space.

At this point in the example, the two files remain contiguous on disk because they were initially created and have not yet experienced growth in size. That growth is represented in the bottom rectangle as the third period of time. Perhaps File A was a Microsoft Word document that needed a bit of extra work. Maybe File A was a system DLL that was updated by a patch or a system routine. In either of these cases, this additional processing of File A required an additional bit of space on disk; however, no contiguous space is available. Thus, File A must be fragmented to the next available piece of space, which is located after File B.

This exact situation is what happens upwards of 12,000 times per week on each and every hard drive in your computer. The daily operations of a computer system require the constant expansion of files, the deletion of files, and the placement of files into open spaces that are made available. As this process iterates, individual files can become fragmented dozens or hundreds of times.

The Cost of Fragmentation

The result is that a single file can require multiple disk passes to be completely read into memory for processing. Rather than reading an entire file at once, the disk's head must locate and read each individual fragment, while at the same time reassembling each of these fragments into useable data. As the level of fragmentation increases, the processing overhead associated with these actions dramatically impacts your computers' performance.

How much performance is lost through this accumulated process? Studies show that once a disk is defragmented, the entire system can see a performance gain of up to 80%, with an average realized benefit of 10% to 20% (Source: http://downloads.diskeeper.com/pdf/The-Impact-Of-Disk-Fragmentation-On-Servers.pdf). Obviously, the improvement in performance is directly related to the amount of fragmentation that can be eliminated, with more fragmentation causing more slowness problems.

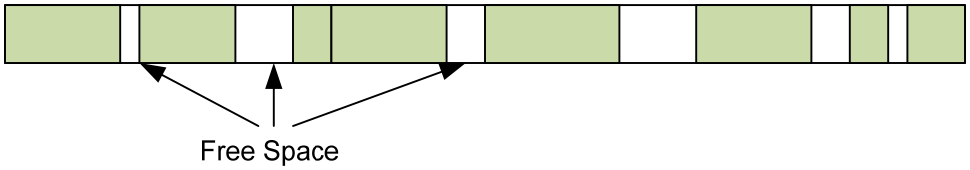

Figure 2: Accumulated fragmentation also impacts the availability of free space on a disk.

A secondary set of problems that grows worse as the level of fragmentation increases has to do with your systems' available free space. Figure 2 shows an example of a disk that has been naturally fragmented due to the typical operations of a Windows OS. There, you can see how the iterative writing, expansion, deletion, and re-writing of files has forced the file system to create "holes" of available disk space. Over time, the count of these holes grows while the size of each hole actually goes down. This reduction in size of free space segments impacts the performance of future writes, because any future writing of files automatically starts in a fragmented state. In effect, *fragmentation begets more fragmentation*.

Solving the Problem

The net result of these factors means that unmanaged fragmentation directly impacts the ability for your users to get their jobs done. As a natural process of the Windows OS, fragmentation isn't going away. And without the right defragmentation tools in place, your users will experience unnecessary slowdowns in performance, your servers will service their clients with reduced effectiveness, and you may find yourself purchasing new and faster hardware that needn't be a part of your budget.

The next two articles in this series will discuss just those problems. Article two will further hone in on the fact that *You Need to Defragment!*, explaining where and why fragmentation impacts system performance and how good practices in defragmentation improve your overall network infrastructure. Article three continues the conversation by answering the question *Doesn't Windows Have This?*, explaining why native OS tools are insufficient to truly get the job done.