# Sustaining SSD Performance
Wipers, Garbage Collection and TRIM

The Problem:

When a file is deleted the drive (HDD and SSD alike) just flags the page as empty in the file allocation table, but it doesn't actually erase the data. The data stays on the drive indefinitely or until it is written over. When the SSD tries to write to the 'empty' page it has to go through a burdensome erase process first. It has to copy the entire block into cache, erase the whole block, then write the pages that have not been deleted back to the SSD. Typically, SSD page size is 4KB and block size is 512KB, or 128 pages, so large chunks of data have to be moved to erase a full block and recycle a few pages. For this reason, an SSD's write performance can degrade sharply after the entire SSD has been written to once. There are a few different solutions for SSD performance degradation.

Deleted page
Data
Empty page
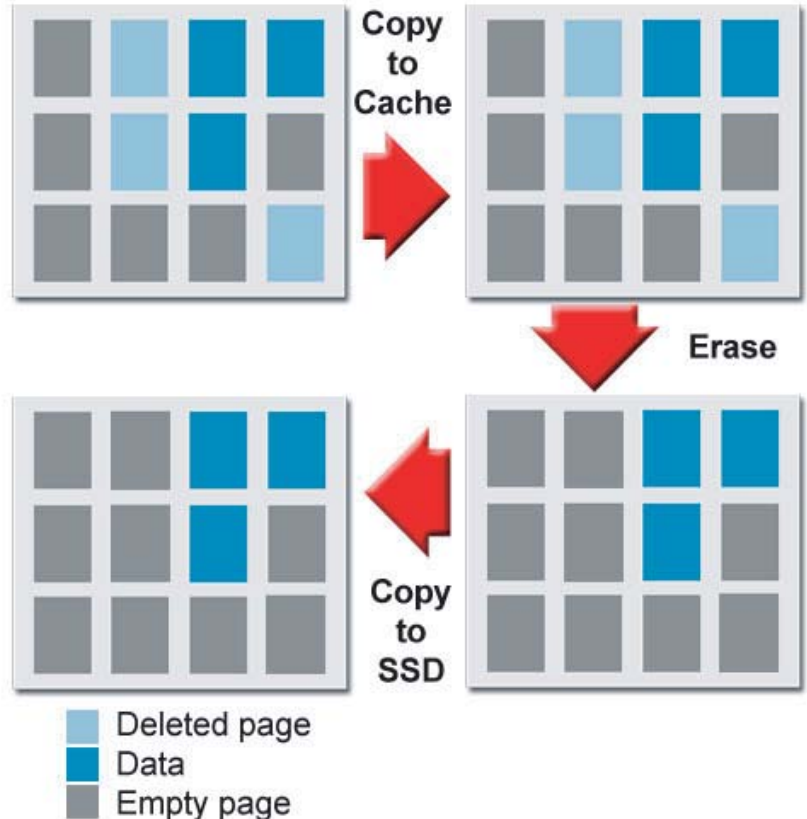
Solutions:

Not Defragmentation
SSDs should never be defragged. Defragmentation is an algorithm developed to improve performance of hard drives by consolidating fragmented files to reduce seek time. But defrag shortens the endurance of the SSD by using up some of its limited write/erase cycles without improving the performance; With no moving parts, SSDs have no seek time. So while defrag will improve the performance of a used hard drive, it should never be applied to an SSD.

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Wiper Utility

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One problem with wiper utilities is that there is no industry standard wiper utility that works with all SSDs. A utility must be specially developed for one SSD model or for one controller/firmware combination. Consequently there are no wiper utilities available for most SSDs. Another drawback of wiper utilities is that they must be executed manually by the user. So write performance is likely to degrade gradually after the wiper utility is applied.

Garbage Collection

Garbage Collection is an odd term for a utility that erases deleted files from the SSD. Garbage collection basically does the same thing as a wiper utility, except that runs in the background, normally when the SSD is inactive. Garbage collection will keep the SSD's performance fresh without the need for manual execution. Garbage collection utilities, like wiper utilities, have to be developed for specific controller/firmware combinations, meaning that different SSDs require different garbage collection utilities.

TRIM

TRIM is an operating system feature in which the OS will pass down commands to an SSD controller to erase deleted pages from the SSD. When the TRIM command is enabled, it will execute automatically in the background to always keep the SSD performing like new.

TRIM is generally the best method for maintaining SSD performance because it is built into the OS and happens automatically. TRIM is supported by Windows® 7 and Windows Server 2008 R2. It will be integrated into Linux in the near future. Other operating systems do not support TRIM.

Although TRIM is an OS feature, the firmware of the SSD must support the TRIM command for it to work. As of February 2010 very few SSDs support TRIM. Another important limitation of TRIM is that it only works on discrete SSDs, not on SSDs in a RAID array. A garbage collection utility remains the most effective way to refresh performance in SSD RAID arrays. ■