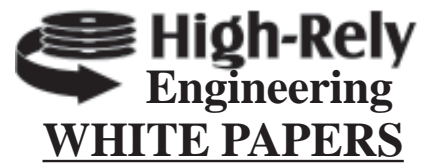


January 24, 2007

## **RE: Write Caching and disk to disk backup performance.**

by Thomas Hoops



*Summary: This paper should help you understand Write Cache and why it can have a big impact on your system performance but little impact on the performance of your disk-to-disk backup.*

**Meaning of Terms: Write Cache.** Write Cache, as it is meant today, refers to a mechanism of your computer system where any information to be stored onto the magnetic media inside your hard drive is temporarily held in close and fast electronic computer memory (RAM or DRAM). The contents of the memory can be written to the hard drive later.

**The benefit of Write Cache.** Write Cache is a performance improvement mechanism. Because the hard drive is usually the slowest form of computer memory, any operations on the hard drive slow the computer down tremendously. If those operations can be performed in the computer's memory, the computer can perform much faster.

Many times programs will create, write to, alter and delete files. If these operations are small enough and close enough together that they can be performed in the memory space in the computer allocated for caching rather than on the hard drive, the performance gain is enormous. For example if a program needs to create a temporary file that stores a computed table of 120000 values based on someone's body weight, the programmer may have opted to save program memory and have the computer store those values in a temporary file. When the program begins creating the file, the computer begins storing the data in its cache memory, unknown to the program which thinks it is creating a file on the hard disk. In this example, the

amount of data chosen will easily fit in the space of most computer's Cache memories. When the program closes or the data changes, the program erases the file. Because this operation is small and quick, the system's cache mechanism never even operates with the hard drive. Thus, all operations are performed without the slowdown associated with transferring data to the hard drive.

Some programs typically alter data in the same spot on the hard drive many times before leaving the data in a stable form. Again, this operation is ideal for write cache because write cache is simply making rapid changes to the same piece of data in memory without needing to update the hard drive.

However, in operations where large amounts of different data must be written to the hard drive, write cache is almost useless. Because write cache is typically the size of the remaining unused electronic memory in the system, most write caches of today's computers are between 128 MB and 800MB in size. When write cache is out of space and can no longer store the write operations, it begins transferring that data to the hard drive. Thus, if you transfer 100GB of data to your hard drive, only the first 128 to 850MB goes quickly.

Because Windows uses unused memory for write cache, if your operating system and programs are using large portions of memory, your available write cache size will be less. So, even if programs are dormant but loaded in memory, other programs which can benefit from write caching can be slowed because there is not enough write cache memory available for the data to stay away from the hard drive.

**The disadvantage of Write Cache.** The primary problem with write cache is that because it is in the computer's memory, if the computer loses power before the data is written to the hard drive, whatever data was supposed to be saved won't be. Thus, it is common for write caching to write data to the hard drive when the system is doing nothing else in order to limit these potential problems. This function is referred to as "Write Delay" - the amount of time from when the program writes the data to the disk before it is REALLY written to the disk.

Write caching is also a bad idea for removable disks. For example, if a program is writing data to your USB hard drive and then signals that it is done, you may unplug the drive before write cache has finished actually writing the data to the disk. Because of this, removable drives under windows usually have write caching disabled.

**The impact of write cache on your backup.**

Because backups typically transfer large volumes of data, write cache's performance improvements are usually negligible. And, because most backup operations are to removable disks, write cache is usually not even enabled.

The graph below illustrates the statistical effectiveness write caching has relative to the amount of cache memory in a system.

