

PerfectCache User Guide

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What is PerfectCache

PerfectCache User Guide

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What is PerfectCache

PerfectCache is software that can greatly enhance disk performance. Hard drives tend to be among the slowest devices in a computer system. PerfectCache puts hard disk data in RAM to dramatically accelerate programs and services that frequently or constantly access that disk data.

PerfectCache functions in 1 of 2 modes:

Caching Mode is the best (and default) choice when the size of the data requiring accelerated access is larger than available system memory. Caching Mode leverages available memory to accelerate data of very large sizes. It also supports the 'tuning' of its cache to extract peak performance from a particular application or server.

Mirror Mode is the best choice when the size of the data to be accelerated is less than the available system memory. In this case, all disk data is stored in RAM, as well as on the disk, resulting in the fastest access times possible.

Both modes support write-through and write-deferred modes. In write-through mode, all write data is immediately saved to disk, effectively eliminating any additional risk of data loss due to a power failure or a system crash. In write-deferred mode, write data is immediately written to RAM, and at a later time written to disk. By deferring writes in this way, extremely high performance is possible for applications and services that modify large quantities of data.

Features

Caching Mode

- Supports volumes sizes from 256 MB to 256 TB
- Supports cache sizes from 128 MB to maximum available memory*
- Unmanaged Memory feature supports all installed memory+ on 32-bit platforms
- Supports Basic or Dynamic disks
- Supports caching the operating system's volume (boot partition)
- Supports caching volumes containing page files
- Supports volumes without drive letters

- Supports volumes with proprietary file systems
- Dynamic configuration, including start and stop caching (no reboot)
- Cache page size (granularity) from 4 KB to 256 KB
- Fail-safe cache allocation
- Write-through or write-deferred modes
- Average dirty page latency setting from 1 to 14400 seconds (4 hours)
- Suspended lazy-write option
- Improved support for NUMA on qualified systems

Mirror Mode

- Supports volumes sizes from 16 MB to maximum available memory*
- Unmanaged Memory feature supports all installed memory+ on 32-bit platforms
- Supports Basic or Dynamic disks
- Supports caching the operating system's volume (boot partition)
- Supports caching volumes containing page files
- Supports volumes without drive letters
- Supports volumes with proprietary file systems
- Dynamic configuration, including start and stop caching (no reboot)
- Write-through or write-deferred modes
- Average dirty page latency setting from 1 to 14400 seconds (4 hours)
- Suspended lazy-write option
- Improved support for NUMA on qualified systems

* "Maximum Available Memory" - The maximum amount of physical memory made available by the operating system plus, in the case of 32-bit installations, any memory detected by the Unmanaged Memory feature when enabled. For example, on a Windows x64 system with 128 GB of main memory and no applications running, Windows may make available about 124 GB. Thus, a cache of about 124 GB could be created. On Windows x86 systems with 16 GB of main memory and no applications running, Windows may make available about 2.5 GB with the Unmanaged Memory (UM) disabled. With the UM feature enabled, another 12 GB would be available. Thus, a cache of about 2.5 GB or 14 GB could be created, depending on the UM setting. The absolute maximum cache size supported is 2 TB.

+ "All Installed Memory" - The amount of main memory actually installed in the machine, and not just the amount managed by Windows. Depending on the Windows edition, only a fraction of the installed memory may actually be managed by Windows and available to PerfectCache. The Unmanaged Memory feature of PerfectCache allows the remainder of installed memory to be used by a cache on 32-bit operating systems. The absolute maximum cache size supported is 2 TB.

System Requirements

Operating Systems

PerfectCache for Desktops

- Windows XP - all editions, 32- and 64-bit (x64)
- Windows Vista - all editions, 32- and 64-bit (x64)
- Windows 7 - all editions, 32- and 64-bit (x64)

PerfectCache for Servers

- Windows 2003 – all editions, 32- and 64-bit (x64)

- Windows 2008 – all editions, 32- and 64-bit (x64)

Processor (CPU)

- 300 MHz processor or higher
- All Intel and AMD Pentium-class processors
- Intel 64-bit: EM64T processor families
- AMD 64-bit: Athlon 64, Opteron
- All SMP and NUMA configurations of the above which are supported by Windows™

Memory

- Minimum: 512 MB RAM
- Recommended: 1 GB or greater
- Maximum:
 - o 32-bit: up to 63 GB with UM enabled
 - o 64-bit: as per amount recognized by Windows
- Types: all including SDRAM, DDR, DDR2, Rambus etc.

Disk and File Systems

- Basic and dynamic disks
- FAT, FAT32, NTFS, RAW and proprietary file systems

Disk Space

- 20MB free disk space for installation

Installing PerfectCache

For the best results, PerfectCache should be used on storage volumes which contain the "hottest" data. The hottest data are those most frequently accessed. Whenever possible, the hot data should be moved off a single, common storage volume (such as the one containing the operating system) and onto a separate volume.

Some applications do not support user-configurable locations, or do not support separating their hottest data. In these cases, volume mount points may be used to redirect accesses away from a single volume to separate accelerated volumes.

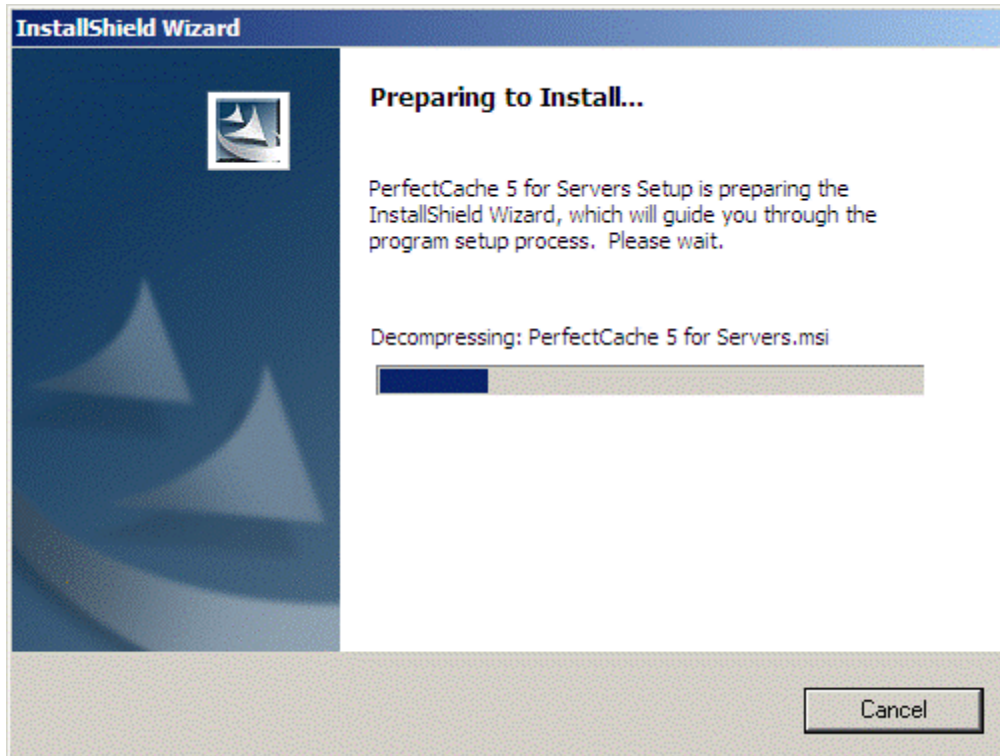
To maximize the benefits of PerfectCache, carefully analyze the application requiring acceleration, and identify and characterize the hottest data stores. Then, if possible, isolate the hottest data in one or more separate volumes.

Finally, use Caching Mode to accelerate volumes larger than available physical memory, or Mirror Mode to accelerate volumes smaller than available physical memory.

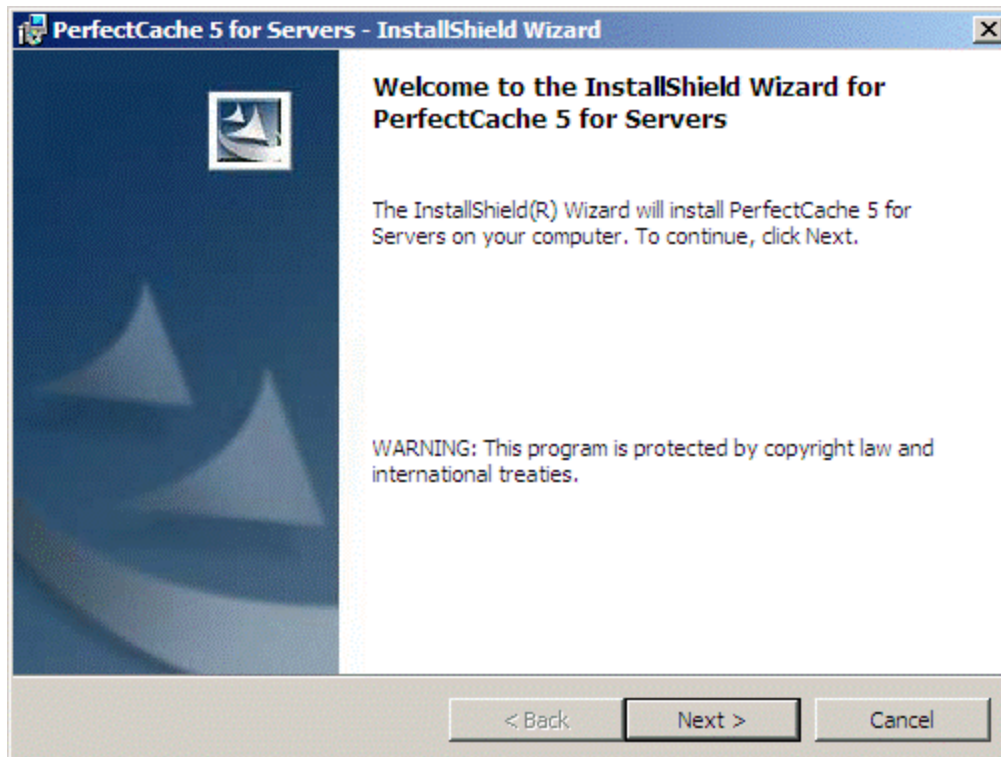
If Caching or Mirror Mode is to be implemented in write-deferred mode, we strongly recommend attaching an uninterruptible power supply (UPS) to the machine. In write-deferred mode, at any given moment,

large amounts of disk data may have been written to RAM, but not yet to disk. If a power failure or system crash occurs, an unprotected system will lose all write data stored only in RAM.

Launch the installation by double-clicking on the .exe file downloaded from Raxco Software. A window looking similar to the following will appear

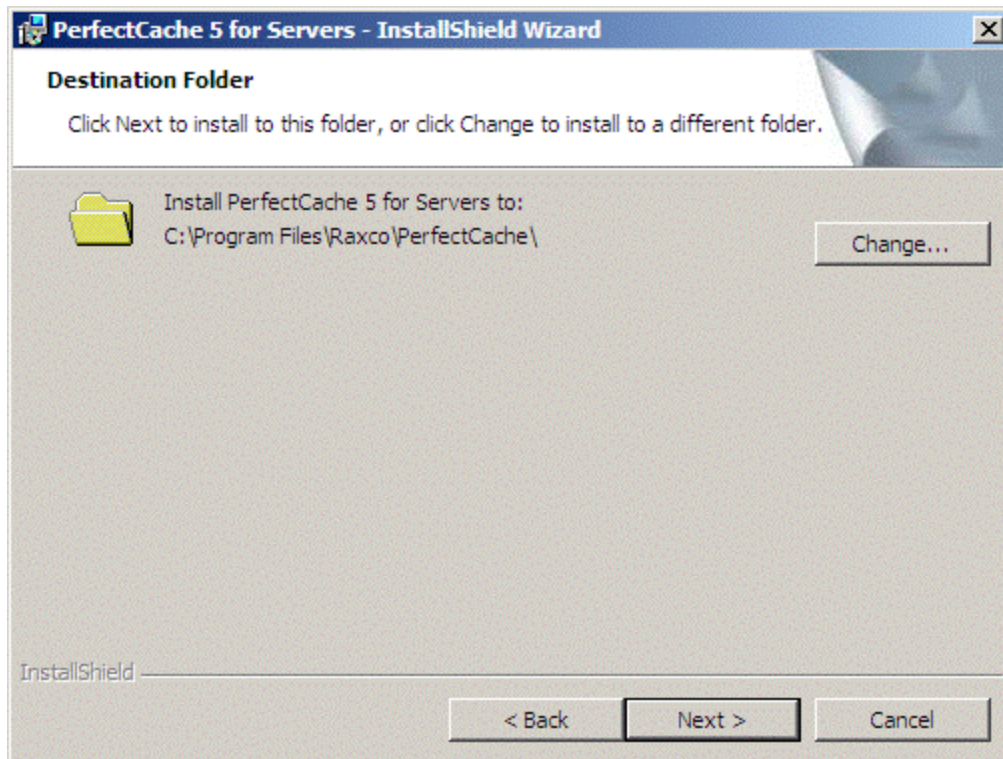


After the installation files are extracted, click **Next**. This will start the Installation Wizard, which will guide you through the process of installing PerfectCache.

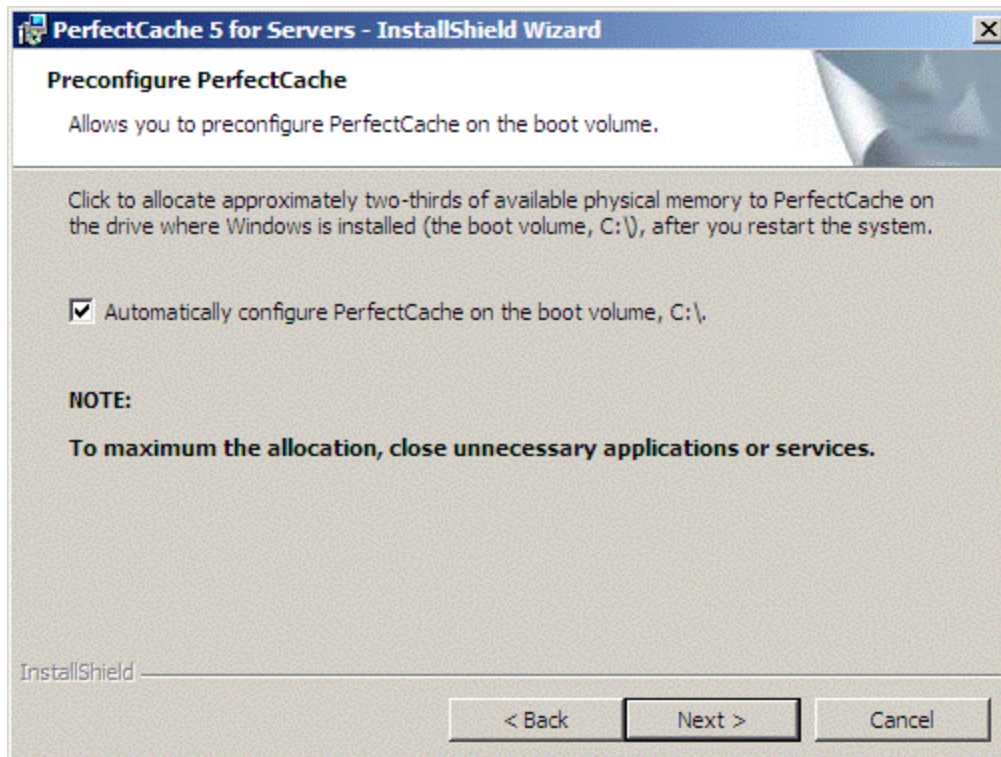


You will be presented with the PerfectCache End User License Agreement. After reviewing, indicated your acceptance of the License Agreement and click **Next**.

You will then be prompted for the PerfectCache installation location. By default, it is installed to the Program Files\Raxco\PerfectCache folder. Click **Next** to accept this location or **Change** to install to a different location.

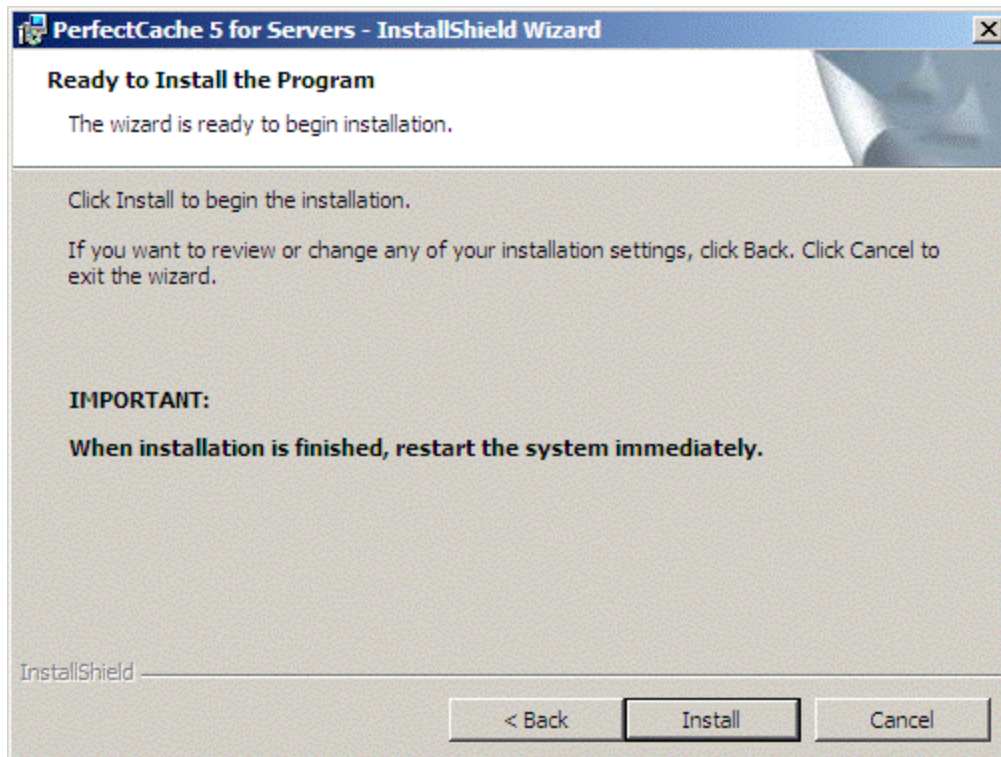


By default, PerfectCache is configured to cache the drive where Windows is installed (typically, the C: drive). Click **Next** to continue the installation process.



At this point, all the information necessary to install PerfectCache has been gathered. Click **Install** to install PerfectCache.

Note: *After installation, a reboot of the system is required and should be performed as soon as possible after the installation completes. For production systems, plan the installation so that an immediate system restart can be performed.*



Functionality

The core functionalities of PerfectCache is implemented in the driver named SscVF.sys, which is stored in the “%WinDir%\System32\Drivers” folder. The driver can activate either the Caching Mode filter or the Mirror Mode filter, but not both concurrently. The filters are activated through a single volume filter device. The ability to activate a filter on a given volume depends on licensing, available memory, and qualifying factors of the volume itself.

PerfectCache is a block-level cache, residing below Windows' file-system cache. PerfectCache is associated with a volume/drive, while Windows' file-system cache is associated with a file system.

Caching Mode is appropriate when the size of the volume/drive requiring acceleration is larger than available physical memory. Mirror Mode is appropriate when the volume/drive size is less than available physical memory.

Almost all the memory resources allocated to PerfectCache is taken from physical memory. This effectively eliminates any burden on the operating system's limited paged and NonPaged pools. Nonetheless, care should be exercised to avoid starving the operating system, services and applications

of physical memory. Under severe conditions, memory resource starvation may lead to a system crash. Additionally, although physical memory may be available for PerfectCache, over-allocation of the physical memory pool to PerfectCache will adversely affect the performance of other system components reducing overall system performance despite the larger cache sizes.

x86 versions of Windows limit main memory usage to 4.0 GB. This means that any RAM above that limit is effectively unusable and wasted. PerfectCache can reclaim that memory by a feature we call Unmanaged Memory. The Unmanaged Memory feature allows PerfectCache to access physical memory that the operating system can't.

For example, on a machine with 6 GB of main memory, Windows x86 will use 4.0 GB, leaving 2.0 GB completely unused. 32-bit Standard Editions of Windows simply don't attempt to manage or use the memory above 4.0 GB. With their Unmanaged Memory feature, PerfectCache can put the unused 2.0 GB to work to enhance system performance. Windows Server 2003, Windows Server 2008, Windows Server 2008 R2 provide special support for systems with a non-uniform memory architecture (NUMA). When active on such platforms, the memory manager for PerfectCache examines the processor and memory affinities reported by Windows, and then optimizes physical memory allocations across the described NUMA nodes. The NUMA support in PerfectCache greatly improves the speed of memory allocations and equalizes the distribution of cache allocations among the NUMA nodes. Currently, NUMA support does not include the ability to build caches on specific nodes.

Please visit www.raxco.com for more details.

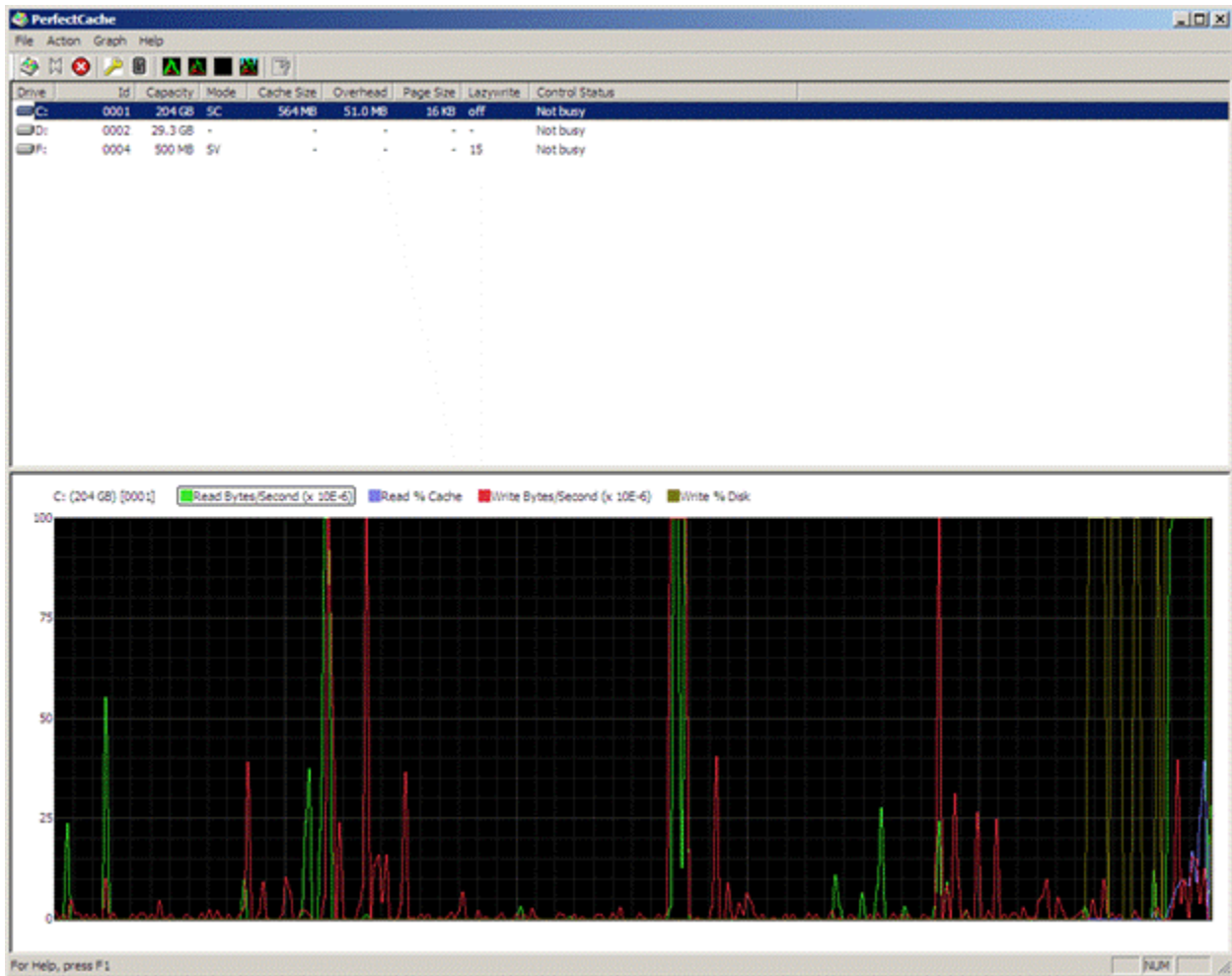
Graphical User Interface

Running PerfectCache

To access the PerfectCache GUI, double click the PerfectCache icon on the desktop or click Start and select Raxco/PerfectCache from the start menu.

Main Window

Storage volumes on which a volume filter device is installed can be managed by the PerfectCache GUI. The main window of the PerfectCache GUI consists of two panes, an upper pane, which displays filtered storage volumes/drives, and a lower pane, which graphically displays basic performance information about the selected volume/drive.

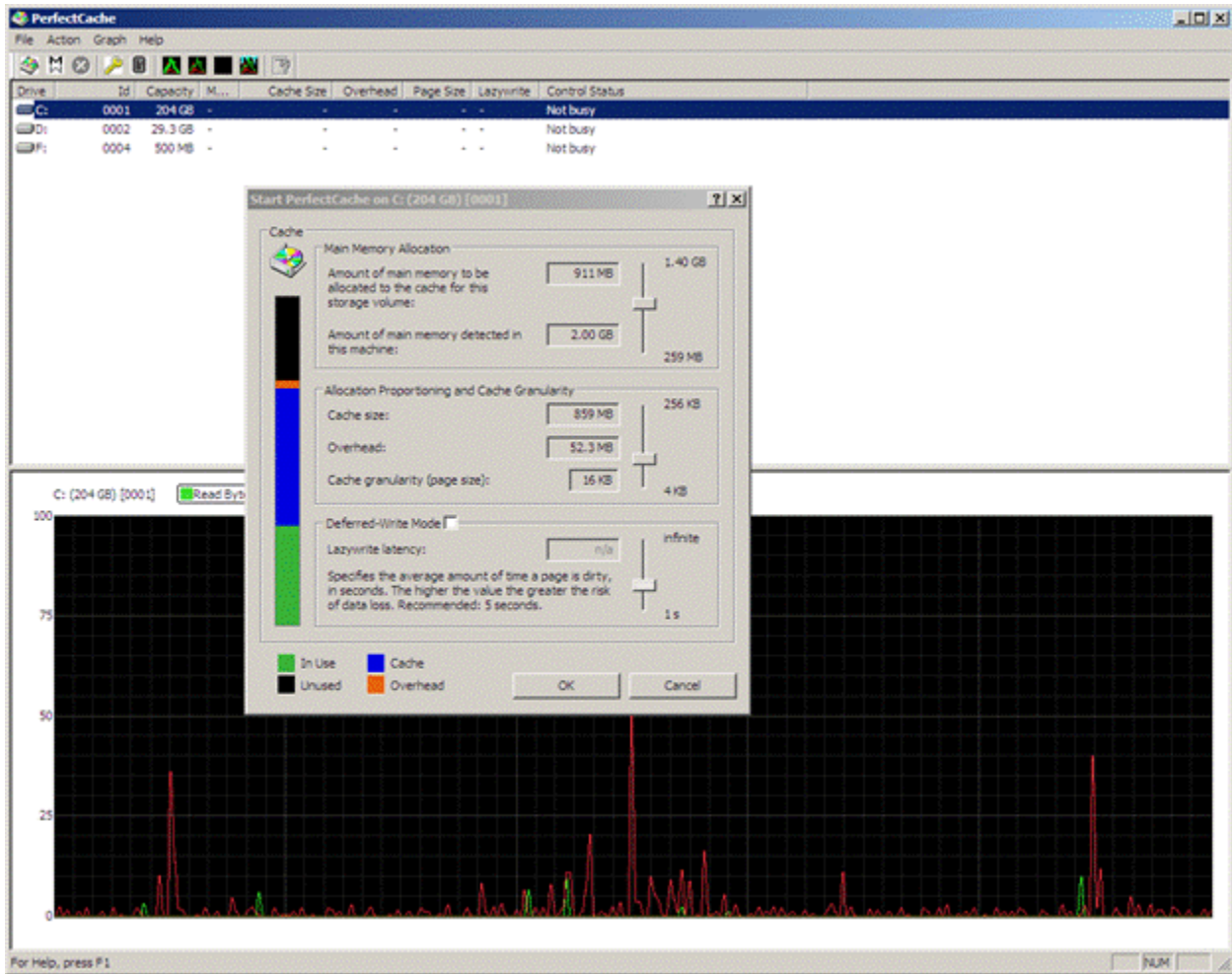


PerfectCache can be enabled, configured, and stopped by right-clicking on the volume/drive of interest, or selecting the volume/drive and clicking on a menu or tool bar option. The performance pane can be configured by double-clicking anywhere within the pane, or by selecting the appropriate menu or tool bar option.

Starting and Stopping PerfectCache

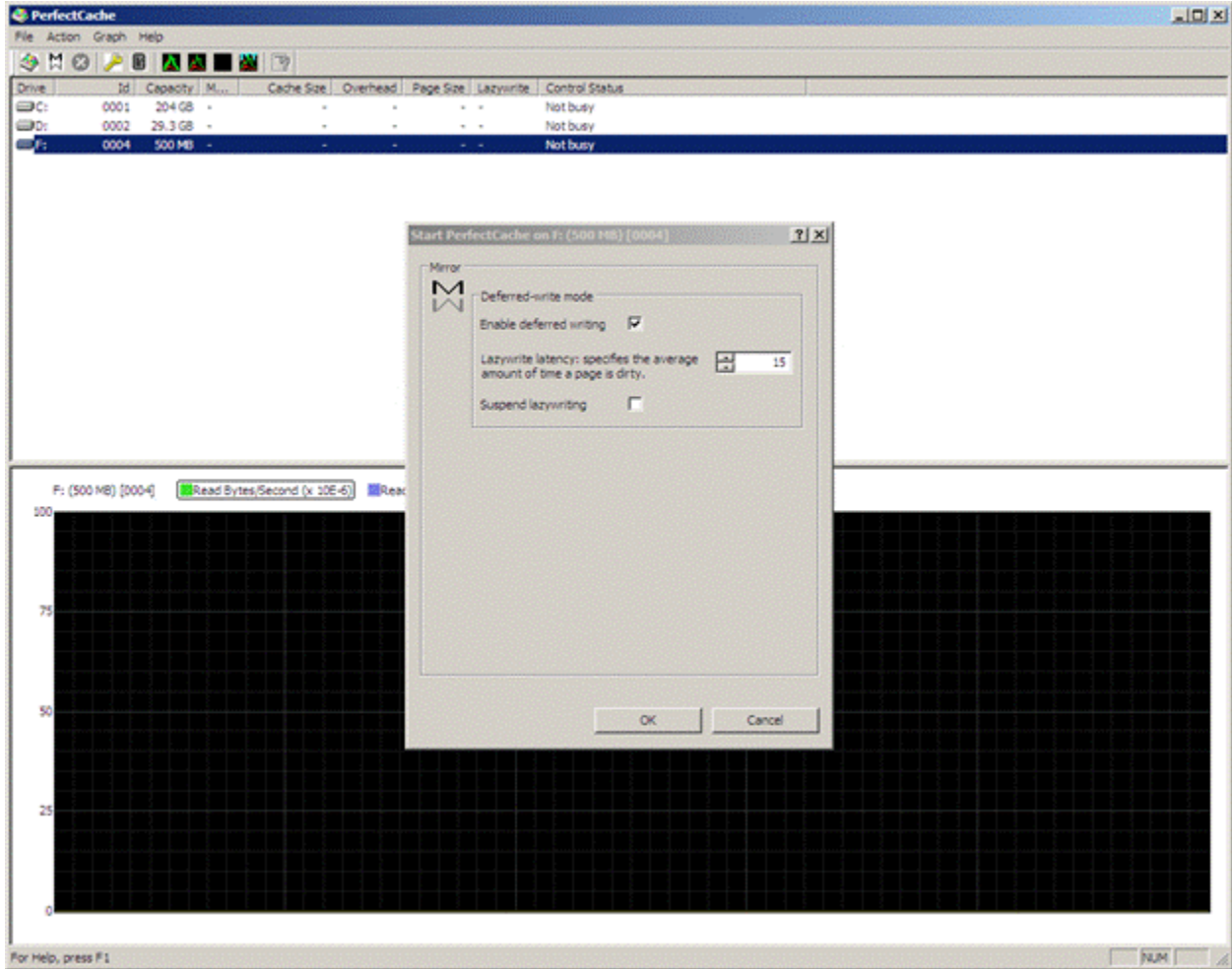
Enable Caching

To enable Caching on a drive, select the drive and either right mouse click and select Cache or click the Cache button in the PerfectCache toolbar.



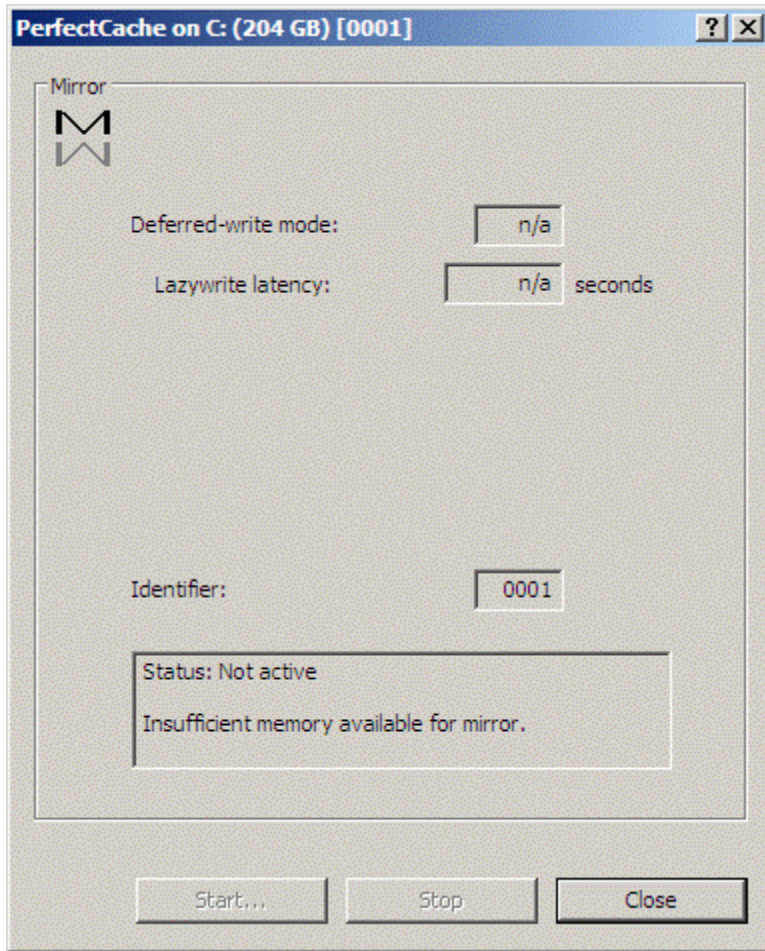
Enable Mirroring

To enable Mirroring on a drive, select the drive and either right mouse click and select Mirror or click the Mirror button in the PerfectCache toolbar.



Mirror Mode and Memory Resources

If there are insufficient memory resources available on the computer, when you try to enable Mirroring you will see the message displayed below.



If you receive this message, this means that there isn't sufficient system memory available in order to Mirror the drive selected. In order to Mirror a drive, you must have free memory available the size of the drive that you wish to Mirror.

Cache Tuning

The various resources in a computer system – processors, buses, memory, controllers and adapters, storage devices, network interfaces, software, etc. – are all factors which determine the rate at which a given task may be executed. Most system resources are shared by the many different software components that are required to execute a task. For example, processor time, system memory, and storage devices must be shared by the operating system kernel and its drivers, operating system services, and other services and applications.

Balancing the use of system resources to maximum system performance is system performance tuning. Much of this tuning is realized automatically by the operating system. However, the operating system provides many parameters that can be modified to improve overall system performance, according to the applications or services being executed. (Search 'windows performance' on Microsoft's Web site.)

PerfectCache improves system performance when storage resources are over utilized compared with system memory and processor resources. However, memory and processor resources must be shared

among many system components, as described earlier. It is the responsibility of the systems engineer or system administrator to balance the use of these resources in order to optimize system performance.

Caching Mode (CM) and Mirror Mode (MM) feature a variety of parameters to assist in system performance tuning. Each parameter is described below, along with recommended settings.

Parameter (Switch)	Product	Range (Default)	Description
Lazywrite latency, in seconds (-lw)	CM MM	(off, 0), 1-14400, infinite	<p>Describes the period, in seconds, during which written data are present in the cache and not on the disk. When off (or 0; writethrough mode), write data are written synchronously to the cache and disk.</p> <p>When not 0 (write-deferred mode), write data are written to the cache and asynchronously to the disk. The cache is called 'dirty' while the written data are present in the cache but are not yet written to disk. The amount of time between when the data are written to the cache and when they are written to the disk is the 'lazywrite latency'.</p> <p>When infinite, write data are written to the cache only as required to make new cache mappings. As old pages age, they become eligible for cleaning to be reused for new mappings. Deferred writing trades improved write performance with greater risk of data loss. The longer the period, the lower the rate at which dirty data will be written out to disk by the lazywriter. Cache performance may be improved by lowering this rate (increasing the latency.) However, the longer dirty data are present in the cache, the greater the risk of data loss and corruption in the event of a power failure or system crash.</p> <p>Important: A non-zero lazywrite latency setting is an average. Some dirty data will be written out in a shorter period, some will be written out after a longer period. We recommend use of this setting only on systems with uninterruptible power supplies (UPS).</p> <p>Caching Mode: Unlike Mirror Mode, Caching Mode also writes out dirty data in response to internal requests for cache page mappings. If the cache become full of dirty data and read or write requests are made for pages not in the cache, dirty pages will be forcibly written out. This operation is given priority over the lazywriter.</p> <p>Mirror Mode: Unlike Caching Mode, during initialization, Mirror Mode automatically loads the entire volume image into its cache. During this time, the cache write mode is always writethrough. Upon completion of the image load, the write mode is changed to the configured setting.</p>

			While loading, the configured setting will be reported even though it may differ from the actual setting.
Cache size, in MB (-cs)	CM	Depends on page size	<p>Describes the size of the cache, in megabytes. This is the single most important parameter to consider for cache tuning. For most server systems, 1 to 2 GB of physical memory (RAM) must be reserved for the operating system, services and applications. The remaining physical memory can be used effectively for PerfectCache.</p> <p>On systems with more than 4 GB of RAM, PerfectCache can dramatically increase performance with little worry about "starving" memory from other system components. On systems with 4 GB of RAM or less, due consideration must be given to sharing memory resources.</p> <p>Care should always be exercised when attempting to allocate "as much memory as possible" to PerfectCache. The system can become memory starved, and its performance greatly hindered. Under extreme circumstance, the system may crash.</p> <p>To tune cache performance, observe the following two metrics:</p> <ul style="list-style-type: none"> - Memory utilization in Task Manager - Application performance using an appropriate application performance monitoring tool - <p>Set the cache size to a relatively low value (it's much faster to allocate memory to the cache in a busy system than to free memory from the cache), and, over a reasonable period of time, note the values of the two metrics.</p> <p>Incrementally increase the cache size, watching its effect over time on the two metrics. At some point the performance will peak, after which it will drop again. The performance will begin to drop when the other system components start to 'feel' the lack of physical memory and the operating system begins paging out virtualmemory. Reset the cache size to the value where the highest performance was realized. The cache is now rough-tuned.</p> <p>Use the other parameters available to fine-tune the cache's performance.</p>
Page size, in KB (-ps)	CM		Describes the granularity of the cache and of volume mappings, in kilobytes. It is similar to allocation unit size in the NTFS.

		<p>Cache fragmentation: The smaller the page size, the lower the average invalid data per page (eg. lower cache fragmentation). This increases cache efficiency, improving the probability of cache hits. Reduced cache fragmentation is often the single most important factor in improving overall cache performance.</p> <p>Cache overhead: The smaller the page size the greater the system resources required for cache overhead. The physical and virtual memory resources required to manage the cache pages is greater, since there are more pages for a given cache size. Similarly, the physical and virtual memory resources required to manage the volume map is greater, since there are more mappings for a given volume size. And the memory and processor resources required for executing an I/O request are greater, since more pages must be managed per transfer.</p> <p>Other factors: Among the factors to include in determining the cache page size are: the average transfer size, the ratio of reads to writes, read-ahead requirements, and the state of file-system caching (enabled or disabled). Generally, larger page sizes should be used only when transfer sizes are large. The default Windows file-system to storage-class driver transfer size is 64 KB. Disk data compression algorithms are optimized to 64 KB.</p> <p>When file-system caching is disabled (files are opened with the FILE_WRITE_THROUGH option), or the storage volume is accessed in RAW mode, the average transfer size is tied directly to the application. PerfMon can report the average size of the transfers, and the number can be used to calculate and set the appropriate cache page size.</p>
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VFCFG.EXE Command-Line Utility

Each drives' caching mode may be controlled via a command-line utility called Vfcfg.exe.

This file is stored in the "%WinDir\System32" folder. This command-line interface (CLI) implements WMI to permit local and remote configuration of the volume filter device. Its usage is displayed by simply typing its name in a command prompt window.

Usage:

```
vfcfg [ [-h hostname] [-n username -p password] ] [volume]
[-status | -sc | -sv | -stop] [-licensing]
[-lw latency] [-cs cachesize [-fs]] [-ps pagesize]
```

Where each switch specifies:

-h Host or target computer. Default: local computer.

-n User name (domain\user or user). Default: current user.

-p Password for specified user account. For an empty password value use two double quotes (""). For a NULL password value do not specify a password. Default: NULL. (Requires -n) volume Drive letter or four-digit identifier specifying target storage volume. Default: all qualified volumes (-status only).

-status Display status of filter on one or all storage volumes.

-sc Activate Caching Mode filter action. (Requires -cs)

-sv Activate Mirror Mode filter action.

-stop Deactivate the current filter action.

-licensing Display licensing information.

-lw Lazywrite latency. 'Off', 'disable', or '0' disables deferredwrite mode (no write caching). 'Inf' or 'infinite' enables deferred-write mode with lazywriting suspended (latency is infinite). A time value in seconds, or in hours, minutes and seconds (H:MM:SS), enables deferred-write mode with lazywriting active and dirty pages remaining such, on average, for the time specified. Maximum limit is 14400 seconds, or 4:00:00. Default: off. (SC and SV)

-cs Cache size (in MB). This value must be specified when activating PerfectCache. The size may be modified while the cache is active. Cache allocations are made in blocks of 4 MB; the value is rounded up accordingly. No default. (SC only)

-fs Fail-safe enable. Applicable only when increasing the cache size, this switch indicates that if the cache size specified cannot be allocated, the maximum amount available should be used. Default: disabled. (SC only)

-ps Cache page size (in KB). This value may be specified only when activating PerfectCache. Once active, the value can be changed only by deactivating the cache and reactivating with a new value. Default: depends on the volume's size and the amount of available memory. (SC only)

All commands may optionally specify the host (target) name, and/or a user name and password.

Ex. vfcfg -h server1 -n "Joe Doe" -p m1n2o3 c: -status

vfcfg -h server1 -n "Joe Doe" -p m1n2o3 0001 -status

vfcfg -h server1 -status

vfcfg -n "Joe Doe" -p m1n2o3 -status

The status of a particular volume may be requested, or, by the absence of a volume specification that of all qualified volumes in the target system.

Ex. vfcfg c: -status

vfcfg 0001 -status

vfcfg -h server2 -status

Contacting Raxco Software

Raxco Software can be contacted at the following address:

6 Montgomery Village Avenue

Suite 500

Gaithersburg, MD 20879

Toll Free: 1 (800) 836-3844

Phone: (301) 527-0803

Fax: (301) 519-7711

Purchase PerfectCache

PerfectCache can be purchased online at www.raxco.com.

To speak to a sales representative, please call:

Toll Free: 1 (800) 836-3844

Phone: (301) 527-0803

Or email sales@raxco.com

Technical Support

If you have technical questions or issues with PerfectCache, please first visit the Raxco Software support site at www.raxco.com/support. Most of your questions can be answered by searching Raxco's knowledge base or reading the Frequently Asked Questions. The support site also contains links for product updates and other useful information. If necessary, you can contact technical support via the e-mail or phone number listed below:

Via Web/Email:

To submit a support request, go to <http://www.raxco.com/support/contact-technical-support>

Submitting a support request provides the fastest technical support response.

Via Phone:

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Toll Free: 1 (800) 836-3844

Phone: (301) 527-0803