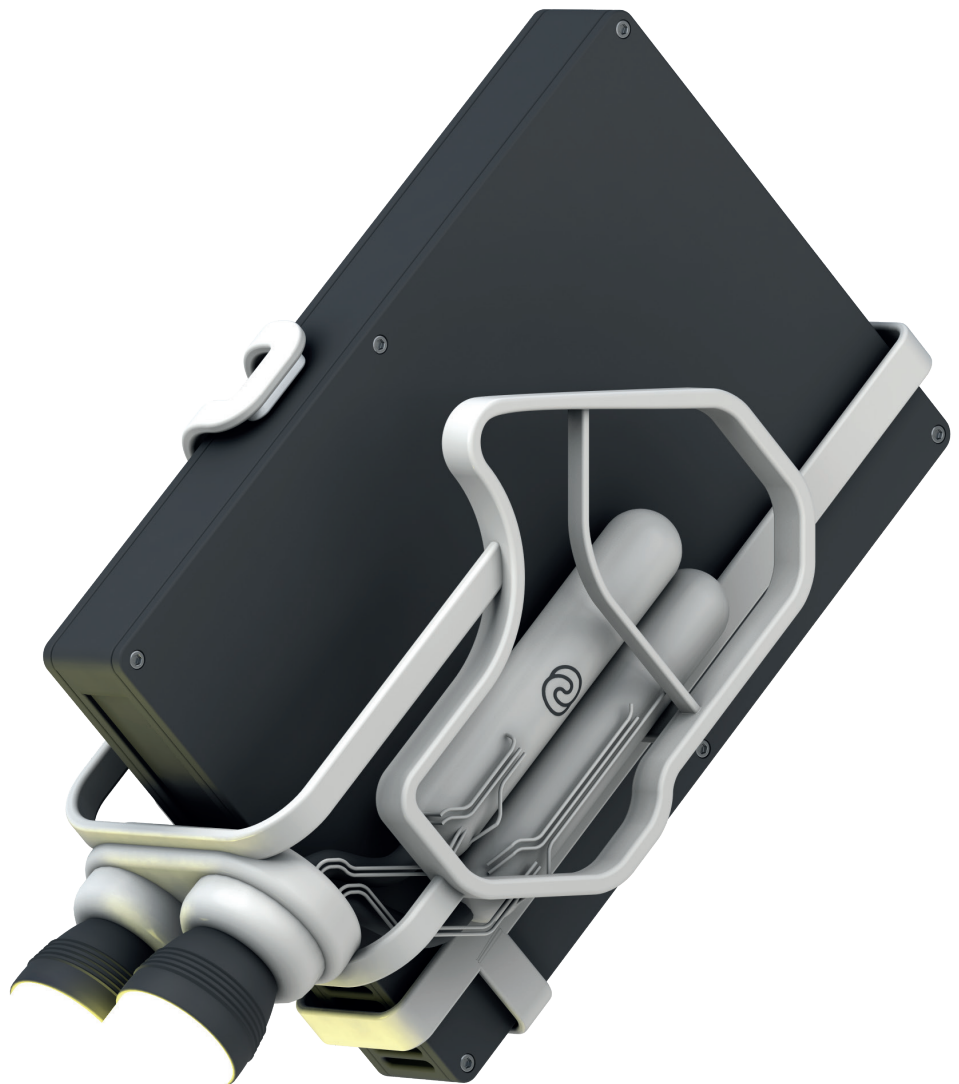
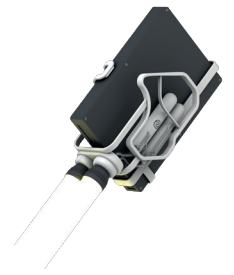


# O&O Defrag and the Windows Defragmenter: A comparison





## Overview

The problem of data fragmentation is inextricably linked with any file system. When you change or delete files on a disk, gaps are created which are later reused for other data. Since these files are usually not the same size, they are spread over several of these gaps. Over time, a mass of files is created on the hard disk that significantly slows down the time needed for accessing them.

But speed is not the only problem: highly fragmented files can also cause system errors (see Microsoft knowledge base article # 967 351') that ultimately result in data inconsistencies and crashes. Another aspect involves the forensics in saving data when the file structure has been damaged. Whenever files are fragmented, data recovery is at best more difficult, at worst impossible.

## Centralized management

An important aspect in the management of a defragmentation solution across a network is the extent and ease with which it can be controlled. The O&O Enterprise Management Console<sup>2</sup> is an ideal tool for centrally controlling O&O Defrag's installation, configuration, and reporting of all processes. The administrator can even decide whether individual users should be given the ability to run or influence O&O Defrag on their own.

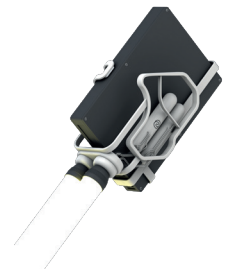
O&O Defrag features a scheduling option that allows a user to define the exact dates and time periods when defragmentation should be executed. This is especially important if other processes such as data backups or consolidations are also scheduled. Overlapping these processes could result in an unnecessary double burden for the machines and lead to longer run times.

Another aspect of the integrated O&O Defrag scheduling is its ability to start and stop certain system processes or applications before and after their execution. This makes it possible, for example, to stop server processes before defragmentation in order to allow sharing for exclusively blocked files. After defragmentation, they can automatically be started again.

Along with these options, O&O Defrag can be fully and transparently integrated into existing network infrastructures and software management systems. A detailed scripting interface offers extensive configuration options for influencing the defragmentation process whenever the need arises.

## Security and control

Data security plays a major role during defragmentation. Access to data and, by extension, to the defragmentation software, must be adjusted accordingly because the program's functionality requires it to access all of the computer's data.



Windows' own Defragmenter requires administrative permissions in order to be run. This means that a user who wants to start a defragmentation must possess the permissions to do so. This is an absolute taboo in a business environment because by allowing this, all other security mechanisms would also be bypassed, and the individual user would then have unlimited control over his computer and its data.

O&O Defrag has countered this problem by developing an elaborate security management. Under it, an administrator can permit a user to use O&O Defrag to its full extent without having to grant him administrative permissions. If the administrator only wants the user to be able to stop defragmentation manually, this can be configured without a problem. O&O Defrag can even be installed and managed completely without a user interface, so that all its processes are run in the background and a user is never disturbed in his day to day work.

### **Encryption of communication**

O&O Defrag, when integrated in O&O Enterprise Management Console<sup>2</sup>, provides an option for encrypting all communication between servers and clients using SSL encryption. This makes access to data by unauthorized third parties impossible. The Windows Defragmenter doesn't provide any of this.

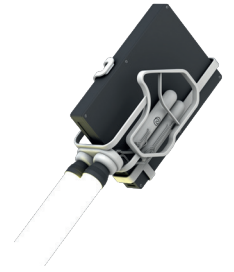
### **Compatibility**

O&O Defrag is compatible with any hardware that is supported by Windows. In addition, O&O Defrag provides its own unique optimization for solid state drives produced by any manufacturer<sup>3</sup>. The software can be run up to XP, and is available in native 32 and 64-bit versions. This makes it possible to work with just one version of O&O Defrag in a heterogeneous environment where various Windows operating systems are being used. The major benefit of this is a simplification of the overall configuration and the possibility of comparing results.

With almost every major release of a Windows operating system since Windows 2000, Microsoft has provided a completely new version of the Windows Disk Defragmenter, partially based on acquired components. In addition to bringing about differences in the quality and functionality of Windows defragmentation, this has sometimes resulted in completely different interfaces for controlling, if one is even available. This makes the setting up a centralized management for Windows defragmentation almost impossible, or possible only with a great amount of effort. In the same way, it's impossible to obtain a clear and unified reporting of results.

### **Optimized for desktops and servers**

O&O Defrag is available in three versions: Professional and Workstation for desktop operating systems, and beyond that, a special Server Edition for Windows Server 2008 (R2) and Windows Server 2012 (R2). Because of this, special attention can be paid to various Windows applications and this leads to optimized strategies for defragmentation and system capacity utilization. The Windows Defragmenter, on the other hand, is identical in both Windows Desktop and Windows Server, whereby it was primarily developed for Windows Desktop and contains no special strategies for the Windows Server operating system.



## Functionality

### Automatic and scheduled background defragmentation

Following a one-time intuitive configuration, O&O Defrag has been optimized to function fully automated and without any further activity on the part of the user. Over the Job Assistant, the user can enter his settings for scheduling defragmentation. If the exact moment for defragmentation is not crucial, it's possible to setup a fully automatic, periodic and even highly granular defragmentation. Defragmentation can then be run with a minimum strain on resources and still achieve excellent defragmentation values.

Defragmenting while the user is not working on his system is especially recommended for desktop computers. This is why we developed screensaver mode – whenever the screensaver is on, O&O Defrag optimizes drives and immediately stops defragmenting as soon as the user resumes working on his system.

The initial defragmentation is usually the one that takes the longest. As a result of a clear division between programs and user data, unnecessary follow-up defragmentation can be effectively avoided. Successive defragmentation will then run much quicker and consume less system resources.

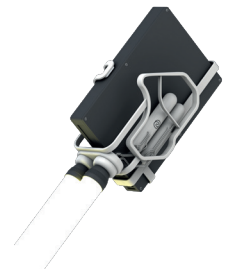
O&O Defrag's consumption of system resources can be minimized even further if a system is required to constantly run at maximum capacity. The O&O ActivityMonitor recognizes the amount of demand O&O Defrag is placing, and will avoid all activities that could burden the system unintentionally. Defragmentation will then be restarted whenever the system's capacity is able to allow it.

O&O Defrag can also be configured to start defragmenting when a system's level of fragmentation exceeds a certain level. This is especially useful for very large drives or very extensive file systems. As a result, the system load caused by O&O Defrag can be minimized even further because defragmentation will only be run when it is really needed.

Theoretically, the defragmentation tool integrated in Windows also runs an automatic optimization at regular intervals. Starting with Windows Vista, the starting time for defragmentation is set for every Wednesday at 1:00 AM. If the computer is not on at this time, there will be, understandably, no defragmentation run.

Windows currently does have a setting for scheduling the time for defragmentation. If the computer is not turned on at this time, defragmentation can be set to run at a later time, or the scheduled defragmentation can be canceled. The biggest problem remains, however, that Windows can also begin its defragmentation at that moment when a system's maximum resources are needed. The productivity of various programs can be reduced considerably when a defragmentation is simultaneously being run.

It's not just O&O Defrag's indisputably superior and yet easy to use scheduling and job-planning features that make it so remarkable. The quality of its results, in particular its long-term proactive reduction of new fragmentation is tangible and measurable proof of why it stands far above rudimentary defragmentation tools.



## Fragmentation level

The level of fragmentation serves as the basis for running the desired action. It will often be used as a threshold above which defragmentation should be started. In this way it only stands to reason that a computer doesn't need to be defragmented when its fragmentation level is below 1%. This is how both O&O Defrag and the Windows Defragmenter function. There is, however, one major difference.

Because we're discussing a percentile value, its calculation – more precisely, the basis for its calculation – is of decisive importance. In order to determine the level of fragmentation, O&O Defrag considers the file's size as well as its number of fragments. Working this way, a large, heavily fragmented file gets more consideration than a small file that is only slightly fragmented. In a similar way, defragmentation will only begin when a large (and therefore important) file is fragmented, although all other files are already defragmented. This is extremely important for server systems with a Microsoft Exchange or SQL database.

Compared to what was just described, other defragmentation products – such as the one integrated in Windows – limit themselves to counting the number of fragmented files and adjusting them to the total number of files. This is a simple and certainly comprehensible method, but one that is really ineffectual in practice. If you imagine a normal Windows system with approximately 150.000 files that are all defragmented, a single fragmented file would never activate a defragmentation. Not even when it involved a 12 GB offline file from Microsoft Outlook consisting of 8.939 fragmented files.

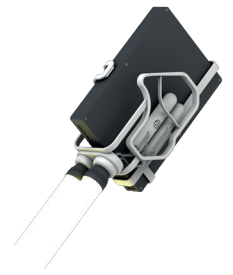
## Defragmentation in one run

O&O Defrag works with a so-called "single pass" strategy. This means that one single execution is enough for achieving a complete and thorough defragmentation and consolidation of all files. This kind of behavior is labeled "deterministic" in information technology, i.e., the result is – depending on intervening changes in the file system – predictable. Or to put it another way: Once O&O Defrag defragments a drive, that drive is defragmented.

The Windows Defragmenter uses a "multi pass" strategy. As the name indicates, multiple executions are needed in order to achieve an optimal result similar to that of O&O Defrag. The number of these executions is not predictable because they are based on a vague observation of the overall file status. Or put another way: After one execution, the Windows Defragmenter is still far from finished.

The problem that arises from this is obvious: if a company-wide defragmentation is planned on many computers, there's no way to know whether these computers are truly and completely defragmented when the Windows' defragmentation has finished. Maybe they still need to be defragmented a couple more times? But when should this be done? And when that finally happens, maybe the level of fragmentation has increased once again so that you'll have to begin right from the beginning. An end to the whole misadventure is nowhere in sight!

O&O Defrag provides a clear and well-defined flowchart for defragmentation: it defragments all fragmented files and offers an option for consolidating free disk space.



### Consolidation of free disk space

A modern defragmentation doesn't only merge file fragments. It should also be able, as much as possible, to prevent new fragmentation from even occurring. This can be done by consolidating free disk space. This comes about by existing files being repositioned and thereby sealing the gaps created by previously deleted files. Compact blocks of files are then created. When files are created, Windows saves them on the first available free space and, in view of successful defragmentation, this immediately guarantees that new fragmentation will be prevented: Because there are now almost complete, contiguous free spaces on the disk available. Virtual machines can really benefit enormously from this because they suffer almost twice as much from fragmentation: first there's the fragmentation on the virtual machine itself, and then that existing on the host system. O&O Defrag is, just for the record, fully compatible with current virtual environments.

An additional scenario involves the shrinking of a partition. Files located at the end of a partition prevent it from actually being shrunk to the smallest possible size. A consolidation of free disk space works very well here because these files will then be moved toward the front of the partition. This is the reason why O&O PartitionManager uses<sup>4</sup> the technology of O&O Defrag to shrink a partition down to its smallest possible size.

The Windows Defragmenter is equally helpless in facing the previously described situation. It is fully unable to consolidate disk space and so ignores an essential part of what an orderly defragmentation should be.

### Detailed reports

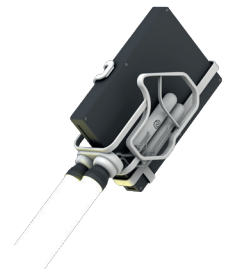
O&O Defrag features an option for creating detailed reports of all activities occurring during defragmentation. An administrator can then get a complete picture about the condition of his IT infrastructure's performance. Thanks to O&O Enterprise Management Console<sup>2</sup>, reports can also be created, archived, and evaluated company-wide. Using the Windows Defragmenter, there is simply no possibility for producing documents related to a completed action, let alone for making any before and after comparison.

### O&O ClusterInspector

A unique product feature in O&O Defrag is the O&O ClusterInspector. It allows the BlockView to display the cluster and sector content of the hard disk. It's then possible to see exactly which files are occupied on which sectors, and how they are spread across the entire hard disk.

### Remote control

Using the remote control feature in O&O Enterprise Management Console<sup>2</sup>, O&O Defrag can be directly connected to a remote computer across a network. You then have the kind of complete control you'd have by sitting right in front of it. This is especially useful for getting an overview of the current status of installed hard disks, their fill level, and level of fragmentation. Of course, it's also possible to perform all activities and create settings the way they'd normally be done on a local user interface.



### Zone filing

One of the most important features that makes O&O Defrag superior to other defragmentation solutions is its ability to divide drives into zones, and separate databases into files that are performance critical and non-critical. The consolidation of free disk space that's achieved by any decent defragmentation tool already results in a noticeable increase in performance. O&O Defrag, however, uses the concept of zone filing to go one logical step further.

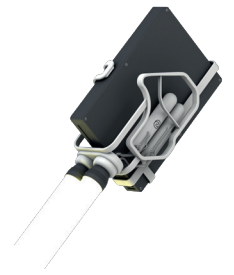
After defragmentation, a special algorithm sees to it that data on the disk is placed in its optimal position. In this way, files are sorted according to the way they're used and their access frequency, and then moved into zones. An example of how this works is by separating system and program files that require very fast access from user data that tends to be more frequently fragmented. As a result of further separating files according to their write frequency, fragmentation can be intelligently and proactively avoided. Thanks to this logical grouping, the time needed for program and system starts is shortened. Successive defragmentation can also be executed much faster, and a fully superfluous mixing of program files with fragmented user data can be excluded from the outset.

### Defragmentation of large disks in the terabyte range

O&O Defrag works without restriction on all drives and drive types that are correctly recognized and controlled by Windows. Internal and external RAID systems, SANs, and crash proof storage clusters are fully supported, regardless of their manufacturer. Standard hard disks can currently reach a capacity of 3 TB. The most frequently used MBR partitioning is still only able to use a maximum of just 2 TB. In order to use the entire disk space of such an enormous drive, it needs to be partitioned using GPT system partitioning.

With O&O Defrag, you make an investment in the future. To help you avoid any limits on using all the space of such large drives, standard MBR partitioning and dynamic volumes as well as GPT partitioned drives are fully supported. There is no arbitrary restriction in place for any maximum value.

At the same time, the mere storage capacity of a drive doesn't reveal anything about its actual database. Even a comparatively small 100 GB drive can consist of millions of files. If these files are heavily fragmented, performance will naturally suffer. But not every defragmentation tool is in a position to help such a file system. O&O Defrag is, however, able to process very large volumes of data and numbers of files while still placing few demands on memory. During development, we worked very hard to guarantee outstanding optimization on even drives whose free disk space is heavily fragmented.



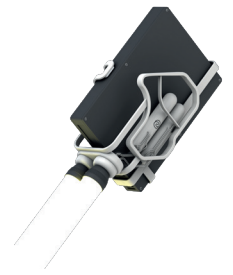
### Further advantages of O&O Defrag

In addition to the advantages we've just described, O&O Defrag also includes a number of other features that are briefly mentioned below:

- ▶ Include/exclude files and folders from defragmentation
- ▶ Defragmentation of folders
- ▶ Defragmentation of NTFS Metadata
- ▶ Defragmentation of the swap file
- ▶ Defragmentation of individual files, folders, and drives using the Windows Explorer
- ▶ Boot Time Defragmentation for files that are blocked while Windows is running

Please note that none of the above features are available with the Windows Defragmenter.





## Summary

The defragmentation of a Windows system doesn't only mean an increase in overall system performance, it also protects against errors that may arise as a result of heavy fragmentation. In addition, defragmentation also makes it easier to recover data if a crash occurs when there is no recent backup available.

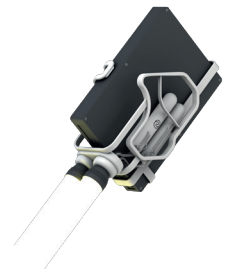
The Windows integrated Defragmenter provides a basic set of functions that can only be used in a professional environment with a great deal of effort. It can sometimes not be used at all: Either because access security is at risk, or there's no way of configuring a precise schedule. An ideal defragmentation solution must also provide a wide range of configuration options and reporting of network processes, and these should be available without constant manual intervention or monitoring by the IT staff. O&O Defrag delivers just that, and what's more, it can be integrated into a company's IT infrastructure wherever necessary.

The Windows Defragmenter actually does wind up costing a great deal of time and labor. For a company, this immediately turns into money that is being spent. When you consider how little O&O Defrag costs compared to the amount of extra work you'll be doing with the Windows Defragmenter, you'll understand why O&O Defrag's overall long term benefits actually pay for themselves within just a few months.

## Benchmarking

### Configuration of the test system

- ▶ CPU: AMD Athlon 64 X2 3800+
- ▶ Motherboard: Asus A8R-MVP
- ▶ RAM: 2 GB DDR (4x512 MB DDR400)
- ▶ Graphic card: nVidia GeForce 8600GTS
- ▶ Hard disks:
  - ▶ System drive: Seagate ST3250820AS (250 GB)
  - ▶ Data drive: Western Digital WD2500JD (250 GB)
- ▶ Software environment:
  - ▶ Windows 7 Enterprise 64bit, all patches up till October 27, 2010
  - ▶ Microsoft Office 2007

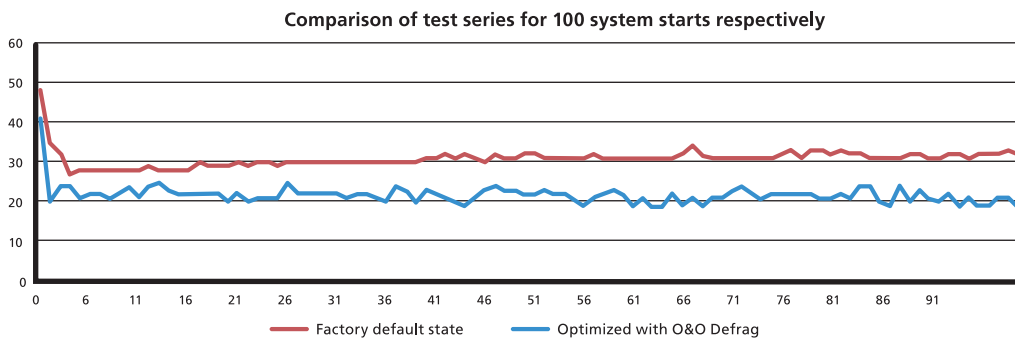


### Test series and results

The following configuration was used on the test system:

1. Original state of the installed system with the above mentioned software (factory default setting)
2. Installation of O&O Defrag on the system and execution of OPTIMIZE / Complete defragmentation (optimized with O&O Defrag)

### Test series

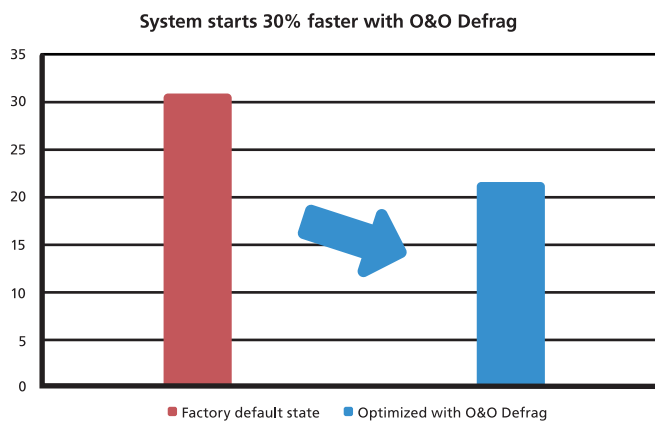


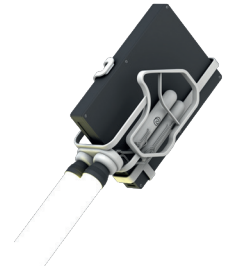
### Result

The average duration of a system start (measured as an average of 100 automated system starts) was:

Configuration	Result
Factory default state	30,87 sec
Optimized with O&O Defrag	21,76 sec

If the system is optimized with O&O Defrag, you can expect a 30% decrease in the time needed for starting your system.





## About O&O Software GmbH

O&O develops solutions for corporate clients to assist them in their daily work and reduce their costs. Our products for system optimization, data imaging, restoration and the secure deletion of data, as well as company-wide administration are pioneers in the Windows area. With our worldwide network of partners, we support companies, corporations, public institutions and private clients in more than 140 countries from our headquarters in Berlin.

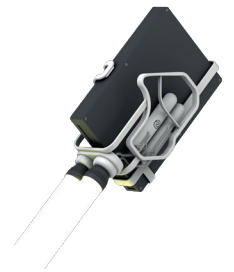
More information is available on the Internet or directly from us:

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## References

- ▶ <sup>1</sup> <http://support.microsoft.com/kb/967351/en-us/>
- ▶ <sup>2</sup> For more information on the O&O Enterprise Management Console go to <http://www.oo-software.com/corp/en/enterprisemanagement/>
- ▶ <sup>3</sup> You can read more about this in the white paper "O&O Defrag and Solid State Drives": [http://www.oo-software.com/en/docs/whitepaper/ood\\_ssd.pdf](http://www.oo-software.com/en/docs/whitepaper/ood_ssd.pdf)
- ▶ <sup>4</sup> More information about O&O PartitionManager can be found online under <http://www.oo-software.com/home/en/products/oopartitionmanager/>



## O&O Defrag

### Up to 100% increased performance

Don't let a slow computer spoil your work or fun! Let O&O Defrag optimize your hard disks and you can experience speed increases of up to 100%! Regular disk defragmentation optimizes your PC performance!

When you defragment, the files that Windows splits up when saving documents across the hard disk are logically put back together again so that files can be quickly recognized and found by the read and write heads inside your hardware. Speed increases of up to 100% are not uncommon, and your hardware suffers much less wear and tear!

#### Product features

- ▶ Speed increases of up to 100%
- ▶ Automatic background defragmentation
- ▶ Prevents new fragmentation from ever occurring
- ▶ Easy-to-Use: Ideal for beginners and professionals
- ▶ Extends the life of your hardware
- ▶ Defrags multiple drives simultaneously
- ▶ Increases chances of recovering lost files and speeds up your backups
- ▶ Power Management for Notebooks
- ▶ Assistant for to schedule the disk defragmenter

