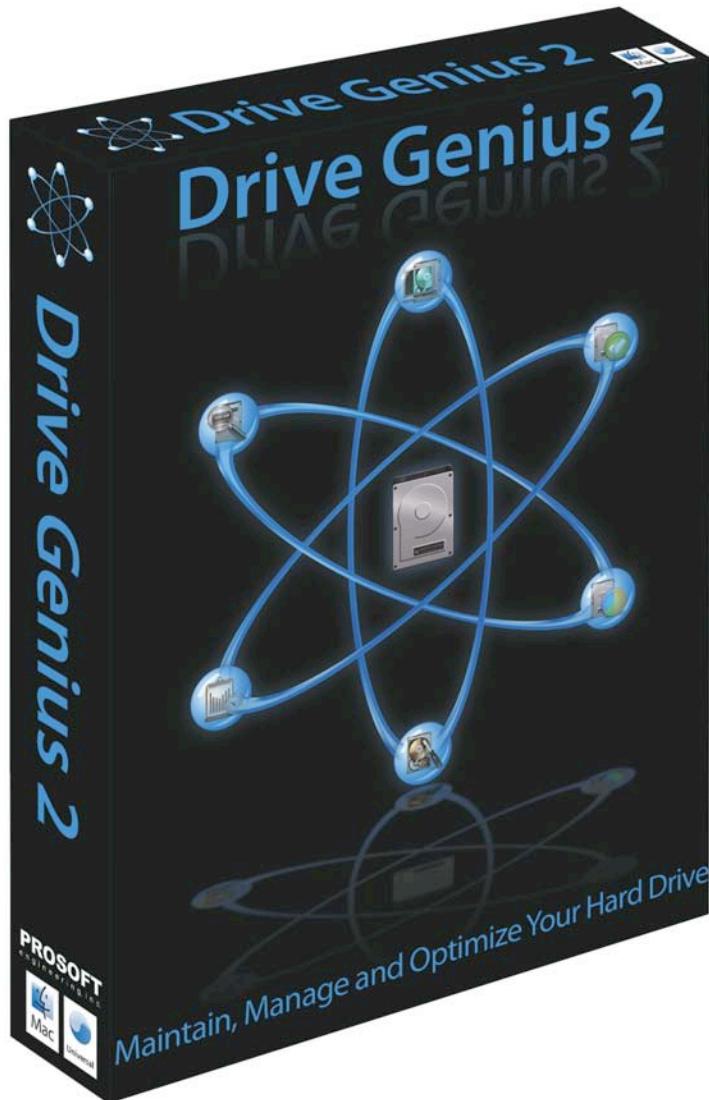


Drive Genius 2

User Guide



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Welcome

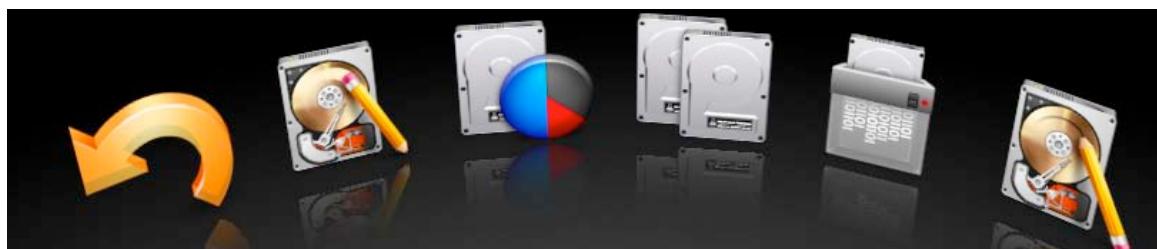
Thank you for purchasing Drive Genius 2™

Drive Genius 2 is a collection of tools and helpers that help guard the data on your drive.

Drive Genius 2 is designed from the ground up specifically for Mac OS X, focusing on providing the best drive maintenance and management tools. Drive Genius 2 optimizes drive performance, protects data and provides easy-to-use yet powerful features for your storage needs.

Drive Genius 2 can defragment a volume, analyze a volume and repair it if necessary. Its testing capability goes a few steps above other drive utilities with media surface scanning and long term data integrity checking. Drive Genius 2 can also measure the throughput of the drives to see if they are performing up to par.

The powerful repartitioning feature enables you to resize your drive without reformatting. Drive Genius 2 can be used to add, initialize and delete partitions from your hard drive. Drive Genius 2 can do volume and device copying. Drive Genius 2 is able to hide partitions from most users. In addition, Drive Genius 2 has the ability to move a partition on the hard drive and even sports a sector editing function to edit the data on any sector of the drive. Last but not least it has a shredding feature that erases drives securely per the Department of Defense's standard.



Drive Genius 2' tool palettes

Latest version of the software



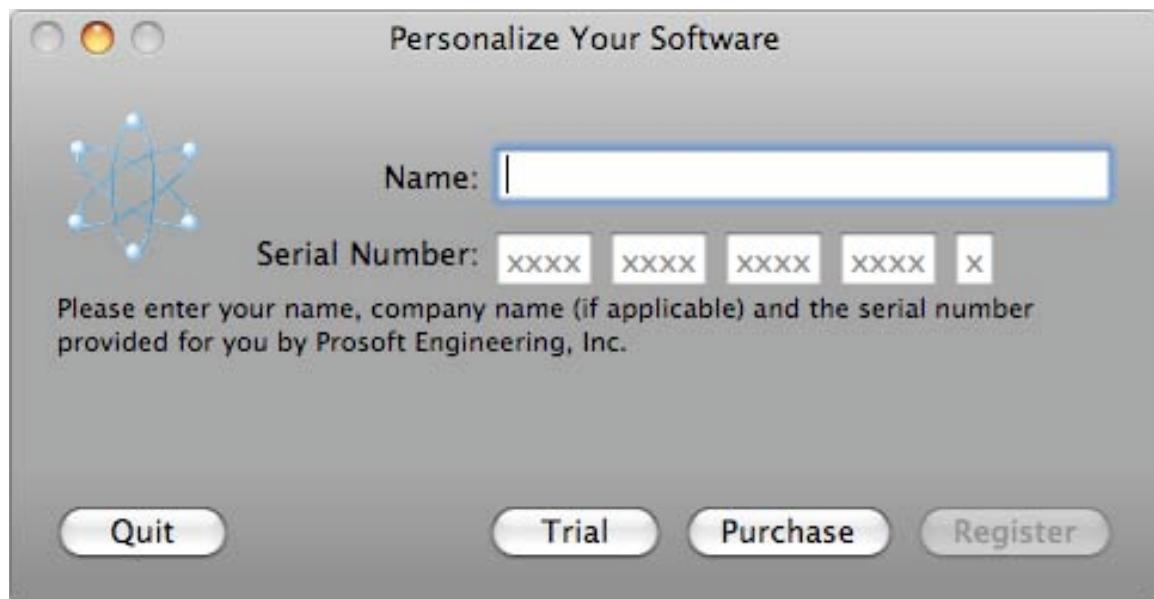
<http://prosoftengineering.com>

Check our web site to find out if you have the latest version of this software.

If you do not have the latest version of Drive Genius 2, you may download it from our web site: <http://prosoftengineering.com/products/downloadcenter.php>

Program Setup

On the DVD, drag the Drive Genius 2.app to the Application folder on your hard drive. The first time you launch Drive Genius 2, you will be prompted to enter your name & serial number. To register enter in your name and serial number, click Register.



Registration window

Trial Version

Drive Genius 2 allows users to try out the software. The Trial version has part of the feature set disabled. To use in Trial mode, click Trial. For users interested in purchasing Drive Genius 2, go to:

<http://prosoftengineering.com>

The following features are not enabled in the trial version:

- Benchtest
- Repartition
- Integrity Check
- Duplicate
- Sector Edit (Writing)
- Defragment
- Initialize
- Repair and Rebuild

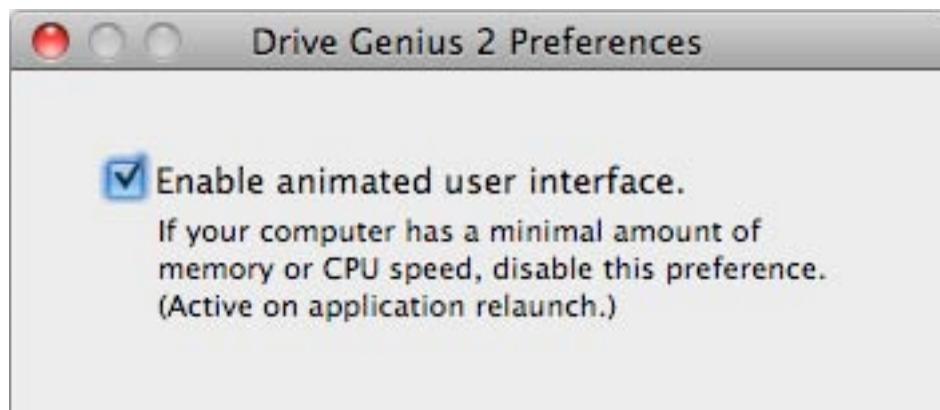
Drive Genius 2 Menu



Preferences

The animated interface is an alternative to view Drive Genius 2 features on your hard drive. Animated mode provides the same features and performance as Drive Genius 2' non-animated interface. Systems that do not meet Drive Genius 2' animation requirements will default to the non-animated mode.

Preferences window



Preferences window

Uninstall

To remove this software from your hard disk:

1. Run uninstall from the Drive Genius 2 menu

Contacting Prosoft Engineering

If you have comments about this product, problems or questions about this user guide, with our web site or if you are interested in a site license – please contact PROSOFT ENGINEERING (please specify the version and serial numbers of your copy):



http://prosoftengineering.com/contact_us.php

Sales: 1-877-477-6763
Tech Support: 925.426.6306
Fax: 925.426.6309

Drive Genius 2 Features

Drive Genius 2 is designed from the ground up specifically for Mac OS X.

Drive Genius 2 optimizes drive performance, protects data and provides easy-to-use yet powerful features for your storage needs. Drive Genius 2 can defragment a volume, analyze a volume and repair it if necessary. Its testing capabilities go a few steps above other drive utilities with media surface scanning and long term data integrity checking.

Written specifically for Mac OS X, Drive Genius 2 includes powerful features that give the user greater flexibility and control in setting up and managing your hard drives.



Analyze, Repair and Rebuild OS X directory information.



Defragment OS X drives for optimum performance.



Create high-speed backup clones of most devices.



Edit devices, volumes and files with the sector editor.



Securely erase drives using U.S. DoD specification algorithms.



Long range throughput tests for performance and diagnostics.



Benchtests for comparing drive performance.



Surface scanning to test for media faults.



Detailed information on drive and volume structure.



Format a comprehensive range of drives in OS X format.



Resize partitions without erasing them.

- Comprehensive Support including ATA, SCSI, Firewire and USB drives.
- Streamlined User Interface allowing most operations to be accomplished in a few clicks.
- Bootable DVD-ROM support ranging from PowerBooks to Macbooks.

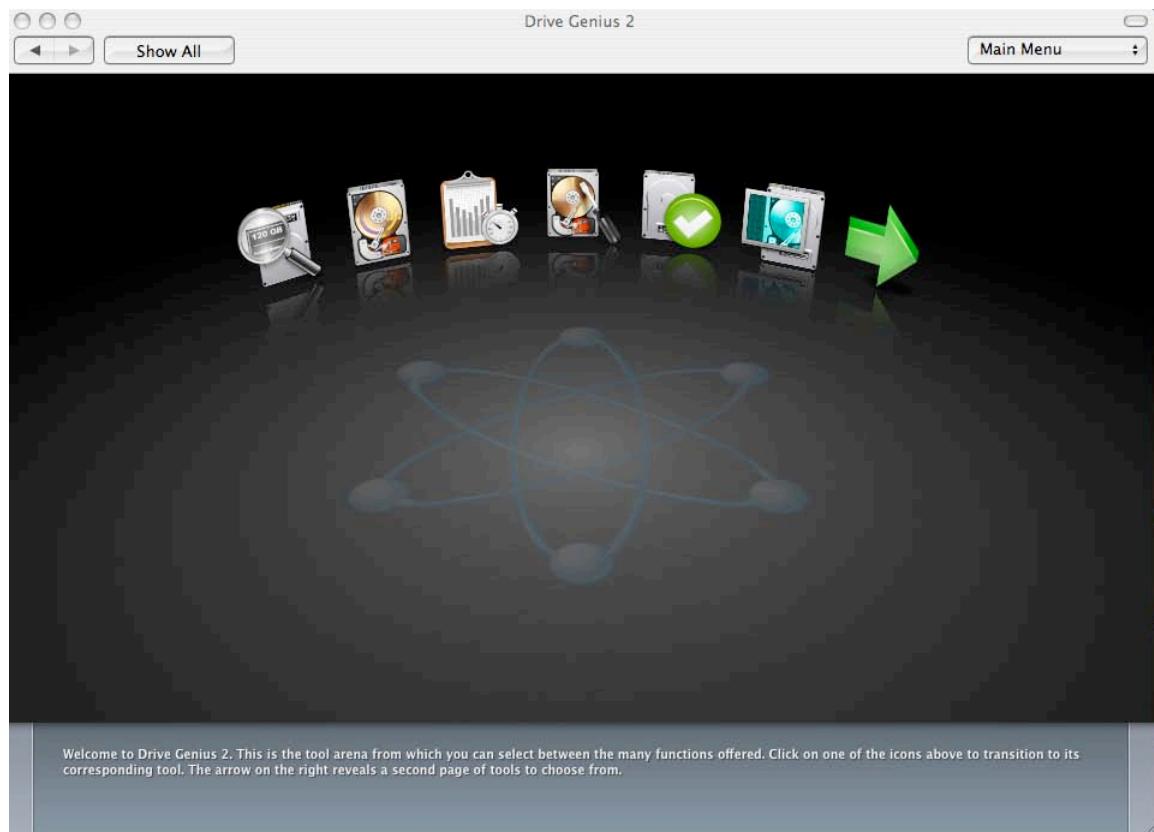
Steps to Complete a Task

Most Drive Genius 2 functions require a three-step process to complete a task:

1. Select an operation.
2. Select a hard drive or volume in the main window.
3. Select a parameter and apply it to the drive or volume.

Selecting a Drive Genius 2 operation.

On the main window, you can select the Drive Genius 2 operation you wish to perform. Click on the **green arrow** to choose more operations.



Drive Genius 2 Tool Arena

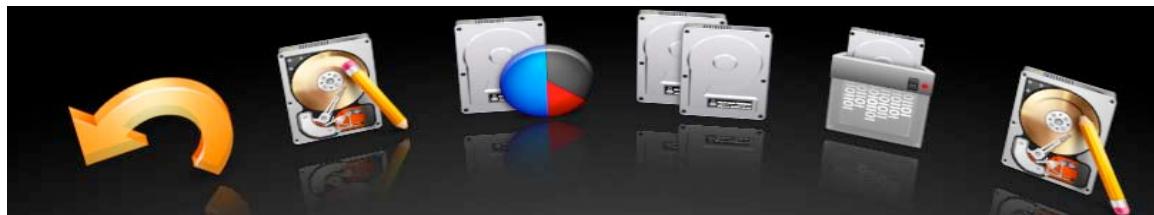
Selecting an Operation

Select a task you want to perform by moving the mouse over and clicking on one of the icon buttons in the middle of the screen.



Information, Defrag, Benchtest, Repair, Integrity Check, Scan

For operations such as copying, partition resizing and sector editing, you will need to enter additional information pertaining to the operation. Shredding, information, benchtest, integrity checking and initialize don't require any additional information.



Initialize, Repartition, Duplicate, Shred, Sector Edit



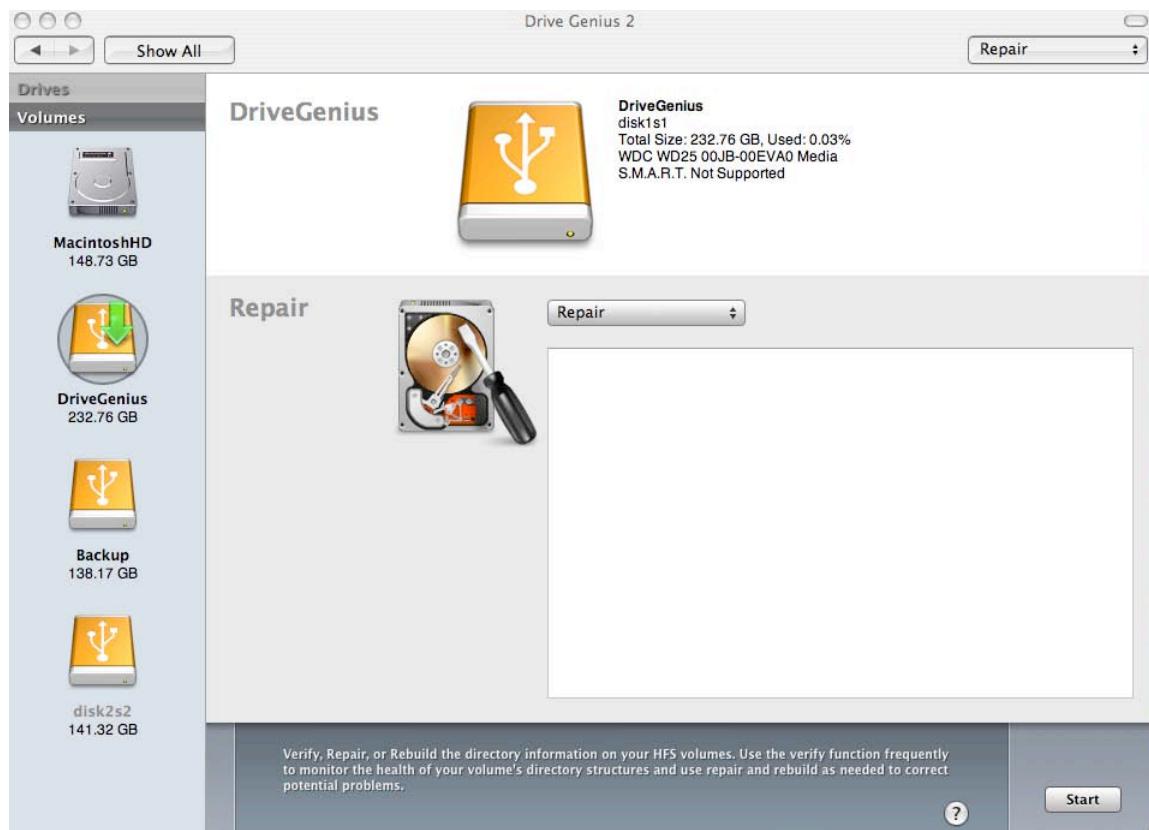
Prosoft recommends backing-up your data before using many features in Drive Genius 2 and regularly; that way, if anything goes wrong (virus, power blackout, OS error or hardware failure etc...), you will be able to recover your data. Also, disable sleep mode before beginning.

DRIVE GENIUS 2 USER GUIDE

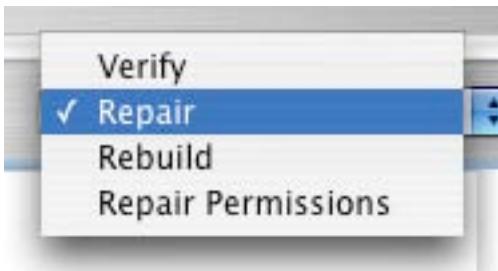
REPAIR

Repair is a tool for verifying and repairing most kinds of hard drive faults. It analyzes the volume for a general overview and can repair/rebuild the volume. It can also be used to enable and disable Apple journaling and fixes OS X file permissions on your boot volume.

Repair should be run whenever excessive system crashes occur. It also pays to run this periodically as it is not unusual for minor faults to appear on a hard drive.



Repair Window



Options for drive repair

- **Verify:** Check a volume for errors.
Runs a general scan over the volume to detect any errors.
- **Repair:** Check for and repair any found errors on a volume.
Checks the volume for any errors, and attempts to repair them if they are found. If the volume has been having serious problems, it is recommended to repeat Repair until it stops reporting that errors have been fixed.
- **Rebuild:** Rebuild the drive table that holds the file information.
This will rebuild the portion of the drive (known as the Catalog B-Tree) that contains information pertaining to the location of all of the files on the volume. It is a separate utility from the Verify and Repair functions and may be used separately to repair faulty volumes. Since it rebuilds the structure based on the existing content of the rest of the drive, it can potentially fix errors that Repair tools cannot.
- **Repair Permissions:** Correct the ownership and permissions according to Apple specifications. Repair Permissions will correctly set the permissions to solve most of problems related to permission issues.



Repair does not verify any physical media defects. Please use the Scan function of Drive Genius 2 to check for media errors.

DRIVE GENIUS 2 USER GUIDE

REPAIR

To **Repair** your drive:

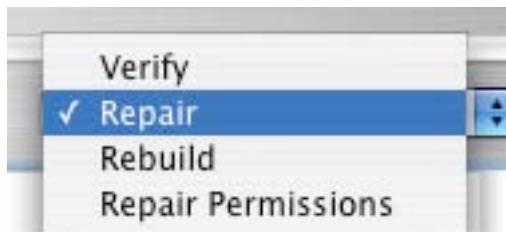
Launch Drive Genius 2.



Click the Repair icon.

Select the Volume you wish to Repair.

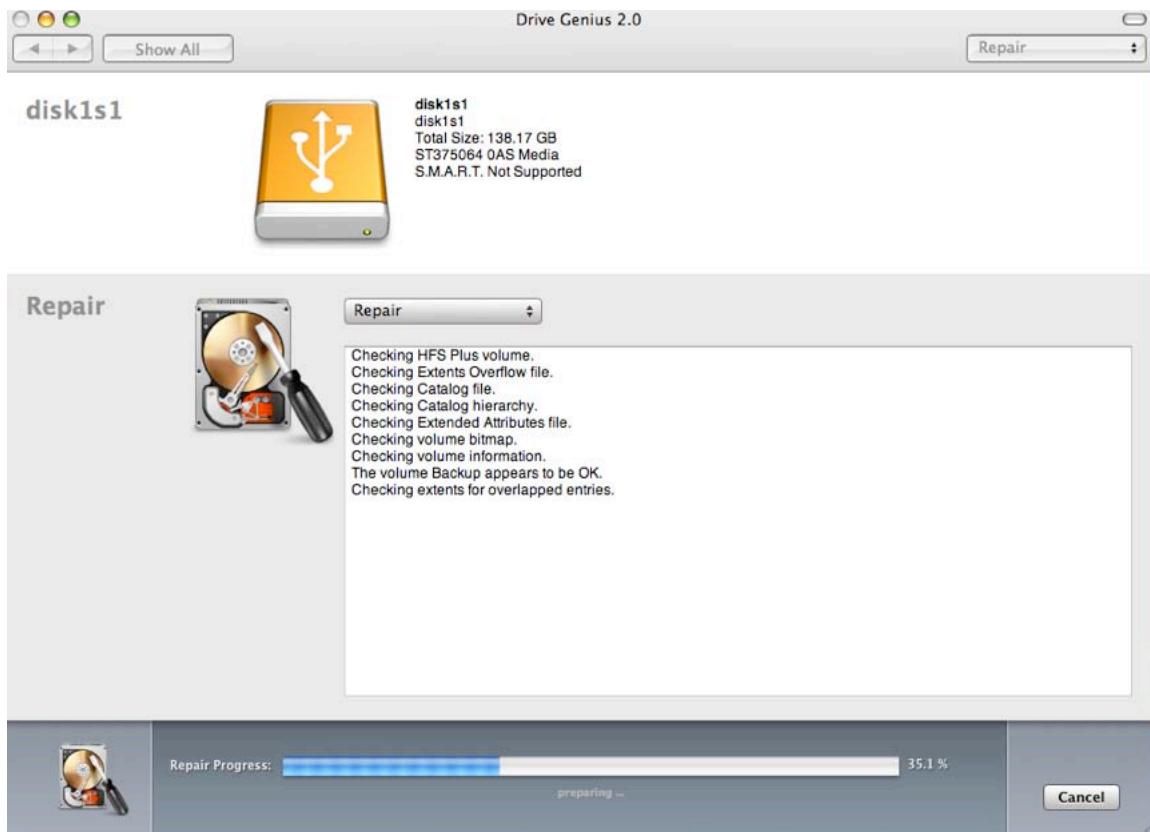
Select from the popup menu whether you want to verify, repair, rebuild the volume, or repair permissions.



Options for Drive Genius 2' Repair feature

DRIVE GENIUS 2 USER GUIDE

REPAIR



Repair Window

Click the **Start** button to proceed.

Click the **Cancel** button to stop.



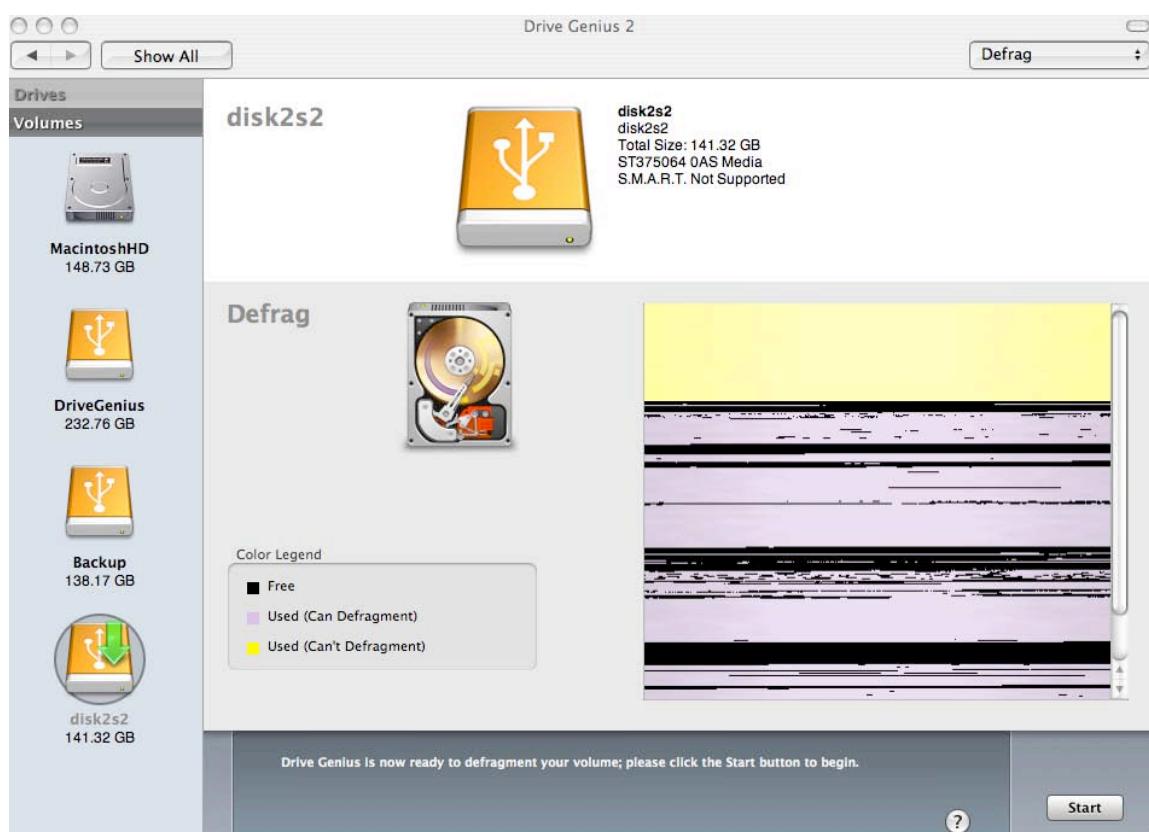
The repair feature should not be used as a substitute for regular backups of your important data.

DRIVE GENIUS 2 USER GUIDE

DEFRAGMENT

Adding and deleting files to and from your hard drive will cause the drive to become fragmented. When the OS writes files to the drive, it will look for empty spaces on the hard drive to write data to. If the space is too small to fit the file, it will write part of the data in one area and the remaining to another area. This way no disk space is wasted. However, this will cause the drive to slow down, as it will need to scan multiple parts of the drive to locate and read the file.

The more writing and deleting you've done to your drive, the more fragmented the drive will be. The process will gradually have an impact on the drive performance. This is why using Drive Genius 2 to defragment your hard drive is an excellent way to boost the performance of your computer. Drive Genius 2 puts all of these broken up pieces into one continuous block with all of the empty space at the end.



Defragment Window



Before you begin make sure sleep is disabled.

DRIVE GENIUS 2 USER GUIDE

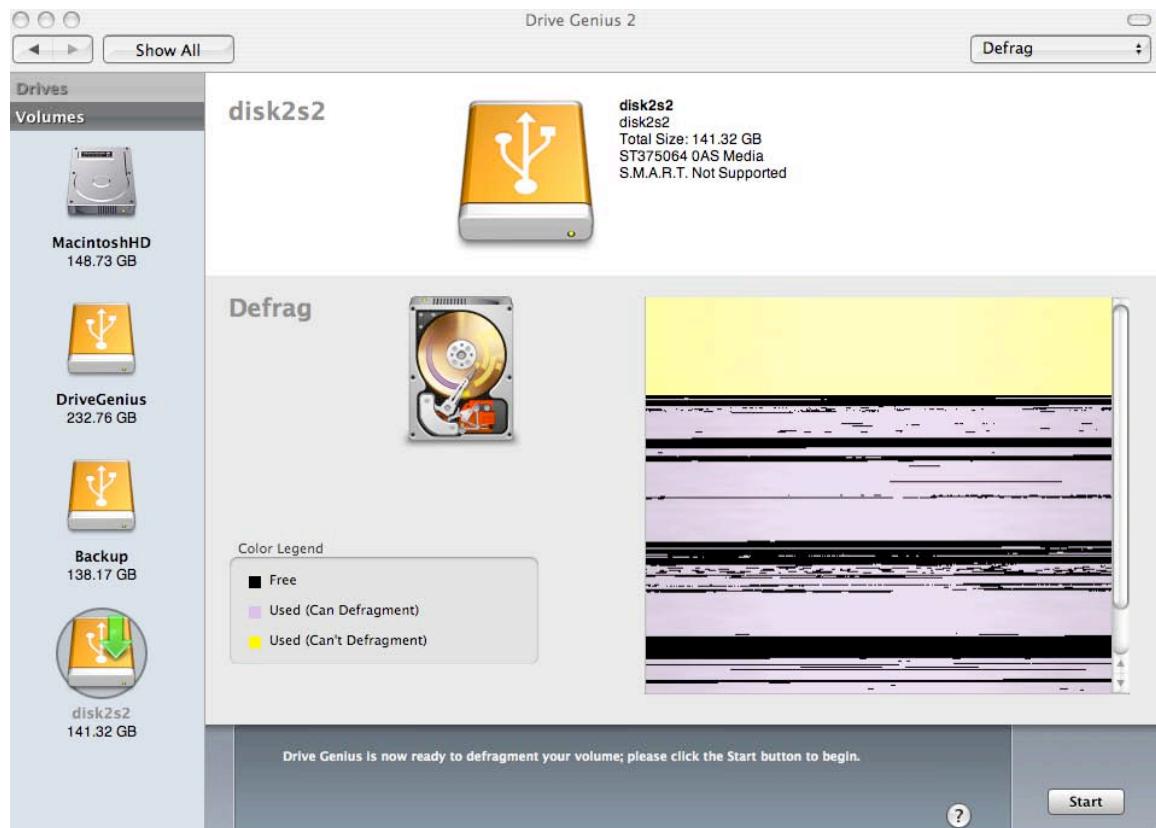
DEFRAGMENT

To **Defragment** your drive:

Launch Drive Genius 2.



Click the Defragment icon.

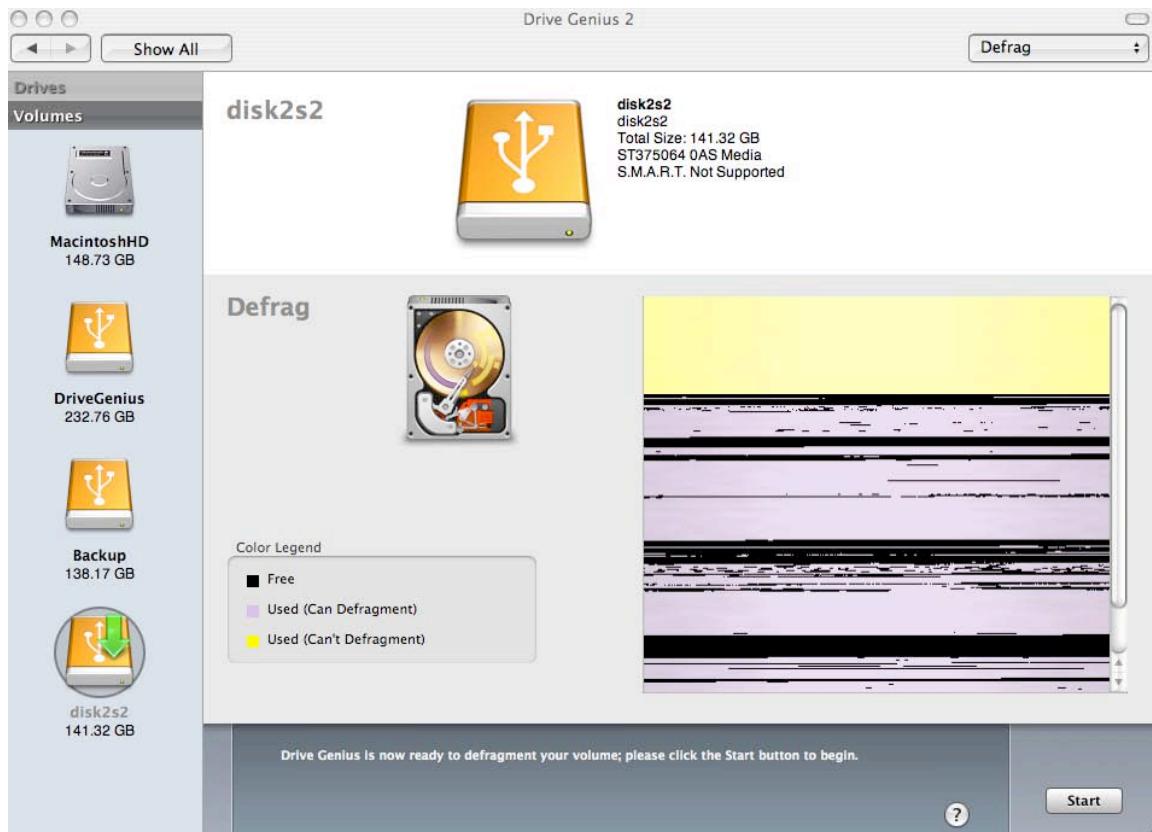


Selecting the volume to defrag

Select the volume you want to defragment by highlighting it.

DRIVE GENIUS 2 USER GUIDE

DEFRAGMENT



The Defragment Window

Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.

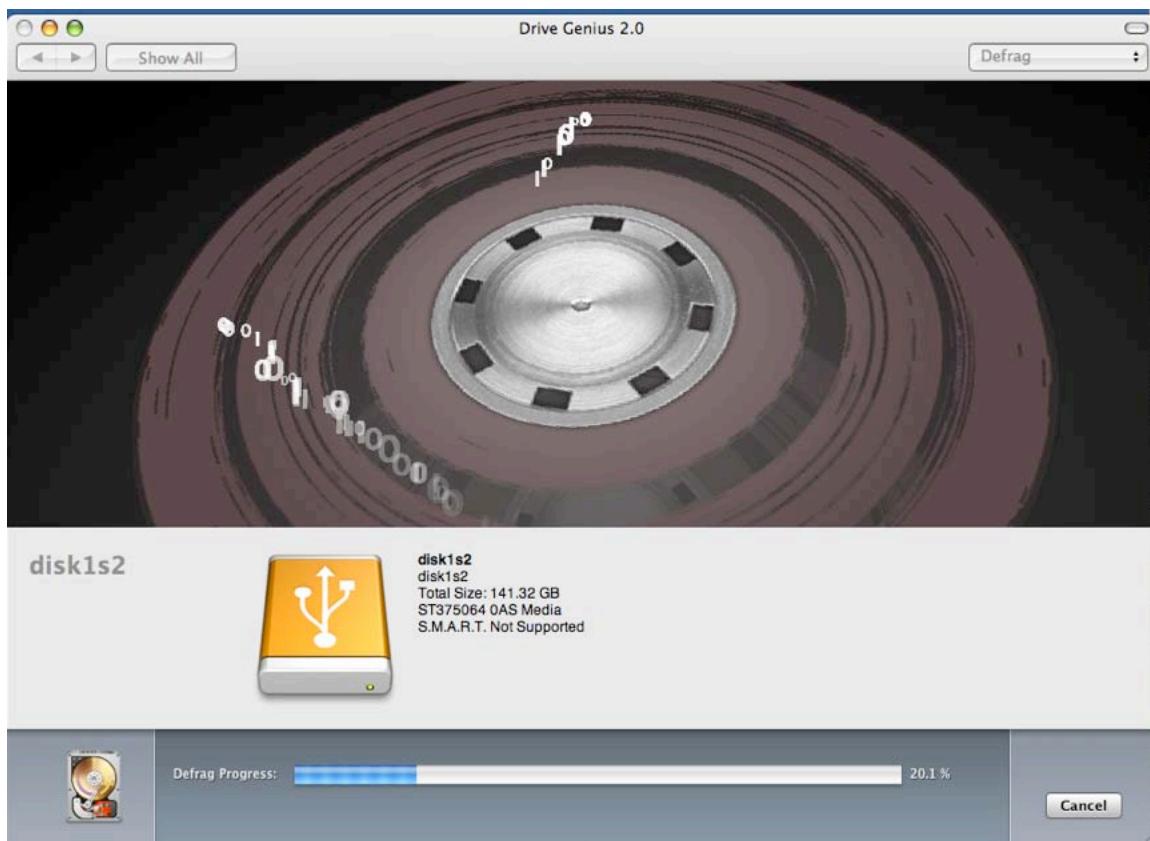
The screen shows the fragmentation of the volume:

- The yellow portion represents the data has already been defragmented.
- The lavender portion represents file that haven't been moved yet.
- The black portion represents the free space.

DRIVE GENIUS 2 USER GUIDE

DEFRAGMENT

Drive Genius 2 verifies the volume and the defrag process begins.



Defragment in progress



It can take from half an hour to a day to defrag a high capacity drive (depending on how fragmented it is). The end of the day is a great time to kick this maintenance routine off.

DRIVE GENIUS 2 USER GUIDE

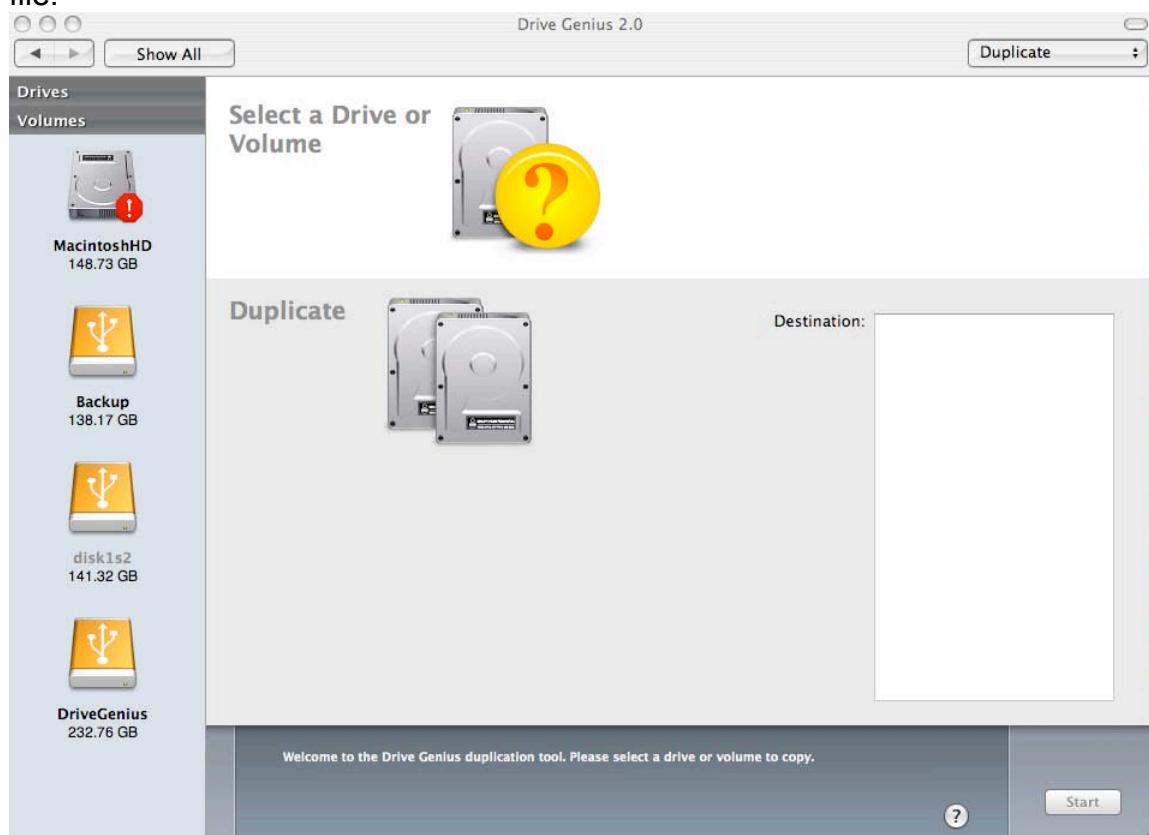
DUPLICATE

The **Duplicate** function copies all the information from the source drive to the destination drive. A copy of the source drive is made to the destination, so if you backup your startup drive, a bootable copy of it is created, with all information such as file permissions preserved.

Unlike most backup programs which copy file-by-file, Drive Genius 2 utilizes a method called device copy. Using device copy enables you to retain every detail of the original drive, from bootability to the icon locations. Device copy is also a lot faster than the traditional file-by-file backup.

Drive Genius 2 supports duplication of drives and volumes. For drive copy, Drive Genius 2 will duplicate an identical copy of the drive. For volume copy, an identical volume is first duplicated, and then Drive Genius 2 will apply a proprietary resizing technology to expand the volume size to the maximum, so no space is wasted.

Duplication can be used for copying one drive to another drive or to a disk image file.



The Duplicate Window

Note: To perform Duplicate on main boot volume you must boot to Drive Genius DVD or a secondary boot drive.

DRIVE GENIUS 2 USER GUIDE

DUPLICATE

To **Duplicate** a volume:

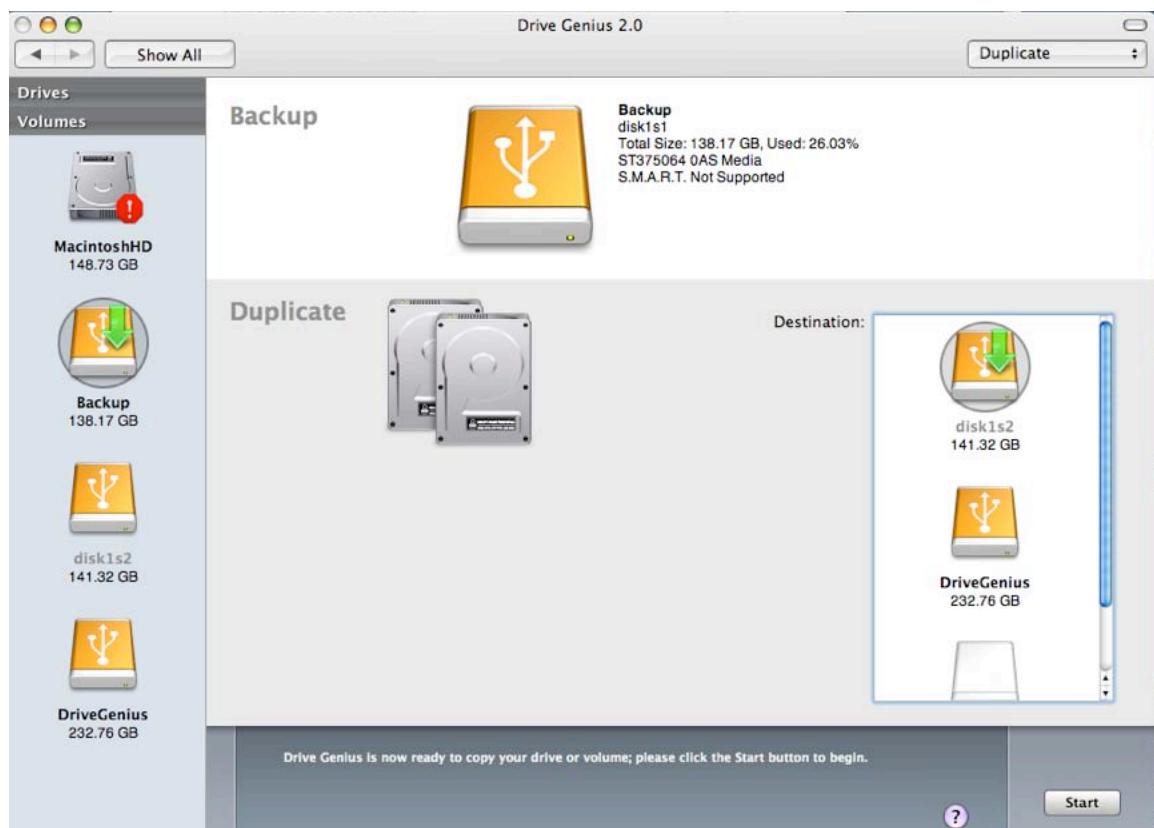
Launch Drive Genius 2.

Click on the **green arrow**.



Click the Duplicate icon.

In the Drive Genius 2 Volumes window, select the volume you want to duplicate.



Selecting a volume to duplicate

Select the target volume from Destination box. You can also duplicate the source volume to a Disk Image as your destination.

Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.



The information on the target drive will be replaced with the information on the source volume. If you want to archive to a file instead then select "New Disk Image" as the target. Drive Genius 2' volume copy is designed to work with OS X volumes. Using Drive Genius 2 on an OS 9 only volume may remove the ability to start up OS 9 from that partition. Drive Genius 2 does not affect the data on OS 9 volumes at all.

Drive Genius 2' device copy will work with almost all file systems including OS 9, Linux and Windows®.

Drive Genius 2 can only duplicate HFS+ volumes (almost all formats can be duplicated in the device view). Drive Genius 2' Device Duplication function clones an exact image of the original drive. Drive Genius 2 utilizes a method called "device-to-device copying". Using device copy enables you to retain every detail of the original drive, from boot ability to the icon locations. Device copy is a lot faster than the traditional file-by-file backup when duplicating a relatively full drive.

Device duplication is useful when you need to have an identical image of the original drive. For example, for forensics reasons, law enforcement agencies require their experts to work on drives identical to the original when dealing with evidence stored in the hard drives. Drive Genius 2 can even be used to clone Windows® or Linux drives.

To **Duplicate** a device:

Launch Drive Genius 2.

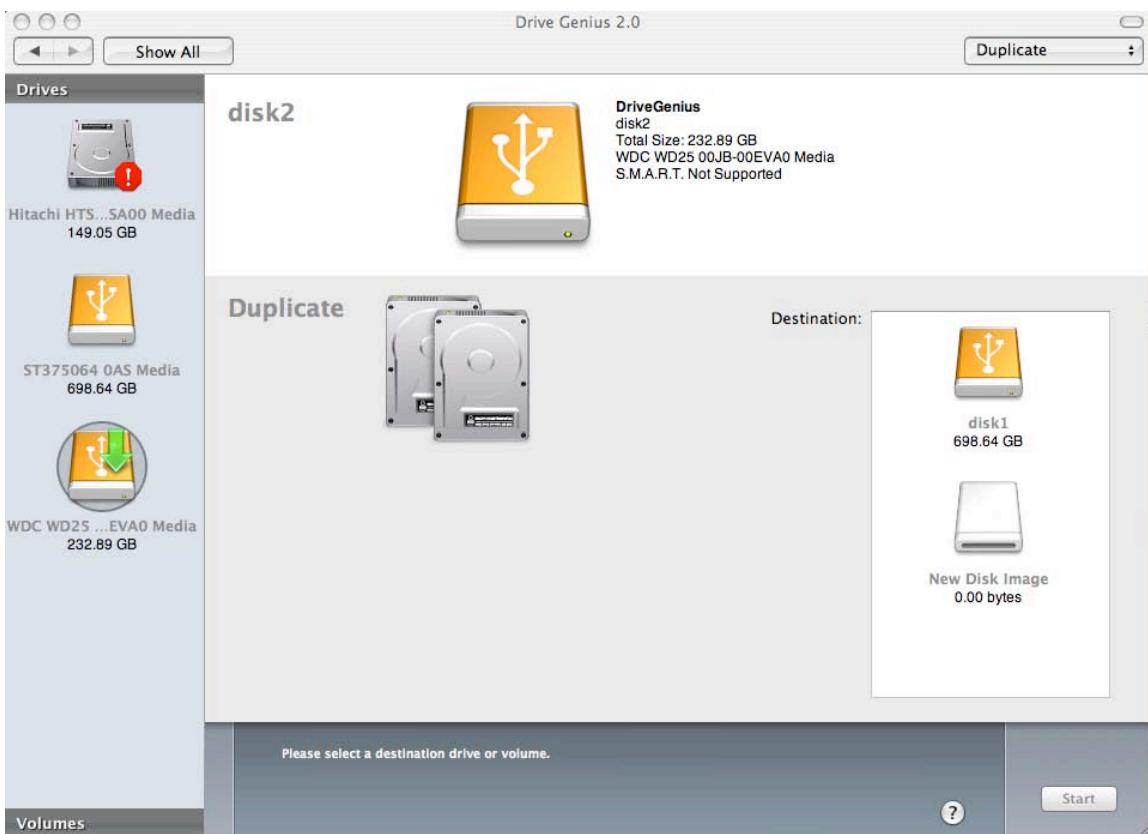


Click the Duplicate icon.

In the Drive Genius 2 Drives view, select the device you want to duplicate.

DRIVE GENIUS 2 USER GUIDE

DUPLICATE



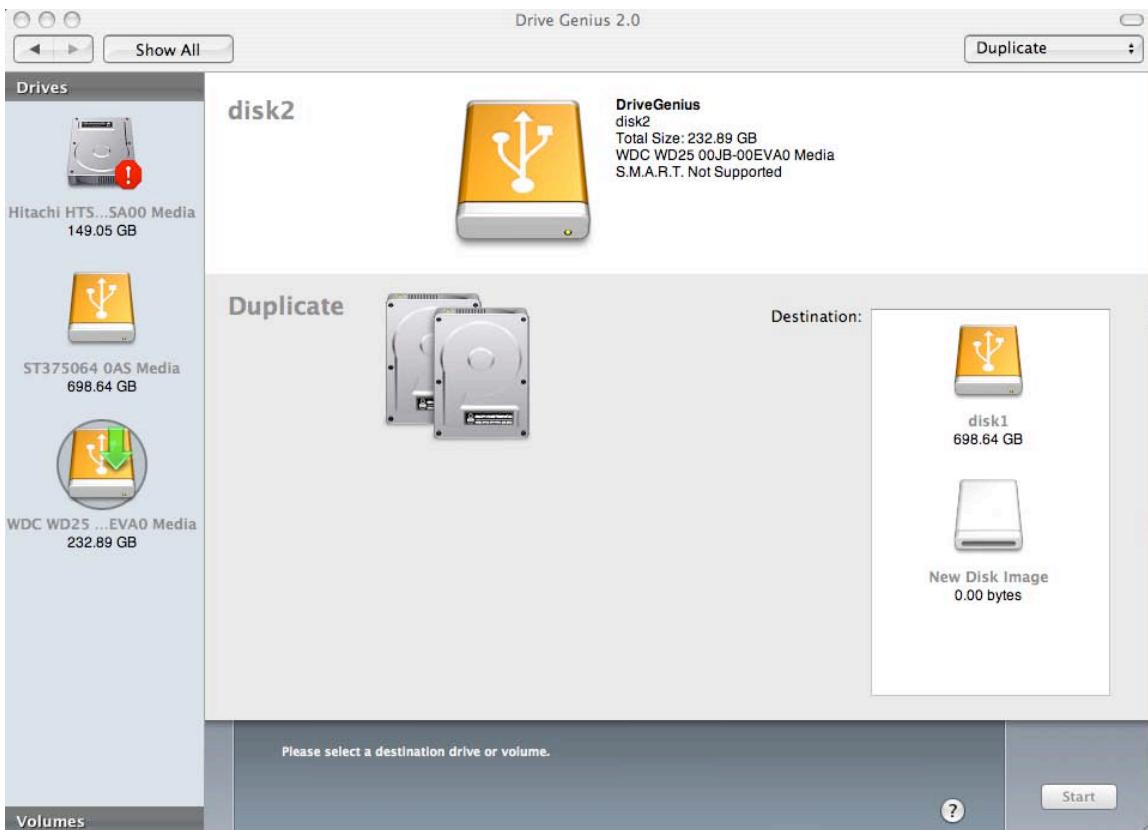
Selecting a device to duplicate



The destination drive's existing partitioning scheme is affected by the Duplicate operation. All data that was previously stored on the destination disk will be replaced with the data from the source disk.

DRIVE GENIUS 2 USER GUIDE

DUPLICATE



Duplicate window for devices

Select the target device from the Destination box. Only disks the same or larger in size than the source disk are listed. You can also create a Disk Image as your backup.

Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.

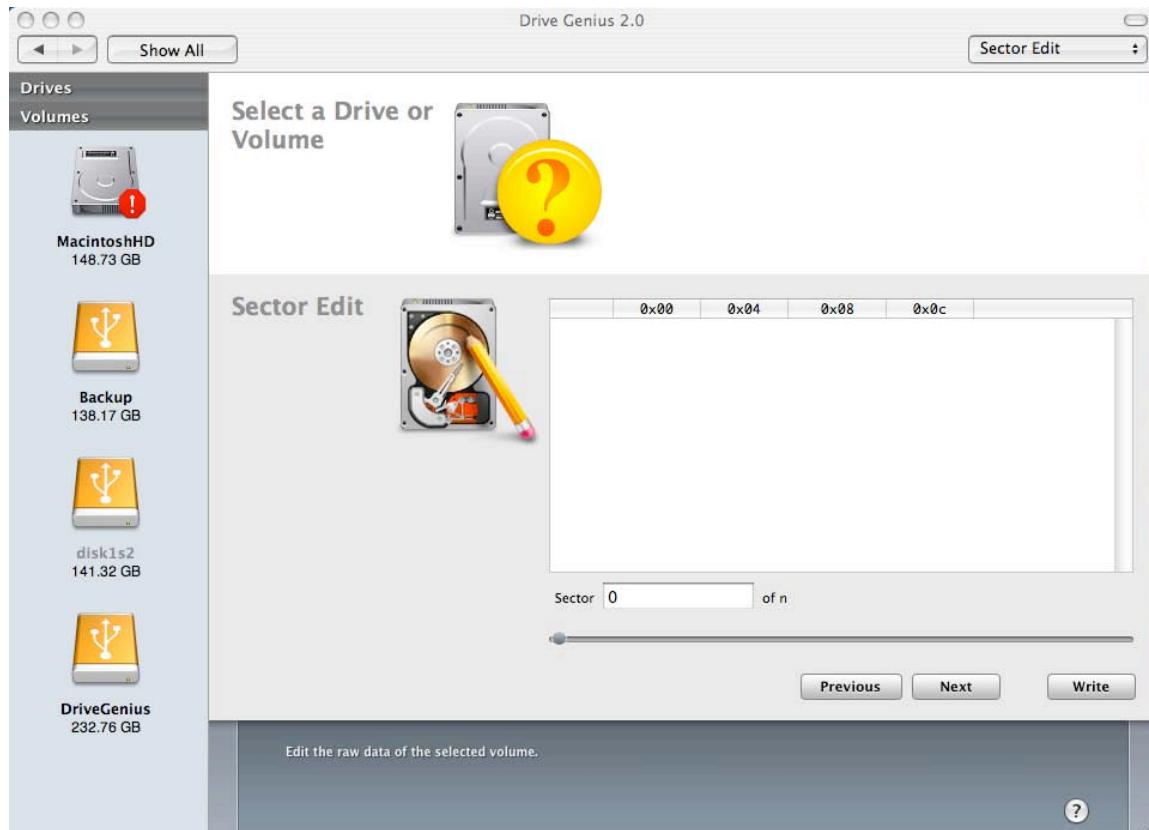


Drive Genius 2 requires the source and the target devices to be unmounted before proceeding with the duplication. You will need a Drive Genius 2 bootable DVD or start up from another drive.

DRIVE GENIUS 2 USER GUIDE

SECTOR EDIT

Drive Genius 2' **Sector Edit** allows expert users the ability to access and modify bits and bytes of a volume or a disk.



Sector Edit Window



Do not use this function unless you are extremely proficient with raw hex data. Editing the data using Sector Edit may render your data files unreadable, or even corrupt your drive.

Note: To perform a Sector Edit on main boot volume you must boot to Drive Genius DVD or a secondary boot drive.

DRIVE GENIUS 2 USER GUIDE

SECTOR EDIT

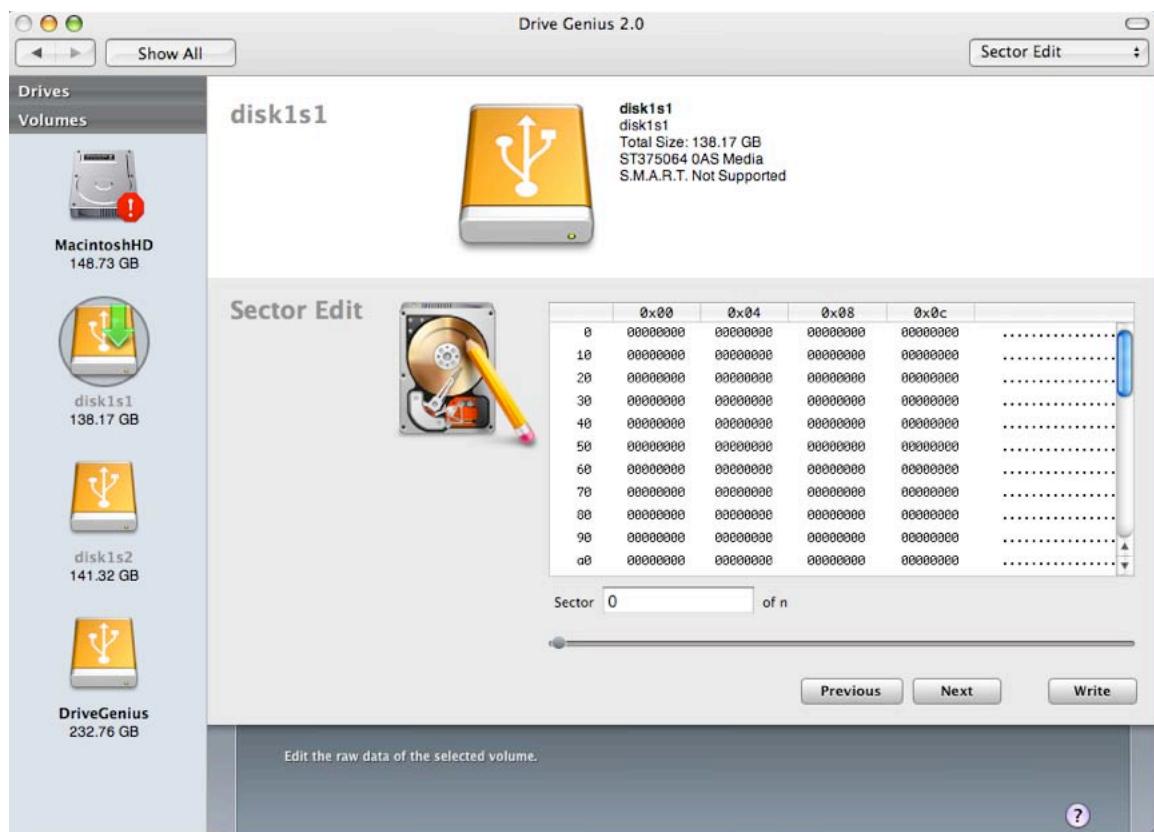
To perform a low level **Sector Edit** on your drive:

Launch Drive Genius 2.
Click the **green arrow**.



Click the Sector Edit icon.

In the Drive Genius 2 Volumes window, select the volume you want to perform a sector edit. You can also perform sector edit on a device by selecting a drive under Drives view.



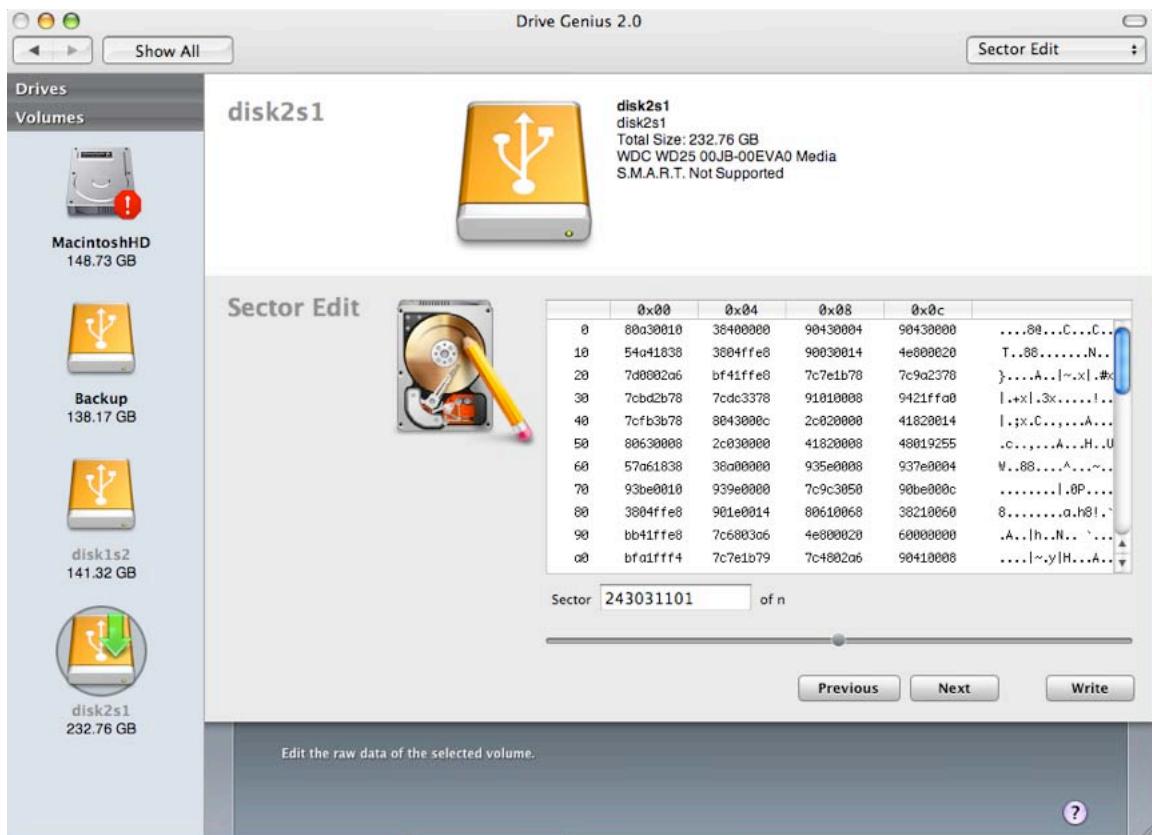
Selecting a drive for sector edit



You can use the sector edit window on any file by using the file menu to open a document.

DRIVE GENIUS 2 USER GUIDE

SECTOR EDIT



Sector Edit window

To navigate to the sector you want to edit, you have three options:

Type in the Sector number in the “**Sector _____ of n**” box.

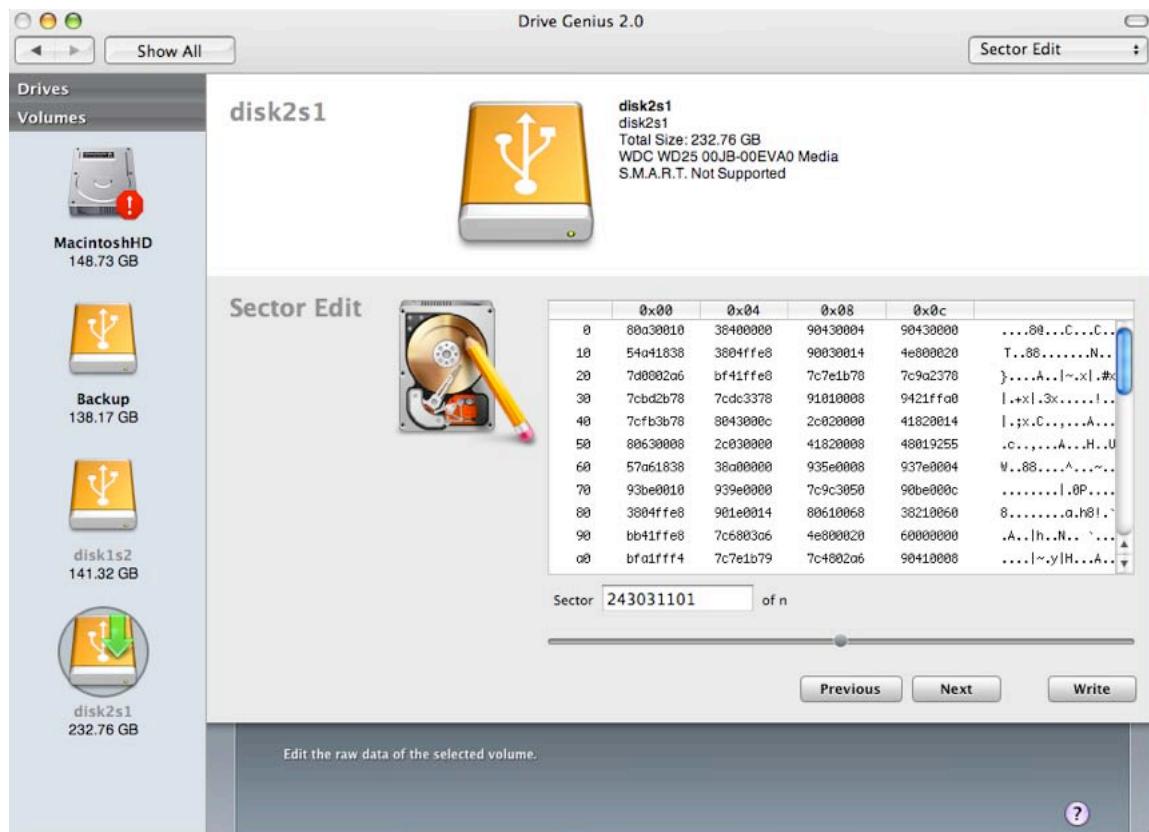
Use the slider.

Use the **Previous** and **Next** buttons.

DRIVE GENIUS 2 USER GUIDE

SECTOR EDIT

To modify the bytes, highlight the byte or bytes you want to modify, and type in the new value.



Sector Edit window

To apply the sector edit modification, click on the **Write** button.



Prosoft recommends backing-up your data before using Sector Edit; that way, if anything goes wrong (virus, power blackout, OS error or hardware failure etc...), you will be able to recover your data.

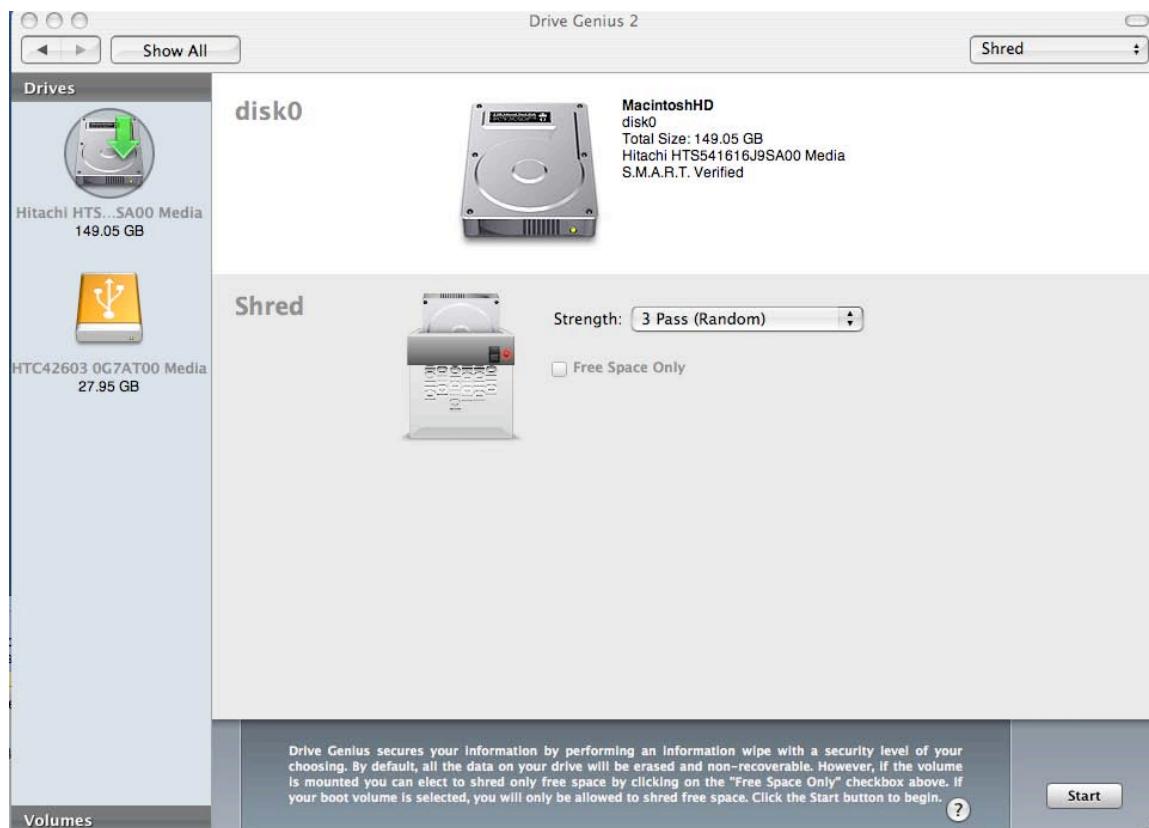
DRIVE GENIUS 2 USER GUIDE

SHRED

Drive Genius 2 **Shred** function is used for securely erasing the contents of a volume or the whole drive. There are many reasons to perform a shredding operation instead of simply dragging the files into the trash and emptying it. For example:

- To avoid identity theft and protect your credit.
- Stop intellectual property theft.
- Permanently get rid of your data files so no one can recover it. For example, a volume with adult oriented materials.
- Permanently remove any software that you are going to be using on your new machine since software licenses usually only apply to one computer.
- Most Government/large corporations require the drives to be securely erased before disposing or transferring to other users.

The only secure way to erase your drive is by writing repeated passes of various data patterns. Drive Genius 2 has been written to conform to the United States Department of Defense standards for drive sanitation.



Shred Window

DRIVE GENIUS 2 USER GUIDE

SHRED

Shred overwrites the volume or the drive with 1, 3 (Random) or 7 pass (DoD) and ensures all previous data will never be recoverable. Drive Genius also features a 35 pass (Gutmann) option, which overwrites every block of data 35 times. Drive Genius 2's Shredder function conforms to the U.S. Department of Defense standard for drive sanitization (DoD 5220.22 M), and it works with IDE (ATA), SCSI, USB, and Firewire hard drives.

Note: US Department of Defense in the clearing and sanitizing standard DoD 5220.22-M recommends the approach "Overwrite all addressable locations with a character, its complement, then a random character, verify for clearing and sanitizing information on the writable media".

Drive Genius 2 can shred either a volume or the whole drive. If you are shredding your boot volume or your startup drive, you will need to boot the system from the Drive Genius 2 DVD, or boot off from another drive with Drive Genius 2 installed.

Drive Genius 2 also allows you to permanently erase the free space on your volume making it impossible for anyone to retrieve old files you have previously deleted.



Drive Genius 2 Shred options

DRIVE GENIUS 2 USER GUIDE

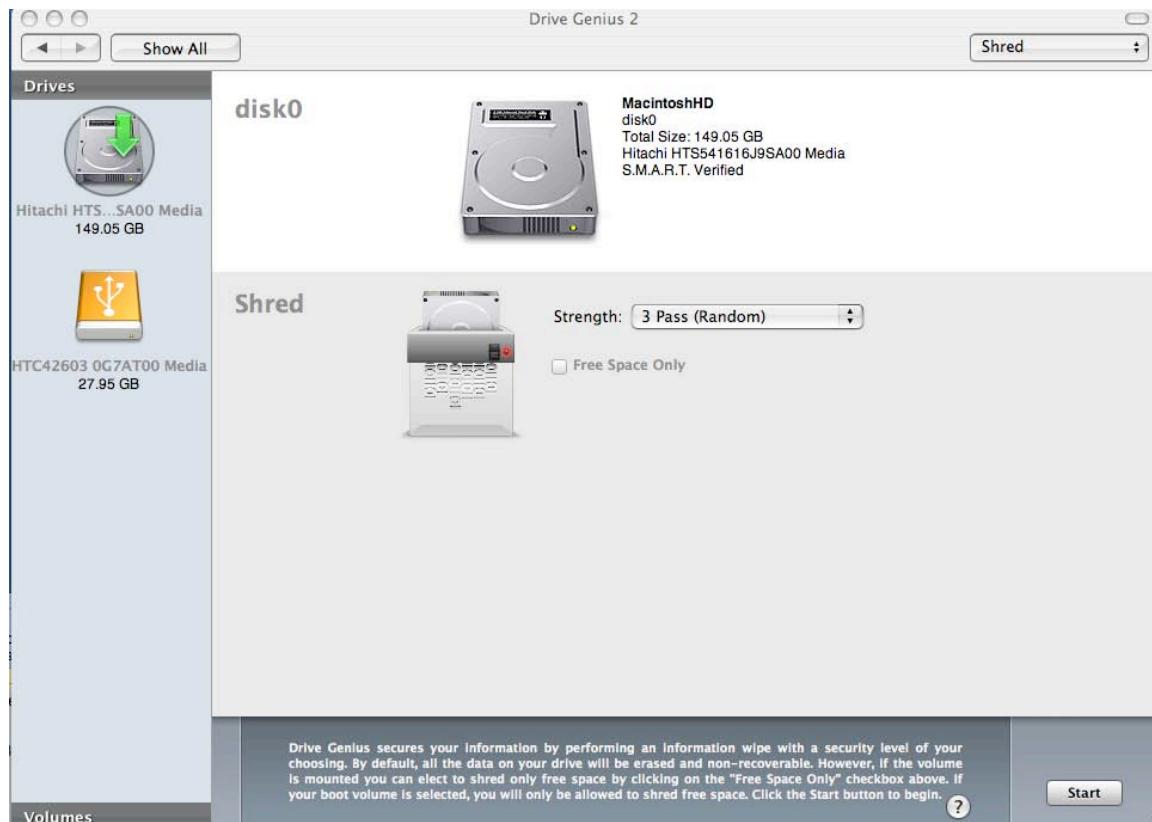
SHRED

To run **Shred** from the Drive Genius 2 DVD:

Insert the Drive Genius 2 DVD. Press and hold down the letter "C" key.



Click the **green arrow** and click on the Shred icon.
From the Volumes view, select the volume you want to shred.



Selecting a volume to shred



To shred a volume instead of free space only, uncheck the Free Space Only check box.

Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.

After the operation, a newly initialized HFS Plus partition will appear on the desktop.

DRIVE GENIUS 2 USER GUIDE

SHRED

When you are done with shredding, quitting Drive Genius 2 will shut down the computer. To eject the Drive Genius 2 DVD, restart the computer, and press and hold (unless other method specified) the mouse button.

DRIVE GENIUS 2 USER GUIDE

SHRED

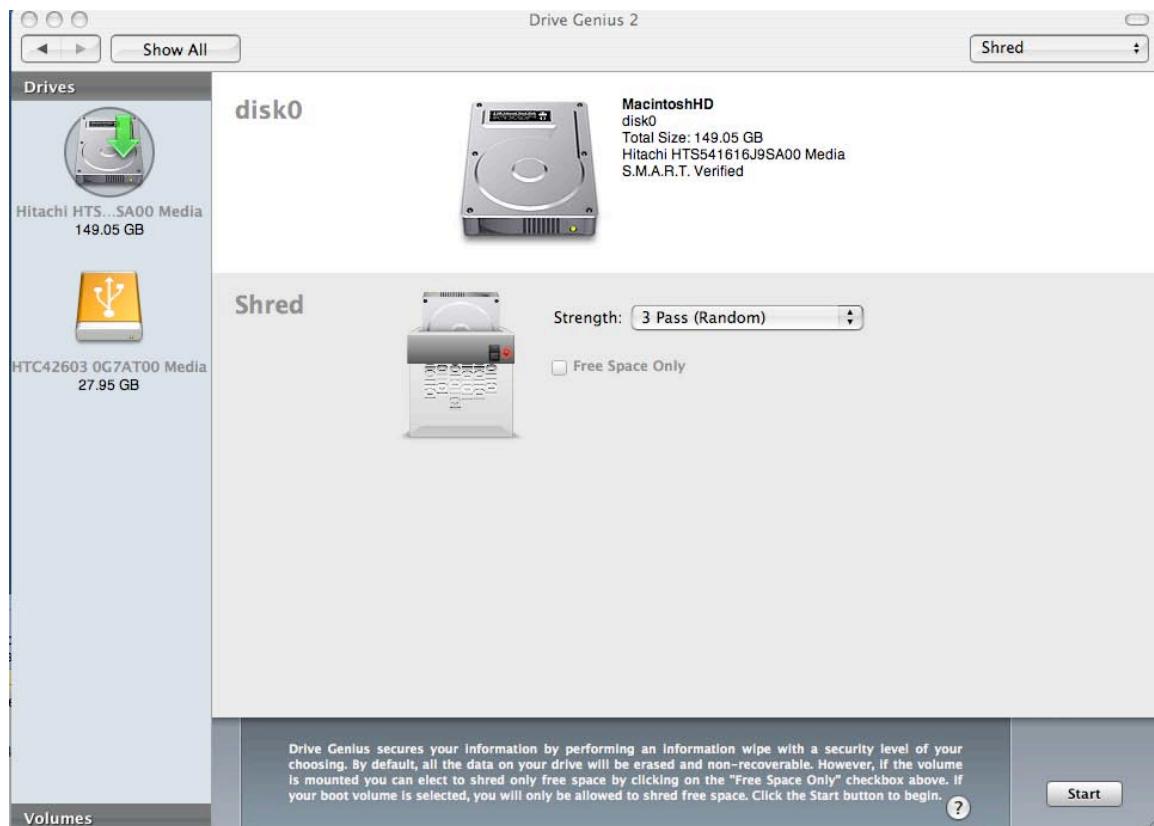
To run **Shred** from your hard drive:

Launch Drive Genius 2.
Click the **green arrow**.



Click on Shred icon.

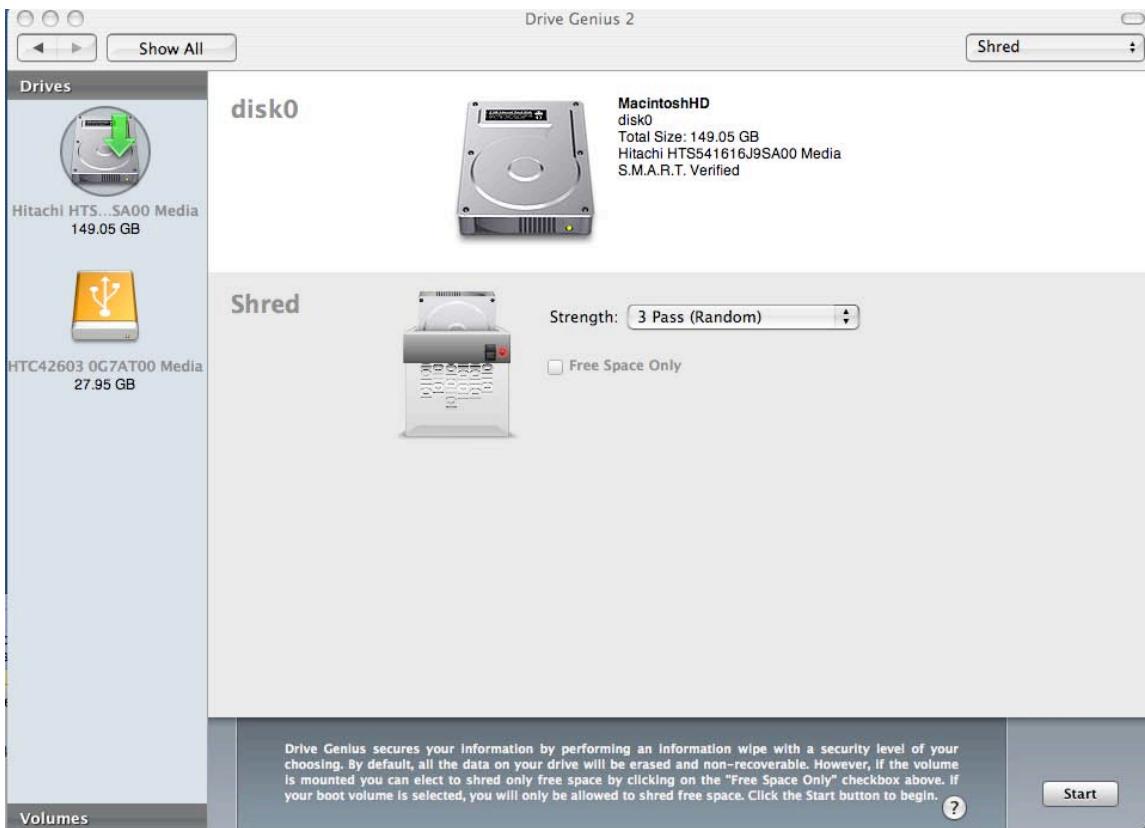
From the Volumes view, select the volume you want to shred.



Selecting a volume to shred

DRIVE GENIUS 2 USER GUIDE

SHRED



Shred Window

Uncheck the Free Space Only check box if you wish to Shred the contents of the entire Volume.

Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.

After the operation, a newly initialized HFS Plus partition will be mounted.

Erasing Free Space

Drive Genius 2 allows you to permanently erase the free space on your volume in a secure fashion making it impossible for anyone to retrieve old files you have previously deleted. Technically, this process is achieved by first filling up your volume with temporary files, and then writing a secure pattern over the files.

This process is particularly important if your hard drive is to be shared among a few users, or you are selling it, or disposing of it.

DRIVE GENIUS 2 USER GUIDE

SHRED

To **erase the free space** of a volume:

Click on the Volumes tab, and click on the volume you want to perform a free space erase.



Click on the Shred icon.

Make sure the **Free Space Only** check box is checked.



Click on the **Start** icon.

A sheet dialog will open to inform you of the progress.

To cancel, click on the **Cancel** button.



If you have a big volume or a slow machine, shredding free space can take a while. If you erase the free space on a disk or other device, there is no way any file recovery programs will be able to retrieve your deleted files up to that point

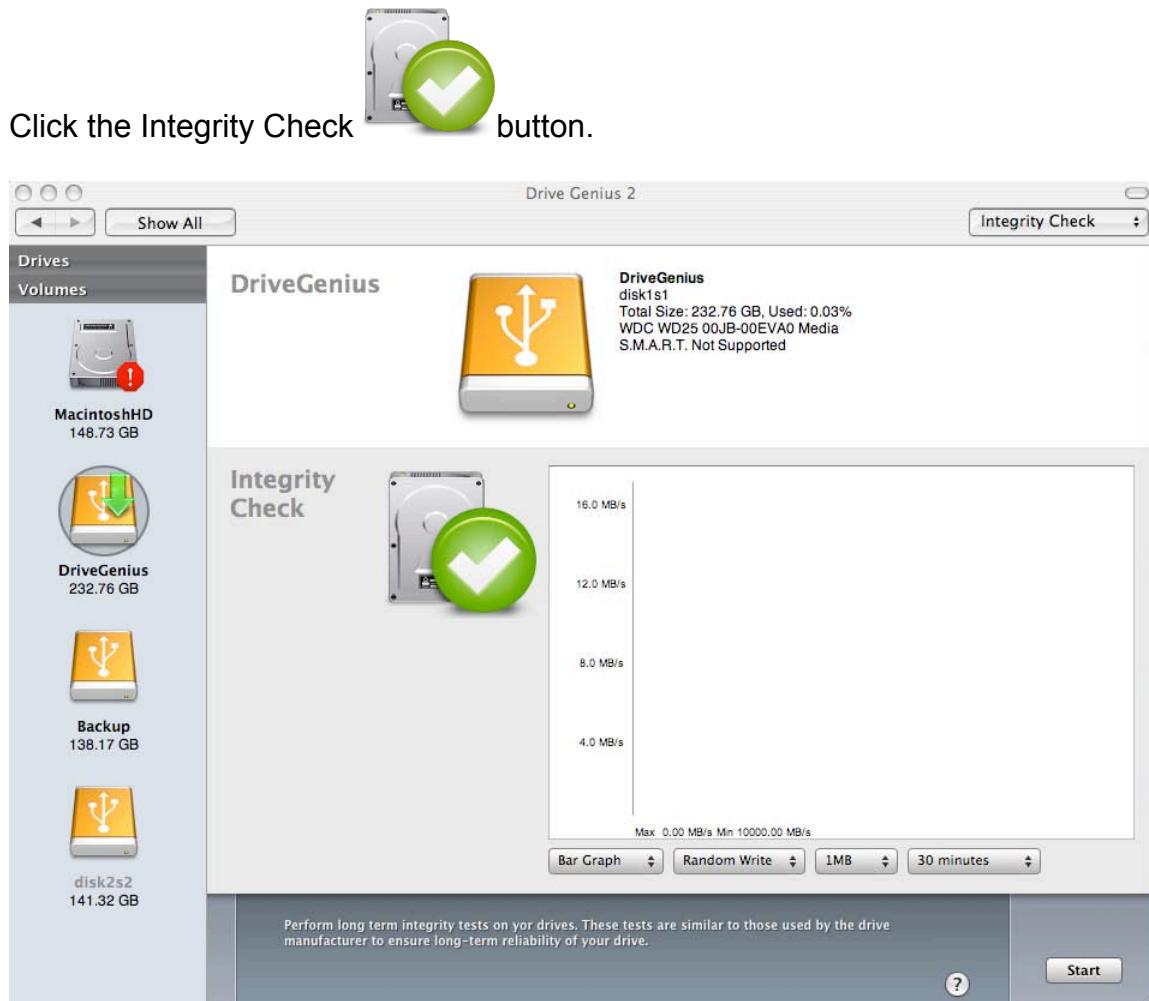
DRIVE GENIUS 2 USER GUIDE

INTEGRITY CHECK

Integrity Check is a suite of diagnostics designed to test the overall integrity of the disk drive by writing and reading various block sizes to and from the drive. By reading, writing and comparing the read and write data, Integrity check measures and reports various aspects of the drive subsystem including the driver, the drive controller, the cabling, the drive's motherboard and the head seek mechanism.

To use **Integrity Check** on a volume/device:

Launch Drive Genius 2.



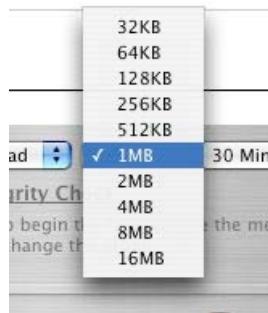
Select the drive you want to test by highlighting it.

Note: To perform Integrity Check on main boot volume you must boot to Drive Genius DVD or a secondary boot drive.

DRIVE GENIUS 2 USER GUIDE

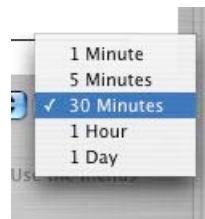
INTEGRITY CHECK

Options for **Integrity check** Settings



Transfer Size

The transfer size ranges from 2 KB to 16 MB. For setup such as mail server or accounting server, test the drive at 2 KB block. Database servers do lots of little searches and hardly ever read lots at a time so small blocks are a good test. Use a bigger block size if you use the drive for graphic intensive application and digital audio and video applications.



Test Duration

The length of test can be varied from one minute to one day. The longer the duration given to the test, the more reliable the results are. Start with smaller time frames and give it a longer period to detect more subtle flaws.

DRIVE GENIUS 2 USER GUIDE

INTEGRITY CHECK

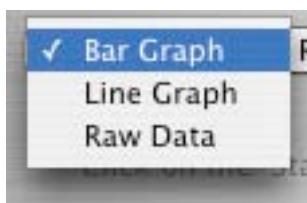


Test type

- **Sequential read** - test measures how many times single-block reads can be performed in one second.
This test is affected by read caching (the larger the read cache, the faster the performance).
- **Sequential write** - test measures how many times single-block writes can be performed in 1 second.
This test is affected by write caching (the larger the write cache, the faster the performance).
- **Random read** - test measures drive performance for reads of blocks of data from 2 kilobytes to 16 megabytes. For small block sizes, seek time and rotational latency are weighted more heavily. For large block sizes, the transfer rate is weighted more heavily.
- **Random write** - test measures drive performance for writes of blocks of data from 2 kilobytes to 16 megabytes.
For small block sizes, seek time and rotational latency are weighted more heavily. For large block sizes, the transfer rate is weighted more heavily.

DRIVE GENIUS 2 USER GUIDE

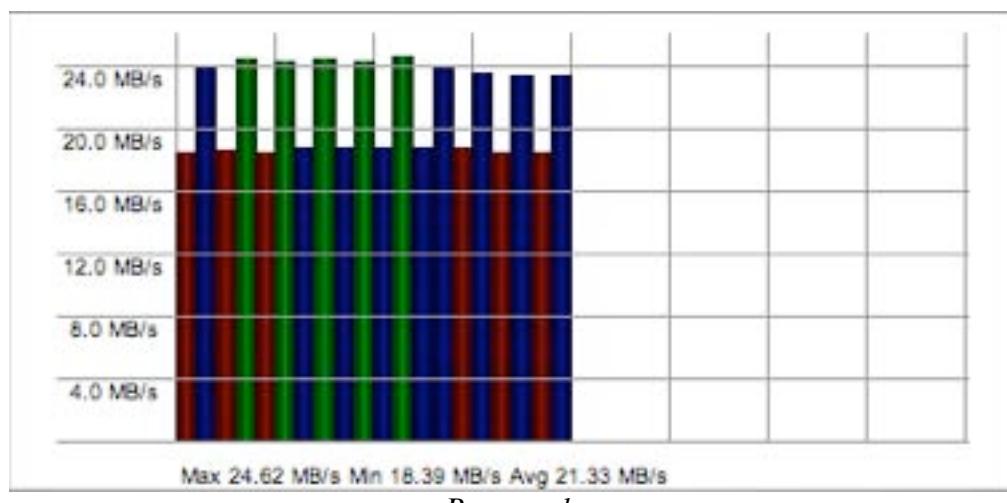
INTEGRITY CHECK



Selecting a graph type

Graph Type: Allows you to select the graphical way that the information related to the speed of the operations is displayed.

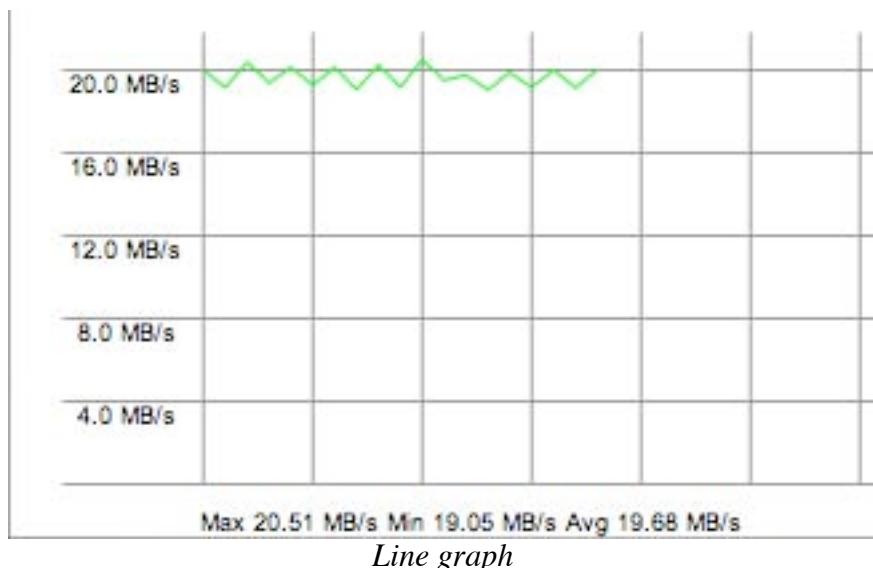
There are three ways to display the data:



Bar graph

DRIVE GENIUS 2 USER GUIDE

INTEGRITY CHECK



Line graph

**20.00 Megabytes per Second
0.05 Seconds per Megabyte**

Max 20.51 MB/s Min 19.05 MB/s Avg 19.68 MB/s

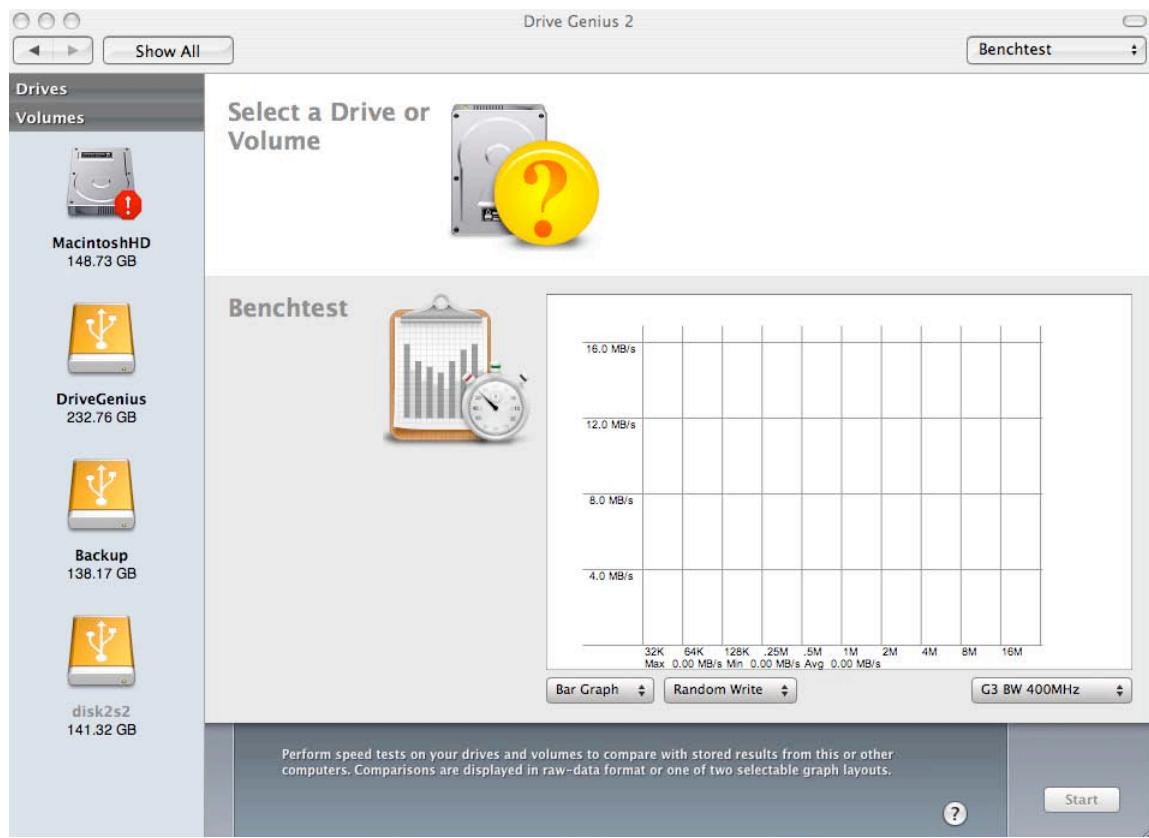
Raw data

DRIVE GENIUS 2 USER GUIDE

BENCHTEST

Benchtest is a tool to test the performance of different drivers, CPU's, operating systems, and data-transfer efficiency of large and small volumes. For example, digital video users can use Benchtest to see how differing custom driver and mode page settings affect the efficiency of video capture and web server administrator can find out how the volume performs under small file transactions.

Benchtest reports the results in either graphical or numeric formats, and you can save them as files. Drive Genius 2 comes with a set of them from most current Macintosh systems. You can select these for a live on-screen comparison between your system and others.



Benchtest Window

Note: To perform Duplicate on boot volume you must boot to Drive Genius DVD or a secondary boot drive.

DRIVE GENIUS 2 USER GUIDE

BENCHTEST

Benchtest will perform the following tests on the drive selected:

- **Sequential read** test measures how many times single-block reads can be performed in one second.
This test is affected by read caching (the larger the read cache, the faster the performance).
- **Sequential write** test measures how many times single-block writes can be performed in 1 second. This test is affected by write caching (the larger the write cache, the faster the performance).
- **Random read** test measures drive performance for reads of blocks of data from 2 kilobytes to 16 megabytes.
For small block sizes, seek time and rotational latency are weighted more heavily. For large block sizes, the transfer rate is weighted more heavily.
- **Random write** test measures drive performance for writes of blocks of data from 2 kilobytes to 16 megabytes.
For small block sizes, seek time and rotational latency are weighted more heavily. For large block sizes, the transfer rate is weighted more heavily.

DRIVE GENIUS 2 USER GUIDE

BENCHTEST

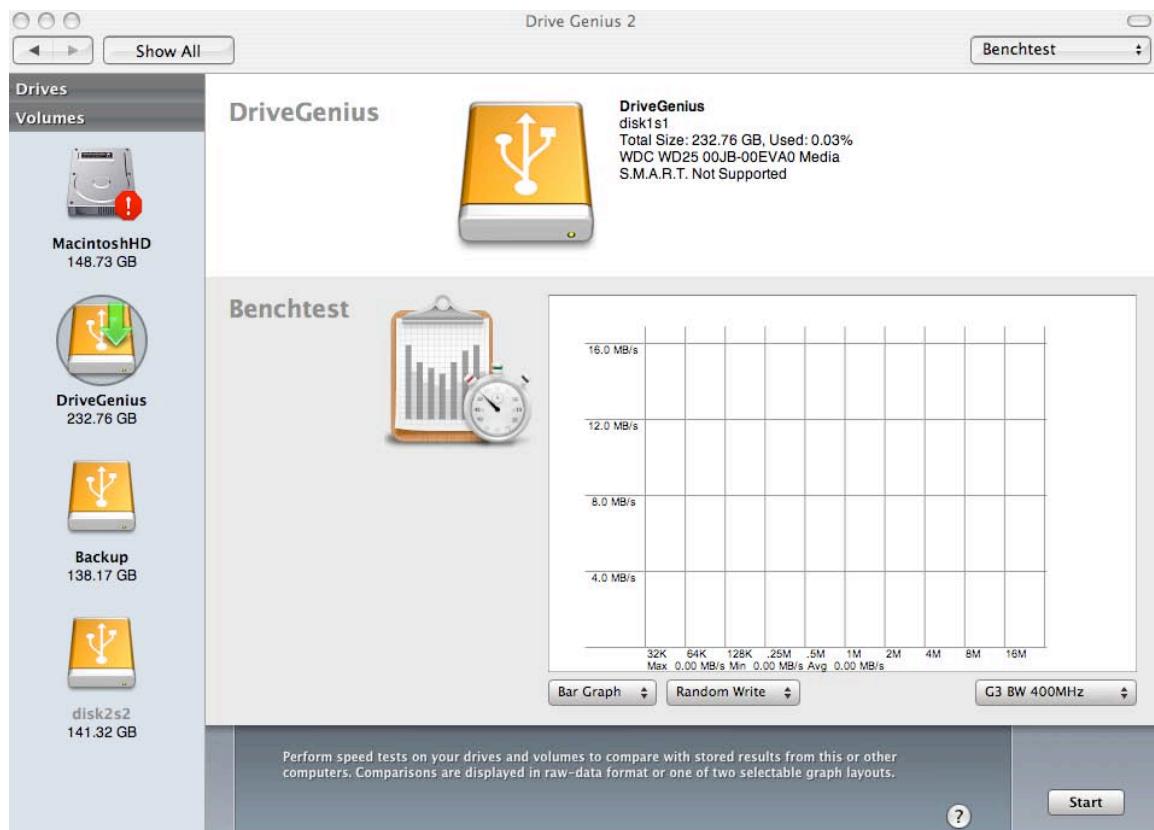
To **Benchtest** your drive:

Launch Drive Genius 2.



Click the Benchtest icon.

Select the drive you want to benchtest by highlighting it.

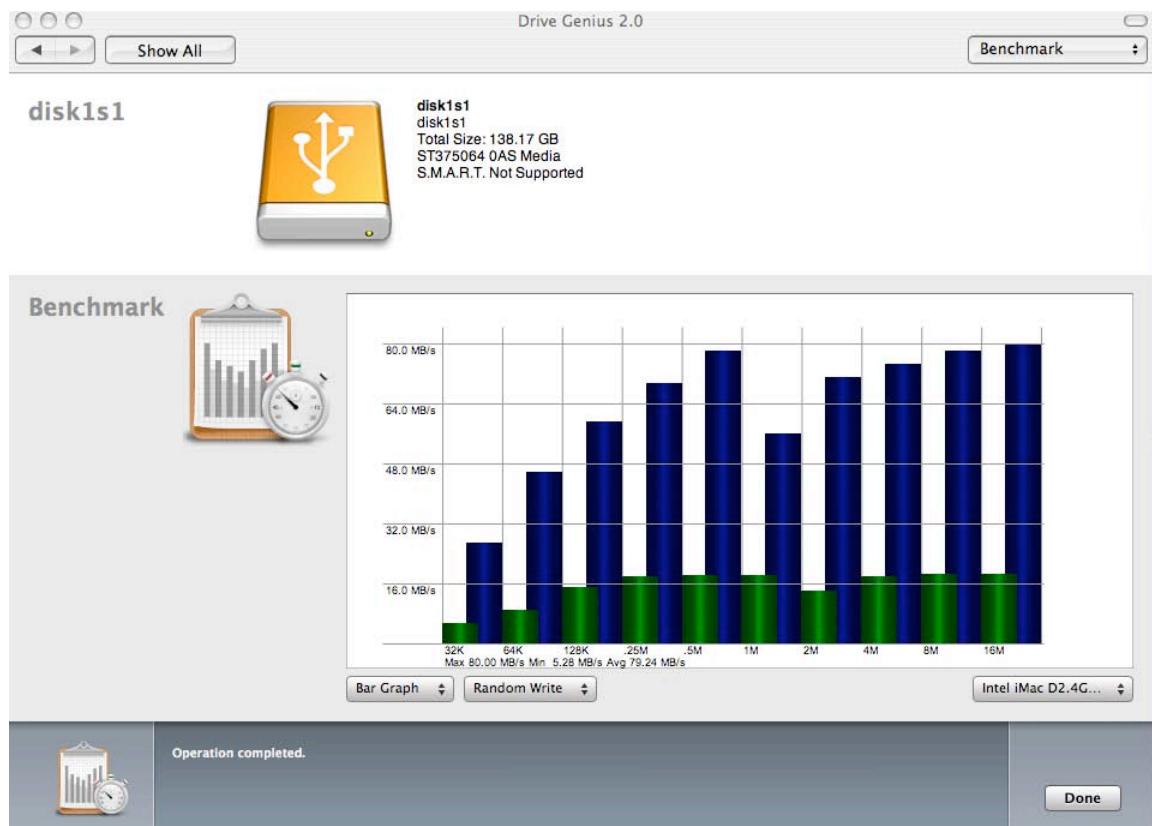


Selecting the drive to Benchtest

DRIVE GENIUS 2 USER GUIDE

BENCHTEST

Depending on the speed of the drive and the CPU, it may take up to ten minutes to finish the test. The test data is updated as soon as each task is completed.



Benchtest window with test results displayed

The graph depicts the read/write performance (vertical axis) in relation to transfer size (horizontal axis).



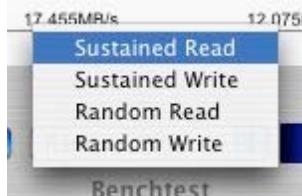
To get the most accurate test results, we recommend that you do not run the Benchtest in the background. Avoid running other CPU intensive applications in the background as this may also affect the results

DRIVE GENIUS 2 USER GUIDE

BENCHTEST

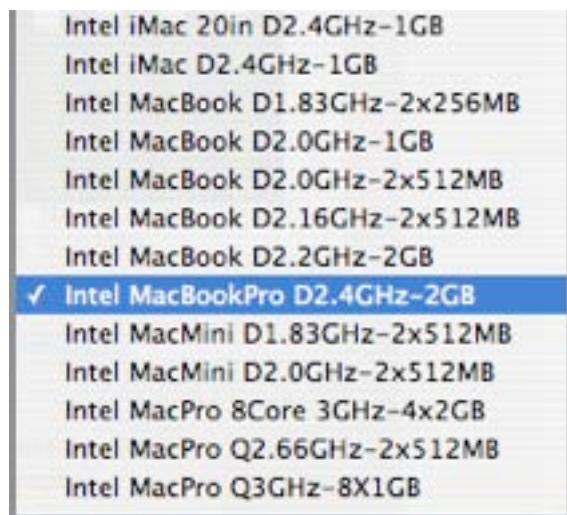
There are various selections to display the test results:

Test Display - Drive Genius 2 performs the following tests: Sustained Read, Sustained Write, Random Read and Random Write. To display any of the tests above, simply select it from the pop-up menu.



Selecting test to be displayed

Comparisons - Drive Genius 2 gives you the ability to compare to other drives as the test is being run and it includes many sets of test data. To select other drives for comparison, click on the Comparison Device pop-up menus on the lower half of the Benchtest window.

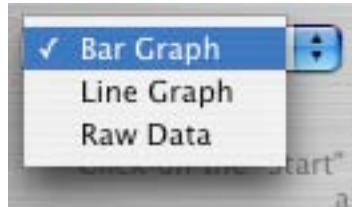


Comparison Window

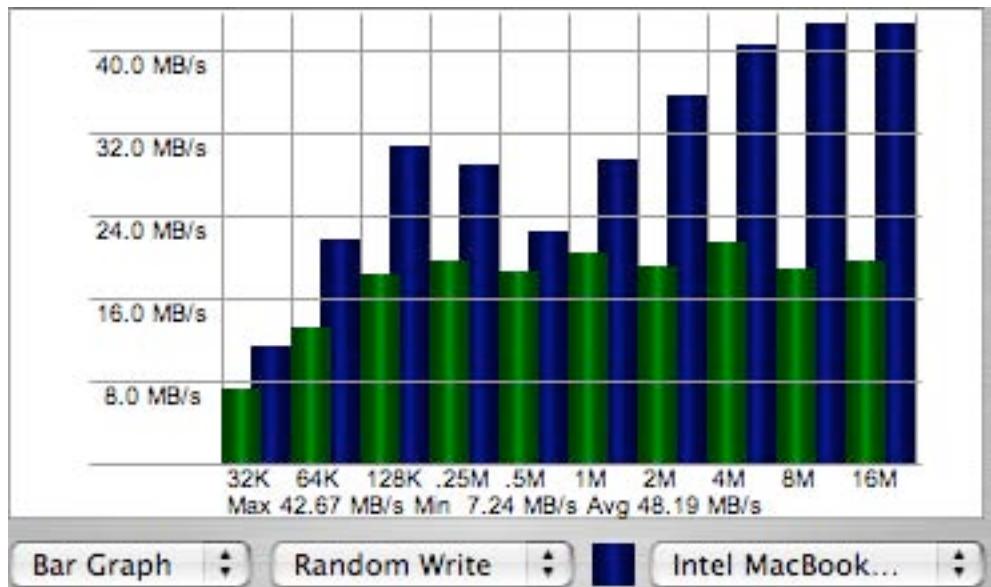
DRIVE GENIUS 2 USER GUIDE

BENCHTEST

Graph Types - Once you have the test results, you can select from a pop-up menu to display the data in various formats. There are three ways to display the data:



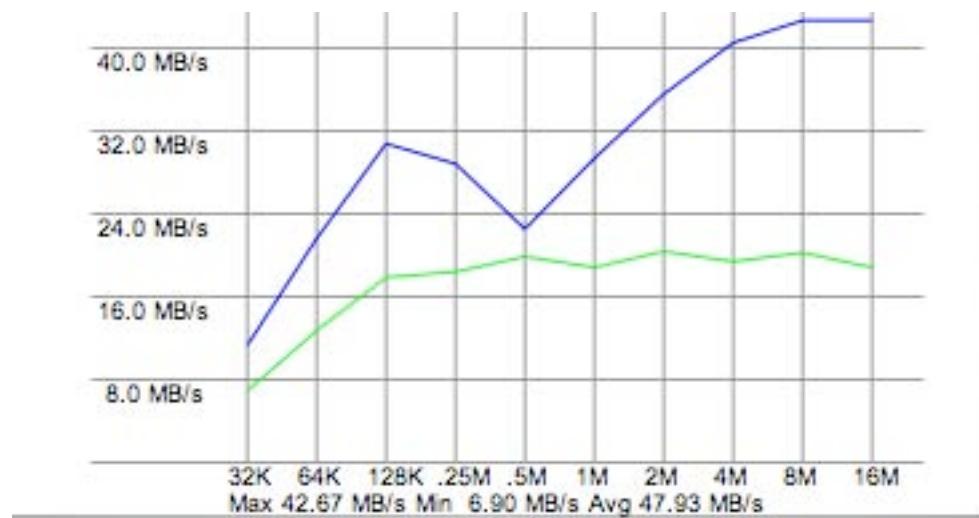
Selecting the type of graph to draw



Bar graph - Draws a bar graph comparing your drive with your choice of a comparison drive.

DRIVE GENIUS 2 USER GUIDE

BENCHTEST



Line graph - Draws a line graph comparing your drive with your choice of a comparison drive.

32K	12.749 MB/s	8.0 MB/s
64K	17.877 MB/s	11.307 MB/s
128K	21.622 MB/s	12.897 MB/s
.25M	30.769 MB/s	17.877 MB/s
.5M	22.535 MB/s	18.391 MB/s
1M	29.358 MB/s	18.824 MB/s
2M	35.556 MB/s	20.382 MB/s
4M	40.506 MB/s	19.394 MB/s
8M	42.667 MB/s	20.253 MB/s
16M	42.667 MB/s	18.824 MB/s

Raw data -- Displays the numerical figures rather than representing the information graphically.

DRIVE GENIUS 2 USER GUIDE

SCAN

Drive Genius 2 Scan is designed specifically to verify that every sector (block which can contain information) on your volume or drive can be read correctly. It is recommended to run this test if you notice abnormal sound emitting from the drive, or the Finder reports some of the files cannot be copied. Drive Genius 2 Scan tests all of your drives data space.

Data on a hard drive is stored in a series of blocks. In usual operation every block of the drive should be able to be written to and read from again. However sometimes a hard drive can develop a problem where one or more blocks may lose storage capacity and become unreadable. Surface Scanning is the process of requesting a read on every block on the drive in sequence and determining if the drive reports an error on any of these requests.

The time required for a Scan test is dependent on the drive's capacity and rotational speed. The blocks are read in sequential order and the operation is performed on all blocks. Drive Genius 2 will not remove or map out bad blocks. If Drive Genius 2 reports any bad block, you may need to reformat the drive with Apple Disk Utility.

To **Scan** your drive:

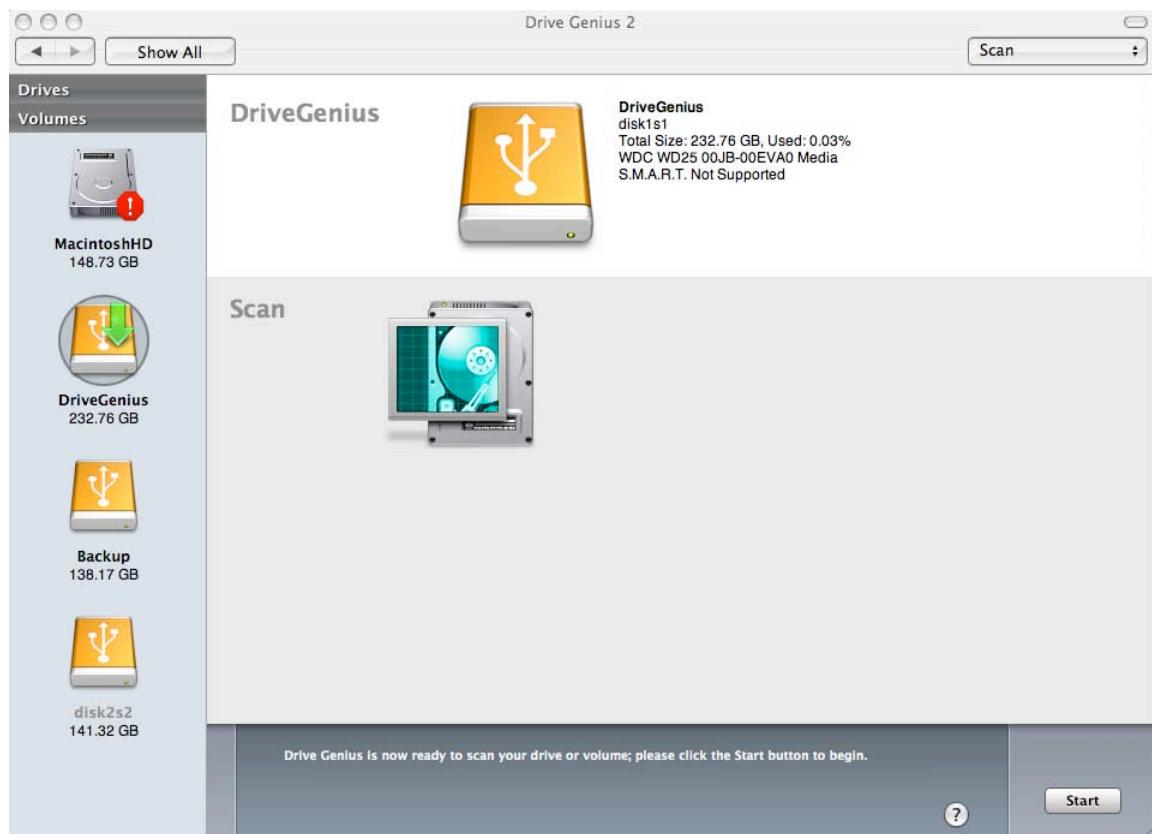
Launch Drive Genius 2.



Click on the Scan icon.

DRIVE GENIUS 2 USER GUIDE

SCAN



Scan window

Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.

DRIVE GENIUS 2 USER GUIDE

INFORMATION

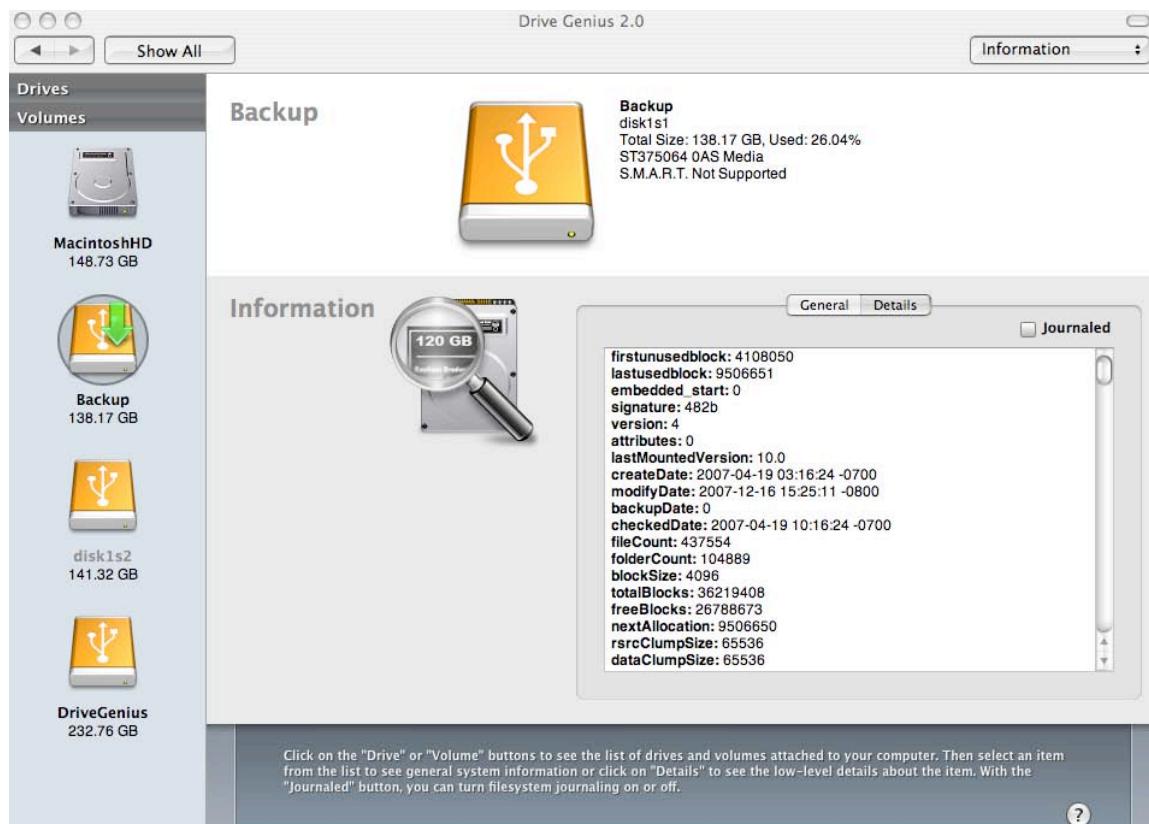
To get **Information** on your drive:

Launch Drive Genius 2.



Click on the Information icon.

Select the volume you want to get Information on by highlighting it.



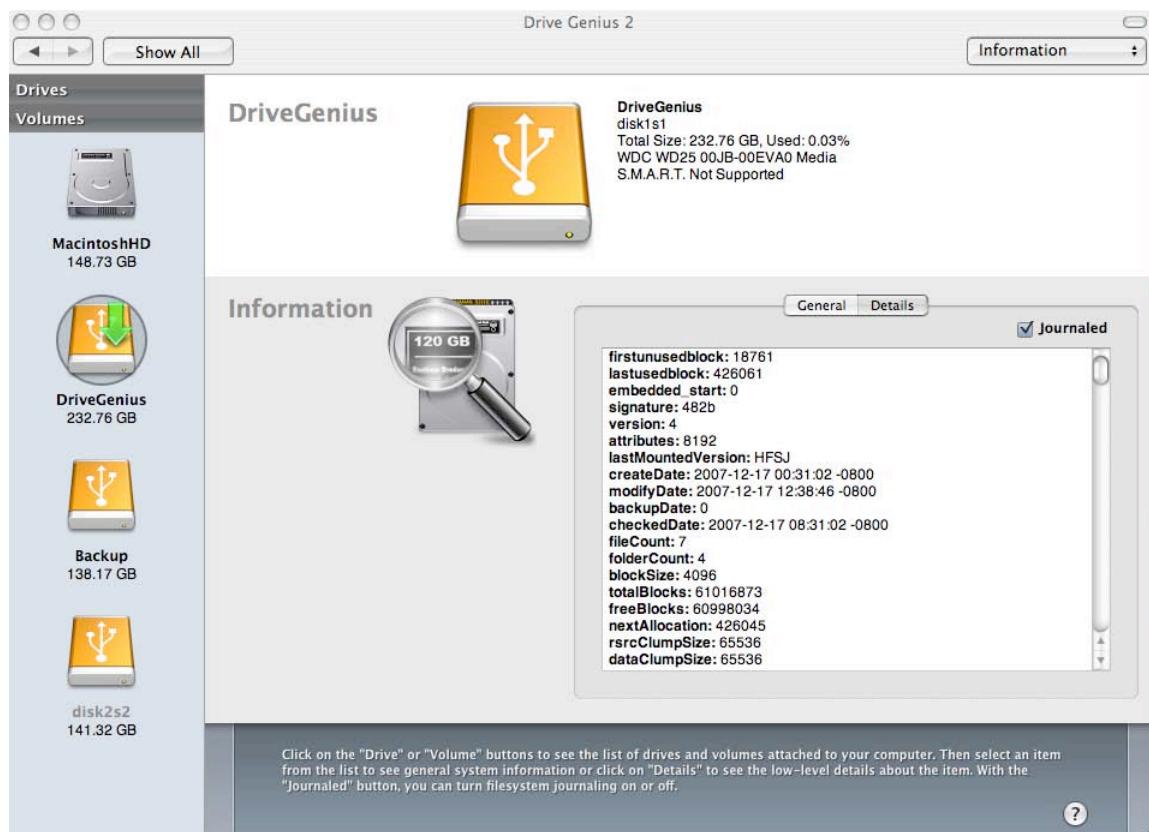
Information Window

The Information window will open, select **General** or **Details** to display information of the volume such as name, total blocks, partition ID and information that expert users will find useful.

DRIVE GENIUS 2 USER GUIDE

INFORMATION

Journaling - Apple's journal file system keeps a log of the hard drive's main data activity. In the case of a crash or other system failure, the file system can retrieve lost data by consulting the "journal" log, restoring the system to its previous state instead of having to go through the lengthy process of rebuilding it. It is important to note that enabling Journaling can potentially slow drive access time down by up to 10%, but can be preferable in situations where data stability is more important than drive access speed.



External drive with the journal system turned on

To turn **Journalized** on/off:



Click the Information icon.

In the Volumes view, select the mounted volume you want journaling to be turned on/off. Check **Journalized** to enable, uncheck to disable.

DRIVE GENIUS 2 USER GUIDE

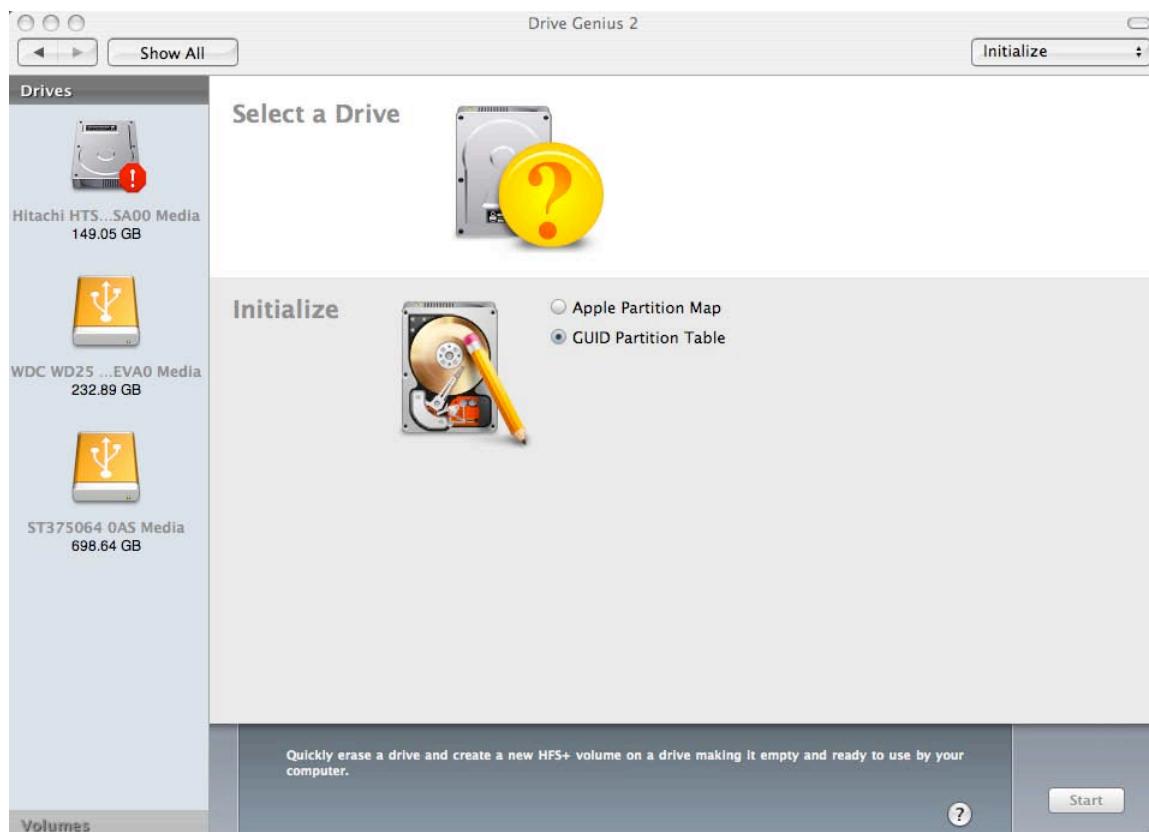
INITIALIZE

Drive Genius 2's Initialize feature is the easiest way to prepare a disk for general use. Most hard drives are already formatted at the factory. However, almost none of them are ready for Mac use. Initialize will:

- Install the Apple driver
- Write a partition map
- Create a new volume and mount it to the desktop

Initializing will wipe out the first few thousand blocks of the drive in order to place a device driver and the partition map on the drive. The rest of the drive is intact but files that were previously on the drive will not be accessible any more. If you accidentally initialize a drive and it contains information that you did not backup, you will need software such as "Data Rescue" to recover the files.

If you are initializing your boot drive or you only have a single drive connected to your system, you will need to boot the system from the Drive Genius 2 DVD.



The Initialize window

To **Initialize** your drive:

DRIVE GENIUS 2 USER GUIDE

INITIALIZE

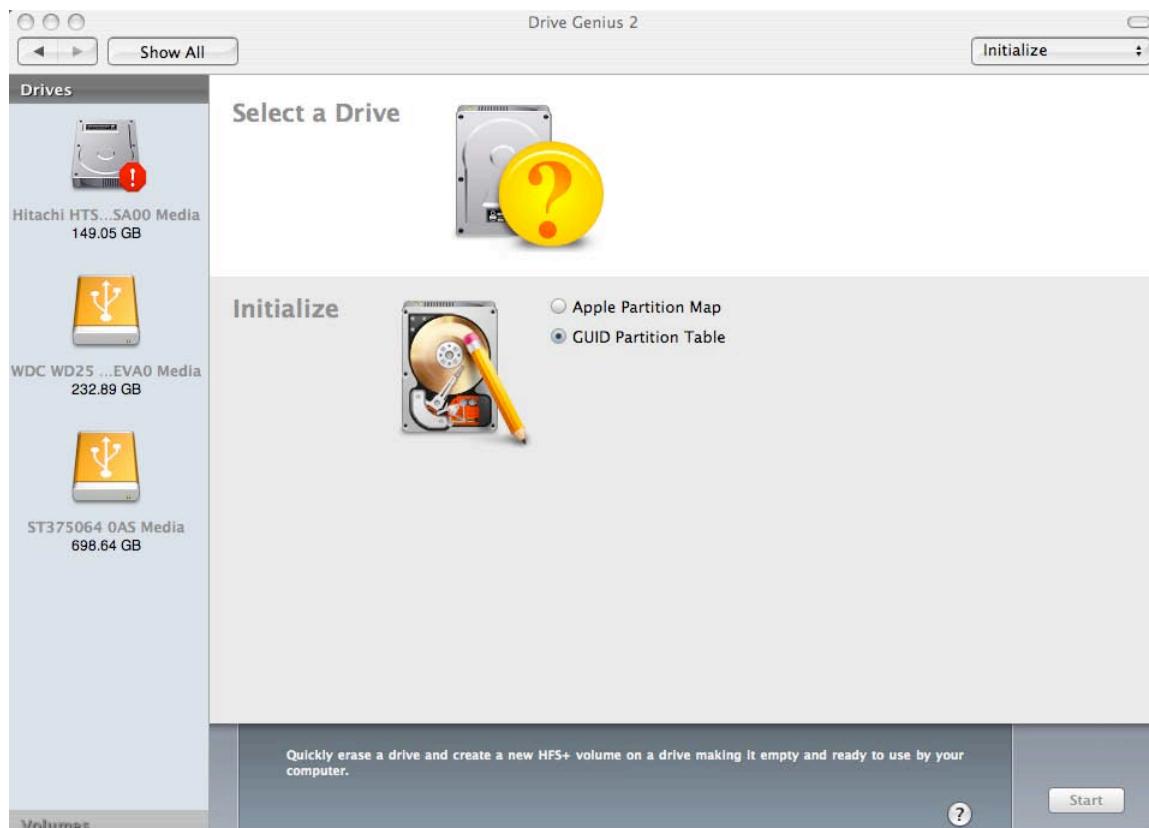
Launch Drive Genius 2 and click on the **green arrow**.



Click the Initialize icon.

Select the drive you want to initialize by highlighting it.

Select Apple Partition Map or GUID depending on which Mac you are using.

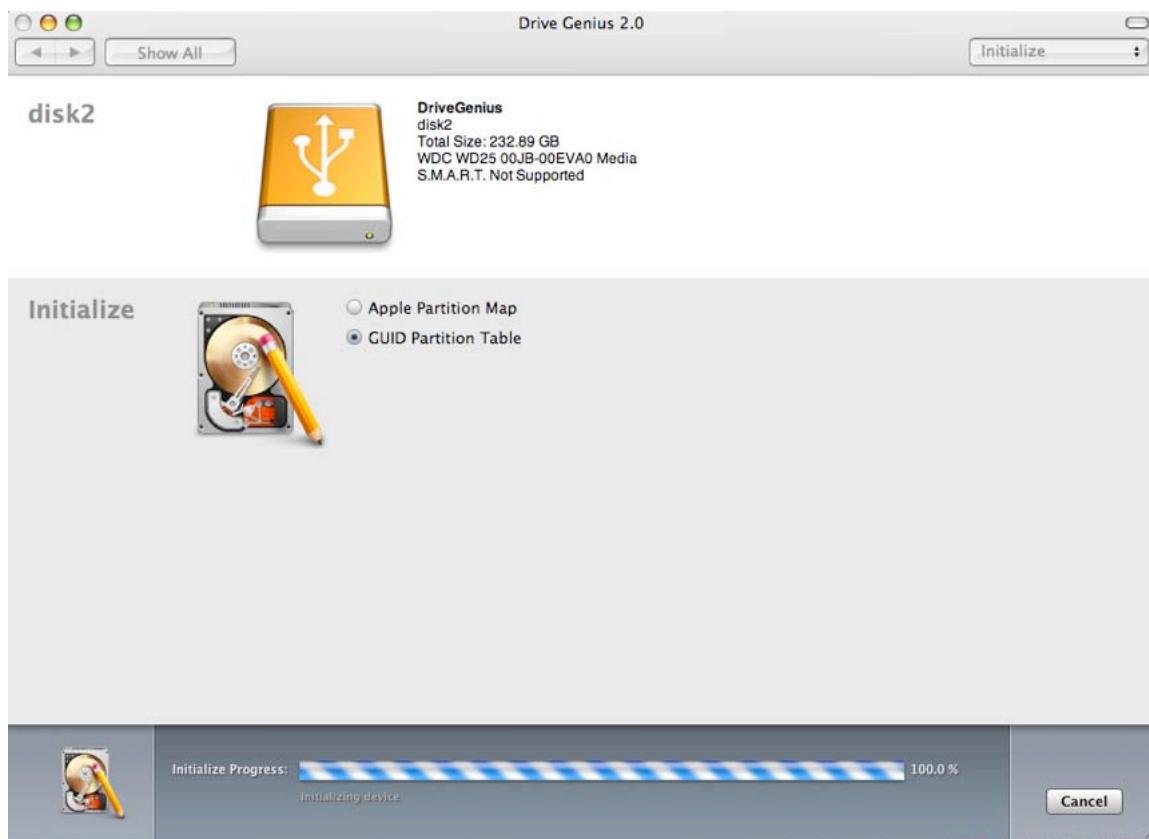


Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.

DRIVE GENIUS 2 USER GUIDE

INITIALIZE



The initialize window

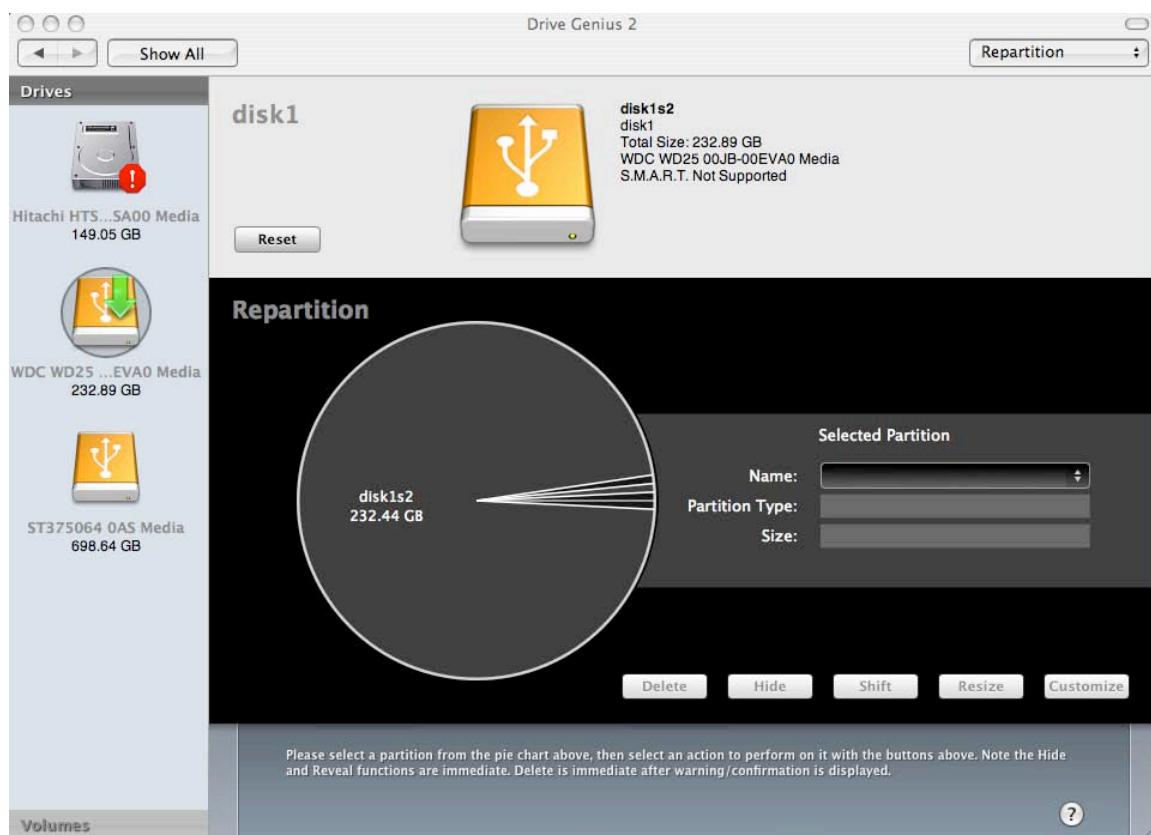
When you are done with initializing the drive, quitting Drive Genius 2 will shut down the computer. To eject the Drive Genius 2 DVD, restart the computer, and press and hold (unless other method specified) the mouse button. If initializing an external drive select "Done" to exit the operation.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

Repartition enables you to resize and manage partitions (volumes) on your hard drives. Unlike traditional methods of backing up, erasing and repartitioning the drive, Drive Genius 2 allows you to expand or shrink partitions without erasing them.

Drive Genius 2 is extremely easy to use. In just a few clicks, Drive Genius 2 will defragment and resize your partition to the size of your choice. You can use the Repartition feature to create and delete partitions. Drive Genius 2 includes many custom icons that can be automatically applied to your newly created partition. The Repartition feature can hide partitions from users as well. Last but not least, the feature also has the ability to shift a partition on the hard drive in addition to reconstructing partition maps.



Drive Genius 2' Repartition window



We have made Repartition a feature that is extremely easy to use. However, we strongly recommend you read the following few sections. The Repartition feature is extremely powerful and will have a negative effect on your drive if not used correctly.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

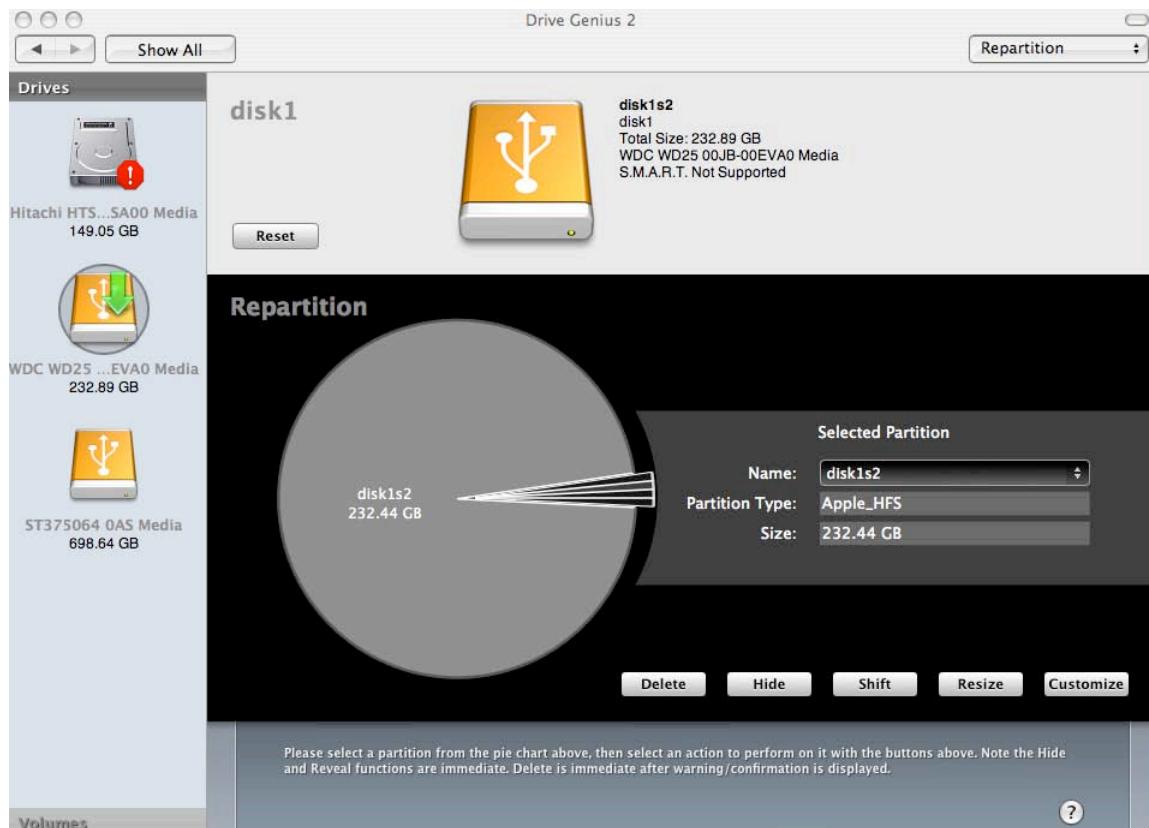
To run **Repartition** from your hard drive:

Launch Drive Genius 2 and click on the **green arrow**.



Click on the  Repartition icon.

From the Drives view, select the drive you want to repartition.



Selecting a drive to repartition



Repartition is designed to work with OS X partitions. Using it on OS 9 volume may remove the ability to start up OS 9 from that partition. It does not affect the data on OS 9 volumes at all.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

There are 3 key areas in the main window:

Partition pie chart - the pie chart shows all the partitions on the currently selected hard drive. The pie chart will also show hidden partitions and partitions with file systems not supported by the OS. Free space contains no data.

Drive Name and Icon – at top of window, name of the drive, the drive's icon and the total size of the drive.

Context-sensitive help - provides help and descriptions of the current active screen.



Prosoft recommends that you back up your data before using Drive Genius 2; that way, if anything goes wrong (virus, power blackout, OS error, or hardware failure etc...), you will be able to recover your data.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

Icon Buttons - the icon buttons shown at the bottom of the Repartition window are used to perform most of the functions within the program:



Provides information on Drive Genius 2' features and step-by-step instructions for performing specific tasks.

Reset

Resets the partition map to regain the extra space wasted during a hardware device-to-device copy.

Add

Add a new volume to the drive.

Delete

Delete a partition from your drive.

Hide

Hide partitions on your drive.

Reveal

Reveal partitions on your hard drive.

Shift

Shift volumes without requiring you to erase them.

Resize

Resize (expand or shrink) your OS X partitions without requiring you to erase the volume.

Customize

Allows you to customize your new volume (icons used with the kind permission of <http://www.iconizer.com/>).

DRIVE GENIUS 2 USER GUIDE

REPARTITION

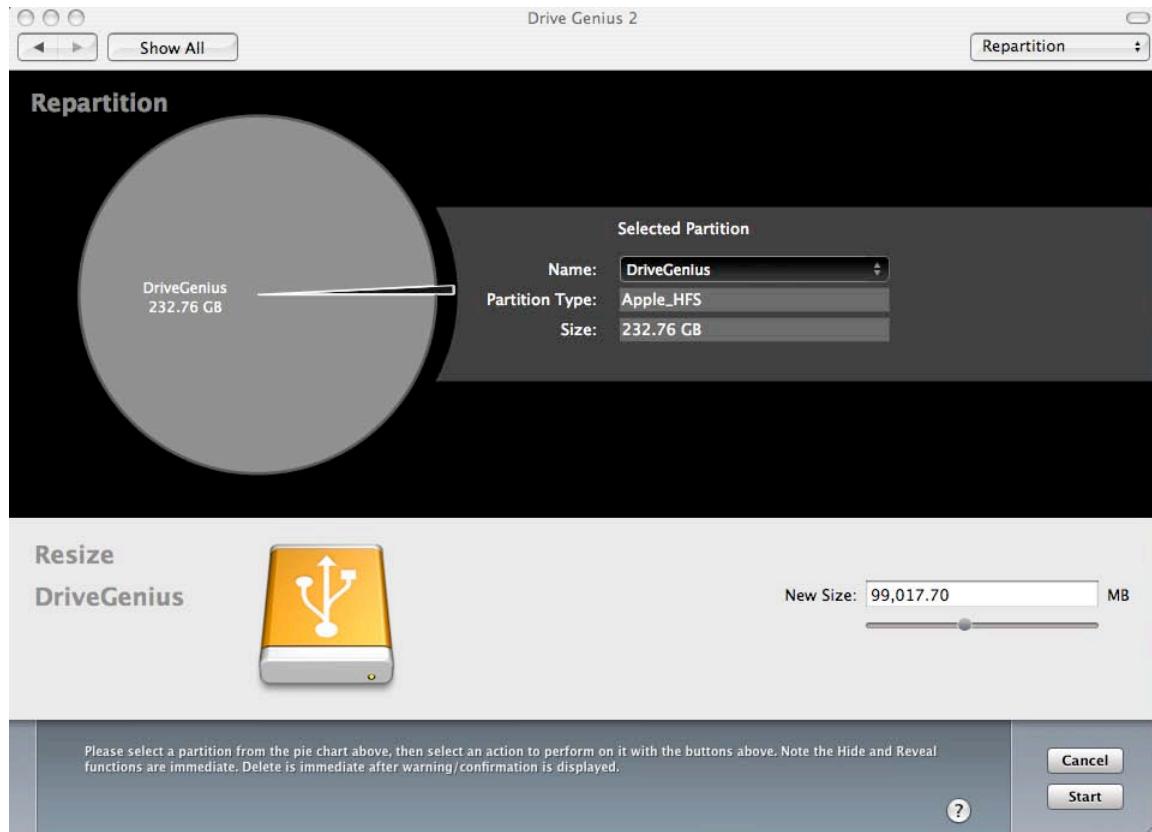
Resize allows you to resize your OS X disk partitions (volumes) without requiring you to erase the volume. Partitions can be shrunk in order to make room for a new partition, or they can be expanded to take advantage of free space on the drive.

To shrink a volume:

On the Repartition window, select the volume/partition you want to work on by highlighting it.

Click the  button.

You will be presented with the dialog as shown below.



The Resize sheet

Use the slider to select the new size of your partition and click **Start** to continue. You can also type in the new size of the partition. Please note that you cannot make a volume smaller unless it has unused space.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

If you are shrinking a partition and the data needs to be defragmented, a new window will pop up for the defragmenting process.



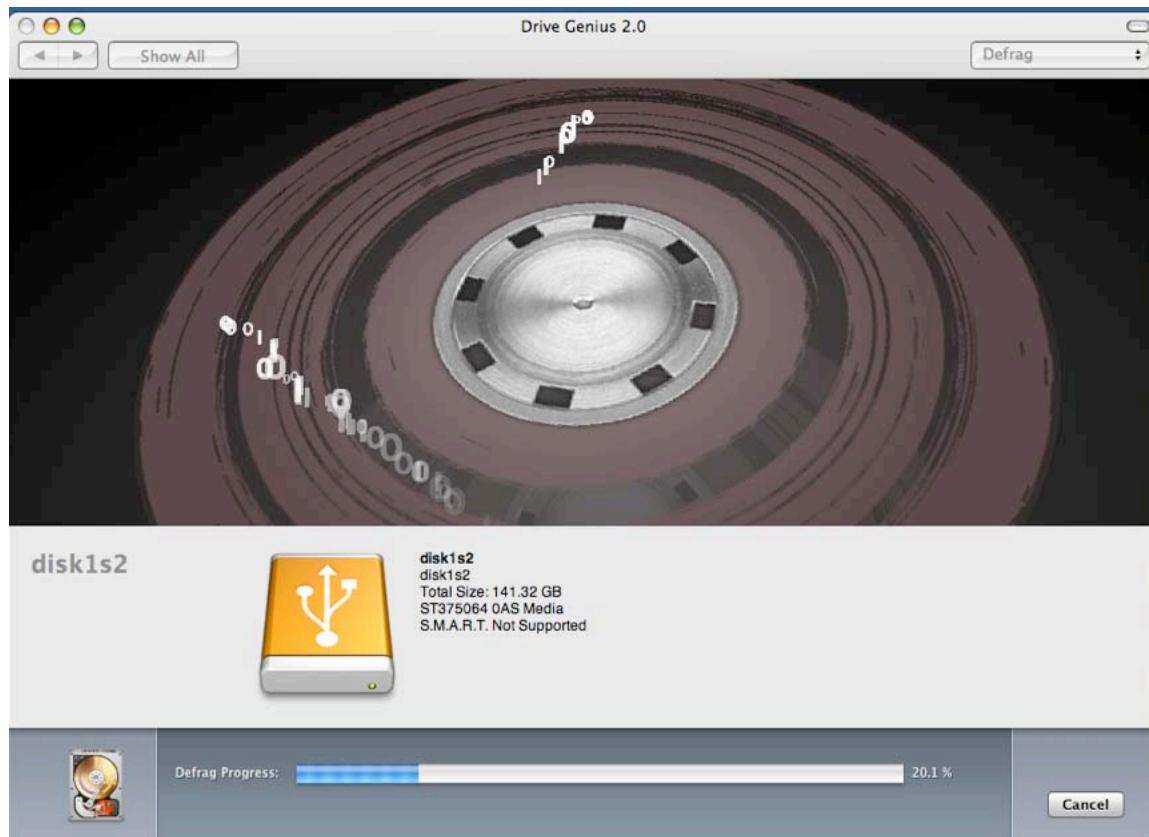
Click the **Continue** button to proceed.

To cancel, click on the **Cancel** button.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

Once the volume integrity is verified by Drive Genius 2, the defrag process begins.



Defrag in progress

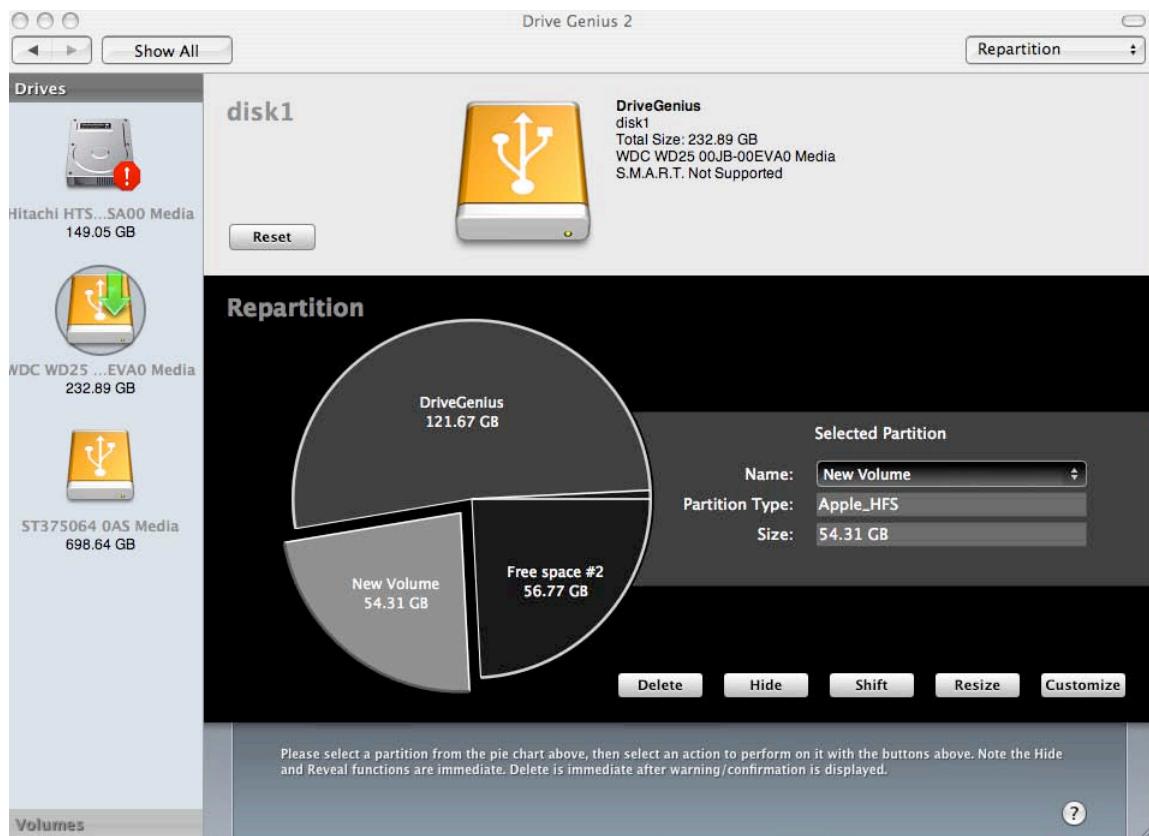


It can take from half an hour to a day to defrag a high capacity drive (depending on how fragmented it is). The end of the day is a great time to kick this maintenance routine off.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

After the operation is completed, a new free space partition will be present.



Volume is resized down



Prosoft recommends that you back up your data before using Drive Genius 2; that way, if anything goes wrong (virus, power blackout, OS error or hardware failure etc...), you will be able to recover your data.

DRIVE GENIUS 2 USER GUIDE

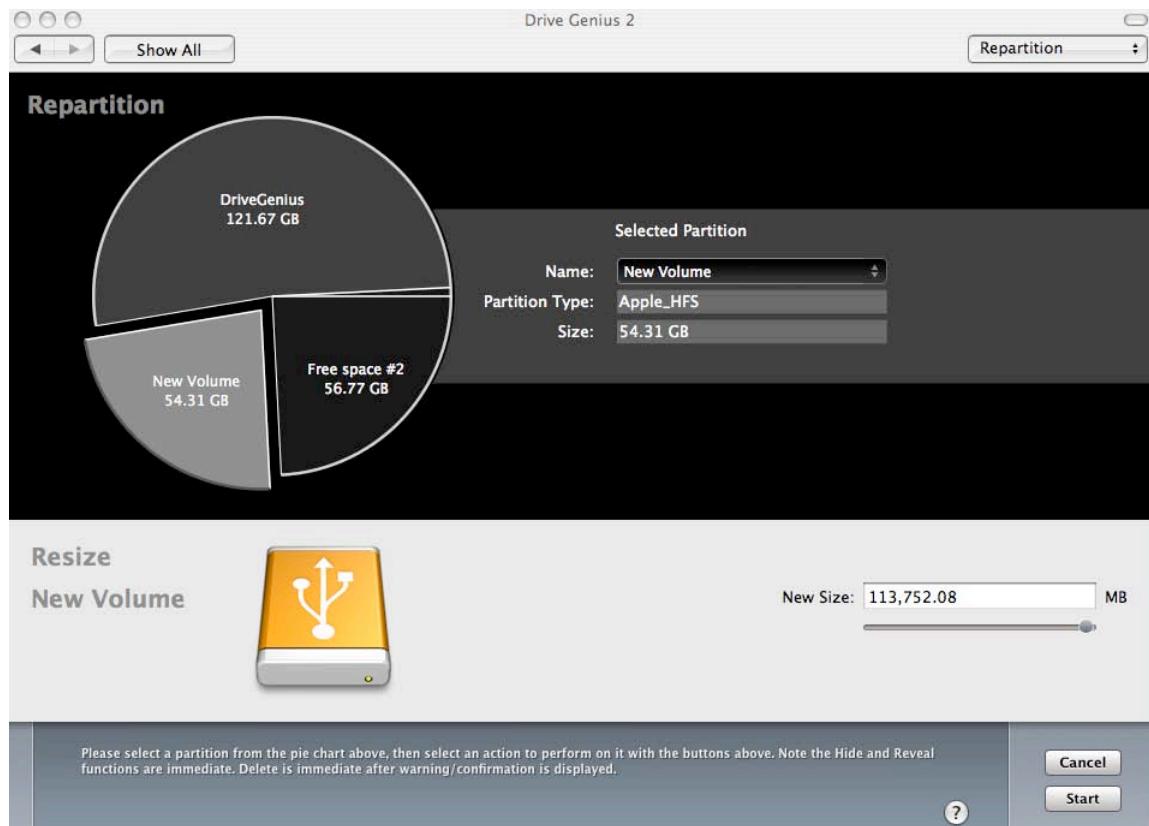
REPARTITION

To expand a volume:

Resize

Click the **Resize** button.

Select the volume you want to expand by clicking on it.
You will be presented with the window shown below.



Selecting a volume to expand

Use the slider to select the new size of your partition. Notice that 'New Size' of 113,752.08 is now the combined size of 54.31gb + 56.77gb.



You will need to have free space counterclockwise to the volume you want to expand. You cannot expand a volume if there is no Apple_Free space adjacent to it.

DRIVE GENIUS 2 USER GUIDE

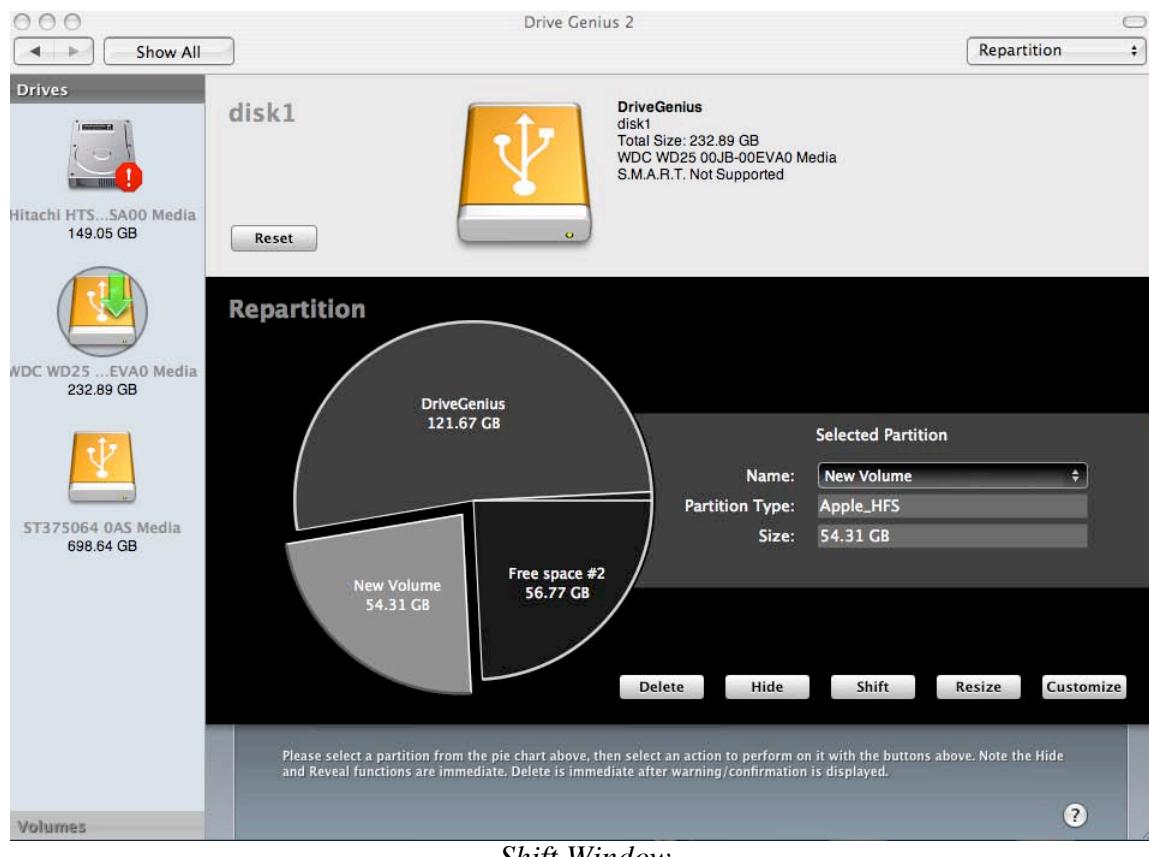
REPARTITION

Drive Genius 2 allows you to shift disk partitions (volumes) without requiring you to erase the volume. Partitions can be moved clockwise and counterclockwise on the hard disk allowing you to combine free spaces into one. When you shift a partition, the partition's data is unaffected. The free space adjacent to the partition will determine how far forward or backward you can move the partition. If there is no free space adjacent to it, the partition cannot be moved. Additionally, you cannot move an Apple_Free partition.

To Shift a Volume:

Shift

Click the **Shift** button.

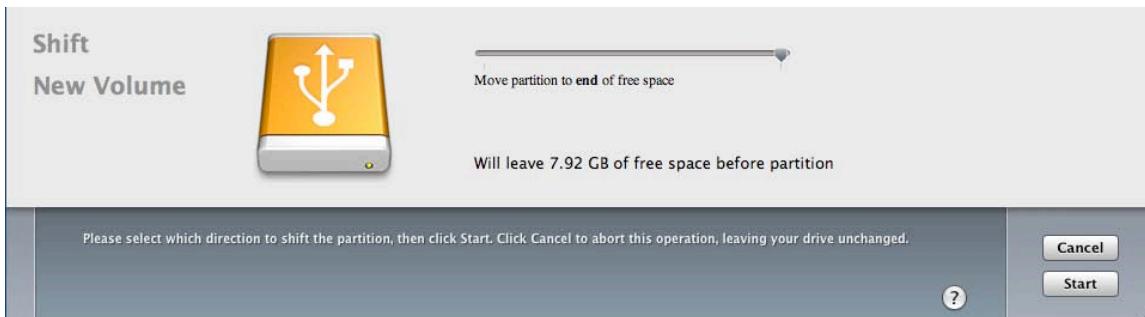


Shift Window

DRIVE GENIUS 2 USER GUIDE

REPARTITION

If you want to shift the partition to move the space to **start** or **end** of current volume, move the slider.



Once you have selected a direction you will be presented with the following dialog:

“Move partition to **start** of free space”. Will leave free space after the partition.

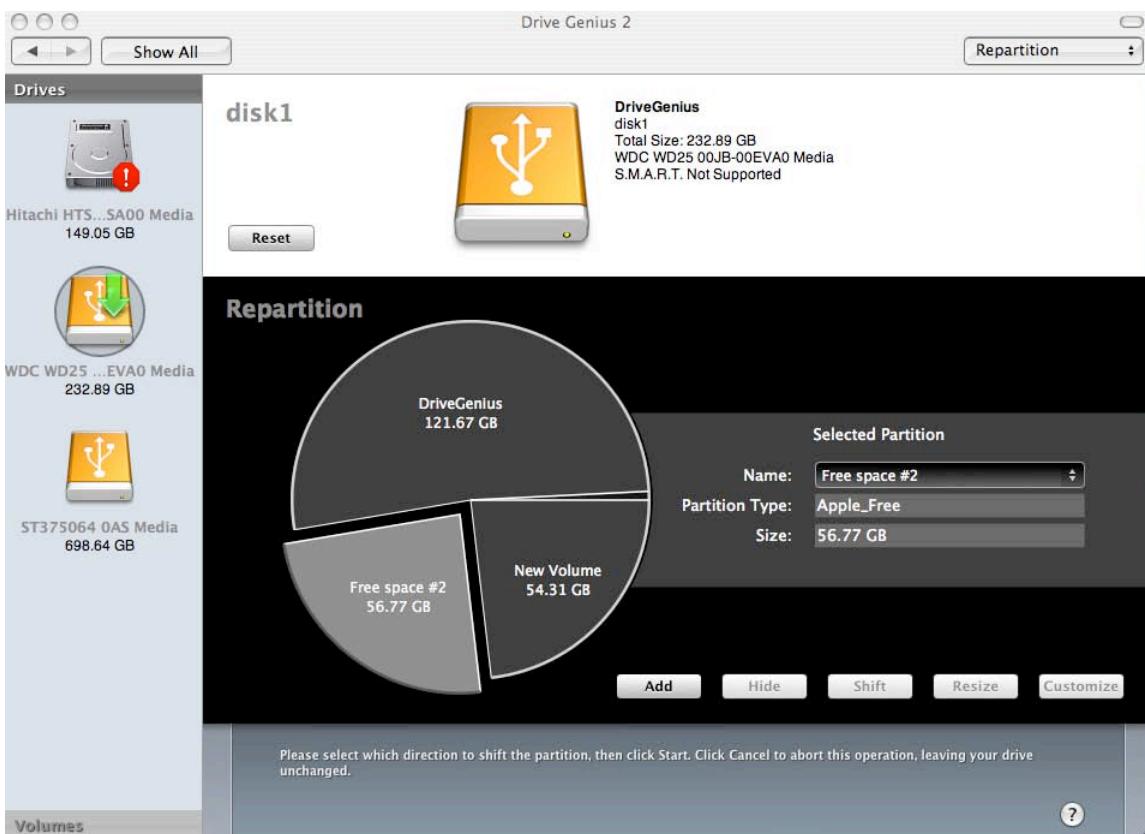
if you move the slider to left:

“Move partition to **end** of free space”. Will leave free space before the partition.

Click the **Start** button to proceed.

DRIVE GENIUS 2 USER GUIDE

REPARTITION



After the shift



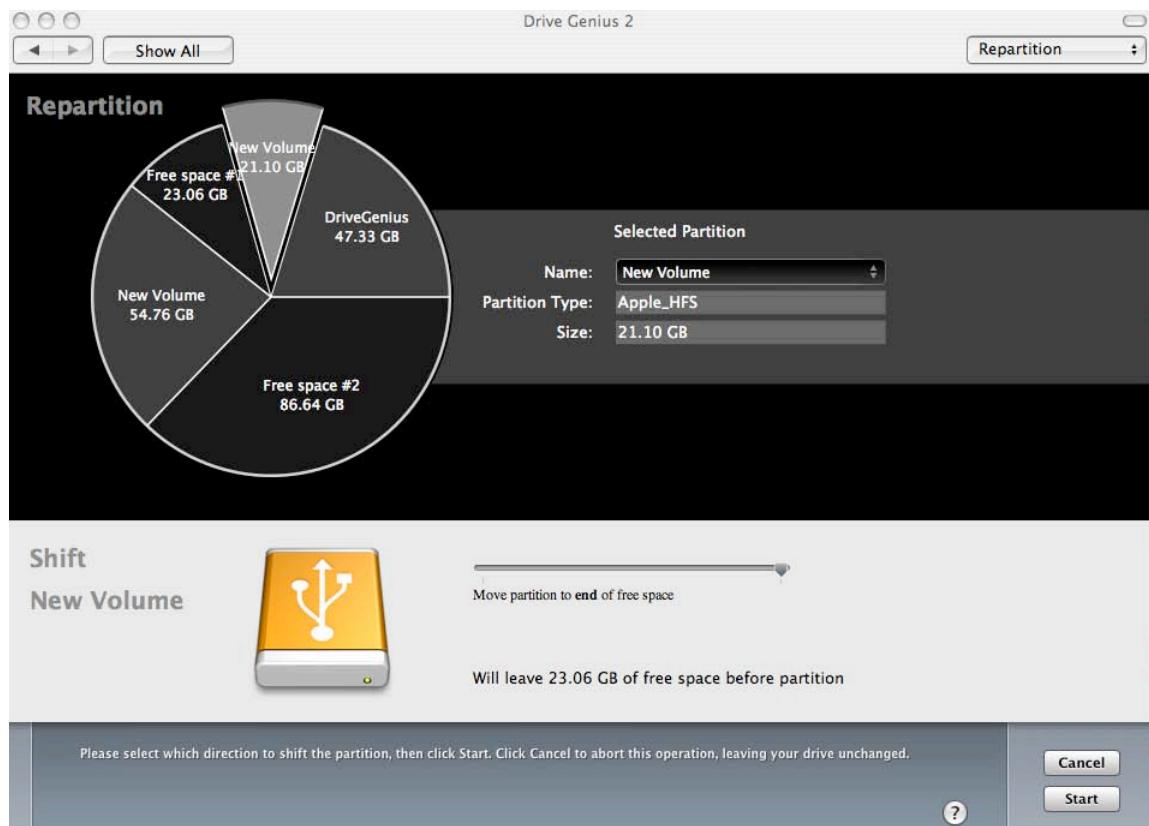
Prosoft recommends that you back up your data before using the shift function of Drive Genius 2; that way, if anything goes wrong, you will be able to recover the data. Once started, the shift process cannot be interrupted.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

Using Partition Shifting before expanding a volume

To expand a volume, in the Repartition pie chart you will need to have free space adjacent (counterclockwise) to the volume you want to expand. You cannot expand a volume if there is no Apple_Free space counterclockwise to it. If the Apple_Free_Space is clockwise to the volume you want to expand, you will need to shift the volume before expanding the volume.



The second partition needs to be shifted

As an example: To expand the 47.33GB volume, the 21.10GB volume will need to be shifted counterclockwise; this will shift the 23.06GB of Free Space adjacent to the 47.33GB Drive Genius volume. To do this, select the 21.10GB partition and click the Shift button. Then click the Start button. When completed, the newly moved partition can be expanded.

Creating and Deleting Volumes

Drive Genius 2 allows you to create or delete a volume on your hard drive. The Delete operation deletes a volume and destroys all its data. This partition will be marked as "free space" until you create a new volume or expand an existing volume.

To **Delete** a volume:

Select the volume you want to delete by clicking on it.

Delete

Click the **Delete** button.



Once you delete a volume, the data will not be available for further use.

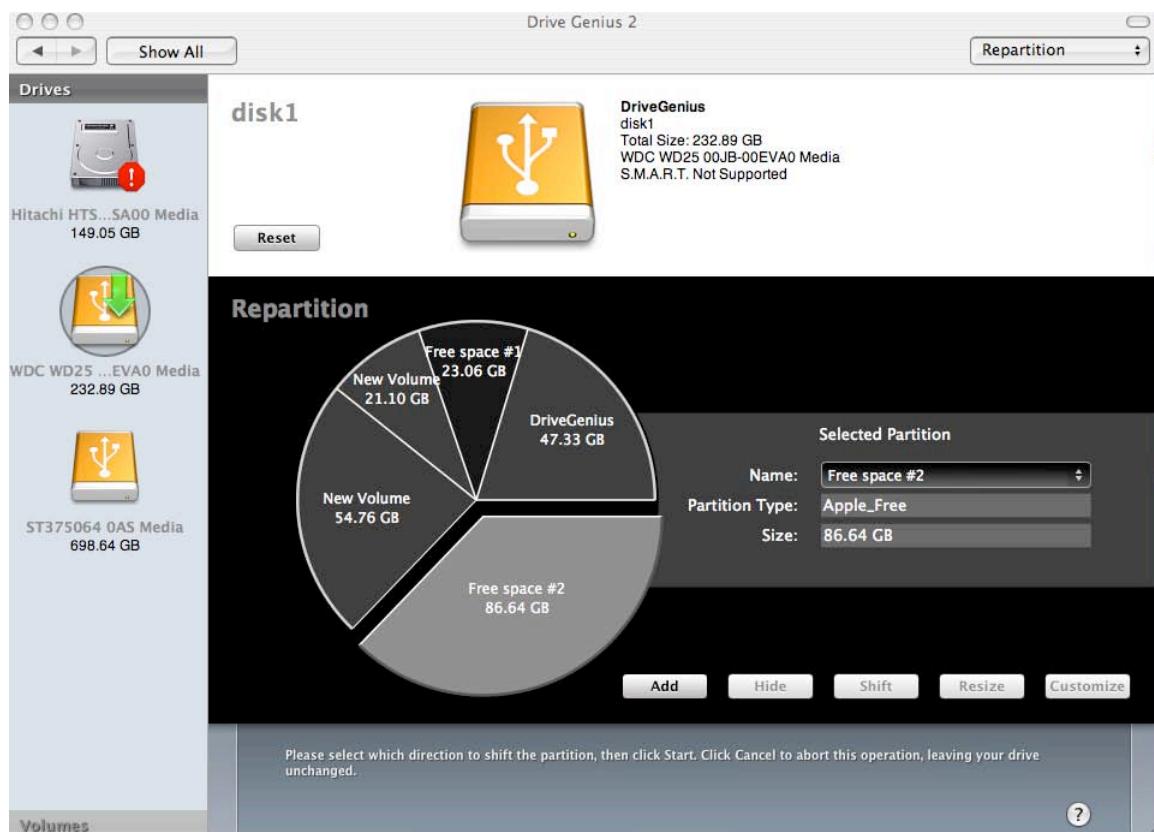
To create a new volume, free space must exist on the drive. If there is no free space, you will need to use resize to shrink a current volume, to open up free space for the volume creation process.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

To **Create** a volume:

Select the free space partition or volume you want to create a new volume on.



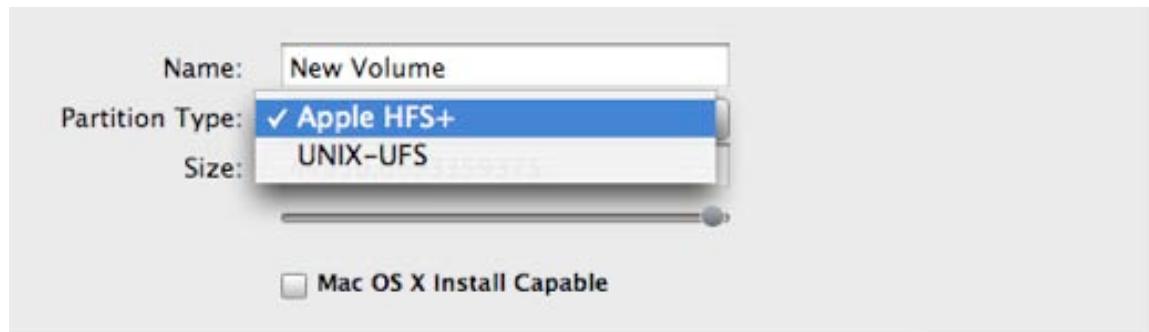
Selecting a free space to create a volume

Click the **Add** button.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

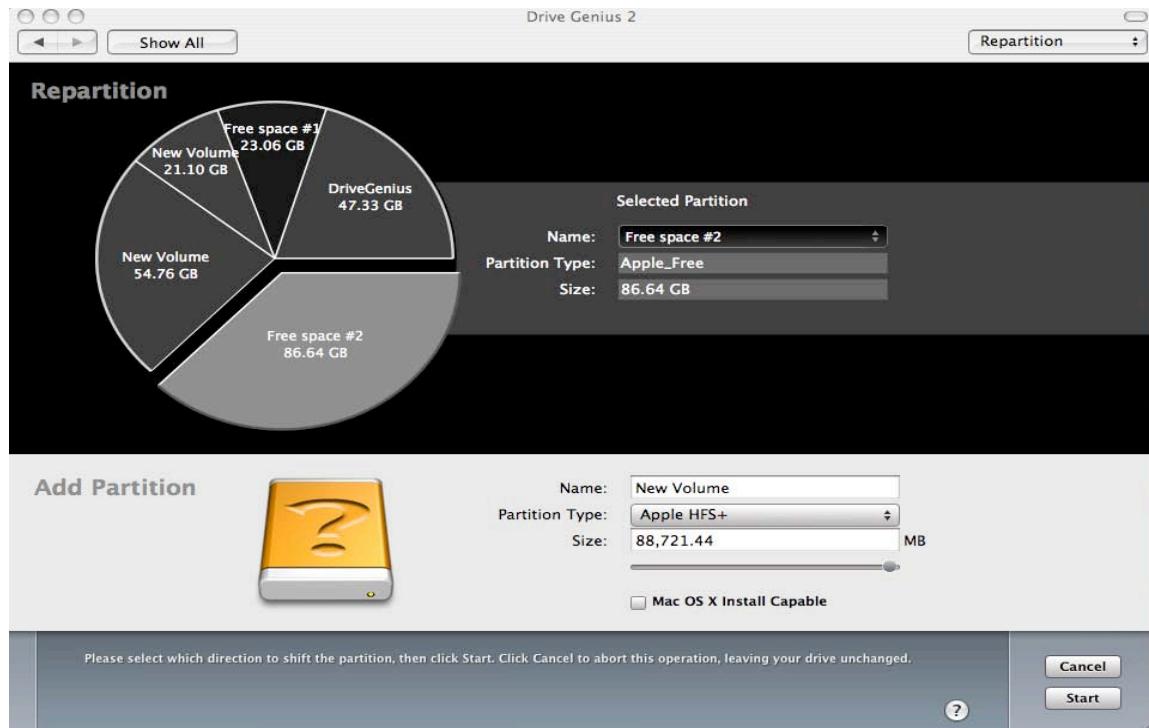
Use the slider to select the new size of your volume. You can also assign a Name to the new volume and select Partition Type.



Partition Type Window

If you are running the application on the hard drive instead of the bootable DVD, you can customize your new volume (icons used with the kind permission of

<http://www.iconizer.com/>) by selecting the Customize **Customize** icon.



Create volume window

Click the **Start** button to proceed.

To cancel, click on the **Cancel** button.

Resetting the Partition Map

After performing device-to-device disk copy using hardware such as Disk Jockey™ from Diskology™, the partition map on your new hard drive will not allow full access to all the space. For example, if you use Disk Jockey to copy a 20GB drive to a brand new 60GB drive, the 60GB drive will show up on the Macintosh as a 20GB drive. Using Drive Genius 2 to reset the partition map allows you to reclaim the 40GB of extra space.

To reset the partition map:

Click the  button.

DRIVE GENIUS 2 USER GUIDE

REPARTITION

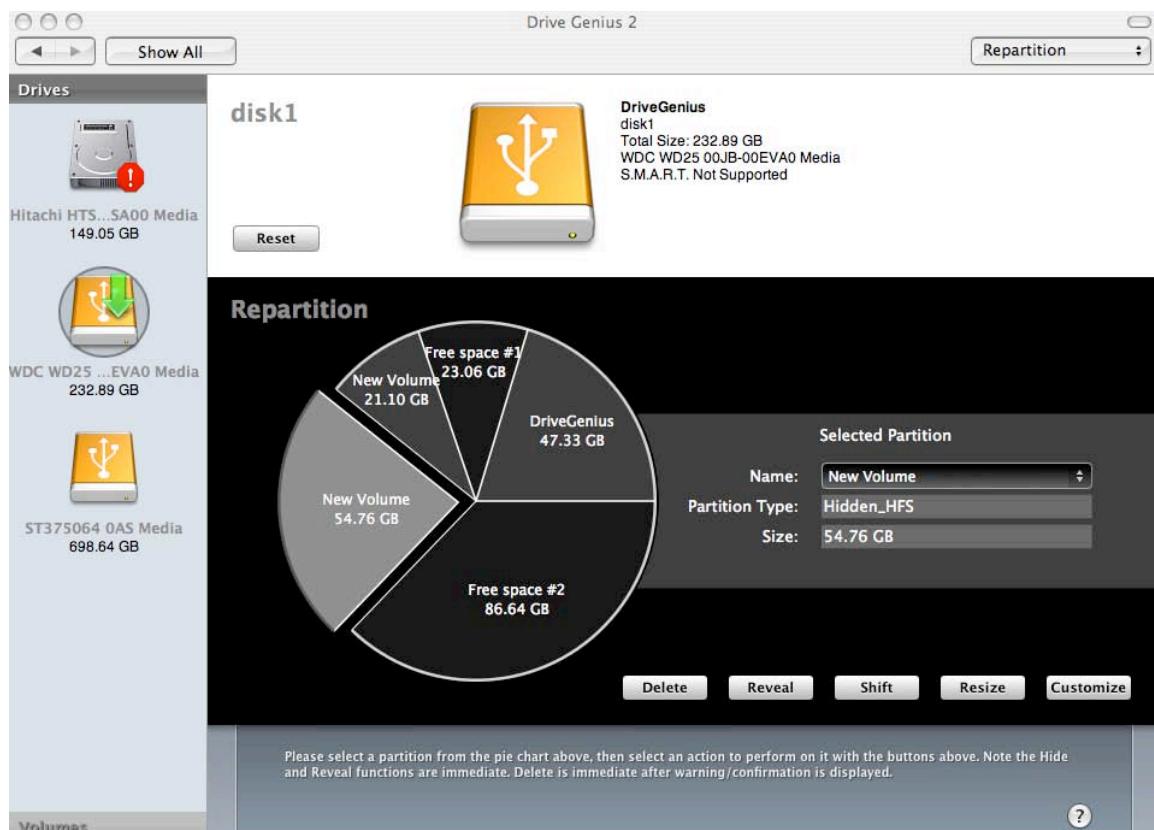
Hiding and Revealing Volumes

You can use Drive Genius 2 to hide and reveal volumes on your hard drive. The Hide volume operation allows you secure volumes against unwanted user access. Hidden volumes will not be visible under normal circumstances and will not mount automatically.

To Hide a volume:

Hide

Click the **Hide** button.



After applying the hide function

To **Reveal** a volume:

Reveal

Click the Reveal **Reveal** button.

DRIVE GENIUS 2 USER GUIDE

QUESTIONS AND ANSWERS

Q. Should the sleep mode be disabled prior to running the Duplicate or Defrag?

A. Yes, if the sleep mode is activated during a delicate write operation this could result in data loss. (Always, be sure to backup your hard drive first)

Q. Why can't I run the Defrag, Duplicate or Repair when launching Drive Genius from my hard drive?

A. In some cases, in order for Drive Genius to run certain operations Drive Genius must unmount the drive. Therefore it is recommended you boot to the Drive Genius DVD.

Q. What is the "Mac OSX Install capable" option in the Repartition>Add operation?

A. The "Mac OSX install capable" option leaves 128MB of free space before a partition so you can install OS X on that part. This is required by Apple's installer.

Q. In Repartitioning, you list UNIX-UFS, are there any restrictions for selecting this?

A. Yes, UNIX-UFS Volumes cannot be added, hidden, resized, or customized. However, UFS Volumes can be shifted or deleted to manipulate free space.

Q. Does Drive Genius 2 work with MSDOS/bootcamp?

A. No, MBR and MSDOS Partition formats are not supported by Drive Genius 2 and cannot be selected.

Q. Can Drive Genius 2 copy the active startup volume/device to another hard drive?

A. No, Drive Genius 2 requires the source and the target volumes to be unmounted before proceeding with the duplication. Use the OS X boot DVD to copy your main drive.

Q. Does the target volume/device have to be *larger* than the source volume/device?

A. Yes, the target volume has to be the same or larger than the source volume.

Q. Will Drive Genius 2 report a problem if the source volume/device is corrupted?

A. No. Since Drive Genius 2 uses a bit-by-bit copy, every problem will be copied over.

Q. Will Drive Genius 2 work with RAID drives?

A. No. The current version of Drive Genius 2 will not work with any RAID arrays.

DRIVE GENIUS 2 USER GUIDE

QUESTIONS AND ANSWERS

Q: Can I use Drive Genius 2 on OS 9 partitions?

A: Drive Genius 2 is designed to work with OS X partitions. Using Drive Genius 2 on OS 9 volume will remove the ability to start up OS 9 from that partition. Drive Genius 2 does not affect the data on OS 9 volumes at all.

Q: I am trying to resize a volume on the startup disk, and Drive Genius 2 gives an error with the message “Unable to unmount”. What gives?

A: In order to modify a volume on the startup disk, you will need to startup from another disk, and run Drive Genius 2 there. Alternatively, you can purchase a bootable DVD from us.

Q: I have 2 partitions with data on my drive. Can I merge them into one partition?

A: Drive Genius 2 cannot do volume merging for now. We are looking into adding the feature in a future version.

Q. Does Drive Genius 2 ‘partitioning without erasing feature’ mean I do not need to backup my data?

A: Changing information on a volume involves some risk. Drive Genius 2 endeavors to ensure that there is no possibility of data corruption during the resizing process. No safety system can beat the security of having a backup.

Q. If I hide a partition using Drive Genius 2, is the partition secure?

A: No, the partition can be easily made visible again by using Drive Genius 2. The hidden mode is designed as a simple/convenient way to hide your data from prying eyes.

Q. I notice there are a few tiny partitions created on my HD when I ran Drive Genius 2 partitioning feature. What are they for? What can I do with them?

A: Unfortunately, the small partitions were created by Apple (OS 10.3 or higher). We have no control over it. Disk Utility leaves big gaps between partitions both in front and behind the space used by volumes. Drive Genius 2 exposes these tiny volumes when it works on the partition map. Drive Genius 2 does not create them, and you can use it to expand a volume or two, to take over them.

Q. I need technical support help, what should I do?

http://prosoftengineering.com/contact_us.php

Tel: 925.426.6306

Fax: 925.426.6309

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ADVANCED INFORMATION ABOUT OPTIMIZATION AND FRAGMENTATION

The following document is a discussion of optimization and defragmenting. The content of this is based on a web page apple publishes on their own site which can be found at <http://docs.info.apple.com/article.html?artnum=25668>



Drive optimization is a process in which the physical locations of files on a volume are "streamlined." Files and metadata are re-arranged in order to improve data access times and minimize time moving a hard drive's head.

Files can become "fragmented" over time as they are changed and saved and as the volume is filled, with different parts of a single file stored in different locations on a volume. The process of collecting file fragments and putting them "back together" is known as optimization.

Do I need to optimize?

You probably won't need to optimize at all if you use Mac OS X. Here's why:

Hard drive capacity is generally much greater now than a few years ago. With more free space available, the file system doesn't need to fill up every "nook and cranny." Mac OS Extended formatting (HFS Plus) avoids reusing space from deleted files as much as possible to avoid prematurely filling small areas of recently freed space.

Hard drive capacity is increasing. Real world analysis shows that users still operate close to their total capacity. File size is increasing at a rate seemingly higher than drive capacity is.

Regular use of a drive with the creation of media files from digital video cameras, multi mega pixel images from still cameras and higher quality music files can and will cause a drive to be operated near it's total capacity.



Mac OS X 10.2 and later includes delayed allocation for Mac OS X Extended-formatted volumes. This allows a number of small allocations to be combined into a single large allocation in one area of the drive.

Apple's innovation has greatly improved this process. It should be stated that in order for this to be successful it needs "a single large allocation in one area of the drive" It is for this reason that the defragment module of the Genius range of software focuses on creating exactly that.



Fragmentation was often caused by continually appending data to existing files, especially with resource forks. With faster hard drives and better caching, as well as the new application packaging format, many applications simply rewrite the entire file each time. Mac OS X 10.3 Panther can also automatically defragment such slow-growing files. This process is sometimes known as "Hot-File-Adaptive-Clustering."

This is correct. Fragmentation in the modern times is caused by the creation of larger files, then deletion, copying and moving of files. This has a tendency (caused by the "Hot-File-Adaptive-Clustering.") to create large chunks interspersed with smaller available allocation areas. The technology developed in the defragment module of the Genius range of software will move the file chunks in order to join the many free ranges into one larger range... ready for the next "Hot-File-Adaptive-Clustering."

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Aggressive read-ahead and write-behind caching means that minor fragmentation has less effect on perceived system performance. Read-ahead caching is excellent at providing fast access to information that is contained in the same track or neighboring tracks to the data that was requested. It is not terribly useful on data that is fragmented randomly across the entire platter.

For these reasons, there is little benefit to defragmenting.

The new technologies added by Apple to the HFS+ file system are an excellent upgrade to the OS X operating system. To assist them has taken new thinking and new development for Apple and for third party developers.

The defragment module of the Genius range of software was designed specifically to augment the new capabilities of the OS X operating system. Particular focus has been placed in creating “a single large allocation in one area of the drive” as required by Apple.

Users who create and/or use large media files also benefit from “a single large allocation in one area of the drive” in which to create the new file.



Mac OS X systems have hundreds of thousands of small files, most of which are rarely accessed. Optimizing them is a major effort for very little practical gain. There is also a chance that one of the files placed in the “hot band” for rapid reads during system startup might be moved during defragmentation, which would actually decrease performance.

If you think you might need to defragment, try restarting first.

This is good advice (as always). This would also be an ideal time to boot from the Drive Genius 2 DVD to have a graphical view of file fragmentation given to you. It may also be a good time to use the volume duplicate function to create a backup of your important data.

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EXPANDING A DRIVE IN WINDOWS XP

To expand a disk in Windows XP after using **Device Duplicate**:

Running Windows XP with the new drive hooked up, open a command prompt window by selecting Start Menu: Programs: Accessories: Command Prompt

Run the Diskpart utility by typing in "diskpart".

List the volumes available on the system by typing "list volume" at the prompt.

Select the volume to expand by typing in "select volume #" at the prompt - where # is the volume number displayed in the volume list.

Expand the volume to include all free space on the disk directly after the selected volume by typing "extend" at the prompt.

Unless DISKPART reported an error, the volume will be extended (type "list volume" at the prompt again and it will show the new size of the volume).

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MOVING THE SWAP FILE IN OS X

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This page is www.math.columbia.edu/~bayer/OSX/swapfile/ Please refer to this page for the most up to date version of this information.

Expert instructions

1. Download and read [rc.swapfile](#), take responsibility for the method, and install it as [/etc/rc.swapfile](#)
2. Redefine [swapvolume](#) in [/etc/rc.swapfile](#), e.g. if [df](#) describes your swap partition as

```
/dev/disk0s10 6280512 151776 6128736 2% /Volumes/Swap
```

then edit [/etc/rc.swapfile](#) to read

```
swapvolume=Swap
```

3. Edit [/etc/rc](#) to read

```
swapdir=/private/var/vm
if [ -f /etc/rc.swapfile ]; then . /etc/rc.swapfile; fi #
    inserted locally
```

4. If the swap partition is on a non-IDE drive, type in a terminal window
`sudo defaults write`

```
/Library/Preferences/SystemConfiguration/autodiskmount
AutomountDisksWithoutUserLogin -bool true
```

5. Restart

Tutorial Introduction

Moving the swapfile is the crux move, when installing a new release of OS X. There is a lot of partial, conflicting advice on the web concerning how to and whether to relocate the virtual memory swapfile to a separate partition. The speedup is debatable but significant and free; showing the machine who's boss is priceless. OS X is going to use a swapfile whether one moves it or not; a decision to move the swapfile has nothing to do with the question of how much memory to install.

If one tries to move the swapfile, there are various possible unintended outcomes:

1. The system won't reboot.
2. The system behaves exactly as it did before, not moving the swapfile.
3. The system moves the swapfile as intended, except after forced reboots (Control, Command, and Power keys), and doesn't completely recover on the next normal restart.
4. The system sometimes moves the swapfile as intended, but sometimes wreaks havoc on volume mounting and uses the wrong partition.

This tutorial explains how to figure out if and when a swapfile strategy is working, and how to develop a swapfile strategy that avoids the above pitfalls. It began as my synthesis of what I learned from the web and my experiments, and has become a kind of moderated discussion, as I have learned from other peoples' experiences with different configurations. I welcome further feedback; we all benefit.

This is a good first hack for Unix novices, but one should read everything written on the web about this topic with a healthy degree of skepticism, including everything written here. Only believe what you can confirm for yourself.

Installations and permissions differ; upgraded systems don't behave like clean installs, and because this hack isn't supported by Apple, no one is sure of all the relevant variables. We're all trying to be helpful, but it is easy to make false inferences from a few trials on a few machines. The only sensible approach is to experiment with a clean install of OS X on a machine you can afford to mess up, and determine exactly how your system behaves under a series of experiments.

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MOVING THE SWAP FILE IN OS X

Familiarize yourself with how your system behaves when it is working properly, so that you can tell the difference when it isn't working properly. Learn to write bits of code by imitation, after reading nearby existing code. Then choose a robust, safe, stress-tested method that you understand for moving the swapfile, move your swapfile, and move on. If it were easier than this, it wouldn't be called a hack.

A good resource for better understanding the Mac OS X boot process is [System Startup](#), found in [Mac OS X Documentation](#). The Bourne shell system-initialization scripts `/etc/rc.boot` and `/etc/rc` are run early in the boot process, but after the option to enter single-user mode. We shall be modifying `/etc/rc`; if imitation doesn't cut it for Bourne shell programming, go to original sources, and read [Steve Bourne's Introduction to the Unix Shell](#).

Partitioning

See [Advantages of Multi-Partition Drives](#) for a discussion of the advantages of partitioning. Many believe that ideally, a swap partition should be on a separate and very fast drive. Others, such as laptop users like myself, find it more practical to put the swap partition on the boot drive. The fastest partition on a drive is the first, or outer partition. One should place either the system or swap here, and the other second, but this isn't mandatory. Once a partition fills to 85% of capacity, its performance seriously degrades, so leave room on the system partition for future growth. With developer tools and other third-party additions that must live with the system, my `OSX` partition contains nearly 6 GB of files. For a while I arranged my TiBook partitions `Swap` (3 GB), `OSX` (9 GB), `OS9` (2 GB), `User` (41.4 GB), and I put users and any third-party applications that I can on `User`. This proved too tight for the `OSX` partition (Adobe products sometimes filled it with their cache files) so when I moved to an 80 GB internal drive after a drive failure, I increased `OSX` to 15 GB for good measure. If I'd had an on-the-fly repartitioning tool like [VolumeWorks](#), I would have done this sooner.

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MOVING THE SWAP FILE IN OS X

A longstanding rule of thumb is to make the swap partition twice the size of physical memory. I remember the gas lights era when this meant 32 MB for a 16 MB Unix machine, and we watched math computations use this 32 MB that would have needed 1 GB if we hadn't compressed the program's internal data. Then as now, when a single process begins to page-thrash, it is very painful to watch. We walked away; no one has the patience to just sit there. The signature is different when several processes collectively need more than physical memory, but they each fit by themselves: Switching between processes is slower, but one can stand to be in front of the machine. The signature is different again for a memory leak. By definition the leaked memory is never used again, so the process merrily marks as used far more than physical memory with no noticeable performance hit, until swap runs out and the process goes splat.

The swap partition also makes a handy bootstrap partition. One can backup, repartition, install a minimum system on [Swap](#), boot from this system to restore the other partitions, and then erase [Swap](#) and use it as a swap partition. This argues for a size of at least 1.5 GB, to fit a minimum system and restore software.

Alternatively, the Apple application [Activity Monitor](#) indicates for my system memory a [VM size](#) of variable size, often around 4-5 GB. A smaller swap partition than this will become the limiting factor for virtual memory. Use a swap partition which is larger than this size, if you can afford the disk space. A bit larger gives the file system room to turn around, but much larger is wasted.

The bottom line: If you need more than twice physical memory for your swap partition, you know who you are. People who say they need more swap than this probably have undiagnosed memory leaks, which are indeed being reported for 10.3.

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MOVING THE SWAP FILE IN OS X

To move a user, e.g. [me](#), to a [User](#) partition, type into into the [Terminal](#) application

```
sudo ditto -v -rsrCFork /Users/me /Volumes/User/Users/me
```

Now open the [NetInfo Manager](#) application and edit the user [me](#) to reflect this change:

```
home /Volumes/User/Users/me
```

Now remove the original directory in [Terminal](#):

```
DVD /Users  
sudo rm -rf me
```

You may need to temporarily give another user administrative privileges to finish moving the administrative user; I've had luck both ways. Leave [/Users/Shared](#) alone, [Adobe Acrobat 6](#) for example won't install without it.

Virtual Memory

How does virtual memory work, out of the box? The system-initialization script [/etc/rc](#) contains the swapfile code

```
swapdir=/private/var/vm  
if [ "${netboot}" = "1" ]; then  
    sh /etc/rc.netboot setup_vm ${swapdir}  
fi  
  
# Make sure the swapfile exists  
if [ ! -d ${swapdir} ]; then  
    echo "Creating default swap directory"  
    mount -uw /  
    mkdir -p -m 755 ${swapdir}  
    chown root:wheel ${swapdir}  
else  
    rm -rf ${swapdir}/swap*  
fi  
  
dynamic_pager -F ${swapdir}/swapfile
```

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MOVING THE SWAP FILE IN OS X

In principle, to move the swapfile, one simply redefines [swapdir](#) at the start of this code. The problem is that the partition [Swap](#) typically hasn't mounted yet.

To understand business as usual, type [man df](#) or [man ls](#) into the [Terminal](#) application, to understand the Unix commands we're about to use. The space bar moves forward through this documentation, and the Q key quits. Now type the [display free disk space command](#)

```
df
```

Getting a listing of the form

Filesystem	512-blocks	Used	Avail	Capacity	Mounted on
/dev/disk0s12	18862272	12274896	6398760	66%	/
devfs	202	202	0	100%	/dev
fdesc	2	2	0	100%	/dev
<volfs>	1024	1024	0	100%	/.vol
/dev/disk0s10	6280512	151776	6128736	2%	/Volumes/Swap
/dev/disk0s14	4183488	1126792	3056696	27%	/Volumes/OS9
/dev/disk0s16	86823312	50578912	36244400	58%	/Volumes/User
automount -nsl [380]	0	0	0	100%	/Network
automount -fstab [394]	0	0	0	100%	
/automount/Servers					
automount -static [394]	0	0	0	100%	
/automount/static					

Note that the system's internal BSD name for my swap partition is [/dev/disk0s10](#) and its Finder name is [Swap](#); in all that follows, use instead of [/dev/disk0s10](#) the internal BSD name of your swap partition and instead of [Swap](#) the Finder name of your swap partition.

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MOVING THE SWAP FILE IN OS X

Now type the [list directory contents](#) command

```
ls -l /Volumes
```

Getting a directory listing of the form

```
drwxrwxrwx 18 root staff 612 5 Jan 14:29 OS9
lrwxr-xr-x 1 root admin 1 5 Jan 15:34 OSX -> /
drwxr-xr-x 7 admin staff 238 5 Jan 15:34 Swap
drwxrwxrwx 18 root staff 612 5 Jan 14:20 User
```

This is where the system mounts volumes; they look like directories, and indeed the system can also put directories here, intentionally or as a result of swapfile code gone haywire. Now type

```
ls -l /private/var/vm
```

Getting a directory listing of the form

```
drwx--x--x 8 root wheel 272 5 Jan 15:30 app_profile
-rw-----T 1 root wheel 67108864 5 Jan 15:34 swapfile0
```

Note that the file [swapfile0](#) was created at the time of the most recent boot, while the directory [app_profile](#) is older. [app_profile](#) maintains information about applications across boots, and probably shouldn't be moved unless your swapfile hack works all of the time; I choose never to move [app_profile](#). However, [swapfile0](#) is set up from scratch on every boot, and there is no harm in having different boots choose different locations, as long as obsolete files are deleted. Recognizing this is key to working out a graceful strategy for dealing with exceptional boots.

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MOVING THE SWAP FILE IN OS X

Editing

To edit `/etc/rc`, type into [Terminal](#)

```
DVD /etc  
sudo cp rc rc.original  
sudo pico rc
```

This changes directories to `/etc`, and as superuser makes a backup copy of `rc` and edits `rc` using the `pico` command line editor. `pico` is a better choice than `vi` or `emacs` for casual users, because its directions are printed on the bottom; `^` stands for the Control key. `vi` is more powerful but has a steeper learning curve. `emacs` was abbreviated from *"eight megabytes and constantly swapping"* in an era when that was real money; a cat walking across an `emacs` keyboard could rearrange the orbits of the planets.

Alternatively, type into [Terminal](#)

```
sudo /Applications/TextEdit.app/Contents/MacOS/TextEdit  
/etc/rc &
```

To edit as superuser with [TextEdit](#), or install the demo or pay version of [BBEdit](#) and choose [Open Hidden...](#) from its [File](#) menu, showing [All Files](#).

It is a good idea, however, to be able to use a command line editor in a pinch. If the `/etc/rc` file gets sufficiently messed up, the system may refuse to boot except in single-user mode. One chooses to boot in single-user mode by pressing the Command and S keys as the computer starts up; I have also been thrown into single-user mode after adding a single misplaced space character to `/etc/rc`. The computer screen is black with white text, and accepts any Unix command. If the root device is mounted read-only, follow the directions given on-screen before proceeding. One can run the `pico` command line editor, remove troublesome insertions from the `/etc/rc` or `/etc/fstab` files, and reboot normally.

Experimenting

How can one tell if **Swap** has mounted yet? Edit **/etc/rc** once, inserting the line
swapdir=/private/var/vm

```
if [ -f /etc/rc.swapfile ]; then . /etc/rc.swapfile; fi #  
inserted locally  
  
if [ "${netboot}" = "1" ]; then  
    sh /etc/rc.netboot setup_vm ${swapdir}  
fi
```

This insertion is harmless by itself, because the file **rc.swapfile** doesn't exist yet. When the file **rc.swapfile** exists, this line executes the contents of **rc.swapfile** exactly as if it were inserted here. Any typos in **rc.swapfile** will still derail the startup process, throwing us into single-user mode, but we will be able to recover simply by renaming **rc.swapfile**:

```
DVD /etc  
mv rc.swapfile rc.swapfile.off  
reboot
```

Astronauts, pilots, and scuba divers practice emergency maneuvers until they become routine; you may want to try single-user mode now. Create a file **/etc/rc.swapfile** with contents

```
swapvolume = Swap  
ConsoleMessage "swapvolume defined as ${swapvolume}"
```

and restart. There aren't supposed to be spaces around the equals sign, so this will throw you into single-user mode. Recover.

To see console messages while booting, boot in verbose mode with the Command and V keys. The screen will look like single-user mode while these messages print.

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MOVING THE SWAP FILE IN OS X

Now, we can imitate the existing code that determines if the swapfile exists.

Create a file [/etc/rc.swapfile](#) with contents

```
swapvolume=Swap
```

```
if [ -d /Volumes/${swapvolume} ]; then
    ConsoleMessage "${swapvolume} available"
else
    ConsoleMessage "${swapvolume} not available"
fi
```

and restart. This code prints a message to the system log file [/var/log/system.log](#), telling us whether or not [/Volumes/Swap](#) is present in the file system at the time of the message. This code does not distinguish between a mounted volume and a directory, an issue that will become significant later, but doesn't matter now.

To read these messages after a system restart, type into [Terminal](#)
`grep Swap /var/log/system.log | tail`

to see the last 10 lines of [/var/log/system.log](#) containing the word [Swap](#). Confirm that [Swap](#) doesn't mount in time for the swapfile code of [/etc/rc](#), by looking for lines of the form

```
Dec 23 16:37:59 localhost ConsoleMessage: Swap not
available
```

Read from the bottom up, paying attention to times and recalling your last boot time.

A more cautious approach would have been to test [rc.swapfile](#) before restarting. To do so, add to [rc.swapfile](#) the lines

```
#!/bin/sh
```

```
swapvolume=Swap
```

```
if [ -d /Volumes/${swapvolume} ]; then
    ConsoleMessage "${swapvolume} available"
else
    ConsoleMessage "${swapvolume} not available"
fi
```

```
echo "rc.swapfile is finished"
```

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MOVING THE SWAP FILE IN OS X

In a terminal, change directories to the directory of your test version of [rc.swapfile](#), by typing [DVD](#) and a space, dragging [rc.swapfile](#) from the Finder into the terminal window to paste its path, backspacing over "/rc.swapfile", and pressing return. Now type

```
chmod +x rc.swapfile
./rc.swapfile
```

and study the error messages. The [ConsoleMessage](#) command is unavailable, and will generate a message; we want to see the "[rc.swapfile is finished](#)" message. Any other messages are a cause for concern. This only tests part of our conditional logic; change the [if](#) to

```
if [ ! -d /Volumes/${swapvolume} ]; then
```

to toggle the logic and test again; remember to change it back. After testing, there is no harm in leaving this extra code in place.

The simplest way to get [Swap](#) to mount in time after normal restarts is to add a line to the system file [/etc/fstab](#):

```
# fs_spec                               fs_file
fs_vfstype   fs_mntops
#
# UUID=DF000C7E-AE0C-3B15-B730-DFD2EF15CB91   /export   ufs
ro
# UUID=FAB060E9-79F7-33FF-BE85-E1D3ABD3EDEA   none      hfs
rw,noauto
# LABEL=This\040Is\040The\040Volume\040Name   none      msdos
ro
/dev/disk0s10 /Volumes/Swap hfs rw 1 2
```

Be sure to replace the BSD name [/dev/disk0s10](#) with the BSD name that corresponds to your swap partition.

There is a flaw, however, with this modification to [/etc/fstab](#): BSD names are created at boot time, and are not guaranteed to be consistent across boots. In practice, it appears that the partitions on the boot device get numbered consistently, but other devices get numbered in the order that they spin up. However, even this is not documented as certain. See the discussion [Topic: drive numbering inconsistent /dev/diskXs10 ?](#).

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MOVING THE SWAP FILE IN OS X

There are other, more stable ways of referencing [Swap](#):

```
UUID=AC05CEB8-906A-3AB1-BD04-D0FC29B9C384 /Volumes/Swap hfs
rw 1 2
LABEL=Swap /Volumes/Swap hfs rw 1 2
```

Unfortunately, these are only understood by [autodiskmount](#), and do not appear to help us here. I could sometimes get these forms to work, but never to any advantage for our purposes.

My preferred approach is patience: If [Swap](#) hasn't mounted in time, wait a few seconds. Do not modify [/etc/fstab](#). Instead, try a more elaborate version of [/etc/rc.swapfile](#):

```
swapvolume=Swap

if [ ! -d /Volumes/${swapvolume} ]; then
    swapcount=1
    ConsoleMessage "Waiting for ${swapvolume} to mount"
    while [ "$swapcount" -le 30 ]; do
        sleep 1
        if [ -d /Volumes/${swapvolume} ]; then
            ConsoleMessage "${swapvolume} mounted after
$swapcount seconds"
            break
        fi
        swapcount=`expr $swapcount + 1`
    done
fi

if [ -d /Volumes/${swapvolume} ]; then
    ConsoleMessage "${swapvolume} available"
else
    ConsoleMessage "${swapvolume} not available"
fi
```

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MOVING THE SWAP FILE IN OS X

Observe now that if **Swap** is a partition on the boot drive or on an IDE drive, then it mounts within a few seconds. Otherwise, **Swap** fails to mount. It turns out that in OS X 10.3, these drives don't mount until a user logs in. See [10.3: A fix for local drives not mounting until user login](#) The fix is to type into a terminal

```
sudo defaults write  
/Library/Preferences/SystemConfiguration/autodiskmount  
AutomountDisksWithoutUserLogin -bool true
```

Now confirm that **Swap** mounts in time for the swapfile code of */etc/rc*. Stress-test this mechanism: Log out all users, wait for the system to quiet down, and perform a forced reboot by pressing the Control, Command, and Power keys. Note that **Swap** still mounts in time after forced reboots.

A forced reboot is an emergency procedure; OS X is a swarming anthill of background processes, all of which get killed without ceremony by a forced reboot. The system can end up in an unstable state, turning your hacking session into a recovery session. It is essential to log out all users before testing forced reboots; in particular, anyone logged in and using FileVault could get hosed. There seems to be no completely safe protocol for testing forced reboots; the same key combination while asleep simply wakes the computer, and a forced reboot in single-user mode appears to skip the extra checks. Apparently, if we know the boot is safe, the system also knows the boot is safe.

It is important to have sorted out how to mount the swap partition *before* trying to move the swapfile, because moving the swapfile during these experiments can make a mess that is difficult to clean up. If you tell the system to use **/Volumes/Swap** before it mounts, it creates and uses a directory by the same name, and later, **Swap** mounts as **/Volumes/Swap 1**. This is a truly famous mishap for swapfile adventurers. From now on, the *directory* **Swap** passes the test to see if **Swap** has mounted. One way to dig out of this hole is to rename the **Swap** partition, comment out every reference to **Swap**, and reboot, so that **Swap** becomes an unused directory that can be deleted. However, if this fix goes poorly, you only compound the problem. It is better never to make this mistake in the first place.

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MOVING THE SWAP FILE IN OS X

For this reason, a safer test is

```
if [ -d /Volumes/Swap/.Trashes ] ; then
```

because the invisible [.Trashes](#) directory exists on volumes, but not typically in other directories.

Warning: Various people have dramatically sped up their boot times by patching the behavior of [BootCacheControl](#), as described in [Topic: HOWTO: Slow 10.3.2 startup fix](#). I now recommend against this modification. I traced a problem to this fix, where my restarts were hanging indefinitely at the "[Login Window Starting](#)" prompt. I'm guessing my boot cache got out of sync. This makes sense; a cache out of sync can wreak all manner of havoc. Apple couldn't get it working, took it out, others discovered they could put it back in, it usually works... Know the song? To remove this fix, type

```
sudo rm /usr/sbin/BootCacheControl
```

Moving the swapfile

We are now ready to try a patient, conservative strategy: Leave [app_profile](#) alone. Move the swapfile if we can, but check first to see if we can, and do something reasonable no matter what happens.

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MOVING THE SWAP FILE IN OS X

Replace the contents of [*/etc/rc.swapfile*](#) with the code

```
##  
# After the line in the system startup script /etc/rc  
#  
# swapdir=/private/var/vm  
#  
# insert the line  
#  
# if [ -f /etc/rc.swapfile ]; then . /etc/rc.swapfile; fi  
# inserted locally  
##  
  
swapvolume=Swap  
  
if [ ! -d /Volumes/${swapvolume}/.Trashes ]; then  
    swapcount=1  
    ConsoleMessage "Waiting for ${swapvolume} to mount"  
    while [ "$swapcount" -le 30 ]; do  
        sleep 1  
        if [ -d /Volumes/${swapvolume}/.Trashes ]; then  
            ConsoleMessage "${swapvolume} mounted after  
$swapcount seconds"  
            break  
        fi  
        swapcount=`expr $swapcount + 1`  
    done  
fi  
  
if [ -d /Volumes/${swapvolume}/.Trashes ]; then  
    ConsoleMessage "Using ${swapvolume} for swapfile"  
    if [ -f ${swapdir}/swapfile0 ]; then  
        rm -rf ${swapdir}/swap*  
    fi  
    swapdir=/Volumes/${swapvolume}/.vm  
else  
    ConsoleMessage "Unable to use ${swapvolume} for  
swapfile"  
fi
```

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Test this code under a variety of conditions. This code has been groomed by various people, and has the following virtues:

- It leaves the existing code in `/etc/rc` alone, inserting new code that redefines `swapdir` only if it can. To revert, or to temporarily turn off moving the swapfile, rename `/etc/rc.swapfile` to `/etc/rc.swapfile.off`.
- It fails gracefully if `Swap` fails to mount, using instead the original swapfile location.
- When it succeeds after a failure, it again works as intended, and deletes the obsolete swap files from the original swapfile location.
- The name of the original swapfile location is not hard-wired into the insertion, so this code is more likely to work without editing in future versions of `/etc/rc`.
- If a system update overwrites `/etc/rc`, we simply hook up `/etc/rc.swapfile` again, following its commented directions.

If you can pick any more fleas off this code, however obscure, let me know. It is intentionally intolerant of spaces in the name of the swap partition, because the code in `/etc/rc` is similarly intolerant. One could instead define a symbolic link, to permit spaces without further modifying `/etc/rc`, but it is simpler to not use spaces. Simple is good.

If your swap partition is on your boot drive, you can probably get away with shaving a few seconds off each normal restart by also modifying `/etc/fstab`, using a BSD name like `/dev/disk0s10`. To me, this slight speedup doesn't seem worth the potential risk.

Alternatives

Further testing establishes that [Swap](#) is nearly always mounted by the end of [/etc/rc](#), after the [SystemStarter](#) call:

```
SystemStarter -gr ${VerboseFlag} ${SafeBoot}
```

```
exit 0
```

This is also true after forced reboots. Others have had success with simply redefining [swapdir](#), and moving the existing swapfile code in [/etc/rc](#) to just before the exit line. However, [SystemStarter](#) calls a plethora of startup scripts, all of which would then run without benefit of virtual memory. I cannot see any harm in this, but as a mathematician I've learned that a lack of imagination is not a proof of anything.

An alternative proposed by [ptwity](#) on [Mac OS X Hints](#), is extremely amusing:

Insert instead into [/etc/fstab](#)

```
/dev/disk0s10 /private/var/vm hfs rw 1 2
```

This has the distinct advantage of avoiding any need to edit [/etc/rc](#); it mounts [Swap](#) where [/etc/rc](#) already wants to put the swapfile. There are compelling arguments for *not* modifying "Apple-owned" system files such as [/etc/rc](#); one is that Apple may overwrite your mods without warning on any future system update. The disadvantage to this method is that it doesn't address the issues raised by forced reboots. It can waste space on the root volume: After a forced reboot, Swap is instead mounted as [/Volumes/Swap](#), and the swapfile is placed in the *directory* [/private/var/vm](#). After the next normal restart, all is well again, but the *directory* [/private/var/vm](#) is inaccessible, having been replaced in the directory tree by the *volume* [/private/var/vm](#), and its obsolete swap files hang around unerased, choking the root volume. Also, this strategy effectively maintains two versions of [app_profile](#), one for forced boots. It also runs into the BSD name issue; I could not get the alternative [/etc/fstab](#) forms to work here.

Automated Solutions

There are various automated solutions out there for moving the swapfile. I prefer to carefully understand all modifications to my system, so that I can debug problems. However, the vast majority of people who move their swapfile are going to rely on an automated solution they don't understand. If you've understood this far, you share a responsibility to the community to go pick a current automated solution and dissect it, and give the author feedback. In my experience, the authors of these programs are extremely responsive. In addition, if you see a "*just use this program, it worked fine for me*" post on the web, where the author of the post gives no clue that they examined the changes to their system, consider posting a followup with your analysis. Without such followups, all anyone can safely assume is that the test system didn't curl blue smoke.

One example of an automated solution that provides beta support for OS X 10.3 behaves as follows, as of January 9, 2004: It presents a slick, confidence-inspiring user interface. (One shouldn't draw conclusions from this; the Cocoa framework makes this easier than any non-programmer would believe possible.) After the user selects the swap volume, it makes a backup copy of `/etc/rc`, and make the following changes to `/etc/rc`:

It replaces the line
`swapdir=/private/var/vm`

with the lines
`/sbin/autodiskmount`
`sleep 3`
`swapdir=/Volumes/Swap/vm`

and it replaces the line
`appprofiledir=/private/var/vm/app_profile`

with the line
`appprofiledir=/Volumes/Swap/vm/app_profile`

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In testing, this worked for me, once after a normal restart and once after a forced reboot. However, no option is provided to change the `autodiskmount` defaults for non-IDE drives, so they could pose a problem. In my experience, the call to `autodiskmount` is harmless, but has no appreciable effect on waiting times; the volumes that are going to mount are already about to mount. Waiting 3 seconds usually suffices, but I've experienced delays of up to 11 seconds, hence my preference for a conditional loop. There is also no conditional code to notice if `Swap` fails to mount, so this method could make one of the classic mounting messes in `/Volume`, with no provision for cleaning it up.

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