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Paragon ExtFS for Mac OS X™

User Manual

Contents

Introduction 3

Features Overview 4

Key Features 4

Supported Media 4

Getting Started 5

Distribution 5

Registration 5

To Register as a New User 5

To Register a New Product 5

Trial Version Activation 6

System Requirements 8

Installing the Driver 8

Using the Driver 12

Configuring the Driver 14

Driver Setup with Graphical Interface 14

Extra Functionality 14

Typical Application Cases 17

Updating the Driver 19

De-installing the Driver 21

Contacting Paragon Software GmbH 22

Glossary 23

Introduction

Paragon ExtFS for Mac OS X™ is a low-level file system driver specially developed to bridge incompatibility of Linux and Mac OS X by providing full read/write access to the Ext2, Ext3 and Ext4 file systems under Mac OS X.

Based on the Paragon UFSD™ (Universal File System Driver) technology our driver enables to provide fast and transparent access to ExtFS partitions as Mac OS X-native, thus achieving an unprecedented high level of performance (the same as for HFS Plus and in some cases even better). Mac OS X programs can process such partitions without any restrictions – browse contents, read and modify files, copy and create new files and folders, etc.

Paragon ExtFS for Mac OS X comes in one universal edition in the form of a standard DMG disk image that includes user manual and installation/uninstallation files to automatically install/uninstall and configure the Ext FS driver. During installation of the driver two powerful utilities to create/format and check/repair Ext2, Ext3 and Ext4 file systems will be integrated into the Disk Utility.

In this manual you will find the answers to many of the technical questions, which might arise while using our driver.

Our company is constantly releasing new versions and updates to its software, that's why images shown in this manual may be different from what you see on your screen.

Features Overview

This chapter dwells upon key benefits and technical highlights of the product.

Key Features

Let us list some of the key features:

- **Extremely easy to use** as it requires no additional configuration after installation
- **Fast and transparent access to any ExtFS (Ext2,Ext3 or Ext4) partition under Mac OS X**
- **Advanced driver engine** to guarantee reliable operation and stability even under heavy workload
- **Unprecedented high level of performance** thanks to the Paragon UFSD™ technology
- **Complete support of Mac OS X 10.5 Leopard, 10.6 Snow Leopard, 10.7 Lion, 10.8 Mountain Lion, 10.9 Mavericks**
- **Advanced support of the HFS Plus file system features** to guarantee data consistency (POSIX file attributes, Hardlinks, Symlinks, Data Fork and Resource Fork, etc.)
- **Advanced support of the ExtFS file system features** to guarantee data consistency (Hardlinks, Symlinks)
- **Support of Mac OS X extended attributes**
- **Support of non-Roman characters**

Supported Media

- Ultra high capacity disks (up to 10 TB tested)
- IDE, SCSI and SATA/eSATA disks
- SSD (Solid State Drive)
- Thunderbolt, FireWire (i.e. IEEE1394), USB 1.0, USB 2.0 , USB 3.0, ZIP® and Jazz® disks
- PC card storage devices (all types of flash memory, etc.)

Getting Started

In this chapter you will find all the information necessary to get the product ready to use.

Distribution

Paragon ExtFS for Mac OS X™ is distributed in two ways:

- Boxed package from Paragon Software GmbH and resellers
- Downloadable package over the Internet at the company's web-site

The two contain a standard DMG disk image with an installation package to automatically install and configure the ExtFS driver.

Thus in order to get the product ready for use, you need to install it first (see Installing the Driver).

If you want to download an update/upgrade of the product, it will be in form of the downloadable installation package.

ExtFS for Mac OS X is a commercially distributed product, which is however can be used with no limitations completely for free during a 10-day trial period. Once it's over, you won't be able to use the product until you activate it through Preferences Pane.

Registration

Paragon Software GmbH provides a wide range of online services through its web-portal - www.paragon-software.com/support:

- Registration of new users;
- Registration of purchased products for registered users;
- Available around-the-clock downloading center, where registered users can get product updates/upgrades as well as all the necessary documentation;
- Downloadable free demo versions and open documentation for all users.

It is recommended to use Safari, Internet Explorer 5+ or any compatible browser.

To Register as a New User

To register as a new user, please do the following:

1. Run an Internet browser and visit the page: www.paragon-software.com/my-account/;
2. Click **Create** of the **Create a Paragon Account** section;
3. Fill out the registration form;
4. Click **Register**.

The most important field in the form is an E-mail address, as it serves as a login to enter the system. Besides your access password will be sent to this address as well.

To Register a New Product

If you are a registered user and would like to register Paragon ExtFS for Mac OS X, please do the following:

1. Run an Internet browser and visit the page: www.paragon-software.com/my-account/;

2. In the **Email** field of the **Authorization** section, enter an E-mail used for registration;
3. In the **Password** field enter a password received after registration;
4. Click **Sign in**;
5. If the user name and password are valid, you will get to your account;
6. Click **Register new product** of the **Products** section;
7. Enter your product serial number in the **Serial Number** field. You can find it in the product box or obtain from your reseller. Click **Next**;
8. On the next page you will be asked to provide some additional data. Also you will need to decide whether you want to get confirmation on registering the product by E-mail or not. Click **Next**, and then click **Finish**.

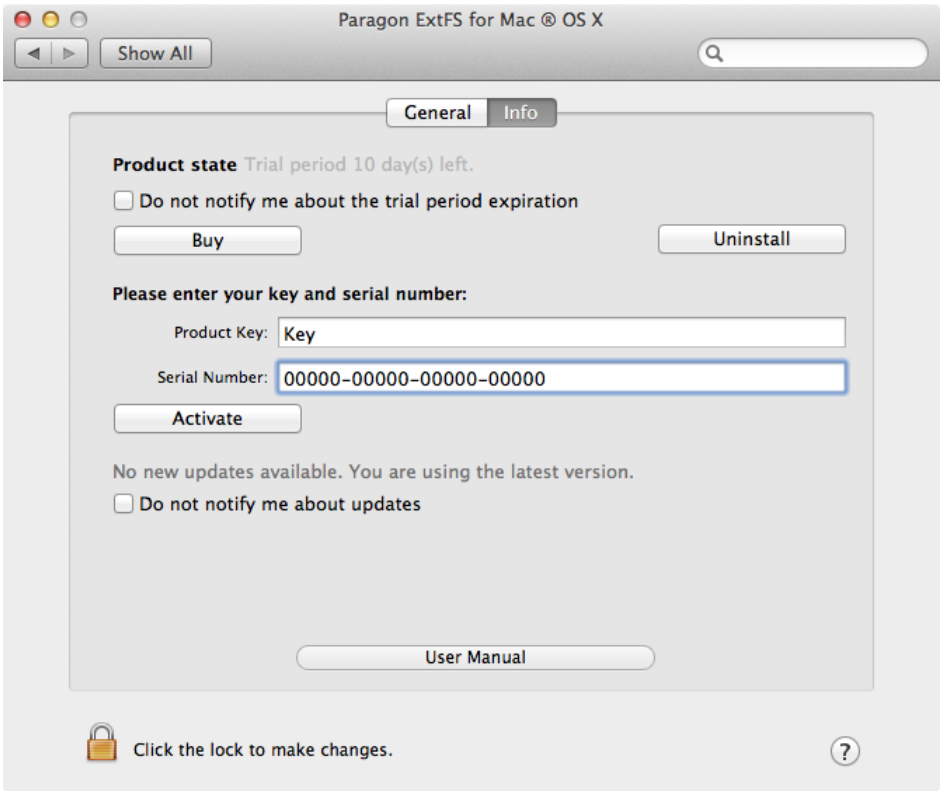
That is all. The product is now registered.

Trial Version Activation

You can purchase and unlock the product for unlimited use at any moment through Preferences Pane. Normally the whole procedure requires an active Internet connection and minimal participation from your part. However if you've got problems with the built-in activator, you can do it manually with the help of our Support Team. Below we'll consider both scenarios.

Online activation

1. First you should purchase the product. The easiest way is to use a direct link located on the ExtFS Preferences Pane:
   - Select **Applications > System Preferences > ExtFS for Mac OS X**;
   - Select **Info**;
   - Click on **Buy**.

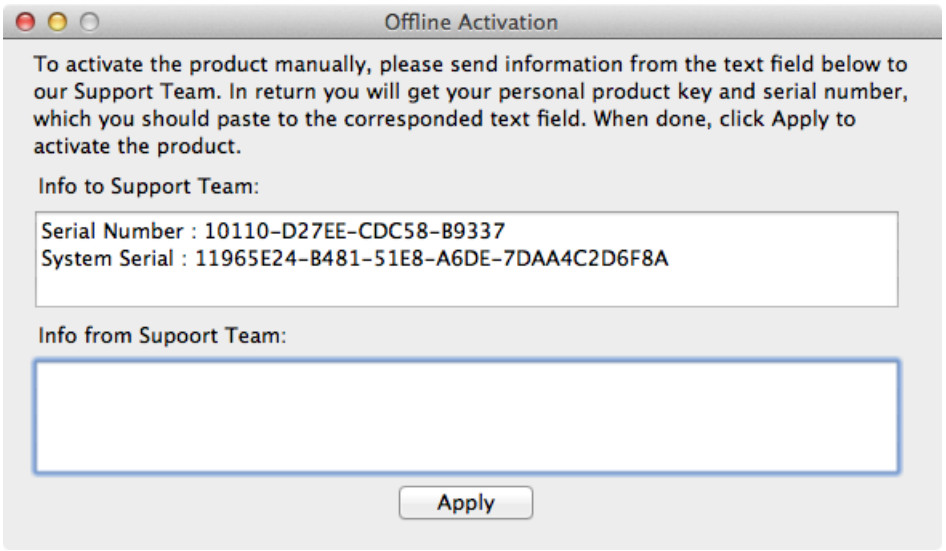


2. As a result you should have your own product key and serial number. Please paste them to the corresponded fields, then click on **Activate**. This info will be sent to our activation server to complete the procedure.
3. If a success, you'll get the following notification.

4. If you've got problems with the Internet or specifically configured Firewall, you'll be prompted to manually activate the product.

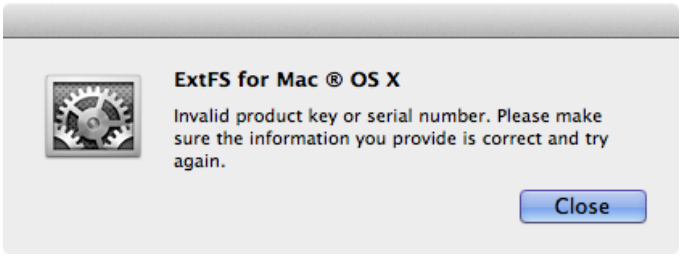
Manual activation

5. If having problems with the online activation, please click on **Offline Activation** to manually activate the product.
6. In the opened dialog you can see the earlier entered serial number of our product and a serial number of your system. Please get in touch with and pass this information to our Support Team. In return you'll get data to paste to the corresponded text field. Click on **Apply** when ready.



Other notification messages

- When providing an incorrect serial number or a product key.



- When trying to use a serial number already activated on another computer.

- When trying to use a product key from a key generator.

System Requirements

To use Paragon ExtFS for Mac OS X, you should install it first. But before that, make sure your computer meets the following minimum system requirements:

- Operating systems: Mac OS X 10.5 Leopard, 10.6 Snow Leopard, 10.7 Lion, 10.8 Mountain Lion, 10.9 Mavericks

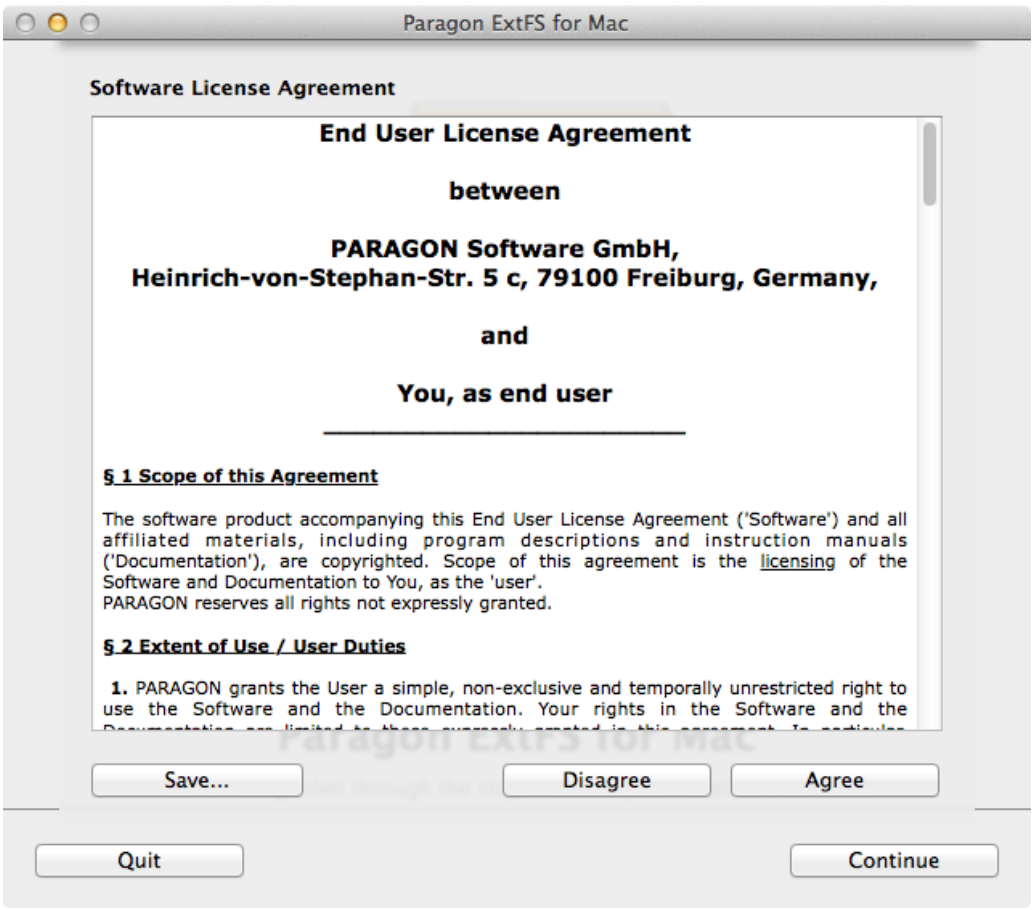
Installing the Driver

To install Paragon ExtFS for Mac OS X, please do the following:

1. Click on the supplied DMG disk image.
2. After the installation package has been extracted you can choose whether to install/de-install the driver or read the product manual. Click **Install ExtFS for Mac® OS X** to initiate installation of the driver.

3. Click **Continue** on the Welcome page.

4. In order to continue the installation you are to accept all conditions stated in Paragon's license agreement by clicking the **Agree** button. You can also save or print the agreement by using the appropriate buttons. Click **Continue** when ready.



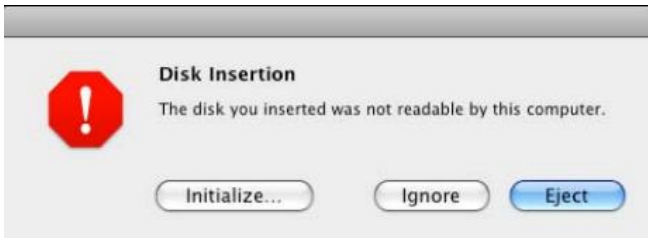
5. Next you are to provide a password of a user with the administrator privilege.

6. Monitor the installation progress.

7. Finally click **Restart** to restart the computer and complete the product installation.

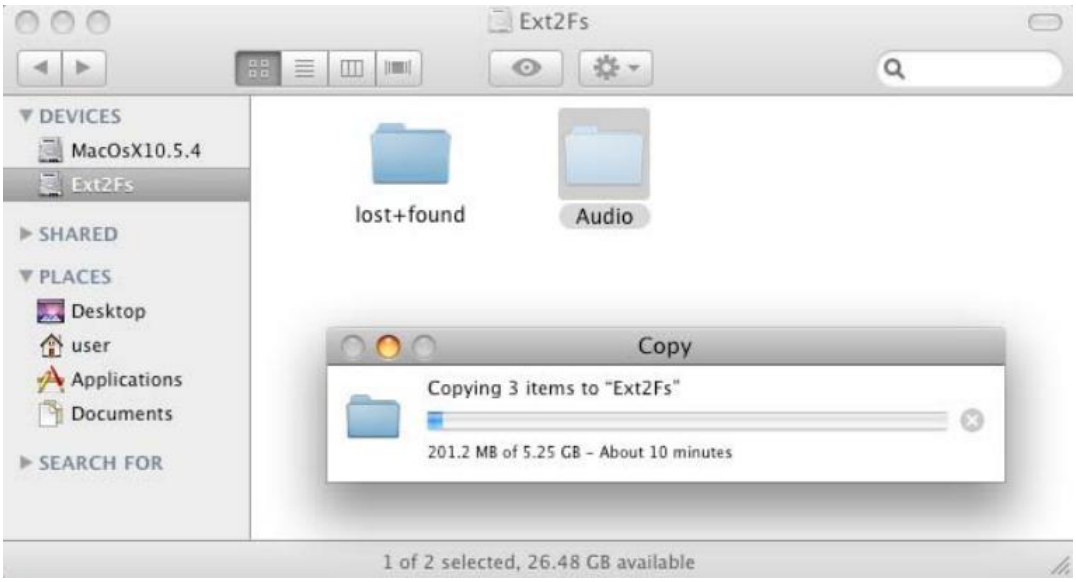
Using the Driver

Once the driver has been installed you obtain full read/write access to any type of ExtFS as if it's Mac OS X-native.

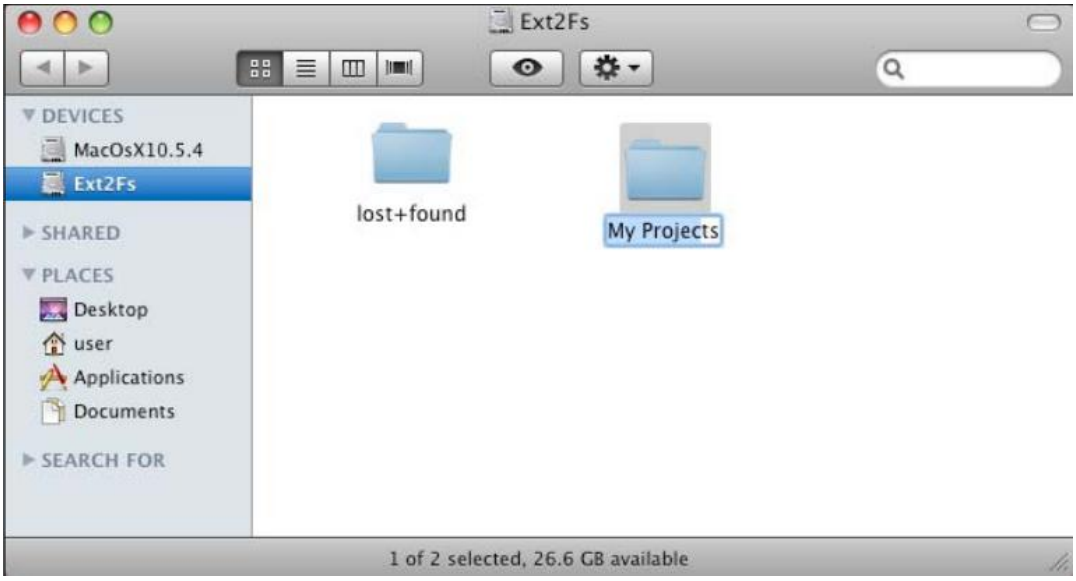
Before installing the Paragon driver	After installing the Paragon driver
 **In case you connect any Ext2, Ext3 or Ext4 formatted disk you can see the message above.**	

You can now carry out any operation on an ExtFS volume, like:

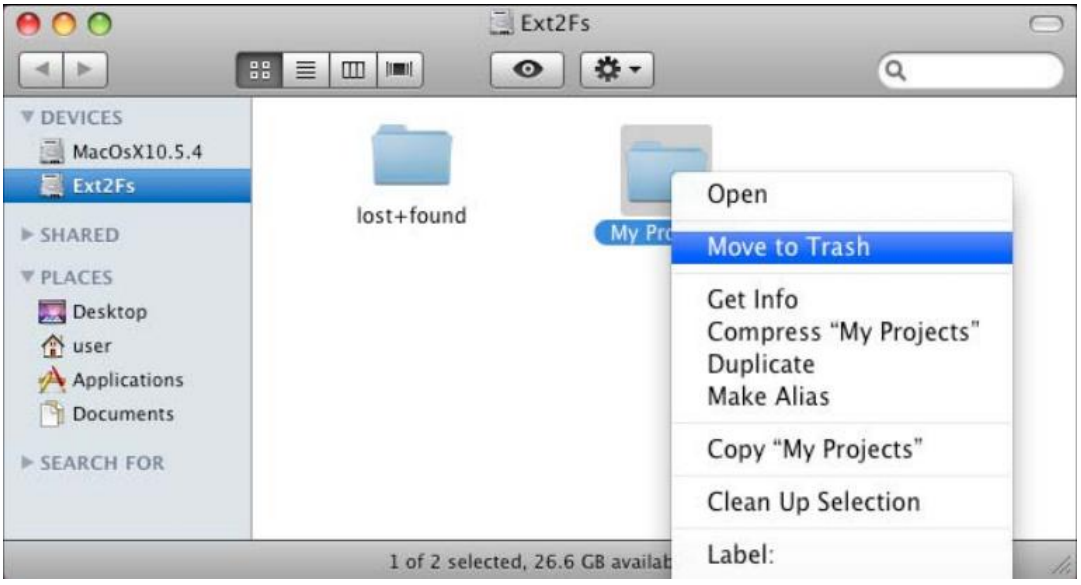
- Transfer data;



- Modify data;



- Delete data;



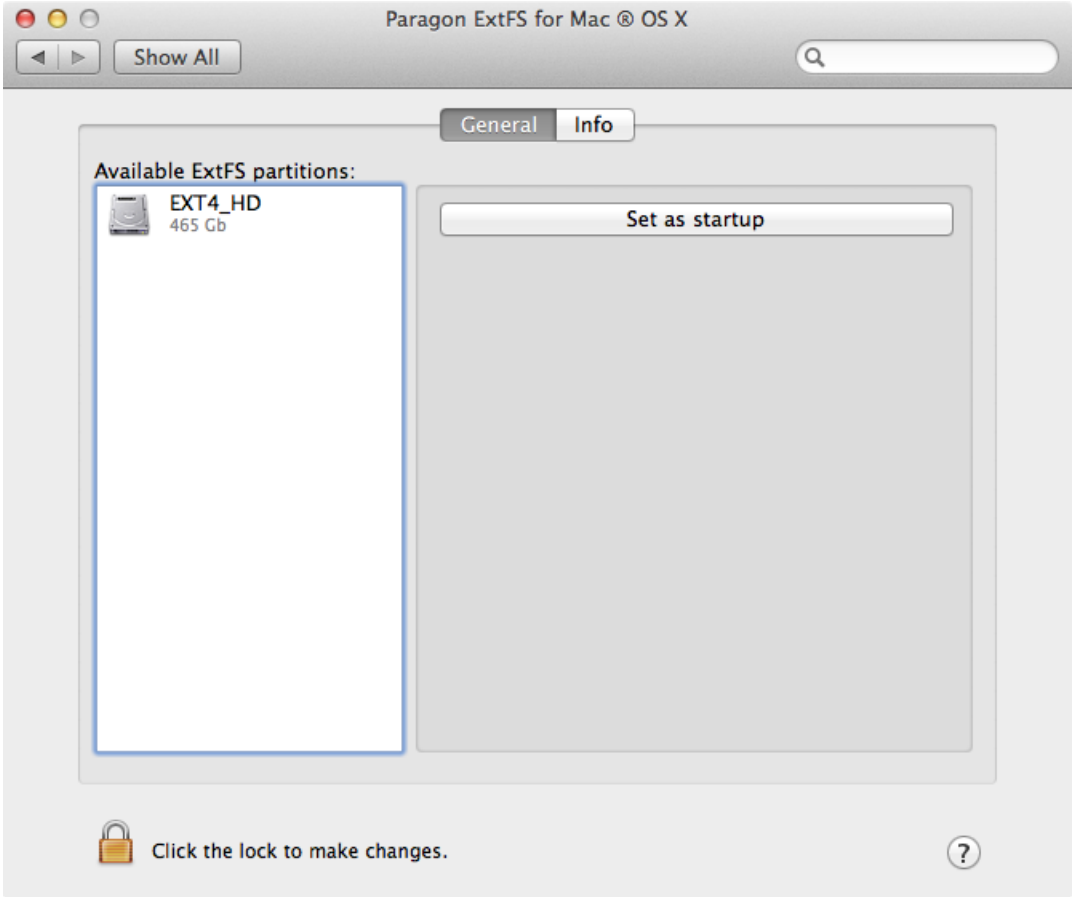
Just whatever you feel like doing.

Configuring the Driver

Paragon ExtFS for Mac OS X is very flexible and can be easily set up either with the help of a graphical interface or from the command line.

Driver Setup with Graphical Interface

To set up the driver, please open the ExtFS Preferences Pane: **Applications > ExtFS for Mac® OS X > ExtFS Preferences** or **Applications > System Preferences > ExtFS for Mac OS X**.

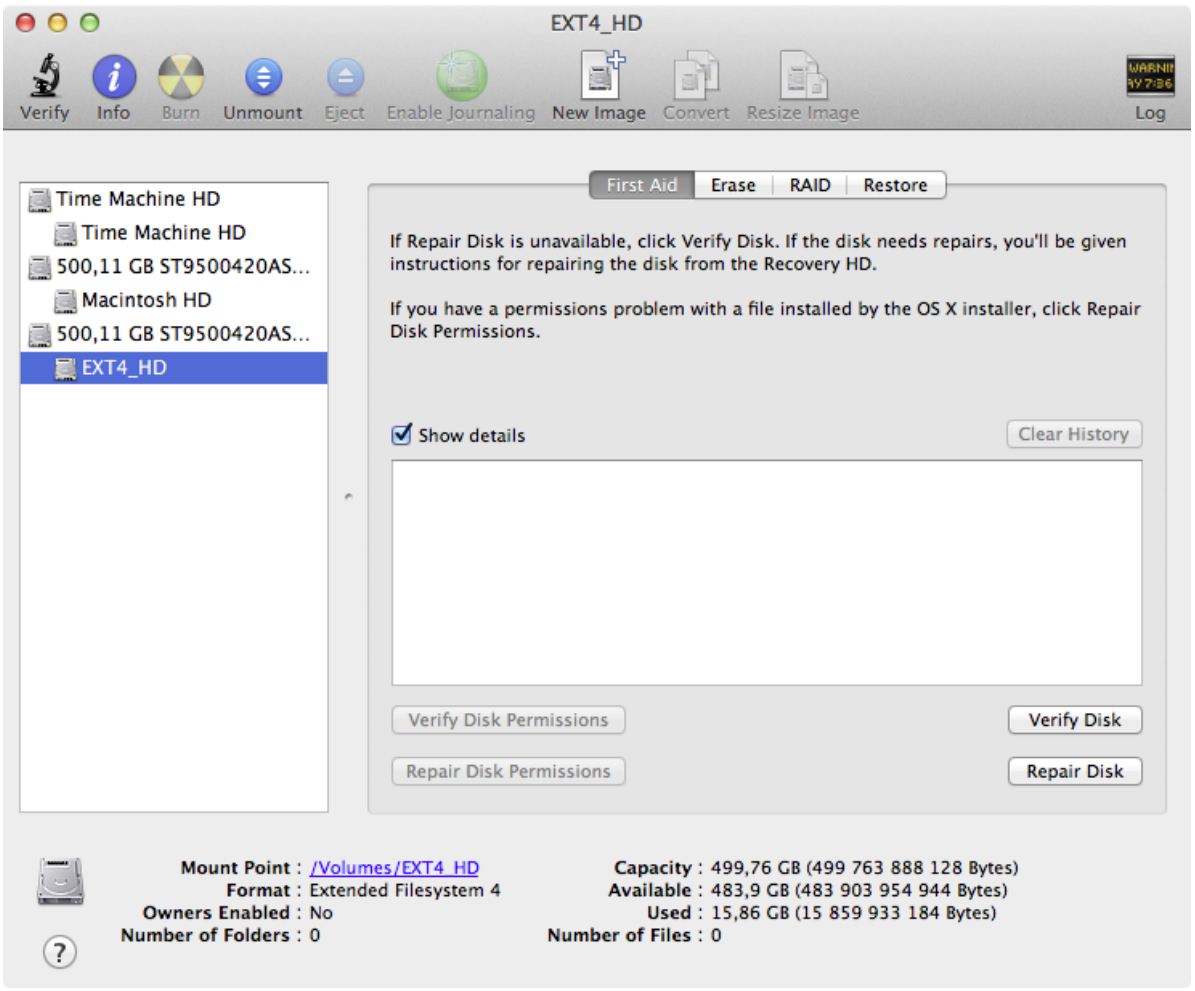


In the opened window you can see a list of available ExtFS partitions (if any) on the left. Select an ExtFS partition on the right and click the **Set as Startup** button to start it up next time you launch the computer if necessary.

Extra Functionality

Besides providing full read/write access to ExtFS partitions under Mac OS X, our driver offers a number of additional features:

1. **Check/Repair ExtFS Volumes**. During installation of our driver, the setup wizard automatically adds to Mac OS X Disk Utility the possibility to check integrity and fix errors on any type of ExtFS. To do that, please follow the steps below:
    - Launch Disk Utility: **Applications > Utilities > Disk Utility**;
    - Select an ExtFS volume from the list of available partitions on the left;
    - Click on the **First Aid** tab at the top of the window;
    - Click on the **Verify Disk** button to check it for integrity or the **Repair Disk** button to fix errors (if any).



You can also carry out these operations from the command line:

- Launch the command line: **Applications > Utilities > Terminal**;
- Type in **fsck_ufsd** to get help.

```
MacOsX10-5-4-Intel:~ user$ fsck_ufsd_ExtFS
fsck_ufsd_ExtFS (Compiled on Oct  2 2008 17:14:26)
Usage: fsck_ufsd_ExtFS (-n | -y) ...
       fsck_ufsd_ExtFS -n device - verify disk, but don't repair
       fsck_ufsd_ExtFS -y device - repair disk
```

Use **fsck_ufsd –n device** to check disk integrity;

Use **fsck_ufsd –y device** to fix disk errors

2. **Format ExtFS Volumes**. You can format ExtFS volumes under Mac OS X from the command line. To do that, please follow the steps below:
   - Launch the command line: **Applications > Utilities > Terminal**;
   - Type in **diskutil** to get help.

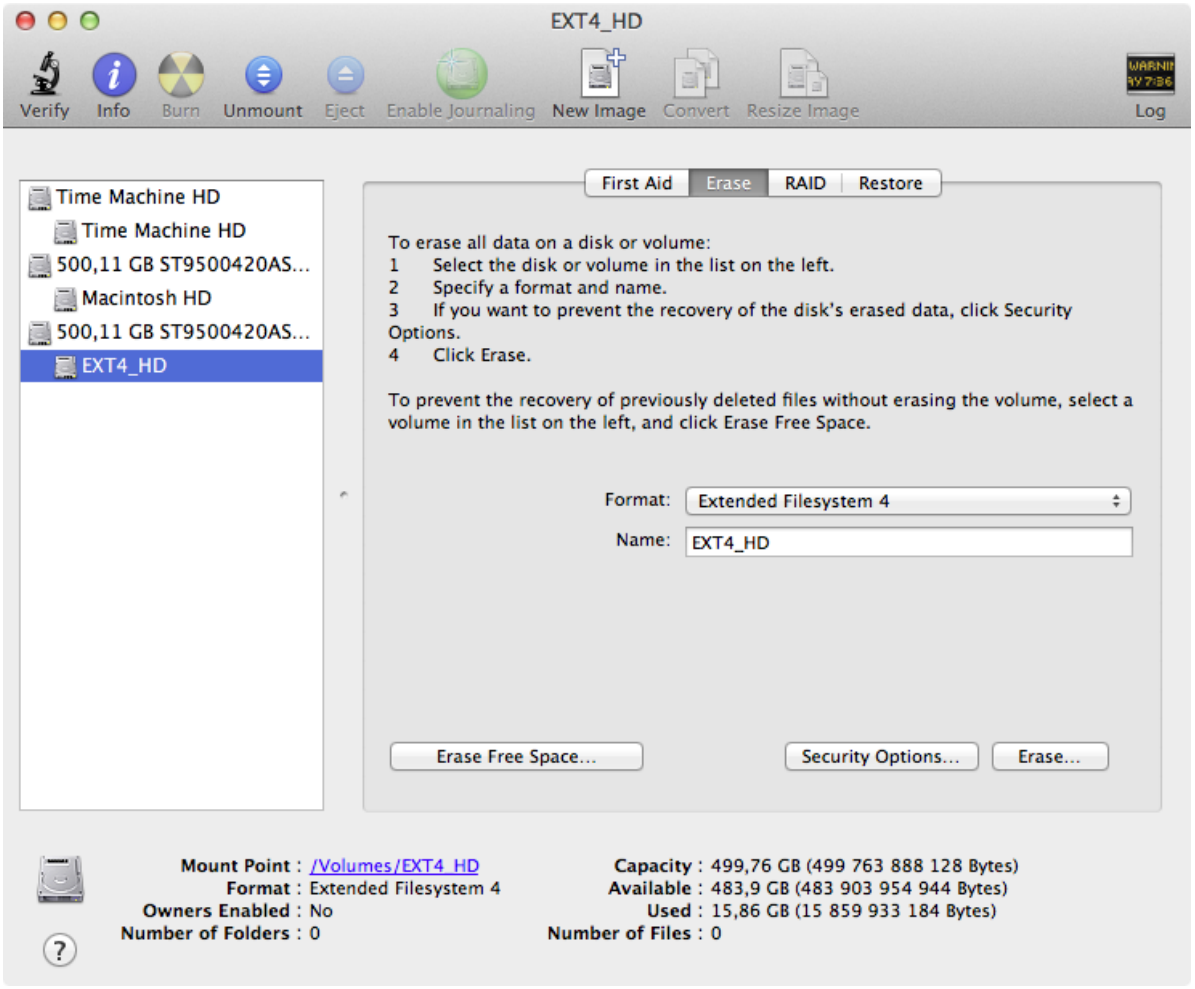
```
MacOsX10-5-4-Intel:~ user$ diskutil
Disk Utility Tool
Utility to manage local disks and volumes.
Most options require root access to the device

Usage:  diskutil <verb> <options>
     <verb> is one of the following:
     list                  (List the partitions of a disk)
     info[rmation]         (Get information on a specific disk or partition)
     listRAID              (List RAID-sets and members)

     u[n]mount             (Unmount a single volume)
     unmountDisk           (Unmount an entire disk (all volumes))
     eject                 (Eject a disk)
     mount                 (Mount a single volume)
     mountDisk             (Mount an entire disk (all mountable volumes))

     enableJournal         (Enable HFS+ journaling on a mounted HFS+ volume)
     disableJournal        (Disable HFS+ journaling on a mounted HFS+ volume)

     rename[Volume]        (Rename a volume)

     verifyVolume          (Verify the file system data structure of a volume)
     repairVolume          (Repair the file system data structure of a volume)
     verifyDisk            (Synonym for verifyVolume)
     repairDisk            (Synonym for repairVolume)

     verifyPermissions     (Verify the permissions of a volume)
     repairPermissions     (Repair the permissions of a volume)
     repairOS9Permissions  (Repair the permissions for the currently-selected
                                Classic boot volume)

     eraseDisk             (Erase an existing disk, removing all volumes)
     eraseVolume           (Erase an existing volume)
```

Use **diskutil eraseVolume UFSD "Disk Label" device** to format the required partition to ExtFS.

There is no need to use inverted commas if label of your ExtFS disk contains just one word.

Besides, during installation of our driver, the setup wizard automatically adds to Mac OS X Disk Utility the possibility to format ExtFS volumes as well, but only for 10.5 Leopard and later:

- Launch Disk Utility: **Applications > Utilities > Disk Utility**;
- Select a partition you need to format to ExtFS from the list of available partitions on the left;
- Click on the **Erase** tab at the top of the window;
- Select **Extended Filesystem** from the popup list;
- Type in a new volume label (irrelevant parameter used for notification purposes);
- Click on the **Erase** button to format the partition.



Typical Application Cases

You might face various situations where Paragon ExtFS for Mac OS X will be the most preferable way out. Let's just consider a little closer two of them.

1. You've got at the disposal a dual-boot system of Mac OS X and Linux and it will be really convenient to get a full-fledged access (read/write) to Windows ExtFS partitions under Mac OS X. To tackle the issue, please follow the steps below:
    - Start up your Mac OS X;
    - Install Paragon ExtFS for Mac OS X;
    - Reboot you computer into Mac OS X once again;
    - Enjoy ExtFS under Mac OS X.
2. You need to transfer data (files over 4GB in size) from your Mac PC to a Linux-based computer using an external hard drive. FAT32 file system that is supported by both systems cannot be used as it doesn't support files over 4GB. To tackle the issue, please follow the steps below:
    - Start up your Mac OS X;
    - Install Paragon ExtFS for Mac OS X;
    - Reboot you computer into Mac OS X once again;
    - Connect an external drive to Mac PC and format it to ExtFS;
    - Copy files you need from your Mac PC to the external drive;

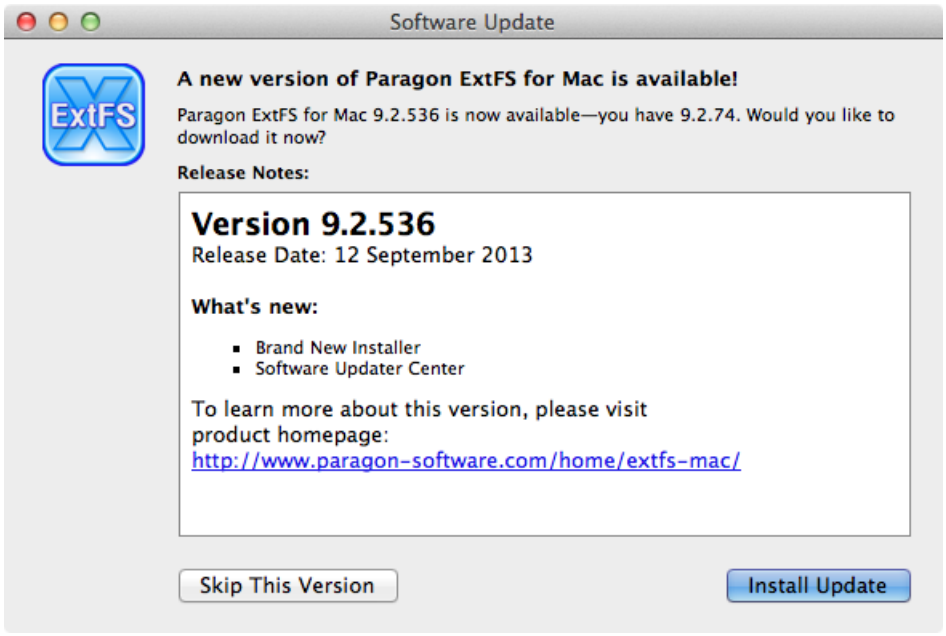
- Connect the external drive to a Linux PC;
- Copy files from the external drive to the Linux PC.

3. You need to read or modify files stored on an external or internal (local) hard drive with Linux extended file system from your Mac PC. To tackle the issue, please follow the steps below:
    - Start up your Mac OS X;
    - Install Paragon ExtFS for Mac OS X;
    - Connect an external drive with Ext2, Ext3 or Ext4 FS partitions to Mac PC (if any);
    - Reboot you computer into Mac OS X once again;
    - Read or modify files stored on the hard disk from your Mac PC.
4. You need to extend the set of used file systems to store your data on the most popular file systems of the most popular operating systems and don't worry where to save your data:
    - Start up your Mac OS X;
    - Install Paragon ExtFS for Mac OS X;
    - Reboot you computer into Mac OS X once again;
    - Enjoy ExtFS under Mac OS X.
5. As a professional using Apple to produce video you need to use the cheapest methods to distribute Digital Cinema Package (DCP) materials. Just install the driver that enables the ability to read from and write to (and even format) Ext formatted drive. ExtFS is the file system format used on USB 2.0 DCP distribution hard drives preferred by the Digital Cinema distribution facilities:
    - Start up your Mac OS X;
    - Install Paragon ExtFS for Mac OS X;
    - Connect an external drive with Ext2, Ext3 or Ext4 FS partitions to Mac PC;
    - Reboot you computer into Mac OS X once again;
    - Write to or read DCP materials stored on the hard disk from your Mac PC.

Updating the Driver

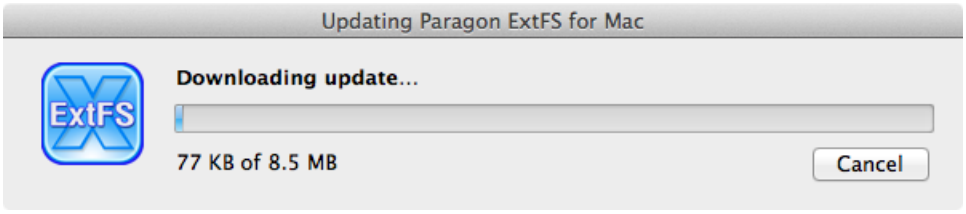
By default, Paragon ExtFS for Mac OS X automatically checks company's website for available updates once a day. You can force this checkup at any moment by using the **Check for Updates…** option of the ExtFS Preferences Pane.

If a new version of the driver has been found, you will be prompted to install it.

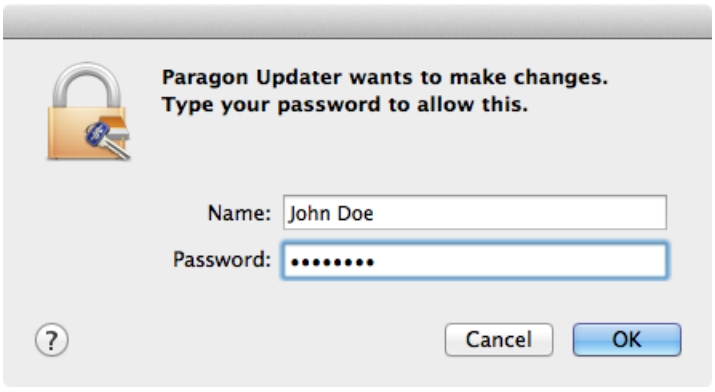


There are several actions you should do to update the driver:

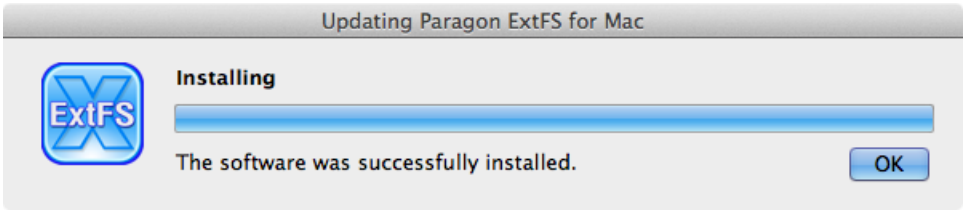
1. Click **Install Update** to initiate the update process.



2. Next you are to provide a password of a user with the administrator privilege.



3. Once the update process is over, click **OK**.



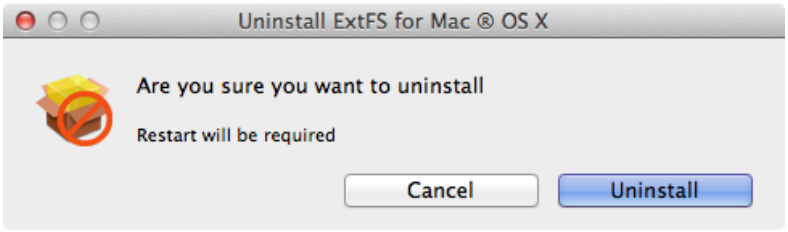
If you don't want our product to automatically check for updates, please mark the corresponding option in the ExtFS Preferences Pane.

De-installing the Driver

To de-install Paragon ExtFS for Mac OS X, please do the following:

1. Open the installation package by clicking on the supplied DMG disk image.
2. After the installation package has been extracted click **Uninstall ExtFS for Mac® OS X** to initiate the de-installation process.

3. The setup wizard will ask confirmation before removing the driver from the system, so please click the **Uninstall** button.



4. Next you are to provide a password of a user with the administrator privilege.

5. Click **OK** to finish the de-installation process.

You can also de-install the product through the ExtFS Preferences Pane.

Contacting Paragon Software GmbH

If you have any questions about the company products, please do not hesitate to contact Paragon Software GmbH.

Service	Contact
Visit Paragon GmbH web site	www.paragon-software.com
Registration & updates web-service	www.paragon-software.com/support
Knowledge Base & Technical Support	kb.paragon-software.com
Pre-sale information	sales@paragon.software.com

Unfortunately, the company can only provide technical support in the following languages at the present time: English, German, French and Russian. We are really sorry for possible inconvenience.

Glossary

Hard Link is a reference, or pointer, to physical data on a storage volume. On most file systems, all named files are hard links. The name associated with the file is simply a label that refers the operating system to the actual data. As such, more than one name can be associated with the same data. Though called by different names, any changes made will affect the actual data, regardless of how the file is called at a later time. Hard links can only refer to data that exists on the same file system.

HFS Plus File System (HFS or Mac OS Extended) is an updated version of HFS (Hierarchical File System) and is applied nowadays as the primary file system for Macintosh computers. Unlike HFS it supports much larger files (block addresses are 32-bit length instead of 16-bit) and uses Unicode (instead of Mac OS Roman) for naming the items (files, folders). Besides it permits filenames up to 255 UTF-16 characters in length, and n-forked files, though almost no software takes advantage of forks other than the data fork and resource fork. One of the crucial improvements of this file system is of course the possibility to use a full 32-bit allocation mapping table that resulted in much less wasted space (and more files).

Ext2 File System is a file system for the Linux OS. It was initially designed as a replacement for the extended file system (ext). Although ext2 is not a journaling file system, its successors, Ext3/Ext4 FS, provide journaling and is almost completely compatible with ext2.

Resource Fork is a construct of the Mac OS operating system used to store structured data in a file, alongside unstructured data stored within the data fork. A resource fork stores information in a specific form, such as icons, the shapes of windows, definitions of menus and their contents, and application code (machine code).

Symbolic Link (Symlink or Soft Link) consists of a special type of file that serves as a reference to another file or directory. Unlike a hard link, which points directly to data and represents another name for the same file, a symbolic link contains a path which identifies the target of the symbolic link. Thus, when the user removes a symbolic link, the file to which it pointed remains unaffected. Symbolic links may refer to files even on other mounted file systems.

UFSD™ (Universal File System Driver) technology developed by Paragon Software provides full read/write access to the so-called popular file systems (NTFS, FAT16/32, Ext2/Ex3FS, etc.) under operating systems that cannot do it by default (e.g. NTFS for Linux, Ext2/Ex3FS for Windows, etc.).

This technology is based on the direct access to physical drives and buffered Input/Output access, that is why it makes it possible to process unsupported partitions (browse contents, read and modify files, copy and create new files and folders, etc.) while keeping an acceptable level of performance.