Paragon Rescue Kit™ for Mac OS X

User Manual

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Introduction

Paragon Rescue Kit™ for Mac OS X is a Linux based bootable recovery environment that gives you an opportunity to get access to the hard disk for maintenance or recovery purposes in case of its malfunction, a virus attack, or a system failure. Its primary objective is to avoid possible data loss by transferring valuable information from a failed hard disk to some other destination, like a removable (CD/DVD, USB, FireWire, etc.) drive or a network share. Besides, it can be used as a real alternative to the Mac OS X native disk imaging tools. With its help you can make a backup of your system or data partition, thus providing the ability to restore it at any time you need.

A highly intelligent program engine together with handy comprehensive wizards for major operations, make the job with Paragon Rescue Kit for Mac OS X easy and efficient.

This guide will help you use Paragon Rescue Kit for Mac OS X at full and tackle many of the technical issues that might arise in the process.

Features Overview

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

Key Features

Well let us list some of the product key features:

- **Installation free recovery environment (Linux based bootable CD/DVD)** to get access to the hard disk for maintenance or recovery purposes in case of its malfunction, a virus attack, or a system failure.
- **Comprehensive wizards** to simplify even the most complex operations.
- **Simple backup/restore** facilities to establish a reliable data protection system.
- **Support of major present day techniques to store backup images**:
  - *Backup to local mounted/unmounted (without drive letter assigned) partitions*;
  - *Backup to a network drive* to stand a better chance of success in case of a hard disk failure;
  - *Backup to external media (CD/DVD)* to guarantee a high level of data protection as long as the backup media is kept secure;
- **Data transfer** facilities to retrieve information you need from a local disk of any file system, a network share, removable media (CD/DVD, USB, FireWire, Flash, etc.) or even backup images and then copy it to the required destination as easy and convenient as possible.
- **Network configuration** facilities to establish a network connection under Linux, thus allowing transmission of data on the net.

Supported File Systems

Paragon Rescue Kit for Mac OS X provides support of major file systems presented on the market today:

- Full read/write access to FAT16/FAT32 partitions.
- Full read/write access to NTFS (Basic and all five types of Dynamic Disks). Compressed NTFS files are also supported.
- Full read/write access to Ext2FS/Ext3FS and Linux Swap partitions.
- Limited read/write access to Apple HFS+ partitions.

> **Unfortunately, support of non-Roman characters for the HFS+ file system is unavailable at the moment. The company is about to implement it in the nearest future.**

Supported Media

- Support of both MBR and GPT hard disks (up to 1,5 TB tested)
- IDE, SCSI and SATA hard disks
- CD-R, CD-RW, DVD-R, DVD+R, DVD-RW, DVD+RW and also DVD-R, DVD+R double layer discs
- FireWire (i.e. IEEE1394), USB 1.0, USB 2.0 hard disks, ZIP® and Jazz® disks
- PC card storage devices (MBR and GPT flash memory, etc.)

Getting Started

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

System Requirements

To use Paragon Rescue Kit for Mac OS X on your computer (it doesn't matter what operating system is installed), make sure that it meets the following minimum system requirements:

- ❑ X86-compatible processor
- ❑ 256 MB of RAM
- ❑ SVGA-compatible monitor
- ❑ Mouse (recommended)

There may be additional requirements if you want to use advanced features:

- ❑ Network card is required to transfer data on the net
- ❑ Recordable CD/DVD drive is needed to burn data to compact disks
- ❑ Removable media can also be used to save data.

> **To know more on the subject, please consult the _Supported Media_ chapter.**

Launching the Recovery Environment

You can launch the recovery environment, i.e. actually a Linux based bootable CD/DVD, by taking the following steps:

1. Insert the disk into a CD/DVD drive;
2. Reboot the computer;
3. Press and hold the *Alt* button until the Apple boot menu starts;
4. Select a CD/DVD device to boot from

As a result of the above mentioned actions, you should see a boot menu of the recovery environment on the screen.
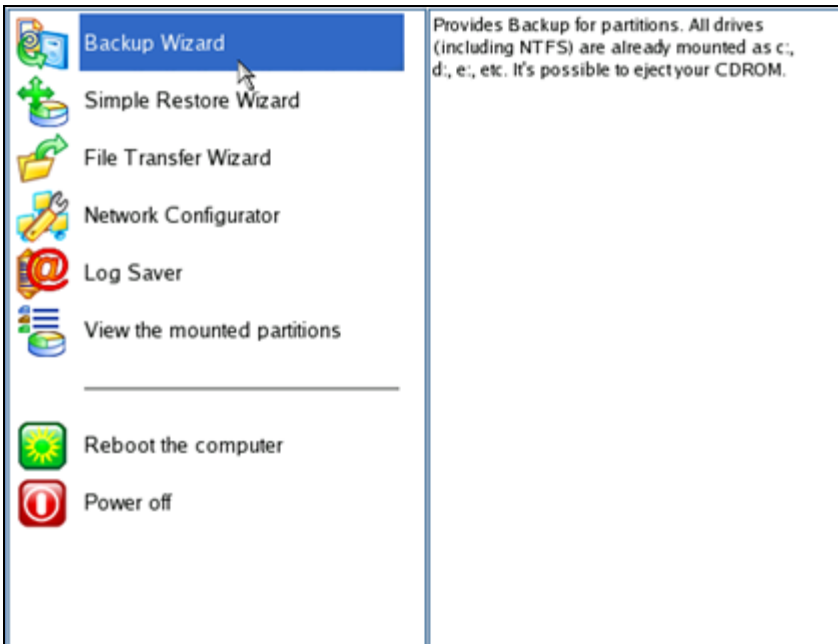
On the left there is a list of all available operations, the bulk of which are wizard driven. To minimize the possibility of making any mistake, you can get on the right an easy to catch description on any operation from the list just by selecting it.

So, the boot menu contains the following commands:

- **Backup Wizard** to make a backup image of a system or data partition and then place it to the required destination;
- **Simple Restore Wizard** to restore a system or data partition with a previously made backup image;
- **File Transfer Wizard** retrieve data from a local disk of any file system, a network share, removable media (CD/DVD, USB, FireWire, Flash, etc.) or even backup images and then copy it to the required destination;
- **Network Configurator** to establish a network connection under Linux, thus allowing transmission of data on the net;

> **If you are going to use network resources, first launch Network Configurator to establish a network connection.**

- **Log Saver** to collect and send the necessary log files to the Technical Support Team;
- **View the mounted partitions** to display a list of all mounted partitions;

> **Drive letters are assigned to partitions the way it is done in DOS, i.e. one after another, primary partitions at first. Thus mounted partitions may have different drive letters from your operating system.**

- **Reboot the computer;**
- **Power off the computer.**

To move within the menu, please use the mouse or the arrow keys of the computer keyboard. Select the required command and then press *Enter* or double click on it to launch.

> **While working with the bootable media you might experience some inconvenience caused by possible video artifacts. It is just a result of changing video modes and in no way will affect the program functionality. If this is the case, please wait a bit and everything will be OK.**

Creating Backup Images

The most reliable way of data protection for the hard disk is the ability to create archive duplications. A modern backup archive uses the so-called image, a snapshot of the whole disk system or its separate partitions. It not only includes the contents of all user-made files, but additionally contains the exact structure of directories, information about file allocation, file attributes and other related data. Thus it enables to recover not only the on-disk data but an operating system as well.

> ⚠️ **Only separate partitions of MBR and GPT hard disks are allowed to back up at the moment.**

Starting

Launch the recovery environment and then click the **Backup Wizard** item of the boot menu. After the mentioned action the welcome page of the wizard will be displayed.

Settings

The Backup Wizard enables to configure the settings and then start the operation in accordance with the entered parameters. Here you can set the following parameters:

❑ **The object to back up**. Only separate partitions of MBR and GPT hard disks are allowed to back up at the moment, so select a hard disk from the popup menu at the top left corner of the window and then choose a partition you need to back up.

⚠️	**Backup of the GPT service partition (also called EFI) is unavailable, but don't worry, it's not used by Apple at the moment.**

❑ **Backup destination**. You are free to save backup archives to local or network drives, to physical partitions (without drive letters assigned), to any removable media (USB, FireWire, Flash, etc.) or burn them to CD/DVD. So select a destination you need by taking the estimated archive size and available space on the backup destination into account.

⚠️	**Select the *Save data to local drives or physical partitions* option and then choose a mapped network drive to save a backup image on the net. You can establish a network connection and map a network drive with the help of Network Configurator.**

❑ **Name and location of the resulted image**. Provide a file name for the new image and its exact location. The program automatically offers an easy to understand name, which can anyway be modified.

⚠️	**The program automatically calculates size of the future archive and informs the user about space available on the selected destination.**

❑ **Archive Comment**. The user can add some additional description to the archive that will later help to distinguish it from the others.

On this page, you can enter a comment and choose the backup mode.

┌─ Archive text comment ────────────────
│ Please enter backup comments to describe the archive:
│
│ ┌──────────────────────────────────────┐
│ │ Archive Img_0_C.pbf, created: 2008.02.28 06:24:51 │
│ └──────────────────────────────────────┘

Please select how to perform the backup:

◉ **Back up now**
   Choose this option if you want to back up the data immediately.

In addition, you can activate an advance mode by marking the appropriate checkbox at the foot of the second page of the wizard (i.e. the **What to back up** page). When it is marked, the next page allows you to define:

❑ Whether the **archive integrity** will be controlled.

> **Checking archive integrity enables to guarantee that all backup images created with the program are 100 percent flawless. Nevertheless if you decided not to control the archive integrity, the backup operation would take about 3-5% less time.**

❑ Whether **image file names** will be set automatically in complex archives.
❑ **Compression level** for the backup image (including the *No compression* variant).
❑ Whether the archive will be **split** (if this is the case the user can set the maximum size for the archive files).

> **Splitting images enables to tackle issues caused by a file size limitation of some file systems.**

❑ Whether the archive will be **protected by password**.
❑ Whether the selected partition will be copied in the **sector-to-sector mode** (including unused sectors as well).
❑ Whether the **OS auxiliary files** (pagefile.sys, hyberfil.sys) will be included in the backup image.
❑ **Recording speed** when the user wants to burn the backup image onto CD/DVDs.

Results

After the backup operation is completed you will receive an image of the selected partition. This image will be placed into the specified destination (a local or network disk, CD/DVD, etc.), its features defined by the wizard.

Available operation scenarios:

❑ Backup to a Local Partition
❑ Backup to a Network Drive
❑ Backup to External Media (CD/DVD)

Restoring System and Data

Actually it is the reverse of the backup operation, thus without having a previously made backup image, you will not be able to use it. However it is the most efficient and easy to use way to recover your system and data.

> ⚠ **All contents on the disk selected for restoring purposes will be deleted during the operation.**

Starting

[Launch the recovery environment](#) and then click the [Simple Restore Wizard](#) item of the boot menu. After the mentioned action the welcome page of the wizard will be displayed.

Settings

The Simple Restore Wizard enables to configure the settings and then start the operation in accordance with the entered parameters. Here you can set the following parameters:

- ❑ **A backup image to be restored**. On the **What to Restore** page press the *Browse* button to look for a backup image you need or type in a full path to it.
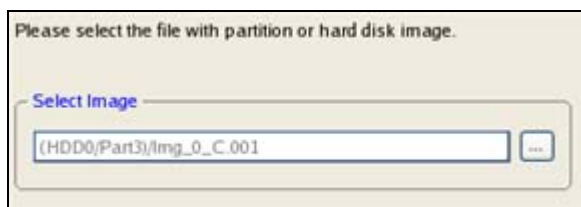
- ❑ **A place to restore the archive to**. Choosing the destination, please note - all contents on the disk selected for restoring purposes will be deleted during the operation.
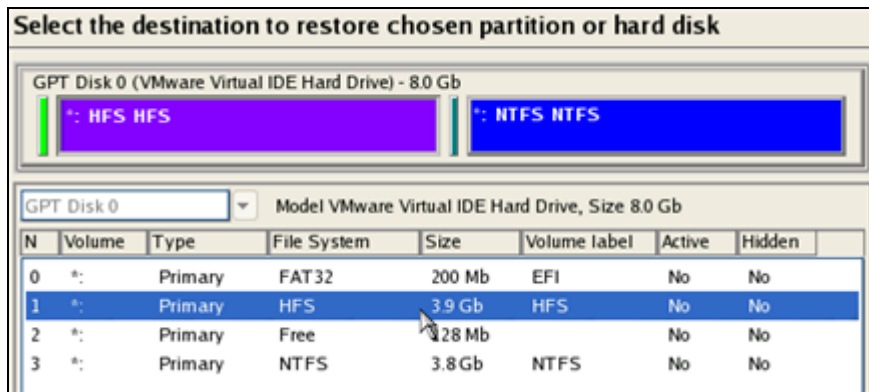
You can only restore a backup image to a partition it was made of at the moment.

To help the user get a clear-cut picture of the operation outcome, the program allows inspecting the resulted disk layout.
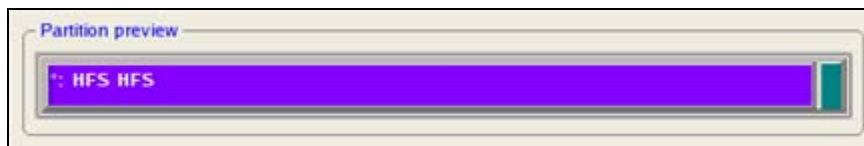
Results

The wizard will restore a partition that has been archived, and make it available to use in the operating system.

Available operation scenarios:

- ❑ Restoring from a Local Partition
- ❑ Restoring from a Network Drive
- ❑ Restoring from External Media (CD/DVD)

Transferring Data

With the *File Transfer Wizard* you can retrieve important data from a failed hard disk and copy it to another hard disk or burn it to CD/DVD before reinstalling the system or replace damaged files by using a previously made backup image.

Starting

Launch the recovery environment and then click the **File Transfer Wizard** item of the boot menu. After the mentioned action the welcome page of the wizard will be displayed.
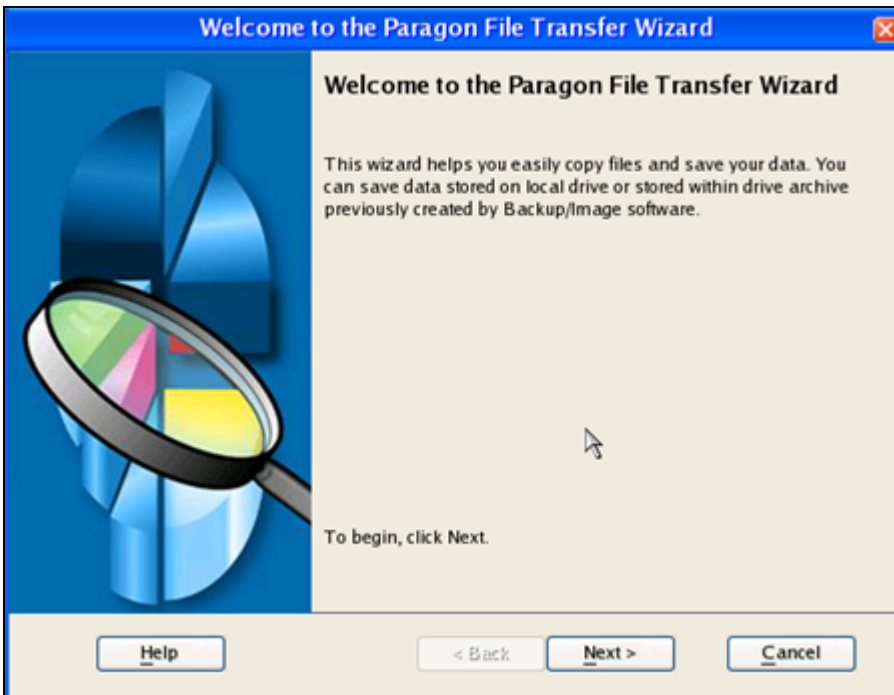
Settings

The File Transfer Wizard enables to configure the settings and then start the operation in accordance with the entered parameters. Here you can set the following parameters:

❑ **Place to look for files/directories**. Select a source disk from the pull-down list in the right pane of the window. The program enables to process both mounted and unmounted (without drive le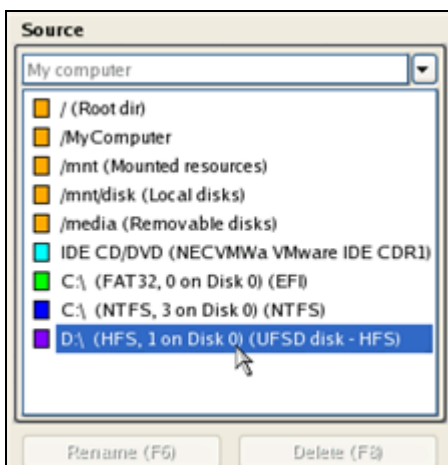tter assigned) partitions of any file system. Besides it is possible to use a mapped network drive or any removable media (USB, FireWire, Flash, etc.).

	To use network resources, please establish a network connection and map a network drive with the help of Network Configurator before launching the File Transfer Wizard.

❑ **Object(s) of operation**. Choose files/directories you want to copy and place them to Clipboard by pressing the *left arrow-button*. To delete a file/directory from the Clipboard, select it in the Clipboard pane and press the *right arrow-button*. You can also irreversibly delete or rename files/directories of the right pane by pressing the *Delete* or *Rename* buttons.
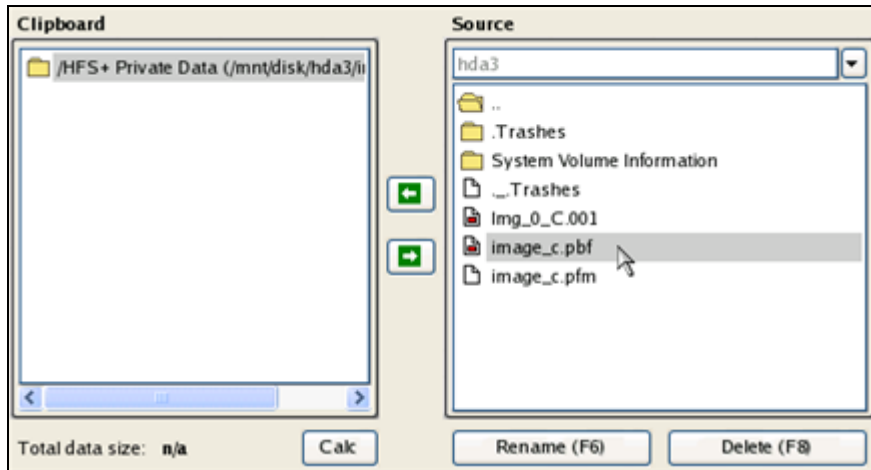
Estimate the resulted data size by pressing the *Calc* button.

Files/directories deleted from the Clipboard remain intact on source disks.

❑ **Destination to store the object(s)**. You are free to copy data to local or mapped network drives, to physical partitions (without drive letters assigned), to removable media (USB, FireWire, Flash, etc.) or burn it to CD/DVDs. Choose the way the data will be stored.
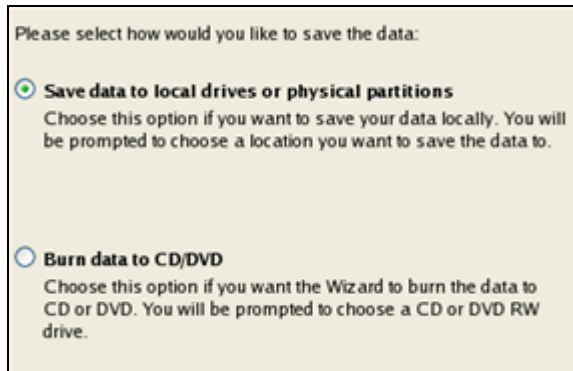
Select the *Save data to local drives or physical partitions* **option and then choose a mapped network drive to save data on the net. You can establish a network connection and map a network drive with the help of Network Configurator.**

❑ **Revision of changes**. The **Operation Summary** page provides structurally divided information on all the actions made in the wizard. Check the changes and come back to any of the steps of the wizard to correct them (if necessary) by clicking the *Back* button.
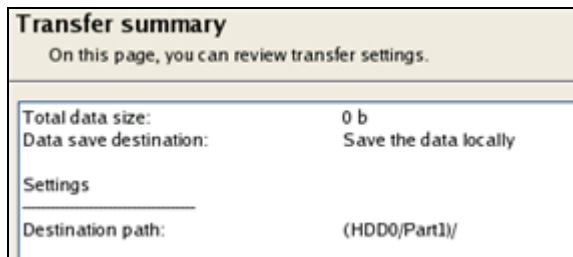
Results

The wizard will transfer files/folders to the specified destination (a local or network disk or removable media).

Available operation scenarios:

- ❑ Copying of data from the corrupted system disk to another hard disk
- ❑ Burning of data from the corrupted system disk to CD/DVD
- ❑ Copying of data from a backup to the corrupted system partition

Linux Network Configuration

With the *Network Configuration Wizard* you can easily set up available network devices and establish a network connection to work with shared resources of the net under Linux.

Starting

Launch the recovery environment and then click the **Network Configurator** item of the boot menu. After the mentioned action the welcome page of the wizard will be displayed.

⚠	If it's not the first time you start Network Configurator and you've already set up a network device properly, just click the *Configure network connections* link to map a network share.

Settings

The Network Configuration Wizard enables to configure the settings and then start the operation in accordance with the entered parameters. Here you can set the following parameters:

- ❑ **Config file destination**. By default, the wizard saves all network settings in the **netconf.ini** file located on the Linux RAM drive, thus it will only be available until you restart the computer. However, you can just once configure your network device and then save this file to some other destination, for instance a local drive, and this way avoid constant re-configuration, just by providing a path to it.

Please select the file with network configuration settings.

Select config file

/etc/netconf.ini
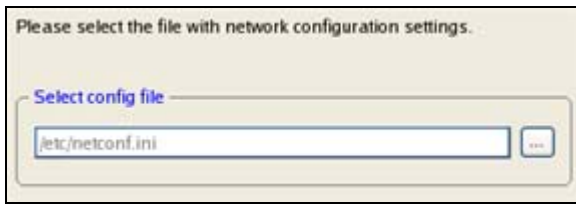
- ❑ **Network device detection**. The wizard automatically attempts to detect all available network devices and then displays them (if any) in form of a list. On every found device there's information about its interface and used driver as well as a brief description. You can manually add a network device in case it hasn't been found automatically by clicking the *Add a device* button and selecting a device you need from the list. Do not forget to check it by clicking the *Probe* button.

Autodetection of network devices

All network devices found during autodetection are listed below. If someone device is not present, you can manually add it from device's list.

Interface	Driver	Device description
eth0	pcnet32	Advanced Micro Devices [AMD] 79c970 [PCnet32 LANCE] (rev 10)

Change device   Add a device
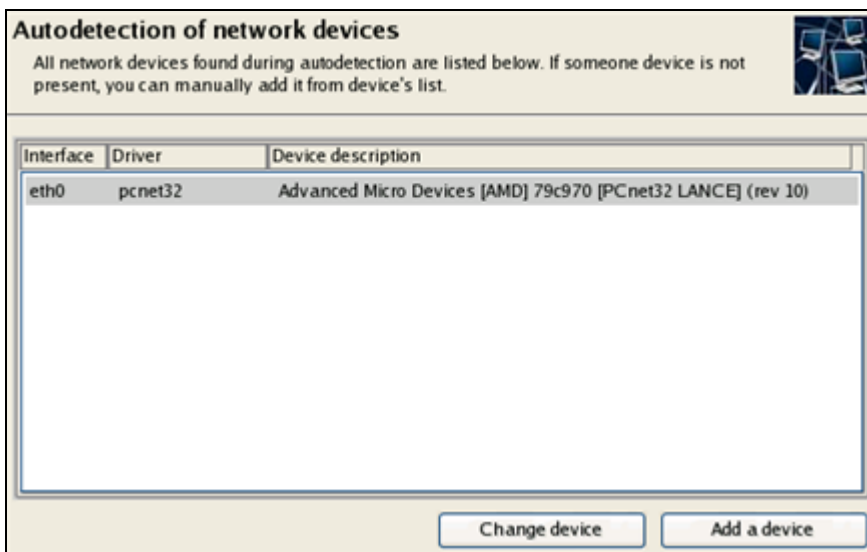
- ❑ **Interface configuration**. After choosing the required network device, you need to properly set it up. If your local network has a DHCP Server, you can just leave everything as is, otherwise manually type in an IP address, a network mask, default gateway, etc.

General

- ⦿ Obtain an IP address automatically
- ○ Use the following IP address

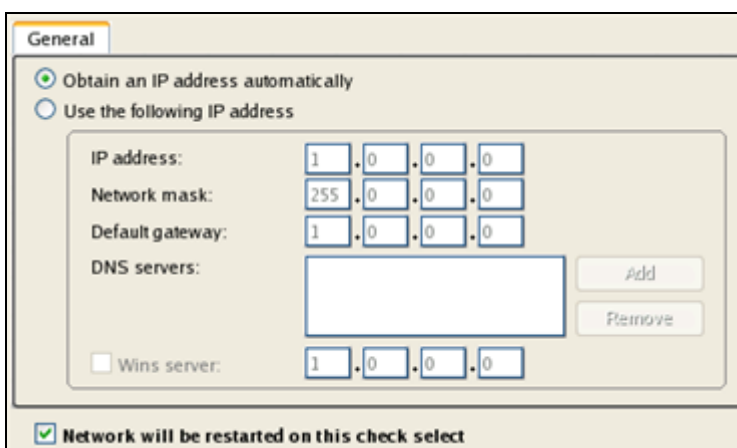|	
IP address:	1 . 0 . 0 . 0
Network mask:	255 . 0 . 0 . 0
Default gateway:	1 . 0 . 0 . 0
DNS servers:	Add / Remove
☐ Wins server:	1 . 0 . 0 . 0

☑ **Network will be restarted on this check select**

- ❑ **Network connection setup**. Click the *Add* button and provide all the necessary information to map a network share in the opened dialog. Click the *Unmount* button to delete an existing network connection.
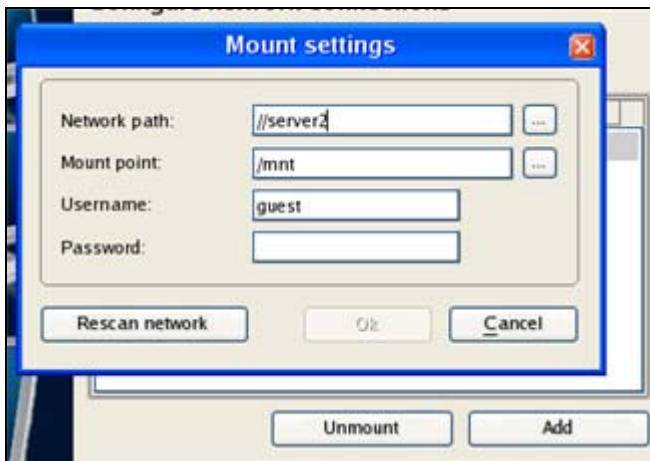
> ⚠️ **On successful accomplishment of Network Configurator (your network device has been properly set up and you've got at least one mapped network share), it is strongly recommended to save the** *netconf.ini* **file by selecting the** *Save config file* **option.**

Results

The wizard will set up a network device and make network resources available to use.

Available operation scenarios:

- ❑ Setting up a Network Device
- ❑ Setting up a Network Connection

Typical Scenarios

This chapter lists a number of the most frequently used scenarios that may be accomplished with the product. You can find here useful recommendations and descriptions of operations.

Backup Scenarios

Backup to a Local Partition

To save a backup archive on a local mounted (drive letter assigned) partition with the Backup Wizard, please do the following:

1. **Launch the recovery environment** and then click the **Backup Wizard** item of the boot menu.
2. On the Wizard's Welcome page, click the *Next* button.
3. On the **What to back up** page, select a partition you need to back up. Click the *Next* button.
4. On the **Backup Destination** page, select the *Save data to local drives or physical partitions* option. Click the *Next* button.
5. Select **a local mounted (drive letter assigned) disk** as a backup destination.

> ⚠ Please take into account values of the parameters *Estimated archive size* and *Space available on backup destination* - if the archive size exceeds the available space, another drive needs to be selected.

6. **Edit the archive name** if necessary. Click the *Next* button.
7. **Add comments** to your backup describing its contents and click the *Next* button to start the backup process.

Backup to a Network Drive

To save a backup archive on a network drive with the Backup Wizard, please do the following:

1. **Launch the recovery environment** and then click the **Backup Wizard** item of the boot menu.
2. On the Wizard's Welcome page, click the *Next* button.
3. On the **What to back up** page, select a partition you need to back up. Click the *Next* button.
4. On the **Backup Destination** page, select the *Save data to local drives or physical partitions* option. Click the *Next* button.
5. Select **a network disk** (it must be mounted and be available in the system by a drive letter).

> ⚠ Please take into account values of the parameters *Estimated archive size* and *Space available on backup destination* - if the archive size exceeds the available space, another network drive needs to be selected.

6. **Edit the archive name** if necessary. Click the *Next* button.
7. **Add comments** to your backup describing its contents and click the *Next* button to start the backup process.

Backup to External Media (CD/DVD)

To store backup images on CD/DVD with the Backup Wizard, please do the following:

1. **Launch the recovery environment** and then click the **Backup Wizard** item of the boot menu.
2. On the Wizard's Welcome page, click the *Next* button.
3. On the **What to back up** page, select a partition you need to back up. Click the *Next* button.
4. On the **Backup Destination** page, select the *Burn data to CD/DVD* option. Click the *Next* button.
5. Select **a recordable device** on the list and edit the archive name, if necessary. Click the *Next* button.
6. **Add comments** to your backup describing its contents and click the *Next* button to start the backup process.

> ⚠️ **After starting the backup process the program will check at first what CD/DVD is in the drive at the moment and then offer either to change it for an empty CD/DVD or erase contents of the current one (if possible).**

Recovery Scenarios

Restoring from a Local Partition

To restore a partition from the backup image situated on a local mounted (drive letter assigned) partition, please do the following:

1. **Launch the recovery environment** and then click the **Restore Wizard** item of the boot menu.
2. Click the *Next* button on the Welcome page.
3. On the **What to Restore** page, either type the **full path to the backup image of the disk, which you are going to restore**, or click the standard browse button **[...]** to find it. Click the *Next* button.
4. On the **Image Properties** page, **make sure that you select the correct image** viewing the provided information about the archive. When the archive has been chosen, click the *Next* button.
5. On the disk layout map, **select a disk**, to be restored. Click the *Next* button.
6. Click the *Finish* button to initiate the restoring process.
7. After completing the operation **reboot the computer**.

Restoring from a Network Drive

To restore a partition from the backup image located on a network drive, please do the following:

1. **Launch the recovery environment**.
2. **Set up a network connection** by selecting the **Network Configurator** item of the boot menu.
3. Complete Network Configurator and then click the **Restore Wizard** item of the boot menu.
4. Click the *Next* button on the Welcome page.
5. On the **What to Restore** page, either type the **full path to the backup image of the disk, which you are going to restore**, or click the standard browse button **[...]** to find it. Click the *Next* button.
6. On the **Image Properties** page, **make sure that you select the correct image** viewing the provided information about the archive. When the archive has been chosen, click the *Next* button.
7. On the disk layout map, **select a disk**, to be restored. Click the *Next* button.
8. Click the *Finish* button to initiate the restoring process.
9. After completing the operation **reboot the computer**.

Restoring from External Media (CD/DVD)

To restore a partition from the backup image located on CD/DVD, please do the following:

1. **Insert a CD/DVD disk** containing the previously prepared backup image into a CD/DVD drive (the BIOS must be enabled to boot the system from the CD/DVD device).

> **This scenario implies that you have got a bootable archive on your CD/DVD.**
>
> **In case the backup image is stored on several CD/DVD disks, please insert the first one.**

2. **Restart** the computer.
3. The *Simple Restore Wizard*™ will be started automatically. Click the *Next* button on the Welcome page.
4. On the **What to Restore** page, either type the **full path to the backup image of the disk, which you are going to restore**, or click the standard browse button **[...]** to find it. Click the *Next* button.
5. On the **Image Properties** page, **make sure that you select the correct image** viewing the provided information about the archive. When the archive has been chosen, click the *Next* button.
6. On the disk layout map, **select a disk**, to be restored. Click the *Next* button.
7. Click the *Finish* button to initiate the restoring process.
8. After completing the operation **reboot the computer**.

Copying of data from the corrupted system disk to another hard disk

To retrieve valuable information from your hard disk and copy it to another hard disk when the system fails to boot, please do the following:

1. **Connect the second hard disk** to the computer.
2. **Launch the recovery environment** and then click the **File Transfer Wizard** item of the boot menu. Click the *Next* button to continue.
3. **Select a disk where the files you need are stored** from the pull-down list in the right pane of the page.
4. **Choose files you want to copy and place them to Clipboard** by pressing the left arrow-button.
5. **Choose the way the data will be stored**. Select the **Save data to local drives or physical partitions** item. Click the *Next* button to continue.
6. On the **Select Destination Path** page, select a hard disk to copy the data to by pressing the *Browse* button. Click the *Next* button to accomplish the operation.
7. After the operation is completed, **exit the wizard** by pressing the appropriate button.
8. **Turn off the computer**.

Burning of data from the corrupted system disk to CD/DVD

To retrieve valuable information from your hard disk and burn it to CD/DVD when the system fails to boot, simply do the following:

1. **Launch the recovery environment** and then click the **File Transfer Wizard** item of the boot menu. Click the *Next* button to continue.
2. **Select a disk where the files you need are stored** from the pull-down list in the right pane of the page.
3. **Choose files you want to copy and place them to Clipboard** by pressing the left arrow-button.
4. **Estimate the resulted data size** by pressing the *Calc* button. Click the *Next* button to continue.
5. **Choose the way the data will be stored**. Select the **Burn data to CD/DVD** item. Click the *Next* button to continue.

6. On the **Choose a recorder** page, select a recorder from the list and then set a volume label by typing it in the appropriate field. Click the *Next* button to continue.

> ⚠️ **The program enables to burn data either to a CD/DVD or an ISO image.**

7. **Insert a blank CD/DVD**. In case the inserted disc is not empty, the program suggests the user erasing its contents. Click the *Next* button to accomplish the operation.
8. After the operation is completed, **exit the wizard** by pressing the appropriate button.
9. **Turn off the computer**.

Copying of data from a backup to the corrupted system partition

The system fails to boot since some files are damaged. If you have a backup of the system partition, you can recopy these files to make the system be operable again:

1. **Launch the recovery environment** and then click the **File Transfer Wizard** item of the boot menu. Click the *Next* button to continue.
2. **Select a disk where the system backup is stored** from the pull-down list in the right pane of the page.
3. **Open the required backup**, choose files you want to copy and place them to Clipboard by pressing the left arrow-button.
4. **Choose the way the data will be stored**. Select the **Save data to local drives or physical partitions** item. Click the *Next* button to continue.
5. On the **Select Destination Path** page, select the required system disk to copy the data to by pressing the **Browse** button. Click the *Next* button to accomplish the operation.
6. After the operation is completed, **exit the wizard** by pressing the appropriate button.
7. **Turn off the computer**.

Network Configuration Scenarios

Setting up a Network Device

1. **Launch the recovery environment** and then click the **Network Configurator** item of the boot menu.
2. On the **Welcome** page of the wizard, click the *Next* button.
3. The second page provides the possibility to select a file with network configuration settings (by default, **netconf.ini**). Click the *Next* button to continue.
4. The program performs auto-detection of installed network devices and then displays a list of available devices (if any). You can add a network device if it is not present on the list by clicking the *Add device* button.
5. Select the required device from the list and click the *Configure selected* button to configure it.
6. On the **Settings for Interface** page set an IP address (automatically defined by the DHCP Server or a static one), a network mask, a gateway and a DNS server address.
7. Restart the network to apply the entered parameters by clicking the *Restart network* button
8. Click the *Next* button to complete the operation.

Setting up a Network Connection

In order to establish a network connection and mount available shared resources, simply do the following:

1. **Launch the recovery environment** and then click the **Network Configurator** item of the boot menu.
2. On the **Welcome** page of the wizard, select the **Configure Network Connections** option. Click the *Next* button.
3. On the **Configure Network Connections** page click the *Add* button to set up and mount a new network resource.
4. In the opened **Mount Setting** dialog, please define the following parameters for a new connection and available shared resources:
   - **Network path** to a shared resource on the net. Browse for it by clicking the appropriate button or manually enter the required path.
   - **Mount point**. It is a local directory where files from a shared network resource will be exported to. Browse for it by clicking the appropriate button or manually enter the required path.
   - **Username** and **Password** that will be given by a network administrator to connect to the shared resource.
5. Click the *Ok* button to confirm the entered parameters.

This connection will be added to the list of available network resources.

Glossary

Active partition is a partition from which an x86-based computer starts up. The active partition must be a primary partition on a basic disk. If you use Windows exclusively, the active partition can be the same as the system volume.
In the *DOS partitioning scheme*, only Primary Partitions can be active due to limitations of the standard bootstrap.

Backup Image is an archive of the disk, which includes all the on-disk files and service information on the disk layout. To restore disks from such an archive means retrieving all informational components of the disk (e.g. a hard disk image consists of its partitions, the Partition Table and even bootstrap code).

Bootable Archives are created by adding a special bootable section when the user is backing up the data to CD/DVDs. The user is able to restore the data from these archives without having to run the program, but by simply booting from these CD/DVDs.

Cluster is the smallest amount of disk space that can be allocated to hold a file. All file systems used by Windows organize hard disks based on clusters, which consist of one or more contiguous sectors. The smaller the cluster size, the more efficiently a disk stores information. If no cluster size is specified during formatting, Windows picks defaults based on the size of the volume. These defaults are selected to reduce the amount of space that is lost and the amount of fragmentation on the volume. A cluster is also called an allocation unit.

Extended Partition is a type of partition that you can create only on basic master boot record (MBR) disks. Extended partitions are useful if you want to create more than four volumes on a basic MBR disk. Unlike primary partitions, you do not format an extended partition with a file system and then assign a drive letter to it. Instead, you create one or more logical drives within the extended partition. After you create a logical drive, you format it and assign it a drive letter. An MBR disk can have up to four primary partitions, or three primary partitions, one extended partition, and multiple logical drives.

File system metadata. The servicing structures of a file system, which contain information about allocating files and directories, security information etc, are named file system metadata. File system metadata are invisible for users and ordinary applications because accidental modifications of the metadata usually make a partition unusable.

Hard disk geometry. Traditionally, the usable space of a hard disk is logically divided into *Cylinders*, Cylinders are divided into *Tracks* (or *Heads*), and Tracks are divided into *Sectors*.

The triad of values {[Sectors-per-Track], [Tracks-per-Cylinder], [Amount-of-Cylinders]} is usually named *Hard Disk Geometry* or *C/H/S geometry*.
Tracks and Cylinders are enumerated from "0", while Sectors are enumerated beginning with "1".
These disk parameters play an essential role in the *DOS Partitioning scheme*. The alignment of partitions takes the parameters of the hard disk geometry into consideration.

Modern hardware uses an advanced scheme for the *linear addressing* of Sectors, which assumes that all on-disk sectors are continuously enumerated from "0". To allow backward compatibility with older standards, modern hard disks can additionally emulate C/H/S geometry.

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 similar to NTFS, 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).

Hidden partitions. The concept of hidden partitions was introduced in the IBM OS/2 Boot Manager. Operating systems do not mount "hidden" partitions, which prevents access to their contents.

A method of hiding partitions consists in changing the Partition ID value that is saved in an appropriate entry of the Partition Table. This is achieved by XOR-ing the Partition ID with the 0x10 hexadecimal value.

This method only works when the set of usable Partition ID values is very limited, since large sets of usable Partition IDs can lead to confusing file system types; for example, Ext2 partitions are marked with the 0x83 Partition ID value. A hidden Ext2 partition would be marked with the 0x93 Partition ID value, which is identical with the Amoeba File system Partition ID.

Master File Table (MFT) is a relational database that consists of rows of file records and columns of file attributes. It contains at least one entry for every file on an NTFS volume, including the MFT itself. MFT is similar to a FAT table in a FAT file system.

MBR & 1st track of the hard disk is the 0th sector of the disk. MBR (Master Boot Record) contains important information about the disk layout:
- The partitioning scheme.
- The starting records of the Partition Table.
- The standard bootstrap code (or the initial code of boot managers, disk overlay software or boot viruses).

Generally, the 0th sector is used for similar purposes in all existing partitioning schemes.
The capacity of the MBR is not sufficient to place sophisticated boot programs. This means that the on-boot software uses the entire 0th track of the hard disk in addition to the 0th sector because it is not included in any partition. For example, boot managing utilities such as LILO, GRUB and Paragon Boot Manager are located in the 0th track.

NTFS File System is an advanced file system that provides performance, security, reliability, and advanced features that are not found in any version of FAT. For example, NTFS guarantees volume consistency by using standard transaction logging and recovery techniques. If a system fails, NTFS uses its log file and checkpoint information to restore consistency of the file system. In its later versions, NTFS also provides advanced features such as file and folder permissions, encryption, disk quotas, and compression.

Partition ID (or File system ID) is the identifier of a file system that is placed in the partition. The partition ID is used to quickly detect partitions of supported types. Some of the operating systems rely completely on the Partition ID when distinguishing supported partitions, while others again do not.
The partition ID is saved in appropriate entries of the *Partition Table*. It takes up only 1 byte of space.

Partition Label (sometimes also referred to as Volume Label) is a small textual field (up to 11 characters) that is located in the partition's boot sector. This value is used for notification purposes only. It is detectable by any partitioning tool including DOS' FDISK utility.

Modern operating systems use other methods to save the Volume Label within the file system, e.g. as a special hidden file. The Volume Label is able to contain a relatively large amount of text in multiple languages. In general, the Volume Label and the Partition Label are rather different.

Partitioning scheme is a set of rules, constraints and the format of on-disk structures that keep information of the partitions that are located on the hard disk. There are several partitioning schemes, which can be used. The most popular partitioning scheme is the so-called *DOS partitioning scheme*. It was introduced by IBM and Microsoft to use multiple partitions in the disk subsystems on IBM PC compatible computers.

Another popular partitioning scheme is the so-called *LDM* (Logical Disks Model) that originates from UNIX mainframe systems. The Veritas Executive accommodates the simplified version of LDM to the Windows 2000 operating system.

Windows 2000 and XP support two quite different partitioning schemes: the old DOS partitioning scheme and the new Dynamic Disk Management (DDM). The problem is that older versions of Windows do not support DDM. In addition, most hard disk utilities do not support it as well.

Recovery Media is a CD or DVD (or even a floppy disk) from which the user can boot and recover the system.

Root Directory is the top-level directory of a formatted logical drive. The Root Directory includes other files and directories.
In modern file systems (e.g. Ext2/Ext3, FNTFS and even FAT32), the Root Directory does not differ from other directories in properties. This is not the case for old FAT12 and FAT16 file systems.

Serial Number. In the DOS partitioning scheme, every hard disk and every partition has a Serial Number, which consists of 32 bits and is represented by an 8-figure hexadecimal value.

The hard disk's Serial Number is stored in the MBR. Its value is assigned when the MBR sector is initialized by standard disk managing tools from Microsoft, such as Windows Disk Administrator and FDISK utility.

In fact, the hard disk's Serial Number is not important for most operating systems and software. It is known that Windows NT, 2000 and XP store hard disks' Serial Number values in the database of assigned drive letters.

A partition's Serial Number is stored in its Boot Sector (in FAT16, FAT32 and NFTS file systems). Its value is assigned when the partition is formatted. In fact, the partition's Serial Number does not play an important role for most operating systems and software.

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.