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## Backup challenge for Home Users

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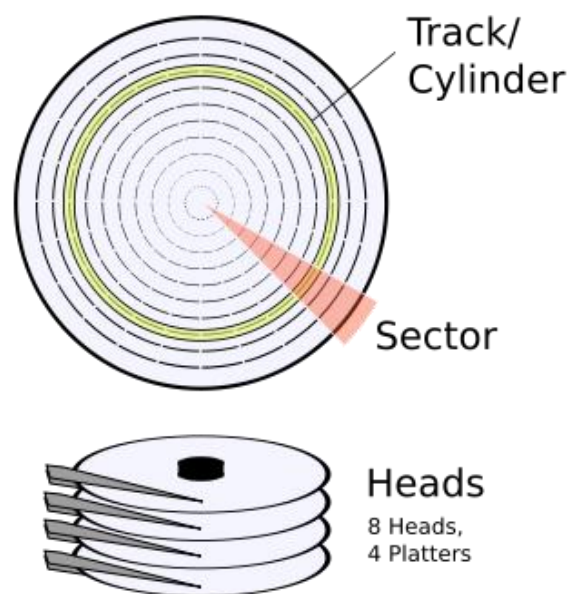
## Introduction

Have you ever been concerned about your data's security? Would you like to rest assured knowing that your files and folders are secured against disaster? Have you ever lost your documents, photos, music and other important data after a computer failure? It can happen suddenly and without warning, again and again. This is a common threat in the computer world.

This document will show you how to ensure your data is protected.

## About Hard Drives

The majority of modern computers use **Hard Drives** for long term data storage. These devices store information as electric signals, interpreted as bytes of data. The smallest piece of raw data stored on a hard drive is a **Sector**, which commonly equals 512 bytes.



Information blocks of this data are spread across hard disks according to logical structures known as **Partitions**. Hard drives can have an unlimited number of partitions or none at all. There are also several types of partitions that can be created.

Partitions alone do not create a map of file and folder locations – that is the task of the **File System**. File systems have been developed for many different operating systems; however NTFS and FAT are the standard File Systems used with Microsoft's Windows operating systems.

To keep things simple, remember - your data actually consists of nothing more than electric signals on a hard drive, which are translated into a meaningful form by computer electronics with the help of various types of software.

## What is a Backup?

Any data in the computer world can be copied or duplicated. From the beginning of the computer age important information has been copied as archives for its safety. This technology is known as **Backup** and archives are also called **backup images**. The purpose and use of data backup may vary by individual, but it mainly focuses on two scenarios. First, it is used for restoring a computer to a previous state after a disaster. Second, to restore a small number of files or folders after they have been accidentally deleted or corrupted. Applications that focus on data storage and duplication is commonly referred to as **Backup Software**. Well-known backup utilities, such as Paragon Drive Backup or Acronis True Image, provide a wide range of functionality for disaster recovery, data security and information cloning.

There are several types of backup images; sector-based and file-based are the most common types. Each offer advantages and disadvantages but can complement each other well.

## Why Backup?

Because hard drives contain moving parts such as disk platters and read/write heads, data reliability is always vulnerable. In many cases hardware failure causes complete data loss. Such failures are rare but are also the most destructive. They may be also caused by an electric short circuit, physical damage (i.e. while transporting a computer), defective parts, etc. Despite this possibility, your data may still be recovered, however these operations are time consuming and quite costly.

Software or file system errors are not fatal, and can commonly be fixed. This type of issue is the most common because of its unlimited number of sources. Computer viruses, buggy applications, user mistakes and system faults are some of the main causes. Take a moment to imagine the possible scenarios. What would you do if you lost all your files and data?

## How to Backup

### Operating system

Commonly, an operating system is installed to the first partition on a hard drive. This partition is sometimes referred to as a system partition and has been specially prepared during the operating system's installation. Best practices dictate that we use this partition only for system files and folders, with only the most needed software and drivers installed in this location. Data storage across several partitions can provide additional security benefits.

The best way to save an operating system and its current state is to create a full **sector-based backup** of the partition it resides on. It may also be necessary to store specialized sectors on a hard drive, such as the Master Boot Record (MBR).

### Files and folders

A user's data is spread across a number of files and folders, and can be stored in a number of archives residing in different locations. Obviously, backing up an entire partition to protect a single file or folder is not an optimal solution, but if you want to save the entire file system with all of its attributes and hidden files, sector archives are what you'll rely on.

Many technologies have been developed to help archive files and folders. These include utilities that simply copying files, to devices write them to a tape device. The most common way to save a number of selected files or file types is to create a **file archive**.

### Sector and file backup comparison

A **sector-based backup** is generated by creating an image (or a snapshot) of the entire hard drive or its separate partitions. It not only includes the contents of all user-created files, but additionally contains the exact structure of all directories, information about file allocation, file attributes and other related data. Sector-based backups enable the successful processing of system partitions or encrypted partitions of any file system type, no matter what kind of information they contain.

In contrast, a **file-based backup** takes into account a file system's structure and only functions on a file or folder level. Thus it is very efficient when archiving separate files or folders, but will in no way help you back up an entire system partition.

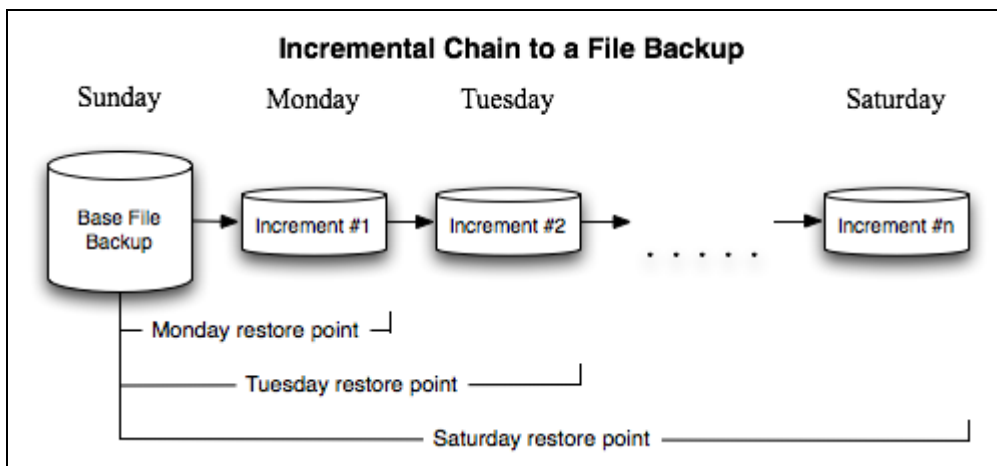
Both technologies have their benefits and drawbacks. The most important of these are listed below:

	<b>Sector Backup</b>
<b>Pro</b>	Independent from a particular file system. May create archives of volumes with unknown file system, encrypted or hidden information
	Creates the most complete and full snapshot of existing data on the partition.
	Excellent for operating system backup and rapid recovery.
<b>Con</b>	Resulting large size of archives may contain redundant data.
	Difficult to manage the backup sets, especially when a small amount of data is being changed.
	<b>File Backup</b>
<b>Pro</b>	Excellent for creating archives of small amounts of data, single files and/or folders.
	The backup task can be customized to include/exclude files based on type or by selected folders. Other criteria filters may also be utilized.
	Provides the possibility to backup data from the same volume with different backup policies.
	Easy to create and control backup sets.
<b>Con</b>	Dependant upon the file system structure
	Cannot create a full archive of an operating system.
	Much slower than sector backup when working with large amounts of data.

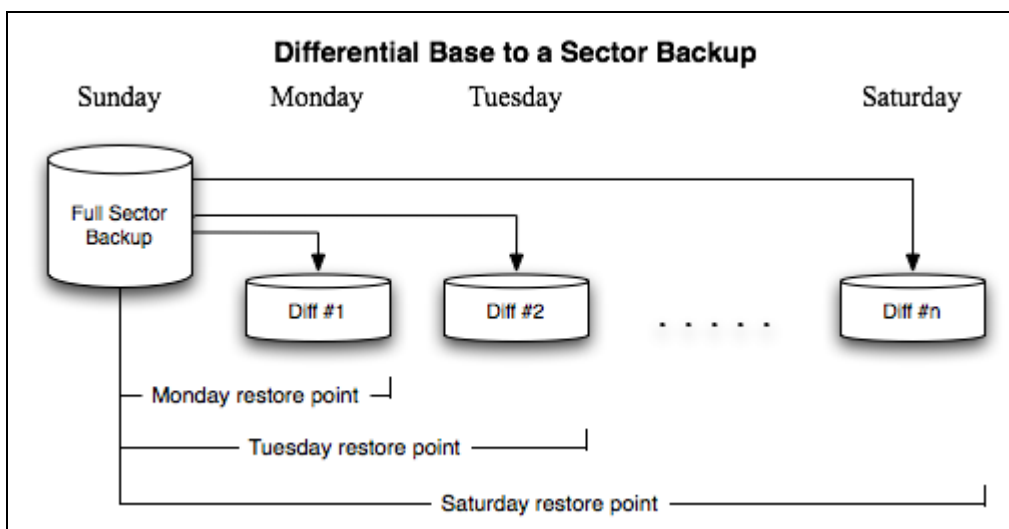
## Incremental, Differential and Full Backup

A **full sector-based** backup image includes all contents of a partition or a hard disk at the moment of its creation. If you roll back your system to the initial state on a regular basis, that's exactly what you're looking for. A **full file-based** archive only contains files and folders. It is extremely efficient when backing up an e-mail database or particular documents, as no redundant data is processed. But if you care about maintaining a file history, you will benefit from one of the supplementary techniques called Incremental or Differential File Backup.

An **incremental archive** contains file data that has changed since the time of creating a full or incremental file-based archive. An incremental archive is smaller in size and takes less time to create than a full archive. When restoring incremental archives you will require the initial full archive and all of its previously created incremental archives, as shown in the example below.



A **differential archive** only contains data which changed since the time of creating a full archive, which forms a base image. This considerably saves your system resources. To restore this kind of backup you will require a full image and any one of its related differential archives, depending on the point in time you would like to restore to. As you can see by the image below, this is also very convenient.



## Where to backup?

Naturally, a place where you can save a file is also a place where a backup image can be stored, but this is not recommended. Should a disaster strike, both original data and archived data would be lost. The following list briefly describes common storage locations:

### Local drives

**Common partitions** are an easy-to-use archive storage location. Most backup applications are able to save archives as normal files, which can co-exist with a user's data and programs. Obviously, the hard drive where your operating system resides isn't protected in an isolated, secure fashion and the archive data may easily be accidentally deleted or corrupted by the user and or running programs. Consider a secondary hard drive or external hard drive for storing your archives.

**Secure partitions** are an improved variant of the common partition. They're still partitions which reside on the same computer's hard drive, but they are specialized to primarily store backup images. They don't contain a blend of various data types or programs and user cannot access their content. Only the backup solution which created the secure partition is able to access it.

### Network locations

Many modern computers are connected by networks. From a local network to the Internet, users work with remote resources. The fact that you don't waste your local drives to store seldom used data is the main advantage of network resources. The disadvantages are their unstable accessibility and slower speed connections.

**Network shares** are simple, but can be used only in local or enterprise networks. They're supported by an operating system, so any application (including backup programs) can use them without much preparation.

**FTP servers** use a simple network protocol to exchange data, so they can be accessed through a local network or the Internet from nearly any location in the world. Unlike network shares, access to ftp servers depends on backup program functionality, if the process is to be automated.

**Network attached storage (NAS)** is becoming more affordable and is now available to home users. In a nutshell, NAS is an advance network share technology where a remote resource (hard drive, flash memory, etc.) is mounted to the system as a local one. The main disadvantage at this time is the cost of these devices.

### Removable media

Most removable media are an ideal long-term archive location, but floppy disks are excluded.

**CD/DVD discs** are a widely available medium for information storage because of their low cost and versatility. Most backup solutions can burn archives to blank or rewritable discs. Some of them can create bootable CD/DVD sets for use in emergency situations.

**USB flash and attached devices** provide better transfer rates (speed) and a capacity for backup storage purposes. But their cost can make CD/DVD more preferable as stand-alone storage.

There are also some specific backup devices, such as magnetic tape, but they are used in enterprise-size networks, not usually in homes. Such devices also come with a higher price tag.

## Recovery Operations

There may come a day when your archived backup data becomes needed.

The opposite of backing up is **restore**. Basically, restore is a process of recovering data from archives or previously saved copies. Despite the backup method used and the archive location, there are usually several ways to recover this information.

You can normally **copy or restore one or multiple files** from an archive. Many types of backup support this operation, even sector-based images. The choice is left up to the user, whether to overwrite existing files and folders, to place copies of the files on the same disk, or to write the information to a new location.

**Complicated sector archives** of entire disks and partitions are commonly recovered as a whole image. It is also possible to shrink or stretch the size of resulting partitions at the expense of free space available on the hard drive. Of course restoration to the original location can normally only be performed under special environments. If the Windows operating system and the backup/restore program are still functioning, it is usually possible to restore information in a special system mode (you may have seen this when your operating system checks your drives for file system errors). If the standard environment is not accessible, or it isn't installed on the computer at all, you should use special recovery means such as: **bootable CD/DVD** and **flash media** (mentioned above), **special bootable partitions** or **network booting (Wake on LAN or PXE)**.

There is also a technology to recover backup archives created from one computer to another one with different hardware. **Adaptive Restore** leverages the fact that Windows operating systems contains a large pool of hardware drivers by default. As a result, a backup/restore application can tune a system to work on different hardware.

## Free Backup Software

Following is a short comparison table of some most interesting, free backup utilities on the market today. As we show Paragon's Drive Backup 9 Express solution is the market leader in terms of included features.

Tool Function	Vista Backup	NT/XP Backup	Archiving tool (ZIP) and file copying	Paragon Drive Backup 9 Express
Backup files and folders	+	+	+	-
Sector backup of partitions	+	-	-	+
Network backup/restore	+	+	+	+
Restore in special environment	-	-	-	+
Restore with resize	-	-	-	+
Restore from bootable media	+	+	-	+
USB flash/Recovery CD	-	+	-	+
Scheduling	+	+	+	-
Availability for all users	-	-	-	+
Support multiple operating systems	-	-	+	+

A note on Vista Backup features:

The *Backup partitions (Complete PC Backup)* feature is available only in the Business, Enterprise and Ultimate editions of Windows Vista.

The *Schedule Backup feature* is available only in the Home Premium, Business, Ultimate, and Enterprise editions of Windows Vista

Vista uses its installation CD/DVD for booting and recovery purposes.

## Summary

Backup technology is an important key to data safety. Only backups can provide the peace of mind that, in case of a computer disaster, you will get your information back with the least amount of hassle. Test a free backup program today and make the choice that is best for you.