



## Mirrored Storage, Inc.

### Understanding BitBackup

White Paper presented by:

**Mirrored Storage, Inc.**

ONLINE BACKUP SOFTWARE

<http://MirroredStorage.com>

#### Overview

BitBackup technology is included in version 9.0 and greater of the [Mirrored Storage's](#) Remote Backup client software. When enabled, this technology can substantially reduce the time it takes to do an online backup of large data files.

It accomplishes this by storing a complete reference copy of all backed up files in a local disk cache. It then uses the contents of this cache during subsequent backups to identify individual records that have changed. The software then backs up only these records. This results in shorter backup times and reduced storage requirements on the offsite server. BitBackup is supported on Windows 2000, XP and Server 2003.

**Warning:** Due to disk cache requirements, use of the BitBackup feature on PCs with less than 5 GB of free disk storage is not recommended.

#### How It Works

BitBackup technology can substantially reduce the amount of time it takes to perform an online backup of a large file. It does this by identifying and archiving only the records within the file that have changed since the last time a complete backup of the file was performed.

For example, consider the case where a critical database of customer records is updated daily. Over time, this file will tend to grow large. However, the amount of data added or deleted on any day may be just a few records.

With a traditional approach to backups, if even a single record in a file changes, a complete copy of the entire file must be transferred to the server. This complete backup could take many

hours to perform and result in substantial usage of offsite storage for each copy of the file maintained.

BitBackups are different.

When performing a BitBackup, a complete file backup is performed the first time. But, on subsequent backups, the software determines the records that have changed since the initial backup and transmits only the changed records (plus some administrative information) to the offsite storage server.

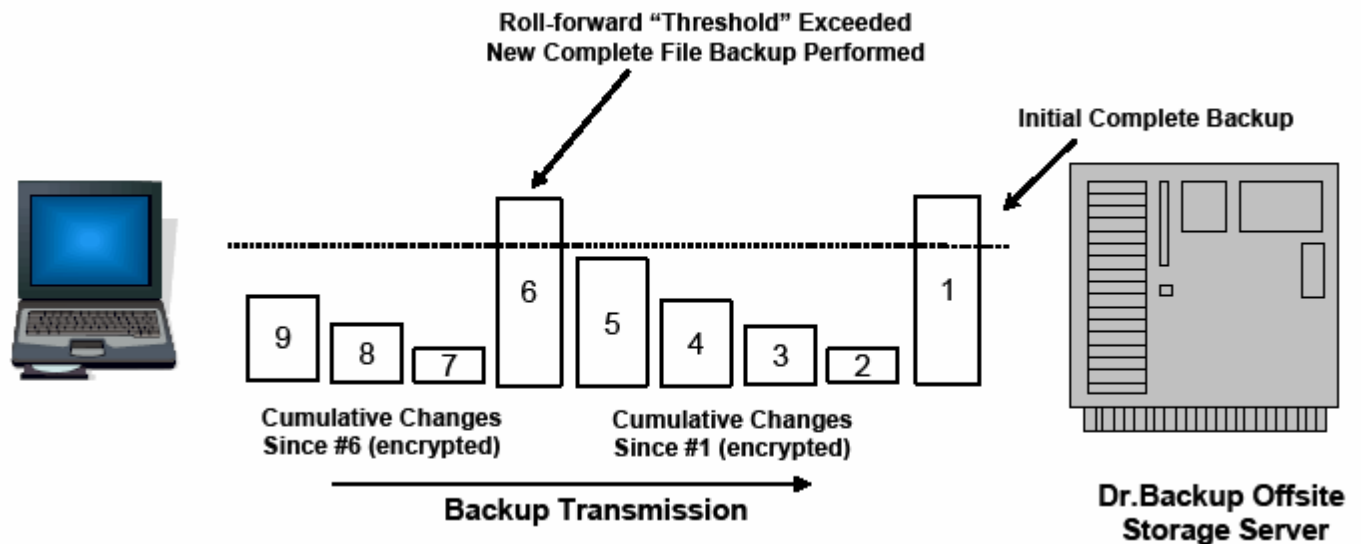
Since the size of the changed records is likely to be much smaller than the size of the entire file, a BitBackup may take just a few minutes to complete. In cases where multiple file copies are maintained, BitBackup technology reduces the use of disk space on the offsite storage server.

BitBackup technology makes extensive use of a local reference disk cache. It also has built-in management intelligence to determine whether it is appropriate to transmit file changes, or to "roll forward" and perform a complete backup of a data file.

Databases, Outlook personal storage files (email), large documents and any other data files which change only modestly each day are ideal candidates for a BitBackup.

### Step-by-Step Walkthrough of a BitBackup

The diagram below provides an illustrated version of how BitBackup operates. Depicted is a single database file that is being backed up nine (9) times, presumably on nine consecutive days.



The first day's backup, illustrated above by the rectangle labeled "1" shows a complete backup of the database being transmitted to the offsite server. At the same time, a reference copy of the database is stored in a local cache on the client PC.

On day two, when the BitBackup ran, it detected that there were changes in the production database file. It then compared the database file in its reference cache to the current database in production on the PC. A small number of records were identified as actually changing. These records, along with some administrative information were then compressed, encrypted and transmitted to the backup server.

On day three there were more changes to the database. Once again, a comparison was made between the production database and the original reference copy in the local cache on the PC (from the backup performed on day one.) The number of changes was still relatively small and this data was transmitted to the offsite storage server.

On days four and five, the process repeated. However, four days have now passed and the version of the database in the local cache differs greatly from the version now in production use.

The amount of change data records being sent over to the server is now substantial since the changes have accumulated for several days.

On day six, more changes were made to the production database. However, because the number of changed records (from the original version) is now substantial, the BitBackup software has decided to perform a complete backup of the file versus sending a large number of change records.

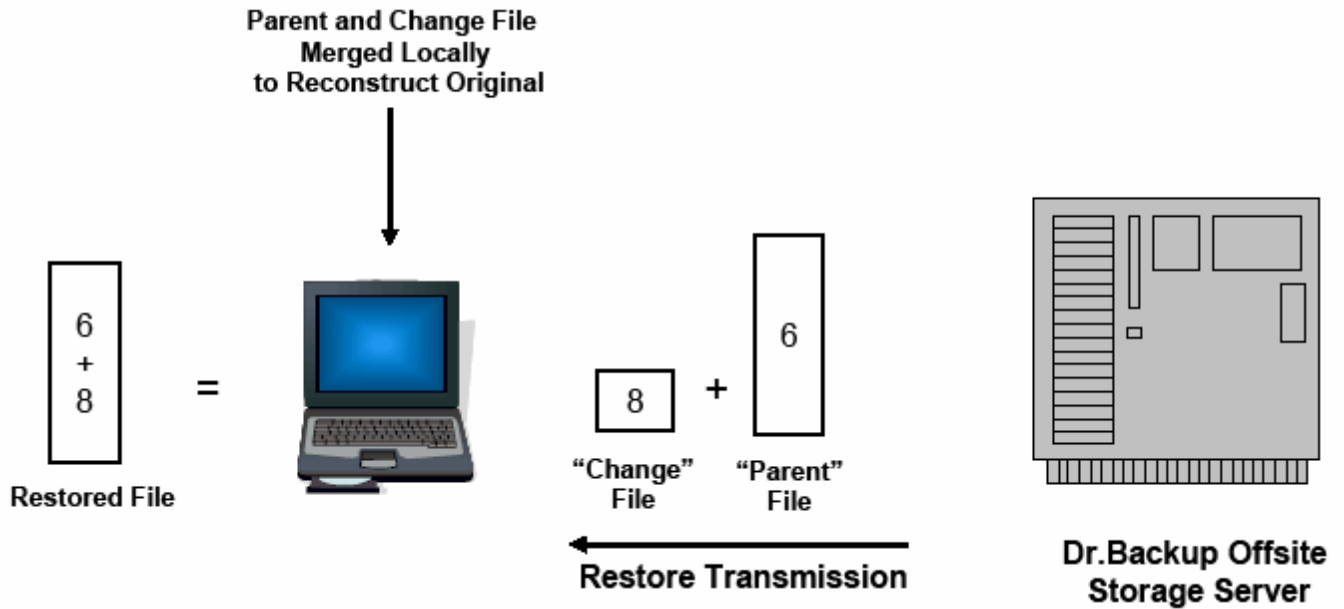
**Note:** We call the process of retransmitting the entire database file a "roll forward." A complete backup is transmitted to the server and is also copied to the local reference cache – replacing the version originally stored on day one.

On days seven, eight and nine, the process continues. Note that the change records transmitted now reflect differences in the production database when compared to the roll forward backup performed on day six.

By enabling BitBackup for this database file, and permitting use of a local reference cache on the client PC, we are able to significantly reduce the amount of offsite storage and reduce the overall time required to perform backups on most nights (except roll forward refreshes.)

### **Restoring a File Using BitBackup**

The diagram below overviews the process of restoring file number eight (see example above) from the offsite storage server.



To BitBackup, file eight is actually reference file number six with changes from day eight applied. So in order to reconstitute the backup from day eight, the software restores change file eight and "parent" file number six. It then uses the administrative information in change file eight to combine files six and eight into the restored file eight.

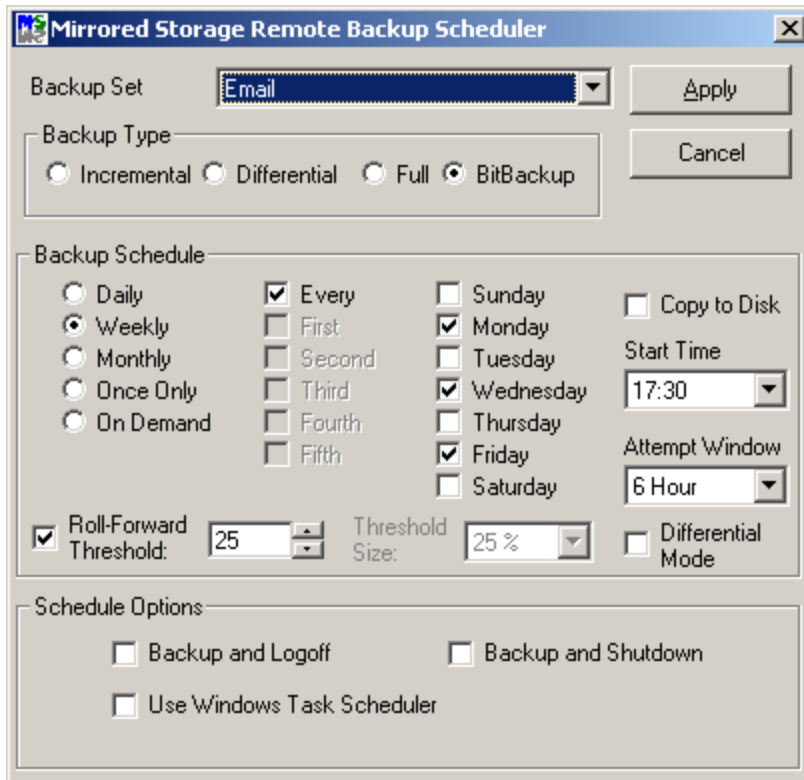
The end user of course never sees any of this complexity - they just get their data back.

**Note:** In some cases, it may be possible to restore data files from the local reference cache without the need to retrieve the data from the offsite storage server.

### **Enabling BitBackup**

BitBackup can be enabled on any backup set. The management controls are found on the scheduler dialog box as shown below.

BitBackup is considered a special form of incremental backup. The first time that a BitBackup set is executed all files in the selection list are backed up – irrespective of the archive flag on the files. However, in subsequent runs, only files which change (as indicated by the file archive flag) are backed up.



Two options are available to manage the size of change files which are transferred to the server. These are: Roll-Forward Threshold and Threshold Size. The settings are mutually exclusive.

Roll-Forward Threshold, if checked, permits you to specify the number of backups which can be performed before the software is forced to transfer a completely new copy of a data file to the offsite server.

Alternatively, Threshold Size permits you to send change data to the offsite server as long as the size of the change file does not exceed 25, 50, 75 or 100% of the reference file already stored on that server. If the change file does exceed the selected percentage, then a roll-forward operation will be performed.

The default behavior of BitBackup is to send change backups to the server until the changes exceed 25% of the size of the full reference file already on the server.

### **Implementation Considerations**

BitBackup is a technology which uses the local resources of a PC, both CPU and disk, to optimize the performance of an online backup. Use of these local resources can both speed up the time required to perform backups (on average) and reduce the storage requirements for clients wishing to keep multiple copies (generations) of a file on the offsite storage server.

Be advised that considerable local computer resources are required to examine each file being backed up to determine on a record by record basis what has changed. Substantial additional storage resources are also required to hold reference copies of data files in a local disk cache.

In general, we do not advise the use of the BitBackup feature on PCs which have less than 5 GB of free disk storage to be used as a local disk cache. Likewise, PCs or servers which currently carry a heavy workload may not be good candidates for use of BitBackup.

**Acknowledgements and Sources:**

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