

There are only two types of non-incremental backup methods that Genesys Micro recommends for data backup:

Grandfather-Father-Son (GFS) method, and the **Tower of Hanoi (TH)** method.

The following is by the Acronis corporation:

“What's a "Generational Backup Scheme" And How Does It Work?

A generational backup is one of the simplest, most effective methods for making and keeping backup copies of your data. Properly done, it combines ease of use and data protection.

The most common generational backup scheme is the three-generation or "grandfather-father-son" (GFS) method. In its most basic form it involves making a complete copy of the data to be backed up on removable media such as tape or CD. This is the *grandfather*. At the next scheduled backup period, say the next day, another complete copy of the data is made, which of course includes the changes in the data during that period. This is the father. At the next scheduled backup, the third copy, or son is produced.

The fourth backup is made by recording over (or replacing, depending on the media) the grandfather copy. The new copy becomes the son, the previous son becomes the new father and the father is promoted to grandfather. This continues in rotation so there are always three backups, each of a different point in time.

The advantage of saving the two previous backups as well as the current backup is that if the computer data somehow become corrupted and the problem isn't caught until after the backup is made, there are still two uncorrupted, albeit increasingly out of date, backup copies. Given reasonable care, it's unlikely a problem will corrupt all three backups before it is caught. Similarly, if one of the backup copies is damaged, you still have two more. The three-generation backup also makes it easy to store one of the copies (usually the grandfather) in a more secure and often off-site location.

Note that this approach *does not* take incremental or differential backups into consideration — each backup is a full backup.

Another approach to this is to create a full backup to serve as the grandfather. Let's say this is on a Sunday. The next backup date might be the following Sunday, when the father backup is created, with the son being created a week later. You still can create incremental backups each day between full backups. That way, instead of losing a week's worth of data, at worst you lose a day's worth, or however many days occurred between the corruption of the data and discovering the problem. This further minimizes the potential loss and, since you're using incremental backups, makes those daily backups much faster than full backups. "

At Genesys Micro LLC, **we recommend a GFS method that uses a minimum of 8 pieces of media, that protects your data for up to 1 month.** A complete daily backup is done Monday through Thursday, and then the Fridays are rotated for 4 weeks. This is the easiest (less complex) method to implement with the greatest possibility of data protection. A full GFS method uses 20 pieces of media to cover the entire year, with the 4th Friday of each month rotated (12 media for the 4th Friday of each month, 3 media for the 1st, 2nd, and 3rd Fridays of each month, and 4 media for the Mon to Thurs. backup).

We do not recommend incremental or differential backups because if one of the pieces of media fails, then its possible that none of the other backups have the data you need for recovery. Yes, you can use less pieces of media, especially if you use the "Tower of Hanoi" (TH) method, but this method is too complex to easily keep track of – you would literally need to keep a chart to know which media to use on any particular day (see below). No other simple backup methods will provide the protection your company needs. Complex backup methods are best suited for larger environments that implement "libraries" that automate the process of backup and recovery. These machines can use complex methodologies and software to provide the most effective backup method for the least number of media.

Need more Information? Contact the technical support representatives at Genesys Micro, at (304) 267-0433.

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The following information is by Seagate, Inc.

TAPE ROTATION SCHEMES

- [Grandfather-Father-Son Backup Method](#)
- [Six-Cartridge Weekly Backup Principle](#)
- [Tower of Hanoi Backup Scheme](#)

By committing to back up your data, you have taken an important first step in protecting your information assets and, in some cases, the existence of your organization. But simply committing to back up data is not enough to adequately protect yourself from the many perils that can jeopardize your critical information.

Many users, network managers and small-business owners alike, believe that performing a daily backup using the same single data cartridge protects them from disaster. However, this line of thought is in itself a disaster. By using only a single backup tape, you are not archiving a history of your data. Corrupt data often exists long before it rears its ugly head into a system crash. By using a single tape, you could be backing up corrupt data and have no chance of finding the clean file or files you have backed up. Having multiple copies on a single media is not acceptable either. In order to protect yourself, you must have multiple copies in multiple places to be assured of retrieving your data in the event of a disaster.

Now you may say, "What if I back up everything on a new tape, every day?" You could do that, but if you have a large data repository, the cost of ownership related to data cartridges can sharply increase.

We suggest using one of two industry-standard tape rotation schemes that are designed to protect your data as well as minimize the cost of ownership related to data cartridges. By incorporating a mix of daily, weekly, monthly and quarterly backups, you can be sure that you have a complete history of your data from various points in time.

Grandfather-Father-Son Method

One of the most commonly used tape rotation schemes is called Grandfather-Father-Son. This scheme uses three sets of tapes for daily, weekly and monthly backup sets. To execute the Grandfather-Father-Son rotation scheme, you will need twelve sets of media. The actual number of backup tapes required in each media set will vary depending on how much data you need to backup.

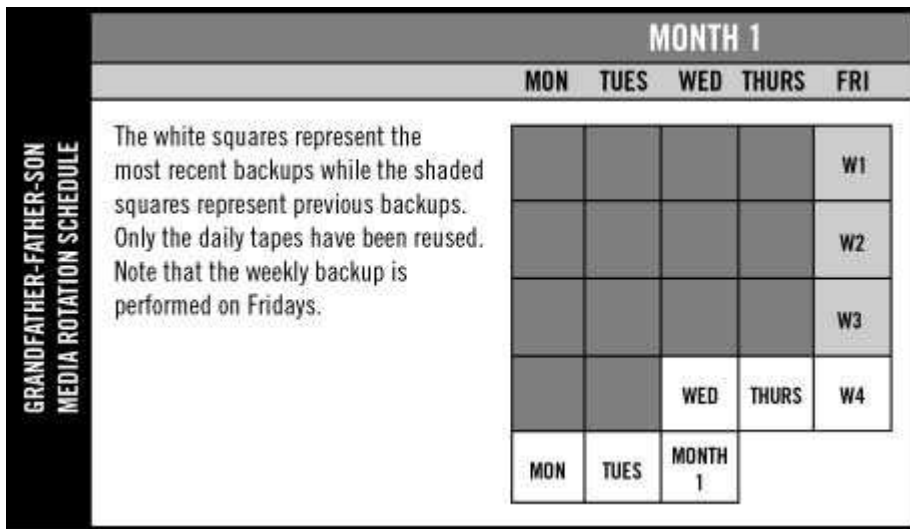
The first set, "Son," represents your daily backups. Assign four tapes as incremental daily backups and label them "Monday" through "Thursday." These tapes will be used to perform daily incremental backups and can be reused weekly on the day that they are labeled.

A second set of up to five weekly tapes, called "Father," is used to perform full backups on the day in which you do not perform a daily incremental backup. This media set should be labeled "Week 1" through "Week 5" and can be reused monthly on the day matching its label.

The final set of three tapes, called "Grandfather," is used to perform full backups on the last business day of each month and can be reused quarterly.

This rotation scheme will back up data on a daily, weekly, monthly, and quarterly basis. In some instances, archived data is required for periods longer than one quarter. In these cases, media sets are often pulled from the rotation and stored in an off-site media vault.

An illustration of the Grandfather-Father-Son rotation scheme is located below.

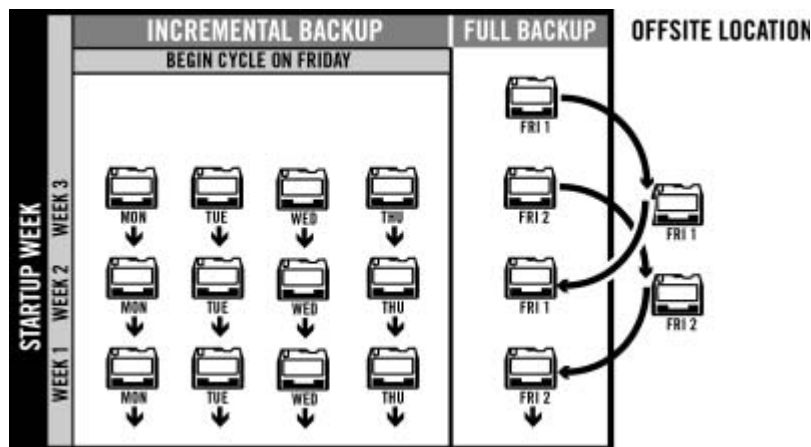


Six-Cartridge Weekly Backup Principle

A simpler and more cost effective implementation of Grandfather-Father-Son is called the Six Cartridge Weekly Backup. Perfect for small businesses, this backup principle requires daily backups and a single weekly off-site backup copy to provide a data history of up to two weeks. Friday backups are full backups. Monday through Thursday backups are incremental. Here are the steps:

1. Label each of six cartridges with **FRI 1, FRI 2, MON, TUE, WED, THU.**
2. Start the cycle on a Friday and backup the entire hard disk onto cartridge **FRI 1.**
3. On Monday, take the **MON** cartridge and back up only the files that have been created or modified since the last backup (**FRI 1**). This is an incremental back up and should be stored on-site. (A full backup, rather than incremental, can be used, if desired).
4. Repeat Step 3 on Tuesday, Wednesday, and Thursday, using corresponding data cartridges.
5. On Friday, take data cartridge **FRI 2**, and perform a full backup. You have just completed a full rotation of the weekly principle. Again, be sure to store this data cartridge in an off-site media vault.
6. The weekly process continues by repeating Step 3 and Step 4 using the same **MON, TUE, WED, THU** data cartridges. Step 5 is implemented by alternating cartridges **FRI 1** and **FRI 2**.

An illustration of the Six-Cartridge Weekly Backup Principle is located below.



Tower of Hanoi Backup Scheme

The other popular tape rotation scheme is called Tower of Hanoi. With the Tower of Hanoi, four media sets are used and are labeled as "A," "B," "C," or "D." The number of tapes in each media set will vary depending on the amount of data you are protecting. Starting on day one, perform a backup using set "A" every other day. Set "A" can be reused on a daily

basis but never two days in a row. You begin and continue using set "B" on the first "non-A" backup day and repeat using set "B" every fourth back session. Media set "C" begins on the first "non-A, non-B" day and repeats every eighth session. Media set "D" begins on the first "non-A, non-B, non-C" day and repeats every sixteenth session.

Increasing your backup history is easy because adding a media set (e.g. set "E" beginning on a "non-A, non-B, non-C, non-D" session and repeating every 32 sessions) doubles the history of your backup. The Tower of Hanoi scheme makes it easy to recover data -- the more often a media set is used, the more recent the archived data is that resides on the set. Best practices suggest that five media sets should be used if you are applying the Tower of Hanoi to weekly backups and eight media sets if you are applying it to daily backups.

An illustration of the Tower of Hanoi tape rotation scheme is provided below.

TOWER OF HANOI MEDIA ROTATION SCHEDULE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		A		A		A		A		A		A		A		A	
MEDIA SET			B				B				B				B		
					C								C				
									D								
																	E

RETURN TO DAY 1

Cost Implications:

Although both tape rotation schemes effectively serve the purpose of protecting your data, each has different cost considerations. While the Tower of Hanoi is more difficult to implement and manage, it is much more cost-effective than that of Grandfather-Father-Son. However, if network management is an issue for your organization, it makes sense to use the simplest method and assume the slightly more expensive cost associated with the Grandfather-Father-Son method. It is also important to save your off-site backup in a safe, secure location.