The Backup Strategy Guide

How to protect your small business from data disaster

Cortex I.T.

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Executive Summary

This manual provides an introduction to data backup strategies using tape, and provides an overview of common tape rotation systems. The steps to implementing a backup strategy are also provided.

This guide is aimed at the people responsible for protecting data in a small business – the small business owner or system administrator.

Additional Resources

This guide should give you enough information to implement a backup system for your small business or organization.

For more information on hardware, be sure to contact your local computer store or technical support personnel.

For information on backup software, visit the following websites:

BackupAssist website – http://www.backupassist.com

Backup Strategies website – http://www.backupstrategy.info

Tape Backups website – http://www.tapebackups.info

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1. Introduction to tape backups

Data Backups – a necessary part of risk management

With the increasing risks of computer viruses, cyber-vandalism and hardware failure, implementing a systemized data backup plan is a necessary part of any business' strategy for risk management.

Data loss can occur because of a multitude of other reasons too, such as accidental file deletion, and may go undetected for days, weeks or longer. A good backup strategy needs to allow you to restore data from a variety of instances back in time.

Tape backups – the ideal medium

Tape is an ideal medium for backing up data because of its high storage capacities, low cost, and the ability to store cartridges off-site.

Organizing a number of tapes into an efficient backup library also allows you to restore data from different points in time, and archive data. This is further explained in Chapter 2.

Tape formats

A number of different tape formats exist. Some common formats include:

Tape format	*Data capacity*[1]	*Data transfer rate*	*Applications*
Travan	1 - 20Gb	1Mb/sec	Home use, low range servers
DAT / DDS / 4mm (Digital Data Storage on Digital Audio Tape)	2 - 20Gb	2.75Mb/sec	Low range servers, small business
AIT (Advanced Intelligent Tape)	15 - 50Gb	3Mb/sec	Low to mid range servers
LTO (Linear Tape Open)	200 - 1600Gb	40-320Mb/sec	Mid to high range servers and mainframes

The average small business and organization will find that a Travan or 4mm DDS tape will provide the solution in terms of data capacity and cost. All data will generally fit onto a single tape, meaning that a single stand-alone tape drive can be purchased (instead of more expensive options such as tape autoloaders, etc)

When should backups take place?

Backups should ideally take place outside of business hours, when network traffic is at its minimum. Scheduling the backup at some time during the night (eg. Midnight) is a suitable tactic for most organizations. Backing up data once a day (after each working day) provides good coverage against data disaster.

[1]Typical uncompressed data capacities and data transfer rates are quoted

Different types of backups

Different types of backups are available in backup software. Each will backup different amounts of data, and different types of files as summaried below:

Backup type	*Files that are copied over to backup media*
Full	All files, system data, etc.
Differential	All files added or changed since the last full backup
Incremental	All files added or changed since the last full, differential or incremental backup
Daily	All files added or changed on the day of the backup

A Full backup will copy all files and system data to the backup media. It allows for the complete restore of all data from one single tape.

Differential, Incremental and Daily are partial backups are designed to reduce amount of data backed-up to the media, resulting in faster backups. To restore data using one of these backups, the last Full backup tape will also be required, along with any other partial backups since the last Full backup.

For example, if Full backups are performed on Mondays, and Incremental backups on the other days, to restore last Thursday's data, 4 tapes would be required (Monday full + Tuesday incremental + Wednesday incremental + Thursday incremental).

The problem with partial backups is the requirement for multiple tapes when restoring data. If any of these tapes is faulty, then the restore cannot be guaranteed to proceed correctly.

Clearly, if all your data can fit onto a single tape, performing full backups all the time is the safest strategy.

Backup Software

The backup tape rotation methods described in Chapter 2 can be implemented manually or in software.

One particular piece of software, BackupAssist (www.backupassist.com) is specifically designed to help small business owners in managing and scheduling their tape backups. It interacts with the Microsoft Windows Backup program to provide an easy way of implementing a tape rotation strategy easily.

More details on using backup software to assist your backup process are given in Chapter 3.

2. Tape Rotation Systems

In a tape rotation system, multiple tapes are organised into a *tape backup pool*, or *tape backup library* to provide you with data recovery capabilities, whilst allowing for selected backup tapes to be stored off-site for added security.

Different tapes are used for different days' backups according to a predefined system. Three such tape rotation systems are described here.

Five tape rotation – one per day

The simplest tape rotation scheme is to have one tape for each day of the working week. Tapes are labelled: *Monday, Tuesday, Wednesday, Thursday, Friday.*

For example, consider the calendar below:

Monday	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
	1 **Tuesday**	2 **Wednesday**	3 **Thursday**	4 **Friday**
7 **Monday**	8 **Tuesday**	9 **Wednesday**	10 **Thursday**	11 **Friday**
14 **Monday**	15 **Tuesday**	16 **Wednesday**	17 **Thursday**	18 **Friday**
21 **Monday**	22 **Tuesday**	23 **Wednesday**	24 **Thursday**	25 **Friday**
28 **Monday**	29 **Tuesday**	30 **Wednesday**		

You can restore data from any one of the tapes in your library – or in this case, any day in the past the week. This strategy requires only five tapes, but only provides one week's data backup history.

Grandfather – Father – Son (GFS)

The grandfather – father – son schedule is the most widely used method, and involves backing up data in the following way:

- daily – on the “son tapes”
- weekly – on the “father tapes”
- monthly – on the “grandfather tapes”

This system is far more powerful than the five tape rotation, but requires more tapes.

For example, consider the calendar below:

Monday	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
	1 **Tuesday**	2 **Wednesday**	3 **Thursday**	4 **Friday**
7 **Month 1**	8 **Tuesday**	9 **Wednesday**	10 **Thursday**	11 **Friday**
14 **Week 2**	15 **Tuesday**	16 **Wednesday**	17 **Thursday**	18 **Friday**
21 **Week 3**	22 **Tuesday**	23 **Wednesday**	24 **Thursday**	25 **Friday**
28 **Week 4**	29 **Tuesday**	30 **Wednesday**		

This strategy provides you with the ability to restore data from the last week, plus any Monday over the last month, plus any month for as many monthly tapes as you have. Variations on this scheme are available, and provide a trade-off between the number of tapes required, and the number of monthly tapes available.

Tower of Hanoi

The Tower of Hanoi a complex strategy where five tapes are used – called *A, B, C, D, E.*

- A is used every other day
- B is used every 4th day
- C is used every 8th day
- D and E are used every 16th day, alternating

This ensures that data is available from the last day, 2 days ago, and three other times in history. However, the range of history of backup is dependent on where one is in the cycle.

Consider the following calendar:

Monday	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
	1 **A**	2 **B**	3 **A**	4 **C**
7 **A**	8 **B**	9 **A**	10 **D**	11 **A**
14 **B**	15 **A**	16 **E**	17 **A**	18 **B**
21 **A**	22 **C**	23 **A**	24 **B**	25 **A**
28 **D**	29 **A**	30 **B**		

This method is clearly confusing, but has the advantage of only requiring 5 tapes. Unless aided by software, this method is not recommended because it is prone to human error.

3. Implementing a backup system

Pitfalls to avoid in a backup system

There are several pitfalls that can reduce the effectiveness of any tape backup system:

- **Faulty media** – if you run the same tapes for years, eventually they will wear out. However, your backup software should be able to detect faulty tapes when it verifies the data written to the tape after each backup.

- **Human error** – if you place the wrong tape in the tape drive for a backup, you'll obviously disrupt the system. There are ways of minimizing human error, which includes using software such as BackupAssist, to email your administrator/secretary daily, and instruct him/her to place a certain tape in the drive.

- **Insecure storage of tapes** – it is critical that your tapes be stored in a secure location such as a fireproof safe, and that your monthly, quarterly and yearly tapes be stored off site. Please note that if you store all your backup tapes next to your file server, and your building gets robbed or burns down, not even the best tape backup library in the world will get your data back.

The 3 steps to implementing a backup system

So now that you know the basic theory and options available, what's the fastest and most cost effective way of protecting your data? Here are the 3 steps that I recommend my clients:

Step 1 – select and purchase your backup hardware

The data of most small organizations will fit onto a single tape. Work out the amount of data that you need to back up, and select an appropriate tape drive according to these rough guidelines:

- Up to 10 Gig – Travan cartridge drive

- Up to 20 Gig – DDS tape backup drive

- Up to 40 Gig – DDS tape backup drive with hardware data compression

Then purchase the necessary tapes for your backup rotation strategy. A good Grandfather-Father-Child variation will require 10 tapes or 14 tapes.

Step 2 – implement backup processes, using software

The next step is to select a tape rotation strategy, devise a calendar of tapes, and to set up your tape backup software to schedule tape backups at the end of the working day. This process is time consuming, but fortunately there is software available to simplify the process.

I recommend BackupAssist (www.backupassist.com) for this purpose, as it provides a simple, inexpensive way of implementing a backup strategy, thus saving time and money. More details and a downloadable trial version can be found on the BackupAssist website.

Step 3 – continually perform your backups!

Backups must be done every working day to be effective.

And as obvious as this sounds, the correct tape should be placed in the drive. For example, placing the "Week 2" tape instead of the "Week 3" tape in the tape drive will reduce the effectiveness of your tape rotation strategy!

Software such as BackupAssist will email your administrator or secretary the correct tape to place in the drive on any given day to minimise human error.

In addition, you should monitor the results of each backup to check for errors. For example, if a tape wears out and data cannot be verified, you need to take action and replace that tape.

By default, Windows Backup will **not** notify you of errors – it's a manual process of opening up the backup logs and ensuring that the backup proceeded correcctly.

However, software such as BackupAssist will email you the backup logs daily, enabling you to monitor the backup results without having to manually check them.

Be sure to also follow your manufacturer's guidelines for drive cleaning and maintenance.

What level of investment is required?

Your investment in data protection will not be insignificant, but is small when compared to the costs associated with data loss.

The prices quoted (in US dollars) here are estimates of typical hardware, from the buy.com website, at 10th April 2003. In the example, 15 tapes have been purchased to implement the "Professional" data backup rotation scheme.

Item	*Qty*	*Cost*
Seagate Travan 20 Gig Drive (STT220000A-RDT)	1	$269.00
Imation 20Gb data cartridges (12118) 3 pack	5	$445.90
BackupAssist software	1	$129.00
Total investment		**$843.90**

What should I do now?

This guide should give you enough information to implement a backup system for your small business or organization. For more information, consult the resources listed in the *Additional Resources* section at the start of this manual.