Tandberg Data SMB Guide to
Backup Best Practices

Data Protection Strategies for the Small-to-Medium Size Business

FEATURES

- *Best practices to ensure your data is fully protected!*
- *Complete checklists for tape migration and backup*
- *Covers both standalone tape drives and autoloaders*

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Data Protection Strategies for the Small-to-Medium Size Business

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1. About this Guide

Data Protection Strategies for the Small-to-Medium Size Business

Suppose for a moment that a virus infects your entire computer network. The virus spreads through every employee's workstation, into every document and database file. All your work, all your data—it's all destroyed. How would your business recover?

Without an adequate backup and recovery plan, your business is at risk. Because your company relies on its data and mission-critical applications, the cost of downtime is exorbitant, potentially exceeding thousands of dollars per hour for such expenses as recovering data and system files, replacing equipment, losing productivity, and losing customers. A recent study[1] reveals the "precarious position" of small business backups: 30% lack formal data backup and storage procedures, 39% review their storage procedures only after a problem occurs, 34% admit to only fair or poor performance in storing backup data offsite, 17% don't consistently perform incremental data backups, and 55% rate their disaster recovery plan as fair or poor. According to a disaster recovery study, nearly half of the companies that are unable to fully restore their data after a disaster will go out of business entirely[2].

Why Tape is Ideal for Backup

Whether you are backing up an individual workstation or a small network, tape is an ideal storage medium because it is capable of storing high capacities of information for a relatively low cost. And, tape is perfect for archival because you can store cartridges off-site for enhanced data security.

Tape Automation—Now Available for SMBs

Until recently, tape backup for the small-to-medium business meant manually inserting tape cartridges into individual tape drives. Tape automation has traditionally been the realm of big-budget IT departments. Now, affordable autoloaders and small tape libraries provide SMBs with the convenience and risk reduction previously available only to large businesses.

If you want to reduce the risk of human error in backups or just don't want to spend time manually inserting and removing tapes each time you back up, consider one of today's automated tape solutions. A ten-cartridge autoloader, such as Tandberg Data's VXA PacketLoader 1x10 1u, can provide reliable, unattended backup for up to two weeks for little more than the price of a standalone tape drive.

Who Should Read this Guide

Read this guide if you are responsible for protecting data in a small or medium business. It provides information about how to use tape technology for backup and recovery and how to implement common backup strategies and tape rotations.

NOTE: Whether you already have a tape backup system in place or you are deciding to purchase a new tape backup system, you can find helpful advice in this guide.

1 CRN, September 19, 2003, "Precarious Position"
2 University of Texas, Center for Research on Information Systems, 1994 Survey

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2. Data Backup Basics

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This chapter addresses some common questions about data backup.

What does it Mean to Back Up, Restore, and Archive?

Data backup is the process of transferring data from your company's primary computer system to a separate storage device, such as a tape drive. If the original data is lost or damaged, you can restore the information from the device and resume normal business operations. An archive is a long-term, Permanent data backup, which is kept off-site.
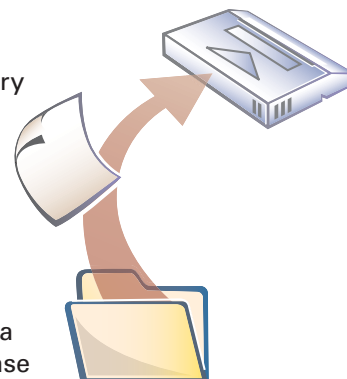
What Types of Files Should Be Backed Up?

The most important files to back up are data files—the files that change on a frequent basis. Periodically, you should also back up the entire system in case of a catastrophic disaster. This periodic backup should include system files that contain specific user information for customized settings and passwords. You may also want to back up software files if you no longer have the original disks. Most backup software provides the option of backing up all files on the drive, the files that have changed since the last backup, or individually selected files.

How Often Should Data Be Backed Up?

Because data files change every time someone enters new information, many companies back up the data files every day (or only those files that have changed) and then perform a complete backup of the entire system on a weekly, bi-weekly, or monthly basis. For your company, you can determine the necessary frequency of backups by asking yourself how often the data changes and how critical are the different types of data files. In other words, how much data can you afford to lose without causing your business undue hardship?

The best strategy is to devise a schedule that works for the majority of your data files. For example, you can schedule a daily backup of new and modified data files and then a weekly backup of all files. If you have critical files that must be backed up more often, you can back up these files throughout the day.

File type	Back up daily	Back up weekly
Data files	*	*
Critical files (may be backed up several times a day)	*	*
All other files (includes system files and software files)		*

When Should Backups Take Place?

Ideally, you should back up data after regular business hours when employee demands on the network are at a minimum. This off-hours time frame is called the "backup window." Most small companies have an adequate backup window to perform backup jobs at night and on weekends.

However, if your business operates 24 hours a day, 7 days a week (24x7), or if you have employees working in different time zones, you may have little or no backup window. In this case, you must determine a time period when employees will be the least affected. Alternatively, you may quickly copy your data to other disk storage reserved for that purpose. That storage may then be backed up to tape without impacting the user community.

TIP: *If your business operates 24x7, use backup software that has an open file option. This option allows you to perform a backup while the files are in use.*

How Long Should Data Be Stored?

How long you store data depends on the type of data and your business requirements.

- **For data files that change frequently, you should keep only the most recent files. As the previous data becomes obsolete, you can overwrite and reuse the tapes.**
- **For the full set of files on your system, you should store the files in a secure, off-site location. By having this complete file set, you can recover the entire system in case a disaster destroys the originals.**
- **For certain types of data (tax records, contracts, personnel files, patient records, and so on), you may need to archive data for a specified time period to meet specific legal requirements. In court cases, courts will hold owners and company officers liable for data loss (despite the reason for the loss).**

Where Should Backup Tapes Be Stored?

You should store one full set of your company's data on-site for immediate recovery and another copy off-site at a secure location in case your business suffers a fire, theft, or other disaster. Many small companies choose to store backup tapes in a safe-deposit box at a local bank or even at the owner's home. To eliminate the hassle and worry, other companies prefer to contract with a vendor who specializes in archival and storage.

How Often Should Tapes Be Retired?

You should follow the tape manufacturer's guidelines for tape storage and replacement. Most manufacturers print these guidelines on the tape packaging. Also, most backup software tracks errors on a given tape, which alerts you that a tape should be retired.

3. An Introduction to Backup Automation

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A tape autoloader is a compact storage device that contains a tape drive, multiple tape cartridge slots, and a robotic mechanism that moves tapes between the slots and the tape drive. Your backup software controls the autoloader, which instructs the autoloader to insert the correct tape before beginning a backup or restore. Each tape has a unique barcode label that your backup software uses to identify and confirm that the correct tape cartridge is in the drive.

With multiple cartridge slots in the autoloader, a single tape loading operation, occurring weekly or even bi-weekly, addresses as many as ten backups. Filling the autoloader with a batch of tapes less often, extending tape swapping intervals, is intrinsically more reliable than depending on daily tape swapping. Less frequent operator intervention reduces the impact of employee absence, forgetfulness, confusion and turnover on the backup process.

The convenience of tape automation is especially helpful if you have remote offices where the clerical staff is responsible for maintaining backups. Because the autoloader can identify the tapes that have been loaded by their barcodes, you can remotely verify that the correct tapes are inserted with your backup software or the autoloader's integrated remote management web page.

In a recent survey[3] over 50% of respondents indicated that their tape failures were sometimes, often or always caused by human error. Tape automation reduces the opportunity for human error by up to 80%, and reduces the likelihood of tape failures by allowing the backup software to automatically and immediately substitute a spare tape when media errors are detected or more capacity is needed.
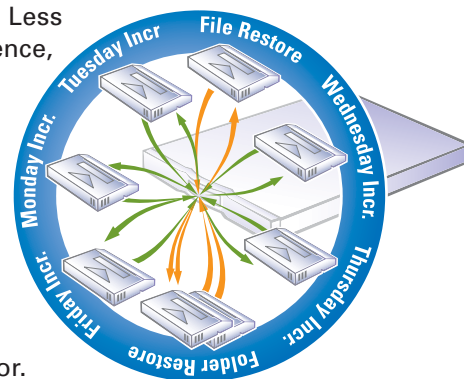
Labor Savings Through Automation

The daily manual exchange of backup tapes imposes a minimum fifteen-minute interruption of an employee's primary duties, amounting to 65 hours of lost productivity per year. By reducing this workload to only fifteen minutes per week, or 13 hours per year, tape automation annually adds 52 hours of employee time for other tasks. Assuming a total employee compensation cost of $60,000, deploying tape automation realizes $1,500 in annual increased productivity. As such, a solution under $3,000 will pay for itself in less than two years through reduced labor costs. These calculations do not include the labor savings an autoloader deployment achieves by precluding the requirement for after-hours recovery by immediately addressing media and tape loading errors.

Protecting several servers, workstations or laptops further cost justifies tape automation. Comsolidating backups is more reliable, easier to manage, and less expensive than purchasing individual tape drives for each system.

Although difficult to quantify, reducing business risk by deploying an autoloader delivers the greatest return on investment. Justifying the cost of an overall backup scheme must include the cost to re-key lost data, or the implications of permanent data loss, factored by the statistical likelihood of such an event. As such, you can weigh the cost of a backup solution compared to its contribution to reducing risk.

3 Storage Magazine, "Tale of the tape", February, 2005

ONCE EVERY TWO WEEKS

REMOVE **10** **TAPES**

INSERT **10** **TAPES**

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4. Types of Backup

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This chapter describes the different types of backup strategies, so you can decide which method is right for your business. Software applications include options for copying the full set of system files, for copying a partial set of new or modified files, and for copying selected, individual files. Most companies use a combination of full and partial backups by performing nightly backups on files that have changed throughout the day, then a full backup of all files on a weekend day.

Full Backups

A full backup copies all the files on the system—the system files, the software files, and the data files. You should perform a full backup on a weekly, bi-weekly, or monthly basis. With a full backup of your data set on tape, you can restore your entire system if a disaster destroys the original files.

TIP: *If your data set is small, you could perform a full backup on a daily basis. However, you should not use the same tape every day. Continuously overwriting a section of tape could damage it over a long period of time. (See Chapter 5 for more information about effective tape rotation schemes.)*

Partial Backups

A partial backup copies all files that have been added or changed since the last backup job. There are two main types of partial backups: incremental and differential, summarized in the table below.

Backup Type	Files Copied
Incremental	Files added or changed since the last full or partial backup.
Differential	Files added or changed since the last full backup.

TIP: *For any crucial files that would be difficult to re-create, you can perform a selective backup at any time during the day. With this method, you don't need to wait until the next scheduled backup to copy the crucial files.*

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Incremental Backups

If you need to save time and cost during regular backup jobs, choose a plan that includes full and incremental backups. In this strategy, you perform a regular backup of all files (weekly, bi-weekly, etc.), then a more frequent backup (daily) of only the files that have changed since the last backup session.

This full/incremental backup method means that fewer files need to be copied and less time is required for the backup procedure. However, this method can also make a complete system restore slower if you have created many different incremental backup tapes (one for each day of the week, for example), or if you need to restore only a particular file and must hunt through several different incremental backup tapes. (See "Which backup strategy is best?" at the end of this chapter for more information.)

TIP: *Because an incremental backup session may only use a small section of tape, you can conserve the required number of backup tapes by using the software's tape-append option. This option allows you to write additional backup sessions where the previous session left off and to make full use of a single tape. However, if you lose this one tape, you've lost data from several backup sessions.*

Differential Backups

If you need to save on restore time and hassle in the event of a disaster, choose a plan that includes full and differential backups. In this strategy, you perform a regular backup of all files (weekly, bi-weekly, etc.), then a more frequent backup (daily) of all files that have changed since the last full backup session.

This full/differential backup method helps the restore process run more efficiently, because only one full backup tape and one differential backup tape are required for a complete restore of the system. However, this method is slower on the backup process because more files are copied daily. (See "Which backup strategy is best?" at the end of this chapter for more information.)

TIP: *If a full data backup requires more than one tape, you might consider investing in a tape autoloader, which includes a tape drive and a robotic arm that automatically handles tape rotation. For a small price increase over a standalone tape drive, an autoloader eliminates the need for manually switching out tapes and eliminates the potential for human error.*

Which Backup Strategy is Best?

Is it better to combine full backups with incremental or differential partial backups? The answer for your situation depends on what factors are most important to you. Do you want to save time and cost on the backup process? If so, you should choose incremental partial backups. Or, is it more important to make the restore process as quick and simple as possible in the event of a disaster? If so, you should choose differential partial backups.

TIP: *Most companies perform full/differential backups, because the restore process only requires 2 tapes (or tape sets).*

The table below highlights the main advantages and disadvantages of incremental versus differential backup strategies.

Backup type	Advantages	Disadvantages
Incremental (all new or modified files since last full or partial backup)	Faster backup time because there are fewer files. Reduced wear on backup device and tape. Fewer tapes may be required.	Slower restore times because there may be more than two tapes required (the full backup tpe and each incremental tape.) Higher cost of downtime in a system disaster.
Differential (all new or modified files since last full backup	Faster restore times because there are only two tape sets required (the full and differential backup tapes). Lower cost of downtime in a system disaster.	Slower backup process because more files are copied. Increased wear on backup device and tape. More tapes may be required.

5. Tape Rotation

This chapter describes some common methods for tape rotation, which determines when to reuse tapes during a backup cycle. A good rotation strategy protects data by ensuring adequate file versions are always available on tape and by protecting the tape from excessive wear and damage, which could lead to unrecoverable data.

Most small companies use one of these rotation schedules: six-tape rotation, Grandfather - Father - Son (GFS), or Tower of Hanoi, described in more detail in the following sections.

NOTE: This chapter provides some suggestions for how to implement these rotation strategies. You can modify the strategies in many different ways to fit your needs.

Six-Tape Rotation

The six-tape rotation method is a simple and cost-effective "tape-a-day" scheme, which is ideal for a small business that does not need to back up high volumes of data. This rotation method involves rotating between two tapes for full backups on Fridays, and then using four tapes for either incremental or differential backups on Monday through Thursday.

TIP: If the full data capacity doesn't fit onto one tape, use "tape sets." Most software provides options for tracking and managing tape sets.
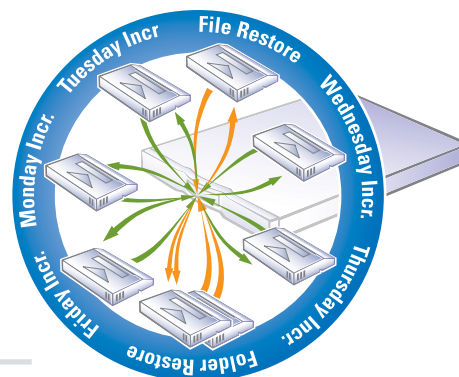
To perform a six-tape rotation method:
1) Purchase six tapes and label them:

Tape 1: FRI1	Tape 4: TUES
Tape 2: FRI2	Tape 5: WED
Tape 3: MON	Tape 6: THU

2) Beginning on a Friday, perform a full backup on the FRI1 tape. Store the FRI1 tape off site.

TIP: For even greater data protection, create duplicate FRI1 tapes: one for on-site storage and one for off-site storage.

3) On Monday, Tuesday, Wednesday, and Thursday, perform an incremental or differential backup on the appropriately labeled tape. Store these tapes at your company site.

4) On the next Friday, perform a full backup on the FRI2 tape. Store this tape off site; and if desired retrieve the FRI1 tape for next Friday's full backup.

5) Repeat step 3, reusing the Monday through Thursday tapes.

6) On Fridays, perform full backups, alternating between the FRI1 and FRI2 tapes. Be sure to store at least one Friday tape off site.

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The chart below shows how you might create a six-tape rotation schedule in a month.

Monday	Tuesday	Wednesday	Thursday	Friday
				FRI 1
MON	TUE	WED	THU	FRI 2
MON	TUE	WED	THU	FRI 1
MON	TUE	WED	THU	FRI 2
MON	TUE	WED	THU	FRI 1
Incremental or Differential				Full

Six-tape rotation method in a one-month period

TIP: *For an even more efficient and cost-effective type of backup schedule, you can perform a three-tape rotation. First, perform a full backup on Tape 1, and then alternate between Tape 2 and Tape 3 for nightly, differential backups. You can perform full backups every 2 weeks, or whenever you feel it's necessary. This three-tape rotation method is ideal if you have a small amount of data to back up and you need to save money on media costs. And, by performing differential backups, you only need two tapes for a full system restore.*

Grandfather - Father - Son (GFS)

The most commonly used tape rotation schedule is called Grandfather - Father - Son (GFS). This rotation scheme operates on the same five-day work week principle as the six-tape rotation method, except that you use more tapes (or tape sets) for backing up data daily (on the "son" tapes), weekly (on the "father" tapes), and monthly (on the "grandfather" tapes). The monthly tapes can be archived for permanent storage or recycled on a quarterly or yearly basis.

The following steps show how to perform a simple GFS rotation method using 20 tapes:

1) **Obtain 20 tapes and label them as follows:**

2) **4 daily tapes (sons) labeled "MON" through "THURS"**
   4 weekly tapes (fathers) labeled "WEEK1" through "WEEK4"
   12 monthly tapes (grandfathers) labeled with the month and year

NOTE: *If a full backup exceeds the capacity of one tape, create "tape sets."*

3) **Beginning on a Friday, perform a full backup on the "WEEK1" tape. Store the "Week" tapes either on site or off site.**

4) **Beginning on the following Monday, perform daily differential or incremental backups on the "MON" through "THURS" tapes. Store the MON through THURS tapes on site.**

5) **On Friday, perform another full backup on the "WEEK2" tape.**

6) **Continue with this rotation method until the last business day of the month. On the last business day (no matter what the day of the week it is), perform a full backup on the first monthly (grandfather) tape. Label the tape with the current date and store it off site.**

The following chart shows how you might create a GFS rotation schedule.

Monday	Tuesday	Wednesday	Thursday	Friday
				WEEK 1
MON	TUE	WED	THU	WEEK 2
MON	TUE	WED	THU	WEEK 3
MON	TUE	WED	THU	WEEK 4
MON	TUE	WED	THU	MONTH 1
Incremental or Differential				Full

GFS rotation method in a one-month period

Tower of Hanoi

The Tower of Hanoi schedule is a secure and cost-effective tape-rotation method, but it's also complex. In Tower of Hanoi, you perform a full backup on five tape sets: labeled A, B, C, D, E. Tape Set A is used every other backup session; Tape Set B is used every fourth backup session; Tape Set C is used every eight sessions; and so on. You could perform these backup sessions nightly, weekly, or at whatever intervals you determine.

The table below shows how the Tower of Hanoi rotation method alternates for each tape set.

TIP: *For archival, you can periodically retire the Tape Set E backup.*

Backup Session	Tape set used
1	A
2	B
3	A
4	C
5	A
6	B
7	A
8	D
9	A
10	B
11	A
12	C
13	A
14	B
15	A
16	E

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To perform a Tower of Hanoi tape rotation:

1) Label five tapes (or tape sets): A, B, C, D, E.

2) For the first backup session, perform a full backup on Tape Set A.

3) For the second backup session, perform a full backup on Tape Set B.

4) Continue alternating the tape sets as shown in the previous table.

5) Once you've reached Tape Set E on the sixteenth day, begin the pattern over again. Store Tape E off site.

The following chart shows a month of backups in the Tower of Hanoi rotation schedule.

Monday	Tuesday	Wednesday	Thursday	Friday
Tape A	Tape B	Tape A	Tape C	Tape A
Tape B	Tape A	Tape D	Tape A	Tape B
Tape A	Tape C	Tape A	Tape B	Tape A
Tape E	Tape A	Tape B	Tape A	Tape C
Tape A	Tape B	Tape A		
Full				

Towe of Hanoi method in a one-month period

Which Rotation Method is Best?

Rotation method	Advantages	Disadvantages
Six-tape	Requires only a few tapes, which provides an easy and cheap rotation method. It's ideal for small data volumes (as much capacity as one tape can hold).	Keeps only a week's worth of data, unless you regularly archive the full-backup tapes.
Grandfather - Father - Son (GFS)	Provides the most secure data protection and implements monthly archival of tapes. It's also a simple method, which most software supports.	Requires more tapes, which can become expensive.
Tower of Hanoi	Allows for easy full-system restores (no shuffling through tapes with partial backups on them). This is ideal for small businesses that are concerned with being able to do full restores. Also, it's more cost effective than GFS (uses fewer tapes).	Requires a difficult rotation strategy, which is not as straightforward to implement as the other rotation methods. Unless your backup software supports it, this method is too complex to track tape rotation manually. Also requires a time-consuming full backup every session.

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6. Planning for Migration

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Data Protection Strategies for the Small-to-Medium Size Business

Like all other components of information technology, your backup systems must eventually be replaced to keep pace with the demands of new technology. As drive capacities have grown to hundreds of gigabytes, older tape technologies offer insufficient capacity and speed to effectively protect all storage. Recent surveys show that 30% to 50% of tape drive users are considering migrating to a new tape format.

This chapter presents a comprehensive overview of the simple migration process from older tape formats to newer tape technologies. By considering the following issues, you will be well prepared for your upcoming migration.
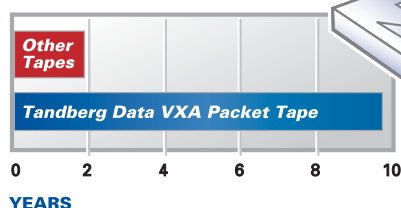
Backup Archive

The most straightforward mechanism for preserving the investment in your backup tapes is to leave all existing backup data on the tapes, and maintain the old tape drive for future restoration of that data as required. The specified life of tape-recorded data is generally at least ten years, with an expectation well beyond that provided the tapes are properly stored.

Leaving your existing archival data on an older format, at current tape street prices, likely provides the lowest cost per gigabyte of long-term storage.

Prior to transitioning to new service, your old tape drive must be thoroughly tested to ensure that its performance remains within specifications. Due to the potential for environmental contamination, the drive should be cleaned, and used only in a dust-free setting.

If your data is to be permanently archived on the older format, it is critical that the tapes be tested during the migration process to ensure readability. Should errors arise due to dust contamination or mechanical misalignment, immediate action will increase the likelihood that your old tape drive can be repaired and the data restored.

EXPECTED TAPE CARTRIDGE LIFE

Other Tapes

Tandberg Data VXA Packet Tape

0   2   4   6   8   10

YEARS

New Applications

If your existing archived data is copied to newer Tandberg Data backup tapes for easier access and greater reliability, the freed tapes may then be moved to a secondary backup application. Transitioned tape backup drives are frequently shifted to protect secondary servers, workstations, or less critical applications with lower data protection requirements.

Maintenance of Your Old Tape Drive

If the old tape drive is semi-retired to only restoring archived data, the drive may sit idle for long periods. Mechanical systems must be exercised periodically to prevent bearings from developing flat spots or areas of inadequate lubrication. It is advised that a cleaning tape be inserted monthly to exercise the drive's mechanics.

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Copying Your Old Backups to the New Format

Although not technically required, some users may elect to copy the existing data archived on tapes to newer tapes. This simple process may be performed at your convenience, as both tape drives generally sit idle outside of the backup window. The Tandberg Data technology provides several reliability features that better protect archived data, increasing confidence in the restorability of old archives. The Tandberg Data formats also allow for faster access and restoration of backup data should the need arise. The copy process further ensures that your older backup tapes are readable, revealing any existing readability issues so they may be addressed in the migration. Should some of the tapes prove to be unreadable, servicing or replacing your old drive may resolve the problem.

Direct Copying

A software program like NovaStor TapeCopy uniquely enables direct older tape format to Tandberg Data tape recording at the maximum tape transfer rate. TapeCopy will copy a full backup tape to a new format in around two hours or less.

Tape Consolidation

Because the new Tandberg Data tape format holds many times as much data as older tape technologies, it may be preferable to copy several older tapes to a single new Tandberg Data cartridge. There are two techniques for consolidating older tapes:

With sufficient disk space on the server, the older tapes can be restored to a folder in groups, and rewritten to new Tandberg Data media. This method requires an amount of free disk space equal to the size of the Tandberg Data cartridge to consolidate multiple tapes at a time. For example: An LT0-3 tape holds 400 GB so your disk must have at least 400 GB of free disk space. The number of tapes consolidated in each batch will be higher if the older tapes contain less than their maximum capacity.

If the current full system backup plus the capacity of an old backup tape is less than the new Tandberg Data tape cartridge's capacity, the data on the old archive tapes can be assimilated via the new backup process. It is common practice to permanently archive at least one full backup each month. Prior to the execution of that backup, an existing backup tape can be restored to an empty folder, with that folder included in the next full backup. The copied old tapes can be re-used for a new application or preferably stored off-site, adding another level of data protection. Using a once-a-month archive cycle, your old backup tapes can be transferred to the new format in one to two years.

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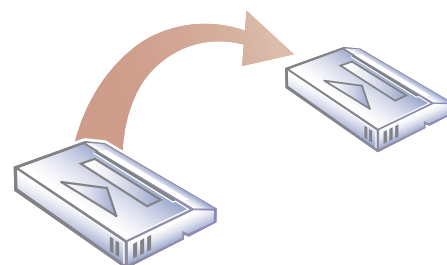
7. Tape Planning

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Data Protection Strategies for the Small-to-Medium Size Business

This chapter provides some considerations for planning the total number of tapes your backup strategy requires and the tape costs associated with that strategy.

Determining the Number of Required Tapes

To help determine how many tapes you need, consider the following:

- **Full backup size. What is the size, in gigabytes, of a full system backup? This amount should include data files, system files, and software files. When you've determined the total capacity, divide that number by the total capacity of each cartridge. For example, if the total capacity of your system is 600 gigabytes, and each tape holds 320 gigabytes, you will need 2 tapes.**
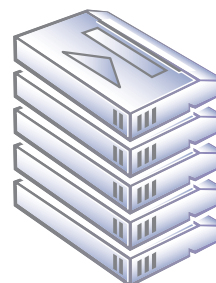
TIP: *Most tape drives and software applications provide a data compression feature to reduce the size of files. By compressing data, you'll reduce the amount of tapes needed.*

- **Partial backup size. Estimate the size, in gigabytes, of an average partial (differential or incremental) backup. This amount includes the data files that change on a daily basis. For example, if an average incremental backup is 60 gigabytes, you will need only one tape for every incremental backup.**

TIP: *By using the software's tape-append feature, you can append incremental or differential backups sets at the end of a previous backup. This saves tape.*

- **Tape rotation method and frequency of backups. What type of tape rotation method will you implement and how many tapes will it require? (See Chapter 6 for how tape rotation methods affect the number of tapes you need.) For example, in a GFS rotation scheme, if you need 1 tape for 4 partial backups a week (1x4=4 tapes), 3 tapes for 4 weekly full backups (3x4=12 tapes), and 3 tapes for 12 monthly full backups (3x12=36 tapes), you would need 52 tapes (4+12+36).**
- **Tape archival. How many tapes will you archive off-site on a yearly basis? Will you archive one full backup monthly or quarterly? For example, if a full backup requires 3 tapes and you plan to archivea copy of one full backup per month, you'll need to purchase 36 tapes a year for archival.**
- **Tape retirement. How often will you retire the tapes used for daily back-ups? You should determine a schedule for retirement, based on the tape's rated service live.**

TIP: *If your software tracks rewrite errors, you may want to monitor that number and discard any tape that shows a significant increase in errors. The cost of replacing a tape is much lower than the cost of losing data.*

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The Tandberg Data SMB Guide to Backup

Determining the Cost

You can purchase tapes in various lengths, which offer various data capacities. Prices for tape cartridges can range from $20 to $100 per tape, depending on the type of tape drive you have. You'll also need to purchase a few cleaning cartridges to ensure proper tape drive operation.

TIP: To help estimate your own tape requirements and cost, contact an Tandberg Data Sales representative.

Tandberg Data Tape Capacities

Tandberg Data tape cartridges are available in several standard capacities, facilitating accurate fulfillment based on the capacity required for your application.

Capacity (GB) Uncompressed/Compressed	
VXA-2 Model X6	20/40
VXA-2 Model X10	40/80
VXA-2 Model X23	80/160
VXA-3 Model X23	160/320
Magnum LTO-2	200/400
Magnum LTO-3	400/800
Magnum LTO-4	800/1600

Calculating Your Tape Requirements

If your backups meet the following criteria, you can replace your old tapes one-for-one with new Tandberg Data tape cartridges:

• **Your backup does not exceed the capacity of a single Tandberg Data tape**
• **You do not anticipate adding new storage in the foreseeable future**
• **You do not anticipate adding servers or workstations to the new backup scheme using the Tandberg Data tape drive**

You should consider purchasing larger Tandberg Data tapes if one of the following applies:

• **Your current full backups will nearly fill a smaller Tandberg Data tape**
• **You anticipate adding storage within the next two years**
• **You plan to add servers or workstations to the new backup scheme using the Tandberg Data tape drive**
• **Your application creates or references very large data files, of which the number or size varies dynamically**

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Plan to obtain a sufficient tape supply if you intend to copy your old archive tapes to the Tandberg Data format. Chapter 5 discusses the various strategies for moving archived data to a new format. To employ the direct copy strategy, you need one new tape for every old archive tape. If you have sufficient disk space for the other consolidation strategies, far fewer tapes are required.

When considering your initial tape purchase, it is important to consider that Tandberg Data tapes last at least five times as long as older media, for two reasons. First, Tandberg Data media recording surfaces are more durable and reliable than older tape technologies. Tandberg Data tape drives are also designed to automatically vary the tape speed to match the data transfer rate of the host, eliminating the need to repeatedly rewind and restart recording.

Further consideration should be given to the fact that today's Tandberg Data tapes will be fully compatible with the next generation of Tandberg Data tape drives. Upgrading your Tandberg Data tape drive to the next generation drive will not require the purchase of new media.

Also with backward compatability, users may save on cartridge cost by using the less expensive previous generation cartridges in the newer tape drive. This works well if the data set size matches the smaller tape and gives the ability to grow into the larger tape, thus extending the return on their tape investment.

8. Planning the Backup Window

Data Protection Strategies for the Small-to-Medium Size Business

Your new backup system will most likely accelerate your backups, reducing the time required for backup completion. The scheduled backup period, also known as the backup window, is critical because users and application access to data is generally limited during the backup process.

Transfer Rate Comparison

The following table compares Tandberg Data tape drive data transfer rates to common older formats. All rates and times are based on an assumed 2:1 compression ratio,

	2:1	20 GB Backup	40 GB Backup
Tandberg Data VXA-2	12 MB/s	27.47 min.	54.94 min.
Tandberg Data VXA-3	24 MB/s	13.53 min.	27.06 min.
Tandberg Data Magnum LTO-2	70 MB/s	4.46 min.	8.92 min.
Tandberg Data Magnum LTO-3	160 MB/s	2.05 min.	4.1 min.
DAT72	6 MB/s	55.33 min.	110.66 min.
DDS-3	3 MB/s	111.07 min.	222.14 min
DDS-4	6 MB/s	55.33 min.	110.66 min.
AIT-1	4 MB/s	83.20 min.	106.4 min.
AIT-2	6 MB/s	55.33 min.	110.66min.

For example, the VXA-2 Packet Tape Drive data transfer rate is twice as fast as a DDS-4 drive, and four times as fast as a DDS-3 drive. Provided that the server can supply data at the rate of 12 MB per second, allowing the data to be compressed to the drive's transfer rate of 6MB per second, the backup window will be reduced by half from DDS-4 and one-quarter from DDS-3 times.

Calculating Your New Backup Window

Estimating the duration of the backup window is straightforward. Divide the total estimated compressed data size by your Tandberg Data tape drive's transfer rate to calculate the time required to complete the backup. This assumes that the tape drive is directly attached to a server capable of supplying data in a steady stream of about twice the transfer rate. If the server is unable to maintain that rate of data transfer, the backup window must be expanded to compensate.

Backup speed of data transported across a network from another server is considerably slower. The maximum theoretical transfer rate of 100 Base-T Ethernet networks is 8 MB per second, although server overheads and other traffic frequently lower this rate.

An overhead of at least 10% should be factored into the backup window duration estimate to allow for server or software delays. A greater overhead factor should be taken into account if the backup may overflow onto a second tape.

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9. Backup Tape Migration Best Practices

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Data Protection Strategies for the Small-to-Medium Size Business

To ensure success with your tape migration efforts, Tandberg Data has compiled the following best practice techniques and suggestions:

- **Perform backups without exception. If your employees are responsible for backing up their own data and you are concerned that backups don't always happen, centralize the backups across a network. To make backups easier, you can use backup software that performs the process automatically. You can also invest in a tape autoloader, which will eliminate the need for a person to insert and remove tapes**

- **Multiple surveys have shown that many companies do not test or otherwise verify their backups. The migration process presents an opportunity to confirm that your archived data is indeed secure. Copying archived tapes to the Tandberg Data format provides absolute assurance that the data is restorable. Otherwise, each tape should be tested by attempting to restore a single critical file or folder.**

- **Institute new procedures to test a backup at least quarterly, and preferably monthly.**

- **Backup best practices dictate that the testing of backup tapes, and the verification of the backup software configuration should be performed by an employee other than the person responsible for backup administration. If that is not possible, or for the highest level of data protection, arrange with your Tandberg Data reseller for regular backup validation consulting services.**

- **Run antivirus software on your computer system to prevent viruses from being transferred onto your backup tapes.**

- **Clearly label tape cartridges so you can quickly identify the correct restore tape. Label each tape with the date of backup, type of drive used, and enough information to generally identify the contents. For example: "2/27/04—Tandberg Data VXA— Weekly Fully Backup of Personnel Records."**

- **If your company has not established an off-site tape rotation scheme, that practice should begin immediately. Ensure that tapes are not left in a hot automobile for any period.**

- **Take proper care of the tapes. Store tapes according to the recommendations listed on the tape packaging. Do not expose tapes to sources of contamination, like copiers and printers that emit toner and paper dust.**

- **Consider using an archive vendor for tape storage. An archive vendor can provide services ranging from secure facilities for tape storage to prepaid delivery of your tapes in the event of a disaster.**

- **You should review your tape rotation schemes to ensure that they are providing a sufficient depth of data protection.**

- **If your intention is to move the old drive to another application, both drives should remain operable on the server for a period of time to allow for emergency file restores from the old format.**

- **Perform the installation at the beginning of a full-backup cycle. Unless you are planning to change to a new backup scheme, maintaining the existing backup cycle will avoid confusion.**

- **Extensively test any new backup system by restoring data from the new backup tapes before rotating the old backup tapes off-site.**

- **If you will be copying your old archive tapes to an Tandberg Data format, devise a scheme to rotate only a few of the old tapes from your off-site location at a time. The complete off-site backup library should never be moved in its entirety.**
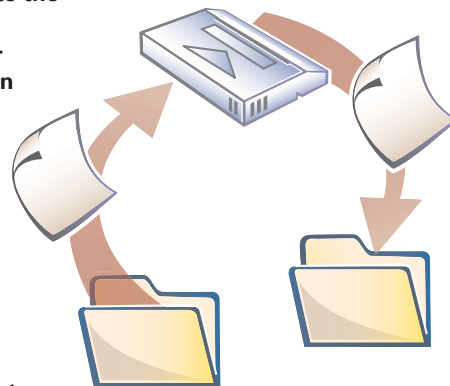
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- **It is preferable to keep the old archive tapes intact, even if their contents are copied to an Tandberg Data format. If the old tapes are to be reused for another application, it is critical that the new Tandberg Data copies be tested to validate the copy process and eliminate human error.**

- **Do not attempt to operate both backup systems for any period of time. Each backup sets "flags" to keep track of what files have changed since the last backup. The two different backups will interfere with each other, causing only subsets of your data to appear on each format.**

- **Be generous in planning for future growth when considering your initial tape purchase. Allow for a minimum of double your current storage capacity.**

Review all aspects of your backup software configuration to ensure that:
- **All data is being backed-up, and that no new drives, applications or folders are overlooked.**
- **All updates and patches have been applied to the backup application and operating system.**
- **The device driver for the Tandberg Data tape drive should be the revision specified by the backup application vendor, which may not be the most current revision.**

When configuring your backup software:
- **Use the backup application's configuration wizards to configure the Tandberg Data tape drive, rather than attempting to set the configuration options manually.**
- **Purchase and install all backup application agents available for your applications, for example Microsoft Exchange, and for any additional clients. The use of agents provides for a faster and more reliable backup and restore.**
- **If your backup application provides the option for hardware or software compression of data to the tape drive, always select hardware over software, and never both.**
- **If your backup application provides the option, select a transfer size of 64 K blocks or larger for the greatest performance.**
- **Password-protect your backup tapes to prevent unauthorized access in the event of theft.**
- **Maintain your backup software in a safe place, such as the fire-proof media safe. If your software license permits, maintain an off-site copy of the backup software.**
- **Institute procedures to ensure that the cleaning tape is inserted as requested by the Tandberg Data tape drive's front panel display.**
- **Institute procedures to review the backup application's log to ensure that errors and warnings are immediately addressed.**
- **Ensure that backup tapes are stored properly, away from monitors or uninterruptible power supplies. On-site tapes should be stored in a fireproof media safe—rated specifically for magnetic media.**
- **Take this opportunity to ensure that all users are aware of and respect the backup window.**

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10. Migration Checklists

To ensure a successful migration, Tandberg Data has prepared the following checklists to ensure that no detail or step is overlooked. By referencing and following the checklists throughout the migration process, your overall level of data protection will be enhanced, and the potential for human error reduced.

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Backup Tape Migration Checklist	
Server:	**Technician:**

Planned Migration Date and time:

Preparing for the Migration

❏	Tandberg Data Tape Drive Ordered	
❏	Initial Tapes Ordered	Reference Chapter 7
❏	Backup Software Compatibility Checked	Reference Tandberg Data Web Site
❏	Archive Migration Strategy Determined	
❏	Internal Mounting Cables and Hardware Acquired -OR-	
❏	External Cabling Acquired	
❏	Tape Rotation Scheme Determined	Reference Chapter 5

Operating System

❏	All Updates and Patches Applied	At least to minimum level specified by backup application vendor
❏	Correct Tape Device Driver Installed	Revision specified by the backup application vendor

Tape Drive Installation

❏	Drive Installed Per Instructions	Reference Product Quick Start Manual
❏	SCSI ID Correctly Assigned	Unique ID – Different from all other devices AND the SCSI controller
❏	All Cables Firmly Seated & Locked	
❏	All Potential Tension Removed from External Cables	
❏	Cleaning Tape Inserted Before First Use	

Backup Application

❏	All Updates and Patches Applied	
❏	All Agents Installed	OS, client and application agents
❏	Tape Drive Configured	Utilizing configuration wizard
❏	Hardware Compression Enabled	Not software compression or both
❏	Transfer Size >= 64 K Blocks	If applicable
❏	Verification of Backup File Set Configuration	Ensure all storage is included
❏	Review of Backup Size to Tape Capacity	Ensure sufficient room for future growth
❏	Review of Backup Window	Ensure sufficient time for completion

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Backup Tape Migration Checklist	
Server:	**Technician:**

Planned Migration Date and time:	

Old Archive Tapes	
❏ All tapes tested -OR-	Reference Chapter 6
❏ All old tapes copied to Tandberg Data tapes -OR-	Reference Chapter 6
❏ Old tape to Tandberg Data tape consolidation scheme implemented	Comments:

Backup Best Practices	
❏ Implement Future Backup Testing Procedures	Monthly or quarterly
❏ Contract for Backup Verification Services	Contact your Tandberg Data Reseller
❏ Review and Implement Off-Site Backup Transfers	Ensure safe conditions during transport
❏ Ensure safe on-site storage	Purchase a fireproof media safe
❏ Implement Procedures to Check Backup Logs Daily	
❏ Educate the User Base on the Backup Window	Schedule, duration and access restrictions

Post Migration	
❏ Initial Backups Tested	
❏ Backup Window Estimate Confirmed	Sufficient time allowed for backup completion with growth
❏ System Error Log Review	Ensure no device errors or conflicts
❏ Old Device Drivers Removed	If the old drive is removed from the server

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