Tape will outlive us all white paper

hp

Now more than 50 years old, magnetic tape has lived through decades of social, political, and technological revolution. Compared with today's blisteringly fast and reliable disk technologies, it looks mechanical, boring, slow, and out of date.

The reality is, far from having one foot in the grave, tape is re-inventing itself as a fast, high-capacity storage medium. Tape technology has become indispensable as the only viable and affordable means of accommodating the sheer magnitude of information that the world now needs to keep safe, sound, and out of harm's way.

The success of a great performer is often down to how well and often they can re-invent themselves to reflect the trends of the day. Two years ago, tape was a dinosaur, killed off by the less durable but cheaper Serial ATA (SATA) disks, which were able to squeeze more data into a smaller space. They also had one other factor going for them—they were new.

Today, in a complete reversal of fortunes, tape has now taken center stage as **the** medium for archive storage. Mounting legislation to prevent accounting fraud, as well as new compliance regulations in financial services and other industries, have made it very clear that disk is not a viable option for maintaining vast, impregnable stores of information. And tape is the only viable solution for storing the astronomical volumes of data generated in film, broadcasting, science, and medicine.

79% of companies are likely to increase or keep their tape storage spending the same in 2005.

—Purchasing Intentions Survey 2004, TechTarget

What is behind this revival?

People believe that tape is dying because the world has seemingly forsaken it for disk. Advocates of disk believe that because magnetic tape has been around for decades, it has no place in the Internet age. In fact, the potential for exchanging personal and financial information with everyone, almost everywhere, plus the increased incidence of natural and deliberate disaster, has opened up gaping holes in information security that make the likelihood of needing to restore systems from archives all the more likely. While disk may have taken over in backup/restore applications, tape has moved down the primary protection list to create the ultimate defense against willful or accidental data loss or damage.

Moreover, while the media has not changed that much physically over the years, new manufacturing and recording technologies have created a tough, lightweight, high-capacity, high-performance media that is perfect for today's automated archive libraries and storage area networks (SANs). It is everything but low-tech. A lot of science and intelligent machinery goes into making a tape. It is a precision-engineered product that involves a complex manufacturing process subject to rigorous quality control and an exhaustive test program to enable tape to tolerate the operating conditions of heavy duty, robotized data silos. Automation and a more risk-aware world have breathed new life into the tape business and, almost by accident, become the enablers for a new class of data management applications.

Figure 1.

Tape does things that other technologies cannot

	Level	Protection	Recovery time	Protects against
Disk-based	1	**RAID Mirroring**	Instant	Device failure Equipment failure
	2			
	3	**Remote replication Two-stage backup**	to minutes	User error Site destruction
Tape-based	4	**Tape backup and restore**	Minutes to hours	Data corruption Equipment failure User error Virus & hacker attacks
	5	**Off-site storage Data Vaulting**	Hours to days	Virus & hacker attacks Natural disasters

Note: Optical disk commonly used for longest term archiving

Big files

Today, hundreds of millions of people have access to computers, all of them generating information by the second, day in, day out.—a trillion email messages a year, 7.3 million new web pages a day, and 2,700 photos a second. Digital artists on *The Lord of the Rings* generated about 1 TB of new data every day and up to 400 GB were being moved between online disk systems. By the end of the three-year project, more than 150 TB of digital material was stored on tape. If the film and news studios were to archive all their movies and broadcasts, they would need 6 ZB of storage. Written to diskettes, that would build a stack to take you all the way to Saturn.

The scientific community also generates vast files. The National Center for Atmospheric Research alone generates 1920 TB of information every year from its satellite and computer modeling weather-tracking activities. The storage requirements for experiments on CERN's nuclear particle accelerators are measured in petabytes, with an estimated new storage requirement of 12 PB by 2006.

In healthcare, new imaging technologies and scanning techniques also present new challenges for the storage industry. A single magnetoencephalography (MEG) scan, which effectively combines MRI and EEG scans, will produce10 GB.

To calculate numbers like these, new, practical, and affordable ways to compress and store more and more information into secure, offline data silos are needed.

Tape cartridge capacity is growing faster than for disk. Projections for 2013 put native tape capacity at 10 TB—double what is forecast for disk. The latest Ultrium 3 data cartridge offers a 400-GB capacity and a data transfer rate of 80 MB/s—and areal densities are improving, too. As capacities increase, the price of tape decreases, making automated tape storage more appealing not only for compliant write once, read many (WORM) storage, but also for write-once, read-seldom-if-ever (WORSE) backup/restore, archive, compliance, and fixed-content applications—applications that represent the single fastest growth area for data storage demand.

Architectural enhancements—including library-embedded disk arrays for caching, tape SANs, WORM, and virtualization—provide large-capacity, automated libraries able to meet new data retention requirements with prices ranging from one-quarter to less than one-twentieth the price per gigabyte of magnetic disk storage.

Little bugs

Many enterprises are already swamped with information and rely largely on the integrity of users to police, protect, and safely store information. Digital information, as already discussed, multiplies like bacteria. Businesses capture massive volumes of data that need to be protected and made readily accessible to users, customers, and suppliers. While organizations struggle to maintain security for their online systems, archives remain vulnerable to malicious attack, fraud, carelessness, as well as accidental loss or damage.

Are mirroring, snapshots, and clones enough?

Disk snapshots of virus-infected servers will take perfect pictures of the viruses, too. Only an archive tape, recorded before the infection, would be secure against a virus. In fact, only tape can protect against all forms of data loss—device failure, accidental damage through human error, viruses, theft, and intrusion.

New laws

In the wake of scandals like Enron and WorldCom, government and industry regulators now insist that organizations file almost everything, in perfect order, forever. Compliance and archival data demand is estimated to grow between 20 and 70 percent a year and is now the fastest growing segment of the storage industry.

The Sarbanes-Oxley Act of 2002 requires all public corporations to preserve financial transaction and email data. IDC forecasts that the number of emails sent daily will grow from 9.7 billion in 2000 to over 35 billion in 2005. In the financial sector, organizations are required to retain every one of their emails.

Required retention periods range from the life of an account, plus up to ten years. No upper limit applies in the case of patient records; copyright records must be kept for at least 95 years; and government records need to be kept for between 20 and 50 years, or simply forever.

New WORM tape technology wins over other storage options because it offers the lowest price per gigabyte and the lowest overall total cost of ownership. Future tape roadmaps ensure that this price advantage will continue for the foreseeable future.

"No matter how many silver bullets or wooden stakes disk storage vendors try, they haven't been able to make tape go away. It is still here, and I think it is going to continue to be here for the foreseeable future, high-profile tape losses notwithstanding. Issues such as cost, capacity, power, portability and bandwidth will see to it."

Henry Newman, "Why Tape Won't Die"
Enterprise Storage Forum.Com, June 2005

Data protection needs are growing—and changing—and tape is still a key component.

There is no one-size-fits-all for data storage. A number of different factors and technologies determine how and where data is managed, backed up, and archived.

- **Media life.** Most fixed-disk compliance solutions use low-cost ATA disks with a maximum usable life of only five years. This means data has to be frequently migrated onto other media, rendering it vulnerable to loss or damage. These solutions use RAID technology to protect the data from failing disks, a cost that can be mitigated with longer term, removable media, that is, tape. Using long-term media avoids the need for frequent migration, thereby reducing the risk of data loss or corruption and the costs of managing the data over time.

- **Overhead.** Fixed-disk solutions require built-in redundancy to protect against failure, with multiple copies being stored in different locations, which increases the cost of fixed-disk content addressable storage (CAS). With write-once magnetic disk solutions, data has to go through an application programming interface (API) to provide an un-erasable layer of data protection while data is being managed in the compliance system. The API can also carry out other functions, such as reducing redundant objects and data encryption, and, importantly, assigning a retention period and locking the data in a non-alterable state for that period. This takes up as much as 25 percent of usable storage—and the API can also degrade performance to a level comparable with removable media.

- **Data growth.** Compliance data is growing by more than 100 percent a year. With fixed disk, the only way to increase data volume is to add more disks, which requires more rack space, more floor space, and, therefore, more money. The solution is to move the data down to the next tier and store it on tape.

- **Compliance.** Storing compliance data on WORM tape media minimizes the amount of data that needs to be backed up on fixed-disk devices. This leads to more efficient use of online hardware.

- **Costs.** A multi-level archive solution saves money by taking storage offline. The cost of expanding capacity is the cost of new tape cartridges, not more hardware. Moreover, data written to tape does not need to be protected because any drive failure will be independent of the media. By using removable write-once media, data protection takes place in the drive's firmware and does not rely on an API to ensure the data is unalterable.

## Tape and disk are not adversaries, they are partners

As part of a multi-level data protection model, tape is the ultimate last resort in the seamless movement of data based on its value. As data becomes less relevant to day-to-day business operations, it can be shifted downwards onto less costly storage media such as tape. WORM tape fulfills the need for tamperproof, compliant data storage, without the high cost of optical disks.

Multi-level protection maximizes the benefits of all storage media—with tape as the ultimate long-stop.

Even in an enterprise-class environment, with regular snapshots/rotating mirrors of data being stored on high-performance disk arrays, there is still a need to back up the snapshots/mirrors to tape regularly. Most backup software can now perform data recovery from a recovery image on disk or tape through a single user interface.

Disk and tape together provide the best solution
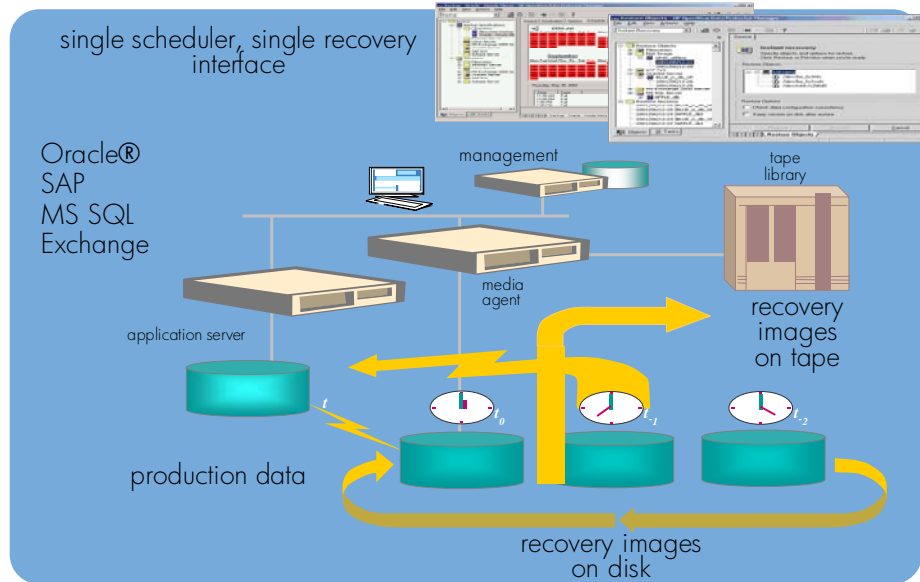
Disk-based data protection	
• RAID	• Instant data recovery
• Replication	• Rapid point-in-time copies
• Snapshots	• Fast, random access
• Cloning	• Perceived Small form factor
	• Continuous backups
	• Multi-level data protection
	• Short shelf life

Tape-based data protection	
• Ultrium, DDS, SDLT, DLT VS, AIT, and so on	• Removable offsite for archival purposes
• Tape drives	• Can be shared amongst multiple hosts
• Tape autoloaders	• Unattended backup available
• Tape libraries	• Excellent long-term storage
	• Can store several 100s of terabytes
	• Low cost per GB
	• Up to 30 years shelf life

All tapes are not created equal

Tape is here to stay. So, the question becomes: Which tape technology meets the requirements?

HP has set out roadmaps for both Ultrium and DDS technologies, supporting a wide range of storage strategies in organizations of any size.

DDS/DAT roadmap stretches to 2010

With an installed based of more than 10 million drives and 6 million users worldwide, DDS/DAT is by far the world's most popular tape storage format. HP and Certance announced in August 2004 that they would continue to develop the technology through to 2010, which is welcome news for all those organizations that already rely on the format for simple, affordable, and reliable tape backup and data protection. HP StorageWorks DAT 72 has a compressed capacity per cartridge of 72 GB and a transfer rate of up to 7 MB/s. The extended roadmap features capacity increases up to 600 GB compressed and transfer rates of up to 32 MB/s—without having to make the boxes any bigger. It means that DAT users can easily manage the growing demand for data storage, in spite of shrinking backup windows—without having to find room for extra hardware.

Ultrium 3—To infinity and beyond?

The Ultrium format is the only effective solution in large-scale rich media, compliance archiving, and SAN applications. Faced with shrinking backup windows, heightened security risks, and increased data protection legislation, more and more data centers are replacing direct-attach storage devices with sophisticated disk arrays that back up data from servers in real time using dedicated SANs. Here, the flexibility and cost-effectiveness of tape media is ideal for deploying a deep data backup and archival model, where short-term data is updated and deleted on the fly and critical data for archiving is moved further back into tape libraries for offsite storage and retention. These libraries, with Ultrium 3 technology, have the potential for enormous capacity, with many drives and thousands of cartridges.

A typical HP StorageWorks ESL E-Series library with 20 Ultrium 3 tape drives will provide:

- Throughput of 80 MB/s native (160 MB/s compressed) **per drive,** which translates into more than half a terabyte per drive per hour and over 11 TB per hour across all 20 drives
- Capacity of 560 TB of compressed storage in a 700-slot library

The roadmap for HP Ultrium tape currently extends to 2012. The format meets all the data center manager's demands for high availability and reliability, high-storage density, ease of management and administration, automation of repetitive tasks, and scalable storage and backup performance.

With more than 11 million HP branded cartridges shipped since launch, Ultrium data media is the fastest growing segment of HP storage media products ever. This amazing success confirms the HP strategy of continuous and extensive testing programs to ensure the outstanding quality of its Ultrium media products, their exceptional reliability, and best-in-class performance.

Third-generation Ultrium media has set a new benchmark in capacity and performance for this format, doubling compressed capacity to 800 GB per cartridge and increasing transfer rates by one-third to 160 MB/s. It is almost twice as fast and half the cost per terabyte of HP StorageWorks SDLT 600, with more than 200 GB more compressed capacity per tape.

Ultrium 3 is the first HP tape product to incorporate WORM capability to guarantee data that is 100 percent accurate and tamperproof. You can buy Ultrium 3 cartridges in two different formats—RW and WORM—for the same Ultrium 3 drive, providing a cost-effective and convenient archiving solution for the retention of compliant data according to SEC Rule 17a-4(f) and other regulatory requirements, such as the Sarbanes-Oxley Act.

Figure 3.

Tape is a key part of HP StorageWorks Tiered Solutions

Online
3 months active, primary data

Near-Online
3-6 months active, infrequently accessed data

Reference Store
Indexed and searchable online archive

Nearline Tape
1 year active, file recovery, off-site recovery

Offline Tape
5 year active, offsite storage, disaster recovery

Archive
30+ year records, offsite storage, retrievable

50+ year records, offsite storage, retrievable

NAS Family, MSA Family, EVA Family, XP Family

Reference Information Storage System

Autoloaders, MSL series, ESL-Series

EML Series

Media, MSL series, ESL Series, Optical

EML Series

Storage Infrastructure • HP Storage Software • HP Services

A brand you can happily stake your future on

"HP LTO Ultrium has more than paid for itself within the last three months with off-the-chart performance and reliability."

Vijay Santi, Chief Technical Officer, ANALYTICi

Data center managers bear a huge responsibility for corporate data. The whole enterprise could depend on being able to retrieve data from a single tape. The HP brand specification for media builds on the open LTO format to deliver a product that data center managers can put their faith in. In smaller organizations, DDS provides ample capacity for backup/restore and archival applications— and HP branded DDS tapes undergo rigorous media and drive testing to ensure reliability.

Summary

- HP tape media is portable, so your backup can be stored safely offsite away from any potential dangers.
- HP tape provides both high capacity and high performance, with transfer rates up to 160 MB/s, and it is scalable from a single drive to a 3000-slot library.
- Unlike disks, HP tape is immune to bugs and viruses.
- HP tape provides the lowest cost per GB of any storage technology, 25 times cheaper per GB than disk.
- HP tape is durable, keeping archives safe for up to 30 years—that is up to six times longer than on disk.
- With HP tape, the future direction is clear—with a defined roadmap through to 2012.

For more information

www.hp.com/go/tape