



**Overview of WORM Technology
Storing Fixed-Content Non-Erasable Data**

White Paper

Product Management



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Abstract

Data growth

Data growth associated with complex applications is a normal event that presents tremendous challenges to organizations. Data growth is not easy to forecast, and even more difficult to manage from both the business and technical perspectives. If these data are not managed properly, the resultant buildup will become a management nightmare, and could pose risks not only to IT budgets, but also to business operations, and especially for legal compliance.

Legal requirements drive data-retention policies

Information is the lifeblood of business. One of the major challenges for organizations, beyond storage, is fixed-content data retention for legal compliance. It seems as though you cannot listen to the news without hearing a story about an organization that failed to manage its business data properly; therefore, find that they face very serious consequences. Two legal compliances are noteworthy due to their significance to organizations that generate business data: SEC Rule 17a-4 and the Sarbanes-Oxley Act:

- SEC Rule 17a-4 requires that companies under its jurisdiction maintain accessible, secure business records, and have the ability to produce records quickly that meet stipulated audit criteria—the penalties can be severe for non-compliance.
- The Sarbanes-Oxley Act of 2002 takes this accountability to the individual level, placing personal requirements on executives to endorse their organization's financial statements, and to ensure that the organization has the ability to audit its business records, including electronic communications. Liability could potentially include financial penalties, exclusion from managing public companies, and even imprisonment.

Legal requirements for business data are not a recent phenomenon. According to EMC, there are more than 15,000 federal and state laws and regulations already on the books, governing how business data should be stored, and 3000 of those deal with electronic record retention.

Governing bodies

Governing bodies such as the Securities and Exchange Commission (SEC), the National Association of Securities Dealers (NASD), the Department of Defense (DOD), the Federal Food and Drug Administration (FDA), and the Internal Revenue Service (IRS), as well as federal and state legal systems have established precedents and guidelines, and enforcing far-reaching laws associated with managing business data.

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Abstract, continued

WORM technology

Many industries have taken measures to safeguard computer-generated data, and most of these industries have settled on Write-Once/Read-Many (WORM) technology as today's most secure long-term storage solution. WORM technology is non-editable data storage, which cannot be altered, over-written, or corrupted. Currently WORM technology falls into these categories:

- Optical disks
 - Magnetic disks
 - Tape
-

Beyond legal requirements

Beyond legal requirements, WORM technology can also play a role in storing other fixed-content such as images, and other business data such as financial statements, etc.

WORM technology beyond optical disks

Until recently, optical media was the only widely recognized technology to deliver robust WORM capability. Increasingly, effective WORM storage solutions were somewhat limited, due to optical-disk capacity and cost. Technical advances in tape and RAID WORM technology promise cost-effective and efficient options for organizations struggling to keep pace with their growing data storage and retention needs.

Audience

This white paper is directed toward organizations seeking knowledge about storing business and fixed-content data on WORM media, and the requirements to have that data retained on un-altered and easily accessible media for legal and business reasons, on an anytime basis.



Introduction

WORM technology evolution

WORM optical disk storage is a technology that had its beginnings some 17 years ago. WORM is starting to get a lot more attention these days, largely due to a raft of high-profile government regulations that require organizations to retain business data long term. WORM tape, a more recent iteration of this technology, is turning out to provide some very timely benefits. It is much less costly than its predecessor, while at the same time providing key performance enhancements and a vastly expanded storage capacity. WORM RAID technology has also been introduced as an emerging solution for the large enterprise space.

Electronic data retention

The growing challenges related to electronic-data retention are turning what was once just a backroom IT process into a strategic, executive-level issue—even a board of directors issue for many corporations. What companies do now to manage these storage challenges can have implications for their businesses many years down the road

Definition

WORM technology is in essence non-editable data storage. Unlike traditional storage, data written to WORM media cannot be altered, over-written, or corrupted. WORM technology protects companies for which data permanence is not only a vital business requirement, but a legal one as well. The data integrity of WORM media is so sound that it is admitted as evidence in court on a regular basis.

WORM and fixed-content data

According to the research firm Yankee Group, the overall volume of fixed-content data will grow 400% between 2003 and 2006, approaching some 1.3 million terabytes. That is much faster growth than foreseen for transactional data or other types of file data. Therefore, beyond legal requirements, WORM storage media can be used to store fixed-content data. WORM technology can provide a cost-effective way to help deal with storing a portion of this rapidly growing category of data.

What constitutes fixed content data?

Fixed-content data includes digital images, presentations, video content, medical images, check images, and other files that do not change over time. It can also be thought of as the "corporate memory," because it includes such records as legal contracts, purchase orders, financial statements, invoices, and other essential business documents.

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Introduction, continued

Fixed-content email archives

Increasingly, however, when people talk about fixed content, they are focusing on what may be the biggest and most complex storage problem of all, email archives. In many industry sectors, it is required that email be preserved or locked down for legal purposes. Most analysts agree that email is the fastest growing fixed content of all. According to the International Data Corporation (IDC), the number of emails sent each day will grow from 9.7 billion in 2000, to over 35 billion in 2005. In addition, the storage demand from email volume is projected to reach 230 petabytes in 2003, for a compound annual growth rate of 300% since 2000. The cause of this growth is mainly due to increasing email volume and size, which includes attachments.

Compliance law and fixed-content management

Unlike transaction-based data, whose usefulness is short lived, fixed-content data must be kept for long periods of time, whether for business reasons, or to comply with the retention periods and provisions called out by government regulations, such as the following:

- The SEC Rule 17a-4 for financial services firms, which went into effect in May, requires the archival of business communications for up to seven years – including email and attachments, memos, instant messages, as well as routine phone conversations.
- The New York Stock Exchange recently introduced revised rules.
- The Sarbanes-Oxley Act of 2002 increases pressure on corporations to improve their storage retention practices.
- The Health Insurance Portability and Accounting Act (HIPAA) is having a significant impact on storage requirements for medical firms.

Those and many other rules are driving organizations to look for cost-effective ways to store and retain their growing fixed-content data for business and legal purposes.

About this white paper

The purpose of this paper is to provide a comparative overview of WORM technologies. In addition, to discuss the cost-effective deployment of these technologies to resolve the growing challenge of storing and retaining fixed-content data for business and legal purposes.



Impact of fixed-content data on businesses

Financial services firms and fixed-content data

What kinds of costs are financial services firms, to name one sector, now facing under the new spotlight of heightened regulation? Charles Brett, a Meta Group analyst, gave an example in an article recently appearing in Computerworld. He said that a firm with 5,000 brokers generates about 20 GB to 50 GB of email per day; if stored on WORM optical disks, each holding about 9 GB that would translate to \$150 to \$500 a day, every day, and that is just the cost of the disks.

Overall, the analyst estimated such a company could spend \$1 million just to get started in complying with the new regulations, using traditional optical disk WORM technology.

Fixed-content data beyond the financial sector

Beyond the financial sector, all organizations need to start evaluating their options for storing and retaining fixed-content data. Why? Because analysts are predicting that fixed-content data will consume more than half of the average organization's storage resources by 2005. Some would suggest that number is already higher. One example: EMC sponsored a study in 2000 on the makeup of all the existing stored content in the world, finding that approximately 75% of it was fixed content.

Therefore, if your company is publicly held, in the financial services sector, or doing business with the government, there is little need to be reminded that regulatory oversight, dictating the retention and safeguarding of business data is a big part of your business practices. Now, other sectors are coming under increasing regulatory scrutiny as well, such as the medical, legal, and broadcast industries. Whether your business is within these industries or you market to them, there will be a need for low-cost WORM technology that can satisfy regulatory requirements.

WORM tape technology

Until recently, cost-effective WORM storage solutions that would meet the challenge of today's fixed-content data growth rates were not available—primarily, these solutions were specific to optical disk technology. Now, industry innovation has produced a new solution, one that not only provides improved performance and capacity, but also does so at lower cost, which is complementary to today's IT budgets. This new solution is WORM tape.



Transition from WORM optical disk to WORM tape

Details of the discussion

From this point forward, the discussion will center on the evolution of older WORM optical disk technology, and the newer WORM tape technology and the role each will play in the ever-growing fixed-content data challenge. *(For high-end, enterprise applications, magnetic disk-based solutions for non-editable fixed-content data are also coming onto the scene; more on that later.)*

WORM optical evolution

Sony first introduced 12-inch optical platters in 1986, holding 5 GB of data. This technology has seen several capacity increases over the years and was broadly accepted due to little competition. Eventually, 5.25-inch optical disks became standard, boasting a capacity of 9 GB per disk. Other optical WORM technologies are DVD-R with a capacity of 4.37 GB per side, and CD-R with a capacity of 700 MB.

WORM Tape challenge to WORM optical

In 2001, Sony announced its AIT WORM tape as a viable alternative to WORM optical disks for regulatory archival requirements. As WORM tape continues to gain acceptance in the marketplace, many believe that WORM optical disk as a fixed-content data storage option has been superseded by this lower priced, higher capacity, and better performing media.



Optical disk and tape WORM technologies

WORM optical media WORM optical media costs about \$100 per 5.25-inch, 9 GB disk and that is just the beginning. Since jukeboxes fully optimized with drives must also be purchased, along with expensive software to control the robotics and the necessary support contracts for this solution, the Total Cost of Ownership (TCO) for WORM optical technology is many times more than that for WORM tape solutions.

WORM tape media WORM optical was once comparable in performance and capacity with tape and disk, but most experts do not believe that the roadmap for optical disk technology will allow it to compete. WORM tape as a part of Sony’s AIT tape technology platform has a very progressive technology roadmap, which extends well into the future.

WORM technology roadmap According to Global Information Distribution, (GID), WORM technology roadmap comparisons are shown in the table below.

WORM Media Technology Roadmap Comparisons		
Year	Optical Media	Tape Media
2002	Magneto-Opt. – 9 GB	AIT-3 – 100 GB
2003	UDO – 30 GB	AIT-4 – 200 GB
2005	UDO-2* – 60 GB	AIT-5 – 400 GB
2007	UDO-3* – 120 GB	AIT-6 – 800 GB
*The designators are for ID purposes only. Model numbers are not known. In addition, the planned release dates for Ultra Density Optical (UDO) beyond 2003 have not been announced to the public.		

The roadmap for optical products shows the largest 5.25-inch disk capacity has reached its apex at 9.1 GB per disk. The largest 12-inch capacity provides 30 GB per platter. In addition, optical is a double-sided media, meaning there are more disk-swaps and increased pressure on library and drive robotics. When one compares the fact that AIT-3 WORM technology holds 100 GB per tape, which will expand to 200 GB per tape with AIT-4, due later in 2003, there is really no comparison.

The low capacity offered by optical disk technology presents an inherent challenge for organizations facing exploding fixed-content data storage demands. As stated, the roadmap for 5.25-inch Magneto Optical (MO) ends with the current 14X generation. The next generation of 5.25-inch UDO anticipates 30 GB per disk, but the media will be incompatible with current MO technology. UDO is expected to be available in 2003, with claims of future generations at 60 GB and 120 GB by 2007.

The Sony AIT roadmap will deliver AIT-4 as soon as late 2003, doubling capacity to 200 GB per tape, and will continue this process every two years to deliver 800 GB per tape by 2008 (*up to 2 TB compressed*). Unlike next generation UDO disk, the AIT tape roadmap does offer backward read/write capability with prior AIT tape formats, which is a significant economic advantage for end users.



A matter of economics

SEC holds fast on WORM standard for securities firms

Just how cost-prohibitive is WORM optical disk technology? The securities industry has been pleading to the SEC for relief. Recent media stories have been chronicling efforts by the securities industry to get the SEC to remove wording from its regulations, dating back to 1991 that require these firms to use the WORM standard. In early May, the SEC announced it was holding firm on WORM technology.

The industry says, quite simply, that they cannot afford the status quo. They also say optical technology is too cumbersome to manage. The general counsel of the Securities Industry Association (SIA) was quoted in one article as saying it can be “an hours long procedure” to retrieve documents from WORM optical disks.

The fall of WORM optical from grace due to costs

Patrick Gordon, an analyst with the Enterprise Storage Group, says few vendors sell WORM optical technology anymore, noting that many securities firms are left to operate systems that are no longer supported. His firm recently released a study comparing the costs to store 1 TB of data on optical disk and tape media. The results were \$40,000 using WORM optical disk, versus \$3000 using WORM tape—less than one-tenth the cost. It has become clear that both the initial purchase price for an AIT WORM tape library as well as its TCO are a mere fraction of the comparable cost of traditional optical disk jukebox solutions.

AIT WORM tape

“AIT WORM is a new paradigm, a big potential market, with a 20-times advantage over optical,” said Stephen Baker, VP of Sony’s Tape Storage Solutions division, at the May 2003 StorageWorld conference.

WORM functionality is incorporated into AIT-3 SCSI interface drives from Sony. When used with specially labeled AIT-3 WORM media, which can be easily identified by a red bar on the cartridge, AIT-3 drives allow for non-rewritable, non-erasable, secure electronic data storage. Notably, AIT-3 drives are also backward compatible, fully supporting AIT-1, AIT-2 and AIT-3 rewritable cartridges, as well as AIT-2 and AIT-3 WORM media.

Once recorded, AIT WORM tape media cannot be re-written or re-formatted, but data can be appended. With this added WORM capability, AIT-3 drives with the associated WORM media eliminate accidental or intentional data erasure, enabling time and date authentication, and facilitating quick search and retrieval of archived files.

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A matter of economics, continued

AIT WORM platform

One cannot have a discussion of WORM tape solutions without addressing the underlying AIT platform and the plans for it from Sony. The technology roadmap for AIT tape is evolving to include SAIT—a “true super drive,” said Baker of Sony. Introduced in February 2003, SAIT-1 became the first tape media to break the 1 TB barrier, with the capability to store 1.3 TB compressed. SAIT drives will also accommodate specially labeled WORM tape media, according to Sony. The company says their roadmap for SAIT has the potential to scale to as much as 4 TB of uncompressed capacity on a single cartridge. “It sets a new level of what tape can provide,” said Baker.

Most would agree that up until now, AIT tape has been seen as a solution for small to midrange storage applications primarily. Sony says it is working with tape automation vendors of enterprise-class solutions as well, which will scale up to 76,000 cartridges and more than 7,500 TBs of native storage.

Spectra Logic is one vendor that offers a wide range of AIT tape library solutions for small, midrange, and enterprise businesses. It was one of the first vendors to automate AIT WORM tape from Sony, which offers native fibre channel (FC) and now iSCSI connectivity in tape libraries.



Total cost of ownership

Shared library services reduce TCO

Another point that looms large when moving beyond small business applications into larger volume midrange applications is TCO. In the past, companies desiring WORM technology were challenged by the need to purchase a separate optical jukebox, along with the software, service, infrastructure, and management costs to run it; that is, in addition to their traditional tape-based backup.

A feature available now with AIT tape-based archival systems does away with this expensive duplication, which allows companies to have a dual-mission automated tape solution. For example, Spectra Logic calls this their Shared Library Services (SLS) feature. Using AIT-3 WORM technology, users now have the ability to partition part of their library for normal operations, while dedicating another partition to WORM storage. Backup of multiple servers running different operating environments can be consolidated onto a single, scalable library resource, using SLS. Consolidation of traditional backup and WORM archive technologies yield investment protection, operational savings, streamlined administration, and substantially reduced TCO.

Media costs

When comparing the costs of optical vs. tape media and drive prices per gigabyte of storage, Spectra Logic AIT-3 drives all ship with WORM functionality—the only additional cost to use them for WORM storage is the purchase of the specialized AIT-3 WORM cartridges (*denoted by a red bar marking*). In comparison to 5.25-inch optical MO technology, AIT-3 WORM tape has a distinct cost advantage. The cost per GB for 5.25-inch optical is eight times more than AIT-3 WORM, which is a significant cost savings when one considers how storage needs are growing today.

Drive costs

As with the media, drive prices favor tape. A 9.1 GB optical (MO) drive costs about \$186 per GB of storage. Multi-function AIT-3 drives at list price are only \$74 per GB. These cost comparisons will soon be even more marked with the introduction of AIT-4 (*as soon as late 2003*), which will double capacity and throughput of the current AIT-3 technology. Examples of midrange AIT solutions for WORM applications would include 10K and 20K libraries from Spectra Logic. StorageTek also has libraries that support WORM capability.



WORM storage options for businesses

Media choices There is a variety of media, from CD-R and DVD-R, to optical disk and AIT tape for businesses of all sizes, looking to implement secure, unalterable WORM storage.

Small businesses archiving options Some small businesses needing to store electronic records on non-erasable media for business or regulatory compliance could simply elect to do low-volume, manual archiving on CD-R or DVD-R disks. Drive prices have continued to drop, with regular performance increases for these technologies—the media is not only available almost anywhere, but getting cheaper all the time. If individual PCs or laptops were all you had, then these media would be readily available solutions. Of course, the major drawback to archiving using these media is that the process is manual and labor-intensive. However, some higher-end laptops now even come equipped with so-called super drives, which combine both DVD-R and CD-RW capabilities. This would permit each person in a very small firm to do their own archiving, assuming they would be diligent about this task.

DVD-R drive manufacturing is ramping up significantly, as a shift of production resources from CD drives continues to meet increasing consumer demand. At least three manufacturers of DVD-R and DVD+R drives have announced they will ship new models in the second half of 2003.

Small businesses and AIT tape drives For smaller companies or applications, Sony has even introduced new internal AIT tape drives for PCs and laptops, as well as internal and external drives for entry-level servers and workstations. These products are marketed under the StorStation name and will likely continue to make inroads into the market share of the older DDS tape, since the drives plug right in to existing 3.5-inch DDS drive bays. Sony says DDS still makes up the largest volume shipped in the tape market, but is a declining segment with AIT being the obvious beneficiary for Sony.

Midsized businesses archiving options What if your business or department is classified in that amorphous midsize sector, or irrespective of business size, your storage needs would be considered midsize in volume? Automated AIT WORM tape solutions have the most application in midsize storage needs, especially when compared to the traditional WORM optical solution.

Companies have historically been limited in options for long-term data preservation, using WORM storage media with optical disks being the primary option. The drawbacks of optical are low storage capacity, high cost of ownership, and performance that just has not kept pace with fixed-content data growth. Nevertheless, optical jukebox systems already in place will continue to be maintained, or even expanded to leverage existing investments in this technology.

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WORM storage options for businesses, continued

**Enterprise
business
archiving
WORM tape
options**

The larger part of the impact that new regulatory agencies are having on businesses is on the very largest firms, those that have expanding storage requirements, of which WORM technology is another component. If a 5000-broker firm can produce up to 50 GB of email per day, (*earlier example*) how much WORM capacity would a firm with 50,000 employees need over the course of one year?

AIT tape libraries with WORM capabilities for enterprise-class applications include:

- The 64K library from Spectra Logic offers up to 166 TB of compressed capacity in 40U of rack space, and scales to 645 cartridges and up to 32 drives.
- The 9310 tape library from StorageTek with T9840B or T9940B tape drives, using VolSafe tape technology; for example, would result in a WORM archive solution that could scale to 28.8 PB (*uncompressed*) capacity and up to 960 drives. To use this technology, the customer would simply purchase the VolSafe tape cartridges, which have unique markings for easy identification. These VolSafe tapes will meet the most stringent electronic storage regulatory requirements, including those of the SEC.

**Enterprise
business
archiving
WORM RAID
option**

Tape is not the only solution getting attention for data-retention due to regulatory compliance requirements; WORM RAID is becoming a factor in this arena as well. The most high profile of these is the Centera Compliance Edition (CE) from EMC, on which the company appears to be pinning much of its growth going forward. EMC calls Centera, “the world's first content-addressed storage solution,” and says it is designed specifically to meet the unique requirements for fixed-content data storage.

Centera provides online access with assured content authenticity and petabyte scalability. Referring to Centera as the first magnetic disk-based WORM device, EMC claims that it facilitates compliance with the most stringent regulatory requirements, saying it provides functionality not available in tape, optical or traditional disk solutions, and that at a lower TCO. With Centera, the application no longer has to track the physical location of stored information. Instead, Centera creates a unique identifier based on the attributes of the content, which applications then use for retrieval. To assure content integrity and authenticity, Centera gives each stored object a unique content address derived from the content itself—no duplicates of the same content are ever stored.

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WORM storage options for businesses, continued

***Enterprise
business
archiving
WORM RAID
options
(continued)***

Network Appliance (NetApp) also provides functionality to address the latest data-retention regulatory requirements for WORM storage. The technology in place from NetApp to deliver disk-based WORM storage is called SnapLock. This option allows users to partition disk space on NearStore file servers as WORM storage capacity.

This SnapLock feature takes advantage of ATA disk drives to store fixed-content data such as e-mail, X-rays, and document images.



Choosing a WORM solution

Key requirements

When selecting a solution for WORM storage consider the following:

- Volume of storage for WORM archival purposes
- Performance and access speed requirements
- Classify the storage by frequency of use
- Media and drive durability requirements
- Media retention times
- Random vs. bulk transfers

Some of these requirements were touched on earlier, but we shall only take an expanded look at some of these.

Speed: tape vs. optical disk

Optical disk is architecturally quite different from tape, and each has performance advantages and disadvantages, depending upon the unique requirements of each application. As an oversimplified analogy, you might think of each as a bicycle that has only one gear; the optical disk having first gear, and the tape with only tenth gear. The optical disk can get moving to its top speed quite quickly, but the tape takes some time to reach its peak performance. Once the tape reaches its top speed, however, it will breeze past the optical disk on a straightaway. In courses with much starting and stopping, the optical bike has an advantage whereas the tape offers advantages when it has ample time to get up to its full cruising speed.

Non-sequential reads and writes: tape vs. optical disk

Optical storage technologies provide some performance advantages over tape in applications that require random, non-sequential reads and writes. Optical drives in jukeboxes generally provide fast cartridge swaps and cartridge load times, reducing the time for reading or writing the first file in a sequence of data. Optical disk drives deliver load times ranging from four to six seconds, which outperform most mid-range tape technologies with load times ranging from 10 to 25 seconds. Where optical technology really shows its strength is the time that it takes to position itself to begin reading a given file on a platter that is already loaded in the drive. Optical disk technologies generally perform this function in the neighborhood of 25 milliseconds, compared to 30-70 seconds for midrange tape technologies.

Given these performance factors, optimal applications for optical technology could be characterized as random read-intensive, rather than write-intensive. In these applications, optical technologies can be coupled with appropriate device management software to deliver impressive performance.

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Choosing a WORM solution, continued

**Large data
block transfers:
tape vs. optical
disk**

For applications such as fixed content archive that can be characterized as being more typified by large block transfers of sequential data, coupled with less frequent data retrieval activity, tape will generally outperform optical on data write operations, and is becoming increasingly competitive on read operations as well. For example, AIT drives from Sony incorporate Memory-In-Cassette (MIC) technology to greatly increase file access to as little as 27 seconds, and improve the overall performance of sequential file access, while offering a 12 MB/second transfer rate, compared to 4 to 6 MB/second on most optical disk technologies.

**Performance
and capacity
tape vs. disk**

Performance capabilities must also take into account the overall capacity of the media. When accessing large amounts of data, optical systems must not only “flip” the disk to access the full 9.1 GB capacity, but also require many more media loads to access the same amount of data that AIT tape can. Sony AIT-3 technology provides access to more data with a single tape, since its capacity is 11 times that of optical disk (*28 times as much with compression*).

**Shelf life tape
vs. optical disk**

Advanced Metal Evaporated (AME) is the tape formulation used in AIT media. Key characteristics include a 100% pure cobalt magnetic layer, dual magnetic layer design, the absence of binder material to prevent tape head contamination, and DLC (*Diamond Like Carbon*) protective coating for extreme durability. The result of this technology is a tape formulation that significantly prolongs head and media life. Based on the media life experiments by Sony, the shelf life for AIT tape is estimated conservatively to be 30 years, well beyond the mandated time period for most archival applications—optical has an estimated 100-year archival shelf life.

**Data protection
tape vs. disk**

A consideration concerning tape, compared to the newer magnetic disk-based fixed content archiving systems that have been introduced for large enterprise applications (*the so-called WORM RAID solution*) is this: Tape, as a removable medium, is by its very nature an off-site storage medium, offering more assurance of protection.



Meeting regulatory requirements

Cohasset Associates, Inc. evaluates Sony's AIT

Sony recently employed Cohasset Associates, Inc. to evaluate whether Sony AIT WORM technology satisfies the stringent regulations set forth by the SEC in regulating the securities broker-dealer industry. SEC Regulation 17a-4 is the specific rule dictating record retention requirements.

Compliance

Because the SEC does not issue advisory rulings to manufacturers on their products' compliance with SEC regulations, Cohasset Associates Inc., regarded as one of the nation's foremost management consultants specializing in document-based information management was retained to evaluate compliance. Here is an excerpt from their report:

- "It is Cohasset's opinion that the AIT-2/3 WORM Tape Cartridges comply with both the letter and spirit of SEC Regulation 17a-4. The technology of the AIT-2/3 WORM Tape Cartridges allows records to be retained on a medium that is both "non-rewriteable" and "non-erasable." The AIT-WORM technology additionally provides for the "automatic verification of the quality and accuracy of the storage recording process" as required by 17a-4. The Regulation's requirements of serialization, time-date recording, and index and records downloadability are also met by Sony's AIT-WORM technology."
- "These results are attained through a variety of features contained within the AIT-2/3 WORM Tape Cartridge itself or in conjunction with the AIT WORM drive, such as the AIT-2/3 WORM Tape Cartridge's addition of an "RMIC", or Remote Memory-in-Cassette and the MIC Mode Switch; the AIT WORM Error Code Correction (ECC) technology which, according to Sony, boasts one of the highest error ratios in the industry at 10^{17} . The removal of an erasure head from the drive and the removal of a recording-enabling hole from the tape cartridge itself, in addition to a variety of other related protections against intentional or unintentional post-recording alteration."

The SEC also recently released a new interpretation of 17-a4, which analysts believe supports the approach of using a combination of hardware and software to achieve the WORM capability. This interpretation gives additional support to RAID manufacturers that have positioned their technologies as an alternative solution for read-intensive WORM archive applications.



Summary

Data retention With 93% of all business documents created electronically, and only 30% ever printed to paper, corporations in the last few years have been compelled to address the retention of and potential liability associated with electronic documents and electronic communication (*fixed-content*). They also must retain business data to defend the organization in the event of an audit, investigation, or lawsuit, whether the firm is in a regulated or non-regulated industry.

Regulatory and legal requirements Records must be retained to comply with certain laws and regulations. Companies are seeking secure storage solutions to safeguard their most important asset, data, and to ensure its availability and integrity; also, to meet regulatory and legal requirements.

AIT WORM technology is available as a “just-in-time” technology in light of the regulatory environment of the past two years. It provides a safe, reliable, and proven platform for secure, non-erasable storage, while greatly reducing TCO compared to previous alternatives.

With a wide range of AIT automated tape library solutions now available, customers can now use a single library to satisfy both WORM archival regulations, *and* conduct their routine data backup and restore operations. This dual-mission capability lets companies greatly reduce the acquisition and administrative costs previously associated with separate, single-purpose tape, and optical disk systems.

Any company facing today’s heightened regulatory compliance issues should be seriously exploring the economic and performance advantages of the latest WORM storage technologies summarized in this paper.



About Datalink Corporation

Datalink Corporation is a leading information storage architect. The company analyzes, designs, implements, and supports information storage infrastructures that store, protect, and provide continuous access to information. Datalink's specialized capabilities and solutions span storage area networks, network-attached storage, direct-attached storage, and IP-based storage, using industry-leading hardware, software, and technical services. Recent news releases and other information are available at www.datalink.com.

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