Fujifilm – the Tape Media Provider becomes the Tape Storage Solution Provider

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Management Summary

When shopping for a new car, there are many things that you can look at, beside the color. What is most important to you? Is it the acquisition price, the mileage rating, the warranty, the entertainment center (in a car?)? The answer is, or at least should be, all of them. The key to any major purchase needs to be the total cost of ownership (TCO) over the period of years that you plan to use it! Some of the items above have a fixed price, like the purchase price for example; others, such as fuel, continue from month to month. The cost of fuel per gallon, for example, does not seem to be coming down any time soon. The demand for it is constant, in fact rising, and it adds considerably to the TCO of your vehicle. As the operating costs continue to increase each year while your income remains fixed, you need to find a better solution that keeps the TCO under control without having to keep your car in the garage. Maybe you need to break out of the box and procure a different kind of vehicle, one whose operating costs are more favorable. This could be a vehicle with a diesel engine, or a high mileage gasoline vehicle (including hybrids), or an all-electric vehicle. Each offers a way to control the operating costs, especially when compared to a more traditional gas-fueled automobile.

There are parallels to this in the data center where the demand for long-term data storage continues to rise at a precipitous rate. While the cost of all storage may be coming down on a cost per terabyte basis, the number of TBs needed is growing so rapidly that the cost of disk likely will break the data center budget, and probably sooner than later. This is due to the fact that more files are being held and for longer and longer periods. The growth in volume and retention time is far outstripping the falling price of disk per TB. Nowhere is this happening more than in the NAS arena with the archiving of previously hot files, which have become cold files, many with a long (like, forever) retention period, and with little or no retrieval for many-to-most of them during any given year. While more traditional operational files also have growth problems (due to multiple copies for use and protection, etc.), the data center now needs a product designed for files, such as video, that need to be preserved forever but only accessed rarely. *How can the enterprise do that and remain within budget?*

For decades, larger data centers have used a variety of types of storage platforms from many different vendors to enable their storage infrastructure. This includes memory-based storage (including Flash), high-performance disks (FC, SAS, and SSDs), and high-capacity devices (SATA and SAS). It also involved deploying backup and archive servers and tape libraries with a wide variety of capabilities. Not surprisingly, this has resulted in an increase in complexity and administrative costs. Along the way, many data centers went to *all-disk* (and SSD) storage strategies, primarily because they believed that tape was outmoded and cumbersome. Unfortunately, going to all-disk is comparable to driving

a vehicle with a gas-guzzling V8 engine when a less powerful engine can handle the job that you have in mind. While there may have been good reasons to rely solely on disks for file storage and retrieval, today this all-disk approach is responsible for driving up storage costs unnecessarily. Thus, **in order to satisfy this insatiable demand for keeping many files for long periods and also to try to keep the costs down, the data center once again may need to change its storage paradigm and consider (or reconsider) tape as the more appropriate storage vehicle for long-term archiving.**

Today's tape is very different from tape of the past, so don't bring too much baggage into a forward-looking consideration. Not only have the capacities of a cartridge gone to multiple terabytes, but files can be stored on tape and accessed directly, plus the cost per TB stored is much lower than before. This makes tape a viable and very desirable low-cost alternative to disk for storing archived files that need to be held for years or decades. Doing so will reduce your NAS and DAS demands for disk-based storage, thus alleviating (at least for a while) the need to buy more disk-based file storage infrastructure.

Long-Term Storage in the Data Center

Just about every enterprise has been experiencing a period of unprecedented data growth, with the resulting problem of trying to find adequate storage to house it. Most data centers are doubling their storage capacity every 12-to-18 months, while some are experiencing even greater growth, compounding the management complexity and the issues involved in accessing data. It doesn't matter whether your data center needs to store ten terabytes of data or hundreds of terabytes, you need an easy to manage, scalable, and reliable system that will enable your storage to scale to meet the growing storage needs of your business without the addition of increased administrative burden. See Exhibit 1, in the next column, for a more complete list of the requirements needed to satisfy the needs of storing data over the long term

This rampant growth is placing a significant burden on the IT budget, as each enterprise attempts to control the TCO of the IT infrastructure. The IT staff not only has to acquire additional primary storage, but they also must provide for the long-term preservation and use of business- and mission-critical information, as

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**Exhibit 1 —
Long-Term Storage
Requirements**

- **Non-Interference** – Be able to provide sufficiently high performance to meet enterprise workload scheduling requirements;
- **High Capacity** – Be able to meet the storage growth demands of the data center;
- **Affordability** – Be able to live within budget limitations;
- **Reliability** – Be able to ensure uninterrupted data access;
- **Scalability** – Allow the data center to protect its investment with seamless upgrades as capacity grows;
- **Security** – Be able to ensure and protect the integrity of the data and prevent unauthorized access for decades, or forever;
- **Energy Efficiency** – Be able to lower the demand on electrical resources and extend the life of the data center, even as backed up and archived data capacity grows;
- **Portability** – Allow the transportation of media offsite to facilitate disaster recovery; and
- **Ease-of-Use** – Do this all while minimizing additional demands being placed upon the IT staff.

Source: The Clipper Group

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well as other archival data, for which access may be sporadic, at best. The real costs that the enterprise must address include the people costs needed to administer the complexity of multifaceted storage. These complexities include coping with storage acquisition and deployment, maintenance, and licensing costs in addition to the ancillary costs, such as the power required to drive and cool the expanded architecture, the data center floor space needed to house the disks, and the additional technology needed to protect the data from unauthorized access.

The TCO, especially in a disk environment, can create an unacceptable burden on the IT budget when this asset class is used for the long-term preservation of archived data.

Preserving thinly-accessed information almost always demands a lower target for the cost of storage. Perhaps tape can be the vehicle to accomplish this.[1]

Many IT organizations are looking to deploy an automated tape library system with the latest technology in order to reduce the TCO and energy consumption of long-term storage. In fact, with the expanded capacity and improved throughput of the newest tape architectures, some data centers are even looking to adopt, or return to, a more direct D2T solution.

Reducing Long-Term Storage Costs

Removing complexity is a good thing. So, what are the stumbling blocks that create complexity, add cost, and interfere with the successful deployment of a long-term storage solution?

Users want to be able to treat files as files, reliable and secure files, and not as something that needs to be stored differently, adding complexity, such as like in a block on a proprietary backup tape. By using a standard file system for files stored on tape, such as *LTFS*[2], the users don't see things differently in terms of file structure and access methods than they would if the files were stored in a file system on a traditional hard drive or SSD (or disk array, etc.). This eliminates complexity. Indeed, the use of standard file access methods helps to protect the enterprise's investment in the IT infrastructure as newer platforms become available and as the requirement for migration between on-site and off-site facilities grows.

Of course, access may be slower with tape, *but that may be okay*, if the short delay is not

mission-threatening. If the TCO per TB of archived data is lowered sufficiently (thus allowing much more data to be preserved at the same cost), it might be a small and acceptable tradeoff for an access that might be delayed by several seconds to a couple of minutes, instead of arriving in a matter of seconds, or less, depending on its size. Remember that this is about archived data that mostly isn't used regularly. Waiting for a minute or two may be acceptable, although intelligent buffering[3] may eliminate the delay. At a time where every data center is restricted by a limited budget, the need for instantaneous access to archived files may be seen in a different light.

In addition, the data center needs to facilitate the migration of files between different tiers of storage, as another example of removing complexity. The value of files can change over time. The data center does not have to keep all, or even most, archived data on Tier-1 storage, but there must be an easy, integrated mechanism for the retrieval of those files when necessary, i.e., someone or something must keep track. Because of the rapid capacity growth of data in an archive, the data center needs the capability for dynamic growth in storage capacity without the requirement for fork-lift upgrades; this again reduces the TCO. Furthermore, reducing the cost of media plays a significant role in reducing the TCO of long-term storage.

Exactly what is the enterprise data center looking for? What is required to deploy a scalable NAS tape library for long-term storage? The key requirements include the following.

- The **Open LTFS Technology** for compatibility across the board with every vendor supporting LTFS;
- **Data Integrity** to ensure the viability of the data;
- **Data Reliability** to enable mission- and business-critical workloads to access the data when needed;
- **Data Redundancy** to protect the enterprise from accidental, or intentional, loss of data; and

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[1] For a discussion on lowering TCO by using tape, see the issue of *The Clipper Group Calculator* dated April 30, 2013, entitled *Revisiting the Search for Long-Term Solution – A TCO Analysis of Tape and Disk,* and available at http://www.clipper.com/research/TCG2013009.pdf.

[2] The LTFS acronym has been used in two ways (depending on the vendor), both referring to the same thing: *Linear Tape File System* and *Long-Term File System*. LTFS is both a hardware standard (for drives and cartridges for storing files on tape, accomplished by creating two tracks on the tape) and a software vehicle for accessing the files on a selected tape. Essentially, each LTFS tape is presented as a separate, standalone file system when mounted in an LTFS-capable drive. See **The Clipper Group Navigator** entitled *Dealing with Cool and Cold Data – and getting it "Just Right"* dated June 28, 2010, and available online at http://www.clipper.com/research/TCG2010031.pdf.

Archiving applications take this one important step further, by indexing (cataloging) and managing access to the collection of files on many LTFS tape cartridges in an automated tape library.

[3] There are many buffering schemes, but many are based on a delay in when data is moved from disk (the cache) to tape. Thus, the longer the initial retention period (when most subsequent accesses will occur), the less likely that there will be a delay in retrieving it. Related to this is the policy of what to do when a file is recalled. Usually, this period of retention is reset, since one use often is followed by additional uses.

- **Data Security** to keep prying eyes out of enterprise business.

See Exhibit 2, to the right, for additional characteristics of these key components for scalable NAS on tape.

Because of these requirements and a bevy of related issues, management often defers making a decision on the right solution *until the right solution is presented to them.* This is where Fujifilm comes into the equation. Fujifilm, the world's largest tape media manufacturer, is one company with a long history of providing for the storage needs of the data center. It now has developed an integrated file archiving solution called *Dternity NAS* offering to facilitate this process of inexpensively storing and randomly retrieving files stored on tape in a tape library. To learn more about Fujifilm's Dternity NAS, please read on.

Fujifilm to the Rescue

Let's make one thing perfectly clear**: Fujifilm knows tape.** Its involvement with data center and enterprise tape media is decades long and well documented. Its collaboration with IBM led to a 2010 announcement that has resulted in the development of a Barium Ferrite tape cartridge with demonstrated capacities exceeding 35TB[4]. That's right, one cartridge that can hold the contents of almost nine 4TB disk drives.[5] Furthermore, this archive-grade media provides enterprise-level support and comes with a limited warranty and a 30-year average shelf life. However, the media is only one small part of the long-term storage solution for the data center. Fujifilm now has turned their decades of tape experience to the logistical aspects of storing files on tape by announcing a set of easy-to-use, cost-effective, scalable NAS solutions to communicate with tape libraries, thus serving as network-attached storage (NAS) for important files that need to be preserved and accessed occasionally. Fujifilm's Dternity NAS "heads" (i.e., the server (or appliance) that sits between the tape library and application servers and users) enable the archiving, cataloging, and accessing, of files on tape, through the deployment of LTFS as the file system.

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[4] See **The Clipper Group Navigator** entitled *IBM and Fujifilm Increase Tape Density – Raising the Bar on Tape Capacity* dated February 10, 2010, and available online at http://www.clipper.com/research/TCG2010003R.pdf.
[5] In reality, you never would load a disk to anywhere close to its full capacity, so the advantage may be more like 10:1.

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Exhibit 2 — Detailed Requirements for Scalable NAS on Tape

Open LTFS Technology
- No dependency on O/S, applications, specialized agents, or proprietary software
- No change to file formats, attributes, rights and privileges, or applications

Data Integrity
- Provides tamper checker and LTFS checker
- Provides archive verification

Data Reliability
- Has unique HASH code per file
- Drive/Tape error correlation
- No delete

Data Redundancy
- Multi-Copy between different media
- Secure over wire replication
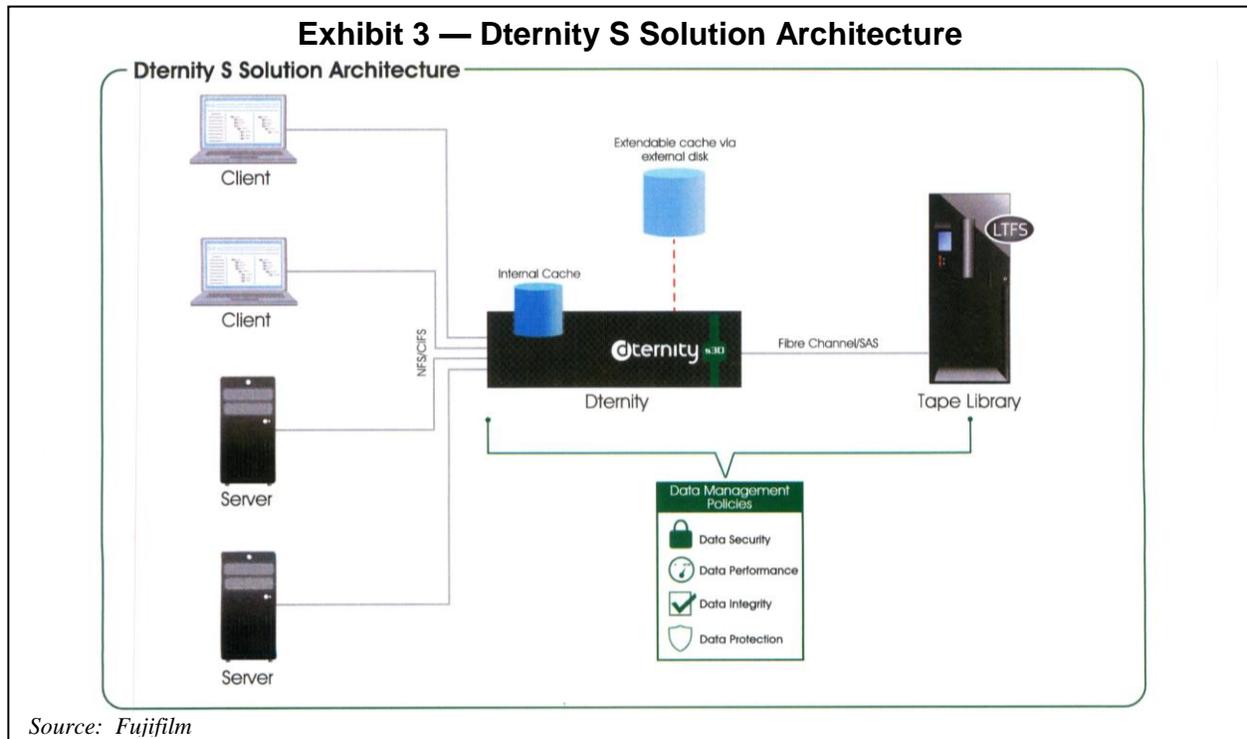- Includes media export

Data Security
- No co-mingling of data
- Data encryption with embedded Enterprise Key Server and offsite/outsourced key sharing
- Role-based access with active directory management

Source: Fujifilm

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A Dternity NAS-controlled tape library enables the data center to access data when and where it is needed. The Dternity NAS solution has been designed as a cost-effective solution for long-term data preservation and retrieval. It also simplifies the traditional file backup process by removing archived data from that process, improving the performance of the enterprise backup processes.[6] It has superior policy-driven data protection built-in, including being capable of creating multiple copies of data on separate media at more than one site. It provides seamless integration with existing file-based workloads and applications.

In summary, Dternity NAS provides online data access, low-cost scalability, and data

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[6] See more on protection and savings in **The Clipper Group Navigator** entitled *Crossroads' Strongbox Simplifies Data Protection* dated October 6, 2011, and available online at http://www.clipper.com/research/TCG2011033.pdf.

Exhibit 3 — Dternity S Solution Architecture

Source: Fujifilm

protection for unstructured, fixed content. Applications and users can access file data stored on LTFS tapes via the ubiquitous CIFS or NFS protocols. Dternity utilizes standard LTFS tape technology to ensure compatibility with standards-compliant LTFS drives, along with an intelligent disk cache, to provide the performance of disk and the economics of tape. The economics are enhanced by the low power requirements and reduced maintenance costs of tape libraries and drives. Dternity can sync file data to libraries[7] at different locations via the LAN/WAN, and also export LTFS tapes from the library for transport to a remote site. See Exhibit 3, above, for a pictorial view of Dternity's architecture.

And There Is More – Fujifilm Cloud Storage

Fujifilm also has announced a file-based, Internet cloud-enabled version of their NAS library, the *Dternity Media Cloud,* for those enterprises that prefer to keep their long-term storage in the cloud, for whatever reason.[8]

Dternity NAS will allow the data center staff to look to a single source for all of their long-term storage requirements, from high-performance disk, to backup server, to library, and to tape in the Cloud. Thus, Fujifilm has announced an integrated solution for enterprise storage needs with a simplified and manageable workflow. See Exhibit 4, on the next page, for a complete list of the benefits of Dternity Media Cloud

The Dternity Media Cloud provides the data center staff with a managed deep storage service for their entire file and project needs, providing built-in preservation and protection features along with a portal access to retrieve files[9]. Once your data is in the cloud, Dternity monitors its health and preserves it, whether on the shelf or not. This is a routine maintenance activity for Dternity that is not always available from other solutions. The data center can use this solution both as part of a multi-site protection strategy (when the enterprise does not want to have a duplicate tape library in its own remote data center, and as an independent repository, as well.

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[7] Dternity NAS can work with tape libraries from many vendors that support LTFS-capable drives and cartridges. For those customers that do not already have a tape library, Fujifilm also can offer a range of tape libraries, thus providing a complete solution from a single source.

[8] For more on keeping storage on tape in the Cloud, see **The Clipper Group Navigator** entitled *Keep Your Archive in*

the Cloud – on Tape dated October 27, 2011, and available online at http://www.clipper.com/research/TCG2011035.pdf.

[9] An enhanced portal access is scheduled to be available late in 2014.

Exhibit 4 —
Benefits of Dternity Media Cloud

Availability

- 99.99% annual uptime
- Instant portal access to the file index
- Enterprise-level support

Flexibility

- Fully customizable SLAs
- Adapts to your requirements
- Completely vendor neutral

Security and Reliability

- World class data centers
- HIPAA HITECH compliant
- Backed by a *Fortune 100* company

Multiple Connections

- SFTP/VPN
- HTTPS/SSL
- Mobile support
- Physical shipping

Data Protection

- Archive verification
- Self-healing
- Multi-copy policy
- Migration services

Source: Fujifilm

Fujifilm Dternity S NAS Models

Fujifilm's *Dternity S Series* is available in three flexible and scalable platforms, the *s10*, the *s20*, and the *s30*, in support of specific data center capacity/throughput requirements. (See Exhibit 5, on the next page.) Each model connects to the network via 1Gb or 10Gb Ethernet, and all three models provide IP Services for *NFS v3*, *UNIX/Linux CIFS*, *SMB1*, and *Windows (CIFS)*, with support for up to 128 File Shares. For security, files may be encrypted, by share, for additional security of data written to tape, with built-in key management functionality and key forwarding. Dternity NAS supports most vendors' tape libraries and LTFS drives, including LTO 5 and 6 and *IBM TS1140* drives[10].

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[10] See **The Clipper Group Navigator** entitled *IBM's New Enterprise Tape Extends Data Retention Capabilities and Lowers the Cost of Data Protection*

Dternity comes with a configurable *delayed action period*, allowing users to retain files on the disk cache[11] for faster access. Once the delayed action period has expired, the files are write-protected and written to tape. The Dternity file retention policy allows the staff to retain entire files on the cache for up to 365 days. Dternity also optimizes tape management by automatically designating an empty tape (one no longer holding archived files) as scratch media, thus allowing it to be reused.

Dternity s10

The Dternity s10 has a 1U form factor and has been configured to satisfy the growing needs of SMBs, managing up to 500TBs of usable storage and up to 100 million files. It has an efficient internal disk cache with 5.7TB of RAID-6 storage for added performance, with a shared network throughput of up to 160 MB/second. It provides support for up to four LTO-5, LTO-6, or IBM TS1140 LTFS tape drives.[12]

Dternity s20

Designed as an affordable configuration for fast-growing data centers, the Dternity s20 has a 2U form factor and can support up to 800 million files with an internal cache capability of 12TB RAID-6 for added performance and has a shared network throughput of up to 320 MB/second. It can also support up to eight LTO-5, LTO-6, or IBM TS1140 tape drives.

Dternity s30

The Dternity s30 is Fujifilm's most robust model, configured in a 3U form factor. It is ideal for the enterprise data center that requires support for up to 16 LTO-5, LTO-6, or IBM TS1140 tape drives. It offers a managed capacity of more than 35PBs or 1.6 billion files with a powerful 21TB RAID-6 internal disk cache to improve performance and has a shared network throughput of up to 600 MB/second.

Conclusion

With data growing, and being preserved for very long periods of time, it has become essential to deploy low-cost, energy-efficient

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dated June 6, 2011, and available online at http://www.clipper.com/research/TCG2011021.pdf.

[11] The internal disk cache can be extended with an external cache to meet performance requirements.

[12] The ultimate maximum capacity of the cartridges and drives used will determine the maximum storage capacity for each of the libraries behind Dternity NAS.

Exhibit 5 — Dternity S Solution Models

Dternity S Series
Dternity NAS is available in three flexible, scalable platforms to meet your specific business needs.

s10
- Ideal for SMBs, managing up to 500 terabytes of usable storage (100 million files)
- Efficient internal disk cache with 5.7 TB RAID 5
- Support for up to 4 LTO 5/6 or IBM TS1140 LTFS tape drives

s20
- The affordable configuration for fast-growing data centers, supporting up to 800 million files
- Expanded internal disk cache with 12 TB RAID 6 for added performance
- Support for up to 8 LTO 5/6 or IBM TS1140 LTFS tape drives

s30
- The most robust Dternity model, ideal for the enterprise data center, offering managed capacity to more than 35 PBs or 1.6 billion files
- Powerful performance with 21 TB of internal disk cache
- Support for 16 LTO 5/6 or IBM TS1140 tape drives

Source: Fujifilm

solutions to decrease the TCO of the IT infrastructure while still meeting application and user needs. Fujifilm's Dternity NAS is a purpose-built NAS appliance designed for that exact purpose – to lower the costs of long-term data protection, with full file access, and to provide simplified management for unstructured, fixed content. It brings simplicity to tape for cost-effective scalability, while eliminating the traditional complexities of data protection.

Dternity attacks the data file explosion with a highly scalable architecture that enables the data center to grow the appliance as enterprise data expands, protecting the investments that have been made in tape library hardware. Dternity enables the data center staff with the ability to simplify the traditional backup process by removing fixed data from that process, improving the performance of the enterprise backup software, either locally or to the Dternity Media Cloud.

In summary, if you need a compelling yet simple solution for archiving more data at a much lower cost per terabyte, you need to look at Fujifilm's Dternity NAS Solution. It may be exactly what you need.

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