



Virtual Tape Reduces Costs & Improves Performance In IBM Mainframe Environments

Tributary Systems' Storage Director Provides Superior ROI

By Ed Ahl, Director of Business Development

Tape plays various important roles in the mainframe environment, unlike in open systems where it is primarily used for data backup. For mainframes, tape is also used for data base log files and mission critical transaction files. This startling fact highlights the contrast between the perception and reality of tape storage. It also suggests that significant savings can be realized from a virtual tape storage solution like [Storage Director®](#) from [Tributary Systems, Inc.](#)

Storage Director both reduces cost and improves performance, providing superior return on investment on both sides of the ROI equation. On the cost side, Storage Director reduces mainframe CPU cycle demands, upgrades, usage charges, space utilization, manpower charges and power consumption. On the benefit side, Storage Director provides much faster recall times, more reliable and realistic disaster recovery, a smoother migration path to new storage technologies, and access to channel-attached backup from multiple servers, including Linux partitions.

This white paper examines basic mainframe storage challenges, and focuses on ways to reduce costs and increase reliability.

SEPARATING PERCEPTION FROM REALITY IN MAINFRAME TAPE DATA

Contrary to popular misconception, the majority of mainframe tape data is *not* mainframe backup data. In open systems environments, tape libraries (or disk replacements for tape libraries) are almost exclusively used for repetitive backup. But in the typical mainframe environment, only 20 to 30 percent (this can vary by installation) of mainframe tape data is used for backup while the remainder is operational data.

Typically the largest user of tape in the mainframe environment is Hierarchical Storage Management (HSM). In IT-speak, this is known as “putting the right type of data on the most cost effective storage at the right time.”

Data begins its life cycle on disk (Direct Access Storage Device, or DASD) in an uncompressed state (Level 0 or L0). Then it is compressed but remains on disk (Migration Level 1 or ML1). Finally it is written to magnetic tape for occasional recall (Migration Level 2 or ML2).



Since HSM ML2 is on tape, and tape data often outnumbered disk data by 10 to 1, this becomes the largest storage element in the mainframe environment. The recall of ML2 data is mission-critical, yet newer tape techniques such as the “Virtual Tape System,” a hybrid disk-staging-to-tape technology, make recall unpredictable and often impossibly slow. Because of this, a larger quantity of uncompressed L0 data is maintained on expensive DASD to provide quicker response to requests.

ELIMINATING A STEP AND RECALLING DATA AT BLAZING SPEED

Technologies like Tributary Systems’ Storage Director make “tape on disk” a reality. By fully emulating tape so that the mainframe cannot distinguish it from a tape subsystem, data normally stored on physical tape can be placed instead on relatively inexpensive disks – without changing programming, procedures or JCL.

Most users can’t tell the difference in access speed of virtual tape from the highest-speed DASD. As a result, operations that were agonizingly slow become consistently and blazingly fast. Indeed, HSM is one of the applications best suited for virtual tape technology. Data can be written directly from DASD (L0) to virtual tape (ML2), bypassing the intermediate, compressed-disk (ML1) phase.

Since Storage Director eliminates the ML1 step, the mainframe CPU no longer has to use processing cycles for compression of data which is done much more cost-effectively by the virtual tape drives. These changes enable profound savings.

In addition, eliminating ML1 data from DASD frees space and postpones the need to purchase additional DASD. Assuming a 3-to-1 data compression ratio, approximately 25% of DASD is freed. This is a significant savings, since DASD is Tier 1 storage and very expensive.

AVOIDING UNNECESSARY MIPS CHARGES AND CPU UPGRADES

Data is often written to tape more frequently than it should be, causing frequent, time consuming recalls down the road. That’s more than inefficient; it’s also costly. Mainframe usage is charged back to those licensing CPUs from IBM according to peak usage in terms of Millions of Instructions per Second (MIPS). In addition to large year-end “true up” bills, the peak demand often triggers an expensive CPU upgrade. Storage Director’s built-in data compression eliminates wasting MIPS on ML1 compression, by directly transmitting data from uncompressed disk (L0) to compressed virtual tape (ML2).

SIGNIFICANTLY REDUCING SPACE AND POWER

The disk technology used for Storage Director’s InfiniCache® technology has become incredibly dense, with no end in sight. Drives that a few years ago were measured in gigabytes are now



multiple terabytes each. This thousand-fold increase in data density also reduces physical storage space and electricity usage.

Mainframe data centers might hold dozens of automated tape systems the size of a small apartment. In addition to occupying huge amounts of space, these systems also consume considerable power and AC, and are extremely costly to maintain.

At one time, when virtual tape libraries were based on smaller DASD technology and required a large number of spindles, the energy costs of large tape libraries and earlier virtual tape solutions could be close. But with the introduction of newer disk technologies that support the powering down of inactive spindles (MAID), and the arrival of 2TB and 3TB disk technology (such as SATA and SAS), power requirements have been reduced significantly. Floor space is also reduced by 90 percent or more.

With Storage Director's capability to support newer high-density Fibre Channel tape libraries instead of the old massive channel attached libraries, there can be a corresponding massive reduction in expensive mainframe equipment and associated maintenance. In fact, a great percent of the purchase price can be eliminated based on maintenance savings alone.

EFFICIENTLY AND RAPIDLY RECALLING THE DATA

There's another advantage of virtual tape technology: the efficiencies realized in actually reading back the data. For example, a user might be placing complex invoices on physical tape quickly in order to avoid billing individual cost centers for disk usage. The problem with this could be that frequent customer queries in the first week or two would require recalling the data thousands of times a day. Each recall could take minutes, resulting in huge inefficiencies and customer dissatisfaction.

This problem can be solved by moving HSM data directly to Storage Director's virtual tape layer in its disk-based InfiniCache from where it can be recalled very rapidly. Storage Director allows you to create storage policies by individual data volumes. You could create a policy to write the HSM data to the virtual tape layer in Storage Director's high-performance disk cache layer ("InfiniCache") for a period of time determined by the need for frequent access. With Storage Director's real-backed virtual policy, data would be written both into the virtual tape layer and also immediately to physical tape for long term retention and access. Data in InfiniCache can be recalled at the speed of disk access, and within a few seconds from the physical tape library.

Manpower cost savings alone would pay for Storage Director, and customer satisfaction would increase greatly. Totaling the savings in MIPS, floor space, power consumption, maintenance costs, and manpower greatly accelerates the ROI of Storage Director.



ASSURING DR WITH CONFIDENCE

Many large mainframe customers admit that DR testing is a major problem area. DR tests tie up human and physical resources for days and don't prove much, but they must be conducted in order to demonstrate compliance. DR testing often amounts to little more than bringing up the DR site and proving that it is operational. In fact, the DR site is often too far away for the latest tapes to be on site, signed in and accessible. The operations staff is forced to state that they can resume all operations within a certain number of hours when they know they really can't.

This is an untenable situation. Recent laws enable shareholders to personally sue anyone who knowingly fails to provide proper safeguards for business continuance if such actions result in a loss of company value. Officers of companies sign documents testifying to the efficacy of DR plans, relying on IT staff to meet the requirements and provide business continuity. As we have seen, tape-based processes and requirements can make this kind of rapid recovery difficult.

Storage Director provides a robust solution to this dilemma:

- First, by replicating VOLSERS over standard TCP/IP lines, or Fibre, and using Storage Director's enhanced replication capabilities to move data to remote sites, a copy of the tape data can be quickly and reliably sent to the remote DR site. Storage Director's enhanced replication capability will optimize WAN traffic and can fully utilize all available bandwidth. The vast majority of Tributary Systems customers replicate their tape data.
- Second, with Storage Director's physical tape management capability, physical tape copies of VOLSERS may also be available for physical recovery of data. This is in addition to virtual data layer in Storage Director's InfiniCache. These VOLSERS are recoverable directly from physical tape and are written in native data formats.
- Third, replication in both directions between data centers allows sites to back up their entire data sets to other sites for off-site storage requirements, removing the need for sending physical tapes off site.

The implications are huge. Most Tributary Systems customers, after completing their first DR test using the replicated data, state that they are confident for the first time that they could actually survive a disaster and continue processing.

We must point out that nothing takes the place of good planning and thorough testing of an environment. However, Storage Director provides assurance that tape data will be where it needs to be to continue processing.



ENCRYPTING DATA

Storage Director has built-in AES 256 Hardware Encryption capability. Storage Director can encrypt all Data at Rest residing in its InfiniCache layer, so compliance needs for data security can be met through all stages of data storage and movement. Data can be un-encrypted before it is sent to physical tape, allowing the physical tape drives to encrypt the data written to tape. This allows tapes to be moved to other locations to similar tape libraries and data to be recovered with the proper encryption keys.

To maintain data security through the entire transmission process when data is replicated site to site, Storage Director can encrypt the data with a single key which can be shared with Storage Director systems in multiple locations.

MIGRATING DATA PAINLESSLY

Customers are concerned that every few years a new tape technology emerges and takes the tape universe to a new level. Unfortunately, to convert, it can require a *physical* recall of every tape – in the library, the DR site and elsewhere. This is expensive, time consuming, and hugely disruptive to operations.

In contrast, Storage Director provides the least disruptive method of physical migration. Storage Director has its own media manager and can support virtually any tape library from any manufacturer, making migrating to new technology extremely simple.

Storage Director separates the physical devices from the mainframe, presenting to the mainframe what it needs to see. So as not to disrupt operations, the new technology can be installed behind Storage Director. Data can be moved to the new tape immediately, placing the newest data on the new technology, without disruption of operations. Nothing changes for the user or operations.

The old library can remain in place and Storage Director can restore data for as long as the customer desires to keep the library in place, or as long as the data in the library remains active. The library can slowly be retired from use as data expires, being used only for restore of the legacy data. Any number of physical tape devices in the library can be retired this way. Considerable maintenance costs can be saved. Another option is to migrate the data through Storage Director from the old library to the new. It can take time, depending on the number of volumes to be read by the mainframe and written out to Storage Director. New VOLSERS could be created to allow larger volumes to be created, or with Storage Director's tape stacking capability, smaller tape volumes can be stacked onto one newer large-capacity tape volume, maximizing the use of the new technology in either case. Once all the data has been moved, the old library can be removed from service and all restores of legacy data will come from the new VOLSERS.



The migration process does not disrupt current operations and significantly reduces the cost associated with using an outside company to migrate the media. Yes, there will always be technology migrations. But with Storage Director, those migrations will be accomplished simply efficiently and electronically.

OVERCOMING BACKUP ROADBLOCKS IN MULTI-SERVER ENVIRONMENTS

As computing environments evolve to heterogeneous data centers, backup requirements become extremely complex. Many platforms require their own direct-attached storage devices to support different operating system requirements, backup utilities and applications. This results in multiple backup administrators, multiple and inefficient storage environments, and costly underutilized storage devices.

A critical IT management challenge continues to be optimizing the existing storage to improve efficiency and return on investment (ROI) while supporting different data storage needs and different business solutions throughout the enterprise.

This challenge is highlighted in the IBM mainframe world where many are adding Linux partitions to their zOS environments. They hit a backup roadblock: these Linux partitions cannot access the mainframe's channel-attached tape devices. The "Any Server to Any Storage Device" capability of Tributary Systems' Storage Director allows them to overcome that roadblock and support the Linux partitions.

Storage Director empowers companies to secure rapidly expanding data volumes from multiple servers, optimize their legacy storage devices, add new storage technologies only where needed and improve their ROI.

CONCLUSION

This white paper has shown how the implementation of Tributary Systems' Storage Director can result in savings in floor space, energy usage, tape costs, manpower, CPU cycles and DASD. These alone make Storage Director highly attractive. Add to that the speed of data access, the huge leap in reliability, extensive DR and compliance capabilities, data migration options, and unification of backup, recovery and DR in multi-server environments, and the case for such a solution is clear: Tributary Systems' Storage Director is simply too attractive for IT and data center managers to ignore. ♦