The role of HP StorageWorks 6000 Virtual Library Systems in a modern data protection strategy white paper

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Executive summary

Data protection has never been more important—data is the lifeblood of any modern company. With the advent of lower cost Serial ATA (SATA)–based disk arrays, disk-assisted backup has been making inroads into areas where physical tape drives were once the primary means of data protection. Tape will always be the lowest cost storage technology, but the role of tape is changing. Tape is still the foundation of a comprehensive data protection strategy because of its low cost/GB and the ability to physically offsite the data on tape. Tape is being used more and more for high-volume data backup (from fast data sources), long-term archiving, and the migration of data that has already been backed up to disk.

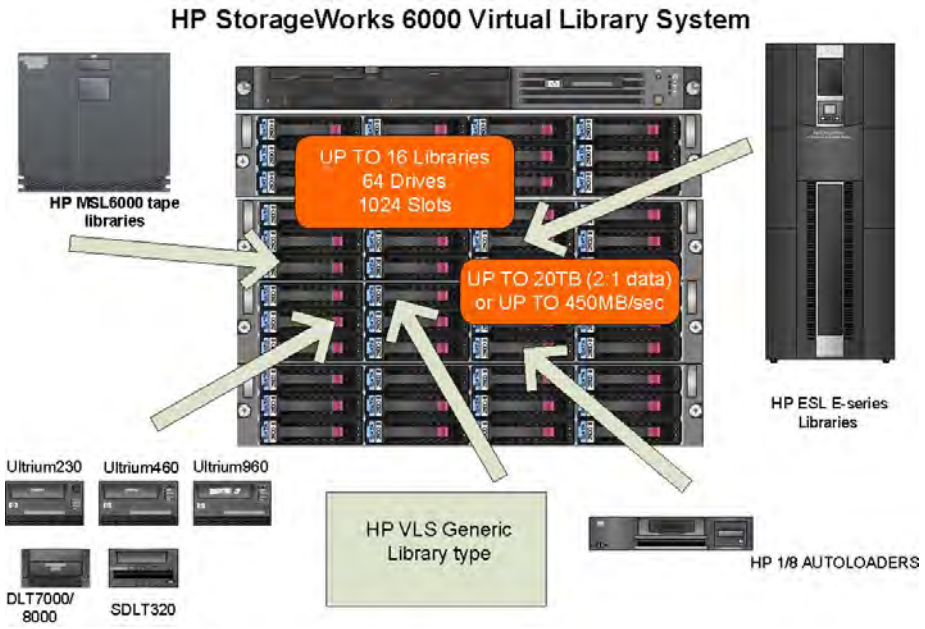
Virtual tape libraries from HP offer a seamless migration to a disk-assisted backup strategy because they "emulate" the existing range of HP tape drives and libraries while protecting a customer's existing investment in backup software. They appear as "real" physical libraries to the backup software, enabling all existing processes and procedures to be used.

The HP StorageWorks 6000 Virtual Library Systems (HP VLS6000) offer up to 10 TB of backup storage (up to 20 TB with software data compression and 2:1 compressible data) at combined data rates of up to 450 MB/sec.

The HP VLS6000 technology is primarily targeted at:

- Long backup windows due to "slow" servers being unable to stream higher performance tape drives in a storage area network (SAN)–based environment. "Slow" in this sense is related to the data type being slow to access, for example, file and print or web servers.
- Environments with many single file restores on a regular basis.
- Data that only has a short life span, for example, transaction logs in Oracle®, SQL, and Exchange.
- People who are using clone or snapshot technology (and hence expensive high-performance disk array space) for non-critical data backup.

Figure 1. The HP StorageWorks 6000 Virtual Library System emulates many popular tape drives and libraries



An additional benefit of implementing an HP VLS6000 solution is that it can also better utilize your existing investment in physical tape—doing more with less. Backup to tape from the HP VLS6000 can now take place at the customer's convenience during the day, with the same physical library being used during the night for backing up the faster parts of the customer's infrastructure (databases, etc.).

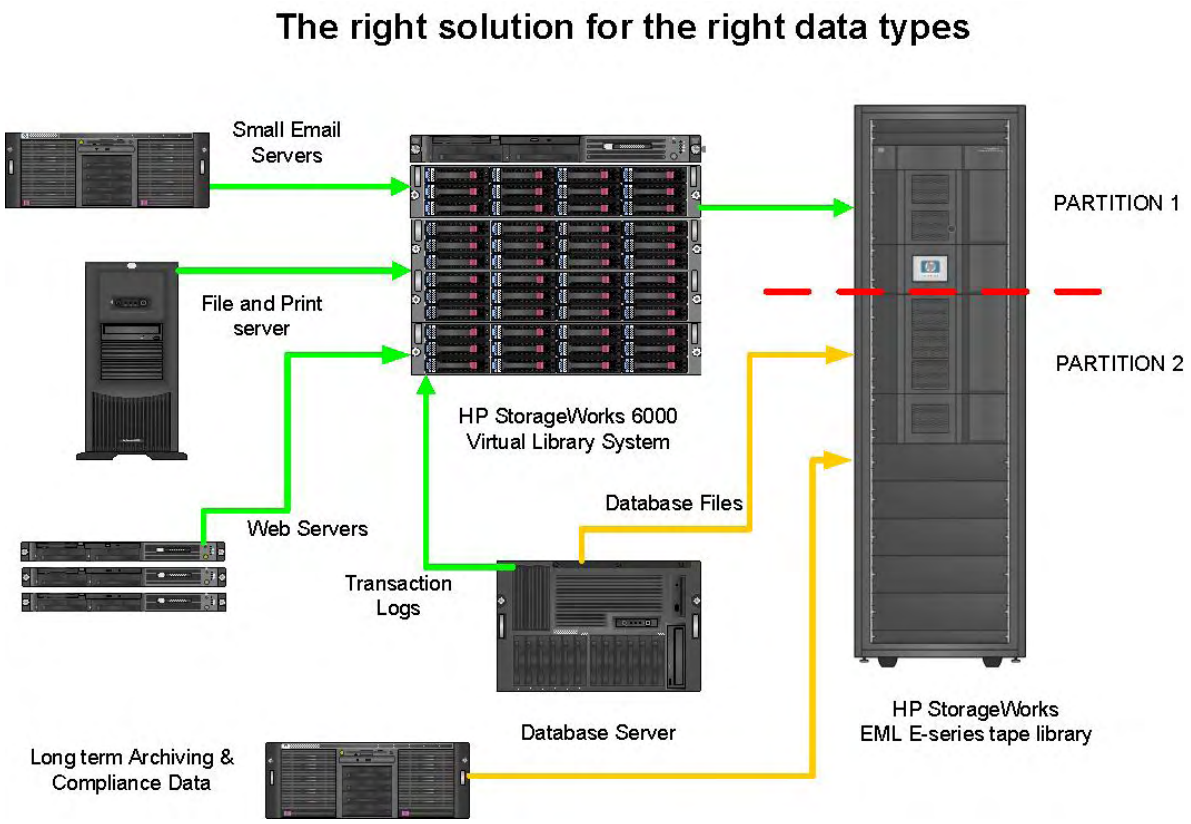
The HP VLS6000 integrates seamlessly into heterogeneous backup environments because the backup application thinks it is backing up to physical tape. Because of its optimized design, as the capacity and performance of the HP VLS6000 grow together, the HP VLS6000 can offer the best cost per MB/sec value in its class.

The HP VLS6000 manages the virtualization node and disk array as a single device, using HP StorageWorks Command View VLS to minimize the management overhead of your IT operation.

Because the HP VLS6000 integrates seamlessly into existing backup and recovery processes to accelerate backup and recovery jobs for slower servers in the SAN, normal backup application software licensing applies, normally based on drive count or slot count. Some major backup application ISVs such as HP OpenView Storage Data Protector and VERITAS Netbackup have modified their licensing rules for virtual tape to license it on a raw per TB basis.

What is becoming apparent in the data protection market is the way that different technologies (virtual tape, disk-to-disk, standard tape) are being deployed according to the different data types and topologies they protect. Consider the example in Figure 2, which shows the typical data types that can benefit from the use of HP virtual tape technology.

Figure 2. Data types suitable for data protection using the HP StorageWorks 6000 Virtual Library System



As can be seen in Figure 2, "slow" data sources such as file/print data or small web server files are best backed up to virtual tape before being transferred (if necessary) to virtual tape. Exchange server backup is often also "slow" because of the Exchange database access API and so it may also be advantageous (performance wise) to back up small distributed email servers to separate "virtual" tape drives—hence reducing the overall backup window for the total number of email servers in a SAN environment. The diagram shows database files being backed up directly to physical tape because these files are generally large in size and held on higher performance disk arrays (to ensure good response times). These factors also ensure they can stream higher performance tape drives and so HP advocates these large capacity/fast/large data transfers to back up directly to tape. However, the small transaction logs associated with these databases can benefit from being backed up to virtual tape since they are typically small and unable to stream physical tape directly.

Objectives and target audience

This white paper shows the specific scenarios where an HP StorageWorks 6000 Virtual Library System can deliver tangible user benefits when used as part of an integrated data protection strategy. The target audiences for this white paper are system architects and IT managers with an interest in improving slow SAN backups, improving single file restore service level agreements, and making better use of existing physical tape infrastructure investments.

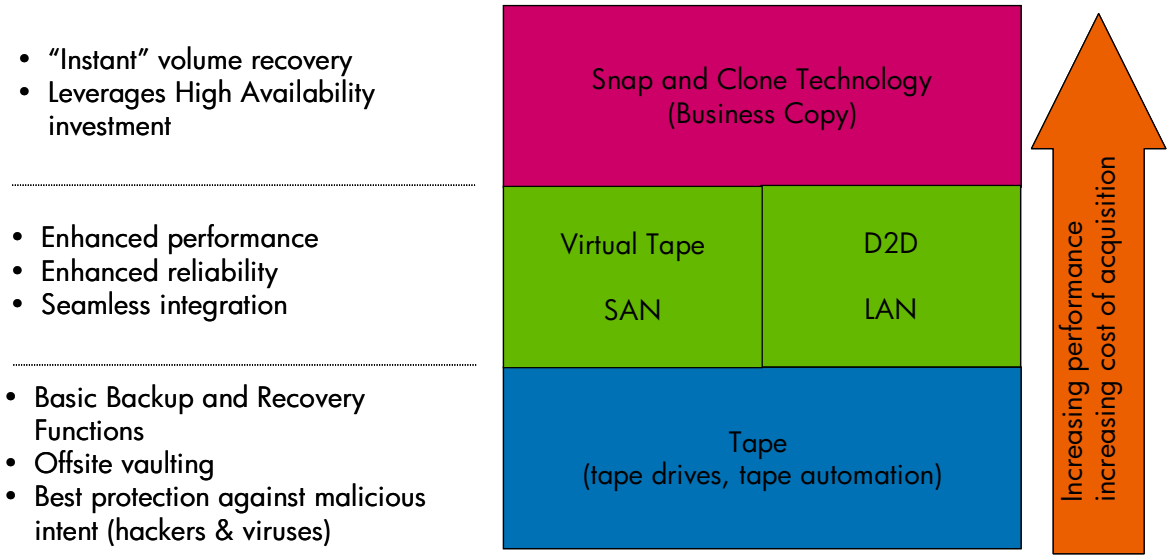
Terminology

Throughout this white paper, the following terminology will be used:

- **HP VLS6000**—HP StorageWorks 6000 Virtual Library System family, the range of HP virtual library configurations.
- **Virtual library**—A device that behaves in an identical way to physical tape drives and tape libraries by emulating the functionality of physical tape drives and automation using hard disk drives and emulation software.
- **SAN clients**—A number of SAN servers connected into a SAN.
- **Managed transfer to physical media**—The migration of data from the virtual library onto physical tape media in a physical tape library using the "object" or "media" copy functionality within an ISV backup application.
- **Automigration**—The migration of data from the virtual library onto physical tape media using the in-built migration utility within Command View VTL (available in late 2005).
- **Command View VLS**—The management GUI used to configure and monitor the HP VLS6000.

Positioning the HP Virtual Library Systems in the hierarchy of data protection solutions

Figure 3. HP disk-assisted backup technologies: Each technology gives a different level of service at a different cost to implement



Physical tape will always be the foundation of a robust data protection strategy offering low cost/GB storage and off-site vaulting capabilities. However, in many cases an increase in backup performance can be achieved by using disk-assisted backup techniques[1].

Disk has the advantage of being random access and does not suffer the same performance (repositioning) issues when backing up lots of small files. Additionally backup to disk does not generally suffer from some error conditions that can cause backup jobs to tape to fail, for example, no media in the media pool, media coming to the end of its useful life, tape jams, and robotic failures.

HP offers several disk-assisted backup solutions:

- Virtual tape
- Disk-to-disk, or D2D (also known as advanced backup to disk within Storage Data Protector software)
- Snap and clone technology

[1] The exception to this statement is when the disk arrays being backed up are very fast, or the number of "streams" that are available to interleave to a single tape is high. In these circumstances when using very high-performance tape drives such as the HP StorageWorks Ultrium 960 (LTO3), the backup to tape can be faster than the equivalent backup to disk.

HP virtual tape allows users to have all the advantages of backup to disk but without having to change existing backup techniques. HP Virtual Library Systems integrate seamlessly into existing SAN-based backup infrastructure because they respond to backup and recovery software as though it actually were physical tape. The primary purpose of virtual tape is to accelerate slow SAN-based backups by allowing as many parallel backup streams to be configured as necessary to back up the slow infrastructure (see scenario examples).

D2D again uses low-cost disk arrays (or older disk arrays being put to extended use) and relies on the backup software specifically supporting write to disk as part of the backup process. HP positions D2D as being ideal for LAN-based disk-assisted backup where a single file system can be maintained on the low-cost disk array and written to by the backup server. D2D could also be used for small SANs (fewer than five servers) but in a SAN environment each server in your system has to have a LUN created on the shared disk array, and that means managing multiple file systems on the shared disk array. This can be time-consuming and confusing in some circumstances, so HP considers this impractical when the number of SAN servers is higher than three to five.

Finally for the most business-critical data, where instant recovery is necessary, snap and clone technologies based in the disk arrays can provide complete images of the data that can be brought online very quickly. These solutions are complete clones/snapshots requiring high-volume disk storage, so they tend to be more expensive than either virtual tape or advanced backup to disk.

Introducing the HP Virtual Library Systems

HP StorageWorks 6000 Virtual Library Systems are turn-key, SATA disk-based SAN backup devices that provide disk to virtual tape (D2D) backup with device side data compression.

The HP VLS6000 is designed specifically to fit into a SAN-based backup environment and can also accommodate over the network backups from remote servers by way of a media server. The disk emulation of tape is specifically optimized for sequential data transfers—just like physical tape drives. This performance tuning of the hardware allows data transfers up to 450 MB/sec (10-TB virtual tape with eight backup streams).

The HP VLS6000 is capable of emulating a wide range of HP tape drives (currently HP DLT7000, DLT8000, SDLT320, HP LTO1, LTO2, LTO3) and libraries (currently HP StorageWorks Autoloader 1/8, HP StorageWorks MSL6000, the ESL E-series). You can determine the number and type of tape libraries, tape drives, and even cartridge size to accommodate your ever-changing environment. HP VLS6000 can emulate up to 16 tape libraries, 64 tape drives, and 1,024 cartridges.

Note
This does not mean 16 libraries of 64 tape drives.

HP VLS6000 is designed to enhance backup and recovery operations in most environments—from the simplest to the most complex. To do this, the HP VLS6000 is supported on mixed IT platforms and backup applications. For the latest support matrix, see http://www.hp.com/go/ebs.

Data stored on HP VLS6000 is easily copied to physical tape for offsite disaster protection or long-term archiving using a backup application running on a separate server and using the “media copy” or “object copy” functionality within the backup application.

Figure 4. Comparison of the HP VLS6000 models

	 VLS 6105	 VLS6510
Useable Native Capacity	2.5 TB - 5.0 TB	5.0 TB - 10.0 TB
Interface	Two 2Gb FC ports	Four 2Gb FC ports
Maximum Aggregate Throughput*	225 MB/s	~ 450 MB/s
Max # of Virtual Tape Drives	64	64
Max # of Virtual Tape Libraries	16	16

The HP VLS6000 comes in two models:

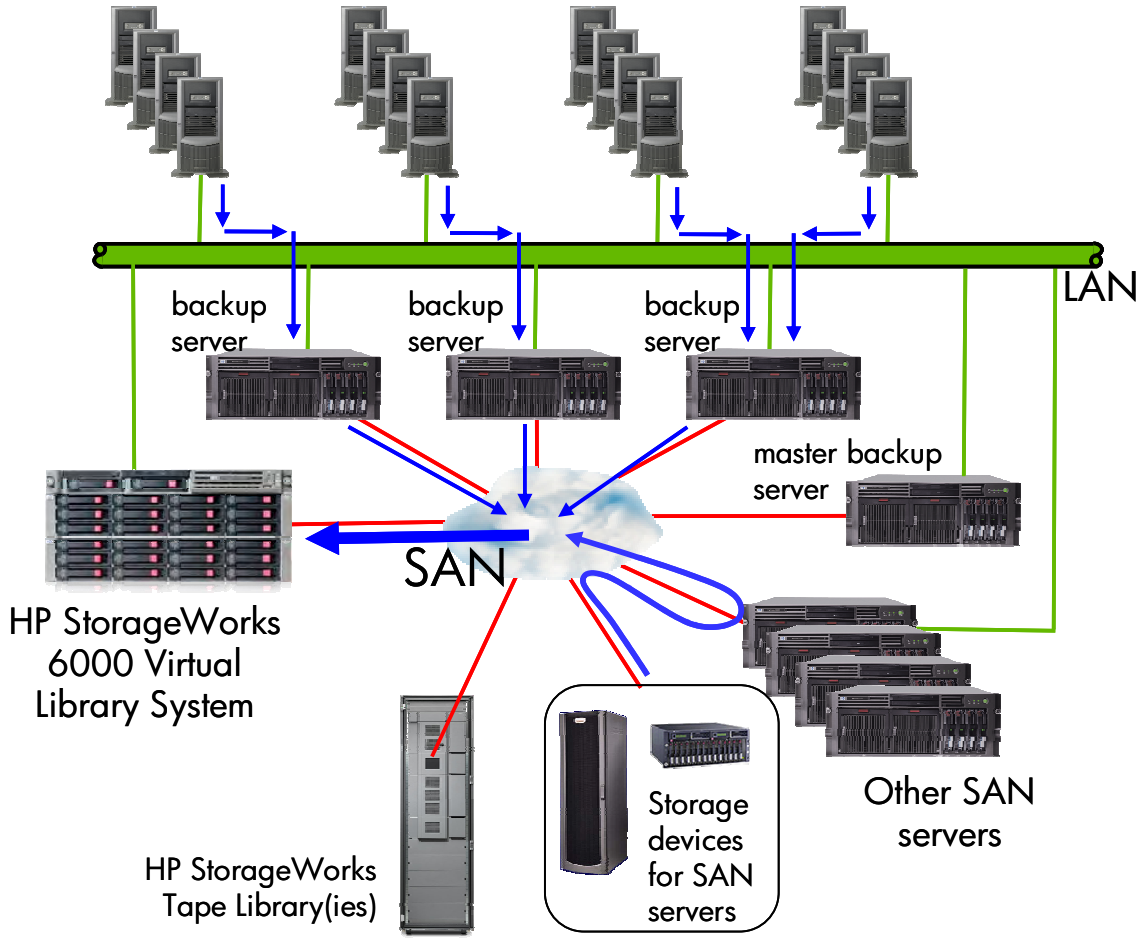
- VLS6105 2.5-TB useable capacity (without compression) upgradeable to 5.0 TB and capable of backup speeds of up to 225 MB/sec over two 2-Gb Fibre Channel ports.
- VLS6510 5.0-TB capacity (without compression) upgradeable to 10 TB and capable of backup speeds of up to 450 MB/sec over four 2-Gb Fibre Channel ports.

The VLS6105 and VLS6510 use different hardware components in the VLS node so there is currently no upgrade from a VLS6105 to a VLS6510. Accurate backup sizing should be performed before deciding which model to purchase.

The hardware design is such that each time a new 2.5-TB capacity bundle is added, a separate disk array channel is added to drive that new capacity bundle. In this way the HP VLS6000 is unique in that as the capacity scales so does the performance.

Figure 5. Typical environment backing up to the HP StorageWorks 6000 Virtual Library System

Step 1. Back up to the VLS6000



Benefits:
***Integrates seamlessly into current infrastructure**
***Increased backup performance for slow SAN servers**
***Improved single-file recovery time**

In Figure 5, data resident on remote LAN-attached servers and on shared storage devices for SAN-attached servers can be directed to the VLS6000 for backup. The VLS6000 can be configured to have as many tape drives (up to 64) and libraries (up to 16) as best meet the backup strategy. For example, each of the servers with SAN-attached storage could have their own dedicated tape drive (based on capacities being backed up), while "groups" of remote LAN-attached servers could be allocated a tape drive and the backups interleaved onto that single (virtual) tape drive. With more resources (virtual tape drives) available, the backups will complete faster than the equivalent backup to the "limited" number of tape drives in a physical library.

The reference to "slow SAN servers" reflects the ability of the SAN server to "push" data over the SAN fast enough to stream a physical tape drive. It is therefore dependent on the performance of the disk array (from which the data is sourced), the processing power of the SAN server, and most importantly the type of data being backed up. For example, Microsoft® Windows® file/print servers and web servers (with several small files) are notoriously slow to back up.

It should be noted in this example that the LAN-based backups can be backed up to their own virtual tape drives, hence improving restore performance because of reduced interleaving. However, the overall LAN backup performance will still be limited by LAN bandwidth (about 100 MB/sec for Gigabit Ethernet). The example merely illustrates that virtual tape is a seamless integration into an existing backup methodology.

The SAN backups, however, will benefit from increased performance because they now happen in parallel. If you have 10 slow SAN servers, create 10 virtual tape drives in the HP VLS6000 and back up the slow SAN servers in parallel. The performance improvement will of course also depend on the performance level of the SAN-attached disk array. Previously the only option was to buy more physical tape drives and expand the physical tape library and then back up the systems in parallel, but this option would be expensive.

The overall backup performance is limited by the number of Fibre Channel ports, disk array performance, and the number of backup streams but a 10-TB VLS6510 is capable of backing up at approximately 450 MB/sec with eight backup streams feeding it. Of course, your performance may vary according to the variables in your particular configuration.

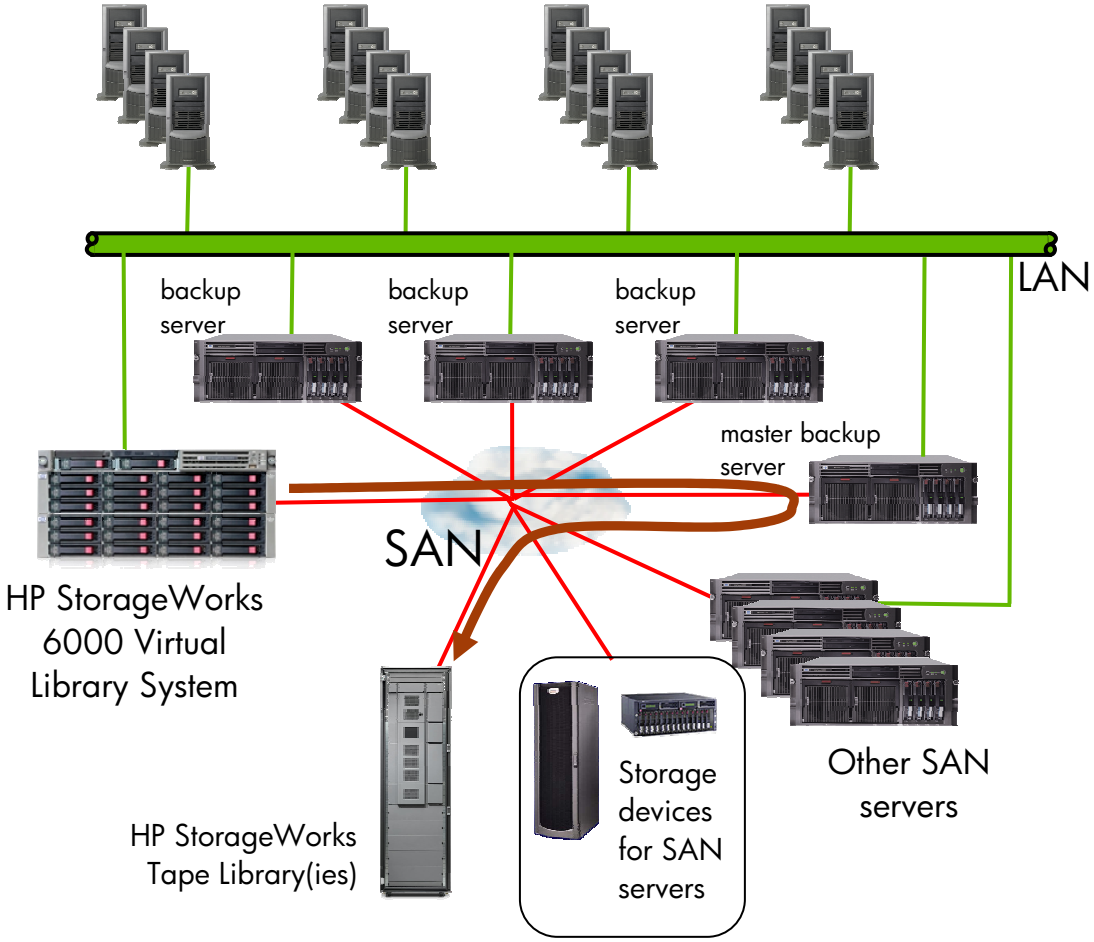
Because no data is totally safe until it is on physically removable media that can be off-sited and vaulted, the HP VLS6000 backups can be migrated to physical tape using the backup application. Remember the backup application sees both the VLS6000 and the physical tape library as "real" libraries and the data stored on the VLS6000 is in tape media format. Therefore, to migrate to physical media in a physical library means only a media or object copy function must be invoked by the user from the backup application software.

In HP OpenView Storage Data Protector, for example, object copy allows multiple backup jobs to be "merged" onto a single physical piece of media, either directly after the backup to VLS, at a future scheduled time, or in interactive mode when the user decides it is necessary.

Storage Data Protector also allows "media copy" where a complete virtual media tape can be copied to a complete physical media tape.

Figure 6. A typical environment showing the migration from virtual tape to physical tape (The migration is controlled by the backup application.)

Step 1. Back up to the VLS6000
Step 2. Migrate from the VLS6000 to physical tape

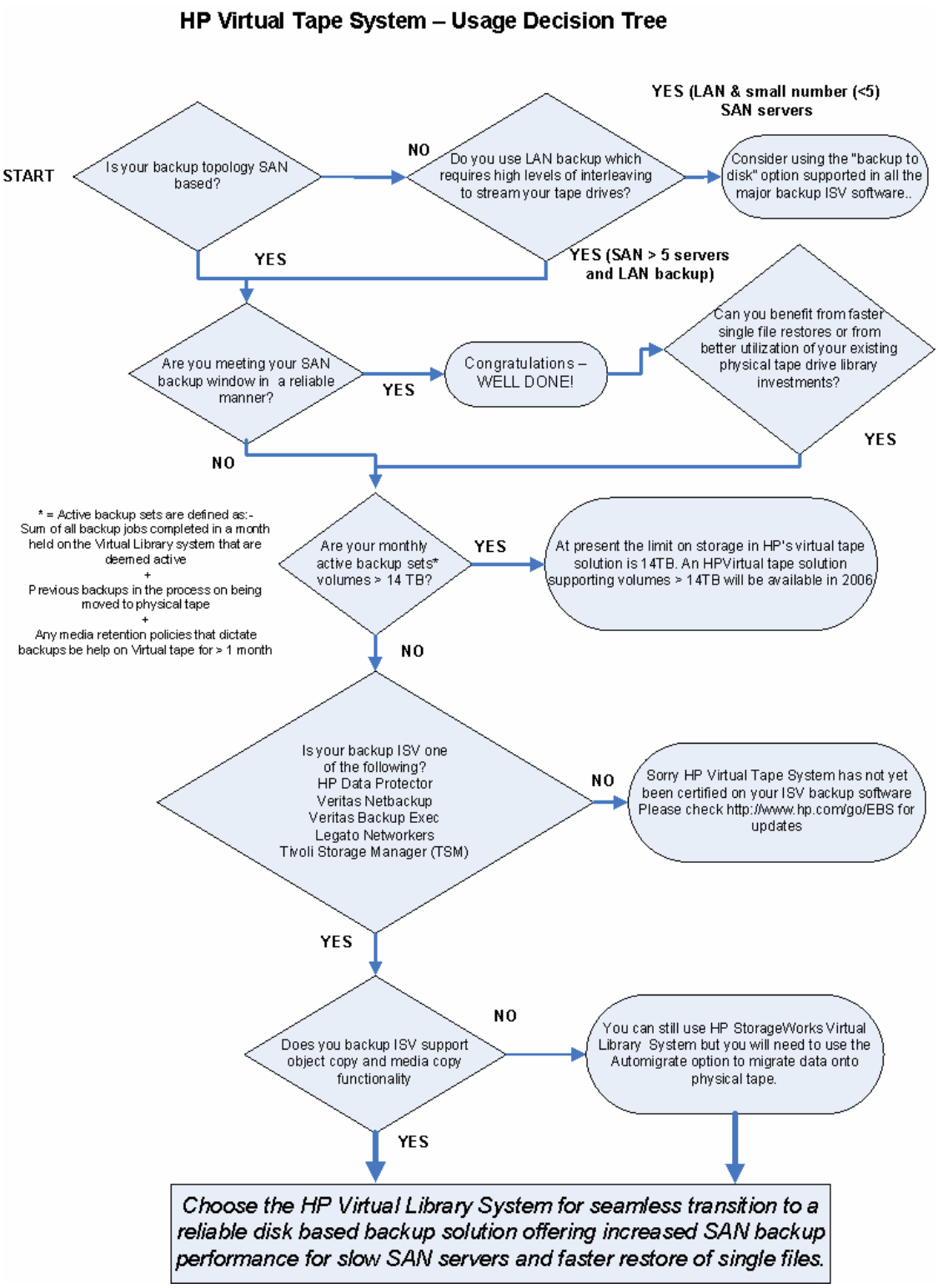


Benefits:
***Integrates seamlessly into current infrastructure**
***Increased backup performance for slow SAN servers**
***Improved single-file recovery time**

As well as being useful in backing up slow SAN hosts, the HP VLS6000 can offer real advantages in other environments:

- Simplifies your backup environment by allowing more flexible allocation of tape drives to hosts.
- Eliminates the large-scale use of physical tape media, only backing up to physical media the data that is business critical or requires archiving. This allows your physical tape investments to be better utilized.
- Performs single file restores faster because the media does not have to be found, loaded, and positioned.
- Is well suited to environments where data only has a small lifespan, for example, transaction logs between full backups in Oracle/SQL Server and Exchange.

Figure 7. Decision tree to help identify appropriate virtual tape applications



Benchmarked example: Improved backup performance in multi-server SAN/LAN environment

Figure 8. Example solution showing how virtual tape improves backup windows and single file restore times

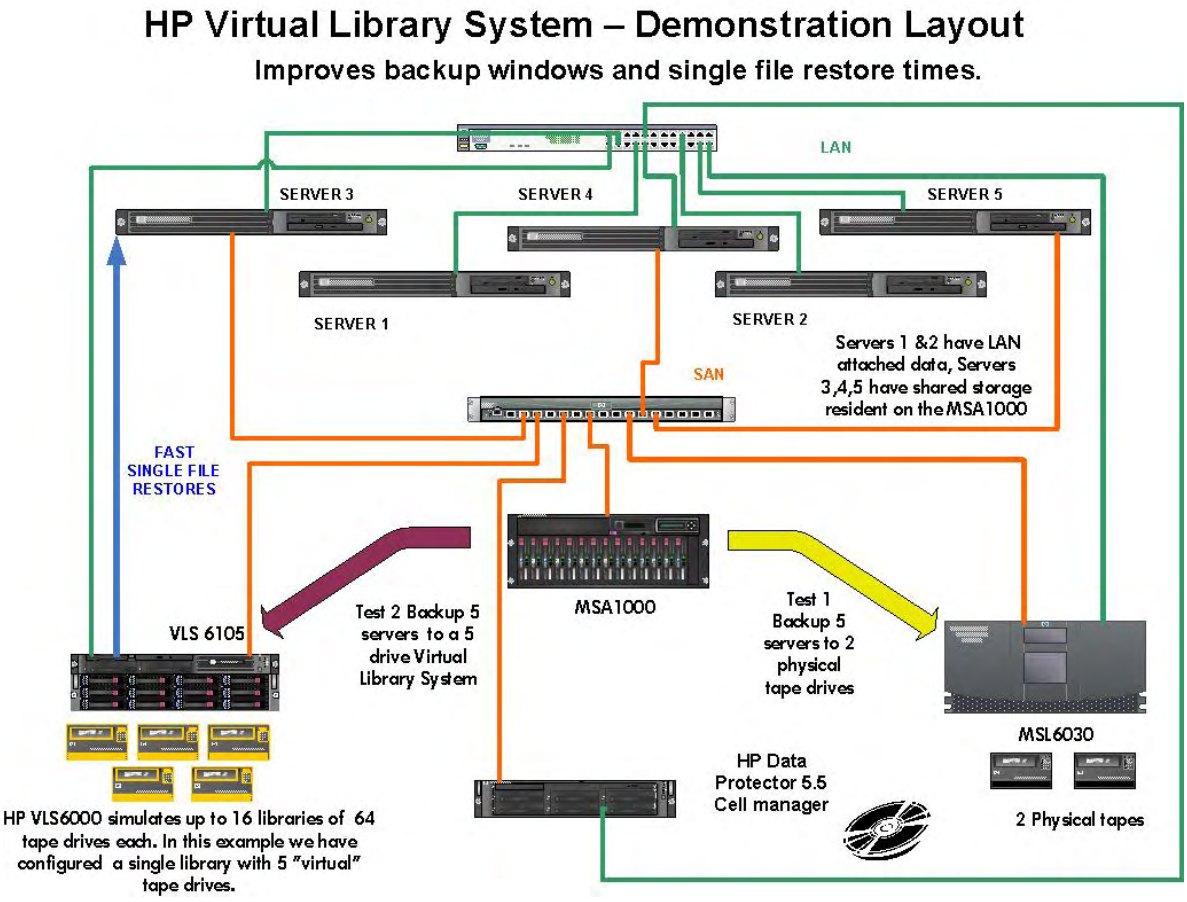


Figure 8 shows five servers. Servers 1 and 2 have network connections to the backup server, while Servers 3, 4, and 5 have SAN-attached storage residing on the HP StorageWorks Modular Smart Array 1000 (MSA1000). The idea is to simulate a small mixed (LAN and SAN) backup environment. Approximately 2.6 GB of known data (file sizes 64 K to 64 MB, 2:1 compressible data) is created on Servers 1 and 2 (on the local drive) and on Servers 3, 4, and 5 as mapped LUNs on the MSA1000 disk array.

The five servers are backed up to three different configurations:

- A physical LTO2 tape library with two physical drives—the HP StorageWorks MSL6030.
- A five-drive virtual tape library with **no** compression on the virtual tape drives.
- A five-drive virtual tape library **with** compression on the virtual tape drives.

A total of approximately 13 GB is backed up and the time is measured as reported by the backup application from start to final completion message.

Faster backups

Configuration	Time	MB/sec
1. (Physical tape)	7 min 23sec (443 sec)	29.34
2. (Virtual tape **no** compression)	3 min 10 sec (190 sec)	68.42
3. (Virtual tape **with** compression)	4 min 12 sec (252 sec)	51.58

With configuration 1, the backup job must wait for physical tape drives to become available for different servers (physical limit of two drives), whereas with the virtual tape backups a dedicated virtual tape drive is allocated to each server, so the backup effectively happens in parallel.

Data compression within the VLS6000 series is performed in software in the VLS node, and this increases the capacity of the VLS6105 in this example from 2.5 TB up to 5.0 TB (with 2:1 compressible data). The downside is that because the data compression is performed in software, the throughput is reduced, as can be seen in the results.

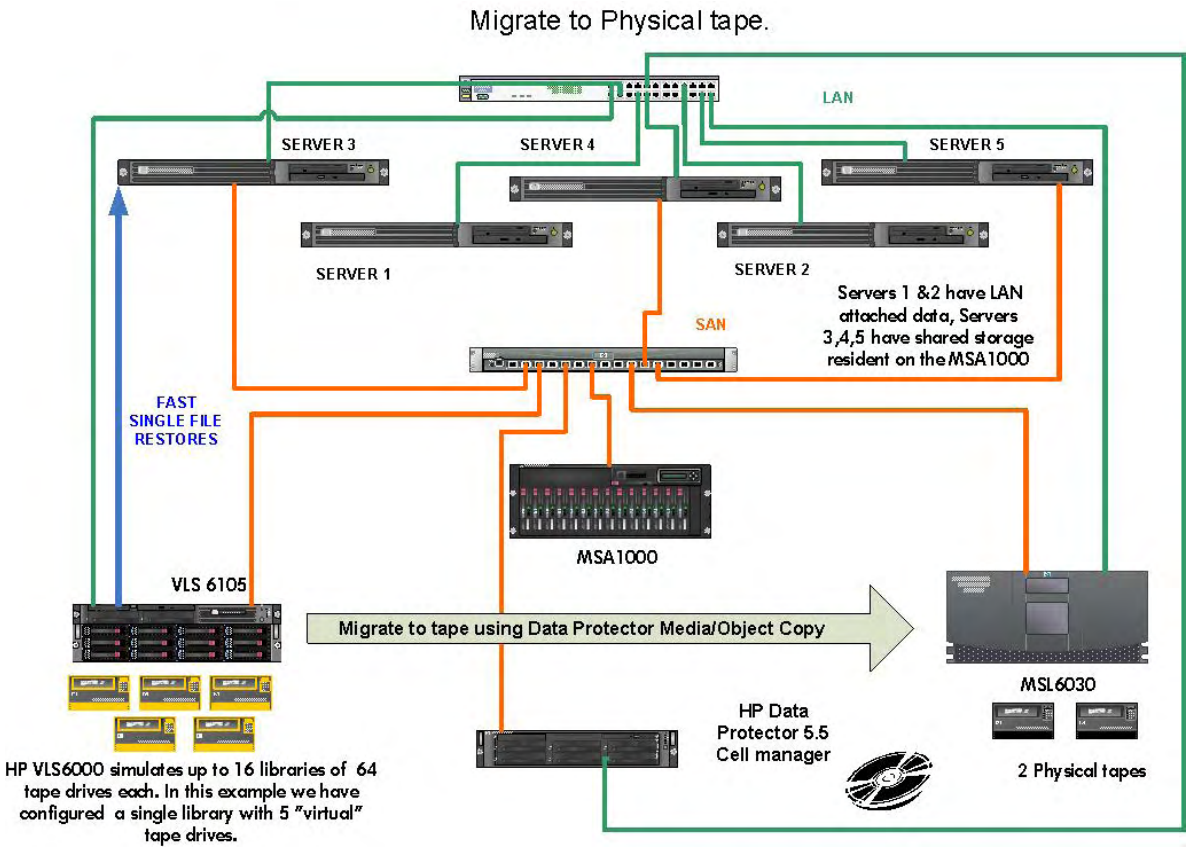
Faster single file restores

The next test was to evaluate the restore times from physical media (already loaded in the library) and from virtual tape. The physical media recovery time obviously would be longer if it had to be retrieved from off-site. The restore consisted of the same single file from approximately 50 percent into the directory structure of the backup.

Time is measured as reported by the backup application start to finish.

Restore type	Restore time
Server 1 from physical tape	2 min 6 sec (126 sec)
Server 3 from physical tape	3 min (180 sec)
Server 1 from virtual tape (no compression)	22 sec
Server 3 from virtual tape (no compression)	20 sec

Figure 9. Migration from virtual tape to physical tape in the example installation



A final test was performed to copy one of the 2.6-GB backup tapes from the virtual tape library onto physical tape for off-site vaulting. The following time includes the time to physically load the physical media into the physical tape drive and unload it when the copy is complete. This action is performed by the backup server (Storage Data Protector Cell Manager in this example).

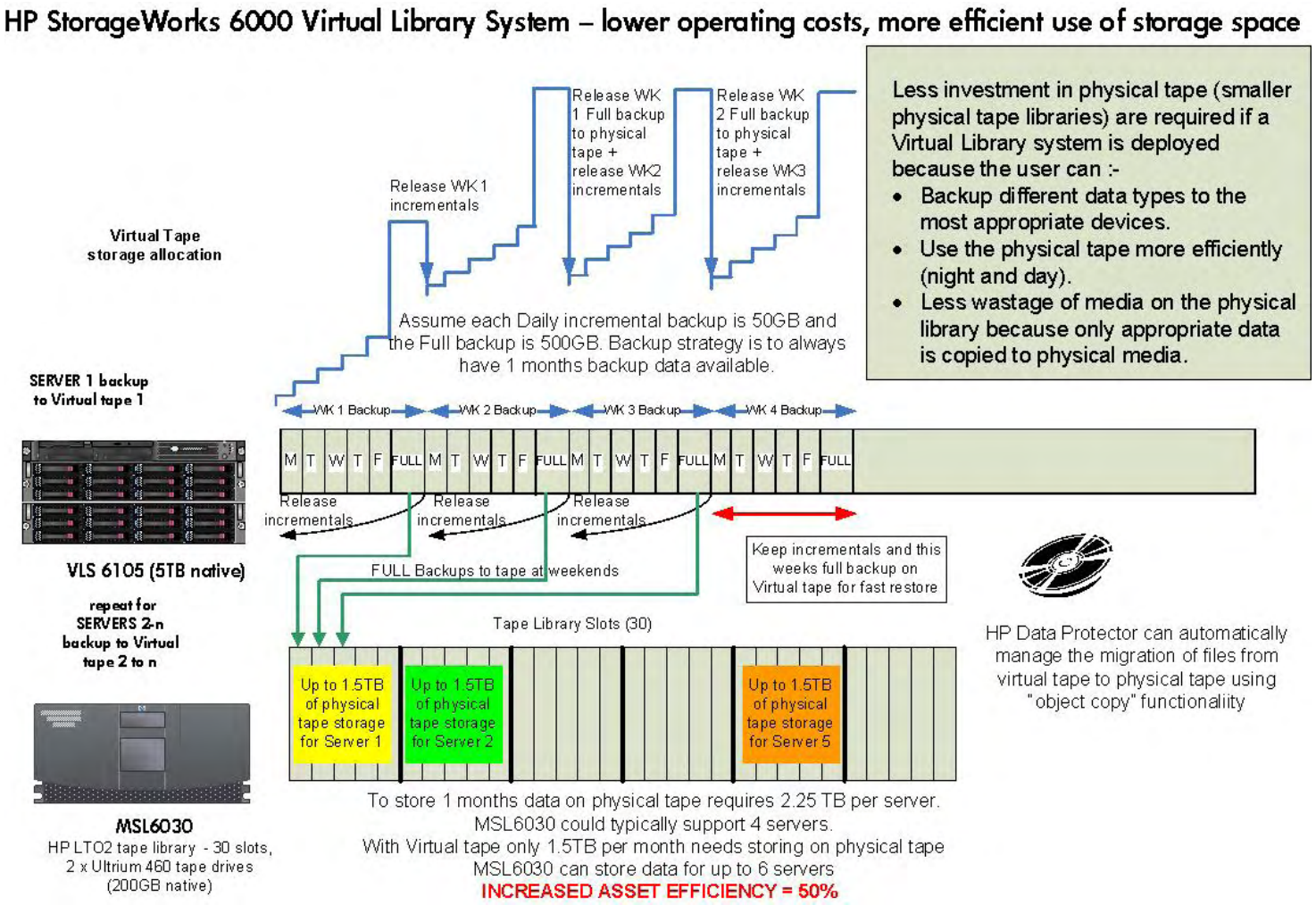
Media tape copy	MB/sec
VLS6105 to MSL6030 (server 3 backup)	31.5

All major backup applications support media copy and object copy functionality, and because the HP VLS6000 appears to the backup software as a real tape library, it can blend seamlessly into being able to use these advanced copy features.

- Media copy—Copies complete piece of media from one device to another
- Object copy—Allows multiple objects from several different backup tapes to be merged onto a secondary single piece of media

Improved asset utilization of existing physical tape infrastructure

Figure 10. The VLS6000 allows you to lower your operating costs and make more efficient use of storage space



One of the other advantages of introducing virtual tape into your data protection strategy is that it can free up existing physical tape infrastructure to be used more effectively (see Figure 10).

Because the VLS files system is effectively managed, there is virtually no wasted storage capacity, unlike the use of physical tape media in a library. Figure 10 shows how by using backups to virtual tape the physical tape can be used to back up/vault more physical servers and their data than it could before virtual tape was deployed.

Looking at this a different way means that while the Virtual Library System is backing up the slow SAN hosts and LAN-attached servers overnight, the physical tape device can be deployed backing up the higher performance main databases or other data. Then, during the day when the physical infrastructure is not normally utilized, the previous night's backups to virtual tape can be migrated to physical tape. All in all, the physical tape infrastructure is used more effectively and the media management issues associated with lots of tapes with small amounts of data are eradicated as consolidation can take place as the backups are migrated to physical tape.

Because the physical tape infrastructure is used more effectively and efficiently, there is a reduced need to expand the physical library infrastructure significantly as data volumes grow, hence the effect of adding a virtual tape library to your backup infrastructure can become "cost neutral," improving total cost of ownership (TCO).

Improved transaction log backup in database environment using the HP VLS6000

Figure 11. The HP VLS6000 is ideal for short-lived data such as transaction logs

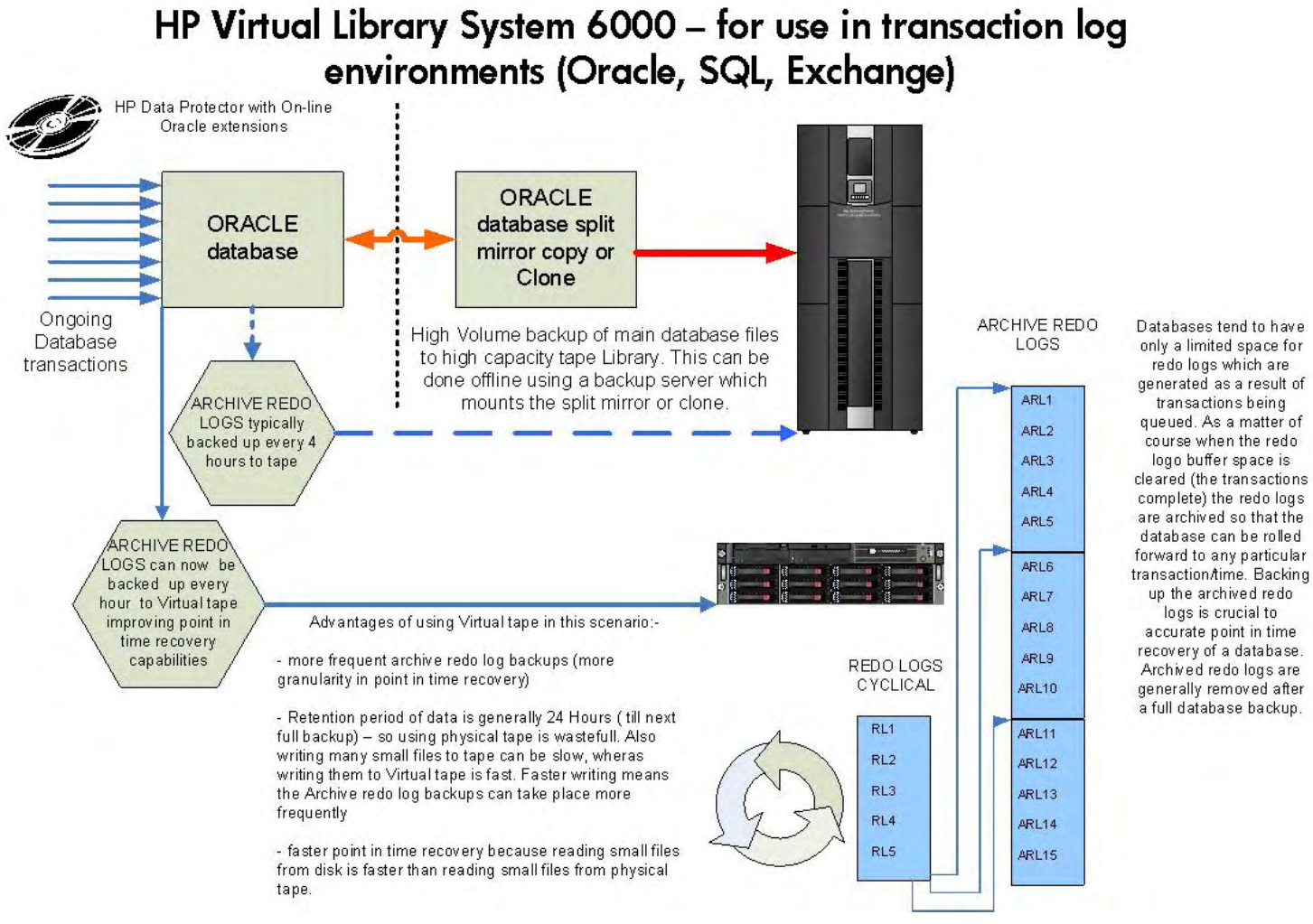


Figure 11 illustrates a familiar concept in database-driven applications—that of redo logs (or, transaction logs). These logs are critical in being able to recover a database to a given point in time (PIT). The logs are only needed in between full backups to roll the database forward or back to a given PIT, and backing them up to tape can be quite a slow process. The benefits of using virtual tape include:

- It is fast.
- Its optimized storage ensures no wasted capacity.
- If necessary, the logs can be backed up more frequently enabling better granularity to a PIT restore.

Current support matrix

For the current range of supported backup ISVs and SAN system hardware, into which HP StorageWorks 6000 Virtual Library System can be integrated, see http://www.hp.com/go/ebs.

Appendix A: Comparison of HP Virtual Library Systems with backup to disk (D2D)

Figure 12. Technology comparison

	Snaps/clones	Virtual tape	"write-to-disk"	Tape
Topology	Within array	SAN	LAN	Any
Backup format	Volume image	Backup application format	Backup application format	Backup application format
Single file restore	Complex/slow	Very good	Very good	Slow
Large file/volume restore	Very good	Slow	Slow	Good
Ideal applications	Mission-critical applications	Business-critical applications	Business-critical applications	All
Cost to implement and maintain	Highest	Medium	Medium	Lowest

Figure 13. Technology comparison

	Snaps/clones	Virtual tape	"write-to-disk"	Tape
Benefits	• Instant full image recovery • Leverages existing HA investment	• Fast recovery for single files • Integrates easily to existing backup system • Removes media issues from backup window	• Fast recovery for single files • Function of existing backup application • Removes media issues from backup	• Inexpensive • Faster than virtual tape or "write-to-disk" for volume restores • Portable
Caveats and disadvantages	• Expensive • Lower cost/performing disk will affect mirror performance • Data is still online and susceptible to attack from hackers/viruses	• Requires additional backup jobs • Caching mode can create discrepancy between physical world and backup software view	• Requires a LUN per host – can result in inefficient use of storage if not managed well	• Slow for single file restore • Experiences physical errors (media handling)

Figure14. Comparison of virtual tape and D2D

	Virtual tape devices	D2D
Focused use model	Improving slow SAN backup	Optimized for consolidated LAN environments
Setup complexity	Sets up just like a physical tape library	Requires configuration of RAID groups, LUNs, volumes, and file systems
Data compression	Software or hardware enabled (software compression generally decreases performance)	No device side data compression available
Performance	Hardware devices are tuned for sequential read and write operations	Performance dependent on target array or server Can suffer from fragmentation Application server affected by copy function
Cost	More expensive acquisition cost Backup software licenses as if physical library or per TB Storage efficiency gained through compression Lower management overhead	Free or licensed per TB in most backup applications Higher management overhead

In most of today's major backup applications there is the ability to back up to a "file library," that is, a disk file directly, which is of course written directly through the operating system file system. This is indeed a disk-assisted backup implementation and these "files on disk" can also be migrated to physical tape through the appropriate "object copy." The main differences between write to disk and virtual tape are listed in Figure 12, Figure 13, and Figure 14.

The most important differences between virtual tape and write to disk include:

- D2D from backup applications requires that within a SAN environment separate "backup disks" (file libraries) are created and managed for each server being backed up. This is relatively simple for a few servers but when the number of servers being backed up is in the 100s (or even over three), the maintenance task of managing the file systems on a shared storage array can be daunting.
- In backup application–sponsored D2D, the backup to disk "files" are not easily identified as they are not "barcoded" as such but use filenames generated on the fly. From a usability perspective this is complicated because you have to rely entirely on the backup catalog to determine which disk backup file your data is actually on.

Write to disk can be more cost-effective if you have older (slower) disk arrays available that are unused and can be re-deployed at minimal cost.

Appendix B: How virtual tape libraries appear to the backup application

One of the key selling features of virtual tape is that to the backup application the virtual tape libraries you have created appear like real physical libraries, ensuring that well-established backup strategies and processes can be continued after the seamless introduction of a virtual library system. The fact that the virtual library appears as a real physical library also ensures that the backup application can monitor and catalog the virtual tape media usage so that restores are quick and efficient. The use of media and object copy functionality in the backup application is also simple to implement with a virtual tape library because the backup application sees the devices as being "the same." Following is an example of how a physical library and a virtual library are presented to use within HP OpenView Storage Data Protector 5.5. Figure 15 shows how a physical two-drive HP StorageWorks MSL6030 library is displayed. It shows two Ultrium 2 drives and 30 slots; some of the slots have media in them with barcodes.

Figure 15. How a physical library device is displayed in Storage Data Protector

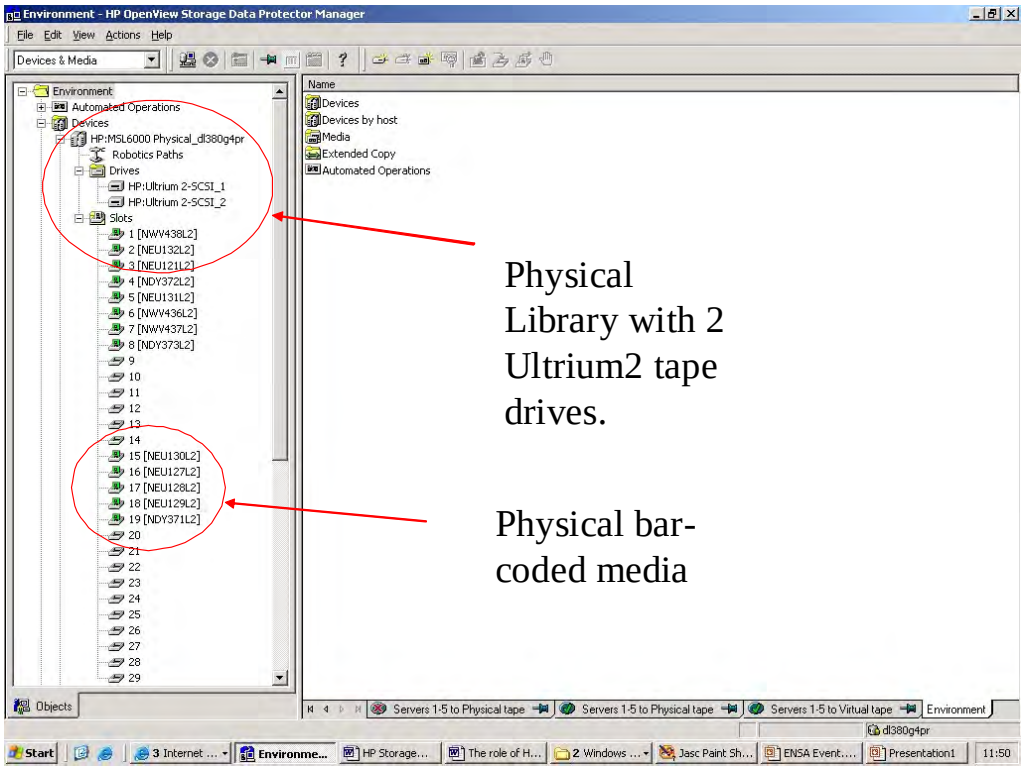
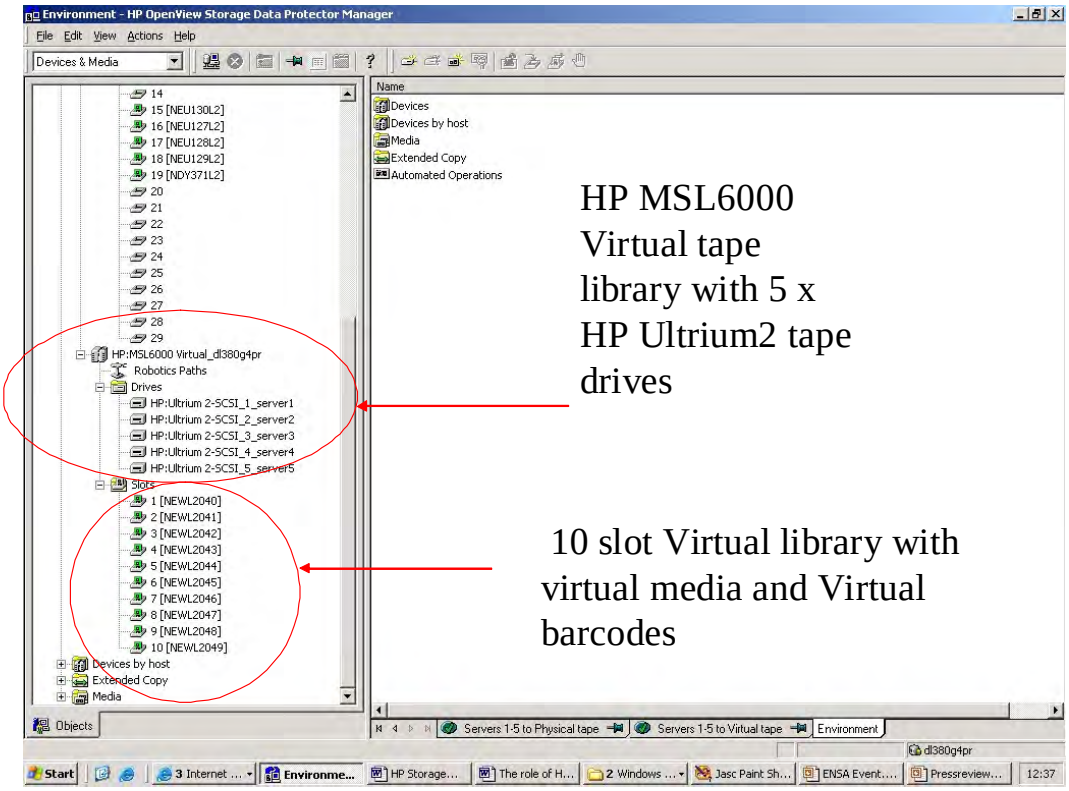


Figure 16. How a virtual library is displayed in Storage Data Protector

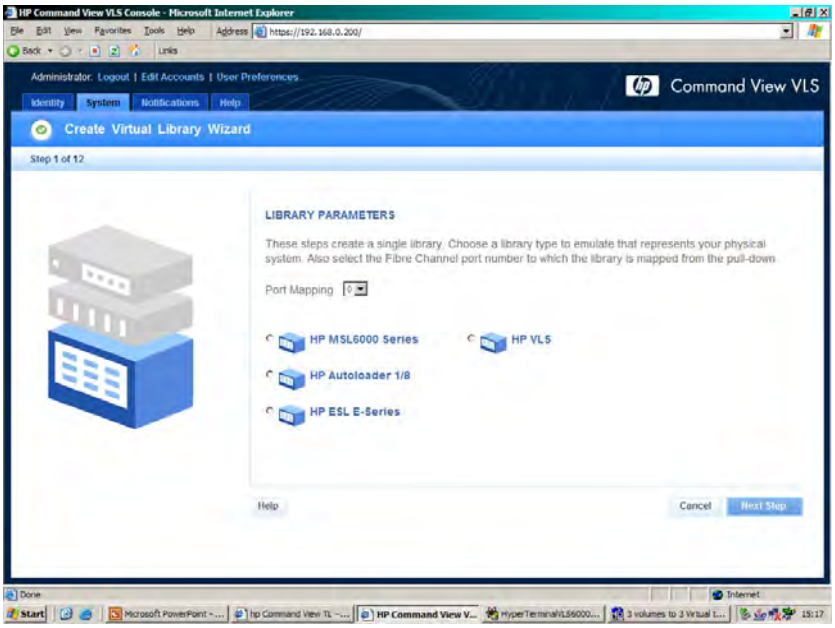


Viewing the virtual tape library (created with five Ultrium 2 drives, 10 slots and each slot loaded with 50-GB media), you can see it appears in exactly the same format as the physical library. The media in the slots each contains a barcode for tracking that was created within the barcode template for the virtual tape library (see Appendix C).

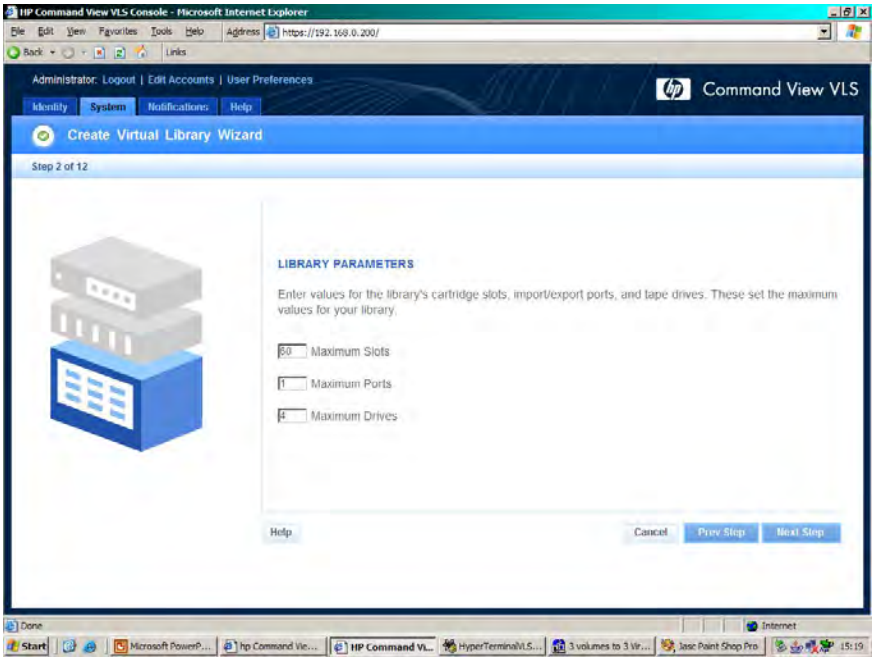
Appendix C: Simple configuration of an HP Virtual Library System

Creating a virtual tape library with the HP StorageWorks 6000 Virtual Library System could not be easier. The basic premise is that you can create tape libraries with **any** permutations of library types, drives, and slots to **perfectly** match your environment. The only limits are 16 libraries, 64 tape drives, and 1,024 cartridges. HP also provides the ability to produce a "generic" virtual tape device for that backup software, which applies strict rules to the "type" of tape libraries it supports, for example, VERITAS Netbackup.

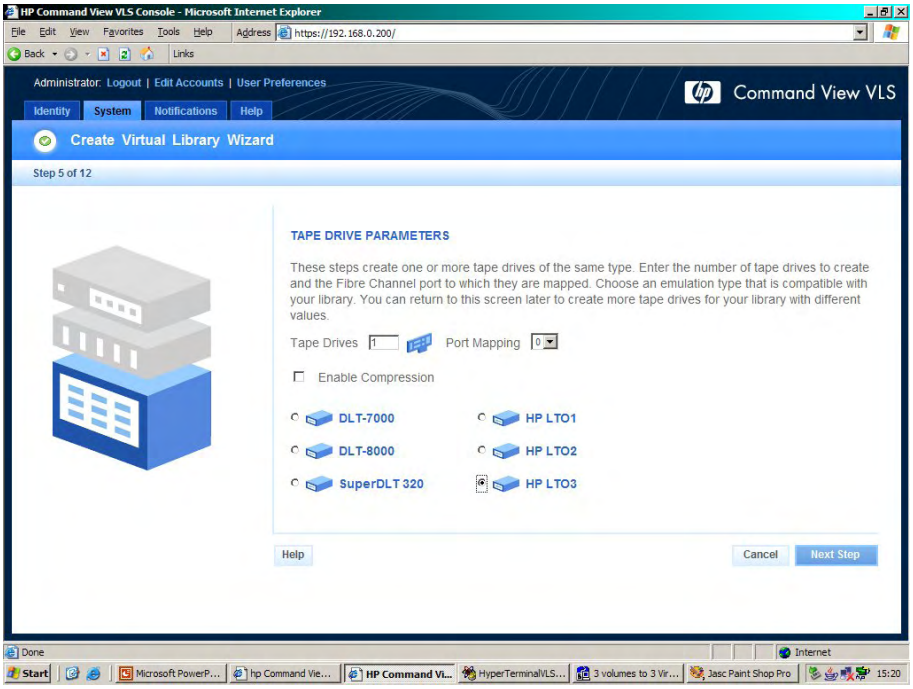
Step 1. Define library emulation.



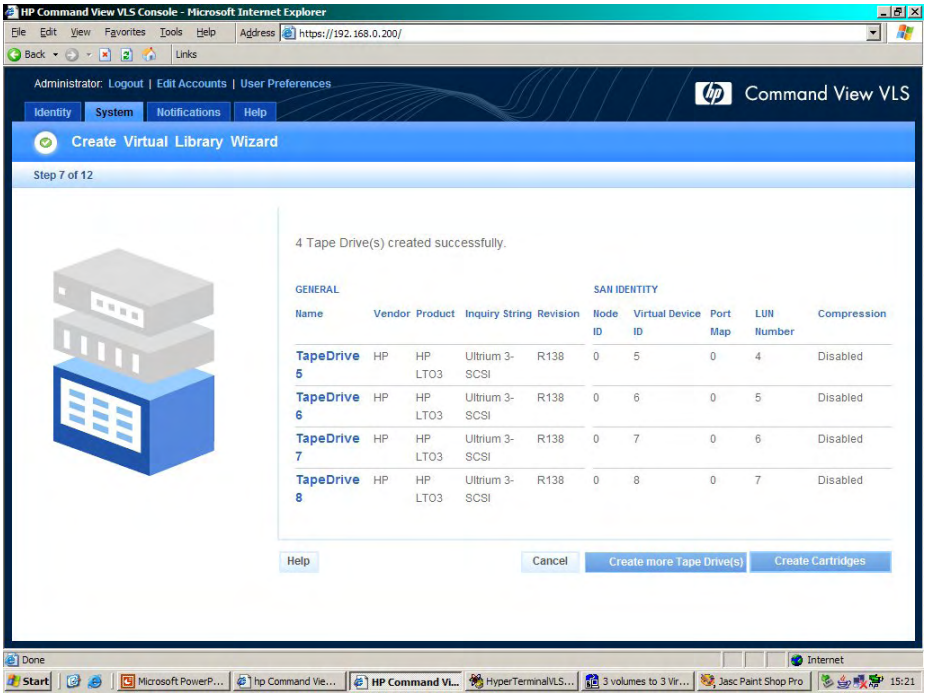
Step 2. Define slots, load ports, and number of virtual tape drives.



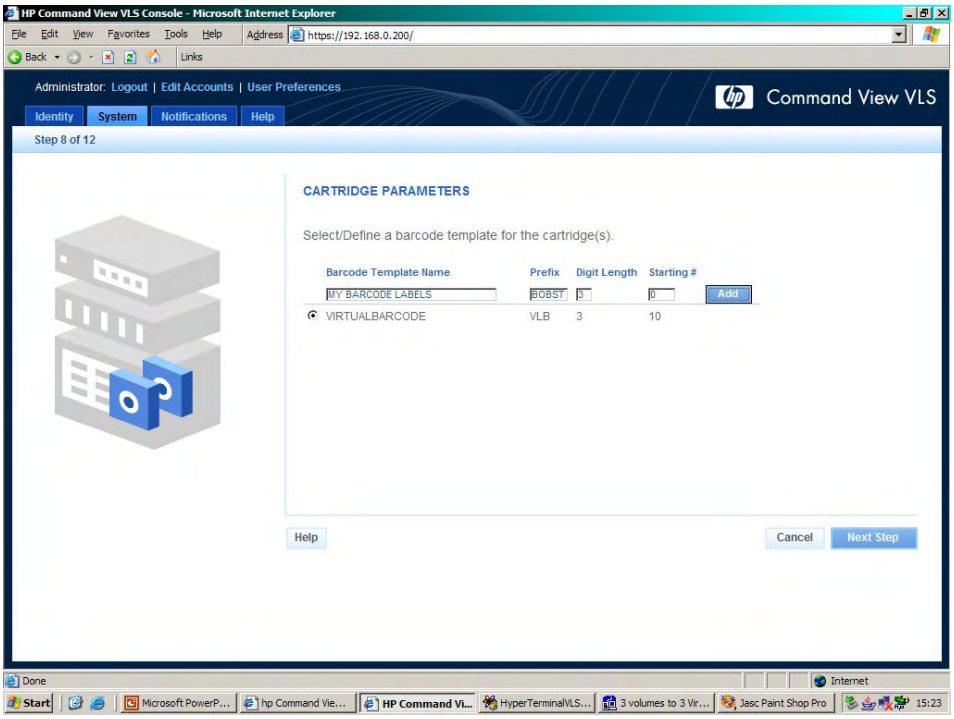
Step3. Define each tape drive type; balance tape drives across available Fibre Channel ports.



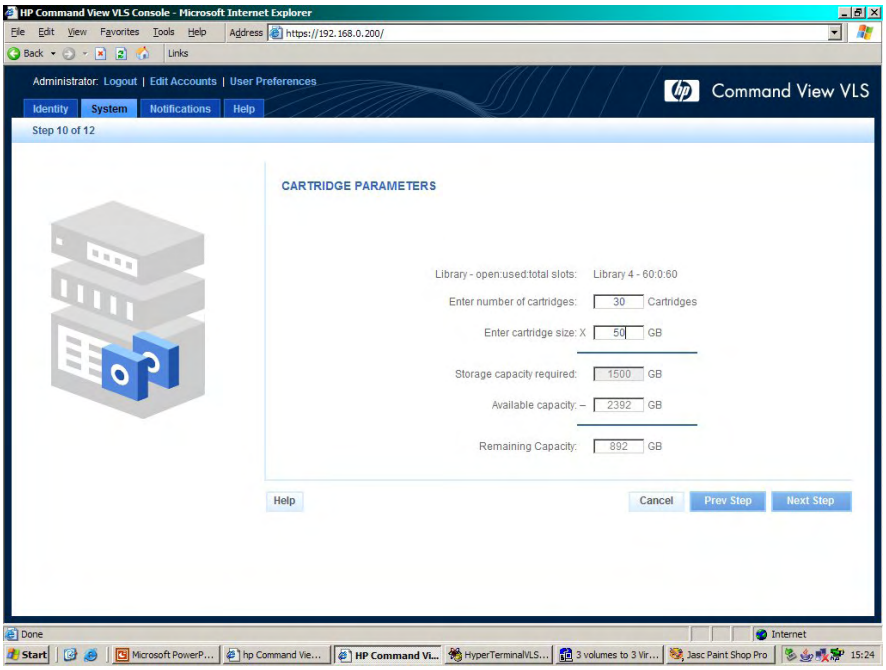
Step 4. Check configuration of defined tape drives.



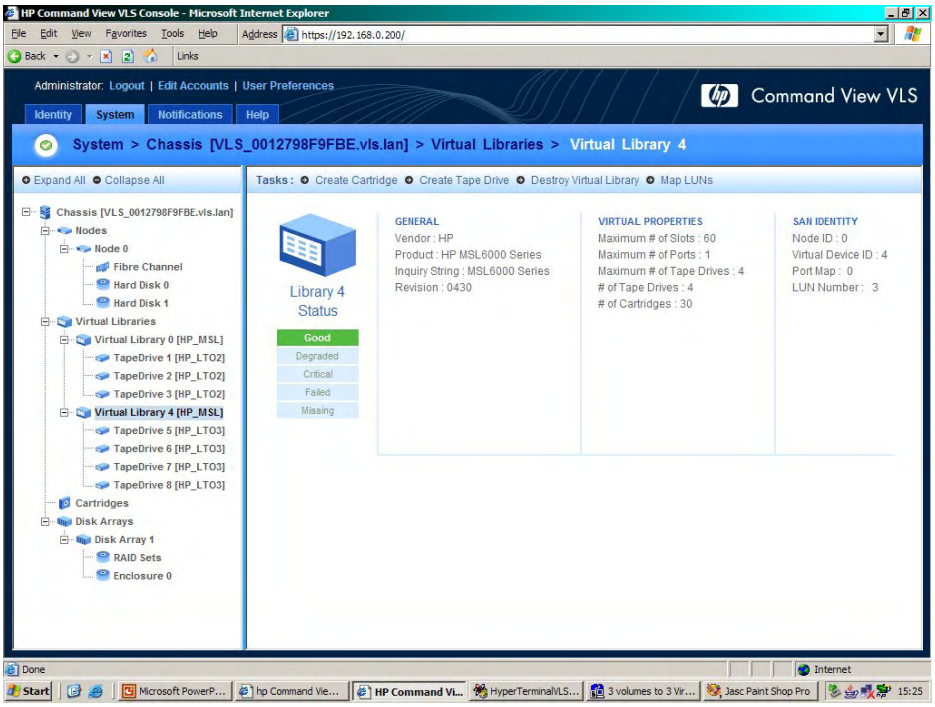
Step 5. Define virtual barcode format.



Step 6. Define number of cartridges and capacity of cartridges.



Step 7. Display/check virtual library configuration.



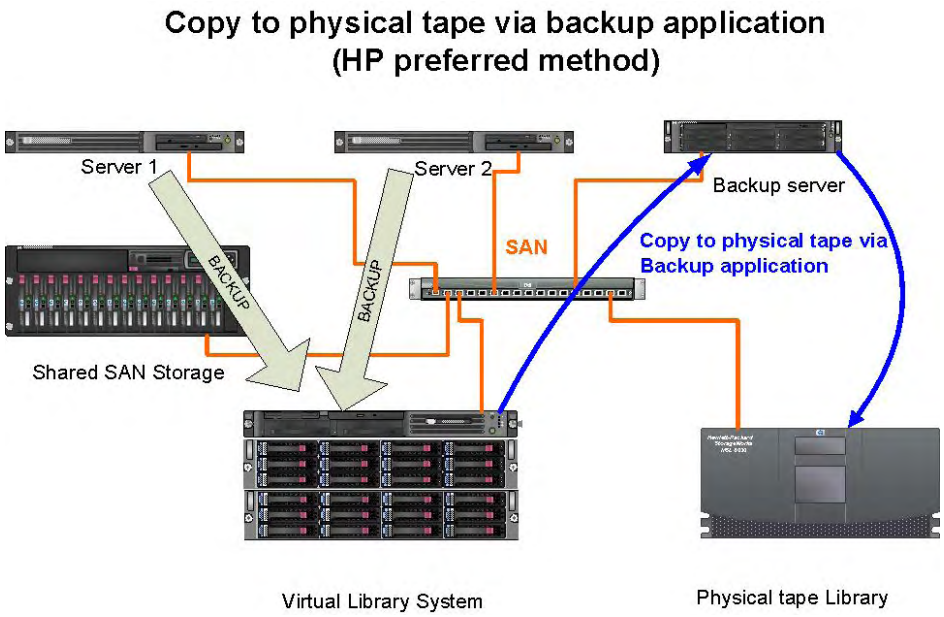
Appendix D: Comparing managed migration of data to physical media (using ISV backup application) with automigration of data to physical media (using features within Command View VTL)

The automigration feature is expected to be introduced in late 2005.

HP listens to customers. Several customers said that the HP StorageWorks 6000 Virtual Library System really solves a major problem within their backup environments. However, the additional licensing costs associated with adding a virtual library to their infrastructure can be expensive, especially if the backup application vendors license by the slot or by the number of tape drives. The leading backup application ISVs such as HP OpenView Storage Data Protector and VERITAS Netbackup have already re-designed their licensing policies for virtual tape to license on a per TB of capacity model, which is a more fair way of licensing virtual tape functionality.

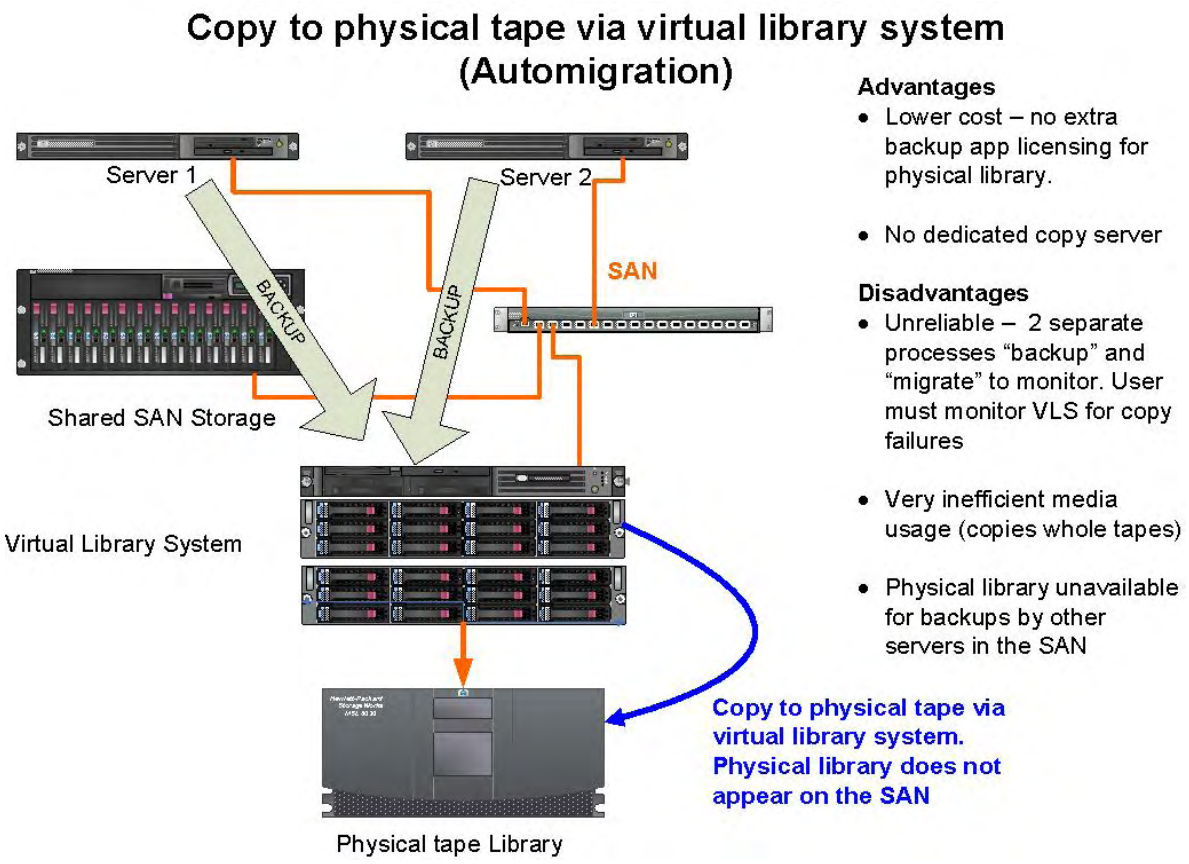
The following graphics illustrate the advantages and disadvantages of "automigration." Automigration is a feature whereby a physical tape library is dedicated exclusively to the virtual library system but is hidden from the SAN/backup application (hence incurring no licensing costs).

Figure 17.



HP strongly recommends the use of the backup application to migrate data from the HP VLS6000 system to physical tape because using the backup application means all the media (virtual and physical) is tracked in the backup application catalog. This ensures reliable, robust data recovery.

Figure 18.


Copy to physical tape via virtual library system (Automigration)
Server 1
Server 2
SAN
BACKUP
BACKUP
Shared SAN Storage
Virtual Library System
Physical tape Library
Advantages
• Lower cost – no extra backup app licensing for physical library.
• No dedicated copy server
Disadvantages
• Unreliable – 2 separate processes "backup" and "migrate" to monitor. User must monitor VLS for copy failures
• Very inefficient media usage (copies whole tapes)
• Physical library unavailable for backups by other servers in the SAN
Copy to physical tape via virtual library system. Physical library does not appear on the SAN

For more information

For more information on the HP StorageWorks 6000 Virtual Library Systems, visit:

- www.hp.com/go/tape
- www.hp.com/go/ebs

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