A COMPARISON OF TAPE POOLING TECHNOLOGIES

WHITE PAPER

STORAGETEK® VIRTUAL TRANSPORT MANAGER (VTM) SOFTWARE WITH THE STORAGETEK® STORAGENET® 6000 STORAGE DOMAIN MANAGER AND CONVENTIONAL SOFTWARE-BASED TAPE POOLING

StorageTek®

TABLE OF CONTENTS

1 INTRODUCTION

Several solutions are now available for pooling tape devices across application servers. These products help reduce the cost and complexity of consolidated tape backup and restore solutions. Most tape pooling solutions are software-based extensions of the major backup applications. This document compares the capabilities of StorageTek® Virtual Transport Manager (VTM) executing on the StorageTek® StorageNet® 6000 (SN 6000) storage domain manager to these software-based solutions. It is assumed that the reader has a basic understanding of VTM, the SN6000 and how the platform functions in a shared tape pool environment.

2 ARCHITECTURE

2.1 SOFTWARE POOLING—"EXCLUSIVE ACCESS"

In a software-based, server-centric, SAN (storage area network) tape pooling solution, the tape drives function as devices that must be shared among all SAN backup servers. But tape drives are single threaded devices, meaning the host writing to, or reading from the tape drive has "exclusive access" to the drive for the duration of the backup or restore. "SAN-aware" tape pooling software attempts to enforce sharing policies at an application level, but has no means of enforcing "exclusive access policies" at the operating system and physical device level.

As the complexity and number of SAN backup servers grow, the probability of errors that impact "exclusive access" increases.

2.2 VTM WITH SN6000—"EXCLUSIVE ACCESS"

VTM running on the SN6000 relies upon the "exclusive access" of tape devices to provide a network-centric, tape-pooling solution. Logical tape drives are "owned" by the backup server and not shared with other backup servers. Servers are isolated from the shared pool of tape drives with tape sharing policies controlled centrally by VTM.

2.3 SOFTWARE POOLING—SERVER ADMINISTRATION

In software-based, server-centric SAN tape pooling solutions, each server must be configured to communicate with every tape drive in the pool. Beyond knowing about all the tape drives, each server in the SAN tape-pooling solution must also see every tape drive in exactly the same order. This means that each host must serve as an administration point for the tape pool. When a new tape drive is added to the tape pool, the new drive must be configured on every server, allowing the tape drive to be defined to the operating system as a SCSI (small computer system interface) device. Minimally this may require a dynamic reconfiguration on the server (administrative effort) or more likely a reboot (downtime) due to server platform or persistent binding of the tape drives to the Fibre Channel HBA (host bus adapter).

As an example, consider a backup solution with 20 servers sharing access to a pool of 40 tape drives. This configuration requires a total of 800 tape device definitions to be configured and maintained to support the software-based, server-centric SAN tape pooling solution. The 800 definitions result from the 40 tape drives being defined on each of the 20 servers. The number of tape device definitions will go up exponentially as tape drives and servers are added.

Note **Seeing all tape drives in the exact order can be problematic with NT and Windows 2000 servers. Software drivers for the HBA's used on these servers may not support persistent binding which can lead to a situation where the servers will see all the tape drives but will occasionally discover them in an out-of-order sequence.**

2.4 VTM WITH SN6000—SERVER ADMINISTRATION

With network-centric tape pooling, such as that enabled by VTM, each server connected to the SN6000 is provided a view to its own set of logical tape drives. VTM presents logical tape drives (one to 16 logical drives per SN6000 port) to each server as though they were directly attached and exclusively owned by the server. VTM isolates the servers from the configuration and quantity of physical tape devices used in the shared tape pool(s). New physical tape drives can be easily added to the VTM by connecting them by Fibre Channel to the SN 6000, then adding them to the tape pool via the VTM GUI (graphical user interface).

This strategy eliminates server reconfigurations does away with the need to implement persistent binding, avoids storage-related downtime and separates systems administration (server) from storage administration. Centralized tape pool administration is conducted entirely by VTM running on the SN6000.

Example: Looking at the same 20 servers, 40 tape drives example where each host is connected to a SN6000 port and has access to 8 logical tape drives, this configuration only requires 160 tape device definitions. The tape device definitions are limited to the 8 logical devices per host and need not be coordinated across each of the 20 servers. Logical tape drives can be predefined at implementation time allowing customers to preplan for future performance and capacity needs.

2.5 SOFTWARE POOLING—PERSISTENT BINDING

A software-based, server-centric SAN tape pooling solution requires all backup servers (backup servers in this white paper are those servers that directly access tape drives from the shared tape pool) to see all shared tape drives in exactly the same order. Persistently binding the World Wide Name (WWN) of the Fibre Channel tape drives to each HBA can guarantee that the backup servers will see all tape drives in a consistent order. Persistent binding will guarantee that out of order or "renumbering" errors cannot occur. An example of a renumbering error is when backup server "A" attempts to access what it believes is tape drive #3 which is already in use by backup server "B" as tape drive #4.

Persistent binding is accomplished by defining the Fibre Channel WWN of the tape drives in the configuration file of the HBA's software driver. The drawback being that the configuration file is only read at boot time of the server and cannot be modified without updating the configuration file and rebooting. Additionally, not all HBA drivers support persistent binding.

Persistent binding can also be accomplished by binding the HBA to a port on a Fibre Channel switch that attaches the tape drives to the SAN. Port binding, as it is called, allows the server to see all the tape drives in order, and permits easy replacement of failing tape drives (the WWN of the replacement drive may or may not be able to be modified) without requiring an update to the HBA's configuration file and subsequent reboot of the server. The drawback to port binding is that it is supported only by a limited number of HBA manufacturers restricting its use as a single method of solving the renumbering problem.

2.6 VTM WITH SN6000—ELIMINATION OF PERSISTENT BINDING

The VTM with SN6000 solution does not require any type of HBA binding, nor does it have any issues regarding tape drive renumbering. Logical tape drives are "owned" by the backup server and not shared with other backup servers. In other words, backup servers are isolated from each other and each backup server has access to its own directly-attached Fibre Channel tape drives (in fact they are logical representations of Fibre Channel tape drives). Logical drives do not fail, they don't disappear, and they will not change order.

2.7 SOFTWARE POOLING—LESS SCALABLE

In a server-centric tape pooling solution, the need may arise to simplify management and administration of a single large tape pool, breaking the large tape pool into several smaller pools. With this division may come the need for additional tape drives to meet backup or recovery schedules, or a situation where idle resources cannot be accessed.

2.8 VTM WITH SN6000—FLEXIBILITY AND SCALABILITY

With VTM, one large tape pool can be created with centralized management and administration. VTM running on the SN6000 will facilitate growth, change, flexibility and fault determination. Tape resources are available to any backup server connected to the SN6000.

3 IMPLEMENTATION

3.1 SOFTWARE POOLING—LABOR INTENSIVE

Implementation of a large tape pool is a labor intensive and time-consuming process in software-based pooling. Not only does each tape device have to be configured within the host-operating environment, the tape devices also need to be configured within the backup software and "SAN-aware" tape pooling software. While a host may only require a single tape drive to accomplish its backup, all tape drives must be defined if the host is to take advantage of the entire tape pool.

3.2 VTM WITH SN6000—SIMPLICITY

With VTM, implementation is greatly simplified by defining a fewer number of logical tape drives per host (one to 16). Each host is treated as an individual backup server with its unique performance requirement, connected to directly-attached logical tape drives. VTM implementation brings the simplicity of directly-attached storage devices (the logical tape drives) with the flexibility, savings and performance enhancements of pooled tape storage.

Additional logical tape drives can be defined to the backup servers to allow future growth and scalability. This will enable customers to define current and future tape drive requirements for the lifecycle of their backup servers when implementing the VTM/SN6000 solution.

4 DRIVE AVAILABILITY

4.1 SOFTWARE POOLING—DRIVE FAILURE—PAINFUL REPAIR

In any storage infrastructure, failures can occur over time. In a software-based pooling solution, replacement of a failing tape transport may require some servers to be rebooted to recognize the replacement drive. Rebooting the server may be necessary if the backup server is not capable of dynamic device reconfiguration or discovery, or persistent binding has been implemented. Often, the lack of a "maintenance window" due to critical processing schedules mandate that rebooting be postponed. This results in inefficient use of tape pools and has a negative effect on overall backup efficiency.

4.2 VTM WITH SN6000—DRIVE FAILURE ISOLATION

In a VTM-enabled, tape-pooling strategy, a failing tape transport only impacts the tape pool by the reduction in drive count until the tape drive is replaced. Replacement is not contingent upon processing schedules or "maintenance windows." Hot replacements of the tape drive can be performed and VTM updated to immediately use the replaced drive. Server reboots are never required.

4.3 SOFTWARE POOLING—UNIQUE DEVICE DRIVERS

Software-based tape pooling requires device drivers for each type of tape drive in the pool. This is no problem if the customer uses common tape drives like the StorageTek® T9840 tape drive, but may become a problem if the customer decides to deploy other tape technologies in the future. Maintaining the latest versions of hardware drivers for frequently changing operating system, backup application and "SAN-aware" pooling software can be an administrative nightmare.

4.4 VTM WITH SN6000—SINGLE DEVICE DRIVER

A VTM/SN6000-enabled tape pooling solution insulates organizations from the administrative hassles associated with maintaining device drivers for multiple tape devices on every host system. Moreover, VTM's translation capability allows existing device drivers to write to dissimilar tape drives (for example, a DLT driver can be used to write to physical T9940s). This isolates the host from unsupported tape devices and tape technology upgrades with no trade-off in performance or capacity. It also simplifies the tape pooling implementation and allows technology upgrades without impacting the hosts.

5 SOFTWARE INDEPENDENCE

5.1 SOFTWARE POOLING—SINGLE BACKUP/RESTORE APPLICATION

In order to share tape drives in a software-based tape pool, all hosts must run the same backup and SAN-aware tape pooling software, typically at the same release level.

5.2 VTM WITH SN6000—TAPE POOLING FOR MULTIPLE BACKUP/RESTORE APPLICATIONS

In a VTM/SN6000-enabled, tape pooling solution, servers running different backup software (VERITAS–NetBackup, Legato–NetWorker, Tivoli Storage Manager, Omniback, etc.) can share a single tape pool. This is ideal for customers running multiple backup applications; migrating to a new backup software; or where an acquisition or consolidation forces support of multiple software environments.

6 CENTRALIZED CONTROL

6.1 SOFTWARE POOLING—MANY TOUCH POINTS

Every host in a server-centric, software-based tape pooling solution is a storage administration point requiring more personnel and time to manage the solution as it scales.

6.2 VTM WITH SN6000—CENTRALIZED CONTROL

The VTM/SN6000 solution simplifies tape pooling because it is the centralized storage administration point.

7 HARDWARE PROBLEM IMPACT

7.1 SOFTWARE POOLING—SAN-BASED ZONING

When deploying software-based tape pool, customers have two options when it comes to administrating their SAN fabric. They must choose whether or not to deploy zoning between the servers and tape drives. Not implementing zoning between the servers and tape drives will greatly reduce the amount of SAN administration that must be performed to add tape drives or servers, but may open the customer to hardware problems that can affect the operation of the entire SAN and can prove difficult to isolate.

By implementing switch-based zoning and segregating each host, hardware problems can be isolated and resolved in a timely fashion. Unfortunately, zoning comes with its own pitfalls; every host and tape addition (or subtraction) will require the zoning to be modified.

7.2 VTM WITH SN6000—ZONING OPTIONAL

In a VTM/SN6000-enabled tape pooling solution, hardware problems are isolated to a particular host because the host only sees a limited number of logical tape drives, not the whole tape pool. Switch-based zoning is not necessary, servers are isolated from each other and troubleshooting is greatly simplified.

8 UPGRADE CAPABILITIES

8.1 SOFTWARE POOLING—REVISION LEVELS

In a software-based, tape pooling solution, the backup software vendor usually requires customers to run their backup software and "SAN-aware" software at a single release level (and patch level) across all backup servers. This support requirement will demand very detailed planning to simultaneously roll out software upgrades to all backup servers.

8.2 VTM WITH SN6000—SIMPLIFIED UPGRADE PATHS

In a VTM/SN6000-enabled tape pooling solution, each host is treated individually, with its own directly-attached logical tape drives. This allows different releases (even totally different backup software) to operate simultaneously and to be upgraded when convenient. VTM greatly simplifies software upgrades and migrations, as well as isolating potential downtime associated with errors in new software releases.

8.3 SOFTWARE POOLING—ADDING A TAPE DRIVE

The following is an overview of the steps necessary to add a tape drive to an existing shared tape pool:

1. Install the new drive in the tape library.
2. Fibre Channel connect the new tape drive to the switch fabric.
3. Modify the zoning on the switch fabric for every server to allow all the servers to see the new tape drive.
4. Update HBA configuration file to persistently bind the tape drive WWN.
5. Reconfigure, and in some cases reboot, the server so that the OS can recognize the tape drive.
6. Define the new tape device to the library control software (this may be the backup software or ACSLS (automated cartridge system library software) server).
7. Define the new tape device to the backup software.
8. Define the new tape device for the SAN sharing software.
9. Repeat steps 5 and 6 for every server.
10. Test.

8.4 VTM WITH SN6000—ADDING A TAPE DRIVE

The following is an overview of the steps necessary to add a tape drive for use to VTM:

1. Install the new drive in the library.
2. Define the new drive to the ACSLS server for robotic access.
3. Fibre Channel attach the drive to the SN6000.
4. Define the new drive to VTM via the GUI.
5. Using the VTM GUI assign the new drive to the shared pool.
6. Test.
7. Done!

9 SUMMATION

9.1 SOFTWARE POOLING

> Requires meticulous attention to device and pool definitions.
> Requires changes to all servers for any software upgrade.
> Requires reconfigure/outage of all servers to add backup resources.
> Requires reconfigure/outage of all servers to repair/replace failed backup hardware.
> Requires outage of all servers to update/add drivers for new technology.
> Requires pool administration at every server accessing the pool.
> Requires drive address sequencing be managed and maintained.
> Requires a single backup product.
> Requires sub-pooling in large environments for effective management.

9.2 VTM WITH SN6000

> Allows each server to see its own tape drives yet still access the entire tape pool.
> Allows simplified software migration strategy.
> Allows drives to be added dynamically without server modifications.
> Allows repair/replacement of drives without server impact.
> Allows use of current existing drivers to support new drive technologies.
> Allows virtualization of tape devices so hardware changes do not affect servers.
> Allows single point pool administration at VTM/SN6000, not at each server.
> Allows heterogeneous backup products to participate in the single drive pool.
> Allows business requirements to dictate sub-pooling of large environments, not manageability.

Bottom line—with the VTM/SN6000 solution, tape resources are available to whoever needs them and are centrally administered—all in all, the VTM with the SN6000 saves your company time, money and resources.

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About StorageTek®

Storage Technology Corporation (NYSE: STK), a $2 billion worldwide company with headquarters in Louisville, CO, has been delivering a broad range of storage management solutions designed for IT professionals for over 30 years. StorageTek offers solutions that are easy to manage, integrate well with existing infrastructures, and allow universal access to data across servers, media types and storage networks. StorageTek's practical and safe storage solutions for tape automation, disk storage systems and storage integration, coupled with a global services network, provide IT professionals with confidence and know-how to manage their entire storage management ecosystem today and in the future.

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