

SANRAD Application Note:

Implementing SANRAD Disk-to-Disk Backup

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Important Notice

The configurations described or tested in this application note are not the only available solutions to data backup and restore. The application note is not intended nor may it be construed as an endorsement of any product(s) tested.

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Overview

Tape has always been the traditional medium for corporate data backup and restores. Tape libraries were cheaper than the expensive disks they were backing up and the backups could be run at night while 'everyone' was asleep. However, backup windows are shrinking into extinction and business continuity demands require that applications be available 24x7 and restores of critical applications be completed in minutes.

At the same time, disk prices declined driven by SATA technology, providing just the needed solution for backup and data continuity strategies using disk instead of tape. Disk-to-disk (D2D) backup provides several advantages over disk-to-tape:

- Fast Backup & Restore
- Scalability
- Manageability
- More Reliable Backup
- Cost-Savings

Disk-to-disk backup can be integrated with existing backup solutions to enhance and improve the overall process; it can be used to migrate an entire backup system or disk-to-disk can be used as the first step in a larger disk-to-disk-to-tape (D2D2T) backup strategy.

This paper examines the advantages disk-to-disk backup offers over disk-to-tape and what SANRAD's disk backup solution can offer over direct-attached disk.

SANRAD's Disk Backup StoragePro™ enables the pooling and partitioning of disk storage pools into virtual tape volumes, each with the functionality of a tape drive ready instantaneously for data transfer.

Why SANRAD Disk-to-Disk Backup

FAST BACKUP & RESTORE

A tape library is made up of tapes for storing data; tape drives for writing/reading the data on the tape and a robotic arm or other mechanical device for manually moving a tape to and from the tape drive. All of this is housed inside a media container. The number of tape drives represents the number of backups that can be performed at the same time. To create a backup tape, the robotic arm must select the correct tape and load it into the tape drive. When the backup finishes, the tape must be unloaded and returned to its slot so that the next tape can be loaded.

With SANRAD's virtual tape volumes, each volume acts as a tape drive and is ready instantaneously for data transfer. SANRAD's virtual tape solution operates as a virtual tape library with practically limitless tape and tape drive capacity. There is no need to search for and load a disk before it can be written/read. Everything can be backed up at the same time – not in limited groups according to the number of tape drives. This decreases both the specific application backup time as well as the overall company backup time – greatly shrinking the backup window.

This further pays off in the restore time. Because tape is a sequential access device, a tape must be loaded and searched for the correct data location before the backup server can begin to restore the data. Because disk is a random access device, almost no time is lost in data location. A disk volume is instantly 'locatable' and available. Again, each disk acts as a tape drive so all applications can, ostensibly, be restored at the same time, with the only limit being the capacity of the backup server. Because disk speeds are higher than tape speeds, a full application restore can be up to 10 times faster than tape.

SCALABILITY

A network's backup capabilities are a function of its speed – the number of applications that can be backed up at a time and its capacity – the total amount of data that can be backed up. Both of these capabilities need to be able to grow as the company's backup needs grow.

To increase backup speed, a company can increase its number of tape drives and/or it can migrate to a faster tape technology. When increased performance is needed, another tape library must be added or the existing tape library must be upgraded to increase the backup speed.

Each tape library also has a maximum tape capacity. To increase capacity, a company must upgrade to a larger library. This upgrade brings with it a large price tag and complex data migration operations.

With SANRAD's virtual tape library, this is not the case. The 'brain' of the SANRAD virtual tape library remains constant with only incremental additions to the backup media. The backup capacity can be increased in real time with the creation of a new virtual volume or, when all attached storage space has been virtualised, with the addition of low-cost disk subsystems. Unlike tape libraries, SANRAD has practically unlimited virtual tape capacity, which translates as unlimited tape drive capacity, as well as overall unlimited total capacity that is scaleable in small affordable increments and is non-disruptive to the production environment.

MANAGEABILITY

Because tape libraries are not readily scalable, a company often begins trying to overcome a small library capacity by increasing the number of tapes without upgrading the tape library. Then begins the manual management exercise of remembering where the tape was stored, when it needs to be put in the tape library to be available for backup and when it needs to be removed to make room for another tape due to receive a backup. While this may save on the immediate cost of a new library, it adds greatly to the backup management overhead.

With tape libraries, even routine activities such as transporting backups, cloning and copying require logistics planning and physical activity in shuffling tapes from place to place – adding even more managerial overhead to an already time-consuming task.

In contrast, SANRAD's virtual tape library is so easily scalable, no management time is lost in migrating to new libraries or ongoing maintenance of unorthodox increased backup capacity and virtual tape volumes can be resized in real time to meet backup needs. In addition, SANRAD's virtual tape volumes can be easily duplicated using SANRAD's replication techniques. SANRAD's virtual tape volumes can be defined as mirrored volumes, allowing for the automatic creation of multiple copies at backup time without increased management overhead above the base backup. Because backups are to disks, SANRAD's virtual tape volumes can be easily replicated locally or remotely through simple volume copy operations, without the need for the backup server.

RELIABILITY

Tape backups are, by definition, single-copy backups on an easily destroyable medium that must be checked to ensure that the backup data was indeed written successfully. Tape can tear; they can be loaded incorrectly into the tape drive and the robotic mechanism for moving tapes to and from tape drives – like all mechanical devices – can break down.

SANRAD virtual tape volumes can be created on mirrored or RAID 5 volumes to provide data redundancy and increased reliability. SANRAD virtual tape volumes are created on disks and disks as a medium are more reliable than tape and disks do not need to be checked to ensure that backup data has been copied.

COST-SAVINGS

When a company weighs its purchase of a tape library, it must consider not just the company's current backup requirements in speed and capacity; it must project its future backup needs as well. Tape storage cannot be scaled gradually and incrementally. It is scaled by the number of tape drives and tape drives cannot be added to a tape library as the need arises. If greater speed or capacity is needed, a company must upgrade to a bigger and/or faster library. This can result in a hardware cost out of all proportion when there is a need for only a slight increase in capacity and/or speed.

Consider a small increase in backup capacity from 1 TB to 2 TB. For a company maintaining two months' worth of weekly backups and four weeks' worth of daily incremental backups, a terabyte of space goes quickly. The increase to 2 TB requires another tape drive to maintain the same backup performance. With a Dell tape library, this means upgrading from a \$20,000 2-tape drive library to a \$45,000 6-tape drive library – a price jump of more than 100%. See Table 1.

With SANRAD's virtual tape library, this is not the case. Virtual tape volumes can be created almost instantaneously on the disk subsystem as the need arises, allowing for precise, real-time scaling of the backup library. Unlike tape libraries, SANRAD has practically unlimited virtual tape capacity, which translates as unlimited tape drive capacity, as well as overall unlimited total capacity.

Consider the same increase in network backup capacity from 1 TB to 2 TB with SANRAD's virtual tape library. The increase to 2 TB involves only the addition of disk space for approximately \$3,000 to the \$12,000 SANRAD virtual tape library. The SANRAD virtual tape backup solution for 2 TB comes in at \$17,000 – a price difference of *more than 250%* compared to Dell's price of \$45,000 for the same 2 TB capacity. See Table 1.

Table 1: Cost Comparison: SANRAD D2D Solution versus DELL Tape Library

System Requirements				System Price		
Capacity (TB)	Number of servers to backup	Tape Lib – number of drives	SANRAD V-Switch model	SANRAD D2D system	Dell Tape Lib 2-drives	Dell Tape Lib 6-drives
1	2 - 4	2	2000	\$15,000	\$20,576	\$40,071
2	4 - 8	3	2000	\$17,000	-	\$45,259
5	8 - 20	4	2000	\$21,000	-	\$55,200
10	20 - 40	6	3000	\$31,000	-	\$70,129

SANRAD Disk-to-Disk Backup

Creating SANRAD disk backups in an IP-SAN environment is faster and simpler than creating traditional backups with direct-attached tape libraries. The SANRAD V-Switch presents its attached, partitioned and virtualised disk volumes to the backup server as virtual tape libraries. The backup server holds the backup volumes as local physical drives or tapes. The physical distances between the disk subsystems and V-Switch are irrelevant because they are connected to the backup server via an IP-SAN.

Backup involves two data transfers: first from the application server to the backup server and then from the backup server to the iSCSI virtual tape drive exposed by the V-Switch. All of this is over a dedicated Gigabit Ethernet connection. Since the backup process uses disks and not tapes, the operation throughput is limited only by the network's 1 Gb Ethernet capacity and the physical disks' performances.

IP-SANs also enable a more efficient backup method: serverless (LAN-free) backup. In a LAN-free backup, the backup server plays only a managerial role in the backup process by exposing the virtual drive to receive the backup data directly to the application server. The application server OS responds to this virtual drive as if it were a local drive. The backup data is copied directly to the virtual drive without first having to be transferred to the backup server. The elimination of this transfer step further increases the backup performance over that of a tape library.

SANRAD Disk-to-Disk Restore

Restoring SANRAD disk backups in an IP-SAN environment gives the performance speed of a regular disk copy rather than of a traditional tape restore. Should data need to be restored to a server application in an IP-SAN, the backup server first needs to expose the failed application server to the virtual tape drive. The backup server can do this in one of two ways: either expose the application server via the backup server for a traditional online backup or directly to the virtual drive for a LAN-free backup. Once the application server is exposed to the backed up volume, the data restore is a simple disk copy operation at network speed.

Figure 1 details both backup and restore operations using SANRAD's disk-to-disk solution.

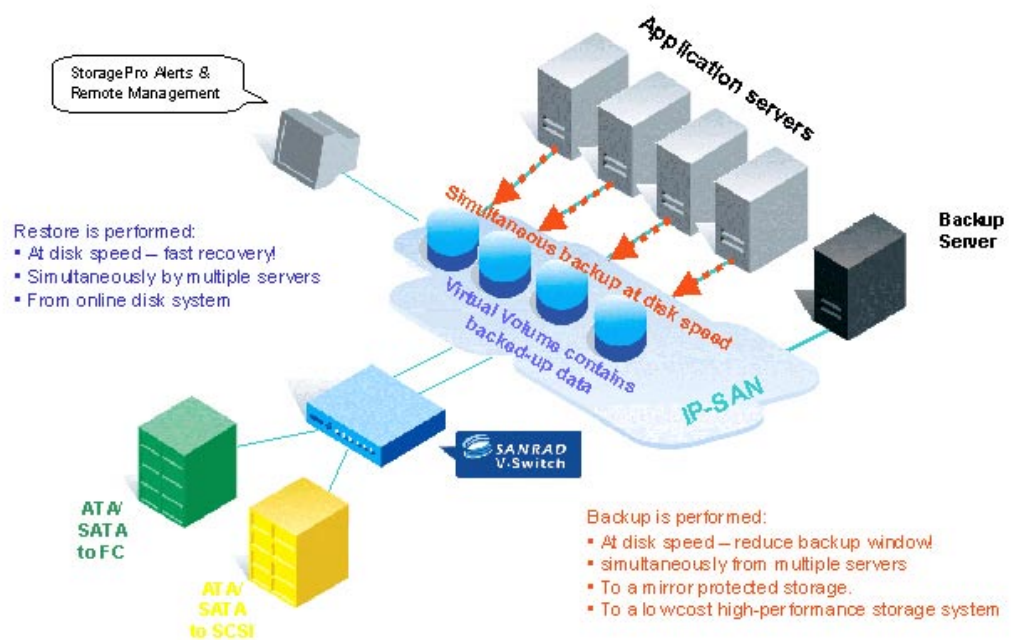


Figure 1. SANRAD Disk-to-Disk Backup and Restore

SANRAD Performance Test

To demonstrate the differences in backup and restore performance, SANRAD set up a test environment and performed four tests:

- Disk-to-Tape backup
- Disk-to-Disk backup
- Tape-to-Disk restore
- Disk-to-Disk restore

Test Environment

For simplicity, a basic LAN was constructed. The test environment was the same for all four experiments: Two IBM® ThinkCenter application servers were linked to an IBM® eServer running as a backup server. Application Server 1 contained 5 GB of data in file format to back up. Application Server 2 contained 21 GB of data in file format to back up. The backup program used was Veritas' Backup Exec™ for Windows Server, version 9.

Table 2: Servers

Application Server 1	Application Server 2	Backup Server
IBM® ThinkCenter	IBM® ThinkCenter	IBM® eServer xSeries 225
Single CPU 2.66 Mhz	Single CPU 2.66 Mhz	Dual CPU 2.8 Mhz
1 GB RAM	1 GB RAM	1 GB RAM
5 GB to backup	21 GB to backup	Microsoft® Windows 2000 server, service pack 4

Table 3: Backup Media

Tape Backup Medium	Disk Backup Medium
Compaq 40/80 DLT 8000	FC JMR 4-bay JBOD 2x36 GB in mirror

Test 1: Disk-to-Tape Backup

In the first test, a Compaq 40/80 DLT 8000 tape drive was connected directly to the backup server to simulate a traditional IT environment where server data is backed up directly to tape. The backup server is responsible for queuing and processing multiple, or in the test case – two, server backups. Figure 2, page 10 shows data from AppServ1 and AppServ2 being backed up to the tape drive through the backup server.

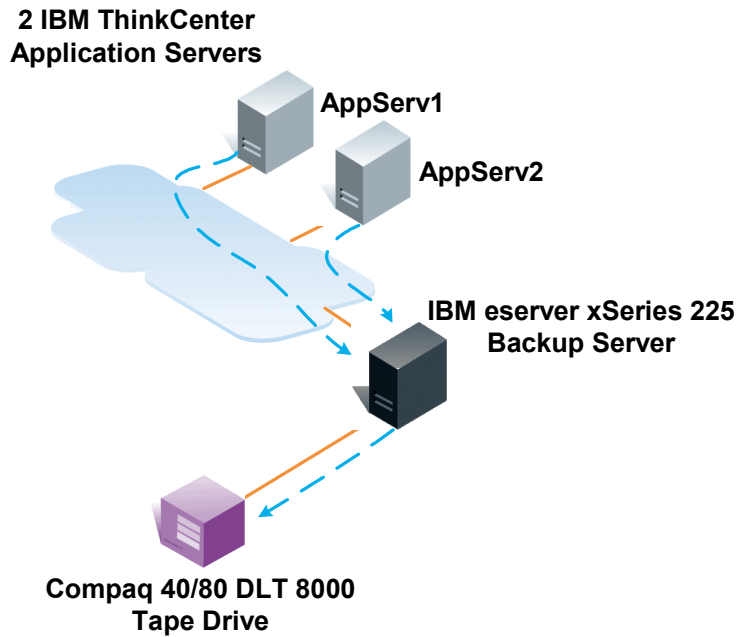


Figure 2. Disk-to-Tape Backup

Test 2: Disk-to-Disk Backup

In the second test, an FC JMR 4-bay JBOD was connected to the V-Switch. A 30 GB mirrored virtual tape volume was created across two 36 GB disks. The V-Switch exposed the virtual volume as a virtual drive to the backup server.

Figure 3 shows data from AppServ1 and AppServ2 being backed up to the mirror backup volume exposed by the V-Switch to the backup server.

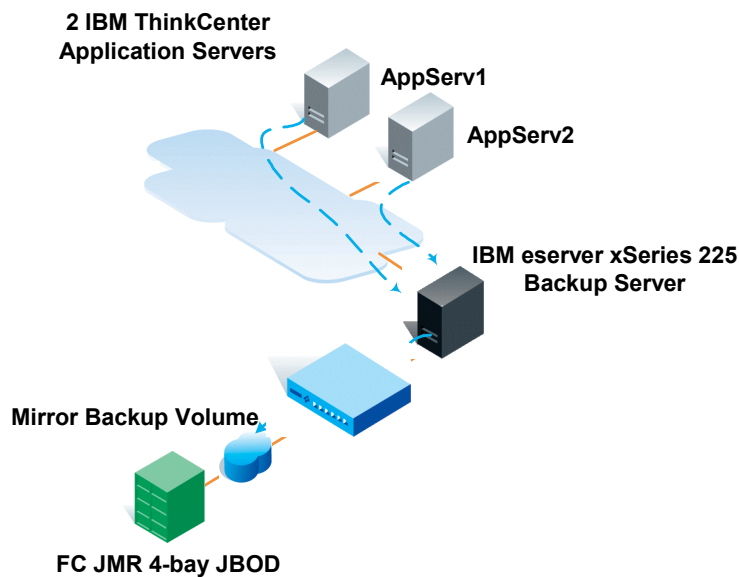


Figure 3. Disk-to-Disk Backup

Test 3: Tape-to-Disk Restore

When it came time to restore the backup data to the application server, restore was done on only one application server. The test was designed to test regular data backups and not a full-scale disaster recovery Figure 4 shows the backup data from the tape drive being restored to AppServ1 through the backup server.

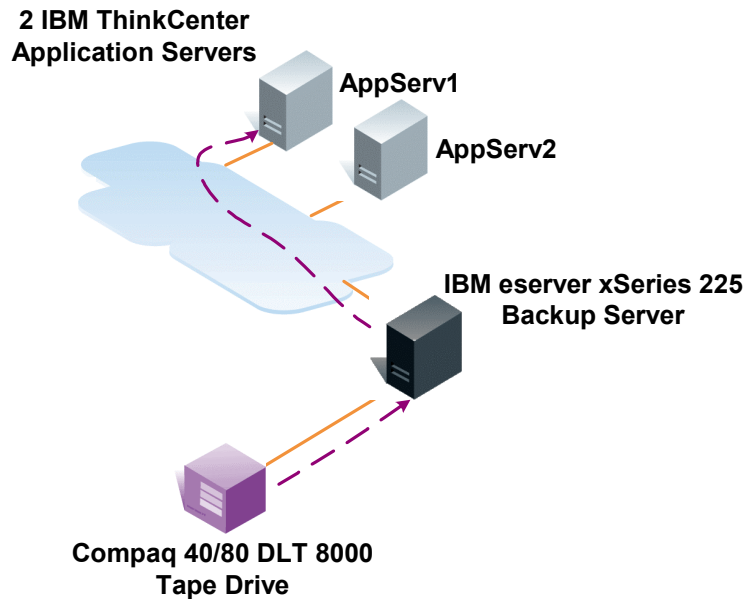


Figure 4. Tape-to-Disk Restore

Test 4: Disk-to-Disk Restore

Once the virtual tape volume and application server were connected, the backup was a simple disk copy operation. Figure 5, page 12 shows the backup data from the V-Switch virtual tape volume being restored to AppServ1 through the backup server.

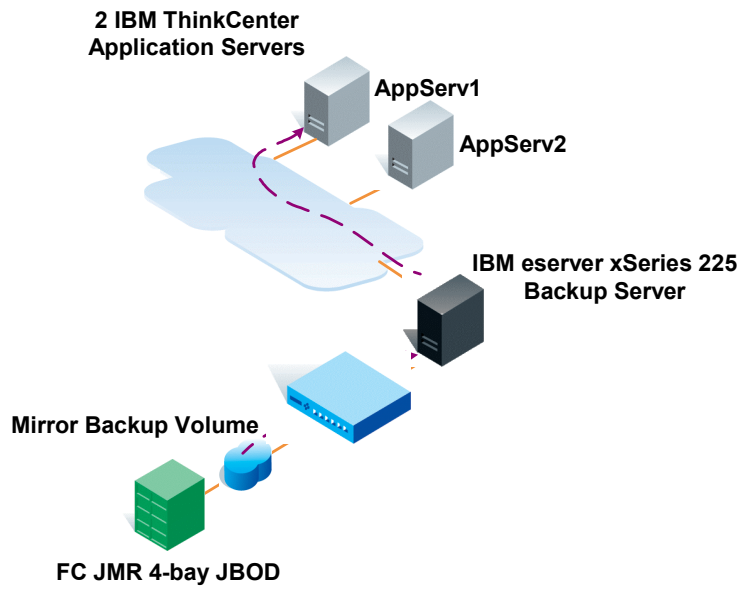
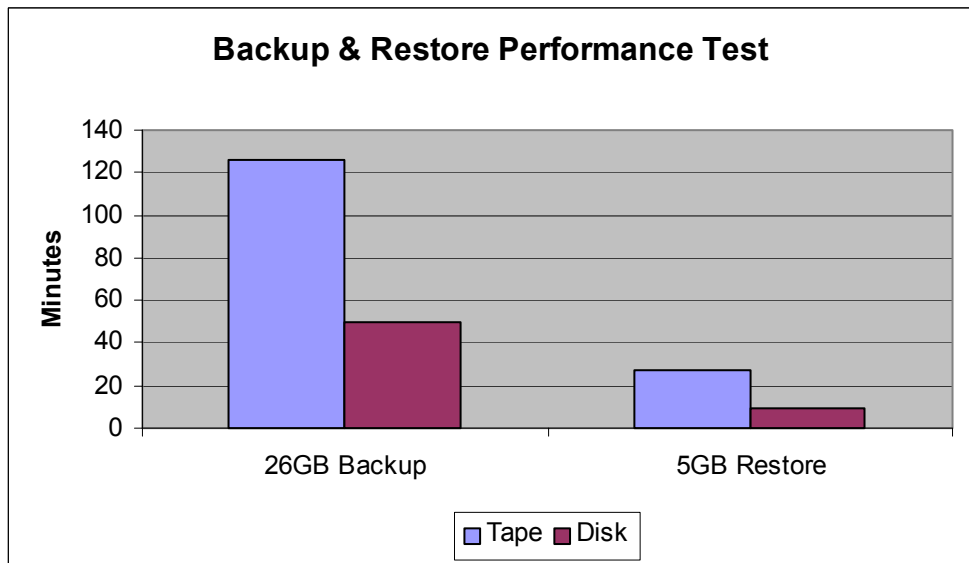


Figure 5. Disk-to-Disk Restore

Test Results

The direct-attached tape drive was able to back up the 26 GB of file data in 126 minutes. SANRAD's virtual tape drive was able to back up the 26 GB of file data on to a mirrored volume in 49 minutes, less than half the time of the disk-to-tape backup.

The tape-to-disk volume restore took 27 minutes to restore 5 GB of data. The SANRAD disk-to-disk restore took just 9 minutes, one third the amount of time of tape-to-disk backup.



Summary

SANRAD Disk Backup StoragePro™ consolidates backup data from multiple application servers onto a pool of low-cost disk storage systems to create a virtual tape library compatible with all popular backup software packages. SANRAD's virtual tape library has practically unlimited virtual tape capacity, which translates as unlimited tape drive capacity, as well as overall unlimited total capacity. SANRAD Disk Backup StoragePro streamlines backup and recovery by using disk-based storage; supports simultaneous backups of multiple servers; ensures backup data availability with mirrored copies and RAID 5 support and greatly shortens recovery time. With SANRAD Disk Backup StoragePro you can expand backup capacity quickly and easily in small increments using low cost ATA/SATA drives to minimize hardware costs and backup management time.