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Lab Validation Report

Dot Hill AssuredSAN 3000

Intelligent, Efficient, Midrange Storage Appliances

By Tony Palmer

September 2010

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ESG Lab Reports

The goal of ESG Lab reports is to educate IT professionals about emerging technologies and products in the storage, data management and information security industries. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments. This ESG Lab report was sponsored by Dot Hill.

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Introduction

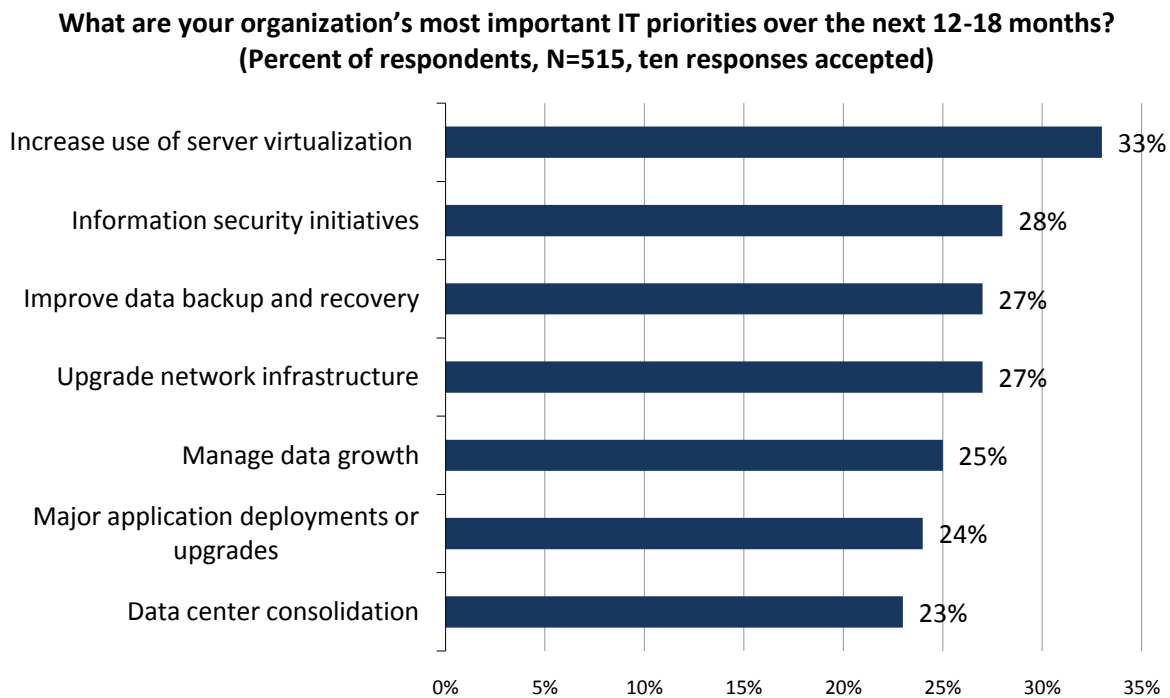
[Dot Hill](#) AssuredSAN 3000 storage systems leverage modular design and robust software capabilities to deliver an impressive blend of storage performance, availability, and functionality that satisfies the business requirements of a broad range of small to medium-sized organizations. This report presents the results of hands-on testing of AssuredSAN 3000 systems with a focus on performance, scalability, ease of management, and eco-friendly efficiency.

Background

ESG recently asked IT professionals to name the business initiatives which would have the greatest impact on IT spending decisions over the next 12-18 months. The number one response was cost reduction, with simplification of business processes a close second.¹ Given the economic uncertainties of recent years, it's no surprise that IT managers are looking to reduce cost and complexity.

Where are IT managers focusing their efforts toward this goal of reducing cost and complexity? As shown in Figure 1, server virtualization is at the top of the list. As a growing number of organizations use server virtualization to reduce the cost and complexity of a consolidated IT infrastructure, improving backup and recovery and finding ways to cost-effectively manage data growth have become top priorities as well.

Figure 1. Top Priorities for IT Managers



Source: Enterprise Strategy Group, 2010.

Nearly half of IT managers within midmarket companies reported having more than 10 TB of data under management, while more than half of the respondents claimed to be experiencing data growth at a rate of 20% or more per year.² For those organizations, data volume is doubling every two to five years. With these challenges in mind, a growing number of IT managers are looking for solutions that can drastically reduce the cost and complexity of storing and managing data. The balance of this report examines the Dot Hill AssuredSAN solution, which uses innovative technologies to address several of the top issues noted in Figure 1 (increasing server virtualization, managing data growth, and data center consolidation).

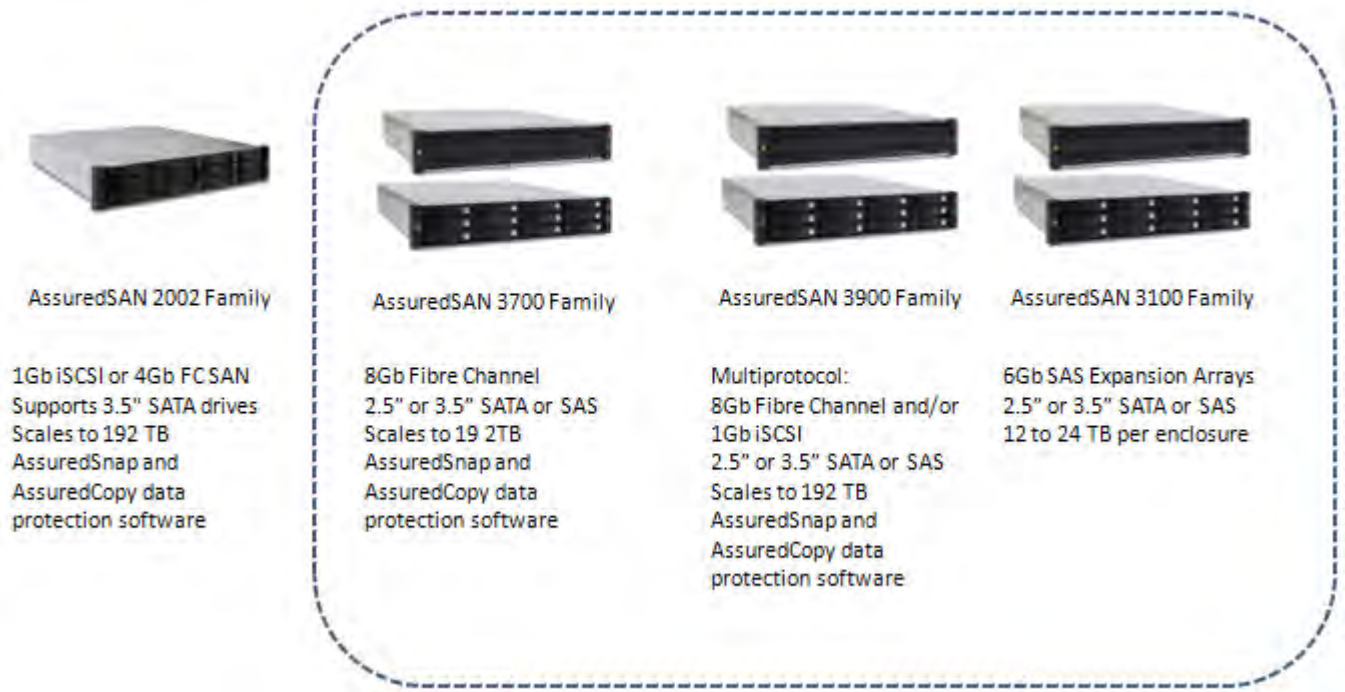
¹ Source: ESG Research Report, [2010 IT Spending Intentions Survey](#), January 2010.

² Source: ESG Research Report, [2010 Data Protection Trends](#), April 2010.

Dot Hill AssuredSAN 3000

Dot Hill AssuredSAN products combine modular, scalable architecture with integrated data availability and power efficiency features to address the most critical challenges IT managers need to address. A Dot Hill AssuredSAN storage system can start as small as 3.6 TB and scale up to 192 TB in a single array, as shown in Figure 2. Performance of the AssuredSAN 3000 has increased dramatically and the AssuredSAN 3000 family provides the flexibility to support a mix of Fibre Channel and iSCSI host connections in the same array.

Figure 2. The Dot Hill AssuredSAN Family



The Dot Hill AssuredSAN 3000 offers an impressive list of capabilities, including:

- **A hybrid SAN appliance:** Dot Hill AssuredSAN 3000 provides both 8 Gb Fibre Channel and Gigabit Ethernet iSCSI connectivity, the first array to do so at an entry level price point, with 10Gb iSCSI on the horizon.
- **Flexible scalability:** SSD, SAS, and SATA support provide performance and capacity flexibility and scalability.
- **Highly available performance:** SimulCache uses ASICs and PCI-Express to pass writes between controllers with no controller overhead, eliminating the mirrored cache “write penalty” and enhancing real-world performance.
- **Cost efficient data protection:** Licenses for snapshots and full volume copy software are included with every AssuredSAN 3000 array at no additional charge.
- **Environmental responsibility:** Dot Hill EcoStor combines drive spin-down (to lower energy consumption) with battery free cache backup using super capacitors and non-volatile flash memory (a unique, patented feature of the AssuredSAN architecture) to reduce the environmental impact of its arrays.
- **Data in place upgrades:** AssuredSAN users can replace 2000/2002 series controllers with 3000 series controllers in place without rewriting any data on the drives.

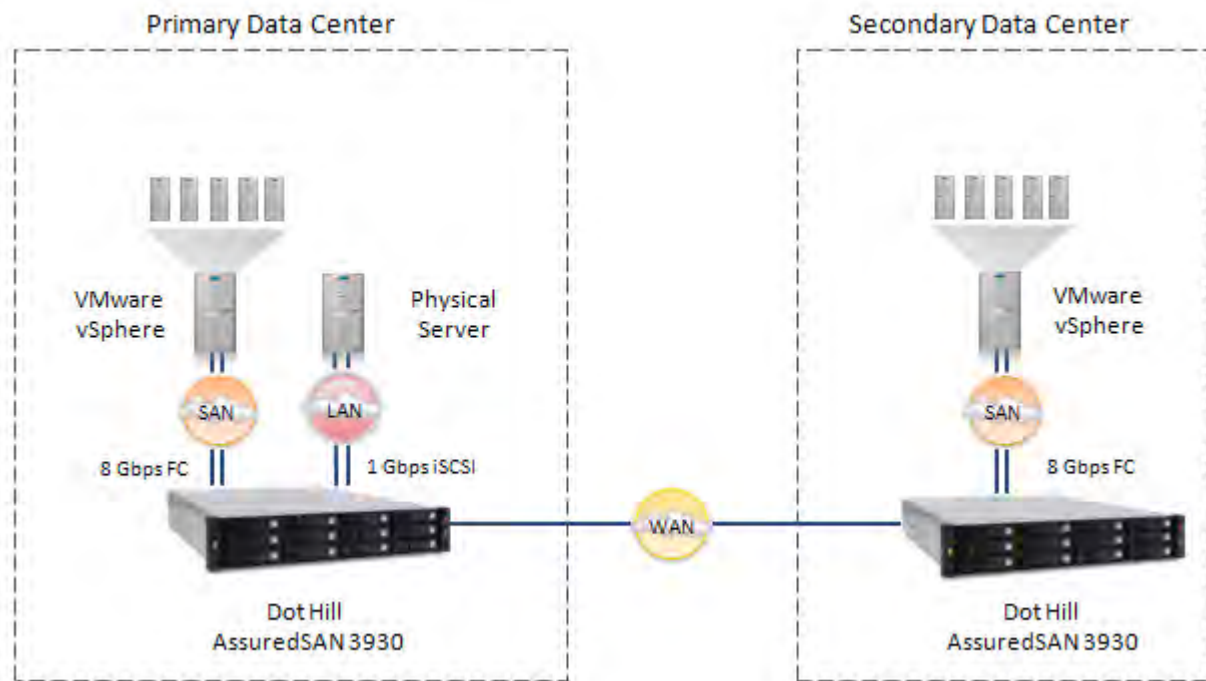
This report documents ESG Lab testing of the Dot Hill AssuredSAN 3000 product family, with a focus on its ability to increase performance, availability, and investment protection while reducing cost, complexity, and energy requirements.

ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of the AssuredSAN 3000 series at a Dot Hill facility in Longmont, Colorado. Testing was designed to validate ease of management, performance scalability, data assurance, and eco-friendliness.

The test bed, shown in Figure 3, was designed to simulate two data center environments. An AssuredSAN 3930 was attached to a VMware vSphere server using 8 Gb Fibre Channel and a physical Windows 2008 server using iSCSI.³ The secondary data center was configured with an AssuredSAN 3930.

Figure 3. AssuredSAN 3000 Test Bed



Hybrid Modularity and Ease of Use

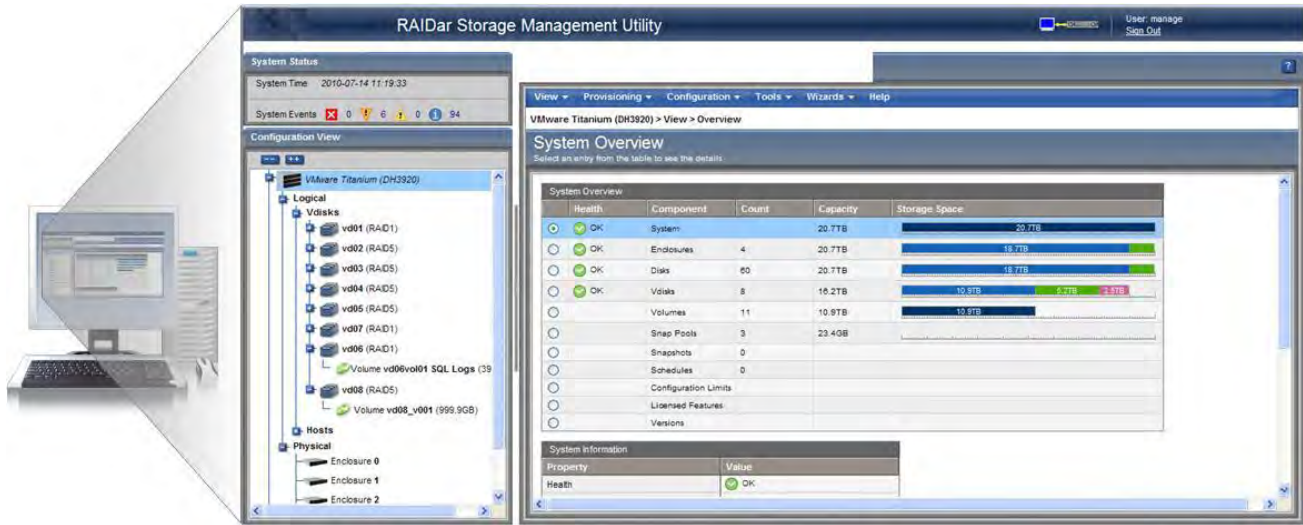
The AssuredSAN 3000 series provides a modular storage solution designed to provide small businesses with an easy way to migrate from physical servers with direct attached storage to a consolidated IT infrastructure. With this modularity comes a simple management interface that provides a straightforward tool to configure access to the storage array. Dot Hill has established a highly modular architecture for its line of storage systems: RAID controllers, host interfaces, chassis, power supplies, and, of course, drive options are all modular components. Most of these components are interchangeable across the product line and backward compatible with earlier generation products.

ESG Lab Testing

ESG Lab first examined the RAIDar storage management utility for Dot Hill's AssuredSAN 3000 Array to evaluate ease of use in provisioning and managing storage in a virtual environment. The system overview, shown in Figure 4, provides an overall picture of the system, showing the health of each component in the storage array as well as information-rich detail for each component. The left hand pane provides easy navigation to the physical and virtual disks as well as volumes. ESG Lab was able to access functions directly from this pane by right clicking on the components.

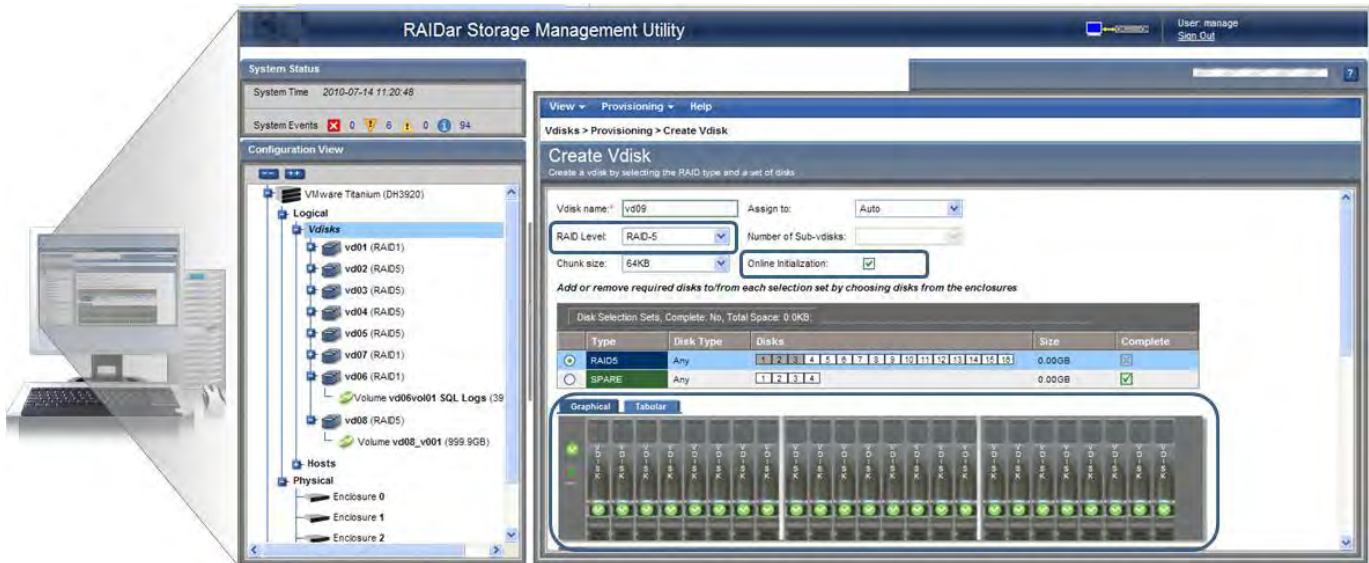
³ Configuration details can be found in the Appendix.

Figure 4. RAIDar System Overview



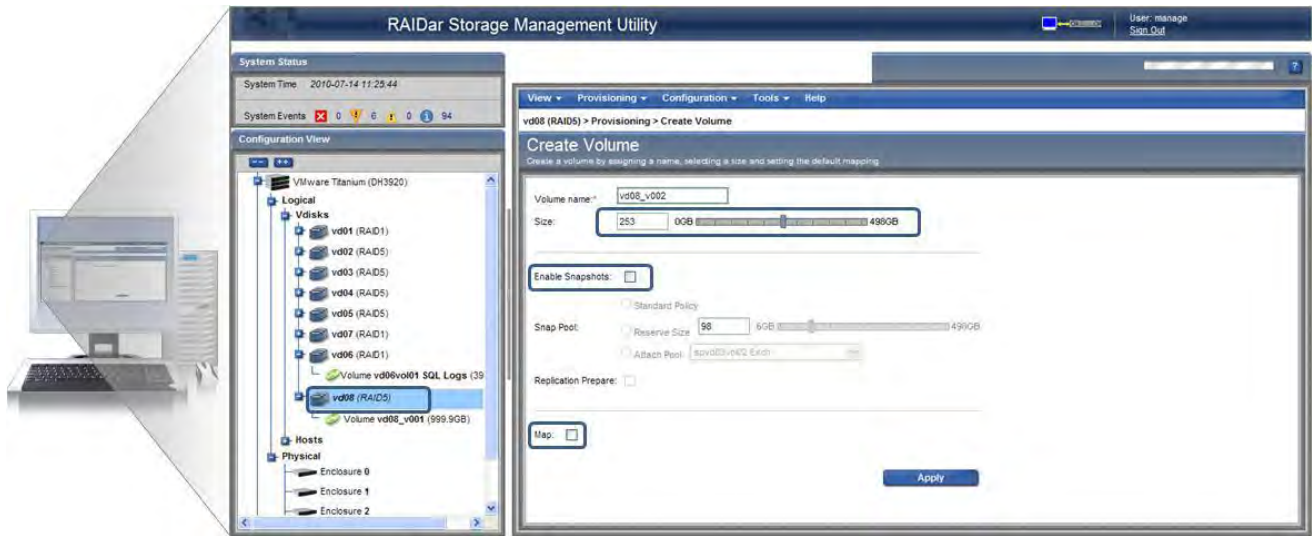
When provisioning storage, the first step, shown in Figure 5, is to create a virtual disk (vdisk) from the physical disks in the storage array. ESG Lab right clicked on the vdisks tree view in the left pane and chose the “create a vdisk” option. The physical disks were assigned simply by clicking on the pictures of the disks shown in the configuration screen and the RAID level was selected from a pull down list. Online initialization, enabled by default, brings the vdisk online upon creation and continues the low level format in the background.

Figure 5. Create a vdisk



Next, ESG Lab created a volume by right clicking on the newly created vdisk, shown in Figure 6.

Figure 6. Create a Volume



From the configuration screen, ESG Lab specified the size of the volume, enabled snapshots, and mapped the volume to all ports on both controllers for the vSphere server. Figure 7 shows the volume mapped to the HP DL380 server on ports 1 and 2 of controllers A and B.

Figure 7. Map a Volume

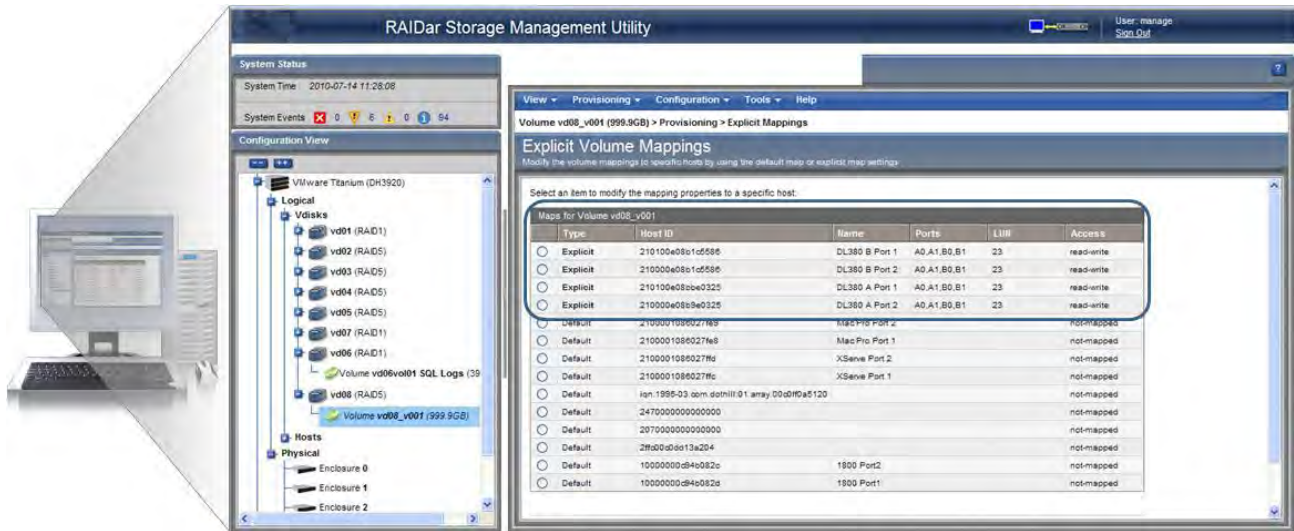
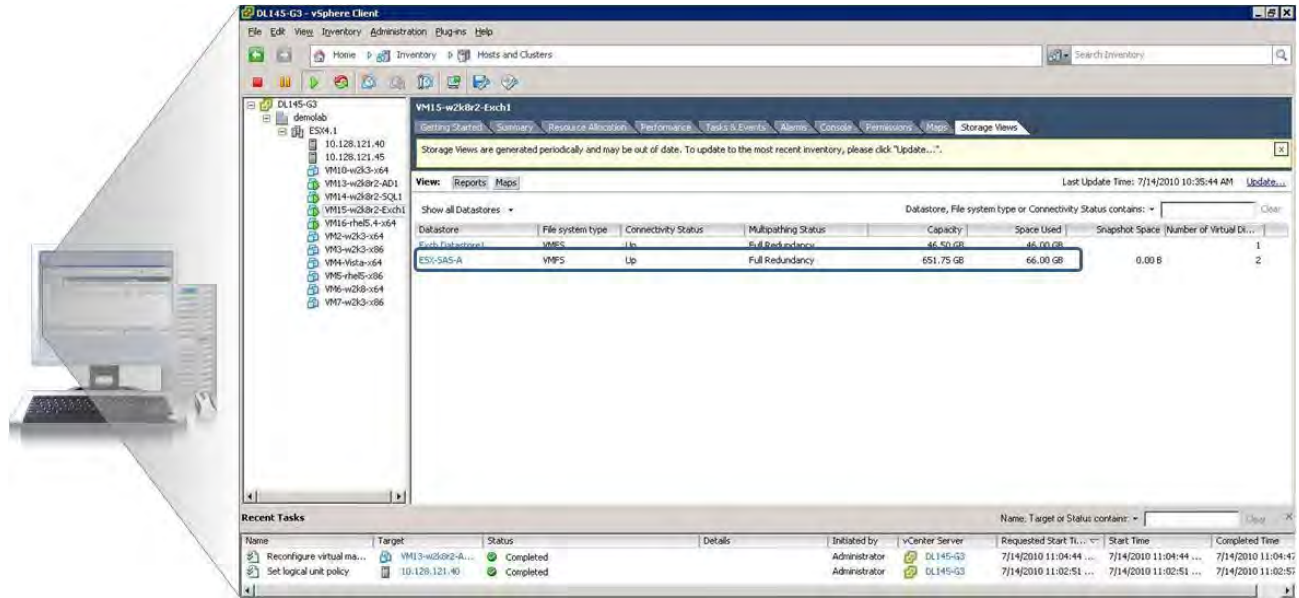


Figure 8 shows the VMware vSphere client after mapping the virtual volume and copying vmdk files into it.

Figure 8. The VMware Storage View



The entire provisioning process—from the first click on raw drives, to availability, to VMware for use by virtual machines—took less than five minutes.

Why This Matters

Modular storage deployments are growing in capacity and complexity within organizations of all sizes. IT managers are increasingly finding themselves expected to manage more storage capacity with higher expectations and the same, or fewer resources. Simple, scalable storage is an absolute requirement.

ESG Lab has confirmed that the Dot Hill AssuredSAN 3000 is extremely easy to configure and just as easy to manage. The RAIDar storage management utility is intuitively simple and straightforward, yet powerful, with configuration wizards to minimize the time administrators spend managing storage. In less than five minutes, raw storage was provisioned, mapped to servers, and ready to accept data. Online initialization of virtual disks ensures that volumes are available to servers as soon as they are provisioned, with no waiting.

Real World Performance

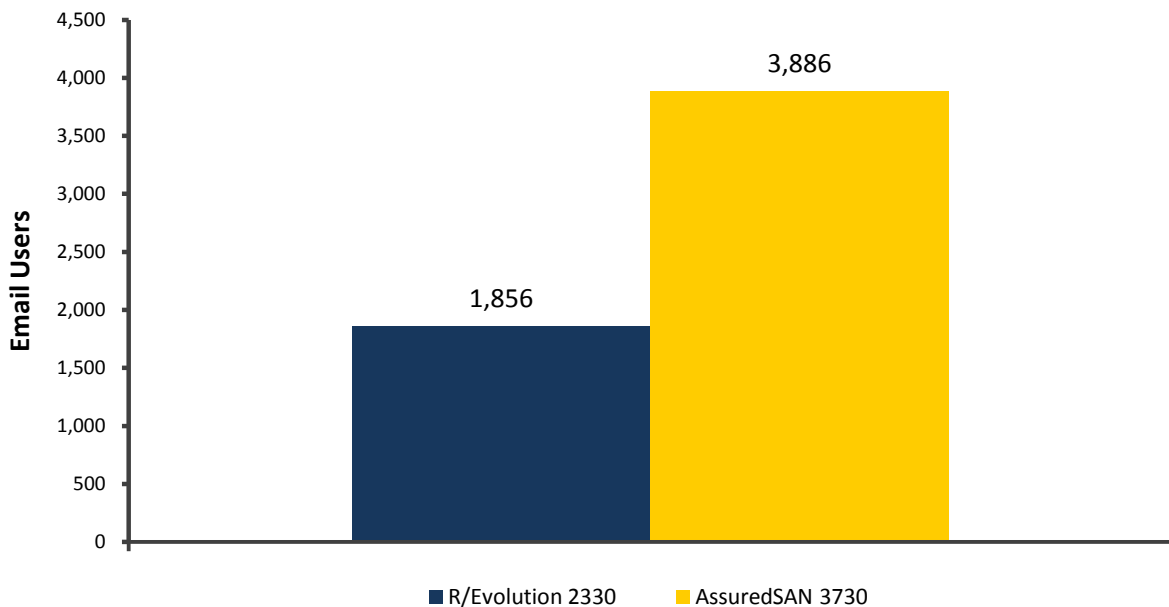
Performance in a storage environment is best measured with the metrics used by the applications organizations actually run. For an e-mail application, that measurement is the number of users or mailboxes a given system configuration can support with acceptable latency. For a streaming media application, the number of objects or streams served concurrently during peak periods of activity is the measurement that matters most. The tests that follow were selected and designed to show actual performance using workloads that mimic real-world applications.

ESG Lab Testing

ESG Lab validated the Enterprise-class performance capabilities of the Dot Hill AssuredSAN architecture via an audit of Microsoft ESRP 2.1 results for a previous generation Dot Hill R/Evolution 2330 array and hands-on testing of a Dot Hill AssuredSAN 3730 array using the Microsoft Jetstress utility. The Exchange Solution Review Program (ESRP) is a Microsoft program designed to facilitate third-party storage testing and solution publishing for Exchange Server. ESRP version 2.1 focuses on Exchange 2007. The programs combine a storage testing harness (Jetstress) with publishing guidelines for Microsoft Gold Certified and Storage OEM Partners. Manufacturers use the ESRP framework to test storage solutions and then submit results to Microsoft for review. Approved solution results are posted on the Microsoft Exchange ESRP website⁴.

The Microsoft Jetstress utility was used to generate e-mail traffic against a Dot Hill AssuredSAN 3730 array with the same number and type of disks as the R/Evolution 2330 array. Jetstress simulates the activity of typical Microsoft Exchange users as they send and read e-mails, make appointments, manage to-do lists, etc. The Jetstress utility is a lightweight tool that is ideally suited for predicting storage performance in a Microsoft Exchange environment. It uses the same jet engine database that Microsoft Exchange uses internally.

Figure 9. Dot Hill Exchange Performance



As can be seen in Figure 9, the AssuredSAN 3730 was able to support more than twice the number of users than the previous generation R/Evolution 2330. As seen in Table 1, the AssuredSAN 3730 contained exactly the same number of 15K RPM SAS drives in exactly the same RAID configuration, yet was able to drive double the IOPS of the R/Evolution 2330. Both arrays passed the Jetstress performance test with less than 20ms latency, but in fact, the AssuredSAN 3000's latency was less than half that of the R/Evolution 2330. Latency is important as it determines

the amount of delay applications pass on to users. An array must complete the Jetstress performance run with lower than 20ms latency in order to pass. In this context, the AssuredSAN 3000 results were quite impressive.

Table 1. Jetstress 2010 Performance Test Results

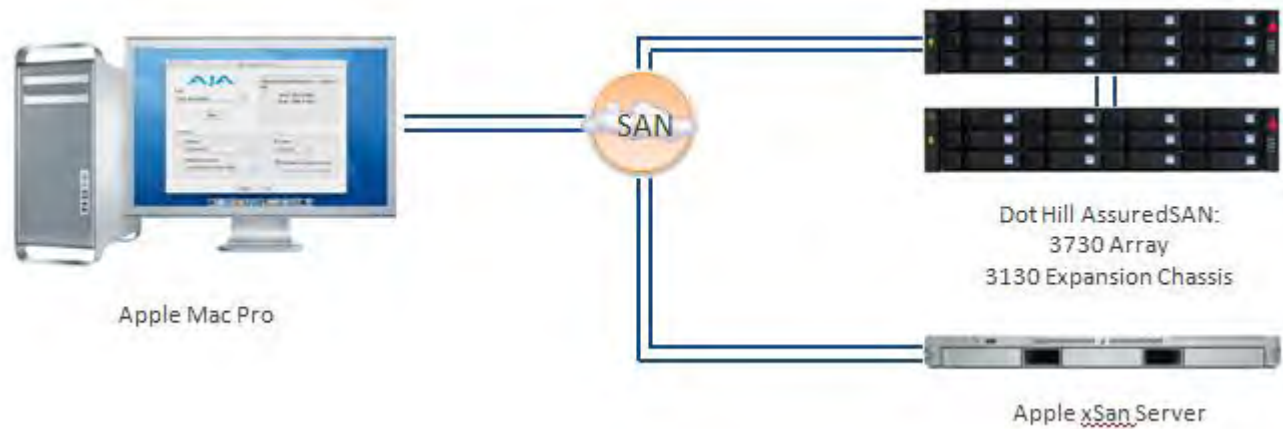
System	Drives	RAID Configuration	IOPS	Average Latency
R/Evolution 2330	12x 15K 146 GB SAS	RAID 1+0, 1	928	<20ms
AssuredSAN 3730	12x 15K 450 GB SAS	RAID 1+0, 1	1,943	<20ms

Next, streaming media performance was examined. This type of traffic is sequential in nature and uses larger block sizes than transactional workloads, putting more of a load on the storage network.

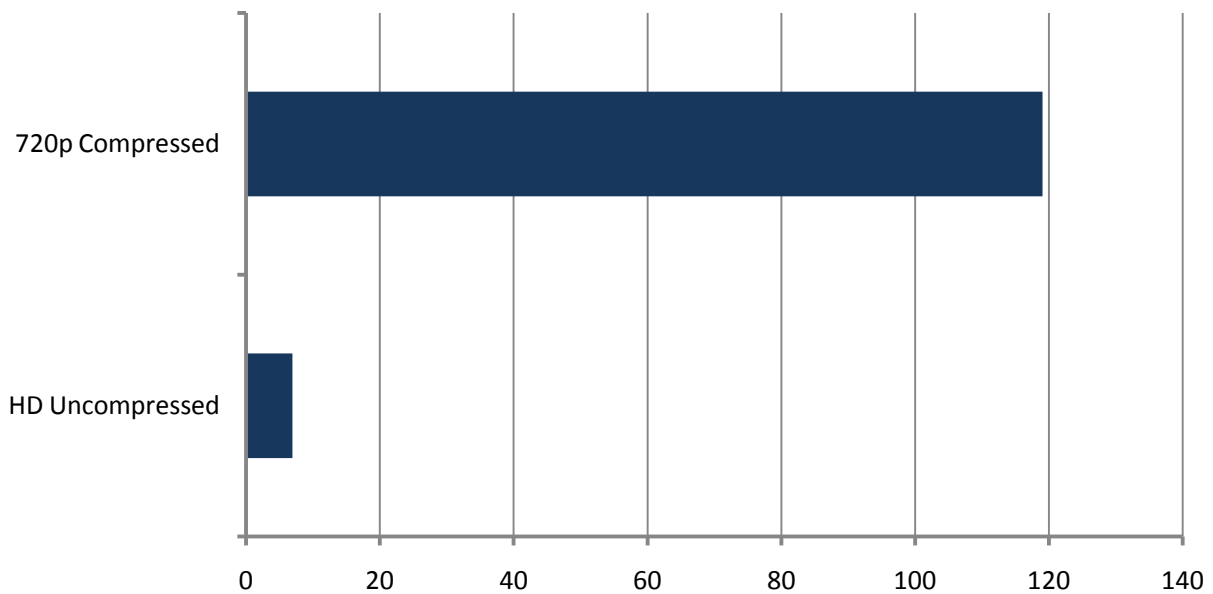
Streaming media performance was also excellent; delivering 1,760 MB/sec in read throughput for a 512KB block size, as used by video streaming applications, and 759 MB/sec in write throughput using a 64KB block size, as used commonly by backup applications. More than 1,500 MB/sec in writes was observed using a large block size of 512KB. Put into perspective, a single AssuredSAN 3930 system was able to drive enough bandwidth to saturate two 8Gbps FC interfaces.

Finally, the AssuredSAN system was tested against an extremely demanding video production workload using an Apple Xsan server and AJA system test software running on a Mac Pro. A Dot Hill AssuredSAN 3730 array with a 3130 expansion chassis provided the storage, as seen in Figure 10.

Figure 10. The Dot Hill Video Production Test Bed



The AssuredSAN 3000 delivered an impressive 1250 MB/sec of read bandwidth, which was used to calculate the number of video streams that could be delivered simultaneously. Rates of 10 MB/sec for compressed high definition video and 180 MB/sec for uncompressed high definition video were used to determine that a single AssuredSAN 3000 has the bandwidth required to simultaneously stream nearly 120 compressed high definition broadcast videos or seven uncompressed HD 4:2:2 streams as used in video editing, shown in Figure 11.

Figure 11. Content Delivery – Concurrent Streams**What the Numbers Mean**

- The AssuredSAN 3730 showed excellent disk response times for both random and sequential IO. The Jetstress average disk IO response time was 3.13ms while streaming media requests from SATA disk were satisfied in just 10ms.
- The AssuredSAN 3730 showed marked improvement over the R/Evolution 2330 in every dimension, supporting more mailboxes with greater storage capacity and lower latency.
- Microsoft stresses that, to ensure a positive user experience, the Exchange database LUN requires read and write response times of 20ms or less so that Exchange can service users' client requests quickly and efficiently. In this context, the AssuredSAN 3730 Jetstress results, with much lower than 20ms latency, demonstrate impressive performance headroom, indicating that a larger pool of users could be easily supported using the same configuration.
- A single AssuredSAN 3730 with just 24 drives demonstrated the bandwidth required to service nearly 120 concurrent, high definition video streams.

Why This Matters

Storage systems are the gateway between end-users and their digital content. Whether it's employees accessing e-mail or video editors producing television shows, a performance bottleneck in any of the systems between user and content can lead to frustration, lost productivity, and, in many cases, lost revenue. Meeting the performance demands of applications with traditional storage system architectures often leads to over-provisioning, wasted capital costs, increased complexity, and excessive demands on data center infrastructure.

ESG Lab found that Dot Hill AssuredSAN performance was very impressive with a variety of different workloads including small-block, random IO (e-mail) as well as high bandwidth, streaming data (video production). The Dot Hill AssuredSAN solution compares extremely favorably with entry level storage offerings and actually meets or exceeds the performance provided by traditional midrange storage solutions using commodity-based hardware and innovative technology.

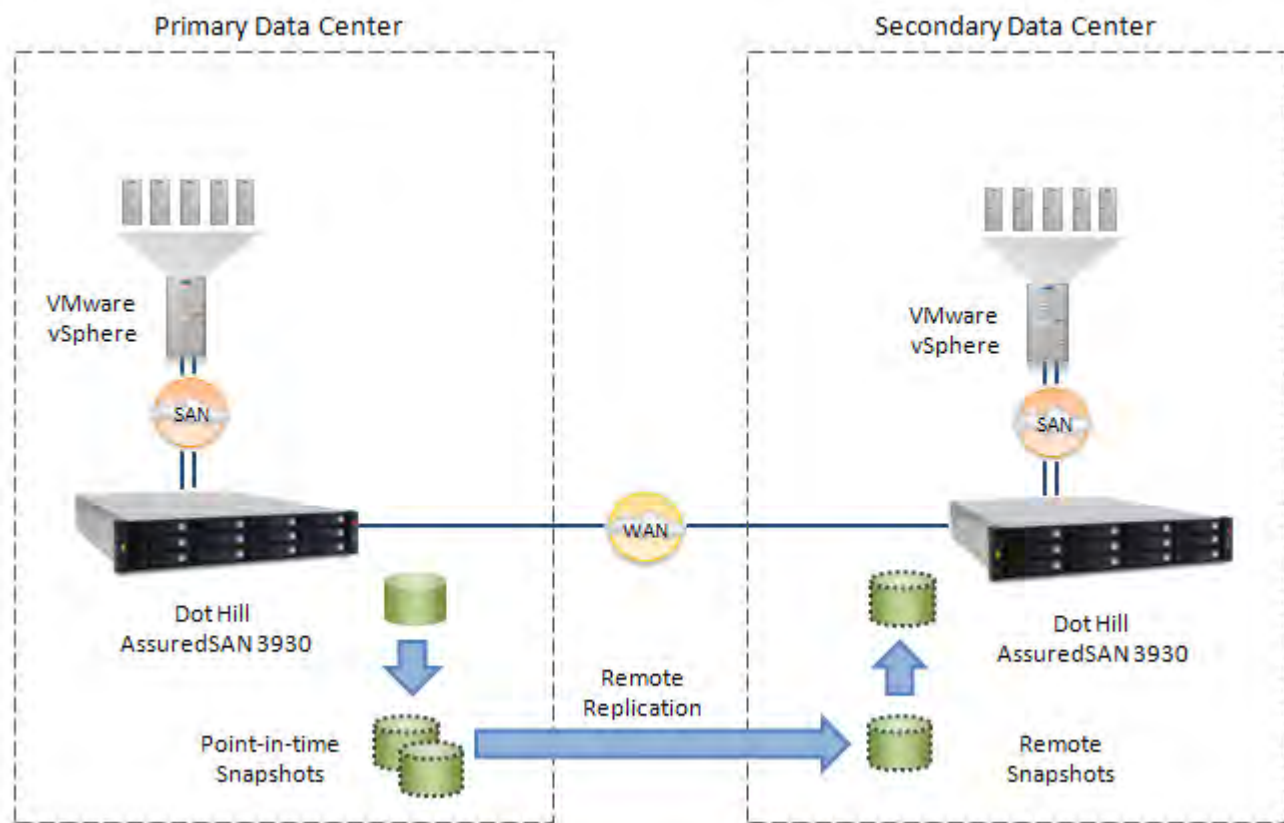
AssuredSAN Data Protection

All Dot Hill AssuredSAN 3000 arrays come fully licensed with AssuredSnap and AssuredCopy software at no additional charge, providing data protection for business critical applications. AssuredSnap provides capacity efficient volume snapshots, creating up to 1000 point-in-time volume images that can be used to instantly restore data after a system failure. AssuredCopy provides full volume copies, to protect against disk failures.

AssuredSAN 3000R arrays include Dot Hill AssuredRemote software, providing array-to-array remote replication and enabling disaster recovery protection and business continuity with the ability to replicate up to 1000 snapshots per storage array. Figure 12 shows the test bed ESG Lab used for local and remote data protection. AssuredRemote allows administrators to replicate a volume to a vdisk in an expansion chassis locally and then physically move the expansion chassis to the remote location where deltas only need be applied, saving an enormous amount of bandwidth that would be required for initial replication.

An AssuredSAN 3930 was configured as the primary system and attached to a VMware vSphere server using 8 Gb Fibre Channel.⁵ The secondary data center was configured with an AssuredSAN 3730 for remote replication testing and the two systems were connected with a 1 Gb/sec Ethernet link.

Figure 12. AssuredSAN Data Protection



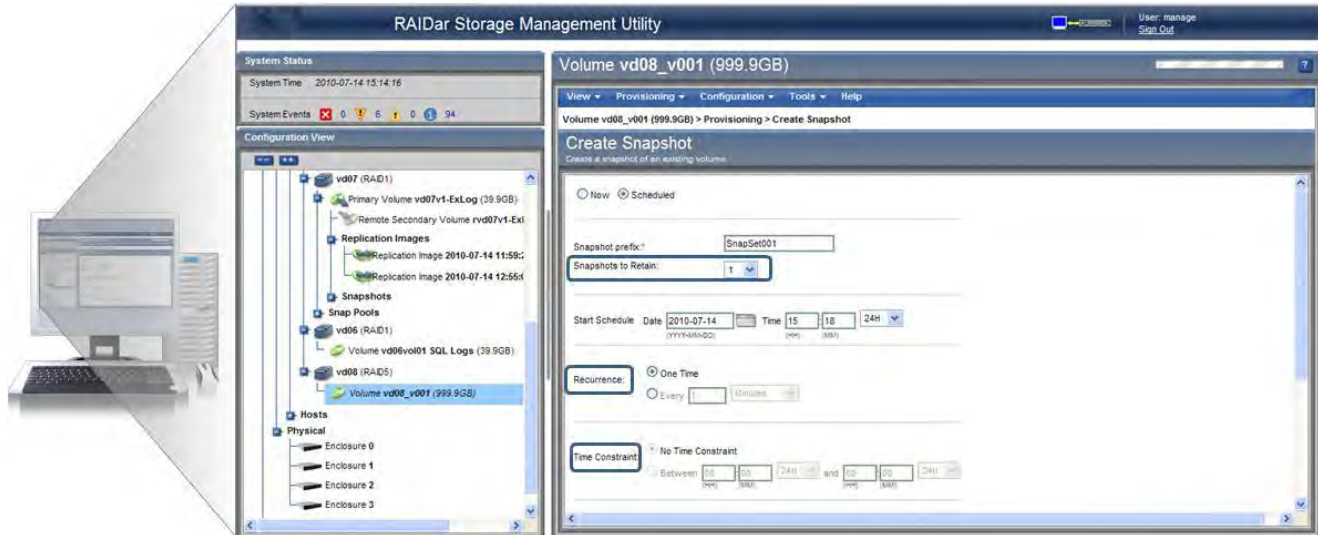
ESG Lab Testing

To test high availability in a VMware environment, ESG Lab created a snapshot of a live volume presented to a Windows 2008 virtual machine using the snapshot scheduler shown in Figure 13. RAIDar provides a simple interface to enable administrators to schedule snapshots, set retention, and restrict snapshot creation by time of day. A one-time snapshot was selected for this test. Once the snapshot was created, files were deleted from the volume to simulate accidental data deletion or corruption. The volume was restored from the snapshot and the virtual server

⁵ Configuration details can be found in the Appendix.

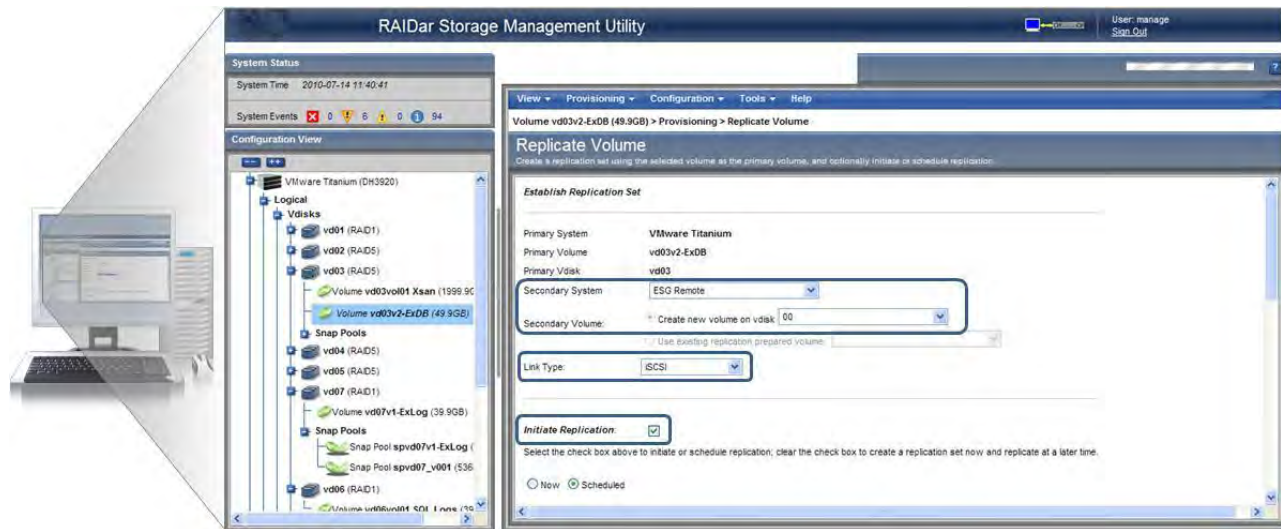
rescanned its volumes in Windows disk administrator. The deleted files were confirmed to be present in the folder they had been deleted from. The restore was nearly instantaneous, taking less time than the re-scan in disk administrator.

Figure 13. AssuredSAN Data Protection – Create Snapshot



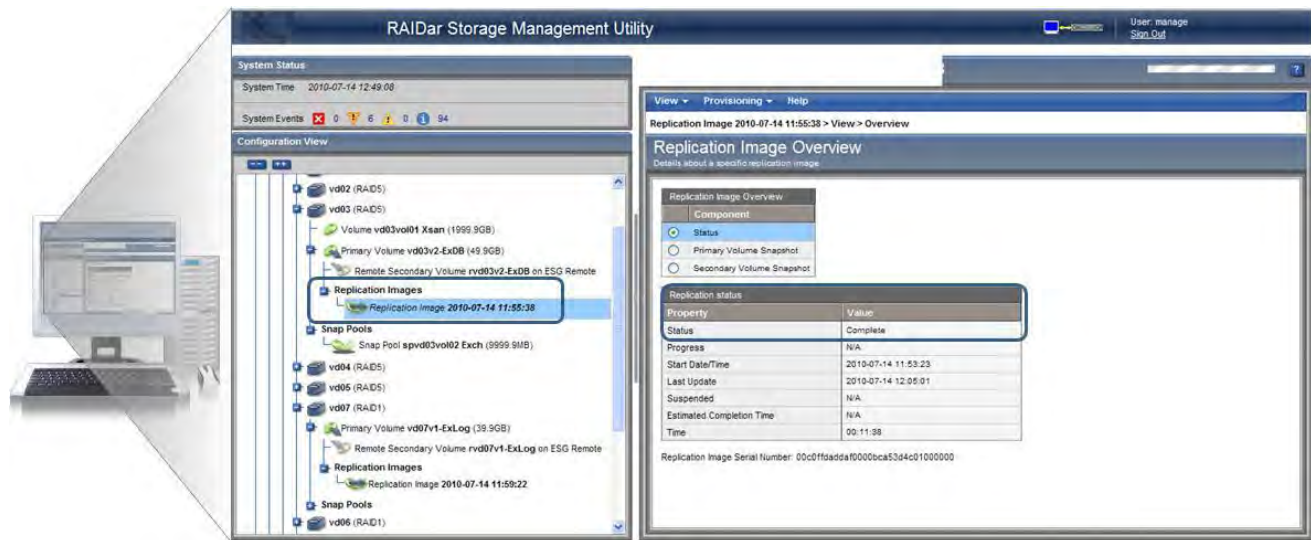
Next, AssuredRemote was used to create a remote copy of a 50 GB volume in a simulated secondary data center. ESG Lab right-clicked on a volume in the primary system and selected “Replicate Volume.”

Figure 14. AssuredSAN Data Protection – Initiate Remote Replication



The administrator has a number of selectable options when creating a replication set, including specifying a pre-configured target volume, whether to use FibreChannel or iSCSI for replication, and whether to initiate replication immediately or to create the replication set but wait to replicate. As displayed in Figure 14, ESG Lab elected to let AssuredRemote create a new volume on the target system, use iSCSI for replication, and start replication immediately. This procedure took three clicks and less than a minute. When replication completed, the remote copy was visible as a secondary volume on the remote system.

Figure 15. AssuredSAN Data Protection – Replication Complete



The final test was to shut down the server at the primary site and mount the remote volume at the secondary site, simulating an administrator's actions during a situation where a primary system goes offline. A virtual server attached to the remote system was booted and the target volume was mounted. The volume was examined and verified to contain all data present at the start of replication. While not tested for this report, AssuredRemote supports failback by reversing the replication relationship and copying the accumulated deltas back to the original source volume once the primary systems are back online.

Next, ESG Lab introduced a number of errors to validate fault tolerance. The following faults were injected as the Iometer workload generation tool ran continuously on a virtual desktop running in the VMware vSphere cluster:

- Shut down a controller
- Pulled an active controller from a live system
- Pulled an active disk drive
- Replaced the pulled drive

First, ESG Lab shut down and restarted Controller A; simulating the actions an administrator would take during a code upgrade. IO on the virtual machine paused briefly as access failed over to Controller B, but Iometer continued to run with no errors. ESG Lab verified that volume ownership had transitioned to the remaining controller. After re-starting Controller A and failing the path back, Controller A was pulled from the system. Again, IO paused briefly, as the path failed over to Controller B, but Iometer again continued to run without error. Figure 16 shows the RAIDar enclosure status screen after Controller A was pulled from the system.

Figure 16. Fault Injection – Controller Pulled



Finally, a drive was pulled from the vdisk containing the volume the virtual server was running iometer against. IO continued without interruption and the vdisk overview in RAIDar showed that the disk was no longer visible and that the volume was degraded. ESG Lab verified that the hot spare had been invoked and the rebuild was proceeding normally.

Figure 17. Fault Injection – Drive Pulled



Through all of the fault injections, the AssuredSAN platform performed flawlessly, providing uninterrupted access to data during both planned and unplanned outage events.

Why This Matters

ESG found that server virtualization was the number one IT priority over the next 12-18 months among IT professionals surveyed. Improving data backup and recovery was third on the list.⁶ Server virtualization consolidates infrastructure within the data center, meaning that users cannot access their data or applications if they cannot connect to systems in the data center. This presents a unique set of operational challenges, including providing continuous access for applications whose environments reside within virtual machines.

The Dot Hill AssuredSAN provides both fault tolerance in its hardware architecture as well as high availability via AssuredSnap, AssuredCopy, and AssuredRemote replication software. AssuredSnap and AssuredCopy are included in every AssuredSAN 3000S system and AssuredRemote is available for users with a need to replicate data offsite. ESG Lab has validated that the Dot Hill AssuredSAN was able to sustain continuous access to virtual servers through disk and controller failures with no interruption to access, while site failures were easily addressed with easy to use AssuredRemote replication.

Eco-Friendly

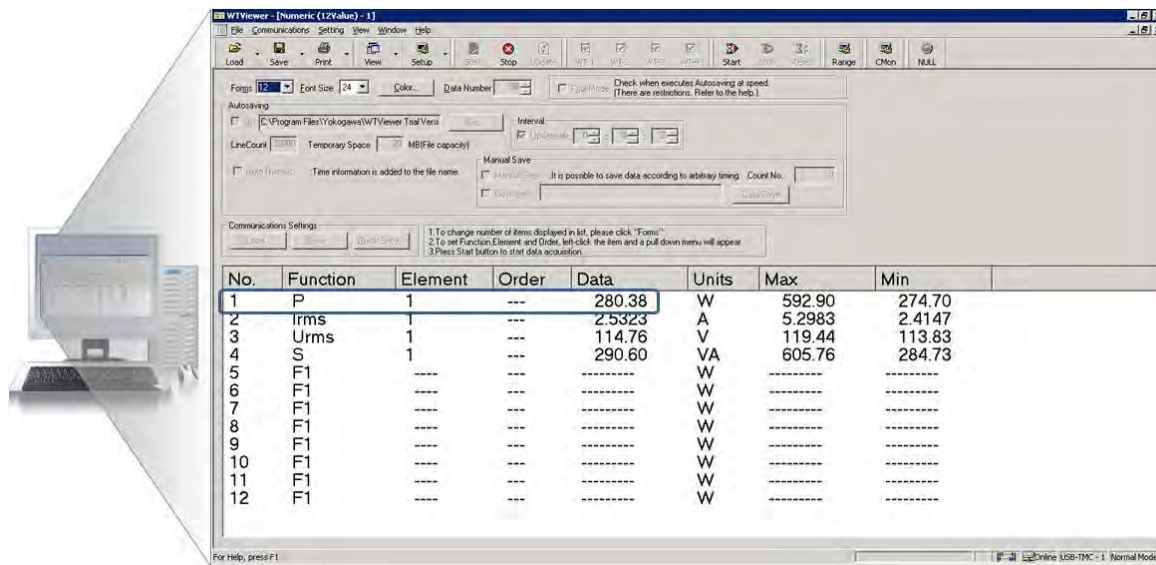
Dot Hill AssuredSAN integrates two ecologically minded features to lower the energy requirements of the system and reduce the environmental impact of electronic waste. AssuredSAN conserves energy by spinning down disks when not in use; since unneeded disks are not spinning, consumption of energy—including cooling costs—are reduced for the system as a whole. Dot Hill uses super capacitors and non-volatile flash memory—both unique, patented features of the AssuredSAN architecture—to preserve cache in the event of a power failure, eliminating the need for large, toxic, chemical batteries.

ESG Lab Testing

Drive spin-down is configured using a simple check box in the RAIDar management application. A Dot Hill AssuredSAN 3930 with 14 300 GB 15K SAS drives installed was plugged in through a Yokogawa GT500 power analyzer. ESG Lab enabled drive spin-down and set the idle time to five minutes, meaning that drives in the array would spin down after five minutes of inactivity. After five minutes, drive activity was verified using the AssuredSAN CLI, which reported that disks 0.0 through 0.23 were spun down.

⁶ Source: ESG Research Report, [2010 IT Spending Intentions Survey](#), January 2010.

Figure 18. Power Consumption with 14 Drives Spun Down



Using the power analyzer, power consumption by the array was verified at 280.38 Watts, as shown in Figure 18. Files were then copied to a volume spanning all 14 drives, which triggered the AssuredSAN to spin up the drives. The copy completed with no errors and no intervention required by an administrator. Again, power consumption was verified using the power analyzer. After a brief spike as the drives got up to speed, power consumption settled in at 358 Watts. Drive spin down resulted in a savings of 20% of the energy required to keep disk spinning while idle. In a large archive, with hundreds of drives accessed infrequently, this could result in significant savings.

Why This Matters

Energy costs are rising steadily and some metropolitan data centers are having trouble adding new systems as they do not have the ability to add power. ESG asked IT professionals about the areas they expected to see the most significant investments over the next 12-18 months with respect to data storage; purchasing more power efficient hardware was high on the list, just behind replication and storage virtualization.⁷

ESG Lab has confirmed that Dot Hill AssuredSAN spin-down technology significantly reduces power requirements for idle drives transparently to applications. Customers can lower power consumption and support green initiatives by spinning down inactive drives with no performance penalty while reducing the system’s overall carbon footprint. Additionally, customers do not have to install any host-based software on application servers connected to AssuredSAN to take advantage of this feature.

⁷ Source: ESG Research Report, [2010 IT Spending Intentions Survey](#), January 2010.

ESG Lab Validation Highlights

- ☑ ESG Lab found AssuredSAN to be extremely easy to configure and use; in less than five minutes, raw storage was provisioned, mapped to servers, and ready to accept data.
- ☑ Dot Hill AssuredSAN performance was very impressive with a variety of different, challenging workloads including small-block, random IO (e-mail) as well as high bandwidth, streaming data (video production).
- ☑ Fault tolerance was excellent, disk failures had zero impact to a running application, and controller failures induced only brief pauses in data IO as paths were remapped.
- ☑ ESG Lab demonstrated high availability using AssuredSAN's snapshot, copy, and replication features, all of which are included in AssuredSAN 3000R arrays. Applications running on a virtual server were able to be resumed within minutes of a failure at the primary site.
- ☑ ESG Lab confirmed that Dot Hill AssuredSAN spin-down technology significantly reduces power requirements for idle drives transparently to applications.

Issues to Consider

- ☑ While Dot Hill AssuredSAN provides many advanced features and functions to increase data availability, ease of management, and efficiency, storage virtualization functionality (thin provisioning, storage tiering) would be valuable additions to the product line. Dot Hill has advised ESG Lab that storage virtualization technologies, including thin provisioning and policy-based storage tiering, are planned for a future code release of the AssuredSAN family.
- ☑ AssuredSAN demonstrated powerful, yet easy to use, snapshot and replication technology. Tighter integration with applications and virtualized environments via application plug-ins and the VMware SRM would provide tremendous value as application uptime could be improved further.

The Bigger Truth

IT managers are increasingly asking themselves tough questions: How can I protect my storage investments—now and in the future? Can I manage more capacity with better performance and service levels with the staff I have today? Will my storage investments complement—or complicate—my virtual server consolidation initiative? How am I going to create a winning strategy that works for my organization and my team?

As local and global economies provide a consistent reminder that costs must be contained, a number of factors must be considered as IT managers examine the benefits of emerging technologies—specifically, data growth, consolidation initiatives, server virtualization, new application deployments, and compliance mandates. Business requirements that necessitate more stringent SLAs make it difficult for IT organizations to keep up with growing demands. IT managers within mid-sized organizations are especially challenged as they look for ways to consolidate, optimize, and automate the delivery of IT services.

Not for the first or last time in the IT business, terminology and semantics can actually create issues; midrange storage is not one standard thing, nor is it defined by one feature or capability. The real value comes from the whole, the sum of the parts—not just the parts themselves. Naturally, anyone will want to deal with a vendor that has done its homework on the user's behalf. Dot Hill has developed many unique, interesting, and, more important, useful technologies in the AssuredSAN architecture (EcoStor and SimulCache to name two), but it's the whole system that provides the value to organizations.

Dot Hill's AssuredSAN delivers business value by minimizing the cost, management, and power required for given capacity and performance requirements. The company has a rich heritage of innovation that it has applied across its last three generations of products. ESG validated performance in two very challenging environments, e-mail and video production, proving that AssuredSAN can perform exceptionally well with plenty of headroom for future growth. Data availability software is included in the bundled products, enabling administrators to reduce recovery times and meet offsite requirements with a simple to manage, modular system.

The bigger truth of this ESG Lab validation can be summed up this way: Simple, efficient performance and availability. The solution tested by ESG Lab is the next generation in a long line of storage systems provided by Dot Hill for years as an OEM to many major IT companies. AssuredSAN is an easy to set up, easy to manage storage system that performs like systems many times its size and price and provides solid data snapshot and replication capabilities. ESG Lab believes that IT managers in mid-sized organizations would be wise to consider the affordability of IT infrastructure built on Dot Hill AssuredSAN technology.

Appendix

Table 2. ESG Lab Test Bed

Primary Test Bed	
Dot Hill AssuredSAN 3000	
AssuredSAN 3720 Array	24 300 GB 2.5" 6Gbit 10k RPM SAS Drives
AssuredSAN 3130 Expansion Array	12 300 GB 3.5" 6Gbit 15k RPM SAS Drives
Client Systems	
HP DL380 G6 One Quad Core Intel Xeon ES530 Processor 6 GB Memory	VMWare ESX 4.0 One Windows Server with Exchange 2010 One Windows Server with SQL Server 2008
HP DL380 G6 One Quad Core Intel Xeon ES530 Processor 6 GB Memory	VMWare ESX 4.0 One Windows Server with Active Directory One Red Hat Enterprise Linux server with Apache
Yokogawa GT500 Power Analyzer	
Performance Tools and Workloads	
Iometer 2006-07-27	Video On Demand: 512KB reads, 100% Sequential Backup Writer: 64KB Writes, 100% Sequential Large Block Write: 512KB writes, 100% Sequential
Microsoft Jetstress 2010	Heavy mailbox Profile: .5 IOPS per mailbox
Apple Xsan Test Bed	
Dot Hill AssuredSAN 3000	
AssuredSAN 3730 Array	12 300 GB 3.5" 3Gbit 15k RPM SAS Drives
AssuredSAN 3130 Expansion Array	12 300 GB 3.5" 3Gbit 15k RPM SAS Drives
Xsan File System	
Apple Xserve Dual Quad Core Intel Xeon 2.4GHz CPU, 6GB RAM, ATTO Celerity FC-82EN 8 Gbit Fibre Channel HBA	OS X Server 10.6.4, Xsan 2.2
Client	
Apple Mac Pro Dual Quad Core Intel Xeon X5570 CPUs 8GB RAM ATTO Celerity FC-82EN 8 Gbit Fibre Channel HBA	OS X 10.6.4
AJA System Test	6.0.1
Black Magic Disk Speed Test	7.5.2



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