



ESG Lab Validation Report™



Quantum DXi-Series Disk Backup and Remote Replication Appliances With Data De-duplication Technology

A validation study
by
ESG Lab
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ESG Validation Reports

The goal of ESG Lab Validation reports is to educate customers about various storage and storage-related products, including storage systems, backup-to-disk solutions, storage management applications, backup and recovery software, storage virtualization platforms, etc. ESG Lab reports are not meant to replace the necessary evaluation process that end-users should conduct before making purchasing decisions, but rather to provide insight into these technologies. Our objective is to go over some of the highlighted features/functions of such 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.

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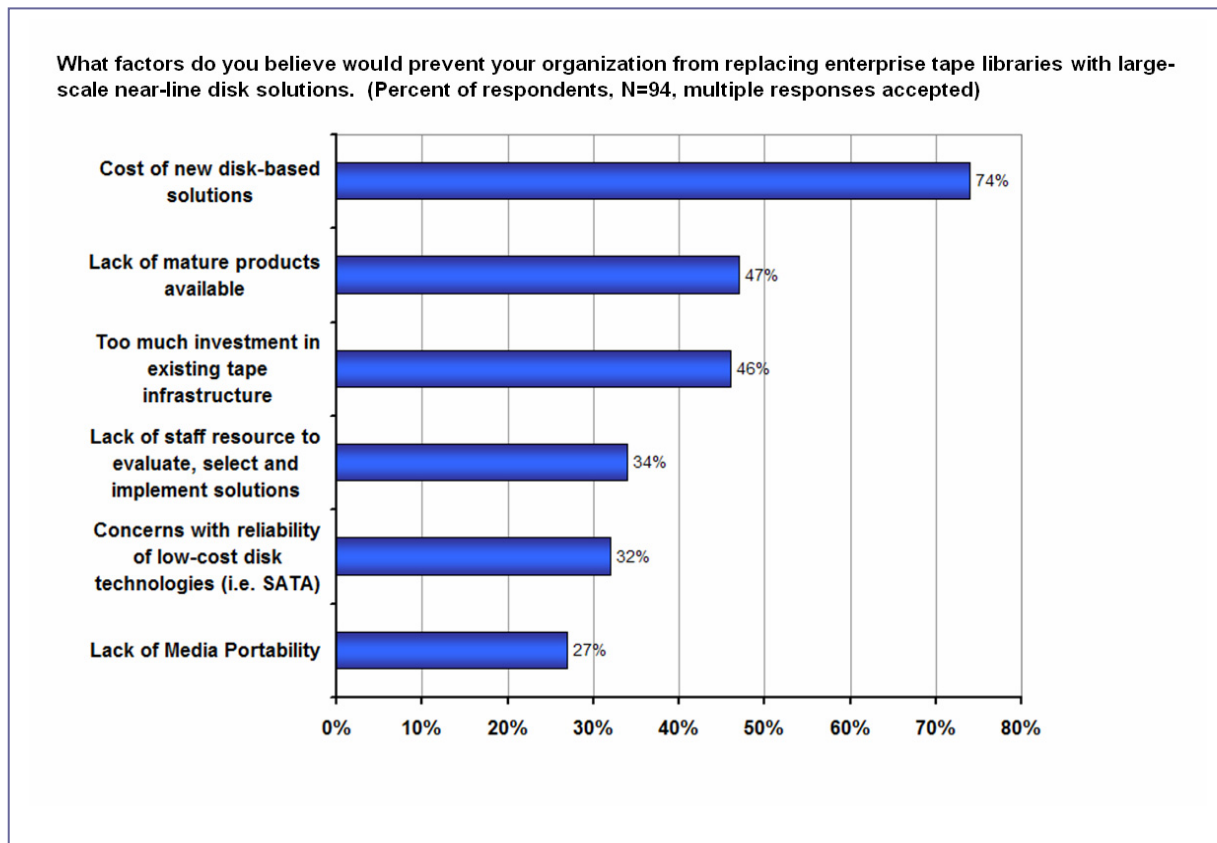
Introduction

Customers have been augmenting their legacy tape-based backup and recovery processes with Quantum’s portfolio of Virtual Tape Library (VTL) systems and disk-based backup appliances for improved performance and reliability since 2002. This report highlights the capabilities of the company’s latest offering for midrange and distributed enterprise environments, the DXi-Series disk-based backup and replication appliances. Introduced in late 2006, Quantum’s DXi-Series platform includes disk-based backup appliances designed to protect up to 11 TB of primary data, featuring data de-duplication technology, WAN-based remote replication, VTL and NAS presentations and enhanced performance.

Background

ESG Research indicates that cost is the primary barrier to widespread adoption of backup to disk products including VTL solutions. As shown in Figure One, when survey respondents were asked what would keep them from replacing some of their enterprise-class tape library capacity with disk-based products, 74% said the cost of the solution was the main factor¹. Quantum’s data de-duplication technology changes the economics of backing up to disk. Data de-duplication reduces the overall cost of the solution by enabling organizations to keep more backups on disk and retain backup data for longer periods of time.

Figure One: Factors Preventing Backup to Disk Adoption



ESG Research indicates that end users are also concerned about the preservation of existing investments in tape infrastructure and the lack of media portability with disk. Quantum disk-based backup customers have proven that disk-based solutions can be used to augment, not replace, existing tape investments using a disk to tape (D2D2T) strategy that works with existing backup software and policies. Now Quantum DXi-Series customers have a new option for off-site archival and disaster recovery—remote replication over the WAN. Instead of moving backup images using tapes and trucks, data reduction and remote replication can be used to cost-effectively move backup images over the wire.

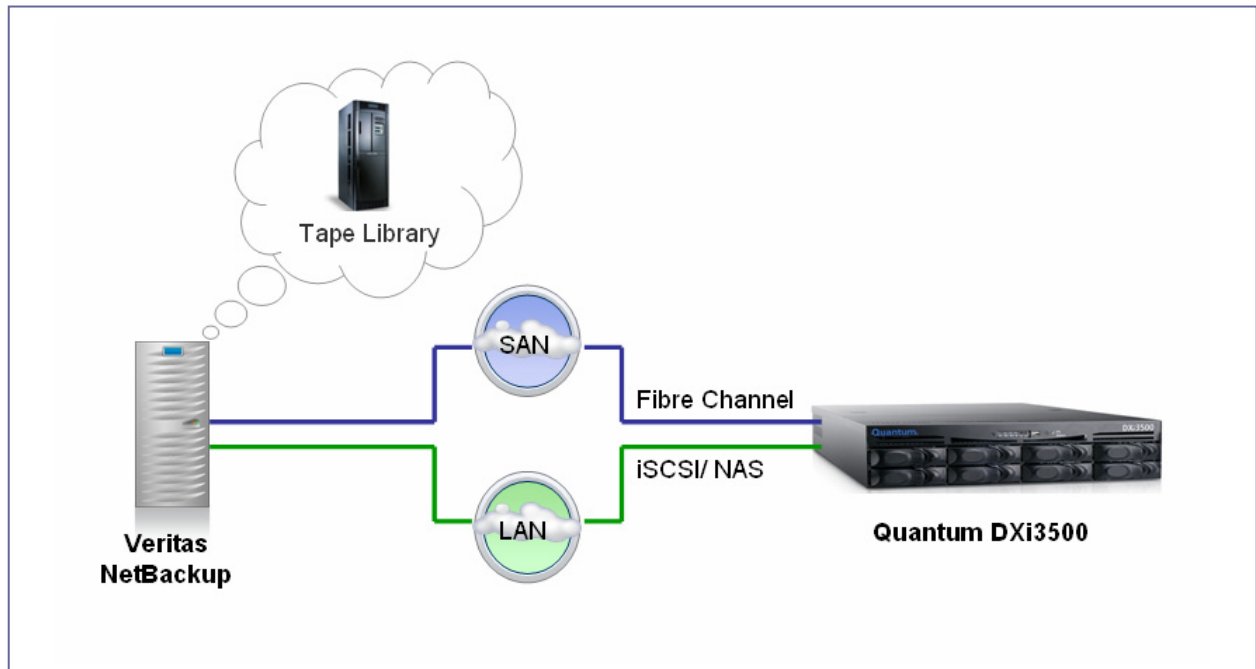
¹ ESG Research Report: [Tape Replacement Realities](#), March, 2005.

Several factors have contributed to Quantum’s early success in the disk-based backup market: very high backup performance (to meet backup window objectives), ease of use (works with existing backup software and policies) and, lastly, but perhaps most importantly, fast and reliable recovery. This report highlights the capabilities of the performance-enhanced DXi-Series including its ease of use, data de-duplication and remote replication.

ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of the DXi-Series disk backup and replication appliances at a Quantum facility in Englewood, Colorado. Both DXi-Series appliance models were used during the evaluation: the DXi3500 and the DXi5500. DXi-Series products work with existing backup software and policies as shown in Figure Two. When operating in virtual tape library mode, a DXi-Series appliance appears to back up software as one or more tape libraries with both drives and cartridges. When operating as NAS, the appliances present themselves as a CIFS share or NFS mount point.

Figure Two: The ESG Lab Test Bed

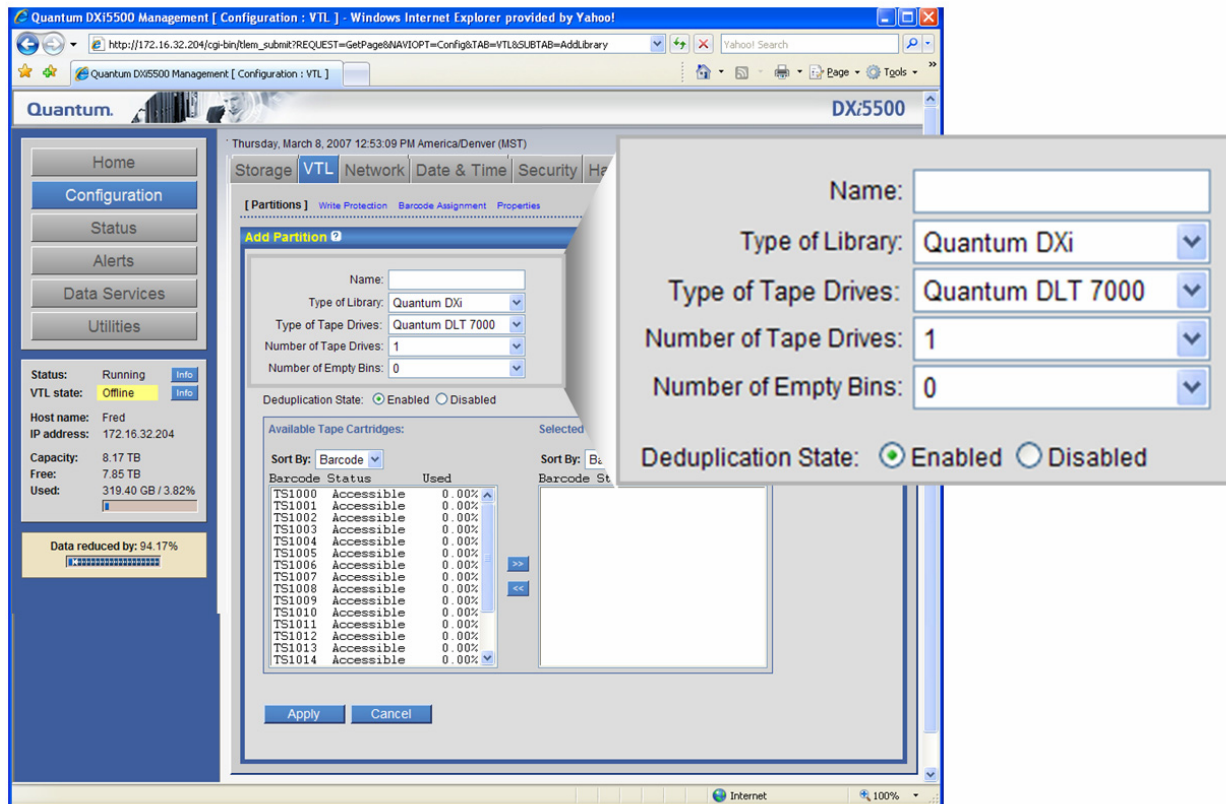


ESG Lab Testing

ESG Lab began the evaluation by configuring a Quantum DXi3500 for use with existing Veritas NetBackup policies. Configuration of the DXi3500 was performed from the web-based DXi3500 console on a pre-wired test bed as shown in Figure Two.

The configuration began by assigning IP addresses for management and iSCSI access and configuring the FC and Ethernet interfaces for backup and restore traffic. With this basic plumbing in place, the next step was the configuration of a virtual tape library, drives and cartridges. ESG Lab found that the user interface, as shown in Figure Three, was easy to navigate, flexible and intuitive.

Figure Three: Getting Started



The *Type of Library* and *Type of Tape Drives* pull down menus were used to configure the library to emulate a Scalar i2000 tape library. It was noted that Quantum has recently expanded the list of libraries and tape drive emulations to include DXi-Series (as shown in Figure Three) and DX-Series products as well as emulations of a variety of tape drives and libraries from various vendors.

Intuitive pull-down menus were used to configure virtual tape cartridges and iSCSI connectivity to a media server. Ten minutes after getting started with the menu-driven configuration, Veritas NetBackup was streaming backup data onto the DXi3500 over an Ethernet interface using the iSCSI protocol.

Why This Matters

A backup to disk solution that is easy to install and use in existing environments saves time and money. Customers choose an appliance with the expectation of simple installation and configuration, especially at remote sites or locations where IT resources may be limited or non-existent. In the case of Quantum's DXi-Series, ESG Lab was not disappointed. Configuring a DXi-Series appliance is straightforward and intuitive. Ten minutes after beginning the configuration, Veritas NetBackup jobs were storing backup data on a Quantum DXi3500.

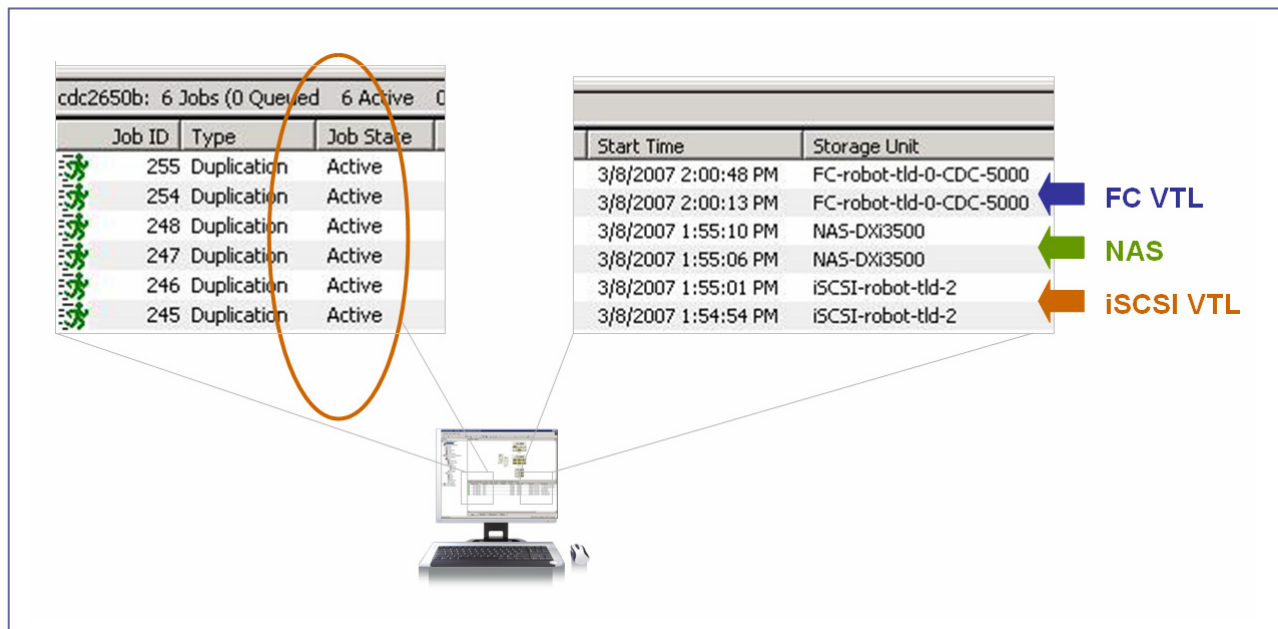
Configuration Flexibility

Media servers running backup software connect to a DXi-Series appliance over a Fibre Channel or Ethernet network. In addition to the FC and iSCSI virtual library connectivity options supported since the DX3000/5000 was announced back in 2005, the DXi-Series can also be presented as Network Attached Storage (NAS) using the CIFS or NFS protocols. When used as a NAS device, the DXi-Series appliance appears to backup software as a big network attached drive—much like a shared network drive accessed from your desktop. Backup software vendors have supported each of these connectivity options for years.

ESG Lab Testing

ESG Lab configured virtual tape libraries for access over Fibre Channel and Ethernet interfaces. The iSCSI initiator built into the Microsoft Windows operating system was used to access the VTL over a Gigabit Ethernet interface on the motherboard of the media server (iSCSI VTL). A Fibre Channel host bus adapter and a switch were used for high speed VTL access over a Storage Area Network (FC VTL). A network attached mount point was configured and presented to the media server as a drive share using the CIFS protocol (NAS). Veritas NetBackup was used to start backup jobs to the DXi-Series appliance on all three interfaces simultaneously as shown in Figure Four.

Figure Four: Simultaneous FC, iSCSI and NAS Backups



Why This Matters

Fibre Channel VTL solutions provide the highest level of performance and transparency. NAS and iSCSI VTL solutions reduce cost by eliminating the need for specialized host bus adapters and switches. ESG Lab verified that the Quantum DXi-Series supports and can provide de-duplication across FC, NAS and iSCSI - all at the same time if desired. The flexibility of the Quantum DXi-Series family of appliances can be used to configure a wide variety of right-sized, right-priced solutions.

Data De-Duplication

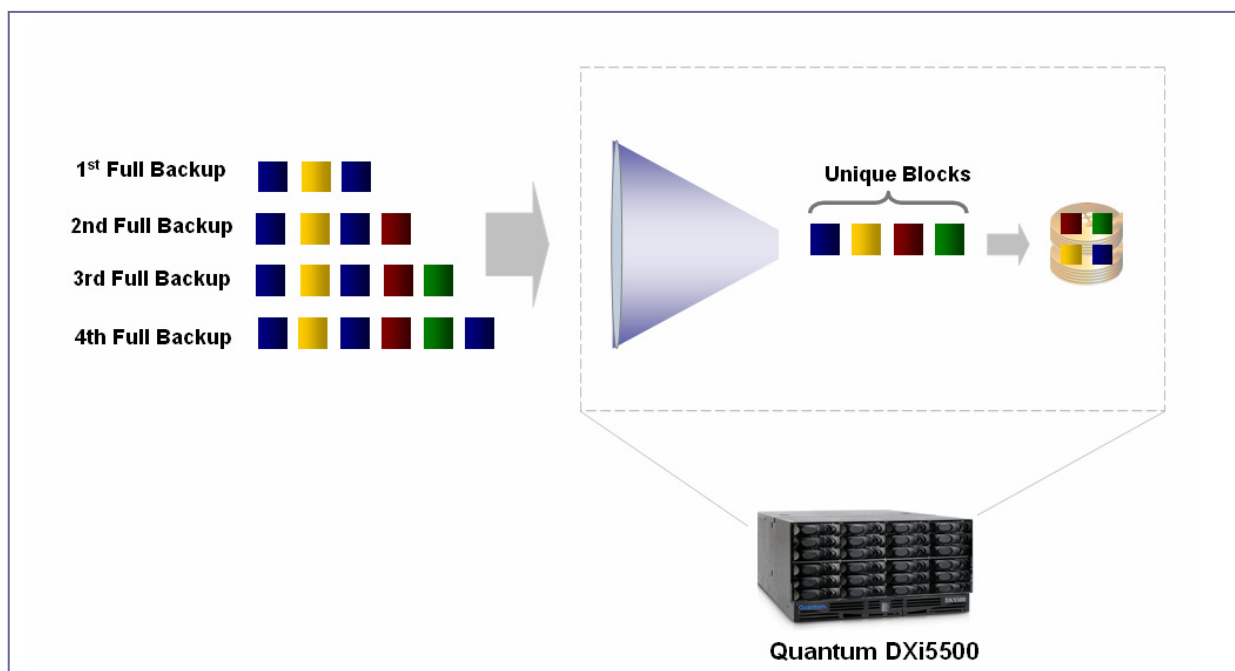
Data de-duplication reduces capacity requirements by ensuring that only unique data is written to disk. As backup data is stored, the DXi-Series appliance leverages Quantum’s patented variable length block-level data de-duplication process which identifies unique blocks of data. As backup data is written, unique blocks are identified and only unique backup data is stored. In other words, when a block is ingested that has already been processed, the appliance stores a pointer to the original block instead of copying the block again.

In Quantum’s case, the data de-duplication process can most closely be defined as “in-line” (or as data is ingested by the appliance) using a buffering process to help speed performance. As data is ingested into the DXi-Series appliance, it is de-duplicated. Unlike post-processing technologies, the DXi-Series appliance does not wait for the backup job to be completed before it begins the de-duplication process. After the data has been fully de-duplicated, the DXi-Series then compresses the data using its patent-pending, built-in hardware compression engine for additional cost- and capacity-savings. A couple of things about Quantum’s approach should be noted:

1. Quantum does the compression in hardware, not software, which avoids the performance pitfalls associated with software-based compression.
2. Quantum is the first vendor to ship an appliance that does *both* data de-duplication and hardware-based data compression. By de-duplicating data and then compressing it, Quantum makes optimal use of disk capacity.
3. Administrators don’t need to schedule a quiescent period so the system can catch up, as may be the case for systems supporting data de-duplication as a post-processing task.

To illustrate how this works, consider the diagram shown in Figure Five. Each horizontal row of blocks on the left represents a full backup. The first backup contains three blocks, two of which are unique (blue and yellow). The second full backup includes the same three blocks as in the first backup and adds one unique block (red). Subsequent backups include one more unique block (green). Four full backups composed of 18 blocks worth of data are reduced to 4 before being stored on disk. In this example, DXi-Series data de-duplication technology has reduced the required disk capacity after four backups by a factor of 4.5 to one (18 divided by 4 is 4.5).

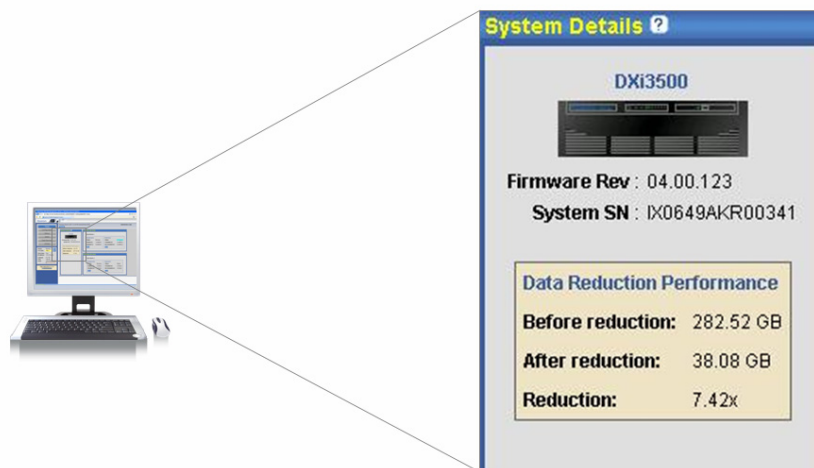
Figure Five: De-duplicating Backup Data



ESG Lab Testing

ESG Lab evaluated the data reduction capabilities of the Quantum DXi-Series using real-world backup sets harvested from a corporate data center, including Microsoft Exchange e-mail and home directory file application data. Full backups performed over four days were evaluated. The home page of the DXi-Series web console, an excerpt of which is shown in Figure Six, was used to monitor the benefits of data reduction after each Veritas NetBackup job had run. These results were collected after the fourth full backup of home directories full of general purpose file data including documents, spreadsheets and presentations was completed.

Figure Six: Monitoring Data Reduction



The results after each of the four full backups as well as the cumulative effects are shown in Table One.

Table One: Data Reduction after Four Full Backups of Home Directory Files

	Event-to-Event Effect			Cumulative Effect ²		
	Before Reduction	After Reduction	Reduction Ratio	Before Reduction	After Reduction	Reduction Ratio
1 st Full Backup	67.9 GB	33.95 GB	2x	67.9 GB	33.95 GB	2x
2 nd Full Backup	71.3 GB	2.02 GB	35.30x	139.2 GB	35.97 GB	3.87x
3 rd Full Backup	71.09 GB	1.16 GB	60.25x	210.29 GB	37.15 GB	5.66x
4 th Full Backup	72.23 GB	0.93 GB	77.67x	282.52 GB	38.08 GB	7.42x

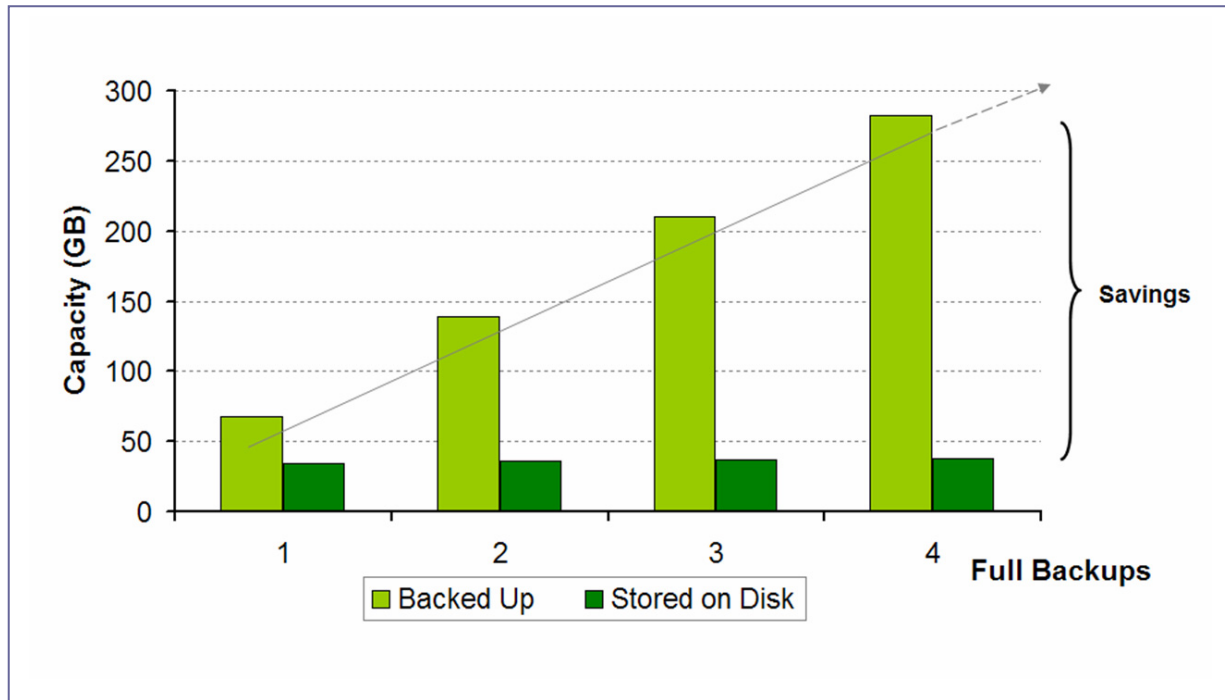
Figure Seven illustrates the effects of data de-duplication for each of the four backups. The difference between the amount of data backed up and the amount of data stored on disk is the capacity savings provided by Quantum data de-duplication and hardware compression. The amount of savings depends on two major variables:

- The rate of change between backups
- The number of backups retained on disk

² As displayed on the Quantum DXi-Series GUI.

Note that in this example, the amount of capacity stored on disk barely moves after the first full backup. This is due to the fact that we are using a daily full backup policy and most of the home directory files that are stored each night are not changing. In general, it is ESG Lab’s experience that this is true for most general purpose business application data. Daily change rates of one percent or less are common for home directories. E-mail tends to change a bit more on a daily basis, but rarely more than 5% a day. This change rate depends greatly on a company’s e-mail policies³.

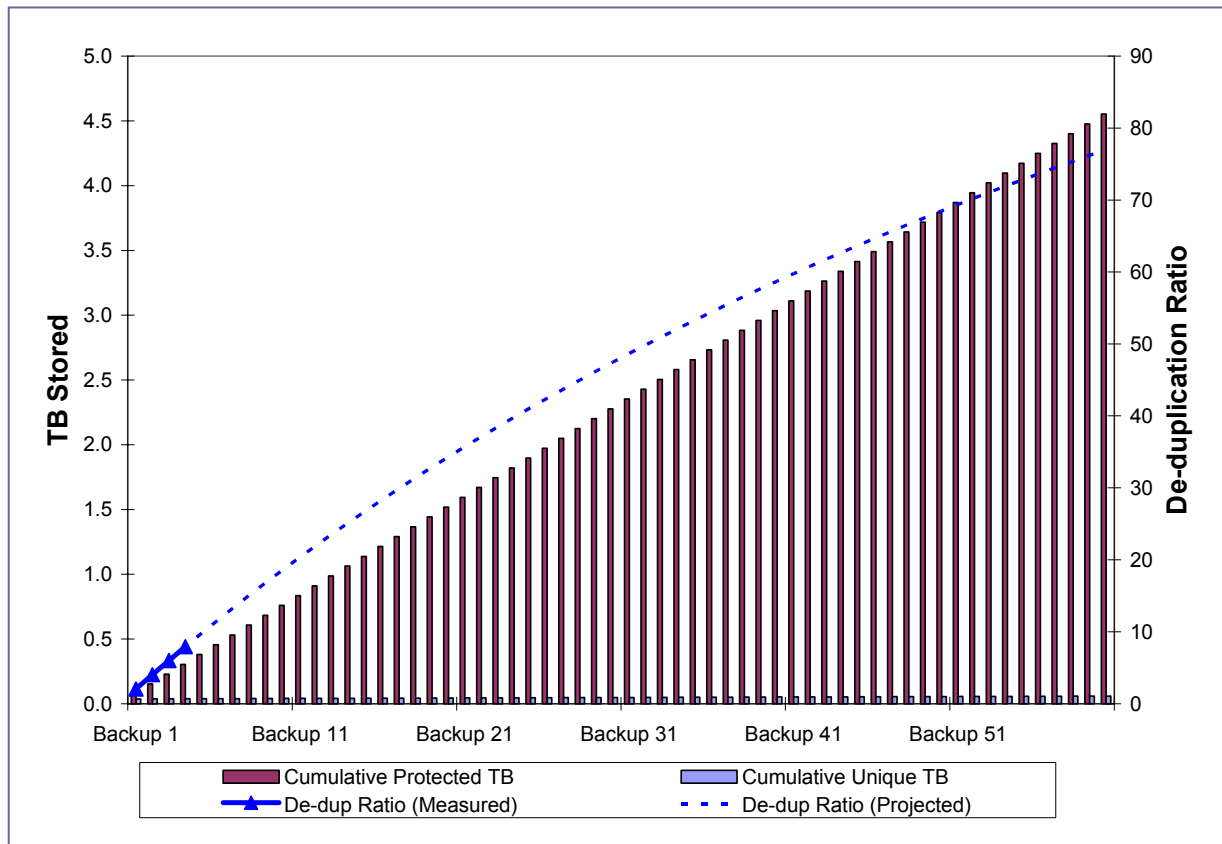
Figure Seven: Measured Reduction after Four Full Backups of Home Directory Files



It’s clear that more full backups retained on disk would yield additional savings. Quantum indicates that reduction ratios between 10 and 50 to one can be expected on DXi-Series appliances. To verify these claims, ESG Lab created a spreadsheet to estimate the savings over time. The spreadsheet, which had been created prior to the validation, was compared to a sizing tool that Quantum uses to help customers during capacity planning. An initial reduction of 2% and a daily change rate of 1% were used to predict the reduction rate over time. As shown in Figure Eight, a reduction rate of 50 to one is achieved after the 33rd full backup. In other words, for this set of real-world file data protected using a daily full backup policy, less than five weeks worth of backups stored on a DXi-Series appliance would yield a reduction ratio of 50x.

³ Please refer to Figure Nine for an example of how a company’s Exchange policies play an important role in measured reduction over time and how these policies can affect the rate of change between backups.

Figure Eight: Measured and Projected Data Reduction for Home Directory Data

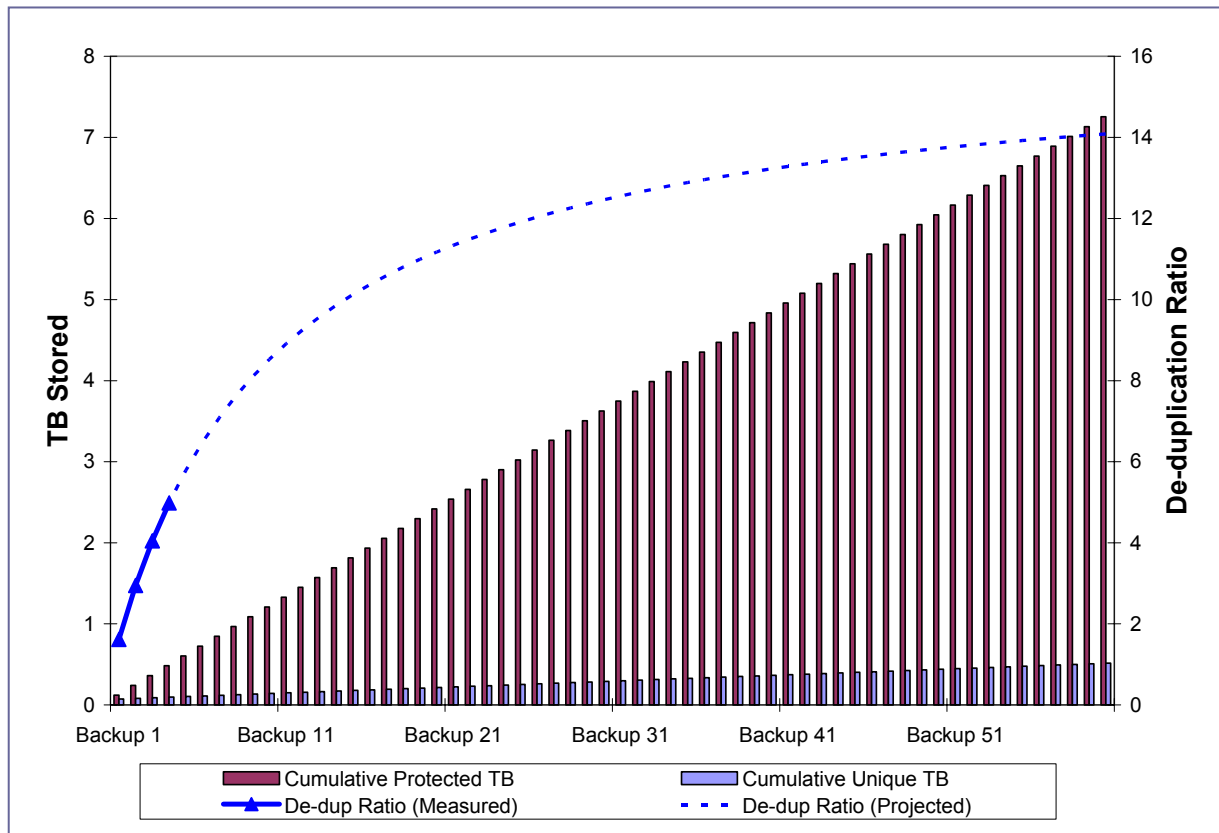


As a further example, ESG Lab measured the results of Microsoft Exchange backup data sets from a customer’s production environment. It is interesting to point out that in this case, the IT department had set fairly strict e-mail mailbox quotas for its users which resulted in a very high (10%) rate of change between backups. As noted earlier, ESG Lab believes this is a higher change rate than is typical for most Exchange environments.

ESG Lab measured the data de-duplication rate over four backup events which yielded a reduction ratio of about five to one as viewed on the DXi-Series GUI, and projected those results over 60 events using Quantum’s sizing tool and the ESG Lab spreadsheet. As seen in Figure Nine, a reduction rate of ten to one is achieved after only fifteen events but, interestingly, the de-duplication curve flattens significantly and after sixty events a reduction rate of about 14 to one is observed. This example stresses the importance for customers to work with their vendors to properly size their backup data sets and the fact that data reduction “mileage may vary” based on the variables discussed previously.

These real-world examples also illustrate the fact that data de-duplication works differently than traditional compression technology (e.g., the hardware-based compression technology that is built into most modern tape drives). First, a data reduction rate of 50 to one using Quantum’s de-duplication technology is significantly better than the two or three to one reduction that is typical with traditional compression algorithms. Second, but just as important, the benefits of data de-duplication are best achieved over time—the more backups retained on disk, the more capacity can be saved. Put differently, data de-duplication provides some savings on a first or second backup, but savings of 10 to one or more take time.

Figure Nine: Measured and Projected Data Reduction - Microsoft Exchange Data



The DXi-Series offers eight distinct capacity offerings divided between its DXi3500 and DXi5500 appliances. The DXi3500 scales to protect from 250 GB up to about 4 TB of primary data, while the DXi5500 can protect up to about 11 TB. These models can scale appropriately to meet the capacity requirements of the customer segments on which they focus. With the addition of its comprehensive sizing tool, Quantum can confidently advise customers on the requirements necessary to protect their application data today and in the future.

Why This Matters

ESG Research indicates that the leading obstacle to disk-based backup deployment has been cost. Data de-duplication changes the economics of backup to disk by reducing the cost of data storage on disk.

ESG Lab has validated that Quantum data de-duplication and hardware compression can be used to reduce disk capacity up to 50 to 1 depending on the type of the data, the change rate of data between backups, the backup policies in use and the retention period. It is also clear that some data sets are more easily reduced than others. Even at 20 to 1, the potential savings are astounding—customers can effectively retain 20 TB of backup data for quick and reliable restores using only 1 TB of disk capacity. This results in lowering the cost per GB for backup data and enables companies to retain data exponentially longer for recovery purposes.

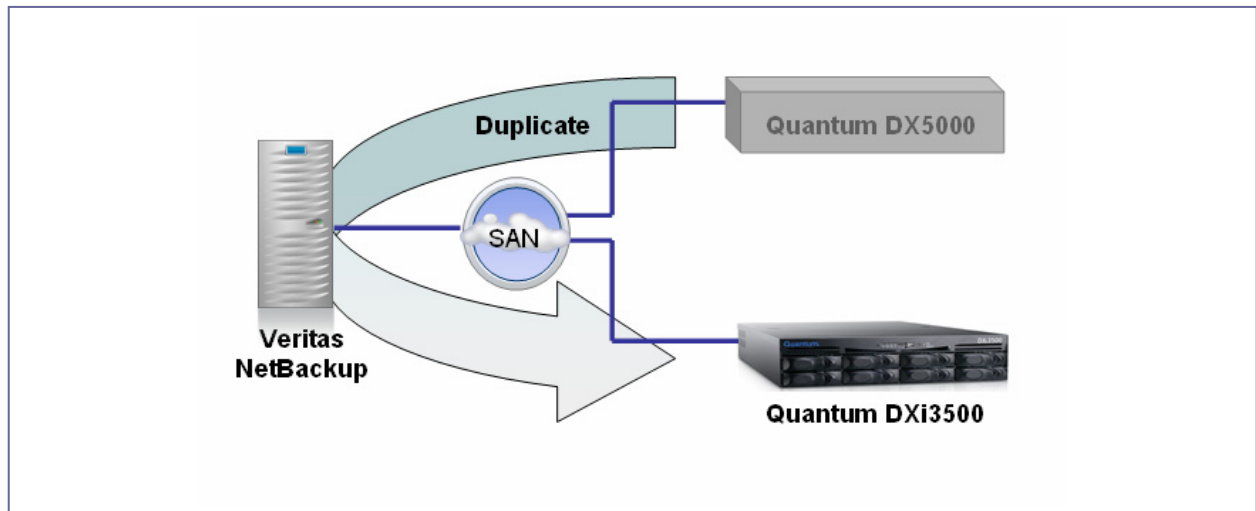
Performance

A tape drive can only perform one backup at a time. To get more than one backup job running at the same time, more tape drives need to be added and run in parallel. A disk-based backup and recovery solution with many random access disk drives emulating many virtual tape drives (up to 64 for the DXi-Series) can run many backup jobs at once. Much like the difference between a DVD and a VCR tape, the random access of disk also provides improved performance when locating files to be restored.

ESG Lab Testing

Real-world application data and Veritas NetBackup was used to assess the performance capabilities of a Quantum DXi3500. Backup images collected from a production IT environment were duplicated using Veritas NetBackup as shown in Figure Ten⁴. This method was chosen to avoid the possible side effects of file system performance overhead in the source file system (the DX5000) while maximizing the amount of data being written by Veritas NetBackup to the disk-based backup and recovery appliance (the DXi3500).

Figure Ten: The DXi3500 Performance Test Configuration



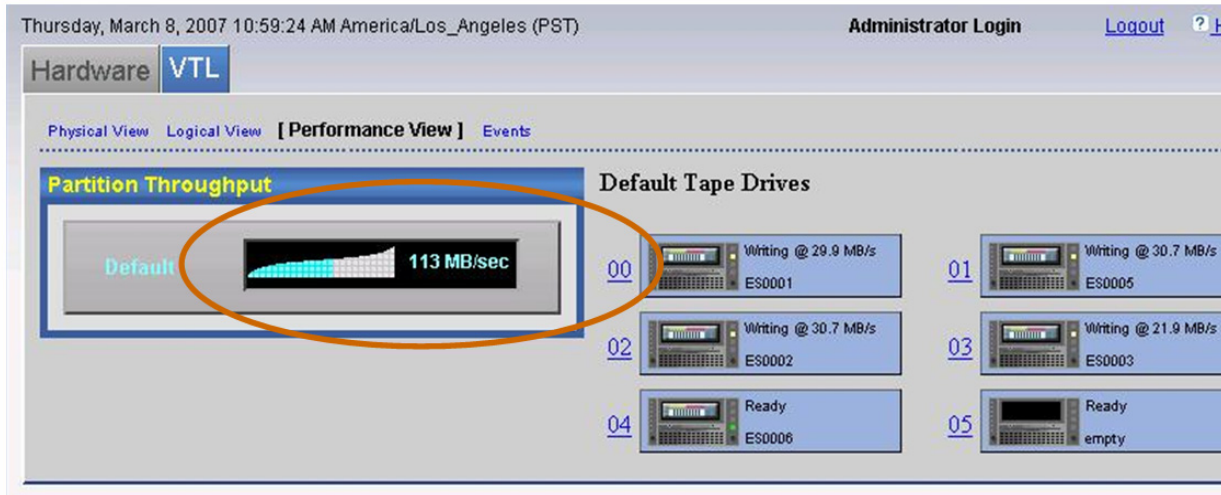
ESG Lab tested both multi-stream (four virtual tape drives) and single-stream test configurations to evaluate the backup performance capabilities of the DXi3500. The DXi3500 was tested with 4.2 TB of usable capacity using Veritas NetBackup version 5.0. Four consecutive days worth of full backups of real-world shared network and home directory data ranging in size from 67.9 to 71.9 GB were used during this phase of testing.

Single stream results were captured during the simulation of a fourth consecutive overnight backup job to assess the potential overhead of data de-duplication and compression. Multi-stream testing was performed with four Veritas jobs storing network share and home directory data on the DXi3500 in parallel. A restore of a single 114 KB file, a typical scenario in day-to-day IT operations, was also tested and took just 18 seconds to complete.

⁴ The home directory data set described previously in the data de-duplication section of this report was also used for this phase of testing.

The screenshot depicted in Figure Eleven shows a peak aggregate throughput of 113 MB/sec which was achieved during the four drive multi-stream test.

Figure Eleven: Multi-Stream DXi3500 Backup Performance



Results for the single and multi-stream performance tests are shown in Table Two.

Table Two: DXi3500 Backup Performance

	Peak Throughput (MB/sec)	Peak Throughput (GB/hour)	Average Throughput (GB/hour)	Capacity protected per 8-hour backup window (Terabytes)
Multi-stream (4 drives)	113	406	356	2.85
Single-stream (1 drive)	89	322	269	2.15

What the Numbers Mean

- The DXi3500 exceeded Quantum's claims of 290 GB/hour for both tests, although as would be suspected, the multi-stream configuration produced higher results (average Throughput of 356 GB/hour).
- A sustained aggregate throughput rate of 356 GB/hour can be used to protect 2.85 Terabytes of primary data in a single eight hour shift.
- ESG Lab audited a similar set of tests run on the DXi5500 and is convinced that it can sustain its specified rating of 800 GB/hour.
- An aggregate backup throughput rate of 800 GB/hour can be used to protect 6.4 TB of data in an eight hour shift.
- Each of the results presented in the table were achieved as in-line de-duplication and compression reduced the amount of data that needed to be written to disk.
- A single file restore completed in only 18 seconds. This highlights the performance advantage of random access disk compared to tape during ad-hoc restores. Restores from disk can be hundreds of times faster than tape depending on the location of data within a tape library and thousands of times faster if the tape is located off-site.

Why This Matters

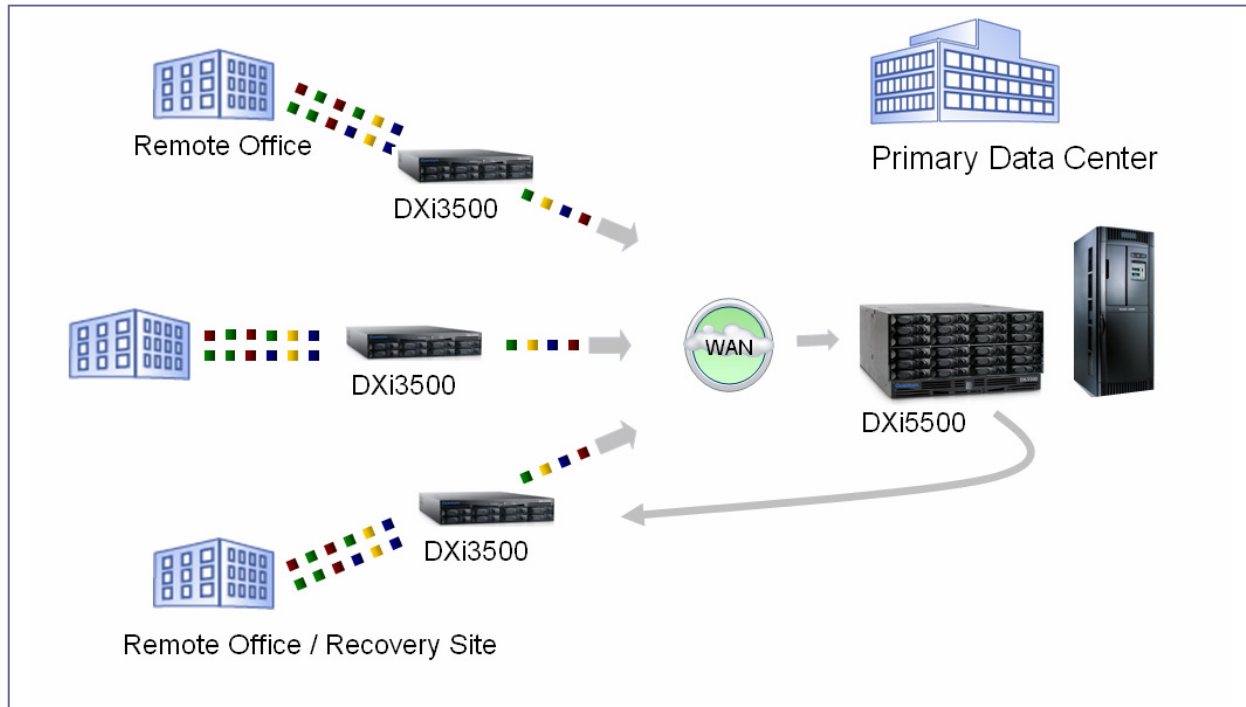
ESG Research has found that the number one priority reported by customers implementing a disk-based backup solution is performance. Backup administrators have been struggling for years to get nightly backups completed before business resumes in the morning. Quicker recoveries are needed to increase user productivity and meet service level agreements.

ESG Lab validated that Quantum's DXi3500 can easily sustain its specified aggregate backup throughput rating of 290 GB/hr and the DXi5500 can sustain 800 GB/hr as advertised. In other words, a single Quantum DXi-Series appliance can be used to back up up to 6.4 TB of data in an eight hour shift and restore a single file in a matter of seconds. Based on ESG Lab's experience in testing disk-based de-duplication solutions, these are extremely impressive performance characteristics for solutions of this class.

Remote Replication

Backup data residing on a DXi-Series appliance can be replicated over a wide area network for secure, network-based disaster recovery protection. Data de-duplication reduces the amount of data that needs to travel over the WAN by 10 to 50 times. Replication occurs automatically and without waiting for the backup jobs to complete. Many to one and bi-directional replication configurations are supported as shown in Figure Twelve. In this example, DXi3500s at three remote offices are configured to replicate automatically to a DXi5500 at a corporate data center. The DXi5500 at the primary data center is replicating critical application data to one of the remote sites.

Figure Twelve: Remote Replication for Disaster Recovery



A disaster avoidance strategy as shown in Figure Thirteen can be used to:

- Automate nightly backup and remote replication at remote offices.
- Eliminate the use of tape at remote offices where qualified IT staff may be in short supply.
- Enable easier off-siting of data by drastically reducing the amount of data traveling over the WAN.
- Reduce, or eliminate, the number of tapes traveling between sites.
- Provide centralized management and control of backup, archive and disaster recovery.
- Take a best practices approach to combining disk and tape solutions for performance, reliability, portability and energy efficiency based upon sound disaster recovery planning.
- Allow faster recovery from a site failure or disaster.

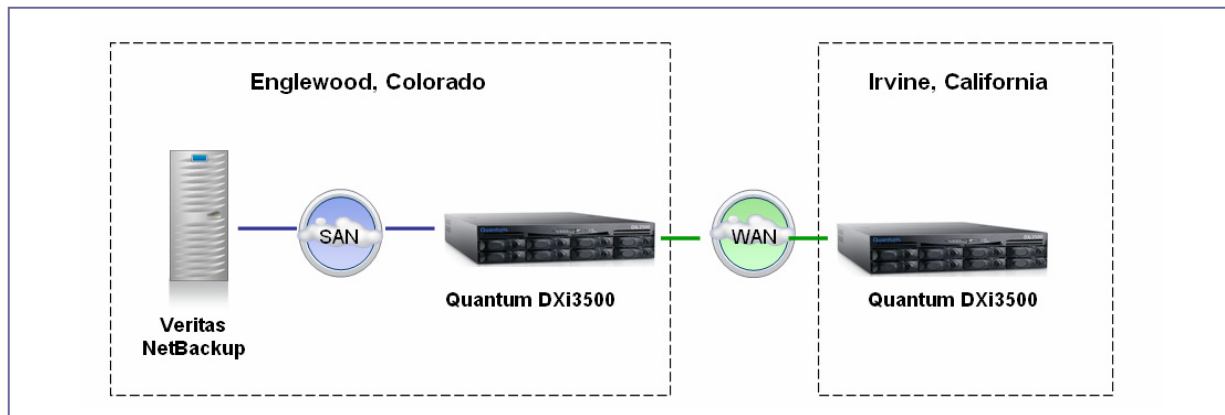
ESG Lab Testing

ESG Lab configured remote replication between DXi3500s in Englewood, Colorado and Irvine, California, as shown in Figure Fourteen. The DXi3500 web console was used to configure and monitor replication over a wide area network.

Testing began with a full backup of a directory containing 3 MB of screen shots taken by ESG Lab during the evaluation. The replication started automatically approximately five minutes after the backup had completed. The replication took 4 minutes to complete over the WAN. The DXi3500 console was used to learn that the replication took 4 minutes to complete and that data de-duplication had reduced the amount of backup data traveling over the WAN by a factor of three to one. ESG Lab noted that this rate of 3 to 1 is quite impressive for a set of already compressed .jpg files.

A screenshot was added to the directory on the media server and a second full backup was run. The second replication completed in 12 seconds as de-duplication drastically reduced the amount of WAN bandwidth required by sending only unique blocks found in the new screenshot over the wire.

Figure Thirteen: Testing DXi3500 Remote Replication



A site failure in the Englewood facility was simulated and files were restored from the DXi3500 in Irvine. Veritas NetBackup was used to scan the catalogue and verify the data integrity of the replicated backup data in Irvine. Veritas displayed the contents of the directory and ESG Lab verified that all of the screenshot files were intact and of the right size. Operations continued using the Quantum DXi3500 at the simulated disaster recovery site in Irvine. ESG Lab then configured the DXi3500s to simulate a fail-back of data protection services from the Irvine disaster recovery site to the Englewood facility. A final verification of the contents and integrity of replicated backup data was performed using Veritas NetBackup.

Why This Matters

Because of the large capacity of backup archives and the high cost of WAN bandwidth, traditional backup to disk solutions prevent customers from replicating the data to a remote site, forcing them to rely on tape-based data transport. Assuming the media is good, finding and restoring applications from tape after a disaster is difficult at best.

ESG Lab has verified that Quantum DXi-Series data de-duplication and hardware compression bring the same level of compelling economic value to WAN bandwidth optimization as it does to disk capacity. Customers can essentially reduce their bandwidth requirements up to 50 times. Reducing bandwidth not only reduces cost but also can be used to protect enormous amounts of data over long distances, which otherwise may have been impossible or required much more costly solutions.

ESG Lab Validation Highlights

- ☑ Veritas NetBackup jobs were streaming data to DXi3500 over an iSCSI interface only ten minutes after beginning the configuration using the web-based DXi-Series console.
- ☑ After the DXi3500 had been configured as a virtual tape library, Veritas NetBackup worked exactly as if it were using a real tape library.
- ☑ Veritas NetBackup jobs were run using VTL and NAS presentations over Fibre Channel and Gigabit Ethernet interfaces simultaneously to verify the flexibility of the DXi3500.
- ☑ A data reduction of 7.46 to one was measured when retaining four full backups of home directory files and a data reduction of 5.00 to one was measured when retaining four full backups of Microsoft Exchange data. These measured rates were projected over 60 backup events.
- ☑ Quantum's comprehensive sizing tool was compared to the ESG Lab sizing spreadsheet. This verified its accuracy and importance when consulting customers' expected data reduction experiences.
- ☑ ESG Lab verified Quantum's claims of up to fifty to one data reduction using home directory file data and validated the achievement of these results after only 33 backup events
- ☑ Multiple single and multi-stream backups were performed using Veritas NetBackup to verify Quantum's claims of backup performance up to 290 GB per hour for the DXi3500. An audit of a similar round of testing was used to validate claims of up to 800 GB per hour for the DXi5500.
- ☑ A single file restore retrieved from an 11.5 GB backup took only 18 seconds to complete.
- ☑ Remote replication was configured between a primary data center in Englewood, Colorado and a secondary data center in Irvine, California. Data de-duplication and compression reduced the amount of data traveling over the WAN for a first full backup by a factor of three to one. A subsequent replication after a second full backup completed in less than a minute.

Disk and Tape Considerations

- ☑ ESG Research indicates that early adopters of disk-based backup technology are using a combination of disk and tape for their backups. Disk backup solutions are being used for improved backup performance and quick and reliable restores. Backup software is being used to make duplicate copies of virtual tape images onto physical tape cartridges for long term and off-site archival. While Quantum's new data reduction capabilities can be used to cost-effectively move backup images to a remote site over the WAN, ESG Lab believes that tape will continue to play a strategic role for the foreseeable future. One of the reasons is the fact that lawyers, regulators and records managers who require portable copies of corporate digital assets for discovery purposes are used to dealing with tape.
- ☑ While a number of customers are using Quantum disk-based technology to improve the speed and reliability of backups for all of their application data, many are taking a more measured approach. Starting with a few applications that have exceeded backup windows or require many ad-hoc restores, these customers have begun to appreciate the benefits of having near-line copies on disk for quick and reliable restores. ESG Lab spoke with one such customer who has found a new and valuable use for Quantum's DXi-Series. Backups to near-line disk are being used as insurance policies before server and application upgrades.

Roadmap Recommendations

- ☑ While ESG Lab found that the DXi-Series GUI is intuitive and easy to use, Quantum indicates that ease-of-use improvements are planned. To that end, ESG Lab believes that system-level data reduction statistics displayed in graphical form over time would be a valuable addition to the home screen.
- ☑ While the new data reduction and remote replication capabilities provide an excellent platform for the automated protection of remote and branch offices, a smaller entry level configuration is recommended to accommodate remote offices with primary data capacities less than 250 GB. A larger system with more than 11 TB of primary capacity is also recommended for simplified deployment and management in enterprise-class shops. ESG has already seen Quantum expand its data de-duplication solutions set as a core feature of its StorNext data management and archival software solution and expects continued enhancements to the disk-based backup portfolio featuring this valuable technology in the future.

ESG Lab's View

ESG Lab has been tracking the progress of Quantum's disk-based backup and recovery solutions for several years, conducting its first hands-on testing of the company's DX100 enterprise VTL system in April, 2005. ESG Lab testing and discussions with end-users have confirmed that Quantum's VTL solutions fit seamlessly into existing backup environments while providing dramatic performance benefits compared to legacy tape-based methods.

During this second round of testing, ESG Lab validated Quantum's claims of data reduction savings of up to 50 to one using real-world file and e-mail data. Quantum's data de-duplication technology, combined with built-in hardware compression, not only delivered dramatic disk capacity savings as advertised, but was also used to reduce network bandwidth when replicating backup data over the WAN.

Quantum acquired ADIC, including the foundational variable length data de-duplication technology from Rocksoft, in late August, 2006. ESG was pleasantly surprised to learn that this patented de-duplication technology had been built into the DXi-Series platform when it was announced only a few months later in December, 2006. What was accomplished in a very short amount of time is very impressive. Quantum has already demonstrated it can leverage its significant customer-facing resources, global service and support scale and huge tape library install base to expand its presence in disk and software. Going forward, ESG Lab believes that the DXi-Series provides Quantum and its customers with an excellent foundation for the deployment of advanced data protection solutions.

ESG Lab believes that the combination of data de-duplication software and hardware compression provides a unique approach for optimizing disk and WAN bandwidth capacity. Quantum customers can now retain 10 to 50 times more data for fast and reliable restores and longer retention periods. Combined with the enhanced capacity, performance and flexibility of the DXi-Series platform, customers have a wide choice of right-size, right-priced configurations in a single appliance solution which can be used to deliver months of near-line protection for primary stores ranging in size from 250 GB to almost 11 TB.

Appendix

The configuration used during ESG Lab testing is listed in the following table.

Table Three: ESG Lab Validation Configuration Details

DXi-Series Disk Backup and Remote Replication Appliances	
Local Site Configuration, de-duplication and performance testing	Quantum DXi3500, 4,2 TB usable capacity
Remote Site Replication and failover	Quantum DXi3500, 4.2 TB usable capacity
Performance audit	Quantum DXi5500, 10.8 TB usable capacity
Media Server	
Server	Dual Xeon, 2.8 GHz, 4 GB RAM
Backup Software	Veritas NetBackup, version 5
Fibre Channel Host Bus Adapter	Emulex LightPulse, 2 x 4 Gbps
Networking	
Fibre Channel switch	Brocade SilkWorm 16 x 4 Gbps
Ethernet switch	Cisco Linksys 16 x 1 Gbps