Lab Validation
Report

Total Data Protection for the Distributed Enterprise

Quantum DXi Disk-Based Backup

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Contents

ESG Lab Reports

The goal of ESG Lab reports is to educate IT professionals about data center technology products for companies of all types and sizes. 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 Quantum.
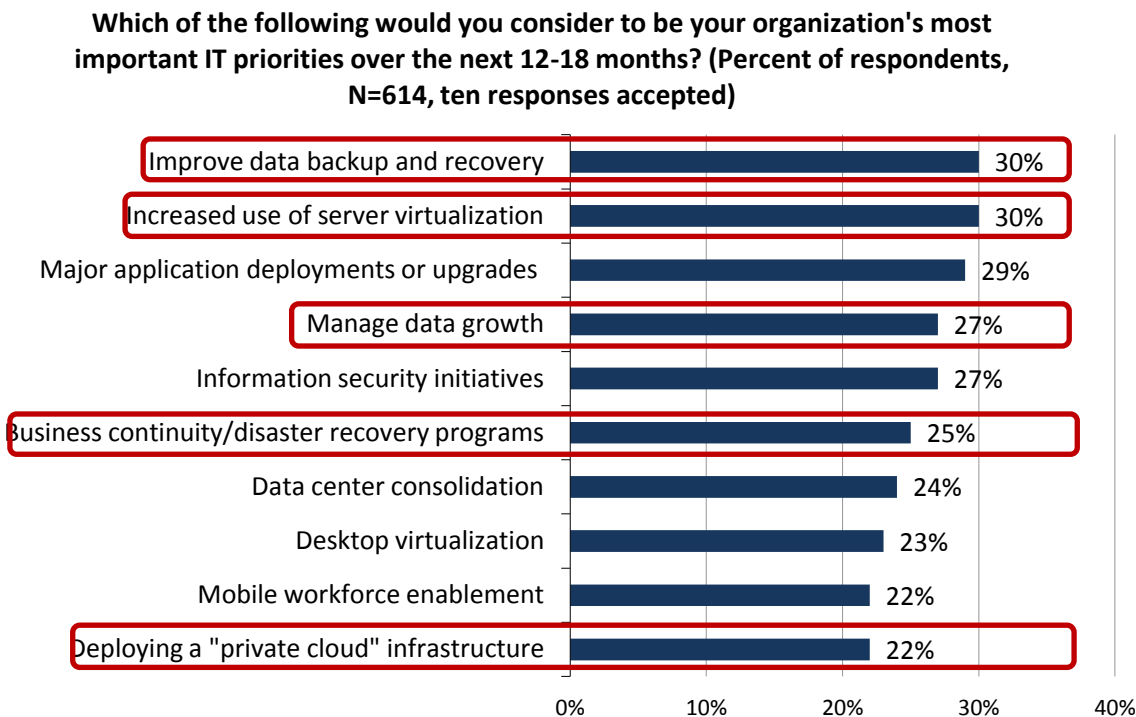
Introduction

This report examines Quantum's DXi disk backup solutions with an emphasis on high performance data center protection in the enterprise, multi-site, automated data protection services, and virtualized data protection. Areas of focus include support for remote and virtualized environments with the new DXi V1000 virtual appliance and Quantum vmPRO software, as well as bandwidth savings for WAN-constrained environments and disk-to-disk-to-tape (D2D2T) management using Quantum's Accent software with Symantec's NetBackup OpenStorage API (OST).

Background

When it comes to IT priorities, improving data backup and recovery tops the list once again.[1] Of course, the desire to increase usage of server virtualization and manage data growth while implementing business continuity measures only puts added pressure on those data protection imperatives. It's clear that increasing data growth and use of server virtualization is driving this need to address ongoing backup and recovery challenges. Private cloud deployments have also cracked the top ten this year. As these solutions become more important to the business, and critical data becomes more distributed, the need for solid business continuity and disaster recovery across the distributed enterprise increases.

*Figure 1. The Most Important IT Priorities for 2012*

Which of the following would you consider to be your organization's most important IT priorities over the next 12-18 months? (Percent of respondents, N=614, ten responses accepted)

	Percent
Improve data backup and recovery	30%
Increased use of server virtualization	30%
Major application deployments or upgrades	29%
Manage data growth	27%
Information security initiatives	27%
Business continuity/disaster recovery programs	25%
Data center consolidation	24%
Desktop virtualization	23%
Mobile workforce enablement	22%
Deploying a "private cloud" infrastructure	22%

Source: Enterprise Strategy Group, 2012.

Quantum Data Protection

The Quantum DXi-Series disk backup systems and software, combined with their Scalar tape libraries, provide a comprehensive data protection solution for organizations ranging from SMBs (Small-to-Medium Businesses) and ROBOs (Remote/Branch Offices) to large enterprises. From the data center to remote offices and virtual environments, Quantum supports geographically and technologically diverse customer environments, and can scale to meet both growing data and throughput requirements, providing a continuous data protection lifecycle from creation to retirement.

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[1] Source: ESG Research Report, *2012 IT Spending Intentions Survey*, January 2012.

Figure 2. Quantum Data Protection
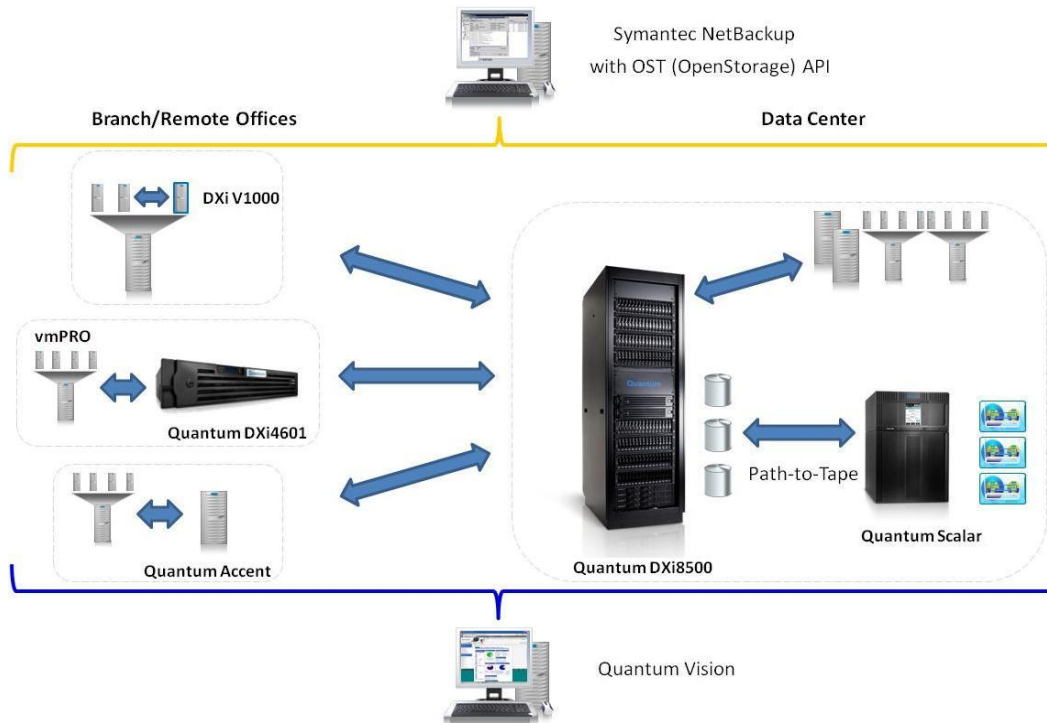
Quantum DXi systems all run Quantum DXi software. Quantum DXi 2.1 is the software that resides on the latest-generation DXi-Series appliances, providing enterprise class data protection. DXi 2.1 software uses inline data deduplication, reducing data stored on disk by up to 90%, while automatic bandwidth-optimized replication provides protection for ROBOs over existing WANs between DXi appliances and directly from NetBackup media servers using Quantum Accent. Multi-protocol support provides universal connectivity over CIFS, NFS, NetBackup OpenStorage (OST), and VTL over Fibre Channel and iSCSI. Simple licensing combines all software licenses including replication, direct tape creation, VTL, OST, and DXi Accent in one package. The Quantum data protection products examined in this report included:

- **DXi8500:** scales from 40 to 320TB of high performance capacity to grow with data protection needs.

- **DXi4601:** provides flexible capacity-on-demand, scaling from 4 to12TB to enable organizations to acquire only what they need, then expand with a simple license upgrade.

- **DXi V1000:** a virtual DXi appliance that enables the Quantum enterprise class feature/function set to run in a virtual machine for organizations without a dedicated hardware appliance.

- **Tested features of the DXi-Series:**

    o **DXi Accent:** optimizes remote backups from Symantec media servers using OST, deduplicates data before it is sent over the wire, and only sends unique data to be stored.

    o **DXi Advanced Reporting Tool:** provides robust reporting and monitoring of enterprise-wide backup, restore, and replication operations.

- **Quantum Scalar Tape Libraries:** provide long term retention for up to 16 PB of data managed in a single library.

- **vmPRO software:** works with DXi appliances to provide backup, restore, and disaster recovery protection for local and remote virtual environments.

- **Quantum Vision Management Software:** offers enhanced multi-site reporting across an entire data protection landscape, simplifying multi-site monitoring and enterprise diagnostics.

ESG Lab Validation

ESG Lab has followed the evolution of Quantum's disk-based backup systems since first testing the DX100 in 2004. ESG Lab examined the DXi7500 as the foundation of an enterprise edge-to-core data protection strategy in 2008 and DXi-Series appliances working in concert with the Symantec NetBackup OpenStorage interface in 2009.[2] This report describes the results of ESG Lab's latest testing of a broad spectrum of Quantum's DXi data protection product offerings.

High Performance Enterprise Data Center Protection

ESG Lab configured, automated, and tracked the protection and migration of enterprise data using Quantum disk and tape products as shown in Figure 3. A distributed enterprise data protection strategy was implemented using Quantum DXi V1000 and DXi4601 appliances located in simulated remote offices. Quantum vmPRO software with SmartView was used to provide granular file level backup and recovery of virtual machines. Remote office backup data was replicated to a DXi8500 in a corporate data center with data movement carried out by the DXi systems. The direct path to tape capabilities of the DXi8500 and the Symantec OpenStorage API were used to write a copy of a backup set, automatically, to removable media in a Fibre Channel SAN attached Quantum Scalar i500 tape library.

Figure 3. The ESG Lab Test Bed
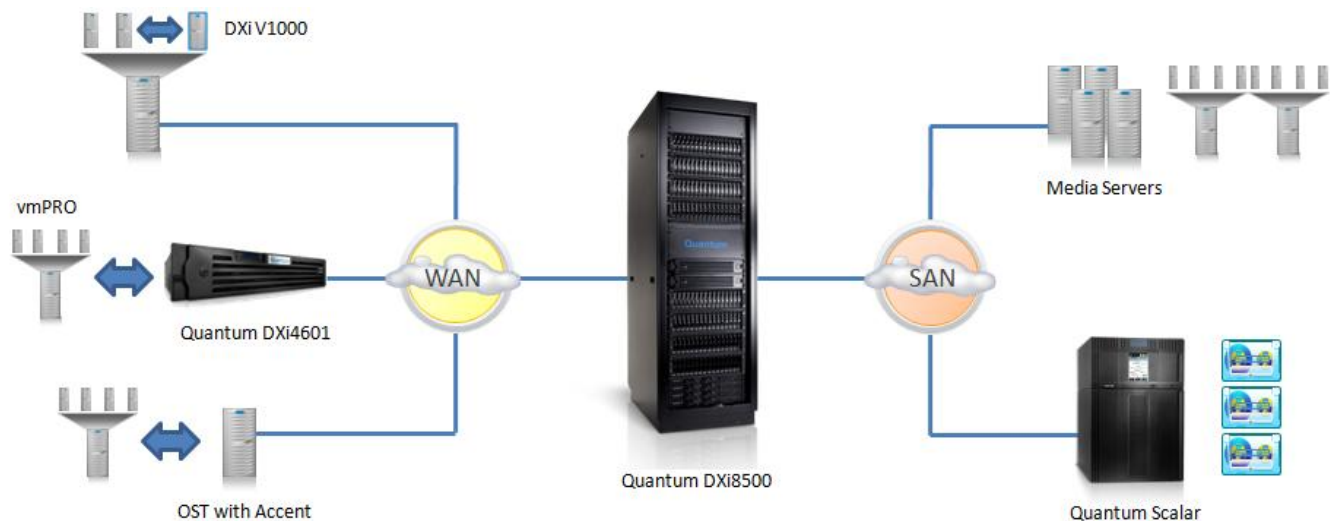

ESG Lab Testing

ESG Lab previously examined Quantum Vision software to confirm its ability to provide a central view of the Quantum tape and disk systems deployed within an organization, as well as the enhanced reporting capabilities covering deduplication, replication, and tape libraries.

A Symantec NetBackup master server in the corporate data center was used to control and catalog backup data residing within the distributed enterprise infrastructure. Quantum Vision software was used as a single point of infrastructure management for all Quantum disk and tape devices. In other words, while the backup software provided a single point of management for backup data, Quantum Vision provided a single point of management for backup infrastructure.

When ESG Lab logged into the Quantum Vision Web console, the devices view presented a visual representation of all systems under management. This global view not only provided a snapshot of the status and health of every backup device in this environment but also detailed the relationships between devices with the ability to see the amount of data transmitted between locations, as shown in Figure 4.

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[2] Source: ESG Lab Validation Report, *Quantum DXi-Series and Symantec NetBackup OpenStorage*, October 2009

Figure 4. Quantum Vision–Devices View
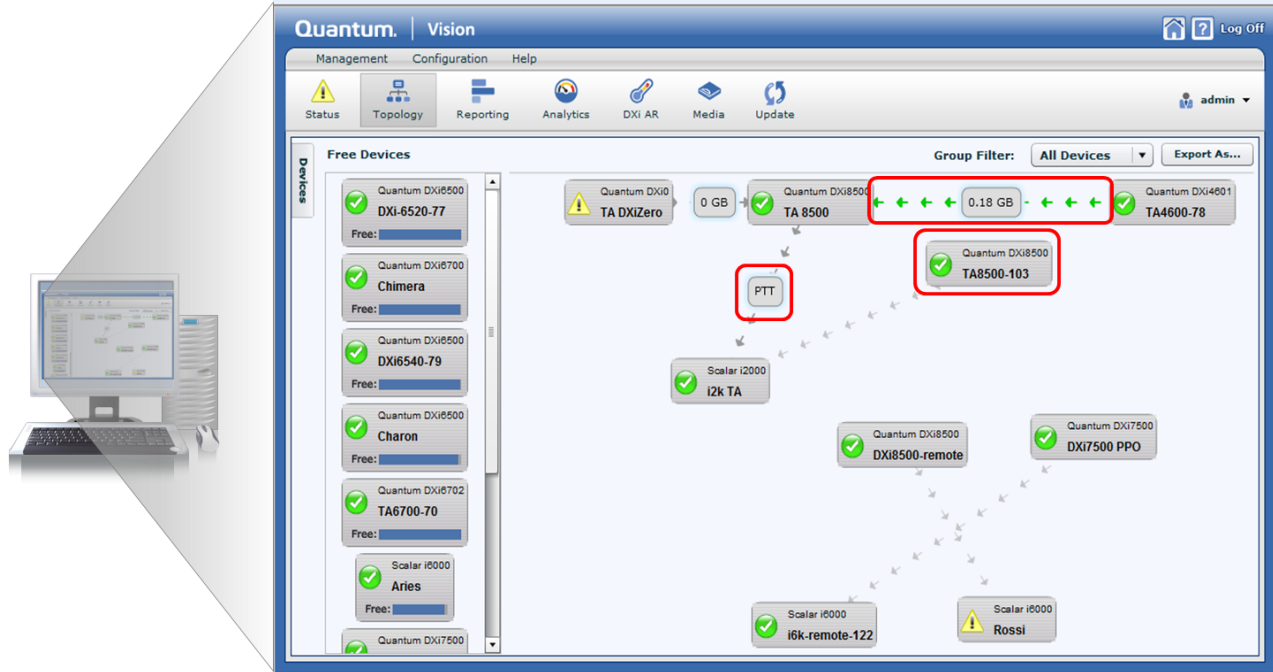
As shown in Figure 5, the Quantum Vision consolidated console presented a global list of all systems under management. In addition to enterprise-wide capacity utilization, Vision presented a snapshot of the status and health of every backup device and the ability to filter by status and quickly drill down into any system that required attention.

Figure 5. Quantum Vision–Consolidated Management
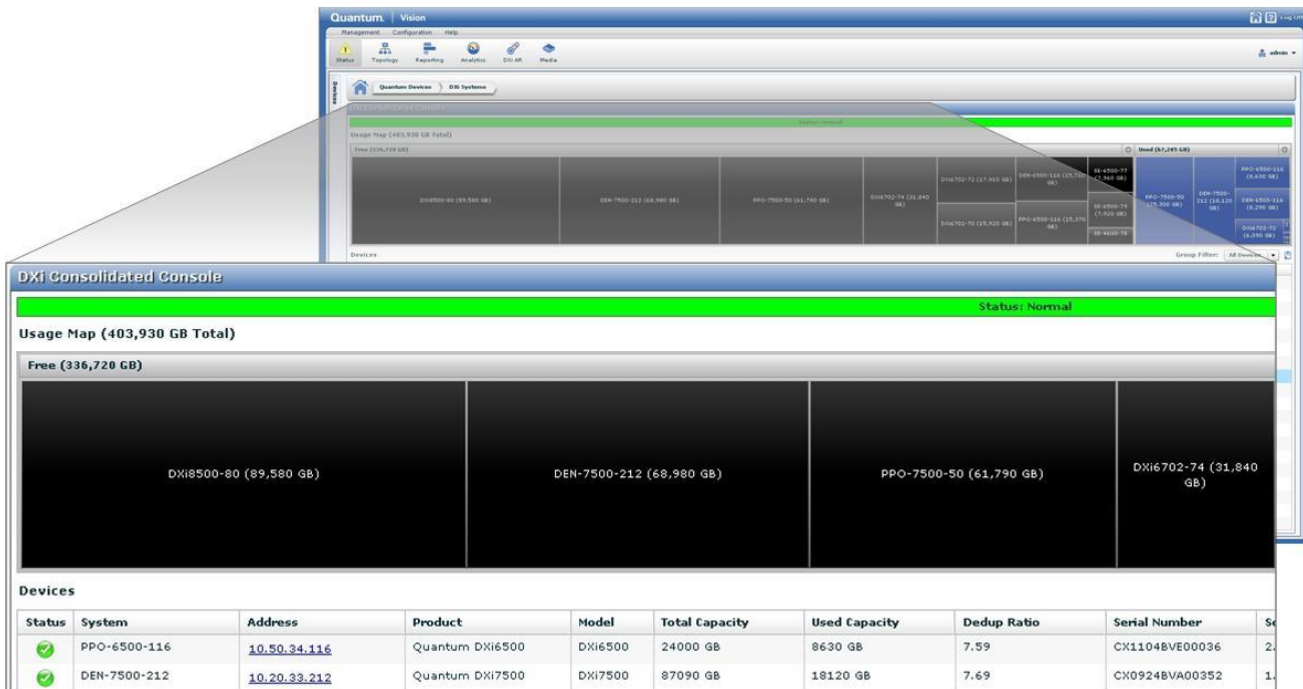
ESG Lab began with a performance characterization in a large scale data center environment. To examine the performance of the DXi8500 in an enterprise data center, ESG Lab performed a series of backups. Nightly full backups were simulated with data sets collected from a production Microsoft Exchange environment. Symantec NetBackup was used to perform the backups. Testing began with eight media servers backing up data from 16 disk arrays and was repeated with 12 media servers backing up the same data on the same 16 arrays.

A script was used to kick off 40 concurrent backup jobs using NetBackup. The DXi Advanced Reporting tool was used to monitor numerous DXi metrics. Throughput, Fibre Channel activity, disk utilization, and data reduction were all captured, as was CPU utilization. The first group of tests, with a single DXi8500 and eight NetBackup media servers, attained throughput of between 6.7 and 9TB per hour.

Quantum then reconfigured the NetBackup environment, adding four media servers and ensuring that the Fibre Channel connections from the servers to the DXi were balanced. Quantum repeatedly achieved results over 10 TB/hour, including the result shown in Figure 6.

Figure 6. The Quantum DXi8500 Backing up at 10.9 TB/hour
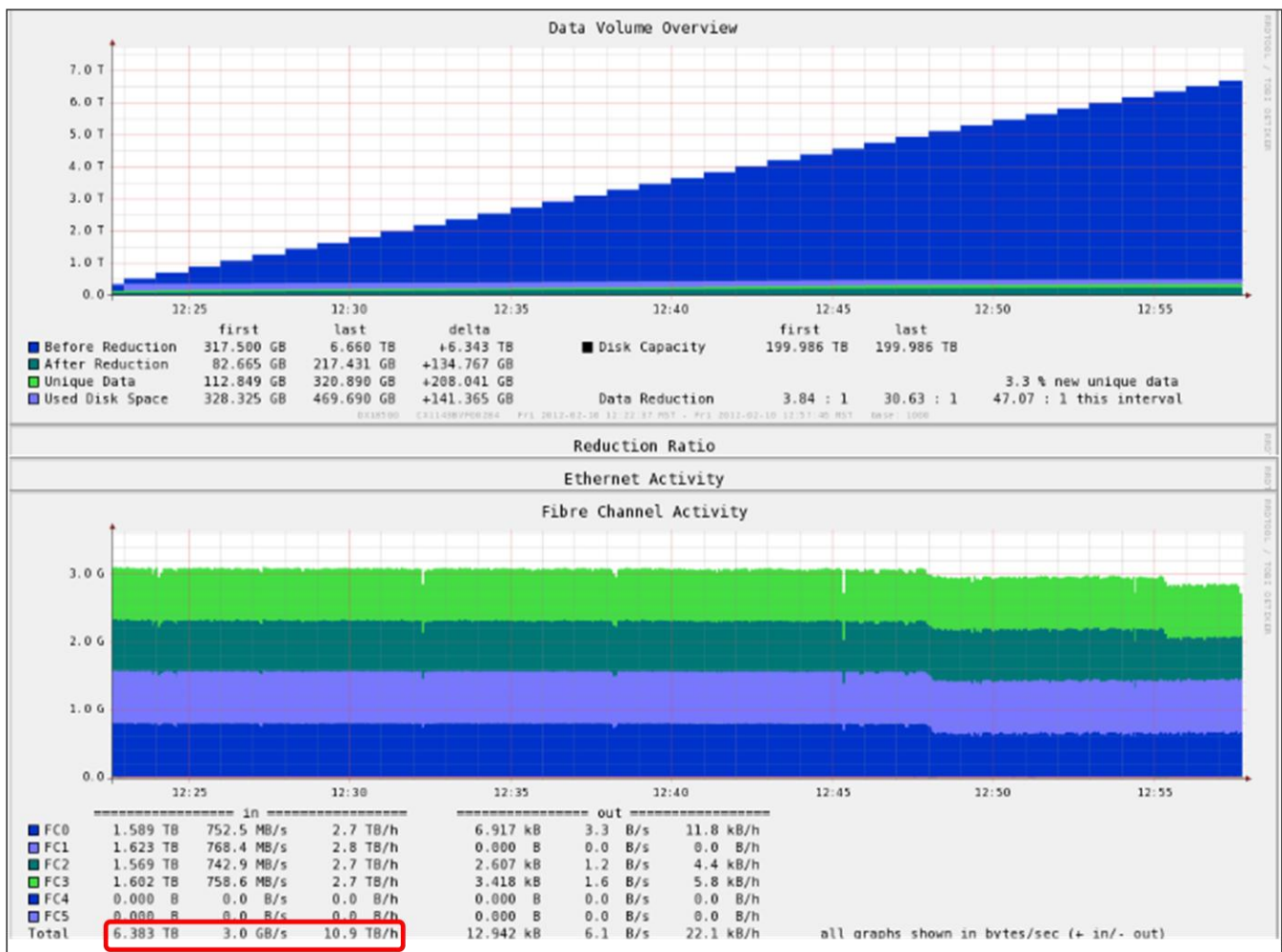
During testing, CPU utilization peaked at 25% during the highest throughput test run, hinting at the potential to drive even more throughput with sufficient server and disk horsepower to support it.

Table 1 shows the detailed results captured by ESG during on site testing and audited results of tests after Quantum added additional media servers.

Table 1. DXi8500 Performance Results

	Media Servers	Disk Arrays	GB/sec	TB/hr
Run 1 (Tested)	8	8	1.9	6.7
Run 2 (Tested)	8	8	2.5	9.0
Run 3 (Audited)	12	16	2.9	10.3
Run 4 (Audited)	12	16	3.0	10.9

What the Numbers Mean

- The DXi8500 was able to sustain 10.9TB/hour, well in excess of a conservative 8.8TB/hour claim. The variance in the throughput shows the importance of attention to the end user ecosystem and tuning.
- CPU utilization peaked at only 25%, indicating that the system had unused reserves that could potentially provide not only higher performance, but additional data movement and management.

Next, ESG Lab examined path-to-tape functionality for long-term data retention. As shown in Figure 7, a NetBackup storage lifecycle policy was configured to automatically perform direct path-to-tape replication from the DXi8500 to a Quantum Scalar i6000 tape library.

Figure 7. Configuring a Storage Lifecycle Policy
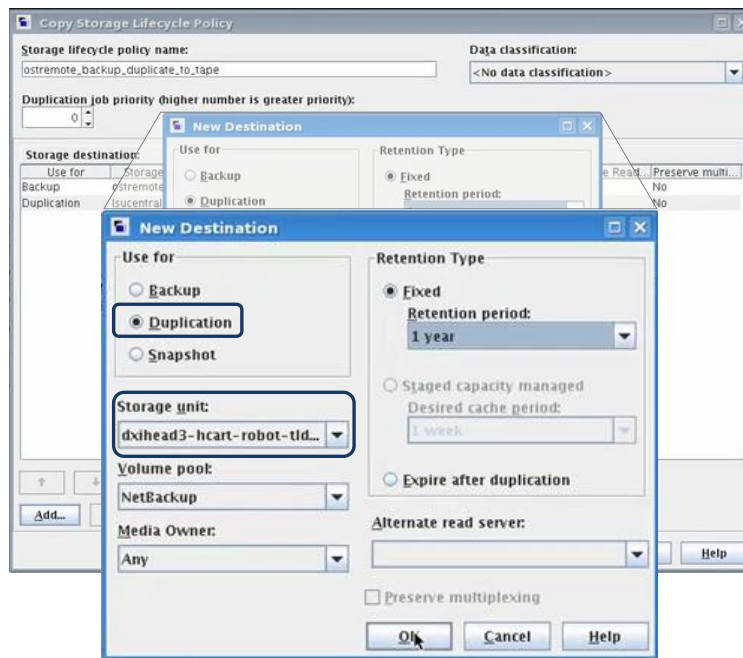
After completing the configuration process, an existing backup policy was modified to take advantage of the new storage lifecycle policy. A backup was started manually and monitored from the NetBackup console. As shown in Figure 8, NetBackup automatically started the path-to-tape replication after the backup job finished.

Figure 8. The NetBackup Activity Monitor
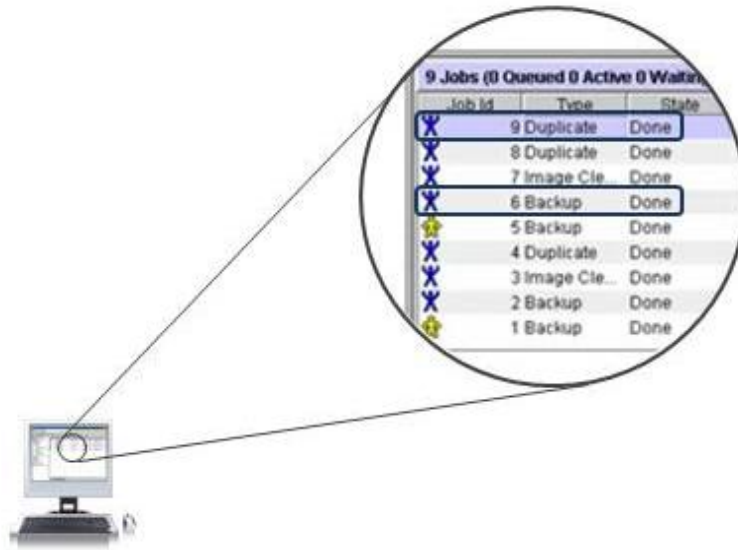
Finally, ESG Lab took a quick tour of the NetBackup catalog. As expected, both copies of the backup job were found and could be used for recovery from a single console and each copy had its own independent retention specification:

- A disk-based copy on the DXi8500 in the corporate data center, which is ideally suited for fast and reliable recovery of lost or corrupt files or entire data sets.
- A removable tape-based copy in the Scalar i6000, which is ideally suited for legal discovery, compliance, and transportation offsite for disaster recovery.

In this example, a 120 GB dataset was backed up to the DXi8500 and then replicated directly by the DXi8500 to the Scalar i6000. Replication to tape completed in 28 minutes.

Why This Matters

Ease of implementation and management has been reported to ESG as one of the top concerns when choosing a data deduplication backup solution. This will become more important as users leverage the technology to create integrated enterprise-wide backup environments that link systems via replication and integrated tape creation. ESG Lab has confirmed that Quantum Vision, as part of a distributed enterprise-class data protection solution, provides enhanced monitoring, reporting on capacity utilization, deduplication savings, and backup and replication performance over time, as well as a single point of management for Quantum disk and tape infrastructure.

According to ESG research, the number one IT priority reported by enterprises is to improve data backup and recovery, with managing data growth close behind.[3] IT administrators have been struggling for years to get nightly backups completed before business resumes in the morning. In addition, nearly one in four report that deploying a private cloud infrastructure to support an increasingly distributed enterprise is one of their top concerns.

ESG Lab validated through direct testing and an audit that Quantum's DXi8500 can easily exceed the aggregate backup throughput claimed by Quantum while using inline deduplication to reduce the amount of data stored on disk. In other words, a single Quantum DXi8500 disk backup system could be used to protect more than 87TB of data in an eight-hour shift (depending on the media server and storage configuration) and restore individual files in a matter of seconds. This means that users can meet the protection requirements of the largest enterprises, enabling optimal performance, regardless of data type, while reducing operational complexity.

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[3] Source: ESG Research Report, *2012 IT Spending Intentions Survey*, January 2012.

Multi-Site Automated Data Protection

Quantum data protection solutions address the needs of organizations of all sizes, from the largest data centers to small remote offices. ESG Lab examined remote backup in two scenarios: one using the Quantum vmPRO 4000 to protect virtual machines in a branch office, and the other using Symantec NetBackup with Quantum DXi Accent to back up directly from a small remote office to a DXi8500 in a central data center. Backup and WAN utilization efficiency were explored, as were granular recoverability for virtual machines and secure, encrypted replication.

ESG Lab Testing

First ESG Lab used Quantum vmPRO software to back up a Windows Server 2008 virtual machine to a Quantum DXi4601 backup appliance over a CIFS share. The DXi4601 was configured to automatically replicate backups to a DXi8500. The entire virtual machine was backed up. Figure 9 shows the Quantum vmPRO configuration wizard, setting up SmartMotion over CIFS.

*Figure 9. Configuring a Backup Using Quantum vmPRO SmartMotion*
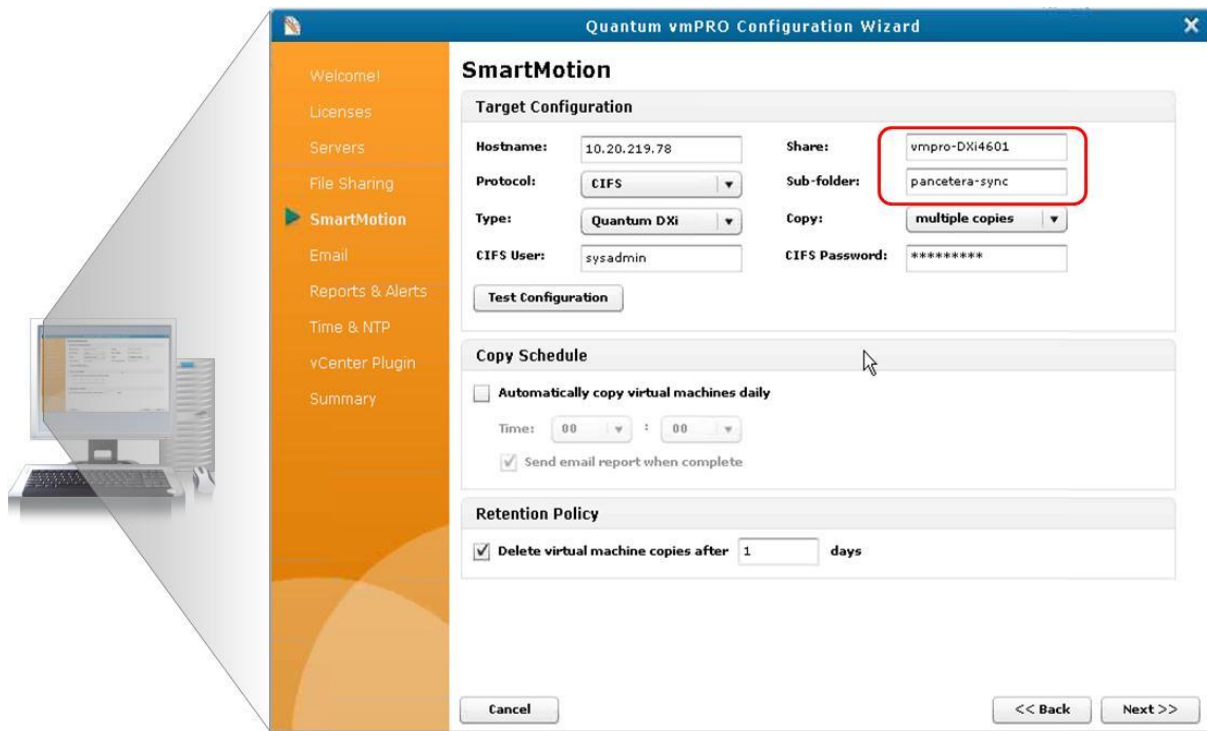
As seen in Figure 10, while 86.7 GB of data was transferred, only 4.7 GB was committed to disk on the DXi4601 after data reduction. During this single-threaded backup, throughput averaged 45.5 MB/sec and CPU utilization never exceeded 10%, indicating plenty of resources in reserve to be able to handle additional jobs.

Figure 10. DXi Advanced Reporting: DXi4601 After Backup Completed
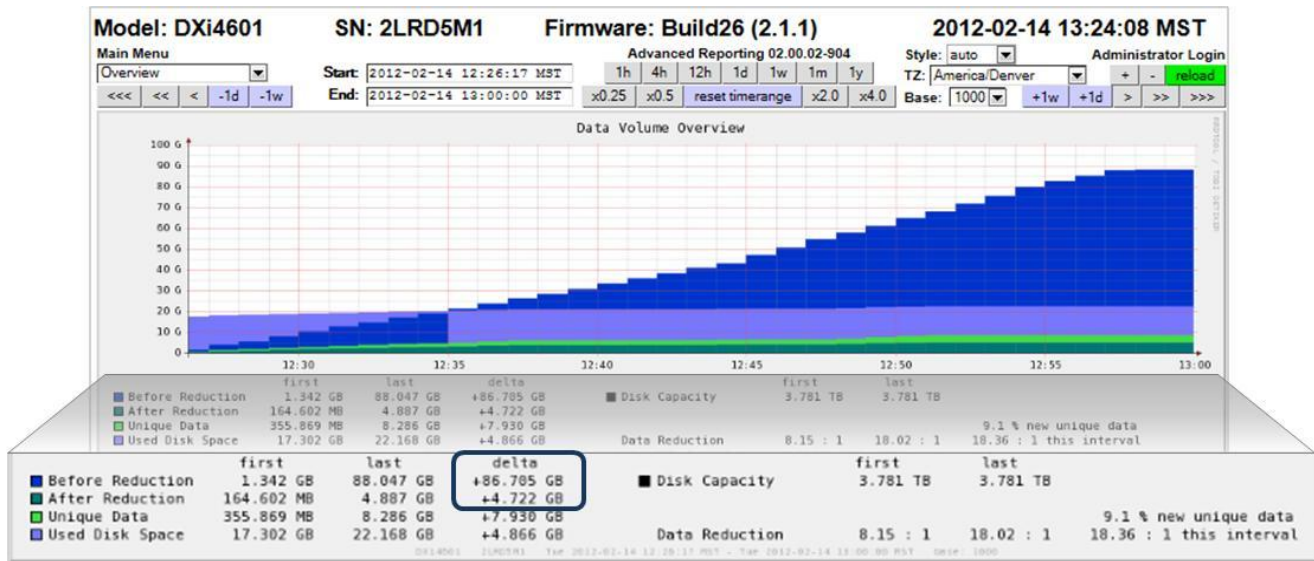
After this backup replicated to the DXi 8500, ESG Lab examined the Progressive Optimization I/O reduction statistics in the Quantum vmPRO console, shown in Figure 11. When Quantum vmPRO performs a backup, unallocated disk blocks are skipped, rather than reading and writing. For this backup, Progressive Optimization saved nearly 29GB of data movement, both to the local DXi4601 as well as to the DXi8500.

Figure 11. Quantum vmPRO Progressive Optimization Statistics
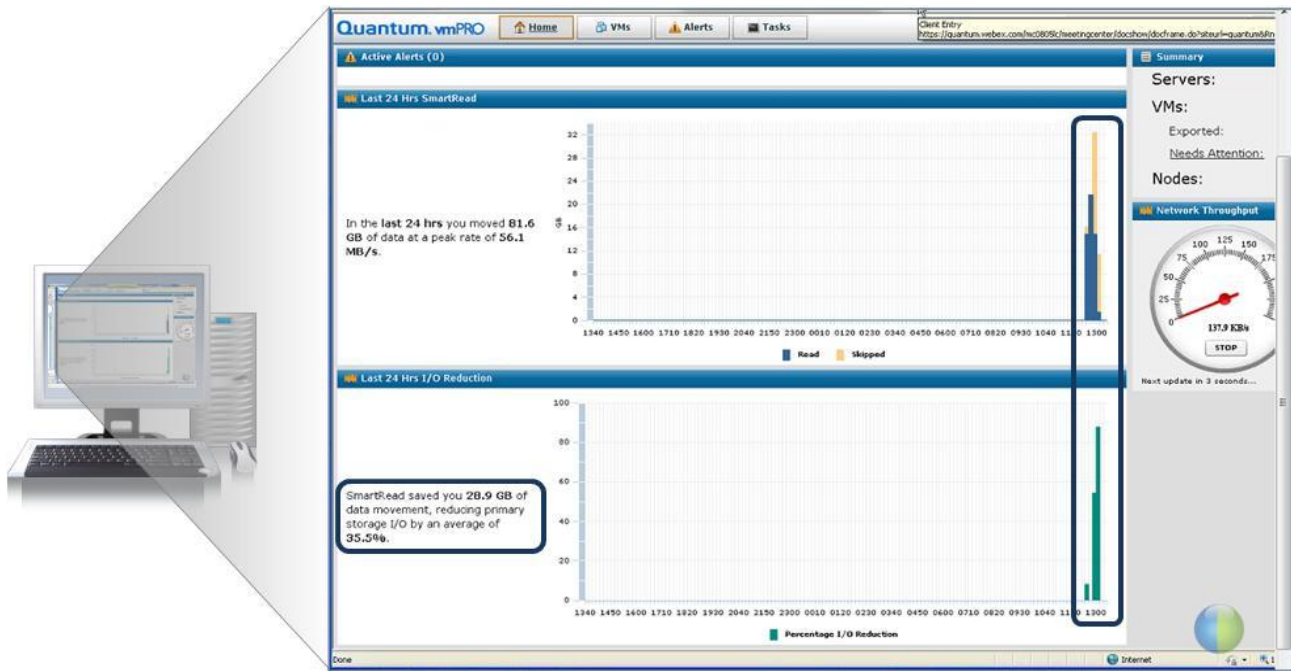
Next, ESG Lab tested a failover/failback disaster recovery scenario. Failover is accomplished by simply pointing Quantum vmPRO at the DXi8500 that the DXi4601 replicated to in the data center. Failback is where a remote office's backups must be restored to the same or a different location.

Failback was initiated from the DXi8500 in a simulated data center to another DXi8500. Figure 12 shows the failback traffic between the two systems. The 86.7GB dataset replicated in just over two minutes, and only 5.2GB of data was transferred across the wire. When the failback was complete, Quantum vmPRO software was used to perform a file-level restore from the failed-back dataset.

*Figure 12. Failback Traffic Between Two DXi8500s*
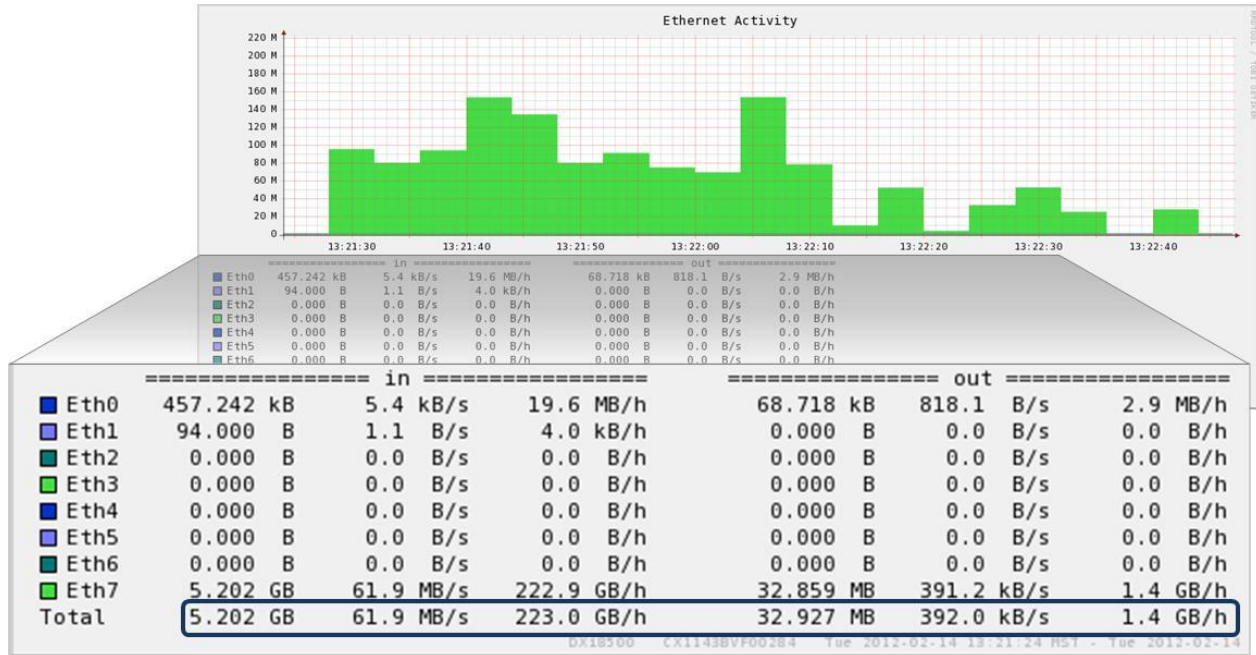
DXi Accent Software for the Media Server

Finally, ESG Lab looked at DXi Accent software to optimize backups across the WAN from a remote office using Symantec NetBackup with OST. DXi Accent installs on the NetBackup media server and executes the deduplication process in the backup data path. At the media server, DXi Accent examines the backup data stream and only sends unique data to be stored. This ensures less traffic between the media server and backup target and enables connections over high latency links. In these tests 126 GB Microsoft Exchange data sets (from consecutive days of full backups) were used as the source. The Exchange data had a daily rate of change of approximately 2.5%.

Figure 13 shows a remote backup of a 126 GB Microsoft Exchange dataset. This backup transferred the entire 126.75GB of data to the DXi8500.

Figure 13. Remote Backup Without DXi Accent
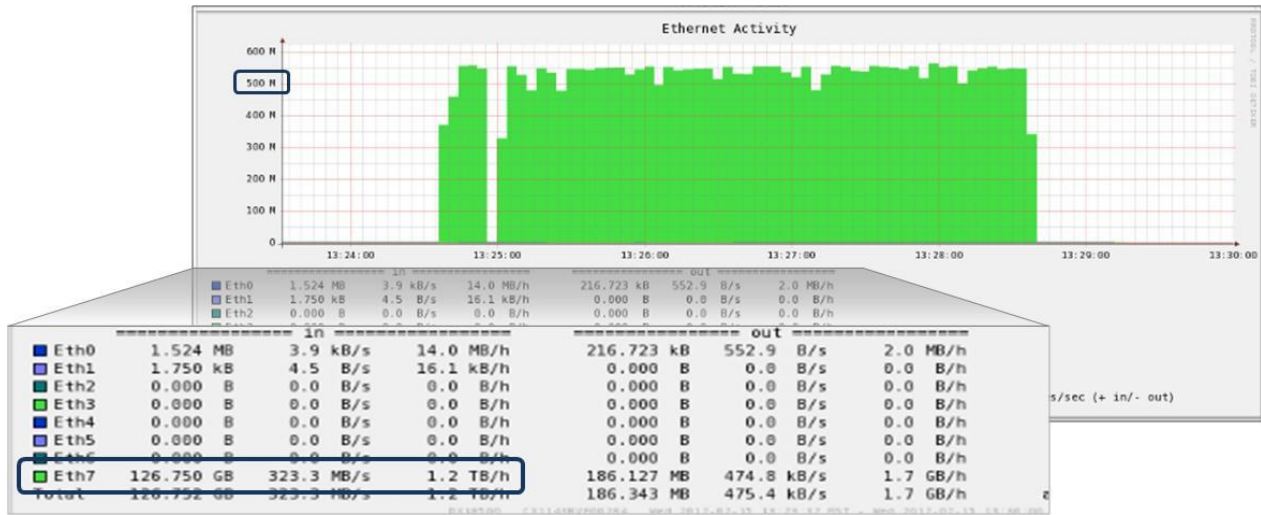
Next, the following day's data set was backed up with DXi Accent turned on. Figure 14 shows the next day's full backup with DXi Accent turned on. In this scenario, only 397 MB of data was transferred across the Ethernet link (which represented the unique data in the data set, plus metadata) in about 8 minutes, providing full protection and efficient deduplication without having to transfer the data to the DXi8500.

Figure 14. Remote Backup with DXi Accent
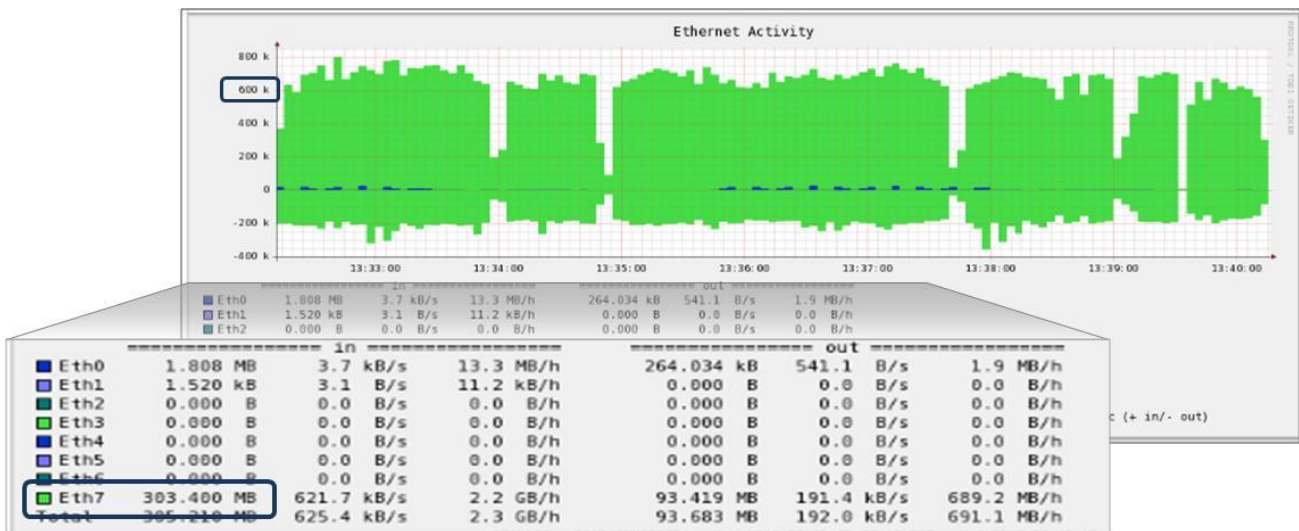
Finally, ESG Lab ran two simultaneous backup streams to the DXi8500. This test backed up 252 GB of data, transferring only 795 MB across the Ethernet, in 13 minutes. Put another way, this remote office could protect this entire 252 GB data set directly from NetBackup to a DXi8500 over a WAN link with less than 10 Mbps of bandwidth.

Figure 15. Remote Backup with Accent–Two Streams
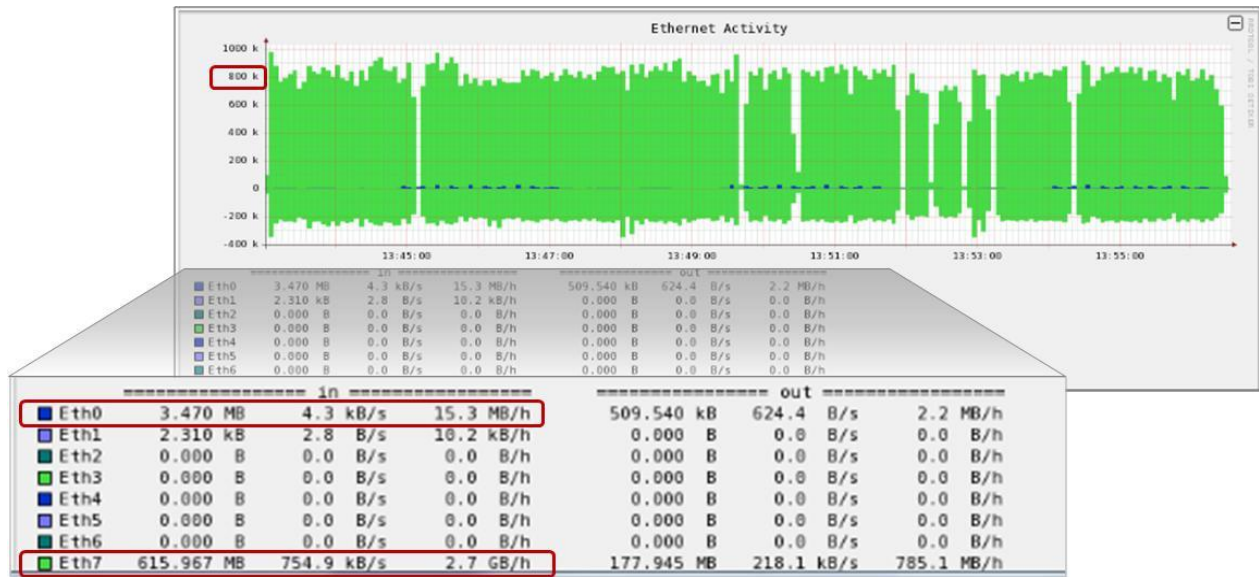
Why This Matters

A growing number of organizations are struggling to protect information assets residing in remote and branch offices. Most are concerned with the rate of data growth in locations that may lack the IT staff and expertise needed to manage traditional data protection methods. Many more are frustrated with the cost and complexity of managing tape media at remote offices. Disk-based backup and replication to a corporate data center reduces the complexity and risk, but until recently, it has been too expensive to justify due to the cost of the remote office disk capacity and WAN connectivity required.

Quantum DXi Accent is an integrated component of Quantum's DXi software platform. Organizations that have DXi systems in a central office or data center, and remote office data that needs to be protected, can use DXi Accent to provide bandwidth optimized deduplication, replication, and Symantec OpenStorage support—only where it's needed. ESG Lab found DXi Accent to be a simple, extremely effective solution for the protection of valuable information assets residing in remote and branch offices with limited budget for dedicated backup systems.

Virtualized Data Protection

One of the newest additions to the Quantum DXi family is the DXi V1000, which provides Quantum's enterprise-class data protection in a virtual DXi appliance with the same look and feel of Quantum's hardware-based DXi family, designed for fully virtualized environments. This section validates the DXi V1000's ability to protect a mixed environment of virtualized Windows and Linux servers. Also of interest was management of remote office protection using the Quantum vmPRO vSphere plug-in.

ESG Lab Testing

ESG Lab backed up a mixed virtualized environment consisting of three Windows 2008 virtual machines and three RHEL Linux virtual machines hosted in a VMware vSphere environment. The total data set was approximately

128GB. Figure 16 shows DXi Advanced Reporting on the DXi V1000 after the completed Backup of six virtual machines to the DXi V1000. The backup completed in approximately 39 minutes and the 128 GB data set reduced to 6.7 GB.

Figure 16. Backing up to the DXi V1000
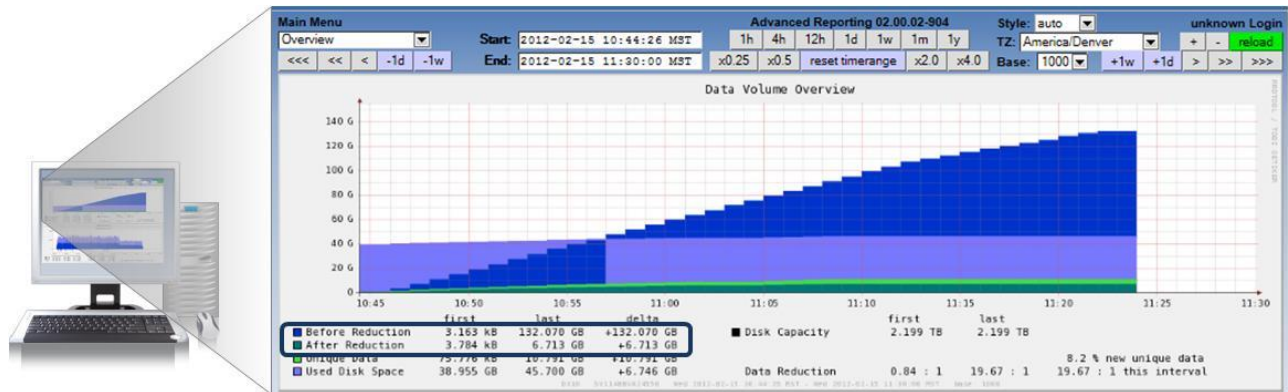
Next, the backup was replicated from the DXi V1000 to the DXi8500. The 128GB data set was replicated with only 7.16 GB unique data and metadata transferred across the Ethernet link.

Figure 17. Replicating From the DXi V1000 to the DXi8500
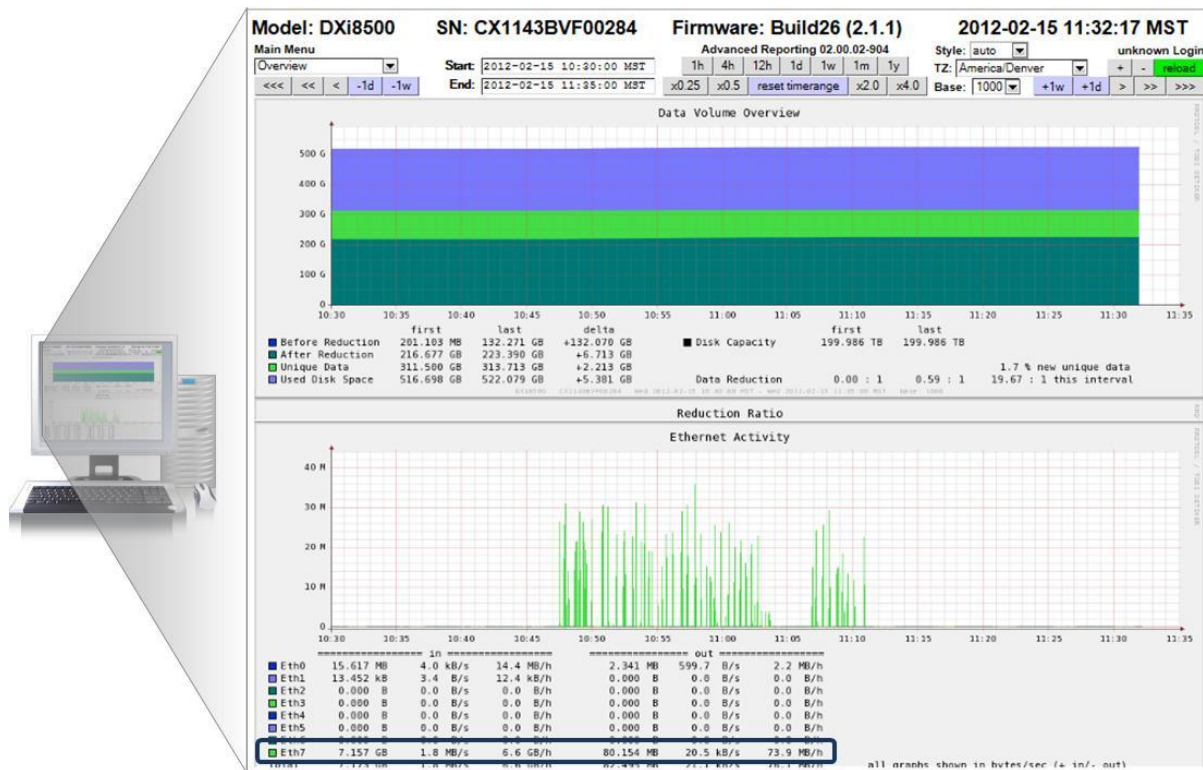
Next, ESG examined the Quantum vmPRO vSphere Plug-in. Figure 18 shows the plug-in with the three Linux virtual machines used in the preceding DXi V1000 test highlighted.

Figure 18. The Quantum vmPRO vSphere Plug-in
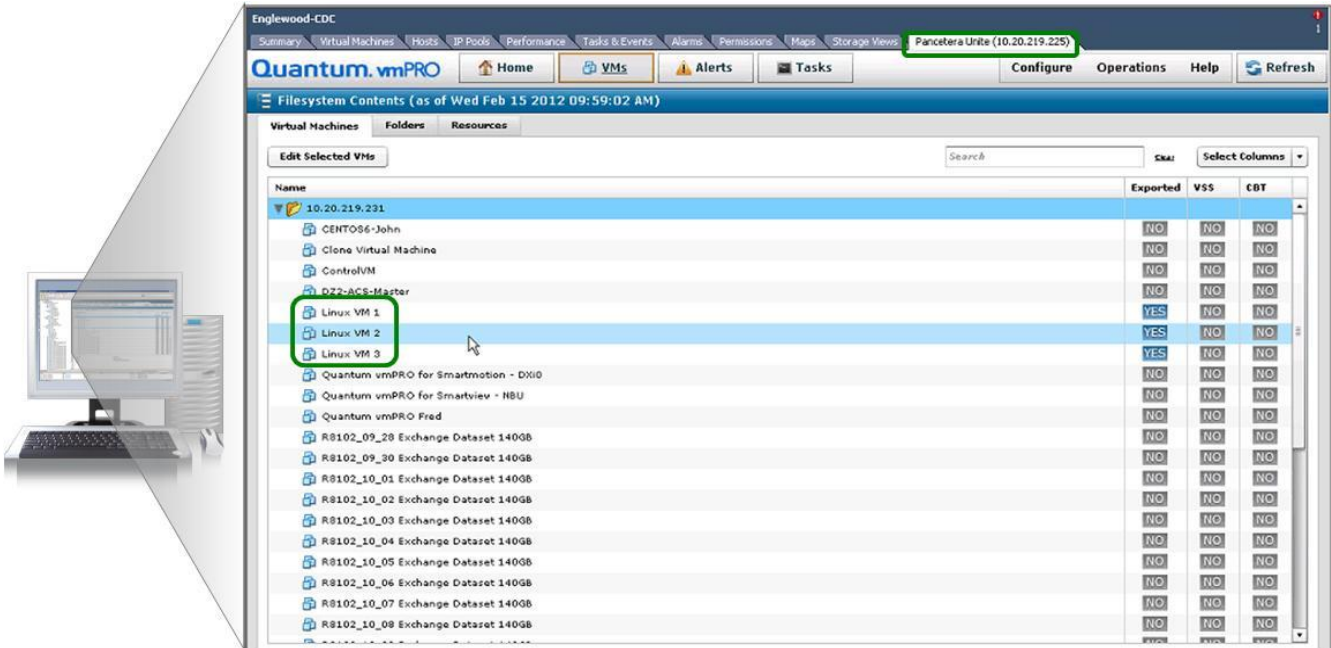
Why This Matters

Server virtualization has accelerated the pace of business by enabling such feats as nearly instant infrastructure provisioning with greater flexibility and availability. Recognizing these benefits, organizations are working to virtualize more production and mission-critical applications. At the same time, these organizations have little tolerance for business interruption and downtime; in a recent ESG research survey, 53% of respondents said they could tolerate less than one hour of downtime for tier-1 data without significant business impact.

ESG Lab has validated that with Quantum vmPRO software and the Quantum DXi V1000 virtual DXi appliance, IT administrators can protect VMs with high performance inline deduplication and optimized replication to a central data center—using the virtualized compute infrastructure they already have in place. This minimizes downtime and disruption to business users, while minimizing cost to IT and the business. No matter what the backup/restore SLA, Quantum has a solution to decrease recovery time and streamline the recovery process.

ESG Lab Validation Highlights

☑ Quantum Vision provided enhanced monitoring and reporting on capacity utilization, deduplication savings, and backup and replication performance over time, as well as a single point of management for Quantum disk and tape infrastructure.

☑ ESG Lab confirmed that the Quantum DXi8500 was able to sustain a multithreaded enterprise backup at 10.9TB/hour, significantly exceeding the aggregate backup throughput reported by Quantum (8.8TB/hour), while using inline deduplication to reduce the amount of data stored on disk.

☑ ESG Lab found the DXi family of disk backup systems, including the capacity-on-demand DXi4601 and the DXi V1000, integrated tightly with Quantum's existing DXi family as well as Symantec NetBackup with OST, offering a robust, comprehensive, data protection solution for large enterprises.

☑ Integration with Symantec's NetBackup OST API was seamless. ESG Lab was able use NetBackup to manage backup data through its entire lifecycle: from a remote office backup, replicated to a data center, then to tape for long-term retention.

☑ DXi Accent proved to be a simple, extremely effective solution for the protection of valuable information assets residing in remote and branch offices, while optimizing for moderate-bandwidth, high-latency links.

☑ ESG Lab used Quantum vmPRO software and the Quantum DXi V1000 virtual DXi appliance to seamlessly protect heterogeneous virtual machines in branch and remote offices and replicate their backups to a central data center.

Issues to Consider

☑ While Quantum vmPRO provides granular backup and restore capabilities and eliminates the need to restore an entire virtual machine when only one file is needed, a useful enhancement to the product would be a direct and automatic method to restore a single file to its target folder from the vmPRO console. To be fair, an administrator could log into the virtual machine which requires the individual file restore, share or export from Quantum vmPRO directly to that virtual machine, then restore the specific file to the folder where it belongs.

The Bigger Truth

The more things change, the more they stay the same—especially when it comes to data protection and its priority within IT. And, as virtual environments grow and enterprises struggle with growing data sets, the need to provide robust and high performance data protection becomes ever more urgent.

Organizations' data grows, but the window to protect and retrieve lost data only shrinks. Only solutions that work seamlessly within an entire IT ecosystem can truly provide the benefits of full data protection and disaster recovery. Those solutions need to be flexible enough to work with multiple backup software solutions and robust enough to handle the protection and security requirements for data at rest and in transit. Virtualization has introduced an additional challenge with its accelerated growth in recent years requiring solutions that can back up and restore not only entire virtual machine images but also reach into those images to back up and restore individual files as required.

Quantum's DXi data protection systems are designed as a comprehensive solution to answer the needs of customers that require protection of the distributed enterprise, from data centers to remote and branch offices. DXi 2.1 data deduplication reduces data stored on disk by up to 90%, saving significant CAPEX in storage requirements; this is significant since data protection tops the list in storage-specific investments over the next 18 months.[4] Quantum's support for fully virtualized environments enables customers to extend data protection to an environment that is becoming increasingly critical to ongoing business operations.

ESG Lab looked at the effective performance of the DXi8500 and found impressive sustained throughput, ideal for high demand environments. The DXi V1000 integrated tightly with Quantum's existing DXi family as well as Symantec NetBackup with OST. In addition, Quantum's DXi Accent software was impressive in its ability to reduce the bandwidth required for backup and operations across the WAN while optimizing for the high latencies expected from trans-continental WAN links. ESG Lab was also impressed with Quantum vmPRO and its ability to protect virtual machines all the way down to the file level.

Quantum has followed its strong lineage and produced an impressive suite of solutions to protect data in the largest physical and virtual data centers and the smallest remote offices. ESG Lab believes that the combination of ubiquitous inline data deduplication, enterprise class performance and scalability—along with comprehensive storage management software and services—provides a unique approach for optimizing data protection and recovery in today's distributed enterprise.

Quantum customers can retain more data for fast and reliable restores and longer retention periods while minimizing impact on backups. Quantum's DXi family offers a wide variety of configurations to satisfy a range of SLAs in a single solution, which can be used to dramatically increase the role of disk in the protection of critical data. Comprehensive infrastructure management and capacity planning provided by Vision ties the global environment together into a single, manageable entity. In sum, Quantum has set the standard for a complete, robust, and integrated data protection solution.

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[4] Source: ESG Research Brief, *2012 Storage Infrastructure Spending Trends*, January 2012.

Appendix

Table 2. ESG Lab Test Bed

Quantum Backup Infrastructure	Version
DXi8500	2.1
DXi4601	2.1
DXi V1000	2.1
Quantum vmPRO	2.3.0
Server/Storage Infrastructure	**OS/Version**
1x Dell R810-Intel Xeon L7545 1.87 GH CPU, 64 GB RAM	VMware vSphere, ENT Windows Server 2008, R2Linux Version 5.3
12x Dell R710–Intel 5500 2.4GHz CPU, 16GB RAM	
16x LSI Logic 4980, 8TB, RAID 5	
Backup Software	**Version**
Symantec NetBackup	7.1