

Technical Validation

# Quantum DXi9000 Deduplication Appliance

## Efficient Data Protection for Modern Data Centers

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## Contents

Introduction .....	3
Summary .....	3
Background .....	3
Quantum Data Protection and DXi9000 .....	4
The Quantum DXi9000 Series .....	4
ESG Technical Validation.....	6
Performance and Scalability .....	6
ESG Testing.....	6
Security, Flexibility, and Efficiency.....	11
Security .....	11
ESG Testing.....	11
Flexibility .....	12
Efficiency .....	13
The Bigger Truth.....	14
Appendix .....	15

### ESG Technical Validations

The goal of ESG Technical Validations is to educate IT professionals about information technology solutions for companies of all types and sizes. ESG Technical Validations 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 objectives are to explore some of the more valuable features and functions of IT solutions, show how they can be used to solve real customer problems, and identify any areas needing improvement. The ESG Validation Team’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.

## Introduction

This report examines [Quantum’s](#) DXi9000 enterprise disk backup appliance, with a focus on how the DXi9000 fits into Quantum's data protection portfolio. ESG examined the performance, deduplication, replication, data availability, scalability, and encryption capabilities of the DXi9000. Also examined: Disaster recovery solutions with Quantum’s Scalar tape libraries and integration with independent software vendor (ISV) offerings such as Veeam’s Data Mover Service (VDMS), Symantec's NetBackup OpenStorage (OST), Auto Image Replication (AIR) and Granular Restore Technology (GRT).

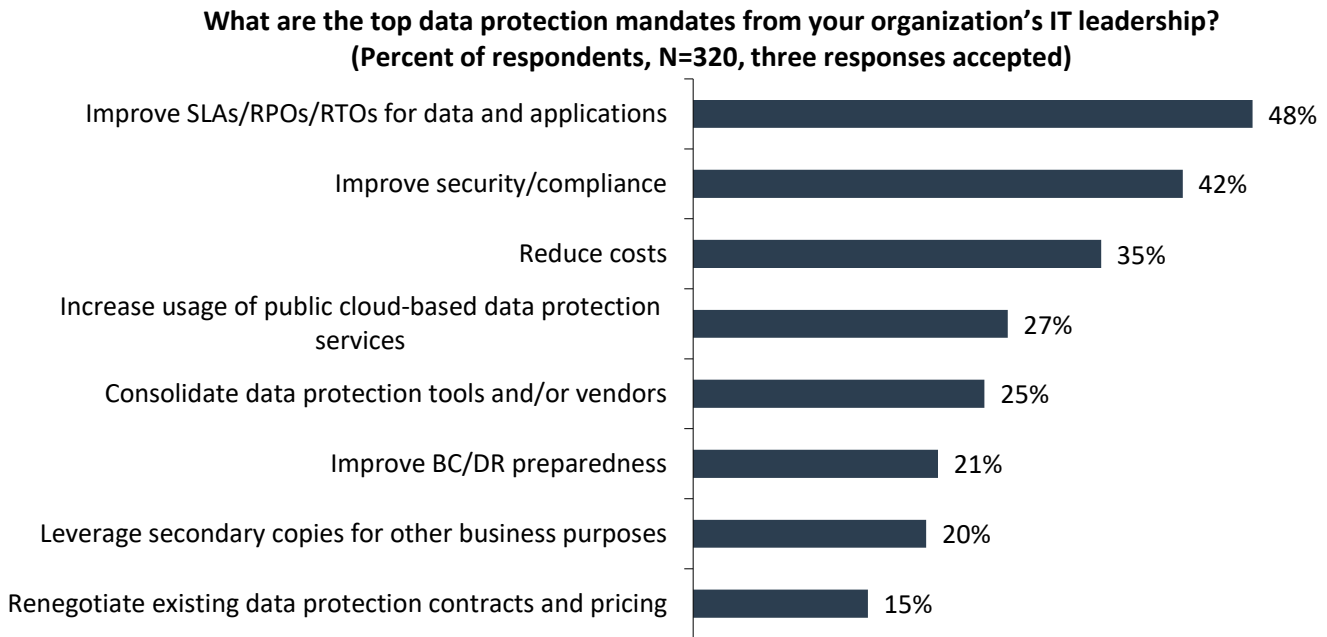
## Summary

ESG validated that a Quantum DXi9000 was able to sustain more than 38.4TB per hour—with DXi Accent—of multithreaded enterprise backup throughput with pay-as-you-grow capacity scalability. The DXi9000 demonstrated advanced security, virtualization, data protection, and management features suited to a wide range of requirements for backup and disaster recovery (DR). ESG confirmed that DXi variable-length deduplication provided significant savings in disk capacity and network bandwidth as compared with fixed-length deduplication. The tight integration of the DXi9000 with backup applications can help customers’ data protection needs across physical and virtual environments.

## Background

As shown in Figure 1, ESG research indicates that improving SLAs, recovery point objectives (RPOs), and recovery time objectives (RTOs) are the most-cited data protection mandates coming from IT leadership.<sup>1</sup> Considering this in combination with the similarly high priorities to improve security and compliance, while reducing costs, adds emphasis to those data protection imperatives. As these areas of IT focus become more important to the business, and critical data becomes more distributed, the need for solid business continuity and disaster recovery systems increases.

**Figure 1. Top Data Protection Mandates**



Source: Enterprise Strategy Group

<sup>1</sup> Source: ESG Master Survey Results, [2018 Data Protection Landscape Survey](#), November 2018. All ESG research references and charts in this Technical Validation were taken from this master survey results, unless otherwise noted.

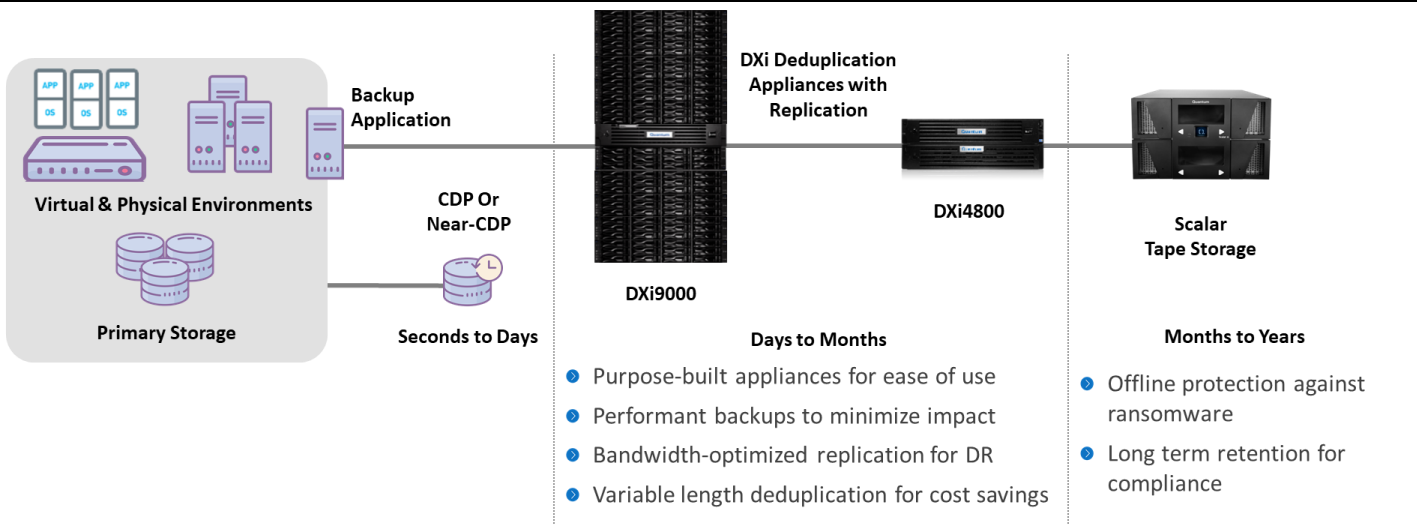
## Quantum Data Protection and DXi9000

Quantum delivers a comprehensive digital asset storage portfolio. Quantum’s data protection portfolio includes DXi-Series enterprise disk backup appliances and Scalar LTO libraries to provide a solid combination of backup and archiving.

Quantum supports geographically and technologically diverse customer environments, from the data center to remote offices and virtual implementations, and it can scale to meet growing data and throughput requirements, providing a continuous data protection lifecycle from creation to retirement.

DXi9000 is the newest member of the Quantum data protection family designed to provide simple, cost-effective enterprise-scale protection. Quantum designed the DXi9000 to provide performance of up to 38.4TB per hour and up to 20.4PB of logical capacity in only 10U of rack space. DXi9000 is compatible with leading backup software, and up to 128 partitions can present themselves as CIFS/NFS shares, VTLs, or OST LSUs for flexibility. Replication, encryption, full hardware redundancy, and an integrated path to tape are standard features, helping to keep costs low and predictable.

**Figure 2. The Quantum Data Protection Portfolio**



Source: Enterprise Strategy Group

### The Quantum DXi9000 Series

Like all Quantum DXi systems, the DXi9000 Series runs Quantum DXi 4.0.1 software, which resides on the latest-generation DXi-Series appliances, providing enterprise-class data protection. DXi software uses patented variable-length, inline data deduplication, reducing data stored on disk by up to 90%, while automatic bandwidth-optimized replication provides a choice of protection approaches for remote sites over existing networks.

Quantum DXi9000 is designed to provide high performance, flexible, pay-as-you-grow disk backup storage leveraging numerous unique differentiating features and technologies:

- **A Broad Capacity Range with Pay-as-you-grow Scalability**—The DXi9000 offers 51TB to 1.02PB usable capacity in 51TB licensable capacity-on-demand (CoD) increments, delivering higher density and greater power-efficiency per terabyte than the previous generation, and proactive data growth management with non-disruptive capacity upgrades.
- **Enterprise-class Performance**—Up to 38.4TB/hour performance with Symantec OST Accent enables organizations to meet evolving backup windows with predictable performance.

- **Improved Data Availability**—This is achieved via Dynamic Disk Pools (DDP) and data integrity checking. Dynamic Disk Pools (DDP) improve system performance during rebuilds without sacrificing availability.
- **Comprehensive Data Security**—12TB self-encrypting drives (SEDs) provide hardware-based data-at-rest encryption, allowing users to enable encryption with zero impact to system performance. Data is also AES 256-bit encrypted during replication.
- **Complete Lifecycle Management**—Integration with independent software vendors (ISVs) provides support—as with Symantec OpenStorage (OST)—and convergence of backup and disaster recovery—as with Symantec Automatic Image Replication (AIR). Integrated path-to-tape (PTT) provides offsite DR, archive, and compliance capabilities.
- **VM Instant Recovery**—DXi and Veeam integration enables the Veeam Data Mover Service (VDMS) to move data between the Veeam proxy server and the DXi appliance. The VDMS communicates with the Veeam proxy server to manage the data flow between Veeam and DXi, reducing the time it takes to create synthetic full backups and run VM instant recovery. DXi appliances are certified through the Veeam Ready program as backup repositories and are Veeam Ready Integrated Storage Solutions. This is the highest level of certification Veeam provides for storage products.
- **Universal Connectivity and Presentation Options**—Multi-protocol support provides simultaneous support for CIFS, NFS, VDMS; Accent distributed deduplication with Veritas OST, RMAN, and Linux OS; and OST over Ethernet, and VTL via FibreChannel.
- **Simple Licensing**—All required software licenses including replication, direct tape creation, VTL, OST, and DXi Accent are combined in one package.

Additional Quantum data protection products and technologies include:

- **DXi4800**—This technology scales from 8TB to 171TB of usable storage using capacity-on-demand, leveraging SSDs for performance and the same feature set as the DXi9000.
- **DXi V-Series**—These virtual DXi appliances enable the Quantum enterprise-class feature/function set to run in a virtual machine for organizations without a dedicated hardware appliance. DXi V2000/V4000 models scale easily from 2TB to 24TB useable capacity, using capacity-on-demand growth.
- **DXi Accent**—Optimizing remote backups from Symantec media servers using OST and Oracle database servers using RMAN, DXi Accent deduplicates data before sending it over the wire and only sends unique data.
- **DXi Dynamic Application Environment (DAE)**—Provides the ability to host an application directly on the DXi server node. Certified applications such as a NetBackup media server or Veeam proxy server can run directly on the DXi, effectively creating a converged backup appliance, and eliminating the need for additional server hardware.
- **Quantum Scalar Tape Libraries**—These provide long-term retention for TBs to PBs of data.
- **Quantum Vision Reporting Software**—This feature offers enhanced multi-site reporting across an entire data protection landscape, simplifying multi-site monitoring and enterprise diagnostics. DXi Advanced Reporting Tool provides robust reporting and monitoring of enterprise-wide backup, restore, and replication operations.

- **Oracle RMAN Integration**—Oracle administrators can leverage Quantum DXi to enable business continuance, improved RPOs with increased retention, data security with no performance penalty, shared deduplication between Oracle data protection products and traditional batch backup software, server-less path to tape, and automated replication, all using familiar Oracle data protection tools and techniques.
- **AccentFS**—Distributed deduplication for any backup application hosted on a Linux server.

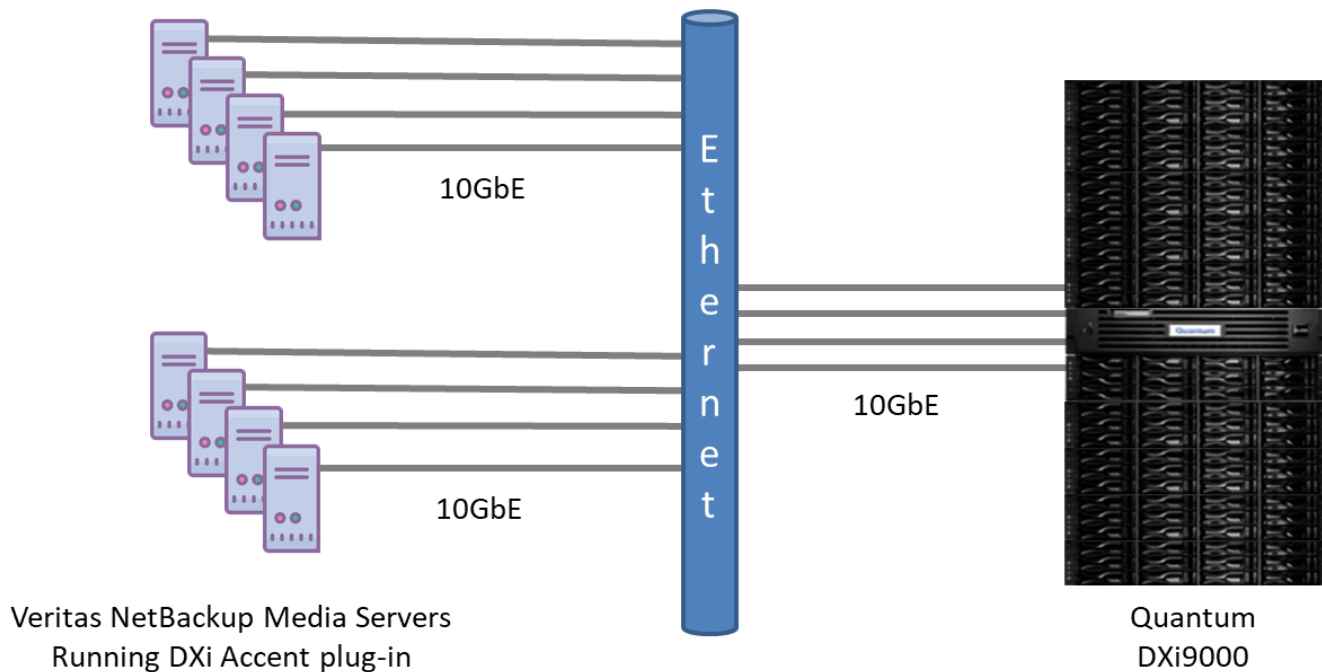
## ESG Technical Validation

ESG has been testing and analyzing the broad spectrum of Quantum’s data storage and protection offerings since 2007. This report examines the newest DXi offering from Quantum, the DXi9000 Series, looking at performance, data reduction, scalability, flexibility, and how it fits into the Quantum ecosystem.

### Performance and Scalability

ESG tested the DXi9000 in a standard configuration, using Symantec NetBackup 7.6 to validate performance. The test bed emulated a simple data center environment as seen in Figure 3. Eight NetBackup media servers backed up multi-terabyte data sets to a Quantum DXi9000 appliance over a 10GbE LAN backbone. The DXi9000 connected to the network via four 10GbE connections.<sup>2</sup>

**Figure 3. The ESG Validation Test Bed**



Source: Enterprise Strategy Group

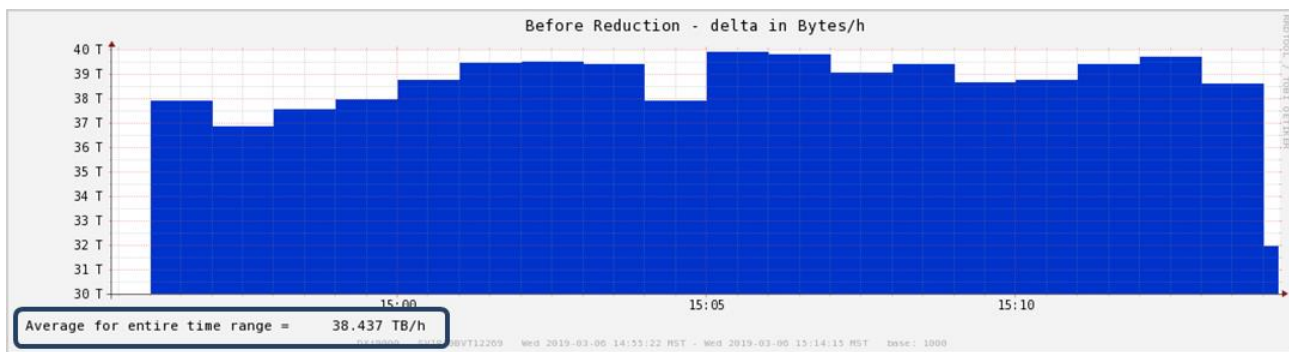
### ESG Testing

ESG started with a series of backups to the DXi9000 via Symantec NetBackup OST. Full backups were run against data sets collected from a production environment. Testing began with eight media servers backing up data from 16 disk arrays to a DXi9000 with five expansion modules and 1.02PB of usable capacity.

<sup>2</sup> Configuration details are listed in the Appendix.

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, Ethernet activity, disk utilization, and data reduction were all captured, as was CPU utilization. The first test attained throughput of 38.4TB per hour, seen in Figure 4.

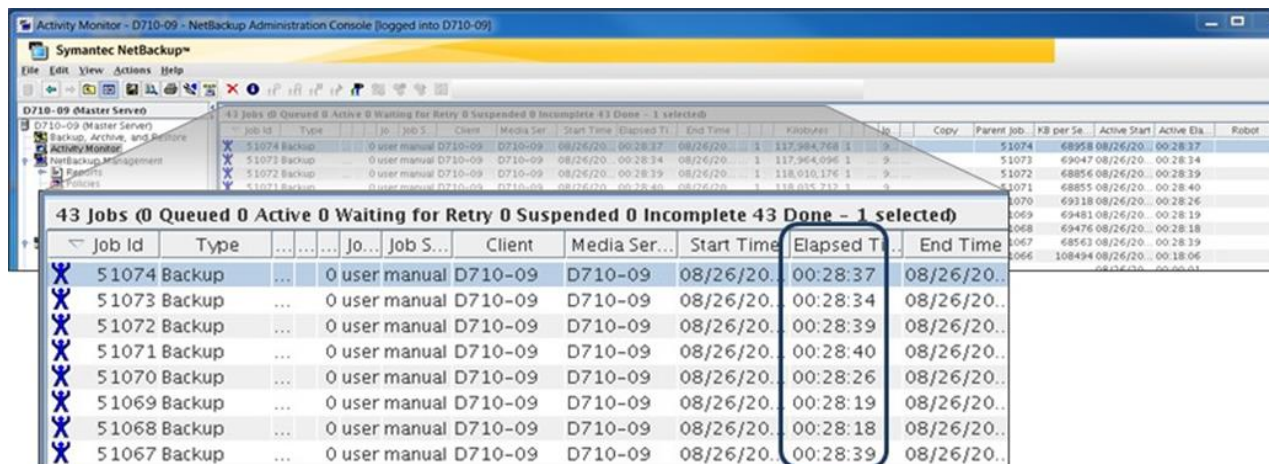
**Figure 4. Quantum DXi9000 38.4TB Per Hour Backup Throughput**



Source: Enterprise Strategy Group

ESG examined the NetBackup Activity Monitor, seen in Figure 5, and confirmed that all jobs completed with no errors, in under 30 minutes.

**Figure 5. Symantec NetBackup Activity Monitor**



Source: Enterprise Strategy Group

Results of the two performance test runs are shown in Table 1.

**Table 1. DXi9000 Performance Results—Symantec OST<sup>3</sup>**

	Media Servers	Usable Capacity (TB)	Number of Spindles	10GbE Ports	GB/sec	TB/hour
Run 1	8	1,020	120	4	10.7	38.4
Run 2	8	1,020	120	4	10.7	38.4

Source: Enterprise Strategy Group

<sup>3</sup> Maximum performance varies by method of presentation.

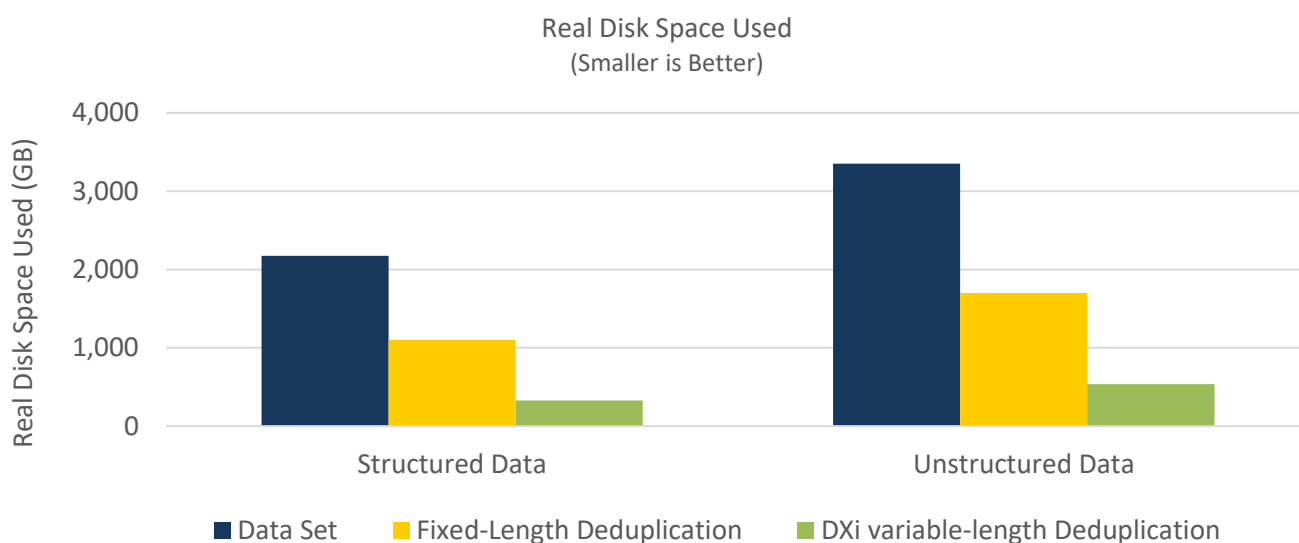
It’s important to note that in previous tests executed on the DXi series, ESG validated that sustained throughput was independent of the amount of storage enabled in the system. A system with 51TB of usable space licensed but the same number of expansion modules installed could be reasonably expected to perform just as well as a system with all storage capacity licensed.

Next, ESG examined data reduction using Quantum DXi deduplication. DXi leverages Quantum’s variable-length deduplication to optimize capacity efficiency in the data center and across the enterprise by efficiently deduplicating data locally, then only replicating deduplicated data. The tests used two data sets harvested from production systems: a 2.2TB structured data set, representative of data generated by a database or email application, and a 3.4TB unstructured data set, representative of file shares and home directories.

The first series of tests used the structured data set, which had a 10% daily change rate. ESG ran daily full backups of the data set to a DXi9000 appliance using a common, commercially available data protection software application that provides fixed-length deduplication. The first series of backups ran with DXi deduplication on and the fixed-length deduplication in the backup software disabled, then the data in the DXi9000 was wiped and the test was repeated with deduplication disabled in the DXi and enabled in the software.

This methodology was also used to test deduplication of the unstructured data set, running 47 days of backups using a full/incremental backup schedule: one full backup every seven days, followed by six days of incremental backups. In both cases, the data set backed up was identical, as was the backup schedule. The only difference was the type of deduplication. Figure 6 shows the results of the test.

**Figure 6. Quantum DXi Variable-length Deduplication versus Fixed-length Deduplication**



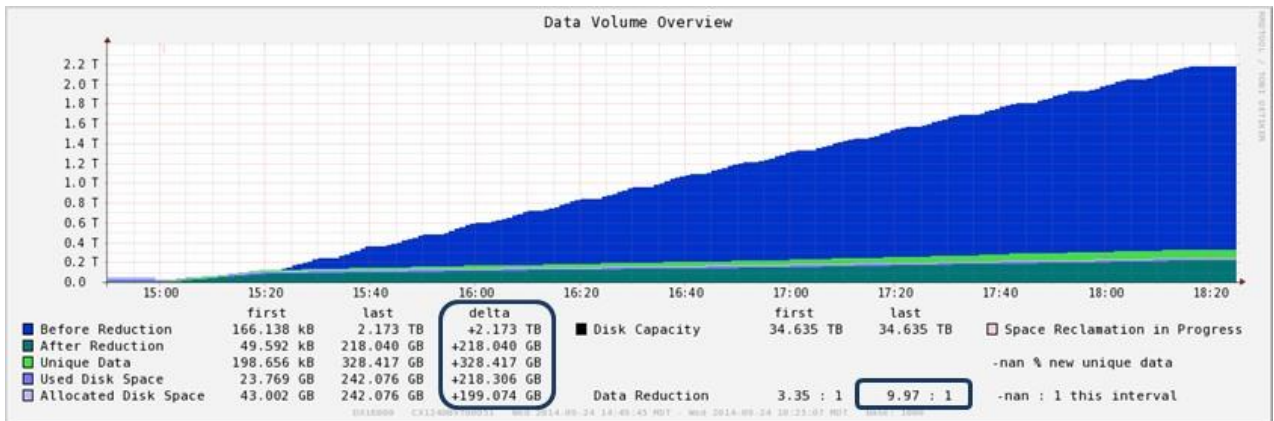
Source: Enterprise Strategy Group

Both systems performed consistently using both data sets and backup methodologies, with fixed rate deduplication reducing the footprint of the original data set by about 50% in both cases. Quantum variable-length deduplication was able to reduce the structured and unstructured data sets by about 85%.

ESG also tested the efficiency of Quantum replication by backing up a generated data set with known compressibility and uniqueness to a DXi9000 appliance and replicating to a DXi. In this test, the DXi9000 reduced the data set by 90%, storing the 2.17TB data set using only 218GB of disk capacity, as shown in Figure 7. During this single-threaded backup, throughput averaged 169 MB/sec.



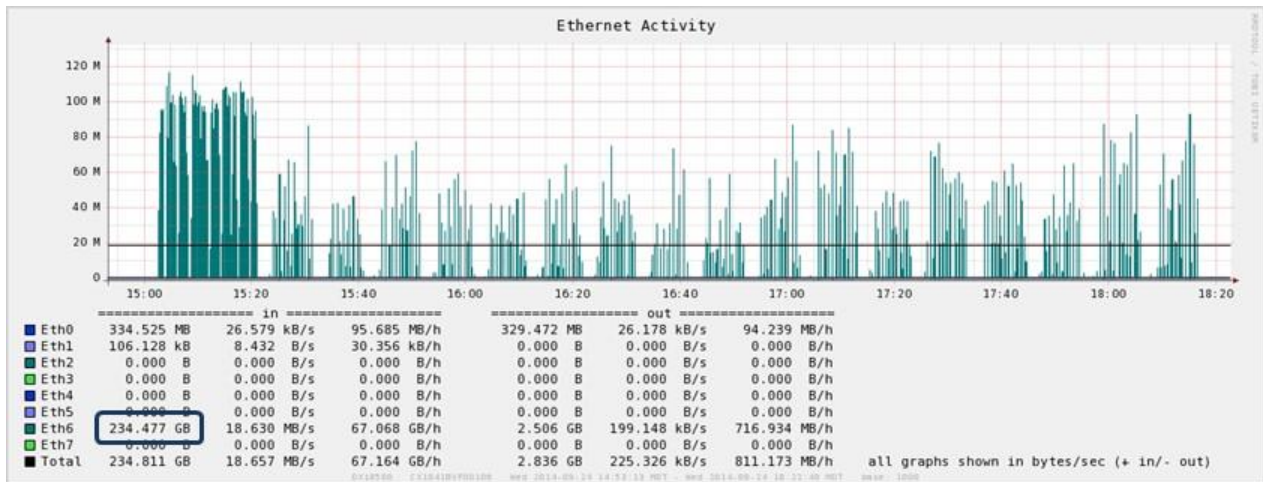
Figure 7. Backing Up to a Local DXi9000



Source: Enterprise Strategy Group

As the backups progressed, the DXi9000 automatically began replicating the unique blocks to the remote DXi, as seen in Figure 8. Once replication completed, ESG observed that the DXi9000 transferred only 234GB across the wire to the DXi.

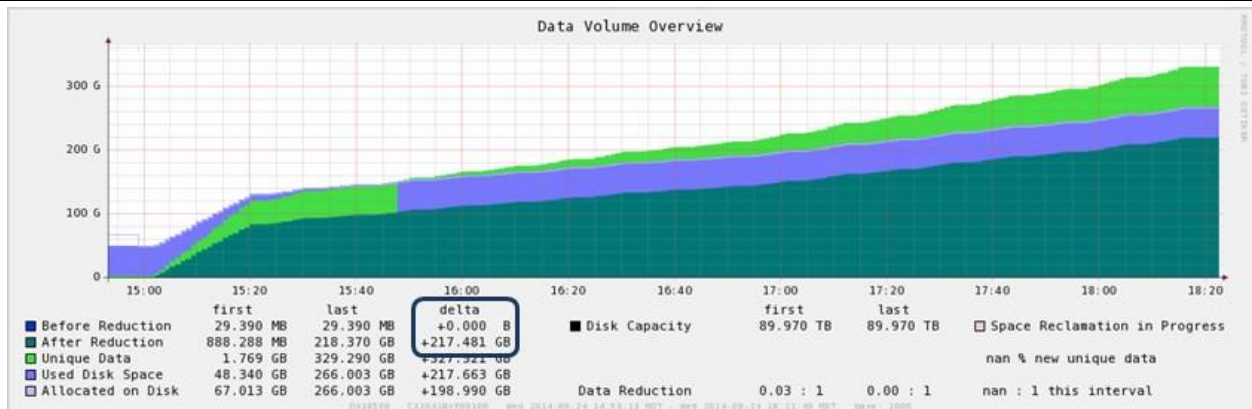
Figure 8. Ethernet Traffic During Replication



Source: Enterprise Strategy Group

Figure 9 shows the data volume overview on the DXi after the backup replication completed.

Figure 9. Data Volume Overview at the Replication Target



Source: Enterprise Strategy Group

ESG observed that the data stored on disk matched the data on disk in the source DXi9000. For this backup, DXi deduplication saved nearly 2TB of data movement, both to the local DXi9000 as well as to the remote DXi.

Finally, ESG upgraded an entry-level DXi9000 by entering a license key and rebooting the appliance to test the ease of accessing capacity on demand. We started with a DXi9000 with 51TB licensed. After entering the license, the DXi showed 102TB Disk capacity.



## Why This Matters

According to ESG research, improving data backup and recovery service levels, RPOs, and RTO's make up the most-cited data protection mandates reported by enterprises (48%), and reducing costs was called out nearly as often (35%). IT administrators have been struggling for years to get nightly backups completed before business resumes in the morning. When asked what specific data protection costs are pain points and/or priorities for their organization, 66% of respondents cited storage hardware and 57% cited management (i.e., labor) costs.

### *Performance*

ESG has validated not only that Quantum's DXi9000 is Quantum's highest performing disk backup and deduplication solution, but also that it achieves this feat while delivering high levels of data reduction. ESG testing demonstrated that a single Quantum DXi9000 disk backup system was able to sustain 38.4TB per hour of Symantec OST performance with four 10GbE connections and could be used to protect more than 300TB of data in an eight-hour shift utilizing less than 50TB of disk space using Quantum's variable-length deduplication, with the ability to restore individual files in a matter of seconds.

### *Capacity Efficiency*

Quantum DXi variable length deduplication was able to provide 85% data reduction for both structured and unstructured data in ESG testing, under both full and incremental backup schedules, compared with just 50% reduction for the tested fixed-length deduplication method. This translates to easier integration into an organization's existing backup environment—since backup admins don't need to adjust their schedules or methods—and substantial savings in both disk capacity and network bandwidth. The DXi9000 clearly demonstrated the ability to efficiently replicate only unique, deduplicated data to another DXi with no reconstitution required.

### *Pay-as-you-grow Scalability*

ESG also validated the pay-as-you-grow scalability of the DXi platform, which enables organizations to scale to 1.02PB of usable capacity—up to 20PB of logical capacity with deduplication—in 51TB increments, on demand, with no disruption to operations.

In summary, Quantum provides enterprise-class performance while reducing complexity and eliminating the need for capacity and performance planning. Combined with Quantum variable-length deduplication, the cost of data protection capacity is minimized as well.

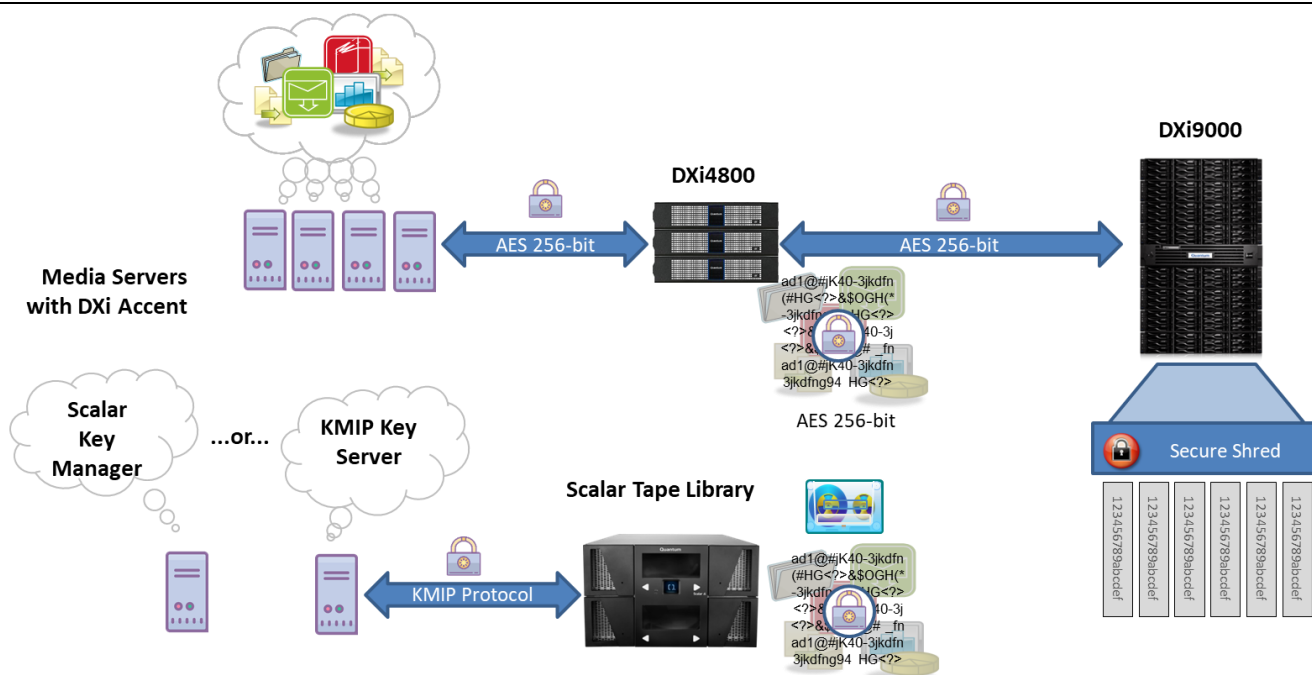
## Security, Flexibility, and Efficiency

Quantum designed the DXi9000 from the ground up to be a secure, flexible, deduplication disk backup solution. The DXi platform can be configured to meet practically any data protection requirement, offering broad flexibility via pay-as-you-grow scalability, universal connectivity, and tight ISV integration.

### Security

It's important to note that some vendors use the term full-drive encryption (FDE) to describe self-encryption capable drives, but the functionality is the same. SEDs were designed to prevent unauthorized access to data if a drive or a group of drives is removed from a system. It's all accomplished in hardware using 256-bit AES encryption, so there is no performance impact. Data in flight is also protected using AES 256-bit encryption. As Figure 10 shows, encryption is one part of Quantum's overall strategy of end-to-end security to protect data everywhere—while it is in transit and at rest, whether it resides on tape or disk, including the ability to securely shred deleted files or virtual tape cartridges, or securely erase an entire DXi system.

**Figure 10. Quantum Comprehensive Security and Encryption**

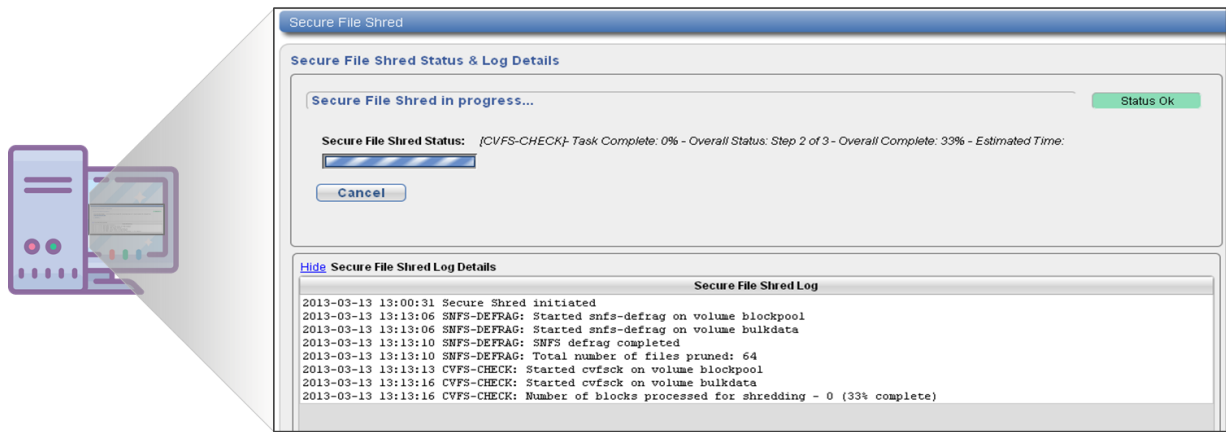


Source: Enterprise Strategy Group

### ESG Testing

ESG examined the secure file shred capability on the DXi family. First, we deleted files on the DXi NAS share, then secure shred was started, as seen in Figure 11. During secure shred, all residual data and metadata associated with the deleted files or cartridges is securely erased from the disk drives by performing a single pass overwrite with zeros. While secure file shred is running, the DXi operates in limited mode, meaning no backups or restores may be performed and scheduled jobs (including replication jobs) are stopped. If necessary, secure shred can be canceled at any time to return the DXi to normal operation. It's important to note that the amount of time it takes for secure file shred to complete is directly dependent on the total capacity enabled on the system.

**Figure 11. Secure File Shred**



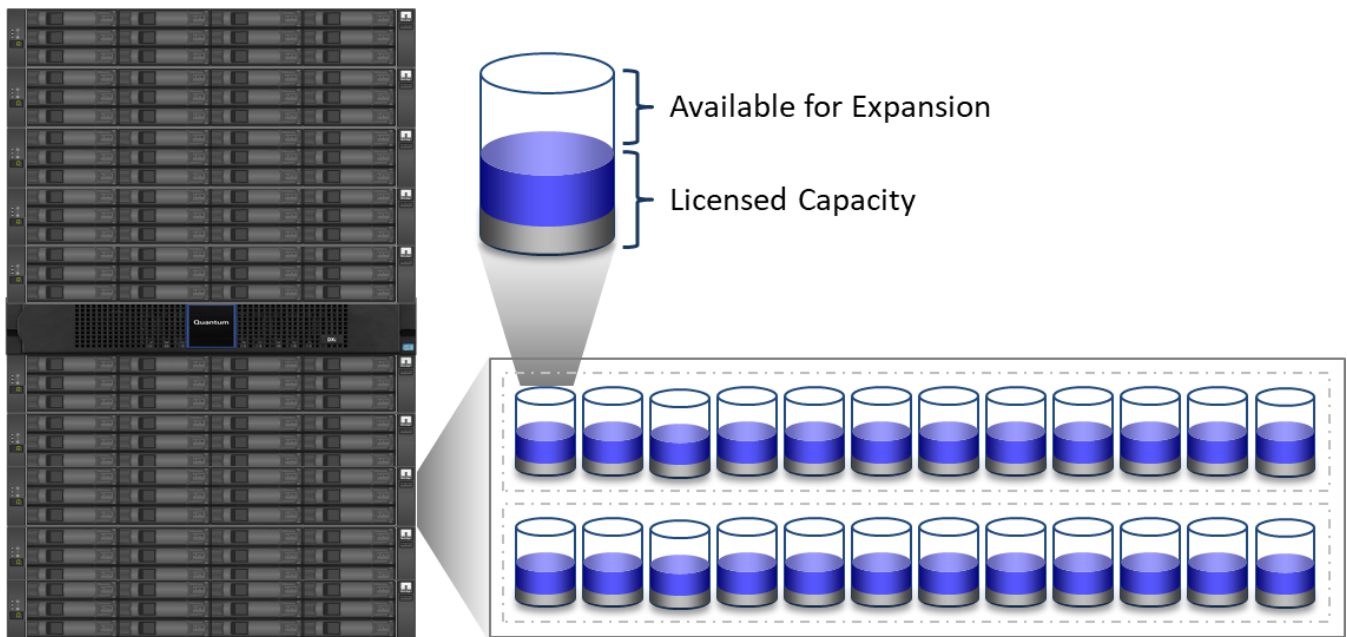
Source: Enterprise Strategy Group

This is not the case for whole-system secure erase, which occurs very quickly because it leverages the SEDs' capability to provide cryptographic erasure. Cryptographic erasure orders SEDs to regenerate their internal key, which makes all existing data unrecoverable because it was encrypted with the old key.

### Flexibility

The DXi architecture leverages intelligent metadata management, broad protocol support, and ISV integration with storage optimization for both high throughput and highly transactional data to provide the flexibility to support any data protection requirement. The DXi9000 uses Dynamic Disk Pools (DDP) based on NetApp E-Series Storage to improve system performance by spreading data and spare capacity across all available drives in each shelf, as shown in Figure 12. This reduces the rebuild time on 12TB drives, improving availability and performance simultaneously.

**Figure 12. Dynamic Disk Pools and Pay-as-you-grow Scalability**



Source: Enterprise Strategy Group

Quantum data protection solutions address the needs of organizations of all sizes, from the largest data centers to small remote offices.

## Efficiency

Quantum architected the DXi series with efficiency top of mind. Leveraging 12TB drives and a new, high-density chassis design on top of their variable length deduplication, the DXi 9000 is particularly suited for reducing data center footprint, reducing power and cooling requirements, and maximizing performance while eliminating hardware upgrades with pay-as-you grow licensing—improving efficiency on many levels.



## Why This Matters

### Security

Widely publicized data breaches, privacy laws, and boardroom jitters are driving a behavioral shift toward security that goes beyond data encryption. ESG research indicates that strengthening cybersecurity initiatives is the most-cited IT priority for 2019.<sup>4</sup> Should personal or financial data become compromised, an organization would potentially be liable for damages and heavy fines. The risk is real, and the costs are high. Encrypting data in flight and on disk reduces risk, avoids potentially crippling costs, and keeps the CEO out of the headlines. The Quantum DXi9000 secures data at rest and in transit with integrated AES encryption, and prevents unauthorized data access.

### Flexibility

A growing number of organizations are struggling to not only protect their information assets, but also manage growing volumes of data and provide offsite protection and disaster recovery. With tens to hundreds of terabytes under management and annual growth rates accelerating, a data protection solution must be flexible enough to grow with an organization's data set while providing predictable performance and secure data protection.

The DXi platform can be configured to meet practically any data protection requirement. ISV integration provides complete lifecycle management support and convergence of backup, business continuance, and disaster recovery. Multi-protocol support provides universal connectivity over CIFS, NFS, and FibreChannel. Simple licensing combines all software functionality, including replication, direct tape creation, VTL, OST, AIR, and DXi Accent, in one package.

### Efficiency

Quantum has been providing an impressively efficient platform for many years. ESG first looked at Quantum DXi in 2007, and has periodically studied the system during the last 12 years. ESG has noted a cadence of continuous improvement in every area of efficiency we've examined, including improvements in ease of use and management, software and capacity licensing, storage density, security, and backup application integration.

<sup>4</sup> Source: ESG research report, [2019 Technology Spending Intentions Survey](#), February 2019.

## The Bigger Truth

Backup and recovery are perennially near the top of the list of IT priorities for many organizations, along with server virtualization, information security, and managing data growth. As virtual environments grow and organizations struggle with expanding data sets, the need to provide flexible, robust, and high-performance data protection becomes ever more urgent.

Even while data grows, the window to protect and retrieve lost data 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 introduces additional challenges requiring solutions that can not only backup and instantly restore entire virtual machine images, but also reach into those images to back up and instantly restore individual files as required.

- ESG found that the DXi9000 sustained maximum throughput independent of the amount of storage in the system. The DXi9000 under test sustained 38.4TB per hour in entry-level, moderate, and full-capacity configurations.
- Quantum’s variable length, inline deduplication was able to reduce real production data sets capacity on disk by 85%.
- ESG validated the DXi platform’s pay-as-you-grow scalability to 1.02PB of usable capacity—up to 20PB of logical capacity with deduplication—in 51TB increments.
- The Quantum DXi9000 secures data at rest and in transit with integrated AES encryption, and prevents unauthorized data access.
- Backup application integration provides advanced functionality, converging backup, business continuance, and disaster recovery. Multi-protocol support provides universal connectivity over CIFS, NFS, and FibreChannel. Users license all software functionality—replication, direct tape creation, VTL, OST, AIR, and DXi Accent in one package.
- ESG found the DXi 9000 highly efficient—reducing data center footprint, reducing power and cooling requirements, and maximizing performance while eliminating hardware upgrades with pay-as-you grow licensing, which improves efficiency on multiple levels.

The results presented in this document are based on testing in a controlled environment. Due to the many variables in each production data center, it is important to perform planning and testing in your own environment to validate the viability and efficacy of any solution.

With the DXi9000, Quantum has once again produced an impressive solution to protect data in physical and virtual data centers of any size. ESG believes that the combination of variable-length inline data deduplication, enterprise-class performance, extreme density, and pay-as-you-grow scalability provides a unique approach for optimizing data protection and recovery in today's distributed enterprise.

If your organization is looking to streamline data protection and optimize the efficiency of backup, archive, and restore, then ESG believes that you should seriously consider Quantum’s DXi9000.

## Appendix

**Table 2. Validation Test Bed**

Quantum Backup Infrastructure	Version
DXi9000	4.0.1
Additional DXi Systems as needed for replication and recovery testing	4.0.1
Server/Storage Infrastructure	OS/Version
1x Dell R810-Intel Xeon L7545 1.87 GH CPU 64GB RAM	VMware vSphere, ENT Windows Server 2008 RedHat Linux Version 6.0
8x Dell D710-Intel E5530 2.4GHz CPU(x8), 8GB RAM	
16x LSI Logic 4980, 8TB, RAID 5	
Backup Software	Version
Symantec NetBackup	7.6

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