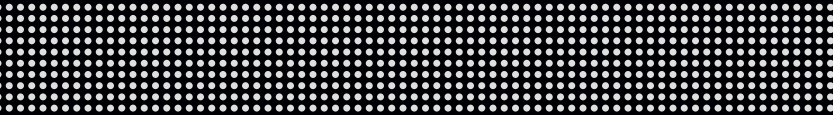


REDUCING STORAGE COMPLEXITY



DIGITAL DATA IS OUTSTRIPPING STORAGE CAPACITY AND COMPLEX SYSTEMS ARE FAILING TO ADAPT UNDER THE STRAIN AS STORAGE DEMANDS GROW FASTER THAN IT BUDGETS. THE GOOD NEWS IS THAT EASY-TO-USE IP-BASED NETWORKED STORAGE WITH BUILT-IN DATA PROTECTION AND MANAGEMENT CAPABILITIES PROMISES TO BRIDGE THE BUDGET GAP—AND EFFECTIVELY COMPLEMENT TRADITIONAL FIBRE CHANNEL-BASED STORAGE AREA NETWORKS.





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Related Categories:

- Dell PowerVault storage*
- Dell/EMC storage*
- Fibre Channel*
- Internet SCSI (iSCSI)*
- Serial Attached SCSI (SAS)*
- Storage*
- Storage architecture*
- Storage area network (SAN)*
- Storage consolidation*
- Virtualization*

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While data growth has exploded at the rate of terabytes, budgets have not. As high-resolution data capture increases relentlessly and enterprise applications spawn ever more sophisticated transactions, cost-efficient storage and unified management for diverse data types have become pressing concerns. In an attempt to keep up with government regulations and privacy standards, many organizations have hurriedly pieced together data management and security tools with expanded storage platforms.

However, the additional burden of complex, heterogeneous storage systems that have evolved through acquisition and merger or in the absence of a centralized IT strategy only complicates matters further. The ramifications of this burgeoning complexity are reaching far beyond the data center to threaten business growth and innovation.

Many executives are already feeling the pinch as storage requirements continue to grow faster than typical IT budgets (see Figure 1). To help avoid shortfalls in funding that might jeopardize support for ongoing service-level agreements, IT organizations must find ways to reduce storage complexity and plug the drain on valuable time and resources. By increasing operational efficiency, manageability, and flexibility, enterprises can help bridge the budget gap and free IT resources to focus on strategic business initiatives.¹

¹For more information about the Dell approach to reducing IT complexity, see "Simplify IT: The Dell Path to Innovation and Growth," by Joe Pollock, in *Dell Power Solutions*, November 2007, DELL.COM/downloads/global/power/ps4q07-20080130-SimplifyIT.pdf.

“Implementing a comprehensive storage strategy based on simple, cost-effective, and capable plug-and-play technologies can help reduce costs, increase efficiency, and ensure business continuity and compliance.”

An effective storage simplification strategy begins at the moment data is created and enables seamless data protection and management through all stages of the information life cycle, from backup and restore to archiving and ultimately deletion. In the past, such a comprehensive scope was difficult for many organizations to achieve because sophisticated storage management tools and capabilities were almost exclusively the realm of high-end UNIX[®] and mainframe systems—and cost-prohibitive for many small and medium businesses (SMBs), remote offices, and enterprise departments and workgroups. Today, Internet SCSI (iSCSI)-based storage area network (SAN) technology, plug-and-play Ethernet infrastructure components, and integrated, out-of-the-box data protection and management capabilities put storage consolidation and networked storage environments within reach of enterprises of all sizes.

IP-BASED NETWORKED STORAGE CONVERGENCE CHANGES ECONOMIES OF SCALE

At the forefront of this major advance is iSCSI technology, which routes data packets through standard Ethernet networks. This advanced protocol is enabling iSCSI-based SANs to extend the benefits of storage consolidation and a shared storage environment to organizations

challenged by the same IT pressures as large enterprises, but with smaller budgets and fewer IT administrators.²

Taking advantage of broad-based support for the open Ethernet protocol and many common operating systems, applications, and platforms—including the Microsoft[®] Windows[®] and Linux[®] operating systems as well as Microsoft Exchange, Microsoft SQL Server[™], Oracle[®] Database 11g, and VMware[®] virtualization software³—iSCSI technology enables a significant reduction in the cost of entry for a networked storage environment compared with Fibre Channel-based SANs. Moreover, iSCSI helps simplify storage in virtualized data center environments by allowing storage resources to be

mapped directly to virtual machines (VMs). For more information, see the “How iSCSI storage unlocks the power of virtual servers” sidebar in this article.

Because Ethernet is ubiquitous in today’s IT infrastructure, iSCSI enables organizations to capitalize on existing expertise to deploy networked storage without the additional cost or special equipment and training that Fibre Channel can require. Solutions such as the Dell[™] PowerVault[™] MD3000i modular disk storage array are designed to perform as a full-fledged enterprise SAN. For more information, see the “iSCSI-based SANs in action” sidebar in this article.

In addition, converging networked storage technologies allow iSCSI to be incorporated into existing SAN and network attached storage (NAS) environments. For example, Dell/EMC CX3 series arrays support both iSCSI and Fibre Channel, and the Dell PowerVault NX1950 unified NAS system includes iSCSI functionality.⁴ And, as 10 Gigabit Ethernet technology becomes available, iSCSI technology is expected to enable unification of the data center storage fabric.

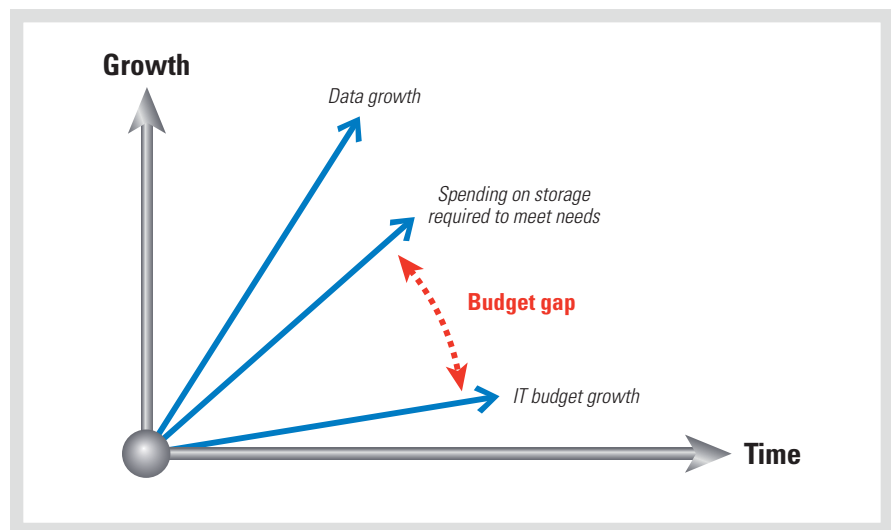


Figure 1. Budget gap: Storage requirements are growing faster than typical IT spending plans

²To learn more about the business benefits of IP-based networked storage in SMBs, see “iSCSI: Changing the Economics of Storage; Part 3—Using iSCSI in Small and Medium Businesses,” by Travis Vigil, in *Dell Power Solutions*, November 2007, DELL.COM/downloads/global/power/ps4q07-20070402-Vigil.pdf.

³Support may vary by iSCSI array depending on vendor tests and certifications.

⁴To learn more about how iSCSI technology is being integrated into networked storage environments, see “iSCSI: Changing the Economics of Storage; Part 1—Understanding iSCSI in Enterprise Environments,” by Travis Vigil, in *Dell Power Solutions*, May 2007, DELL.COM/downloads/global/power/ps2q07-20070335-Vigil.pdf.

In the meantime, a complementary mix of iSCSI and Fibre Channel provides a powerful and cost-effective approach, particularly for environments running a mix of applications. For example, iSCSI is well suited for applications with random I/O such as databases and virtualized servers, whereas Fibre Channel works well for high-throughput, low-latency applications with sequential I/O, such as streaming media and decision support software.

In high-bandwidth applications—especially those involving heavy transaction processing or high-speed, large-block data transfers—Fibre Channel can enable significant performance advantages, including functionality that can help increase utilization and simplify expansion for data-intensive applications. By combining iSCSI and Fibre Channel connectivity, organizations can capitalize on the benefits of both while moving toward network convergence on a simplified Ethernet infrastructure. For an example of how one company is taking advantage of both iSCSI and Fibre Channel storage, see the “Fluid Power Resource keeps data pumping with IP and Fibre Channel hybrid” sidebar in this article.

STORAGE-AWARE APPLICATIONS LEVERAGE DAS FOR COST-EFFICIENT GROWTH

Serial Attached SCSI (SAS), the successor to parallel SCSI, is designed to increase data transfer speeds and provide performance and reliability comparable to high-end systems. With broader reach and the ability to connect more devices per port than parallel SCSI, SAS offers a cost-effective way to optimize storage architectures.

In addition to enabling tiered direct attach storage (DAS), SAS is compatible with Serial ATA (SATA) and can run server drives as well as external and networked storage at exceptional speeds. Dell storage arrays incorporating SAS and SATA drives with iSCSI functionality for tiered DAS

HOW iSCSI STORAGE UNLOCKS THE POWER OF VIRTUAL SERVERS

iSCSI-based SAN technology allows applications to move around a virtualized data center environment while remaining attached to their storage. As a result, iSCSI is poised to take the business benefits of virtualization to the next level by helping simplify management and increase flexibility while increasing cost efficiency for the overall IT infrastructure.

For example, as a physical protocol that maps to a physical server, Fibre Channel requires administrators to manually rezone switches and change permissions when storage relationships change. iSCSI, in contrast, is an IP-based protocol that helps reduce the cost and complexity of deploying virtual servers compared with Fibre Channel by allowing administrators to map VMs directly to shared storage—in the same familiar way they manage the relationship between physical servers and shared storage (see Figure A).* This seamless VM mobility without complex reconfiguration allows unprecedented response to dynamic workload fluctuations and evolving business conditions. In addition, when an iSCSI network is configured with the proper logical or physical separations, iSCSI enables comparable security to Fibre Channel.

To create virtual servers with shared storage, organizations can deploy iSCSI alone or together with Fibre Channel in a tiered configuration. By offering products that support both iSCSI and a combination of iSCSI and Fibre Channel (see the “IP-based networked storage convergence changes economies of scale” section in this article), Dell enables organizations to optimize storage connectivity based on server workload.

For more information about Dell iSCSI storage, visit DELL.COM/iSCSI.

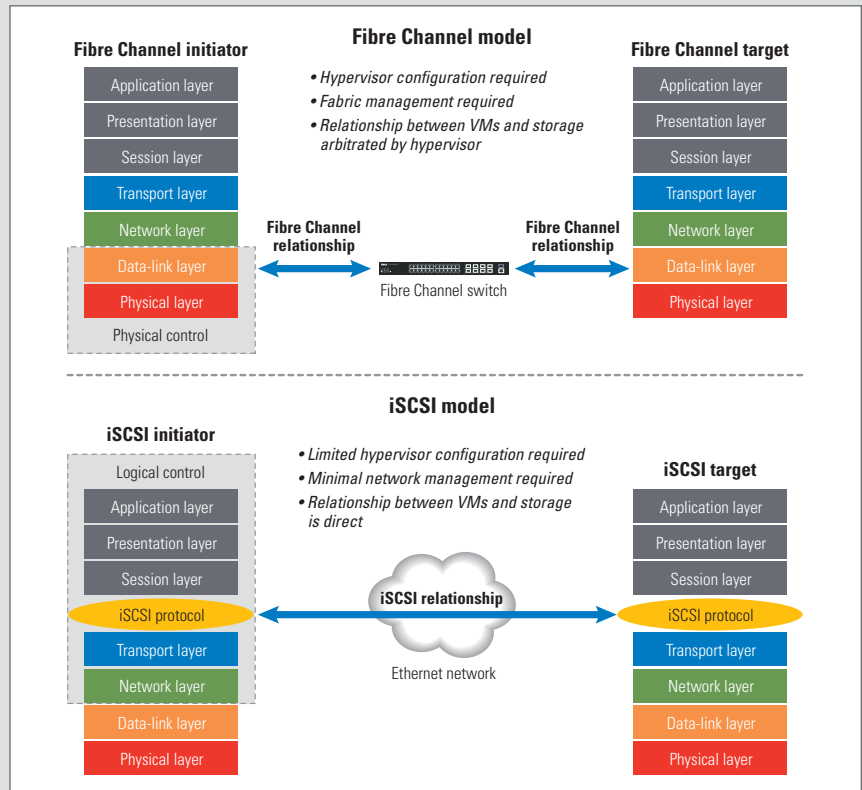


Figure A. Unlike Fibre Channel, iSCSI allows administrators to map virtual machines directly to shared storage

*For more information, see “iSCSI: Changing the Economics of Storage; Part 2—Deploying iSCSI in Virtualized Data Centers,” by Matt Baker and Travis Vigil, in *Dell Power Solutions*, August 2007, DELL.COM/downloads/global/power/ps3q07-20070401-Baker.pdf.

applications include the Dell/EMC AX150i, Dell/EMC CX3 series, Dell PowerVault NX1950, and Dell PowerVault MD3000i.

As SAS and SATA drive options break through previous DAS scalability barriers with enhanced capacity and performance, many organizations are reconsidering DAS as a way to build out storage in cost-effective increments—particularly for burgeoning e-mail data.

Because e-mail is pervasive and protecting data generally costs more than simply storing it, the DAS model allows organizations to offer higher service

levels and higher capacity with lower complexity and cost than a shared e-mail storage design. DAS helps simplify provisioning and data protection compared with shared networked storage because the rack of external hard drives in a DAS configuration is a logical extension of the host server's internal storage—and is managed the same way. In comparison, shared networked storage connected to multiple servers must be provisioned with security at the array level, which adds to deployment costs and management complexity.

Moreover, a number of critical enterprise applications—including Microsoft Exchange Server 2007, Microsoft SQL Server, and Oracle software—are being designed to facilitate storage-related tasks that enhance data availability, backup functionality, access management, and fault tolerance. Notably, applications with built-in replication capabilities are increasing the relevance of DAS deployments. Understanding how to take advantage of storage-related features in enterprise applications can also help businesses reduce storage

FLUID POWER RESOURCE KEEPS DATA PUMPING WITH IP AND FIBRE CHANNEL HYBRID

Fluid Power Resource, LLC, is an investment holding company that operates a premium group of 10 fluid power equipment distributors across the United States. The company employs approximately 1,100 people at 38 locations and is growing quickly. After a recent acquisition, the IT team decided to consolidate its distributed IT infrastructure in a central location. At the same time, the IT team needed a viable disaster recovery plan.

The distributed IT environment was configured to allow data in one location to access data from other locations should the power go out. However, downtime was common in the distributed IT environment, requiring substantial travel and expense to support ongoing operations and maintenance. To consolidate the IT environment and introduce the flexibility and availability needed for cost-efficient growth, the team deployed an EMC iSCSI/Fibre Channel storage platform with a blend of dedicated Dell PowerEdge™ physical servers running the Microsoft Windows Server® 2003 OS for some critical applications (such as Microsoft Exchange), and servers running VMware ESX Server virtualization software to host multiple VMs.

"We chose the EMC storage array for its ability to leverage both iSCSI and Fibre Channel connectivity simultaneously," says Jim Overly, director of IT at

Fluid Power Resource. "This provides us with the flexibility to support all of our data access requirements in a single solution."

In addition, the array's simple storage management capabilities allow the IT team to manage information efficiently and exploit the capabilities of a mixed physical and virtual server environment. "The combination of Dell servers, VMware virtualization software, and the EMC storage array has provided our business with a comprehensive solution and ideal path to support future growth as business requirements evolve," Overly adds.

All critical information is now consolidated on highly available EMC storage arrays, enabling employees in multiple locations to access enterprise data when they need it. Most of the business applications access data through iSCSI; however, the IT team takes advantage of integrated Fibre Channel connectivity to support its Microsoft SQL Server database. For Overly, this translates into the performance users need and cost-effective scalability to support the company's growth and budget.



By simultaneously supporting iSCSI and Fibre Channel connectivity, EMC storage arrays enable Fluid Power Resource to support diverse data access requirements with a single, consolidated solution.

complexity and bridge the budget gap, especially when DAS may be a viable alternative or complement to networked storage arrays.

UNIFIED MANAGEMENT AND DATA PROTECTION REACHES FROM DESKTOP TO DATA CENTER

Many organizations are challenged to provide comprehensive data sharing, protection, and management—an urgent consideration for business continuity and compliance with regulations such as the Sarbanes-Oxley Act and the Health Insurance Portability and Accountability Act (HIPAA). The Dell Intelligent Data Management strategy is designed to enable a holistic environment of data protection and management. This approach entails capturing data at the point of creation; protecting it immediately, whether locally or remotely; ensuring integrity as diverse data types traverse multiple connections and travel through multiple systems; archiving, classifying, and searching; and ultimately deleting data at the end of the information life cycle.

A key cost-containment consideration is to match the expense of the storage platform to the value of the data. For example, bulk e-mail messages can be stored on inexpensive drives or even offline on tape, but sensitive materials that may be required for litigation or audits must be stored in a safe, secure way that allows quick and easy access. Open systems with intuitive, out-of-the-box storage and server management can allow organizations to back up, restore, and archive valuable intellectual property and transaction data in a cost-efficient, standards-based plug-and-play network environment.

STORAGE SIMPLIFICATION ALIGNS IT WITH STRATEGIC BUSINESS OBJECTIVES


As new voice and video technologies generate data by the terabyte, organizations

iSCSI-BASED SANs IN ACTION

To demonstrate the performance potential of an IP-based storage network in a consolidated storage environment, Dell engineers recently placed the application data for five Dell PowerEdge servers on one Dell PowerVault MD3000i array with two attached PowerVault MD1000 expansion enclosures. Located in the Austin, Texas-based Dell Enterprise Technology Center (DELL.COM/TechCenter), the team ran five separate workloads and performed two incremental backups over an eight-hour period to simulate a typical workday. In this test case, the results indicated that the PowerVault MD3000i effectively handled I/O throughput from the five example workloads—which included two nodes of a fully redundant Microsoft Exchange cluster, a Web-serving application, a Microsoft SQL Server database, and file-serving data transfers.*

In enterprise storage networks, the PowerVault MD3000i iSCSI array is designed to consolidate up to 16 fully redundant hosts, expanding to support up to 18 TB of data on SAS drives.

*For details, see "Storage Consolidation with the Dell PowerVault MD3000i iSCSI Array," by Dave Jaffe, Ph.D., and Kendra Matthews, in *Dell Power Solutions*, November 2007, DELL.COM/downloads/global/power/ps4q07-20080169-Jaffe.pdf.

have to change the economics of storage—not just to keep up with burgeoning capacity demands and regulatory requirements, but to free vital resources for business innovation and growth. Implementing a comprehensive storage strategy based on simple, cost-effective, and capable plug-and-play technologies can help reduce costs, increase efficiency, and ensure business continuity and compliance. A modular, open systems storage architecture based on custom pre-configured hardware and unified storage management enables organizations to streamline deployment and support, reduce complexity, and avoid the pitfalls of proprietary technologies that can impede business agility—all potential competitive differentiators in today's information-centric digital marketplace. 

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