WHITE PAPER

Driving Business Value with Flash-Optimized Dell Storage Solutions

Sponsored by: Dell

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IDC OPINION

Getting the best from a virtualized environment is a vital concern for IT managers struggling to deal with shrinking budgets, fewer staff, and other pressures brought about by the tough financial climate. Capital investment in IT is typically under severe scrutiny at the board level, while business units demand new and better applications as they strive to deliver higher levels of customer service.

In general, IT staff no longer have the time to spend on basic storage management issues just to keep the system running. Load balancing, application optimization, and disk maintenance should be devolved to the array where they are managed automatically.

Dell has stepped up to the challenge with primary storage platforms designed to blend operational efficiency, ease of management, and high performance. Its intention is to deliver superior business value through user productivity gains, extended product life span, innovative software licensing, and proactive service and support.

Business Value Highlights

Dell Storage Solution customers are achieving a 513% ROI and earning back their investment in 6.2 months on average through the following benefits:

- Cutting IT infrastructure costs by 32% and enabling longer-term planning
- Reducing the impact of unplanned downtime by 99%, which enhanced user productivity by 31 hours per year and contributed $374,000 in revenue annually
- Increasing storage system performance by 34%, thereby generating a net increase in business operations productivity of 4%

To quantify the business value of the Dell Storage PS Series (EqualLogic) and Dell Storage SC Series (Compellent) storage systems, IDC interviewed 15 worldwide customers. The average return on investment (ROI) for the Dell storage solutions was 513%, with an average payback period of 6.2 months from deployment. Savings came from four main areas: infrastructure, IT administration, IT user productivity, and overall business productivity.

To put this result into context, IT hardware investments commonly provide payback in a 9- to 12-month period. Payback in 6 to 9 months is normally considered to be very rapid, so the 6.2-month payback for Dell storage in this study should be considered an exceptional performance.

For example, system managers were able to provision more quickly, resulting in more rapid response to business requests, and spent less time "fire fighting," allowing more time for proactive initiatives that take the company's business forward. IDC also found that application availability was significantly improved, particularly in dynamic environments that were growing rapidly.

With this research, IDC believes that automated, self-optimizing, and efficient storage platforms such as Dell PS Series and SC Series are a financially prudent investment for companies looking for more from their storage infrastructure. In addition, users typically find that the Dell storage becomes a strategic enabler through more proactive IT staff, consistently high service levels to the users, and greater flexibility to business change.

IN THIS WHITE PAPER

This white paper sets out a business value assessment of Dell's PS Series and SC Series storage systems in the context of IDC research into the priorities and challenges faced by IT managers looking for midrange and high-end open systems storage solutions.

The study is based on 15 interviews with Dell PS Series or SC Series users, using either HDD-only, hybrid-flash, or all-flash systems. IDC is therefore able to demonstrate and quantify the business value provided by flash in PS Series and SC Series storage.

SITUATION OVERVIEW

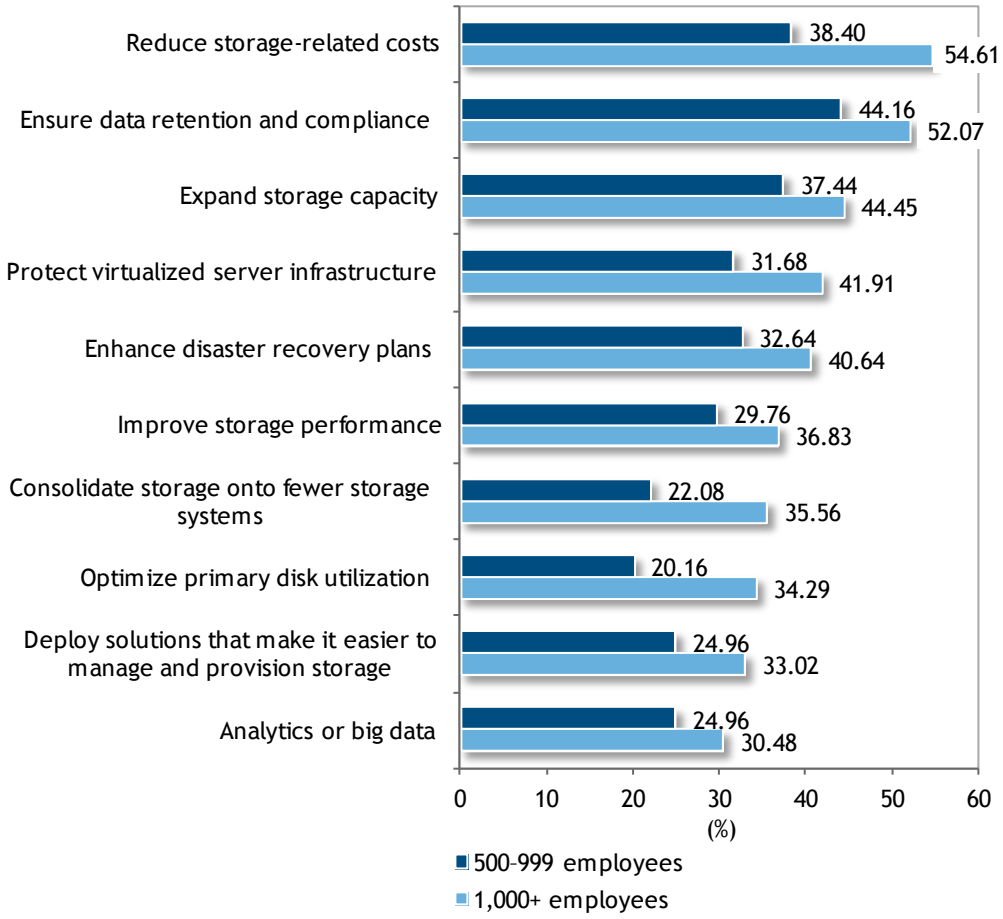
Users Need Sophistication Without Complexity

IDC interviewed 500 companies to understand their priorities for storage investment over the next 12 months (see Figure 1).

FIGURE 1

Top Priorities Related to Storage for the Next 12 Months

Q. How much of a priority is each of the following factors to your organization's storage requirements for the next 12 months?



Source: IDC, 2015

The key pain points are clearly seen when IT managers are asked for their top priorities regarding future storage spending: reduce storage-related costs, ensure data compliance, and protect virtual machine data while increasing capacity and performance.

As they plan for the future, many companies are increasingly moving toward a consolidated, standardized, and automated IT infrastructure to boost capability while driving down the cost of doing business. Storage must play its part in facilitating this strategic plan and should ideally exhibit the following characteristics:

- **Support the business objectives.** During the economic downturn, funding was tight and companies were focused on minimizing capital outlays. As the economic situation in some countries has improved, the priorities shifted markedly as companies looked for ways to deploy new and better services for customers in a bid for market share.
- **New level of price/performance and reduced whole-life costs.** Storage must respond to the need for lower capital costs and must also deliver significant operational cost savings throughout its useful life.
- **Make archive transparent and productive.** Over the past five years, meeting data compliance regulations has shifted from a low to a high priority. Having an effective archival process mitigates data growth on primary storage as well as meeting regulatory mandates.
- **Enable business continuity and disaster recovery (DR).** IDC research shows that improving DR capability is one of the top drivers for storage investment. It is essential that storage systems have efficient recovery points, rapid recovery times, and powerful replication capabilities, including synchronous replication that was previously only the preserve of large-scale enterprise systems.
- **More automation.** As much as possible, storage must be self-optimizing, self-managing, and self-healing.
- **Simpler data migration.** When bringing new capacity online, midsize companies will not accept the significant migration costs experienced by enterprise companies. It is therefore essential that migration can be conducted in a rapid and transparent manner.
- **Need to extend the benefit of virtualization into the storage realm.** Storage virtualization transforms physical storage assets into a flexible pool that can be provisioned and reallocated as changing workload demands dictate.
- **Need to extend the life of legacy storage arrays.** It is no longer acceptable for a company to discard two- or three-year-old arrays simply because they lack modern functions such as thin provisioning.
- **Need for operation and management by nonstorage specialists.** An intuitive GUI with configuration wizards and readily accessible support resources is now of more value.
- **Scalability.** The current market environment demands that transparent scalability is possible in several dimensions. Capacity should increase by adding drives to an array or by adding an array to a virtual pool. I/O throughput should be directly scalable to meet the evolving needs of the workloads.

Dell Storage System Overview

The business value of Dell's enterprise-class storage platforms is delivered in three ways: provide better efficiency, increase IT agility, and achieve operational resiliency. Efficiency is provided through eliminating excessive license fees and forklift upgrades while requiring less hardware to buy and manage. Agility is increased by reducing time to provision and freeing up resources to support business innovation, and operational resiliency is achieved with exceptional availability and integrated data protection.

PS Series Storage

"Uncomplicated and versatile storage for an IT generalist"

Dell's PS Series (including Dell EqualLogic) family of storage systems is designed to offer a highly cost-effective, seamlessly scalable, and effortless Ethernet-networked storage platform for growing virtual and mixed server environments. The ease of use is appreciated by users: As one user noted, "Quite honestly, when we started looking at it, this was one of the things that I really enjoyed about the PS Series platform." Its low entry point and scale-out architecture enable customers to buy only what they need and expand later with ease but without disruption. A PS Series SAN can start with one array and be scaled out to a cluster (called a group) containing up to 16 arrays. Multiple generations of arrays with different capabilities can be combined in a group. This allows for mixing storage with various performance and capacity points to match workload needs and provides investment protection for existing equipment as well as seamless upgrades to new generations of equipment.

Built-in automated management capabilities, like autonomous load balancing, dynamic tiering, automated setup for new LUNs, and an easy-to-use interface, lower the administrative overhead associated with legacy storage systems, freeing up valuable time for IT staff. As an IP-specialist storage platform, PS Series supports both iSCSI SAN and CIFS/NFS NAS access for unified storage management and storage systems consolidation. All-inclusive pricing for all the data management features, like snapshots or replication, dramatically improves overall TCO while making budget planning simpler and predictable by eliminating unforeseen licensing costs.

SC Series Storage

"Self-optimized and powerful storage for a storage specialist"

SC Series (including Dell Compellent) Storage Center is Dell's enterprisewide storage infrastructure, serving all Fibre Channel, IP SAN, and NAS needs for unified storage management. An SC Series array can scale up to create a large pool of storage managed by a single, self-optimizing system. Multiple systems can create a storage grid in the datacenter with live volume migration to support VM motion, fully transparent to the hosts and applications.

In addition, all SC Series systems can be monitored and managed from a single pane of glass, but the deep integration with virtualization, systems management, and orchestration with vendors ensures that management overheads associated with storage provisioning are kept to a minimum. As one user noted: "I can provision new storage on a server in less than a minute. Before, to provision, it would take a couple of hours, and it's a task we need to perform twice a week."

A grid infrastructure can span across multiple SC Series generations, ensuring investment protection and non-disruptive expansion. Built-in enterprise-class data protection capabilities like pointer-based snapshots and thin remote replication, coupled with Dell's proactive remote technical support, allow for peace of mind even for the most mission-critical business applications.

SC Series Data Progression and Flash

Data Progression is fully automated and integrated into the storage layer. The tiering software virtualizes and moves data based on policy-driven profiles at a granular level. Data Progression automatically migrates data to the optimum storage tier and/or RAID level based on actual use and performance needs, without manual intervention.

Using metadata, Data Progression can determine if a block is heavily accessed and how those accesses typically occur. If a block is heavily used, Data Progression can place that block on a high-performance disk. If the block is inactive, Data Progression can migrate it down to a lower-cost, high-capacity disk.

The traditional (HDD-only) SC Series Data Progression model runs once a day with two primary functions:

- Perform RAID-level migration for newly created read-only (replay) data pages to a more space-efficient RAID type (typically from RAID 10 to RAID 5 or 6). This migration enables data to be written most quickly with no RAID write penalty and then moved into the more space-efficient RAID 5 or 6. This methodology minimizes the need to use write cache to mask write latency introduced by parity calculations.
- Move pages of data between performance and capacity disk tiers based on access frequency. More frequently accessed data is kept on a performance-optimized disk tier, and less frequently accessed data is kept on a capacity-optimized disk tier. Data retained for a replay (snapshot) that is not being actively used is automatically stored on the capacity-optimized tier.

These two functions are based on the recommended profile; however, the user can create additional custom profile settings to meet the needs of specific applications.

With flash, Data Progression operates on a real-time basis to ensure the highest tier remains available for incoming writes.

SSDs — MLC and SLC Media

Although flash storage can be substituted for HDD storage in a datacenter, it is fundamentally a different medium with different performance, cost, and data retention characteristics that may impact the economics and operations of the application workloads.

The core component of an SSD is NAND flash. The two basic types of NAND flash are SLC and MLC. Unlike magnetic media on HDD storage, data stored on flash needs to be erased before new data can be written or "programmed" — known as the Program-Erase Cycle (PE/C). The maximum number of PE/Cs of NAND is dependent on the technology (SLC or MLC). Typically, this is in the order of a few thousand per NAND cell, after which the performance and reliability of the flash storage cannot be guaranteed. This characteristic of flash technology limits the number of write operations that can be performed on a flash drive.

Each cell in SLC NAND is capable of storing a single "bit" of data. This enables SLC drives to write faster and achieve high cell endurance while making the drives more expensive than MLC. Cell endurance is defined as the number of times the media can be rewritten (erased and programmed).

MLC NAND, on the other hand, can store multiple "bits" per cell. This results in significantly higher memory density, thereby reducing cost. This comes at the expense of slower write speeds and significantly lower cell endurance. MLC NAND, however, still possesses good random read performance.

As with hard drives, SSDs are typically developed and sold for two distinct markets: enterprise and personal storage. Enterprise-grade SSDs typically have features not found on consumer products such as non-volatile write cache, significant amounts of NAND over-provisioning, more write channels, and a 6Gb dual-ported SAS interface. All of these features are important for data integrity, high availability, and enterprise-grade performance.

The two classifications for enterprise-grade SAS SSDs that SC Series uses are write intensive and read intensive. The main distinctions between these drive types are their endurance specifications, capacities, and cost. SC Series has used write-intensive SSDs for more than five years and has found that the endurance characteristics of these drives make it unlikely they will wear out during the life of a storage array. For this white paper, the term *write-intensive SSD* refers to an SLC SSD, and the term *read-intensive SSD* refers to an MLC SSD.

With the cost of SSDs continuing to decline at a faster pace than that of HDDs, read-intensive SSDs may soon replace 15K hard drives for high-performance storage. The issues with using a single tier of read-intensive MLC SSDs in a standard array is that there is a possibility for them to wear out in a short period of time and their write performance suffers under heavy workloads.

In SC Series' approach in which two types of flash drives are deployed in a single enclosure, flash is tiered across the SLC SSDs and MLC SSDs, which have a higher capacity and lower endurance but a considerably lower price, blending the attributes of these SSDs to achieve a superior dollar per gigabyte.

SC Series is currently the only vendor that blends the optimal characteristics of both into a single virtual device: the performance characteristics of SLC SSD with the lower cost and higher capacity of the MLC drives. There is no need to compromise between the two, as the blended model provides the best characteristics of both in a single device.

SC Series Enhancements for Flash

Dell has made the following enhancements to improve using flash in the SC Series storage architecture:

- Rewritten core aspects of the Storage Center firmware to optimize the performance and low latency available in SSDs
- Created flash-optimized Data Progression to leverage the endurance of write-intensive SSDs and the value of read-intensive SSDs. Data Progression runs as needed, rather than a 24-hour basis as in previous versions of code, to meet the performance needs of flash.

- Added management and monitoring capabilities specifically for flash; for example, you now have the ability to monitor wear on any SSD in the array
- Added sub-millisecond performance monitoring to the Dell SC Series Enterprise Manager and Storage Center user interfaces to provide a more precise view of flash storage performance

Table 1 details key storage management functions, functional characteristics, and associated business value benefits.

TABLE 1

Key Storage Management Functions and Associated Business Value

Storage Management Function	Functional Characteristic	Associated Business Value Benefit
Reduced technology refresh costs due to extended product life	The storage pool can be extended by adding new arrays or controllers while preserving existing investments.	Storage can start small and grow over time, reducing over-provisioning.
	Five-year standard warranty	Existing Dell storage (legacy) assets can remain part of the virtualized storage pool, extending their useful life.
		Array investments can typically be depreciated over five years rather than three.
		Many of the users interviewed by IDC for this study were still using the original controllers within the storage pool, despite undertaking several upgrade cycles.
		Since forklift upgrades are never required, further savings in professional services fees can be made.
		No premium is levied on service contracts for out-of-warranty units.
		SC Series "perpetual" software license does not need renewal if a controller is upgraded.
		PS Series "all inclusive" software licensing means all software features are accessible at no additional charge.
Rapid time to deployment	Performance and capacity can be added without disrupting existing workloads.	This speeds up the ability to deploy new storage capabilities to enable key business initiatives or to support changing workload profiles.

TABLE 1

Key Storage Management Functions and Associated Business Value

Storage Management Function	Functional Characteristic	Associated Business Value Benefit
Data Progression	Data Progression provides a mechanism to automatically migrate "hot" data to a higher-performing tier within the storage pool.	Automatic relocation of data to the most cost-effective storage tier results in reduced management overheads while cost/performance is continually optimized.
	"Cold" data is automatically migrated to lower storage tiers based on lower-cost drive technology.	The users interviewed for this study found that 70–80% of data was migrated to the lowest tier using capacity-optimized lower-cost drives. Upgrade expense was therefore reduced. As a guideline, capacity-optimized tiers are 10% of the cost per gigabyte of performance-optimized tiers.
	Migration policies can be tailored to suit the needs of different departments within the organization.	This results in more consistent performance in meeting SLA requirements. IDC research shows that manually repositioning data to address performance problems can take days to execute since data must be selected, moved, and then monitored to test that the problem has been solved. Automation of the process allows the system to respond correctly to surges in demand without operator intervention.
		The SC Series Data Progression function and PS Series Automated Performance Load Balancer leverage the performance of SSD drives by automatically selecting and positioning data in the SSD layer according to the current workload requirement. Thus a relatively small quantity of SSD can make a larger positive impact on system performance.
Simplified management	Completely virtualized storage separates the management of storage services from hardware configuration.	This reduces complexity of IT operations and the need for specialized expertise and minimizes time-consuming, error-prone manual tasks, resulting in lower cost of operations.
		Staff time is freed up to allow increased focus on understanding and supporting business requirements.
		Real-time reporting allows users to plan and tier more accurately, further improving efficiency.

TABLE 1

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Multiple drive–type support	Support for HDD and solid state drives (SSDs)	The ability to optimize the drive price/performance to match the performance and capacity needs of the business
		SSD for high-IOPS transactional workloads and high duty–cycle SAS drives for mission-critical applications
Thin provisioning	The Dell array allocates and uses physical disk capacity only when data is actually written.	Greatly increased storage utilization and reduced stranded capacity; utilization can rise from a typical 30–40% to over 70%; can significantly reduce the amount of physical disk needed
		By using disk capacity more efficiently, capacity upgrades can be reduced or deferred.
		Capacity planning in dynamic environments is greatly simplified, as the physical space allocation always closely matches the real capacity requirement. It is no longer required to estimate the future disk capacity requirement and to pre-allocate capacity.
		Reduced labor costs because of improved capacity planning capability
Support	Proactive 24 x 7 support service	Users interviewed by IDC for this study consistently expressed high levels of satisfaction with Dell SC Series Copilot support. In many cases, proactive interventions by Copilot had enhanced uptime, availability, and overall performance.
		Copilot was repeatedly identified as an invaluable component of the Dell storage proposition. In some cases, Copilot remotely resolved technical issues during the night, with IT staff receiving a resolution report when they arrived in the morning. Users told IDC that Copilot typically allowed them to allocate IT staff resources elsewhere.
Business continuity and disaster recovery	Continuous, writeable thin snapshots	Enhanced recovery point objectives and recovery time objectives to optimize business continuity service levels, leading to reduced downtime costs
	Thin replication — send only changes to data to any storage system	Simplified backup management and reduced impact of data protection operations; backup windows shortened; offload backup processing from production servers
		Simplified replication — just clicks to set up; reduced bandwidth costs; reduced hardware costs for a replication target system

Source: IDC, 2015

THE BUSINESS VALUE OUTCOME

Study Demographics

In spring/summer 2014, IDC interviewed five companies using Dell PS Series or SC Series storage in hybrid-flash or all-flash configurations. The findings have been aggregated with 10 Dell storage user interviews conducted in a previous study, where the systems were all-HDD configurations. Thus the previous ROI model has been updated to include the impact of flash storage on the average business value outcome. The organizations ranged from medium-sized companies with as few as 450 employees to enterprises as large as 10,000 employees. The organizations interviewed are based in Western Europe and North America and include representatives from the finance, healthcare, cloud hosting, legal services, agriculture, education, and government market segments. The interviews were designed to elicit both quantifiable information and anecdotes so that IDC could interpret the full impact of Dell Storage Solutions on the organization. Table 2 offers an aggregated profile of the 15 companies interviewed.

TABLE 2

Survey Demographics (Average)

Employees	3,531
IT staff	42
Physical servers	131.6
Percentage of images virtualized	54%
Virtual images per server	9
Storage	784TB
Annual storage growth	14%
Industries	Education, cloud hosting, government, legal services, healthcare, finance, agriculture
Regions	Western Europe, North America

Source: IDC, 2015

Selecting Dell Storage Solutions

Most of the organizations selected Dell storage solutions because they were impressed with the flexibility and low management overhead compared with other storage options. The interviews identified several more areas of benefit, resulting in a generally high level of satisfaction with Dell storage. Some examples are provided here to illustrate common themes:

- **Enterprise features.** (SC Series user) "Initially, we were seeking to put in a SAN, with one of our main goals being data replication, since we always have to worry about damages and outages from hurricanes and tropical storms. We chose SC Series primarily because it's very easy to get features into their development cycles and very progressive. It just gives us more options … more tools in the toolbox to figure out different ways to stage applications. And that makes us more agile. I'd say that this translates into better recoverability … more uptime."
- **Easy management.** (SC Series user) "We actually hadn't considered Dell in the past. They just weren't on our radar, and I think the Dell technical team here, in particular the storage team here in [location], is very good. Their solution center here … they gave us some good demos. And convinced us on the technical performance of the product, plus it's a huge attraction for us to have ... the amount of flash that we have ... plus the amount of capacity and performance that it provides. We previously had a [non-Dell system]. We found the Dell storage to be ... manageability for the Dell was far simpler, including reporting, alerting, configuration ... much simpler, and the technology behind it ... the ... intelligent data progression, storage tiering ... it figures it out itself."
- **Easy management.** (PS Series user) "Quite honestly, when we started looking at it, this was one of the things that I really enjoyed about the PS Series platform. This was prior to the Dell acquisition, but it certainly holds true today, as well. I was talking to the sales engineer when we were getting ready to try their solution and evaluate it. I asked him what it would take to get an evaluation unit in and test it out. He brought it in and said … there you go … I can certainly walk you through the setup."
- **Cost effective.** (PS Series user) "We were looking at a storage platform for some of our remote smaller offices for a shared environment for a virtual platform. We were looking at a solution that would enable us to remove the backup tapes in the environment. We were looking for physical-based backup, allowing us to do 'snapshotting' and replication to other facilities, as well as being a platform for the virtual environment. We did a 'bakeoff' between four different products, including PS Series, which had the feature set and was the most cost effective of all of those solutions."
- **Cost effective.** (SC Series user) "We have 30% growth per year at the moment. But that sort of highlights one of the benefits … one of the reasons that we bought SC Series is that we can buy cheap capacity to grow our data and still have the performance of the flash."
- **Extended product life.** (PS Series user) "I mean I still have some original PS100s that are 8.5 years running. Some of our other vendors … even now, I'm not 100% PS Series storage, and those vendors press you after 3 years to replace the arrays … so I'd say 4 max. They just price you out with support."
- **Extended product life.** (SC Series user) "We believe it will have a longer lifetime because of the ability to purchase low-cost capacity without needing to purchase additional performance, since the flash gives us the performance we need. And very competitive support costs … and hardware purchase costs ... and ... what used to bind us on the [previous vendor], for example, is once it got to three years old, then we have to renew support for the array. It was pretty much as expensive as buying a new one."

- **Reduced floor space footprint.** (PS Series user) "Yes, it saves space. It does in my remote offices. Because I can put one PS Series array, whereas if I buy a larger chassis like a [Vendor 1] or [Vendor 2], the footprint is much larger. In the remote offices, I'd say that another vendor would be 50% larger."
- **Data protection.** (PS Series user) "The SAN definitely helps our recovery speed. If we have an application or a service that went down for some other reason, the SAN allows us to make copies and bring stuff up faster than if we had a bunch of standalone boxes. I'd say that the DR speed has increased by at least 50%. And now we can bring something up in one to two hours."
- **Scalability.** (SC Series user) "Some systems are configured where it can only have so many disk chassis, or it can only hold so many disks. SC Series separates its system into different components, and the controllers just hook up to different disk enclosures. If you need more, all you have to do is add more disk enclosures … and there is no set limit."
- **Predictable expansion and support costs.** (PS Series user) "We have a good idea from the onset what it's going to cost us to expand and grow the system over time. We also know that we're not going to be hit ... or at least we've been very much promised that we're not going to be hit after three years with a ridiculous support renewal cost."
- **Remote management/support.** (SC Series user) "Copilot support … I suppose that's simply become Dell Storage Support now. A happy support experience … with very skilled engineers, very willing to assist. They helped us through a software upgrade on the SC Series. It was a very, very easy, very pleasant experience. Zero impact to our production environment. So we're very happy with that. Before, we would be able to do it ... online, but it was always a little tricky. We'd have to bring a [previous vendor] engineer in and pay for their time. And we have experienced a few issues with [previous vendor] software upgrades in the past. That's an additional time saving."

To conclude the interview, the users were asked to identify the part of Dell storage that they valued most highly. In most cases, they mentioned the Dell Copilot remote support and management service, usually followed by an anecdote showing how Copilot had helped or saved the day in some way. This is not to say that there is a reliability issue with Dell storage; there was no evidence of that. The Copilot service appears to act like an expert storage administrator that is available 24 hours a day, something that is highly valued when in-house admin resources are under pressure.

FINANCIAL BENEFITS ANALYSIS

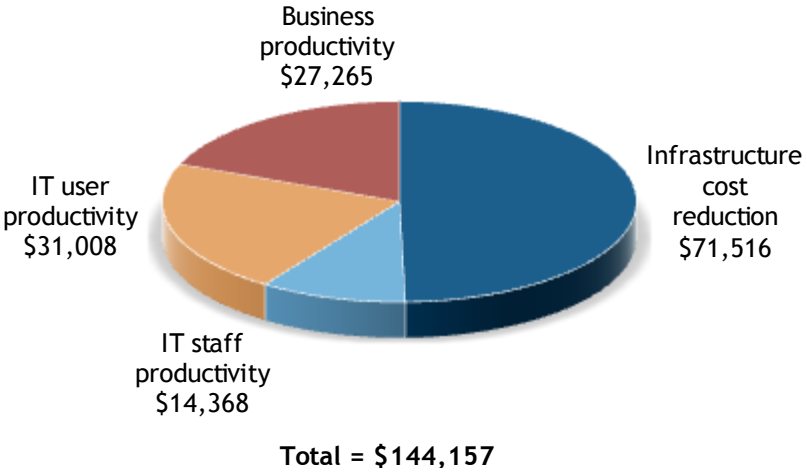
From the interviews, IDC was able to measure the financial impact of Dell Storage Solutions. IDC found that customers in this study achieved benefits in four areas: storage infrastructure cost reduction, IT staff productivity gains, increased end-user productivity, and enhanced overall business productivity. The aggregate financial benefit experienced by the organizations in this study, as Figure 2 shows, is $144,157 per 100 end users per year from the following areas:

- **Reduced storage environment infrastructure costs.** Dell storage solutions are more efficient and have higher utilization rates and longer productive life spans. Organizations in the study used Dell storage solutions to optimize and expand their storage environments, annually saving $71,516 per 100 IT users.

- **Optimized IT staff productivity.** Organizations were able to greatly enhance their ability to proactively manage their storage environments and operations, saving $14,368 per 100 users per year.
- **Enhanced end-user productivity.** Organizations in the study were able to reduce storage-related service disruption and provide quicker responses, resulting in 99% improvement in end-user downtime. End-user productivity benefited from reducing downtime, and organizations saved on average $31,008 per 100 users per year.
- **Improved business productivity.** Users in this study, particularly the five flash users, were able to describe improvements in business performance that were directly attributable to the Dell storage deployment – for example, production system performance that led to higher sales margins, higher sales win ratios, and the faster rollout of new products or services. These can be difficult areas to quantify, and IDC has taken a conservative view in calculating what is directly due to the Dell platform. Nevertheless, an average benefit of $27,265 per 100 IT users per annum compared with legacy storage was contributed in this area.

FIGURE 2

Average Annual Benefits per 100 Users



Source: IDC, 2015

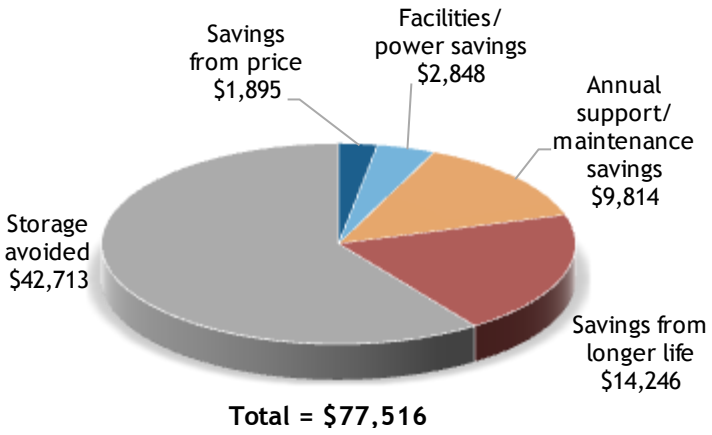
Storage Infrastructure Savings

As a result of deploying Dell Storage Solutions, customers in this study have lowered their annual IT expenses for storage by an average of $71,516 per 100 users (see Figure 3). These savings stem from the following key areas:

- **Higher efficiency.** Dell storage solutions are modular and more flexible than frame-based chassis systems. So tiering is much easier; adding or moving storage resources around is easier, which increases utilization. Organizations did not have to over-resource to meet changing needs. As explained by one Dell customer: "With a PS Series platform, it has a pair of controllers and disk with every unit you buy. And so it scales up and out." On average, organizations in the study found Dell storage solutions to be 35% more efficient than other storage solutions they had used.
- **Longer life.** SC Series installations tended to have a 66% longer productive life span than non-Dell storage solutions. Organizations in the study were replacing SC Series or PS Series solutions every 6.75 years compared with 4.08 years for their other storage environments.
- **Greater cost-effectiveness.** Dell PS Series storage solutions are delivered as a complete solution with all software features enabled. Whereas some competitive storage providers charge additional fees for add-on capabilities, as stated by one company: "PS Series was cheaper, definitely. The reason it was less expensive is not necessarily the cost of the platform itself, but all of the software on top of the other solutions. For example, if I wanted to do 'snapshotting' with some of the other solutions, I would have to purchase a separate software license for 'snapshotting.' If I wanted to do replication to another facility, there was another license for software for some of the other products. But with PS Series, by the time you put it all together in one bundle, it was 20% cheaper." Dell SC Series software licenses are "perpetual" in that they do not have to be repurchased after a controller upgrade.
- **Lower annual support/maintenance.** By reducing the need for capacity upgrades, and extending the useful life, annual maintenance costs were reduced by an average $9,814 per 100 users annually.
- **Facilities/power.** By reducing the need for capacity upgrades, facilities and power costs were reduced by an average $2,848 per 100 users annually.
- **IT labor avoided.** Staffing efficiency was a result of Dell Storage Solutions extending the amount of storage it could manage through automated load balancing and simplified management of a virtualized storage pool. So while these organizations were continuing to grow their storage requirements annually at 159% in response to business demands, they did not have to grow their IT staff as much because they were able to create a more efficient storage management operation. Many of the SC Series users emphasized the labor-saving impact made by Dell Copilot support services. Common examples included the proactive supply of parts to fix issues during out-of-hours periods and the active supervision of system upgrades.

FIGURE 3

Annual Infrastructure Cost Savings per 100 Users



Source: IDC, 2015

Optimized IT Staff Productivity

The organizations in the study selected Dell storage primarily because the solutions were highly cost efficient. What they found after the solutions had been in place for some time was that the automation, quality, modularity, and longevity optimized their IT staff resources so that despite growth, they were able to manage their storage operations without a corresponding growth in IT staff. As Figure 4 shows, the Dell storage solutions impacted every IT task associated with managing storage resources:

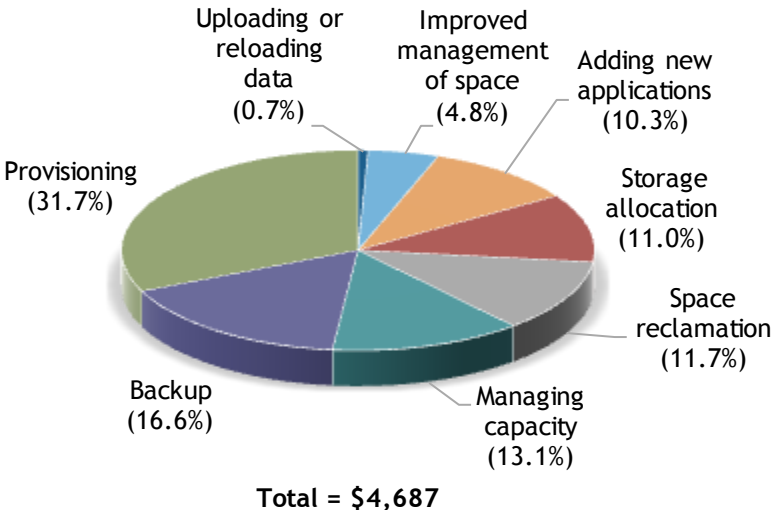
- **Storage provisioning and allocation.** Standardizing on a platform that allows you to provision and allocate storage based on preset criteria tailored to your organization's needs reduces the time normally spent responding to each instance. (PS Series user) "Here's the problem: if I were still building servers the old way, I'd buy the storage five years in advance. So I'd build the server and pay a lot of money to put the storage in the server. And it would just sit there. Now, I don't do that. I just use it as I need it. And it comes out of a pool, basically. When we bring in a new array, we just put it in. We don't manage it from a data migration perspective. But if we were using another vendor, I think we'd be spending time each time that happens … if I had to actually somehow migrate data."
- **Adding new applications.** The organizations were able to implement disk extensions quickly to support new applications.
- **Managing capacity.** Scale-out architecture enables flexible capacity. Managed capacity enables an organization to meet changing demand without changing the overall footprint. (SC Series user) "We let it self-migrate for a while and then put in 2TB drives in the same footprint. We were just moving … shuffling data within the unit itself. All of it is self-managed on SC Series. There's more time savings there because when you're doing an upgrade on something that has an 8TB volume, you don't have to go … and say, oh we're out of disk space, we have to go copy our data someplace else and move it and bring it in. There's a huge cost saving there."

- **Space reclamation.** The data progression does that automatically, eliminating that requirement.
- **Improved management of space.** Dealing with downtime is significantly reduced due to fewer instances and quicker MTTR.
- **Shorter windows and less hands-on from the IT staff.** The ability to backup and upload or reload data operations is more automated and standardized, creating shorter windows and requiring less hands-on from the IT staff.

On an annual basis, the companies saved $4,687 per 100 users by increasing IT productivity.

FIGURE 4

Annual IT Staff Cost Savings per 100 Users



Source: IDC, 2015

Impact on User Productivity

Businesses continue to automate their operations to reduce costs and increase agility. However, the IT environment is rapidly changing. Today, increased computing resources are more densely packed into fewer facilities, so storage failures due to capacity shortfalls, I/O issues, and extended backup operations are more frequently incurring disruptions that significantly impact operations. IT staff constantly seek to increase the reliability of their operations. The organizations in the study experienced high storage growth rates, which have resulted in increased complexity in their environments. Despite that increased complexity, they report that Dell storage has helped them reduce the incidence of storage-related downtime. The organizations were effective at keeping the frequency of incidents down even prior to deployment of Dell storage solutions (less than one per month), but recovery time was slow at nearly eight hours. With Dell's storage solutions, they were able to reduce service failures by 59%. In fact, three of the organizations reported eliminating storage downtime entirely. More significantly, they were able to reduce recovery time to around 30 minutes.

On average, Dell Storage Solutions customers in the study were able to reduce their lost user productivity by 99%, restoring 37.9 hours of annual productivity to each end user. With an average working week of 40 hours, a company with 100 employees would restore nearly 4,000 hours, or two full-time equivalents (FTEs), per year. Table 3 shows annual IT user productivity savings per 100 users.

TABLE 3

Annual IT User Productivity Savings per 100 Users

User Productivity	Improvement (%)
Number of downtime incidents per month	60
Average downtime duration (hours)	97
Downtime hours per year per user	99

Source: IDC, 2015

Overall Business Productivity

Business productivity refers to improvements in business performance that are directly attributable to the Dell storage deployment – for example, system performance improvements that led to higher sales margins, higher sales win ratios, or the faster rollout of new products or services (see Table 4).

TABLE 4

Business Productivity Benefits

Increase in system performance	34%
Net increase in productivity	4%
Increased operations performance per 100 users	$26,186
Increased revenue	$373,150
Operating margin	10%
Increased margin	$37,375
Increased operating margin per 100 users	$1,078
Total business productivity	$27,265

Source: IDC, 2015

The study highlighted several examples where the Dell storage brought about a significant improvement in the performance of production systems, leading in turn to improved business outcomes for the company. These included improvements in salesperson productivity, sales revenue, and average margin. Reducing downtime by 99% also impacted revenue. Increased reliability of operations contributed $373,150 in average additional revenue. For this study, IDC has taken a conservative view of the business productivity benefits, yet an average $27,265 per 100 users annually can be added to the overall financial benefit of the Dell storage deployment.

The Impact of Flash

Adding flash to Dell PS Series or SC Series storage had a significant positive benefit for the users in the study. IDC found that flash-equipped systems ran faster, supported more VMs, and had higher utilization rates than those without flash (see Tables 5 and 6).

TABLE 5

Advantages of Flash

Flash Performance KPI	HDD	SSD	Percentage of Change
Utilization rate (%)	47	85	80
Average latency (ms)	13.03	1.75	87
Average I/O per second (IOPS)	418	6,500	1,457
Life span (years)	5.17	6.88	33
Virtual images per server	5.83	10.37	78

Source: IDC, 2015

The Dell Data Progression function meant that users enjoyed significant performance boost without additional operational overhead or the need to manage an additional storage silo. As one user put it, " … we don't have the performance issues any more, and the box manages itself."

Since the sample included both flash and non-flash users, it was possible to make flash versus HDD comparisons in terms of IT labor costs and user productivity. IDC found that Dell flash customers experienced reduced IT labor and infrastructure costs yet higher user productivity. The drive count was reduced as flash eliminated the need for wide striping across numerous HDDs to meet I/O performance needs. Higher system performance in turn led to enhanced user productivity.

TABLE 6

The Financial Advantages of Flash Versus HDD

	Percentage of Benefit Over HDD
IT labor cost avoidance	85
Reduction in drives (TB)	32
Net increase in user productivity	38

Source: IDC, 2015

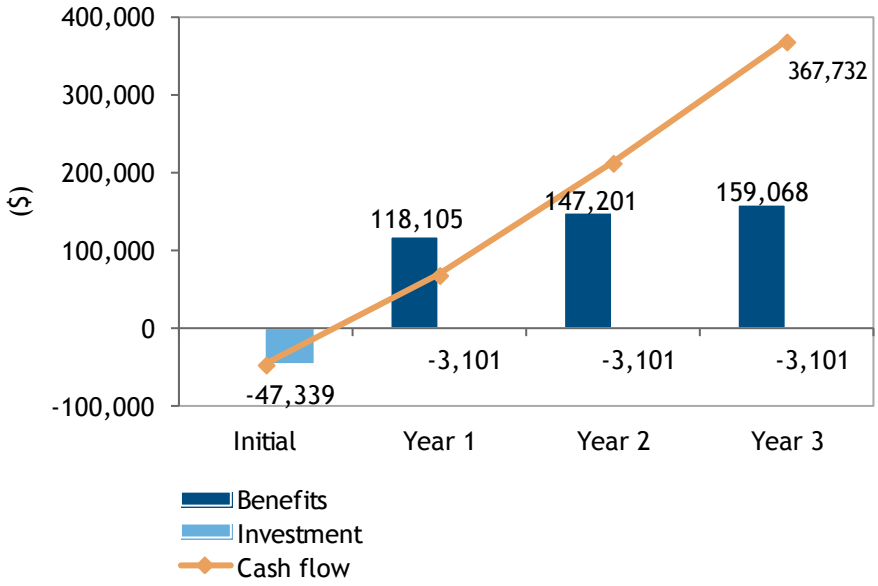
ROI Analysis

IDC looks at the cash flows of the financial benefits compared with the investment or total costs of the IT initiatives over a three-year period to assess return on investment. The initial investment included the average total costs to purchase and deploy the new systems, which include hardware and software purchase, consulting and other third-party services required to architect and install the new systems, the costs and lost productivity associated with IT training, and the IT labor required for installation and migration of applications. Annual costs are for support and upgrades. Annual benefits include infrastructure savings, reduced IT labor support, and increased end-user productivity.

Figure 5 shows the undiscounted cash flow analysis. Organizations in this study made an initial average investment of $47,339 per 100 users, which included the purchase and implementation costs to include consulting services and the IT labor required to deploy and train. Based on that investment, the organizations realized average annual benefits of $100,005 per 100 users. Over a three-year period, each company saw cumulative net savings of over $367,732 per 100 users.

FIGURE 5

Cost Benefit Analysis



Source: IDC, 2015

Table 7 presents a three-year view of the financial impact of Dell storage solutions per 100 users. IDC uses a 12% cost of capital to discount cash flows.

The three-year ROI analysis shows that on average, the organizations in this study spent $54,787 (discounted) per 100 users on technology refresh and received $336,020 (discounted) per 100 users in benefits for a net present value (NPV) of $281,233. The companies saw an average payback in 6.2 months (after deployment) and an average ROI of 513%.

To put this result into context, IT hardware investments commonly provide payback in a 9- to 12-month period. Payback in 6 to 9 months is normally considered to be very rapid, so the 6.2-month payback for Dell storage in this study should be considered an exceptional performance.

TABLE 7

Three-Year ROI Analysis per 100 Users

Benefit	$336,020
Investment	$54,787
NPV	$281,233
ROI	513%
Payback period	6.2 months
Discount rate	12%

Source: IDC, 2015

FUTURE OUTLOOK

Dell's expansion of its storage portfolio is notable, and not just for the energy and investment that the firm is putting into this part of its business. The company's focus on acquiring, developing, and integrating storage technologies, as well as launching services to respond to specific customer pain points, indicates a well-thought-out strategy and commitment to success.

An example of how Dell leverages acquired technology is the Dell Fluid Cache for SAN, which integrates technology from the RNA acquisition to extend the data placement capability of the SC Series platform. With Fluid Cache for SAN, an SC Series array can automatically migrate hot data from the array to server-side flash, cutting latency to the minimum. Dell claims a performance of 5M IOPS from the fastest configurations, yet the data can be managed, protected, and provisioned using the standard SC Series interface and processes.

Dell's Intelligent data placement in which data is positioned automatically so as to be in the right place at the right time and at the right cost is the foundation for the company's storage vision. Data is moved automatically through a spectrum of storage tiers that may cover a 1,000x range in price/performance. This will provide dramatic increases in performance while maintaining high levels of data protection for a wide range of workloads. This is an example of how Dell's investment strategy in servers, storage, and networking is intended to bring benefits across the datacenter.

The PS Series and SC Series platforms are set to converge to a common code base. This will allow Dell to optimize its R&D resources to bring new features to market more quickly. Users with both platforms will potentially simplify and standardize management processes, leading to cost savings.

As a major vendor of general-purpose servers and storage, Dell is understandably positive in promoting the acceptance of software-defined storage. This will offer an alternative to high-priced storage appliances, as users simply run their choice of storage software on standard server and

storage enclosures. Dell is partnering with vendors such as Nexenta, Microsoft, and VMware to bring approved configurations to market with a full suite of service offerings. Dell's intention is to deliver the price/performance of software-defined solutions with the high levels of support and service that appliance buyers expect. If successful, this strategy could effectively rebase storage pricing without compromising performance or support.

CHALLENGES AND OPPORTUNITIES

Dell faces several clear challenges and opportunities in its storage business:

- Dell is still seen as a "PC company" by those that have not followed its rapid progress in recent years. That unwarranted prejudice is an additional challenge for the company as it bids for large datacenter projects.
- The broad Dell portfolio now touches almost every part of the mainstream IT market. That diversity gives Dell sales and support people an extra challenge as they compete with more focused pure-play storage vendors.
- Dell still lacks market awareness of its storage capability. Many of the users interviewed in this study mentioned how Dell was not on the original vendor shortlist but was "discovered" almost by accident.

Dell is pushing hard to make a success of software-defined storage, which is currently at the early-adopter stage, and may not blossom into mainstream use for several years yet. Dell has historically focused on high-volume, well-established markets. It therefore could face years of sales and marketing effort before SDS revenue rise to an acceptable level.

CONCLUSION

In talking to companies about their IT investments, IDC has found that the most successful projects usually combine three important elements: consolidation, standardization, and automation. A project with one or two of these can be effective, but if all three are included, it can be a major success.

The rapid financial return seen by Dell storage users can be attributed to the same three factors. Companies were typically able to consolidate storage silos, standardize on a single platform and management interface, and utilize the embedded automation to keep performance levels up and management time at a minimum.

The ease with which flash was deployed was very apparent. Without the need for specialized storage administrators, flash brought sustained and consistent performance uplifts, without additional risk or management complexity.

In conducting this survey, it was notable that Dell storage users expressed particularly high levels of satisfaction. In many cases, users were impressed with the capabilities of Dell storage solutions compared with their experience with other vendors. Flash-based systems displayed high levels of performance that led directly to productivity gains for users and the business as a whole.

The interviews strongly validated the benefits that Dell promotes in its marketing campaigns. Automated tiered storage, simplified management, automatic load balancing, seamless flash upgrades, long life cycles, and proactive support services were all seen to deliver significant customer value.

Despite its global IT presence, Dell could be considered a relative newcomer to the world of high-performance storage solutions. Through the vision of its advanced architecture, it has a clear framework for the delivery of a broad and coherent set of storage solutions and services. The company is highly focused on integrating new technology acquisitions into the portfolio and is spending heavily on research and development. In IDC's view, Dell is making strong progress in its evolution from a reseller of storage arrays to an end-to-end provider of innovative and commercially sound storage solutions.

APPENDIX

IDC ROI Methodology

IDC performs a three-step process to calculate the ROI and payback period:

1. Measure the benefits from reduced costs, increased availability, and improved IT productivity.
2. Ascertain the total investment in the solution (hardware, software, FTE requirements for deployment and annual maintenance, customization, training, and consulting).
3. Project the investment and benefit over three years and calculate the ROI and payback period for the solution.

To account for the time value of money, IDC bases the ROI and payback period calculations on a 12% discounted cash flow.

Note: All numbers in this document may not be exact due to rounding.

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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