

White Paper

The IBM FlashSystem 840: Technical Evolution to Deliver Business Value

By Mark Peters, Senior Analyst; and Monya Keane, Research Analyst

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Contents

The Value of Flash.....	3
Flash Adoption Rates Are Still Rising	3
How IT Organizations Are Implementing Flash	4
The Message IT Wants to Hear: ‘Better Storage Performance Will Improve Your Business Operations’	4
The Value of a Flash <i>Portfolio</i>	6
Flash Is Valuable in Several Places.....	6
IBM Has Expanded Its Flash Portfolio.....	7
The Newest Member of IBM’s Flash-based Family Is a New, All-flash Appliance.....	7
The Four Pillars of the IBM FlashSystem 840	8
The Bigger Truth	10

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The Value of Flash

Although solid-state in various forms has been a specialist storage technology since the late 1970s, it shed its “niche” moniker for good in 2008. Enterprise-ready flash—fast, not astronomically expensive, and versatile—had arrived, and its maturation allowed storage vendors to begin packaging the technology in ways that could directly improve not only their customers’ IT efficiency, but also their business effectiveness.

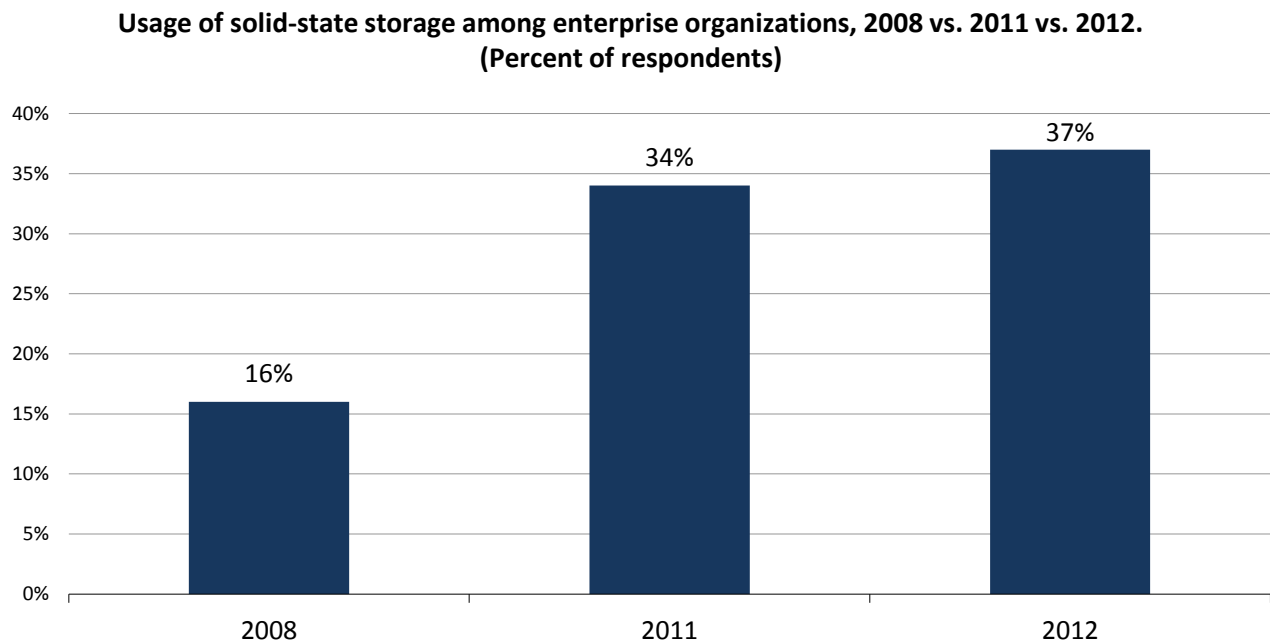
This high-speed storage technology has tremendous potential to support I/O-intensive and/or latency-sensitive applications. Today, seemingly every storage system vendor, large and small, offers at least one flash solution. Some vendors go further, offering wide assortments of flash options inside servers, storage subsystems, and appliances.

Flash Adoption Rates Are Still Rising

ESG has been tracking flash storage adoption trends among enterprise organizations since 2008. Not surprisingly considering the expansion in flash-centric options in recent years, adoption is progressing at a healthy pace. According to ESG research, the number of enterprise organizations leveraging solid-state storage technology more than doubled between 2008 and 2012 (see Figure 1).¹

As of 2011, 34% of ESG research respondents were reporting that their organizations were already leveraging solid-state storage in some form. Another 17% planned to deploy the technology in the next 12 months, and 18% were evaluating doing so, hoping to solve performance problems that were affecting particular business applications.²

Figure 1. Significant Increases in Solid-state Storage Use Among Enterprise Organizations



Source: Enterprise Strategy Group, 2013.

But having more flash-based choices at hand is not the only factor influencing adoption: Drops in cost appear to be contributing to the trend, too. Absolute *and* relative prices have been declining due to competitive pressures and the emergence of “flash-complementary” products for caching and tiering—those tools allow IT organizations to be judicious in using a relatively small amount of flash to spur a comparatively broad positive impact across a storage environment.

¹ Source: ESG Research Report, [Solid-state Storage Market Trends](#), November 2011.

² Source: ESG Research Brief, [Solid-state Storage Continues to Shed ‘Niche’ Moniker](#), May 2013.

How IT Organizations Are Implementing Flash

Flash’s modern era began with enterprise storage vendors inserting solid-state drives (SSDs) in external disk storage subsystems. It was an easy way to add faster “disk” to spindle-based architectures, requiring few or no changes to underlying hardware data paths or software layers. (Later, however, some vendors did make vast changes to the software layers to better exploit flash technology’s advantages.)

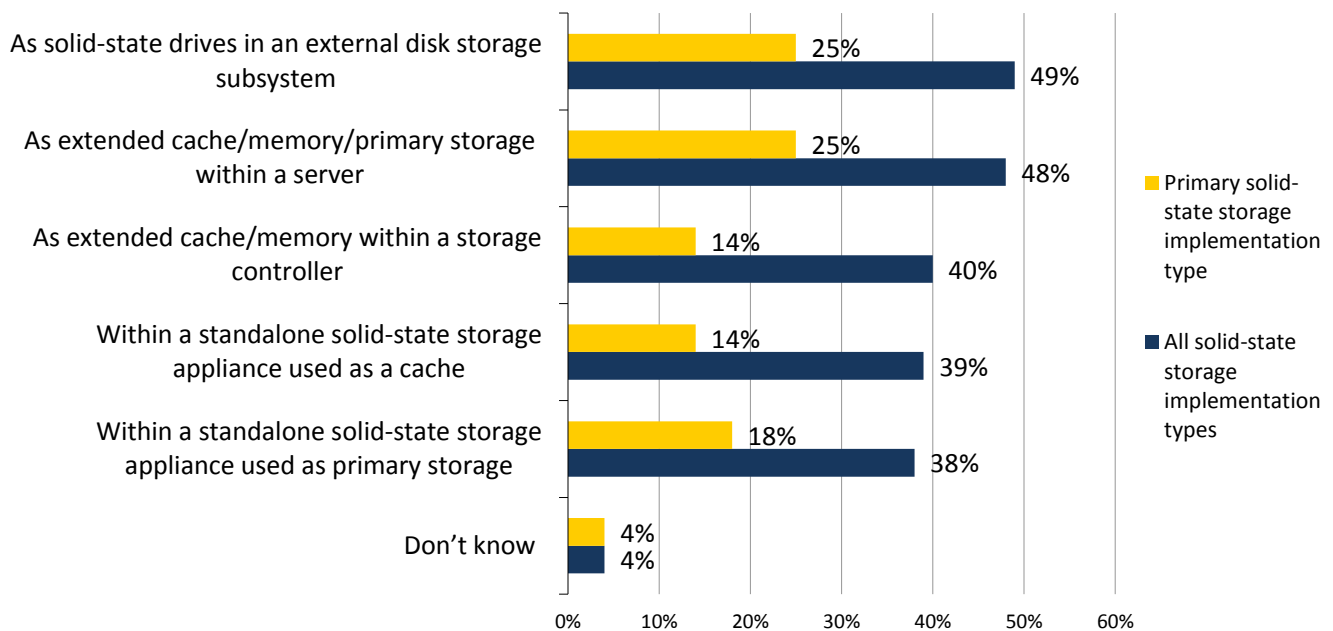
Another approach manipulated flash at the fastest, lowest data path level possible: hardware. A couple of vendors, including Texas Memory Systems (later acquired by IBM), offered all-flash-optimized appliances.

Today, those two implementations—SSDs in external disk arrays and all-flash-optimized appliances—remain the most common, with 43% of surveyed current users leveraging them as their primary solid-state storage implementation type.³ Other major implementations involve using flash in extended cache, memory, or internal storage inside servers rather than added to external arrays.

As Figure 2 shows, many organizations are now using *standalone* flash appliances.⁴ Perhaps it is another indication that IT professionals genuinely understand and appreciate the potential operational/financial value that an all-flash array may provide.

Figure 2. Solid-state Storage Implementation Types Among Current Users

Which of the following implementations of solid-state storage technology is your organization currently using? Which is your **primary** (as measured by greatest amount of solid-state storage capacity) implementation type? (Percent of respondents, N=133)



Source: Enterprise Strategy Group, 2013.

The Message IT Wants to Hear: ‘Better Storage Performance Will Improve Your Business Operations’

All storage vendors have shouted “better performance” since the dawn of, well, the storage industry! However, today’s pragmatic and viable use of flash is moving that conversation to a whole new level. Yes, we know that when storage buyers are considering what to buy, many decision criteria exist. TCO, increased reliability, more longevity, improved environmental factors, and good service/support all play a role. But when it comes to flash storage in particular, IT administrators who oversee “need-for-speed” production applications are overwhelmingly interested

³ Source: ESG Research Report, [2012 Storage Market Survey](#), November 2012.

⁴ Ibid.

in hearing about one thing above all else: performance.⁵ Indeed, to emphasize this point, when ESG asked about the key messages that they believe storage vendors should emphasize, respondents ranked performance as the top value proposition they wanted to hear (see Table 1).⁶

Table 1. The Most Important Messages That Storage Vendors Can Deliver

What is the most important message you can hear from a storage vendor today? Please rank the following messages from 1 to 8 in terms of their importance (with 1 being <i>most</i> important and 8 being <i>least</i> important). (N=418)	
Message	Rank
Our product offers the best storage performance	1
Our product has the lowest price per terabyte (\$/TB)	2
Our product can reduce operational costs (e.g., staff, power & cooling, etc.)	3
Our product can solve specific application(s) performance challenges	4
Our product can enable a specific business process	5
We offer an integrated computing stack (i.e., server, storage, networking, etc.)	6
We enable the management of heterogeneous storage vendors/systems	7
We have a compelling vision to transition you to cloud computing	8

Source: Enterprise Strategy Group, 2013.

And of course, without question, performance is the key attribute of flash. However, its real business value and operational impact are heavily weighted toward something bigger: economics. I/O performance is the engine that accelerates a mission-critical application. In other words, storage performance is a means to an end; it is not often an end in itself.

A well-chosen, well-implemented flash-based system can have a positive effect on an organization’s critical applications. This positive effect is manifested, for instance, as faster response times, lower TCO, smaller data center footprint, or speedier or more frequent application updating. In the same way that flash affects applications, applications, in turn, affect the business. *Thus, with the kinds of IT-centric improvements just mentioned in place, valuable business-level enhancement and competitive differentiation can follow.* Some specific examples might include:

- A supermarket chain’s data warehouse average response time could shrink from minutes to just a few milliseconds, providing the company’s sales and inventory analysts with more, and more timely, actionable intelligence, which then could generate increased sales.
- A telco’s call center representatives could get faster access to customers’ account, usage, and billing data—enabling those representatives to address potential issues faster, uncover new feature opportunities, demonstrate the type of “customer awareness” that drives satisfaction up, and therefore maintain (or even grow) subscriber numbers.
- A credit card company could process hundreds of thousands of incoming sales with no noticeable latency, even on the most transaction-heavy shopping day of the year. That speed would translate into not only customer satisfaction, but also improved ROI and income for the company because in its business more than most, time really is money.

Sometimes, the connection between using a technology component (flash, in this case) and enhancing business value is not immediately apparent. However, when one examines the technology’s effect on IT applications in terms

⁵ Source: ESG Research Report, [Solid-state Storage Market Trends](#), November 2011.

⁶ Source: ESG Research Report, [2012 Storage Market Survey](#), November 2012.

of that technology's role as an enabler, it becomes far easier to spot the "technology upgrade equals more profit and happier customers" linkage.

And it *is* a crucial mental connection for IT and business people to make because, bottom line, a flash-storage implementation decision is more of a business decision than a technical one.

The Value of a Flash Portfolio

It is wise, however, to stop thinking about flash as "one item." Several varieties of flash are now available, and IT organizations are (as Figure 2 showed) using more than one of them. For example, a super-fast and relatively expensive PCIe flash card inside a server addresses different use cases from a solid-state drive in a storage array.

All forms of flash have their own uses. In the same way that IT organizations have figured out appropriate ways of deploying and using hierarchies of spinning drives, servers, routers, and all sorts of other IT tools, they now have a range of flash to pick from as their needs, specific applications, and economic priorities dictate.

From this cost-benefit analysis standpoint, flash storage isn't a product at all. It is a technology being packaged in a variety of ways to serve as a business enabler. Consider an automotive analogy. Some cars are designed for carrying groceries; others are designed to win at the track. Both have their legitimate place and purpose.

It stands to reason that flash storage buyers should seek out an IT vendor that can offer them a *full* portfolio of flash-based solutions to pick from. Otherwise, they may find themselves tied to vendors who will persist in claiming that their one-stop alternative is still perfect, somehow, for any job at hand. When it comes to vendors like that, the adage is true: "If the only thing you have in your tool box is a hammer, then every challenge looks like a nail."

It would behoove IT organizations to investigate and as needed, implement a *portfolio* of data storage technologies—including a range of flash storage—that can address the full spectrum of their performance and capacity needs.

Flash Is Valuable in Several Places

Here's why vendors should be **offering** a flash-based portfolio ... *and* why users should be **deploying** a flash-based portfolio: Users need to support diverse types of applications. It's safe to say that all those applications have some degree of performance requirement in common, but in other ways, they vary so extensively that they would be best served by different implementations of flash. That reality produces the market's desire for the range of flash technologies we see today. It's also worth noting that no list of "silver bullet" flash applications exists. One organization might categorically need flash for, let's say e-mail, while another organization considers e-mail relatively unimportant. Again, the value proposition for flash is not tied to specific applications but to business drivers, which could embody some combination of speed, cost, business differentiation, competitive pressure, etc. Those business priorities and the applications that support them vary from organization to organization.

This situation also likely explains why ESG research indicates that current flash-related interest among users reflects a need for tools that can support both specific vertical applications and general, horizontal infrastructure elements.⁷ For instance, auto-tiering and caching options for flash are popular now, in part because such options don't require IT to predefine exactly how they will leverage those flash resources. Some vendors, noting the increases in applications suited for flash storage, are responding by offering a broader range of flash tools suited for supporting applications and implementations running on physical or virtual machines, and operating in both traditional data centers and the cloud.

Another interesting phenomenon is that more than one dimension to "performance" exists. For example, virtual desktop infrastructures and e-commerce applications need *low latency*—i.e., zero perceptible delay between input received and output returned. But databases, OLTP platforms, and messaging infrastructures (again, as examples)

⁷ Ibid.

tend to need *acceleration*—i.e., really fast throughput under even the most high-stress, transaction-heavy conditions. Both categories of performance can be important, in varying degrees, in enterprise flash deployments.

Many “shades” of need exist when it comes to performance, and even a single-flash implementation can bring some degree of improvement. The point is that employing multiple optimized flash deployment strategies can deliver *even better* results.

IBM Has Expanded Its Flash Portfolio

As mentioned, some storage vendors today are promoting a one-size-fits-all flash solution. Others are taking a smarter route, presenting to their customers and prospects a range of flash “flavors” to choose from as suits their application and business appetites. One such vendor is [IBM](#).

IBM states that it offers the most comprehensive flash portfolio available anywhere to help organizations compete, innovate, and grow. It also claims to lead the industry in regard to flash optimization within both hardware and software.

IBM is clearly serious about flash. Beyond just developing and selling flash technologies, it also operates 12 “Flash Centers of Competency” worldwide whose mission in part involves helping customers tailor the correct IBM flash-centric hardware/software technologies to their distinctive business needs. IBM has also stated that it is investing \$1 billion in its flash business.

IBM’s portfolio encompasses flash-optimized storage arrays, all-flash appliances, flash software, flash drawers, flash adapters, and SSDs. In terms of all-flash appliances specifically, customers until now have been able to choose from the IBM FlashSystem 710 and FlashSystem 720 (with SLC flash), and the FlashSystem 810 and FlashSystem 820 (with eMLC flash).

The Newest Member of IBM’s Flash-based Family Is a New, All-flash Appliance

Now, prospects can opt for something else as well—the just-announced IBM FlashSystem 840.

FlashSystem 840 builds on the success of the FlashSystem product family, taking the same fundamental architectural approach and value proposition, but improving reliability-accessibility-serviceability (RAS) and scalability characteristics for demanding enterprise environments. In other words, IBM made an already-broad storage product line more capable of supporting an enterprise’s existing hardware, application, and even human capital resources flexibly and appropriately. IBM already prided itself on having a portfolio of storage systems that would be considered end-to-end by most definitions. But this IT vendor is continuing to evolve and grow, mirroring its clients’ demands for ever-greater choice.

How did IBM specifically do this with the new FlashSystem 840? By improving things that businesses care about: reliability, accessibility, and serviceability, without compromising performance. And remember, performance is the number-one

IBM FlashSystem 840 Tech Specs

The most impressive characteristic of the IBM FlashSystem 840 is what it can do to enhance business operations. But for readers who haven’t yet had a chance to read IBM’s data sheets about this new storage system, here are a few technical highlights:

- Performance: 1 million IOPS, 8GB/sec bandwidth
- Latency: ~100us
- Capacity: Granular usable capacity of up to 48TB
- Interfaces: 16/8/4Gb FC, 10Gb FCoE, 40Gb QDR IB
- Flash chips: eMLC
- RAID: patented Variable Stripe RAID and Two-Dimensional RAID
- Power draw: 625 watts (in a 2U form factor)
- Serviceability: Enterprise data center-optimized design with front-load hot-swap modules, concurrent code load, full redundancy throughout, and simple GUI-based management console. The system supports non-disruptive maintenance and firmware updates, and it is field upgradable.

message that production-focused storage administrators want to hear—provided that the product in question can also meet reliability requirements.

The new system also comes with typical IBM ruggedness. Its RAS level exceeds that of the prior-generation FlashSystem, and its management efficiency has risen as well. An IT professional working with FlashSystem 840 will find a familiar, single-pane-of-glass interface that is essentially the same as that used on the IBM Storwize, XIV, and DS8K product lines.

The management efficiency improvement is particularly notable. ESG research indicates that service and support are key considerations among organizations engaged in selecting a storage vendor or solution. Fifty-three percent of respondents identified good service/support as an important criterion, making it the second most-frequently mentioned selection criterion after TCO.⁸ And what company is more equipped to provide great, global, enterprise-class support than an IT powerhouse such as IBM? (Some startups value IBM-caliber support so much that they actually contract with IBM's support organization to gain the kind of "internal" support resources they want to offer to customers but simply cannot provide all by themselves.)

The new all-flash appliance embodies several features that are "enterprise data center expected" today. It offers full redundancy (which enhances reliability), hot-pluggability with front and rear accessibility (so a shutdown is not required to perform an upgrade), nondisruptive maintenance and firmware updating (concurrent code load), and field upgradability (supporting efficiency and productivity). Additionally, power usage on a per-unit basis has gone down.

Although overall performance has been boosted significantly, the I/Os have not actually gone up on a per-unit basis. Rather, the performance boost is a system-level one. The previous generation (FlashSystem 820) was a 1U offering. This generation is a 2U. The unit height has doubled, so on a system-wide basis, I/O has doubled—from roughly 500,000 read IOPS to 1 million read IOPS.

The Four Pillars of the IBM FlashSystem 840

IBM describes the attributes of the FlashSystem 840 (and its whole FlashSystem family) in the context of "four pillars." They are:

- **Enterprise Reliability**—represented by its redundant hot-swappable components, data encryption, concurrent code load support, call-home capability, patented data protection technology, and remote power-up capability.
- **Macro Efficiency**—represented by its 2U form factor, minimal footprint, low power needs, and non-disruptive, field-upgradable maintenance capabilities. Furthermore, its custom flash modules provide economic efficiency because IBM does not need to pay an OEM "middleman" to put together the solid-state drives.
- **IBM MicroLatency**—represented by its 110/25µs read/write latency (response time) and its corresponding ability to maximize host CPU utilization by greatly reducing time spent waiting for I/O.
- **Extreme Performance**—represented by its 1 million IOPS, 8GB/sec bandwidth provided with standard storage interfaces including 16 Gbit Fibre Channel, 40 Gbit quad data rate InfiniBand, and 10 Gbit Fibre Channel over Ethernet.

It should be noted that all of those terms and descriptors listed above reflect how IBM, not ESG, describes the FlashSystem 840. This is important because although the four pillars certainly encapsulate some very impressive foundational elements, they do not take the next big leap. Specifically, they don't *overtly connect* the product's remarkable technical characteristics to the business improvements that a transaction-intensive environment deploying this system should expect to see.

⁸ Source: ESG Research Report, [2012 Storage Market Survey](#), November 2012.

Ideally, the four pillars should *directly* support IBM's umbrella claim that the FlashSystem 840 will improve a business's economics. Why is it focused on the mechanical guts? Where's the front-and-center story of business improvement? Again, the pillars themselves are extremely solid from a technical perspective, but they will likely appeal more to the storage operations team than to the application owners. Indeed, IBM is, if anything, underselling what it has: What matters these days should be just as much about the beauty of the building (one might even say "architecture" to make the analogy more IT relevant) as about the comprehensive and strong nature of the pillars upon which it is built.

It is forgivable, and certainly typical of the good-old, somewhat-prone-to-be-nerdy IBM that we've known and loved for decades. Admittedly, the company excels at promoting very high-level messages: "The Smarter Planet" campaign, for example, is visionary in its scope, goals, and appeal. But IBM itself concedes that its technologists tend to be more comfortable talking about practical engineering matters and less comfortable making the kinds of pie-in-the-sky boasts that pass, often all-too effortlessly, from competitors' lips.

However, the whole point of this new IBM system is its potential to provide unusually significant *business value* to organizations running mission-critical, transaction-intensive applications. IBM might want to reorganize its messaging to emphasize that value just a bit more. For example:

- IBM could consider tying its RAS reputation and the RAS strengths of the FlashSystem 840 more closely to users' strong desire to receive good service and support.
- IBM currently ties the "four pillar" attributes—Enterprise Reliability, Macro Efficiency, IBM MicroLatency, and Extreme Performance—directly to its FlashSystem family. It may make sense for IBM to map those important concepts further, to its broader flash portfolio overall, and then discuss the business value of such a broad portfolio.

In all, IBM could justifiably lead less with statements about low latency or high IOPS, and way more with descriptions of the business improvements a customer could achieve by deploying this system, especially alongside other software- and hardware-based elements of IBM's broad flash portfolio.

Examples of how better performance allows a business to achieve economic improvements might include how:

- Financial institutions can give their customers an edge.
- Telcos can deliver services and products to their customers faster.
- E-commerce sites can operate more efficiently, thus creating superior client experiences and further retaining their clients' attention or dollar spend.

IBM has these stories in hand (and in spades!) already—stories of how its customers are driving products and services to market faster, how they are improving their own customers' satisfaction and loyalty, how they are cutting response times so dramatically that significant financial improvements have been derived. IBM's own customers are sharing these anecdotes, and the stories are very appealing to prospective users.

For the right environment, flash trumps traditional-spinning-storage-only deployment models, not just in terms of better performance and reliability, but also from a higher-level economic perspective. As IBM likes to state, data is the new currency of business. And as such, IBM is well positioned to help its customers drive the best data economics—and derive the most business value out of that data.

The Bigger Truth

Aristotle said long ago, “The whole is greater than the sum of its parts.” The fact that IBM is continually improving and adding to “the whole” of its flash product portfolio is commendable. A portfolio offers an IT organization a degree of value much greater than individual pieces alone could ever do. The newest portfolio element, FlashSystem 840, extends IBM’s family of all-flash systems—some of which have entry-level (but expandable) capacity points, while others are suited for larger-scale business operations.

FlashSystem 840 boasts a set of impressive, even exciting, features that place it firmly in the upper echelon of products in its category. It has the potential to deliver balance from front-end to back, achieving maximum performance to drive enhanced economic value. The product can provide a boost to a wide range of applications—currency exchange platforms, e-trading systems, real-time data analytics systems, mainframe transaction processing environments, as well as more humble e-mail and database operations—all of which need to process massive amounts of information very quickly and require high-reliability IT systems. Traditional spinning-disk storage, even when optimized for high performance, cannot keep up with the physical I/O activity (or often the reliability levels) that applications such as those require.

However, the real value is *not* centered in the attributes of the product itself. FlashSystem 840, like any IT hardware, has no innate value as a machine; it is merely a collection of components and code. In use, though, it offers massive value to certain IT operations. Those operational improvements, in turn, have serious, positive business-level implications. This system can help an organization *to make decisions and take actions faster*. In other words, the real value of this system lies not in what it can do for business data per se, but what doing so can mean for a business.



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20 Asylum Street | Milford, MA 01757 | Tel: 508.482.0188 Fax: 508.482.0218 | www.esg-global.com