



## White Paper

# Storage Redesign: Quantifying the Business Value of IBM FlashSystem

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## EXECUTIVE SUMMARY

Flash storage transforms organizations' ability to deliver unprecedented performance and operational efficiency and to meet the new requirements for providing a great end-user experience in digital transformation initiatives like Big Data and analytics and omni-channel marketing.

As a result, we see an increasing number of companies looking to flash storage systems as a way to drive new levels of innovation and operational efficiency in storage.

To measure the transformational impact of flash storage systems, IDC interviewed eight IBM clients supporting key business applications and workloads with IBM FlashSystem. According to these organizations, IBM FlashSystem has provided the storage performance and availability their business operations require, enabling them to better serve their customers and increase their employees' productivity.

Based on interviews with these clients, IDC projects that they will realize financial benefits through their use of IBM FlashSystem worth an annual average of \$667,700 per 100TB (\$1.63 million per organization) by:

- Performing significantly better than legacy storage platforms
- Supporting better customer engagement
- Enabling higher productivity for employees who depend on fast and consistent flow of data
- Providing the highly reliable storage operating environments that these organizations require for critical applications, limiting the impact of outages on operations
- Serving as an efficient and cost-effective storage platform

IDC believes that IBM FlashSystem offers a unique blend of functional, operational, and financial characteristics. This study demonstrates how users have translated this into productivity gains, cost savings, and better customer service, with a significant business value for the organization.

### Business Value Highlights

- Three-year average ROI of 364% across the survey sample
- Three-year total average benefits of \$1.60 million per 100TB deployed
- Average payback period: 5 months after production deployment
- Average productivity gains per affected employee equate to 95 hours per year or 9.4 FTE per organization
- Less than one minute of unplanned downtime per user per year
- 25% less IT staff time for ongoing administration

## SITUATION OVERVIEW

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Digital transformation initiatives are at the top of the CEO agenda today, and drive significantly different requirements at the storage infrastructure layer. Delivering a great customer experience through applications and the use of information to create new digital products and services is at the core of digital transformation initiatives. Flash storage systems deliver the unprecedented performance and operational efficiency required to speed up existing applications and power new applications required for digital transformation.

IT managers are acutely aware of the new performance and efficiency requirements that are passed on to them, and turn to flash storage systems as a solution. A recent IDC survey reveals that improving security and compliance, and server and storage technology refresh are the top priorities for organizations today. This is a recognition of the fact that managing data efficiently and securely is the key to digital transformation success and that the current IT infrastructure is not fit for the task. In addition, improving IT staff productivity rounds out the top 3 priorities, as IT budgets remain under pressure.

Organizations are adopting flash storage systems at a rapid pace to deliver innovation, performance, and efficiency at the storage layer. Adoption has been so rapid that flash storage is already deployed in more than 50% of all storage systems shipped, and is expected to reach more than 75% in 2020. The success of flash storage systems is driven by the following factors:

- **Need for performance.** Flash storage systems can speed up legacy applications and support performance-hungry digital transformation like Big Data and analytics, the Internet of Things (IoT), click-stream analysis, and ecommerce websites. With fewer performance issues, more resources once devoted to them can now be allocated to activities that support innovation.
- **Need for scalability.** While traditional enterprise applications still form the core of datacenter deployments, new scale-out applications based on Big Data, IoT, etc. are starting to become business-critical as well. If they are successful, they ramp up quickly, driving a greater need for storage system scalability.
- **Integration with legacy systems to drive TCO down.** Organizations are focusing on easy integration with their current infrastructure, both on the application and the IT infrastructure layer, to keep operational costs down and drive as much efficiency as possible, despite growing data volumes.

## IBM FLASHSYSTEM OVERVIEW

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Due to IBM's financial muscle and R&D resources, the evolution of IBM FlashSystem has followed a distinctly different path from what is normally seen with other storage vendors. With its purchase of Texas Memory Systems in 2012, IBM acquired an ultra-high-performance product in RamSan that was high-priced but proven to deliver extreme levels of performance to a specialized group of customers who typically valued performance above other considerations.

By 2013, IBM announced a \$1 billion investment in flash optimization research and development and the opening of 12 Flash Centers of Competency around the world. Product enhancement has been exceptionally rapid due to IBM's ability to integrate new and existing technologies. For example, the IBM FlashSystem V9000 includes the storage virtualization codebase from the established SAN Volume Controller (SVC), to provide arguably the most powerful storage management functionality available in any flash array.

IBM's investment in FlashSystem has yielded rapid improvements in speed, capacity, real-time compression, snapshots, replication, and the management GUI. Another key objective was to add

the resiliency, availability, and serviceability (RAS) characteristics that are a normal expectation for high-end storage customers. This market segment has been dominated by IBM, Dell EMC, and HDS for decades. Few other storage companies have the credibility or resources to operate successfully at this level, and this capability helps differentiate IBM FlashSystem from the competition.

In October 2017, IBM announced a range of FlashSystem hardware and software enhancements. The first of these was a technology upgrade to IBM-enhanced 3D triple-level cell (TLC) flash media, which provides higher storage densities and lower cost per gigabyte than the previous generation. A fully loaded FlashSystem 900 array can now offer 180TB of usable capacity.

The second update was the addition of inline hardware data compression, offering a 2:1 or better average sight unseen compression ratio with no perceptible negative performance impact. Other enhancements were also made to the encryption key management and the user-friendliness of the GUI.

IDC research shows that performance is still the most important selection criteria for companies choosing all-flash arrays. This is no surprise as many companies struggle with the server-storage performance gap and a need for submillisecond latency. However, long-term satisfaction with storage also depends on ease of management, level of automation, reliability, and consistency of performance. In IDC's view, IBM FlashSystem now offers an arguably unique combination of consistent high performance, storage efficiency, simple manageability, scalability, and high-end RAS functionality.

## IBM FlashSystem Features and Associated Business Value

Table 1 identifies key IBM FlashSystem functional characteristics together with the business benefits that users can expect to receive. Not all features are present on every model because this chart encompasses a wide range of user environments and price points.

**TABLE 1**

### IBM FlashSystem Functional Characteristics

<b>IBM FlashSystem: Key Functional Characteristics</b>	<b>Functional Benefit</b>	<b>Business Value Benefit</b>
Data reduction: Pattern removal, data deduplication, and inline hardware compression	<p>Inline, real-time pattern matching and removal, data deduplication and compression with hardware acceleration (A9000 only).</p> <p>Combined compression, deduplication, and pattern removal yields typically &gt;5:1 reduction (A9000 only).</p> <p>Inline hardware data compression with no perceptible negative performance impact (FlashSystem 900).</p> <p>Data reduction is implemented in FPGA hardware to allow rapid response times and avoid affecting other data services, including snapshots, replication, and host offload features such as VMware VAAI.</p>	<p>Deferred capacity upgrades reduce upgrade frequency and cost.</p> <p>Higher storage density simplifies data protection and business continuity infrastructure and management, reducing admin cost.</p> <p>Data reduction reduces initial purchase cost compared with a similar array without compression.</p> <p>For SVC/V9000 implementations this can be very beneficial since the user no longer has to rely on real-time compression to achieve greater storage capacity and efficiency with almost no additional performance impact. For A9000, although it does not rely on</p>

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		FlashSystem 900's native compression ability, the metadata tables do utilize that capability and do improve the overall system performance.
Multitenancy (FlashSystem A9000 only)	Isolation of logical domains of storage resources among numerous tenants, with the ability to set different QoS levels for each domain.  Multitenancy enables the division of storage system administration tasks into logical domains by using role-based permissions.	Enables faster deployments while minimizing the need for extensive planning, tuning, or field upgrades.  Capacity and performance can be allocated to meet the distinct requirements of isolated users of the same array. System resources are thereby allocated according to need, reducing the need for over-provisioning and thus saving cost.  With isolated customers, chargeback can be implemented more accurately and easily.
Host rate limiting: QoS (FlashSystem A9000 and V9000)	In environments with applications that include various performance objectives, the QoS feature enables the client to restrict IOPs, bandwidth, or both to the appropriate object domain, pool, host group, or volume.  System resources, such as storage and cache, constitute a virtualized environment that is shared by all hosts and applications.  QoS is available at the domain, pool, and volume levels.  QoS can be used to ensure that applications do not use too much of the storage system resources.  This feature maximizes the resources that are available for applications that require the most performance.	If a key application suffers reduced response time incident, user productivity is reduced and admin time is needed to identify the cause, realign data to resolve the problem, and monitor performance to ensure that the realignment has worked.  In some cases, IDC found that the diagnosis/remediation/testing cycle could take several days. Automatic QoS saves money by delivering sustained application performance and obviating the need for administrative interventions.  The tuning of high-end legacy arrays is considered a specialist area requiring expensive storage admin staff. QoS limits the need for such people.  QoS management reduces the need for expensive arrays with high IOPS headroom.
Fibre Channel and iSCSI host attach	FlashSystem A9000, A9000R, and V9000 support the Fibre Channel ND iSCSI. FlashSystem 900 supports Fibre Channel and InfiniBand communication protocols for host attachment, migration, and remote mirroring.	Leverages the existing network infrastructure and expertise.  Reduced need for additional network investment and IT staff training.
Snapshots	The snapshot capability in the FlashSystem A9000 uses a redirect on write design that allows snapshots to occur in a subsecond time frame with no effect on	Faster recovery of data and reduced probability of data loss.

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	<p>performance. The FlashSystem V9000 uses a similarly fast copy on write design.</p> <p>Either system supports multiple differential snapshots of a volume.</p> <p>Any of the snapshots can be made writable.</p> <p>Snapshots can be taken of the newly writable snapshots (snapshots of snapshots).</p> <p>Volumes can be restored from the writable snapshots.</p>	<p>Reduced cost of managing data protection and business continuity infrastructure.</p> <p>Reduced need for expensive data protection software, backup targets, and specialist IT staff.</p> <p>Higher productivity for IT users due to faster restores.</p>
<p>Synchronous and asynchronous remote mirroring</p>	<p>Synchronous or asynchronous remote mirroring can be performed over FC or iSCSI connections.</p> <p>Both protocols are supported for two-way mirroring connectivity.</p> <p>For practical reasons (latency), ensure that the synchronous mirroring distance is less than 100km (62 miles). For longer distances, asynchronous replication is more appropriate.</p>	<p>Enhanced recovery point objectives and recovery time objectives to optimize business continuity service levels leading to reduced downtime costs.</p> <p>Simplified backup management and reduced impact of data protection operations. Backup windows shortened, offload backup processing from production servers.</p> <p>Simplify replication — just clicks to set up. Reduced bandwidth costs. Reduced hardware costs for a replication target system.</p>
<p>Data migration and hyperscale mobility</p>	<p>IBM FlashSystem V9000 can act as a host and gain access to volumes on a storage system for non-disruptive migrations between heterogeneous systems. The storage services of the FlashSystem V9000 can also be extended to over 300 brands of third-party storage arrays.</p> <p>The system is configured as a proxy to respond to requests between the current hosts and the storage while migrating data in the background.</p> <p>FlashSystem A9000 with hyperscale mobility allows a volume to be migrated non-disruptively from one IBM FlashSystem A9000 to another over synchronous WAN distances without host disruption.</p> <p>This capability is in addition to the standard data migration that allows IBM FlashSystem to proxy as a host and migrate volumes from other third-party arrays.</p>	<p>Data can be migrated more quickly to new storage capacity, reducing administration overhead.</p> <p>IDC research shows that migration projects typically take weeks or months to complete.</p> <p>If migration is accelerated, new arrays with higher performance and reliability can be brought online more quickly, allowing the organization to benefit earlier from improved system performance and less downtime.</p> <p>Investments in legacy storage technologies can be extended by compressing and encrypting third-party arrays.</p>
<p>Encryption</p>	<p>IBM FlashSystem can secure data with industry-standard AES-256 encryption for data at rest.</p> <p>Encryption is accomplished in hardware to avoid performance impact.</p>	<p>The security and management of personal data is subject to mandatory legislation and severe penalties for misuse. Data security through encryption is increasingly considered to</p>

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	<p>All FlashSystem offerings support IBM Security Key Lifecycle Manager (SKLM).</p>	<p>be a standard requirement for storage subsystems.</p> <p>In terms of business value payback, encrypted storage reduces the possibility of a security breach, reduces the number of days before a breach is discovered, accelerates its containment, and reduces the per capita cost. An external key management process will be needed, adding slightly to administrative cost.</p>
<p>Authentication by using Lightweight Directory Access Protocol (LDAP)</p>	<p>LDAP can be used to provide user logon authentication, which allows IBM FlashSystem to integrate with Microsoft Active Directory, Open LDAP, or Oracle Java Systems Directory Server.</p> <p>Multiple directory servers can be configured to provide redundancy if one server becomes unavailable.</p>	<p>The benefits of an LDAP-based centralized user management can be substantial when the size and complexity of the overall IT environment are considered. Maintaining local user credential repositories is relatively straightforward when dealing with only a few users and storage systems. As the number of users and interconnected systems grows, the complexity of user account management increases and managing such an environment becomes a time-consuming task.</p>
<p>VMware synergy</p>	<p>IBM Spectrum Control Base V3.0 allows a simplified deployment and efficient integration of IBM FlashSystem with the VMware vCloud suite.</p>	<p>Faster to deploy and integrate with vCloud.</p> <p>Reduced requirement for training and/or specialist IT administrators.</p>
<p>Reliability, availability, serviceability (RAS)</p>	<p>Redundant hot-swappable components. Each flash enclosure has two clustered, hot-swappable canisters that each contain two hot-swappable fan modules, two management controllers, four management Ethernet ports, and a USB port for service connectivity.</p> <p>The batteries, fans, and power supplies are all redundant and hot-swappable.</p> <p>The two-dimensional RAID protection (2D-RAID) of the flash enclosure protects against IBM MicroLatency module, flash chip, and other flash-system-related failures. An included hot spare means no user intervention is required before a rebuild begins.</p> <p>IBM Variable Stripe RAID is a patented IBM technology that provides an intra-module RAID stripe within each flash module.</p>	<p>Reduced unplanned downtime due to hardware failure. Reduces downtime costs including loss of customers, adverse publicity, and loss of brand perception due to system outage.</p> <p>2D-RAID including Variable Stripe RAID reduces the chance of data loss due to a flash module failure. Reduces administrator time required for the recovery process. Reduces loss of productivity for IT users.</p>

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	<p>Variable Stripe RAID technology helps reduce downtime and maintain performance and capacity during partial or full flash chip failures.</p> <p>FlashSystem A9000 grid controllers have automatic failover capabilities. The cache of a grid controller is triplicated; that is, one copy is local and two other copies are on two other grid controllers.</p> <p>The system remains operational if it can still maintain at least one secondary cache. This behavior implies that an IBM FlashSystem which is equipped with three grid controllers can stand one grid controller outage.</p> <p>Debug utilities, including x-ray data collection on IBM FlashSystem and diagnostic collection on the host side.</p> <p>IBM technician has access to service tools for concurrent upgrade, scale up, etc.</p> <p>Call-home and remote support capabilities.</p>	
<p>Storage management interface</p>	<p>FlashSystem A9000 IBM Hyper-Scale Manager utilizes a web-based management graphical user interface from which one or more supported IBM FlashSystem can be managed and monitored in real time from a web browser.</p> <p>All-encompassing customizable dashboard.</p> <p>Context-oriented user interface in a single-page, web-based application that enables the viewing of all relevant information for every object.</p> <p>View of object relationships and dependencies in a visual map.</p> <p>Object-centered management and monitoring.</p> <p>Filters for focusing on the required object.</p> <p>FlashSystem V9000 GUI provides an easy to use and uncluttered tool for configuring and monitoring the FlashSystem and other virtualized storage arrays.</p>	<p>Reduces complexity of IT operations. This reduces the need for specialized expertise and minimizes time-consuming, error-prone manual tasks which results in lowered cost of operations.</p> <p>Staff time is freed up to allow increased focus on understanding and supporting business requirements.</p> <p>Real-time reporting allows users to plan and tier more accurately, further improving efficiency.</p>

Source: IDC, 2016

**THE BUSINESS VALUE OF IBM FLASHSYSTEM**

**Study Demographics**

IDC interviewed eight IBM clients about their experiences with IBM FlashSystem, asking them a variety of qualitative and quantitative questions about its impact on their storage, IT, and business operations. These organizations varied by size, location, and industry by design to help provide a



representative picture of potential different experiences with IBM FlashSystem. Overall, they shared a common need to have a storage platform that could provide the performance they required to support time- and availability-dependent services on which their business success hinged. Their industry verticals included financial services, retail, IT services, and manufacturing.

**TABLE 2**

**Demographics of Interviewed Organizations, IBM FlashSystem**

	<b>Average</b>	<b>Median</b>
Number of employees	21,200	2,300
Number of IT staff	926	155
Number of IT users	18,600	2,300
Number of customers	1.9 million	155,000
Number of TBs (total environment)	2,390	300
Number of business applications	555	70
Number of IBM FlashSystem storage systems	5	2
Number of TBs, IBM FlashSystem	244	107
Countries	United States, Denmark, Sweden	
Industries	Financial services, IT services provider, manufacturing, retail	

Source: IDC, 2016 (n = 8)

**Choice and Use of IBM FlashSystem**

Interviewed organizations unanimously reported choosing IBM FlashSystem at least in large part after concluding that it would provide the performance levels and modern storage architectures on which their business operations depend. One organization noted the centrality of the IBM FlashSystem platform to its business operations: "We use FlashSystem for business-driven objectives, that is to say singular systems or special systems that need the extra performance ... for our trading and investment management systems that are really central to our business." The criticality of performance means that IBM FlashSystem has impacted application performance and business outcomes, as discussed in this study.

Most interviewed organizations deployed IBM FlashSystem alongside traditional storage array solutions; this means that FlashSystem has generally been used to add capabilities and performance for these organizations rather than to replace existing storage infrastructure. Organizations reported supporting a mix of performance-dependent applications with FlashSystem. They are using FlashSystem most often for transaction processing workloads, with virtual desktop infrastructure (VDI), database, and Big Data analytics also being named by at least two organizations as workloads they are supporting with FlashSystem.



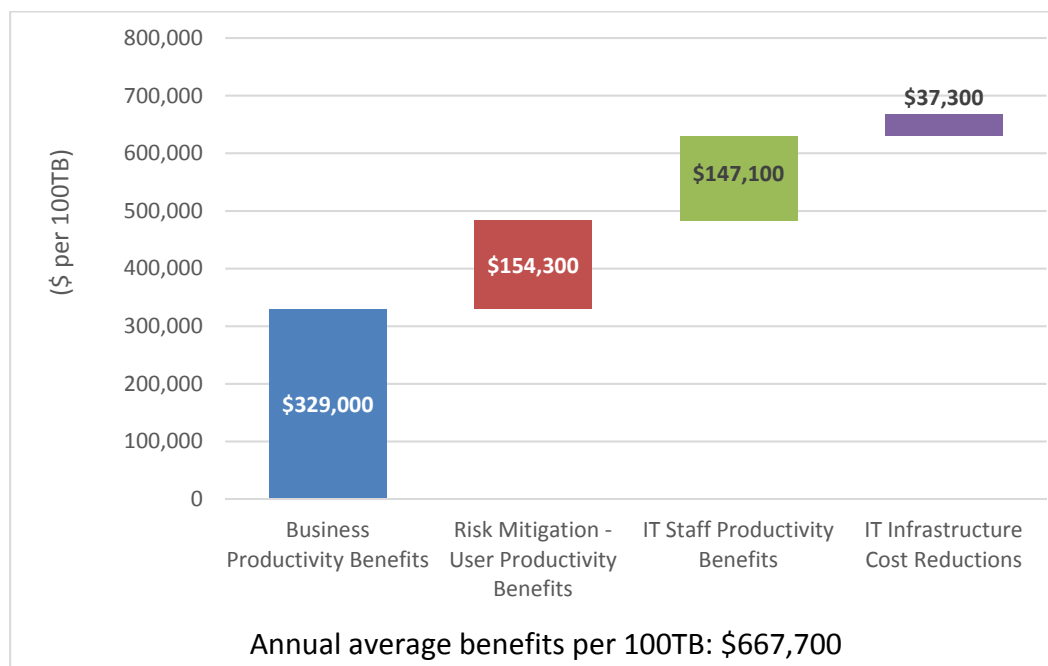
## Business Value Analysis

IBM clients reported that moving to the IBM FlashSystem storage platform has provided the storage-related performance levels required by their business operations. Having the requisite level of storage performance enables these organizations to better serve their customers by meeting evolving customer demand and become more operationally efficient by enabling their employees. IDC's interviews with these organizations demonstrate that they are realizing strong value with IBM FlashSystem, which IDC calculates will be worth an annual average of \$667,700 per 100TB (\$1.63 million per organization) over three years, in the following areas:

- **Business productivity benefits.** Improved storage system performance supports more effective business applications and services, while ease of deployment means greater storage-related agility. As a result, interviewed organizations reported that they can better serve their customers and increase the productivity of certain groups of employees requiring high performance from certain applications. IDC projects that this higher performance-related productivity will be worth an average of \$329,000 per 100TB (\$801,800 per organization) over three years.
- **Risk mitigation, user productivity benefits.** Reducing the frequency, duration, and impact of unplanned storage-related outages means that users and business operations face less disruption, and enables organizations to meet a higher percentage of their SLAs. IDC calculates that the value of user time saved and SLA penalties avoided will be worth an average of \$154,300 per 100TB over three years (\$376,200 per organization).
- **IT staff productivity gains.** Ease of deployment and administration means that IT storage teams must spend less time on day-to-day tasks, freeing up time to be invested in other activities. IDC puts the value of these time efficiencies for IT staff at an annual average of \$147,100 per 100TB over three years (\$358,500 per organization).
- **Cost reductions.** Moving to a more cost-effective storage platform will enable savings that IDC calculates at \$37,300 per 100TB per year over three years (\$91,000 per organization) in server, power, and facilities cost reductions.

FIGURE 1

### Average Annual Benefits per 100TB



Source: IDC, 2016

### Business Productivity Benefits

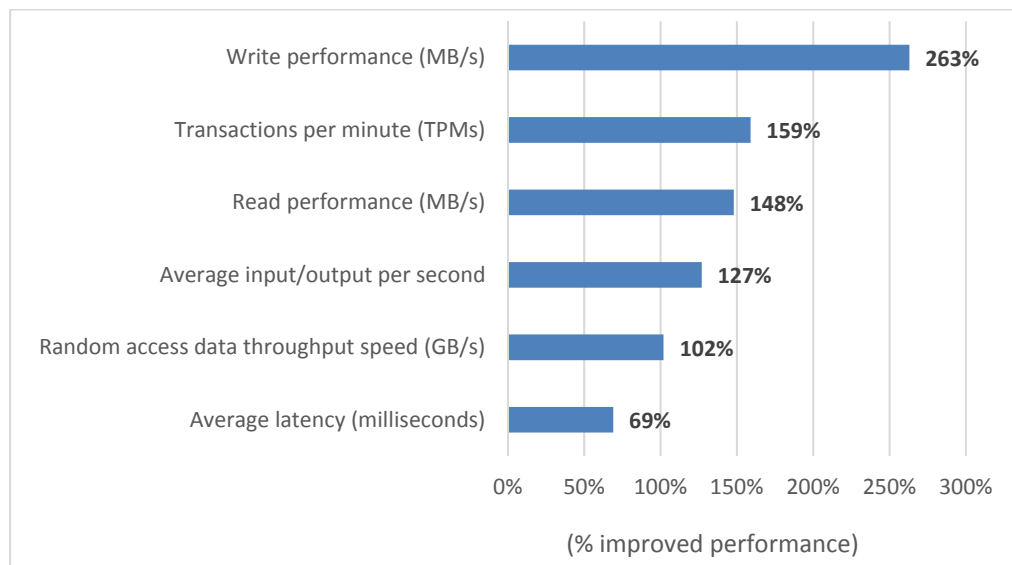
Interviewed customers all deployed IBM FlashSystem to address a common need: they have workloads critical to their business operations that require the highest possible level of performance from their storage systems. They found that their legacy storage platforms were unable to provide the levels of performance required, which made it a challenge to fully address business opportunities and maximize employee productivity. One organization commented: "We wanted a way to increase productivity and speed for queries and how the applications were hitting these databases. That's why we deployed FlashSystem – we wanted to make things better for the business."

Figure 2 demonstrates the significant impact that interviewed organizations' deployment of IBM FlashSystem has had on key storage-related performance metrics. With FlashSystem, critical data gets through to users faster, applications face lower levels of latency, and transactions complete in less time. All of these metrics contribute to these organizations having the levels of storage performance needed to support their business operations. Examples provided by interviewed IBM clients included:

- **Lower latency, even compared with other flash.** "We have gotten much better latency on the IBM FlashSystem compared to our other flash systems. The throughput is the same, but the FlashSystem gets better latency."
- **Database performance.** "We're running massive database jobs with FlashSystem. To give one example, it used to take 6 to 7 hours on our old storage array for these jobs and now it takes 40 minutes. It's a tremendous speed increase for these types of workloads."

FIGURE 2

## Storage Performance Improvements, IBM FlashSystem



Source: IDC, 2016

## Enabling the Business with Performance

Interviewed organizations made it clear that IBM FlashSystem was helping them achieve better business outcomes, even though its effect was generally deeply enough embedded in their overall processes to make it challenging to quantify the impact. However, they provided numerous examples of FlashSystem enabling them to better serve their customers:

- **Process orders faster.** A retailer explained: "We used to experience queuing of orders at certain times because the I/O on our order management system couldn't keep up with volume, which put us up to 10 hours behind on order processing. This year, with FlashSystem, we were less than 30 minutes behind even with 30% growth. That's the type of performance we were able to get with FlashSystem."
- **Provide customers better services at lower cost.** A service provider commented: "With IBM FlashSystem, we can provide better performance for the same price, or sometimes even a lower price. So for our core service, we are now delivering more for less."
- **Better business-focused models.** A financial services company explained: "The faster our quantitative teams can run queries and crunch numbers that are going to the databases, the more efficient they are and they can move on to the next thing. That leads to better investment models that they are working on, which can lead to better performance and higher client retention and new clients. It's all correlated."
- **Stability of system.** A manufacturing company noted: "The stability and the uptime of FlashSystem, that all contributes to allowing the lines of business managers to develop and market their products and services faster."

## Enabling Employees with Performance

In addition to enabling their business operations, interviewed organizations were able to point to specific groups of employees who have benefited from significant improvements in storage system performance with IBM FlashSystem. As a result of having higher performing business applications

that can deliver robust data and information to them in less time, these organizations have more than 200 employees who perform better and deliver more value to their organizations, including:

- **Business intelligence team.** One organization reported that much improved performance of its database reporting with IBM FlashSystem meant faster and more timely delivery of BI reports, thereby enabling its 100-member business intelligence team.
- **Commercial finance team.** One organization explained that being able to run rate reports in a timely manner with FlashSystem means that its 250-member commercial finance team has the information they need to more effectively sell their products and services.
- **Data analysts.** One organization noted that its 200-member data analyst team benefits from the reliability of IBM FlashSystem, which helps them make insightful data available to business leaders.
- **VDI users.** One organization commented that higher performance levels for its 100-plus employees using VDI supported by FlashSystem contributed to fewer complaints about performance, and the ability to extend VDI to new users.

**TABLE 3**

**User Productivity and Business Benefits, IBM FlashSystem**

	Per Organization	Per 100TB
Number of users impacted	202	83
Average productivity gain, impacted users	23%	23%
Average productive hours per impacted user per year gained	95	39
Equivalent FTE gain	9.4	3.8

Source: IDC, 2016

**Risk Mitigation and Availability**

Every interviewed organization mentioned the reliability of IBM FlashSystem as a benefit. Given the types of workloads these organizations are supporting with FlashSystem – including business-critical transactional, database, and analytics workloads – this focus on reliability is no surprise. According to interviewed organizations, IBM FlashSystem has met their expectations from an absolute and relative perspective. As shown in Table 3, compared with their legacy storage environments, these organizations are losing an average of 98% less productive time due to unplanned outages, which equates to less than one minute per year per user with FlashSystem. One organization commented: "FlashSystem has changed our thinking because it's less downtime for the users which translates into literally getting the data whenever they need it, and there's less maintenance downtime."

In addition to limiting the impact of storage-related outages on operations and employees, interviewed IBM clients also reported that they are able to meet more SLAs, whether in terms of delivery of services or required performance levels. On average, they are meeting eight percentage points more SLAs with IBM FlashSystem. Although they do not always incur costs for not meeting SLAs, several organizations reported that they have reduced costs associated with previously unmet SLAs since deploying FlashSystem, for an average of \$166,700 per year. One interviewed organization explained the customer impact of better meeting SLAs: "FlashSystem is

giving us the ability to meet and exceed the SLAs that external customers have requested. It's all about the stability of the system. Experiencing less downtime really translates into uptime and better SLAs for our customers."

**TABLE 4**

**Risk Mitigation – Unplanned Downtime and SLAs**

	Before IBM FlashSystem	With IBM FlashSystem	Difference	% Benefit
Unplanned downtime				
Number of instances per year	3.6	2.3	1.3	38%
MTTR (hours)	10.8	2.5	8.3	77%
Productive hours lost per 100 IT users per year	32.6	0.6	32.0	98%
Equivalent FTEs	3.2	0.1	3.1	98%
SLAs				
Percentage of SLAs met	87%	95%	8%	9%
Cost per SLA percentage not met	\$21,000	\$21,000		
SLA fines per year	\$273,300	\$106,600	\$166,700	61%

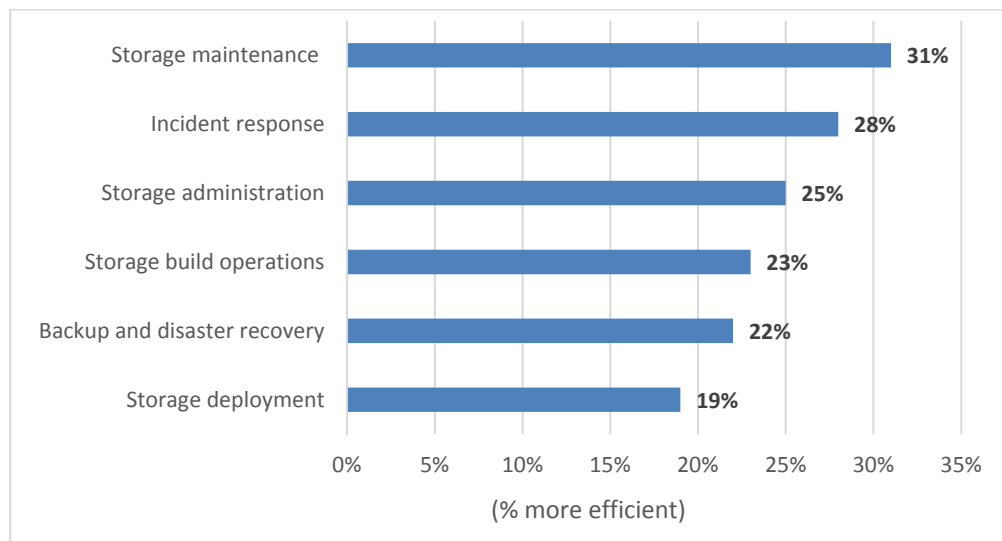
Source: IDC, 2016

***IT Staff Efficiencies***

Interviewed organizations are benefiting from the ease of deploying, managing, and administering their IBM FlashSystem storage systems. On average, interviewed organizations reported that they are spending less time on storage-related activities across the board, including 31% less time on storage maintenance and 25% less time on ongoing administration of their storage systems (see Figure 3). They cited efficiencies related to the high reliability of FlashSystem, needing less time for backend system management and administration, leveraging automation and scripting, and the ease of deploying storage and server resources. FlashSystem users provided a number of examples of these efficiencies, with one explaining: "The time needed with IBM FlashSystem to manage our storage environment is much less now – there's not much to do once it's up and running, whereas before we regularly had to deal with performance issues. On a monthly basis, we've gone from spending 12-14 hours troubleshooting to an hour or two with FlashSystem."

**FIGURE 3**

### IT Staff Efficiencies, IBM FlashSystem



Source: IDC, 2016

### IT Infrastructure Cost Reductions

Although interviewed organizations are mostly using FlashSystem as an additive element of their IT storage environments to support workloads requiring the highest levels of performance, they have been able to reduce some storage- and IT infrastructure-related costs with FlashSystem. In particular, where these organizations have been able to retire legacy storage systems, they have cut costs associated with maintenance fees, servers, power, and facilities. One organization explained that its move to flash storage with IBM FlashSystem was part of its broader virtualization initiative: "One of the reasons for getting IBM FlashSystem was that we wanted to go virtual. We used to have about 120 physical servers and now we have about 50. It was part of the same initiative bringing in the FlashSystem and going virtual." Another organization noted that it can utilize server resources more efficiently to support its business with IBM FlashSystem: "We now have fewer servers because we are getting more VMs per server. We have virtual capacity, CPU, memory, network, storage that we sell to our customers. With FlashSystem, we can sell more virtual components off of each physical server, more than we can without it."

### ROI Analysis

IDC interviewed eight organizations that have deployed IBM FlashSystem as their flash storage platform for business-critical workloads. IDC used the following three-step method for conducting its return on investment (ROI) analysis:

1. **Gathered quantitative benefit information during the interviews using a before-and-after assessment.** In this study, the benefits included staff time savings and productivity gains, user productivity increases, increased revenue, and storage-related cost reductions.
2. **Created a complete investment (three-year total cost analysis) profile based on the interviews.** Investments go beyond the upfront and annual costs of using IBM FlashSystem and can include additional costs related to the solution, including migrations, planning, consulting, configuration or maintenance, and staff or user training.
3. **Calculated the ROI and payback period.** IDC conducted a depreciated cash flow analysis of the benefits and investments for these organizations' use of IBM FlashSystem over a

three-year period. ROI is the ratio of the net present value (NPV) and the discounted investment. The payback period is the point at which cumulative benefits equal the initial investment.

Table 5 presents IDC's analysis of the three-year discounted benefits and investment costs associated with interviewed organizations' use of IBM FlashSystem. IDC calculates that these organizations will invest \$0.34 million per 100TB of data managed (\$0.84 million per organization) over three years. In return, IDC projects that these organizations can expect to achieve an average of \$1.60 million per 100TB of data managed (\$3.90 million per organization) in benefits over three years. This level of benefits and investment would result in an average ROI of 364% and allow interviewed organizations to break even on their investments in five months.

**TABLE 5**

**Three-Year ROI Analysis**

	Per Organization	Per 100TB of Data Managed
Benefit (discounted)	\$3.90 million	\$1.60 million
Investment (discounted)	\$0.84 million	\$0.34 million
Net present value (NPV)	\$3.06 million	\$1.26 million
Return on investment (ROI)	364%	364%
Payback (months)	5	5
Discount rate	12%	12%

Source: IDC, 2016

**CHALLENGES AND OPPORTUNITIES FOR IBM FLASHSYSTEM**

Flash storage has moved far beyond the early-adopter phase into solid mainstream acceptance, with users generally having a good understanding of the benefits over legacy arrays. As a result, spending on flash arrays is growing rapidly, despite a shallow decline in the overall storage array market. New market entrants have been rapacious in their quest for market share, with profitability seen as a secondary or long-term aspiration.

The resulting downward pressure on price is a major challenge for the array vendors, and it is inevitable that only the financially strongest will survive. In this context we would identify the following challenges faced by IBM:

- **Share of voice.** Despite its size, IBM can be out-marketed by VC-backed smaller companies prepared to make provocative claims in a death-or-glory bid for market traction.
- **Outdated capex-led vendor selection.** Storage buyers have traditionally focused on \$/GB initial purchase prices. A better selection criterion is the business value that the solution delivers, which (as shown in this paper) is mainly a result of the product's functional, operational, and vendor support characteristics.
- **Trend toward public cloud or hosted infrastructure.** Storage buyers have many perceived alternatives to on-premise hardware, often with attractive opex-based pricing models. Increasingly, on-premise investments are compared to hosted alternatives as well as to the



traditional competition. This is less of an issue for a low-latency solution like IBM FlashSystem, but it may add time and complexity to the sales cycle.

- **Point solution versus broad portfolio.** IDC research shows that the most effective storage investments generally include some form of consolidation, standardization, and automation of the storage infrastructure. This is typically achieved more easily when buying from a single storage vendor with a broad range of integrated solutions and services. Customers may be wary of a perceived "vendor lock-in" but can create bigger problems for themselves by selecting a mix of point solutions that is more complex and time consuming to manage.

## SUMMARY AND CONCLUSION

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This research shows clearly that the functional and operational characteristics of a flash array are the key factors that determine the return on investment for a user. In comparison, the acquisition cost is a less important factor.

For example, in this study IBM FlashSystem delivered exceptional levels of I/O and throughput performance, particularly in demanding high load conditions. For the users interviewed, this consistently high performance translated directly into significant productivity gains for the application users and the IT administrators. Another example would be the exceptional level of reliability, availability, and serviceability built into FlashSystem, a consequence of the decades of experience that IBM has in high-end enterprise storage. A third example would be the level of management automation that is possible with FlashSystem.

An ROI analysis is essentially a before-and-after comparison, so the worse the starting point, the better the ROI outcome. If an IT organization is poorly managed or chaotic, new investments will tend to deliver exaggerated financial benefits. However, the organizations interviewed in this study were generally above-average in their IT management skills. Therefore, for the sample to receive an average payback period of just 5 months is an outstanding result, and validates the IBM FlashSystem design and quality.

## APPENDIX

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IDC utilized its standard ROI methodology for this project. This methodology is based on gathering data from current users of IBM FlashSystem as the foundation for the model. Based on these interviews, IDC performs a three-step process to calculate the ROI and payback period:

- Measure the savings from reduced IT costs (staff, hardware, software, maintenance, and IT support), increased user productivity, and improved revenue over the term of the deployment.
- Ascertain the investment made in deploying the solution and the associated migration, training, and support costs.
- Project the costs and savings over a three-year period and calculate the ROI and payback for the deployed solution.

IDC bases the payback period and ROI calculations on a number of assumptions, which are summarized as follows:

- Time values are multiplied by burdened salary (salary +28% for benefits and overhead) to quantify efficiency and manager productivity savings.
- Downtime values are a product of the number of hours of downtime multiplied by the number of users affected.

- The impact of unplanned downtime is quantified in terms of impaired end-user productivity and lost revenue.
- Lost productivity is a product of downtime multiplied by burdened salary.
- Lost revenue is a product of downtime multiplied by the average revenue generated per hour.
- The net present value of the three-year savings is calculated by subtracting the amount that would have been realized by investing the original sum in an instrument yielding a 12% return to allow for the missed opportunity cost. This accounts for both the assumed cost of money and the assumed rate of return.

Because every hour of downtime does not equate to a lost hour of productivity or revenue generation, IDC attributes only a fraction of the result to savings. As part of our assessment, we asked each company what fraction of downtime hours to use in calculating productivity savings and the reduction in lost revenue. IDC then taxes the revenue at that rate.

Further, because IT solutions require a deployment period, the full benefits of the solution are not available during deployment. To capture this reality, IDC prorates the benefits on a monthly basis and then subtracts the deployment time from the first-year savings.

Note: Some numbers in this document were subject to rounding and therefore may not be exact.

## About IDC

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