The Business Value of Dell EMC Flash Storage

Sponsored by:
Dell EMC

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September 2018

Business Value Highlights

331
three-year ROI

8 months
lower cost of operations

32%
lower cost of storage

69%
more efficient IT storage teams

43%
reduced latency

62%
less unplanned downtime

$1.3 million
additional revenue per 100TB through business enablement and reduced downtime

EXECUTIVE SUMMARY

Technology is quickly moving to the forefront as organizations undertake digital and information technology (IT) transformation projects that enable strategic differentiation in a world where users are leveraging applications and data in new ways. The reality is, most organizations were not born digital but instead have legacy business processes, applications, and infrastructure that require modernization and automation. As a result, businesses must embark on IT transformation to modernize and automate their legacy infrastructure and prime themselves to achieve their digital business goals.

A major component in modernizing a datacenter is moving to all-flash storage, and it has become clear that moving to flash is about more than just performance gains. Flash storage is now available in every major type of primary storage platform, including both scale-up and scale-out designs, and is in broad use in IT organizations of all sizes worldwide. The most successful established enterprise storage vendors generally do not offer just a single flash storage solution; rather, they offer a broad portfolio of solutions that covers the five major enterprise storage consumption models: storage appliances, software only, converged infrastructure (CI), hyperconverged infrastructure (HCI), and cloud. Customers have broadly deployed these storage platforms not only for the performance benefits they provide but also for the significantly better total cost of ownership (TCO) they offer relative to hard disk drive (HDD)-based storage platforms for primary storage workloads.

IDC interviewed organizations of various sizes to understand the impact of moving significant parts of their storage environments to Dell EMC Flash Storage. These study participants explained that moving to flash storage with Dell EMC has improved their storage performance and scalability, which helps them better meet customer expectations and deliver more efficient operations through much-improved application performance for internal users. Further, they reported leveraging the enhanced performance and capabilities of Dell EMC Flash Storage to make their storage operations more agile, efficient, and cost effective. Based on the study participants' experiences, IDC projects that these Dell EMC customers will realize benefits worth more than four times the total investment costs (331% three-year ROI) over three years through:

- **Higher revenue.** The improved performance, availability, and agility of all-flash storage results in improved IT responsiveness and drives overall higher company revenue.
- **Improved operational efficiencies.** All-flash storage requires significantly less day-to-day administrative time in significant part because of improved reliability (flash versus spinning disk).
- **Optimized storage costs.** All-flash storage delivers better performance, requires less storage infrastructure, and enables the use of storage efficiency technologies such as inline data reduction that reduce the cost to store data.

IDC
ANALYZE THE FUTURE

SITUATION OVERVIEW

As IT organizations have moved toward digital transformation, CIOs must modernize infrastructure to better meet evolving business requirements. Key benefits sought by organizations that engage in IT infrastructure modernization include improved operational and cost efficiency for existing workloads and the ability to rapidly scale out new workloads. To achieve these goals, IT departments are increasingly looking to flash storage not only for the performance benefits but also for the significantly better TCO relative to HDD-based storage platforms. Well-publicized studies show that moving to "all flash" for primary storage drives considerable benefits in the areas of streamlined IT infrastructure, improved reliability, improved administrative productivity, and energy and floor space savings.

As IT infrastructure is modernized, it must enable the cost-effective consolidation of a mix of both legacy and next-generation workloads. This mix of storage workloads generates significant demands for lower storage latencies and higher throughput and bandwidth. Primary storage performance and capacity requirements started to outrun the capabilities of HDDs well over five years ago, and this has driven the rapid transition to all-flash storage. In 2017, all-flash arrays (AFAs) drove over 70% of all primary, external storage revenue, and that will only increase as IT organizations routinely handle storage technology refreshes by replacing existing arrays with newer AFAs.

The performance benefits of flash were clear. Relative to even the fastest HDDs, solid state disks (SSDs) reduced latencies by up to 10 times and increased throughput and bandwidth by at least that amount. Persistent flash storage also delivered much more predictable performance with the varying mix of workloads IT administrators increasingly had to handle. But as AFAs started to be used more by IT organizations for mixed workload consolidation, significant TCO benefits began to appear as well. IDC research around the TCO benefits of AFA deployment across a wide range of storage system sizes and industries indicates that IT organizations could potentially see cost savings over the life of an AFA platform in the following areas:

- **Far fewer devices to meet performance and capacity requirements.** The fact that SSDs delivered at least 10 times the throughput (if not more) of HDDs for the types of random workloads popular in today's datacenters meant that any given IOPS target could be met with far fewer SSDs in a system. Flash performance also meant that larger-capacity devices could be effectively used in performance-sensitive workloads, whereas HDD-based systems configured for performance tend to use smaller drive sizes, further driving up the device count required. Flash performance also meant that inline data reduction technologies (compression, deduplication, thin provisioning, pattern recognition, write minimization, space-efficient snapshots, and delta differential–based replication) could be used to significantly increase the effective capacity of any given SSD (further reducing the effective cost per gigabyte [GB] of flash capacity) without meaningfully impacting application performance.

- **Much lower energy and floor space consumption.** The increased infrastructure density enabled by flash storage technology at the array level leads to lower power consumption and smaller system sizes to meet any given performance and capacity requirement. This not only reduces costs immediately but also provides for more efficient use of datacenter resources (energy and floor space) as storage systems are expanded.
- **Reductions in associated server infrastructure costs.** The consistently low latencies delivered by flash storage make much better utilization of server-side CPU resources, enabling a server of a given size to handle an increased workload. The need for fewer servers can also translate into lower software licensing costs, which can easily outweigh the cost savings for relatively expensive enterprise applications because of fewer servers. Note, however, that these savings are mostly available on greenfield (new) rather than brownfield (existing) deployments because software vendors may not be willing to refund license fees for products that have already been purchased.
- **Lowered administration costs.** With HDD-based arrays that were significantly challenged to meet storage performance requirements, administrators spent a significant amount of time fielding customer complaints about performance and tuning systems to address performance problems. AFAs have largely changed that, and every organization that deploys them notes a significant decrease in the time spent dealing with storage performance issues. Flash storage can easily accommodate burst I/O requirements up to 10 times higher than steady state, giving it a much better ability to deal with varying I/O workloads with no tuning whatsoever. This ease of use can increase administrative span of control and make it easier for less experienced administrators to effectively manage storage, leading to lower administrative costs.
- **Improved reliability.** HDDs are mechanical devices, while SSDs are solid state, and as a result, flash storage is much more reliable. With HDD-based arrays requiring typically significantly higher numbers of devices to meet storage performance requirements, administrators will clearly spend more time identifying and replacing failed devices in HDD-based arrays than they will with AFAs. This frees up administrators for more strategic projects and further promotes reduced administration costs.

Based on these factors, it is clear how AFAs have come to dominate primary external storage spend over the past several years. As flash storage costs continue to decrease at 26.1% per year for the next five years, AFAs will start to encroach upon less performance-sensitive secondary storage environments as well, bringing many of these same TCO benefits. The largest enterprise SSDs (15TB) are already larger than the largest enterprise HDDs (14TB) in terms of raw capacity, and the transition to quad-level cell (QLC) flash media technology over the next 12–18 months will only increase the SSD capacity advantage, helping further drive down the cost per gigabyte of enterprise flash storage.

THE BUSINESS VALUE OF DELL EMC FLASH STORAGE

Study Demographics

For this study, IDC interviewed seven organizations about the impact of deploying Dell EMC Flash Storage on their IT operations, businesses, and costs. The size of the organizations surveyed represented a mix and includes IT organizations of all sizes, with this mix reflected in the average employee base (approximately 42,000 employees) and median employee base (1,100 employees).

All study participants were United States based, with a good level of diversity by industry vertical, and reflected experiences from the biotechnology, education, financial services, healthcare, IT services, retail, and transportation sectors. Table 1 shows the attributes of these organizations in terms of sample average as well as segmented by enterprise (10,000+ employees), midsize (1,000–9,999 employees), and smaller organizations (<1,000 employees).

TABLE 1 Demographics of Interviewed Organizations

	Average (7)	Enterprise (2)	Midsize (2)	Smaller (3)
Number of employees	42,036	145,000	1,675	300
Number of IT staff	4,359	15,150	87	13
Number of business applications	3,821	13,250	70	37
Number of terabytes (TB), total storage environment	30,512	102,000	475	2,877
Number of terabytes, flash storage environment	4,241	14,400	225	146
Revenue per year	$11.54 billion	$39.7 billion	$575 million	$54.3 million
Industries		Financial services, healthcare	IT services, retail	Biotechnology, education, transportation

n = 7

Source: IDC, 2018

Selection and Use of Dell EMC Flash Storage

All interviewed organizations connected their deployment of flash storage with Dell EMC to broader efforts to modernize their IT operations. They are pursuing datacenter modernization and IT transformation initiatives because they need to improve IT performance levels to meet customer and line-of-business expectations while also making their IT operations more efficient. Dell EMC customers reported that flash storage is an important component of their IT modernization strategies that helps them achieve these dual objectives.

Interviewed IT managers described an array of reasons for choosing Dell EMC Flash Storage. They pointed to key selection criteria that included:

- **Scalability:** *"We looked at other flash storage solutions and ran the same benchmarks, and they were all fairly close. But the scale-out capability of Dell EMC Flash Storage is really what differentiates it."*
- **Need to be competitive:** *"Dell EMC Flash Storage is more efficient … [and] we want to make our storage as efficient and fast as possible to remain competitive. Our customers look at performance based upon their response time for the services we provide."*
- **Future-proof storage:** *"Dell EMC Flash Storage prepares us for a mixed data world. It handles data sources that come from many new places, including sensors and IoT devices. We're laying the groundwork with it to support data aggregation and scale."*
- **Trusted reliable supplier:** *"We have a long-standing partnership with Dell EMC, plus we thought Dell EMC Flash Storage was the best product on the market in terms of what we've researched."*

As shown in Table 2, these organizations have substantial Dell EMC Flash Storage environments — more than 3PB on average (3,170TB). Study participants are supporting workloads and applications used by a majority of internal line-of-business users and substantially all (89%) of their revenue-generating business operations. Table 2 also provides this information by organization size in terms of enterprise, midsize, and smaller organizations.

Interviewed organizations have deployed Dell EMC Flash Storage primarily to support their production environments (about 75% of capacity), with the remaining capacity split nearly evenly between testing, quality assurance, and disaster recovery activities. Study participants are using about three-quarters of their Dell EMC Flash storage environments to support workloads they migrated from other storage solutions, with the remainder divided between growth in these workloads and net-new greenfield workloads. Generally, they have replaced more traditional non-flash storage arrays with Dell EMC Flash Storage systems.

TABLE 2 Dell EMC Flash Storage Environments Deployed by Interviewed Organizations

	Average	Enterprise (2)	Midsize (2)	Smaller (3)
Number of Dell EMC Flash Storage arrays	10	24	8	3
Number of terabytes (TB)	3,170	10,650	225	146
Number of business applications	1,309	4,463	70	33
Number of users of applications (internal)	30,306	104,063	1,675	222
Percentage of revenue supported	89	95	100	77

n = 7

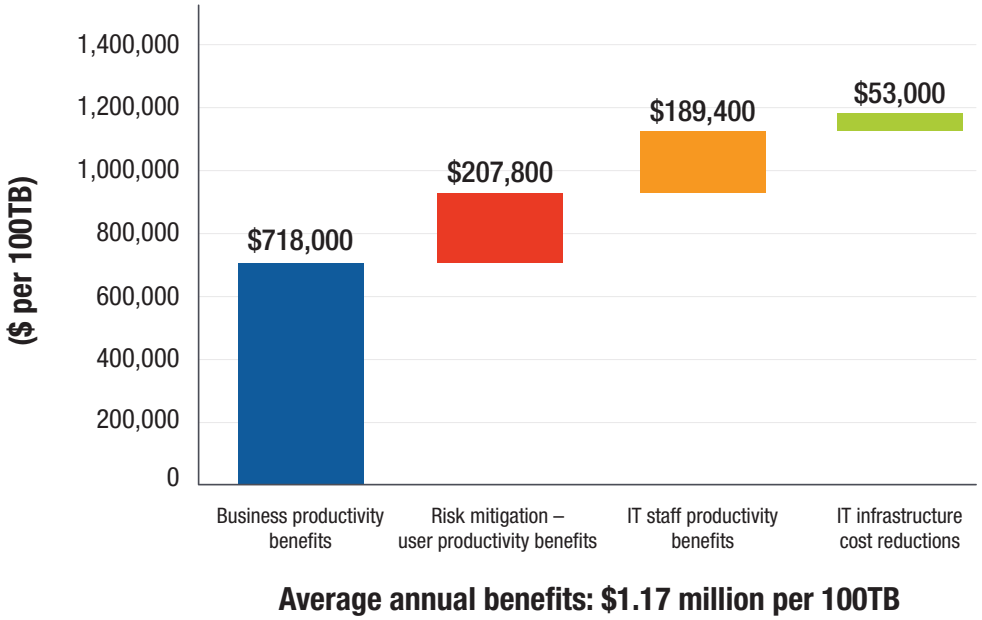
Source: IDC, 2018

Business Value Analysis

Interviewed organizations are using Dell EMC Flash Storage to provide the levels of storage performance they need to support growing business operations that increasingly rely on the timely and robust movement of data. Substantial improvements in performance and resiliency enable higher employee productivity and the generation of additional revenue. Further, improved storage performance and enhanced capabilities are helping the organizations spend less on their storage environments and limit the amount of staff time required for day-to-day management and support activities. As shown in Figure 1, IDC calculates the value of these benefits at an annual average of $1.17 million per 100TB ($37.03 million per organization) over three years in the following areas (see the Business Value Results section in the Appendix for a specific breakdown of the benefits):

- **Business productivity benefits.** Improved application performance and faster delivery of new applications and features lead to higher revenue and user productivity, which IDC calculates as being worth an annual average of $718,000 per 100TB ($22.76 million per organization), or 61% of total benefits.
- **Risk mitigation — user productivity benefits.** Minimizing productivity and revenue losses caused by unplanned outages will have an annual average value of $207,800 per 100TB ($6.59 million per organization), or 18% of total benefits.
- **IT staff productivity benefits.** More efficient storage deployment, management, and support benefits from higher-performing and more flexible storage environments free up IT storage teams to work on other initiatives. Meanwhile, application development teams are able to speed up release cycles and deliver more functional applications and features. IDC puts the value of higher levels of productivity for these teams at an annual average of $189,400 per 100TB ($6.00 million per organization), or 16% of total benefits.
- **IT infrastructure cost reductions.** Dell EMC Flash Storage not only costs less than refreshing legacy storage environments but also carries lower ongoing costs in terms of power, datacenter space, and maintenance/warranty costs. IDC puts the value of storage-related cost savings at an annual average of $53,000 per 100TB ($1.68 million per organization), or 5% of total benefits.

FIGURE 1 Average Annual Benefits per 100TB



Source: IDC, 2018

Business Productivity Benefits

Study participants have enabled their businesses and become more operationally efficient with Dell EMC Flash Storage. Dell EMC Flash Storage provides the levels of performance, scalability, and agility these organizations need to run important business applications and services. IDC calculates that they will achieve benefits worth an annual average of $718,000 per 100TB over three years (for further details, see the Appendix) by:

- **Addressing business opportunities and winning more business through improved performance,** which IDC calculates will have an annual value recognized for purposes of IDC's financial model of $96,800 per 100TB ($645,400 of higher gross revenue), or 13% of business productivity gains quantified for IDC's financial model
- **Making line-of-business users more productive** through improved application performance and timely delivery of new features, to which IDC attributes a value of $621,200 per 100TB in higher employee productivity levels, or a net productivity gain of almost 1% across more than 30,000 employees per organization (956 employees per 100TB), or 87% of business productivity gains quantified for IDC's financial model

Improving Storage Performance

As described previously, Dell EMC Flash Storage is integral to study participants' efforts to transform their IT operations and execute business strategies because it provides the requisite levels of storage performance. For these organizations, ensuring strong storage performance is not optional; they have huge numbers of customers and users that rely on the timely flow of data to and from business applications and services. Further, they must do this while handling high data growth created by forces ranging from new technologies (e.g., IoT and sensors) to business expansion.

Study participants uniformly reported that Dell EMC has supported their business operations by improving storage and application performance. In particular, they have recorded significant improvements in terms of storage IOPS (148% higher on average) and lower application latency (43% lower on average). Interviewed Dell EMC customers described performance-related benefits for data-intensive workloads as well as across-the-board application performance improvements, especially for latency-sensitive applications such as virtual desktop infrastructure (VDI).

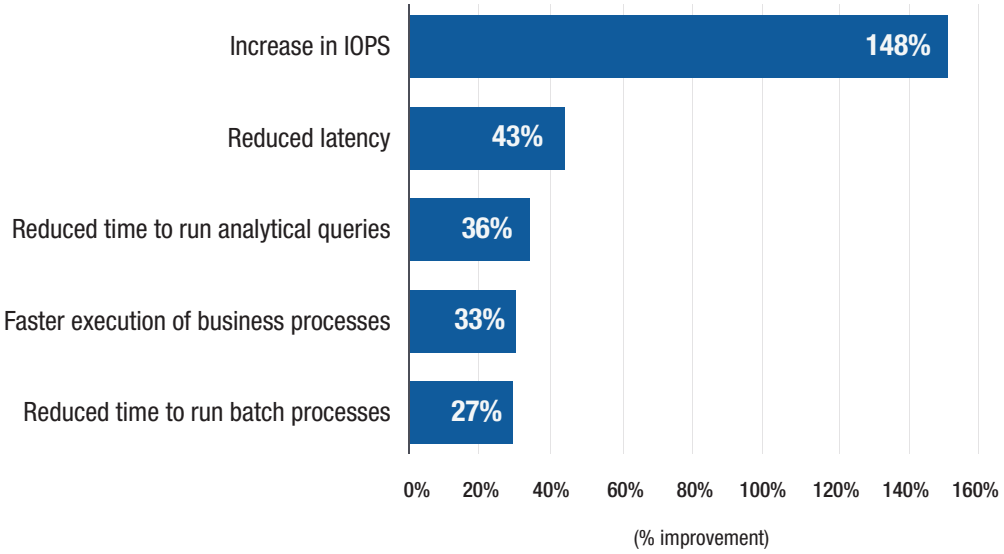
Interviewed organizations provided examples of Dell EMC Flash Storage's impact on performance:

- **Data-intensive workloads:** *"Dell EMC Flash Storage allows our initial data crunching to happen at much faster speeds. Workflows write to hundreds of thousands if not millions of individual files with thousands of directories. The process is to put that all back together. Think about a billion-piece jigsaw puzzle put into a tornado and then put back together again. It's a pretty intensive process, and performance is absolutely critical."*

- **Broad-based application performance improvements:** *"We've seen big performance improvements in a lot of applications, which means developers spend less time troubleshooting performance issues. On average, performance has probably increased by 10–15%, while on the high side, we've seen improvements in the 50–60% range."*

As shown in Figure 2, these performance benefits extend beyond higher IOPS and reduced latency to include the ability to run queries faster (36% on average) and execute business processes (33% faster) and batch processes (27% faster) in less time. These types of storage performance improvements have helped study participants lay the groundwork for delivering a better experience to customers and line-of-business users and helped ensure that they have the foundation in place for extensions to data-intensive workloads and applications. The result, as noted previously and explained in this section, is higher productivity for end users of applications and increased revenue because these organizations can better address business opportunities and serve their customers.

FIGURE 2 Storage Performance Improvements



Source: IDC, 2018

Enable the Business with Performance, Scalability, and Reliability

Study participants reported that their business operations have benefited from improved performance with Dell EMC Flash Storage, as described previously. These organizations increasingly rely on the timely and robust movement of data to and from business applications. With flash storage from Dell EMC, these organizations have sped up the movement of data and ensured their ability to extend their storage environments as needed. The net result for them has been substantial operational efficiencies in the form of higher levels of employee productivity and increased revenue through business enablement and resiliency.

Study participants provided details about how they are leveraging storage performance improvements to deliver higher-performing applications and services. The lower latency and enhanced scalability enabled by the Dell EMC solutions translate into a better user experience, which leads to more efficient operations in the form of higher employee productivity levels that IDC quantifies at 13% higher gross productivity (0.9% higher net productivity for purposes of IDC's financial model).

Interviewed customers provided varied examples of how Dell EMC Flash Storage has enabled their businesses and operations. Regarding performance benefits, one study participant commented: *"Dell EMC Flash Storage enables us to have the highest levels of speed, reliability, and redundancy."* On being better able to deliver required service levels, another said: "*We've missed no customer SLAs with Dell EMC Flash Storage, so that's pretty huge. We still have SLA problems outside of storage."* Another commented on the value of the improved flow of information to the business: *"The performance that we get with Dell EMC Flash Storage is one of the most critical parts of our business. That includes customer-facing activities, as well as our financials, where we perform*

real-time data analytics that help drive our decisions and give us insight into the overall financial health and operational efficiency of our business." Another noted the positive impact on customer perceptions of service levels and ultimately revenue: *"Dell EMC Flash Storage protects our revenue because we don't lose customers as a result of performance issues."*

Table 3 provides additional metrics on business enablement and operational efficiencies attributed to the Dell EMC Flash Storage platform.

TABLE 3 Business and User Impact

	Per Organization	Per 100TB
Higher revenue, business enablement		
Total gross revenue gain per year	$20.46 million	$645,400
Total net revenue gain per year*	$3.07 million	$96,800
Higher user productivity		
Number of users impacted	30,292	956
Average gross productivity gain	12.9%	
Average net productivity gain	0.9%	
Value of higher productivity per year	$19.69 million	$621,200
Total business productivity benefits (net revenue gain + value of higher productivity)	$22.76 million	$718,000

n = 7

**IDC applies a 15% margin assumption to all gross revenue numbers for purposes of the IDC financial model.*

Source: IDC, 2018

Risk Mitigation: User Productivity Benefits

Meanwhile, storage-related outages and downtime can also be very costly for Dell EMC customers in terms of how their employees work. One customer explained how it has architected its storage environment to minimize the likelihood of disruptions to the flow of data: *"We've designed our Dell EMC Flash Storage environment so that we put two Dell EMC XtremIO behind VPLEX. It mirrors the data so that if one of them becomes completely unavailable, we don't lose access to data."* Improved performance and higher resiliency with Dell EMC Flash Storage have minimized the impact of storage-related unplanned outages on employee productivity — 58% fewer unplanned storage-related outages and 62% less productive time lost due to outages on average (see Table 4). Higher storage reliability also means fewer business interruptions, with less revenue lost due to downtime (see Table 5).

IDC quantifies the value of reducing risk related to storage-related outages as being worth $207,800 in terms of (for further details, see the Appendix):

- **Reducing the amount of productive employee time lost due to outages,** which IDC values at $109,100 per 100TB per year, or 52% of the risk mitigation — user productivity benefits
- **Minimizing revenue lost during outages,** which IDC calculates as being worth $98,700 per 100TB per year for purposes of IDC's financial model ($658,200 gross revenue per 100TB), or 48% of the risk mitigation — user productivity benefits

TABLE 4 Impact of Unplanned Downtime on User Productivity

	Before/Without Dell EMC Flash Storage	With Dell EMC Flash Storage	Difference	Change (%)
Unplanned outages per year per organization	22.0	9.2	12.9	58
MTTR (hours)	2.5	1.5	1	39
Hours per user of lost productivity per year	4.9	1.9	3	62
FTE impact, lost user productivity per 100TB per year	2.5	1.0	1.5	62

n = 7

Source: IDC, 2018

TABLE 5 Impact of Unplanned Downtime on Revenue

	Per Organization	Per 100TB
Reduced revenue loss due to unplanned outages		
Total gross revenue loss avoided per year	$20.86 million	$658,200
Total net revenue loss avoided per year*	$3.13 million	$98,700

n = 7

**IDC applies a 15% margin assumption to all gross revenue numbers for purposes of the IDC financial model.*

Source: IDC, 2018

IT Staff Productivity Benefits

Study participants reported that their IT infrastructure and application development teams benefit from the reliability, functionality, and agility of Dell EMC Flash Storage. IDC puts the total value of productivity gains and efficiencies for these teams at an annual average of $189,400 per 100TB (for further details, see the Appendix), which they are achieving in terms of:

- **More productive application development efforts,** which IDC values at an annual average of $168,800 per 100TB, or 89% of total IT staff productivity benefits
- **Improved efficiencies of storage infrastructure teams,** which IDC quantifies as being worth an average of $20,600 per 100TB per year, or 11% of total IT staff productivity benefits

Providing IT Agility and Enabling Development

A key goal for IT organizations is delivering timely and high-value applications and services to their lines of business and to customers. Study participants reported that Dell EMC Flash Storage is helping them achieve that objective by making their storage environments more agile. Increased agility has two benefits: faster provisioning of new storage capacity and needing less staff time to carry out storage deployments. Having this kind of agility helps these organizations react better to changing business conditions and enables their development teams to more efficiently provision storage required for testing and deploying new applications and features needed to meet business demand.

Several Dell EMC customers talked about how their development teams benefit from faster provisioning of testing environments. On this topic, one customer said: *"We create testing environments for our developers and Dell EMC Flash Storage saves time in doing this. It now takes about four hours, whereas it used to take probably three times longer to set up."*

Table 6 provides specific metrics on storage agility. For example, the time to deploy new storage dropped by 57%, while the staff time required for deploying a new storage array dropped by an average of 63%.

TABLE 6 Impact on Storage Agility

	Before/Without Dell EMC Flash Storage	With Dell EMC Flash Storage	Difference	Change (%)
Time to deploy new storage (days)	23.8	10.3	13.5	57
Staff time to deploy per new storage array (hours)	130	48	82	63

n = 7

Source: IDC, 2018

Increased storage agility helps the organizations' development teams deliver more value as measured by the number of new features/releases as well as development life-cycle times. Study participants attributed more frequent releases of new features and functionality to their use of

Dell EMC Flash Storage — one-quarter more — while reducing the overall time required for development-related activities per new feature by about one-fifth, or two weeks on average.

The result is that users and customers benefit from more entirely new features and applications and more frequent and timely delivery of updates and enhancements. IDC calculated the relative productivity gain for the organizations' application development teams attributable to Dell EMC Flash Storage at an average of 12%. Study participants talked about specific benefits, including:

- **Faster testing cadence, which speeds up the overall development process:** *"We can run more tests with Dell EMC Flash Storage, and more tests equals more money coming in … we can support our most data-hungry applications, which generate terabytes of data per day."*
- **The ability to get production environments up and running quickly:** *"We deploy new applications about once per month, and it takes about 30 minutes with Dell EMC Flash Storage. Before, it could be a day to configure a new server. That's largely a virtualization benefit, but it's also definitely faster — I'd say 15%."*

Table 7 provides metrics on the impact of Dell EMC Flash Storage on application development tasks and goals in the organizations surveyed.

TABLE 7 Impact on Application Development

	Before/Without Dell EMC Flash Storage	With Dell EMC Flash Storage	Difference	Change (%)
Number of new features (per 100TB per year)	20.5	25.6	5.1	25
Development life cycle, new features (weeks)	9.8	7.9	1.9	19
Developer productivity (per 100TB per year)	$1,219,200	$1,388,000	$168,800	12

n = 7

Source: IDC, 2018

Creating a More Efficient Storage Environment

Dell EMC customers also discussed the benefits of having a more efficient storage environment. Tuning and incident response were identified as two key areas where they are realizing efficiencies. They reported benefiting from proactive self-monitoring capabilities and fewer performance issues that tended to require excessive staff attention. Ease of provisioning also was cited as requiring less staff time to fulfill. Beyond time savings and efficiencies for existing staff, these organizations are also achieving additional value by avoiding hiring new staff to handle growth in their storage environments. Study participants offered the following examples of how these IT storage teams are translating day-to-day efficiencies into value for the businesses they are supporting:

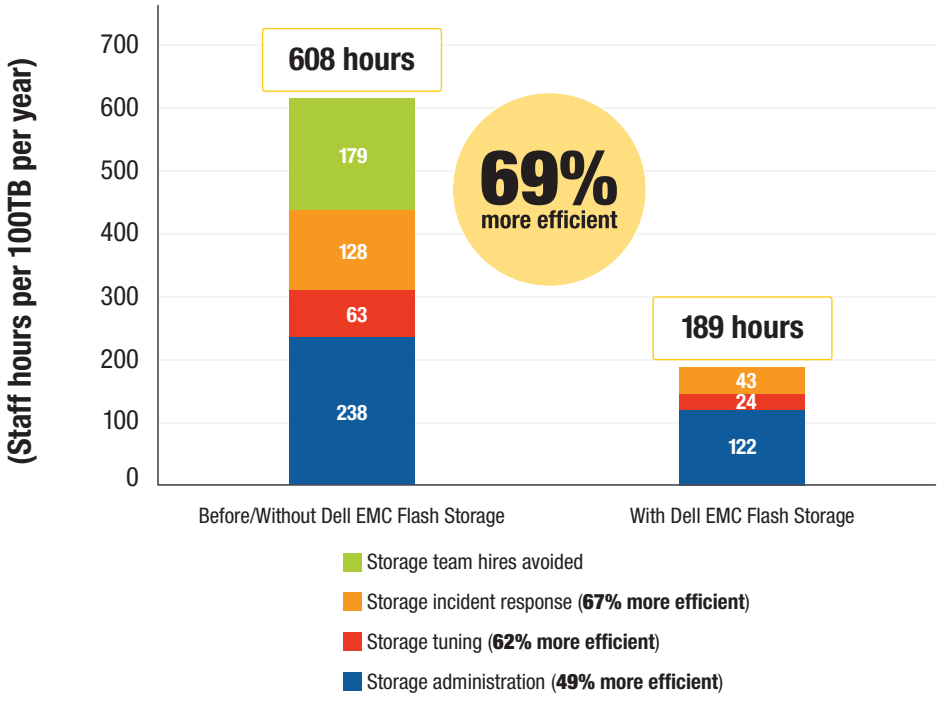
- **Time freed up from tuning:** *"We used to spend around 20 hours a month doing performance tuning. That time has now been freed up with Dell EMC Flash Storage to work on more proactive projects … for example, we're spending more time on capacity management, and it's helping us maintain 20% free space on any storage provisioned."*

- **Moving the focus of senior staff away from day-to-day activities:** *"We now spend a negligible amount of time on storage tuning with Dell EMC Flash Storage; maybe 20 hours compared with 80 hours annually. We're also not spending any time dealing with performance issues compared with probably about 50–60 hours a year before … the biggest thing is freeing up senior people to work with line-of-business users to come up with new ways of doing things instead of fixing storage problems — that's a win."*

- **Freeing up time for other initiatives:** *"We're using time freed up with Dell EMC Flash Storage for a couple of different things. We're leveraging it for migrations that we wouldn't be able to do if we were spending all of our time administering and tuning storage. We're saving money now and definitely delivering faster."*

IDC has calculated the levels of improvement in team efficiencies (see Figure 3). For example, storage incident response was 67% more efficient and storage tuning was 62% more efficient, with overall IT storage team efficiencies at an average of 69%, including hires avoided with Dell EMC Flash Storage. Taken together, these improvements result in efficiencies for these teams worth an annual average of $20,600 per 100TB.

FIGURE 3 IT Storage Team Efficiencies



Source: IDC, 2018

IT Infrastructure Cost Reductions

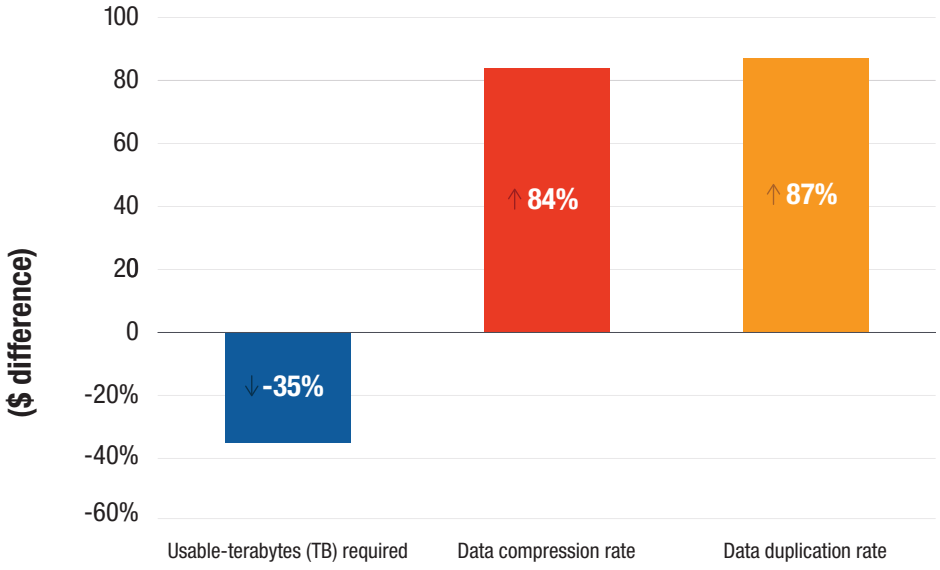
Reducing the Cost of Storage

Study participants reported lowering storage-related costs even as they benefit from improved storage performance and resiliency, as mentioned previously. They described having lower total storage-related costs because they require less storage and benefit from operational cost efficiencies. These savings can be linked to several factors identified by study participants and are presented in Figure 4:

- **Increased infrastructure density and capacity utilization:** Dell EMC Flash Storage delivered better performance from systems that were smaller, with fewer storage devices, and required less energy and floor space than the systems they replaced. Because of improvements in the data reduction ratios — 84% higher data compression and 87% higher deduplication — customers made much better use of existing storage capacity, allowing them to provision less storage (35% less usable storage was required) and avoid investing in other storage efficiency tools. One customer commented: *"We're using compression and deduplication capabilities with Dell EMC Flash Storage to run at a higher capacity utilization rate."*

- **Longer life spans:** Improved performance and lower effective use rates put less pressure on storage hardware, resulting in longer life spans and fewer refresh cycles. Addressing this benefit, another study participant commented: *"I think we'll get 10 years out of this Dell EMC Flash Storage equipment. If we were using spinning disk, it would be probably 3 years."*

FIGURE 4 Key Storage Use Metrics



Source: IDC, 2018

ROI Analysis

Table 8 presents IDC's analysis of the benefits and costs for study participants of using Dell EMC Flash Storage. IDC projects that the study participants will achieve benefits worth a discounted average of $2.78 million per 100TB over three years ($88.12 million per organization) based on a total three-year discounted investment of $0.64 million per 100TB ($20.44 million per organization). This would result in a three-year ROI of 331%, with breakeven on their investment occurring after eight months on average. For more details on IDC's ROI methodology, see the Appendix.

TABLE 8 Three-Year ROI Analysis

	Three-Year Average per 100TB	Three-Year Average per Organization
Benefit (discounted)	$2.78 million	$88.12 million
Investment (discounted)	$0.64 million	$20.44 million
Net present value (NPV)	$2.14 million	$67.68 million
Return on investment (ROI)	331%	331%
Payback period	8 months	8 months
Discount rate	12%	12%

Source: IDC, 2018

DELL EMC FLASH STORAGE

Dell EMC realized the importance of persistent flash storage for broad use among IT organizations of all sizes early on, introducing its first AFA in late 2013. Since then, it has flash-optimized all its major enterprise storage platforms and offers flash storage solutions through all five enterprise storage consumption models. Dell EMC's broad all-flash portfolio includes a number of different offerings targeted to meet the needs of different customer types and workloads:

- **Dell EMC high-end all-flash solutions**
  - **PowerMax and VMAX.** Targeted at higher-end, unified storage customers interested in dense, mixed workload consolidation, Dell EMC's flagship enterprise storage platforms deliver "six-nines" availability, a complete set of enterprise-class data services, and extensive datacenter ecosystem integration capabilities. While they both run the same HYPERMAX storage operating system, the VMAX is based around 12Gb SAS and the PowerMax is an end-to-end NVMe-based storage platform.
  - **XtremIO.** The XtremIO platform is targeted at midrange and larger customers looking for the lowest latencies for block-based workloads such as high-performance databases, virtual desktop infrastructure, and/or snapshot-intensive workloads, and it features a metadata-driven architecture that can be scaled both up (for additional capacity) and out (for additional performance) within a single system image.
- **Dell EMC midrange all-flash solutions**
  - **SC Series.** Dell EMC SC Series is targeted at entry-level and midrange customers that want a block-based solution that delivers self-optimizing value through advanced auto-tiering and multi-array federation.
  - **Dell EMC Unity.** Dell EMC Unity is targeted at midrange customers that want a unified (block/file) storage solution that emphasizes simplicity of deployment, management, and scaling.
- **Dell EMC entry level**
  - **Dell EMC PowerVault.** Dell EMC PowerVault is targeted at customers requiring entry-level storage solutions with enterprise-class features. Dell EMC PowerVault systems support all-flash and hybrid configurations and start at under $5,000.
- **Dell EMC scale-out NAS**
  - **Dell EMC Isilon.** Dell EMC Isilon is targeted at customers requiring a scale-out NAS system that can easily handle the largest-scale unstructured workloads. Isilon is available in all-flash, hybrid, and archive storage appliance configurations.

- **Dell EMC converged infrastructure**
  - » **Dell EMC VxBlock.** Dell EMC VxBlock is targeted at customers that want a fully integrated, preconfigured, and pretested block- and/or file-based CI solution with ease of deployment for mixed workloads that feature disaggregated storage. VxBlock is available in configurations that include Dell EMC PowerMax, VMAX, XtremIO, Isilon, or Unity.
- **Hyperconverged infrastructure**
  - » **Dell EMC VxRail.** Dell EMC VxRail is targeted at customers that want a fully integrated, preconfigured, and pretested block- and/or file-based HCI solution with ease of deployment, management, and scaling for mixed workloads. VxRail is available in configurations that include Dell PowerEdge servers and VMware vSAN.
  - » **Dell EMC Cloud Marketplace.** This offering is targeted at customers that are looking for cloud platforms, cloud-enabled infrastructure, consumption models, and services, all in one place.
  - » **Dell EMC Data Protection.** Dell EMC offers a full range of data protection solutions targeted at both physical and virtual workloads, both on-premise and in the cloud. These solutions are designed to span the varied platforms and application deployment platforms used by modern IT organizations.

With this broad level of choice across different price bands and consumption models, Dell EMC is well positioned to meet a variety of different customer and workload requirements with highly flash-optimized, enterprise-class storage solutions that are easy to manage and scale.

CHALLENGES AND OPPORTUNITIES

Datacenter workloads are continuing to evolve, and real-time big data analytics is a new workload on the horizon that will begin to challenge the performance capabilities of even SCSI-based flash storage. A new interface protocol standard has arisen, called NVMe, that was specifically developed for flash storage and is significantly more efficient at releasing the full performance capabilities of flash media than SCSI. As workloads evolve over the next two to three years, customers will look to NVMe to help them keep up. While SCSI-based AFAs can meet most storage performance requirements today, vendors must provide nondisruptive migration paths to NVMe technology as customers grow into needing it. Customers should understand their enterprise storage vendors' NVMe vision and how easy it will be to integrate this new high-performance technology into their storage infrastructure.

Many IT organizations that are deploying AFAs today are running them at lower levels of performance utilization than the arrays they are replacing. This is because the newer AFAs are offering much better performance than the legacy arrays, so the migrated workloads require less of the maximum performance capabilities of the new arrays. Flash provides very predictable latencies with great burst ability, making it ideal for mixed workloads that are governed by strict service-level agreements (SLAs). Given that these newer arrays support very high levels of availability (six-nines for many of them), customers can consider more densely consolidating even mission-critical workloads despite increased failure domain sizes (due to higher infrastructure density in the arrays themselves). Denser consolidation can potentially allow customers to operate their businesses with fewer storage platforms, simplifying administration, reducing energy and floor space consumption, and generally lowering costs. This consolidation may also allow customers to reduce the number of storage vendors with which they need a relationship, resulting in further simplifications. For more of the factors that customers should look at when considering denser storage consolidation, see *Storage Workload Consolidation: When Is It Feasible and Why* (IDC #US43662318, March 2018).

CONCLUSION

IDC's study demonstrates the extent to which organizations can benefit from much-improved performance and optimized costs with Dell EMC Flash Storage solutions. While these organizations must meet demand from customers and employees for application performance levels, they must also deliver cost-effective storage environments — especially in the context of rapid growth to data. This research shows the extent to which organizations of varying sizes — including enterprises, midsize organizations, and smaller organizations — can benefit from running important business applications on Dell EMC Flash Storage. IDC projects that on average, these Dell EMC customers will realize a return of more than 4:1 (331%) on their investment in three years by achieving operational efficiencies in the form of higher user and IT productivity levels, increasing revenue, and reducing costs.

APPENDIX

Business Value Results

Table 9 lays out the areas in which IDC has quantified the average annual value for organizations using Dell EMC Flash Storage on a per-organization and per-100TB basis.

TABLE 9 Value of Benefits from Use of Dell EMC Flash Storage

	Per Organization	Per 100TB
Total annual benefits	$37.03 million	$1.17 million
Business productivity benefits	$22.76 million	$718,000
Higher user productivity	$19.69 million	$621,200
Higher net revenue	$3.07 million	$96,800
Risk mitigation — user productivity benefits	$6.59 million	$207,800
Reduced impact of lost productivity	$3.46 million	$109,100
Reduced revenue losses	$3.13 million	$98,700
IT staff productivity benefits	$6.00 million	$189,400
Higher application development productivity	$5.35 million	$168,800
Higher productivity, other IT teams	$0.65 million	$20,600
IT infrastructure cost reductions	$1.68 million	$53,000

Source: IDC, 2018

METHODOLOGY

IDC's standard ROI methodology was utilized for this project. This methodology is based on gathering data from organizations currently using Dell EMC Flash Storage as the foundation for the model. Based on interviews with these study participants, IDC has calculated the benefits and costs to these organizations of using Dell EMC Flash Storage. IDC used the following three-step method for conducting the ROI analysis:

1. **Gathered quantitative benefit information during the interviews using a before-and-after assessment of the impact of Dell EMC Flash Storage.** In this study, the benefits included staff time savings and productivity benefits and storage- and IT-related cost reductions.

2. **Created a complete investment (three-year total cost analysis) profile based on the interviews.** Investments go beyond the initial and annual costs of using Dell EMC Flash Storage and can include additional costs related to migrations, planning, consulting, 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 the study participants' use of Dell EMC Flash Storage 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.

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 productivity savings. For purposes of this analysis, based on the geographic locations of the interviewed organizations, IDC has used assumptions of an average fully loaded salary of $100,000 per year for IT staff members and an average fully loaded salary of $70,000 per year for non-IT staff members. IDC assumes that employees work 1,880 hours per year (47 weeks x 40 hours).

- 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.

- 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 interviewed organization 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: All numbers in this document may not be exact due to rounding.

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